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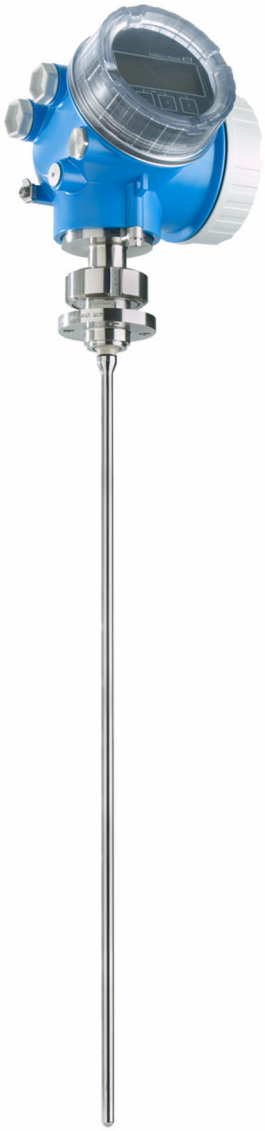
2022-12-13

01.01.zz (Device software)

Operating Instructions
Levelflex FMP53
FOUNDATION Fieldbus

Guided wave radar



Endress+Hauser
People for Process Automation

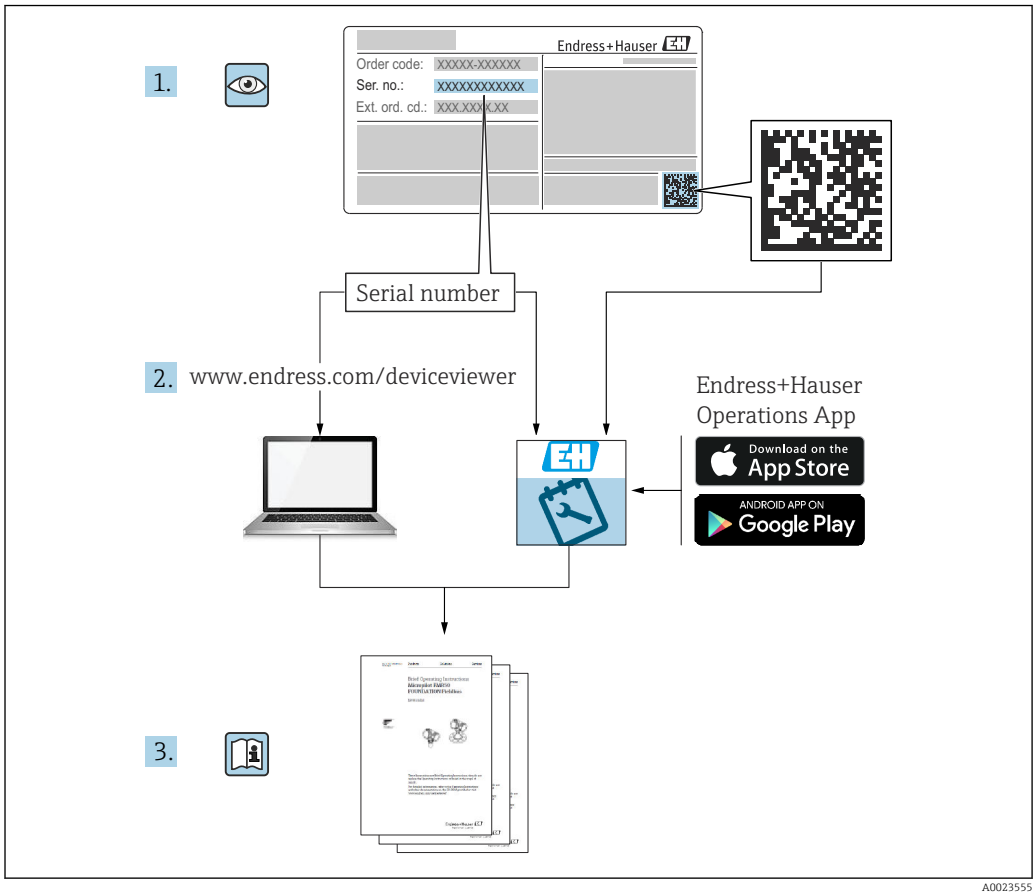

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX-XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
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Table of contents

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

Alternating current

Direct current and alternating current

Direct current

Ground connection

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

Protective earth (PE)

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

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

1.2.3 Tool symbols

Phillips head screwdriver

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

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

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

DTM
Device Type Manager

ε_r (Dk value)
Relative dielectric constant

PLC
Programmable logic controller (PLC)

CDI
Common Data Interface

Operating tool
The term "operating tool" is used in place of the following operating software:
SmartBlue (app), for operation using an Android or iOS smartphone or tablet

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

PLC
Programmable logic controller (PLC)

CDI
Common Data Interface

PFS
Pulse Frequency Status (Switch output)

MBP
Manchester Bus Powered

PDU
Protocol Data Unit

1.5 Registered trademarks

FOUNDATION™ Fieldbus
Registration-pending trademark of the FieldComm Group, Austin, Texas, USA

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TRI-CLAMP®
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2 Basic safety instructions

2.1 Requirements for the personnel

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

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

2.2 Intended use

Application and media
The measuring device described in this manual is intended only for the level 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
- 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 °C (176 °F). When in operation, the sensor may reach a temperature close to the medium temperature.

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

2.3 Workplace safety

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

With separable probe rods, medium may penetrate the joints between the individual parts of the rod. This medium may escape when the joints are loosened. This can cause injuries in the case of dangerous (e.g., aggressive or toxic) media.
- ▶ When loosening the joints between the individual parts of the probe rod, wear appropriate protective equipment according to the medium.

2.4 Operational safety

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

Modifications to the device

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

Repair

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

Hazardous area

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

2.5 Product safety

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

NOTICE

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

2.5.1 CE mark

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

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

2.5.2 EAC conformity

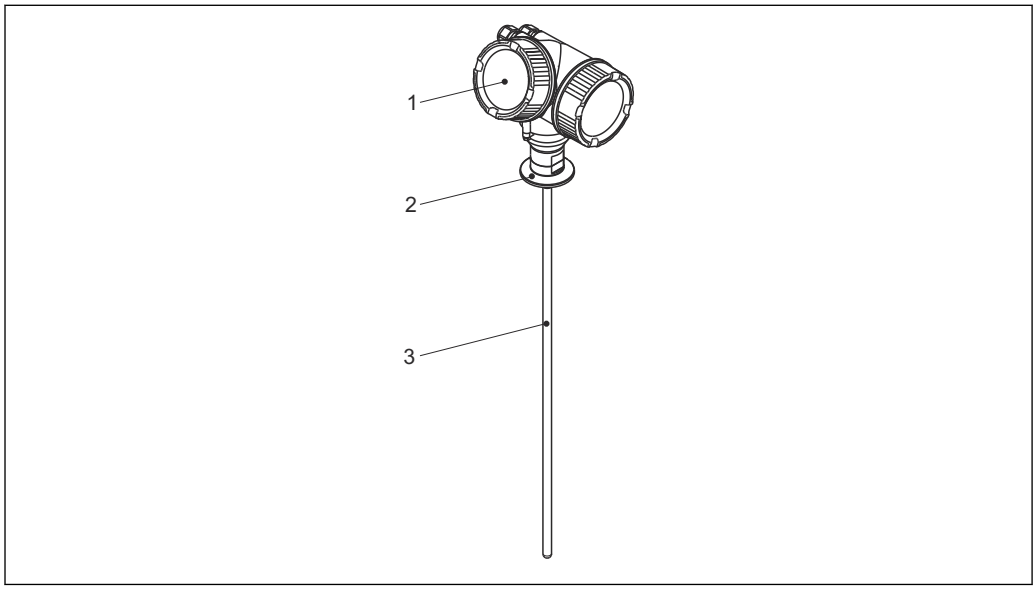
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

3 Product description

3.1 Product design

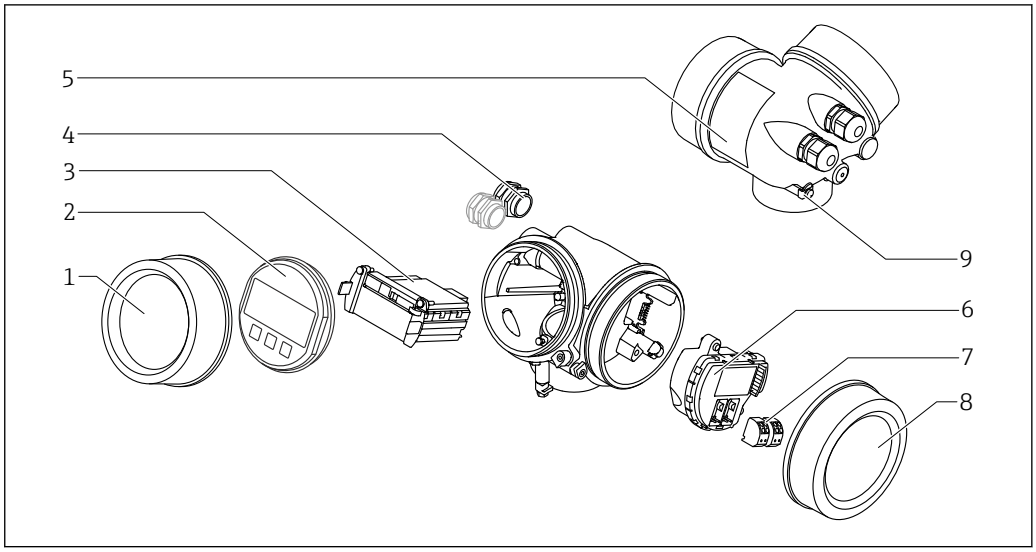
3.1.1 Levelflex FMP53



1 Design of the Levelflex

1 Electronics housing
2 Process connection
3 Rod 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

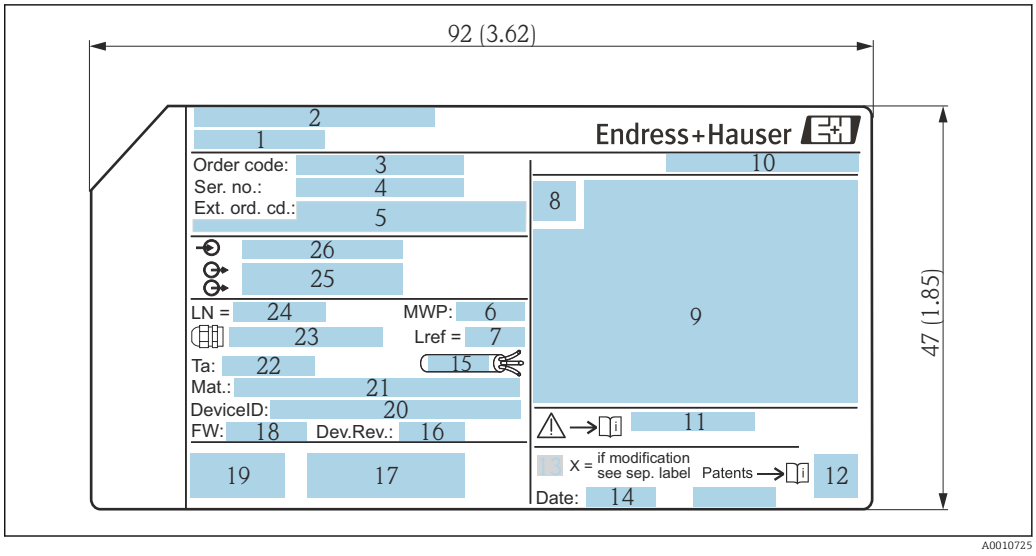
Check the following during incoming acceptance:
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): are the Safety Instructions (XA) provided?

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

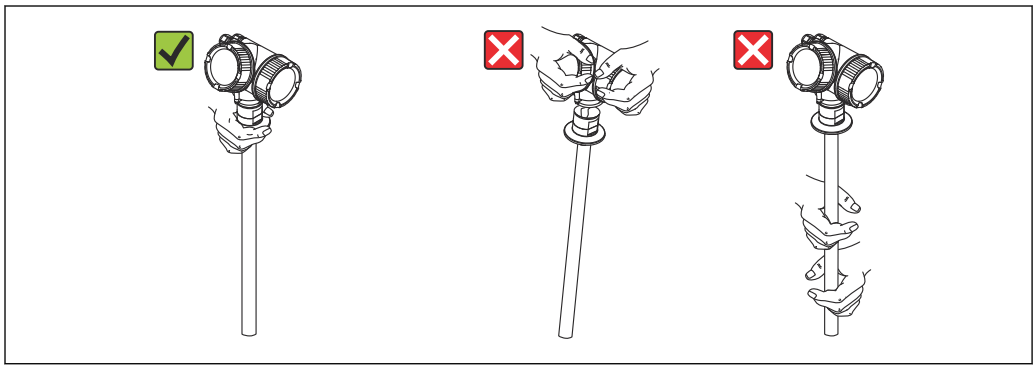
5.2 Transporting the product to the measuring point

⚠ 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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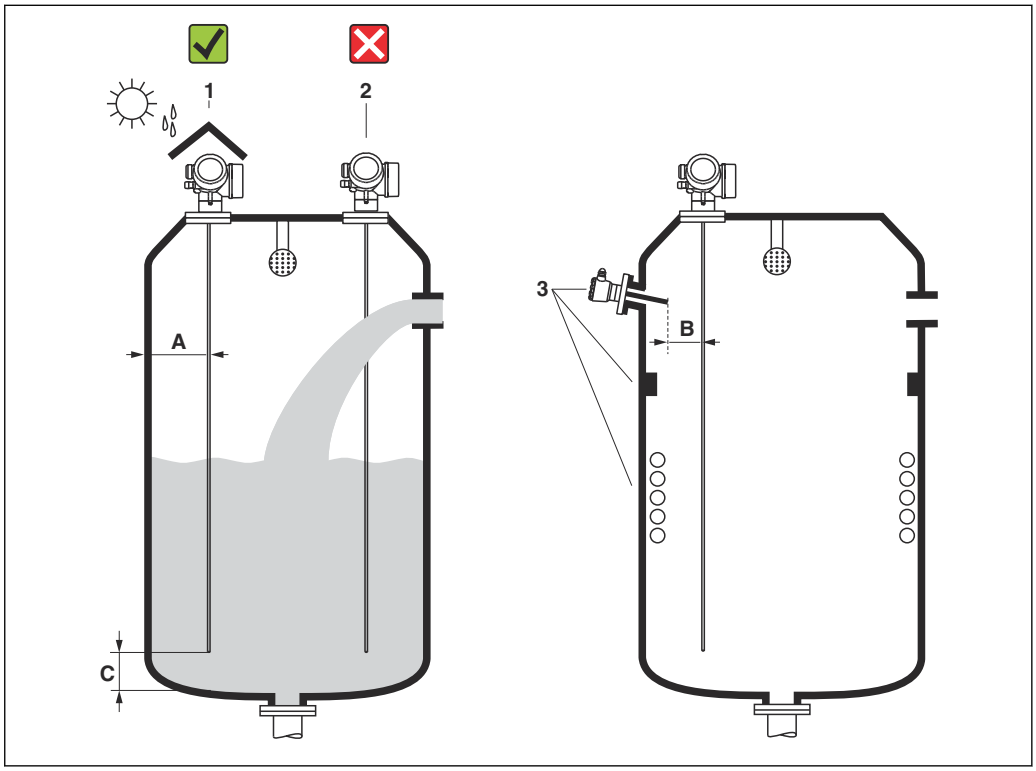
6 Mounting

6.1 Mounting requirements

6.1.1 Suitable mounting position



4 *Installation conditions for Levelflex*

Spacing requirements when mounting

- Distance (A) between the vessel wall and rod probes:
  - For smooth metallic walls: > 50 mm (2 in)
  - For plastic walls: > 300 mm (12 in) to metallic parts outside the vessel
- Distance (B) between rod probes and internal fittings (4): > 300 mm (12 in)
- When using more than one Levelflex:
  Minimum distance between the sensor axes: 100 mm (3.94 in)
- Distance (C) from the end of the probe to the bottom of the vessel: > 10 mm (0.4 in)

Additional conditions

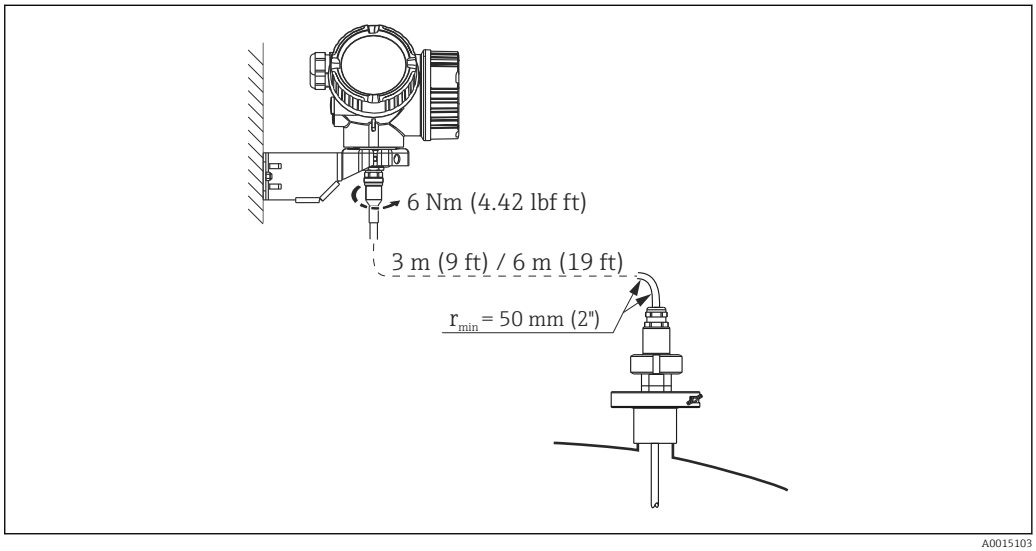
- When mounting outdoors, a weather protection cover (1) can be used to protect the device against extreme weather conditions.
- Do not mount the probe in the filling curtain (2).

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

6.1.2 Mounting under confined conditions

Mounting with remote probe

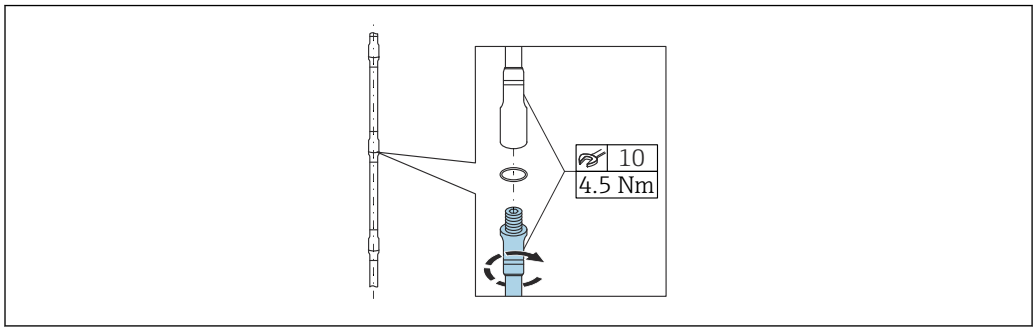
The device version with a remote probe is suitable for applications with restricted mounting space (product structure: probe design). In this case, the electronics housing is mounted at a separate position from the probe.



- The connecting cable is connected to the probe upon delivery.
  - Length: 3 m (9 ft) or 6 m (18 ft)
  - Minimum bending radius: 50 mm (2 inch)
- The mounting bracket for the electronics housing is included in the delivery with this version. Mounting options:
  - Wall mounting
  - Mounting on DN32 to DN50 (1-1/4 to 2 inch) post or pipe

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

Separable probes



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The use of separable rod probes (Ø 8 mm) is advisable in confined mounting conditions (limited distance to the ceiling).

- Max. probe length 6 m (19.68 ft)
- Max. lateral loading capacity 10 Nm
- Probes can be separated several times, with the individual parts having the following lengths:
  - 500 mm (20 in)
  - 1000 mm (40 in)
- The connection points are sealed gap-free by an O-ring.

To avoid damage to the surface of the probe: use fitting pliers with a plastic surface to mount the probe rod.

6.1.3 Notes on the mechanical load of the probe

Lateral loading capacity (flexural strength) of rod probes

FMP53

Rod 8mm (0.31") 316L
10 Nm

Rod 8mm (0.31") 316L separable
10 Nm

Lateral load (bending moment) from flow conditions

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

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

With:

c_w: coefficient of friction

ρ [kg/m³]: density of the medium

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

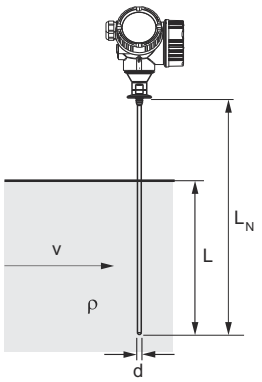
d [m]: diameter of the probe rod

L [m]: level

LN [m]: probe length

Sample calculation

Coefficient of friction c_w	0.9 (assuming turbulent flow - high Reynolds number)
Density ρ [kg/m³]	1000 (e.g. water)
Probe diameter d [m]	0.008
$L = L_N$	(unfavorable conditions)



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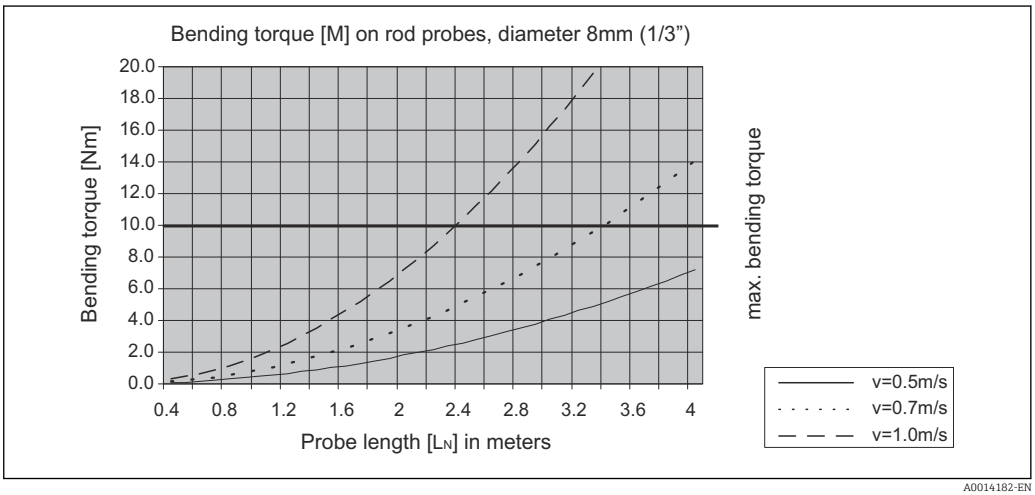

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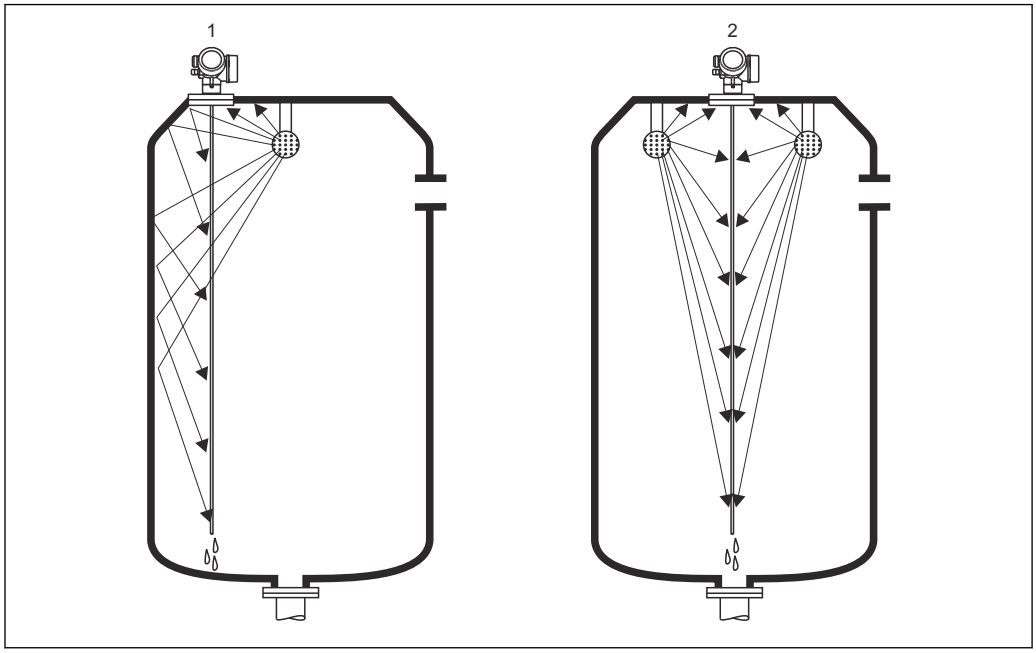
6.1.4 Special installation situations

Tanks with spray ball for probe cleaning



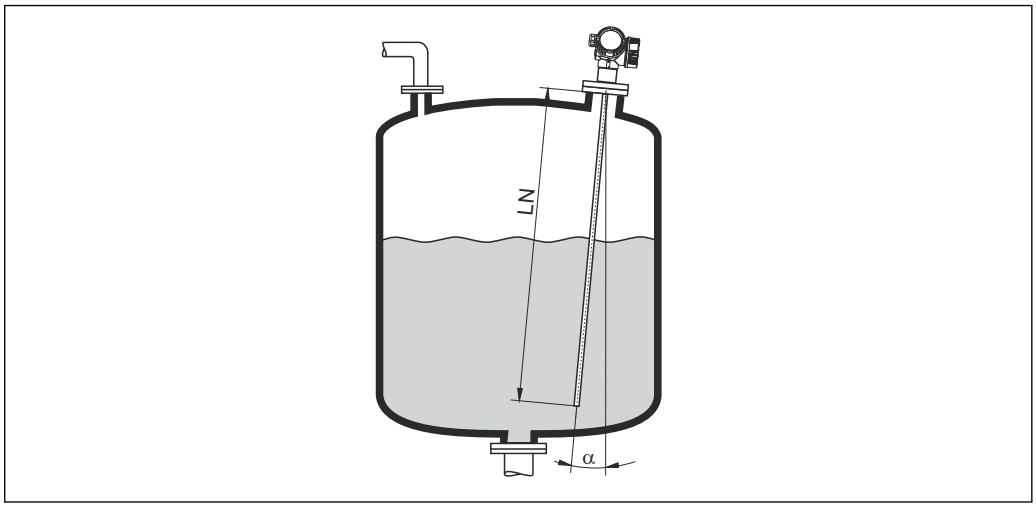
Mounting close to vessel wall

Mounting the probe close to the vessel wall improves the cleaning effect when a spray ball is used. The cleaning jet is directed onto the probe via the vessel wall. As a result, the probe is also cleaned in places the spray ball jet would normally not reach. You only require one spray ball for this probe arrangement.

Mounting in the center of the vessel

If the probe is mounted in the center of the vessel, the use of a second spray ball may be necessary. These balls should then be mounted to the left and right of the probe.

Mounting at an angle



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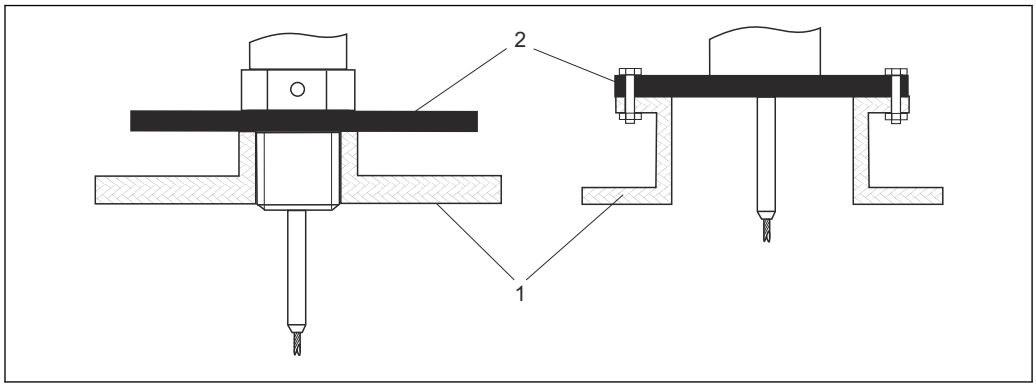
- For mechanical reasons, the probe should be installed as vertically as possible.
- If the probe is installed at an angle, the length of the probe must be reduced depending on the angle of installation.
  - α 5 °: $LN_{max.}$ 4 m (13.1 ft)
  - α 10 °: $LN_{max.}$ 2 m (6.6 ft)
  - α 30 °: $LN_{max.}$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

Non-metal vessels

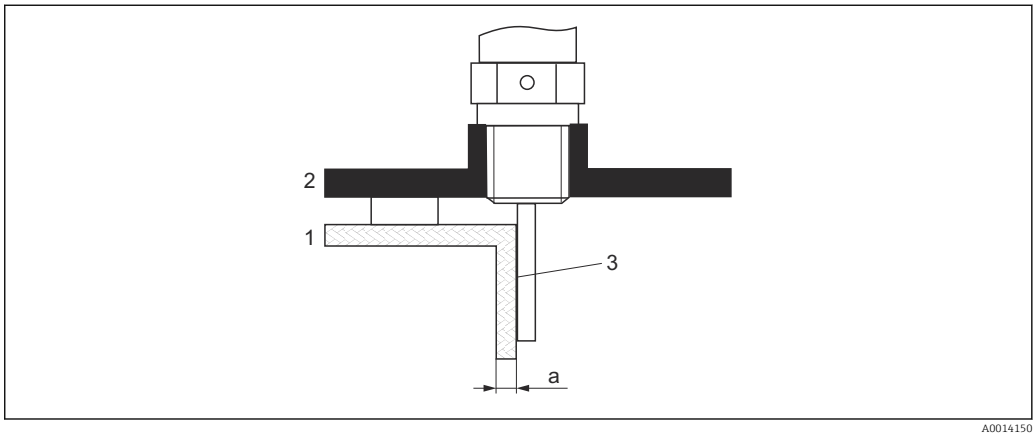


1 Non-metal vessel
2 Metal sheet or metal flange

To ensure good measurement results when mounting on non-metal vessels, at the process connection mount a metal sheet with a diameter of at least 200 mm (8 in) at a right angle to the probe.

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

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



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

Requirements

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

Note the following when mounting the device:

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

Adjustment when mounting on the vessel exterior

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

Compensation via gas phase compensation factor

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

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

1. Parameter Expert → Sensor → Gas phase compensation → GPC mode
   ↳ Select the **Const. GPC factor** option.

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

Compensation via the calibration parameters

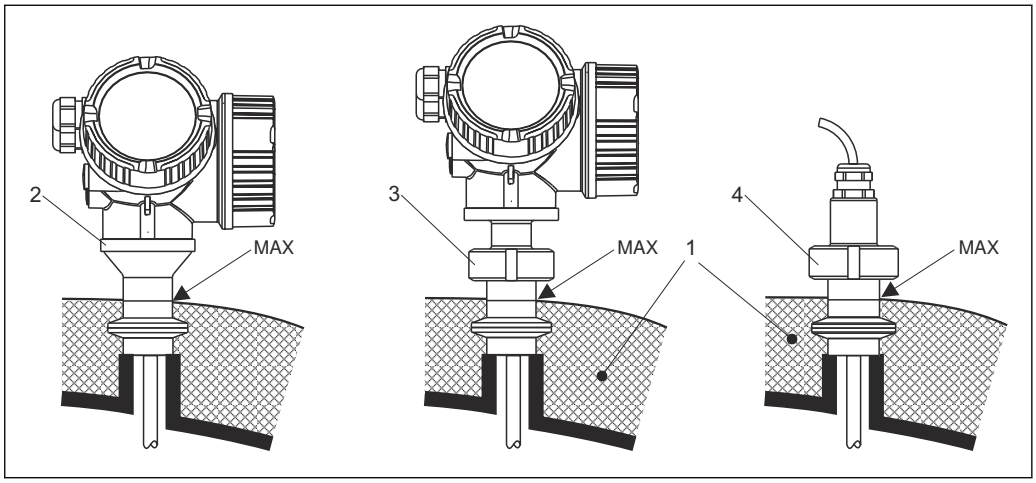
If it is necessary to actually compensate for a gas phase, the gas phase compensation function is not available for the correction of external mounting. The calibration parameters (**Empty calibration** and **Full calibration**) must be adjusted in this case. Furthermore, a value that is greater than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

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

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

Vessel with thermal insulation

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

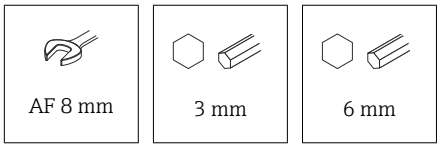


5 *Hygienic process connections*

1 *Vessel insulation*
2 *Compact device*
3 *Compact device, detachable*
4 *Sensor, remote*

6.2 Mounting the measuring device

6.2.1 Tool list



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

6.2.2 Mounting the "Sensor, remote" version

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

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

- The probe with process connection and connecting cable (3 m (9 ft) or 6 m (18 ft))
- The electronics housing
- The mounting bracket for mounting the electronics housing on a wall or post

The connecting cable is connected to the probe upon delivery.

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

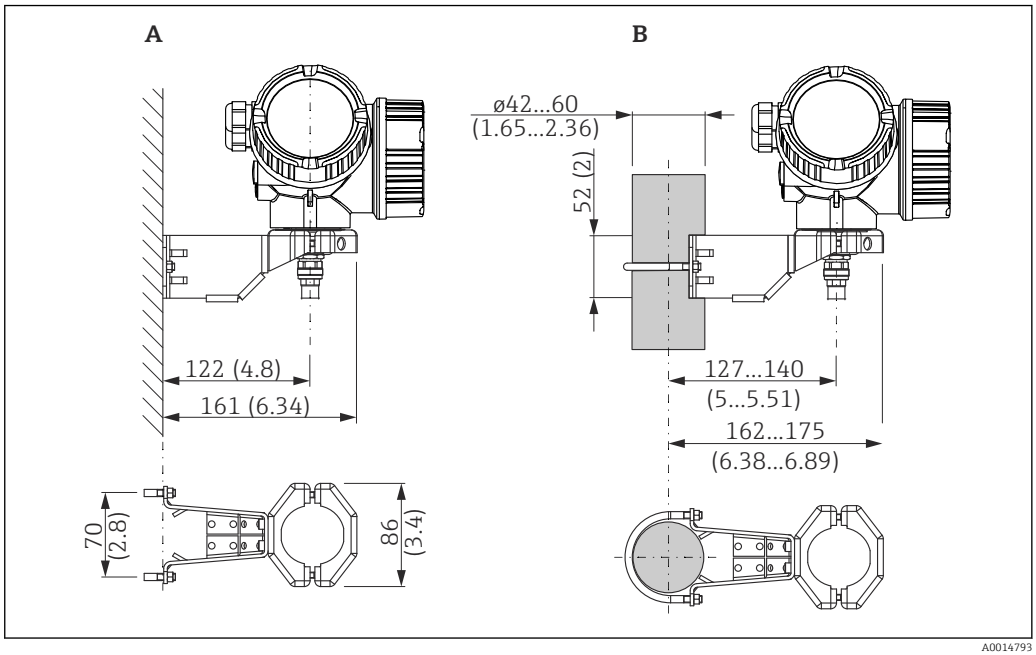
⚠ CAUTION

Mechanical stress can damage the plug of the connection cable or cause it 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: 50 mm (2 in).
- ▶ Torque of the union nut at the plug on the electronics side: 6 Nm
- ▶ Torque of the union nut at the plug on the sensor side: 20 Nm

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

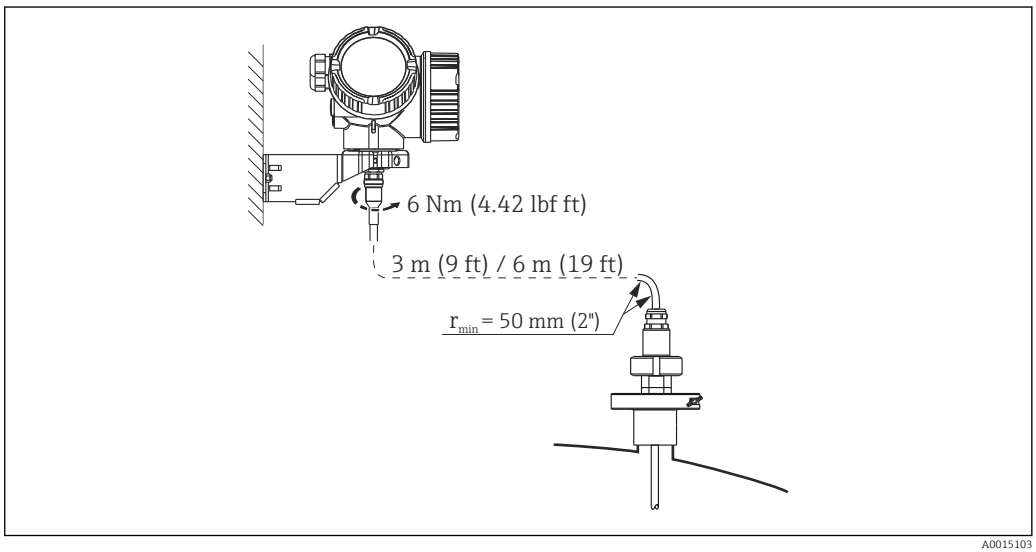
Mounting the electronics housing



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

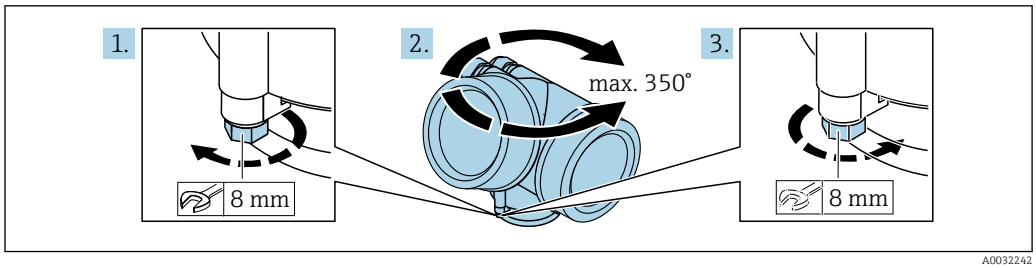
A Wall mounting
B Post mounting

Connecting the connecting cable



6.2.3 Turning the transmitter housing

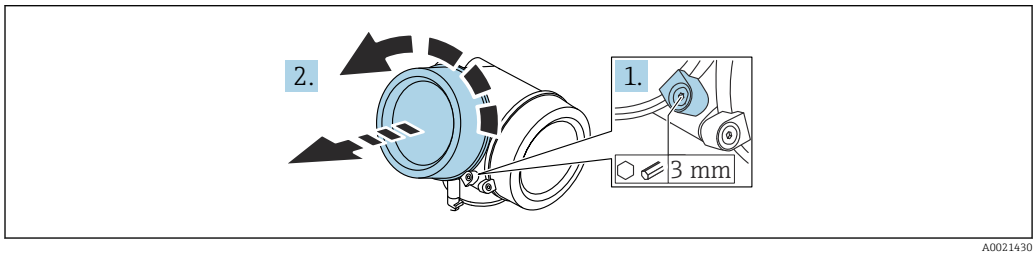
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



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).

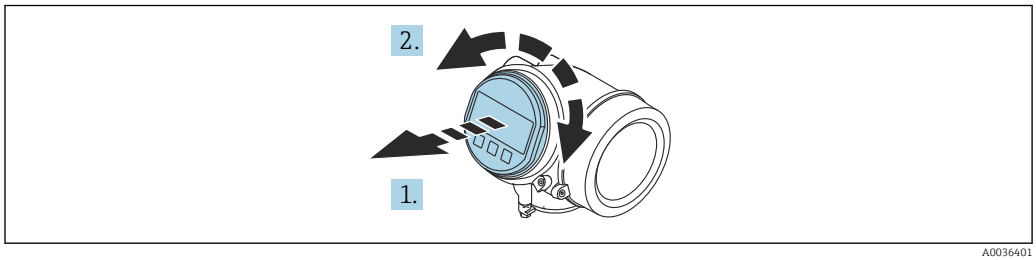
6.2.4 Turning the display

Opening the cover



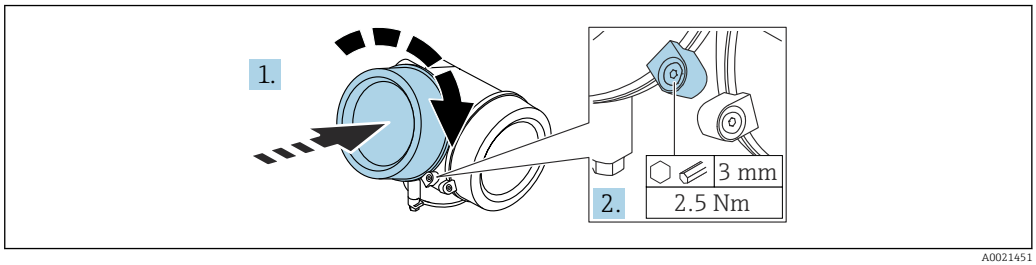
1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.
2. Unscrew the electronics compartment cover and check the cover seal; replace it if necessary.

Turning the display module



1. Pull out the display module with a gentle rotational movement.
2. Turn the display module to the desired position: Max. 8 × 45 ° in each direction.
3. Feed the coiled cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.

Closing the cover of the electronics compartment



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?

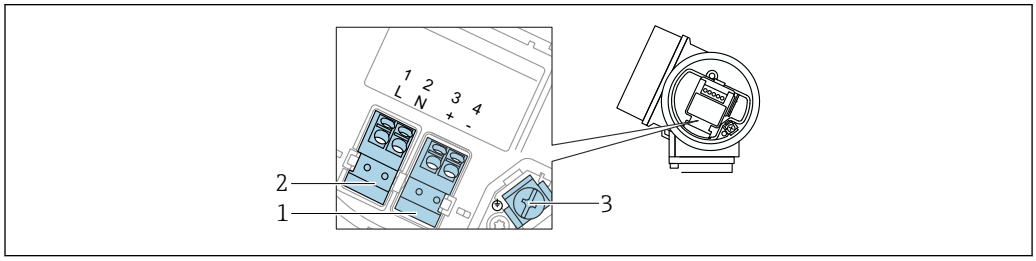
❑ Is the device properly secured?

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})



7 *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:

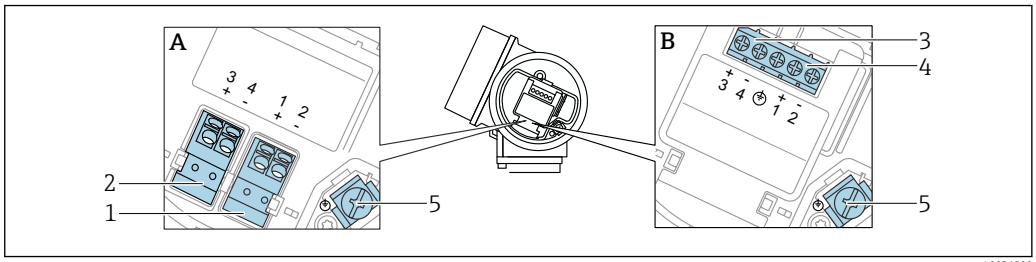
- ▶ Do not disconnect the protective ground connection.
- ▶ Disconnect the device from the supply voltage before disconnecting the protective ground.

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

In order to ensure electromagnetic compatibility (EMC): do **not** ground the device exclusively via the protective ground conductor of the supply cable. Instead, the functional grounding must also be connected to the process connection (flange or threaded connection) or to the external ground terminal.

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

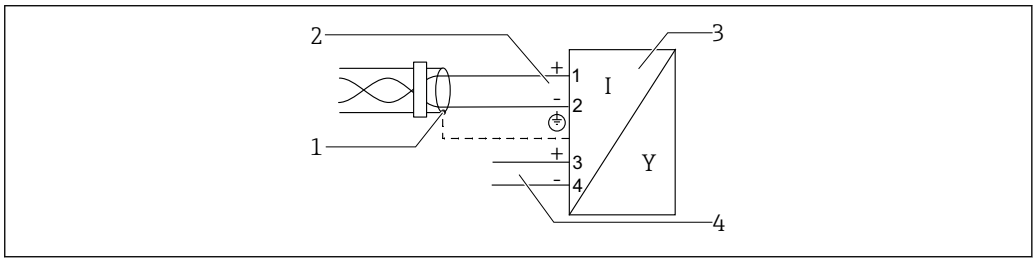
Terminal assignment PROFIBUS PA / FOUNDATION Fieldbus



8 *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

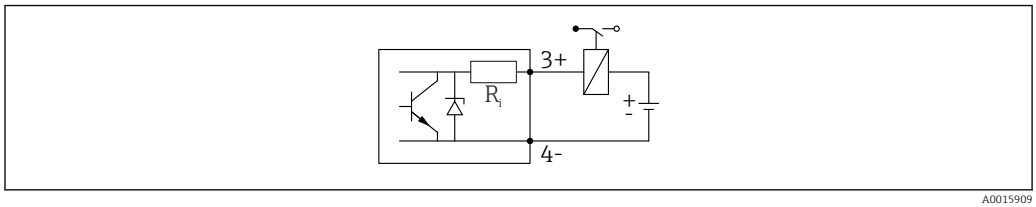
Block diagram PROFIBUS PA / FOUNDATION Fieldbus



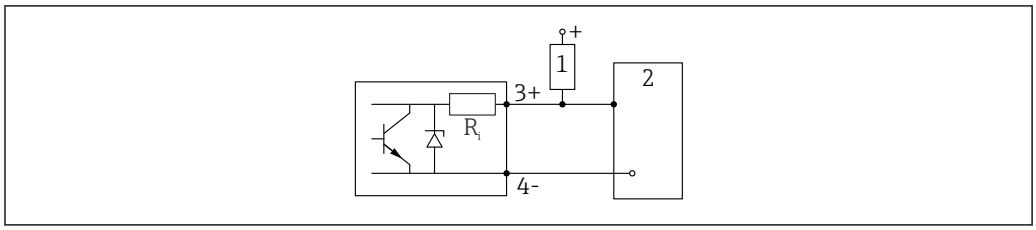
9 *Block diagram PROFIBUS PA / FOUNDATION Fieldbus*

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



10 *Connection of a relay*



11 *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 < 1 000 Ω.

7.1.2 Cable specification

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

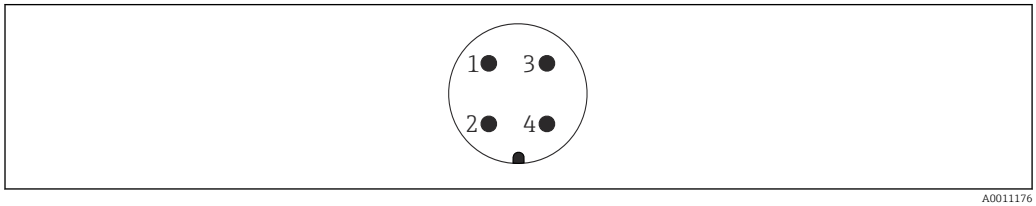
FOUNDATION Fieldbus

Endress+Hauser recommends using twisted, shielded two-wire cables.

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus 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.



12 *Pin assignment of 7/8" plug*

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

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

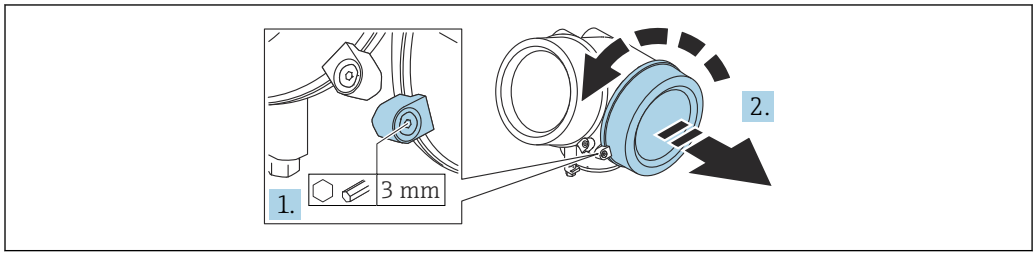
Explosion Hazard!

- ▶ 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.

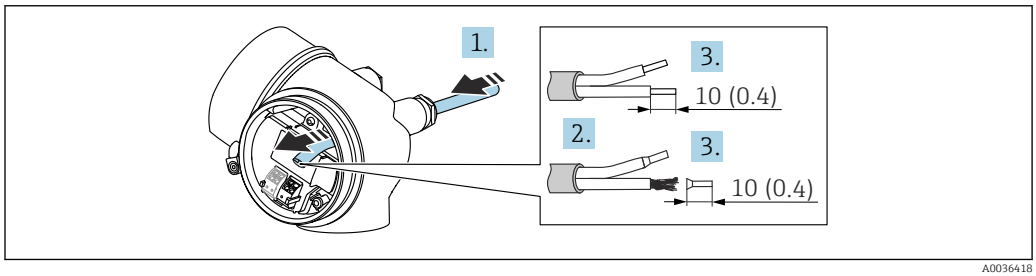
7.2.1 Opening cover



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

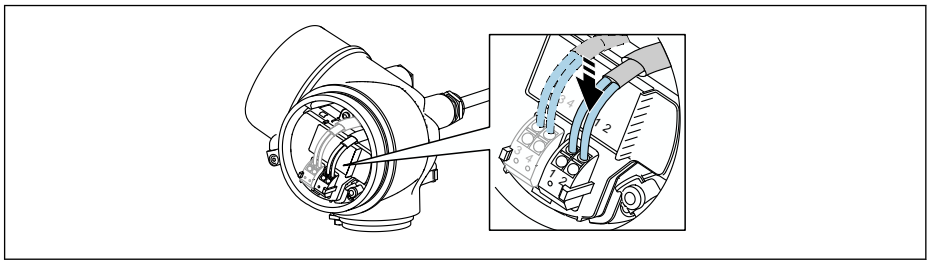


A0036418

13 *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.
   ↳

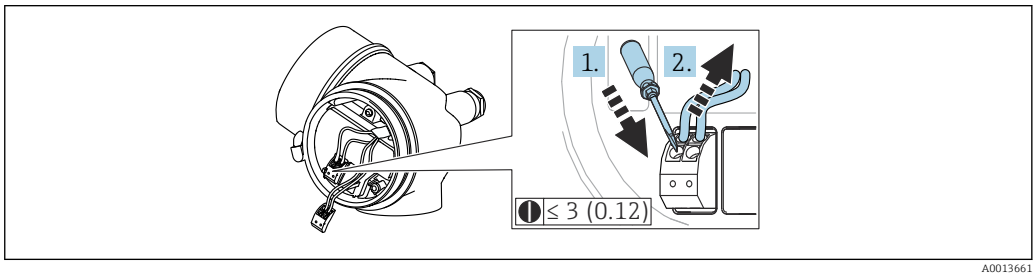


A0034682

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.



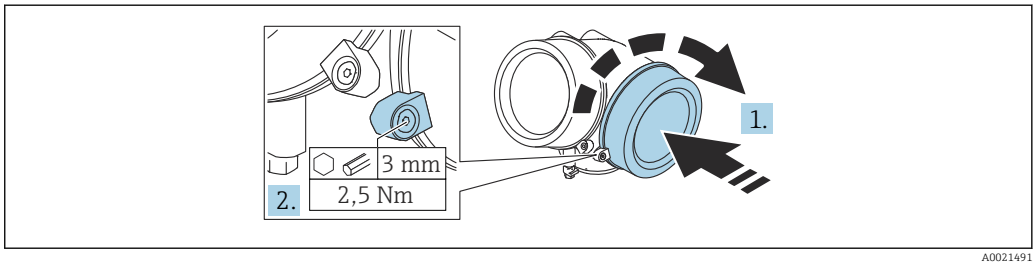
A0013661

14 *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?

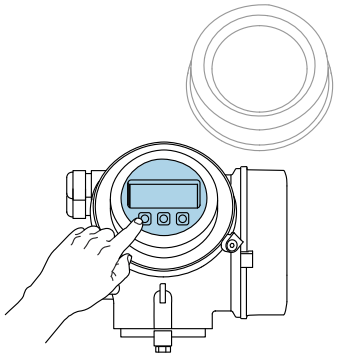
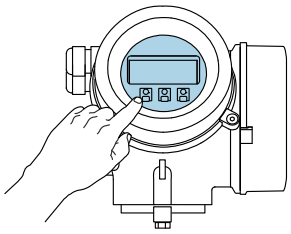
❑ Are all the housing covers installed and tightened?

❑ Is the securing clamp firmly tightened?

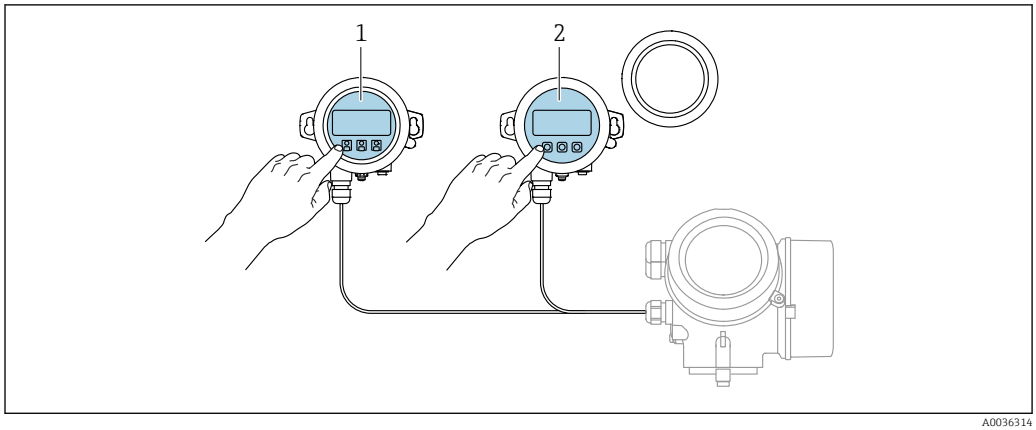
8 Operation methods

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 °C (–4 to +158 °F) The readability of the display may be impaired at temperatures outside the temperature range.	
Operating elements	local operation with 3 push buttons (⊞, ⊟, Ⓔ)	external operation via touch control; 3 optical keys: ⊞, ⊟, Ⓔ
	Operating elements also accessible in various hazardous areas	
Additional functionality	Data backup function The device configuration can be saved in the display module.	
	Data comparison function The device configuration saved in the display module can be compared to the current device configuration.	
	Data transfer function The transmitter configuration can be transmitted to another device using the display module.	

8.1.2 Operation with remote display and operating module FHX50

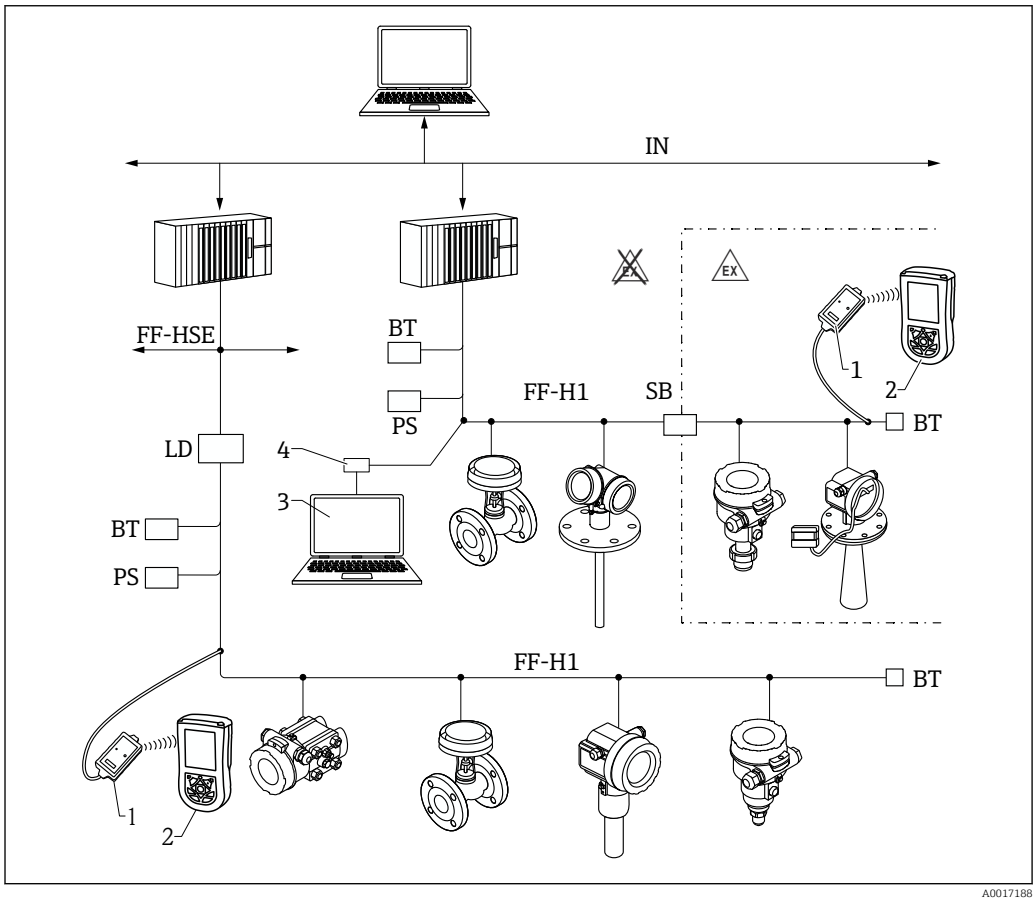


15 FHX50 operating options

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 FOUNDATION Fieldbus

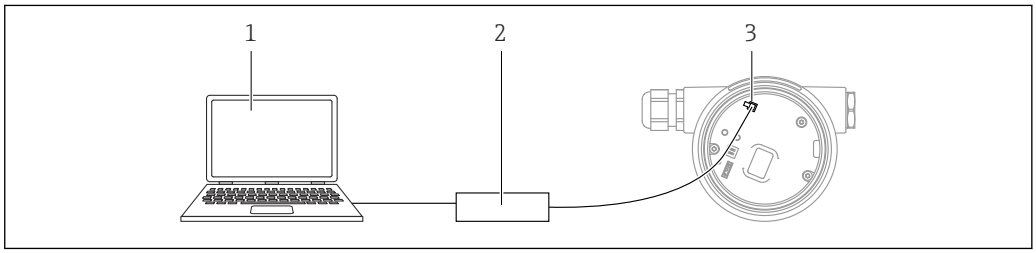


16 FOUNDATION Fieldbus system architecture with associated components

1 FFblue Bluetooth modem
2 Field Xpert SFX350/SFX370
3 DeviceCare/FieldCare
4 NI-FF interface card

IN	Industrial network
FF-HSE	High Speed Ethernet
FF-H1	FOUNDATION Fieldbus-H1
LD	Linking Device FF-HSE/FF-H1
PS	Bus Power Supply
SB	Safety Barrier
BT	Bus Terminator

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: GP01015F (FOUNDATION Fieldbus)	**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 → 47.
- 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 → 📄 46.

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.

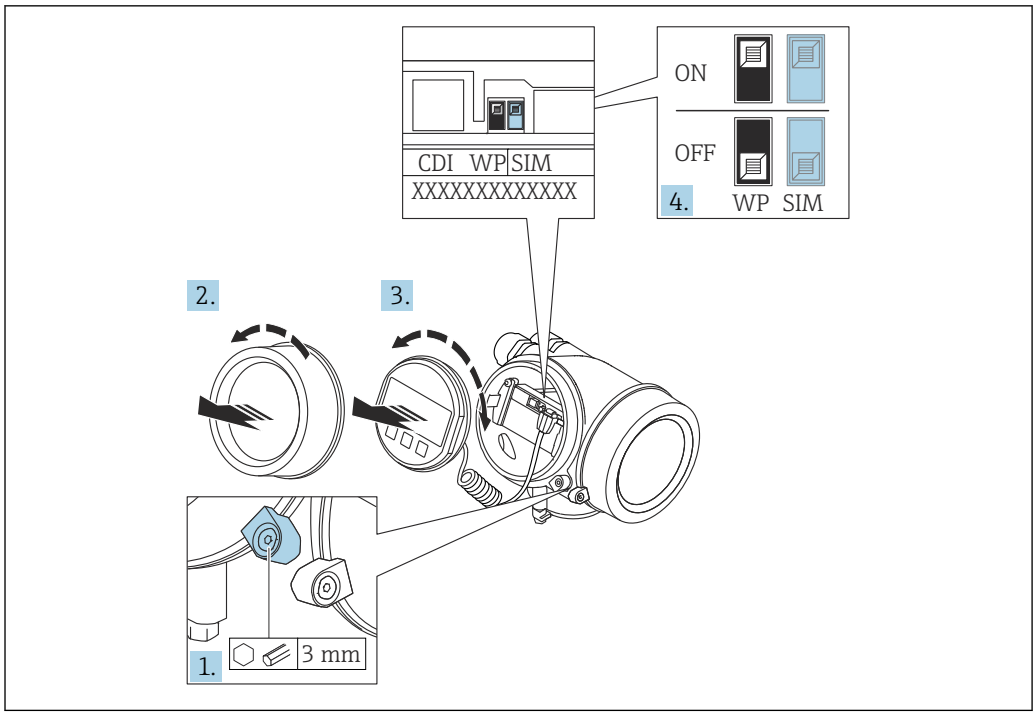
Via an operating tool (e.g. FieldCare)

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

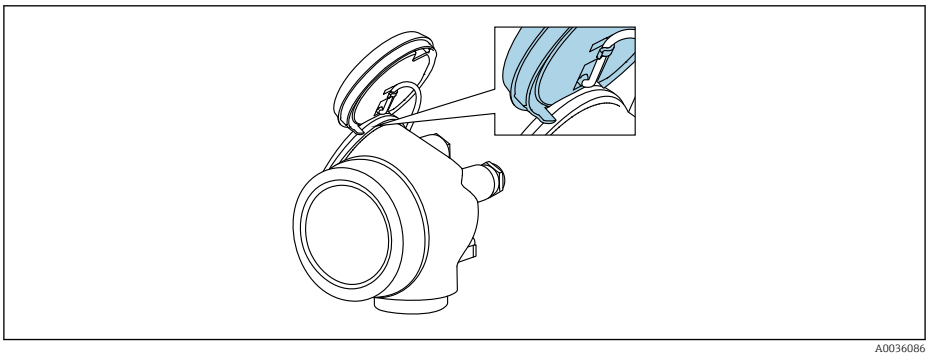
Unlike parameter write protection via a user-specific access code, this allows the user to lock write access to the entire operating menu - apart from the **"Contrast display" parameter**.

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



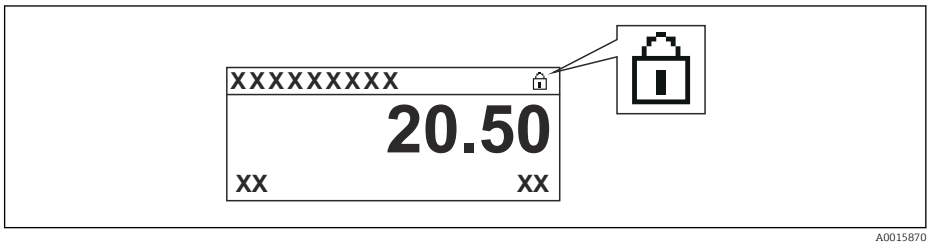
A0021474

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

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

To activate the keylock manually:

1. The device is in the measured value display.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu select the **Keylock on** option.
   ↳ The keypad lock is switched on.

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

Switching off the keypad lock

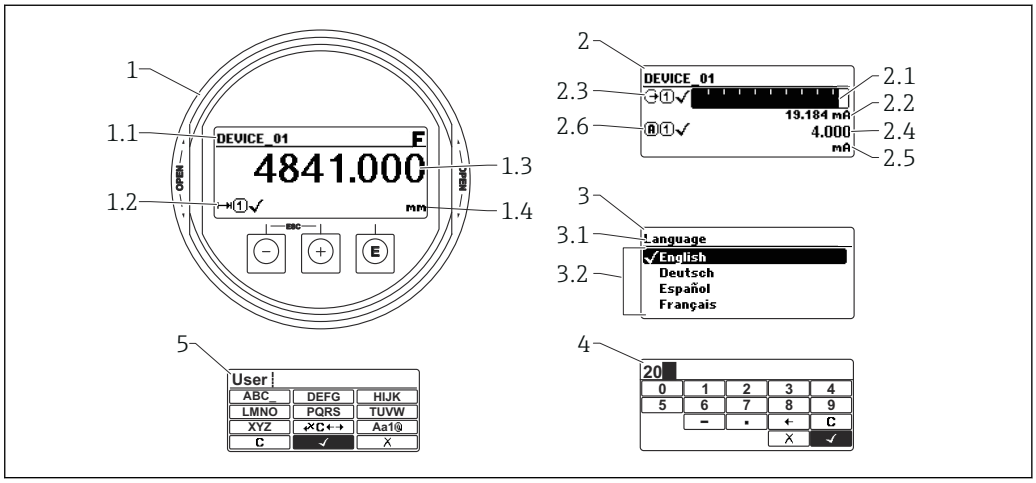
1. The keypad lock is switched on.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu select the **Keylock off** option.
   ↳ The keypad lock is switched off.

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



A0012635

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.

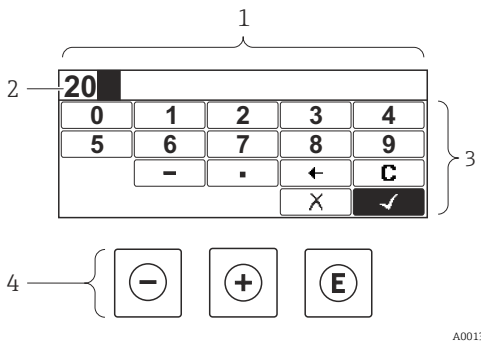
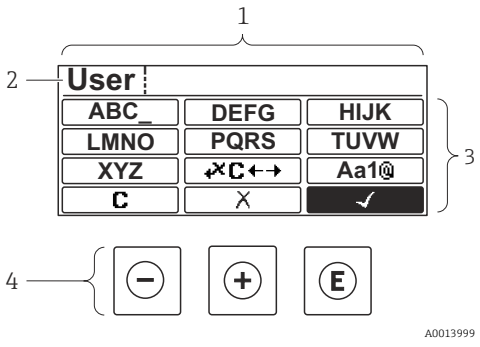
Measured value symbols

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).
 A0018328	**Enter key** *For measured value display* ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. *In a menu, submenu* ▪ Pressing the key briefly: Opens the selected menu, submenu or parameter. ▪ Pressing the key for 2 s in a parameter: If present, opens the help text for the function of the parameter. *In the text and numeric editor* ▪ Pressing the key briefly: ▪ Opens the selected group. ▪ Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.
 A0032909	**Escape key combination (press keys simultaneously)** *In a menu, submenu* ▪ Pressing the key briefly: ▪ Exits the current menu level and takes you to the next higher level. ▪ If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s returns you to the measured value display ("home position"). *In the text and numeric editor* Closes the text or numeric editor without applying changes.
 A0032910	**Minus/Enter key combination (press and hold down the keys simultaneously)** Reduces the contrast (brighter setting).
 A0032911	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).

8.3.3 Entering numbers and text

Numeric editor	Text editor
	

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

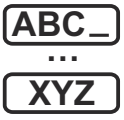
Input mask

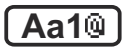
The following input and operating symbols are available in the input mask of the numeric and text editor:

Numeric editor

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

Text editor

Symbol	Meaning
 A0013997	Selection of letters from A to Z

 A0013981	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters
 A0013985	Confirms selection.
 A0013987	Switches to the selection of the correction tools.
 A0013986	Exits the input without applying the changes.
 A0014040	Clears all entered characters.

Text correction under 

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

8.3.4 Opening the context menu

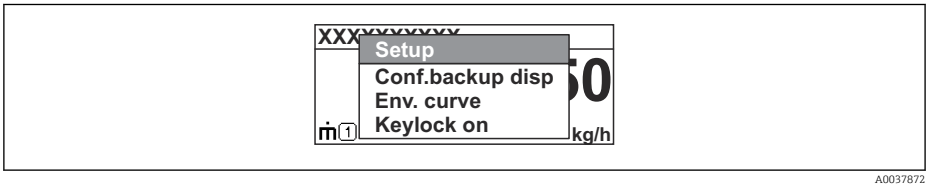
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

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

Calling up and closing the context menu

The user is in the operational display.

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



A0037872

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

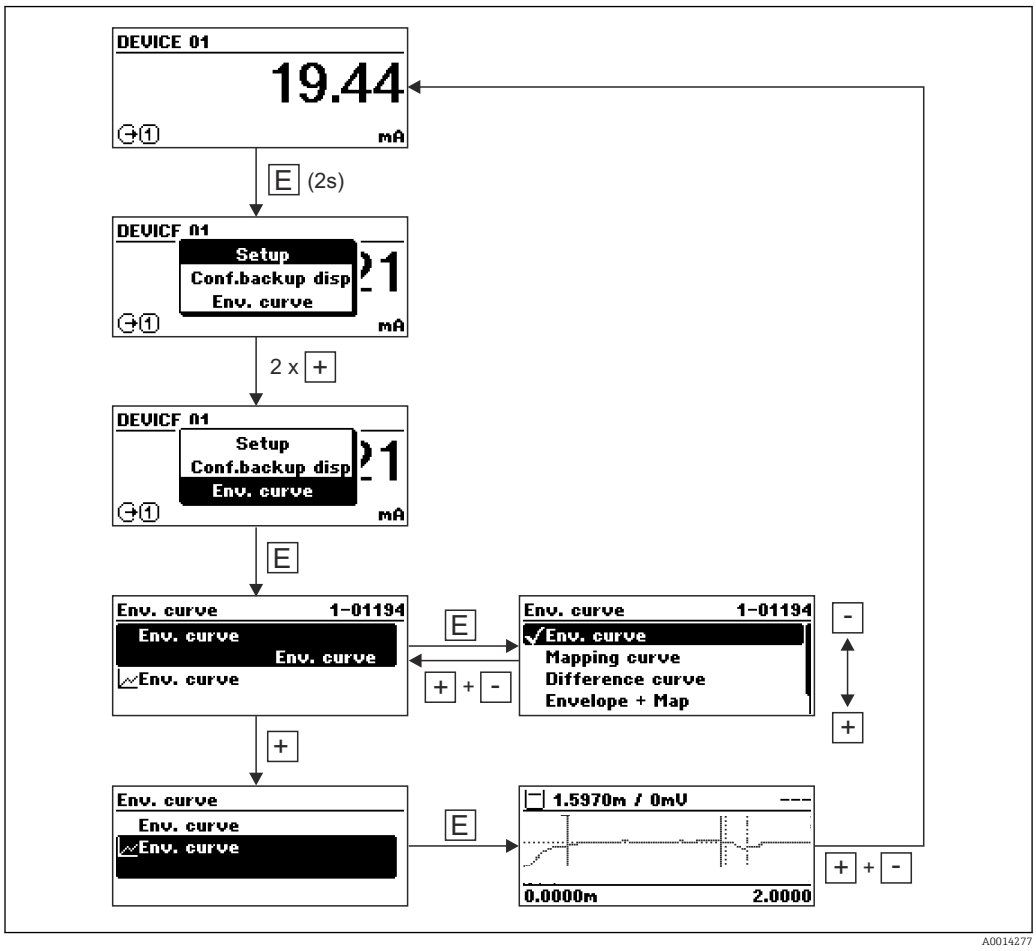
Calling up the menu via the context menu

1. Open the context menu.
2. Press + to navigate to the desired menu.

3. Press E to confirm the selection.
   ↳ The selected menu opens.

8.3.5 Envelope curve display on the display and operating module

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



9 Integration into a FOUNDATION Fieldbus network

9.1 Device Description (DD)

You require the following to configure a device and integrate it into an FF network:
- An FF configuration program
- The Cff file (Common File Format: *.cff)
- The device description (DD) in one of the following formats
  - Device Description format 4 : *sym, *ffo
  - Device Description format 5 : *sy5, *ff5

Information on the device-specific DD

Manufacturer ID	452B48hex
Device Type	100Fhex
Device Revision	05hex
DD Revision	Information and files at: ▪ www.endress.com ▪ www.fieldcommgroup.org
CFF Revision	

9.2 Integration into the FOUNDATION Fieldbus network

- For more in-depth information on integrating the device into the FF system, see the description for the configuration software used.
- When integrating the field devices into the FF system, make sure you are using the right files. You can read out the required version by means of the Device Revision/ DEV_REV and DD Revision/ DD_REV parameters in the Resource Block.

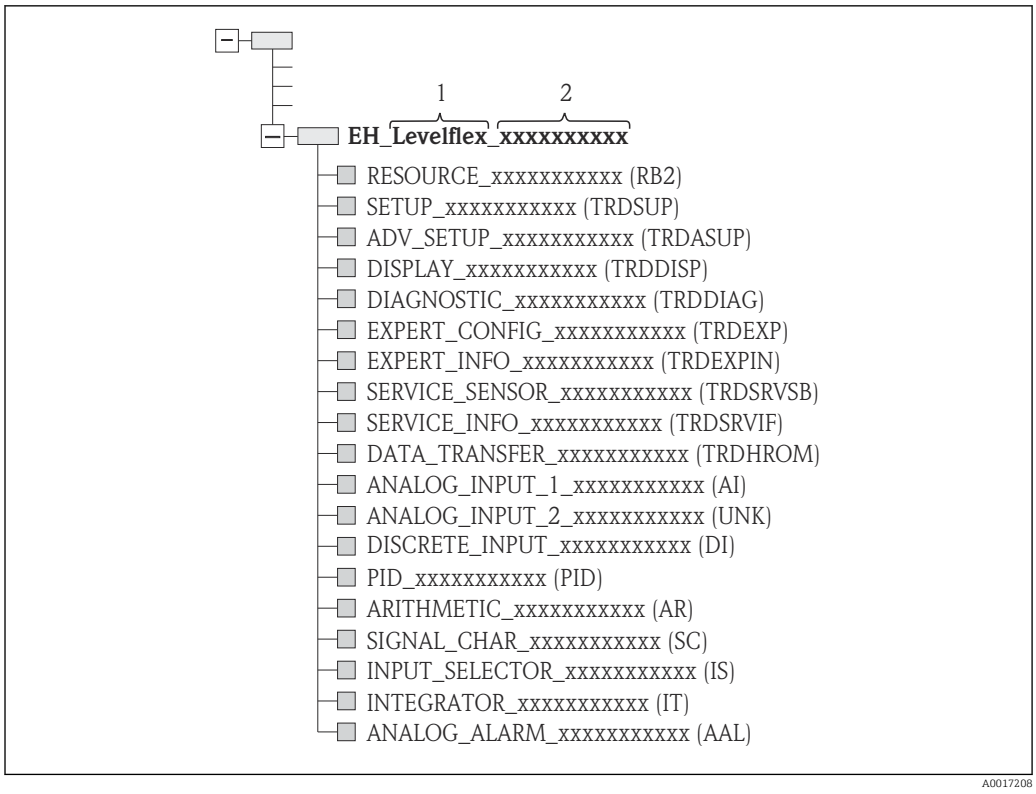
The device is integrated into the FF network as follows:

1. Start the FF configuration program.
2. Download the Cff and device description files (*.ffo, *.sym (for format 4) *ff5, *sy5 (for format 5) to the system.
3. Configure the interface.
4. Configure the device for the measuring task and for the FF system.

9.3 Device identification and addressing

FOUNDATION Fieldbus identifies the device using its ID code (Device ID) and automatically assigns it a suitable field address. The identity code cannot be changed. The device appears in the network display once you have started the FF configuration program and integrated the device into the network. The blocks available are displayed under the device name.

If the device description has not yet been loaded, the blocks report "Unknown" or "(UNK)".



18 Typical display in a configuration program after the connection has been established

1 Device name
2 Serial number

9.4 Block model

9.4.1 Blocks of the device software

The device has the following blocks:
- Resource Block (device block)
- Transducer Blocks
  - Setup Transducer Block (TRDSUP)
  - Advanced Setup Transducer Block (TRDASUP)
  - Display Transducer Block (TRDDISP)
  - Diagnostic Transducer Block (TRDDIAG)
  - Expert Configuration Transducer Block (TRDEXP)
  - Expert Information Transducer Block (TRDEXPIN)
  - Service Sensor Transducer Block (TRDSRVSB)
  - Service Information Transducer Block (TRDSRVIF)
  - Data Transfer Transducer Block (TRDHROM)
- Function Blocks
  - 2 Analog Input Blocks (AI)
  - 1 Discrete Input Block (DI)
  - 1 PID Block (PID)
  - 1 Arithmetic Block (AR)
  - 1 Signal Characterizer Block (SC)
  - 1 Input Selector Block (IS)
  - 1 Integrator Block (IT)
  - 1 Analog Alarm Block (AAL)

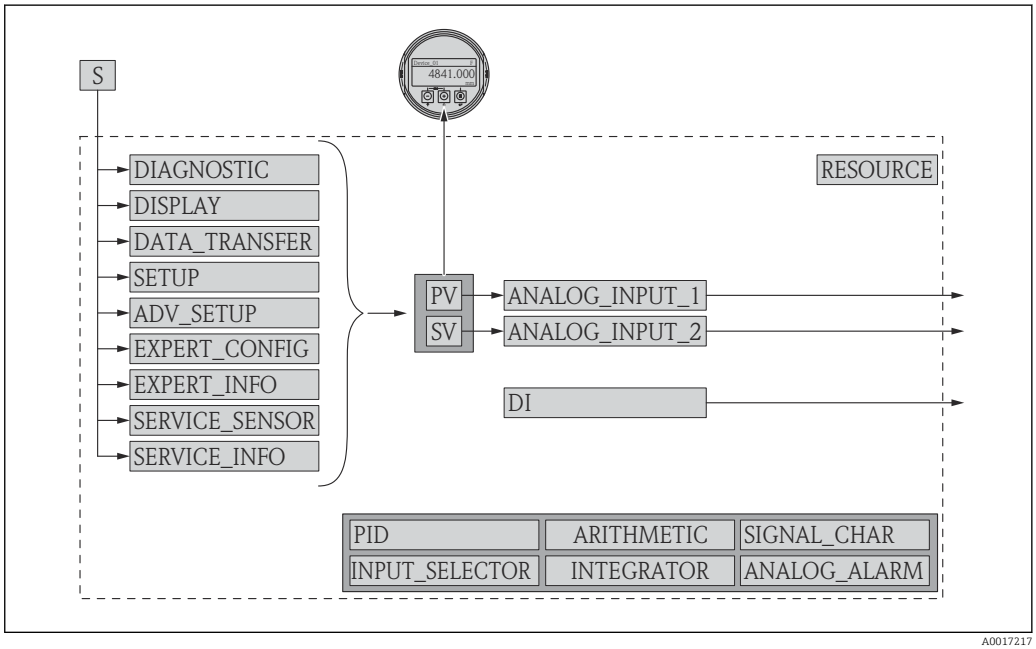
In addition to the pre-instantiated blocks already mentioned, the following blocks can also be instantiated:
- 5 Analog Input Blocks (AI)
- 2 Discrete Input Blocks (DI)
- 3 PID Blocks (PID)
- 3 Arithemetic Blocks (AR)
- 2 Signal Characterizer Blocks (SC)
- 5 Input Selector Blocks (IS)
- 3 Integrator Blocks (IT)
- 2 Analog Alarm Blocks (AAL)

Up to 20 blocks can be instantiated in the device altogether, including the blocks already instantiated. For instantiating blocks, see the appropriate Operating Instructions of the configuration program used.

Endress+Hauser Guideline BA00062S.

The guideline provides an overview of the standard function blocks that are described in FOUNDATION Fieldbus Specifications FF 890 - 894. It is designed to help operators use the blocks implemented in the Endress+Hauser field devices.

9.4.2 Block configuration when device is delivered



19 *Block configuration when device is delivered*

S Sensor
PV Primary value: Level linearized
SV Secondary value: Distance

9.5 Assignment of the measured values (CHANNEL) in an AI Block

The input value of an Analog Input Block is defined by the **CHANNEL** parameter.

Channel	Measured value
0	Uninitialized
89	Measured capacitance
144	EOP shift

Channel	Measured value
145	Interface distance
172	Calculated DC value
211	Terminal voltage
212	Sensor debug
32785	Absolute EOP amplitude
32786	Absolute echo amplitude
32787	Absolute interface amplitude
32856	Distance
32885	Elektronic temperature
32938	Interface linearized
32949	Level linearized
33044	Relative echo amplitude
33045	Relative interface amplitude
33070	Noise of signal
33107	Upper interface thickness

9.6 Index tables of Endress+Hauser parameters

The following tables list the manufacturer-specific device parameters for the Resource Blocks. For the FOUNDATION Fieldbus parameters, see the document BA062S "Guidline - FOUNDATION Fieldbus Function Blocks", which can be downloaded from www.endress.com.

9.6.1 Setup Transducer Block

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
confirm_distance	Confirm distance	82	ENUM16	2	Static	x	OOS	→ 130
filtered_dist_val	Distance	76	FLOAT	4	Dynamic			→ 129
map_end_x	Present mapping	84	FLOAT	4	Dynamic			→ 131
mapping_end_point	Mapping end point	83	FLOAT	4	Static	x	AUTO	→ 131
record_map	Record map	86	ENUM16	2	Static	x	OOS	→ 132
signal_quality	Signal quality	81	ENUM16	2	Dynamic			→ 130
medium_group	Medium group	55	ENUM16	2	Static	x	OOS	→ 127
tank_type	Tank type	52	ENUM16	2	Static	x	OOS	→ 126
tube_diameter	Tube diameter	53	FLOAT	4	Static	x	OOS	→ 126
empty_calibration	Empty calibration	56	FLOAT	4	Static	x	OOS	→ 127
full_calibration	Full calibration	57	FLOAT	4	Static	x	OOS	→ 128
distance_unit	Distance unit	51	ENUM16	2	Static	x	OOS	→ 126
level_unit	Level unit	58	ENUM16	2	Static	x	OOS	→ 141
output_unit_after_linearization	Unit after linearization	62	ENUM16	2	Static			→ 147
level_linearized	Level linearized	64	FLOAT	4	Dynamic			→ 149
present_probe_length	Present probe length	87	FLOAT	4	Dynamic	x	AUTO	→ 156
level	Level	60	FLOAT	4	Dynamic			→ 128

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
decimal_places_menu_ro	Decimal places	93	ENUM16	2	Static	x	AUTO	→ 167
locking_status	Locking status	96	BIT_ENUM16	2	Dynamic			→ 136
medium_type_ro	Medium type	92	ENUM16	2	Static	x	OOS	→ 138

9.6.2 Advanced Setup Transducer Block

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
blocking_distance	Blocking distance	55	FLOAT	4	Static	x	OOS	→ 141
medium_type	Medium type	50	ENUM16	2	Static	x	OOS	→ 138
present_probe_length_ro	Present probe length	80	FLOAT	4	Dynamic	x	AUTO	→ 156
confirm_probe_length	Confirm probe length	79	ENUM16	2	Static	x	OOS	→ 157
process_property	Process property	52	ENUM16	2	Static	x	OOS	→ 139
advanced_process_conditions	Advanced process conditions	53	ENUM16	2	Static	x	OOS	→ 140
medium_property	Medium property	51	ENUM16	2	Static	x	OOS	→ 138
linearization_type	Linearization type	71	ENUM16	2	Static	x	OOS	→ 146
activate_table	Activate table	70	ENUM16	2	Static	x	OOS	→ 152
table_mode	Table mode	69	ENUM16	2	Static	x	OOS	→ 150
custom_table_sel_level	Level	73	FLOAT	4	Static	x	OOS	→ 128
custom_table_sel_value	Customer value	74	FLOAT	4	Static	x	OOS	→ 152
unit_after_linearization	Unit after linearization	63	ENUM16	2	Static	x	OOS	→ 147
free_text	Free text	64	STRING		Static	x	AUTO	→ 148
diameter	Diameter	66	FLOAT	4	Static	x	OOS	→ 149
output_echo_lost	Output echo lost	76	ENUM16	2	Static	x	OOS	→ 153
intermediate_height	Intermediate height	67	FLOAT	4	Static	x	AUTO	→ 150
level_correction	Level correction	56	FLOAT	4	Static	x	OOS	→ 142
level_unit_ro	Level unit	54	ENUM16	2	Static	x	OOS	→ 141
assign_limit	Assign limit	82	ENUM16	2	Static	x	AUTO	→ 160
maximum_value	Maximum value	65	FLOAT	4	Static	x	OOS	→ 149
assign_diag_behavior	Assign diagnostic behavior	83	ENUM16	2	Static	x	AUTO	→ 160
value_echo_lost	Value echo lost	77	FLOAT	4	Static	x	OOS	→ 153
ramp_at_echo_lost	Ramp at echo lost	78	FLOAT	4	Static	x	OOS	→ 154
switch_output_failure_mode	Failure mode	88	ENUM16	2	Static	x	AUTO	→ 163
switch_output_function	Switch output function	81	ENUM16	2	Static	x	AUTO	→ 159
switch_status	Switch status	89	ENUM16	2	Dynamic			→ 163
switch_off_delay	Switch-off delay	87	FLOAT	4	Static	x	AUTO	→ 163
switch_off_value	Switch-off value	86	FLOAT	4	Static	x	AUTO	→ 162
switch_on_delay	Switch-on delay	85	FLOAT	4	Static	x	AUTO	→ 162
switch_on_value	Switch-on value	84	FLOAT	4	Static	x	AUTO	→ 161
table_number	Table number	68	UINT8	1	Static	x	OOS	→ 151
level_semiautomatic	Level	75	FLOAT	4	Dynamic			→ 152

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
assign_status	Assign status	91	ENUM16	2	Static	x	AUTO	→ 159
locking_status	Locking status	99	BIT_ENUM16	2	Dynamic			→ 136
decimal_places_menu	Decimal places menu	93	ENUM16	2	Static	x	AUTO	→ 169
distance_unit_ro	Distance unit	92	ENUM16	2	Static	x	OOS	→ 126

9.6.3 Display Transducer Block

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
access_status_display	Access status display	51	ENUM16	2	Static			→ 136
display_damping	Display damping	65	FLOAT	4	Static	x	AUTO	→ 168
display_interval	Display interval	64	FLOAT	4	Static	x	AUTO	→ 168
header	Header	66	ENUM16	2	Static	x	AUTO	→ 168
format_display	Format display	55	ENUM16	2	Static	x	AUTO	→ 165
number_format	Number format	69	ENUM16	2	Static	x	AUTO	→ 169
display_separator	Separator	68	ENUM16	2	Static	x	AUTO	→ 169
language	Language	54	ENUM16	2	Static	x	AUTO	→ 165
contrast_display	Contrast display	71	FLOAT	4	Static	x	AUTO	→ 170
header_text	Header text	67	STRING		Static	x	AUTO	→ 169
access_code_for_display	Enter access code	52	UINT16	2	Static	x	AUTO	→ 137
configuration_management	Configuration management	75	ENUM16	2	Static	x	AUTO	→ 171
decimal_places_1	Decimal places 1	57	ENUM16	2	Static	x	AUTO	→ 167
decimal_places_2	Decimal places 2	59	ENUM16	2	Static	x	AUTO	→ 167
decimal_places_3	Decimal places 3	61	ENUM16	2	Static	x	AUTO	→ 167
decimal_places_4	Decimal places 4	63	ENUM16	2	Static	x	AUTO	→ 167
last_backup	Last backup	74	STRING		Static	x	AUTO	→ 171
value_1_display	Value 1 display	56	ENUM16	2	Static	x	AUTO	→ 167
value_2_display	Value 2 display	58	ENUM16	2	Static	x	AUTO	→ 167
value_3_display	Value 3 display	60	ENUM16	2	Static	x	AUTO	→ 167
value_4_display	Value 4 display	62	ENUM16	2	Static	x	AUTO	→ 167
locking_status_display	Locking status	50	ENUM16	2	Static			→ 136
define_access_code	Define access code	53	UINT16	2	Static	x	AUTO	→ 174
comparison_result	Comparison result	76	ENUM16	2	Static	x	AUTO	→ 172
decimal_places_menu	Decimal places menu	70	ENUM16	2	Static	x	AUTO	→ 169
operating_time	Operating time	73	STRING		Dynamic			→ 171
locking_status	Locking status	85	BIT_ENUM16	2	Dynamic			→ 136

9.6.4 Diagnostic Transducer Block

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
operating_time	Operating time	55	STRING		Dynamic			→ 171
diagnostics_1	Diagnostics	56	UINT32	4	Static			→ 179

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK	Description
diagnostics_2	Diagnostics 2	58	UINT32	4	Static			→ 179
diagnostics_3	Diagnostics 3	60	UINT32	4	Static			→ 179
diagnostics_4	Diagnostics 4	62	UINT32	4	Static			→ 179
diagnostics_5	Diagnostics 5	64	UINT32	4	Static			→ 179
operating_time_from_restart	Operating time from restart	54	STRING		Dynamic			→ 178
launch_signal	Launch signal	81	ENUM16	2	Dynamic			→ 195
start_device_check	Start device check	77	ENUM16	2	Static	x	AUTO	→ 194
level_signal	Level signal	80	ENUM16	2	Dynamic			→ 195
simulation_device_alarm	Simulation device alarm	75	ENUM16	2	Static	x	OOS	→ 193
filter_options	Filter options	66	ENUM8	1	Static	x	AUTO	→ 180
previous_diagnostics	Previous diagnostics	52	UINT32	4	Static			→ 177
actual_diagnostics	Actual diagnostics	50	UINT32	4	Static			→ 177
assign_sim_meas	Assign measurement variable	71	ENUM16	2	Static	x	OOS	→ 192
sim_value_process_variable	Process variable value	72	FLOAT	4	Static	x	OOS	→ 192
switch_output_simulation	Switch output simulation	73	ENUM16	2	Static	x	OOS	→ 192
sim_switch_status	Switch status	74	ENUM16	2	Static	x	OOS	→ 193
result_device_check	Result device check	78	ENUM16	2	Dynamic			→ 194
last_check_time	Last check time	79	STRING		Dynamic			→ 194
linearization_type	Linearization type	84	ENUM16	2	Static	x	OOS	→ 146
unit_after_linearization_ro	Unit after linearization	85	STRING		Static	x	AUTO	→ 147
decimal_places_menu	Decimal places menu	88	ENUM16	2	Static	x	AUTO	→ 169
level_unit_ro	Level unit	90	ENUM16	2	Static	x	OOS	→ 141
assign_channel_1	Assign channel 1	92	ENUM16	2	Static	x	AUTO	→ 186
assign_channel_2	Assign channel 2	93	ENUM16	2	Static	x	AUTO	→ 186
assign_channel_3	Assign channel 3	94	ENUM16	2	Static	x	AUTO	→ 186
assign_channel_4	Assign channel 4	95	ENUM16	2	Static	x	AUTO	→ 186
clear_logging_data	Clear logging data	97	ENUM16	2	Static	x	AUTO	→ 187
logging_interval	Logging interval	96	FLOAT	4	Static	x	AUTO	→ 187
display_filter_options	Filter options	99	ENUM8	1	Static	x	AUTO	→ 180
locking_status	Locking status	108	BIT_ENUM16	2	Dynamic			→ 136
distance_unit_ro	Distance unit	89	ENUM16	2	Static	x	OOS	→ 126

9.6.5 Expert Configuration Transducer Block

The parameters of the **Expert Configuration Transducer Block** are described in GP01015F: "Levelflex FMP5x - Description of Device Parameters - FOUNDATION Fieldbus"

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
acknowledge_alarm	Acknowledge alarm	81	ENUM16	2	Static	x	AUTO
integration_time	Integration time	67	FLOAT	4	Static	x	OOS
result_self_check	Result self check	77	ENUM16	2	Dynamic		

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
start_self_check	Start self check	76	ENUM16	2	Static	x	AUTO
broken_probe_detection	Broken probe detection	75	ENUM16	2	Static	x	AUTO
gpc_mode	GPC mode	68	ENUM16	2	Static	x	OOS
reference_echo_threshold	Reference echo threshold	73	FLOAT	4	Static	x	OOS
const_gpc_factor	Const. GPC factor	74	FLOAT	4	Static	x	OOS
build_up_ratio	Build-up ratio	90	FLOAT	4	Dynamic		
build_up_threshold	Build-up thres.	91	FLOAT	4	Static	x	AUTO
delay_time_echo_lost	Delay time echo lost	78	FLOAT	4	Static	x	AUTO
empty_capacity	Empty capacity	92	FLOAT	4	Static	x	AUTO
external_pressure_selector	External pressure selector	69	ENUM16	2	Static	x	OOS
measured_capacity	Measured capacitance	89	FLOAT	4	Dynamic		
gas_phase_compens_factor	Gas phase compensation factor	70	FLOT	4	Static	x	OOS
in_safety_distance	In safety distance	80	ENUM16	2	Static	x	OOS
ratio_amplitude_interface_level	Ratio amplitude interface/level	86	FLOAT	4	Static	x	OOS
interface_criterion	Interface criterion	87	FLOAT	4	Dynamic		
control_measurement	Measurement	106	ENUM16	2	Static	x	AUTO
control_measurement	Control measurement	105	ENUM16	2	Static	x	AUTO
filter_dead_time	Dead time	66	FLOAT	4	Static	x	OOS
present_reference_distance	Present reference distance	72	FLOAT	4	Dynamic		
history_reset	History reset	83	ENUM16	2	Static	x	OOS
safety_distance	Safety distance	79	FLOAT	4	Static	x	OOS
history_learning_control	History learning	85	ENUM16	2	Static	x	AUTO
history_learning_control	History learning control	84	ENUM16	2	Static	x	AUTO
sensor_module	Sensor module	107	ENUM16	2	Static		
evaluation_mode	Evaluation mode	82	ENUM16	2	Static	x	OOS
thin_interface	Thin interface	88	ENUM16	2	Static	x	OOS
calculated_dc_value	Calculated DC value	59	FLOAT	4	Dynamic	x	AUTO
dc_value_expert	DC value	55	FLOAT	4	Static	x	OOS
distance_offset	Distance offset	60	FLOAT	4	Static	x	OOS
level_limit_mode	Level limit mode	62	ENUM16	2	Static	x	OOS
level_high_limit	High limit	63	FLOAT	4	Static	x	OOS
level_low_limit	Low limit	64	FLOAT	4	Static	x	OOS
output_mode	Output mode	65	ENUM16	2	Static	x	OOS
level_external_input_1	Level external input 1	93	ENUM16	2	Static	x	AUTO
level_external_input_2	Level external input 2	96	ENUM16	2	Static	x	AUTO
function_input_1_level	Function Input 1 Level	94	ENUM16	2	Static	x	AUTO
function_input_2_level	Function Input 2 Level	97	ENUM16	2	Static	x	AUTO
fixed_value_inp_1	Fixed value inp.1	95	FLOAT	4	Static	x	AUTO
fixed_value_inp_2	Fixed value inp.2	98	FLOAT	4	Static	x	AUTO
interface_external_input_1	Interface external input 1	99	ENUM16	2	Static	x	OOS
interface_external_input_2	Interface external input 2	102	ENUM16	2	Static	x	OOS
function_input_1_interface	Function input 1 interface	100	ENUM16	2	Static	x	OOS
function_input_2_interface	Function input 2 interface	103	ENUM16	2	Static	x	OOS

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
fixed_value_input_1_interface	Fixed value input 1 interface	101	FLOAT	4	Static	x	OOS
fixed_value_input_2_interface	Fixed value input 2 interface	104	FLOAT	4	Static	x	OOS
distance_unit_ro	Distance unit	53	ENUM16	2	Static	x	OOS
level_unit_ro	Level unit	61	ENUM16	2	Static	x	OOS
operating_mode_ro	Operating mode	54	ENUM16	2	Static	x	OOS
enter_access_code	Enter access code	52	UINT16	2	Static	x	AUTO
locking_status	Locking status	50	BIT_ENUM16	2	Dynamic		
access_status_tooling	Access status tooling	51	ENUM16	2	Static		
reference_distance	Reference distance	71	FLOAT	4	Static	x	OOS
sw_option_active_overview	SW option active overview	110	BIT_ENUM32	4	Static		
decimal_places_menu	Decimal places menu	109	ENUM16	2	Static	x	AUTO
fieldbus_type	Fieldbus Type	111	ENUM8	1	Static		
interface_property_ro	Interface property	108	ENUM16	2	Static	x	OOS
medium_type_ro	Medium type	112	ENUM16	2	Static	x	OOS
eop_level_evaluation_ro	EOP level evaluation	113	ENUM16	2	Static	x	OOS
sensor_type_ro	Sensor type	114	ENUM16	2	Static	x	OOS
calculated_dc_status_en	Status	58	ENUM8	1	Dynamic		

9.6.6 Expert Information Transducer Block

The parameters of the **Expert Information Transducer Block** are described in GP01015F: "Levelflex FMP5x - Description of Device Parameters - FOUNDATION Fieldbus"

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
abs_echo_amp_val	Absolute echo amplitude	51	FLOAT	4	Dynamic		
abs_eop_amp_val	Absolute EOP amplitude	55	FLOAT	4	Dynamic		
absolute_interface_amplitude	Absolute interface amplitude	58	FLOAT	4	Dynamic		
application_parameter	Application parameter	74	ENUM16	2	Dynamic		
electronic_temp_value	Electronic temperature	66	FLOAT	4	Dynamic		
eop_shift_value	EOP shift	69	FLOAT	4	Dynamic		
found_echoes	Found echoes	71	ENUM16	2	Dynamic		
max_electr_temp	Max. electronics temperature	73	FLOAT	4	Dynamic	x	AUTO
time_max_electr_temp	Time max. electronics temperature	75	STRING		Dynamic		
measurement_frequency	Measurement frequency	76	FLOAT	4	Dynamic		
min_electr_temp	Min. electronics temperature	77	FLOAT	4	Dynamic	x	AUTO
time_min_electr_temp	Time min. electronics temperature	78	STRING		Dynamic		
rel_echo_amp_val	Relative echo amplitude	53	FLOAT	4	Dynamic		
relative_interface_amplitude	Relative interface amplitude	60	FLOAT	4	Dynamic		
reset_min_max_temp	Reset min./max. temp.	79	ENUM16	2	Static	x	AUTO
noise_signal_val	Noise of signal	63	FLOAT	4	Dynamic		
used_calculation	Used calculation	80	ENUM16	2	Dynamic		
tank_trace_state	Tank trace state	81	ENUM16	2	Dynamic		
max_draining_speed	Max. draining speed	82	FLOAT	4	Dynamic	x	AUTO

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
max_filling_speed	L max. fill speed	83	FLOAT	4	Dynamic	x	AUTO
time_max_level	Time max. level	84	STRING		Dynamic		
max_level_value	Max. level value	85	FLOAT	4	Dynamic	x	AUTO
time_min_level	Time min. level	86	STRING		Dynamic		
min_level_value	Min. level value	87	FLOAT	4	Dynamic	x	AUTO
reset_min_max	Reset min./max.	94	ENUM16	2	Static	x	AUTO
interf_max_drain_speed	I max. drain speed	88	FLOAT	4	Dynamic	x	AUTO
interf_max_fill_speed	I max. fill speed	89	FLOAT	4	Dynamic	x	AUTO
time_max_interface	Time max. interface	90	STRING		Dynamic		
max_interface_value	Max. interface value	91	FLOAT	4	Dynamic	x	AUTO
time_min_interface	Time min. interface	92	STRING		Dynamic		
min_interface_value	Min. interface value	93	FLOAT	4	Dynamic	x	AUTO
application_parameter	Application parameter	95	ENUM16	2	Dynamic		
operating_mode_ro	Operating mode	108	ENUM16	2	Static	x	OOS
temperature_unit	Temperature unit	72	ENUM16	2	Static	x	AUTO
activate_sw_option	Activate SW option	110	UINT32	4	Static	x	AUTO
target_echo_status	Status	56	ENUM8	1	Dynamic		
iface_target_echo_status	Status	61	ENUM8	1	Dynamic		
signal_noise_status	Status	64	ENUM8	1	Dynamic		
sens_temp_status	Status	67	ENUM8	1	Dynamic		
eop_shift_status	Status	70	ENUM8	1	Dynamic		
terminal_voltage_1	Terminal voltage 1	97	FLOAT	4	Dynamic		
calculated_dc_value	Calculated DC value	100	FLOAT	4	Dynamic	x	AUTO
upper_interface_thickness	Upper interface thickness	103	FLOAT	4	Dynamic		
debug_value	Debug value	106	FLOAT	4	Dynamic	x	AUTO
sw_option_active_overview	SW option active overview	111	BIT_ENUM32	4	Static		
locking_status	Locking status	113	BIT_ENUM16	2	Dynamic		
decimal_places_menu_ro	Decimal places menu	109	ENUM16	2	Static	x	AUTO
linearization_type	Linearization type	104	ENUM16	2	Static	x	OOS
eop_level_evaluation	EOP level evaluation	112	ENUM16	2	Static	x	OOS
access_status_tooling	Access status tooling	114	ENUM16	2	Static		
calculated_dc_status	Status	99	UINT8	1	Dynamic		
status_up_iface_thickness	Customized upper phase thickness status	102	UINT8	1	Dynamic		
debug_status		107	UINT8	1	Dynamic	x	AUTO

9.6.7 Service Sensor Transducer Block

The parameters of the **Service Sensor** Transducer Block can only be operated by authorized Endress+Hauser service personnel.

9.6.8 Service Information Transducer Block

The parameters of the **Service Information** Transducer Block can only be operated by authorized Endress+Hauser service personnel.

9.6.9 Data Transfer Transducer Block

The parameters of the **Data Transfer Transducer Block** are described in GP01015F: "Levelflex FMP5x - Description of Device Parameters - FOUNDATION Fieldbus"

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
used_calculation	Used calculation	87	ENUM16	2	Dynamic		
bdt_cfg_rdwr_ctrl		101	UINT16	2	Static	x	AUTO
bdt_transferred_ctrl		102	BYTEARRAY		Static	x	AUTO
bdt_data_trans		103	BYTEARRAY		Static	x	AUTO
bdt_prepare		99	BYTEARRAY		Static	x	AUTO
bdt_status		100	BYTEARRAY		Static		
sw_option_active_overview	SW option active overview	98	BIT_ENUM32	4	Static		
digits_at_0_mVdB		90	FLOAT	4	Dynamic	x	AUTO
digits_per_mVdB		91	FLOAT	4	Dynamic	x	AUTO
actual_diagnostics	Actual diagnostics	97	UINT32	4	Static		
electric_probe_length	Electric probe length	92	FLOAT	4	Dynamic		
empty_calibration_ro	Empty calibration	93	FLOAT	4	Static	x	OOS
full_calibration_ro	Full calibration	94	FLOAT	4	Static	x	OOS
distance_unit_ro	Distance unit	95	ENUM16	2	Static	x	OOS
operating_mode_ro	Operating mode	88	ENUM16	2	Static	x	OOS
present_probe_length_ro	Present probe length	89	FLOAT	4	Dynamic	x	AUTO
trend_operation_hours		104	UINT32	4	Static		
trend_package_size		105	UINT8	1	Static	x	AUTO
trend_storage_time	Trend storage time	106	UINT32	4	Static		
trend_sup_pack_size		107	UINT8	1	Static		
gpc_mode_ro	GPC mode	109	ENUM16	2	Static	x	OOS
eop_level_evaluation_ro	EOP level evaluation	110	ENUM16	2	Static	x	OOS
temperature_unit_ro	Temperature unit	111	ENUM16	2	Static	x	OOS
max_trend_entries		108	UINT16	2	Static		
line_mapping_point_number	Line mapping point number	126	UINT16	2	Static	x	AUTO
line_mapping_array_x	Line mapping array X	127	FLOAT	4	Static	x	AUTO
line_mapping_array_y	Line mapping array Y	128	FLOAT	4	Static	x	AUTO
mapping_end_point_ro	Mapping end point	125	FLOAT	4	Static	x	AUTO
mapping_start_point	Mapping start point	124	FLOAT	4	Static	x	AUTO
function_block_table		143	UINT32	4	Static		
custom_empty_value		112	FLOAT	4	Static		
custom_full_value		113	FLOAT	4	Static		
customized	Customized	121	UINT8	1	Static		
reset_ordered_configuration	Reset ordered configuration	122	ENUM16	2	Static	x	AUTO
empty_scale		114	FLOAT	4	Static	x	AUTO
eop_map_point_number		116	UINT16	2	Static	x	AUTO
factory_data_valid		123	UINT8	1	Static		
fieldbus_type	Fieldbus Type	144	ENUM8	1	Static		
full_scale		115	FLOAT	4	Static	x	AUTO

Name	Label	Index	Data type	Size (Bytes)	Storage Class	Write access	MODE_BLK
init_map_point_number		117	UINT16	2	Static	x	AUTO
max_not_assoc_track		118	UINT16	2	Static	x	AUTO
ref_max_dist	Ref max. dist.	119	FLOAT	4	Static	x	AUTO
ref_min_dist	Ref min. dist.	120	FLOAT	4	Static	x	AUTO
line_mapping_accuracy	Line mapping accuracy	130	FLOAT	4	Static	x	AUTO
mapping_curve_left_margin	Mapping curve left margin	131	FLOAT	4	Static	x	AUTO
device_calib_changed		133	ENUM16	2	Static	x	AUTO
echo_thresh_attenuat_const_ee	Threshold attenuation constant	134	FLOAT	4	Dynamic	x	AUTO
echo_threshold_far_ee		135	FLOAT	4	Static	x	AUTO
echo_thresh_inactive_len		137	FLOAT	4	Static	x	AUTO
echo_threshold_near_ee		136	FLOAT	4	Static	x	AUTO
present_probe_length_ee		138	FLOAT	4	Static	x	AUTO
reset_appl_para_chg_flags		139	ENUM16	2	Static	x	AUTO
reset_dyn_persistent		140	ENUM16	2	Static	x	AUTO
locking_status	Locking status	142	BIT_ENUM16	2	Dynamic		
decimal_places_menu	Decimal places menu	96	ENUM16	2	Static	x	AUTO
access_status_tooling	Access status tooling	141	ENUM16	2	Static		
level_linearized	Level linearized	147	FLOAT	4	Dynamic		
bdt_transferred_ctrl		197	UINT8	1	Static	x	AUTO
bdt_cfg_rdwr_ctrl		196	UINT16	2	Static	x	AUTO

9.7 Methods

The FOUNDATION Fieldbus Specification includes the use of methods to make device operation easier. A method is a sequence of interactive steps to be carried out in the specified order so as to configure certain device functions.

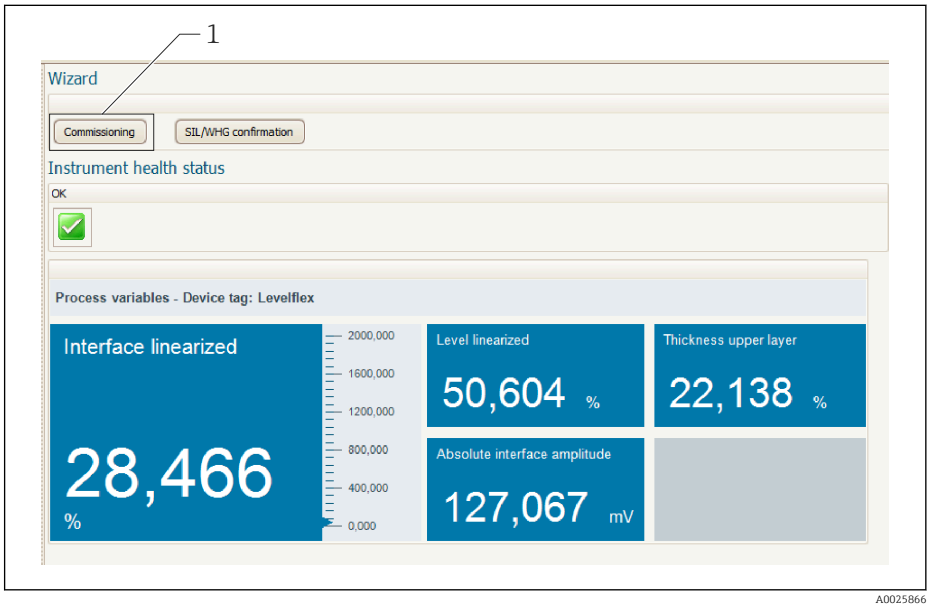
The following methods are available for the device:

- **Restart**
  This method is located in the Resource Block and directly prompts the setting of the **Device reset** parameter. This resets the device configuration to a defined state.
- **ENP Restart**
  This method is located in the Resource Block and directly prompts the setting of the parameters of the Electronic Name Plate (ENP).
- **Setup**
  This method is located in the SETUP Transducer Block and allows to set the most important parameters in this block for device configuration (measuring units, type of tank or vessel, type of medium, empty and full calibration).
- **Linearization**
  This method is located in the ADV_SETUP Transducer Block and allows to manage the linearization table by which the measured value is converted into volume, mass or flow.
- **Self Check**
  This method is located in the EXPERT_CONFIG Transducer Block and prompts the device self check parameters.

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.

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.

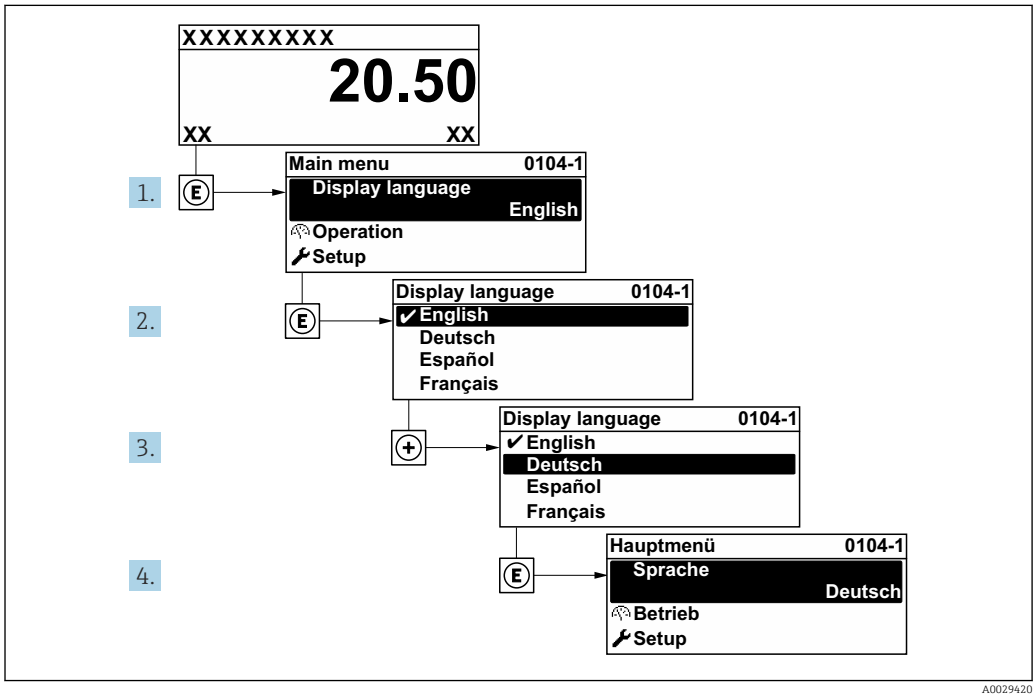
11 Commissioning via operating menu

11.1 Function check

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

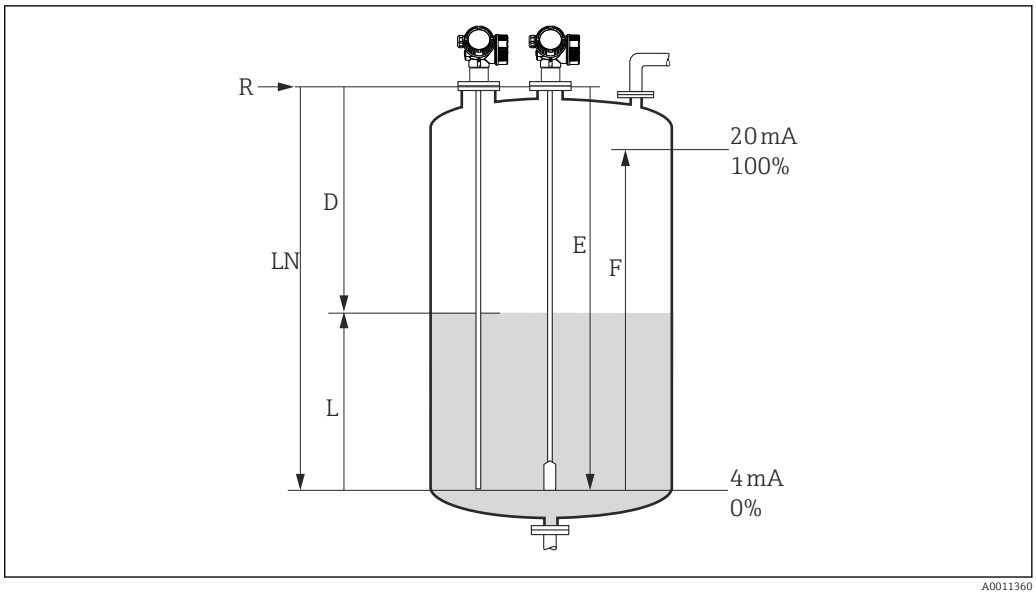
11.2 Setting the operating language

Factory setting: English or ordered local language



20 *Taking the example of the local display*

11.3 Configuring level measurement



21 *Configuration parameters for level measurement in liquids*

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

If the ε_r value is lower than 7 in the case of rope probes, measurement is not possible in the area of the tensioning weight. The empty calibration *E* should not exceed *LN* - 250 mm (*LN* - 10 in) in these cases.

1. Setup → Device tag
   ↳ Enter device tag.
2. Navigate to: Setup → Distance unit
   ↳ Select the distance unit.
3. Navigate to: Setup → Tank type
   ↳ Select tank type.
4. For **Tank type** parameter = Bypass / pipe:
   Navigate to: Setup → Tube diameter
   ↳ Specify the diameter of the bypass or stilling well.
5. Navigate to: Setup → Medium group
   ↳ Specify the medium group: (**Water based (DC >= 4)** or **Others**)
6. Navigate to: Setup → Empty calibration
   ↳ Specify the empty distance E (distance from reference point R to 0% mark).
7. Navigate to: Setup → Full calibration
   ↳ Specify the full distance F (distance from the 0% mark to the 100% mark).
8. Navigate to: Setup → Level
   ↳ Displays the measured level L.
9. Navigate to: Setup → Distance
   ↳ Displays the distance D between the reference point R and the level L.
10. Navigate to: Setup → Signal quality
    ↳ Displays the signal quality of the analyzed level echo.

11. Operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Compare the distance displayed with the actual value to start recording an interference echo map (where applicable).
12. Operation via operating tool:
    Navigate to: Setup → Confirm distance
    ↳ Compare the distance displayed with the actual value to start recording an interference echo map (where applicable).

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.

22 "Load Reference Curve" function

11.5 Configuring the local display

11.5.1 Factory setting of local display for level measurements

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

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 Commissioning (block-oriented operation)

12.1 Function check

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

- "Post-installation check" checklist → 33
- "Post-connection check" checklist → 39

12.2 Block configuration

12.2.1 Preparatory steps

1. Switch on the measuring device.
2. Make a note of the **DEVICE_ID**.
3. Open the configuration program.
4. Load Cff and device description files into the host system or the configuration program. Make sure you are using the right system files.
5. Identify the device using the **DEVICE_ID** (see Point 2). Assign the desired tag name to the device via the **Pd-tag/FF_PD_TAG** parameter.

12.2.2 Configuring the Resource Block

1. Open the Resource Block.
2. If necessary, disable the lock for device operation.
3. If necessary, change the block name. Factory setting: RS-xxxxxxxxxx (RB2)
4. If necessary, assign a description to the block via the **Description of the identification tag/TAG_DESC** parameter.
5. If necessary, change other parameters as required.

12.2.3 Configuring the Transducer Blocks

The measurement and the display module are configured via the Transducer Blocks. The basic procedure is the same for all Transducer Blocks:

1. If necessary, change the block name.
2. Set the block mode to **OOS** via the **Block mode/MODE_BLK** parameter, **TARGET** element.
3. Configure the device in accordance with the measuring task.
4. Set the block mode to **Auto** via the **Block mode/MODE_BLK** parameter, **TARGET** element.

The block mode must be set to **Auto** to ensure the smooth operation of the device.

12.2.4 Configuring the Analog Input Blocks

The device has 2 Analog Input Blocks that can be assigned as required to the various process variables.

Factory setting	
Analog Input Block	**CHANNEL**
AI 1	32949: Level linearized
AI 2	32856: Distance

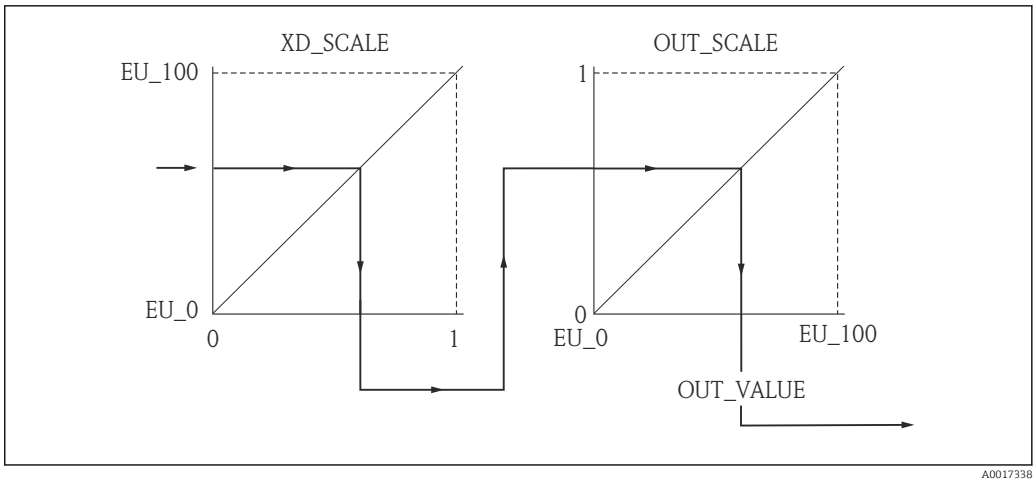
1. If necessary, change the block name.
2. Set the block mode to **OOS** via the **Block mode/MODE_BLK** parameter, **TARGET** element.
3. Via the **Channel/CHANNEL** parameter, select the process variable which should be used as the input value for the Analog Input Block .
4. Via the **Transducer scale/XD_SCALE** parameter, select the desired unit and the block input range for the process variable → 80. Make sure that the selected unit suits the process variable that is selected. If the process variable and the unit do not suit one another, the **Block error/ BLOCK_ERR** parameter reports the **Block Configuration Error** and the block mode cannot be set to **Auto**.
5. Via the **Linearization type/L_TYPE** parameter, select the type of linearization for the input variable (factory setting: **Direct**). Make sure that the settings for the **Transducer scale/XD_SCALE** and **Output scale/OUT_SCALE** parameters are the same for the **Direct** linearization type. If the values and units do not match, the **Block error/ BLOCK_ERR** parameter reports the **Block Configuration Error** and the block mode cannot be set to **Auto**.
6. Enter the alarms and critical alarm messages via the **High alarm limit/ HI_HI_LIM**, **High early warning limit/HI_LIM**, **Low alarm limit/ LO_LO_LIM** and **Low early warning limit/LO_LIM** parameters. The limit values entered must be within the value range specified for the **Output scale/OUT_SCALE** parameter → 80.
7. Specify the alarm priorities via the **Priority for high limit value alarm/HI_HI_PRI**, **Priority for high early warning/HI_PRI**, **Priority for low limit value alarm/ LO_LO_PRI** and **Priority for low limit value early warning/LO_PRI** parameters. Reporting to the field host system only takes place with alarms with a priority greater than 2.
8. Set the block mode to **Auto** via the **Block mode/MODE_BLK** parameter, **TARGET** element. For this purpose, the Resource Block must also be set to the **Auto** block mode.

12.2.5 Additional configuration

1. Link the function blocks and output blocks.
2. After specifying the active LAS, download all the data and parameters to the field device.

12.3 Scaling the measured value in the AI Block

The measured value can be scaled if the **L_TYPE** = **Indirect** linearization type has been selected in the AI Block. **XD_SCALE** defines the input range with the **EU_0** and **EU_100** elements. This is mapped linearly to the output range, defined by **OUT_SCALE** also with the elements **EU_0** and **EU_100**.



23 Scaling the measured value in the AI Block

- If you have selected the **Direct** mode in the **L_TYPE** parameter, you cannot change the values and units for **XD_SCALE** and **OUT_SCALE**.
- The **L_TYPE**, **XD_SCALE** and **OUT_SCALE** parameters can only be changed in the OOS block mode.

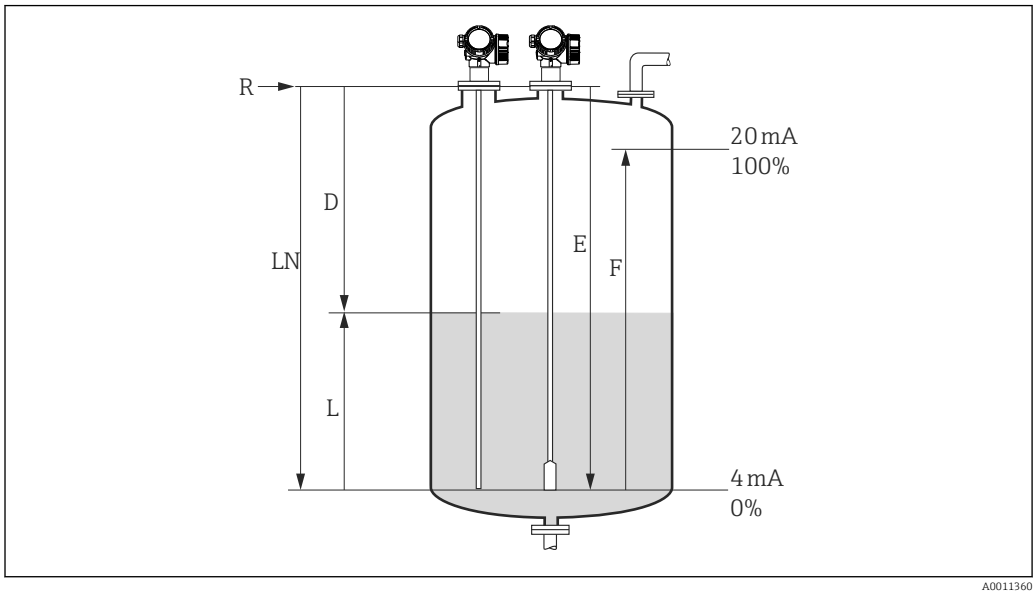
12.4 Selecting the language

Step	Block	Parameter	Action
1	DISPLAY (TRDDISP)	Language (language)	Select the language [1]. **Options:** ▪ 32805: Arabic ▪ 32824: Chinese ▪ 32842: Czech ▪ 32881: Dutch ▪ 32888: English ▪ 32917: French ▪ 32920: German ▪ 32945: Italian ▪ 32946: Japanese ▪ 32948: Korean ▪ 33026: Polish ▪ 33027: Portuguese ▪ 33062: Russian ▪ 33083: Spanish ▪ 33103: Thai ▪ 33120: Vietnamese ▪ 33155: Indonesian ▪ 33166: Turkish

1) The languages the device supports are specified when the device is ordered. See feature 500 "Additional operating language" in the product structure for this purpose

12.5 Configuring level measurement

The **Setup** method can also be used to configure the measurement. This method can be called via the SETUP Transducer Block (TRDSUP).



24 *Configuration parameters for level measurement in liquids*

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

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

Step	Block	Parameter	Action
1	SETUP (TRDSUP)	Distance unit (distance_unit)	Select the distance unit. **Options:** ▪ 1010: m ▪ 1013: mm ▪ 1018: in ▪ 1019: ft
2	SETUP (TRDSUP)	Tank type (tank_type)	Select tank type. **Options:** ▪ 32816: Bypass/stilling well ▪ 33288: Metal ▪ 33302: Coax ▪ 33432: Double cable ▪ 33433: Double rod ▪ 33437: Rope, metal centering disk ▪ 33438: Rod, metal centering disk ▪ 33441: Non-metal ▪ 33444: Installation outside
3	SETUP (TRDSUP)	Tube diameter (tube_diameter) [1]	Specify the diameter of the bypass or stilling well.
4	SETUP (TRDSUP)	Medium group (medium_group)	Specify the medium group. **Options:** ▪ 316: Water-based (DC > 4) ▪ 256: Other (DC > 1.9) [2]

Step	Block	Parameter	Action
5	SETUP (TRDSUP)	Empty calibration (empty_calibration)	Specify the empty distance E (distance from reference point R to 0% mark).
6	SETUP (TRDSUP)	Full calibration (full_calibration)	Specify the full distance F (distance from the 0% mark to the 100% mark).
7	SETUP (TRDSUP)	Level (level)	Displays the measured level L.
8	SETUP (TRDSUP)	Distance (filtered_dist_val)	Displays the distance D between the reference point R and the level L.
9	SETUP (TRDSUP)	Signal quality (signal_quality)	Displays the signal quality of the analyzed level echo.
10	SETUP (TRDSUP)	Confirm distance (confirm_distance)	Compare the distance displayed with the actual value to start recording an interference echo map. **Options:** ▪ 179: Record map manually ▪ 32847: Delete mapping curve ▪ 32859: Distance Ok ▪ 32860: Distance too large ▪ 32861: Distance too small ▪ 32862: Distance unknown ▪ 33100: Tank empty

1) Only available for coated probes and "Tank type" = "Bypass/stilling well"
2) Lower DCs can also be entered in the "DC Value (dc_value)" parameter if necessary. However, the measuring range can be limited if DC<1.6. In this case, contact Endress+Hauser.

12.6 Configuring the local display

12.6.1 Factory setting of local display for level measurements

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

The local display can be customized in the Transducer Block **DISPLAY (TRDDISP)**.

12.7 Configuration management

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

Path in the menu
Setup → Extended setup → Data backup → Configuration management

Block operation
Block: **DISPLAY (TRDDISP)**
Parameter: **Configuration management (configuration_management)**

Functions of the parameter options

Options	Description
33097: Backup	A backup copy of the current device configuration in the HistoROM is saved to the display module of the device. The backup copy includes the transmitter data of the device.
33057: Restore	The last backup copy of the device configuration is copied from the display module to the HistoROM of the device. The backup copy includes the transmitter data of the device.
33838: Duplicate	The transmitter configuration from another device is duplicated to the device using the display module.
265: Compare	The device configuration saved in the display module is compared to the current device configuration of the HistoROM.
32848: Delete data backup	The backup copy of the device configuration is deleted from the display module of the device.

HistoROM
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

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.

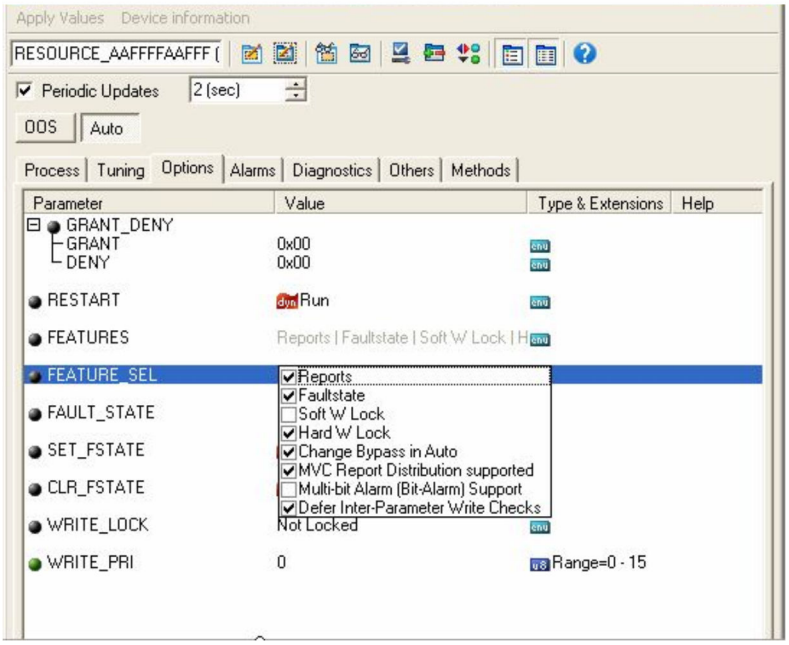
In devices with FOUNDATION Fieldbus communication, the "PD-Tag" parameter is also accepted when duplicating the parameters. If necessary, set this parameter to the desired value after duplication.

12.8 Configuring event behavior according to FOUNDATION Fieldbus specification FF912

The device complies with FOUNDATION Fieldbus specification FF912. Among other things this means that:

- The diagnostic category as per NAMUR Recommendation NE107 is transmitted over the fieldbus in a format that is independent of the manufacturer:
  - F: Failure
  - C: Function check
  - S: Out of specification
  - M: Maintenance required
- The diagnostic category of the predefined event groups can be adapted by the user according to the requirements of the individual application.
- Certain events can be separated from their group and be treated individually:
  - 941: Lost echo
  - 942: In safety distance
- Additional information and troubleshooting measures are transmitted over the fieldbus with the event message.

Diagnostic messages according to FF912 are only available in the host if the **Multi-bit Alarm Support** option is activated in the **FEATURE_SEL** parameter of the Resource Block. For reasons of compatibility, this option is **not** enabled when the device is delivered:



12.8.1 Event groups

The diagnostic events are divided into 16 groups according to the **source** and the **weighting**. A **default event category** is assigned to each group at the factory. Here, one bit of the assignment parameters belongs to every event group.

Event weighting	Default event category	Event source	Bit	Events in this group
Highest weighting	Failure (F)	Sensor	31	▪ F003: Broken probe detected ▪ F046: Buildup detected ▪ F083: Memory content ▪ F104: HF cable ▪ F105: HF cable ▪ F106: Sensor
		Electronics	30	▪ F242: Software incompatible ▪ F252: Modules incompatible ▪ F261: Electronic modules ▪ F262: Module connection ▪ F270: Main electronic failure ▪ F271: Main electronic failure ▪ F272: Main electronic failure ▪ F273: Main electronic failure ▪ F275: I/O module failure ▪ F276: I/O module failure ▪ F282: Data storage ▪ F283: Memory content ▪ F311: Memory content
		Configuration	29	▪ F410: Data transfer ▪ F411: Upload/download ▪ F435: Linearization ▪ F437: Configuration incompatible
		Process	28	▪ F803: Loop current 1 ▪ F825: Operating temperature ▪ F936: EMC interference ▪ F941: Echo lost [1)] ▪ F970: Linearization

1) This event can be removed from the group and treated separately; see the "Configurable area" section.

Event weighting	Default event category	Event source	Bit	Events in this group
High weighting	Function check (C)	Sensor	27	Not used in Levelflex
		Electronics	26	Not used in Levelflex
		Configuration	25	▪ C411: Upload/download ▪ C431: Trim ▪ C484: Failure mode simulation ▪ C485: Simulation measured value ▪ C491: Simulation current output ▪ C585: Simulation distance
		Process	24	Not used in Levelflex

Event weighting	Default event category	Event source	Bit	Events in this group
Low weighting	Out of specification (S)	Sensor	23	Not used in Levelflex
		Electronics	22	Not used in Levelflex

Event weighting	Default event category	Event source	Bit	Events in this group
		Configuration	21	S441: Current output 1
		Process	20	▪ S801: Energy too low ▪ S825: Operating temperature ▪ S921: Change of reference ▪ S942: In safety distance [1)] ▪ S943: In blocking distance ▪ S944: Level range ▪ S968: Level limited

1) This event can be removed from the group and treated separately; see the "Configurable area" section.

Event weighting	Default event category	Event source	Bit	Events in this group
Lowest weighting	Maintenance required (M)	Sensor	19	Not used in Levelflex
		Electronics	18	▪ M270: Main electronics error ▪ M272: Main electronics error ▪ M311: Memory content
		Configuration	17	M438: Dataset
		Process	16	M801: Loop current 1

12.8.2 Assignment parameters

Event categories are assigned to the event groups via four assignment parameters. These are located in the **RESOURCE (RB2)** Block:

- **FD_FAIL_MAP**: For the **Failure (F)** event category
- **FD_CHECK_MAP**: For the **Function check (C)** event category
- **FD_OFFSPEC_MAP**: For the **Out of specification (S)** event category
- **FD_MAINT_MAP**: For the **Maintenance required (M)** event category

Each of these parameters consists of 32 bits with the following meaning:

- **Bit 0:** Reserved by the Fieldbus Foundation
- **Bits 1 to 15:** Configurable area; certain diagnostic events can be assigned here independently of the event group they belong to. They are then removed from the event group and their behavior can be configured individually.
  In the Levelflex the following parameters can be assigned to the configurable area:
  - 941: Lost echo
  - 942: In safety distance
- **Bits 16-31:** Standard range; these bits are permanently assigned to the event groups. If the bit is set to **1**, this event group is assigned to the individual event category.

The following table indicates the default setting of the assignment parameters. In the default setting, there is a clear assignment between the event weighting and the event category (i.e. the assignment parameter).

Default setting of assignment parameters

	Standard range																Configurable area
Event weighting	**Highest weighting**				**High weighting**				**Low weighting**				**Lowest weighting**				
Event source [1]	S	E	C	P	S	E	C	P	S	E	C	P	S	E	C	P	
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15 … 1
FD_FAIL_MAP	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FD_CHECK_MAP	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
FD_OFFSPEC_MAP	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
FD_MAINT_MAP	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0

1) S: Sensor; E: Electronics; C: Configuration; P: Process

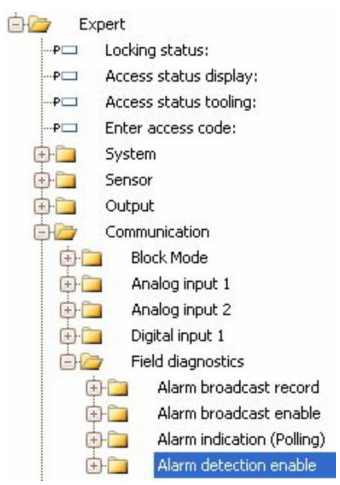
Proceed as follows to change the diagnostic behavior of an event group:

1. Open the assignment parameter in which the group is currently assigned.
2. Change the event group bit from **1** to **0**. When operating via FieldCare, this is done by unchecking the corresponding check box (see the next example).
3. Open the assignment parameter to which the group should be assigned.
4. Change the event group bit from **0** to **1**. When operating via FieldCare, this is done by checking the corresponding check box (see the next example).

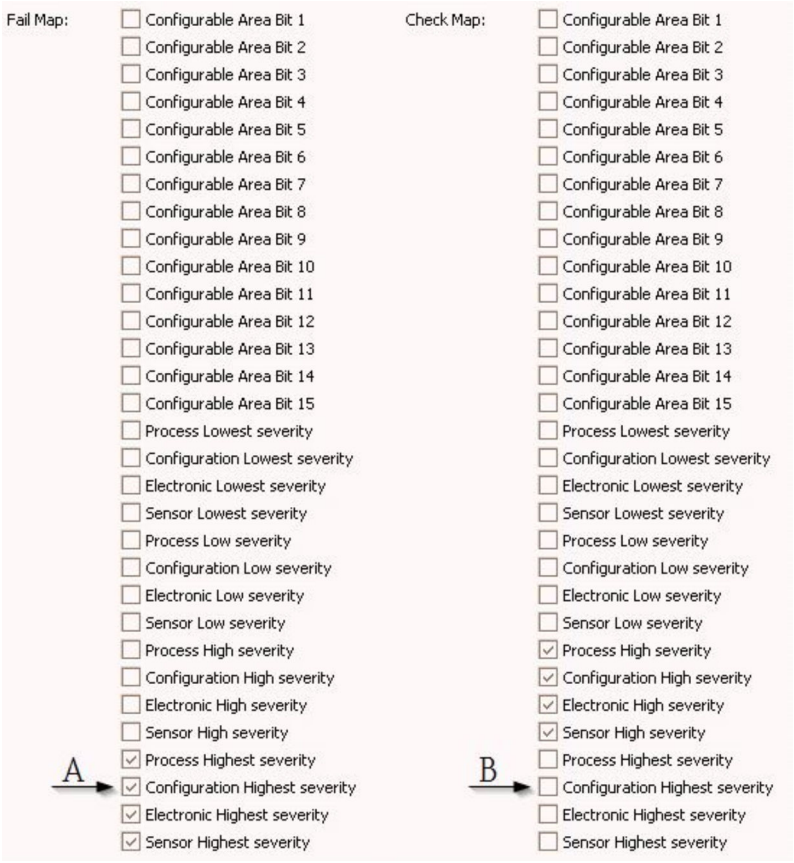
Example

The **Highest weighting / configuration error** group contains the events **410: Data transfer**, **411: Upload/download**, **435: Linearization** and **437: Configuration**

incompatible. These should be categorized as **Function check (C)** and no longer as **Failure (F)**.

1. 

In the FieldCare navigation window, navigate to **Expert → Communication → Field diagnostics → Alarm detection enable**.

2. 

25 The "Fail Map" and "Check Map" columns in the as-delivered state

In the **Fail Map** column, look for the **Configuration Highest Severity** group and uncheck the corresponding check box (A). Check the relevant check box in the **Check Map** (B) column. Note that you must press the Enter key to confirm every entry.

26 *The "Fail Map" and "Check Map" columns after the change*

Please ensure that the corresponding bit is set in at least one of the assignment parameters for each event group. Otherwise no category will be transmitted with the event over the bus, and the control system will therefore generally ignore the presence of the event.

The detection of diagnostic events is parameterized on the **Alarm detection enable** FieldCare page but the transmission of messages over the bus is not. The latter is performed on the **Alarm broadcast enable** page. The operation of this page is identical to the operation of the **Alarm detection enable** page. The Resource Block must be in the **Auto** mode for the status information to be transmitted over the bus.

12.8.3 Configurable area

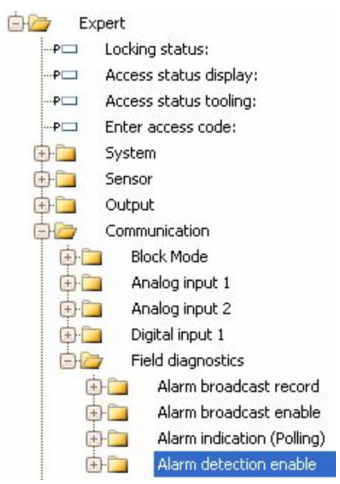
The event category can be individually defined for the following events - irrespective of the event group they are assigned to in the default setting:

- **F941**: Lost echo
- **S942:** In safety distance

To change the event category, the event first has to be assigned to one of the bits 1 to 15. The **FF912 ConfigArea_1** to **FF912ConfigArea_15** parameters in the **DIAGNOSTIC (TRDDIAG)** Block are used for this purpose. Then the corresponding bit can be set from **0** to **1** in the desired assignment parameter.

Example

Error **942 "In safety distance"** should no longer be categorized as **Out of specification (S)** and should be categorized as **Function check (C)** instead.

1. 

   In the FieldCare navigation window, navigate to **Expert → Communication → Field diagnostics → Alarm detection enable**.

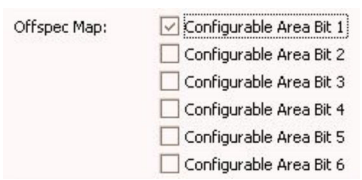
2. 

   In the default setting, all bits in the **Configurable Area Bits** column have the value **not used**.

3. 

   Select one of these bits (here for example: **Configurable Area Bit 1**) and select the **In safety distance** option from the corresponding selection list. Press Enter to confirm the option selected.

4.



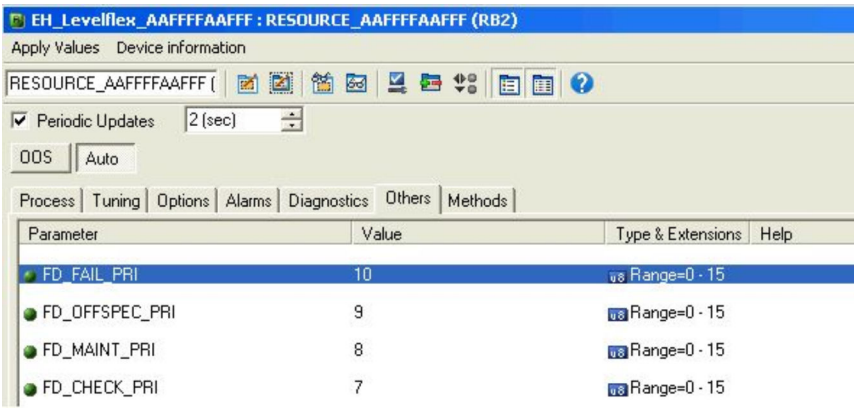
Go to the **Offspec Map** column and check the check box for the corresponding bit (here: **Configurable Area Bit 1**). Press ENTER to confirm your entries.

A change to the **In safety distance** error category does not affect an error that already exists. The new category is only assigned if this error occurs again after the change has been made.

12.8.4 Transmission of event messages over the bus

Event priority

Event messages are only transmitted over the bus if their priority is between 2 and 15. Priority 1-events are displayed but are not transmitted over the bus. Priority 0-events are ignored. In the factory setting, the priority of all events is 0. The priority can be individually changed for the four assignment parameters. The following four parameters of the Resource Block are used for this purpose:



Suppression of certain events

It is possible to suppress certain events during transmission over the bus using a mask. While these events are displayed they are not transmitted over the bus. This mask is in FieldCare under **Expert → Communication → Field diagnostics → Alarm broadcast enable**. The mask is a negative selection mask, i.e. if a field is selected the associated events are **not** transmitted over the bus.

12.9 Protecting settings from unauthorized access

The settings can be protected from unauthorized access in the following ways:

- Locking via write protection switch (hardware locking)
- Locking via the operating menu (software locking)
- Locking via block operation:
  - Block: **DISPLAY (TRDDISP)**; parameter: **Define access code**
  - Block: **EXPERT_CONFIG (TRDEXP)**; parameter: **Enter access code**

13 Diagnostics and troubleshooting

13.1 General troubleshooting

13.1.1 General errors

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

13.1.2 Parametrization errors

Parametrization errors for level measurements

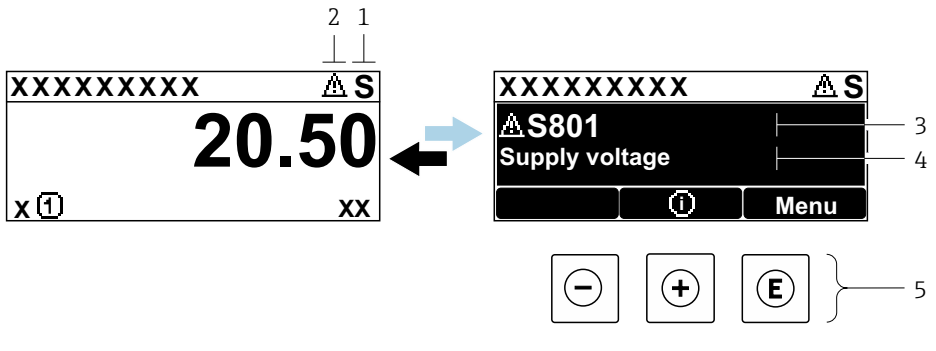
Problem	Possible cause	Remedy
Measured value is incorrect	If measured distance (Setup → Distance) matches the real distance: Calibration error	▪ Check the **Empty calibration** parameter (→ 127) and correct if necessary. ▪ Check the **Full calibration** parameter (→ 128) and correct if necessary. ▪ Check the linearization and correct if necessary (**Linearization** submenu (→ 144)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 130)).
No change of measured value on filling/emptying	An interference echo is present.	Carry out mapping (**Confirm distance** parameter (→ 130)).
	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 (→ 127). If necessary, select a more detailed setting with the **Medium property** parameter (→ 138).
	Level echo suppressed.	Delete the map and record it again if necessary (**Record map** parameter (→ 132)).
Device displays a level when the tank is empty.	Incorrect probe length	Perform probe length correction (**Confirm probe length** parameter (→ 157)).
	Interference echo	Carry out mapping over the entire probe length when the tank is empty (**Confirm distance** parameter (→ 130)).
Wrong slope of the level over the entire measuring range	Wrong tank type selected.	Select the correct **Tank type** parameter (→ 126).

13.2 Diagnostic information on local display

13.2.1 Diagnostic message

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

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

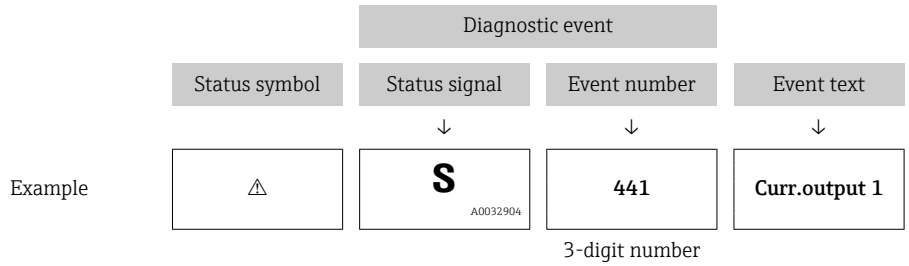
F A0032902	**"Failure (F)" option** A device error has occurred. The measured value is no longer valid.
C A0032903	**"Function check (C)" option** The device is in the service mode (e.g. during a simulation).
S A0032904	**"Out of specification (S)" option** The device is operated: ▪ Outside of its technical 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.



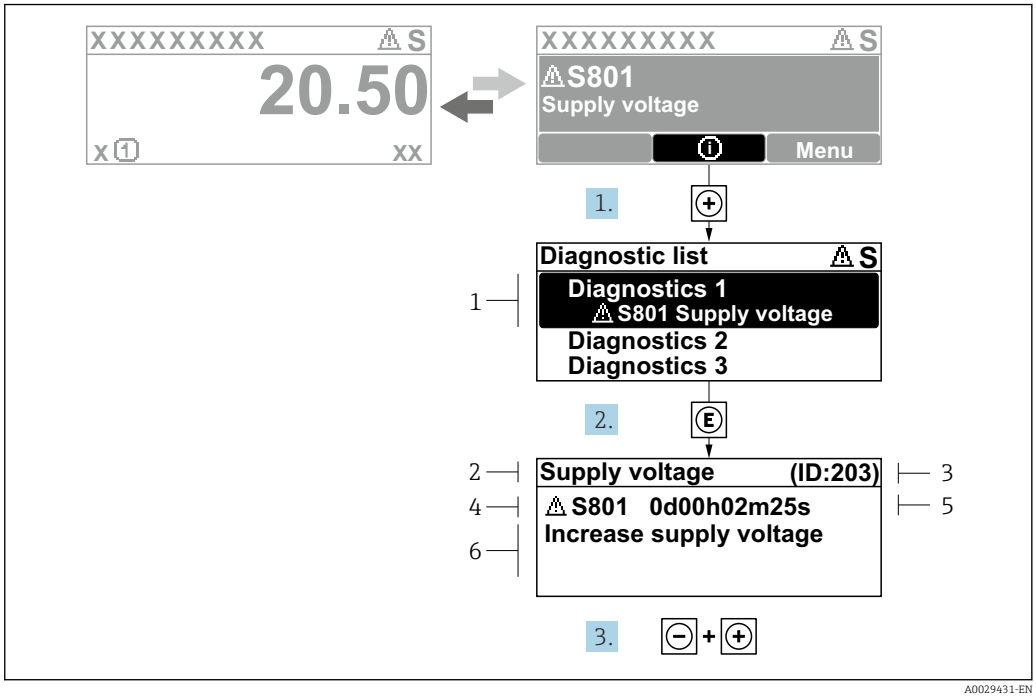
If two or more diagnostic events occur simultaneously, only the diagnostic message with the highest priority is shown. Additional queued diagnostic messages can be shown in the **Diagnostic list** submenu.

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.
Ⓔ	**Enter key** Opens the operating menu.

13.2.2 Calling up remedial measures



27 *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.

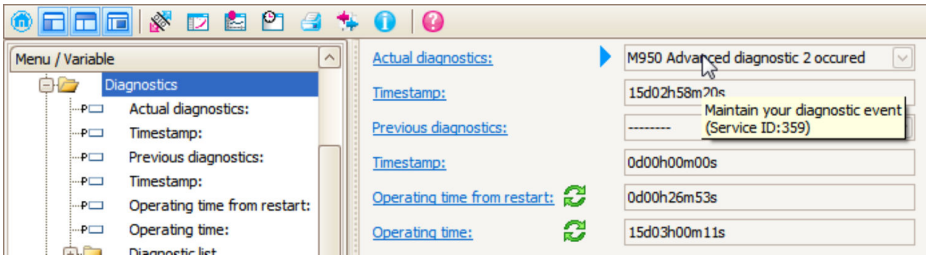
13.3 Diagnostic event in the operating tool

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

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

A: Via the operating menu

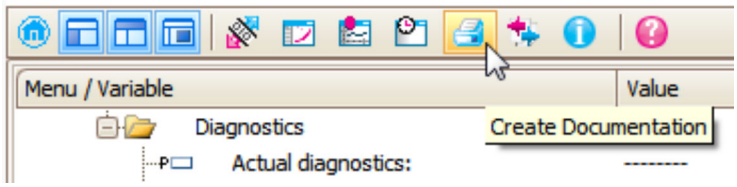
1. Navigate to the **Diagnostics** menu.
   ↳ In the **Actual diagnostics** parameter, the diagnostic event is shown with event text.
2. On the right in the display range, hover the cursor over the **Actual diagnostics** parameter.
   ↳



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

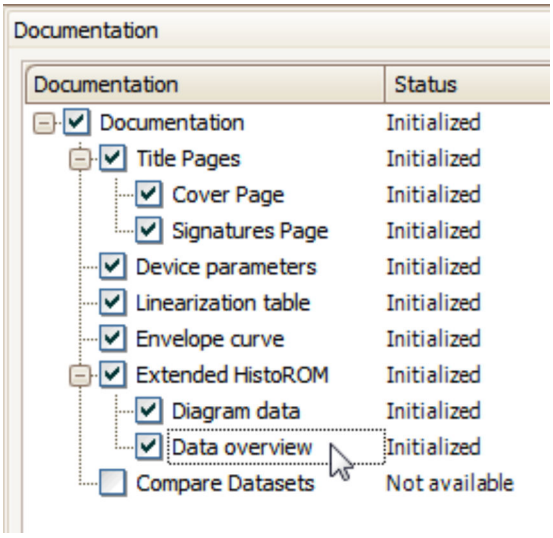
B: Via the "Create documentation" function

1.



Select the "Create documentation" function.

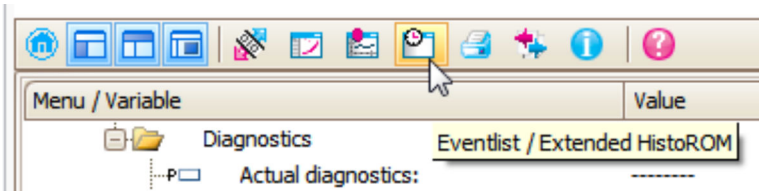
2.



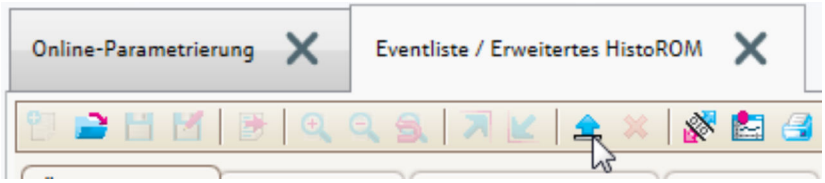
Make sure "Data overview" is marked.

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.

13.4 Diagnostic messages in the DIAGNOSTIC Transducer Block (TRDDIAG)

- The **Actual diagnostics** parameter displays the message with the highest priority. Every message is also output as per the FOUNDATION Fieldbus Specification by means of the **XD_ERROR** and **BLOCK_ERROR** parameters.
- A list of diagnostic messages is displayed in the **Diagnostics 1** to **Diagnostics 5** parameters. If more than 5 messages are currently active, only those with the highest priority are displayed.
- You can view a list of alarms which are no longer active (event log) via the **Previous diagnostics** parameter.

13.5 Diagnostic list

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

Navigation path
Diagnostics → Diagnostic list

Calling up and closing the remedial measures

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

13.6 Event logbook

13.6.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu [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 E
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press − + + simultaneously.
   ↳ The message about the remedial measures closes.

13.6.2 Filtering the event logbook

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

Navigation path
Diagnostics → Event logbook → Filter options

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

13.6.3 Overview of information events

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

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

Info number	Info name
I1092	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
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

13.7 Firmware history

Date	Firmware version	Modifications	Documentation (FMP53, FOUNDATION Fieldbus)		
			Operating Instructions	Description of Device Parameters	Technical Information
04.2012	01.00.zz	Original software	BA01053F/00/EN/01.12	GP01015F/00/EN/01.12	TI01002F/00/EN/14.12
05.2015	01.01.zz	▪ Support of SD03 ▪ Additional languages ▪ HistoROM functionality enhanced ▪ "Advanced Diagnostics" function block integrated ▪ Improvements and bugfixes	BA01053F/00/EN/03.15 BA01053F/00/EN/04.16 [1]	GP01015F/00/EN/02.15	TI01002F/00/EN/17.15 TI01002F/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.

14 Maintenance

No special maintenance work is required.

14.1 Exterior cleaning

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

14.2 General cleaning instructions

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

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

14.3 Cleaning the probe

14.3.1 Cleaning the probe in the vessel

If a suitable mounting position has been selected, the probe can be cleaned by a spray ball in the vessel → 24.

14.3.2 Cleaning the probe outside the vessel

The probe can be removed for better cleaning.

The following tool is required for cleaning:
- Vise with fiber jaws (surface protection for the polished rod probe)
- Hook wrench with lug ϕ 54 mm (2.1 in)
- Open-ended wrench AF27/AF32 with torque setting up to 20 Nm

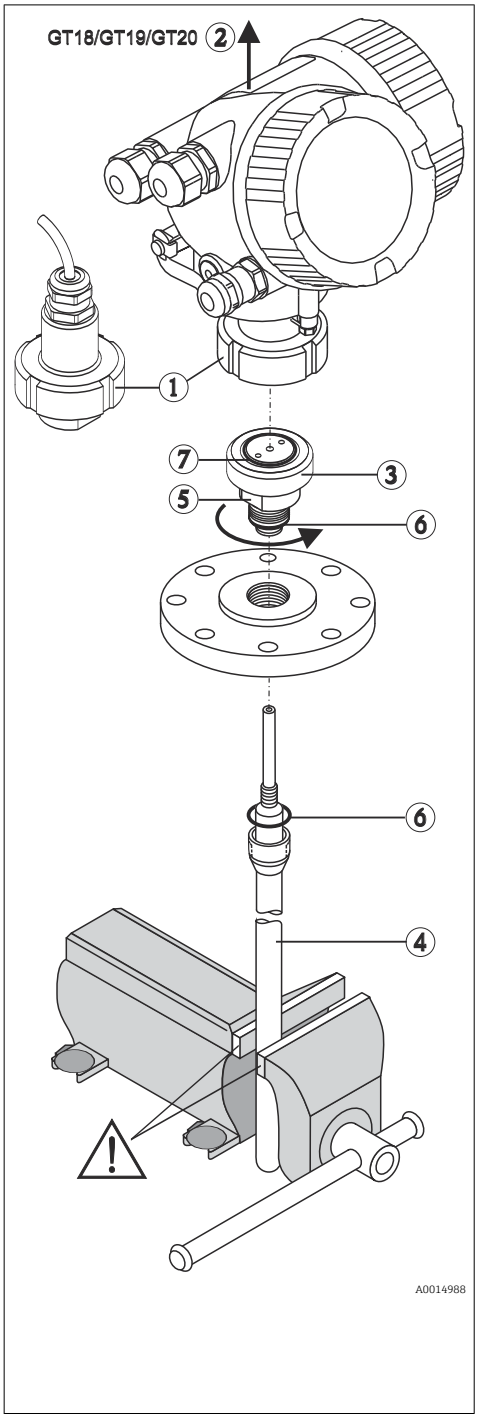
Caution!
- Before starting work, make sure that the power supply for the device is switched off.
- When unscrewing the slotted nut (1), make sure to provide counter-support at the process connection ring (5) with an open-ended wrench. Otherwise the adapter (3) will become detached from the flange.

Disassembling the electronics housing
- Unscrew the slotted nut (1) with the hook wrench.
- Remove the loosened housing (2), together with the housing holder, from the adapter (3) of the process connection towards the top. The housing holder remains connected to the housing. Put the housing to one side. In the case of the "Remote sensor" version, only the cable adapter must be removed.
- Replace the O-ring (7) if necessary.
  Order number: see Device Viewer → 🖹 106

Disassembling the rod probe
- Unscrew the adapter (3) from the process connection (the flange in the example): at the wrench flats unscrew the adapter with an open-ended wrench (AF27) and remove from the vessel together with the probe rod (max. 4 m).
- Clamp the probe rod (4) at the wrench flats or use fitting pliers.
  Caution: Protect the surface of the polished probe rod! It must not be damaged by scratches or denting.
- Unscrew the adapter (3) from the probe rod (approx. 12 turns in the counter-clockwise direction) and remove it (plug-in connection). The probe rod is screwed into the insulating bush with 4.5 Nm.
- The O-ring seals (6) of the probe rod and adapter are now freely accessible and can be exchanged if necessary. The probe rod and adapter can be autoclaved.
  Order numbers of O-rings: see Device Viewer → 🖹 106

Probe mounting

Assembly is the reverse of the disassembly sequence:
- Screw the adapter (3) onto the probe rod (4) with 4.5 Nm.
- Screw the adapter together with the probe rod into the vessel process connection and tighten with 20 Nm.
- Fit the housing (2) along with the housing holder onto the adapter and screw together with the slotted nut (1); torque 20 Nm.



15 Repair

15.1 General information

15.1.1 Repair concept

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

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

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

15.1.2 Repair of Ex-certified devices

⚠ WARNING

Incorrect repair can compromise electrical safety!
Explosion Hazard!

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

15.1.3 Replacing electronics modules

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

15.1.4 Replacing a device

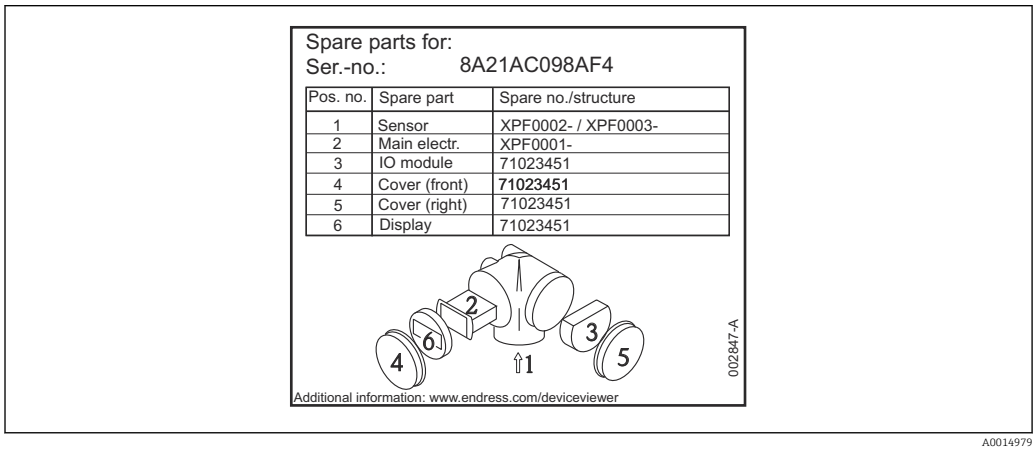
Once a complete device has been replaced, the parameters can be transferred back into the device using one of the following methods:

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

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

15.2 Spare parts

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



28 *Example for spare part nameplate in the connection compartment cover*

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

15.3 Return

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

1. Refer to the web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

15.4 Disposal

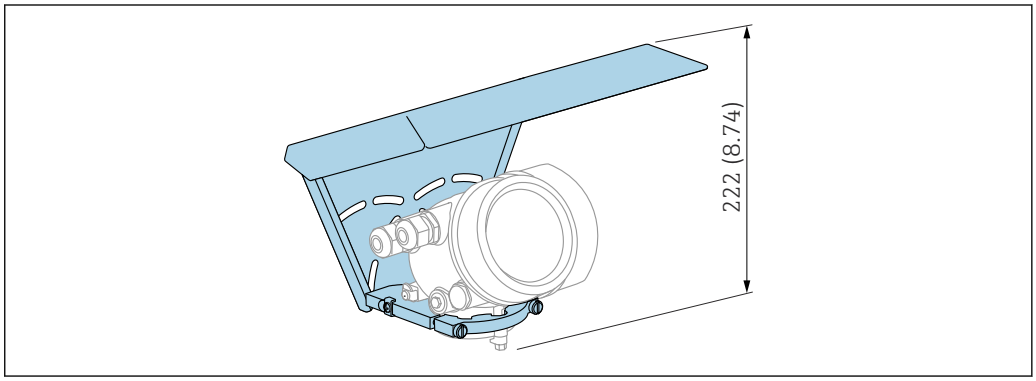
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

16 Accessories

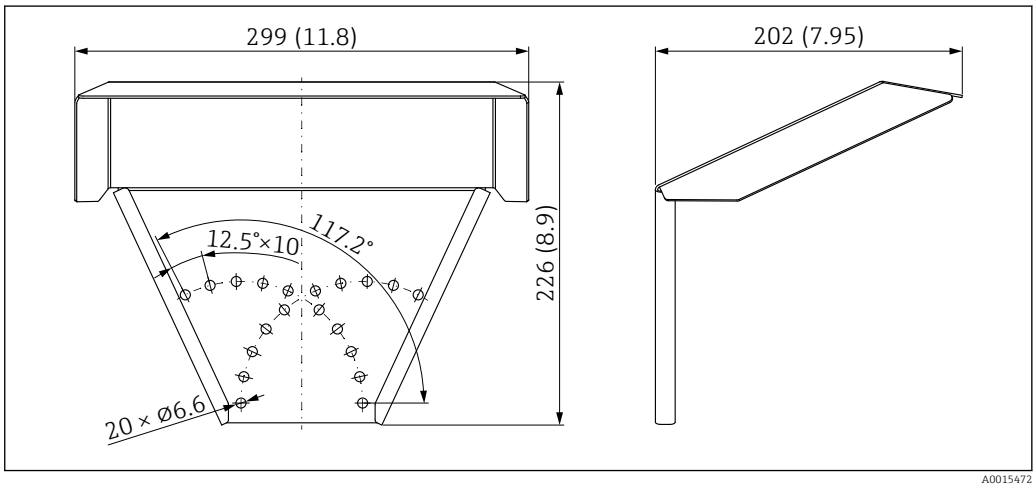
16.1 Device-specific accessories

16.1.1 Weather protection cover

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



29 *Height. Unit of measurement mm (in)*

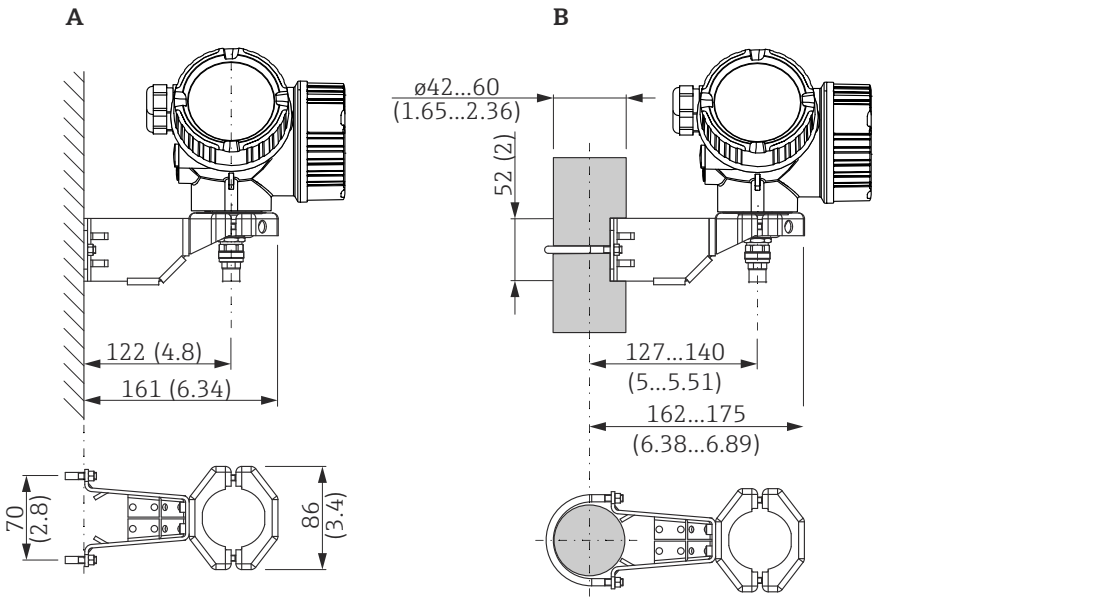


30 *Dimensions. Unit of measurement mm (in)*

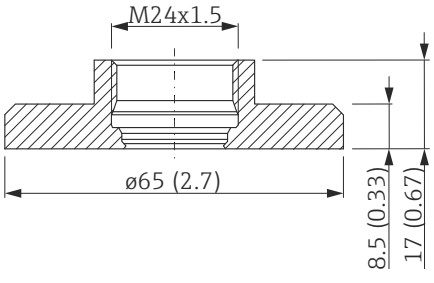
Material
316L

Order number for accessories:
71162242

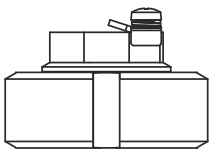
16.1.2 Mounting bracket for electronics housing

Accessories	Description
Mounting bracket for electronics housing	 *31 Mounting bracket for electronics housing; engineering unit: mm (in)* *A Wall mounting* *B Post mounting* 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).

16.1.3 Weld-in adapter

Accessories	Description
Weld-in adapter M24 D65	 With M24x1.5 thread for flush-mounted installation of sensor. Material: 1.4435 (AISI 316L) Weight: 0.22 kg (0.48 lbs) Order number ▪ Standard version: 71041381 ▪ With 3.1 material certificate: 71041383 For details, see Operating Instructions BA361F.

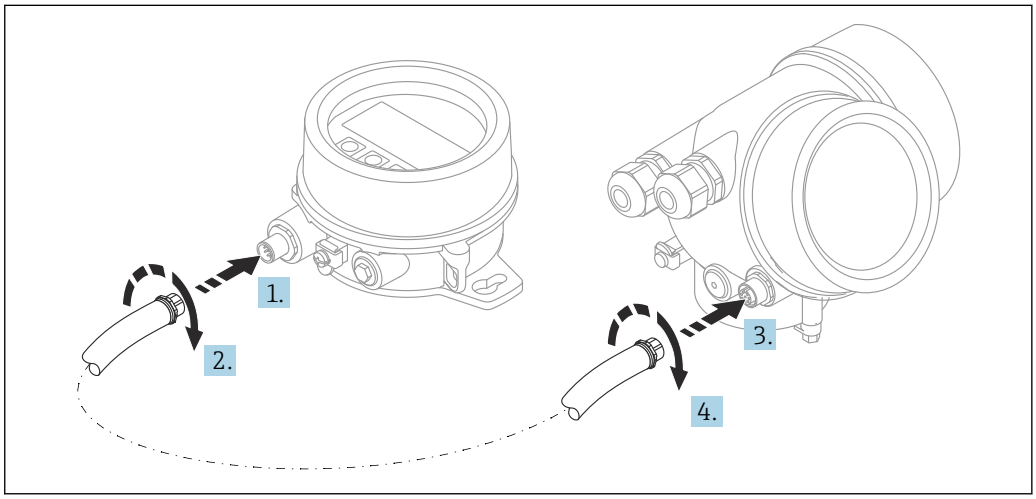
16.1.4 Protective cover

Accessories	Description
Protective cover	 A0013589 For closing off the probe when the electronics module is removed Order number: 71041379 For details, see Operating Instructions BA362F.

16.1.5 Calibration kit

Accessories	Description
Calibration kit	The calibration kit is used for regular testing of the accuracy and reproducibility of the Levelflex FMP53 level measurement device. Order number: 71041382 For details, see Operating Instructions SD01003F.

16.1.6 Remote display FHX50



A0019128

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

- Connecting cable:
  - Cable supplied with device up to 30 m (98 ft)
  - Standard cable supplied by customer up to 60 m (196 ft)
- Ambient temperature:–40 to 80 °C (–40 to 176 °F)
- Ambient temperature (option): –50 to 80 °C (–58 to 176 °F) [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.

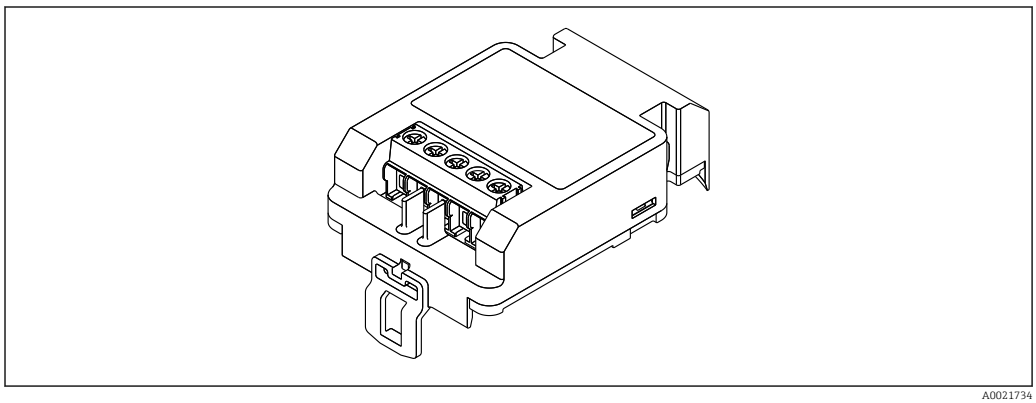
Retrofitting is not possible on transmitters with:
- An approval for use in areas with flammable dust (dust ignition-proof approval)
- Type of protection Ex nA

For details, see the "Special Documentation" SD01007F

16.1.7 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 × 0.5 Ω_{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 °C (–58 °F) was selected in feature 580 "Test, Certificate". If the temperature is permanently below –40 °C (–40 °F), higher failure rates can be expected.

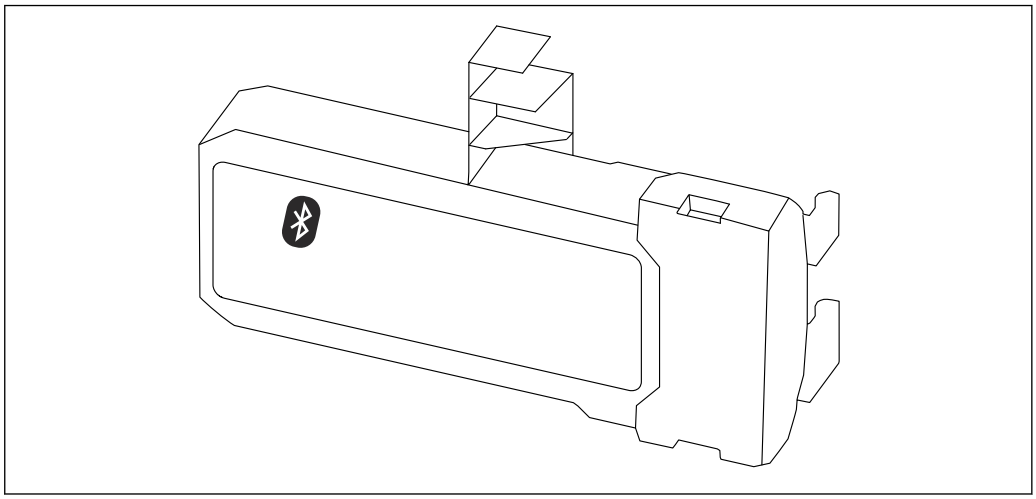
- Capacitance at 1 MHz: < 1.5 pF
- Nominal leakage current (8/20 µs): 10 kA
- Suitable for conductor cross-sections: 0.2 to 2.5 mm² (24 to 14 AWG)

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

For details, see the "Special Documentation" SD01090F

16.1.8 Bluetooth module BT10 for HART devices

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



A0036493

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

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

For details, see the "Special Documentation" SD02252F

16.2 Communication-specific accessories

Commubox 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

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

For details, see Operating Instructions BA01202S

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

For details, see Operating Instructions BA01202S

16.3 Service-specific accessories

DeviceCare SFE100
Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices

Technical Information TI01134S

FieldCare SFE500
FDT-based plant asset management tool
It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.

Technical Information TI00028S

16.4 System components

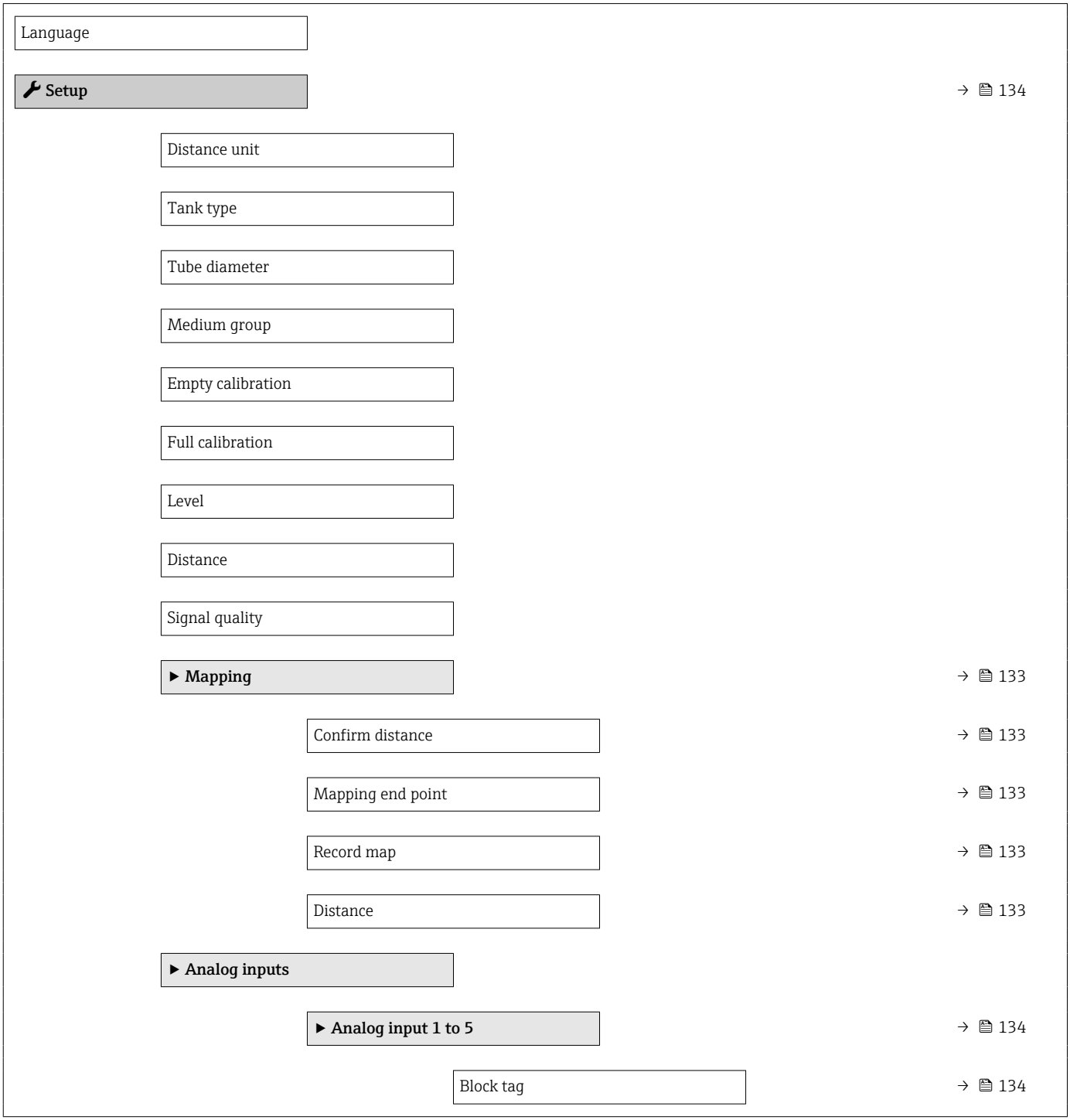
Memograph M graphic data manager
The Memograph M graphic data manager provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or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

Technical Information TI00133R and Operating Instructions BA00247R

17 Operating menu

17.1 Overview of the operating menu (display module)

Navigation Operating menu



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  - Customer value
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- ▶ **Probe settings** → 156
  - Probe grounded → 156
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  - Level linearized → 149
  - Terminal voltage 1 → 184
- ▶ **Analog inputs**
  - ▶ **Analog input 1 to 5** → 184
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    - Units index → 185
- ▶ **Data logging** → 186
  - Assign channel 1 to 4 → 186
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- ▶ **Simulation** → 191
  - Assign measurement variable → 192
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  - Switch status → 193
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  - Start device check → 194
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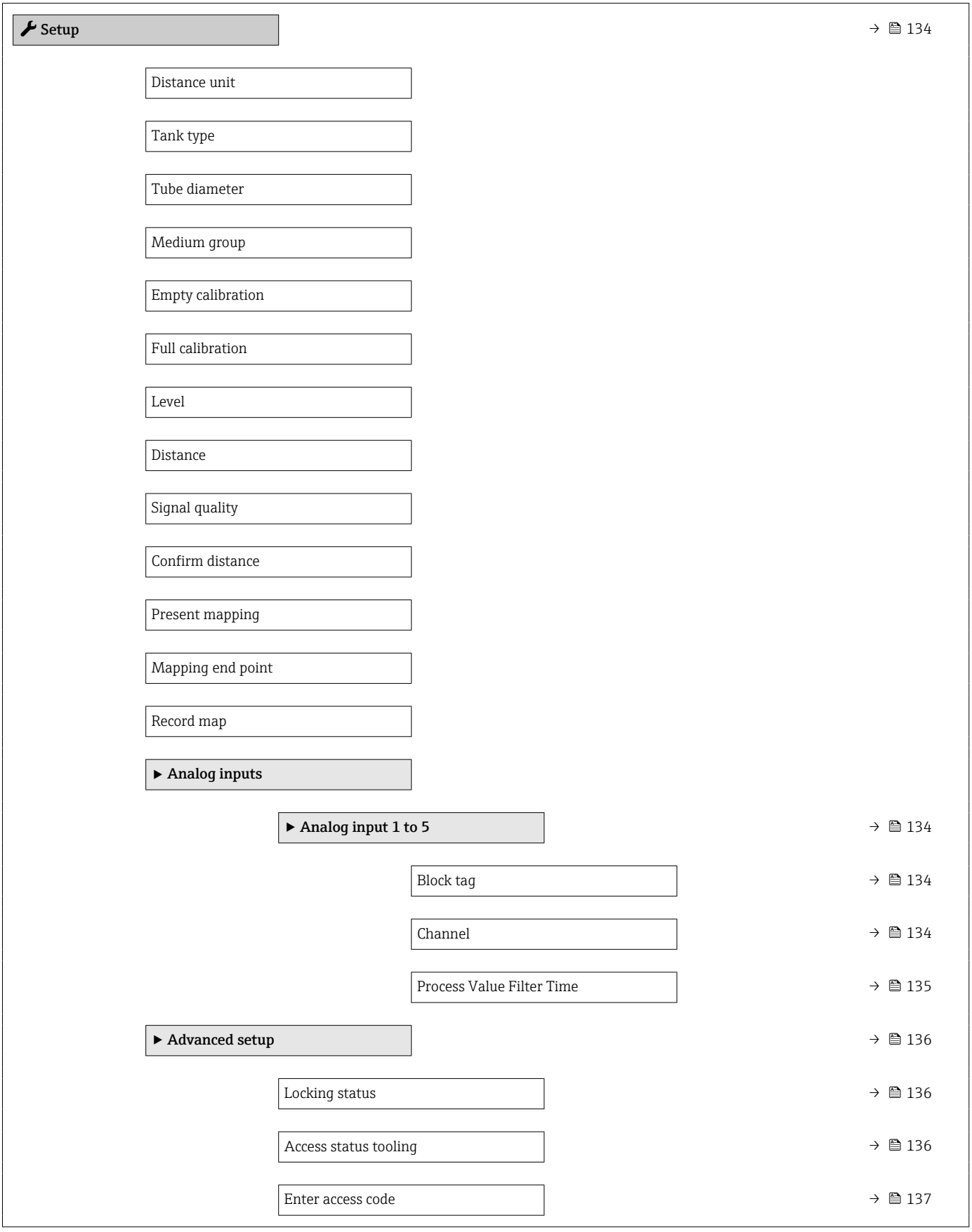
17.2 Overview of the operating menu (operating tool)

Navigation Operating menu



	Ramp at echo lost	→ 154
	Blocking distance	→ 141
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	Probe grounded	→ 156
	Present probe length	→ 156
	Confirm probe length	→ 157
▶ **Switch output**		→ 159
	Switch output function	→ 159
	Assign status	→ 159
	Assign limit	→ 160
	Assign diagnostic behavior	→ 160
	Switch-on value	→ 161
	Switch-on delay	→ 162
	Switch-off value	→ 162
	Switch-off delay	→ 163
	Failure mode	→ 163
	Switch status	→ 163
	Invert output signal	→ 163
▶ **Display**		→ 165
	Language	→ 165
	Format display	→ 165
	Value 1 to 4 display	→ 167
	Decimal places 1 to 4	→ 167
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- Header text → 169
- Separator → 169
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- Decimal places menu → 169
- Backlight → 170
- Contrast display → 170
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  - Operating time → 171
  - Last backup → 171
  - Configuration management → 171
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- ▶ **Administration** → 174
  - Define access code
  - Device reset → 174

Diagnostics → 177

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- Timestamp → 177
- Previous diagnostics → 177
- Timestamp → 178
- Operating time from restart → 178
- Operating time → 171

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  - Timestamp 1 to 5 → 179
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  - Device tag → 181
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  - Distance → 129
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    - Value → 185
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  - Assign channel 1 to 4 → 186
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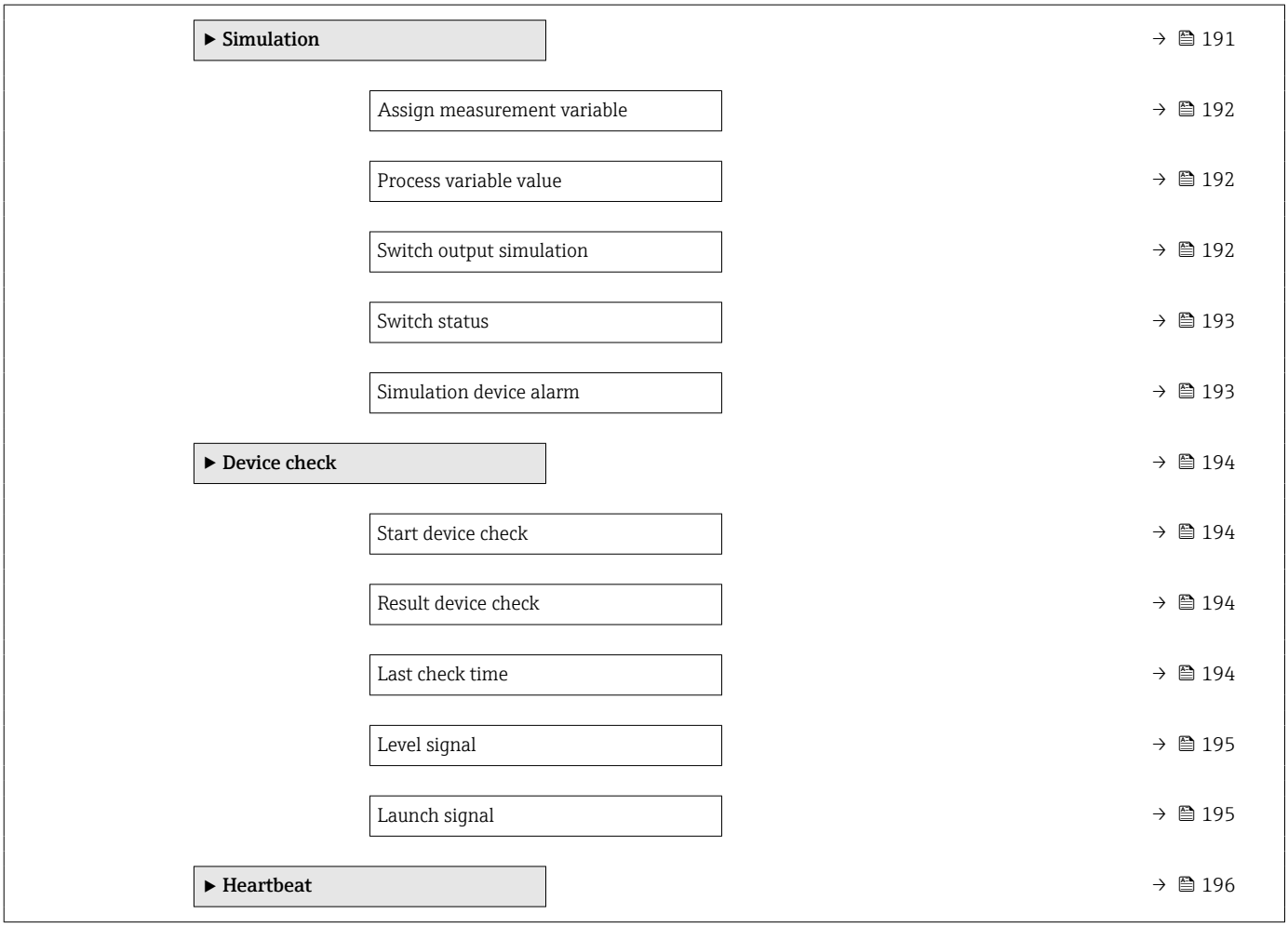
▶ Simulation
→ 191
Assign measurement variable
→ 192
Process variable value
→ 192
Switch output simulation
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Switch status
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Simulation device alarm
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▶ Device check
→ 194
Start device check
→ 194
Result device check
→ 194
Last check time
→ 194
Level signal
→ 195
Launch signal
→ 195
▶ Heartbeat
→ 196

17.3 "Setup" menu

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

Navigation Setup

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 (→ 138) = 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 (→ 126) = Bypass / pipe**

Description Specify diameter of bypass or stilling well.

User entry 0 to 9.999 m

Medium group

Navigation Setup → Medium group

Prerequisite **Medium type (→ 138) = 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 (→ 138).

The **Medium group** parameter presets the **Medium property** parameter (→ 138) as follows:

Medium group	Medium property (→ 138)
Others	Unknown
Water based (DC >= 4)	DC 4 … 7

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

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

Empty calibration

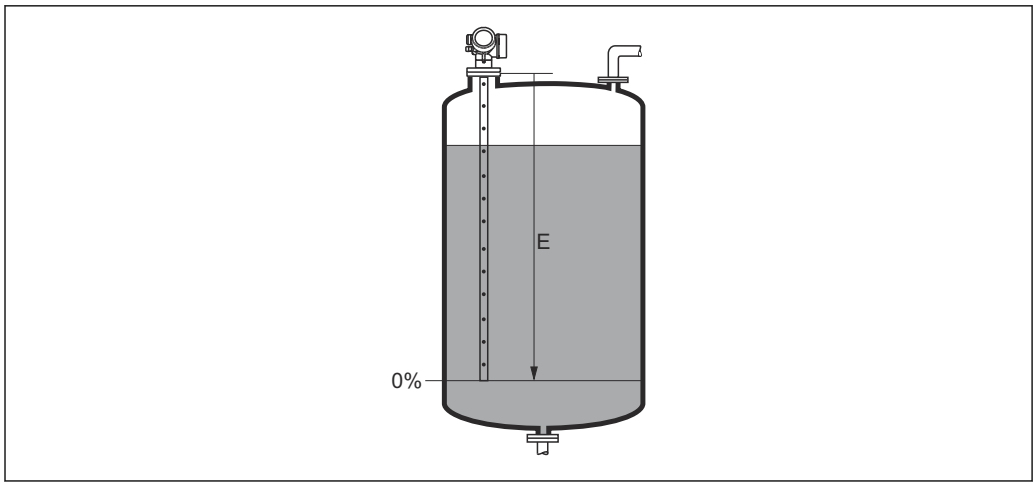
Navigation Setup → Empty calibr.

Description Distance process connection to min. level.

User entry Depending on the probe

Factory setting Depending on the probe

Additional information



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

Full calibration

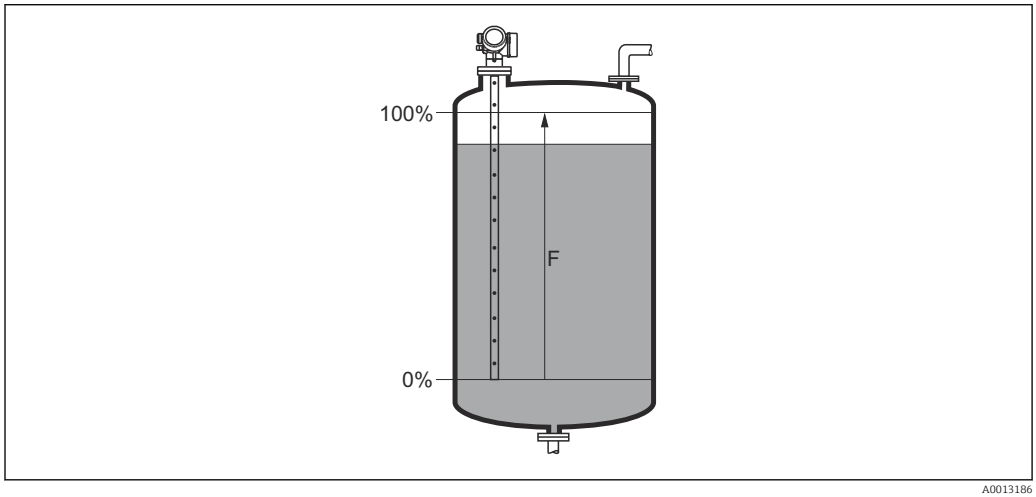
Navigation Setup → Full calibr.

Description Span: max. level - min level.

User entry Depending on the probe

Factory setting Depending on the probe

Additional information



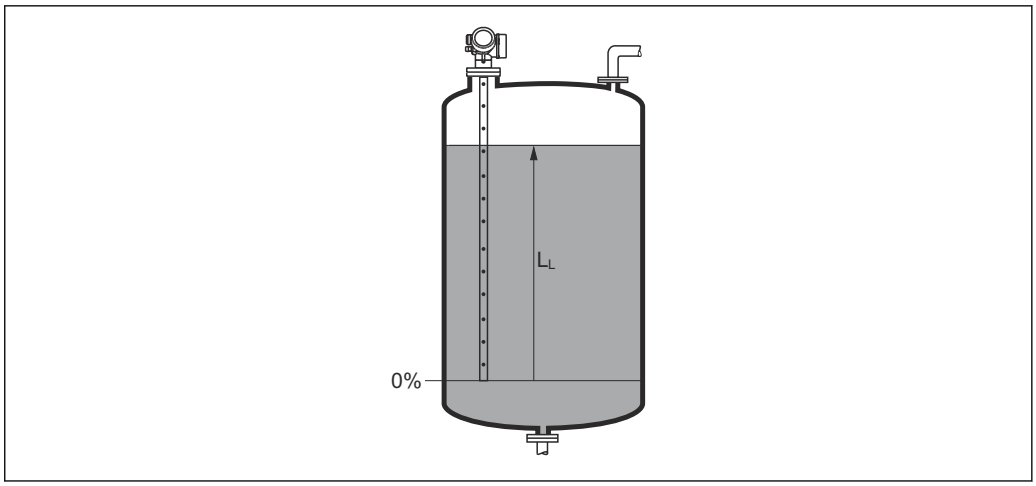
33 *Full calibration (F) for level measurements in liquids*

Level

Navigation Setup → Level

Description Displays measured level L_L (before linearization).

Additional information



34 *Level in case of liquid measurements*

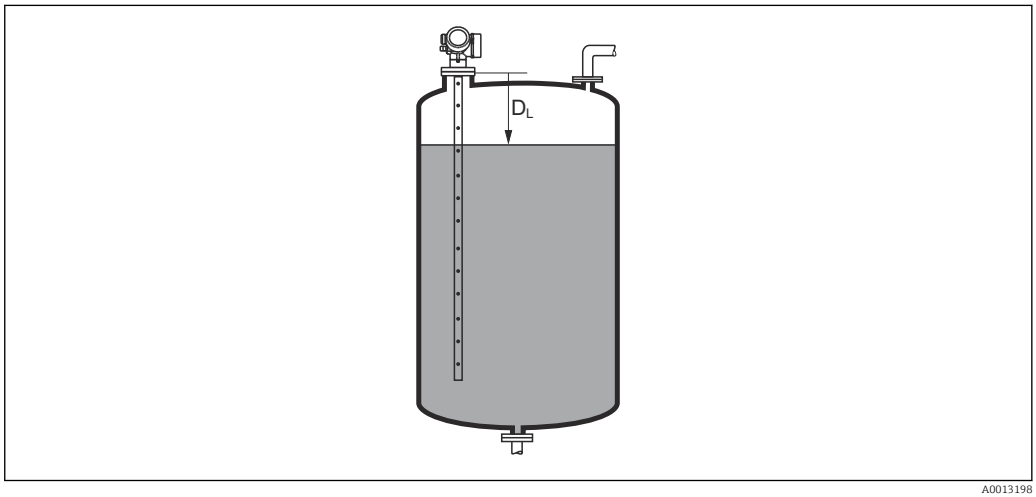
The unit is defined in the **Level unit** parameter (→ 141).

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



35 *Distance for liquid measurements*

The unit is defined in the **Distance unit** parameter (→ 126).

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 [4] 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 (→ 153) = Alarm**.
- S941, if another option has been selected in **Output echo lost (→ 153)**.

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

Additional information

Meaning of the options
- **Manual map**
  To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter (→ 131). In this case it is not necessary to confirm the distance.
- **Distance ok**
  To be selected if the measured distance matches the actual distance. The device performs a mapping.
- **Distance unknown**
  To be selected if the actual distance is unknown. A mapping can not be performed in this case.

4) Of these two echos the one with the lower quality is indicated.
* Visibility depends on order options or device settings

- **Distance too small**
  To be selected if the measured distance is smaller than the actual distance. The device searches for the next echo and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
- **Distance too big** [5)]
  To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
- **Tank empty**
  To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range.
- **Factory map**
  To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the **Confirm distance** parameter and a new mapping can be recorded.

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

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.

Mapping end point

Navigation Setup → Map. end point

Prerequisite **Confirm distance (→ 130)** = **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 (→ 131) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

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

Record map

Navigation Setup → Record map

Prerequisite **Confirm distance (→ 130)** = **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 ☑.

17.3.1 "Mapping" wizard

The **Mapping** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the mapping are located directly in the **Setup** menu (→ 126).

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 → 130

Mapping end point

Navigation Setup → Mapping → Map. end point

Description → 131

Record map

Navigation Setup → Mapping → Record map

Description → 132

Distance

Navigation Setup → Mapping → Distance

Description → 129

17.3.2 "Analog input 1 to 5" submenu

There is an **Analog inputs** submenu for every 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 block can be configured in this submenu. For a detailed configuration of the AI blocks refer to the **Expert** menu.

Navigation Setup → Analog inputs → Analog input 1 to 5

Block tag

Navigation Setup → Analog inputs → Analog input 1 to 7 → Block tag

Description Defined to be unique throughout the control system at one plant site. The tag may be changed using the FB_Tag service.

User entry Character string comprising numbers, letters and special characters (32)

Channel

Navigation Setup → Analog inputs → Analog input 1 to 7 → Channel

Description Use this function to select the input value that should be processed in the Analog Input function block.

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

* Visibility depends on order options or device settings

Process Value Filter Time

Navigation Setup → Analog inputs → Analog input 1 to 7 → PV Filter Time

Description Use this function to enter the filter time specification for the filtering of the unconverted input value (PV).

User entry Positive floating-point number

Additional information *Factory setting*

If the value 0 s is entered, filtering will not be performed.

17.3.3 "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
- 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 (→ 137).

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 (→ 136).

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 (→ 137).

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 (→ 136).

Enter access code

Navigation Setup → Advanced setup → Ent. access code

Description Enter access code to disable write protection of parameters.

User entry 0 to 9 999

Additional information

- The customer-specific access code that was defined in the **Define access code** parameter (→ 174) must be entered for local operation.
- If an incorrect access code is entered, users retain their current access authorization.
- The write protection affects all parameters marked with the symbol in the document. On the local display, the symbol in front of a parameter indicates that the parameter is write-protected.
- If no key is pressed for 10 minutes or the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s.

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

"Level" submenu

Navigation Setup → Advanced setup → Level

Medium type

Navigation Setup → Advanced setup → Level → Medium type

Description Specify type of medium.

User interface
- Liquid
- Solid

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

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

Medium property

Navigation Setup → Advanced setup → Level → Medium property

Prerequisite **EOP level evaluation ≠ Fix DC**

Description Specify the dielectric constant ε_r of the medium.

Selection
- Unknown
- DC 1.4 ... 1.6
- DC 1.6 ... 1.9
- DC 1.9 ... 2.5
- DC 2.5 ... 4
- DC 4 ... 7
- DC 7 ... 15
- DC > 15

Factory setting Depends on the **Medium type (→ 138)** and **Medium group (→ 127)** parameters.

Additional information

Dependency of "Medium type" and "Medium group"

Medium type (→ 138)	Medium group (→ 127)	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 ... 7
	Others	Unknown

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

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

Process property

Navigation

Setup → Advanced setup → Level → Process property

Description

Specify typical rate of level change.

Selection

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

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

Additional information

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

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

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

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

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

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

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

Advanced process conditions

Navigation Setup → Advanced setup → Level → Adv. conditions

Description Specify additional process conditions (if required).

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

Additional information

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

Level unit

Navigation Setup → Advanced setup → Level → Level unit

Description Select level unit.

Selection

SI units
- %
- m
- mm

US units
- ft
- in

Additional information The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 126):

- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 127)** and **Full calibration (→ 128)**).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Blocking distance

Navigation Setup → Advanced setup → Level → Blocking dist.

Description Specify upper blocking distance UB.

User entry 0 to 200 m

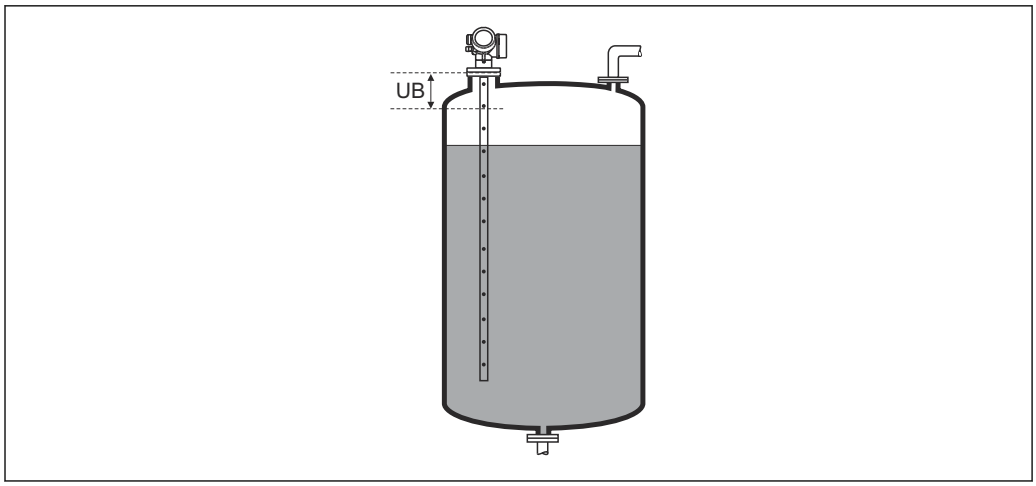
Factory setting For rod and rope probes up to 8 m (26 ft): 200 mm (8 in)

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.

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



36 Blocking distance (UB) for liquid measurements

Level correction

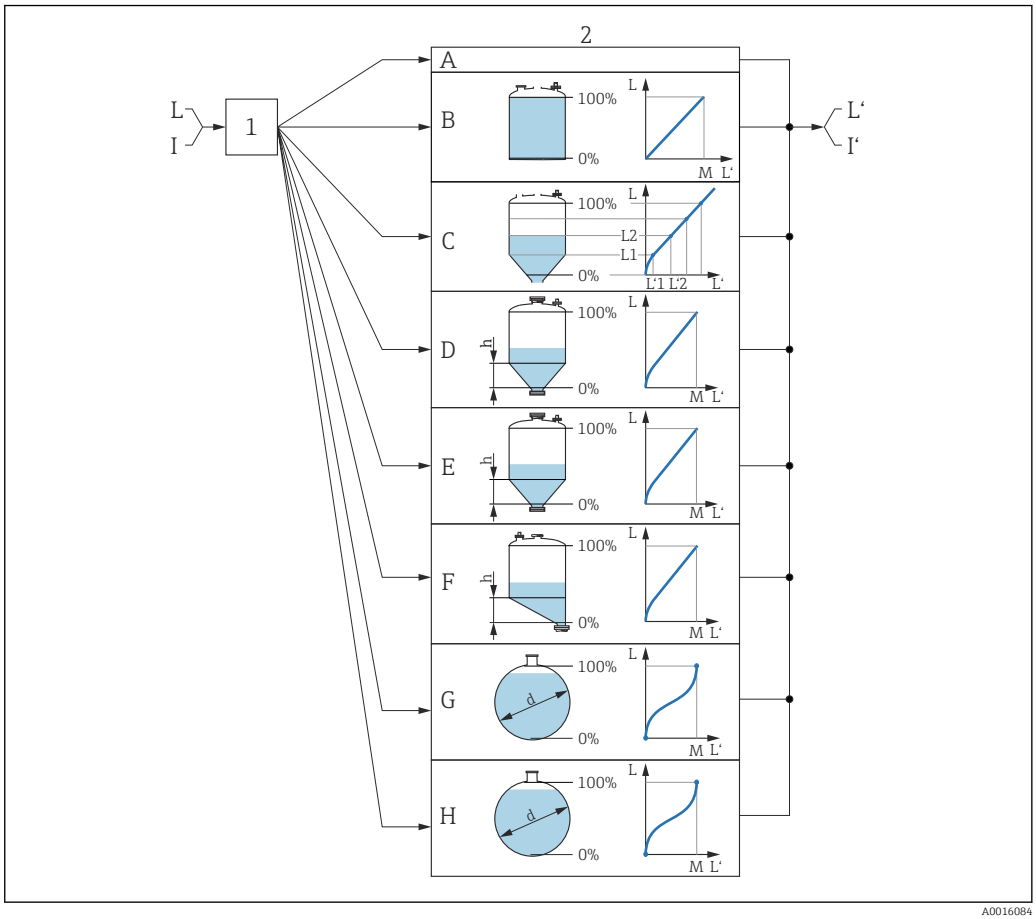
Navigation Setup → Advanced setup → Level → Level correction

Description Specify level correction (if required).

User entry −200 000.0 to 200 000.0 %

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

"Linearization" submenu

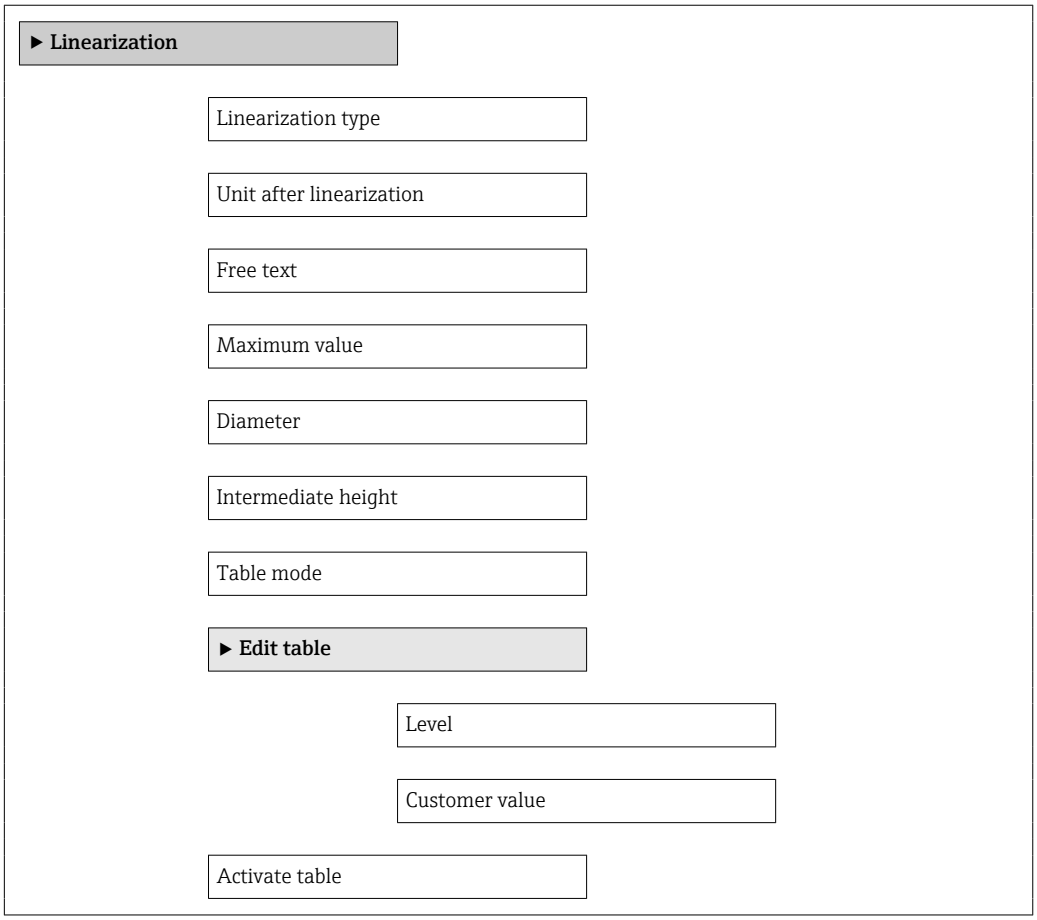


37 *Linearization: Conversion of the level and, if applicable, interface into a volume or a weight; the conversion depends on the vessel shape*

1 Selection of linearization type and unit
2 Configuration of the linearization
A Linearization type (→ 146) = None
B Linearization type (→ 146) = Linear
C Linearization type (→ 146) = Table
D Linearization type (→ 146) = Pyramid bottom
E Linearization type (→ 146) = Conical bottom
F Linearization type (→ 146) = Angled bottom
G Linearization type (→ 146) = Horizontal cylinder
H Linearization type (→ 146) = Sphere
I For "Operating mode" = "Interface" or "Interface with capacitance": interface before linearization (measured in the level unit)
I' For "Operating mode" = "Interface" or "Interface with capacitance": interface after linearization (corresponds to volume or weight)
L Level before linearization (measured in level unit)
L' Level linearized (→ 149) (corresponds to volume or weight)
M Maximum value (→ 149)
d Diameter (→ 149)
h Intermediate height (→ 150)

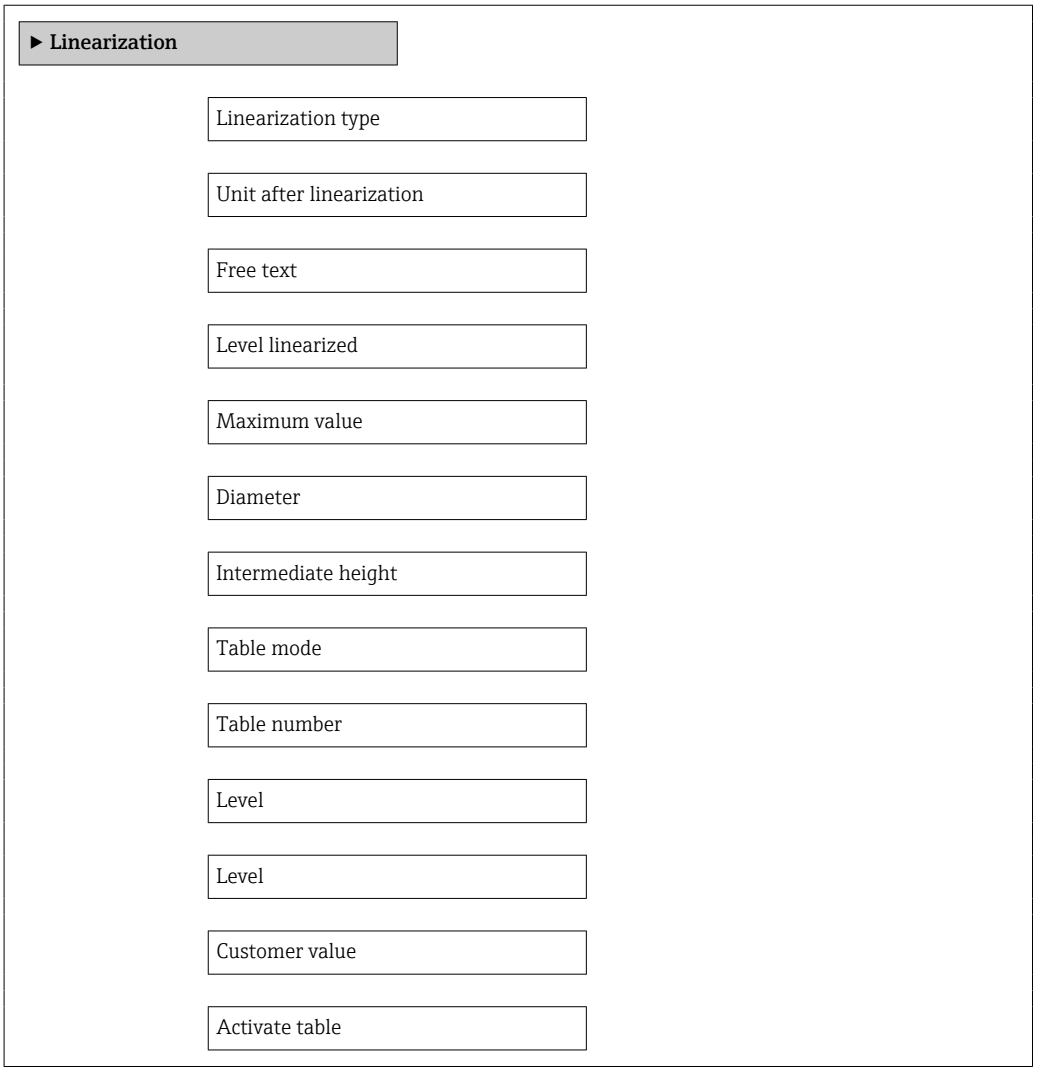
Structure of the submenu on the local display

Navigation Setup → Advanced setup → Linearization



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

Navigation Setup → Advanced setup → Linearization



Description of the parameters

Navigation Setup → Advanced setup → Linearization

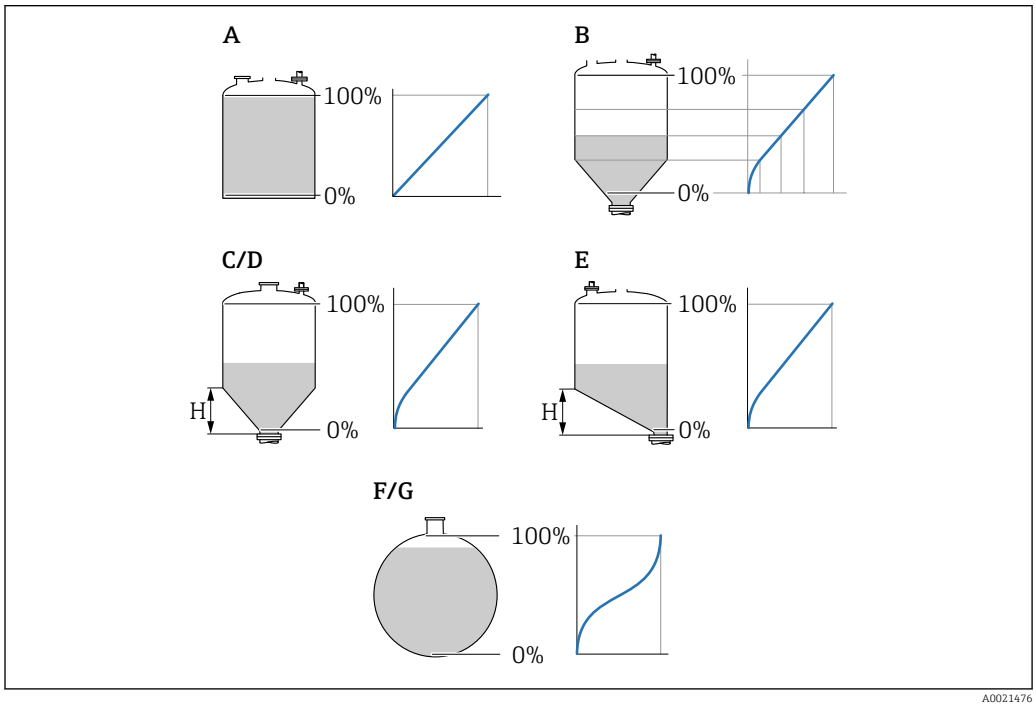
Linearization type

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



38 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 (→ 147)**
  - **Maximum value (→ 149)**: 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 (→ 147)**
  - **Table mode (→ 150)**
  - For every point in the table: **Level (→ 151)**
  - For every point in the table: **Customer value (→ 152)**
  - **Activate table (→ 152)**
- **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 (→ 147)**
  - **Maximum value (→ 149)**: maximum volume or weight
  - **Intermediate height (→ 150)**: 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 (→ 147)**
  - **Maximum value (→ 149)**: maximum volume or weight
  - **Intermediate height (→ 150)**: 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 (→ 147)**
  - **Maximum value (→ 149)**: maximum volume or weight
  - **Intermediate height (→ 150)**: 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 (→ 147)**
  - **Maximum value (→ 149)**: maximum volume or weight
  - **Diameter (→ 149)**
- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following parameters must also be specified:
  - **Unit after linearization (→ 147)**
  - **Maximum value (→ 149)**: maximum volume or weight
  - **Diameter (→ 149)**

Unit after linearization

Navigation Setup → Advanced setup → Linearization → Unit lineariz.

Prerequisite **Linearization type (→ 146)** ≠ 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 (→ 148).

Free text

Navigation Setup → Advanced setup → Linearization → Free text

Prerequisite **Unit after linearization (→ 147) = Free text**

Description Enter unit symbol.

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

Level linearized

Navigation Setup → Advanced setup → Linearization → Level linearized

Description Displays linearized level.

Additional information The unit is defined by the **Unit after linearization** parameter → 147.

Maximum value

Navigation Setup → Advanced setup → Linearization → Maximum value

Prerequisite **Linearization type (→ 146)** 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 (→ 146)** has one of the following values:
- Horizontal cylinder
- Sphere

User entry 0 to 9 999.999 m

Additional information The unit is defined in the **Distance unit** parameter (→ 126).

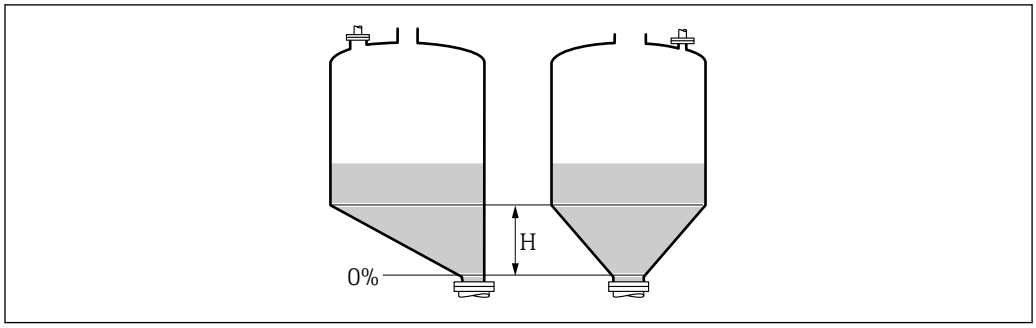
Intermediate height

Navigation Setup → Advanced setup → Linearization → Intermed. height

Prerequisite **Linearization type (→ 146)** 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 (→ 126).

Table mode

Navigation Setup → Advanced setup → Linearization → Table mode

Prerequisite **Linearization type (→ 146)** = **Table**

Description Select editing mode of the linearization table.

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

Additional information

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

* Visibility depends on order options or device settings

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

Before entering a linearization table, the values for **Empty calibration (→ 127)** and **Full calibration (→ 128)** 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 (→ 150)** = **Clear table**). Then enter a new table.

How to enter the table
- Via FieldCare
  The table points can be entered via the **Table number (→ 151)**, **Level (→ 151)** and **Customer value (→ 152)** parameters. As an alternative, the graphic table editor may be used: Device Operation → Device Functions → Additional Functions → Linearization (Online/Offline)
- Via local display
  Select the **Edit table** submenu to call up the graphic table editor. The table is displayed and can be edited line by line.

The factory setting for the level unit is "%". If you want to enter the linearization table in physical units, you must select the appropriate unit in the **Level unit** parameter (→ 141) beforehand.

Table number

Navigation Setup → Advanced setup → Linearization → Table number

Prerequisite **Linearization type (→ 146)** = **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 (→ 146)** = Table
- **Table mode (→ 150)** = 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 (→ 146)** = **Table**
- **Table mode (→ 150)** = **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 (→ 146)** = **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 (→ 146)** = **Table**

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

Selection
- Disable
- Enable

Additional information

Meaning of the options
- **Disable**
  The measured level is not linearized.
  If **Linearization type (→ 146)** = **Table** at the same time, the device issues error message F435.
- **Enable**
  The measured level is linearized according to the table.

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

"Safety settings" submenu

Navigation Setup → Advanced setup → Safety 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** [6)]
  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 (→ 154).
- **Value echo lost** [6)]
  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 153).
- **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 (→ 153)** = **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 (→ 141)**
- with linearization: **Unit after linearization (→ 147)**

6) Only visible if "Linearization type (→ 146)" = "None"

Ramp at echo lost

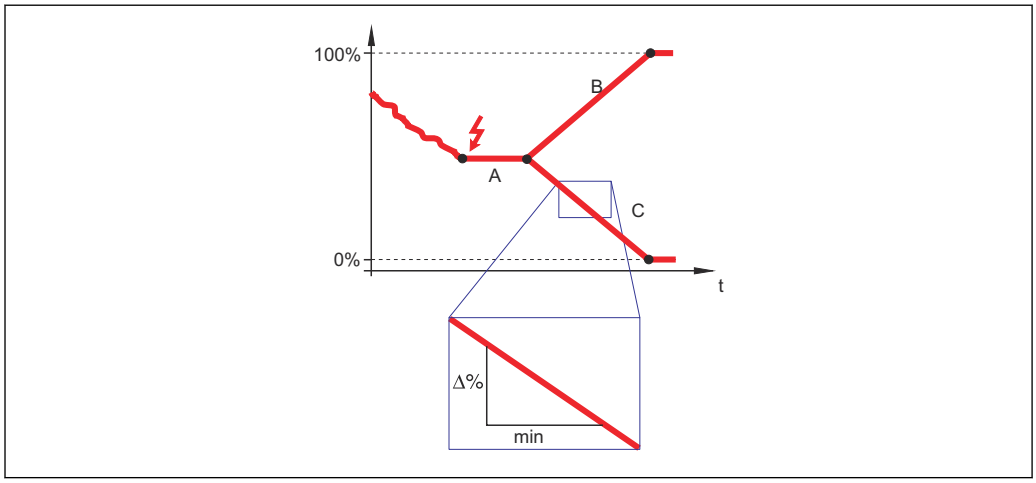
Navigation Setup → Advanced setup → Safety sett. → Ramp echo lost

Prerequisite **Output echo lost (→ 153) = 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 (→ 154) (positive value)
C Ramp at echo lost (→ 154) (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 rod and rope probes up to 8 m (26 ft): 200 mm (8 in)

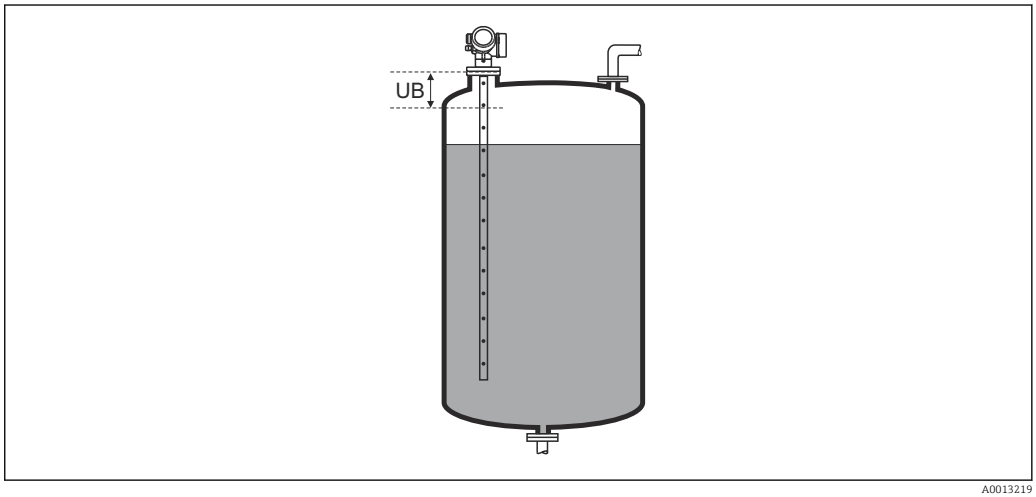
Additional information Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance

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.

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



39 Blocking distance (UB) for liquid measurements

"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 (→ 157)** = **Manual input** in order to enter the value manually.

If a mapping (interference echo suppression) has been recorded after shortening the probe, it is no longer possible to perform an automatic probe length correction. In this case there are two options:
- Delete the map using the **Record map** parameter (→ 132) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→ 132).
- Alternative: Select **Confirm probe length (→ 157)** = **Manual input** and enter the probe length manually into the **Present probe length** parameter → 156.

An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter (→ 156).

Navigation Setup → Advanced setup → Probe settings

Probe grounded

Navigation Setup → Advanced setup → Probe settings → Probe grounded

Prerequisite **Operating mode** = **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 (→ 157)** = **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 → 156 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 → 156. 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 → 156. 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 → 156 [7].
- **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.

.

7) 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 (→ 156).

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

Confirm probe length

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

Description → 157

Present probe length

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

Description → 156

"Switch output" submenu

The **Switch output** submenu (→ 159) is only visible for devices with switch output. [8)]

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 (→ 160) 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 (→ 160)**
  - **Switch-on value (→ 161)**
  - **Switch-off value (→ 162)**
- **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 (→ 159).

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 (→ 159)** = **Digital Output**

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

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

- Digital output 1
- Digital output 2
- Digital output 3
- Digital output 4
- Digital output 5
- Digital output 6
- Digital output 7
- Digital output 8

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 (→ 159)** = **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 (→ 159)** = **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

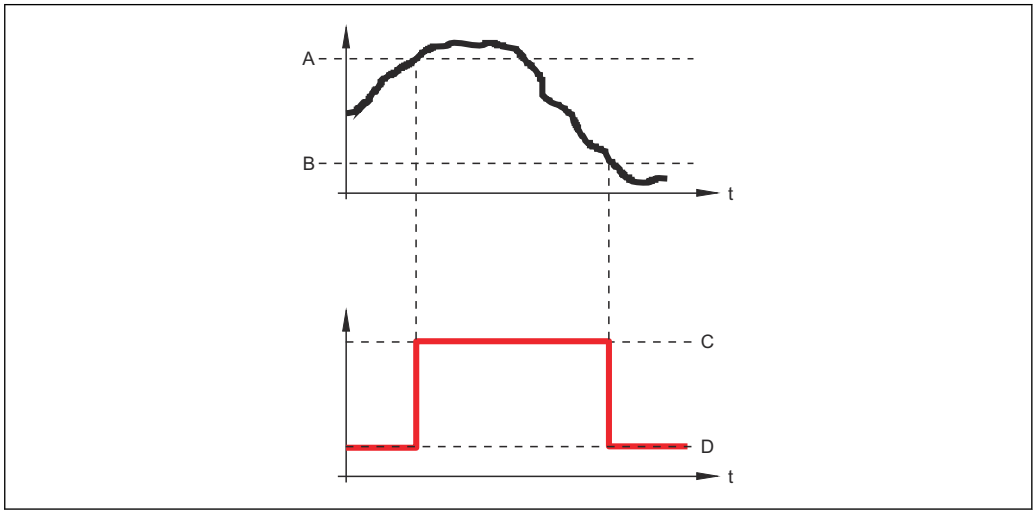
Prerequisite **Switch output function (→ 159) = Limit**

Description Enter measured value for the switch-on point.

User entry Signed floating-point number

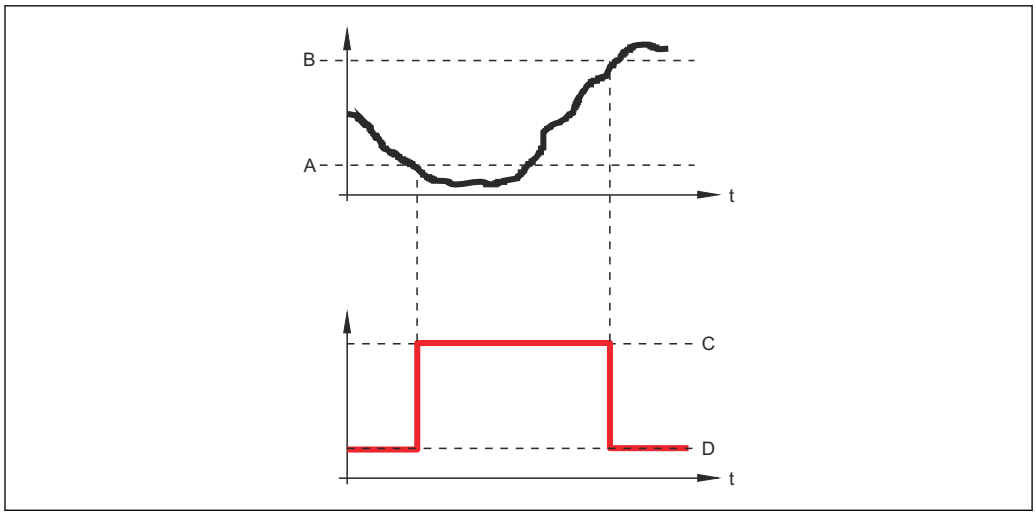
Additional information The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters:

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**.



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 (→ 159) = Limit**
- **Assign limit (→ 160) ≠ 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 (→ 159) = 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 (→ 161).

Switch-off delay

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

Prerequisite
- **Switch output function (→ 159)** = **Limit**
- **Assign limit (→ 160)** ≠ **Off**

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

User entry 0.0 to 100.0 s

Failure mode

Navigation Setup → Advanced setup → Switch output → Failure mode

Prerequisite **Switch output function (→ 159)** = **Limit** or **Digital Output**

Description Define output behavior in alarm condition.

Selection
- Actual status
- Open
- Closed

Additional information

Switch status

Navigation Setup → Advanced setup → Switch output → Switch status

Description Shows the current switch output status.

Invert output signal

Navigation 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

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

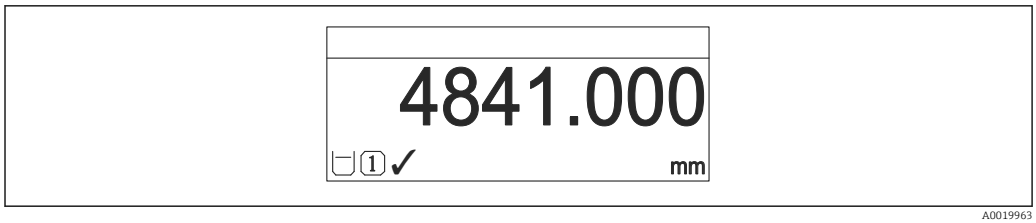
Navigation Setup → Advanced setup → Display → Format display

Description Select how measured values are shown on the display.

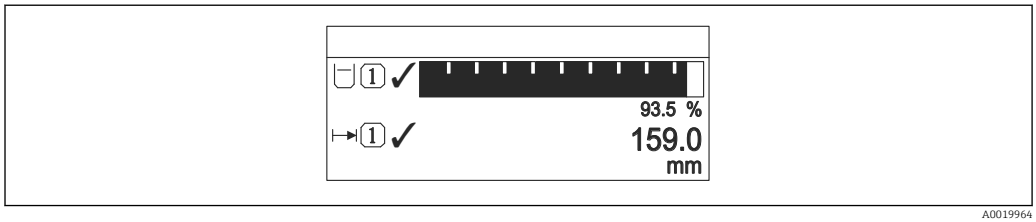
Selection
- 1 value, max. size
- 1 bargraph + 1 value
- 2 values
- 1 value large + 2 values
- 4 values

* Visibility depends on order options or device settings

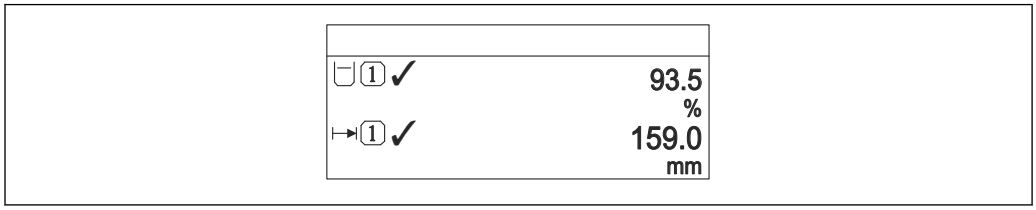
Additional information



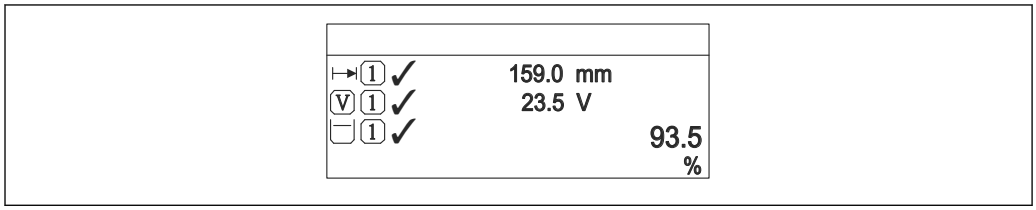
40 *"Format display" = "1 value, max. size"*



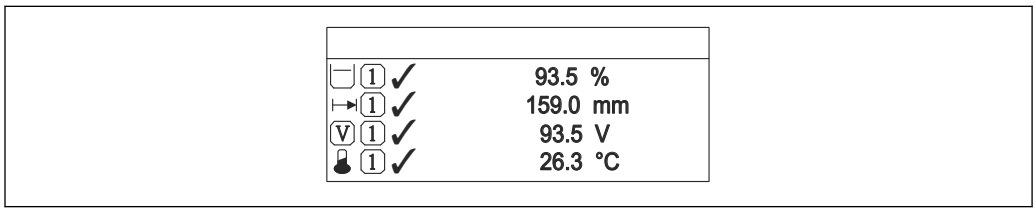
41 *"Format display" = "1 bargraph + 1 value"*



42 *"Format display" = "2 values"*



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



44 *"Format display" = "4 values"*

- The **Value 1 to 4 display** → 167 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 (→ 168).

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 adv. diagnostics 1
- Analog output adv. diagnostics 2
- Analog output 1
- Analog output 2
- Analog output 3
- Analog output 4
- Analog output 5
- Analog output 6
- Analog output 7
- Analog output 8

Factory setting **For level measurements**
- Value 1 display: Level linearized
- Value 2 display: Distance
- Value 3 display: Current output 1
- Value 4 display: None

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

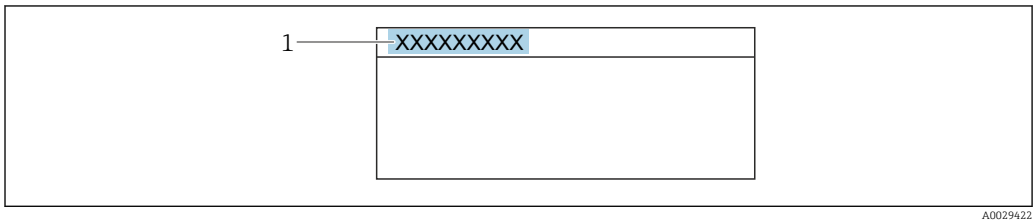
Header

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 (→ 169).

Header text

Navigation Setup → Advanced setup → Display → Header text

Prerequisite **Header (→ 168)** = **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** → 167 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.

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

Contrast display

Navigation Setup → Advanced setup → Display → Contrast display

Description Adjust local display contrast setting to ambient conditions (e.g. lighting or reading angle).

User entry 20 to 80 %

Factory setting Dependent on the display.

Additional information

Setting the contrast via push-buttons:

- Darker: press the ⊖ E buttons simultaneously.
- Brighter: press the ⊕ E buttons simultaneously.

"Configuration backup display" submenu

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

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

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
- Display incompatible

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 (→ 172).
- **Clear backup data**
  The backup copy of the device configuration is deleted from the display module of the device.

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

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

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

Backup state

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

Description Displays which backup action is currently in progress.

Comparison result

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

Description Comparison between present device data and display backup.

Additional information

Meaning of the display options

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

To start the comparison, set **Configuration management (→ 171)** = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Configuration management (→ 171)** = **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

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

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

Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 137).

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

If operating via the local display: the new access code is only valid once it has been confirmed in the **Confirm access code** parameter (→ 176).

Device reset

Navigation Setup → Advanced setup → Administration → Device reset

Setup → Advanced setup → Administration → Device reset

Selection

- Cancel
- To fieldbus defaults
- 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

Define access code

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

Description → 174

Confirm access code

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

Description Confirm the entered access code.

User entry 0 to 9 999

17.4 "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

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

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

Timestamp

Navigation Diagnostics → Timestamp

Previous diagnostics

Navigation Diagnostics → Prev.diagnostics

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

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

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

Timestamp

Navigation Diagnostics → Timestamp

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)

17.4.1 "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

17.4.2 "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 (→ 180). 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

17.4.3 "Device information" submenu

Navigation Diagnostics → Device info

Device tag

Navigation
Diagnostics → Device info → Device tag
Diagnostics → Device info → Device tag

Description
Enter tag for measuring point.

User interface
Character string comprising numbers, letters and special characters

Serial number

Navigation
Diagnostics → Device info → Serial number
Diagnostics → Device info → Serial number

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
Diagnostics → Device info → Firmware version

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
- Diagnostics → Device info → Device name

Order code

Navigation
- Diagnostics → Device info → Order code
- Diagnostics → Device info → 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
- 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.

17.4.4 "Measured values" submenu

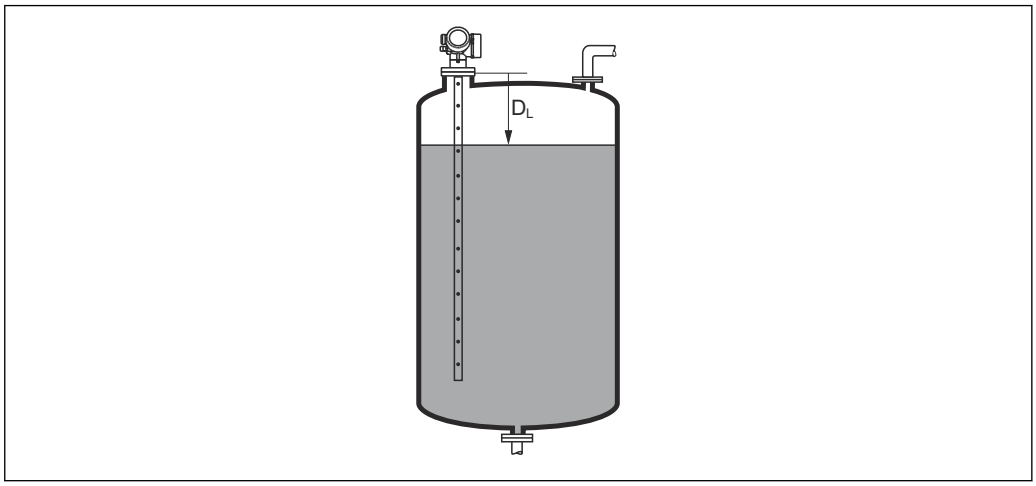
Navigation Diagnostics → Measured val.

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



45 *Distance for liquid measurements*

The unit is defined in the **Distance unit** parameter (→ 126).

Level linearized

Navigation Diagnostics → Measured val. → Level linearized

Description Displays linearized level.

Additional information The unit is defined by the **Unit after linearization** parameter → 147.

Terminal voltage 1

Navigation Diagnostics → Measured val. → Terminal volt. 1

17.4.5 "Analog input 1 to 5" submenu

There is an **Analog inputs** submenu for every 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 block can be configured in this submenu. For a detailed configuration of the AI blocks refer to the **Expert** menu.

Navigation Diagnostics → Analog inputs → Analog input 1 to 5

Block tag

Navigation Diagnostics → Analog inputs → Analog input 1 to 7 → Block tag

Description Defined to be unique throughout the control system at one plant site. The tag may be changed using the FB_Tag service.

User entry Character string comprising numbers, letters and special characters (32)

Channel

Navigation Diagnostics → Analog inputs → Analog input 1 to 7 → Channel

Description Use this function to select the input value that should be processed in the Analog Input function block.

Selection
- Uninitialized
- Level linearized
- Absolute echo amplitude
- Absolute EOP amplitude
- Absolute interface amplitude *
- Distance
- Electronic temperature
- EOP shift
- Interface linearized *
- Interface distance *
- Measured capacitance *
- Relative echo amplitude
- Relative interface amplitude *
- Noise of signal

* Visibility depends on order options or device settings

- Terminal voltage
- Thickness upper layer *
- Calculated DC value *
- Analog output adv. diagnostics 2
- Analog output adv. diagnostics 1

Status

Navigation Diagnostics → Analog inputs → Analog input 1 to 7 → Status

Description Indicates the status of the output of the AI block according to the FOUNDATION Fieldbus specification.

Value

Navigation Diagnostics → Analog inputs → Analog input 1 to 7 → Value

Description Indicates the output value of the AI block.

Units index

Navigation Diagnostics → Analog inputs → Analog input 1 to 7 → Units index

Description Indicates the unit of the output value.

* Visibility depends on order options or device settings

17.4.6 "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
- Analog output 1
- Analog output 2
- Analog output 3
- Analog output 4

Additional information

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

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

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

* Visibility depends on order options or device settings

Logging interval

Navigation

Diagnostics → Data logging → Logging interval

Diagnostics → Data logging → Logging interval

User entry

1.0 to 3 600.0 s

Additional information

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

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

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

The logged data are deleted if this parameter is changed.

Example

When using 1 logging channel

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

Clear logging data

Navigation

Diagnostics → Data logging → Clear logging

Diagnostics → Data logging → Clear logging

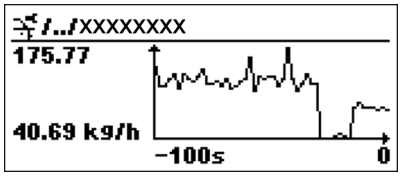
Selection

- 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

17.4.7 "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.

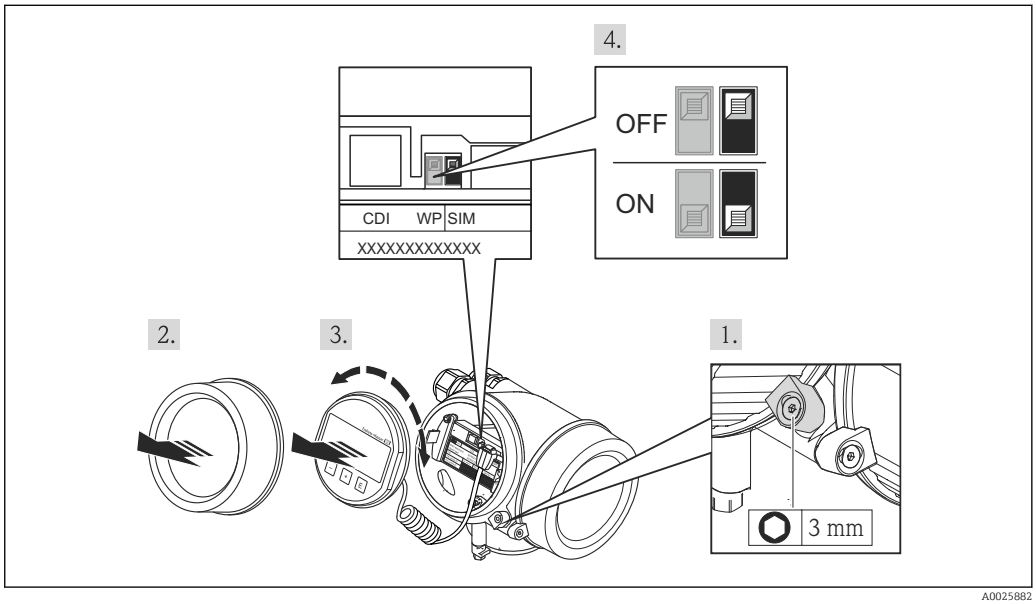
Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	▪ Assign measurement variable (→ 192) ▪ Process variable value (→ 192)
Specific state of the switch output	▪ Switch output simulation (→ 192) ▪ Switch status (→ 193)
Existence of an alarm	Simulation device alarm (→ 193)

Enable/disable simulation

The simulation of measured values can be enabled or disabled via a hardware switch (SIM switch) at the electronics. Simulating a measured value is only possible if the SIM switch is in the ON position.

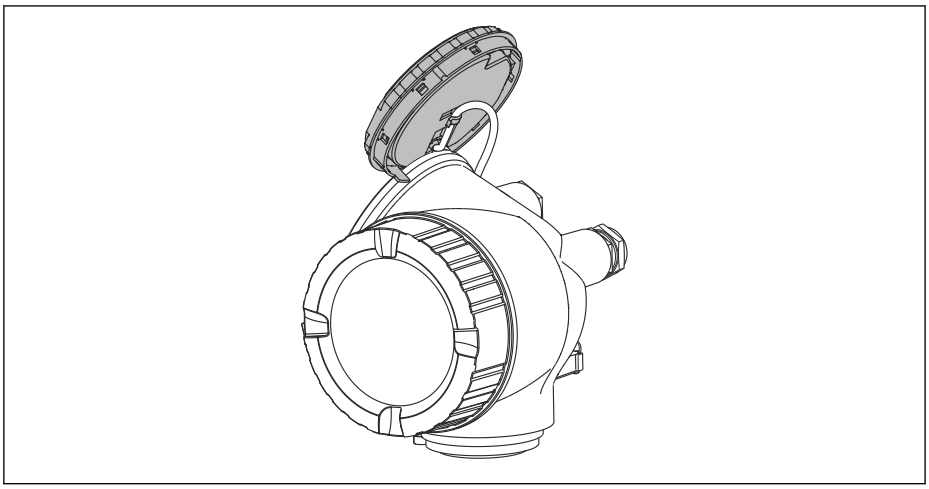
The switch output can always be simulated, irrespective of the position of the SIM switch.



A0025882

1. Loosen the securing clamp.
2. Unscrew the housing cover.

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

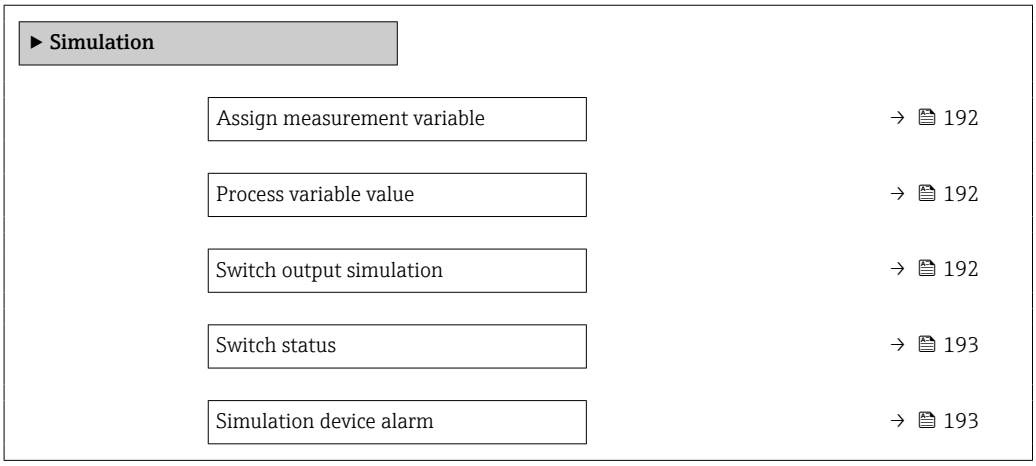


A0013909

4. SIM switch in the **ON** position: measured values can be simulated. SIM switch in the **OFF** position (factory setting): Simulation of measured values is disabled.
5. Feed the spiral 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. Screw the electronics compartment cover closed and tighten the securing clamp.

Structure of the submenu

Navigation Expert → Diagnostics → Simulation



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 **Process variable value** parameter (→ 192).
- If **Assign measurement variable ≠ Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Process variable value

Navigation Expert → Diagnostics → Simulation → Proc. var. value

Prerequisite **Assign measurement variable (→ 192) ≠ 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 (→ 192)** = **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.

Diagnostic event simulation

Navigation Expert → Diagnostics → Simulation → Diag. event sim.

Description Select a diagnostic event to simulate this event.

Additional information When operated via the local display, the selection list can be filtered according to the event categories (**Diagnostic event category** parameter).

17.4.8 "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.

17.4.9 "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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