Operating Instructions
Levelflex FMP55
PROFIBUS PA

Guided wave radar

Endress+Hauser

People for Process Automation

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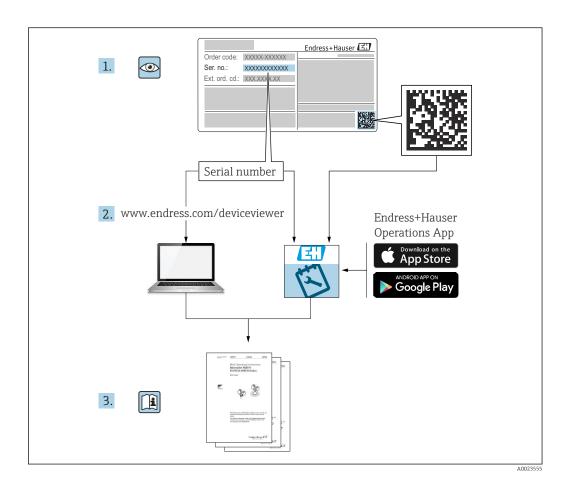
Table of contents

1   Important document information

1.1   Purpose of this document

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

1.2   Symbols

1.2.1   Safety symbols

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

1.2.2   Electrical symbols

$\sim$

Alternating current

$\overline{\sim}$

Direct current and alternating current

$=$

Direct current

Ground connection

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

⏚ **Protective earth (PE)**

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

The ground terminals are located on the interior and exterior of the device:
• Interior ground terminal: protective earth is connected to the mains supply.
• Exterior ground terminal: device is connected to the plant grounding system.

1.2.3   Tool symbols

✚ ✐
Phillips head screwdriver

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

🛈 **Tip**
Indicates additional information

Reference to documentation

Reference to graphic

▶
Notice or individual step to be observed

1., **2.**, **3.**
Series of steps

⌐▶
Result of a step

Visual inspection

Operation via operating tool

Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

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

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

1.3   Documentation

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

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

1.3.1   Technical Information (TI)

Planning aid
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
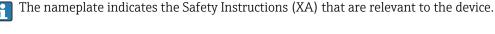
1.3.2   Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.3.3   Safety Instructions (XA)

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

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

1.3.4   Functional Safety Manual (FY)

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

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

1.4   Terms and abbreviations

BA
Document type "Operating Instructions"

KA
Document type "Brief Operating Instructions"

TI
Document type "Technical Information"

SD
Document type "Special Documentation"

XA
Document type "Safety Instructions"

PN
Nominal pressure

MWP
Maximum working pressure
The MWP is indicated on the nameplate.

ToF
Time of Flight

ε_r (Dk value)
Relative dielectric constant

PLC
Programmable logic controller (PLC)

CDI
Common Data Interface

BD
Blocking Distance; no signals are analyzed within the BD.

PLC
Programmable logic controller (PLC)

CDI
Common Data Interface

PFS
Pulse Frequency Status (Switch output)

1.5   Registered trademarks

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TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

2 Basic safety instructions

2.1 Requirements for the personnel

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

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

2.2 Intended use

Application and media

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

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

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

Incorrect use

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

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

Residual risks

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

Danger of burns from contact with surfaces!
▸ In the event of high medium temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

When working on and with the device:
▸ Wear the required protective equipment according to federal or national regulations.

2.4 Operational safety

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
▸ If modifications are nevertheless required, consult with the manufacturer.

Repair

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

Hazardous area

To eliminate danger to persons or the installation when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):
▸ Check the nameplate to verify whether the ordered device can be put to its intended use in the hazardous area.
▸ Observe the specifications in the separate supplementary documentation, which is an integral part of this manual.

2.5 Product safety

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

> **NOTICE**
> **Loss of degree of protection by opening of the device in humid environments**
> ▸ If the device is opened in a humid environment, the degree of protection indicated on the nameplate is no longer valid. This may also impair the safe operation of the device.

2.5.1 CE mark

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

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

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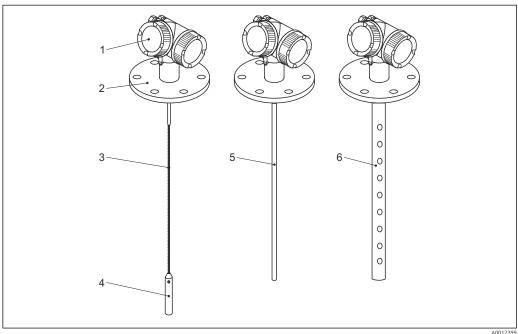
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

3   Product description

3.1   Product design
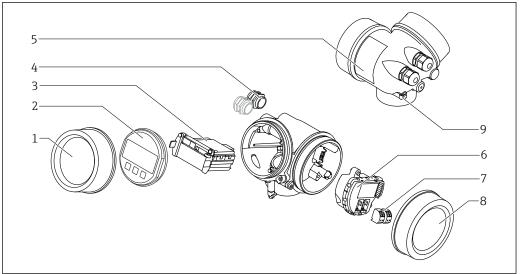
3.1.1   Levelflex FMP51/FMP52/FMP54/FMP55

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🖼 1   Design of the Levelflex

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

3.1.2 Electronics housing

2   Design of the electronics housing

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

4　Incoming acceptance and product identification

4.1　Incoming acceptance

Check the following during incoming acceptance:
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): are the Safety Instructions (XA) provided?
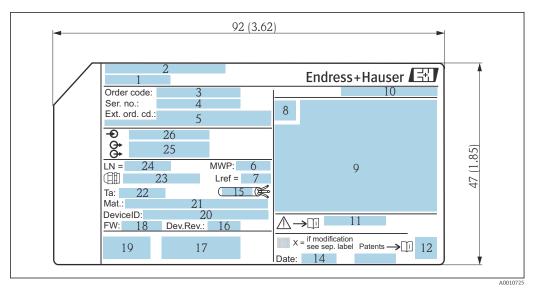
If one of these conditions is not met, please contact your Endress+Hauser sales office.

4.2　Product identification

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

4.2.1 Nameplate

3 Nameplate of the Levelflex; engineering unit: mm (in)

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

Up to 33 characters of the extended order code are indicated on the nameplate. If the extended order code contains additional characters, these cannot be displayed. However, the complete extended order code can also be displayed via the device operating menu: **Extended order code 1 to 3** parameter

5   Storage, transport

5.1   Storage temperature

- Permitted storage temperature: –40 to +80 ℃ (–40 to +176 ℉)
- Use original packaging.
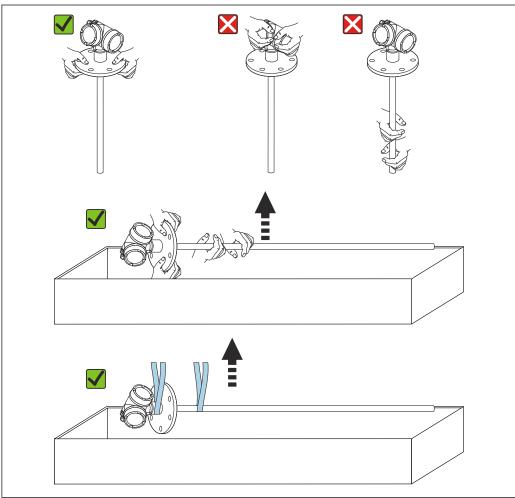
5.2   Transporting the product to the measuring point

⚠ WARNING

Housing or rod may become damaged or pull off.

Danger of injury!

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

▸ Always secure lifting equipment (slings, eyes, etc.) at the process connection and never lift the device by the electronic housing or probe. Pay attention to the center of gravity of the device so that it does not tilt or slip unintentionally.

▸ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.6 lbs) (IEC 61010).
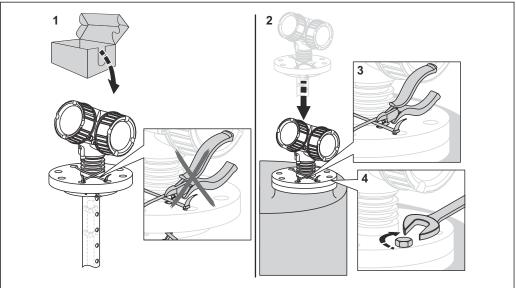
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NOTICE

Transport lock in the FMP55 with coax probe

▶ The coax tube is not firmly connected to the electronics housing in the FMP55 with coax probe. It is fixed onto the mounting flange with two cable ties during transportation. These cable ties must not be released during transportation or installation of the device to prevent the spacer from sliding at the probe rod. They may only be removed immediately before screwing the process connection flange into place.

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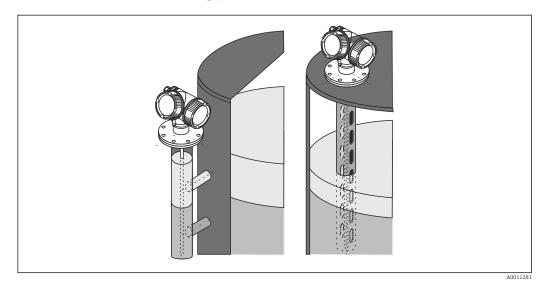
6   Mounting

6.1   Mounting requirements

6.1.1   Suitable mounting position
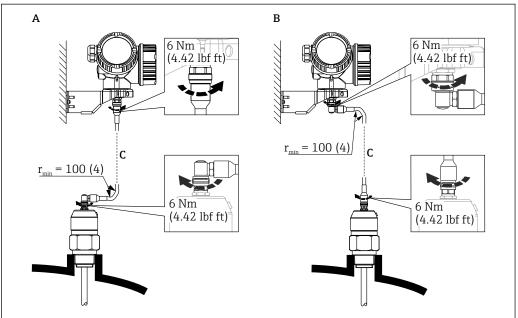
🖼 4   *Mounting position of Levelflex FMP55*

- Rod probes/rope probes: mount in the bypass/stilling well.
- Coax probes can be mounted at any distance from the wall.
- When mounting outdoors, a weather protection cover can be used to protect the device against extreme weather conditions.
- Minimum distance from the end of the probe to the bottom of the vessel: 10 mm (0.4 in)

6.1.2   Mounting under confined conditions

Mounting with remote probe

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

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

- Product structure, feature 600 "Probe design":
  Version MB "Sensor remote, 3m cable"
- The connecting cable is included in the delivery with these versions.
  Minimum bending radius: 100 mm (4 inch)
- The mounting bracket for the electronics housing is included in the delivery with these versions. Mounting options:
  - Wall mounting
  - Mounting on DN32 to DN50 (1-1/4 to 2 inch) post or pipe
- The connection cable has one straight plug and one plug angled at 90°. Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

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

6.1.3   Notes on the mechanical load of the probe

Tensile loading capacity of rope probes

FMP55

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

Lateral loading capacity (flexural strength) of rod probes

FMP55

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

6.1.4   Lateral loading capacity (flexural strength) of coax probes

FMP55

Probe Ø 42.4 mm 316L
300 Nm

6.1.5   Mounting cladded flanges

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

The PTFE flange cladding normally acts simultaneously as a seal between the nozzle and the device flange.
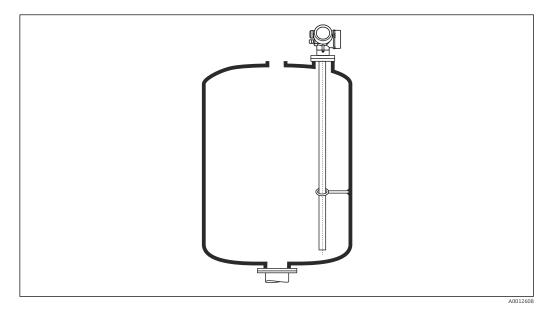
Flange size	Number of screws	Tightening torque
EN		
DN40/PN40	4	35 to 55 Nm
DN50/PN16	4	45 to 65 Nm
DN50/PN40	4	45 to 65 Nm
DN80/PN16	8	40 to 55 Nm
DN80/PN40	8	40 to 55 Nm
DN100/PN16	8	40 to 60 Nm
DN100/PN40	8	55 to 80 Nm
DN150/PN16	8	75 to 115 Nm
DN150/PN40	8	95 to 145 Nm
ASME		
1½"/150lbs	4	20 to 30 Nm
1½"/300lbs	4	30 to 40 Nm
2"/150lbs	4	40 to 55 Nm
2"/300lbs	8	20 to 30 Nm
3"/150lbs	4	65 to 95 Nm
3"/300lbs	8	40 to 55 Nm
4"/150lbs	8	45 to 70 Nm
4"/300lbs	8	55 to 80 Nm
6"/150lbs	8	85 to 125 Nm
6"/300lbs	12	60 to 90 Nm
JIS		
10K 40A	4	30 to 45 Nm
10K 50A	4	40 to 60 Nm
10K 80A	8	25 to 35 Nm
10K 100A	8	35 to 55 Nm
10K 100A	8	75 to 115 Nm

6.1.6   Securing the probe

Securing coax probes

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

A0012608
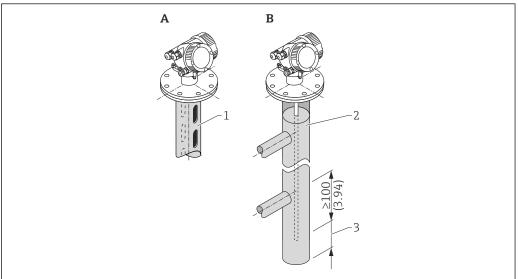
Coax probes can be secured (fixed) at any point in the ground tube.

6.1.7   Special installation situations

Bypasses and stilling wells

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

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

A0014129
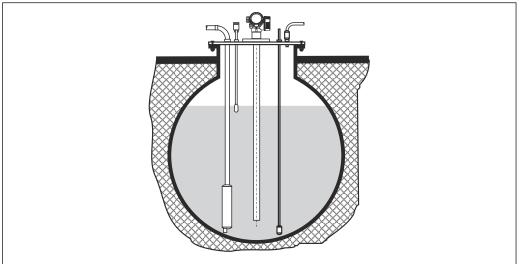
1   Mounting in stilling well
2   Mounting in bypass
3   Minimum distance between probe end and lower edge of bypass 10 mm (0.4 in)

- Pipe diameter: > 40 mm (1.6 in) (for rod probes).
- A rod probe can be installed in pipes with a diameter of up to 150 mm (6 in). The use of a coax probe is recommended for larger pipe diameters.
- Side outlets, holes, slots and welds - with a maximum inward projection of 5 mm (0.2 in) - do not affect the measurement.
- There should not be any changes in the diameter of the pipe.
- The probe must be 100 mm (4 in) longer than the lower outlet.
- The probes must not touch the pipe wall within the measuring range. Support or brace the probe if necessary. All rope probes are prepared for bracing in vessels (tensioning weight with anchor hole).
- The probes must not touch the pipe wall within the measuring range. If necessary, use a PFA centering star.
- Coax probes can be used within any restrictions provided that the pipe diameter permits their installation.

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

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

ℹ 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

Underground tanks

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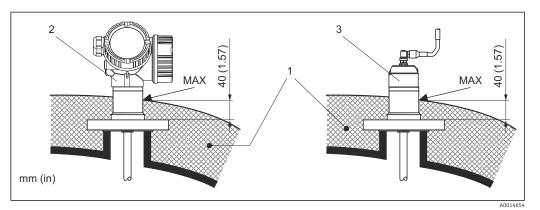
In the case of nozzles with large diameters, use a coax probe to avoid reflections at the nozzle wall.

Non-metal vessels

Use a coax probe if mounting in non-metal vessels.

Vessel with thermal insulation

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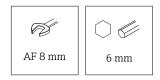
5   Process connection with flange

1   Vessel insulation
2   Compact device
3   Sensor, remote

6.2   Mounting the measuring device

6.2.1   Tool list

AF 8 mm	6 mm

For flanges and other process connections: use an appropriate mounting tool

6.2.2   Mounting the device

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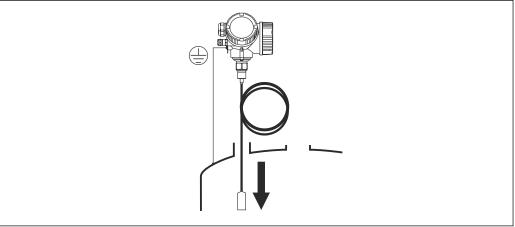
If a seal is used to mount the device, use uncoated metal screws to ensure good electrical contact between the process flange and the probe flange.

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.

6.2.3   Mounting the "Sensor, remote" version

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

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

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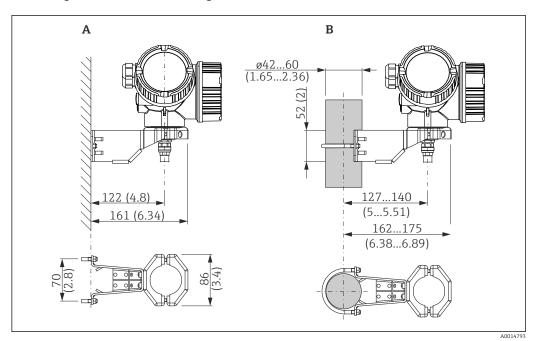
⚠ CAUTION

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

▶ Mount the probe and the electronics housing securely before connecting the connecting cable.

▶ Lay the connecting cable in such a way that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4 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.

ℹ 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
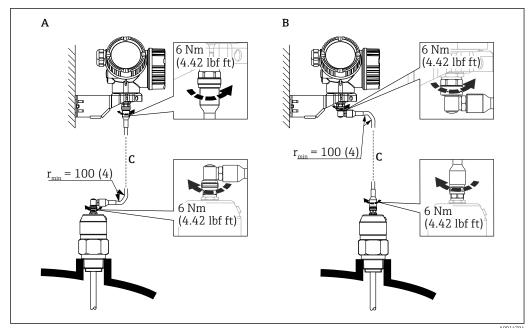
🖼 6   *Mounting the electronics housing with the mounting bracket. Unit of measurement mm (in)*

A   Wall mounting
B   Post mounting

Connecting the connecting cable

AF 18 mm
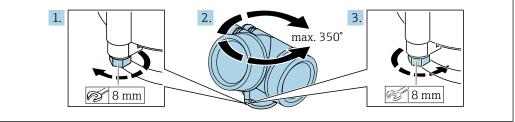
🖼 *7   Connecting the connecting cable. The cable can be connected in the following ways:. Unit of measurement mm (in)*

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

6.2.4   Turning the transmitter housing

To provide easier access to the connection compartment or display module, the transmitter housing can be turned:
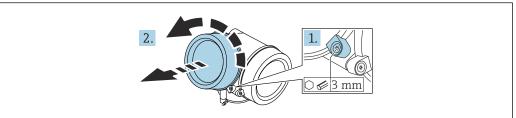
1. Unscrew the securing screw using an open-ended wrench.

2. Rotate the housing in the desired direction.

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

6.2.5   Turning the display
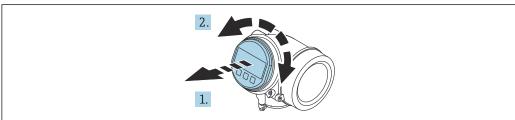
Opening the cover

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.
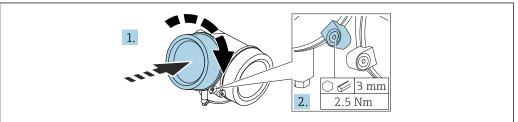
Turning the display module

A0036401

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

2. Turn the display module to the desired position: Max. 8 × 45 ˚ in each direction.

3. Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

Closing the cover of the electronics compartment

A0021451

1. Screw down the cover of the electronics compartment.

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

6.3   Post-installation check

❑ Is the device undamaged (visual inspection)?

❏ Does the device comply with the measuring point specifications?
- Process temperature
- Process pressure
- Ambient temperature range
- Measuring range

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

❏ Is the device adequately protected against precipitation and direct sunlight?

❏Is the device adequately protected against impact?

❏Are all mounting and safety screws securely tightened?
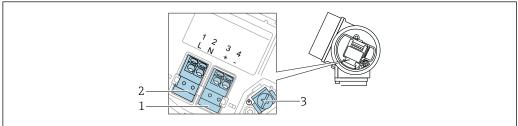
❏ Is the device properly secured?

7 Electrical connection

7.1 Connecting requirements

7.1.1 Terminal assignment

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

A0036519
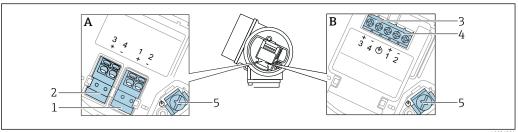
🖾 *8* *Terminal assignment, 4-wire: 4 to 20 mAHART (90 to 253 V$_{AC}$)*

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

⚠ CAUTION

To ensure electrical safety:
▶ Do not disconnect the protective ground connection.
▶ Disconnect the device from the supply voltage before disconnecting the protective ground.

ℹ Connect protective ground to the inner ground terminal (3) before connecting the supply voltage. If necessary, connect the potential matching line to the outer ground terminal.

ℹ 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.

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

Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus

A0036500
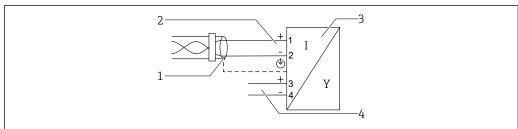
⊠ 9   Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus

A   Without integrated overvoltage protection
B   With integrated overvoltage protection
1   Connection, PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, without integrated overvoltage protection
2   Connection, switch output (open collector): terminals 3 and 4, without integrated overvoltage protection
3   Connection, switch output (open collector): terminals 3 and 4, with integrated overvoltage protection
4   Connection, PROFIBUS PA / FOUNDATION Fieldbus: terminals 1 and 2, with integrated overvoltage protection
5   Terminal for cable shield

Block diagram PROFIBUS PA / FOUNDATION Fieldbus

A0036530
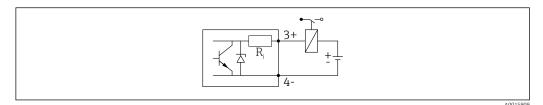
⊠ 10   Block diagram PROFIBUS PA / FOUNDATION Fieldbus
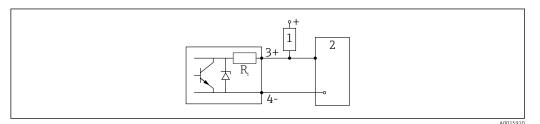
1   Cable screen; observe cable specification
2   Connection PROFIBUS PA / FOUNDATION Fieldbus
3   Measuring device
4   Switch output (open collector)

Connection examples for the switch output

☒ 11   Connection of a relay

☒ 12   Connection to a digital input

1   Pull-up resistor
2   Digital input

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

7.1.2   Cable specification

- **Devices without integrated overvoltage protection**
  Pluggable spring-force terminals for wire cross-sections 0.5 to 2.5 mm^2 (20 to 14 AWG)
- **Devices with integrated overvoltage protection**
  Screw terminals for wire cross-sections 0.2 to 2.5 mm^2 (24 to 14 AWG)
- For ambient temperature $T_U \geq 60$ °C (140 °F): use cable for temperature T_U +20 K.
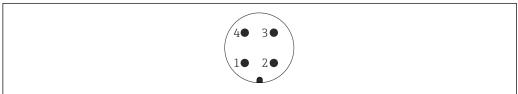
PROFIBUS

Use a twisted, screened two-wire cable, preferably cable type A.

For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

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.

☒ 13   Pin assignment of M12 plug

1   Signal +
2   Not assigned
3   Signal -
4   Ground

7.1.4   Supply voltage

PROFIBUS PA, FOUNDATION Fieldbus

"Power supply; output"[1]	"Approval"[2]	Terminal voltage
E: 2-wire; FOUNDATION Fieldbus, switch output **G:** 2-wire; PROFIBUS PA, switch output	• Non-hazardous • Ex nA • Ex nA[ia] • Ex ic • Ex ic[ia] • Ex d[ia] / XP • Ex ta / DIP • CSA GP	9 to 32 V [3]
	• Ex ia / IS • Ex ia + Ex d[ia] / IS + XP	9 to 30 V [3]

1) Feature 020 in the product structure
2) Feature 010 in the product structure
3) Input voltages up to 35 V do not destroy the device.

Polarity-dependent	No
FISCO/FNICO compliant according to IEC 60079-27	Yes

7.1.5   Overvoltage protection

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

Integrated overvoltage protection module

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

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

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

External overvoltage protection module

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

For detailed information please refer to the following documents:
• HAW562: TI01012K
• HAW569: TI01013K

7.2   Connecting the device

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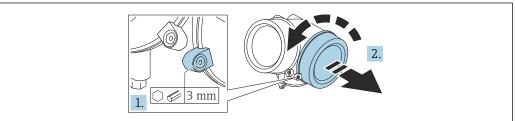
Explosion Hazard!
▸ Observe applicable national standards.
▸ Comply with the specifications in the Safety Instructions (XA).
▸ Use specified cable glands only.
▸ Check to ensure that the power supply matches the information on the nameplate.
▸ Switch off the power supply before connecting the device.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

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

### 7.2.1   Opening cover
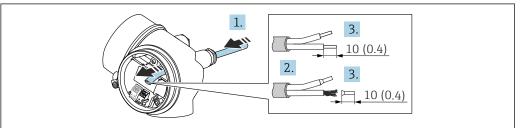
A0021490

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

A0036418
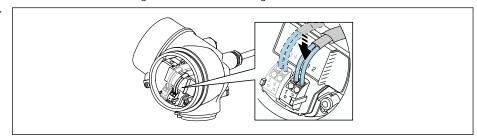
⊠ 14   *Engineering unit: mm (in)*

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

2. Remove the cable sheath.

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

4. Firmly tighten the cable glands.
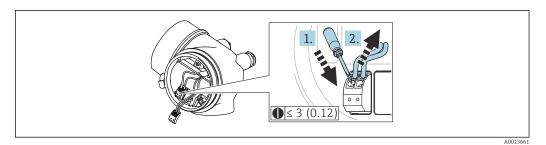
5. Connect the cable according to the terminal assignment.

A0034682

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
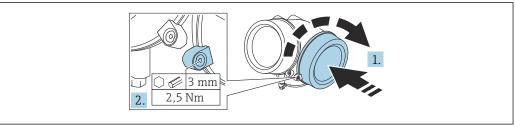
🔲 *15   Engineering unit: mm (in)*

To remove the cable from the terminal again:

1. Using a flat-blade screwdriver ≤ 3 mm, press down on the slot between the two terminal holes

2. Simultaneously pull the cable end out of the terminal.

7.2.4 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?

❑ Does the supply voltage match the specifications on the nameplate?

❑ Is the terminal assignment correct?

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

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

❑ Are all the housing covers installed and tightened?

❑ Is the securing clamp firmly tightened?
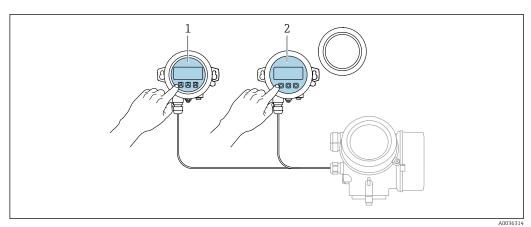
8   Operation methods

8.1   Overview

8.1.1   Local operation

Operation with	*Pushbuttons*	*Touch Control*
Order code for "Display; Operation"	Option **C** "SD02"	Option **E** "SD03"
	A0036312	A0036313
Display elements	4-line display	4-line display white background lighting; switches to red in event of device error
	Format for displaying measured variables and status variables can be individually configured	
	Permitted ambient temperature for the display: −20 to +70 ℃ (−4 to +158 ℉) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	local operation with 3 push buttons (⊞, ⊟, 𝔼)	external operation via touch control; 3 optical keys: ⊞, ⊟, 𝔼
	Operating elements also accessible in various hazardous areas	
Additional functionality	Data backup function The device configuration can be saved in the display module.	
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration.	
	Data transfer function The transmitter configuration can be transmitted to another device using the display module.	

8.1.2 Operation with remote display and operating module FHX50
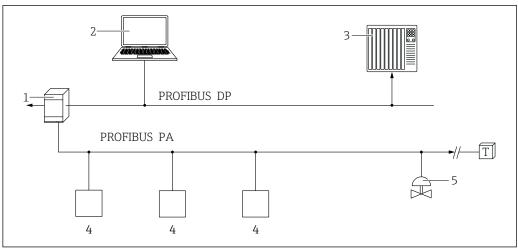
16   FHX50 operating options

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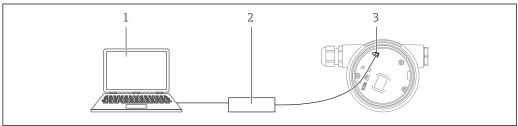
8.1.3 Remote operation

Via PROFIBUS PA protocol

1   Segment coupler
2   Computer with PROFIusb and operating tool (e.g. DeviceCare/FieldCare)
3   PLC (programmable logic controller)
4   Transmitter
5   Additional functions (valves etc.)

Via service interface (CDI)

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

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

Menu	Submenu / parameter	Meaning
	Language [1]	Defines the operating language of the local display
Commissioning [2]		Launches the interactive wizard for guided commissioning. Additional settings generally do not need to be made in the other menus when the wizard is finished.
Setup	Parameter 1 ... Parameter N	Once values have been set for these parameters, the measurement should generally be completely configured.
	Advanced setup	Contains additional submenus and parameters: • For more customized configuration of the measurement (adaptation to special measuring conditions). • For converting the measured value (scaling, linearization). • For scaling the output signal.
Diagnostics	**Diagnostic list**	Contains up to 5 currently active error messages.
	Event logbook [3]	Contains the last 20 messages (which are no longer active).
	Device information	Contains information for identifying the device.
	Measured values	Contains all current measured values.
	Data logging	Contains the history of the individual measuring values.
	Simulation	Is used to simulate measured values or output values.
	Device check	Contains all parameters needed to check the measurement capability of the device.
	Heartbeat [4]	Contains all the wizards for the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.
Expert [5] Contains all the parameters of the device (including those that are already contained in one of the other menus). This menu is organized according to the function blocks of the device. The parameters of the Expert menu are described in: GP01001F (PROFIBUS PA)	**System**	Contains all higher-level device parameters that do not pertain either to the measurement or to measured value communication.
	Sensor	Contains all parameters needed to configure the measurement.
	Output	Contains all parameters needed to configure the switch output (PFS).

Menu	Submenu / parameter	Meaning
	Communication	Contains all parameters needed to configure the digital communication interface.
	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 → Advanced setup → Display"
2) Only if operating via an FDT/DTM system
3) Only available if operating via the local display
4) Only available if operating via DeviceCare or FieldCare
5) When you call up the "Expert" menu, you are always asked for an access code. If a customer-specific access code has not been defined, "0000" must be entered.
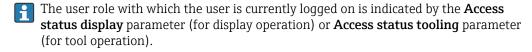
8.2.2 User roles and related access authorization

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

Access authorization to parameters

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

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

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

8.2.3 Data access - Security

Write protection via access code

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

Define access code via local display

1. Navigate to: Setup → 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.

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

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

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

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

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

- If write access is activated via an access code, it can only be deactivated again via this access code → ▤ 43.
- In the "Description of Device Parameters" documents, each write-protected parameter is identified with the ⌾-symbol.

Disabling write protection via access code

If the ⓐ symbol appears in front of a parameter on the local display, the parameter is write-protected by a device-specific access code and its value cannot currently be changed via the local display → 🗎 42.

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

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

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

Deactivation of the write protection via access code

Via local display

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

2. Enter **0000**.

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

Via an operating tool (e.g. FieldCare)
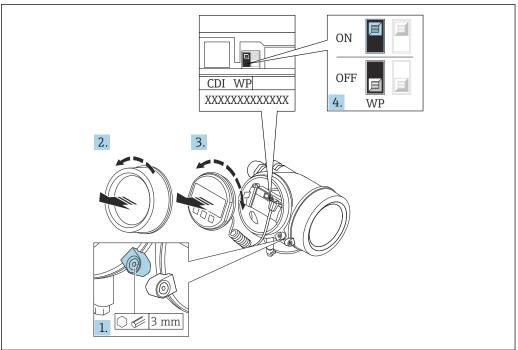
1. Navigate to: Setup → Advanced setup → Administration → Define access code

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

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**.
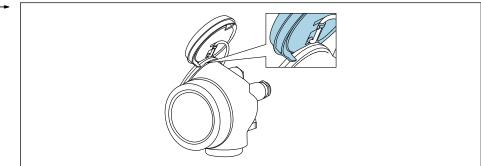
The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
• Via local display
• Via PROFIBUS PA protocol
• Via PROFIBUS DP protocol
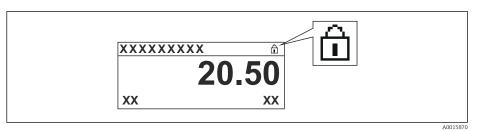
A0026157

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

A0015870

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

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

6. Reverse the removal procedure to reassemble the transmitter.

Enabling and disabling the keypad lock

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

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

Switching on the keypad lock

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

To activate the keylock manually:

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

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

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

Switching off the keypad lock

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

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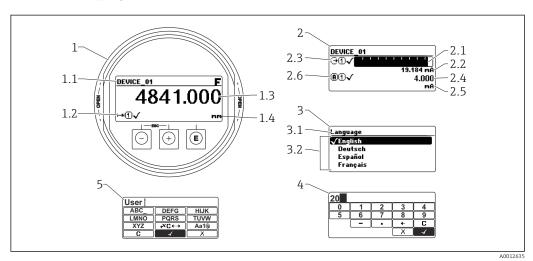
Bluetooth® wireless technology

Signal transmission via Bluetooth® wireless technology uses a cryptographic technique tested by the Fraunhofer Institute
- The device is not visible via *Bluetooth®* wireless technology without the SmartBlue app
- Only one point-to-point connection between **one** sensor and **one** smartphone or tablet is established

8.3   Display and operating module

8.3.1   Display

☒ *17   Display format on the display and operating module*

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

Display symbols for the submenus

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

Status signals

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

Display symbols for locking status

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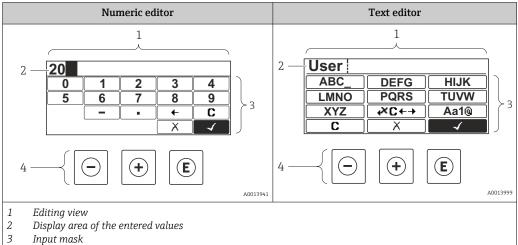
Measured value symbols

Symbol	Meaning
Measured values	
A0032892	Level
A0032893	Distance
A0032908	Current output
A0032894	Measured current
A0032895	Terminal voltage
A0032896	Electronics or sensor temperature
Measuring channels	
A0032897	Measuring channel 1
A0032898	Measuring channel 2
Status of the measured value	
A0018361	**"Alarm" status** The 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

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

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

□ + ⊞
 A0032909
	Escape key combination (press keys simultaneously)
	
	 In a menu, submenu
	 • Pressing the key briefly:
	   • Exits the current menu level and takes you to the next higher level.
	   • If help text is open, closes the help text of the parameter.
	 • Pressing the key for 2 s returns you to the measured value display ("home position").
	
	 In the text and numeric editor
	 Closes the text or numeric editor without applying changes.

□ + E A0032910	**Minus/Enter key combination (press and hold down the keys simultaneously)** 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

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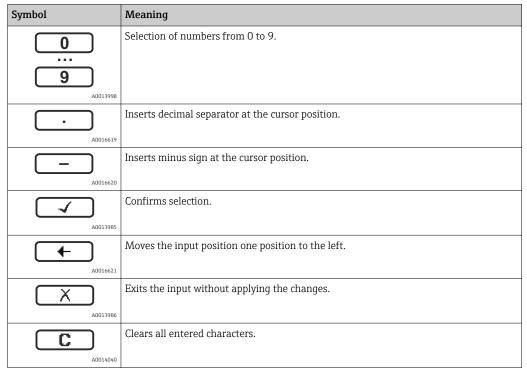
1 Editing view
2 Display area of the entered values
3 Input mask
4 Operating elements

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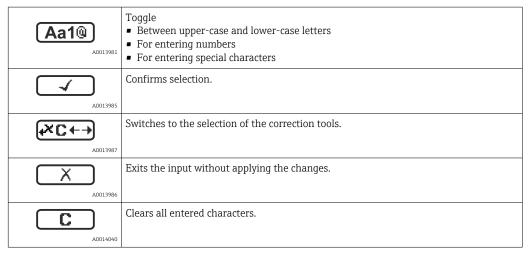
The following input and operating symbols are available in the input mask of the numeric and text editor:

Numeric editor

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

Text editor

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

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

Text correction under ⊁C←→

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

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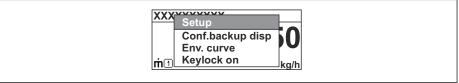
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

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

Calling up and closing the context menu

The user is in the operational display.

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

A0037872

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

Calling up the menu via the context menu

1. Open the context menu.

2. Press ⊞ to navigate to the desired menu.
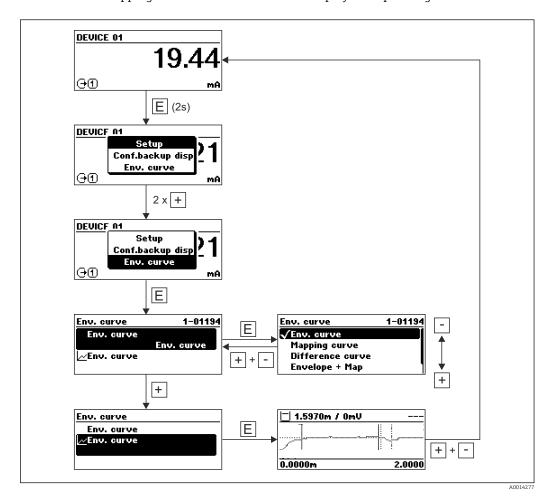
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

8.3.5 Envelope curve display on the display and operating module

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

A0014277
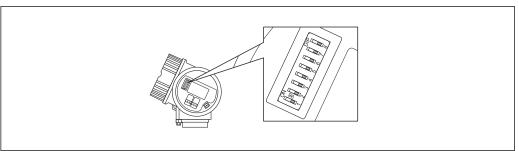
9 Integration into a PROFIBUS network

9.1 Overview of device master file (GSD)

Manufacturer ID	17 (0x11)
Ident number	0x1558
Profile version	3.02
GSD file	Information and files available at:
GSD file version	■ www.endress.com ■ www.profibus.org

9.2   Setting the device address

🖻 18   Address switch in the connection compartment
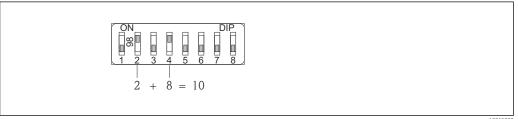
9.2.1   Hardware addressing

1. Set switch 8 to the "OFF" position.

2. Using switches 1 to 7, set the address as indicated in the table below.

The change of address takes effect after 10 seconds. The device is restarted.

Switch	1	2	3	4	5	6	7
Value in "ON" position	1	2	4	8	16	32	64
Value in "OFF" position	0	0	0	0	0	0	0
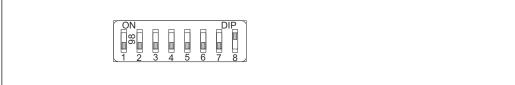
🖻 19   Example of hardware addressing; switch 8 is set to the "OFF" position; switches 1 to 7 define the address.

9.2.2   Software addressing

1. Set switch 8 to "ON".

2. The device restarts automatically and reports the current address (factory setting: 126).

3. Configuring the address via the operating menu: Setup → Device address
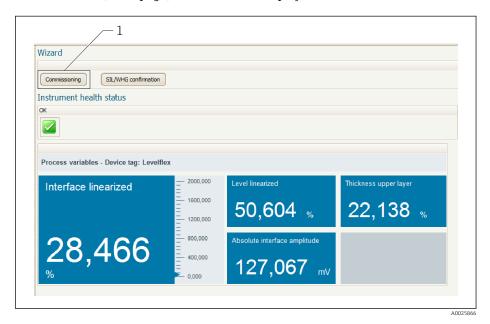
🖻 20   Example of software addressing; switch 8 is set to the "ON" position; the address is defined in the operating menu (Setup → Device address).

10   Commissioning using the Commissioning Wizard

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

1. Connect the device with FieldCare or DeviceCare.

2. Open the device in FieldCare or DeviceCare.
    ↳ The dashboard (homepage) of the device is displayed:

1   "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.

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

---

[1]   DeviceCare is available for download at www.software-products.endress.com. To download the software, it is necessary to register in the Endress +Hauser software portal.
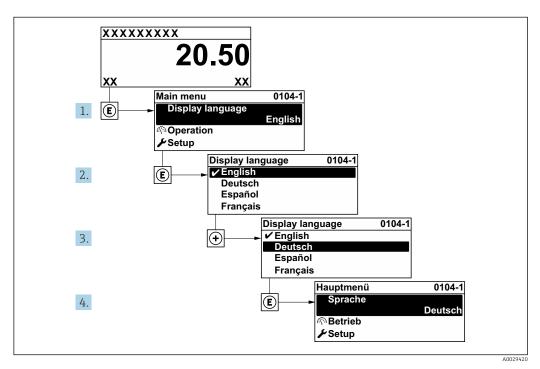
11   Commissioning via operating menu

11.1   Function check

Before commissioning your measuring point, ensure that the post-installation and post-connection checks have been performed:
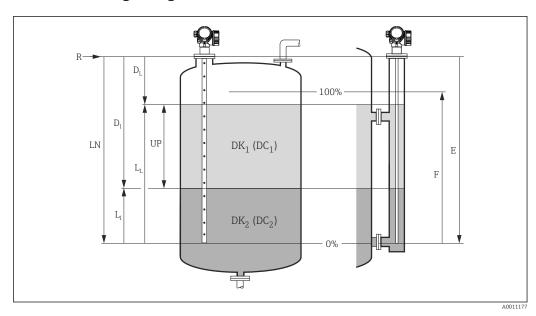
11.2   Setting the operating language

Factory setting: English or ordered local language

🖼 21   Taking the example of the local display

11.3   Configuring interface measurement

⊠ 22   Configuration parameters for interface measurement

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

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

2. Navigate to: Setup → Device address
   ↳ Enter the bus address of the device (only for software addressing).

3. Navigate to: Setup → Operating mode
   ↳ Select the **Interface with capacitance** option.

4. Navigate to: Setup → Distance unit
   ↳ Select the distance unit.

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

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

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

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

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

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

11. Navigate to: Setup → Interface
    ↳ Displays the interface height L$_I$.

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

13. Navigate to: Setup → Interface distance
    ↳ Displays the distance D$_I$ between the reference point R and the interface L$_I$.

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

15. Operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Ensure that the tank is fully drained. Then select the Tank empty option.

16. Via an operating tool (e.g. FieldCare):
    Navigate to: Setup → Confirm distance
    ↳ Ensure that the tank is fully drained. Then select the Tank empty option.

NOTICE
Wrong measurement due to incorrect dielectric constant of the lower medium
▸ The dielectric constant (DC value) of the lower medium must be specified if the lower
  medium is not water when **Operating mode** = **Interface with capacitance**. Navigation:
  Setup → Advanced setup → Interface → DC value lower medium

NOTICE
Wrong measurement due to incorrect empty capacitance
▸ In the case of rod and rope probes in the bypass, a correct measurement is only possible
  for **Operating mode** = **Interface with capacitance** after the empty capacitance has
  been determined. For this purpose, select **Confirm distance** = **Tank empty** after
  installing the probe when the tank is completely empty.A calculated empty capacitance
  can be entered for rod probes in the following parameters in exceptional cases only (if
  the tank cannot be emptied during commissioning): Expert → Sensor → Interface
  → Empty capacitance.

The empty capacitance is always calibrated ex works in the case of coax probes.

11.4 Recording the reference envelope curve

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

Path in the menu

Expert → Diagnostics → Envelope diagnostics → Save reference curve

Meaning of the options

- No
  No action
- Yes
  The current envelope curve is saved as a reference curve.

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

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

 23   *"Load Reference Curve" function*

11.5   Configuring the local display

11.5.1   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

11.5.2   Adjusting the local display

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

11.6   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:
  Medium type
- **Compare**
  The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of the comparison is displayed in the **Comparison result** parameter.
- **Clear backup data**
  The backup copy of the device configuration is deleted from the display module of the device.

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

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

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

11.7   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)

12   Diagnostics and troubleshooting

12.1   General troubleshooting

12.1.1   General errors

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

12.1.2   Parametrization errors

Parametrization errors for level measurements

Problem	Possible cause	Remedy
Measured value is incorrect	If measured distance (Setup → Distance) matches the real distance: Calibration error	• Check the **Empty calibration** parameter (→ 🖹 102) and correct if necessary. • Check the **Full calibration** parameter (→ 🖹 103) and correct if necessary. • Check the linearization and correct if necessary (**Linearization** submenu (→ 🖹 123)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 🖹 107)).
No change of measured value on filling/emptying	An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 🖹 107)).
	Buildup at the probe.	Clean the probe.
	Error in the echo tracking.	Deactivate echo tracking (Expert → Sensor → Echo tracking → Evaluation mode = **History off**).
Echo lost diagnostic message appears after the supply voltage is switched on.	Echo threshold too high.	Check the **Medium group** parameter (→ 🖹 102). If necessary, select a more detailed setting with the **Medium property** parameter.
	Level echo suppressed.	Delete the map and record it again if necessary (**Record map** parameter (→ 🖹 109)).
Device displays a level when the tank is empty.	Incorrect probe length	Perform probe length correction (**Confirm probe length** parameter (→ 🖹 139)).
	Interference echo	Carry out mapping over the entire probe length when the tank is empty (**Confirm distance** parameter (→ 🖹 107)).
Wrong slope of the level over the entire measuring range	Wrong tank type selected.	Select the correct **Tank type** parameter (→ 🖹 101).
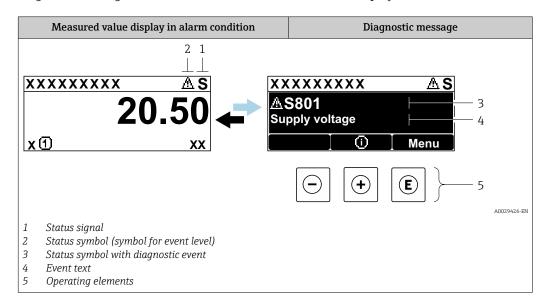
Parametrization errors for interface measurements

Problem	Possible cause	Remedy
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 (→ 🖹 105)).
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 (→ 🖹 105)).
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.

12.2   Diagnostic information on local display

12.2.1   Diagnostic message

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

Measured value display in alarm condition	Diagnostic message

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

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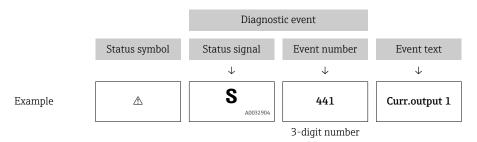
F	A0032902	**"Failure (F)" option** A device error has occurred. The measured value is no longer valid.
C	A0032903	**"Function check (C)" option** The device is in the service mode (e.g. during a simulation).
S	A0032904	**"Out of specification (S)" option** The device is operated: • Outside of its technical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

Status symbol (symbol for event level)

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

Diagnostic event and event text

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

		Diagnostic event	
Status symbol	Status signal	Event number	Event text
	↓	↓	↓
Example	**S** A0032904	441	**Curr.output 1**
		3-digit number	

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

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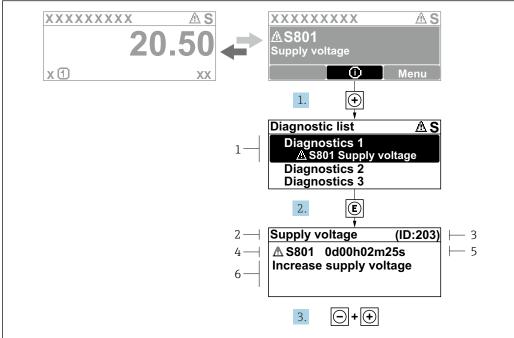
Operating elements

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

12.2.2　Calling up remedial measures

🖼 24　Message for remedial measures

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

The user is in the diagnostic message.

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

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

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

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

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

2. Press ⊟ + ⊞ simultaneously.
   ↳ The message about the remedial measures closes.
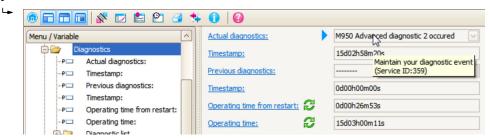
12.3   Diagnostic event in the operating tool

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

- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
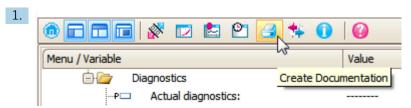
A: Via the operating menu

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

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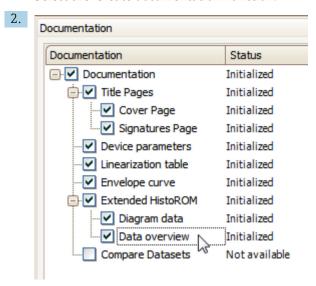
   A tool tip with remedial measures for the diagnostic event appears.

B: Via the "Create documentation" function

1.
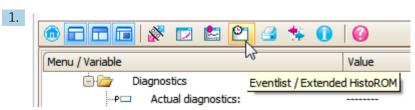
   Select the "Create documentation" function.

2.

   Make sure "Data overview" is marked.

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

C: Via the "Eventlist / Extended HistoROM" function

1.

Select the "Eventlist / Extended HistoROM" function.

2.

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

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

12.5   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	1. Tighten HF cable connection 2. Check sensor 3. Change HF cable	F	Alarm
106	Sensor	1. Check sensor 2. Check HF cable 3. Contact service	F	Alarm
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change I/O or main electronic module	F	Alarm
261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
262	Module connection	1. Check module connections 2. Change electronic modules	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	1. Emergency operation via display 2. Change main electronics	F	Alarm
275	I/O module failure	Change I/O module	F	Alarm
276	I/O module failure	1. Restart device 2. Change I/O module	F	Alarm
282	Data storage	1. Restart device 2. Contact service	F	Alarm
283	Memory content	1. Transfer data or reset device 2. Contact service	F	Alarm
311	Electronic failure	1. Transfer data or reset device 2. Contact service	F	Alarm
311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact service	M	Warning
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing Download	Download active, please wait	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
435	Linearization	Check linearization table	F	Alarm
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
482	Block in OOS	Set Block in AUTO mode	F	Alarm
484	Simulation failure mode	Deactivate simulation	C	Alarm
485	Simulation measured value	Deactivate simulation	C	Warning
494	Switch output simulation	Deactivate simulation switch output	C	Warning
495	Simulation diagnostic event	Deactivate simulation	C	Warning
497	Simulation block output	Deactivate simulation	C	Warning
585	Simulation distance	Deactivate simulation	C	Warning
Diagnostic of process				
801	Energy too low	Increase supply voltage	S	Warning
825	Operating temperature	1. Check ambient temperature	S	Warning
825	Operating temperature	2. Check process temperature	F	Alarm
921	Change of reference	1. Check reference configuration 2. Check pressure 3. 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	1. Check level 2. Check safety distance 3. 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.

12.6 Event logbook

12.6.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu [2].

Navigation path
Diagnostics → Event logbook → Event list

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

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

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

Calling up and closing the remedial measures

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

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

12.6.2 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 → Event logbook → Filter options

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

12.6.3 Overview of information events
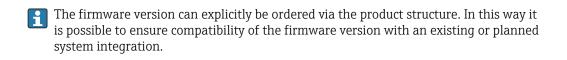
Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Trend data deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list

Info number	Info name
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

12.7   Firmware history

Date	Firmware version	Modifications	Documentation (FMP55, PROFIBUS)		
			Operating Instructions	Description of Device Parameters	Technical Information
07.2011	01.00.zz	Original software	BA01008F/00/EN/10.10	GP01001F/00/EN/10.10	TI01003F/00/EN/13.11
02.2015	01.01.zz	• Support of SD03 • Additional languages • HistoROM functionality enhanced • "Advanced Diagnostics" function block integrated • Improvements and bugfixes	BA01008F/00/EN/14.14 BA01008F/00/EN/15.16 [1]	GP01001F/00/EN/13.14	TI01003F/00/EN/17.14 TI01003F/00/EN/20.16 [1]

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

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.

13 Maintenance

No special maintenance work is required.

13.1 Exterior cleaning

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

13.2 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.

13.3 Cleaning coax probes

The ground tube can be removed towards the bottom for cleaning purposes. When disassembling and reassembling, make sure that the spacers between the probe rod and ground tube are not displaced. A spacer is located approx. 10 cm (4 in) from the end of the probe. Depending of the length of the probe there may be additional spacers evenly distributed along the probe.

14   Repair

14.1   General information

14.1.1   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.

14.1.2   Repair of Ex-certified devices

⚠ WARNING

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

14.1.3   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.

14.1.4   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:
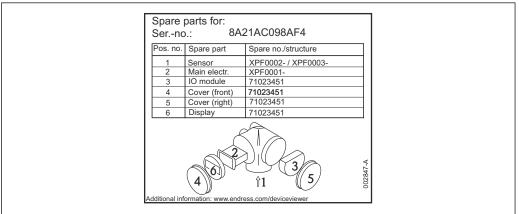
- Using the display module
  Prerequisite: The configuration of the old device was saved previously to the display module.
- Via FieldCare
  Prerequisite: The configuration of the old device was saved previously to the computer using FieldCare.

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

14.2   Spare parts

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

⊠ 25   Example for spare part nameplate in the connection compartment cover

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

14.3   Return

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

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

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

14.4   Disposal

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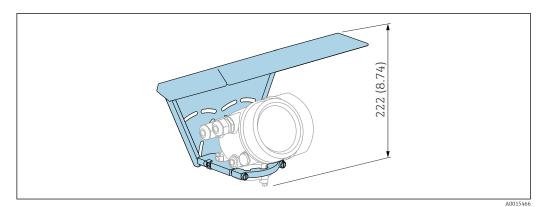
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

15   Accessories
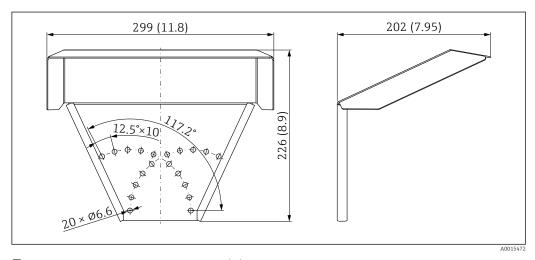
15.1   Device-specific accessories

15.1.1   Weather protection cover

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

🖻 *26   Height. Unit of measurement mm (in)*

🖻 *27   Dimensions. Unit of measurement mm (in)*
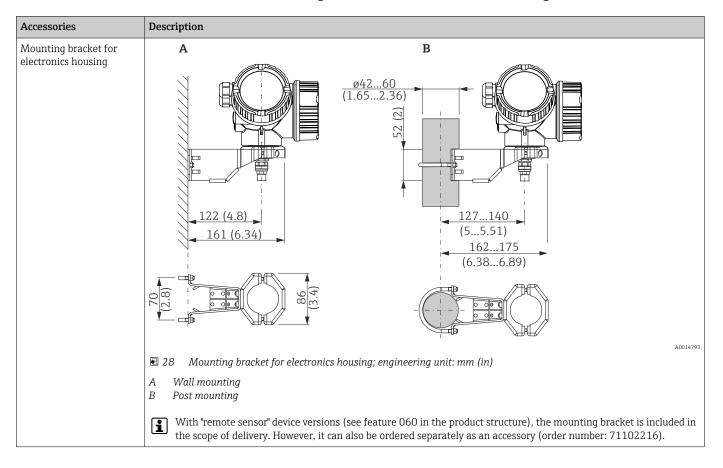
Material
316L
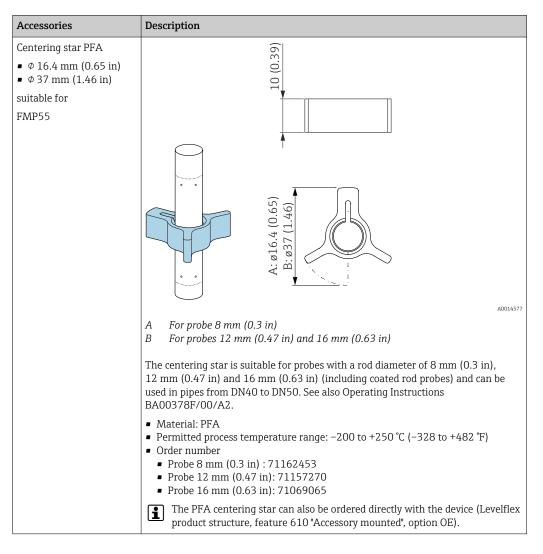
Order number for accessories:
71162242
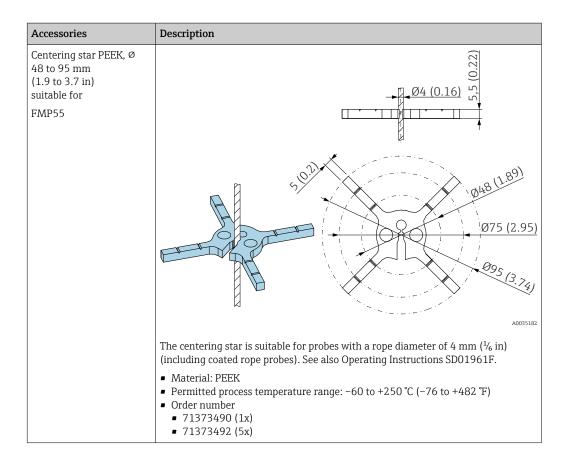
15.1.2 Mounting bracket for electronics housing

Accessories	Description
Mounting bracket for electronics housing	**A** **B** ⊡ *28 Mounting bracket for electronics housing; engineering unit: mm (in)* A Wall mounting B Post mounting ℹ️ With "remote sensor" device versions (see feature 060 in the product structure), the mounting bracket is included in the scope of delivery. However, it can also be ordered separately as an accessory (order number: 71102216).

15.1.3 Centering star

Accessories	Description

Centering star PFA
• ⌀ 16.4 mm (0.65 in)
• ⌀ 37 mm (1.46 in)
suitable for
FMP55
	
	A0014577
	
	A For probe 8 mm (0.3 in)
	B For probes 12 mm (0.47 in) and 16 mm (0.63 in)
	
	The centering star is suitable for probes with a rod diameter of 8 mm (0.3 in), 12 mm (0.47 in) and 16 mm (0.63 in) (including coated rod probes) and can be used in pipes from DN40 to DN50. See also Operating Instructions BA00378F/00/A2.
	
	• Material: PFA
	• Permitted process temperature range: –200 to +250 ℃ (–328 to +482 ℉)
	• Order number
	  • Probe 8 mm (0.3 in) : 71162453
	  • Probe 12 mm (0.47 in): 71157270
	  • Probe 16 mm (0.63 in): 71069065
	
	ℹ The PFA centering star can also be ordered directly with the device (Levelflex product structure, feature 610 "Accessory mounted", option OE).

Accessories	Description

Centering star PEEK, Ø 48 to 95 mm (1.9 to 3.7 in) suitable for FMP55	The centering star is suitable for probes with a rope diameter of 4 mm ($\frac{1}{6}$ in) (including coated rope probes). See also Operating Instructions SD01961F.
	• Material: PEEK
	• Permitted process temperature range: −60 to +250 °C (−76 to +482 °F)
	• Order number
	  • 71373490 (1x)
	  • 71373492 (5x)

15.1.4 Remote display FHX50

Technical data
- Material:
  - Plastic PBT
  - 316L/1.4404
  - Aluminum
- Degree of protection: IP68 / NEMA 6P and IP66 / NEMA 4x
- Suitable for display modules:
  - SD02 (push buttons)
  - SD03 (touch control)

- Connecting cable:
  - Cable supplied with device up to 30 m (98 ft)
  - Standard cable supplied by customer up to 60 m (196 ft)
- Ambient temperature:–40 to 80 ℃ (–40 to 176 ℉)
- Ambient temperature (option): –50 to 80 ℃ (–58 to 176 ℉) [3]

Ordering information

- If the remote display is to be used, the device version "Prepared for display FHX50" must be ordered.
  For the FHX50, the option "Prepared for display FHX50" must be selected under "Measuring device version".
- If a measuring device has not been ordered with the version "Prepared for display FHX50" and is to be retrofitted with an FHX50, the version "Not prepared for display FHX50" must be ordered for the FHX50 under "Measuring device version". In this case, a retrofit kit for the device is supplied with the FHX50. The kit can be used to prepare the device so that the FHX50 can be used.

Use of the FHX50 may be restricted for transmitters with an approval. A device may only be retrofitted with the FHX50 if the option "Prepared for FHX50" is listed in the associated Safety Instructions (XA) under *Basic specifications*, "Display, operation".

Also pay attention to the Safety Instructions (XA) of the FHX50.

Retrofitting is not possible on transmitters with:
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Type of protection Ex nA
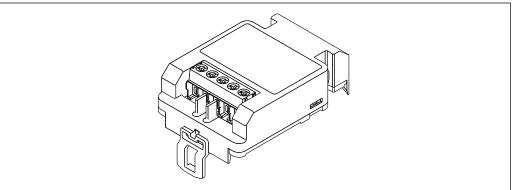
For details, see the "Special Documentation" SD01007F

15.1.5 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

---

3)   This range applies if the option JN "Transmitter ambient temperature" –50 ℃ (–58 ℉) was selected in feature 580 "Test, Certificate". If the temperature is permanently below –40 ℃ (–40 ℉), higher failure rates can be expected.

- 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 mm^2 (24 to 14 AWG)

If retrofitting:
- Order number for 1-channel devices (OVP10): 71128617
- Order number for 2-channel devices (OVP20): 71128619
- The use of the OVP module may be restricted depending on the transmitter approval. A device may only be retrofitted with the OVP module if the option *NA* (overvoltage protection) is listed under *Optional specifications* in the Safety Instructions (XA) associated with the device.
- In order to keep the necessary safety distances when using the surge arrester module, the housing cover also needs to be replaced when the device is retrofitted.
  Depending on the housing type, the suitable cover can be ordered using the following order number:
  - Housing GT18: 71185516
  - Housing GT19: 71185518
  - Housing GT20: 71185517
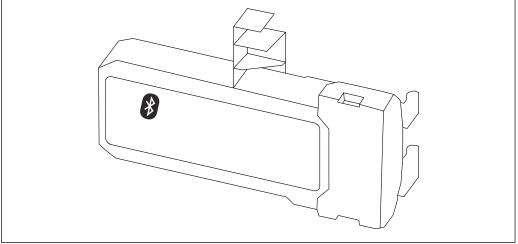
📖 For details, see the "Special Documentation" SD01090F

15.1.6 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

15.2 Communication-specific accessories

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

15.3 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

15.4 System components

Memograph M graphic data manager
The Memograph M graphic data manager provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.

📖 Technical Information TI00133R and Operating Instructions BA00247R

16   Operating menu

16.1   Overview of the operating menu (display module)

Navigation   ▣   Operating menu

Language	
🔧 Setup	→ 🖺 100
Device tag	→ 🖺 100
Device address	→ 🖺 100
Operating mode	→ 🖺 100
Distance unit	→ 🖺 101
Tank type	→ 🖺 101
Tube diameter	→ 🖺 101
DC value	→ 🖺 105
Medium group	→ 🖺 102
Empty calibration	→ 🖺 102
Full calibration	→ 🖺 103
Level	→ 🖺 104
Interface	→ 🖺 106
Distance	→ 🖺 104
Interface distance	→ 🖺 107
Signal quality	→ 🖺 105
▶ **Mapping**	→ 🖺 110
Confirm distance	→ 🖺 110
Mapping end point	→ 🖺 110

	Unit after linearization		→ 🕮 126
	Free text		→ 🕮 127
	Maximum value		→ 🕮 128
	Diameter		→ 🕮 128
	Intermediate height		→ 🕮 129
	Table mode		→ 🕮 129
	▶ Edit table		
		Level	
		Customer value	
	Activate table		→ 🕮 131
▶ Safety settings			→ 🕮 133
	Output echo lost		→ 🕮 133
	Value echo lost		→ 🕮 133
	Ramp at echo lost		→ 🕮 134
	Blocking distance		→ 🕮 134
▶ WHG confirmation			→ 🕮 136
▶ Deactivate WHG			→ 🕮 137
	Reset write protection		→ 🕮 137
	Code incorrect		→ 🕮 137
▶ Probe settings			→ 🕮 138
	Probe grounded		→ 🕮 138
	▶ Probe length correction		→ 🕮 140
		Confirm probe length	→ 🕮 140
		Present probe length	→ 🕮 140
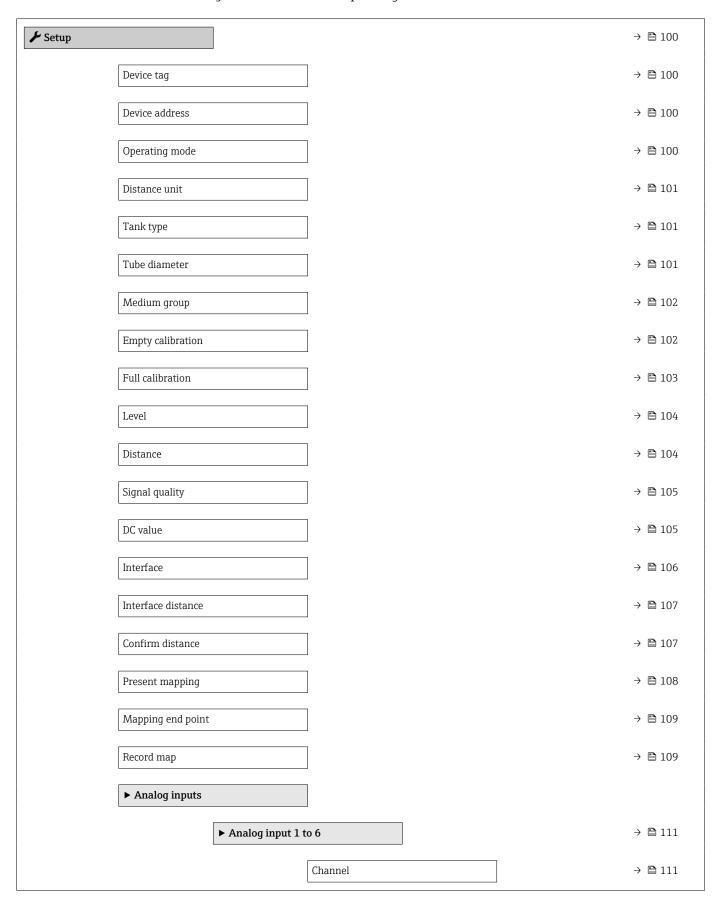
‣ Switch output		→ 🗎 141
	Switch output function	→ 🗎 141
	Assign status	→ 🗎 141
	Assign limit	→ 🗎 142
	Assign diagnostic behavior	→ 🗎 142
	Switch-on value	→ 🗎 143
	Switch-on delay	→ 🗎 144
	Switch-off value	→ 🗎 144
	Switch-off delay	→ 🗎 145
	Failure mode	→ 🗎 145
	Switch status	→ 🗎 145
	Invert output signal	→ 🗎 145
‣ Display		→ 🗎 147
	Language	→ 🗎 147
	Format display	→ 🗎 147
	Value 1 to 4 display	→ 🗎 149
	Decimal places 1 to 4	→ 🗎 149
	Display interval	→ 🗎 150
	Display damping	→ 🗎 150
	Header	→ 🗎 150
	Header text	→ 🗎 151
	Separator	→ 🗎 151
	Number format	→ 🗎 151
	Decimal places menu	→ 🗎 151

	Backlight		→ 🕮 152
	Contrast display		→ 🕮 152
‣ Configuration backup display			→ 🕮 153
	Operating time		→ 🕮 153
	Last backup		→ 🕮 153
	Configuration management		→ 🕮 153
	Comparison result		→ 🕮 154
‣ Administration			→ 🕮 156
	‣ Define access code		→ 🕮 158
		Define access code	→ 🕮 158
		Confirm access code	→ 🕮 158
	Device reset		→ 🕮 156

ᵇ Diagnostics		→ 🕮 159
Actual diagnostics		→ 🕮 159
Previous diagnostics		→ 🕮 159
Operating time from restart		→ 🕮 160
Operating time		→ 🕮 153
‣ Diagnostic list		→ 🕮 161
	Diagnostics 1 to 5	→ 🕮 161
‣ Event logbook		→ 🕮 162
	Filter options	
	‣ Event list	→ 🕮 162
‣ Device information		→ 🕮 163
	Device tag	→ 🕮 163
	Serial number	→ 🕮 163

	Firmware version			→ 🕮 163
	Device name			→ 🕮 163
	Order code			→ 🕮 164
	Extended order code 1 to 3			→ 🕮 164
	Status PROFIBUS Master Config			→ 🕮 164
	PROFIBUS ident number			→ 🕮 164
‣ Measured values				→ 🕮 165
	Distance			→ 🕮 104
	Level linearized			→ 🕮 128
	Interface distance			→ 🕮 107
	Interface linearized			→ 🕮 128
	Thickness upper layer			→ 🕮 166
	Terminal voltage 1			→ 🕮 167
	Switch status			→ 🕮 145
‣ Analog inputs				
	‣ Analog input 1 to 6			→ 🕮 168
		Channel		→ 🕮 111
		Out value		→ 🕮 168
		Out status		→ 🕮 169
		Out status HEX		→ 🕮 169
‣ Data logging				→ 🕮 170
	Assign channel 1 to 4			→ 🕮 170
	Logging interval			→ 🕮 170
	Clear logging data			→ 🕮 171
	‣ Display channel 1 to 4			→ 🕮 172

▶ Simulation	→ 🕮 174
Assign measurement variable	→ 🕮 175
Value process variable	→ 🕮 175
Switch output simulation	→ 🕮 175
Switch status	→ 🕮 176
Simulation device alarm	→ 🕮 176
Diagnostic event category	
Simulation diagnostic event	→ 🕮 176
▶ Device check	→ 🕮 177
Start device check	→ 🕮 177
Result device check	→ 🕮 177
Last check time	→ 🕮 177
Level signal	→ 🕮 178
Launch signal	→ 🕮 178
Interface signal	→ 🕮 178

16.2   Overview of the operating menu (operating tool)

Navigation   ⊠   Operating menu

		PV filter time	→ 🖹 111
		Fail safe type	→ 🖹 112
		Fail safe value	→ 🖹 112
‣ Advanced setup			→ 🖹 113
	Locking status		→ 🖹 113
	Access status tooling		→ 🖹 113
	Enter access code		→ 🖹 114
	‣ Interface		→ 🖹 115
		Process property	→ 🖹 115
		Interface property	→ 🖹 115
		DC value lower medium	→ 🖹 116
		Level unit	→ 🖹 117
		Blocking distance	→ 🖹 117
		Level correction	→ 🖹 118
		Manual thickness upper layer	→ 🖹 118
		Measured thickness upper layer	→ 🖹 119
		DC value	→ 🖹 119
		Calculated DC value	→ 🖹 119
		Use calculated DC value	→ 🖹 120
	‣ Linearization		→ 🖹 123
		Linearization type	→ 🖹 125
		Unit after linearization	→ 🖹 126
		Free text	→ 🖹 127
		Level linearized	→ 🖹 128
		Interface linearized	→ 🖹 128

	Assign limit	→ 🖹 142
	Assign diagnostic behavior	→ 🖹 142
	Switch-on value	→ 🖹 143
	Switch-on delay	→ 🖹 144
	Switch-off value	→ 🖹 144
	Switch-off delay	→ 🖹 145
	Failure mode	→ 🖹 145
	Switch status	→ 🖹 145
	Invert output signal	→ 🖹 145
▸ Display		→ 🖹 147
	Language	→ 🖹 147
	Format display	→ 🖹 147
	Value 1 to 4 display	→ 🖹 149
	Decimal places 1 to 4	→ 🖹 149
	Display interval	→ 🖹 150
	Display damping	→ 🖹 150
	Header	→ 🖹 150
	Header text	→ 🖹 151
	Separator	→ 🖹 151
	Number format	→ 🖹 151
	Decimal places menu	→ 🖹 151
	Backlight	→ 🖹 152
	Contrast display	→ 🖹 152
▸ Configuration backup display		→ 🖹 153
	Operating time	→ 🖹 153

		Last backup	→ 🖺 153
		Configuration management	→ 🖺 153
		Backup state	→ 🖺 154
		Comparison result	→ 🖺 154
	‣ Administration		→ 🖺 156
		Define access code	
		Device reset	→ 🖺 156

🜂 Diagnostics			→ 🖺 159
	Actual diagnostics		→ 🖺 159
	Timestamp		→ 🖺 159
	Previous diagnostics		→ 🖺 159
	Timestamp		→ 🖺 160
	Operating time from restart		→ 🖺 160
	Operating time		→ 🖺 153
	‣ Diagnostic list		→ 🖺 161
		Diagnostics 1 to 5	→ 🖺 161
		Timestamp 1 to 5	→ 🖺 161
	‣ Device information		→ 🖺 163
		Device tag	→ 🖺 163
		Serial number	→ 🖺 163
		Firmware version	→ 🖺 163
		Device name	→ 🖺 163
		Order code	→ 🖺 164
		Extended order code 1 to 3	→ 🖺 164

	Status PROFIBUS Master Config	→ 🗎 164
	PROFIBUS ident number	→ 🗎 164
‣ Measured values		→ 🗎 165
	Distance	→ 🗎 104
	Level linearized	→ 🗎 128
	Interface distance	→ 🗎 107
	Interface linearized	→ 🗎 128
	Thickness upper layer	→ 🗎 166
	Terminal voltage 1	→ 🗎 167
	Switch status	→ 🗎 145
‣ Analog inputs		
	‣ Analog input 1 to 6	→ 🗎 168
	Channel	→ 🗎 111
	Out value	→ 🗎 168
	Out status	→ 🗎 169
	Out status HEX	→ 🗎 169
‣ Data logging		→ 🗎 170
	Assign channel 1 to 4	→ 🗎 170
	Logging interval	→ 🗎 170
	Clear logging data	→ 🗎 171
‣ Simulation		→ 🗎 174
	Assign measurement variable	→ 🗎 175
	Value process variable	→ 🗎 175
	Switch output simulation	→ 🗎 175
	Switch status	→ 🗎 176

16.3   "Setup" menu

ℹ️ • ⊚ : 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 tag for measuring point.

User entry	Up to 32 alphanumerical characters

Device address	🔒

Navigation	⊚▤ Setup → Device address

Description	• for **Address mode** = **Software**: Enter bus address. • for **Address mode** = **Hardware**: Displays bus address.

User entry	0 to 126

Operating mode	🔒

Navigation	⊚▤ Setup → Operating mode

Prerequisite	The device has the "interface measurement" application package [4]. FMP55 always contains this package.

Description	Select operating mode.

Selection	• Level • Interface with capacitance * • Interface *

Factory setting	FMP55: **Interface with capacitance**

Additional information	The **Interface with capacitance** option is only available for FMP55.

---

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

Distance unit   🔒

Navigation   ◨◨   Setup → Distance unit

Description   Length unit for distance calculation.

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

Tank type   🔒

Navigation   ◨◨   Setup → Tank type

Prerequisite   **Medium type** = **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 (→ 🖩 101)** = **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** (→ 🗎 100) = **Level** • **Medium type** = **Liquid**

Description	Select medium group.

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

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

The **Medium group** parameter presets the **Medium property** parameter as follows:

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

ℹ 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.

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

Empty calibration	⌨
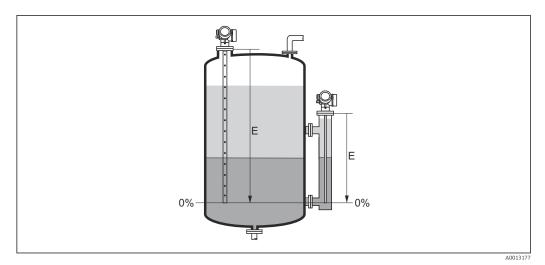
Navigation	⌨⊟ Setup → Empty calibr.

Description	Distance process connection to min. level.

User entry	Depending on the probe

Factory setting	Depending on the probe

Additional information

🖾 29   Empty calibration (E) for interface measurements

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

Full calibration	🔒
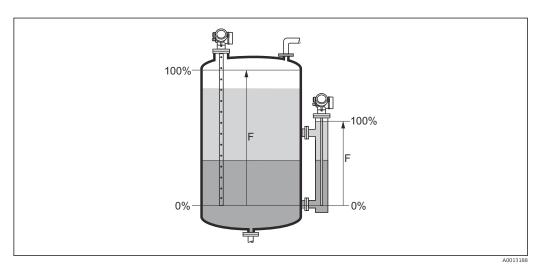
Navigation   ◧◧◨   Setup → Full calibr.

Description   Span: max. level - min level.

User entry   Depending on the probe

Factory setting   Depending on the probe

Additional information

🖾 30   Full calibration (F) for interface measurements

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

Level	
Navigation	ⓘ☒ Setup → Level
Description	Displays measured level L_L (before linearization).
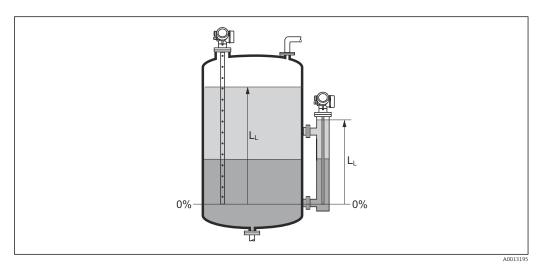
Additional information

31 Level in case of interface measurements

ℹ️ • The unit is defined in the **Level unit** parameter (→ 🖺 117).
   • In case of interface measurements, this parameter always refers to the total level.
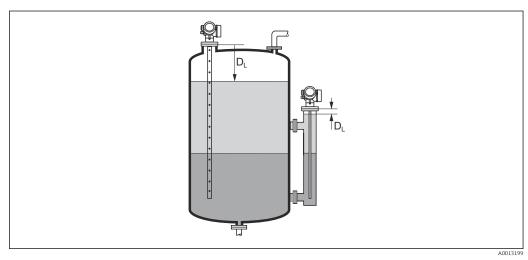
Distance	
Navigation	ⓘ☒ Setup → Distance
Description	Displays the measured distance D_L between the reference point (lower edge of the flange or threaded connection) and the level.

Additional information

32 Distance for interface measurements

ℹ️ The unit is defined in the **Distance unit** parameter (→ 🖺 101).

Signal quality

Navigation	▣▤ Setup → Signal quality

Description	Displays the signal quality of the evaluated echo.

Additional information	**Meaning of the display options**

- **Strong**
  The evaluated echo exceeds the threshold by at least 10 mV.
- **Medium**
  The evaluated echo exceeds the threshold by at least 5 mV.
- **Weak**
  The evaluated echo exceeds the threshold by less than 5 mV.
- **No signal**
  The device does not find a usable echo.

The signal quality indicated in this parameter always refers to the currently evaluated echo: either the level/interface echo [5] or the end-of-probe echo. To differentiate between these two, the quality of the end-of-probe echo is always displayed in brackets.

In case of a lost echo (**Signal quality = No signal**) the device generates the following error message:
- F941, for **Output echo lost (→ 🖺 133) = Alarm**.
- S941, if another option has been selected in **Output echo lost (→ 🖺 133)**.

DC value	🔒

Navigation	▣▤ Setup → DC value

Prerequisite	The device has the "Interface measurement" application package [6].
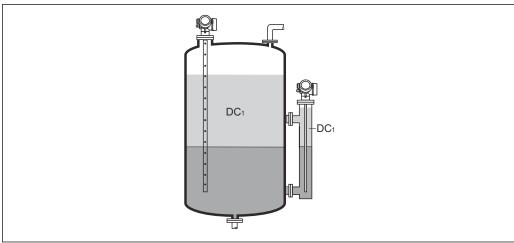
Description	Specify the relative dielectric constant ε_r of the upper medium (DC_1).

User entry	1.0 to 100

---

5) Of these two echos the one with the lower quality is indicated.
6) Product structure: feature 540 "Application packages", option EB "Interface measurement"

Additional information

DC1   Relative dielectric constant of the upper medium.
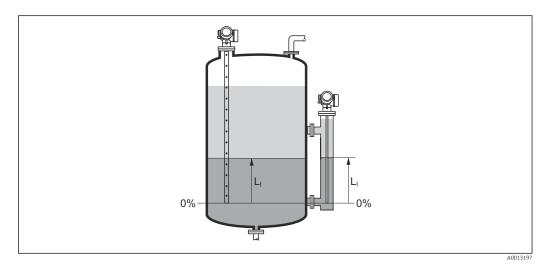
ℹ️ For the dielectric constants (DC values) of many media commonly used in industry, please refer to:
  • Dielectric constant (DC value) Compendium CP01076F
  • The Endress+Hauser "DC Values app" (available for Android and iOS)

Interface

Navigation   Setup → Interface

Prerequisite   Operating mode (→ 🖺 100) = **Interface** or **Interface with capacitance**

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

Additional information

ℹ️ The unit is defined in the **Level unit** parameter (→ 🖺 117).

Interface distance	
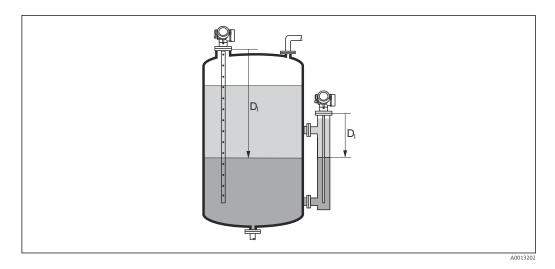
Navigation	◙▤ Setup → Interface dist.
Prerequisite	Operating mode (→ 🖩 100) = Interface or Interface with capacitance
Description	Displays the measured distance D_I between the reference point (lower edge of flange or threaded connection) and the interface.
Additional information	

A0013202

The unit is defined in the **Distance unit** parameter (→ 🖩 101).

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

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 (→ 🖺 109). 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** [7]

  To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.

- **Tank empty**

  To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range.

  To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range minus **Map gap to LN**.

- **Factory map**

  To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the **Confirm distance** parameter and a new mapping can be recorded.

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

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

  ℹ️ For FMP55 with rope probes and **Operating mode (→ 🖺 100) = Interface with capacitance** the mapping must be recorded with the tank being empty, and the **Tank empty** option must be selected. Otherwise the device can not register the correct empty capacitance.

  For FMP55 with coax probes a mapping must be recorded at least in the upper part of the probe, as tightening the flange has an influence on the envelope curve. However, even with coax probes it is recommended to record the mapping with the tank being completely empty (and selecting the **Tank empty** option).

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

Present mapping

Navigation	🖳	Setup → Present mapping

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

---

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

Mapping end point	⌂

Navigation   ▣   Setup → Map. end point

Prerequisite   Confirm distance (→ 🗏 107) = 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 (→ 🗏 108) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

Record map	⌂

Navigation   ▣   Setup → Record map

Prerequisite   Confirm distance (→ 🗏 107) = Manual map or Distance too small

Description   Start recording of the map.

Selection   • No
                  • Record map
                  • Delete map

Additional information   Meaning of the options
                  • **No**
                  The map is not recorded.
                  • **Record map**
                  The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing ☑.
                  • **Delete map**
                  The mapping (if one exists) is deleted and the device displays the recalculated measured distance and the mapping range. When operating via the local display, these values must be confirmed by pressing ☑.

16.3.1 "Mapping" wizard

ℹ️ The **Mapping** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the mapping are located directly in the **Setup** menu (→ 🖺 100).

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

Navigation   🖳   Setup → Mapping

Confirm distance	🔒

Navigation	🖳	Setup → Mapping → Confirm distance
Description	→ 🖺 107	

Mapping end point	🔒

Navigation	🖳	Setup → Mapping → Map. end point
Description	→ 🖺 109	

Record map	🔒

Navigation	🖳	Setup → Mapping → Record map
Description	→ 🖺 109	

Distance	

Navigation	🖳	Setup → Mapping → Distance
Description	→ 🖺 104	

16.3.2 "Analog input 1 to 6" submenu

There is an **Analog input** submenu for each AI block of the device. The AI block is used to configure the measured value transmission to the bus.

Only the most basic properties of the AI blocks can be configured in this submenu. For a detailed configuration of the AI blocks refer to Expert → Analog inputs → Analog input 1 to 6.

Navigation   ▣   Expert → Analog inputs → Analog input 1 to 6

Channel	🔓

Navigation	▣▣ Expert → Analog inputs → Analog input 1 to 6 → Channel
Description	Standard parameter **CHANNEL** of the Analog Input Block according to the PROFIBUS Profile.
Selection	• Level linearized • Distance • Interface linearized * • Interface distance * • Thickness upper layer * • Terminal voltage • Electronic temperature • Measured capacitance * • Absolute echo amplitude • Relative echo amplitude • Absolute interface amplitude * • Relative interface amplitude * • Absolute EOP amplitude • Noise of signal • EOP shift • Calculated DC value * • Sensor debug • Analog output adv. diagnostics 1 • Analog output adv. diagnostics 2
Additional information	Allocates a measured value to the AI block.

PV filter time	🔓

Navigation	▣▣ Expert → Analog inputs → Analog input 1 to 6 → PV filter time
Description	Standard parameter **PV_FTIME** of the Analog Input Block according to the PROFIBUS profile.
User entry	Positive floating-point number

_____

* Visibility depends on order options or device settings

Additional information	This parameter defines the damping constant τ (in seconds) for the output of the Analog Input Block.

Fail safe type   ⏗

Navigation	▣▤ Expert → Analog inputs → Analog input 1 to 6 → Fail safe type
Description	Standard parameter **FSAFE_TYPE** of the Analog Input Block according to the PROFIBUS profile.
Selection	• Fail safe value • Fallback value • Off

Additional information	**Meaning of the options**
	This parameter specifies the output value of the Analog Input block in the event of an error.
	• **Fail safe value**
	  The output value in the event of an error is defined in the **Fail safe value** parameter (→ 🗎 112).
	• **Fallback value**
	  The last output value that was valid before the error occurred is retained.
	• **Off**
	  The output value follows the current measured value. The status is set to BAD.

Fail safe value   ⏗

Navigation	▣▤ Expert → Analog inputs → Analog input 1 to 6 → Fail safe value
Prerequisite	Fail safe type (→ 🗎 112) = **Fail safe value**
Description	Standard parameter **FSAFE_VALUE** of the Analog Input Block according to the PROFIBUS profile.
User entry	Signed floating-point number
Additional information	This parameter defines the output value of the Analog Input Block in case of an error.

16.3.3 "Advanced setup" submenu

Navigation   ▣   Setup → Advanced setup

Locking status

Navigation	▣▣ Setup → Advanced setup → Locking status
Description	Indicates the write protection with the highest priority that is currently active.
User interface	• Hardware locked • SIL locked • WHG locked • Temporarily locked

Additional information   **Meaning and priorities of the types of write protection**
• **Hardware locked (priority 1)**
  The DIP switch for hardware locking is activated on the main electronics module. This
  locks write access to the parameters.
• **SIL locked (priority 2)**
  The SIL mode is activated. Writing access to the relevant parameters is denied.
• **WHG locked (priority 3)**
  The WHG mode is activated. Writing access to the relevant parameters is denied.
• **Temporarily locked (priority 4)**
  Write access to the parameters is temporarily locked on account of internal processes in
  progress in the device (e.g. data upload/download, reset etc.). The parameters can be
  modified as soon as the processes are complete.

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

Access status tooling

Navigation	▣ Setup → Advanced setup → Access stat.tool
Description	Shows the access authorization to the parameters via the operating tool.

Additional information   The access authorization can be changed via the **Enter access code** parameter
(→ 📄 114).

  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 (→ 📄 113).

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 (→ 🖺 114).
	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 (→ 🖺 113).

Enter access code

Navigation	Setup → Advanced setup → Ent. access code
Description	Enter access code to disable write protection of parameters.
User entry	0 to 9999
Additional information	• The customer-specific access code that was defined in the **Define access code** parameter (→ 🖺 156) 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.

"Interface" submenu

Navigation   ⌷⌷ Setup → Advanced setup → Interface

Process property

Navigation   ⌷⌷ Setup → Advanced setup → Interface → Process property

Description   Specify typical rate of change for the interface position.

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

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

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

Interface property

Navigation   ⌷⌷ Setup → Advanced setup → Interface → Interface prop.

Prerequisite   Operating mode (→ ⌷ 100) = Interface with capacitance

Description   Select interface property.

                               The interface property determines how the Guided Radar and the Capacitance
                               Measurement interact.

Selection   • Special: automatic DC
                               • Build up
                               • Standard
                               • Emulsion layer

Additional information

Meaning of the options

- **Special: automatic DC**
  - Condition:
    The specific capacitance (pF/m) is known. [8]
  - Signal evaluation:
    As long as a clear interface is detected, both the total and the interface level are determined via the Guided Radar. The dielectric constant of the upper medium is continuously adjusted. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.
- **Build up**
  - Condition:
    The dielectric constant of the upper medium and the specific capacitance (pF/m) are known. [8]
  - Signal evaluation:
    As long as a clear interface is detected, the interface level is determined via the Guided Radar as well as via the Capacitance Measurement. If these two values start to diverge from each other due to build-up formation, an error message is generated. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.
- **Standard**
  - Condition:
    The dielectric constant of the upper medium is known.
  - Signal evaluation:
    As long as a clear interface is detected, the specific capacitance (pF/m) is continuously adjusted. Therefore build-up has only little influence on the measurement. If an emulsion layer is present, the total level is determined via the Guided Radar whereas the interface level is determined via the Capacitance Measurement.
- **Oil/Water condensate**
  - Condition:
    The dielectric constant of the upper medium and the specific capacitance (pF/m) are known. [8]
  - Signal evaluation:
    The total level is always determined via the Guided Radar. The interface level is always determined via the Capacitance Measurement.

DC value lower medium   🔒

Navigation   😊🖳 Setup → Advanced setup → Interface → DC lower medium

Prerequisite   **Operating mode (→ 🗎 100) = Interface** or **Interface with capacitance**

Description   Specify the dielectric constant ε_r of the lower medium.

User entry   1 to 100

---

8)   The specific capacitance of the media depends on the DC value and the geometry of the probe, which may differ noticeably. For rod probes < 2 m, the probe geometry is measured after production and the resulting specific capacitance for conductive media is preset on delivery.
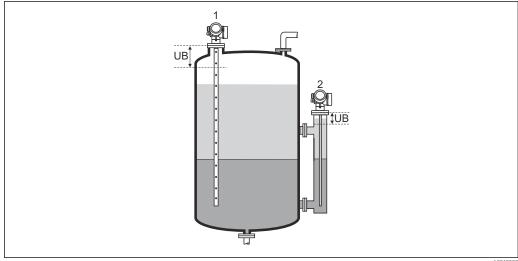
Additional information   ℹ️   For the dielectric constants (DC values) of many media commonly used in industry, please refer to:
- Dielectric constant (DC value) Compendium CP01076F
- The Endress+Hauser "DC Values app" (available for Android and iOS)

ℹ️   The factory setting, ε_r = 80, applies for water at 20 ℃ (68 ℉).

Level unit   🔒

Navigation	⚙️▣	Setup → Advanced setup → Interface → Level unit

Description   Select level unit.

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

Additional information   The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 🗎 101):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 🗎 102)** and **Full calibration (→ 🗎 103)**).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level and interface position.

Blocking distance   🔒

Navigation	⚙️▣	Setup → Advanced setup → Interface → Blocking dist.

Description   Specify upper blocking distance UB.

User entry   0 to 200 m

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

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

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

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

Level correction	🔒

Navigation	🗖🖳 Setup → Advanced setup → Interface → Level correction

Description	Specify level correction (if required).

User entry	−200 000.0 to 200 000.0 %

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

Manual thickness upper layer	🔒
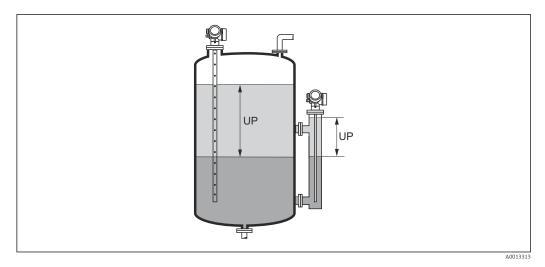
Navigation	🖳 Setup → Advanced setup → Interface → Man.thick.up.lay

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

User entry	0 to 200 m

Additional information

UP   Interface thickness (= thickness of upper medium)

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

Measured thickness upper layer

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

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

DC value   🔒

Navigation   🖳   Setup → Advanced setup → Interface → DC value

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

Calculated DC value

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

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

Use calculated DC value	🔒

Navigation	🔲	Setup → Advanced setup → Interface → Use calc. DC
Description		Specify whether the calculated dielectric constant is to be used.
Selection		• Save and exit
		• Cancel and exit
Additional information		**Meaning of the options**

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 (→ 🖹 119) is displayed together with this parameter.

"Automatic DC calculation" wizard
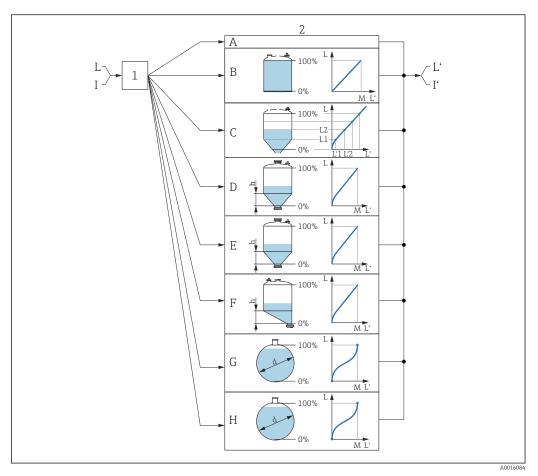
ℹ️ The **Automatic DC calculation** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the automatic DC calculation are located directly in the **Interface** submenu (→ 🗐 115)

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

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

Manual thickness upper layer   🔒

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

Description   → 🗐 118

DC value   🔒

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

Description   → 🗐 119

Use calculated DC value   🔒

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

Description   → 🗐 120

"Linearization" submenu

33   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 (→ 🖪 125) = None
B   Linearization type (→ 🖪 125) = Linear
C   Linearization type (→ 🖪 125) = Table
D   Linearization type (→ 🖪 125) = Pyramid bottom
E   Linearization type (→ 🖪 125) = Conical bottom
F   Linearization type (→ 🖪 125) = Angled bottom
G   Linearization type (→ 🖪 125) = Horizontal cylinder
H   Linearization type (→ 🖪 125) = Sphere
I   For "Operating mode (→ 🖪 100)" = "Interface" or "Interface with capacitance": interface before linearization (measured in the level unit)
I'   For "Operating mode (→ 🖪 100)" = "Interface" or "Interface with capacitance": interface after linearization (corresponds to volume or weight)
L   Level before linearization (measured in level unit)
L'   Level linearized (→ 🖪 128) (corresponds to volume or weight)
M   Maximum value (→ 🖪 128)
d   Diameter (→ 🖪 128)
h   Intermediate height (→ 🖪 129)

Structure of the submenu on the local display

Navigation   ⊚   Setup → Advanced setup → Linearization

▸ Linearization

    Linearization type

    Unit after linearization

    Free text

    Maximum value

    Diameter

    Intermediate height

    Table mode

    ▸ Edit table

        Level

        Customer value

    Activate table

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

Navigation   ▯   Setup → Advanced setup → Linearization

```
┌─────────────────────────────────────────────────────────────────────────────┐
│  ▶ Linearization                                                              │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Linearization type         │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Unit after linearization   │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Free text                  │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Level linearized           │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Interface linearized       │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Maximum value              │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Diameter                   │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Intermediate height        │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Table mode                 │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Table number               │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Level                      │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Level                      │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Customer value             │                                   │
│              └────────────────────────────┘                                   │
│                                                                               │
│              ┌────────────────────────────┐                                   │
│              │ Activate table             │                                   │
│              └────────────────────────────┘                                   │
└─────────────────────────────────────────────────────────────────────────────┘
```

Description of the parameters

Navigation   Setup → Advanced setup → Linearization

| **Linearization type** | 🔒 |

Navigation   Setup → Advanced setup → Linearization → Lineariz. type

Description   Select linearization type.

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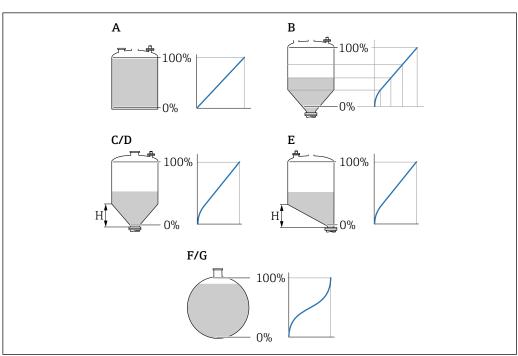   • Table
                        • Pyramid bottom
                        • Conical bottom
                        • Angled bottom
                        • Horizontal cylinder
                        • Sphere

Additional information

 34   Linearization types

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

Meaning of the options

• **None**
The level is output in the level unit without being converted (linearized) beforehand.

• **Linear**
The output value (volume/weight) is proportional to the level L. This applies, for example, to vertical cylindrical tanks and silos. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight

• **Table**
The relationship between the measured level L and the output value (volume/weight) is defined by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight" respectively. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Table mode** (→ 🖺 129)
  • For every point in the table: **Level** (→ 🖺 131)
  • For every point in the table: **Customer value** (→ 🖺 131)
  • **Activate table** (→ 🖺 131)

• **Pyramid bottom**
The output value corresponds to the volume or weight in a silo with a pyramid bottom. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight
  • **Intermediate height** (→ 🖺 129): the height of the pyramid

• **Conical bottom**
The output value corresponds to the volume or weight in a tank with a conical bottom. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight
  • **Intermediate height** (→ 🖺 129): the height of the cone

• **Angled bottom**
The output value corresponds to the volume or weight in a silo with an angled bottom. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight
  • **Intermediate height** (→ 🖺 129): height of the angled bottom

• **Horizontal cylinder**
The output value corresponds to the volume or weight in a horizontal cylinder. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight
  • **Diameter** (→ 🖺 128)

• **Sphere**
The output value corresponds to the volume or weight in a spherical tank. The following parameters must also be specified:
  • **Unit after linearization** (→ 🖺 126)
  • **Maximum value** (→ 🖺 128): maximum volume or weight
  • **Diameter** (→ 🖺 128)

Unit after linearization   🔒

Navigation   🖩🖩 Setup → Advanced setup → Linearization → Unit lineariz.

Prerequisite   **Linearization type** (→ 🖺 125) ≠ None

Description	Select the unit for the linearized value.

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

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

Distance-to-distance linearization is also possible, i.e. a linearization from the level unit to another length unit. Select the **Linear** linearization mode for this purpose. To specify the new level unit, select the **Free text** option in the **Unit after linearization** parameter and enter the unit in the **Free text** parameter (→ 🖺 127).

Free text   🔒

Navigation   🎛🖥 Setup → Advanced setup → Linearization → Free text

Prerequisite   **Unit after linearization** (→ 🖺 126) = **Free text**

Description   Enter unit symbol.

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

Level linearized

| Navigation | 🔲 Setup → Advanced setup → Linearization → Level linearized |

Description   Displays linearized level.

Additional information   ℹ️ • The unit is defined by the **Unit after linearization** parameter → 🗐 126.
                                   • For interface measurements, this parameter always refers to the total level.

Interface linearized

| Navigation | 🔲 Setup → Advanced setup → Linearization → Interf. lineariz |

Prerequisite   **Operating mode (→ 🗐 100)** = **Interface** or **Interface with capacitance**

Description   Displays the linearized interface height.

Additional information   ℹ️ The unit is defined in the **Unit after linearization** parameter → 🗐 126.

Maximum value   🔒

| Navigation | 🔳🔲 Setup → Advanced setup → Linearization → Maximum value |

Prerequisite   **Linearization type (→ 🗐 125)** has one of the following values:
                               • Linear
                               • Pyramid bottom
                               • Conical bottom
                               • Angled bottom
                               • Horizontal cylinder
                               • Sphere

User entry   –50 000.0 to 50 000.0 %

Diameter   🔒

| Navigation | 🔳🔲 Setup → Advanced setup → Linearization → Diameter |

Prerequisite   **Linearization type (→ 🗐 125)** has one of the following values:
                               • Horizontal cylinder
                               • Sphere

User entry	0 to 9999.999 m

Additional information   The unit is defined in the **Distance unit** parameter (→ 🗎 101).
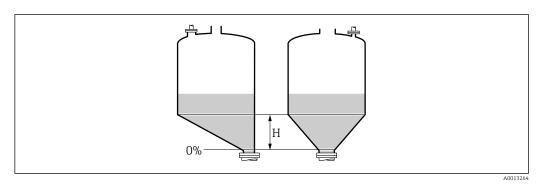
Intermediate height	🔒

Navigation   🖩🖥 Setup → Advanced setup → Linearization → Intermed. height

Prerequisite   **Linearization type** (→ 🗎 125) has one of the following values:
- Pyramid bottom
- Conical bottom
- Angled bottom

User entry   0 to 200 m

Additional information

H   Intermediate height

The unit is defined in the **Distance unit** parameter (→ 🗎 101).

Table mode	🔒

Navigation   🖩🖥 Setup → Advanced setup → Linearization → Table mode

Prerequisite   Linearization type (→ 🗎 125) = **Table**

Description   Select editing mode of the linearization table.

Selection
- Manual
- Semiautomatic *
- Clear table
- Sort table

---

*   Visibility depends on order options or device settings

Additional information **Meaning of the options**
- **Manual**
  The level and the associated linearized value are entered manually for each linearization point.
- **Semiautomatic**
  The level is measured by the device for each linearization point. The associated linearized value is entered manually.
- **Clear table**
  Deletes the existing linearization table.
- **Sort table**
  Rearranges the linerization points into an ascending order.

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

ℹ Before entering a linearization table, the values for **Empty calibration** (→ 🕮 102) and **Full calibration** (→ 🕮 103) must be set correctly.

 If values of the table need to be changed after the full or empty calibration have been changed, a correct evaluation is only ensured if the existing table is deleted and the complete table is entered again. To do so delete the existing table (**Table mode** (→ 🕮 129) = **Clear table**). Then enter a new table.

How to enter the table
- Via FieldCare
  The table points can be entered via the **Table number** (→ 🕮 130), **Level** (→ 🕮 131) and **Customer value** (→ 🕮 131) parameters. As an alternative, the graphic table editor may be used: Device Operation → Device Functions → Additional Functions → Linearization (Online/Offline)
- Via local display
  Select the **Edit table** submenu to call up the graphic table editor. The table is displayed and can be edited line by line.

ℹ The factory setting for the level unit is "%". If you want to enter the linearization table in physical units, you must select the appropriate unit in the **Level unit** parameter (→ 🕮 117) beforehand.

Table number   🔒

Navigation   Setup → Advanced setup → Linearization → Table number

Prerequisite   **Linearization type** (→ 🕮 125) = **Table**

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

User entry   1 to 32

Level (Manual)   ⓐ

Navigation	⊟ Setup → Advanced setup → Linearization → Level
Prerequisite	• Linearization type (→ 🖹 125) = Table • Table mode (→ 🖹 129) = Manual
Description	Enter level value of the table point (value before linearization).
User entry	Signed floating-point number

Level (Semiautomatic)

Navigation	⊟ Setup → Advanced setup → Linearization → Level
Prerequisite	• Linearization type (→ 🖹 125) = Table • Table mode (→ 🖹 129) = **Semiautomatic**
Description	Displays measured level (value before linearization). This value is transmitted to the table.

Customer value   ⓐ

Navigation	⊟ Setup → Advanced setup → Linearization → Customer value
Prerequisite	Linearization type (→ 🖹 125) = Table
Description	Enter linearized value for the table point.
User entry	Signed floating-point number

Activate table   ⓐ

Navigation	⊟⊟ Setup → Advanced setup → Linearization → Activate table
Prerequisite	Linearization type (→ 🖹 125) = **Table**
Description	Activate (enable) or deactivate (disable) the linearization table.
Selection	• Disable • Enable

Additional information	Meaning of the options

Meaning of the options
- **Disable**
  The measured level is not linearized.
  If **Linearization type (→ 🖹 125)** = **Table** at the same time, the device issues error message F435.
- **Enable**
  The measured level is linearized according to the table.

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

"Safety settings" submenu

Navigation   Setup → Advanced setup → Safety sett.

| Output echo lost | 🔒 |

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

Additional information	**Meaning of the options**
	• **Last valid value**
	  The last valid value is kept in the case of a lost echo.
	• **Ramp at echo lost** [9]
	  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 (→ 🖺 134).
	• **Value echo lost** [9]
	  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 🖺 133).
	• **Alarm**
	  In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter

| Value echo lost | 🔒 |

Navigation	Setup → Advanced setup → Safety sett. → Value echo lost
Prerequisite	**Output echo lost** (→ 🖺 133) = **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: • without linearization: **Level unit** (→ 🖺 117) • with linearization: **Unit after linearization** (→ 🖺 126)

---

9) Only visible if "Linearization type (→ 🖺 125)" = "None"

Ramp at echo lost	🔒
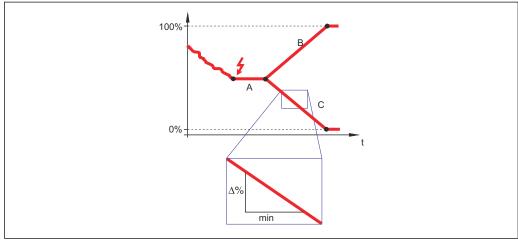
Navigation	🔘🔲 Setup → Advanced setup → Safety sett. → Ramp echo lost

Prerequisite   Output echo lost (→ 🗎 133) = **Ramp at echo lost**

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

User entry   Signed floating-point number

Additional information

A   Delay time echo lost
B   Ramp at echo lost (→ 🗎 134) (positive value)
C   Ramp at echo lost (→ 🗎 134) (negative value)

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

Blocking distance	🔒

Navigation	🔘🔲 Setup → Advanced setup → Safety sett. → Blocking dist.

Description   Specify upper blocking distance UB.

User entry   0 to 200 m

Factory setting
- For coax probes: 0 mm (0 in)
- For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)
- For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge

For FMP51/FMP52/FMP54 with the **Interface measurement** application package [10] and for FMP55:
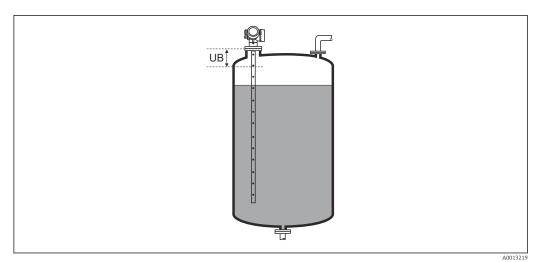100 mm (3.9 in) for all antenna types

Additional information

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

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

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

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

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

35   Blocking distance (UB) for liquid measurements

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

"WHG confirmation" wizard

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

The **WHG confirmation** wizard is used to lock the device according to 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   ▣▢   Setup → Advanced setup → WHG confirmation

"Deactivate WHG" wizard

ℹ️ The **Deactivate WHG** wizard (→ 🖺 137) is only visible if the device is WHG-locked. For details refer to the "Functional Safety Manual" of the respective device.

Navigation   🎛️🖥️   Setup → Advanced setup → Deactivate WHG

Reset write protection   🔒

Navigation   🎛️🖥️   Setup → Advanced setup → Deactivate WHG → Res. write prot.

Description   Enter unlocking code.

User entry   0 to 65 535

Code incorrect   🔒

Navigation   🎛️🖥️   Setup → Advanced setup → Deactivate WHG → Code incorrect

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

Selection   • Reenter code
                              • Abort sequence

"Probe settings" submenu

The **Probe settings** submenu helps to ensure that the end of probe signal within the envelope curve is correctly assigned by the evaluation algorithm. The assignment is correct if the length of probe indicated by the device matches the acutal lenght of the probe. The automatic probe length correction can only be performed if the probe is installed in the vessel and is completely uncovered (no medium). For partially filled vessels and if the probe length is known, select **Confirm probe length (→ 🖺 139) = Manual input** in order to enter the value manually.

ℹ️   If a mapping (interference echo suppression) has been recorded after shortening the probe, it is no longer possible to perform an automatic probe length correction. In this case there are two options:
  • Delete the map using the **Record map** parameter (→ 🖺 109) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→ 🖺 109).
  • Alternative: Select **Confirm probe length (→ 🖺 139) = Manual input** and enter the probe length manually into the **Present probe length** parameter → 🖺 138.

ℹ️   An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter (→ 🖺 138).

Navigation   ⊟⊟   Setup → Advanced setup → Probe settings

Probe grounded   🔒

Navigation	⊟⊟ Setup → Advanced setup → Probe settings → Probe grounded
Prerequisite	**Operating mode (→ 🖺 100) = Level**
Description	Specify whether the probe is grounded.
Selection	• No • Yes

Present probe length   🔒

Navigation	⊟ Setup → Advanced setup → Probe settings → Pres. length

Description	• In most cases:
	  Displays the length of the probe according to the currently measured end-of-probe signal.
	• For **Confirm probe length (→ 🖺 139) = Manual input**:
	  Enter actual length of probe.

User entry	0 to 200 m

Confirm probe length	🔒

Navigation	🔲 Setup → Advanced setup → Probe settings → Confirm length
Description	Select, whether the value displayed in the **Present probe length** parameter → 🗎 138 matches the actual length of the probe. Based on this input, the device performs a probe length correction.
Selection	• Probe length OK • Probe length too small • Probe length too big • Probe covered • Manual input • Probe length unknown
Additional information	**Meaning of the options** • **Probe length OK** To be selected if the indicated length is correct. An adjustment is not required. The device quits the sequence. • **Probe length too small** To be selected if the displayed length is smaller than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter → 🗎 138. This procedure has to be repeated until the displayed value matches the actual length of the probe. • **Probe length too big** To be selected if the displayed length is bigger than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is indicated in the **Present probe length** parameter → 🗎 138. This procedure has to be repeated until the displayed value matches the actual length of the probe. • **Probe covered** To be selected if the probe is (partially or completely) covered. A probe length correction is impossible in this case. The device quits the sequence. • **Manual input** To be selected if no automatic probe length correction is to be performed. Instead, the actual length of the probe must be entered manually into the **Present probe length** parameter → 🗎 138 [11]. • **Probe length unknown** To be selected if the acutal length of the probe is unknown. A probe length correction is impossible in this case and the device quits the sequence. .

---

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

"Probe length correction" wizard

The **Probe length correction** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the probe length correction are located directly in the **Probe settings** submenu (→ 🖺 138).

Navigation   🔲🔲   Setup → Advanced setup → Probe settings → Prob.length corr

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Confirm probe length   🔒

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

Description   → 🖺 139

Present probe length   🔒

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

Description   → 🖺 138

"Switch output" submenu

ℹ️ The **Switch output** submenu (→ 🗎 141) is only visible for devices with switch output. [12]

Navigation   ⓘ⊟ Setup → Advanced setup → Switch output

Switch output function	🔒

Navigation	ⓘ⊟ Setup → Advanced setup → Switch output → Switch out funct
Description	Select function for switch output.
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 (→ 🗎 142) determines for which type of event the output is opened.
	• **Limit**
	  The output is normally closed and is only opened if a measured variable exceeds or falls below a defined limit. The limit values are defined by the following parameters:
	  • **Assign limit** (→ 🗎 142)
	  • **Switch-on value** (→ 🗎 143)
	  • **Switch-off value** (→ 🗎 144)
	• **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 (→ 🗎 141).
	
	ℹ️ The **Off** and **On** options can be used to simulate the switch output.

Assign status	🔒

Navigation	ⓘ⊟ Setup → Advanced setup → Switch output → Assign status
Prerequisite	Switch output function (→ 🗎 141) = Digital Output
Description	Select device status for switch output.

---

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

Selection   • Off
                                   • Digital output AD 1
                                   • Digital output AD 2
                                   • Digital output 1
                                   • Digital output 2
                                   • Digital output 3
                                   • Digital output 4

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

Assign limit

Navigation   ◨◩ Setup → Advanced setup → Switch output → Assign limit

Prerequisite   **Switch output function** (→ 🖺 141) = **Limit**

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

Assign diagnostic behavior

Navigation   ◨◩ Setup → Advanced setup → Switch output → Assign diag. beh

Prerequisite   **Switch output function** (→ 🖺 141) = **Diagnostic behavior**

Description   Select diagnostic behavior for switch output.

Selection   • Alarm
                                   • Alarm or warning
                                   • Warning

---

*   Visibility depends on order options or device settings

Switch-on value	🔒

Navigation	🔘🔲 Setup → Advanced setup → Switch output → Switch-on value
Prerequisite	**Switch output function** (→ 🗎 141) = **Limit**
Description	Enter measured value for the switch-on point.
User entry	Signed floating-point number
Additional information	The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters: **Switch-on value > Switch-off value** • The output is closed if the measured value is larger than **Switch-on value**. • The output is opened if the measured value is smaller than **Switch-off value**.
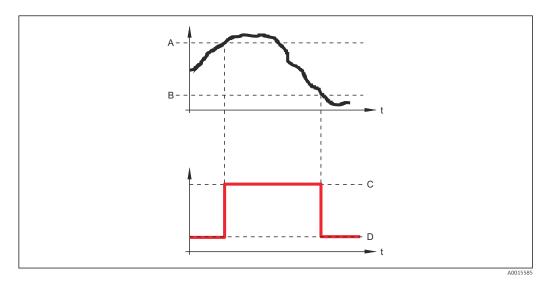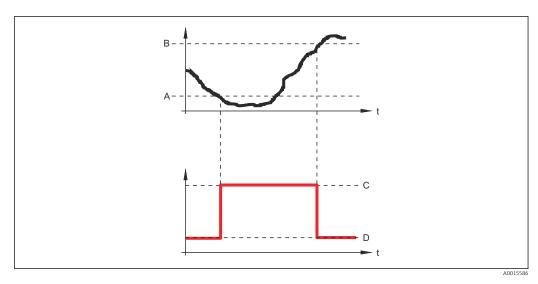
A   Switch-on value
B   Switch-off value
C   Output closed (conductive)
D   Output opened (non-conductive)

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

A0015586

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

Switch-on delay   ⌂

Navigation   ▣▤ Setup → Advanced setup → Switch output → Switch-on delay

Prerequisite   • Switch output function (→ 🗎 141) = Limit
                        • Assign limit (→ 🗎 142) ≠ Off

Description   Define delay for the switch-on of status output.

User entry   0.0 to 100.0 s

Switch-off value   ⌂

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

Prerequisite   Switch output function (→ 🗎 141) = Limit

Description   Enter measured value for the switch-off 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
                        (→ 🗎 143).

Switch-off delay	ⓐ

Navigation	⓪⊟ Setup → Advanced setup → Switch output → Switch-off delay
Prerequisite	• Switch output function (→ 🗎 141) = **Limit** • Assign limit (→ 🗎 142) ≠ **Off**
Description	Define delay for the switch-off of status output.
User entry	0.0 to 100.0 s

Failure mode	ⓐ

Navigation	⓪⊟ Setup → Advanced setup → Switch output → Failure mode
Prerequisite	Switch output function (→ 🗎 141) = **Limit** or **Digital Output**
Description	Define output behavior in alarm condition.
Selection	• Actual status • Open • Closed

Additional information

Switch status	

Navigation	⓪⊟ Setup → Advanced setup → Switch output → Switch status
Description	Shows the current switch output status.

Invert output signal	ⓐ

Navigation	⓪⊟ Setup → Advanced setup → Switch output → Invert outp.sig.
Description	Invert the output signal.
Selection	• No • Yes

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

"Display" submenu

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

Navigation   ⊞⊟   Setup → Advanced setup → Display

Language	

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

Format display	

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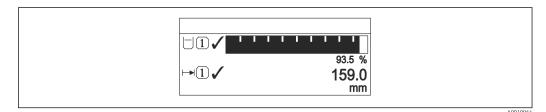
---

*   Visibility depends on order options or device settings

Additional information

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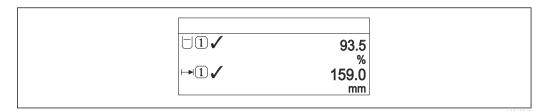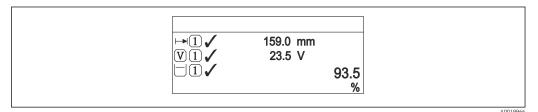
🖽 *36   "Format display" = "1 value, max. size"*

A0019964
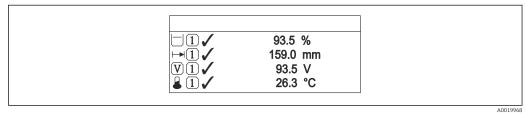
🖽 *37   "Format display" = "1 bargraph + 1 value"*

A0019965

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

A0019966

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

A0019968

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

- The **Value 1 to 4 display** → 🖺 149 parameters specify which measured values are shown on the display and in which order.
- If more measured values are specified than the current display mode permits, the values alternate on the device display. The display time until the next change is configured in the **Display interval** parameter (→ 🖺 150).

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 * • Terminal voltage • Electronic temperature • Measured capacitance * • Analog output 1 • Analog output 2 • Analog output 3 • Analog output 4 • Analog output adv. diagnostics 1 • Analog output adv. diagnostics 2
Factory setting	**For interface measurements and one current output** • Value 1 display: Interface linearized • Value 2 display: Level linearized • Value 3 display: Thickness upper layer • Value 4 display: Current output 1 **For interface measurements and two current outputs** • Value 1 display: Interface linearized • Value 2 display: Level linearized • Value 3 display: Current output 1 • Value 4 display: Current output 2

Decimal places 1 to 4	⌧

Navigation	⌸⌷ Setup → Advanced setup → Display → Decimal places 1
Description	Select the number of decimal places for the display value.
Selection	• x • x.x • x.xx • x.xxx • x.xxxx
Additional information	The setting does not affect the measuring or computational accuracy of the device.

---

*   Visibility depends on order options or device settings

Display interval	

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

Display damping	🔒

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

Header	🔒
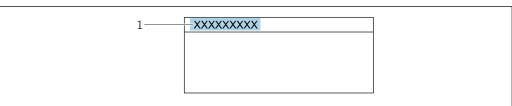
Navigation	◾◰◰ Setup → Advanced setup → Display → Header
Description	Select header contents on local display.
Selection	• Device tag • Free text

Additional information

1   Position of the header text on the display

Meaning of the options

• **Device tag**
  Is defined in the **Device tag** parameter.
• **Free text**
  Is defined in the **Header text** parameter (→ 🗎 151).

Header text   🔒

Navigation   ◷◳ Setup → Advanced setup → Display → Header text

Prerequisite   Header (→ 🖹 150) = Free text

Description   Enter display header text.

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

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

Separator   🔒

Navigation   ◷◳ Setup → Advanced setup → Display → Separator

Description   Select decimal separator for displaying numerical values.

Selection   • .
                      • ,

Number format   🔒

Navigation   ◷◳ Setup → Advanced setup → Display → Number format

Description   Choose number format for the display.

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

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

Decimal places menu   🔒

Navigation   ◷◳ Setup → Advanced setup → Display → Dec. places menu

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

Selection   • x
                      • x.x
                      • x.xx
                      • x.xxx
                      • x.xxxx

Additional information	• Is only valid for numbers in the operating menu (e.g. **Empty calibration**, **Full calibration**), but not for the measured value display. The number of decimal places for the measured value display is defined in the **Decimal places 1 to 4** → 🖩 149 parameters. • The setting does not affect the accuracy of the measurement or the calculations.

Backlight

Navigation	🔊🖳 Setup → Advanced setup → Display → Backlight
Prerequisite	The device has the SD03 local display (with optical keys).
Description	Switch the local display backlight on and off.
Selection	• Disable • Enable
Additional information	**Meaning of the options** • **Disable** Switches the backlight off. • **Enable** Switches the backlight on. ℹ️ Regardless of the setting in this parameter the backlight may be automatically switched off by the device if the supply voltage is too low.

Contrast display

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

"Configuration backup display" submenu

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

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

ℹ️ Configurations can only be exchanged between devices which are in the same operating mode (see the **Operating mode** parameter (→ 🖺 100)).

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

Operating time

Navigation	🔘🔲 Setup → Advanced setup → Conf.backup disp → Operating time
Description	Indicates how long the device has been in operation.
Additional information	*Maximum time*
	9 999 d (≈ 27 years)

Last backup

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

Configuration management   🔒

Navigation	🔘🔲 Setup → Advanced setup → Conf.backup disp → Config. managem.
Description	Select action for managing the device data in the display module.
Selection	• Cancel
	• Execute backup
	• Restore
	• Duplicate
	• Compare
	• Clear backup data

Additional information	Meaning of the options
	• **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:
	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 (→ 🖺 154).
	• **Clear backup data**
	The backup copy of the device configuration is deleted from the display module of the device.

ℹ️ 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.

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

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

Backup state

Navigation	🖺	Setup → Advanced setup → Conf.backup disp → Backup state
Description		Displays which backup action is currently in progress.

Comparison result

Navigation	🖼🖺	Setup → Advanced setup → Conf.backup disp → Compar. result
Description		Comparison between present device data and display backup.

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

                                🛈 To start the comparison, set **Configuration management** (→ 🖺 153) = **Compare**.

                                🛈 If the transmitter configuration has been duplicated from a different device by
                                    Configuration management (→ 🖺 153) = **Duplicate**, the new device configuration
                                    in the HistoROM is only partially identical to the configuration stored in the display
                                    module: Sensor specific properties (e.g. the mapping curve) are not duplicated. Thus,
                                    the result of the comparison will be **Settings not identical**.

"Administration" submenu

Navigation   ⊞   Setup → Advanced setup → Administration

Define access code   🔒

Navigation	⊞	Setup → Advanced setup → Administration → Def. access code
Description		Define release code for write access to parameters.
User entry		0 to 9 999
Additional information	ℹ️	If the factory setting is not changed or if "0" is entered, the parameters are not write-protected and the device configuration data can therefore always be modified. The user is logged on in the "Maintenance" role.
	ℹ️	The write protection affects all parameters marked with the 🔒 symbol in the document. On the local display, the 🔒 symbol in front of a parameter indicates that the parameter is write-protected.
	ℹ️	Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 🖺 114).
	ℹ️	Please contact your Endress+Hauser Sales Center if you lose the access code.
	ℹ️	If operating via the local display: the new access code is only valid once it has been confirmed in the **Confirm access code** parameter (→ 🖺 158).

Device reset   🔒

Navigation	▣▥	Setup → Advanced setup → Administration → Device reset
Description		Reset the device configuration - either entirely or in part - to a defined state.
Selection		• Cancel • To 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.

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

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Define access code

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

Description   → 🖺 156

Confirm access code

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

Description   Confirm the entered access code.

User entry   0 to 9999

16.4   "Diagnostics" menu

Navigation   ⊞⊟   Diagnostics

Actual diagnostics

Navigation	⊞⊟ Diagnostics → Actual diagnos.
Description	Displays current diagnostic message.
Additional information	The display consists of: • Symbol for event behavior • Code for diagnostic behavior • Operating time of occurrence • Event text

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

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

Timestamp

Navigation	⊟ Diagnostics → Timestamp

Previous diagnostics

Navigation	⊞⊟ Diagnostics → Prev.diagnostics
Description	Displays the last diagnostic message which has been active before the current message.
Additional information	The display consists of: • Symbol for event behavior • Code for diagnostic behavior • Operating time of occurrence • Event text

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

Timestamp

Navigation   ▣   Diagnostics → Timestamp

Operating time from restart

Navigation   ▣▣   Diagnostics → Time fr. restart

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

Operating time

Navigation   ▣▣   Diagnostics → Operating time

Description   Indicates how long the device has been in operation.

Additional information   *Maximum time*

                            9 999 d (≈ 27 years)

16.4.1   "Diagnostic list" submenu

Navigation   Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation   Diagnostics → Diagnostic list → Diagnostics 1

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

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

Timestamp 1 to 5

Navigation   Diagnostics → Diagnostic list → Timestamp 1 to 5

16.4.2 "Event logbook" submenu

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

Navigation   Diagnostics → Event logbook

Filter options

Navigation		Diagnostics → Event logbook → Filter options
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 (→ 🖹 162). A maximum of 100 events are displayed in chronological order.

The following symbols indicate whether an event has occurred or has ended:
• ⊕: Event has occurred
• ⊖: Event has ended

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

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

Navigation   Diagnostics → Event logbook → Event list

16.4.3 "Device information" submenu

Navigation   ⊠⊡   Diagnostics → Device info

Device tag

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

---

Serial number

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

Firmware version

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

Device name

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

Order code   🔒

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

Extended order code 1 to 3   🔒

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

Status PROFIBUS Master Config

Navigation	🗐🖳 Diagnostics → Device info → Stat Master Conf
Description	Indicates whether the cyclic data exchange with the master is currently active.
User interface	• Active • Not active

PROFIBUS ident number

Navigation	🗐🖳 Diagnostics → Device info → Ident number
Description	Indicates the ident number of the device.
Additional information	The **Ident number selector** parameter can be used to define which ident number is used.

16.4.4 "Measured values" submenu
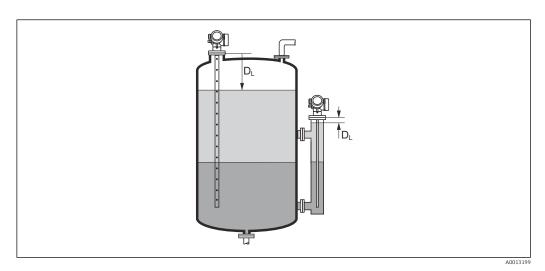
Navigation   ⊞⊟   Diagnostics → Measured val.

Distance

Navigation   ⊞⊟   Diagnostics → Measured val. → Distance

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

Additional information

❖ *41   Distance for interface measurements*

The unit is defined in the **Distance unit** parameter (→ 🖺 101).

Level linearized

Navigation   ⊞⊟   Diagnostics → Measured val. → Level linearized

Description   Displays linearized level.

Additional information   • The unit is defined by the **Unit after linearization** parameter → 🖺 126.
                        • For interface measurements, this parameter always refers to the total level.

Interface distance
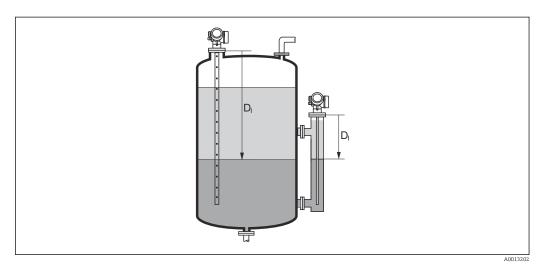
Navigation   ⊞⊟   Diagnostics → Measured val. → Interface dist.

Prerequisite   Operating mode (→ 🖺 100) = **Interface** or **Interface with capacitance**

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

Additional information

The unit is defined in the **Distance unit** parameter ($\rightarrow$ 101).

Interface linearized

Navigation	呂呂 Diagnostics → Measured val. → Interf. lineariz
Prerequisite	**Operating mode** ($\rightarrow$ 100) = **Interface** or **Interface with capacitance**
Description	Displays the linearized interface height.
Additional information	The unit is defined in the **Unit after linearization** parameter $\rightarrow$ 126.

Thickness upper layer
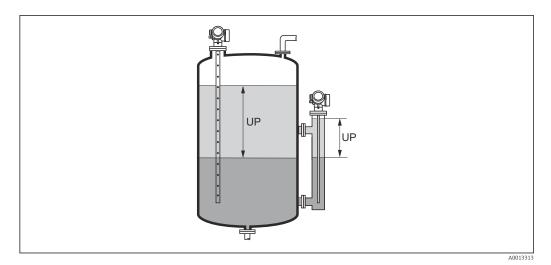
Navigation	呂呂 Diagnostics → Measured val. → Thickn.upp.layer
Prerequisite	**Operating mode** ($\rightarrow$ 100) = **Interface** or **Interface with capacitance**
Description	Displays the upper interface thickness (UP).

Additional information

UP   Thickness upper layer

The unit is defined by the **Unit after linearization** parameter → 🖺 126.

Terminal voltage 1

Navigation   ⓘ☲ Diagnostics → Measured val. → Terminal volt. 1

Switch status

Navigation   ⓘ☲ Diagnostics → Measured val. → Switch status

Description   Shows the current switch output status.

16.4.5 "Analog input 1 to 6" submenu

ℹ️ There is an **Analog input** submenu for each Analog Input Block of the device. Only the most important parameters of the respective block are available at this position of the operating menu. For a complete list of the block parameters refer to: Diagnostics → Analog inputs → Analog input 1 to 6

Navigation 🖩🗒 Diagnostics → Analog inputs → Analog input 1 to 6

Channel 🔂

Navigation	🖩🗒 Diagnostics → Analog inputs → Analog input 1 to 6 → Channel
Description	Standard parameter **CHANNEL** of the Analog Input Block according to the PROFIBUS Profile.
Selection	• Level linearized • Distance • Interface linearized * • Interface distance * • Thickness upper layer * • Terminal voltage • Electronic temperature • Measured capacitance * • Absolute echo amplitude • Relative echo amplitude • Absolute interface amplitude * • Relative interface amplitude * • Absolute EOP amplitude • Noise of signal • EOP shift • Calculated DC value * • Sensor debug • Analog output adv. diagnostics 1 • Analog output adv. diagnostics 2
Additional information	Allocates a measured value to the AI block.

Out value

Navigation	🖩🗒 Diagnostics → Analog inputs → Analog input 1 to 6 → Out value
Description	Element **Value** of the standard parameter **OUT** in the Analog Input Block according to the PROFIBUS Profile.
User entry	Signed floating-point number

---

* Visibility depends on order options or device settings

| Additional information | • For **Mode block actual** = **Man**:
  Enter the output value of the Analog Input Block.
• Else:
  Displays the output value of the Analog Input Block. |

Out status

| Navigation | 🗐🖥 Diagnostics → Analog inputs → Analog input 1 to 6 → Out status |

| Description | Element **Status** of the standard parameter **OUT** in the Analog Input Block accordintg to the PROFIBUS Profile. |

| User interface | • Good
• Uncertain
• Bad |

| Additional information | Only the two quality bits are evaluated in this parameter. |

Out status HEX

| Navigation | 🗐🖥 Diagnostics → Analog inputs → Analog input 1 to 6 → Out status HEX |

| Description | Element **Status** of the standard parameter **OUT** in the Analog Input Block according to the PROFIBUS Profile. |

| User entry | 0 to 255 |

| Additional information | The complete status byte is displayed in the form of a two-digit hexadecimal number in this parameter. |

16.4.6   "Data logging" submenu

Navigation   🔲🖳 Diagnostics → Data logging

Assign channel 1 to 4	🔒

Navigation   🔲🖳 Diagnostics → Data logging → Assign chan. 1 to 4

Selection
- Off
- Level linearized
- Distance
- Unfiltered distance
- Interface linearized *
- Interface distance *
- Unfiltered interface distance
- Thickness upper layer *
- 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).

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

Logging interval	🔒

Navigation   🖳   Diagnostics → Data logging → Logging interval
                       🔲   Diagnostics → Data logging → Logging interval

User entry   1.0 to 3 600.0 s

---

*   Visibility depends on order options or device settings

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

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

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

The logged data are deleted if this parameter is changed.

Example

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

Clear logging data	🔒

Navigation   ▭   Diagnostics → Data logging → Clear logging

                      ▣   Diagnostics → Data logging → Clear logging

Selection   • Cancel
                      • Clear data
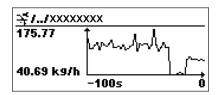
"Display channel 1 to 4" submenu

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

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

- x-axis: depending on the number of selected channels, 250 to 1000 measured values of a process variable are displayed.
- y-axis: covers the approximate measured value span and constantly adapts this to the measurement.

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

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

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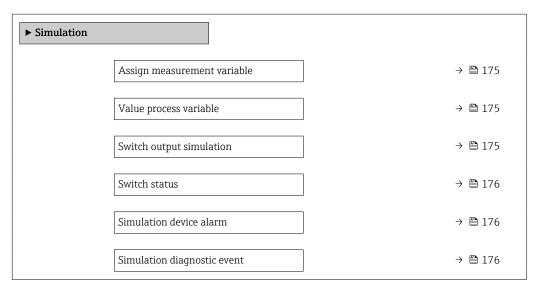
The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	▪ Assign measurement variable (→ 🕮 175) ▪ Value process variable (→ 🕮 175)
Specific state of the switch output	▪ Switch output simulation (→ 🕮 175) ▪ Switch status (→ 🕮 176)
Existence of an alarm	Simulation device alarm (→ 🕮 176)
Existence of a specific diagnostic message	Simulation diagnostic event (→ 🕮 176)

Structure of the submenu

Navigation   ▣   Expert → Diagnostics → Simulation

‣ Simulation	
Assign measurement variable	→ 🖹 175
Value process variable	→ 🖹 175
Switch output simulation	→ 🖹 175
Switch status	→ 🖹 176
Simulation device alarm	→ 🖹 176
Simulation diagnostic event	→ 🖹 176

Description of parameters

Navigation   ▤▣ Expert → Diagnostics → Simulation

Assign measurement variable   ▣

| Navigation | ▤▣ Expert → Diagnostics → Simulation → Assign meas.var. |

Selection
• Off
• Level
• Interface *
• Level linearized
• Interface linearized
• Thickness linearized

Additional information
• The value of the variable to be simulated is defined in the **Value process variable** parameter (→ 🖺 175).
• If **Assign measurement variable** ≠ **Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Value process variable   ▣

| Navigation | ▤▣ Expert → Diagnostics → Simulation → Value proc. var. |

Prerequisite   **Assign measurement variable** (→ 🖺 175) ≠ **Off**

User entry   Signed floating-point number

Additional information   Downstream measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.

Switch output simulation   ▣

| Navigation | ▤▣ Expert → Diagnostics → Simulation → Switch sim. |

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

Selection
• Off
• On

---

* Visibility depends on order options or device settings

Switch status	🔒

Navigation	🎛🖥 Expert → Diagnostics → Simulation → Switch status
Prerequisite	Switch output simulation (→ 🖹 175) = On
Description	Select the status of the status output for the simulation.
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.

Simulation device alarm	🔒

Navigation	🎛🖥 Expert → Diagnostics → Simulation → Sim. alarm
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 **Simulation failure mode** diagnostic message.

Simulation diagnostic event	

Navigation	🎛🖥 Expert → Diagnostics → Simulation → Sim. diag. event
Description	Select a diagnostic event for the simulation process that is activated.
Additional information	When operated via the local display, the selection list can be filtered according to the event categories (**Diagnostic event category** parameter).

16.4.8   "Device check" submenu

Navigation   ⊞⊟   Diagnostics → Device check

Start device check   🔒

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

Description   Start a device check.

Selection   • No
                       • Yes

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

Result device check

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

Description   Displays the result of the device check.

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

Last check time

Navigation   ⊞⊟   Diagnostics → Device check → Last check time

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

User interface   Character string comprising numbers, letters and special characters

---

Level signal

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

Launch signal

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

Interface signal

Navigation	ⓘ▣ Diagnostics → Device check → Interface signal
Prerequisite	• **Operating mode** (→ 🖻 100) = **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

16.4.9   "Heartbeat" submenu

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

Detailed description
SD01872F

Navigation   Diagnostics → Heartbeat

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