01.03.zz (Device firmware)

Operating Instructions Levelflex FMP51, FMP52, FMP54 HART

Guided-wave radar







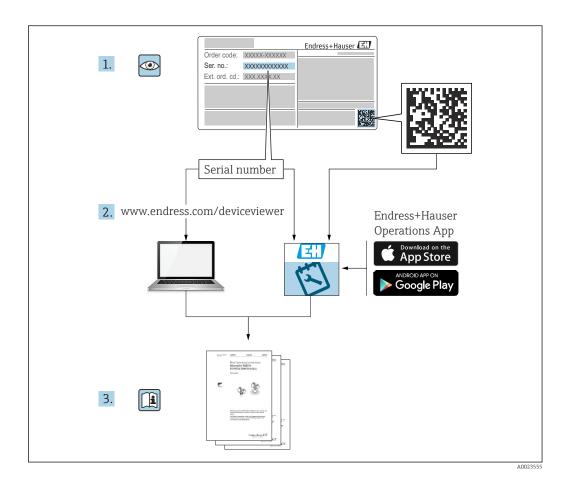


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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER

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

WARNING

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

A CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
===	Direct current
~	Alternating current
$\overline{\sim}$	Direct and alternating current
≐	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective earth (PE) 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



Flat blade screwdriver



Torx screwdriver



Allen key



Open-ended wrench

1.2.4 Symbols for certain types of information and graphics

✓ Permitted

Procedures, processes or actions that are permitted

✓ ✓ Preferred

Procedures, processes or actions that are preferred

Forbidden

Procedures, processes or actions that are forbidden

1 Tip

Indicates additional information



Reference to documentation



Reference to graphic



Notice or individual step to be observed

1., 2., 3

Series of steps



Result of a step



Visual inspection



Operation via operating tool

A

Write-protected parameter

1, 2, 3, ...

Item numbers

A, B, C, ...

Views

△ → **■** Safety instructions

Observe the safety instructions contained in the associated Operating Instructions

□ Temperature resistance of the connection cables

Specifies the minimum value of the temperature resistance of the connection cables

1.3 List of abbreviations

BA

Document type "Operating Instructions"

ΚА

Document type "Brief Operating Instructions"

TI

Document type "Technical Information"

SD

Document type "Special Documentation"

XA

Document type "Safety Instructions"

ΡN

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

ε_r (Dk value)

Relative dielectric constant

PI.C

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)

CD

Common Data Interface

PFS

Pulse Frequency Status (Switch output)

1.4 Documentation



- 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.

The following documentation may be available depending on the device version ordered:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (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.
Operating Instructions (BA)	Your reference document These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are a constituent part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

1.5 Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

Bluetooth®

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FISHER®

Registered trademark of Fisher Controls International LLC, Marshalltown, USA

MASONEILAN®

Registered trademark of Dresser, Inc., Addison, USA

2 Basic safety instructions

2.1 Requirements for the personnel

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

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

The operating personnel must fulfill the following requirements:

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

2.2 Intended use

Application and media

The measuring instrument described in this manual is intended only for the level and interface measurement of liquids. Depending on the version ordered, the measuring instrument 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 instrument may be used only for the following measurements:

- ▶ 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 instrument remains in proper condition for the operation time:

- ▶ Use the measuring instrument only for media to which the process-wetted materials are sufficiently resistant.
- ▶ Observe the limit values in the "Technical data".

Incorrect use

The manufacturer is not liable for harm caused by improper or unintended use.

Clarification for 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 elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

When working on and with the device:

▶ Wear the required personal protective equipment as per 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 ensuring that the device is in good working order.

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 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 if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

2.5 Product security

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

NOTICE

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

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

2.5.1 **CE mark**

The measuring system meets the legal requirements of the applicable 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

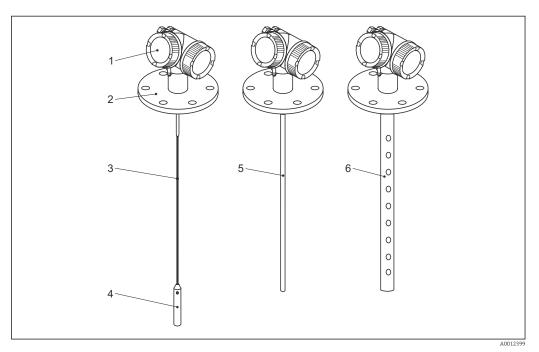
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

Product description 3

3.1 Product design

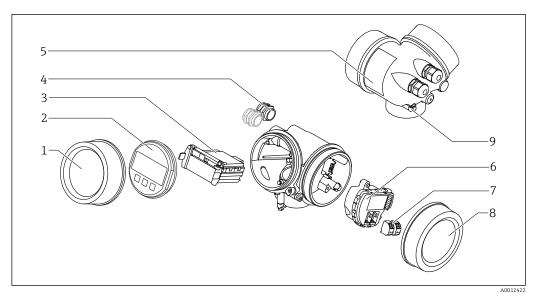
3.1.1 Levelflex FMP51/FMP52/FMP54/FMP55



₽ 1 Design of the Levelflex

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

3.1.2 Electronics housing

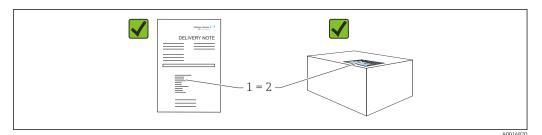


■ 2 Design of the electronics housing

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

4 Incoming acceptance and product identification

4.1 Incoming acceptance



Check the following during incoming acceptance:

- Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
- Are the goods undamaged?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- Is the documentation provided?
- If required (see nameplate): are the Safety Instructions (XA) provided?
- If one of these conditions is not met, please contact the manufacturer's sales office.

4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- ► *Device Viewer*(www.endress.com/deviceviewer); manually enter the serial number from the nameplate.
 - ► All the information about the measuring device is displayed.
- ► *Endress+Hauser Operations app*; manually enter the serial number indicated on the nameplate or scan the 2D matrix code on the nameplate.
 - ► All the information about the measuring device is displayed.

4.2.1 Nameplate

The information that is required by law and is relevant to the device is shown on the nameplate, e.q.:

- Manufacturer identification
- Order number, extended order code, serial number
- Technical data, degree of protection
- Firmware version, hardware version
- Approval-related information, reference to Safety Instructions (XA)
- DataMatrix code (information about the device)

4.2.2 Manufacturer address

Endress+Hauser SE+Co. KG Hauptstraße 1 79689 Maulburg, Germany Place of manufacture: See nameplate.

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.

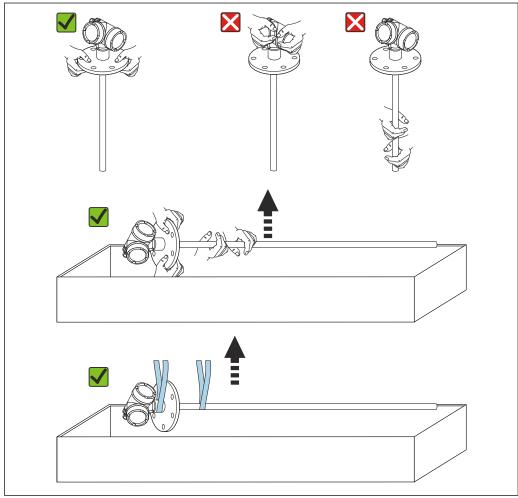
5.2 Transporting to the measuring point

A WARNING

Housing or probe may become damaged or break off.

Risk of injury!

- ► Transport the measuring instrument 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).

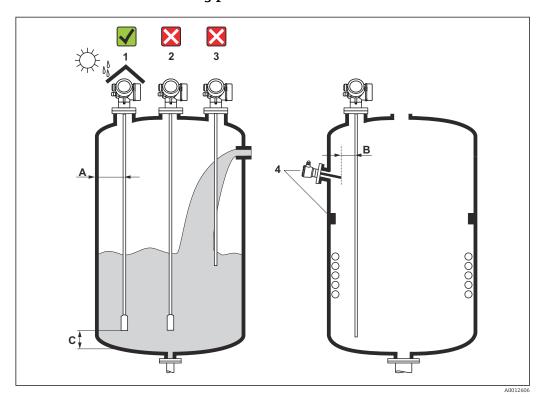


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6 Installation

6.1 Mounting requirements

6.1.1 Suitable mounting position



■ 3 Installation positions

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)
 - Coaxial probe: > 10 mm (0.4 in)
- Coaxial probes can be mounted at any distance to the wall and internal fixtures.

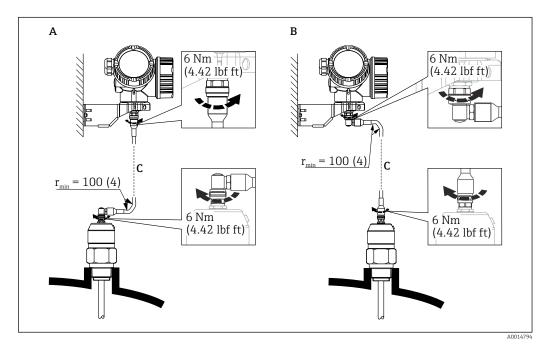
Additional mounting requirements

- 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 weight and the cone of the vessel, however, does not influence the measurement provided that the relative permittivity is at least $\epsilon_r = 1.8$.
- When mounting the housing in a recess (e.g. in a concrete ceiling), observe a minimum distance of 100 mm (4 in) between the cover of the connection compartment/electronics compartment and the wall. Otherwise the connection compartment/electronics compartment will not be accessible after installation.

6.1.2 Mounting under confined conditions

Mounting with remote probe

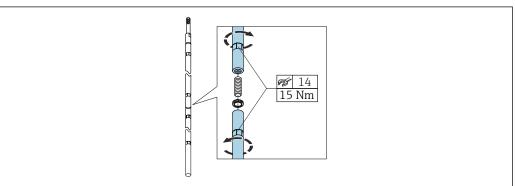
The device version with a remote probe is suitable for applications with restricted mounting space. In this case, the electronics housing is mounted at a separate position from the probe.



- 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 "Remote sensor, 3 m cable"
 - Version MC "Remote sensor. 6 m cable"
 - Version MD "Remote sensor, 9 m 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 (1¼ to 2 inch) post or pipe
- The connecting 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



A002164

In confined mounting conditions (ceiling clearance), the use of separable rod probe $(\emptyset 16 \text{ mm})$ is advisable.

- 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 4 mm ($\frac{1}{6}$ in) 316

Tensile loading capacity5 kN

Rope 4 mm (1/6 in) Alloy C

Tensile loading capacity5 kN

Rope 4 mm ($\frac{1}{6}$ in) PFA>316L

Tensile loading capacity 1 kN

FMP52

Rope 4 mm (1/6 in) PFA>316

Tensile loading capacity 2 kN

FMP54

Rope 4 mm (1/6 in) 316

Tensile loading capacity 10 kN

Lateral loading capacity (flexural strength) of rod probes

FMP51

Rod 8 mm ($\frac{1}{3}$ in) 316L

10 Nm

Rod 12 mm (½ in) 316L

Flexural strength 30 Nm

Rod 12 mm (½ in) AlloyC

Flexural strength 30 Nm

Rod 16 mm (0.63 in) 316 L separable

Flexural strength 30 Nm

FMP52

Rod 16 mm (0.63 in) PFA>316L

Flexural strength 30 Nm

FMP54

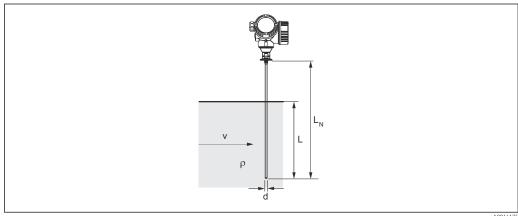
Rod 16 mm (0.63 in) 316L

Flexural strength 30 Nm

Rod 16 mm (0.63 in) 316 L separable

Flexural strength 30 Nm

Lateral load (bending moment) from flow conditions



A00141

- ρ Density of the medium [kg/m³]
- v Flow velocity [m/s] of the medium, perpendicular to the probe rod
- d Diameter [m] of probe rod
- L Level [m]
- LN Probe length [m]

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

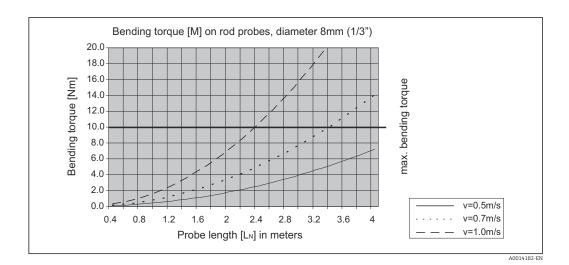
Sample calculation

Coefficient of friction $c_{\rm w}$ 0.9 (assuming turbulent flow - high Reynolds number)

Density ρ [kg/m³] 1000 (e.g. water)

Probe diameter d [m] 0.008

 $L = L_N$ (unfavorable conditions)



6.1.4 Lateral loading capacity (flexural strength) of coaxial probes

FMP51

Probe Ø21.3 mm316L

Flexural strength:60 Nm

Probe Ø42.4 mm316L

Flexural strength:300 Nm

Probe Ø 42.4 mm AlloyC

Flexural strength:300 Nm

FMP54

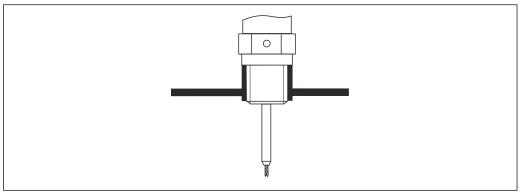
Probe Ø 42.4 mm 316L

Flexural strength:300 Nm

6.1.5 Information concerning the process connection

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



 \blacksquare 4 Mounting with threaded connection; flush with the vessel ceiling

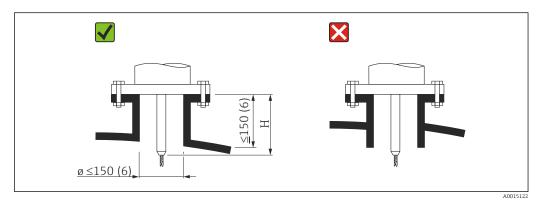
Sealing

The thread and the type of seal comply with DIN3852 Part 2, screwed plug, form A. The following types of sealing ring can be used:

- For thread $G^{3}/4$ ": according to DIN7603 with dimensions 27 mm \times 32 mm
- For thread G1½": according to DIN 7603 with dimensions 48 mm × 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: ≤ 150 mm (6 in)
 For larger diameters, the near-range measuring capability may be reduced.
 For large nozzles, see the section "Mounting in nozzles ≥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.

22 Endress+Hauser

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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.



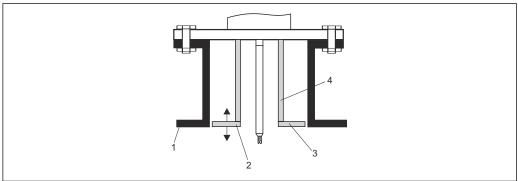
This accessory consists of the extension rod, corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when used in bulk solids.

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 cloqqed 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.



- Lower edge of the nozzle
- 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)
- 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.

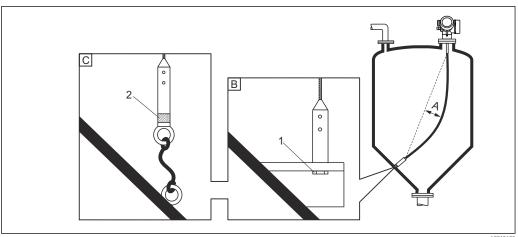
The PTFE flange cladding normally acts simultaneously as a seal between the nozzle and the device flange.

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

Flange size	Number of screws	Tightening torque
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

Securing the probe 6.1.7

Securing rope probes



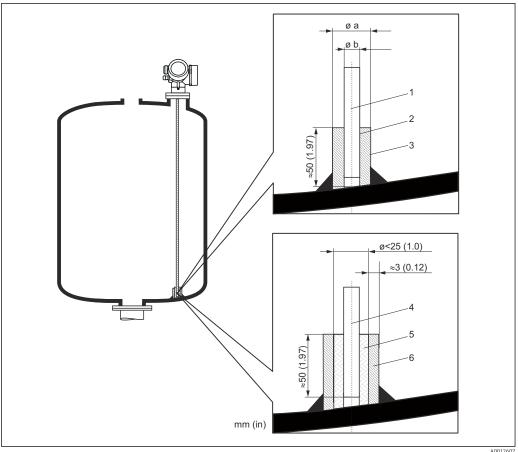
- Sag: ≥ 10 mm/m (0.12 in/ft) probe length Reliably grounded end of probe Reliably insulated end of probe Fastener in female thread of probe weight Α
- В
- С
- 1
- Insulated fastening kit

- The end of the rope probe must be secured or fixed down under the following conditions: If the probe temporarily comes 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 ($\frac{1}{6}$ in), 316: M 14
- When fixed down, the end of the probe must be reliably grounded or reliably insulated. If it is not otherwise possible to secure the probe with a reliably insulated connection, use the insulated fastening kit.
- If the end of the probe is fixed down and grounded, the search for a positive end-of-probe signal must be activated. Otherwise automatic probe length correction is not possible.
 - Navigation: Expert \rightarrow Sensor \rightarrow EOP evaluation \rightarrow 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: $\geq 10 \text{ mm/m}$ (0.12 in/ft) rope length.

Pay attention to the tensile loading capacity of rope probes.

Securing rod probes

- In the case of WHG approval: a support is required for probe lengths ≥ 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
- Probe rod, coated
- Plastic sleeve, e.g. PTFE, PEEK, PPS
- Short metal pipe, e.g. welded in place

Probe Ø 8 mm (0.31 in)

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

Probe Ø 12 mm (0.47 in)

- a < Ø 20 mm (0.78 in)
- $b = \emptyset 12.5 \text{ mm } (0.52 \text{ in})$

Probe Ø 16 mm (0.63 in)

- a < Ø 26 mm (1.02 in)
- \bullet 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

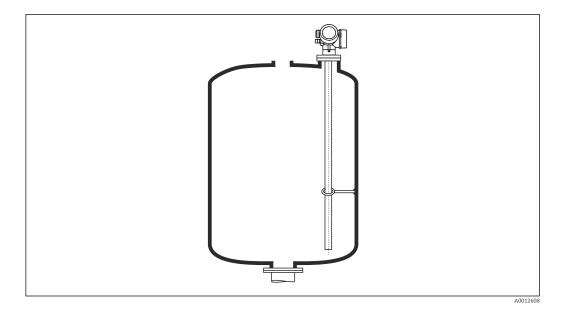
Welding can damage the main electronics module.

▶ Before welding: Ground the probe rod and remove the electronics.

Securing coaxial probes

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

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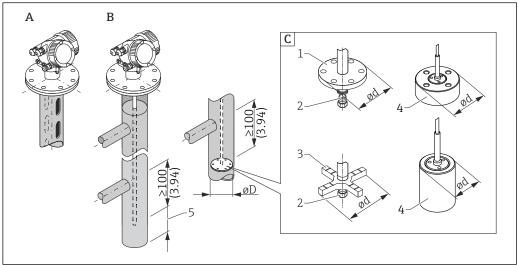


Coaxial probes can be secured (fixed) at any point in the ground tube.

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.
- Since the measuring signal permeates a large number of plastics, incorrect measurements can result when the device is installed in bypasses or stilling wells made of plastic. For this reason use a bypass or stilling well made of metal.



- **₽** 5 Unit: mm (in)
- Α Mounting in stilling well
- Mounting in bypass
- С Centering disk/centering star/centering weight
- Metal centering disk (316L) for level measurement
- Securing screw; torque: 25 Nm \pm 5 Nm
- Non-metal centering star (PEEK, PFA) preferred for interface measurement
- Metal centering weight (316L) for level measurement
- 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 coaxial 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 (probe 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.

 Coaxial 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 relative permittivity (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 (Ø d) 45 mm (1.77 in)

for pipe diameters (\varnothing D) DN50/2" to DN65/2 $\frac{1}{2}$ "

Rod centering disk (Ø d) 75 mm (2.95 in)

for pipe diameters (Ø D) DN80/3" to DN100/4"

Rope centering disk (Ø d) 75 mm (2.95 in)

for pipe diameters (Ø D) DN80/3" to DN100/4"

Metal centering weight (316L)

for level measurement

Rope centering weight (Ø d) 45 mm (1.77 in), h 60 mm (2.36 in)

for pipe diameters (\emptyset D) DN50/2"

Rope centering weight (Ø d) 75 mm (2.95 in), h 30 mm (1.81 in)

for pipe diameters (Ø D)

DN80/3"

Rope centering weight (Ø d) 95 mm (3.74 in), h 30 mm (1.81 in)

for pipe diameters (Ø D)

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 (Ø d) 48 to 95 mm (1.89 to 3.74 in)

for pipe diameters (Ø D)

≥ DN50/2"

Non-metal centering star (PFA)

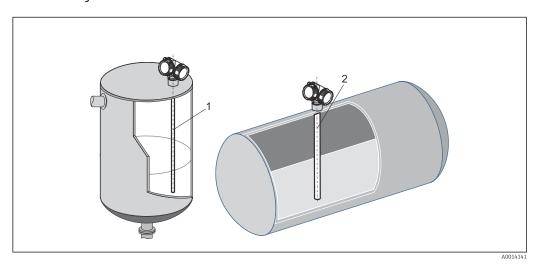
for level and interface measurement, operating temperature: -200 to +250 °C (-328 to +482 °F)

Rod centering star (Ø d) 37 mm (1.46 in)

for pipe diameters (Ø D)

 \geq 40 mm (1.57 in)

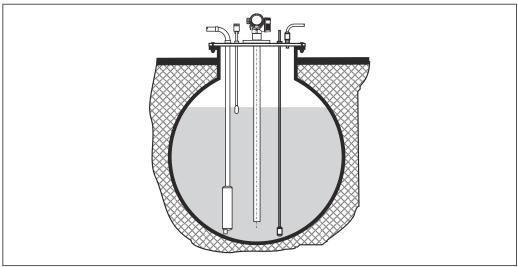
Horizontal cylindrical and vertical tanks



Coaxial probe

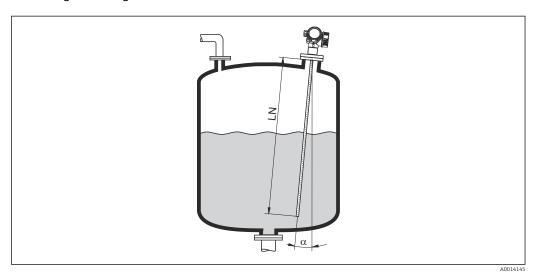
- Any distance from wall provided occasional contact is avoided.
- Use a coaxial probe (1) if installing in tanks with many internal fixtures or internal fixtures located close to the probe.

Underground tanks



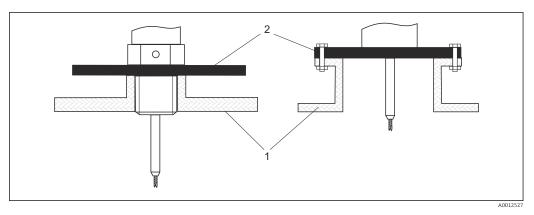
In the case of nozzles with large diameters, use a coaxial probe to avoid reflections at the nozzle wall.

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

Non-metal vessels



- Non-metal vessel
- 2 Metal sheet or metal flange

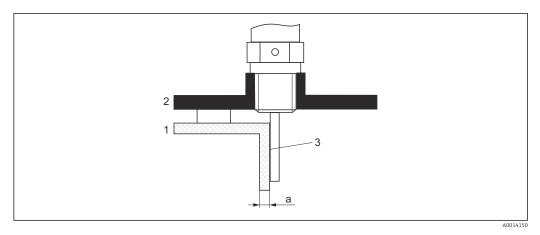
To ensure good measurement results when mounting on non-metal vessels

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

A metal surface is not required at the process connection in the case of coaxial 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

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

Note the following when mounting the device:

- Mount the probe directly on the tank wall without any clearance.
- To protect against interference with the measurement, fit a plastic half pipe with a minimum diameter of 200 mm (8 in) or a similar protective unit on the probe.
- If the vessel diameter is less than 300 mm (12 in):
 On the opposite side of the vessel, fit a grounding plate that is conductively connected to the process connection and covers around half of the vessel's circumference.
- If the vessel diameter is 300 mm (12 in) or higher:
 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 wave velocity 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 end-of-probe signal 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 **Const. GPC factor** option.
- 2. Parameter Expert → Sensor → Gas phase compensation → Const. GPC factor
 Quotient: Enter "(actual probe length)/(measured probe length)".

Compensation via the calibration parameters

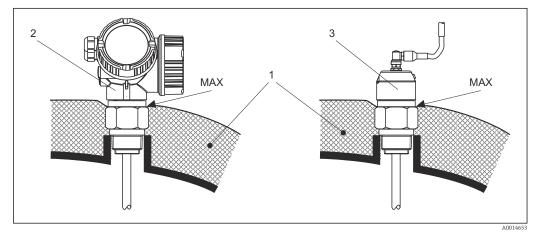
If it is necessary to actually compensate for a gas phase, the gas phase compensation function is not available for the correction of external mounting. In this case, the

calibration parameters (**Empty calibration** and **Full calibration**) must be adjusted. In addition, a value that is greater than the actual probe length must be entered in the **Present probe length** parameter. In all three cases, the correction factor is the quotient of the probe length measured when the vessel is empty and the actual probe LN.

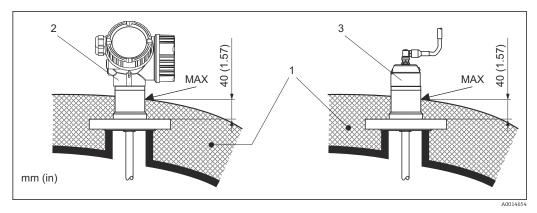
- The device searches for the end-of-probe signal in the differential curve. Therefore, the value of the measured probe length depends on the mapping curve. In order to obtain a more accurate value, it is advisable to determine the measured probe length manually using the envelope curve display in FieldCare.
- 1. Parameter Setup → Empty calibration
 - Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
- 2. Parameter Setup → Full calibration
 - Increase the parameter value by the factor "(measured probe length)/(actual probe length)".
- 3. Parameter Setup → Advanced setup → Probe settings → Probe length correction → Confirm probe length
 - ► Select **Manual input** option.
- 4. Parameter Setup → Advanced setup → Probe settings → Probe length correction → Present probe length
 - ► Enter the measured probe length.

Vessel with thermal insulation

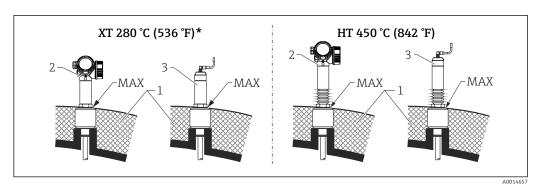
If process temperatures are high, the device must be included in normal vessel insulation (1) in order to prevent the electronics heating up as a result of thermal radiation or convection. The insulation may not go beyond the points labeled "MAX" in the drawings.



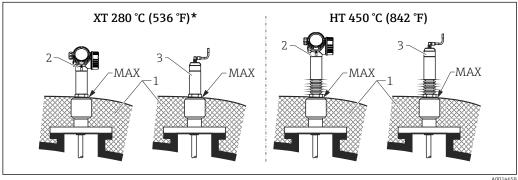
- 6 Process connection with thread
- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote



- **№** 7 Process connection with flange
- 1 Vessel insulation
- 2 Compact device
- 3 Sensor, remote



- ₩ 8 Process connection with thread - sensor version XT and HT
- Vessel insulation
- 2 Compact device
- Sensor, remote
- The XT version is not recommended for saturated steam above 200 $^{\circ}$ C (392 $^{\circ}$ F); the HT version should be used instead



- **₽** 9 Process connection with flange - sensor version XT and HT
- Vessel insulation
- 2 Compact device
- Sensor, remote
- The XT version is not recommended for saturated steam above 200 °C (392 °F); the HT version should be used instead

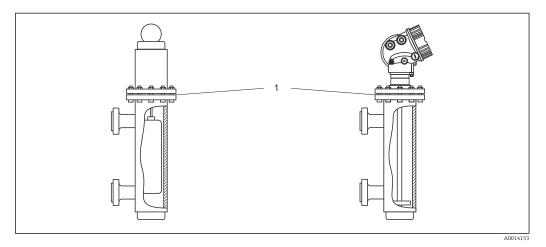
Replacing a displacer system in an existing displacer chamber

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:

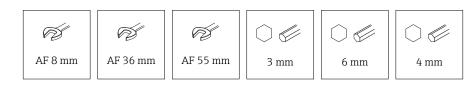
- In normal cases, use a rod probe. When installing into a metal displacer chamber up to 150 mm (5.91 in), you have all the advantages of a coaxial probe.
- Contact between the probe and the side wall must be avoided. Where necessary, use a centering disk or centering star at the bottom end of the probe.
- 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 coaxial 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 device

6.2.1 Tool list

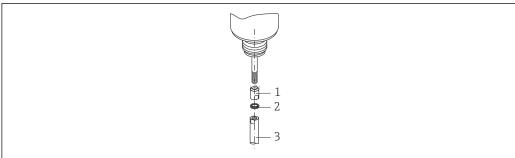


- To shorten rope probes: use a saw or bolt cutters.
- To shorten rod or coaxial probes: use a saw.
- For flanges and other process connections: use an appropriate mounting tool.

6.2.2 Mounting the rod probe

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

The device is 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

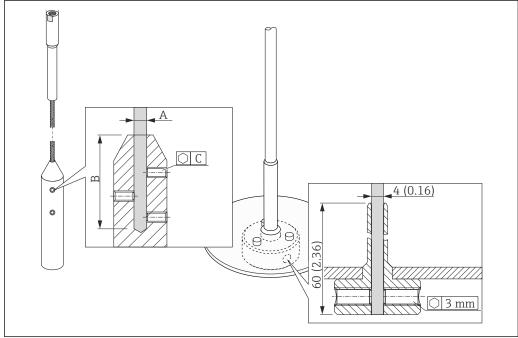
Rod probes must be shortened if the distance to the vessel floor or outlet cone is less than 10 mm (0.4 in). To shorten, saw off the bottom end of the rod probe.

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.



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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 coaxial probes

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

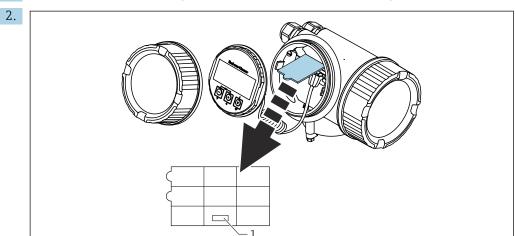
Coaxial probes can be shortened by a maximum of 80 mm (3.2 in) from below. They have centering devices on the inside to secure the rod centrally in the pipe. A raised edge holds the centering devices in place on the rod. It is possible to shorten the probe up to approx. 10 mm (0.4 in) below the centering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

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

Entering the new probe length

After shortening the probe:

1. Switch 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 Device with gas phase compensation: mounting the probe rod

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

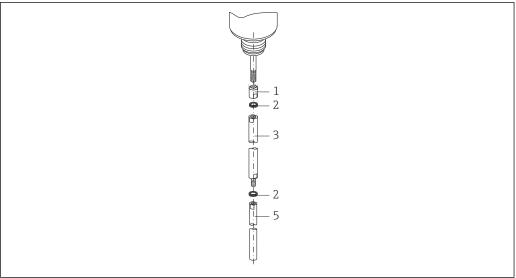
Coaxial probes

Coaxial 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.

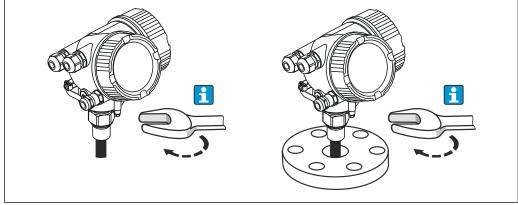


A001454

- 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



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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 ¾": € 36 mm
- Thread 1½": 655 mm
- Maximum permissible tightening torque:
 - Thread ¾": 45 Nm
 - Thread 1½": 450 Nm
- Recommended torque when using the supplied aramid fiber seal and 40 bar (580 psi) pressure (FMP51 only; no seal is supplied for FMP54):
 - Thread ¾": 25 Nm
 - Thread 1½": 140 Nm
- When installing in metal vessels, ensure there is good metal contact between the process connection and the vessel.

Mounting devices with a flange

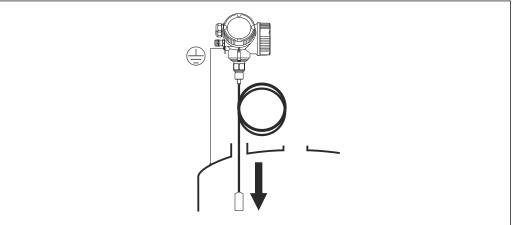
If a seal is used to mount the device, use uncoated metal screws to ensure good electrical contact between the process flange and the probe flange.

Mounting rope probes

NOTICE

Electrostatic discharge can damage the electronics.

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



A0012852

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

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

6.2.6 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 angled at 90°. Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

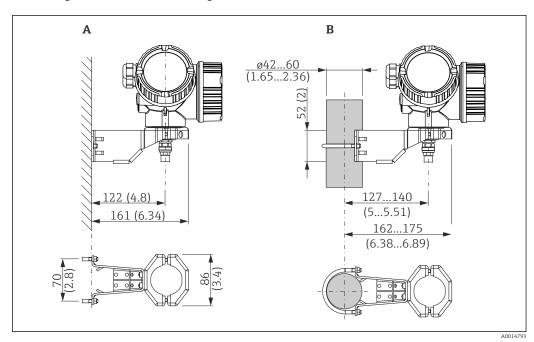
A CAUTION

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

- ► Mount the probe and the electronics housing securely before connecting the connecting cable.
- ► Lay the connecting cable in such a way that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4 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

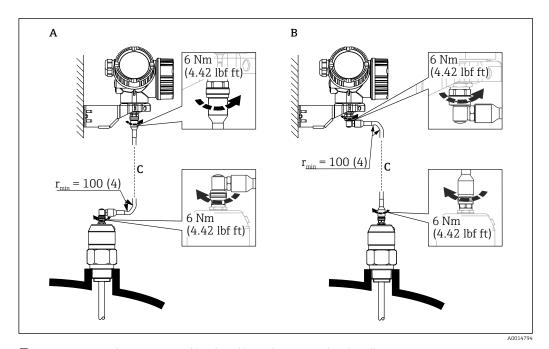


■ 10 Mounting the electronics housing with the mounting bracket. Unit of measurement mm (in)

- A Wall mounting
- B Post mounting

Connecting the connecting cable

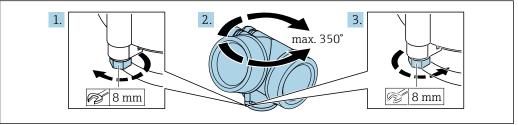




- 11 Connecting the connecting cable. The cable can be connected in the following ways:. Unit of measurement mm (in)
- A Angled plug at the probe
- B Angled plug at the electronics housing
- C Length of the remote cable as ordered

6.2.7 Turning the transmitter housing

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

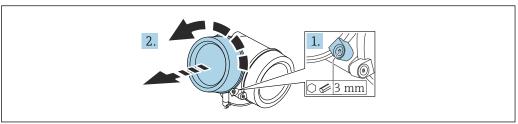


A0032242

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

6.2.8 Turning the display

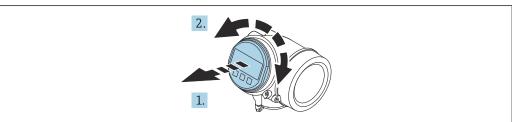
Opening the cover



A0021430

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

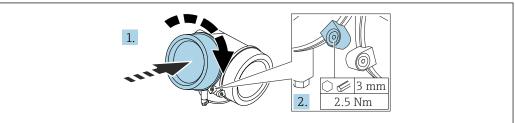
Turning the display module



A0036401

- 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



A0021451

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

6.3 Post-mounting check

- ☐ Is the device free from damage (visual inspection)?
- \Box Are the measuring point identification and labeling correct (visual inspection)?

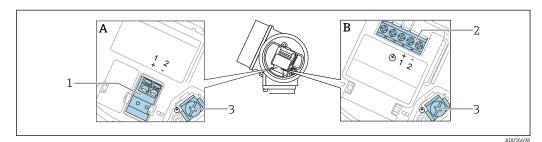
	Is the measuring device protected against precipitation and sunlight?
	Are the securing screws and cover lock tightened securely?
	Does the measuring device comply with the measuring point specifications
For	example:
• 🗆	Process temperature
• [Process pressure
• 🗆	Ambient temperature
• 🗆	Measuring range

7 **Electrical connection**

Connecting requirements 7.1

7.1.1 Terminal assignment

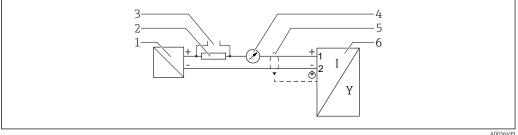
Terminal assignment, 2-wire: 4 to 20 mA HART



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

- Α Without integrated overvoltage protection
- В 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
- Terminal for cable shield

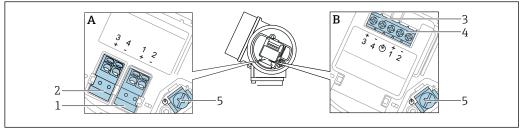
Function diagram of 4 to 20 mA HART



■ 13 Function diagram of 4 to 20 mA HART

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

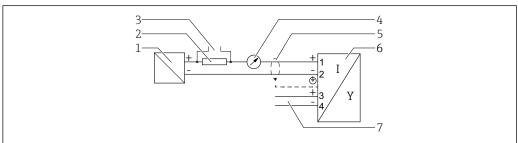
Terminal assignment, 2-wire: 4 to 20 mA HART, switch output



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

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

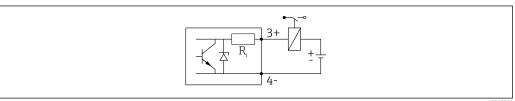
Function diagram 4 to 20 mA HART, switch output



Function diagram 4 to 20 mA HART, switch output

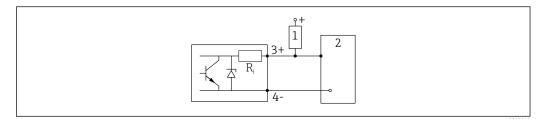
- 1 Active barrier for power supply; observe terminal voltage.
- Resistor for HART communication ($\geq 250 \Omega$); observe maximum load.
- 3 Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)
- Analog display unit; observe maximum load
- Cable screen; observe cable specification
- 6 Measuring instrument
- Switch output (open collector)

Connection example of relay



■ 16 Connection example of relay

Connection example for the digital input

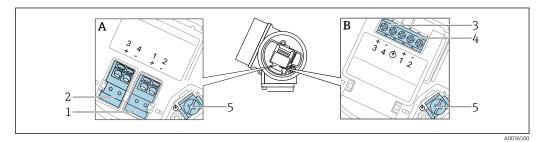


■ 17 Connection example for the digital input

- Pull-up resistor
- Digital input

Α

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



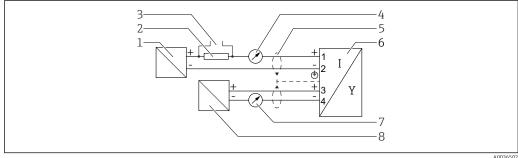
€ 18 Terminal assignment, 2-wire: 4 to 20 mA HART, 4 to 20 mA

- В With integrated overvoltage protection

Without integrated overvoltage protection

- 1 Connection current output 1, 4 to 20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
- 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
- Terminal for cable shield

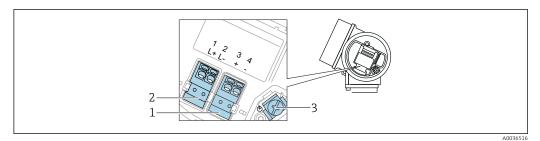
Function diagram 4 to 20 mA HART + 4 to 20 mA analog



Function diagram 4 to 20 mA HART + 4 to 20 mA analog

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

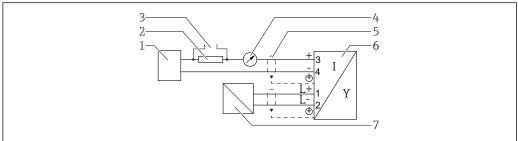
Terminal assignment, 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})



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

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

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

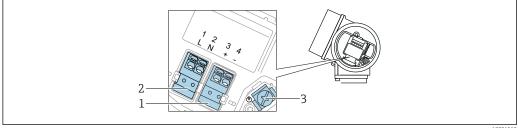


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€ 21 Function diagram 4-wire: 4 to 20 mA HART (10.4 to 48 V_{DC})

- Evaluation unit, e.g. PLC
- Resistor for HART communication ($\geq 250 \Omega$); observe maximum load
- Connection for Commubox FXA195 or FieldXpert (via VIATOR Bluetooth modem)
- Analog display unit; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Device
- Supply voltage; observe terminal voltage, observe cable specification

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



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

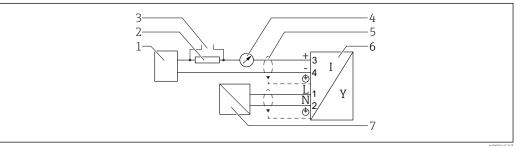
- Connection 4 to 20 mA HART (active): terminals 3 and 4
- Power supply connection: terminals 1 and 2
- Terminal for cable shield

A CAUTION

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 power supply. 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 switch must be marked as a disconnector for the device (61010IEC/).

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



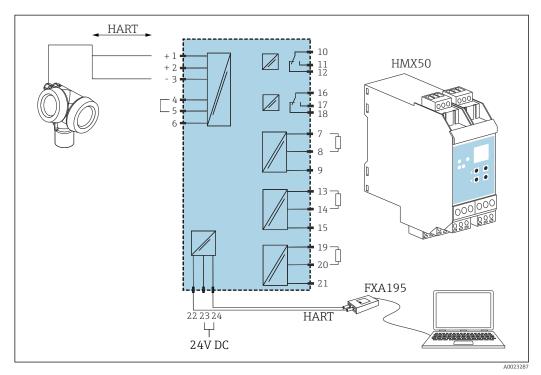
A00365

 \blacksquare 23 Function 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 (via VIATOR Bluetooth modem)
- 4 Analog display unit; observe maximum load
- 5 Cable screen; observe cable specification
- 6 Device
- 7 Supply voltage; observe terminal voltage, observe cable specification

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.



■ 24 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

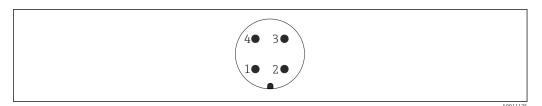
- Devices without integrated overvoltage protection
 Pluggable spring-force terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Devices with integrated overvoltage protection Screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)
- For ambient temperature $T_U \ge 60$ °C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

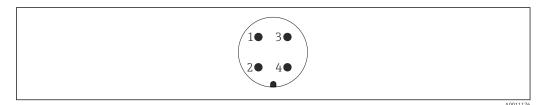
7.1.3 Device plug

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



■ 25 Pin assignment of M12 plug

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



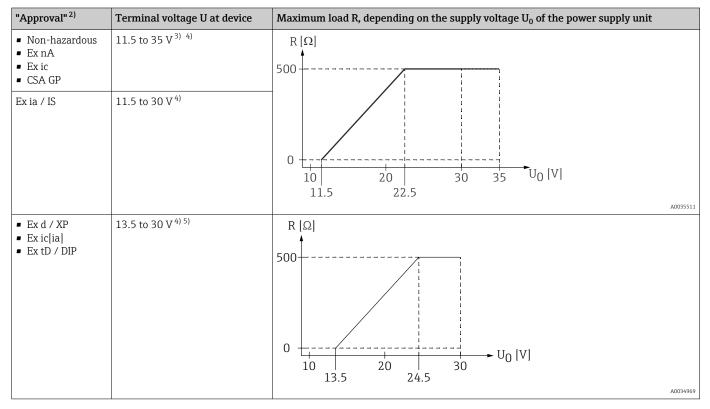
■ 26 Pin assignment of 7/8" plug

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

7.1.4 Supply voltage

2-wire, 4-20mA HART, passive

2-wire; 4-20mA HART 1)



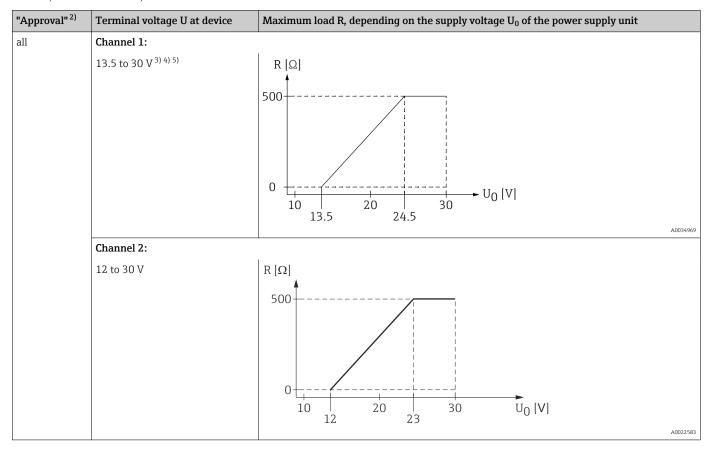
- 1) Feature 020 in the product structure: option A
- 2) Feature 010 in the product structure
- At ambient temperatures $T_a \le -30$ °C, a terminal voltage $U \ge 14$ V is required to start the device with the minimum failure current (3.6 mA). At ambient temperatures $T_a > 60$ °C, a terminal voltage $U \ge 12$ 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 $I \ge 4.5$ mA (HART Multidrop mode), a voltage $U \ge 11.5$ V in the entire ambient temperature range suffices.
- 4) If the Bluetooth module is used, the minimum supply voltage increases by 2 V.
- At ambient temperatures $T_a \le -30$ °C, a terminal voltage $U \ge 16$ 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]
■ Ex ia / IS ■ Ex ia + Ex d[ia] / IS + XP	13.5 to 30 V ^{3) 4)}	0 10 20 30 U ₀ [V] 13.5 24.5 35

- 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 $U \ge 16$ 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 $\,\mathrm{V}.$

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



- 1) Feature 020 in the product structure: option C
- 2) Feature 010 in the product structure
- At ambient temperatures $T_a \le -30$ °C, a terminal voltage $U \ge 16$ 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 $U \le 28$ 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 V
Permitted residual ripple with f = 100 to 10000 Hz	U _{SS} < 10 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 device is intended to be used for level measurement of flammable liquids which requires overvoltage protection in accordance with DIN EN 60079-14, test standard 60060-1 (10 kA, pulse $\frac{8}{20}$ µs): use the overvoltage protection module.

Integrated overvoltage protection module

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

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

Resistance per channel	Maximum 2 × 0.5 Ω
DC sparkover voltage	400 to 700 V
Trip surge voltage	< 800 V
Capacity at 1 MHz	< 1.5 pF
Nominal discharge current (8/20 µs)	10 kA

External overvoltage protection module

The HAW562 or HAW569 for example from Endress+Hauser are suitable options for external overvoltage protection.



More information is provided in the following documents:

■ HAW562: TI01012K ■ HAW569: TI01013K

7.2 Connecting the device

A WARNING

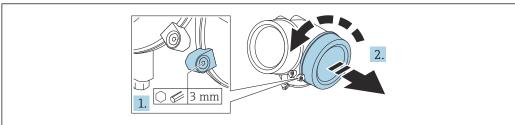
Explosion hazard!

- ► Comply with 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:

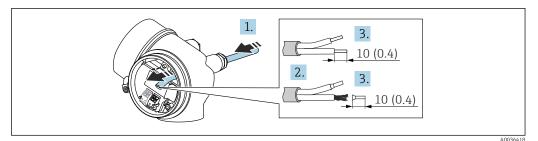
- For devices with a cover lock: Allen key AF3
- Wire stripper
- When using stranded cables: One ferrule for every wire to be connected.

7.2.1 Opening cover



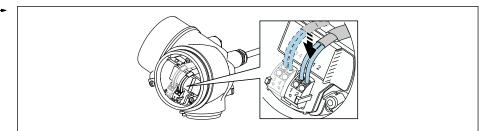
- 1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
- 2. Unscrew the connection compartment cover and check the cover seal; replace it if necessary.

7.2.2 Connecting



■ 27 Unit: mm (in)

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

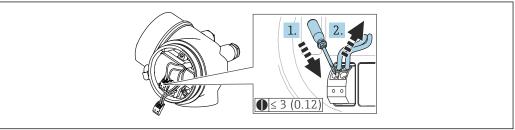


A003468

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.



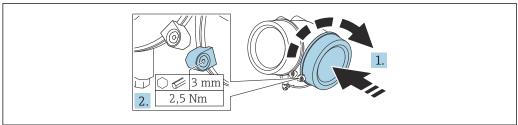
A0013661

■ 28 Unit: mm (in)

To remove the cable from the terminal again:

- 1. Use a flat-blade screwdriver \leq 3 mm (0.12 in) to 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



A0021491

- 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

- ☐ 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?
- \square Does the supply voltage match the specifications on the nameplate?
- \square 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?

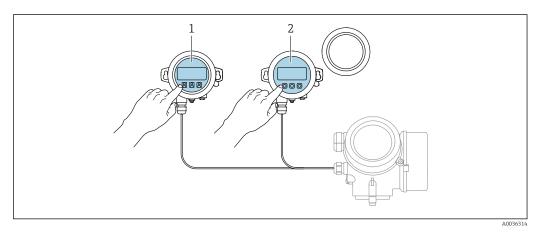
8 Operation options

8.1 Overview of operation options

8.1.1 Access to operating menu via local display

Operation with	Pushbuttons	Touch control	
Order code for "Display; operation"	Option C "SD02" Option E "SD03"		
	A0036312	A0036313	
Display elements	4-line display	4-line display White background lighting; switches to red in event of device errors	
	Format for displaying measured variables and status variables can be individually configured		
	Permitted ambient temperature for the display: -20 to $+70$ °C (-4 to $+158$ °F) The readability of the display may be impaired at temperatures outside the temperature range.		
Operating elements	Onsite operation with 3 pushbuttons (±, □, E) External operation via touch control; 3 optical keys: ±, □, E		
	Operating elements also accessible in various hazardous areas		
Additional functionality	Data backup function The device configuration can be saved in the display module.		
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration.		
	Data transfer function The transmitter configuration can be transmitted to another device using the display module.		

Operation with remote display and operating module FHX50



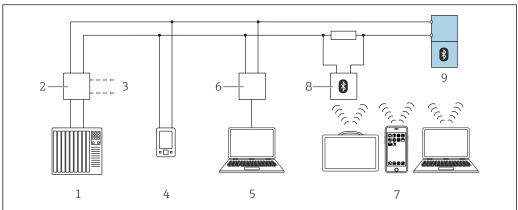
■ 29 FHX50 operating options

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

56

8.1.2 Access to the operating menu via the operating tool

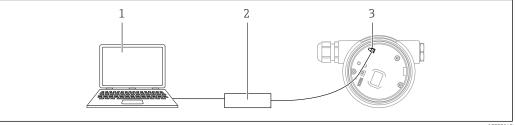
Via HART protocol



■ 30 Options for remote operation via HART protocol

- 1 PLC (programmable logic controller)
- Transmitter power supply unit, e.g. RN221N (with communication resistor) 2
- Connection for Commubox FXA195 and AMS $Trex^{TM}$ device communicator
- AMS $Trex^{TM}$ device communicator
- 5 Computer with operating tool (e.g. DeviceCare/FieldCare , AMS Device View, SIMATIC PDM)
- Commubox FXA195 (USB)
- $Field\ Xpert\ SMT70/SMT77,\ smartphone\ or\ computer\ with\ operating\ tool\ (e.g.\ Device Care/Field\ Care\ ,\ AMS)$ Device View, SIMATIC PDM)
- Bluetooth modem with connecting cable (e.g. VIATOR)
- Transmitter

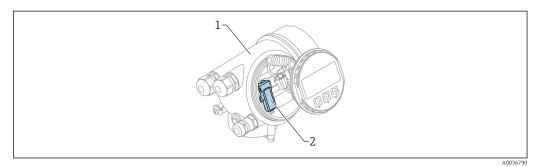
Via service interface (CDI)



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

Operation via Bluetooth® wireless technology

Requirements



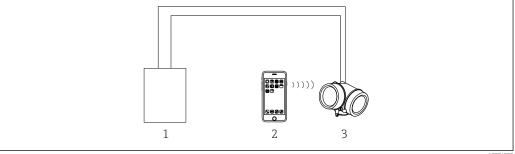
■ 31 Device with Bluetooth module

- 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)



A003493

- 32 Operation via SmartBlue (app)
- 1 Transmitter power supply unit
- 2 Smartphone / tablet with SmartBlue (app)
- 3 Transmitter with Bluetooth module

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

Menu	Submenu / parameter	Meaning
	Language ¹⁾	Defines the operating language of the local display
Commissioning ²⁾		Launches the interactive wizard for guided commissioning. Additional settings generally do not need to be made in the other menus when the wizard is finished.

Menu	Submenu / parameter	Meaning
Setup	Parameter 1 Parameter N	Once values have been set for these parameters, the measurement should usually be fully configured.
	Advanced setup	Contains additional submenus and parameters: For more accurate 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 measured 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 already contained in one of the other menus). This menu is organized	System	Contains all higher-level device parameters that do not affect measurement or measured value communication.
according to the function blocks of the device.	Sensor	Contains all parameters for configuring the measurement.
The parameters of the Expert menu are described in: GP01000F (HART)	Output	 Contains all parameters for configuring the analog current output. Contains all parameters to configure the switch output (PFS)
	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 \rightarrow Advanced setup \rightarrow Display"
- 2) Only if operating via an FDT/DTM system
- 3) Only available if operating via the local display
- 4) Only available if operating via DeviceCare or FieldCare
- 5) When you call up the "Expert" menu, you are always asked for an access code. If a customer-specific access code has not been defined, "0000" must be entered.

8.2.2 User roles and related access authorization

The two user roles **Operator** and **Maintenance** have different write access to the parameters if a device-specific access code has been defined. This protects the device configuration via the local display from unauthorized access $\rightarrow \triangleq 60$.

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 (if operating via the local display) or the **Access status tooling** parameter (if operating via an operating tool).

8.2.3 Data access - Security

Write protection via access code

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

Defining the access code via the local display

- Navigate to: Setup → Advanced setup → Administration → Define access code
 Define access code
- 2. Define a max. 4-digit numeric code as an access code.
- 3. Repeat the numeric code in the **Confirm access code** parameter to confirm it.
 - ► The 🗈-symbol appears in front of all write-protected parameters.

Defining the access code via 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 be only be deactivated again via this access code.
 - In the "Description of Device Parameters" documents, each write-protected parameter is identified with the 🛍-symbol.

Disabling write protection via access code

If the \bigcirc 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.

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

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

Deactivation of the write protection via access code

Via local display

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

Via an operating tool (e.g. FieldCare)

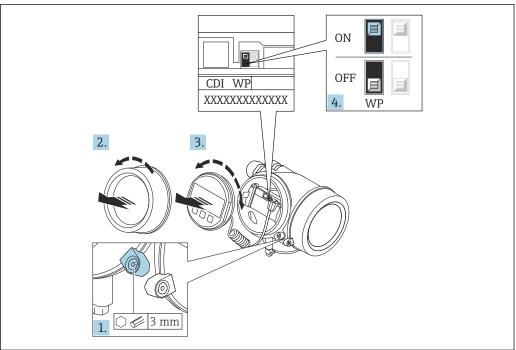
- 1. Navigate to: Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Define access code
- 2. Enter **0000**.
 - The write protection is deactivated. Parameters can be changed without entering an access code.

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.

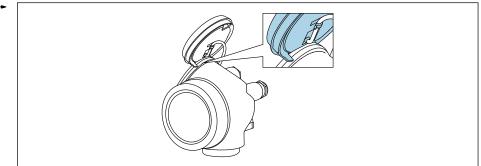
The parameter values are now read only and cannot be edited any more (exception "Contrast display" parameter):

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



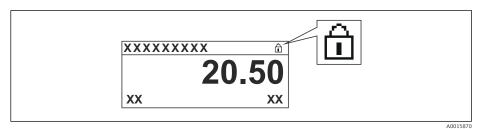
A0026157

- 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.



A0036086

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



If hardware write protection is disabled: No option is displayed in the **Locking status** parameter. On the local display, the \blacksquare 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. Reassemble the transmitter in the reverse order.

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.

Switching on the keypad lock manually

- 1. The device is in the measured value display.

 Press © for at least 2 seconds.
 - ► A context menu appears.
- 2. Select the **Keylock on** option in the context menu.
 - ► 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 © for at least 2 seconds.
 - ► A context menu appears.

- 2. Select the **Keylock off** option in the context menu.
 - The keypad lock is switched off.

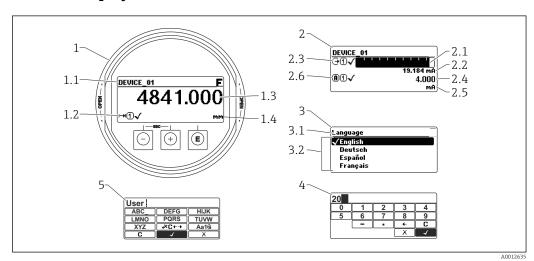
Bluetooth® wireless technology

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 is established between one sensor and one smartphone or tablet

8.3 Display and operating module

8.3.1 Display format



■ 33 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 drop-down list)
- 3.1 Header containing parameter name and error symbol (if an error is active)
- 3.2 Drop-down list; \square marks the current parameter value.
- 4 Input matrix for numbers
- 5 Input matrix for alphanumeric and special characters

Display symbols for the submenus

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

Status signals

Symbol	Meaning	
A0032902	"Failure" A device error has occurred. The measured value is no longer valid.	
The device is in the service mode (e.g. during a simulation).		
S	 "Out of specification" The device is operated: Outside its technical specifications (e.g. during startup or cleaning) Outside 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
A001314	Read-only parameter The parameter shown is only for display purposes and cannot be edited.
	Device locked
A001315	 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

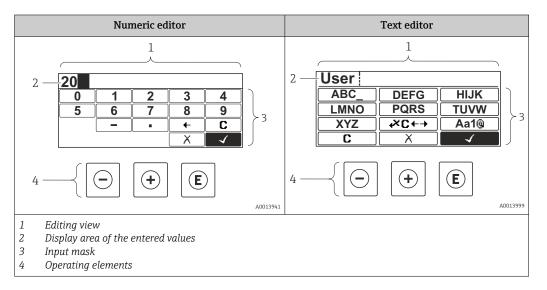
Symbol	Meaning
Measured values	
~~	Level
A0032892	
A0032893	Distance
()	Current output
A0032908	
(A)	Measured current
A0032894	
(Terminal voltage
A0032895	Electronics or sensor temperature
.	
Measuring channels	
Tricuburing chamicis	Measuring channel 1
(1)	Weasuring Chainter 1
A0032897	
2	Measuring channel 2
A0032898	
Status of the measure	d value
A0018361	"Alarm" status Measurement is interrupted. The output assumes the defined alarm condition. A diagnostic message is generated.
A0018360	"Warning" status The device continues to measure. A diagnostic message is generated.

8.3.2 Operating elements

Operating key	Meaning
	Minus key
_	In a menu, submenu Moves the selection bar upwards in a picklist.
A0018330	In the text and numeric editor In the input screen, 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	In the text and numeric editor In the input screen, moves the selection bar to the right (forwards).

Operating key	Meaning	
	Enter key	
	For measured value display ■ Pressing the key briefly opens the operating menu. ■ Pressing the key for 2 s opens the context menu.	
A0018328	 In a menu, submenu Pressing the key briefly: Opens the selected menu, submenu or parameter. Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. 	
	 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"). 	
	In the text and numeric editor Closes the text or numeric editor without applying changes.	
-+F	Minus/Enter key combination (press and hold down the keys simultaneously)	
A0032910	Reduces the contrast (brighter setting).	
++E A0032911	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

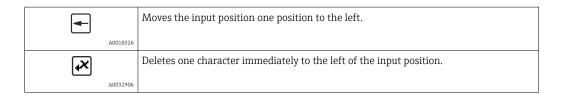
Symbol	Meaning	
0	Selection of numbers from 0 to 9	
9 A0013998		
A0016619	Inserts decimal separator at the cursor position.	
A0016620	Inserts minus sign at the cursor position.	
A0013985	Confirms selection.	
A0016621	Moves the input position one position to the left.	
X A0013986	Exits the input without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

Text editor

Symbol	Meaning
ABC_	Selection of letters from A to Z
XYZ A0013997	
Aa1 @	Toggle Between upper-case and lower-case letters For entering numbers For entering special characters
A0013985	Confirms selection.
4×□←→	Switches to the selection of the correction tools.
X A0013986	Exits the input without applying the changes.
A0014040	Clears all entered characters.

Text correction under ▼C←→

Symbol	Meaning
C	Clears all entered characters.
A0032907	
-	Moves the input position one position to the right.
A0018324	



8.3.4 Opening the context menu

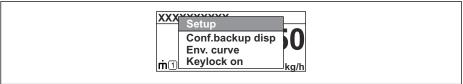
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- 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.



A00378

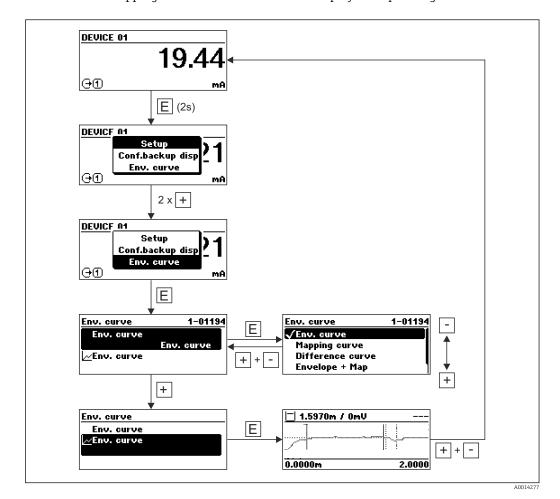
- 2. Press \Box + \pm simultaneously.
 - ► The context menu is closed and the operational display appears.

Calling up the menu via the context menu

- 1. Open the context menu.
- 2. Press ± to navigate to the desired menu.
- 3. Press 🗉 to confirm the selection.
 - ► The selected menu opens.

8.3.5 Envelope curve display on the display and operating module

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



9 System integration

9.1 Overview of the device description files

HART

Manufacturer ID	0x11
Device type code	0x1122
HART specification	7.0
DD files	Information and files available at: www.endress.com www.fieldcommgroup.org

9.2 Measured variables via HART protocol

The following measured values are assigned to the device variables at the factory:

Device variables for level measurement

Device variable	Measured 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 measurement

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

The assignment of the measured values to the device variables can be changed in the following submenu:

Expert \rightarrow Communication \rightarrow Output

10 Commissioning via SmartBlue (App)

10.1 Operation via Bluetooth® wireless technology (optional)

Prerequisite

- Device with device display including Bluetooth
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.05 or FieldXpert SMT70

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

The operating keys on the display are locked as soon as the device is connected via Bluetooth.

A flashing Bluetooth symbol indicates that a Bluetooth connection is available.

🚹 Please note the following

If the Bluetooth display is removed from one device and installed in another device:

- All the log-in data are only saved in the Bluetooth display and not in the device
- The password changed by the user is also saved in the Bluetooth display

10.1.1 Operation via SmartBlue App

The device can be operated and configured with the SmartBlue App.

- The SmartBlue App must be downloaded onto a mobile device for this purpose.
- For information on the compatibility of the SmartBlue App with mobile devices, see Apple App Store (iOS devices) or Google Play Store (Android devices).
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption.
- The Bluetooth® function can be deactivated after initial device setup.







A003320

■ 34 QR code for free Endress+Hauser SmartBlue App

Download and installation:

- 1. Scan the QR code or enter **SmartBlue** in the search field of the Apple App Store (iOS) or Google Play Store (Android).
- 2. Install and start the SmartBlue App.
- 3. For Android devices: enable location tracking (GPS) (not required for iOS devices).
- 4. Select a device that is ready to receive from the device list displayed.

Login:

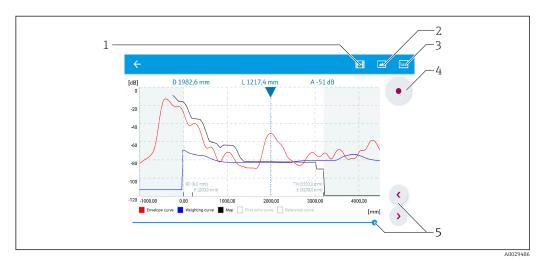
- 1. Enter the user name: admin
- 2. Enter the initial password: serial number of the device
- Change the password after logging in for the first time.
- Forgotten your password? Contact Endress+Hauser Service.

Envelope curve display in SmartBlue 10.2

Envelope curves can be displayed and recorded in SmartBlue.

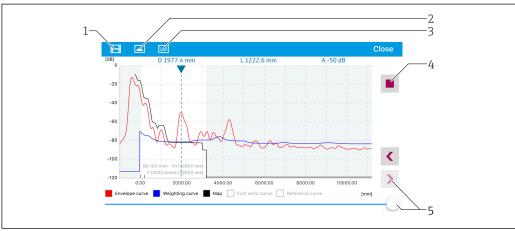
In addition to the envelope curve, the following values are displayed:

- 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



Envelope curve display (sample) in SmartBlue for Android

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



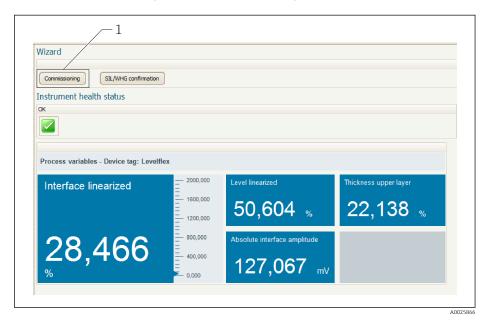
 \blacksquare 36 Envelope curve display (sample) in SmartBlue for iOS

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

11 Commissioning using the wizard

FieldCare and DeviceCare have a wizard that guides the user through initial commissioning.

- 1. Connect the device with FieldCare or DeviceCare.
- 2. Open the device in FieldCare or DeviceCare.
 - └ The dashboard (homepage) of the device is displayed:



l "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.

12 Commissioning via operating menu

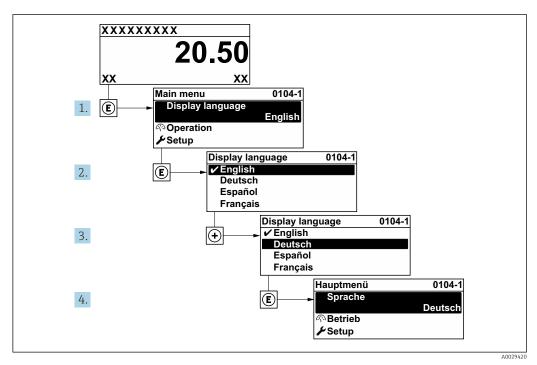
12.1 Installation and function check

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.

- Post-mounting check
- Post-connection check

12.2 Configuring the operating language

Factory setting: English or ordered local language



■ 37 Using the example of the local display

12.3 Checking the reference distance

This section applies only to the FMP54 with gas phase compensation (product structure: feature 540 "Application Package", 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:

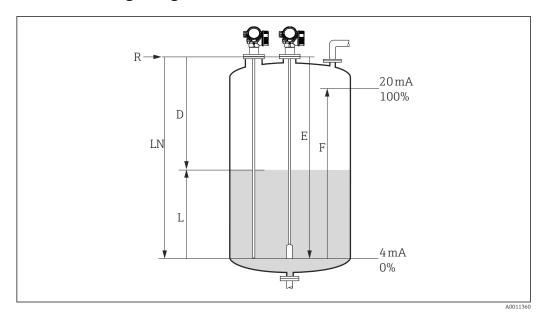
After mounting the rod probe in the stilling well or bypass, check and - if necessary - correct the setting of the reference distance in the unpressurized state. The level should be at least 200 mm below the reference distance $L_{\rm ref}$ in order to achieve maximum accuracy.

Step	Parameter	Action
1	Expert \rightarrow Sensor \rightarrow Gas phase compensation \rightarrow GPC mode	Select the On option to enable gas phase compensation.
2	Expert → Sensor → Gas phase compensation → 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	Accept 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



38 Configuration parameters for level measurement in liquids

LN Length of probe

- R Reference point of the measurement
- D Distance
- L Level
- *E Empty calibration (= zero point)*
- F Full calibration (= span)
- If the ε_r value is lower than 7 in the case of rope probes, measurement is not possible in the area of the probe weight. The empty calibration E should not exceed LN 250 mm (LN 10 in) in these cases.
- 1. Setup → Device tag
 - ► Enter the tag name.
- 2. For devices in the "Interface measurement" application package:

Navigate to: Setup → Operating mode

- Select the **Level** option.
- 3. Navigate to: Setup \rightarrow Distance unit
 - ► Select the length unit.
- 4. Navigate to: Setup → Tank type
 - ► Select tank type.
- 5. For **Tank type** parameter = Bypass / pipe:

Navigate to: Setup → Tube diameter

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

- **10**. Navigate to: Setup → Distance
 - └ Displays the distance D between the reference point R and the level L.
- 11. Navigate to: Setup → Signal quality
 - └ Displays the signal quality of the analyzed level echo.
- **12.** Operation via local display:

Navigate to: Setup \rightarrow Mapping \rightarrow Confirm distance

Compare the distance displayed with the actual value to start recording an interference echo map if necessary.

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

13. Operation via operating tool:

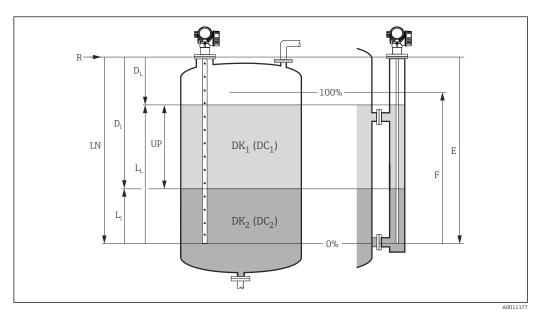
Navigate to: Setup \rightarrow Confirm distance

Compare the distance displayed with the actual value to start recording an interference echo map if necessary.

NOTICE For FMP54 with gas phase compensation (product structure: feature 540 "Application Package", option EF or EG) a 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".



■ 39 Configuration parameters for interface measurement

LN Length of probe

- R Reference point of the measurement
- DI Interface distance (distance from flange to lower medium)
- LI Interface
- DL Distance
- LL Level
- UP Thickness upper layer
- *E* Empty calibration (= zero point)
- F Full calibration (= span)
- 1. Navigate to: Setup → Device tag
 - ► Enter the tag name.
- 2. Navigate to: Setup → Operating mode
 - ► Select the **Interface** option.
- 3. Navigate to: Setup \rightarrow Distance unit
 - ► Select the length unit.
- 4. Navigate to: Setup → Tank type
 - ► Select tank type.
- 5. For **Tank type** parameter = Bypass / pipe:

Navigate to: Setup → Tube diameter

- ► Specify the diameter of the bypass or stilling well.
- 6. Navigate to: Setup → Tank level
 - ► Specify the filling level (**Fully flooded** or **Partially filled**)
- 7. Navigate to: Setup \rightarrow Distance to upper connection
 - In bypasses: Specify the distance from the reference point R to the lower edge of the upper outflow. In all other cases, retain the factory setting.
- 8. Navigate to: Setup \rightarrow DC value
 - Specify the relative dielectric constant (ε_r) of the upper medium.

- 9. Navigate to: Setup → Empty calibration
 - ► Specify 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
 - ► Displays the measured level L_L.
- 12. Navigate to: Setup → Interface
 - Displays the interface height L_I.
- 13. Navigate to: Setup → Distance
 - ightharpoonup Displays the distance D_L between the reference point R and the level L_L .
- 14. Navigate to: Setup → Interface distance
 - ightharpoonup 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 to start recording an interference echo map if necessary.

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

17. Via an operating tool (e.g. FieldCare):

Navigate to: Setup → Confirm distance

Compare the distance displayed with the actual value to start recording an interference echo map if necessary.

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

12.6 Recording the reference echo curve

After the measurement has been configured, it is recommended to record the current envelope curve as a reference echo 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 echo 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.



■ 40 "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 (For devices with two current outputs)	Relative echo amplitude	0 mV	2 000 mV

12.8.2 Factory setting of current outputs for interface measurements

Current output	Assigned measured value	4mA value	20mA value
1	Interface linearized	0% or the corresponding linearized value	100% or the corresponding linearized value
2 (For devices with two current outputs)	Level linearized	0% or the corresponding linearized value	100% or the corresponding linearized value

12.8.3 Adjusting the current outputs

The current outputs can be adjusted in the following submenus:

Basic setup

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 → Advanced setup → Configuration backup display → Configuration management

Meaning of the options

Cancel

No action is executed and the user exits the parameter.

■ Execute backup

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

Restore

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

Duplicate

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

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

Compare

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

Clear backup data

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

- While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.
- If an existing backup copy is restored on a device other than the original device using the **Restore** option, in some cases individual device functions may not be available. In some cases it is also not possible to restore the original state by resetting to the "asdelivered" 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)

13.1.2 Error - SmartBlue operation

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	Android end device	Is the location function permitted for the app, was it approved the first time?
via 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 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 Bluetooth module) and change, paying attention to lower/upper case
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)

13.1.3 Parameter configuration errors

Parameter configuration errors for level measurements

Error	Possible cause	Solution
Measured value is incorrect	If measured distance (Setup → Distance) matches the real distance: Calibration error	 Check the Empty calibration parameter (→ ☐ 137) and correct if necessary. Check the Full calibration parameter (→ ☐ 138) and correct if necessary. Check the linearization and correct if necessary (Linearization submenu (→ ☐ 163)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo is present.	Carry out mapping (Confirm distance parameter ($\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
No change of measured value on filling/emptying	An interference echo is present.	Carry out mapping (Confirm distance parameter ($\Rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
	Buildup at the probe.	Clean the probe.

Error	Possible cause	Solution
	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 $(\rightarrow \boxminus 136)$. If necessary, select a more detailed setting with the Medium property parameter $(\rightarrow \boxminus 151)$.
	Level echo suppressed.	Delete the map and record it again if necessary (Record map parameter (→ 🖺 147)).
Device displays a level when the tank is empty.	Incorrect probe length	Perform a probe length correction (Confirm probe length parameter (→ 🖺 179)).
	Interference echo	Carry out mapping over the entire probe length when the tank is empty (Confirm distance parameter (→ 🖺 145)).
Wrong slope of the level over the entire measuring range	Wrong tank type selected.	Select the correct Tank type parameter (→ 🖺 136).

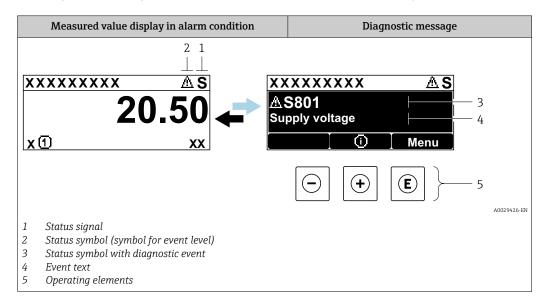
Parameter configuration errors for interface measurements

Error	Possible cause	Solution
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 (→ 🖺 154)).
level displayed jumps to higher values when the tank is emptied.		Set Tank level parameter (→ 🖺 142) = 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 154)).
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 (→ 🖺 143)).
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 (→ 🖺 143)).
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 instrument are displayed as a diagnostic message in alternation with the measured value display.



Status signals

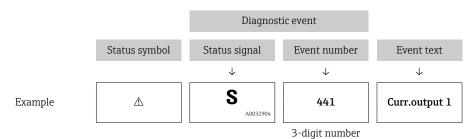
A0032902	"Failure (F)" option A device error has occurred. The measured value is no longer valid.
C	"Function check (C)" option The device is in the service mode (e.g. during a simulation).
S	 "Out of specification (S)" option The device is operated: Outside its technical specifications (e.g. during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

Status symbols (symbol for event level)

8	"Alarm" status Measurement is interrupted. The signal outputs adopt the defined alarm state. A diagnostic message is generated.
Δ	"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 several diagnostic events are pending at the same time, only the diagnostic message with the highest priority is displayed. 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.			
Enter key Opens the operating menu.				

XXXXXXXX XXXXXXXX ΔS **AS801** Supply voltage χŒ 1. $(\mathbf{+})$ Diagnostic list \triangle S Diagnostics 1 ∆ S801 Supply voltage Diagnostics 2 Diagnostics 3 2. ₤ Supply voltage (ID:203) — 3 △ S801 0d00h02m25s **—** 5 Increase supply voltage 3. $| \ominus | + | \oplus |$

13.2.2 Calling up remedial measures

A0029431-EN

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

The user is in the diagnostic message.

- 1. Press ± (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 **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.

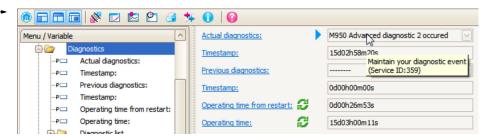
13.3 Diagnostic event in the operating tool

If a diagnostic event has occurred in the device, the status signal appears in the top left status area of the operating tool together with the corresponding symbol for the event level according to NAMUR NE 107:

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

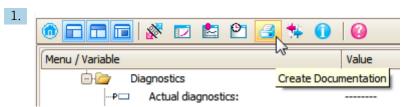
A: Via the operating menu

- 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 area, hover the cursor over the **Actual diagnostics** parameter.

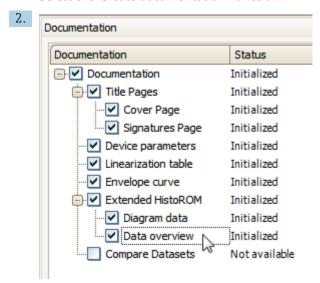


A tool tip with remedy information for the diagnostic event appears.

B: Via the "Create Documentation" function



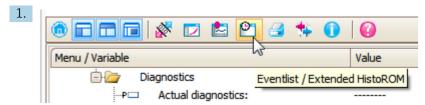
Select the "Create documentation" function.



Make sure that "Data overview" is marked.

- 3. Click "Save as..." and save a PDF of the report.
 - ightharpoonup The report contains the diagnostic messages including remedial measures.

C: Via the "Event list/Extended HistoROM" function



Select the ("Event list/Extended HistoROM") function.



Select the "Load event list" function.

The event list including remedial measures is displayed 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 → Diagnostic list

Calling up and closing the remedial measures

- 1. Press €.
 - └ 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 sensor						
003	Broken probe detected	1. Check map 2. 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 el	lectronic			'		
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 co	onfiguration					
410	Data transfer	Check connection 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
801	Energy too low	Increase supply voltage	S	Warning
803	Current loop	Check wiring Change I/O module	F	Alarm
825	Operating temperature	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	M	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**

(This submenu only exists if operating via the local display. In the case of operation via FieldCare, the event list can be displayed with the "Event list/HistoROM" functionality of FieldCare.

Navigation path

 $Diagnostics \rightarrow Event logbook \rightarrow Event list$

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

The event history includes entries for:

- Diagnostic events
- Information events

In addition to the operating time when the event occurred, each event is also assigned a symbol that indicates whether the event has occurred or is finished:

- Diagnostic event
 - ①: Occurrence of the event
 - 🕒: End of the event
- Information event
 - €: Occurrence of the event

Calling up and closing the remedial measures

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

13.6.2 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

Diagnostics \rightarrow Event logbook \rightarrow Filter 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		
11000	(Device ok)		
I1089	Power on		
11090	Configuration reset		
I1091	Configuration changed		

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		

13.7 Firmware history

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/10.10 • GP01000F/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	

Date	Firmware	re Modifications	Documentation (FMP51, FMP52, FMP54, HART)		
version			Operating Instructions	Description of Device Parameters	Technical Information
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		■ TI01001F/00/EN/17.13 ■ TI01001F/00/EN/18.14
04.2016	01.03.zz	 Update to HART 7 All 17 languages are available in the device Improvements and bugfixes 	■ BA01001F/00/EN/18.16 ■ BA01001F/00/EN/ 19.16 ¹⁾ ■ BA01001F/00/EN/ 21.18 ²⁾	GP01000F/00/EN/16.16	 TI01001F/00/EN/20.16 TI01001F/00/EN/22.16 ¹⁾ TI01001F/00/EN/24.18 ²⁾

- 1) Contains information on the Heartbeat wizards available in the current DTM version for DeviceCare and. FieldCare
- 2) Contains information on the Bluetooth interface.

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

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 Repairs to Ex-approved devices

A WARNING

Incorrect repair can compromise electrical safety!

Explosion hazard!

- ► Repairs to Ex-approved 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

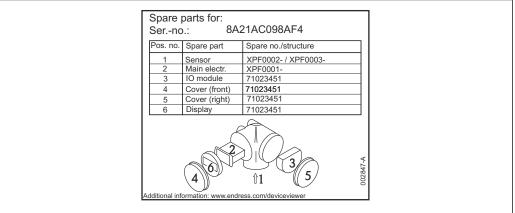
Once a complete device has been replaced, the parameters can be transferred back into the device using one of the following methods:

- 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 instrument 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 instrument, including their ordering information.
 - The URL to the *W@M Device Viewer* (www.endress.com/deviceviewer):
 All the spare parts for the measuring instrument, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.



A0014979

ceil 42 Example for spare part nameplate in the connection compartment cover

- Measuring instrument 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: https://www.endress.com/support/return-material
 - ► Select the region.
- 2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

15.4 Disposal



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

The accessories currently available for the product can be selected at www.endress.com:

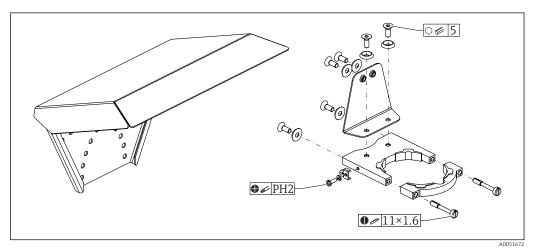
- 1. Select the product using the filters and search field.
- 2. Open the product page.
- 3. Select **Spare parts & Accessories**.

16.1 Device-specific accessories

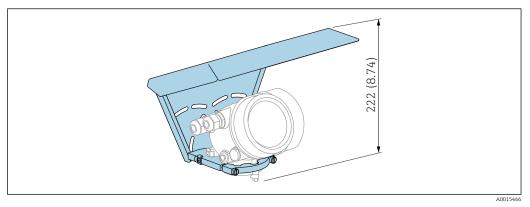
16.1.1 Weather protection cover

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

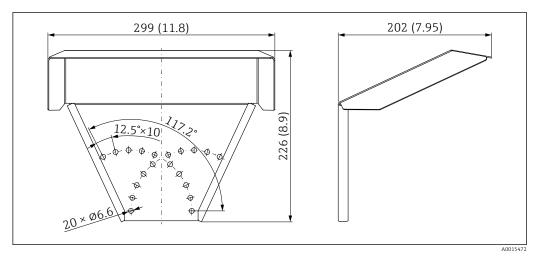
It is used to protect against direct sunlight, precipitation and ice.



■ 43 Overview



■ 44 Height. Unit of measurement mm (in)



€ 45 Dimensions. Unit of measurement mm (in)

Material

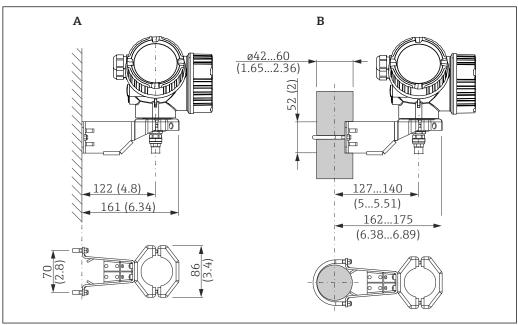
- Protection cap; 316L (1.4404)
- Bracket; 316L (1.4404)
- Angle bracket; 316L (1.4404)
- Clamping screw; 316L (1.4404) + carbon fiber
- Molded rubber part (4x); EPDM
- Screws; A4
- Disks; A4
- Ground terminal; A4, 316L (1.4404)

Order number for accessories:

71162242

16.1.2 Mounting bracket for electronics housing

With "remote sensor" device versions (feature 060 in the product structure), the mounting bracket is included in the scope of delivery. It can be ordered as a separate accessory.

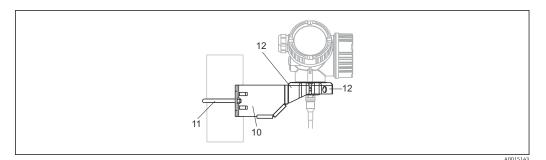


€ 46 Mounting bracket for electronics housing; unit: mm (in)

- Wall mounting
- В Post mounting

Endress+Hauser 101

A0014793



■ 47 Material; mounting bracket

- Bracket, 316L (1.4404)
 Round bracket, 316L (1.4404); screws/nuts, A4-70; distance sleeves, 316L (1.4404)
 Half-shells, 316 L (1.4404)

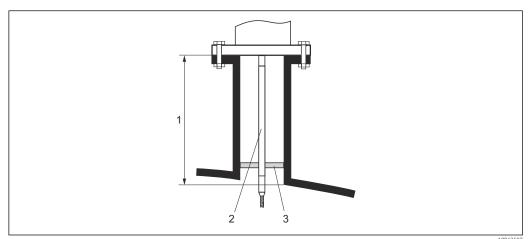
Order number for accessories:

71102216

102

16.1.3 Rod extension (centering device) HMP40

The rod extension (centering device) HMP40 is ordered via the Product Configurator.



- 1 Nozzle height
- 2 Extension rod
- 3 Centering disk

Permitted temperature at lower edge of nozzle:

- Without centering disk, no restriction
- With centering disk, -40 to +150 °C (-40 to +302 °F)



For details, see SD01002F.

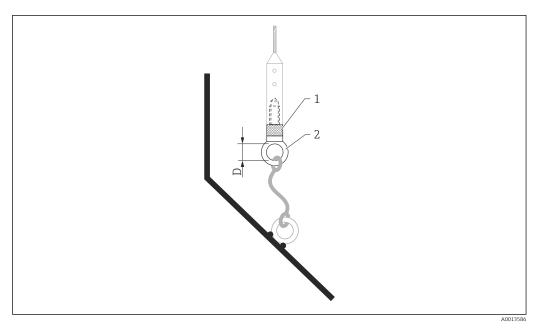
16.1.4 Mounting kit, insulated

To secure rope probes so that they are reliably insulated.

Maximum process temperature: 150 °C (300 °F)

Mounting set, insulated, can be used for:

- FMP51
- FMP54



■ 48 Scope of delivery of mounting kit:

- 1 Insulation sleeve
- 2 Ring bolt

For rope probes 4 mm ($\frac{1}{6}$ in) or 6 mm ($\frac{1}{4}$ in) with PA > steel: Diameter D = 20 mm (0.8 in)

Order number for accessories:

52014249

For rope probes 6 mm ($\frac{1}{4}$ in) or 8 mm ($\frac{1}{3}$ in) with PA > steel: Diameter D = 25 mm (1 in)

Order number for accessories:

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.

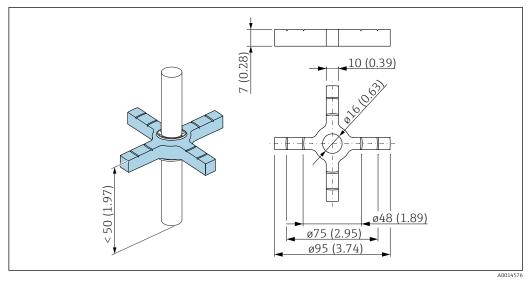
The mounting kit can also be ordered directly with the device (Levelflex product structure, feature 620 "Accessory enclosed", version PG "mounting kit, insulated, rope").

16.1.5 Centering star

Centering star PEEK, Ø 48 to 95 mm (1.89 to 3.74 in)

Suitable for:

- FMP51
- FMP54



■ 49 Dimensions; centering star PEEK Ø 48 to 95 mm (1.89 to 3.74 in)

The centering star is suitable for probes with a rod diameter of 16 mm (0.6 in) and can be used in pipes from DN50 to DN100. The markings make it easer to cut to size, ensuring that the centering star can be adjusted to the pipe diameter.

 \blacksquare For details, see SD02316F.

- Material of centering star: PEEK
- Material of retaining rings: PH15-7Mo (UNS S15700)
- Permitted process temperature range: -60 to +250 °C (-76 to +482 °F)

Order number for accessories:

71069064

- If the centering star is used in a bypass, it must be positioned below the lower bypass outlet. This must be taken into account when choosing the probe length. In general, the centering star should not be mounted more than 50 mm (1.97") above the probe tip. It is advised not to use the PEEK centering star in the measuring range of the rod probe.
- The PEEK centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OD). In this case, it is not secured to the rod using the retaining rings, but instead is secured using a hexagonal-headed bolt (A4-70) and a Nord Lock washer (1.4547) at the tip of the probe rod.

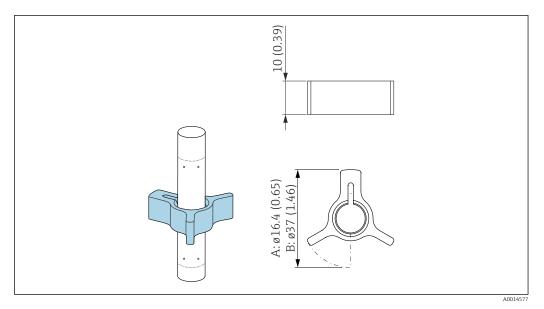
Centering star PFA

Suitable for:

- FMP51
- FMP52
- FMP54

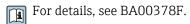
Available versions:

- Ø 16.4 mm (0.65 in)
- Ø 37 mm (1.46 in)



- 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.



- Material: PFA
- Permitted process temperature range: -200 to +250 °C (-328 to +482 °F)

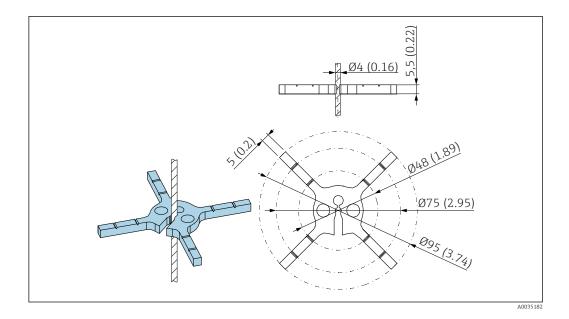
Order number for accessories:

- 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).

Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in)

Suitable for:

- FMP51
- FMP52
- FMP54



The centering star is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) (including coated rope probes).

For details, see SD01961F.

- Material: PEEK
- Permitted process temperature range: -60 to +250 °C (-76 to +482 °F)

Order number for accessories:

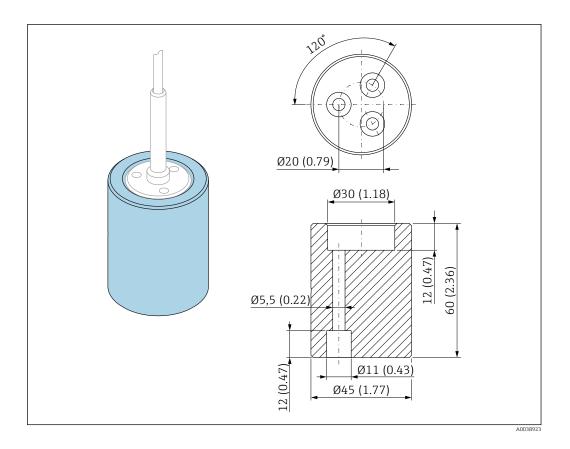
- 71373490 (1x)
- 71373492 (5x)

16.1.6 Centering weight

Centering weight 316 L for DN50/2" pipes

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.

The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OK** (for pipe DN50/2").

Centering weight 316 L for pipes ≥ DN80/3"

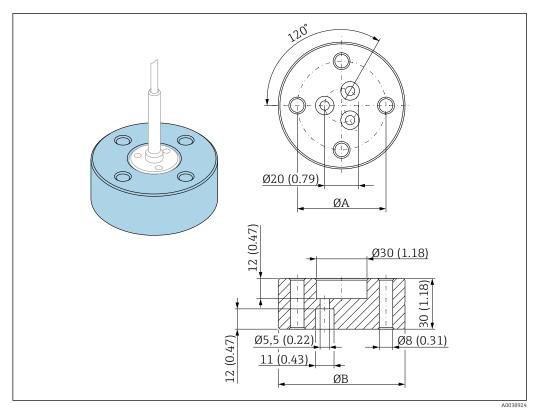
Suitable for:

- FMP51
- FMP54

Available versions:

- Ø 75 mm (2.95 in)
- Ø 95 mm (3.7 in)

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 $\emptyset A = 52.5 \text{ mm } (2.07 \text{ in}) \text{ for } DN80/3" \text{ pipe}$

= 62.5 mm (2.47 in) for DN100/4" pipe

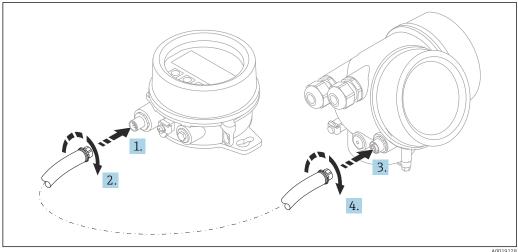
 $\emptyset B = 75 \text{ mm } (2.95 \text{ in}) \text{ for } DN80/3" \text{ pipe}$

= 95 mm (3.7 in) for DN100/4" pipe

The centering weight is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) and can be used in DN80/3" or DN100/4" pipes.

The centering weight can be ordered directly with the device (product structure Levelflex) or as a probe without a process connection (product structure XPF0005-) using feature 610 "Accessory mounted", version **OL** (for pipe DN80/3") or **OM** (for pipe DN100/4").

16.1.7 Remote display FHX50



A001912

109

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 provided by customer onsite up to 60 m (196 ft)
- Ambient temperature: -40 to 80 °C (-40 to 176 °F)
- Ambient temperature, optionally available for order. −50 to 80 °C (−58 to 176 °F)

 NOTICE If the temperature is permanently below −40 °C (−40 °F), higher failure rates can be expected.

Ordering information

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

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

- If a measuring instrument 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 can only be retrofitted with the FHX50 if the option "Prepared for FHX50" is listed under *Basic specifications*, "Display, operation" in the Safety instructions (XA) for the device.

Also refer to the Safety Instructions (XA) of the FHX50.

Retrofitting is not possible on transmitters with:

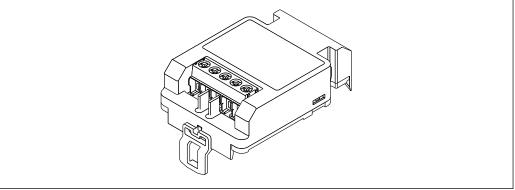
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Type of protection Ex nA
- For details, see "Special Documentation" document SD01007F.

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



A0021734

Technical data

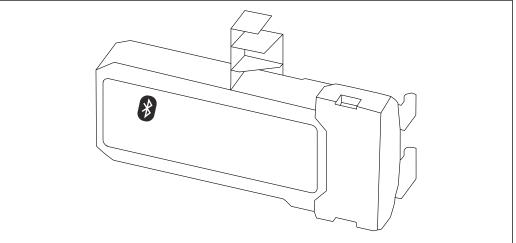
- Resistance per channel: $2 \times 0.5 \Omega_{max}$ ■ Threshold DC voltage: 400 to 700 V
- Threshold surge voltage: < 800 V
- Capacitance at 1 MHz: < 1.5 pF
- Nominal leakage current (8/20 µs): 10 kA
- Suitable for conductor cross-sections: 0.2 to 2.5 mm² (24 to 14 AWG)

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: 71185516Housing GT19: 71185518Housing GT20: 71185517
- $oxed{\mathbb{F}}$ 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.



A0036493

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" TI00404F

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" TIO1297S 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 TIO1229S and Operating Instructions ${\tt BA00050S}$

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

16.3 Service-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

16.4.1 Memograph M RSG45

The Advanced Data Manager is a flexible and powerful system for organizing process values.

The Memograph M is used for electronic acquisition, display, recording, analysis, remote transmission and archiving of analog and digital input signals as well as calculated values.



Technical Information TI01180R and Operating Instructions BA01338R

16.4.2 RN42

Single-channel active barrier with wide-range power supply for safe electrical isolation of 4 to 20 mA standard signal circuits, HART transparent.

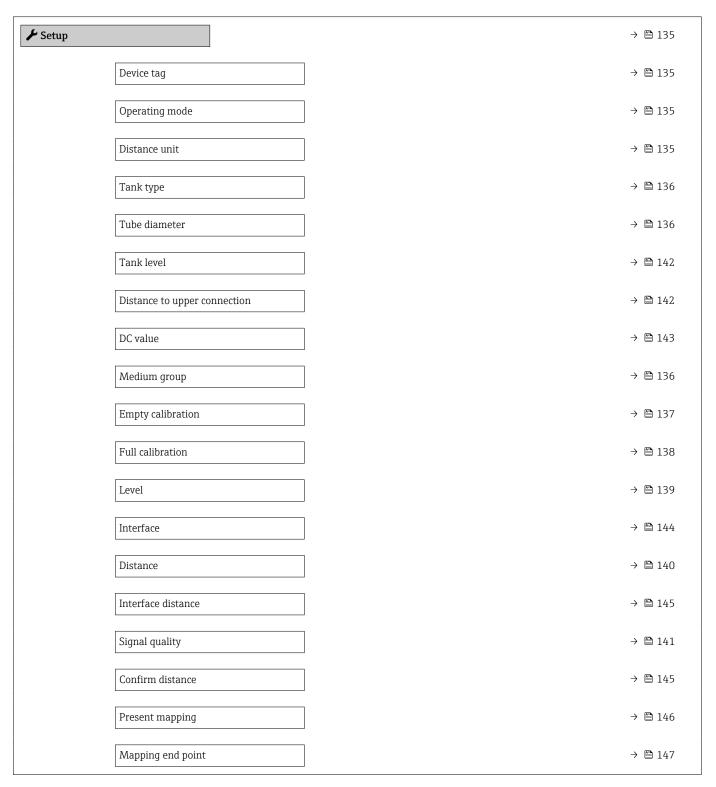


Technical Information TI01584K and Operating Instructions BA02090K

17 Operating menu

17.1 Overview of the operating menu (SmartBlue)

Navigation SmartBlue



Record map			→ 🖺 147
► Advanced setup			→ 🖺 149
	Locking status		→ 🖺 149
	Access status toolin	ng	→ 🖺 149
	Enter access code		→ 🖺 150
	► Level		→ 🖺 151
		Medium type	→ 🖺 151
		Medium property	→ 🖺 151
		Process property	→ 🖺 152
		Advanced process conditions	→ 🖺 153
		Level unit	→ 🖺 154
		Blocking distance	→ 🖺 154
		Level correction	→ 🖺 155
	► Interface		→ 🖺 156
		Process property	→ 🖺 156
		DC value lower medium	→ 🖺 156
		Level unit	→ 🖺 157
		Blocking distance	→ 🖺 157
		Level correction	→ 🖺 158
		Manual thickness upper layer	→ 🖺 158
		Measured thickness upper layer	→ 🖺 159
		DC value	→ 🖺 159
		Calculated DC value	→ 🖺 159
		Use calculated DC value	→ 🖺 160
	► Advanced setup	► Advanced setup Locking status	Locking status Access status tooling Enter access code ▶ Level Medium type Medium property Process property Advanced process conditions Level unit Blocking distance Level correction ▶ Interface Process property DC value lower medium Level unit Blocking distance Level correction Manual thickness upper layer Measured thickness upper layer DC value Calculated DC value

► Linearization		→ 🖺 163
Linearization		7 월 103
	Linearization type	→ 🖺 165
	Unit after linearization	→ 🖺 166
	Free text	→ 🖺 167
	Level linearized	→ 🖺 168
	Interface linearized	→ 🖺 168
	Maximum value	→ 🖺 168
	Diameter	→ 🖺 169
	Intermediate height	→ 🖺 169
	Table mode	→ 🖺 169
	Table number	→ 🖺 170
	Level	→ 🖺 171
	Level	→ 🖺 171
	Customer value	→ 🖺 171
	Activate table	→ 🗎 171
► Probe settings		→ 🖺 178
	Probe grounded	→ 🗎 178
	Present probe length	→ 🖺 178
	Confirm probe length	→ 🖺 179
► Safety settings		→ 🖺 173
	Output echo lost	→ 🖺 173
	Value echo lost	→ 🖺 173
	Ramp at echo lost	→ 🖺 174
	Blocking distance	→ 🖺 154

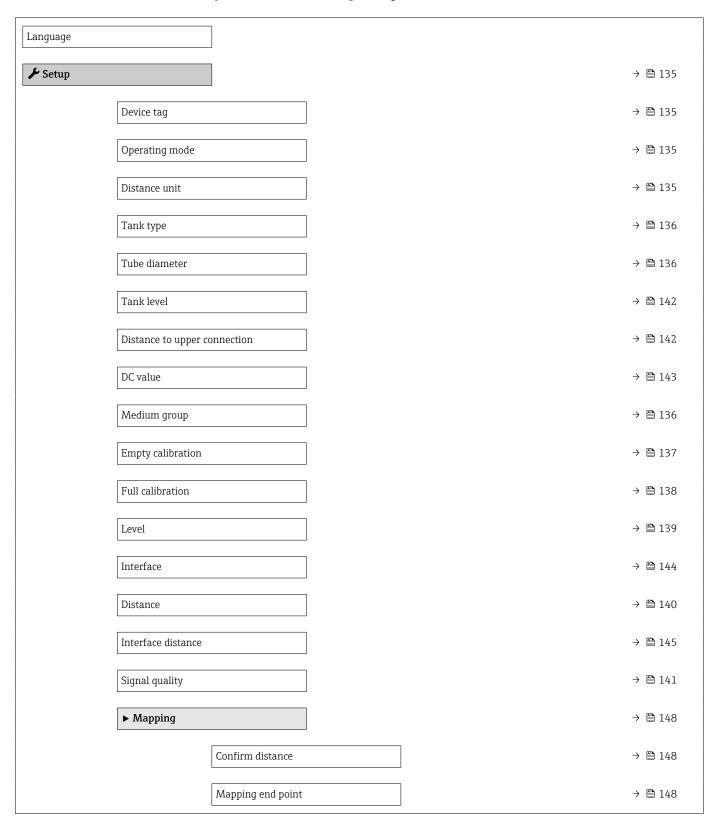
	► Current output 1	to 2	→ 🖺 182
		Assign current output	→ 🗎 182
		Current span	→ 🗎 183
		Fixed current	→ 🖺 184
		Damping output	→ 🗎 184
		Failure mode	→ 🖺 184
		Failure current	→ 🖺 185
		Output current 1 to 2	→ 🖺 186
	► Switch output		→ 🖺 187
		Switch output function	→ 🖺 187
		Assign status	→ 🖺 188
		Assign limit	→ 🖺 188
		Assign diagnostic behavior	→ 🖺 188
		Switch-on value	→ 🖺 189
		Switch-on delay	→ 🖺 190
		Switch-off value	→ 🖺 190
		Switch-off delay	→ 🖺 191
		Failure mode	→ 🖺 191
		Switch status	→ 🖺 191
		Invert output signal	→ 🖺 191
♥ Diagnostics			→ 🖺 205
Actual diagnostics			→ 🖺 205
Timestamp			→ 🖺 205
Previous diagnostics			→ 🖺 205
Timestamp			→ 🖺 206

Operating time	e from restart	→ 🖺 206
Operating time	2	→ 🖺 199
► Diagnostic	list	→ 🖺 207
	Diagnostics 1 to 5	→ 🖺 207
	Timestamp 1 to 5	→ 🖺 207
► Measured v	ralues	→ 🖺 212
	Distance	→ 🖺 140
	Level linearized	→ 🖺 168
	Interface distance	→ 🖺 145
	Interface linearized	→ 🖺 168
	Thickness upper layer	→ 🖺 214
	Output current 1 to 2	→ 🖺 186
	Measured current 1	→ 🖺 214
	Terminal voltage 1	→ 🖺 215
► Device info	rmation	→ 🖺 209
	Device tag	→ 🖺 209
	Serial number	→ 🖺 209
	Firmware version	→ 🖺 209
	Device name	→ 🖺 209
	Order code	→ 🖺 210
	Extended order code 1 to 3	→ 🖺 210
	Device revision	→ 🖺 210
	Device ID	→ 🖺 210

Device type	→ 🖺 211
Manufacturer ID	→ 🖺 211
	→ 🖺 220
Assign measurement variable	→ 🖺 221
Process variable value	→ 🖺 221
Current output 1 to 2 simulation	→ 🖺 221
Value current output 1 to 2	→ 🖺 222
Switch output simulation	→ 🖺 222
Switch status	→ 🖺 222
	→ 🖺 223
	Assign measurement variable Process variable value Current output 1 to 2 simulation Value current output 1 to 2 Switch output simulation

17.2 Overview of the operating menu (display module)

Navigation © Operating menu



	Record map			→ 🖺 148
	Distance]	→ 🗎 148
► Advanced setup				→ 🖺 149
	Locking status			→ 🖺 149
	Access status displa	ay		→ 🖺 150
	Enter access code			→ 🖺 150
	► Level			→ 🖺 151
		Medium type		→ 🖺 151
		Medium property		→ 🖺 151
		Process property		→ 🖺 152
		Advanced process c	onditions	→ 🖺 153
		Level unit		→ 🖺 154
		Blocking distance		→ 🗎 154
		Level correction		→ 🖺 155
	► Interface			→ 🖺 156
		Process property		→ 🖺 156
		DC value lower med	lium	→ 🖺 156
		Level unit		→ 🖺 157
		Blocking distance		→ 🖺 157
		Level correction		→ 🖺 158
		► Automatic DC ca	alculation	→ 🖺 161
			Manual thickness upper layer	→ 🖺 161
			DC value	→ 🖺 161
			Use calculated DC value	→ 🖺 161

			_
► Linearization			→ 🖺 163
Lin	nearization type		→ 🖺 165
Un	nit after linearizati	on	→ 🖺 166
Fre	ee text		→ 🖺 167
Ma	aximum value		→ 🖺 168
Dia	ameter		→ 🖺 169
Int	termediate height		→ 🖺 169
Tal	ble mode		→ 🖺 169
▶1	Edit table		
		Level	
		Customer value	
Ac	tivate table		→ 🖺 171
► Safety settings			→ 🗎 173
Ou	itput echo lost		→ 🖺 173
Va	llue echo lost		→ 🖺 173
Rai	mp at echo lost		→ 🖺 174
Blo	ocking distance		→ 🖺 154
► SIL/WHG confirmati	ion		→ 🖺 176
► Deactivate SIL/WHG	3		→ 🖺 177
Res	set write protectio	on	→ 🖺 177
Coo	de incorrect		→ 🖺 177

► Probe settings			→ 🖺 178
	Probe grounded		→ 🖺 178
	► Probe length co	rrection	→ 🖺 180
		Confirm probe length	→ 🖺 180
		Present probe length	→ 🖺 178
► Current output	1 to 2]	→ 🗎 182
	Assign current outp	put	→ 🖺 182
	Current span		→ 🗎 183
	Fixed current		→ 🗎 184
	Damping output		→ 🖺 184
	Failure mode		→ 🖺 184
	Failure current		→ 🖺 185
	Output current 1 to	2	→ 🖺 186
► Switch output			→ 🖺 187
	Switch output funct	tion	→ 🖺 187
	Assign status		→ 🗎 188
	Assign limit		→ 🖺 188
	Assign diagnostic b	pehavior	→ 🗎 188
	Switch-on value		→ 🖺 189
	Switch-on delay		→ 🖺 190
	Switch-off value		→ 🗎 190
	Switch-off delay		→ 🖺 191
	Failure mode		→ 🗎 191
	Switch status		→ 🖺 191
	Invert output signa		→ 🖺 191

▶ Display		→ 🖺 193
	Language	→ 🖺 193
	Format display	→ 🖺 193
	Value 1 to 4 display	→ 🖺 195
	Decimal places 1 to 4	→ 🖺 195
	Display interval	→ 🖺 196
	Display damping	→ 🖺 196
	Header	→ 🖺 196
	Header text	→ 🖺 197
	Separator	→ 🖺 197
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	Decimal places menu	→ 🖺 197
	Backlight	→ 🖺 198
	Contrast display	→ 🖺 198
► Configuration b	packup display	→ 🖺 199
	Operating time	→ 🖺 199
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		Configuration management	→ 🖺 1	.99
		Comparison result	→ 🖺 2	200
•	• Administration		→ 🖺 2	202
		▶ Define access code	→ 🖺 2	204
		Define access code	→ 🖺 2	204
		Confirm access code	→ 🖺 2	204
		Device reset	→ 🖺 2	202
Ç Diagnostics	_		→ 🖺 2	205
Actual diagnostics			→ 🖺 2	205
Previous diagnostics			→ 🖺 2	205
Operating time from re	estart		→ 🖺 2	206
Operating time			→ 🖺 1	199
▶ Diagnostic list			→ 🖺 2	207
D	Diagnostics 1 to 5		→ 🖺 2	207
► Event logbook			→ 🖺 2	208
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	• Event list		→ 🖺 2	208
► Device information	ı		→ 🖺 2	209
D	Device tag		→ 🖺 2	209
Se	erial number		→ 🖺 2	209
Fi	ïrmware version		→ 🖺 2	209
D	Device name		→ 🖺 2	209
[]	Order code		→ 🖺 2	210
	extended order code	1 to 3	→ 🖺 2	
	Device revision		→ 🖺 2	

	Device ID	→ 🖺 210
	Device type	→ 🖺 211
	Manufacturer ID	→ 🖺 211
> 1	Measured values	→ 🖺 212
	Distance	→ 🖺 140
	Level linearized	→ 🖺 168
	Interface distance	→ 🖺 145
	Interface linearized	→ 🖺 168
	Thickness upper layer	→ 🖺 214
	Output current 1 to 2	→ 🖺 186
	Measured current 1	→ 🖺 214
	Terminal voltage 1	→ 🖺 215
▶ 1	Data logging	→ 🖺 216
	Assign channel 1 to 4	→ 🖺 216
	Logging interval	→ 🖺 217
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▶ :	Simulation	→ 🗎 220
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]

	Switch status	→ 🖺 222
	Device alarm simulation	→ 🖺 223
▶ Device check		→ 🖺 224
	Start device check	→ 🖺 224
	Result device check	→ 🖺 224
	Last check time	→ 🖺 224
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	Launch signal	→ 🗎 225
	Interface signal	→ 🖺 225

17.3 Overview of the operating menu (operating tool)

Device tag ⇒ ≘ 135 Operating mode ⇒ ≘ 135 Distance unit ⇒ ≘ 135 Tank type ⇒ ≘ 136 Tube diameter ⇒ ≘ 136 Medium group ⇒ ≘ 136 Empty calibration ⇒ ≘ 137 Full calibration ⇒ ≘ 137 Level ⇒ ≘ 139 Distance ⇒ ≘ 140 Signal quality ⇒ ≘ 141 Tank level ⇒ ≘ 142 Distance to upper connection ⇒ ≘ 142 DC value ⇒ ≘ 143	
Operating mode → □ 135 Distance unit → □ 136 Tank type → □ 136 Tube diameter → □ 136 Medium group → □ 136 Empty calibration → □ 137 Full calibration → □ 139 Level → □ 139 Distance → □ 140 Signal quality → □ 141 Tank level → □ 142 Distance to upper connection → □ 143	
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Tank type ⇒ □ 136 Tube diameter ⇒ □ 136 Medium group ⇒ □ 136 Empty calibration ⇒ □ 137 Full calibration ⇒ □ 138 Level ⇒ □ 149 Distance ⇒ □ 140 Signal quality ⇒ □ 141 Tank level ⇒ □ 142 Distance to upper connection ⇒ □ 143	
Tube diameter → □ 136 Medium group → □ 136 Empty calibration → □ 137 Full calibration → □ 138 Level → □ 149 Distance → □ 140 Signal quality → □ 141 Tank level → □ 142 Distance to upper connection → □ 143	
Medium group ⇒ ₱ 136 Empty calibration ⇒ ₱ 137 Full calibration ⇒ ₱ 138 Level ⇒ ₱ 139 Distance ⇒ ₱ 140 Signal quality ⇒ ₱ 141 Tank level ⇒ ₱ 142 Distance to upper connection ⇒ ₱ 142 DC value ⇒ ₱ 143	
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Full calibration → □ 138 Level → □ 139 Distance → □ 140 Signal quality → □ 141 Tank level → □ 142 Distance to upper connection → □ 142 DC value → □ 143	
Level \Rightarrow \$\begin{align*} \text{139} \\ \text{Distance} \end{align*} Signal quality \Rightarrow \$\begin{align*} \text{141} \\ \text{Tank level} \\ \text{Distance to upper connection} \\ \text{\$\Rightarrow\$ \$\begin{align*} \text{\$\Rightarrow\$ \$\text{\$\text{\$\text{\$align*}}\$} \\ \text{\$\Rightarrow\$ \$\text{\$\text{\$\text{\$\text{\$\text{\$\text{\$align*}}\$}} \\ \$\text{\$\	
Distance ⇒	
Signal quality \Rightarrow 141 Tank level \Rightarrow 142 Distance to upper connection \Rightarrow 142 DC value \Rightarrow 143	
Tank level ⇒	
Distance to upper connection → 🖺 142 DC value	
DC value → 🖺 143	
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Confirm distance \rightarrow $\stackrel{ riangle}{\Rightarrow}$ 145	
Present mapping \rightarrow $\stackrel{ riangle}{\Rightarrow}$ 146	
Mapping end point $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
Record map → 🖺 147	
► Advanced setup → 🖺 149	
Locking status → 🖺 149	

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	Access status toolir	ng	→ 🖺 149
[Enter access code		→ 🖺 150
	► Level		→ 🖺 151
		Medium type	→ 🖺 151
		Medium property	→ 🖺 151
		Process property	→ 🖺 152
		Advanced process conditions	→ 🖺 153
		Level unit	→ 🖺 154
		Blocking distance	→ 🖺 154
		Level correction	→ 🖺 155
	► Interface		→ 🖺 156
		Process property	→ 🖺 156
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	Output echo lost	→ 🖺 173
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► SIL/WHG confi	rmation	→ 🖺 176
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	Sold Medicel	, = 1,1
► Probe settings		→ 🖺 178
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		Failure current	→ 🖺 185
		Output current 1 to 2	→ 🖺 186
	► Switch output		→ 🗎 187
		Switch output function	→ 🖺 187
		Assign status	→ 🖺 188
		Assign limit	→ 🖺 188
		Assign diagnostic behavior	→ 🖺 188
		Switch-on value	→ 🖺 189
		Switch-on delay	→ 🖺 190
		Switch-off value	→ 🖺 190
		Switch-off delay	→ 🖺 191
		Failure mode	→ 🗎 191
		Switch status	→ 🖺 191
		Invert output signal	→ 🗎 191
	► Display		→ 🖺 193
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		Display interval		→ 🖺 196
		Display damping	· 	→ 🖺 196
		Header		→ 🖺 196
		Header text		→ 🖺 197
		Separator		→ 🖺 197
		Number format		→ 🖺 197
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		Backlight		→ 🖺 198
		Contrast display		→ 🖺 198
	► Configuration b	ackup display		→ 🖺 199
		Operating time		→ 🖺 199
		Last backup		→ 🖺 199
		Configuration management		→ 🖺 199
		Backup state		→ 🖺 200
		Comparison result		→ 🖺 200
	► Administration			→ 🖺 202
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▶ Device info	ormation	→ 🖺 209
	Device tag	→ 🖺 209
	Serial number	→ 🖺 209
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	Device ID	→ 🖺 210
	Device type	→ 🖺 211
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► Measured	values	→ 🖺 212
	Distance	→ 🖺 140
	Level linearized	→ 🖺 168
	Interface distance	→ 🖺 145
	Interface linearized	→ 🖺 168
	Thickness upper layer	→ 🖺 214
	Output current 1 to 2	→ 🖺 186
	Measured current 1	→ 🖺 214
	Terminal voltage 1	→ 🖺 215
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	Logging interval	→ 🖺 217
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► Simulation		→ 🖺 220
	Assign measurement variable	→ 🖺 221
	Process variable value	→ 🖺 221
	Current output 1 to 2 simulation	→ 🖺 221
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	Switch status	→ 🖺 222
	Device alarm simulation	→ 🖺 223
► Device check		→ 🖺 224
	Start device check	→ 🖺 224
	Result device check	→ 🖺 224
	Last check time	→ 🖺 224
	Level signal	→ 🖺 225
	Launch signal	→ 🖺 225
	Interface signal	→ 🖺 225
► Heartbeat		→ 🖺 226

"Setup" menu 17.4



- 🗐 : 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

Device tag		
Navigation	Setup → Device tag	
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.	
User entry	Character string comprising numbers, letters and special characters (32)	
Operating mode		
Navigation		
Prerequisite	The device has the "interface measurement" application package (available for FMP51, FMP52, FMP54) $^{1)}$.	
Description	Select operating mode.	
Selection	 Level Interface with capacitance * Interface * 	
Factory setting	FMP51/FMP52/FMP54: Level	
Distance unit		
Navigation		
Description	Used for the basic calibration (Empty / Full).	
Selection	SI units ■ mm ■ ft ■ m ■ in	

¹⁾ Product structure: Feature 540 "Application Package", Option EB "Interface measurement"

Endress+Hauser

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Visibility depends on order options or device settings

Tank type	
Navigation	Setup → Tank type
Prerequisite	Medium type (→ 🗎 151) = Liquid
Description	Select tank type.
Selection	 Metallic Bypass / pipe Non metallic Mounted outside Coaxial
Factory setting	Depending on the probe
Additional information	 Depending on the probe some of the options mentioned above may not be available or there may be additional options. For coax probes and probes with metallic center washer Tank type parameter corresponds to the type of probe and cannot be changed.
Tube diameter	
Navigation	Setup → Tube diameter
Prerequisite	 Tank type (→ 🖺 136) = Bypass / pipe The probe is coated.
Description	Specify diameter of bypass or stilling well.
User entry	0 to 9.999 m
Medium group	
Navigation	Setup → Medium group
Prerequisite	■ For FMP51/FMP52/FMP54/FMP55: Operating mode (→ 🗎 135) = Level

Prerequisite

■ Medium type (→ 🖺 151) = Liquid

Description Select medium group.

Selection Others

■ Water based (DC >= 4)

This parameter roughly specifies the dielectric constant (DC) of the medium. For a more Additional information detailed definition of the DC use the **Medium property** parameter ($\rightarrow \implies 151$).

The **Medium group** parameter presets the **Medium property** parameter ($\rightarrow \implies 151$) as follows:

Medium group	Medium property (→ 🖺 151)
Others	Unknown
Water based (DC >= 4)	DC 4 7

- The **Medium property** parameter can be changed at a later point of time. However, when doing so, the **Medium group** parameter retains its value. Only the **Medium property** parameter is relevant for the signal evaluation.
- The measuring range may be reduced for small dielectric constants. For details refer to the Technical Information (TI) of the respective device.

Empty calibration	
Empty calibration	

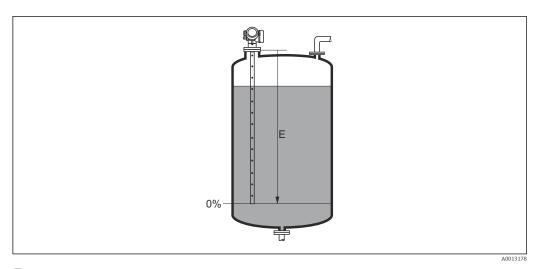
Navigation $\blacksquare \square$ Setup \rightarrow Empty calibr.

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

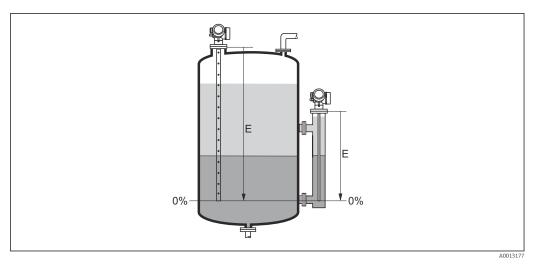
User entry Depending on the probe

Factory setting Depending on the probe

Additional information



■ 50 Empty calibration (E) for level measurements in liquids



■ 51 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

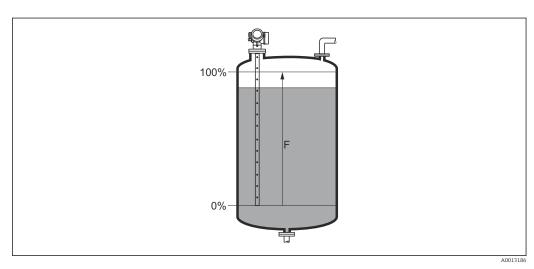
Navigation $\blacksquare \Box$ Setup \rightarrow Full calibr.

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

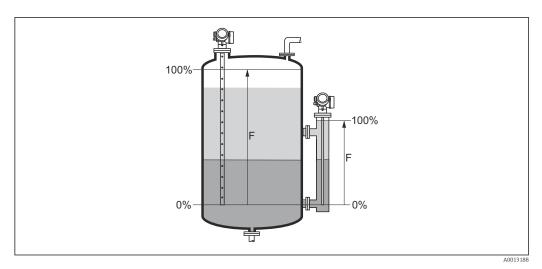
User entry Depending on the probe

Factory setting Depending on the probe

Additional information



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



■ 53 Full calibration (F) for interface measurements

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

Level

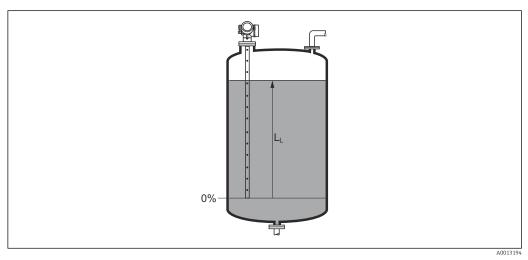
Navigation

Setup → Level

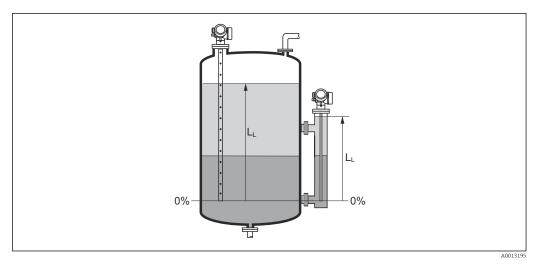
Description

Displays measured level L_L (before linearization).

Additional information



■ 54 Level in case of liquid measurements



■ 55 Level in case of interface measurements

The unit is defined in the **Level unit** parameter (→ 🗎 154).

■ In case of interface measurements, this parameter always refers to the total level.

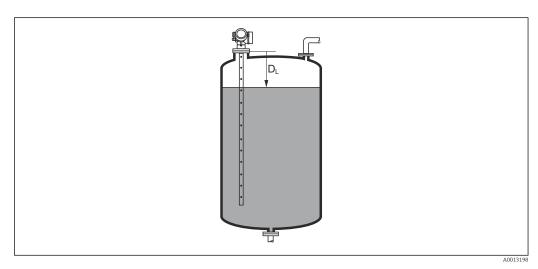
Distance

Navigation

Description

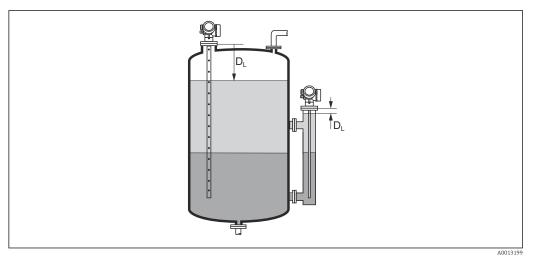
Displays the measured distance D_L between the reference point (lower edge of the flange or threaded connection) and the level.

Additional information



■ 56 Distance for liquid measurements

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57 Distance for interface measurements

The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 135$).

Signal quality

Navigation

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.

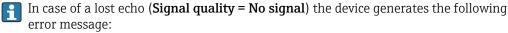
Weak

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 ²⁾ or the end-of-probe echo. To differentiate between these two, the quality of the end-of-probe echo is always displayed in brackets.



- F941, for Output echo lost (\rightarrow 🗎 173) = Alarm.
- S941, if another option has been selected in **Output echo lost** (\rightarrow $\stackrel{ riangle}{=}$ **173**).

²⁾ Of these two echos the one with the lower quality is indicated.

Tank level

Prerequisite Operating mode (→ 🖺 135) = Interface

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

Selection ■ Partially filled ■ Fully flooded

Additional information

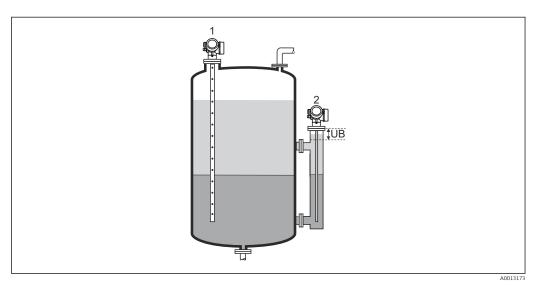
Meaning of the options

Partially filled

The device searches for 2 echo signals, one for the interface and one for the total level.

■ Fully flooded

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



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

Distance to upper connection

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Dist. up.connect

Prerequisite The device has the "Interface measurement" application package ³⁾.

Description Specify distance D_{IJ} to upper connection.

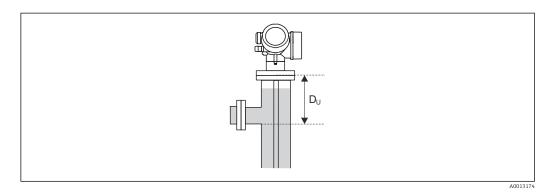
User entry 0 to 200 m

³⁾ Product structure: Feature 540 "Application Package", Option EB "Interface measurement"

Factory setting

- For Tank level (→ 🖺 142) = Partially filled: 0 mm (0 in)
- For Tank level ($\rightarrow \triangle$ 142) = Fully flooded: 250 mm (9.8 in)

Additional information



Dependence on the "Tank level" parameter

- Tank level (→ 🗎 142) = 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 (→ 🗎 142) = Fully flooded: In this case enter the distance D_U between the reference point and the lower edge of the upper connection.

DC value		
Navigation	Setup → DC value	

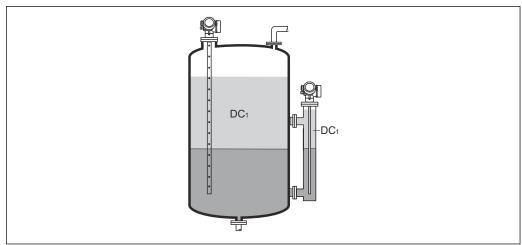
Prerequisite The device has the "Interface measurement" application package ⁴⁾.

Description Specify the relative dielectric constant ε_r of the upper medium (DC₁).

User entry 1.0 to 100

⁴⁾ Product structure: feature 540 "Application packages", option EB "Interface measurement"

Additional information



DC1 Relative dielectric constant of the upper medium.

A0013181

- For the relative permittivity values (ϵ_r values) of many media commonly used in industry, please refer to:
 - Relative permittivity (ε_r value), Compendium CP01076F
 - The Endress+Hauser "DC Values app" (available for Android and iOS)

Interface

Navigation

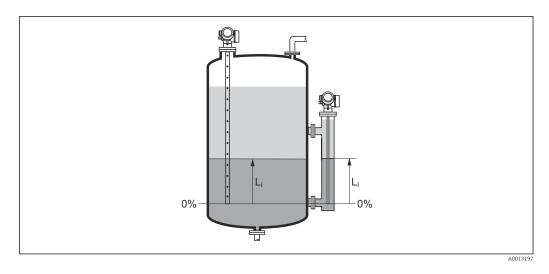
Prerequisite

Operating mode (→ 🖺 135) = Interface or Interface with capacitance

Description

Displays the measured interface level $L_{\rm I}$ (before linearization).

Additional information



The unit is defined in the **Level unit** parameter ($\Rightarrow \triangleq 154$).

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Interface distance

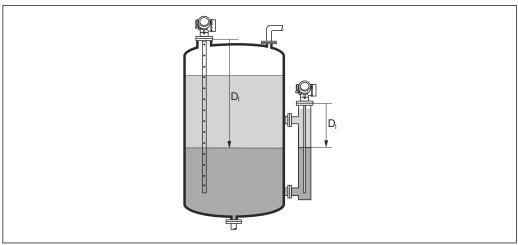
Navigation Setup → Interface dist.

Prerequisite

Description Displays the measured distance D_I between the reference point (lower edge of flange or

threaded connection) and the interface.

Additional information



The unit is defined in the **Distance unit** parameter ($\Rightarrow \triangleq 135$).

Confirm distance

Navigation Setup → Confirm distance

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

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

Selection Manual map

- Distance ok
- Distance unknown
- Distance too small
- Distance too big
- Tank empty
- Delete map

Visibility depends on order options or device settings

Additional information

Meaning of the options

Manual map

To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter ($\Rightarrow \implies 147$). 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 ⁵⁾

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

 \square Setup \rightarrow Present mapping

Description

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

⁵⁾ Only available for "Expert → Sensor → Echo tracking → **Evaluation mode** parameter" = "Short time history" or "Long time history"

Mapping end point

Navigation \square Setup \rightarrow Map. end point

Prerequisite Confirm distance (→ 🖺 145) = 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 ($\Rightarrow \triangleq 146$) is displayed together with this parameter. It indicates up to which distance a mapping has already

been recorded.

Record map

Prerequisite Confirm distance (→ 🖺 145) = Manual map or Distance too small

Description Start recording of the map.

Selection • No

Record mapDelete map

Additional information

Meaning of the options

■ No

The map is not recorded.

Record map

The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing \square .

■ Delete map

The mapping (if one exists) is deleted and the device displays the recalculated measured distance and the mapping range. When operating via the local display, these values must be confirmed by pressing \square .

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 (→ ≅ 135).
- 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.

Confirm distance		
Navigation	Setup → Mapping → Confirm distance	
Description	→ 🖺 145	
Mapping end point		<u> </u>
Navigation	Setup → Mapping → Map. end point	
Description	→ 🖺 147	
Record map		<u> </u>
Navigation	Setup → Mapping → Record map	
Description	→ 🗎 147	
Distance		
Navigation	Setup → Mapping → Distance	
Description	→ 🖺 140	

17.4.2 "Advanced setup" submenu

Navigation \square Setup \rightarrow Advanced setup

Locking status

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow 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 a-symbol appears in front of parameters that cannot be modified since they are write-protected.

Access status tooling

Navigation \square Setup \rightarrow Advanced setup \rightarrow Access stat.tool

Description Shows the access authorization to the parameters via the operating tool.

Additional information

The access authorization can be changed via the **Enter access code** parameter $(\rightarrow \implies 150)$.

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 ($\rightarrow \implies 149$).

Access status display

Navigation

Setup → Advanced setup → Access stat.disp

Prerequisite

The device has a local display.

Description

Indicates access authorization to parameters via local display.

Additional information

The access authorization can be changed via the **Enter access code** parameter $(\rightarrow \implies 150)$.

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 ($\Rightarrow \implies 149$).

Enter access code

Navigation

Description

Enter access code to disable write protection of parameters.

User entry

0 to 9999

Additional information

- The customer-specific access code that was defined in the **Define access code** parameter
 (→ ≦ 202) 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 ($\rightarrow \triangleq 151$) is only visible for **Operating mode** ($\rightarrow \triangleq 135$) = **Level**

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Level

Medium type

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Level \rightarrow Medium type

Description Specify type of medium.

User interface • Liquid

Selection

Solid

Factory setting FMP50, FMP51, FMP52, FMP53, FMP54, FMP55: Liquid

Additional information The Solid option is only available for Operating mode (→ 🗎 135) = Level

This parameter determines the value of several other parameters and strongly influences the complete signal evaluation. Therefore, it is strongly recommended **not to change** the factory setting.

Medium property

Navigation $\blacksquare \square$ Setup \rightarrow Advanced setup \rightarrow Level \rightarrow Medium property

Prerequisite ■ Operating mode (→ 🖺 135) = Level

■ EOP level evaluation ≠ Fix DC

Description Specify the dielectric constant ε_r of the medium.

UnknownDC 1.4 ... 1.6

■ 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 ($\rightarrow \triangleq 151$) and Medium group ($\rightarrow \triangleq 136$) parameters.

Additional information

Dependency of "Medium type" and "Medium group"

Medium type (→ 🗎 151)	Medium group (→ 🗎 136)	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 7
	Others	Unknown

- For the relative permittivity values (ϵ_r values) of many media commonly used in industry, please refer to:
 - Relative permittivity (ϵ_r value), Compendium CP01076F
 - The Endress+Hauser "DC Values app" (available for Android and iOS)
- If **EOP level evaluation** = **Fix DC**, the exact dielectric constant must be specified in the **DC value** parameter (→ 🖺 143). The **Medium property** parameter therefore does not apply in this case.

Process 1	property
-----------	----------

Navigation

Description

Specify typical rate of level change.

Selection

For "Medium type" = "Liquid"

- Very fast > 10 m (400 in)/min
- Fast > 1 m (40 in)/min
- Standard < 1 m (40in) /min
- Medium < 10 cm (4in) /min
- Slow < 1 cm (0.4in) /min
- No filter / test

For "Medium type" = "Solid"

- Very fast > 100 m (333 ft) /h
- Fast > 10 m (33 ft) /h
- Standard < 10 m (33 ft) /h
- Medium < 1 m (3ft) /h
- Slow < 0.1 m (0.3ft) /h
- No filter / test

Additional information

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

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

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

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

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

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

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

Advanced process conditions

Navigation

Prerequisite

Operating mode ($\rightarrow \equiv 135$) = Level

Description

Specify additional process conditions (if required).

Selection

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

Additional information

Meaning of the options

Oil/Water condensate (only Medium type = Liquid)

Makes sure that in the case of two-phase media only the total level is detected (example: oil/condensate application).

■ Probe near tank bottom (only for Medium type = Liquid)

Improves the empty detection, especially if the probe is mounted close to the tank bottom.

■ Build up

Increases **EOP range upper area** in order to ensure a safe empty-detection even if the end-of-probe signal has shifted due to build-up.

Enables a safe empty-detection even if the end-of-probe signal has shifted due to build-up.

■ Foam (>5cm/0,16ft) (only for Medium type = Liquid)

Optimizes the signal evaluation in applications with foam formation.

Level unit

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Level \rightarrow Level unit

Description Select level unit.

Selection $SI \ units$ $US \ units$ $\bullet \ \%$

• m

■ mm

Additional information

The level unit may differ from the distance unit defined in the **Distance unit** parameter $(\rightarrow \implies 135)$:

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration** ($\rightarrow \boxminus 137$) and **Full calibration** ($\rightarrow \boxminus 138$)).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Blocking distance

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Level \rightarrow 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 ⁶⁾ and for FMP55:

100 mm (3.9 in) for all antenna types

Additional information

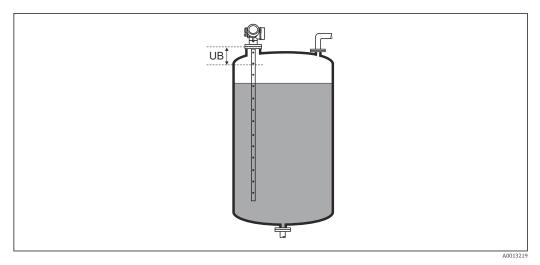
Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are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

⁶⁾ Ordering feature 540 "Application Package", option EB "Interface measurement"



■ 58 Blocking distance (UB) for liquid measurements

Level correction

Navigation Setup \rightarrow Advanced setup \rightarrow Level \rightarrow Level correction

Description Specify level correction (if required).

User entry -200 000.0 to 200 000.0 %

Additional information The value specified in this parameter is added to the measured level (before linearization).

"Interface" submenu

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Interface

Process property

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Process property

Description Specify typical rate of change for the interface position.

Selection ■ Fast > 1 m (40 in)/min

Standard < 1 m (40in) /minMedium < 10 cm (4in) /min

■ Slow < 1 cm (0.4in) /min

■ No filter / test

Additional information

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

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

DC value lower medium	
-----------------------	--

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow DC lower medium

Prerequisite Operating mode (→ 🖺 135) = 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 relative permittivity values (ϵ_r values) of many media commonly used in industry, please refer to:
 - Relative permittivity (ɛˌ value), Compendium CP01076F
 - The Endress+Hauser "DC Values app" (available for Android and iOS)
- The factory setting, ε_r = 80, applies for water at 20 °C (68 °F).

Level unit	6

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Level unit

Description Select level unit.

Selection SI units US units

% m in

Additional information

The level unit may differ from the distance unit defined in the **Distance unit** parameter $(\rightarrow \implies 135)$:

- The unit defined in the Distance unit parameter is used for the basic calibration (Empty calibration (→ □ 137) and Full calibration (→ □ 138)).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level and interface position.

Blocking distance		Â
Navigation	Setup → Advanced setup → Interface → Blocking dist.	
Description	Specify upper blocking distance UB.	
User entry	0 to 200 m	

Factory setting ■ For coax probes: 100 mm (3.9 in)

■ For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)

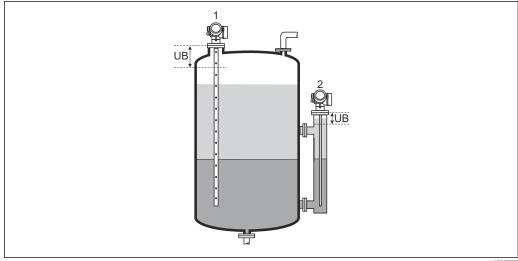
• For rod and rope probes above 8 m (26 ft): 0.025 * length of probe

Additional information

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

• to suppress interference echoes at the top end of the probe.

• to suppress the echo of the total level in the case of flooded bypasses.



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

Level correction	

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Level correction

Description Specify level correction (if required).

User entry -200 000.0 to 200 000.0 %

Additional information The value specified in this parameter is added to the measured total and interface levels

(before linearization).

Manual thickness upper layer

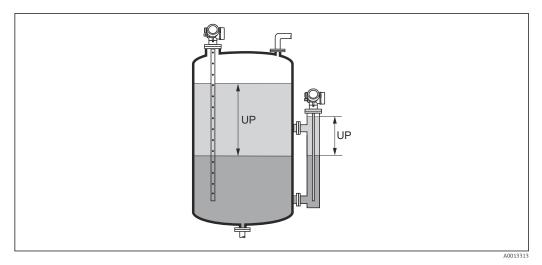
Navigation \square Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Man.thick.up.lay

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

medium).

User entry 0 to 200 m

Additional information



UP Interface thickness (= thickness of upper medium)

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 upp	per layer	
Navigation		
Description	Displays the measured interface thickness. (Thickness UP of the upper medium).	
DC value		
Navigation		
Description	Displays relatvie dielectric constant ϵ_{r} of the upper medium (DC $_{\!1})$ before correction.	
Calculated DC value		
Navigation		
Description	Displays calculated (i.e. corrected) relative dielectric constant $\epsilon_{\rm r}$ (DC1) of the upper medium.	

 Use calculated DC value

 Navigation
 \blacksquare Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Use calc. DC

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

Selection ■ Save and exit ■ Cancel and exit

Additional information Meaning of the options

Save and exit

The calculated constant is assumed to be the correct one.

Cancel and exit The calculated dielectric constant is rejected; the previous dielectric constant remains active.

On the local display, the **Calculated DC value** parameter ($\Rightarrow \triangleq 159$) is displayed together with this parameter.

"Automatic DC calculation" wizard

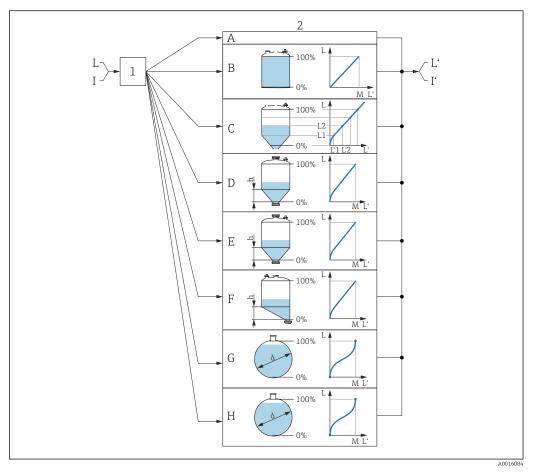
The **Automatic DC calculation** wizard is only available when operating via the local display. When operating via an operating tool, the parameters for automatic DC calculation are located directly in **Interface** submenu $(\rightarrow \implies 156)$

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

Navigation Setup \rightarrow Advanced setup \rightarrow Interface \rightarrow Autom. DC calc.

Manual thickness upper	layer	
Navigation		
Description	Specify the manually determined interface thickness UP (i.e. the thickness of the upper medium).	
DC value		
Navigation	Setup → Advanced setup → Interface → Autom. DC calc. → DC value	
Description	Displays relative dielectric constant $\epsilon_{\rm r}$ of the upper medium (DC_1) before correction.	
Use calculated DC value		Â
Navigation	Setup → Advanced setup → Interface → Autom. DC calc. → Use calc. DC	
Description	Specify whether the calculated dielectric constant should be used.	
Selection	Save and exitCancel and exit	
Additional information	Meaning of the options ■ Save and exit The calculated dielectric constant is adopted. ■ Cancel and exit	

"Linearization" submenu



59 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 ($\rightarrow \square 165$) = None
- *B* Linearization type ($\rightarrow \blacksquare 165$) = Linear
- C Linearization type ($\Rightarrow \triangleq 165$) = Table
- *D* Linearization type ($\rightarrow \Box$ 165) = Pyramid bottom
- *E* Linearization type ($\rightarrow \equiv 165$) = Pyramia bottom *E* Linearization type ($\rightarrow \equiv 165$) = Conical bottom
- *F* Linearization type ($\rightarrow \Box$ 165) = Angled bottom
- *H* Linearization type (\rightarrow 🖺 165) = Sphere
- I For "Operating mode ($\rightarrow \boxtimes 135$)" = "Interface" or "Interface with capacitance": interface before linearization (measured in the level unit)
- I' For "Operating mode ($\rightarrow \cong 135$)" = "Interface" or "Interface with capacitance": interface after linearization (corresponds to volume or weight)
- L Level before linearization (measured in level unit)
- M Maximum value ($\rightarrow \square$ 168)
- d Diameter (→ 🖺 169)
- *h* Intermediate height ($\rightarrow \blacksquare 169$)

Structure of the submenu on the local display

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

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

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization

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

Description of the parameters

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Linearization

Linearization type

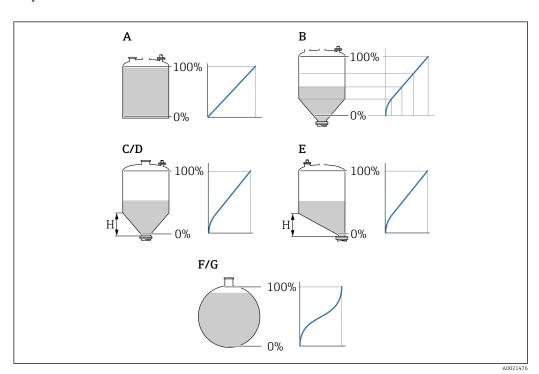
Navigation Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Lineariz. type

Description Select linearization type.

Selection ■ None

- Linear
- Table
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cylinder
- Sphere

Additional information



- **■** 60 Linearization types
- A None
- B Table
- C Pyramid bottom
- D Conical bottom
- $E \qquad \textit{Angled bottom}$
- 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:

- Maximum value (→ 🖺 168): 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:

- **■** Table mode (→ 🗎 169)
- For every point in the table: **Level** (\rightarrow 🖺 **171**)
- For every point in the table: **Customer value** (→ 🗎 171)
- Activate table (→ \(\bigcirc \) 171)

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:

- **Maximum value** (→ 🗎 168): maximum volume or weight
- **Intermediate height (→** 🗎 **169)**: 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:

- Maximum value (→ 🖺 168): maximum volume or weight
- **Intermediate height (→** 🖺 **169)**: 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:

- Maximum value (→ 🗎 168): maximum volume or weight
- **Intermediate height (→** 🗎 **169)**: 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:

- Maximum value (→ 🖺 168): maximum volume or weight
- **■** Diameter (→ 🗎 169)

Sphere

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

- Maximum value (→ 🖺 168): maximum volume or weight
- **■** Diameter (→ 🗎 169)

Unit after linearization

Navigation

Prerequisite

Linearization type (\rightarrow $\stackrel{\triangle}{=}$ **165**) ≠ 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.]
- \bullet 1043 = [ft³]
- \blacksquare 1571 = [cm³]
- \bullet 1035 = [dm³]
- \blacksquare 1034 = [m³]
- 1038 = [l]
- 1041 = [hl]
- **1**342 = [%]
- -1010 = [m]
- 1012 = [mm]
- 1018 = [ft]
- 1019 = [inch]
- 1351 = [l/s]
- 1352 = [l/min]
- 1353 = [l/h]
- \blacksquare 1347 = [m³/s]
- \blacksquare 1348 = [m³/min]
- \blacksquare 1349 = $[m^3/h]$
- \blacksquare 1356 = [ft³/s]
- \blacksquare 1357 = [ft³/min]
- $1358 = [ft^3/h]$
- 1362 = [US Gal./s]
- 1363 = [US Gal./min]
- 1364 = [US Gal./h]
- 1367 = [Imp. Gal./s]
- 1358 = [Imp. Gal./min]
- 1359 = [Imp. Gal./h]
- \blacksquare 32815 = [Ml/s]
- \blacksquare 32816 = [Ml/min]
- 32817 = [Ml/h]
- 1355 = [Ml/d]

Additional information

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



Distance-to-distance linearization is also possible, i.e. a linearization from the level unit to another length unit. Select the **Linear** linearization mode for this purpose. To specify the new level unit, select the Free text option in the Unit after linearization parameter and enter the unit in the **Free text** parameter ($\rightarrow \triangleq 167$).

Free text

Navigation

Prerequisite

Unit after linearization (→ 🗎 166) = Free text

Description

Enter unit symbol.

User entry

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

Level linearized

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Level linearized

Description Displays linearized level.

Additional information

• This unit is defined by the **Unit after linearization** parameter.

• In the case of interface measurements, this parameter always refers to the total level.

Interface linearized

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Interf. lineariz

Prerequisite Operating mode (→ 🖺 135) = Interface or Interface with capacitance

Description Displays the linearized interface height.

Additional information

This unit is defined by the **Unit after linearization** parameter.

Maximum value

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Maximum value

Prerequisite Linearization type ($\rightarrow \Box$ 165) has one of the following values:

- Linear
- Pyramid bottom
- Conical bottom
- lacktriangle 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 \blacksquare Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Diameter

Prerequisite Linearization type $(\rightarrow \ \ \ \ \ \ \ \ \ \ \)$ 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 ($\rightarrow \triangleq 135$).

Intermediate height

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Intermed. height

Prerequisite Linearization type ($\rightarrow \triangleq 165$) has one of the following values:

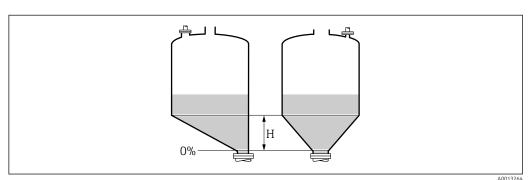
Pyramid bottomConical bottom

Angled bottom

Description Height of the pyramid, conical or angled bottom.

User entry 0 to 200 m

Additional information



Intermediate height

The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 135$).

Table mode

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Table mode

Prerequisite Linearization type (→ 🖺 165) = 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** ($\rightarrow \equiv 137$) and **Full calibration** ($\rightarrow \equiv 138$) must be set correctly.

How to enter the table

Via FieldCare

The table points can be entered via the **Table number** ($\rightarrow \boxminus 170$), **Level** ($\rightarrow \boxminus 171$) and **Customer value** ($\rightarrow \boxminus 171$) 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 $(\rightarrow \triangleq 154)$ 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

 \square Setup → Advanced setup → Linearization → Table number

Prerequisite

Linearization type ($\rightarrow \triangleq 165$) = Table

Description

Select table point you are going to enter or change.

User entry 1 to 32

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Level

Prerequisite ■ Linearization type (→ 🗎 165) = Table

■ Table mode (→ 🖺 169) = Manual

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

User entry Signed floating-point number

Level (Semiautomatic)

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Level

Prerequisite • Linearization type ($\rightarrow \triangleq 165$) = Table

■ Table mode (→ 🗎 169) = Semiautomatic

Description Displays measured level (value before linearization). This value is transmitted to the table.

Customer value

Navigation \square Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Customer value

Prerequisite Linearization type ($\rightarrow \triangleq 165$) = Table

Description Enter linearized value for the table point.

User entry Signed floating-point number

Activate table

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Linearization \rightarrow Activate table

Prerequisite Linearization type ($\rightarrow \triangleq 165$) = Table

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

Selection • Disable

■ Enable

Additional information

Meaning of the options

Disable

The measured level is not linearized.

If **Linearization type** (\rightarrow **\stackrel{\triangle}{=} 165)** = **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 $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Safety sett.

Output echo lost

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Safety sett. \rightarrow Output echo lost

Description Output signal in case of a lost echo.

Selection ■ Last valid value

Ramp at echo lostValue 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 ⁷⁾

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 ($\Rightarrow \triangleq 174$).

■ Value echo lost 7)

In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter ($\rightarrow \triangleq 173$).

Alarm

In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter $(\rightarrow \implies 184)$

Value echo lost

Navigation $\blacksquare \square$ Setup \rightarrow Advanced setup \rightarrow Safety sett. \rightarrow Value echo lost

Prerequisite Output echo lost $(\rightarrow \ \ \ \ \ \ \ \ \ \ \)$ = Value echo lost

Description Output value in case of a lost echo

User entry 0 to 200 000.0 %

Additional information Use the unit which has been defined for the measured value output:

⁷⁾ Only visible if "Linearization type ($\Rightarrow = 165$)" = "None"

Ramp at echo lost

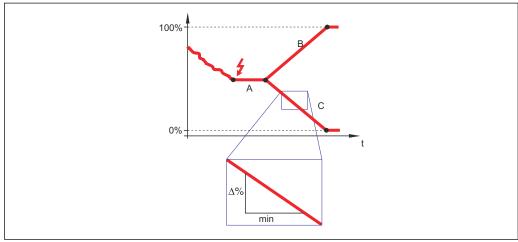
Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Safety sett. \rightarrow Ramp echo lost

Prerequisite Output echo lost (→ 🖺 173) = Ramp at echo lost

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

User entry Signed floating-point number

Additional information



A001326

- A Delay time echo lost
- *B* Ramp at echo lost ($\rightarrow \blacksquare 174$) (positive value)
- *C* Ramp at echo lost ($\Rightarrow \triangleq 174$) (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 continuously increased until it reaches 100%.

Blocking distance

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Safety sett. \rightarrow 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 ⁸⁾ and for FMP55:

100 mm (3.9 in) for all antenna types

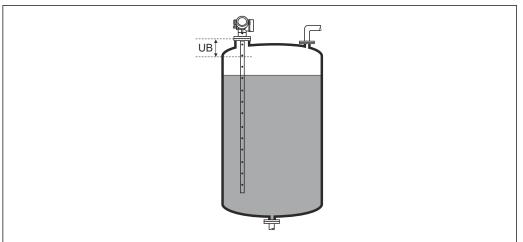
Additional information

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.



A0013219

Blocking distance (UB) for liquid measurements

⁸⁾ 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

Selection

"Deactivate SIL/WHG" wizard

i

Reenter codeAbort sequence

The **Deactivate SIL/WHG** wizard ($\rightarrow \triangleq 177$) 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 $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Deactiv. SIL/WHG

 Reset write protection

 Navigation
 Setup → Advanced setup → Deactiv. SIL/WHG → Res. write prot.

 Description
 Enter unlocking code.

 User entry
 0 to 65 535

 Code incorrect

 Navigation
 Setup → Advanced setup → Deactiv. SIL/WHG → Code incorrect

 Description
 Indicates that a wrong unlocking code has been entered. Select procedure.

"Probe settings" submenu

The **Probe settings** submenu helps to ensure that the device correctly assigns the end of probe signal within the envelope curve. 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) over the entire length. For partially filled vessels and if the probe length is known, select **Confirm probe length** (\rightarrow 179) = **Manual input** to enter the value manually.

- If a mapping has been recorded after shortening the probe, it is no longer possible to perform an automatic probe length correction. There are two options if this occurs:
 - First delete the mapping curve using the. **Record map** parameter ($\rightarrow \triangleq 147$) and the probe length correction can then be performed. After the probe length correction, a new mapping curve can be recorded using the **Record map** parameter ($\rightarrow \triangleq 147$).
 - Alternatively, select **Confirm probe length (→ 🖺 179) = Manual input** and manually enter the probe length in the **Present probe length** parameter.
- An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter ($\rightarrow \implies 178$).

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Probe settings

Probe grounded		a	
Navigation			
Prerequisite	Operating mode (→ 🖺 135) = Level		
Description	Specify whether the probe is grounded.		
Selection	■ No ■ Yes		
Present probe length			
Navigation			
Description	 In most cases: Displays the length of the probe according to the currently measured end-of-probe signal. For Confirm probe length (→ 🗎 179) = Manual input: Enter actual length of probe. 		
User entry	0 to 200 m		

Confirm probe length Navigation Setup → Advanced setup → Probe settings → Confirm length Description Specify whether the value displayed in the Present probe length parameter matches the actual length of the probe. Based on this input, the device performs a probe length

Selection

■ Probe length OK

correction.

- 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 correct probe length is displayed. A correction is not required. The device exits the sequence.

Probe length too small

To be selected if the displayed length is less than the actual probe length. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter. 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 greater than the actual probe length. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter. 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.

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 in the **Present probe length** parameter. ⁹⁾

Probe length unknown

To be selected if the actual probe length is unknown. A probe length correction is impossible in this case.

⁹⁾ When operating via FieldCare, the **Manual input** option does not need to be selected explicitly; manual editing of the probe length is always possible here.

"Probe length correction" wizard



The **Probe length correction** wizard is only available when operating via the local display. When operating via an operating tool, the parameters for probe length correction are located directly in the **Probe settings** submenu ($\rightarrow \square$ 178).

Navigation

 \blacksquare Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Prob.length corr

Confirm probe length

Navigation

Setup \rightarrow Advanced setup \rightarrow Probe settings \rightarrow Problem9th corr \rightarrow Confirm length

Description

Specify whether the value displayed in the **Present probe length** parameter 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 correct probe length is displayed. A correction is not required. The device exits the sequence.

■ Probe length too small

To be selected if the displayed length is less than the actual probe length. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter. 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 greater than the actual probe length. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter. 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.

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 in the **Present probe length** parameter. $^{10)}$

■ Probe length unknown

To be selected if the actual probe length is unknown. A probe length correction is impossible in this case.

¹⁰⁾ When operating via FieldCare, the **Manual input** option does not need to be selected explicitly; manual editing of the probe length is always possible here.

Present probe length		
Navigation		
Description	 In most cases: Displays the length of the probe according to the currently measured end-of-probe signal. For Confirm probe length (→ 🖺 179) = Manual input: Enter actual length of probe. 	
User entry	0 to 200 m	

"Current output 1 to 2" submenu

The **Current output 2** submenu ($\rightarrow \triangleq 182$) is only available for devices with two current outputs.

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

Assign current output 1 to 2

Navigation

Description

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

- Interface linearized
- Interface distance
- Thickness upper layer
- Relative interface amplitude

Factory setting

For level measurements

- Current output 1: Level linearized
- Current output 2 ¹¹⁾: Level linearized

For interface measurements

- Current output 1: Interface linearized
- Current output 2 ¹²⁾: Level linearized

Additional information

Definition of the current range for the process variables

Process variable	4 mA value	20 mA 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 \boxminus 137) (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	0 % ¹⁾ or the associated linearized value	$100\ \%^{\ 2)}$ or the associated linearized value
Interface distance	0 (i.e. interface at the reference point)	Empty calibration (→ 🖺 137) (i.e. interface is at 0 %)

¹¹⁾ only for devices with two current outputs

¹²⁾ 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 ($\rightarrow \triangleq 137$)
- 2) The 100% level is defined by **Full calibration** parameter ($\rightarrow \implies 138$)
- 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

Navigation

Description

Determines the current range used to transmit the measured value.

'4...20mA':

Measured variable: 4 ... 20 mA

'4...20mA NAMUR':

Measured variable: 3.8 ... 20.5 mA

'4...20mA US':

Measured variable: 3.9 ... 20.8 mA

'Fixed current':

Measured variable transmitted via HART only

Note:

Currents below 3.6 mA or above 21.95 mA can be used to signal an alarm.

Selection

- 4...20 mA
- 4...20 mA NAMUR
- 4...20 mA US
- Fixed current

Additional information

Meaning of the 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

Prerequisite

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 ($\rightarrow \implies 184$).		

- In the case of an error, the output current assumes the value defined in the **Failure** mode parameter (→ 🗎 184).
 - If the measured 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 (> 🖺 184) = 4 mA

Fixed current	
Navigation	
Prerequisite	Current span (→ 🗎 183) = Fixed current
Description	Define constant value of the output current.
User entry	4 to 22.5 mA
Damping output	
Navigation	
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 the output reacts immediately to changes of the measured value. With a big time constant the reaction of the output is more delayed. For $\tau=0$ (factory setting) there is no damping.
Failure mode	
Navigation	

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Current span (→ 🗎 183) ≠ 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 valueActual valueDefined 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 ($\rightarrow \triangleq 183$).

Max.

The current output adopts the value of the upper alarm level according to the **Current span** parameter ($\Rightarrow \triangleq 183$).

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 $(\rightarrow \implies 185)$.

The error behavior of other output channels is not influenced by these settings but is defined in separate parameters.

Failure current

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

Prerequisite Failure mode ($\rightarrow \triangleq 184$) = 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

i

The **Switch output** submenu ($\rightarrow \triangleq 187$) is only available for devices with a switch output. ¹³⁾

Navigation

Switch output function

Navigation

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 ($\rightarrow \triangleq 188$) 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:

- **■** Switch-on value (→ 🗎 189)
- Switch-off value (→ 🖺 190)
- 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 ($\Rightarrow \implies 188$).



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

¹³⁾ Order code 020 "Power supply; output", option B, E or G

Assign status

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Assign status

Prerequisite Switch output function (→ 🖺 187) = Digital Output

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

Selection ■ Off

Digital output AD 1Digital output AD 2

Additional information The Digital output AD 1 and Digital output AD 2 options refer to the Advanced

Diagnostics Blocks. A switch signal generated in these blocks can be output via the switch

output.

Assign limit

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Assign limit

Prerequisite Switch output function ($\Rightarrow \triangleq 187$) = 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 ³

Relative echo amplitude

Relative interface amplitude *

Absolute echo amplitude

Absolute interface amplitude *

Assign diagnostic behavior

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Assign diag. beh

Prerequisite Switch output function (→ 🖺 187) = Diagnostic behavior

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

188

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

Selection

- Alarm
- Alarm or warning
- Warning

Switch-on value

Navigation

Prerequisite Switch output function ($\rightarrow \triangleq 187$) = Limit

Description Defines the switch-on point.

The output is closed if the assigned process variable rises above this point.

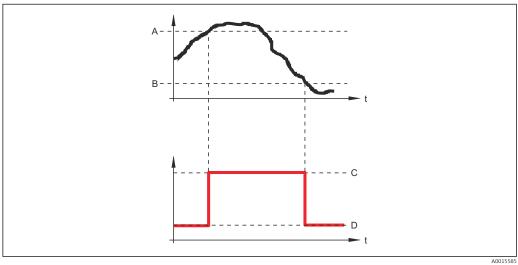
User entry Signed floating-point number

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

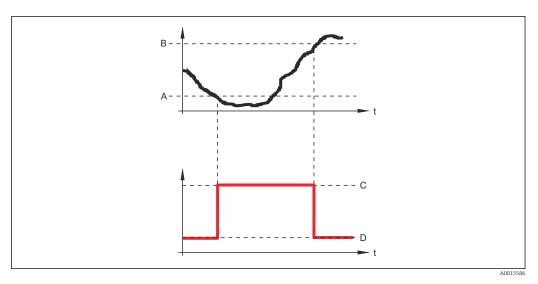
- The output is closed if the measured value is larger than **Switch-on value**.
- The output is opened if the measured value is smaller than **Switch-off value**.



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

Switch-on value < Switch-off value

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



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

Switch-on delay	
	-

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch-on delay

Prerequisite Switch output function ($\Rightarrow \triangleq 187$) = Limit

■ Assign limit (→ 🖺 188) ≠ 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 Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch-off value

Prerequisite Switch output function (→ 🖺 187) = 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

(→ 🖺 189).

Switch-off delay

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch-off delay

Prerequisite • Switch output function ($\rightarrow \stackrel{\triangle}{=} 187$) = Limit

■ Assign limit (→ 🖺 188) ≠ Off

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

User entry 0.0 to 100.0 s

Failure mode

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Failure mode

Prerequisite Switch output function (→ 🗎 187) = Limit or Digital Output

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

Selection • Actual status

OpenClosed

Additional information

Switch status

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Switch status

Description Current status of the switch output.

Invert output signal

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Switch output \rightarrow Invert outp.siq.

Description 'No'

The switch output behaves as per its parameter setting.

'Yes'

The switching behavior is inverted as compared to its parameter setting.

Selection ■ No

Yes

Additional information

Meaning of the options

No

The behavior of the switch output is as described above.

Yes

The states **Open** and **Closed** are inverted as compared to the description above.

192

"Display" submenu

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

Navigation

Language

Navigation

Description Set display language.

Selection ■ English

Deutsch

■ Français ■ Español

■ Italiano

Nederlands

Portuguesa

■ Polski

■ русский язык (Russian) *

Svenska

Türkçe

■ 中文 (Chinese) *

■ 日本語 (Japanese) *

■ 한국어 (Korean) *
■ Bahasa Indonesia *

tiếng Việt (Vietnamese) *

čeština (Czech)

Factory setting The language selected in feature 500 of the product structure.

If no language has been selected: English

Additional information

Format display

Navigation

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

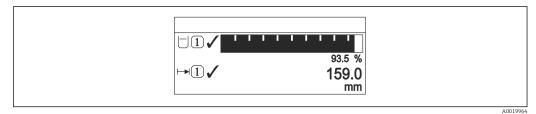
4 values

Visibility depends on order options or device settings

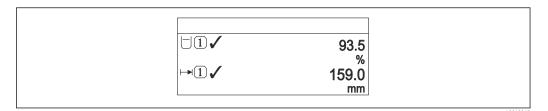
Additional information



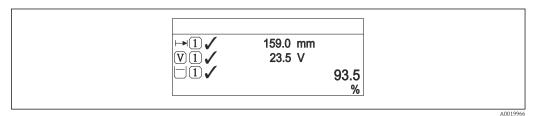
■ 62 "Format display" = "1 value, max. size"



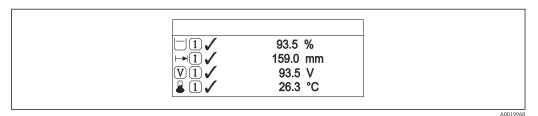
■ 63 "Format display" = "1 bargraph + 1 value"



■ 64 "Format display" = "2 values"



■ 65 "Format display" = "1 value large + 2 values"



■ 66 "Format display" = "4 values"

- The **Value 1 to 4 display** parameters are used to specify which measured values are shown on the local display and in what order.
 - If more measured values are specified than the display mode selected permits, then the values alternate on the device display. The display time until the next change is configured in the **Display interval** parameter ($\rightarrow \implies 196$).

Value 1 to 4 display Navigation Setup → Advanced setup → Display → Value 1 display Description Select the measured value that is shown on the local display.

Selection

- Level linearized
- Distance
- Interface linearized
- Interface distance
- Thickness upper layer
- Current output 1
- Measured current
- Current output 2
- Terminal voltage
- Electronic temperature
- Measured capacitance
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2

Factory setting For level measurements

- Value 1 display: Level linearized
- Value 2 display: Distance
- Value 3 display: Current output 1
- Value 4 display: None

For interface measurements and one current output

- Value 1 display: Interface linearized
- Value 2 display: Level linearized
- Value 3 display: Thickness upper layer
- Value 4 display: Current output 1

For interface measurements and two current outputs

- Value 1 display: Interface linearized
- Value 2 display: Level linearized
- Value 3 display: Current output 1
- Value 4 display: Current output 2

Decimal places 1 to 4

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Decimal places 1

Description This selection does not affect the measurement and calculation accuracy of the device.

Selection ■ X ■ X.X

x.xxx.xxx

X.XXXX

Additional information

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

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

Display interval

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow 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 $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Display damping

Description Set display reaction time to fluctuations in the measured value.

User entry 0.0 to 999.9 s

Header 🗈

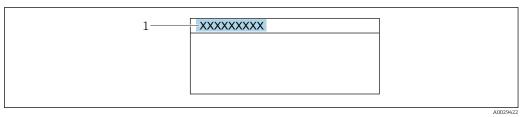
Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Header

Description Select header contents on local display.

Selection ■ Device tag

■ Free text

Additional information



1 Position of the header text on the display

Meaning of the options

Device tag

Is defined in the **Device tag** parameter ($\rightarrow \implies 135$).

Free text

Is defined in the **Header text** parameter ($\rightarrow \triangleq 197$).

Header text

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Header text

Prerequisite Header (→ 🗎 196) = Free text

Description Enter display header text.

User entry Character string comprising numbers, letters and special characters (12)

Additional information The number of characters which can be displayed depends on the characters used.

Separator

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Separator

Description Select decimal separator for displaying numerical values.

Selection • .

■ ,

Number format

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Number format

Description Choose number format for the display.

Selection • Decimal

■ ft-in-1/16"

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

Decimal places menu

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Dec. places menu

Description Select number of decimal places for the representation of numbers within the operating

menu.

Selection ■ x

X.XX.XXX.XXXX.XXXX

Additional information

- Is only valid for numbers in the operating menu (e.g. **Empty calibration**, **Full calibration**), but not for the measured value display. The number of decimal places for the measured value display is defined in the **Decimal places 1 to 4** parameters
- This setting does not affect the accuracy of the device for measuring or calculating the value

Backlight

Navigation $\blacksquare \blacksquare$ Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Backlight

Prerequisite The device has the SD03 local display (with optical keys).

Description Switch the local display backlight on and off.

Selection • Disable

■ Enable

Additional information

Meaning of the options

Disable

Switches the backlight off.

■ Enable

Switches the backlight on.

Regardless of the setting in this parameter the backlight may be automatically switched off by the device if the supply voltage is too low.

Contrast display

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Display \rightarrow 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

i

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 ($\Rightarrow \implies 135$)).

Navigation

 \blacksquare Setup \rightarrow Advanced setup \rightarrow Conf.backup disp

_	. •	
()n	eratina	time
\mathbf{v}	CIGUIIU	uiiic

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Conf.backup disp \rightarrow Operating time

Description Indicates how long the device has been in operation.

Additional information *Maximum time*

9999 d (≈ 27 years)

Last backup

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

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

Configuration management

Navigation \blacksquare Setup \rightarrow Advanced setup \rightarrow Conf.backup disp \rightarrow 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 ($\rightarrow \implies 200$).

Clear backup data

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

- While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.
- If an existing backup is restored to a different device using the **Restore** option, it may occur that some device functionalities are no longer available. In some cases even a device reset will not restore the original status.

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

Backup state	
Navigation	Setup → Advanced setup → Conf.backup disp → Backup state
Description	Displays which backup action is currently in progress.
Comparison result	
Navigation	
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** ($\rightarrow \triangleq 199$) = **Compare**.
- If the transmitter configuration has been duplicated from a different device by Configuration management (→ 🗎 199) = 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 \square Setup \rightarrow Advanced setup \rightarrow Administration

Navigation \square Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow Def. access code

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 results symbol in the document. On the local display, the results 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 $(\rightarrow \implies 150)$.
- 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 ($\Rightarrow \triangleq 204$).

Device reset

Navigation $\blacksquare \Box$ Setup \rightarrow Advanced setup \rightarrow Administration \rightarrow 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 the factory default if customer specific settings have been ordered.

This option is only visible if customer specific settings have been ordered.

Of customer settings

All customer parameters are reset to their factory setting. Service parameters, however, remain unchanged.

■ To transducer defaults

Every measurment-related parameter is reset to its factory setting. Service parameters and communication-related parameters, however, remain unchanged.

■ Restart device

The restart resets every parameter which is stored in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

"Define access code" wizard

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

Define access code		A
Navigation	Setup → Advanced setup → Administration → Def. access code → Def. access code	ode
Description → □ 202		
Confirm access code		
Navigation		<u> </u>
Description	Confirm the entered access code.	
User entry	0 to 9 999	

17.5 "Diagnostics" menu

Actual diagnostics

Navigation \Box Diagnostics \rightarrow Actual diagnos.

Description Displays current diagnostic message.

Additional information The display consists of:

- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text
- 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 ③ symbol on the display.

Timestamp

Navigation □ Diagnostics → Timestamp

Description Displays the timestamp for the currently active diagnostic message.

Previous diagnostics

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

Additional information The

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 ① symbol on the display.

Timestamp

Navigation □ Diagnostics → Timestamp

Description Shows the timestamp of the previous diagnostic message.

Operating time from restart

Navigation \Box Diagnostics \rightarrow Time fr. restart

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

Operating time

Navigation \blacksquare Diagnostics \rightarrow 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 \Box 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 behaviorCode for diagnostic behaviorOperating time of occurrence

Event text

Timestamp 1 to 5

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

Description Timestamp of the diagnostic message.

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".

Filter options	
----------------	--

Navigation

Diagnostics → Event logbook → Filter options

Description

Define which category of event messages is shown in the Events list submenu.

Selection

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

Additional information



- This parameter is only used for operation via the local display.
- The status signals are categorized according to NAMUR NE 107.

"Event list" submenu

The **Event list** submenu displays the history of past events of the category selected in the **Filter options** parameter ($\rightarrow \implies 208$). 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 \square Diagnostics \rightarrow Event logbook \rightarrow Event list

17.5.3 "Device information" submenu

Navigation $\blacksquare \square$ Diagnostics \rightarrow Device info

Device tag

Navigation \square Diagnostics \rightarrow Device info \rightarrow Device tag

Description Enter the name for the measuring point.

User interface Character string comprising numbers, letters and special characters

Serial number

Navigation \blacksquare Diagnostics \rightarrow Device info \rightarrow 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 \blacksquare 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 $\blacksquare \square$ Diagnostics \rightarrow Device info \rightarrow Device name

Description Shows the name of the transmitter.

Order code

Navigation $\blacksquare \Box$ Diagnostics \rightarrow Device info \rightarrow Order code

Description Shows the device order code.

User interface Character string comprising numbers, letters and special characters

Additional information The order code is generated from the extended roder code, which defines all device

features of the product structure. In contrast, the device features can not be read directly

from the order code.

Extended order code 1 to 3

Navigation \blacksquare Diagnostics \rightarrow Device info \rightarrow Ext. order cd. 1

Description Display the three parts of the extended order code.

User interface Character string comprising numbers, letters and special characters

Additional information The extended order code indicates the version of all the features of the product structure

and thus uniquely identifies the device.

Device revision

Navigation $\blacksquare \Box$ Diagnostics \rightarrow Device info \rightarrow Device revision

Description Shows the device revision with which the device is registered with the HART

Communication Foundation.

Additional information The device revision is used to allocate the correct Device Description file (DD) to the device.

Device ID

Navigation \blacksquare Diagnostics \rightarrow Device info \rightarrow 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 \Box Diagnostics \rightarrow Device info \rightarrow Device type

Description Shows the device type with which the measuring device is registered with the HART

Communication Foundation.

Additional information

Manufacturer ID

Description Use this function to view the manufacturer ID with which the measuring device is

registered with the HART Communication Foundation.

User interface 2-digit hexadecimal number

Factory setting 0x11 (for Endress+Hauser)

17.5.4 "Measured values" submenu

Navigation $\blacksquare \blacksquare$ Diagnostics \rightarrow Measured val.

Distance

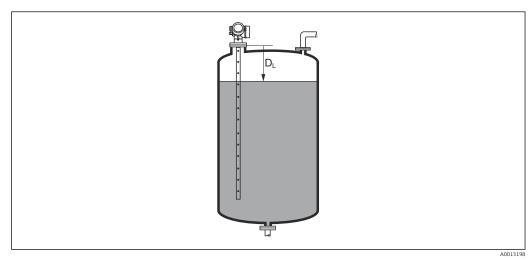
Navigation

 \blacksquare Diagnostics \rightarrow Measured val. \rightarrow Distance

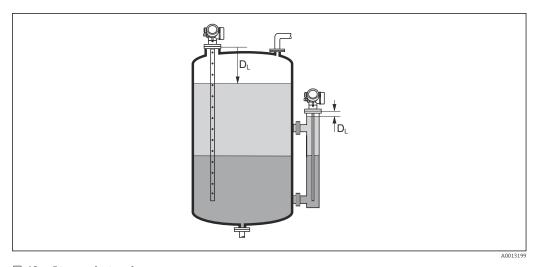
Description

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

Additional information



■ 67 Distance for liquid measurements



 \blacksquare 68 Distance for interface measurements

The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 135$).

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Level linearized

Navigation \blacksquare Diagnostics \rightarrow Measured val. \rightarrow Level linearized

Description Displays linearized level.

Additional information

- This unit is defined by the **Unit after linearization** parameter.
- In the case of interface measurements, this parameter always refers to the total level.

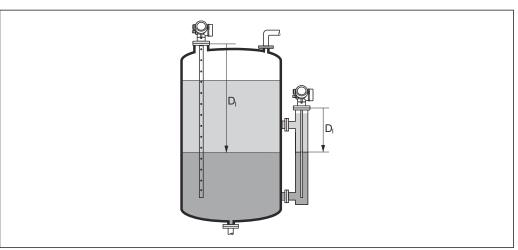
Interface distance

Navigation $\blacksquare \blacksquare$ Diagnostics \rightarrow Measured val. \rightarrow Interface dist.

Prerequisite Operating mode (→ 🖺 135) = Interface or Interface with capacitance

threaded connection) and the interface.

Additional information



A0013202

The unit is defined in the **Distance unit** parameter ($\rightarrow \triangleq 135$).

Interface linearized

Navigation \blacksquare Diagnostics \rightarrow Measured val. \rightarrow Interf. lineariz

Prerequisite Operating mode (→ 🖺 135) = Interface or Interface with capacitance

Description Displays the linearized interface height.

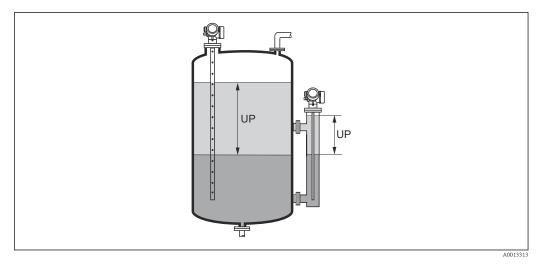
Additional information This unit is defined by the **Unit after linearization** parameter.

Thickness upper layer

Prerequisite Operating mode (→ 🖺 135) = Interface or Interface with capacitance

Description Displays the upper interface thickness (UP).

Additional information



UP Thickness upper layer

The unit is defined by the **Unit after linearization** parameter $\rightarrow \triangleq 166$.

Output current 1 to 2 $\,$

Navigation \blacksquare Diagnostics \rightarrow Measured val. \rightarrow Output curr. 1 to 2

Description Shows the actual calculated value of the output current.

Measured current 1

Navigation \Box Diagnostics \rightarrow Measured val. \rightarrow Measur. curr. 1

Prerequisite Only available for current output 1

Description Shows the current value of the current output which is currently measured.

Terminal voltage 1

Navigation \blacksquare Diagnostics \rightarrow Measured val. \rightarrow Terminal volt. 1

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

17.5.5 "Data logging" submenu

Assign channel 1 to 4

Navigation

Description

Assign a process variable to logging channel.

Selection

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

Additional information

A total of 1000 measured values can be logged. This means:

- 1000 data points if 1 logging channel is used
- 500 data points if 2 logging channels are used
- 333 data points if 3 logging channels are used
- 250 data points if 4 logging channels are used

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

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

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

Logging interval	
Logging interval	

Navigation Diagnostics → Data logging → Logging interval

> Diagnostics → Data logging → Logging interval

Description Define the logging interval tlog for data logging. This value defines the time interval

between the individual data points in the memory.

User entry 1.0 to 3600.0 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 · 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

- $T_{log} = 1000 \cdot 1 \text{ s} = 1000 \text{ s} \approx 16.5 \text{ min}$
- $T_{log} = 1000 \cdot 10 \text{ s} = 1000 \text{ s} \approx 2.75 \text{ h}$
- $T_{log} = 1000 \cdot 80 \text{ s} = 80000 \text{ s} \approx 22 \text{ h}$ $T_{log} = 1000 \cdot 3600 \text{ s} = 3600000 \text{ s} \approx 41 \text{ d}$

Clear logging data

Navigation Diagnostics → Data logging → Clear logging

> Diagnostics → Data logging → Clear logging

Description Clear the entire logging data.

Selection Cancel

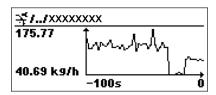
■ Clear data

"Display channel 1 to 4" submenu



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

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



- x-axis: depending on the number of selected channels, 250 to 1000 measured values of a process variable are displayed.
- y-axis: covers the approximate measured value span and constantly adapts this to the measurement.
- To return to the operating menu, press \pm and \Box simultaneaously.

Navigation

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

17.5.6 "Simulation" submenu

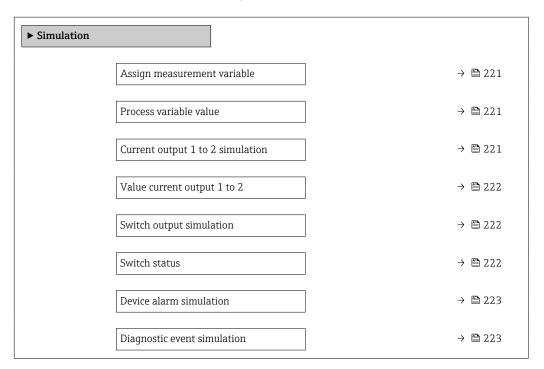
The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters		
Specific value of a process variable	 Assign measurement variable (→ 🖺 221) Process variable value (→ 🖺 221) 		
Specific value of the output current	 Current output simulation (→		
Specific state of the switch output	■ Switch output simulation (→ 🖺 222) ■ Switch status (→ 🖺 222)		
Existence of an alarm	Device alarm simulation (→ 🖺 223)		
Existence of a specific diagnostic message	Diagnostic event simulation (→ 🖺 223)		

Structure of the submenu

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation



Description of parameters

Navigation $\blacksquare \blacksquare$ Expert \rightarrow Diagnostics \rightarrow Simulation

Assign measurement variable

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Assign meas.var.

Description Defines the process variable to be simulated.

Selection ■ Off

LevelInterface

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 ($\rightarrow \cong 221$).
- If **Assign measurement variable** ≠ **Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Process variable value

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Proc. var. value

Prerequisite Assign measurement variable (→ 🗎 221) ≠ Off

Description Defines the value of the selected variable.

The outputs assume values or states according to this value.

User entry Signed floating-point number

Additional information Downstream measured value processing and the signal output use this simulation value. In

this way, users can verify whether the measuring device has been configured correctly.

Current output 1 to 2 simulation

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Curr.out. 1 to 2 sim.

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

Endress+Hauser

221

Visibility depends on order options or device settings

Selection ■ Off

■ On

Additional information An active simulation is indicated by a diagnostic message of the *Function check (C)*

category.

Value current output 1 to 2

Navigation $\blacksquare \blacksquare$ Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Value curr.out 1 to 2

Prerequisite Current output simulation ($\rightarrow \stackrel{\triangle}{=} 221$) = 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 simulation

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Switch sim.

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

Selection ■ Off

On

Switch status

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Switch status

Prerequisite Switch output simulation ($\rightarrow \triangleq 222$) = On

Description Current status of the switch output.

Selection ■ Open

Closed

Additional information

The switch status assumes the value defined in this parameter. This helps to check correct

operation of connected control units.

Device alarm simulation

Navigation $\blacksquare \blacksquare$ Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow Dev. alarm sim.

Description Switch the device alarm on and off.

Selection ■ Off

■ On

Additional information When selecting the **On** option, the device generates an alarm. This helps to check the

correct output behavior of the device in the case of an alarm.

An active simulation is indicated by the **⊗C484 Failure mode simulation** diagnostic

message.

Diagnostic event simulation

Navigation \blacksquare Expert \rightarrow Diagnostics \rightarrow Simulation \rightarrow 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 $\blacksquare \square$ Diagnostics \rightarrow Device check

Start device check

Navigation \blacksquare Diagnostics \rightarrow Device check \rightarrow Start dev. check

Description Start a device check.

Selection ■ No ■ Yes

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

Result device check

Navigation $\blacksquare \blacksquare$ Diagnostics \rightarrow Device check \rightarrow Result dev.check

Description Displays the result of the device check.

Additional information Meaning of the display options

■ Installation ok

Measurement possible without restrictions.

Accuracy reduced

A measurement is possible. However, the measuring accuracy may be reduced due to the signal amplitudes.

■ Measurement capability reduced

A measurement is currently possible. However, 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 \blacksquare Diagnostics \rightarrow Device check \rightarrow Last check time

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

User interface Character string comprising numbers, letters and special characters

Level signal

Navigation \blacksquare Diagnostics \rightarrow Device check \rightarrow 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 OKCheck 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 $\blacksquare \square$ Diagnostics \rightarrow Device check \rightarrow Launch signal

Prerequisite Device check has been performed.

Description Displays result of the display check for the launch signal.

User interface ■ Check not done

Check not OKCheck 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 $\blacksquare \Box$ Diagnostics \rightarrow Device check \rightarrow Interface signal

Prerequisite ■ Operating mode (→ 🖺 135) = 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

17.5.8 "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

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