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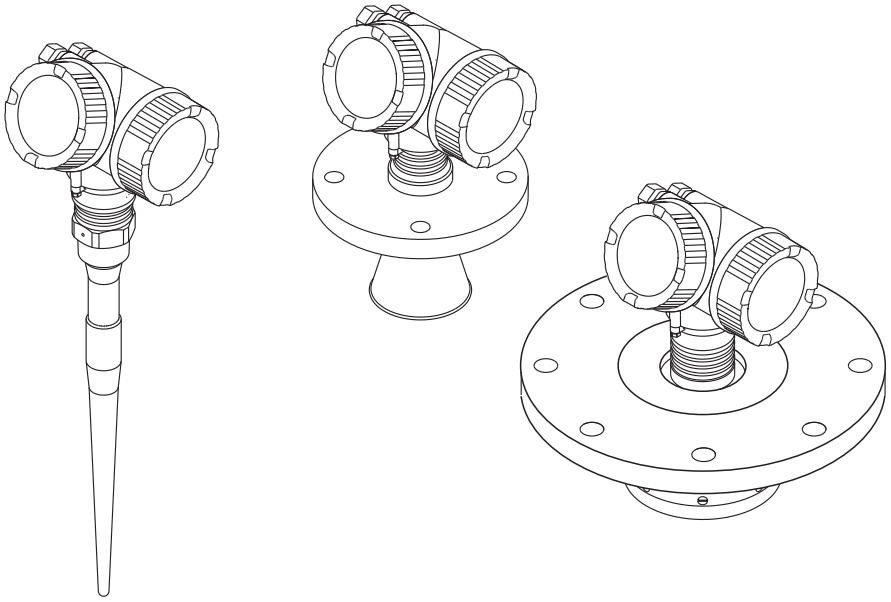
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BA01050F/00/EN/03.14
71272464
01.01.zz (Device firmware)

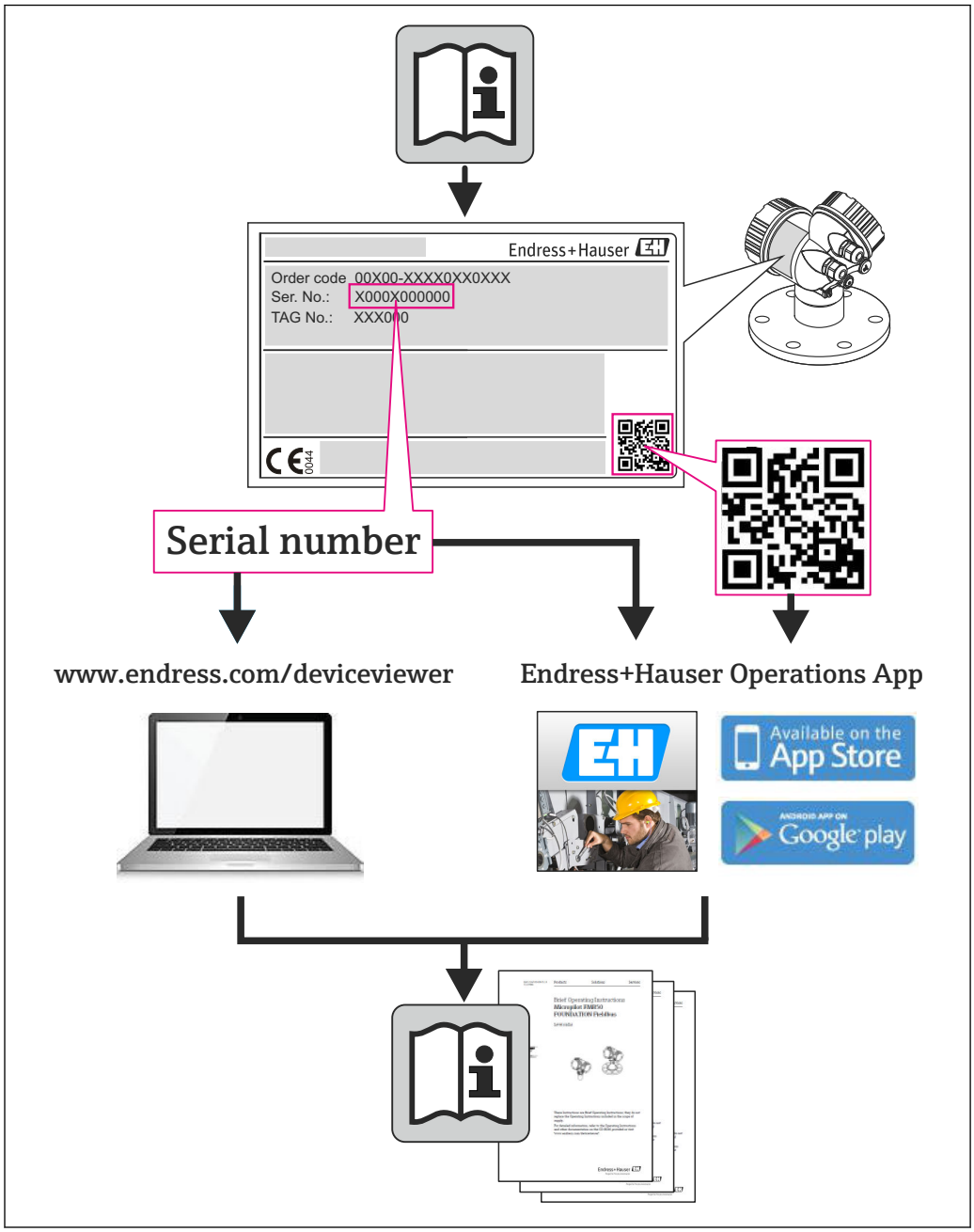


# Operating Instructions
# **Micropilot FMR53, FMR54 HART**

Free space radar



Endress+Hauser
People for Process Automation


Endress+Hauser
Order code 00X00-XXXX0XX0XXX
Ser. No.: X000X000000
TAG No.: XXX000
Serial number
www.endress.com/deviceviewer
Endress+Hauser Operations App
Available on the App Store
Google play
A0023555

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# 1 Important document information

## 1.1 Document function

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

## 1.2 Symbols

### 1.2.1 Safety symbols

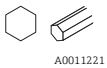
| Symbol | Meaning |
|---|---|
| DANGER | **DANGER!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury. |
| WARNING | **WARNING!**<br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in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

### 1.2.2 Electrical symbols

| Symbol | Meaning | Symbol | Meaning |
|---|---|---|---|
| ⎓ | Direct current | ~ | Alternating current |
| ⎓ ~ | Direct current and alternating current | ⏚ | **Ground connection**<br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
| ⏚ | **Protective ground connection**<br>A terminal which must be connected to ground prior to establishing any other connections. | ⏚ | **Equipotential connection**<br>A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice. |

### 1.2.3 Tool symbols

| Symbol | Meaning |
|---|---|
| <br>A0013442 | Torx screwdriver |
| <br>A0011220 | Flat blade screwdriver |

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

## 1.2.4 Symbols for certain types of information

| Symbol | Meaning |
|---|---|
|  | **Permitted**<br>Procedures, processes or actions that are permitted. |
|  | **Preferred**<br>Procedures, processes or actions that are preferred. |
|  | **Forbidden**<br>Procedures, processes or actions that are forbidden. |
|  | **Tip**<br>Indicates additional information. |
|  | Reference to documentation |
|  | Reference to page |
|  | Reference to graphic |
| 1., 2., 3. ... | Series of steps |
|  | Result of a sequence of actions |
|  | Help in the event of a problem |
|  | Visual inspection |

## 1.2.5 Symbols in graphics

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

### 1.2.6 Symbols at the device

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

## 1.3 Additional documentation

| Document | Purpose and content of the document |
|---|---|
| Technical Information<br>TI01041F (FMR53, FMR54) | **Planning aid for your device**<br>The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device. |
| Brief Operating Instructions<br>KA01101F (FMR53/FMR54, HART) | **Guide that takes you quickly to the 1st measured value**<br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning. |
| Description of Device Parameters<br>GP01014F (FMR5x, HART) | **Reference for your parameters**<br>The document provides a detailed explanation of each individual parameter in the operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations. |

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

### 1.3.1 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.

| | | | Feature 020 "Power Supply; Output" | | | | |
|---|---|---|---|---|---|---|---|
| **Feature 010** | **Approval** | **Available for** | **A** [1] | **B** [2] | **C** [3] | **E** [4]**/G** [5] | **K** [6]**/L** [7] |
| BA | ATEX: II 1 G Ex ia IIC T6-T1 Ga | ▪ FMR53<br>▪ FMR54 | XA00677F | XA01224F | XA001225 | XA00685F | - |
| BB | ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00677F | XA01224F | XA001225 | XA00685F | - |
| BC | ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00680F | XA00680F | XA01232F | XA00688F | XA01233F |
| BD | ATEX: II 1/2/3 G Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc | ▪ FMR53<br>▪ FMR54 | XA00678F | XA01226F | XA01227F | XA00686F | XA01228F |
| BG | ATEX: II 3 G Ex nA IIC T6-T1 Gc | ▪ FMR53<br>▪ FMR54 | XA00679F | XA01229F | XA01230F | XA00687F | XA01231F |
| BH | ATEX: II 3 G Ex ic IIC T6-T1 Gc | ▪ FMR53<br>▪ FMR54 | XA00679F | XA01229F | XA01230F | XA00687F | XA01231F |
| BL | ATEX: II 1/2/3 G Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc | ▪ FMR53<br>▪ FMR54 | XA00678F | XA01226F | XA01227F | XA00686F | XA01228F |

| | | | Feature 020 "Power Supply; Output" | | | | |
|---|---|---|---|---|---|---|---|
| **Feature 010** | **Approval** | **Available for** | **A** [1] | **B** [2] | **C** [3] | **E** [4]/**G** [5] | **K** [6]/**L** [7] |
| B2 | ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 D Ex ia IIIC Txx°C Da/Db | ▪ FMR53<br>▪ FMR54 | XA00683F | XA00683F | XA01235F | XA00691F | - |
| B3 | ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 D Ex ta IIIC Txx°C Da/Db | ▪ FMR53<br>▪ FMR54 | XA00684F | XA00684F | XA00684F | XA00692F | XA01236F |
| B4 | ATEX:II 1/2 G Ex ia IIC T6-T1 Ga/Gb<br>ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00681F | XA00681F | XA01234F | XA00689F | - |
| CB | CSA C/US XP Cl.I Div.1 Gr.A-D | FMR54 | XA01112F | XA01112F | XA01112F | XA01114F | - |
| CC | CSA C/US XP Cl.I Div.1 Gr.A-D | FMR54 | XA01113F | XA01113F | XA01113F | XA01115F | XA01113F |
| C2 | CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div. 2, Ex ia | ▪ FMR53<br>▪ FMR54 | XA01112F | XA01112F | XA01112F | XA01114F | - |
| C3 | CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d | ▪ FMR53<br>▪ FMR54 | XA01113F | XA01113F | XA01113F | XA01115F | XA01113F |
| FA | FM IS Cl.I Div.1 Gr.A-D | FMR54 | XA01116F | XA01116F | XA01116F | XA01118F | - |
| FB | FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2 | ▪ FMR53<br>▪ FMR54 | XA01116F | XA01116F | XA01116F | XA01118F | - |
| FC | FM XP Cl.I Div.1 Gr.A-D | FMR54 | XA01117F | XA01117F | XA01117F | XA01119F | XA01117F |
| FD | FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2 | ▪ FMR53<br>▪ FMR54 | XA01117F | XA01117F | XA01117F | XA01119F | XA01117F |
| IA | IECEx: Ex ia IIC T6-T1 Ga | ▪ FMR53<br>▪ FMR54 | XA00677F | XA01224F | XA001225 | XA00685F | - |
| IB | IECEx: Ex ia IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00677F | XA01224F | XA001225 | XA00685F | - |
| IC | IECEx: Ex d [ia] IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00680F | XA00680F | XA01232F | XA00688F | XA01233F |
| ID | IECEx: Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc | ▪ FMR53<br>▪ FMR54 | XA00678F | XA01226F | XA01227F | XA00686F | XA01228F |
| IG | IECEx: Ex nA IIC T6-T1 Gc | ▪ FMR53<br>▪ FMR54 | XA00679F | XA01229F | XA01230F | XA00687F | XA01231F |
| IH | IECEx: Ex ic IIC T6-T1 Gc | ▪ FMR53<br>▪ FMR54 | XA00679F | XA01229F | XA01230F | XA00687F | XA01231F |
| IL | IECEx: Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc | ▪ FMR53<br>▪ FMR54 | XA00678F | XA01226F | XA01227F | XA00686F | XA01228F |
| I2 | IECEx: Ex ia IIC T6-T1 Ga/Gb<br>IECEx: Ex ia IIIC Txx°C Da/Db | ▪ FMR53<br>▪ FMR54 | XA00683F | XA00683F | XA01235F | XA00691F | - |
| I3 | IECEx: Ex d [ia] IIC T6-T1 Ga/Gb<br>IEXEx: Ex ta IIIC Txx°C Da/Db | ▪ FMR53<br>▪ FMR54 | XA00684F | XA00684F | XA00684F | XA00692F | XA01236F |
| I4 | IECEx: Ex ia IIC T6-T1 Ga/Gb<br>IECEx: Ex d [ia] IIC T6-T1 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA00681F | XA00681F | XA01234F | XA00689F | - |
| KA | KC Ex ia IIC T6 Ga | ▪ FMR53<br>▪ FMR54 | XA01045F | XA01045F | XA01045F | XA01047F | - |
| KB | KC Ex ia IIC T6 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA01045F | XA01045F | XA01045F | XA01047F | - |
| KC | KC Ex d[ia] IIC T6 | ▪ FMR53<br>▪ FMR54 | XA01046F | XA01046F | XA01046F | XA01048F | XA01046F |
| MA | INMETRO: Ex ia IIC T6 Ga | ▪ FMR53<br>▪ FMR54 | XA01286F | XA01287F | XA01288F | XA01296F | - |
| MC | INMETRO: Ex d[ia] IIC T6 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA01292F | XA01292F | XA01293F | XA01298F | XA01294F |
| MH | INMETRO: Ex ic IIC T6 Gc | ▪ FMR53<br>▪ FMR54 | XA01289F | XA01290F | XA01291F | XA01297F | - |

| | | | Feature 020 "Power Supply; Output" | | | | |
|---|---|---|---|---|---|---|---|
| **Feature 010** | **Approval** | **Available for** | **A** [1] | **B** [2] | **C** [3] | **E** [4]/**G** [5] | **K** [6]/**L** [7] |
| NA | NEPSI Ex ia IIC T6 Ga | ▪ FMR53<br>▪ FMR54 | XA01199F | XA01199F | XA01199F | XA01208F | - |
| NB | NEPSI Ex ia IIC T6 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA01199F | XA01199F | XA01199F | XA01208F | - |
| NC | NEPSI Ex d[ia] IIC T6 Ga/Gb | ▪ FMR53<br>▪ FMR54 | XA01202F | XA01202F | XA01202F | XA01211F | XA01202F |
| NG | NEPSI Ex nA II T6 Gc | ▪ FMR53<br>▪ FMR54 | XA01201F | XA01201F | XA01201F | XA01210F | XA01201F |
| NH | NEPSI Ex ic IIC T6 Gc | ▪ FMR53<br>▪ FMR54 | XA01201F | XA01201F | XA01201F | XA01210F | XA01201F |
| N2 | NEPSI Ex ia IIC T6 Ga/Gb, Ex iaD 20/21 T85…90oC | ▪ FMR53<br>▪ FMR54 | XA01205F | XA01205F | XA01205F | XA01214F | - |
| N3 | NEPSI Ex d[ia] IIC T6 Ga/Gb, DIP A20/21 T85…90oC IP66 | ▪ FMR53<br>▪ FMR54 | XA01206F | XA01206F | XA01206F | XA01215F | XA01206F |
| 8A | FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G | ▪ FMR53<br>▪ FMR54 | ▪ XA01112F<br>▪ XA01113F<br>▪ XA01116F<br>▪ XA01117F | ▪ XA01112F<br>▪ XA01113F<br>▪ XA01116F<br>▪ XA01117F | ▪ XA01112F<br>▪ XA01113F<br>▪ XA01116F<br>▪ XA01117F | ▪ XA01114F<br>▪ XA01115F<br>▪ XA01118F<br>▪ XA01119F | - |

1) 2-wire; 4-20mA HART
2) 2-wire; 4-20mA HART, switch output
3) 2-wire; 4-20mA HART, 4-20mA
4) 2-wire; FOUNDATION Fieldbus, switch output
5) 2-wire; PROFIBUS PA, switch output
6) 4-wire 90-253VAC; 4-20mA HART
7) 4-wire 10.4-48VDC; 4-20mA HART

For certified devices the relevant Safety Instructions (XA) are indicated on the nameplate.

If the device is prepared for the remote display FHX50 (product structure: feature 030: Display, Operation", option L or M), the Ex marking of some certificates changes according to the following table [1]:

| Feature 010 ("Approval") | Feature 030 ("Display, Operation") | Ex marking |
|---|---|---|
| BG | L or M | ATEX II 3G Ex nA [ia Ga] IIC T6 Gc |
| BH | L or M | ATEX II 3G Ex ic [ia Ga] IIC T6 Gc |
| B3 | L or M | ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb,<br>ATEX II 1/2D Ex ta [ia Db] IIIC Txx°C Da/Db |
| IG | L or M | IECEx Ex nA [ia Ga] IIC T6 Gc |
| IH | L or M | IECEx Ex ic [ia Ga] IIC T6 Gc |
| I3 | L or M | IECEx Ex d [ia] IIC T6 Ga/Gb,<br>IECEx Ex ta [ia Db] IIIC Txx°C Da/Db |
| MH | L or M | Ex ic [ia Ga] IIC T6 Gc |
| NG | L or M | NEPSI Ex nA [ia Ga] IIC T6-T1 Gc |
| NH | L or M | NEPSI Ex ic [ia Ga] IIC T6-T1 Gc |
| N3 | L or M | NEPSI Ex d [ia] IIC T6-T1 Ga/Gb, DIP A20/21 [ia D] TA, Txx°C IP6X |

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

# 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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:
- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

## 2.2 Designated use

**Application and measured materials**
The measuring device described in these Operating Instructions is intended for the continuous, contactless level measurement of liquids, pastes and sludge. Because of its operating frequency of about 6 GHz, a maximum radiated pulsed power of 12.03 mW and an average power output of 0.024 mW, the operation is completely harmless to humans and animals.

Observing the limit values specified in the "Technical data" and listed in the Operating Instructions and supplementary documentation, the measuring device may be used for the following measurements only:
- Measured process variables: level, distance, signal strength
- Calculated process variables: Volume or mass in arbitrarily shaped vessels; flow through measuring weirs or flumes (calculated from the level by the linearization functionality)

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

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

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

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

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

## 2.3 Workplace safety

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

## 2.4 Operational safety

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

### Conversions to the device

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

### Repair

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

### Hazardous area

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

## 2.5 Product safety

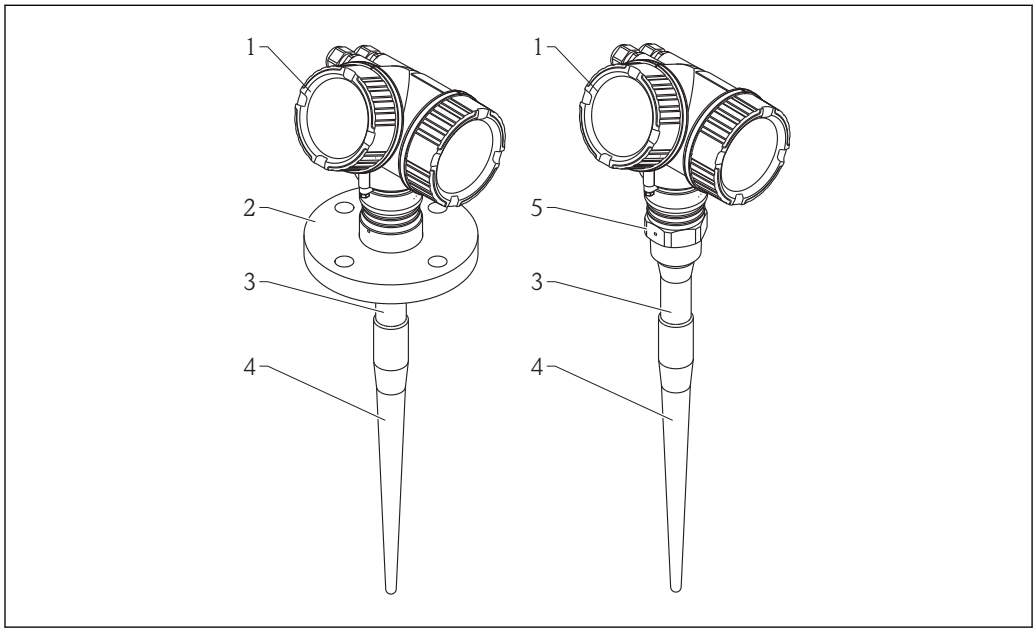
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

# 3 Product description

## 3.1 Product design

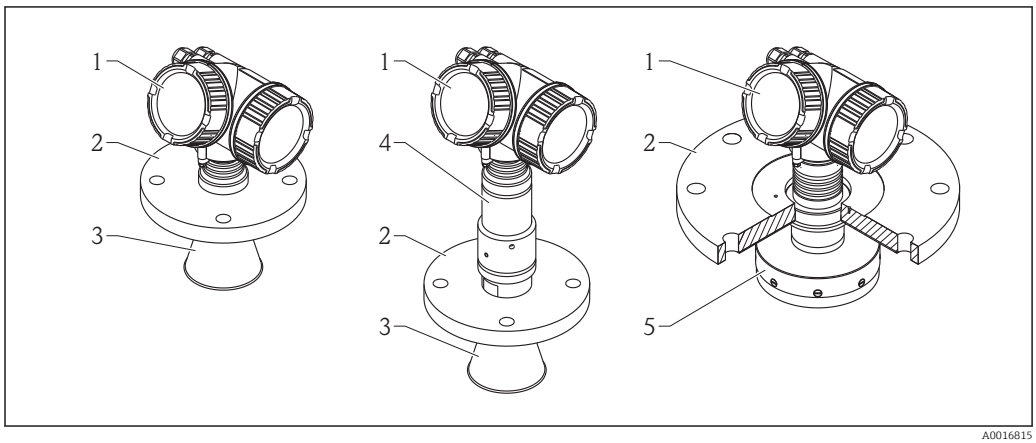
### 3.1.1 Micropilot FMR53




*1 Design of the Micropilot FMR53 (6 GHz)*

*1 Electronics housing*
*2 Flange*
*3 Inactive length*
*4 Active part of the antenna*
*5 Process connection (Thread)*

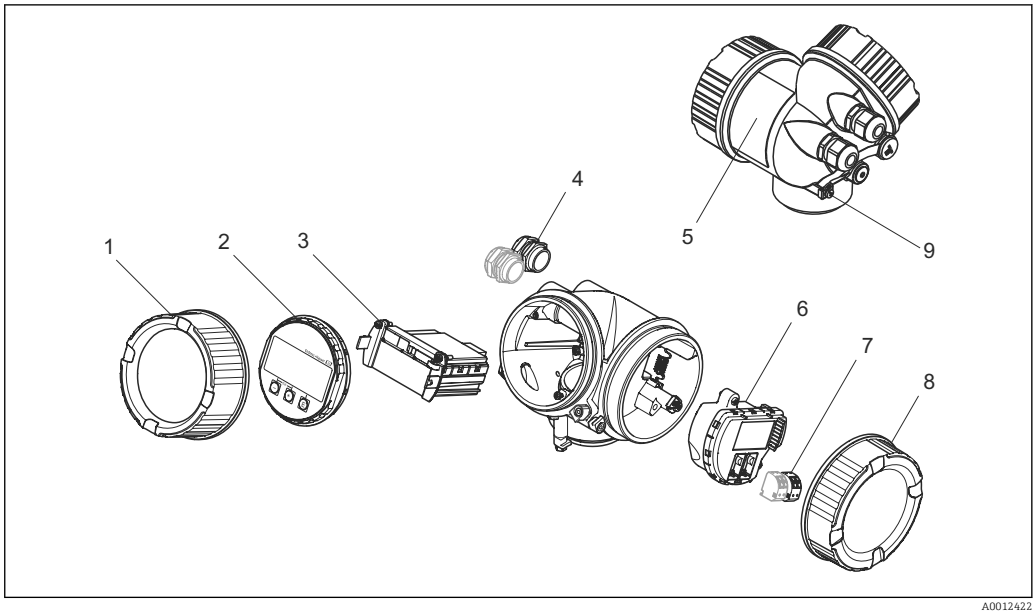
### 3.1.2 Micropilot FMR54




*2 Design of the Micropilot FMR54 (6 GHz)*

*1 Electronics housing*
*2 Flange*
*3 Horn antenna*
*4 High temperature antenna fitting*
*5 Planar antenna*

### 3.1.3 Electronics housing




*3 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*

## 3.2 Registered trademarks

**HART®**
Registered trademark of the HART Communication Foundation, Austin, USA

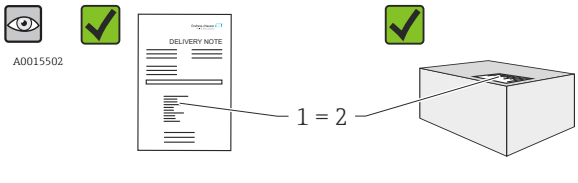
**KALREZ®, VITON®**
Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

**TEFLON®**
Registered trademark of E.I. DuPont de Nemours & Co., Wilmington, USA

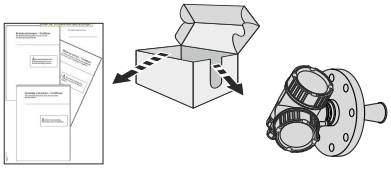
**TRI CLAMP®**
Registered trademark of Alfa Laval Inc., Kenosha, USA

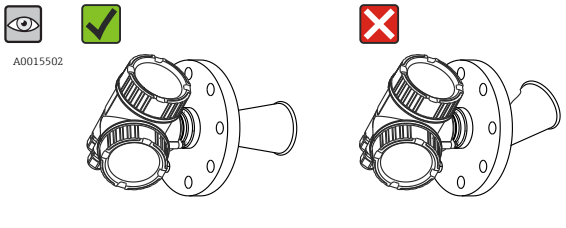
# 4 Incoming acceptance and product identification

## 4.1 Incoming acceptance

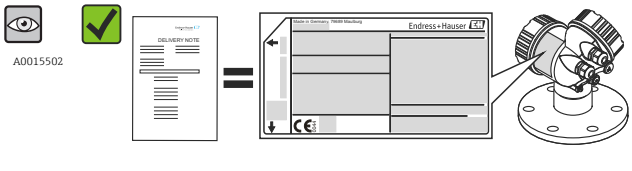



Are the order codes on the delivery note (1) and the product sticker (2) identical?

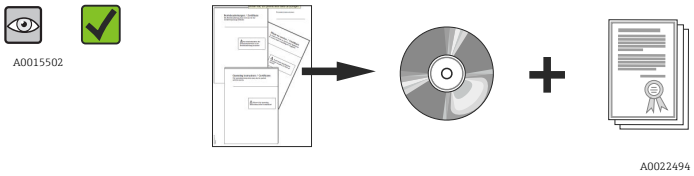



Are the goods undamaged?




Do the nameplate data match the ordering information on the delivery note?




Is the DVD with the operating tool present?
If required (see nameplate): Are the Safety Instructions (XA) present?

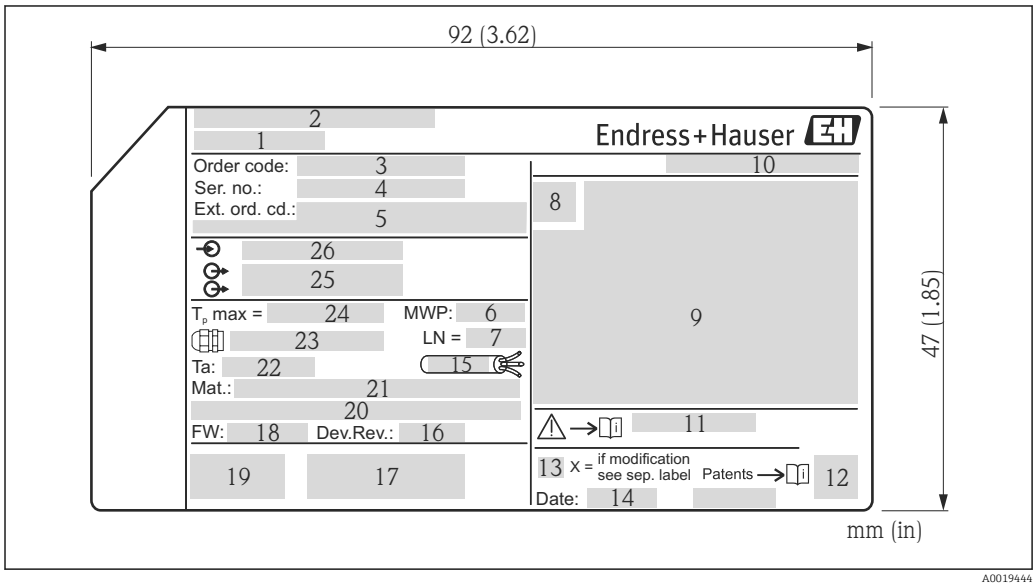
If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

## 4.2 Product identification

The following options are available for identification of the measuring device:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* ( www.endress.com/deviceviewer ): All information about the measuring device is displayed.
- Enter the serial number from the nameplates 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 for the measuring device is displayed.

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

### 4.2.1 Nameplate




4 *Nameplate of the Micropilot*

1 *Device name*
2 *Address of manufacturer*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Process pressure*
7 *Antenna length (only for FMR51 with antenna extension)*
8 *Certificate symbol*
9 *Certificate and approval relevant data*
10 *Degree of protection: e.g. IP, NEMA*
11 *Document number of the Safety Instructions: e.g. XA, ZD, ZE*
12 *Data Matrix Code*
13 *Modification mark*
14 *Manufacturing date: year-month*
15 *Temperature resistance of the cable*
16 *Geräterevision (Dev.Rev.)*
17 *Additional information about the device version (certificates, approvals, communication): e.g. SIL, PROFIBUS*
18 *Firmware version (FW)*
19 *CE mark, C-Tick*
20 *Profibus PA: Profil-Version; FOUNDATION Fieldbus: Device ID*
21 *Material in contact with process*
22 *Permitted ambient temperature ($T_a$)*
23 *Size of the thread of the cable glands*
24 *Maximum process temperature*
25 *Signal outputs*
26 *Operating voltage*

Only 33 digits of the extended order code can be indicated on the nameplate. If the extended order code exceeds 33 digits, the rest will not be shown. However, the complete extended order code can be viewed in the operating menu of the device: **Extended order code 1 to 3** parameter

# 5 Storage, Transport

## 5.1 Storage conditions

- Permitted storage temperature: −40 to +80 °C (−40 to +176 °F)
- Use the original packaging.

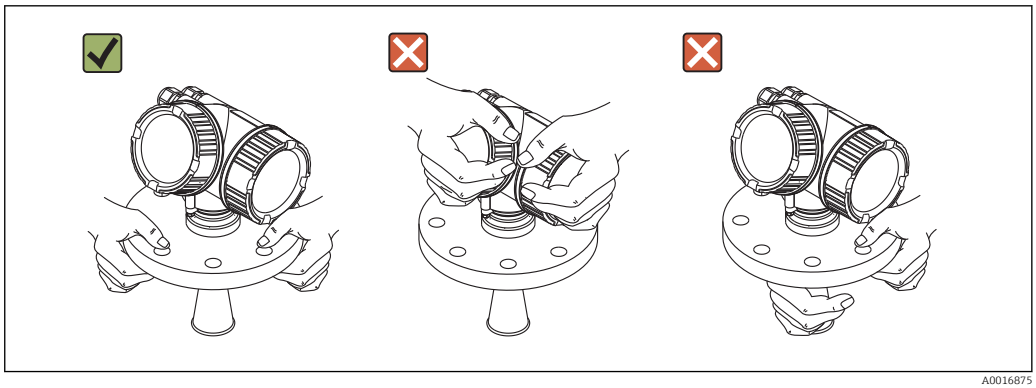
## 5.2 Transport product to the measuring point

NOTICE

**Housing or antenna horn may be damaged or break away.**

Risk of injury!

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

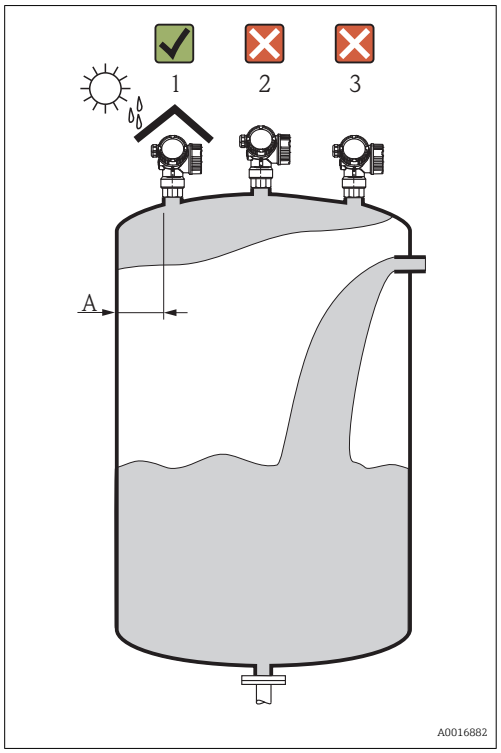


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# 6 Installation

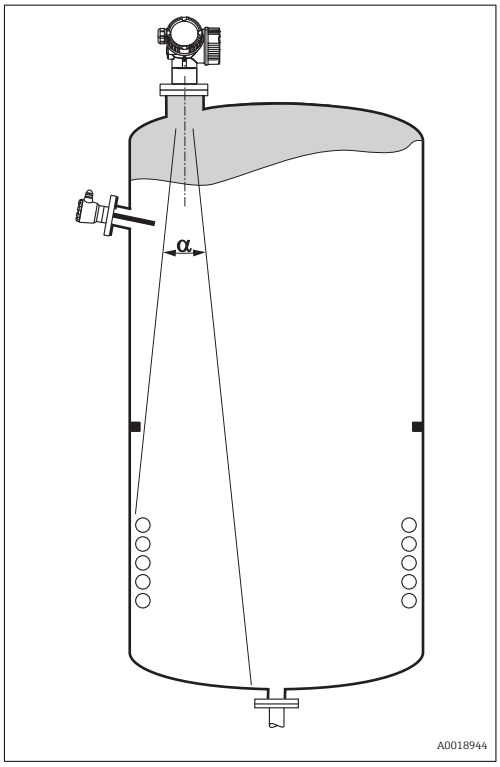
## 6.1 Installation conditions

### 6.1.1 Mounting position



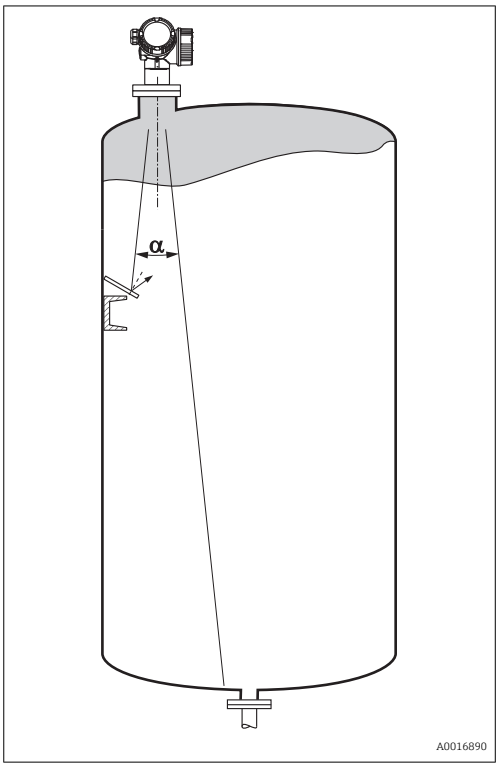

- Recommended distance **A** from wall to outer edge of nozzle: ~ 1/6 of tank diameter.
  Nevertheless the device should not be installed closer than 30 cm (11.8 in) to the tank wall.
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended to us a weather protection cover (1) in order to protect the device from direct sun or rain.

### 6.1.2 Vessel installations




Avoid any installations (point level switches, temperature sensors, braces, vacuum rings, heating coils, baffles etc.) inside the signal beam. Take into account the beam angle → 📄 21.

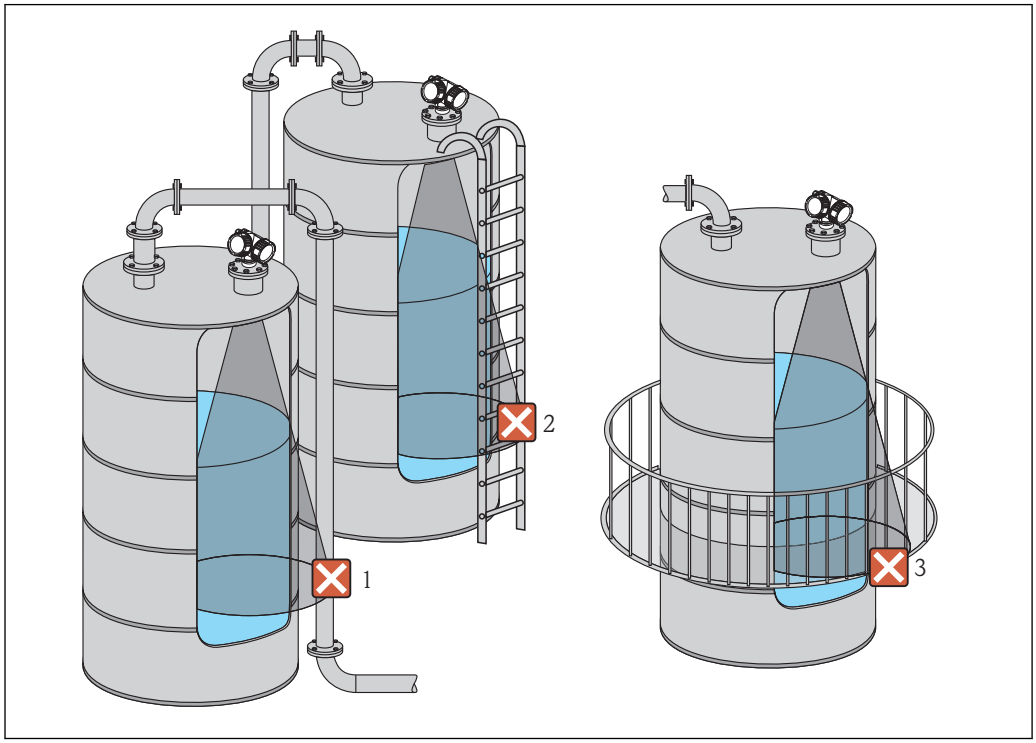
### 6.1.3 Reduction of interference echoes




Metallic screens mounted at a slope spread the radar signal and can, therefore, reduce interference echoes.

### 6.1.4 Measurement in a plastic vessel

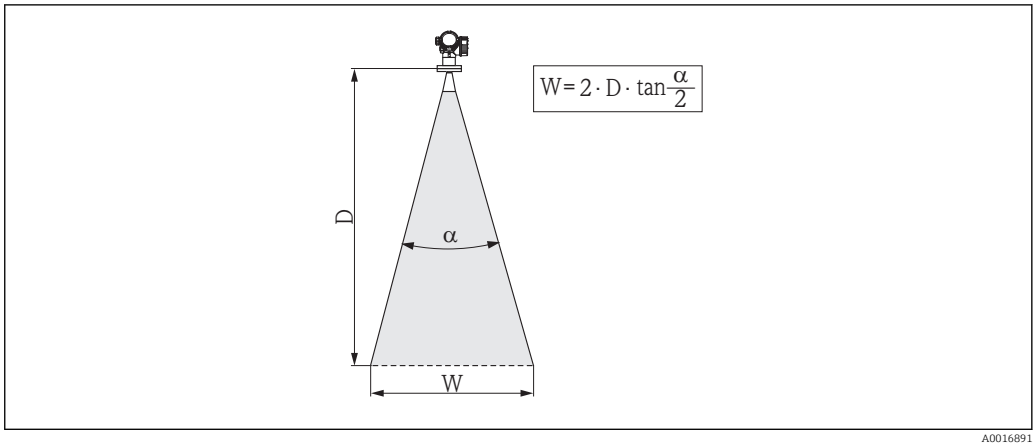
If the outer wall of the vessel is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the signal beam (e.g. metallic pipes (1), ladders (2), grates (3), ...). Therefore, there should be no such interfering installations in the signal beam. Please contact Endress+Hauser for further information.




### 6.1.5 Optimization options

- Antenna size
  The bigger the antenna, the smaller the beam angle α and the fewer interference echoes → 🖹 21.
- Mapping
  The measurement can be optimized by means of electronic suppression of interference echoes.
  See the **Confirm distance** parameter (→ 🖹 107) for details.
- Antenna alignment
  Take into account the marker on the flange or threaded connection → 🖹 24 → 🖹 25 .
- Stilling well
  A stilling well can be applied to avoid interferences → 🖹 27.
- Metallic screens mounted at a slope
  They spread the radar signals and can, therefore, reduce interference echoes.

### 6.1.6 Beam angle




*5 Relationship between beam angle α, distance D and beamwidth diameter W*

The beam angle is defined as the angle α where the energy density of the radar waves reaches half the value of the maximum energy density (3-dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations.

Beam diameter **W** as a function of beam angle **α** and measuring distance **D**:

| **FMR53** | |
|---|---|
| **Beam angle α** | 23° |
| | |
| **Measuring distance (D)** | **Beamwidth diameter W** |
| 3 m (9.8 ft) | 1.22 m (4 ft) |
| 6 m (20 ft) | 2.44 m (8 ft) |
| 9 m (30 ft) | 3.66 m (12 ft) |
| 12 m (39 ft) | 4.88 m (16 ft) |
| 15 m (49 ft) | 6.1 m (20 ft) |
| 20 m (66 ft) | 8.14 m (27 ft) |

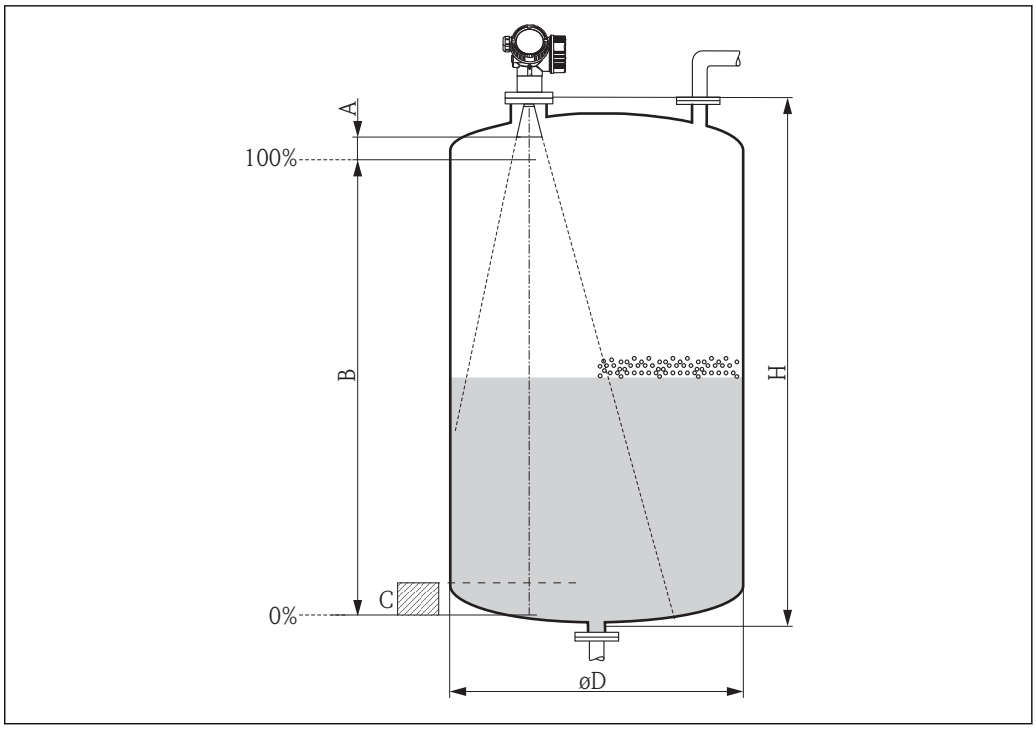
| **FMR54 - Horn antenna** | | | |
|---|---|---|---|
| **Antenna size** | 150 mm (6 in) | 200 mm (8 in) | 250 mm (10 in) |
| **Beam angle α** | 23° | 19° | 15° |
| | | | |
| **Distance (D)** | **Beamwidth diameter W** | | |
| 3 m (9.8 ft) | 1.22 m (4 ft) | 1 m (3.3 ft) | 0.79 m (2.6 ft) |
| 6 m (20 ft) | 2.44 m (8 ft) | 2.01 m (6.6 ft) | 1.58 m (5.2 ft) |
| 9 m (30 ft) | 3.66 m (12 ft) | 3.01 m (9.9 ft) | 2.37 m (7.8 ft) |
| 12 m (39 ft) | 4.88 m (16 ft) | 4.02 m (13 ft) | 3.16 m (10 ft) |
| 15 m (49 ft) | 6.1 m (20 ft) | 5.02 m (16 ft) | 3.95 m (13 ft) |
| 20 m (66 ft) | 8.14 m (27 ft) | 6.69 m (22 ft) | 5.27 m (17 ft) |

## 6.2 Measuring conditions

- In case of **boiling surfaces**, **bubbling** or tendency for **foaming** use FMR53 or FMR54. Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions. For FMR50, FMR51 and FMR52, the additional option "Advanced dynamics" is recommended in these cases (feature 540: "Application Package", option EM).
- In case of heavy **steam development** or **condensate**, the maximum measuring range of FMR50, FMR51 and FMR52 may decrease depending on density, temperature and composition of the steam → use FMR53 or FMR54.
- For the measurement of absorbing gases such as **ammonia $NH_3$** or some **fluorocarbons** [2], please use Levelflex or Micropilot FMR54 in a stilling well.
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- For stilling well applications, the zero should be positioned at the end of the tube, as the electromagnetic waves do not propagate completely outside the tube. It must be taken into account that the accuracy may be reduced in the area **C**. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the end of the tube (see figure).
- In case of media with a low dielectric constant ($\varepsilon_r$ = 1.5 to 4) [3] the tank bottom can be visible through the medium at low levels (low height **C**). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance **C** (see figure) above the tank bottom in these applications.
- In principle it is possible to measure up to the tip of the antenna with FMR51, FMR53 and FMR54. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than **A** (see figure) to the tip of the antenna.
- When using FMR54 with planar antenna, especially for media with low dielectric constants, the end of the measuring range should not be closer than **A: 1 m (3.28 ft)** to the flange.
- The smallest possible measuring range **B** depends on the antenna version (see figure).
- The tank height should be at least **H** (see table).

2) Affected compounds are e.g. R134a, R227, Dymel 152a.

3) Dielectric constants of important media commonly used in various industries are summarized in the DC manual (CP01076F) and in the Endress +Hauser "DC Values App" (available for Android and iOS).




A0018872

| Device | A | B | C | H |
|---|---|---|---|---|
| FMR53 | 50 mm (1.97 in) | > 0.5 m (1.6 ft) | 150 to 300 mm (5.91 to 11.8 in) | > 1.5 m (4.9 ft) |
| FMR54 - horn antenna | 50 mm (1.97 in) | | | |
| FMR54 - planar antenna | 1 m (3.28 ft) | | | |

## 6.3 Mounting cladded flanges

For cladded flanges of FMR53, observe the following:
- Use flange screws according to the number of flange holes.
- Tighten the screws with the required torque (see table).
- Retighten the screws after 24 hours or after the first temperature cycle.
- Depending on process pressure and process temperature check and retighten the screws at regular intervals.

| Flange size | Number of screws | Recommended torque [Nm] | |
|---|---|---|---|
| | | minimum | maximum |
| **EN** | | | |
| DN50/PN16 | 4 | 45 | 65 |
| DN80/PN16 | 8 | 40 | 55 |
| DN100/PN16 | 8 | 40 | 60 |
| DN150/PN16 | 8 | 75 | 115 |
| **ASME** | | | |
| 2"/150lbs | 4 | 40 | 55 |
| 3"/150lbs | 4 | 65 | 95 |
| 4"/150lbs | 8 | 45 | 70 |
| 6"/150lbs | 8 | 85 | 125 |

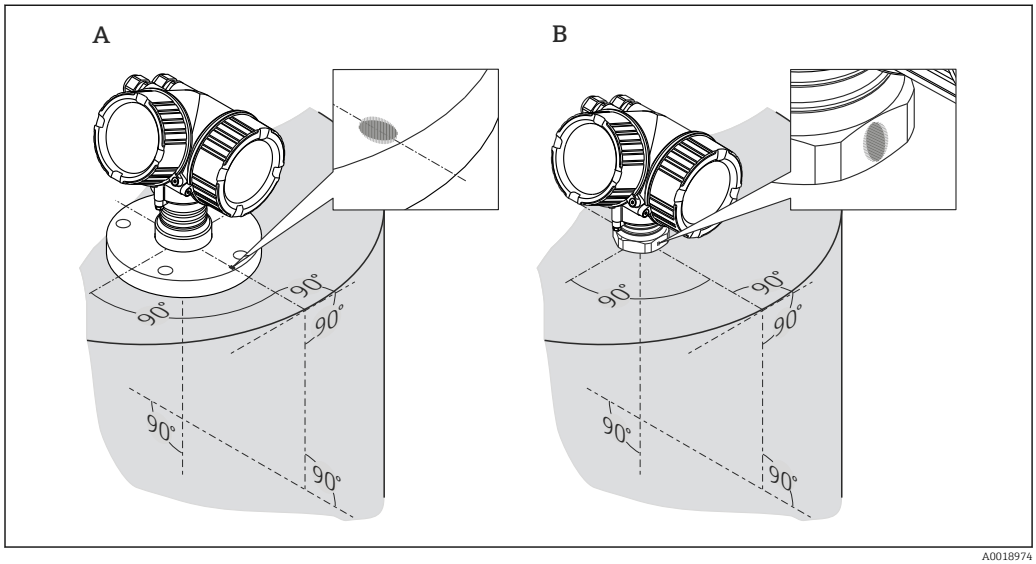
| Flange size | Number of screws | Recommended torque [Nm] | |
|---|---|---|---|
| | | minimum | maximum |
| JIS | | | |
| 10K 50A | 4 | 40 | 60 |
| 10K 80A | 8 | 25 | 35 |
| 10K 100A | 8 | 35 | 55 |
| 10K 100A | 8 | 75 | 115 |

## 6.4 Installation in vessel (free space)

### 6.4.1 Rod antenna (FMR53)

#### Alignment

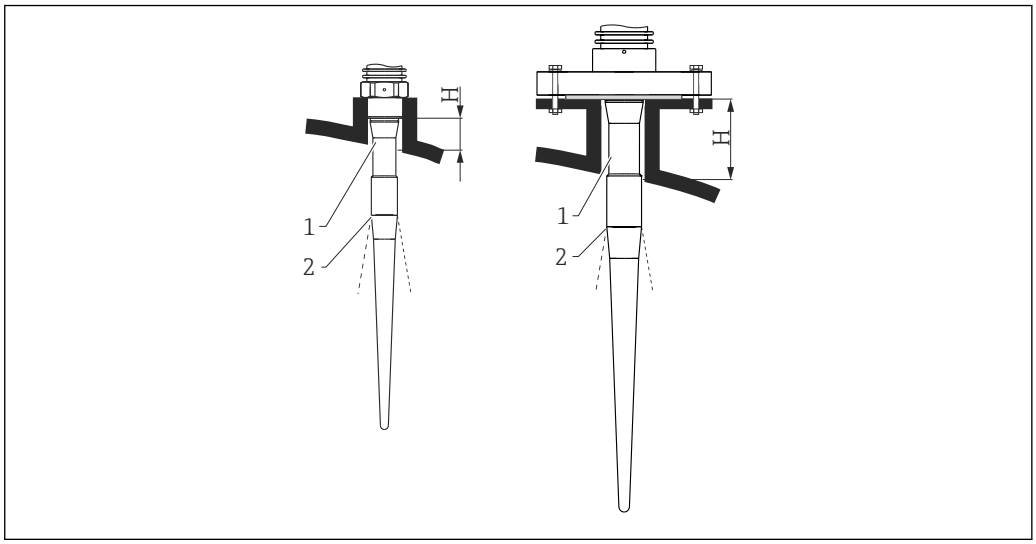
- Align the antenna vertically to the product surface.
- A marking at the flange (somwhere between the flange holes) or the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.




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Depending on the device version the marking may be a circle or two short parallel lines.

### Nozzle mounting




6 *Nozzle height an diameter for the rod antenna (FMR53)*

*1 Inactive lengthof the antenna*
*2 Beam launched here*

| | | |
|---|---|---|
| **Antenna length** | 390 mm (15.4 in) | 540 mm (21.3 in) |
| **Nozzle height H** | < 100 mm (3.94 in) | < 250 mm (9.84 in) |

The inactive part (1) of the rod antenna must extend below the nozzle.

- For flanges with PTFE cladding: Observe the notes on the mounting of cladded flanges → 23.
- Usually, the PTFE flange cladding also serves as a seal between the nozzle and the device flange.

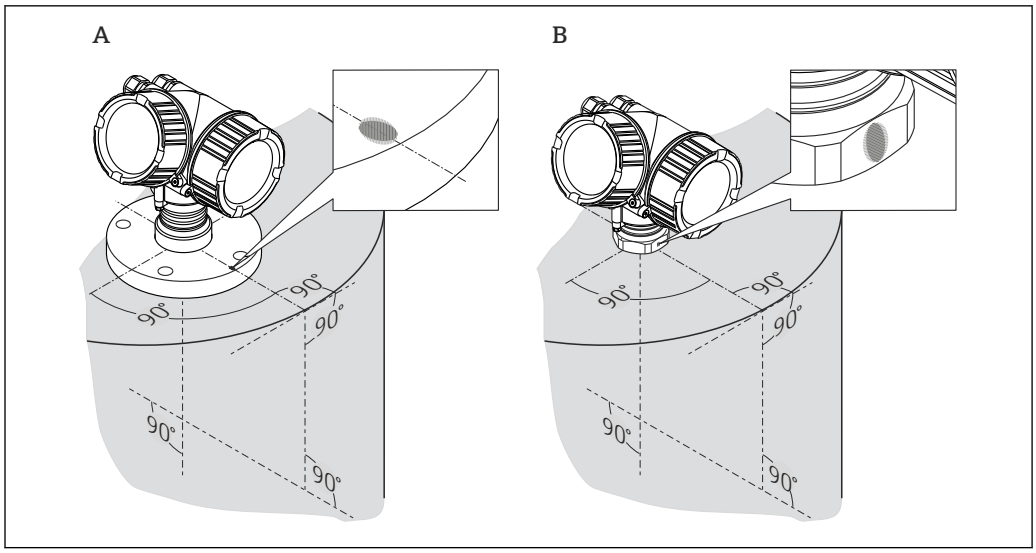
### Threaded connection

- Tighten with the hexagonal nut only.
- Tool : 55 mm hexagonal wrench
- Maximum permissible torque:
  - Thread PVDF: 35 Nm (26 lbf ft)
  - Thread 316L: 60 Nm (44 lbf ft)

## 6.4.2 Horn antenna (FMR54)

### Alignment

- Align the antenna vertically to the product surface.
- A marking at the flange (somwhere between the flange holes) enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.

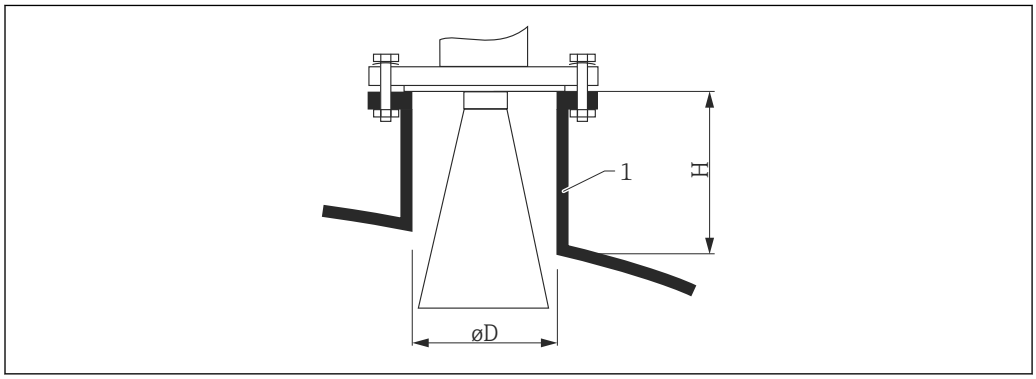



A0018974

Depending on the device version the marking may be a circle or two short parallel lines.

### Nozzle mounting

The horn antenna must extend below the nozzle; if necessary select the device version with antenna extension 100 to 400 mm (4 to 16 in) [4].




A0016822

7 *Nozzle height and diameter for the horn antenna (FMR54)*

*1 Mounting nozzle*

| Antenna [1] | Nozzle diameter *D* | Maximum nozzle height $H_{max}$ [2] |
|---|---|---|
| BE: 150mm/6" | 146 mm (5.75 in) | 205 mm (8.07 in) |
| BF: 200mm/8" | 191 mm (7.52 in) | 290 mm (11.4 in) |
| BG: 250mm/10" | 241 mm (9.49 in) | 380 mm (15 in) |

1) Feature 070 of the product structure; the antenna versions BC (Horn 80mm/3") and BD (Horn 100mm/4") should not be mounted directly into the tank. They are only suited for bypass and stilling well applications.
2) valid for antennas without antenna extension

4) See product structure: feature 610 "Accessory Mounted", options OM, ON, OR, OS.

**Measurement from the outside through plastic walls**

- Dielectric constant of the medium: $\varepsilon_r > 10$
- If possible use the 250 mm (10 in) antenna.
- The distance between the lower edge of the antenna and the tank should be about 100 mm (4 in).
- If possible, avoid mounting location where condensation or build-up might occur.
- In case of outdoor mounting, the space between antenna and vessel has to be protected from the elements.
- Do not mount any potential reflectors (e.g. pipes) outside the tank in the signal beam.

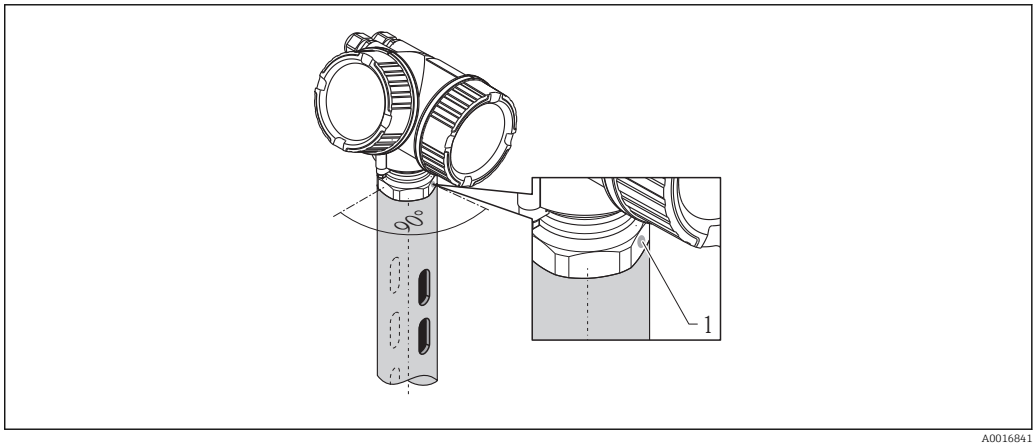
*Suitable thickness of the tank ceiling*

| Penetrated material | PE | PTFE | PP | Plexiglas |
|---|---|---|---|---|
| DK / $\varepsilon_r$ | 2.3 | 2.1 | 2.3 | 3.1 |
| Optimum thickness | 16 mm (0.65 in) | 17 mm (0.68 in) | 16 mm (0.65 in) | 14 mm (0.56 in) |

### 6.4.3 Planar antenna (FMR54)

The planar antenna is only suited for stilling well applications → 27. It can not be used for free space applications.

## 6.5 Installation in stilling well




A0016841

8 *Installation in stilling well*

1 *Marking for antenna alignment*

- For horn antenna: Align the marking towards the slots of the stilling well.
- No alignment is required for planar antennas.
- Measurements can be performed through an open full bore ball valve without any problems.
- After mounting, the housing can be turned 350° in order to facilitate access to the display and the terminal compartment → 32.

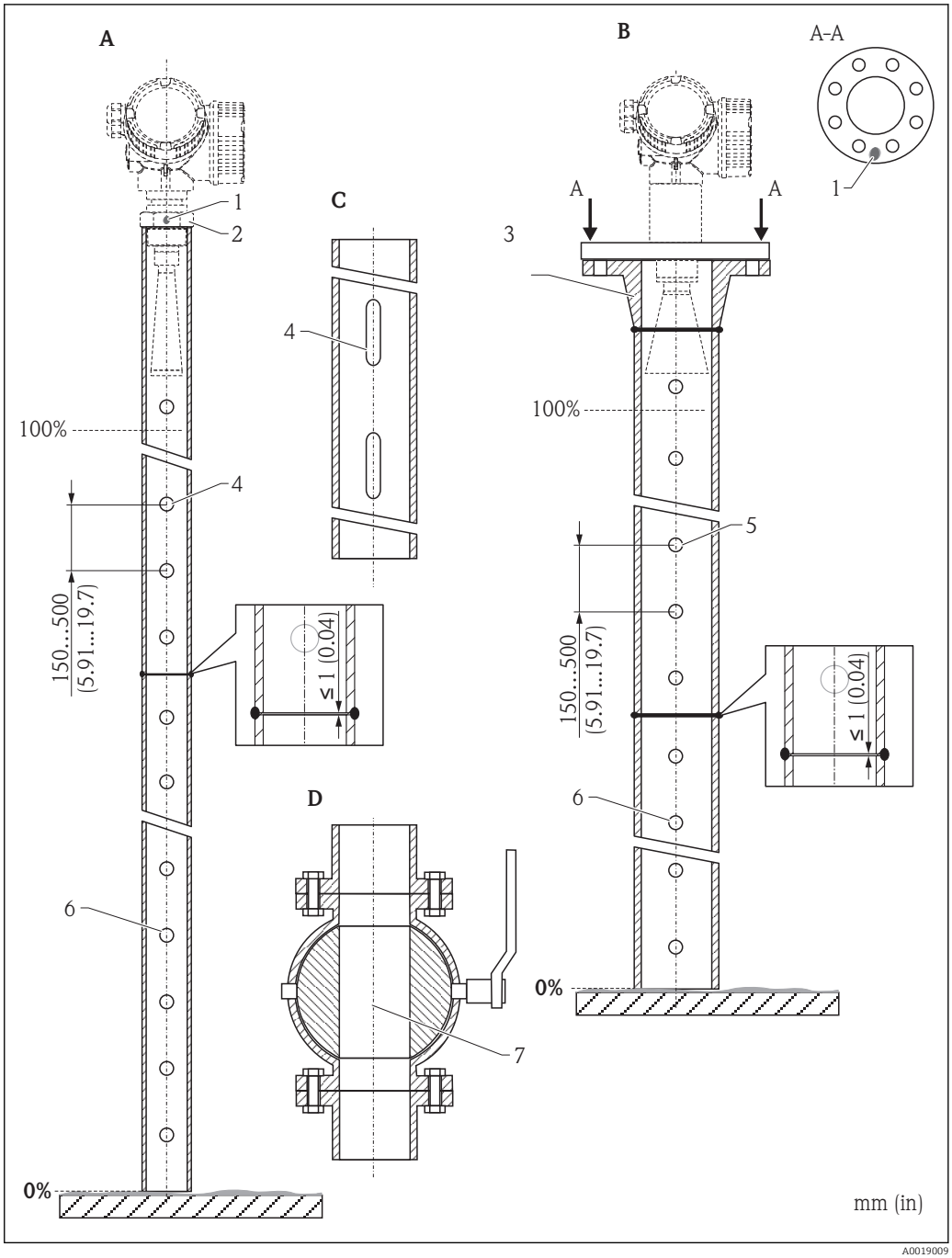
### 6.5.1 Recommendations for the stilling well

- Metal (no enamel coating; plastic on request).
- Constant diameter.
- Diameter of stilling well not larger than antenna diameter.
- Diameter difference between horn antenna and inner diameter of the stilling well as small as possible.
- Weld seam as smooth as possible and on the same axis as the slots.
- Slots offset 180° (not 90°).

- Slot width or diameter of holes max. 1/10 of pipe diameter, de-burred. Length and number do not have any influence on the measurement.
- Select horn antenna as big as possible. For intermedaite sizes (e.g. 180 mm (7 in)) select next larger antenna and adapt it mechanically (for horn antennas)
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be left exceeding 1 mm (0.04 in).
- The stilling well must be smooth on the inside (average roughness $R_z \leq$ 6.3 µm (248 µin)). Use extruded or parallel welded metal pipe. An extension of the pipe is possible with welded flanges or pipe sleeves. Flange and pipe have to be properly aligned at the inside.
- Do not weld through the pipe wall. The inside of the stilling well must remain smooth. In case of unintentional welding through the pipe, the weld seam and any unevenness on the inside need to be carefully removed and smoothened. Otherwise, strong interference echoes will be generated and material build-up will be promoted.
- In the case of smaller nominal widths flanges must be welded to the pipe such that they allow for a correct orientation (marker aligned toward slots).

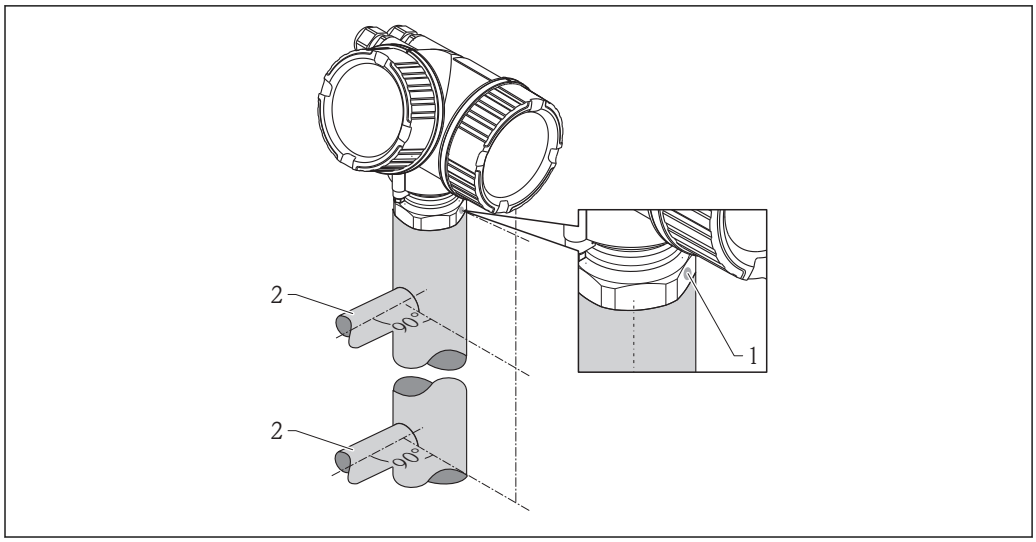
The performance of Micropilot FMR54 with planar antenna is not dependent on the alignment or geometry of standard stilling wells. No special alignment is required. However, make sure that the planar antenna is installed vertically relative to the stilling well axis.

## 6.5.2 Examples for the construction of stilling wells




*A Micropilot FMR50/FMR51: Horn 40mm(1½")*
*B Micropilot FMR50/FMR51/FMR52/FMR54: Horn 80mm(3")*
*C Stilling well with slots*
*D Full bore ball valve*
*1 Marking for axial alignment*
*2 Threaded connection*
*3 e.g. welding neck flange DIN2633*
*4 Φ hole max. 1/10 Φ stilling well*
*5 Φ hole max. 1/10 Φ stilling well; single sided or drilled through*
*6 Inside of holes deburred*
*7 Diameter of opening of ball valve must always be equivalent to pipe diameter; avoid edges and constrictions.*

## 6.6 Installation in bypass




*9 Installation in bypass*

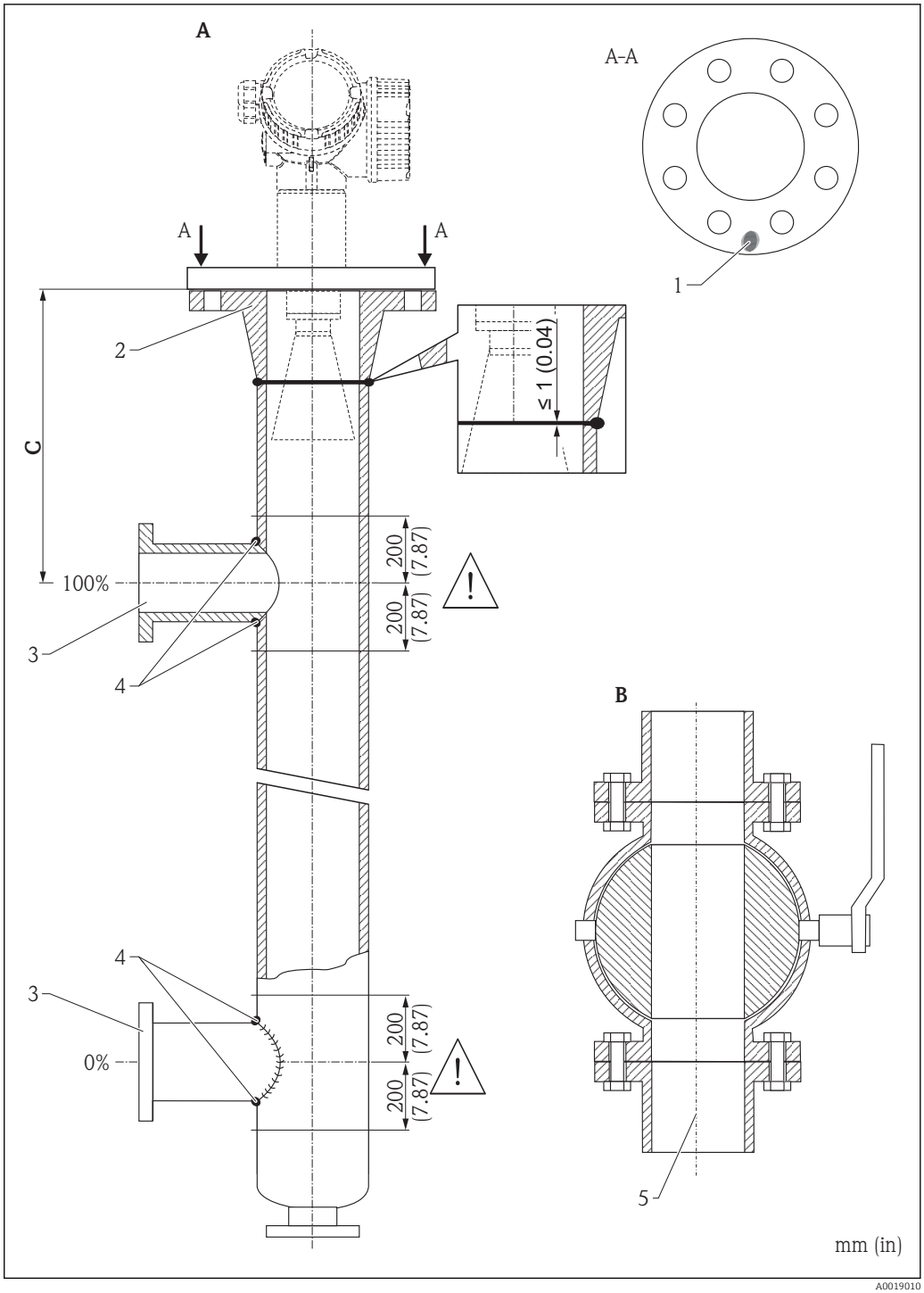
*1 Marking for antenna alignment*
*2 Tank connectors*

- Alighn the marker perpendicular (90°) to the tank connectors.
- Measurements can be performed through an open full bore ball valve without any problems.
- After mounting, the housing can be turned 350° in order to facilitate access to the display and the terminal compartment → 32.

### 6.6.1 Recommendations for the bypass pipe

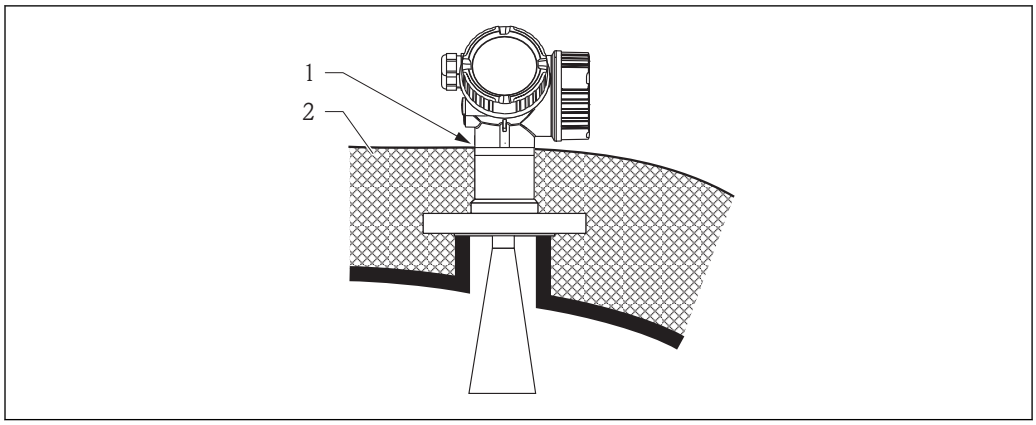
- Metal (no plastic or enamel coating).
- Constant diameter.
- Select horn antenna as big as possible. For intermediate sizes (e.g. 95 mm (3.5 in)) select next larger antenna and adapt it mechanically (for horn antennas).
- Diameter difference between horn antenna and inner diameter of the bypass as small as possible.
- At any transition (i.e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04 in).
- In the area of the tank connections (~ ±20 cm (7.87 in)) a reduced accuracy of the measurement has to be expected.

### 6.6.2 Example for the construction of a bypass




*A Micropilot FMR50/FMR51/FMR52/FMR54: Horn 80mm(3")*
*B Full bore ball valve*
*C Minimum distance to upper connection pipe: 400 mm (15,7 in)*
*1 Marking for axial alignment*
*2 e.g. welding neck flange DIN2633*
*3 Diameter of the connection pipes as small as possible*
*4 Do not weld through the pipe wall; the inside of the bypass must remain smooth.*
*5 Diameter of opening of ball valve must always be equivalent to pipe diameter. Avoid edges and constrictions.*

## 6.7 Vessels with heat insulation

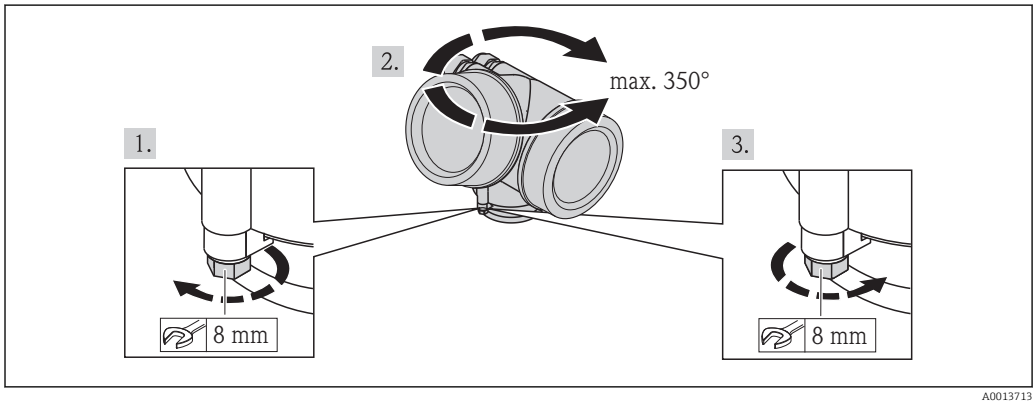



A0019142

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

## 6.8 Turning the transmitter housing

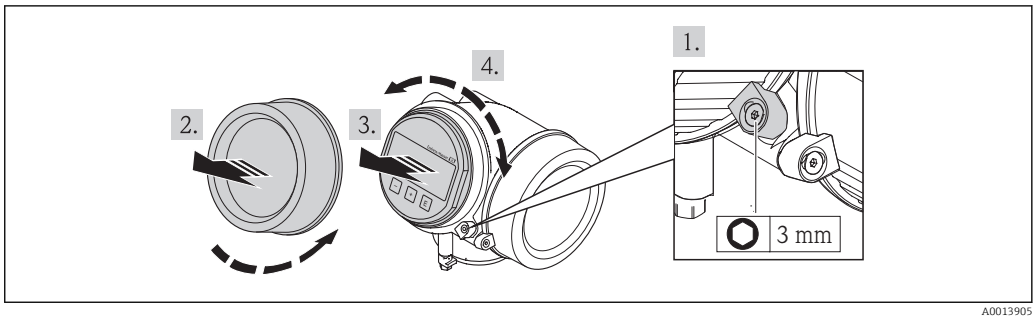
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:




A0013713

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 plastics housing; 2,5 Nm for aluminium or stainless steel housing).

## 6.9 Turning the display module




A0013905

1. If present: Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key and turn the clamp 90° conterclockwise.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Pull out the display module with a gentle rotation movement.
4. Rotate the display module into the desired position: Max. 8 × 45 ° in each direction.
5. Feed the spiral cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.
6. Screw the cover of the electronics compartment firmly back onto the transmitter housing.
7. Tighten the securing clamp again using the Allen key (Torque: 2.5 Nm).

## 6.10 Post-installation check

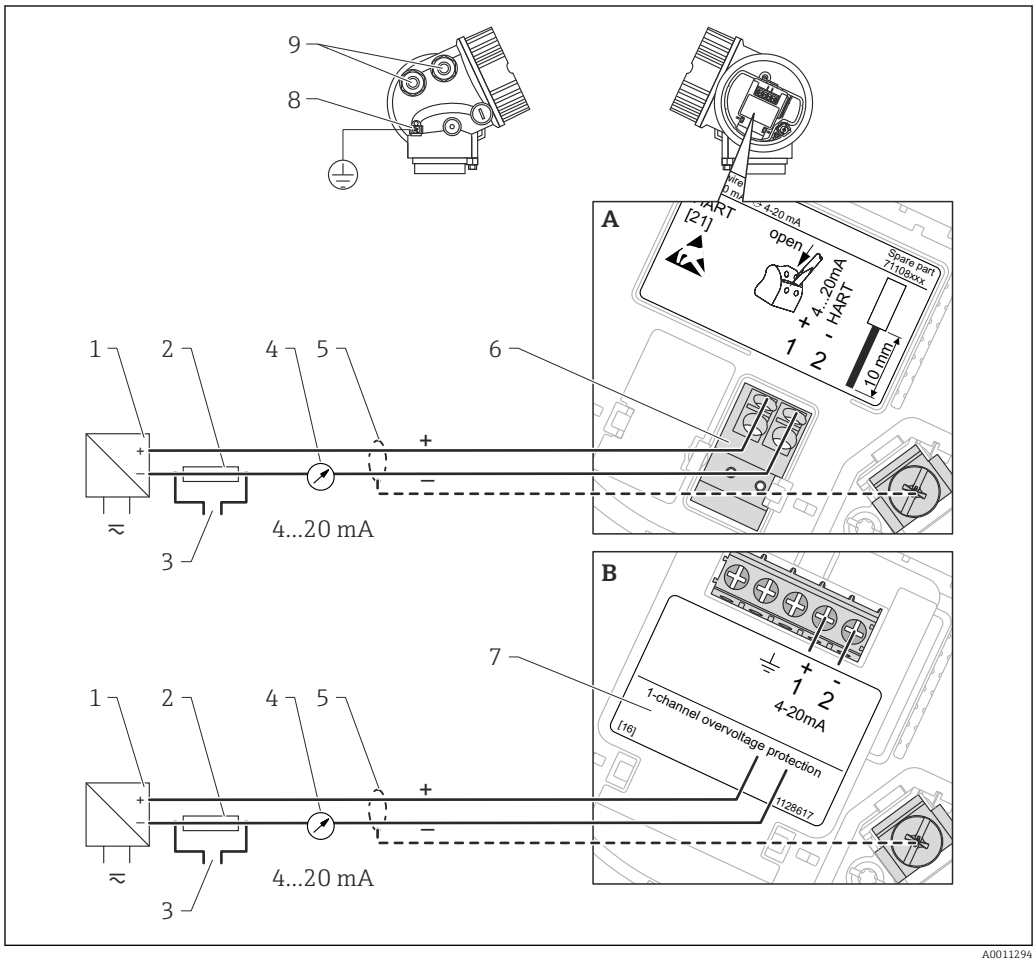
| | |
|---|---|
| ❍ | Is the device undamaged (visual inspection)? |
| ❍ | Does the device conform to the measuring point specifications?<br>For example:<br>▪ Process temperature<br>▪ Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document)<br>▪ Ambient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

# 7 Electrical connection

## 7.1 Connection conditions

### 7.1.1 Terminal assignment

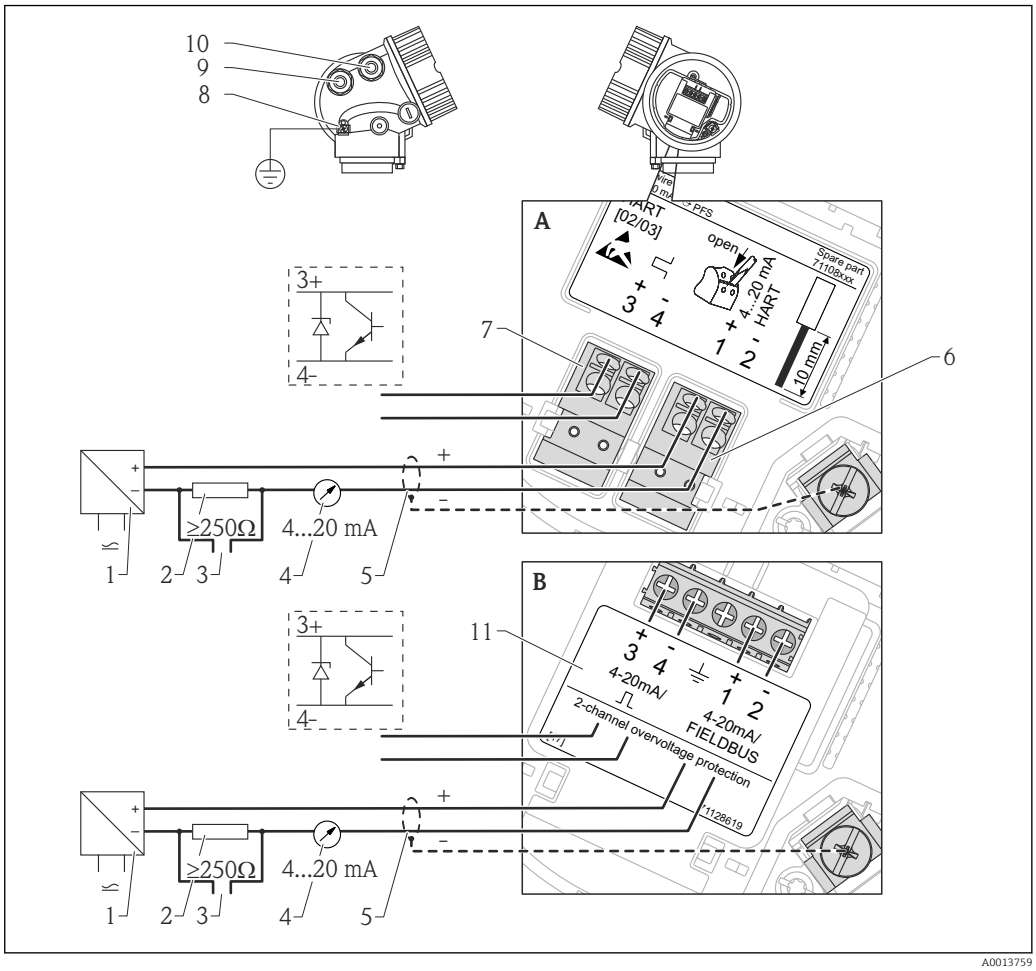
**2-wire: 4-20mA HART**




*10 Terminal assignment 2-wire; 4-20mA HART*

*A Without integrated overvoltage protection*
*B With integrated overvoltage protection*
*1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage*
*2 HART communication resistor (≥250 Ω): Observe maximum load*
*3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
*4 Analog display device: Observe maximum load*
*5 Cable screen; observe cable specification*
*6 4-20mA HART (passive): Terminals 1 and 2*
*7 Overvoltage protection module*
*8 Terminal for potential equalization line*
*9 Cable entry*

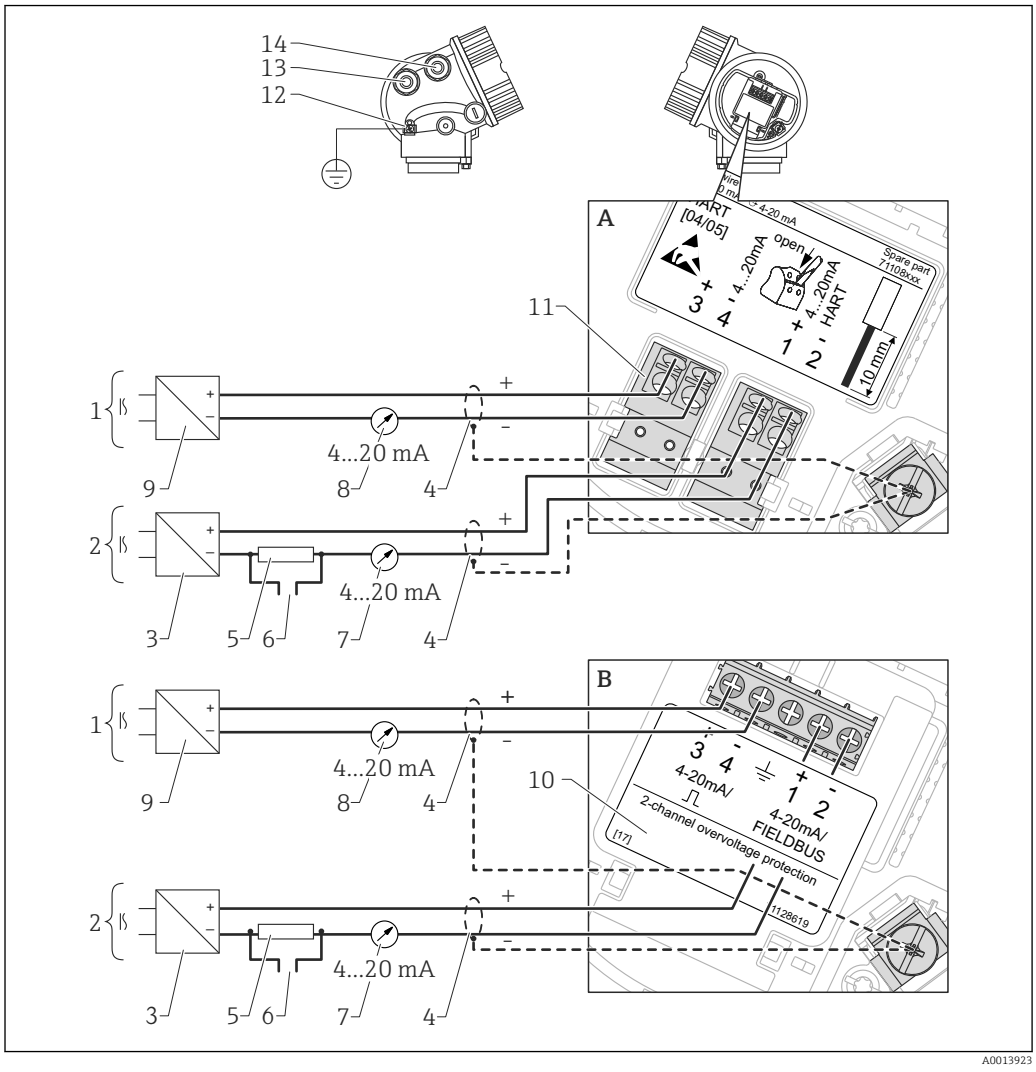
### 2-wire: 4-20mA HART, switch output




*11 Terminal assignment 2-wire; 4-20mA HART, switch output*

*A Without integrated overvoltage protection*
*B With integrated overvoltage protection*
*1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage*
*2 HART communication resistor (≥250 Ω): Observe maximum load*
*3 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
*4 Analog display device: Observe maximum load*
*5 Cable screen; observe cable specification*
*6 4-20mA HART (passive): Terminals 1 and 2*
*7 Switch output (open collector): Terminals 3 and 4*
*8 Terminal for potential equalization line*
*9 Cable entry for 4-20mA HART line*
*10 Cable entry for switch output line*
*11 Overvoltage protection module*

### 2-wire: 4-20mA HART, 4-20mA

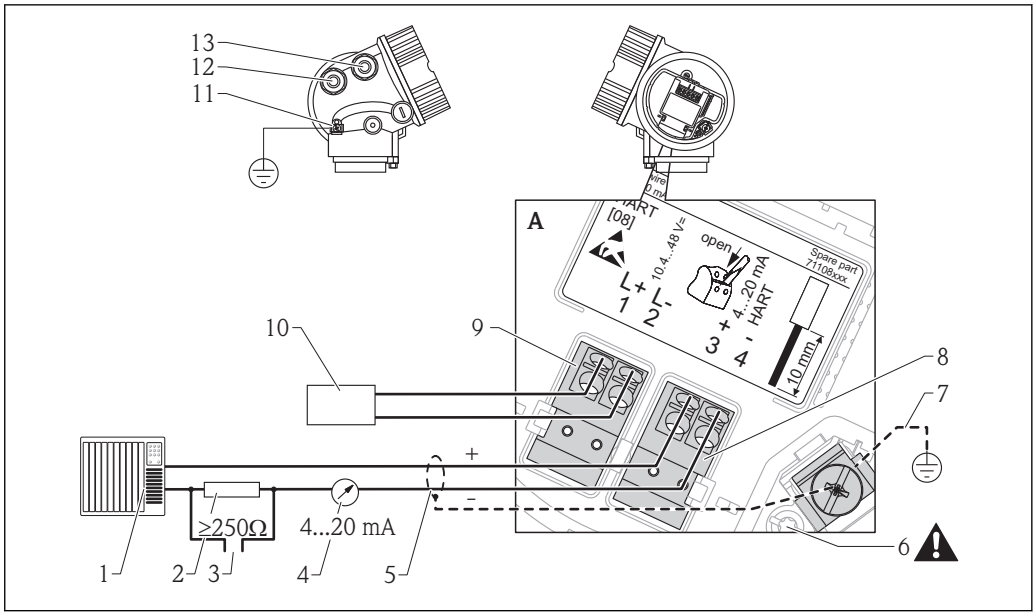



12 *Terminal assignment 2-wire, 4-20 mA HART, 4...20mA*

*A Without integrated overvoltage protection*
*B With integrated overvoltage protection*
*1 Connection current output 2*
*2 Connection current output 1*
*3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage*
*4 Cable screen; observe cable specification*
*5 HART communication resistor (≥250 Ω): Observe maximum load*
*6 Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
*7 Analog display device ; observe maximum load*
*8 Analog display device ; observe maximum load*
*9 Supply voltage for current output 2 (e.g. RN221N); Obeserve terminal voltage*
*10 Overvoltage protection module*
*11 Current output 2: Terminals 3 and 4*
*12 Terminal for the potential equalization line*
*13 Cable entry for current output 1*
*14 Cable entry for current output 2*

This version is also suited for single-channel operation. In this case, current output 1 (terminals 1 and 2) must be used.

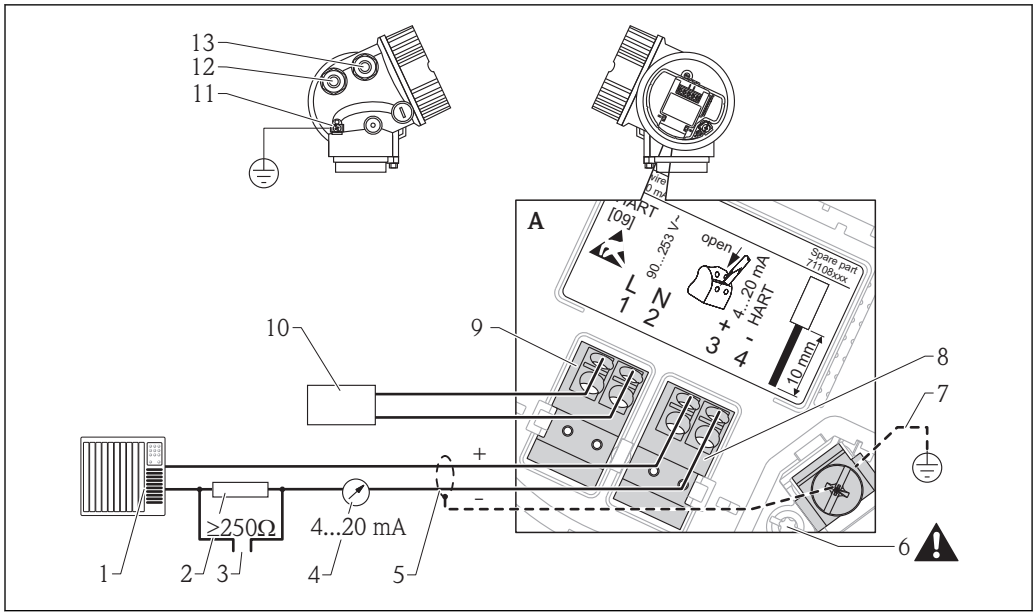
### 4-wire: 4-20mA HART (10.4 to 48 $V_{DC}$)




*13 Terminal assignment 4-wire; 4-20mA HART (10.4 to 48 VDC)*

1 *Evaluation unit, e.g. PLC*
2 *HART communication resistor (≥250 Ω): Observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display device: Observe maximum load*
5 *Signal cable including screening (if required), observe cable specification*
6 *Protective connection; do not disconnect!*
7 *Protective earth, observe cable specification*
8 *4...20mA HART (active): Terminals 3 and 4*
9 *Supply voltage: Terminals 1 and 2*
10 *Supply voltage: Observe terminal voltage, observe cable specification*
11 *Terminal for potential equalization*
12 *Cable entry for signal line*
13 *Cable entry for power supply*

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




14 *Terminal assignment 4-wire; 4-20mA HART (90 to 253 VAC)*

1 *Evaluation unit, e.g. PLC*
2 *HART communication resistor (≥250 Ω): Observe maximum load*
3 *Connection for Commubox FXA195 or FieldXpert SFX350/SFX370 (via VIATOR Bluetooth modem)*
4 *Analog display device: Observe maximum load*
5 *Signal cable including screening (if required), observe cable specification*
6 *Protective connection; do not disconnect!*
7 *Protective earth, observe cable specification*
8 *4...20mA HART (active): Terminals 3 and 4*
9 *Supply voltage: Terminals 1 and 2*
10 *Supply voltage: Observe terminal voltage, observe cable specification*
11 *Terminal for potential equalization*
12 *Cable entry for signal line*
13 *Cable entry for power supply*

**⚠ CAUTION**

**To ensure electrical safety:**

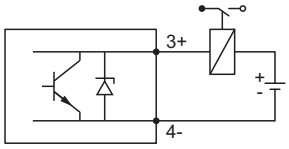
- ▶ Do not disconnect the protective connection (6).
- ▶ Disconnect the supply voltage before disconnecting the protective earth (7).

Connect protective earth to the internal ground terminal (7) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (11).

In order to ensure electromagnetic compatibility (EMC): Do not only ground the device via the protective earth 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).

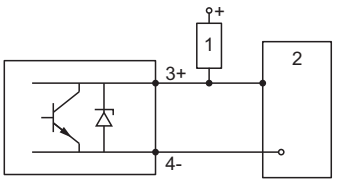
**Connection examples for the switch output**




A0015909

*15 Connection of a relay*

Suitable relays (examples):
- Solid-state relay: Phoenix Contact OV-24DC/480AC/5 with mounting rail connector UMK-1 OM-R/AMS
- Electromechanical relay: Phoenix Contact PLC-RSC-12DC/21




A0015910

*16 Connection of 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

- Minimum cross-section: See the "Terminal" specification in the Technical Information for the device.
- For ambient temperature $T_U \geq 60$ °C (140 °F): use cable for temperature $T_U$ +20 K.

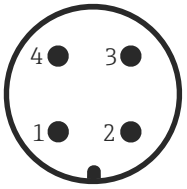
### HART

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

### 7.1.3 Device plug connectors

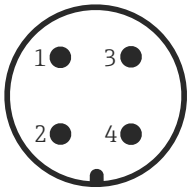
For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

*Pin assignment of the M12 plug connector*




| Pin | Meaning |
|---|---|
| 1 | Signal + |
| 2 | not connected |
| 3 | Signal - |
| 4 | Ground |

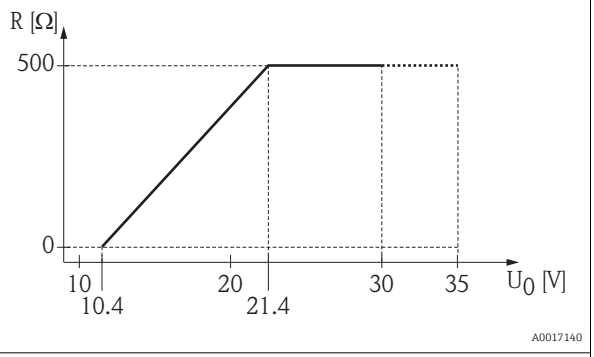
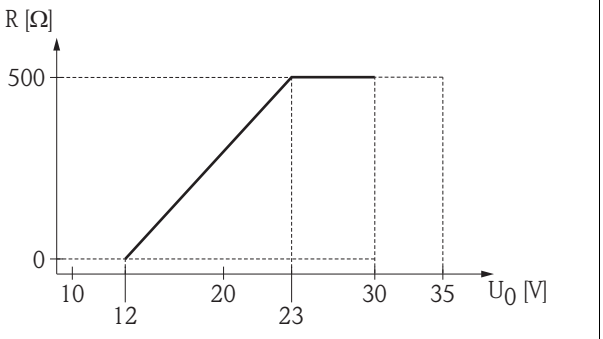
*Pin assignment of the 7/8" plug connector*



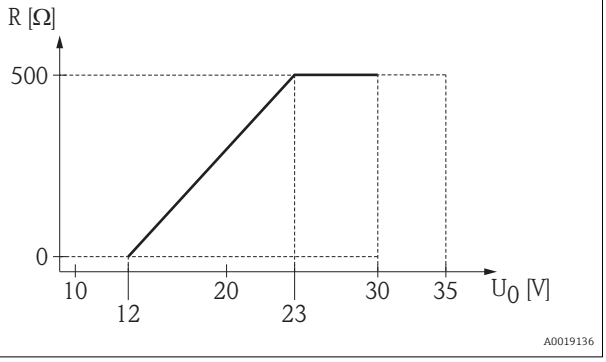

| Pin | Meaning |
|---|---|
| 1 | Signal - |
| 2 | Signal + |
| 3 | Not connected |
| 4 | Screen |

## 7.1.4 Supply voltage

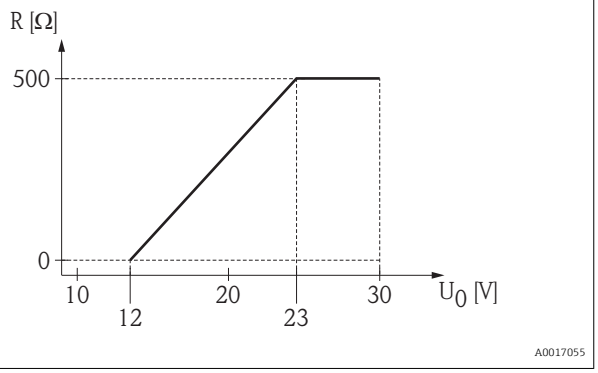
### 2-wire, 4-20mA HART, passive

| "Power Supply, Output" [1] | "Approval" [2] | Terminal voltage U at the device | Maximum load R, depending on the supply voltage $U_0$ at the supply unit |
|---|---|---|---|
| **A:** 2-wire; 4-20mA HART | ▪ Non-Ex<br>▪ Ex nA<br>▪ Ex ic<br>▪ CSA GP | 10.4 to 35 V [3] |  |
| | Ex ia / IS | 10.4 to 30 V [3] | |
| | ▪ Ex d(ia) / XP<br>▪ Ex ic(ia)<br>▪ Ex nA(ia)<br>▪ Ex ta / DIP | 12 to 35 V [4] |  |
| | Ex ia + Ex d(ia) / IS + XP | 12 to 30 V [4] | |

1) Feature 020 of the product structure
2) Feature 010 of the product structure
3) For ambient temperatures $T_a \leq$ -20 °C (-4 °F) a minimum voltage of 15 V is required for the sartup of the device at the MIN error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current I ≥ 5,5 mA (HART multidrop mode), a voltage of U ≥ 10,4 V is sufficient throughout the entire range of ambient temperatures.
4) For ambient temperatures $T_a \leq$ -20 °C (-4 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

| "Power Supply, Output" [1] | "Approval" [2] | Terminal voltage U at the device | Maximum load R, depending on the supply voltage $U_0$ at the supply unit |
|---|---|---|---|
| **B:** 2-wire; 4-20 mA HART, switch output | ▪ Non-Ex<br>▪ Ex nA<br>▪ Ex nA(ia)<br>▪ Ex ic<br>▪ Ex ic(ia)<br>▪ Ex d(ia) / XP<br>▪ Ex ta / DIP<br>▪ CSA GP | 12 to 35 V [3] |  |
| | ▪ Ex ia / IS<br>▪ Ex ia + Ex d(ia) / IS + XP | 12 to 30 V [3] | |

1) Feature 020 of the product structure
2) Feature 010 of the product structure
3) For ambient temperatures $T_a \leq$ -30 °C (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

| "Power Supply, Output" [1] | "Approval" [2] | Terminal voltage U at the device | Maximum load R, depending on the supply voltage $U_0$ at the supply unit |
|---|---|---|---|
| **C:** 2-wire; 4-20mA HART, 4-20mA | any | 12 to 30 V [3] |  |



1) Feature 020 of the product structure
2) Feature 010 of the product structure
3) For ambient temperatures $T_a \leq$ -30 °C (-22 °F) a minimum voltage of 16 V is required for the startup of the device at the MIN error current (3.6 mA).

| | |
|---|---|
| **Polarity reversal protection** | Yes |
| **Admissible residual ripple at f = 0 to 100 Hz** | $U_{SS}$ < 1 V |
| **Admissible residual ripple at f = 100 to 10000 Hz** | $U_{SS}$ < 10 mV |

### 4-wire, 4-20mA HART, active

| "Power supply; Output" [1] | Terminal voltage | Maximum load $R_{max}$ |
|---|---|---|
| **K:** 4-wire 90-253VAC; 4-20mA HART | 90 to 253 $V_{AC}$ (50 to 60 Hz), overvoltage category II | 500 Ω |
| **L:** 4-wire 10,4-48VDC; 4-20mA HART | 10.4 to 48 $V_{DC}$ | |

1) Feature 020 of the product structure

## 7.1.5 Overvoltage protection

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

### Integrated overvoltage protection

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

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

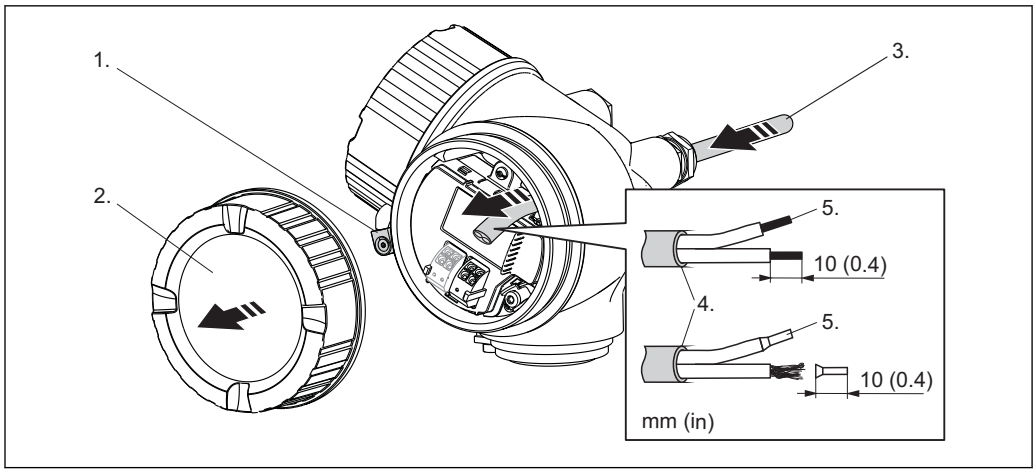
For detailed information please refer to the following documents:
- HAW562: TI01012K
- HAW569: TI01013K

# 7.2 Connecting the device

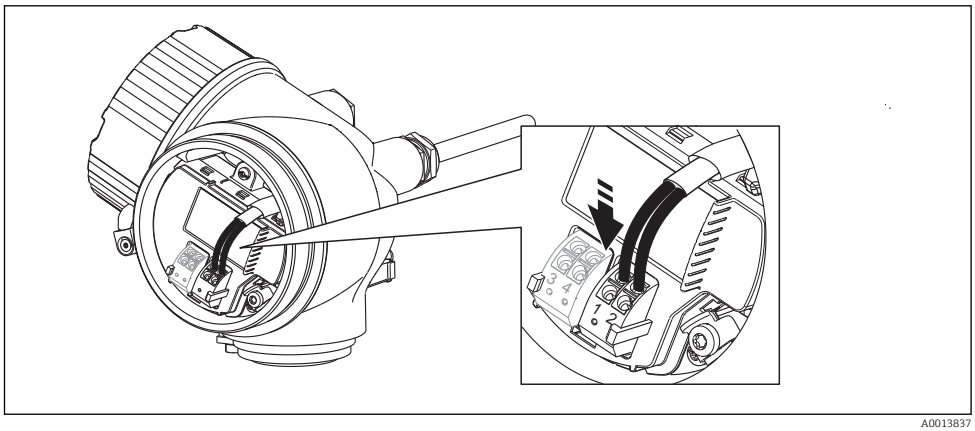
**⚠ WARNING**

**Explosion hazard!**
- ▶ Comply with the relevant national standards.
- ▶ Observe the specifications in the Safety Instructions (XA).
- ▶ Only use the specified cable glands.
- ▶ Check whether the supply voltage matches the specifications on the nameplate.
- ▶ Before connecting the device: Switch the supply voltage off.
- ▶ Before switching on the supply voltage: Connect the potential bonding line to the exterior ground terminal.

**Required tools and accessories:**
- For instruments with safety pin for the lid: AF 3 Allen key
- Wire stripping pliers
- When using stranded wires: Wire end sleeves.




A0012619

1. Loosen the screw of the securing clamp of the connection compartment cover and turn the clamp 90° counterclockwise.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable.
5. Strip the cable ends 10 mm (0.4 in). For stranded cables, also attach wire end ferrules.
6. Firmly tighten the cable glands.
7. 

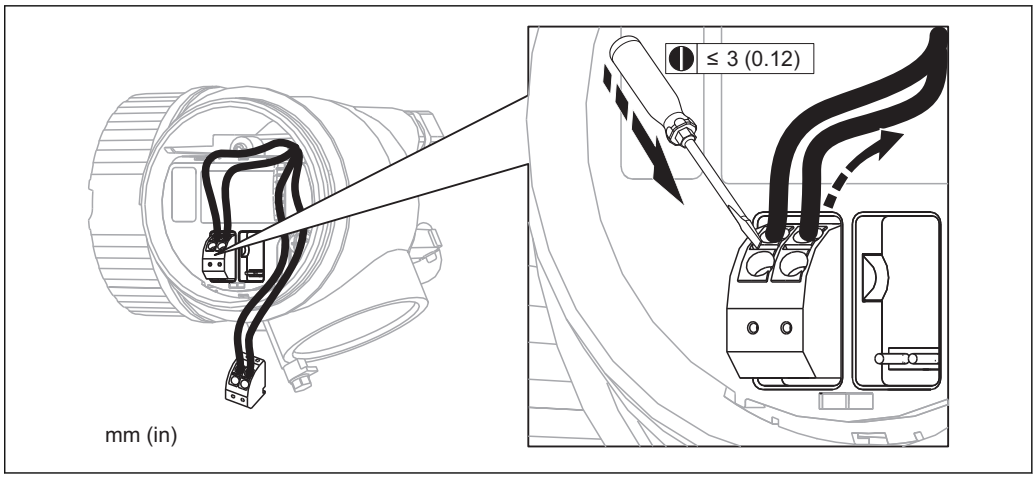
A0013837

   Connect the cable in accordance with the terminal assignment → 📄 34.
8. When using screened cable: Connect the cable screen to the ground terminal.
9. Screw the cover onto the connection compartment.
10. For instruments with safety pin for the lid: Adjust the safety pin so that its edge is over the edge of the display lid. Tighten the safety pin.

### 7.2.1 Pluggable spring-force terminals

Instruments without integrated overvoltage protection have pluggable spring-force terminals. Rigid conductors or flexible conductors with cable sleeve can directly be inserted and are contacted automatically.

To remove cables from the terminal: Press on the groove between the terminals using a flat-tip screwdriver ≤ 3 mm (0.12 inch) while pulling the cables out of the terminals.




A0013661

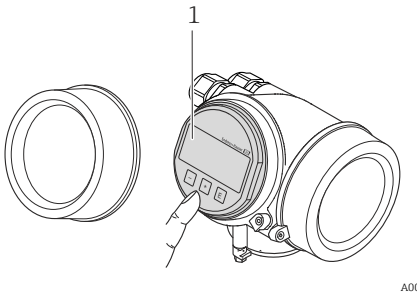
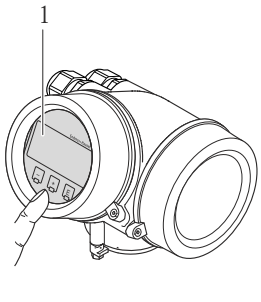
## 7.3 Post-connection check

| | |
|---|---|
| ❍ | Are cables or the device undamaged (visual inspection)? |
| ❍ | Do the cables comply with the requirements? |
| ❍ | Do the cables have adequate strain relief? |
| ❍ | Are all cable glands installed, firmly tightened and correctly sealed? |
| ❍ | Does the supply voltage match the specifications on the transmitter nameplate? |
| ❍ | Is the terminal assignment correct → 🖹 34? |
| ❍ | If required: Is the protective earth connected correctly ? |
| ❍ | If supply voltage is present: Is the device ready for operation and do values appear on the display module? |
| ❍ | Are all housing covers installed and firmly tightened? |
| ❍ | Is the securing clamp tightened correctly? |

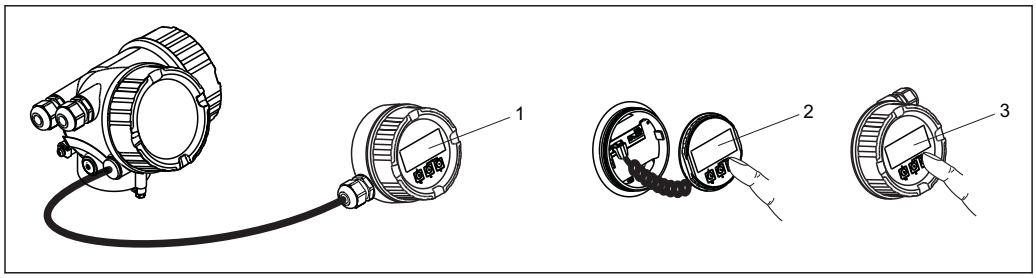
# 8 Operation options

## 8.1 Overview

### 8.1.1 Local operation

| Order code for "Display; Operation", option **C** "SD02" | Order code for "Display; Operation", option **E** "SD03" |
|---|---|
|  |  |
| *1 Operation with pushbuttons* | *1 Operation with touch control* |

### 8.1.2 Operation with remote display and operating module FHX50

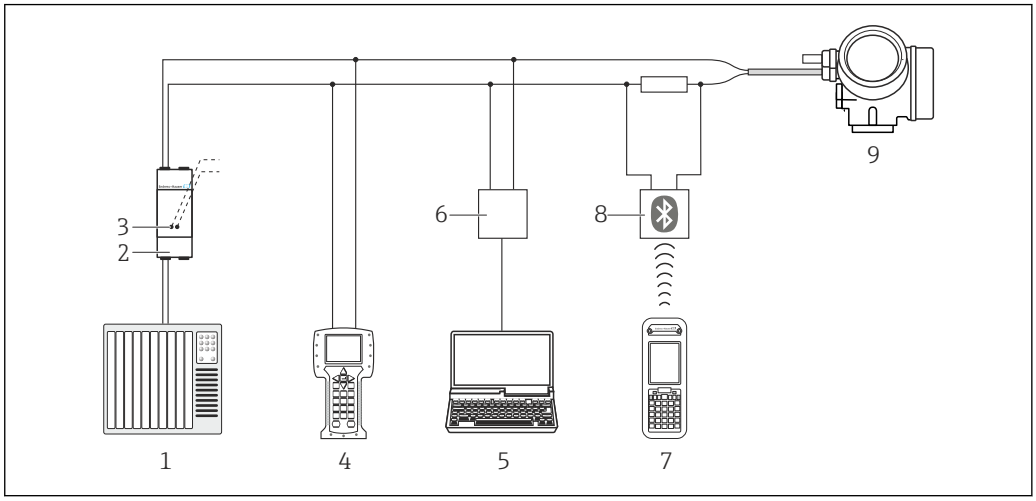



*17 FHX50 operating options*

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

### 8.1.3 Remote operation

#### Via HART protocol

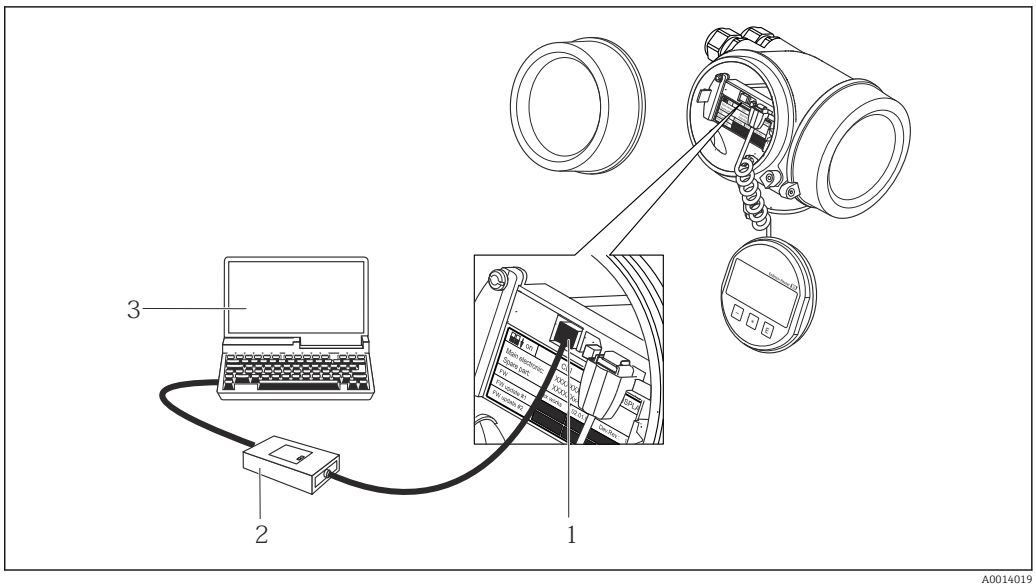



A0013764

*18 Options for remote operation via HART protocol*

1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA191, FXA195 and Field Communicator 375, 475*
4 *Field Communicator 475*
5 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
6 *Commubox FXA191 (RS232) or FXA195 (USB)*
7 *Field Xpert SFX350/SFX370*
8 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

#### Via service interface (CDI)




A0014019

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

## 8.2 Structure and function of the operating menu

### 8.2.1 Structure of the operating menu

| Menu | Submenu / parameter | Meaning |
|---|---|---|
| | Language [1] | Defines the operating language of the on-site display. |
| Setup | Parameter 1<br>...<br>Parameter N | When all these parameters have been assigned appropriate values, the measured should be completely configured in a standard application. |
| | **Advanced setup** | Contains further submenus and parameters:<br>▪ to adapt the device to special measuring conditions.<br>▪ to process the measured value (scaling, linearization).<br>▪ to configure the signal output. |
| **Diagnostics** | **Diagnostic list** | Contains up to 5 currently active error messages. |
| | **Event logbook** [2] | Contains the last 20 messages (which are no longer active). |
| | **Device information** | Contains information needed to identify the device. |
| | **Measured values** | Contains all current measured values. |
| | **Data logging** | Contains the history of the individual measuring values. |
| | **Simulation** | Used to simulate measured values or output values. |
| | **Device check** | Contains all parameters needed to check the measurement capability of the device. |
| **Expert** [3]<br>Contains all parameters of the device (including those which are already contained in one of the above submenus). This menu is organized according to the function blocks of the device.<br>The parameter of the **Expert** menu are described in:<br>GP01014F (HART) | **System** | Contains all general device parameters which do not affect the measurement or the communication interface. |
| | **Sensor** | Contains all parameters needed to configure the measurement. |
| | **Output** | ▪ Contains all parameters needed to configure the current output.<br>▪ Contains all parameters neeed to configure the switch output (PFS). |
| | **Communication** | Contains all parameters needed to configure the digital communication interface. |
| | **Diagnostics** | Contains all parameters needed to detect and analyze operational errors. |

1) In case of operation via operating tools (e.g. FieldCare), the "Language" parameter is located at "Setup → Advanced setup → Display"
2) only available with local operation
3) On entering the "Expert" menu, an access code is always requested. If a customer specific access code has not been defined, "0000" has to be entered.

### 8.2.2 User roles and related access authorization

The two user roles **Operator** and **Maintenance** have different write access to the parameters if a device-specific access code has been defined. This protects the device configuration via the local display from unauthorized access → 50.

*Access authorization to parameters*

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

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

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

### 8.2.3 Write protection via access code

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

**Define access code via local display**

1. Navigate to: "Setup" menu → Advanced setup → Administration → Define access code → Define access code
2. Define a max. 4-digit numeric code as an access code.
3. Repeat the same code in **Confirm access code** parameter.
   ↳ The 🔒-symbol appears in front of all write-protected parameters.

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

1. Navigate to: "Setup" menu → Advanced setup → Administration → Define access code
2. Define a max. 4-digit numeric code as an access code.
   ↳ Write protection is active.

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

If no key is pressed for 10 minutes in the navigation and editing mode, the device automatically locks the write-protected parameters. 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 access code, it can be also be deactivated only via the access code → 📄 51.
- In the "Description of Device Parameters" documents, each write-protected parameter is identified with the 🔒-symbol.

### 8.2.4 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a device-specific access code and its value cannot be changed at the moment using the local display → 📖 50.

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

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

### 8.2.5 Deactivation of the write protection via access code

**Via local display**

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

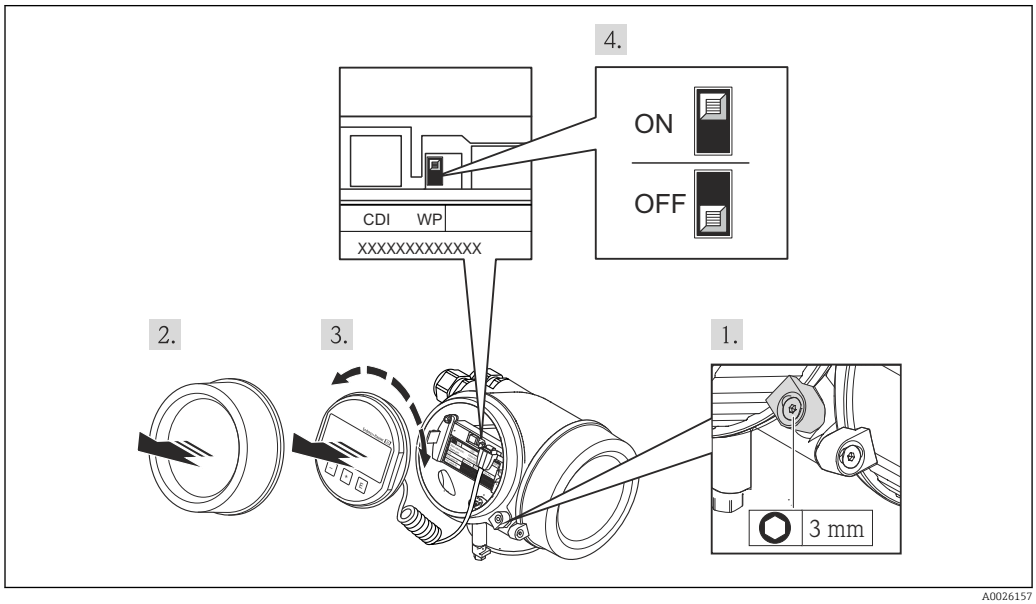
**Via operating tool (e.g. FieldCare)**

1. Navigate to "Setup" menu → Advanced setup → Administration → Define access code
2. Enter **0000**.
   ↳ The write protection is deactivated. Parameters can be changed without entering an access code.

### 8.2.6 Write protection via write protection switch

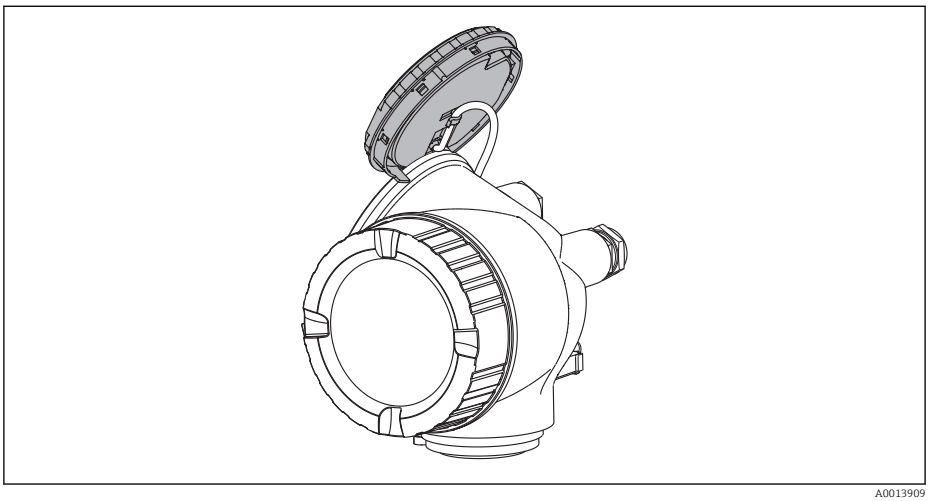
Unlike write protection via a user-specific access code, this allows write access to the entire operating menu - other than the **"Contrast display" parameter** - to be locked.

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



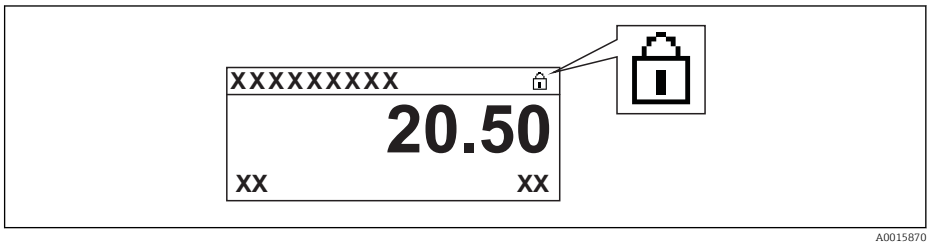

A0026157

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




A0015870

   If the hardware write protection is disabled: No option is displayed in the **Locking status** parameter. The 🔒-symbol disappears in the header of the measured value display and in the navigation view in front of the parameters.

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.

### 8.2.7 Enabling and disabling the keypad lock

The keypad lock allows to disable access to the entire operating menu via local operation. Thus navigating through the operating menu or modifying the values of individual parameters is no longer possible. Only the measured values on the measured value display can be read off.

The keylock is enabled and disabled via a context menu.

#### Enabling the keylock

**For the SD03 display:**
The keylock is automatically activated:
- If the device has not been operated via the display for > 1 minute.
- After a restart of the device.

#### 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. Select **Keylock on** from the context menu.
   ↳ The keylock is enabled.

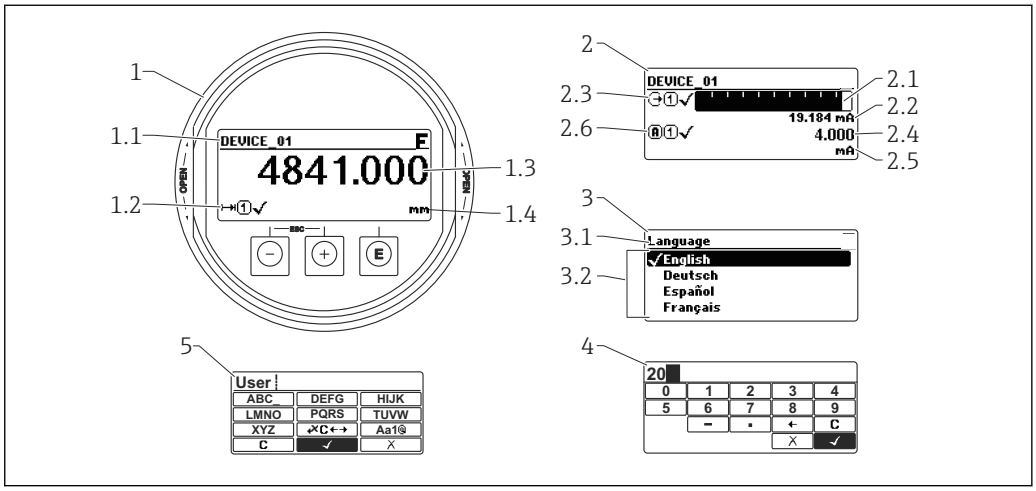
When attempting to access the operating menu while the keylock is enabled, the **Keylock on** message appears.

#### Disabling the keylock

1. The keylock is enabled.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. Select **Keylock off** from the context menu.
   ↳ The keylock is disabled.

## 8.3 Display and operating module

### 8.3.1 Display appearance




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

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

### Display symbols for the submenus

| Symbol | Meaning |
|---|---|
|  A0011975 | **Display/operation**<br>Is displayed:<br>▪ in the main menu next to the selection "Display/operation"<br>▪ in the header, if you are in the "Display/operation" menu |
|  A0011974 | **Setup**<br>Is displayed:<br>▪ in the main menu next to the selection "Setup"<br>▪ in the header, if you are in the "Setup" menu |
|  A0011976 | **Expert**<br>Is displayed:<br>▪ in the main menu next to the selection "Expert"<br>▪ in the header, if you are in the "Expert" menu |
|  A0011977 | **Diagnostics**<br>Is displayed:<br>▪ in the main menu next to the selection "Diagnostics"<br>▪ in the header, if you are in the "Diagnostics" menu |

### Status signals

| | |
|---|---|
| F A0013956 | **"Failure"**<br>A device error is present. The measured value is no longer valid. |
| C A0013959 | **"Function check"**<br>The device is in service mode (e.g. during a simulation). |
| S A0013958 | **"Out of specification"**<br>The device is operated:<br>▪ Outside of its technical specifications (e.g. during startup or a cleaning)<br>▪ Outside of the configuration carried out by the user (e.g. level outside configured span) |
| M A0013957 | **"Maintenance required"**<br>Maintenance is required. The measured value is still valid. |

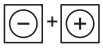
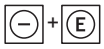
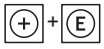
### Display symbols for the locking state

| Symbol | Meaning |
|---|---|
|  A0011978 | **Display parameter**<br>Marks display-only parameters which can not be edited. |
|  A0011979 | **Device locked**<br>▪ In front of a parameter name: The device is locked via software and/or hardware.<br>▪ In the header of the measured value screen: The device is locked via hardware. |

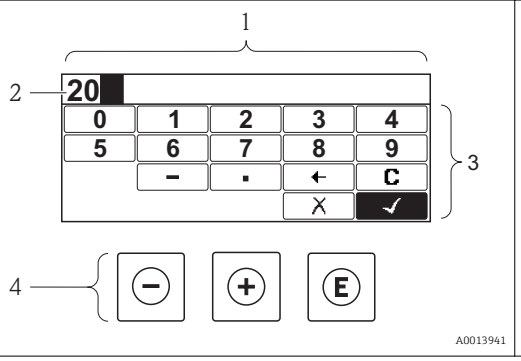
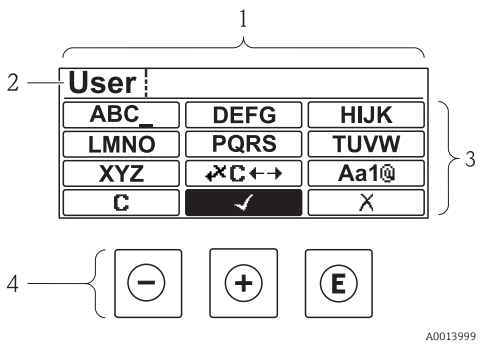
### Measured value symbols

| Symbol | Meaning |
|---|---|
| **Measured values** | |
|  A0011995 | **Level** |
|  A0011996 | **Distance** |
|  A0011998 | **Current output** |
|  A0011999 | **Measured current** |
|  A0012106 | **Terminal voltage** |
|  A0012104 | **Temperature of the electronics or the sensor** |
| **Measuring channels** | |
|  A0012000 | **Measuring channel 1** |
|  A0012107 | **Measuring channel 2** |
| **Status of the measured value** | |
|  A0012102 | **Status "Alarm"**<br>The measurment is interrupted. The output assumes the defined alarm value. A diagnostic message is generated. |
|  A0012103 | **Status "Warning"**<br>The device continues measuring. A diagnostic message is generated. |

### 8.3.2 Operating elements

| Key | Meaning |
|---|---|
|  A0013969 | **Minus key**<br>*For menu, submenu*<br>Moves the selection bar upwards in a picklist.<br>*For text and numeric editor*<br>In the input mask, moves the selection bar to the left (backwards). |
|  A0013970 | **Plus key**<br>*For menu, submenu*<br>Moves the selection bar downwards in a picklist.<br>*For text and numeric editor*<br>In the input mask, moves the selection bar to the right (forwards). |
|  A0013952 | **Enter key**<br>*For measured value display*<br>▪ Pressing the key briefly opens the operating menu.<br>▪ Pressing the key for 2 s opens the context menu.<br>*For menu, submenu*<br>▪ Pressing the key briefly<br>Opens the selected menu, submenu or parameter.<br>▪ Pressing the key for 2 s for parameter:<br>If present, opens the help text for the function of the parameter.<br>*For text and numeric editor*<br>▪ Pressing the key briefly<br>– Opens the selected group.<br>– Carries out the selected action.<br>▪ Pressing the key for 2 s confirms the edited parameter value. |
|  A0013971 | **Escape key combination (press keys simultaneously)**<br>*For menu, submenu*<br>▪ Pressing the key briefly<br>– Exits the current menu level and takes you to the next higher level.<br>– If help text is open, closes the help text of the parameter.<br>▪ Pressing the key for 2 s returns you to the measured value display ("home position").<br>*For text and numeric editor*<br>Closes the text or numeric editor without applying changes. |
|  A0013953 | **Minus/Enter key combination (press and hold down the keys simultaneously)**<br>Reduces the contrast (brighter setting). |
|  A0013954 | **Plus/Enter key combination (press and hold down the keys simultaneously)**<br>Increases the contrast (darker setting). |
|  A0013955 | **Minus/Plus/Enter key combination (press and hold down the keys simultaneously)**<br>*For measured value display*<br>Enables or disables the keypad lock. |

### 8.3.3 Entering numbers and text

| Numeric editor | Text editor |
|---|---|
|  |  |



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

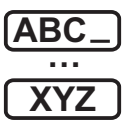
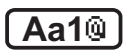
#### Input mask

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

*Numeric editor symbols*

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

*Text editor symbols*

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

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

| **Correction symbols under**  | |
|---|---|
|  A0013989 | Clears all entered characters. |
|  A0013991 | Moves the input position one position to the right. |
|  A0013990 | Moves the input position one position to the left. |
|  A0013988 | Deletes one character immediately to the left of the input position. |

### 8.3.4 Opening the context menu

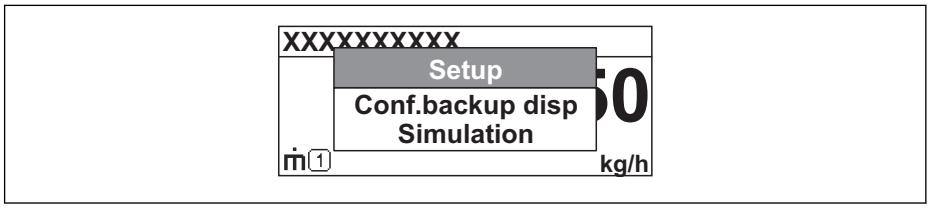
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Conf. backup disp.
- Simulation

#### Calling up and closing the context menu

The user is in the operational display.

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




A0014003-EN

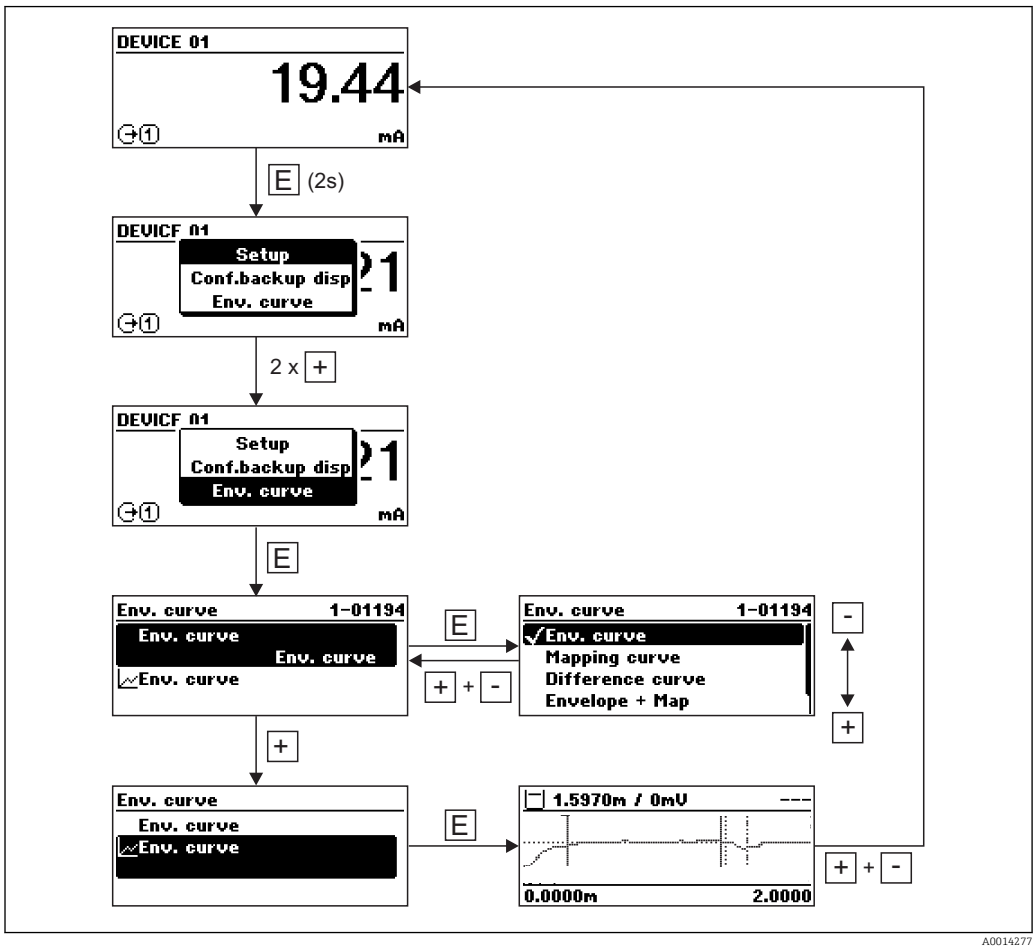
2. Press − + + simultaneously.
   ↳ The context menu is closed and the operational display appears.

#### Calling up the menu via the context menu

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

### 8.3.5 Envelope curve on the display and operating module

In order to assess the measuring signal, the envelope curve and - if a mapping has been recorded - the mapping curve can be displayed:



# 9 System integration via HART protocol

## 9.1 Overview of the Device Description files (DD)

| | |
|---|---|
| Manufacturer ID | 0x11 |
| Device type | 0x28 |
| HART specification | 6.0 |
| DD files | For information and files see:<br>▪ www.endress.com<br>▪ www.hartcomm.org |

## 9.2 Measured values via HART protocol

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

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

The allocation of the device variables can be changed in the operating menu:
Expert → Communication → Output

In a HART multidrop loog only one device may use the output current for signal transmission. For all other devices the follwing must be set:
- **Current span (→ 137)** = **Fixed current**
- **Fixed current (→ 137)** = **4 mA**

# 10 Commissioning via operating menu

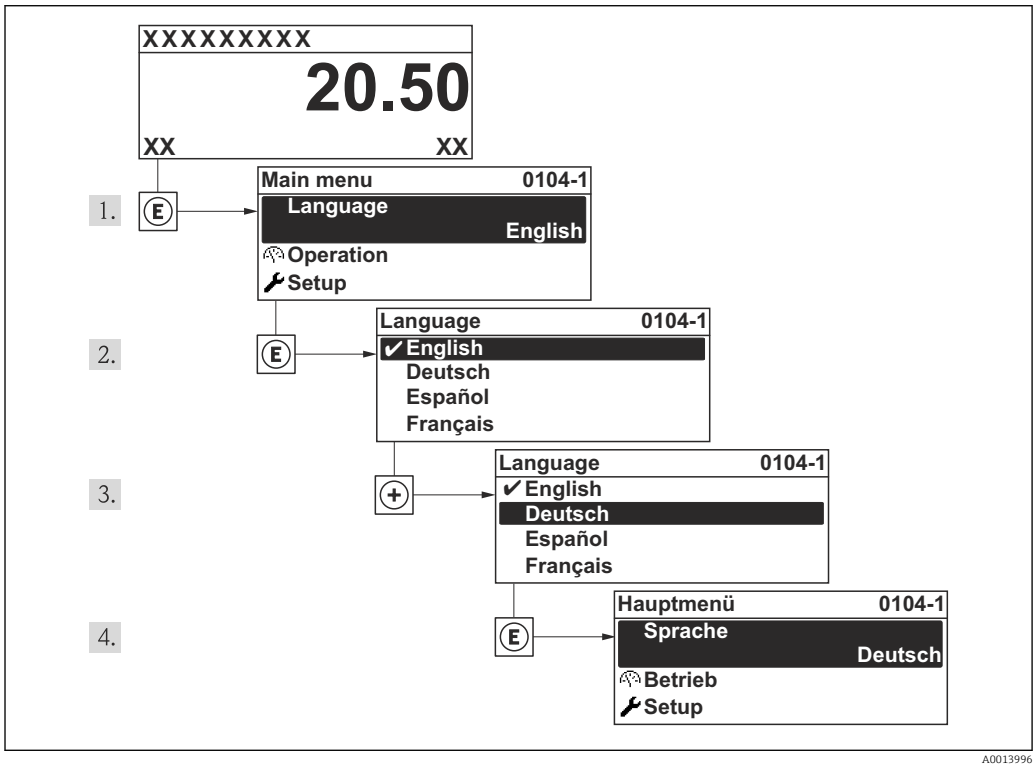
## 10.1 Installation and function check

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

- Checklist "Post-installation check" → 33
- Checklist "Post-connection check" → 45

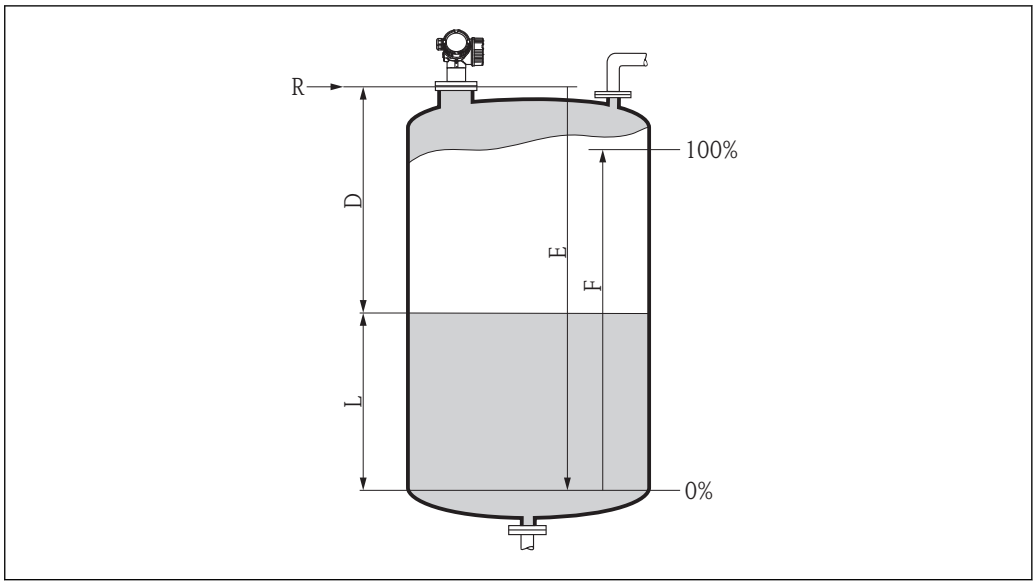
## 10.2 Setting the operating language

Factory setting: English or ordered local language




20 *Using the example of the local display*

## 10.3 Configuration of a level measurement




21 *Configuration parameters for level measurements in liquids*

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

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

5) If, for example, the measuring range covers only an upper part of the tank (E << tank height), it is mandatory to enter the acutal tank height into the "Setup → Advanced Setup → Level → Tank/silo height" parameter.

11. When operating via local display:
    Navigate to: "Setup" menu → Mapping → Confirm distance
    ↳ Compare distance indicated on the display to real distance in order to start the recording of an interference echo map.
12. When operating via operating tool:
    Navigate to: "Setup" menu → Confirm distance
    ↳ Compare distance indicated on the display to real distance in order to start the recording of an interference echo map.
13. Navigate to: "Setup" menu → Advanced setup → Level → Level unit
    ↳ Select level unit: %, m, mm, ft, in (Factory setting: %)

The response time of the device is preset by the **Tank type** parameter (→ 103). More detailed settings are possible in the **Advanced setup** submenu.

## 10.4 Recording the reference curve

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

**Navigation in the menu**
"Expert" menu → Diagnostics → Envelope diagnostics → Save reference curve

**Meaning of the options**
- No
  No action
- Yes
  The current envelope curve is saved as reference curve.

In devices which have been delivered with software version 01.00.zz, this submenu is only visible for the "Service" user role.

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



22 *The "Load Reference Curve" function*

## 10.5 Configuration of the on-site display

### 10.5.1 Factory settings of the on-site display

| Parameter | Factory setting |
|---|---|
| Format display | 1 value, max. size |
| Value 1 display | Level linearized |
| Value 2 display | None |
| Value 3 display | None |
| Value 4 display | None |

### 10.5.2 Adjustment of the on-site display

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

## 10.6 Configuration of the current outputs

### 10.6.1 Factory setting of the current outputs

| Current output | Allocated measuring vlaue | 4mA value | 20mA value |
|---|---|---|---|
| 1 | Level linearized | 0% or the corresponding linearized value | 100% or the corresponding linearized value |
| 2 [1)] | Distance | 0 | Empty calibration |

1) for devices with 2 current outputs

### 10.6.2 Adjustment of the current outputs

The current outputs can be adjusted in the following menus:

**Basic settings**
Setup → Advanced setup → Current output 1 to 2

**Advanced settings**
Expert → Output 1 to 2 → Current output 1 to 2
See "Description of Device Parameters", GP01014F

## 10.7 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.

**Navigation path in the operating menu**
"Setup" menu → Advanced setup → Configuration backup display → Configuration management

**Meaning of the options**
- **Cancel**
  No action is executed and the user exits the parameter.
- **Execute backup**
  A backup copy of the current device configuration in the HistoROM (built-in in the device) is saved to the display module of the device. The backup copy comprises the transmitter and sensor data of the device.
- **Restore**
  The last backup copy of the device configuration is copied from the display module to the HistoROM of the device. The backup copy comprises the transmitter and sensor data of the device.
- **Duplicate**
  The transmitter configuration is duplicated to another device using the transmitter display module. The following parameters, which characterize the individual measuring point are **not** included in the transmitted configuration:
  – HART date code
  – HART short tag
  – HART message
  – HART descriptor
  – HART address
  – Device tag
  – Medium type
- **Compare**
  The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of this comparison is displayed in the **Comparison result** parameter.
- **Clear backup data**
  The backup copy of the device configuration is deleted from the display module of the device.

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

If an existing backup is restored to a different device using the **Restore** option, it may occur that some device functionalities are no longer available. In some cases even a device reset → 📄 155 will not restore the original status.

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

## 10.8 Protection of the settings against unauthorized changes

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

- Via parameter settings (software locking) → 🖹 50
- Via locking switch (hardware locking) → 🖹 52

# 11 Diagnostics and troubleshooting

## 11.1 General trouble shooting

### 11.1.1 General errors

| Error | Possible cause | Remedial action |
|---|---|---|
| Device does not respond. | Supply voltage does not match the value indicated on the nameplate. | Connect the correct voltage. |
| | The polarity of the supply voltage is wrong. | Correct the polarity. |
| | The cables do not contact the terminals properly. | Ensure electrical contact between the cable and the terminal. |
| Values on the display invisible | Contrast setting is too weak or too strong. | ▪ Increase contrast by pressing ⊞ and Ⓔ simultaneously.<br>▪ 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. | Exchange display. |
| Output current < 3.6 mA | Signal cable connection incorrect. | Check connection. |
| | Electronics is defective. | Replace electronics. |
| HART communication does not function. | Communication resistor missing or incorrectly installed. | Install the communication resistor ( 250 Ω) correctly → 🖹 34. |
| | Commubox connected incorrectly. | Connect Commubox correctly → 🖹 47. |
| | Commubox not switched to HART mode. | Set the selection switch of the Commubox to the HART position. |
| CDI communication does not work. | Wrong setting of the COM port on the computer. | Check the setting of the COM port on the computer and change it if necessary. |
| Device measures incorrectly. | Parametrization error | Check and adjust parameterization. |

### 11.1.2 Parametrization errors

| Error | Possible cause | Remdy |
|---|---|---|
| Measured value incorrect | If measured distance ("Setup" menu → Distance) matches the real distance:<br>Calibration error | ▪ Check and adjust **Empty calibration** parameter (→ 🖹 105) if necessary.<br>▪ Check and adjust **Full calibration** parameter (→ 🖹 105) if necessary.<br>▪ Check and adjust linearization if necessary (**Linearization** submenu (→ 🖹 121)). |
| | For measurements in bypasses / stilling well:<br>▪ Wrong tank type<br>▪ Wrong tube diameter | ▪ Select **Tank type (→ 🖹 103)** = **Bypass / pipe**.<br>▪ Enter correct diamter in **Tube diameter** parameter (→ 🖹 104). |
| | Enter correct diamter in | Enter correct value in **Level correction** parameter (→ 🖹 118). |

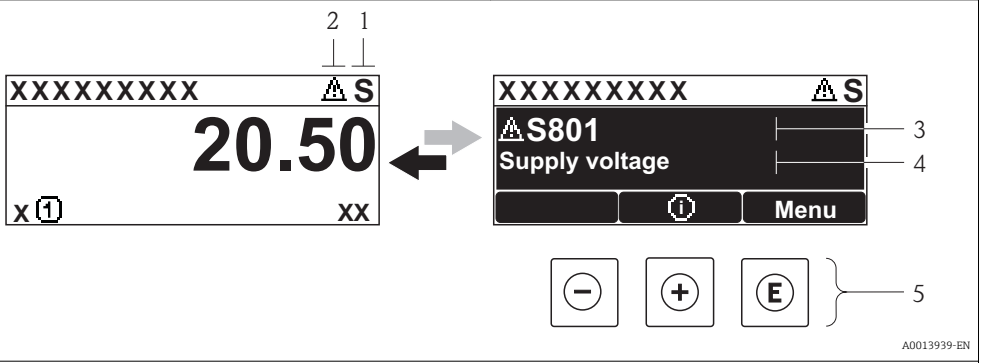
| Error | Possible cause | Remdy |
|---|---|---|
| | If measured distance (Setup → Distance) does not match the real distance:<br>Interference echo | Carry out tank mapping (**Confirm distance** parameter (→ 🖹 107)). |
| No change of measured value on filling / emptying | Interference echo from installations, nozzle or build-up on the antenna. | ▪ Carry out tank mapping (**Confirm distance** parameter (→ 🖹 107)).<br>▪ If necessary, clean antenna<br>▪ If necessary, selet better mopunting position |
| If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level | Signal is weakened by the rough surface - the interference echoes are sometimes stronger. | ▪ Carry out tank mapping (**Confirm distance** parameter (→ 🖹 107)).<br>▪ Select **Tank type (→ 🖹 103)** = **Process vessel with agitator**.<br>▪ Increase integration time ("Expert" menu → Sensor → Distance → Integration time)<br>▪ Optimize orientation of the antenna<br>▪ If necessary, select a better mounting position and/or larger antenna. |
| During filling/emptying the measxured value jumps downwards | Multiple echoes | ▪ Check **Tank type** parameter (→ 🖹 103).<br>▪ If possible, do not select central installation position.<br>▪ If appropriate, use a stilling well. |
| Error message F941 or S941 "Echo lost" | Level echo is too weak. | ▪ Check **Medium group** parameter (→ 🖹 104).<br>▪ If necessary, select a more detailed setting in **Medium property** parameter (→ 🖹 115).<br>▪ Optimize alignment of antenna<br>▪ If necessary, select a better installation position and/or larger antenna. |
| | Level echo suppressed. | Delete mapping and record it again. |
| Device displays a level when the tank is empty. | Interference echo | Carry out mapping over entire measuring range when the tank is empty (**Confirm distance** parameter (→ 🖹 107)). |
| Wrong slope of the level in the entire measuring range | Wrong tank type selected. | Set **Tank type** parameter (→ 🖹 103) correctly. |

## 11.2 Diagnostic information on local display

### 11.2.1 Diagnostic message

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

| Measured value display in alarm condition | Diagnostic message |
|---|---|




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

#### Status signals

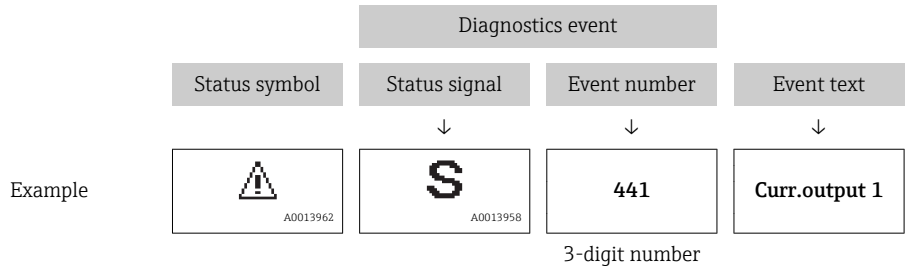
| | |
|---|---|
| F A0013956 | **"Failure"**<br>A device error is present. The measured value is no longer valid. |
| C A0013959 | **"Function check"**<br>The device is in service mode (e.g. during a simulation). |
| S A0013958 | **"Out of specification"**<br>The device is operated:<br>▪ Outside of its technical specifications (e.g. during startup or a cleaning)<br>▪ Outside of the configuration carried out by the user (e.g. level outside configured span) |
| M A0013957 | **"Maintenance required"**<br>Maintenance is required. The measured value is still valid. |

#### Status symbol (symbol for event level)

| | |
|---|---|
| A0013961 | **"Alarm" status**<br>The measurement is interrupted. The signal outputs take on the defined alarm condition. A diagnostic message is generated. |
| A0013962 | **"Warning" status**<br>The device continues to measure. A diagnostic message is generated. |

### Diagnostics event and event text

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



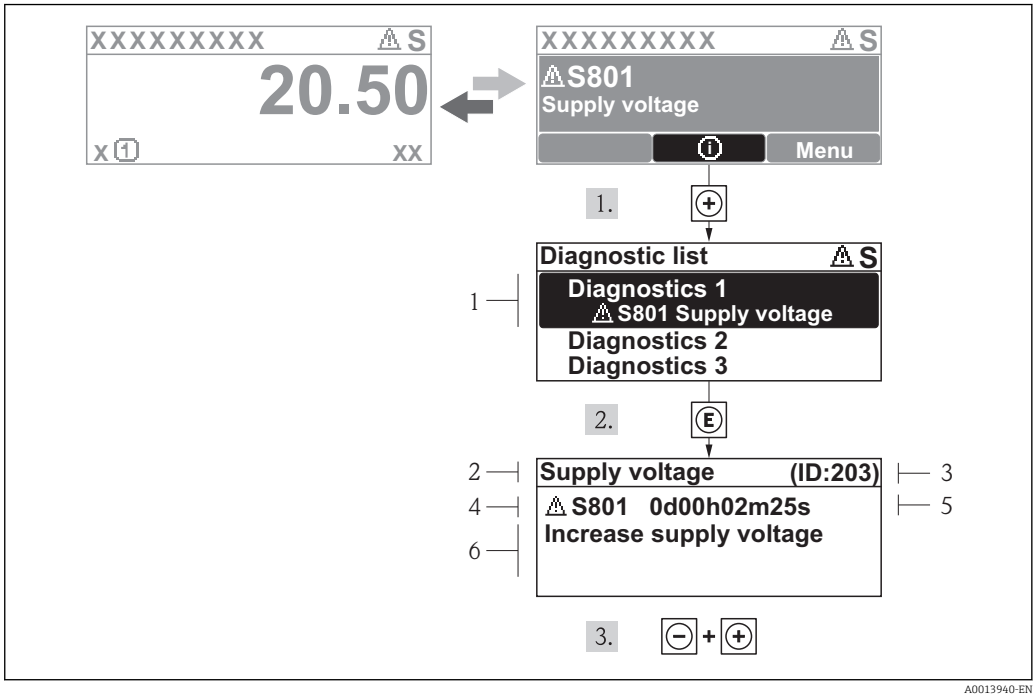

If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in **Diagnostic list** submenu (→ 160).

Past diagnostic messages that are no longer pending are shown as follows:
- On the local display:
  in **Event logbook** submenu (→ 161)
- In FieldCare:
  via the "Event List /HistoROM" function.

### Operating elements

| Operating functions in menu, submenu | |
|---|---|
| A0013970 | **Plus key**<br>Opens the message about the remedial measures. |
| A0013952 | **Enter key**<br>Opens the operating menu. |

### 11.2.2 Calling up remedial measures




*23 Message for remedial measures*

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

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol).
   ↳ **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ .
   ↳ The message for the remedial measures for the selected diagnostic event opens.
3. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

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

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

## 11.3 Diagnostic event in the operating tool

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

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

### Calling up remedial measures

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.

## 11.4 Diagnostic list

In the Diagnostic list 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" menu → Diagnostic list

### Calling up and closing the remedial measures

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

## 11.5 Overview of diagnostic events

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| **Diagnostic of electronic** | | | | |
| 242 | Software incompatible | 1. Check software<br>2. Flash or change main electronics module | F | Alarm |
| 252 | Modules incompatible | 1. Check electronic modules<br>2. Change I/O or main electronic module | F | Alarm |
| 261 | Electronic modules | 1. Restart device<br>2. Check electronic modules<br>3. Change I/O Modul or main electronics | F | Alarm |
| 262 | Module connection | 1. Check module connections<br>2. Change electronic modules | F | Alarm |
| 270 | Main electronic failure | Change main electronic module | F | Alarm |
| 271 | Main electronic failure | 1. Restart device<br>2. Change main electronic module | F | Alarm |
| 272 | Main electronic failure | 1. Restart device<br>2. Contact service | F | Alarm |
| 273 | Main electronic failure | 1. Emergency operation via display<br>2. Change main electronics | F | Alarm |
| 275 | I/O module failure | Change I/O module | F | Alarm |
| 276 | I/O module failure | 1. Restart device<br>2. Change I/O module | F | Alarm |
| 282 | Data storage | 1. Restart device<br>2. Contact service | F | Alarm |
| 283 | Memory content | 1. Transfer data or reset device<br>2. Contact service | F | Alarm |
| 311 | Electronic failure | 1. Transfer data or reset device<br>2. Contact service | F | Alarm |
| 311 | Electronic failure | Maintenance required!<br>1. Do not perform reset<br>2. Contact service | M | Warning |
| **Diagnostic of configuration** | | | | |
| 410 | Data transfer | 1. Check connection<br>2. Retry data transfer | F | Alarm |
| 411 | Up-/download active | Up-/download active, please wait | C | Warning |
| 431 | Trim 1 to 2 | Carry out trim | C | Warning |
| 435 | Linearization | Check linearization table | F | Alarm |
| 437 | Configuration incompatible | 1. Restart device<br>2. Contact service | F | Alarm |
| 438 | Dataset | 1. Check data set file<br>2. Check device configuration<br>3. Up- and download new configuration | M | Warning |
| 441 | Current output 1 to 2 | 1. Check process<br>2. Check current output settings | S | Warning |
| 484 | Simulation failure mode | Deactivate simulation | C | Alarm |

| Diagnostic number | Short text | Remedy instructions | Status signal [from the factory] | Diagnostic behavior [from the factory] |
|---|---|---|---|---|
| 485 | Simulation measured value | Deactivate simulation | C | Warning |
| 491 | Simulation current output 1 to 2 | Deactivate simulation | C | Warning |
| 494 | Switch output simulation | Deactivate simulation switch output | C | Warning |
| 495 | Simulation diagnostic event | Deactivate simulation | C | Warning |
| 585 | Simulation distance | Deactivate simulation | C | Warning |
| 586 | Record map | Recording of mapping<br>please wait | C | Warning |
| **Diagnostic of process** | | | | |
| 801 | Energy too low | Increase supply voltage | S | Warning |
| 803 | Current loop | 1. Check wiring<br>2. Change I/O module | F | Alarm |
| 825 | Operating temperature | 1. Check ambient temperature<br>2. Check process temperature | S | Warning |
| 825 | Operating temperature | 1. Check ambient temperature<br>2. Check process temperature | F | Alarm |
| 921 | Change of reference | 1. Check reference configuration<br>2. Check pressure<br>3. Check sensor | S | Warning |
| 941 | Echo lost | Check parameter 'DC value' | S | Warning |
| 941 | Echo lost | Check parameter 'DC value' | F | Alarm |
| 942 | In safety distance | 1. Check level<br>2. Check safety distance<br>3. Reset self holding | S | Warning |
| 942 | In safety distance | 1. Check level<br>2. Check safety distance<br>3. Reset self holding | S | Alarm |
| 943 | In blocking distance | Reduced accuracy<br>Check level | S | Warning |
| 950 | Advanced diagnostic 1 to 2 occured | Maintain your diagnostic event | M | Warning [1)] |

1) Diagnostic status is changeable.

# 11.6 Event logbook

## 11.6.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu [6)].

**Navigation path**
Diagnostics → Event logbook → Event list

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

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

The event history includes entries for:
- 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.

## 11.6.2 Filtering the event logbook

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

**Navigation path**
"Diagnostics" menu → Event logbook → Filter options

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

## 11.6.3 Overview of information events

| Info number | Info name |
|---|---|
| I1000 | --------(Device ok) |
| I1089 | Power on |
| I1090 | Configuration reset |
| I1091 | Configuration changed |
| I1092 | Trend data deleted |
| I1110 | Write protection switch changed |
| I1137 | Electronic changed |
| I1151 | History reset |
| I1154 | Reset terminal voltage min/max |
| I1155 | Reset electronic temperature |
| I1156 | Memory error trend |
| I1157 | Memory error event list |
| I1184 | Display connected |
| I1185 | Display backup done |
| I1186 | Restore via display done |

| Info number | Info name |
|---|---|
| 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 |

## 11.7 Firmware history

| Date | Firmware version | Modifications | Documentation (FMR53/FMR54, HART) | | |
|---|---|---|---|---|---|
| | | | Operating Instructions | Description of Parameters | Technical Information |
| 12.2012 | 01.00.zz | Original software | BA01050F/00/EN/01.12 | GP01014F/00/EN/01.12 | TI01041F/00/EN/01.12 |
| 02.2015 | 01.01.zz | ▪ Support of SD03<br>▪ additional languages<br>▪ HistoROM functionality enhanced<br>▪ Improvements and bugfixes | BA01050F/00/EN/03.14 | GP01014F/00/EN/04.14 | TI01041F/00/EN/05.14 |

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

# 12 Maintenance

The measuring device requires no special maintenance.

## 12.1 Exterior cleaning

When exterior-cleaning the device, always use cleaning agents that do not attack the surface of the hosuing and the seals.

## 12.2 Replacing seals

The process seals of the sensors (at the process connection) must be replaced periodically, particularly if molded seals (aseptic construction) are used. The period between changes depends on the frequency of cleaning cycles and on the temperature of the measured substance and the cleaning temperature.

# 13 Repairs

## 13.1 General information on repairs

### 13.1.1 Repair concept

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

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

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

### 13.1.2 Repairs to Ex-approved devices

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

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

### 13.1.3 Replacement of an electronics module

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

### 13.1.4 Replacement of a device

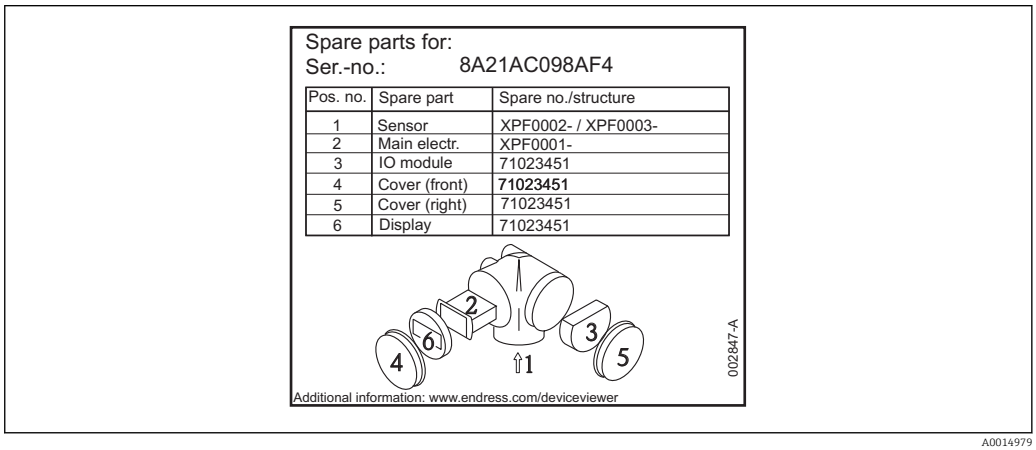
After a complete device or electronic module has been replaced, the parameters can be downloaded into the instrument again in one of the following ways:

- Via the display module
  Condition: The configuration of the old device has been saved in the display module → 🖹 152.
- Via FieldCare
  Condition: The configuration of the old device has been saved to the computer via FieldCare.

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

## 13.2 Spare parts

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




24 *Example for spare part nameplate in connection compartment cover*

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

## 13.3 Return

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

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

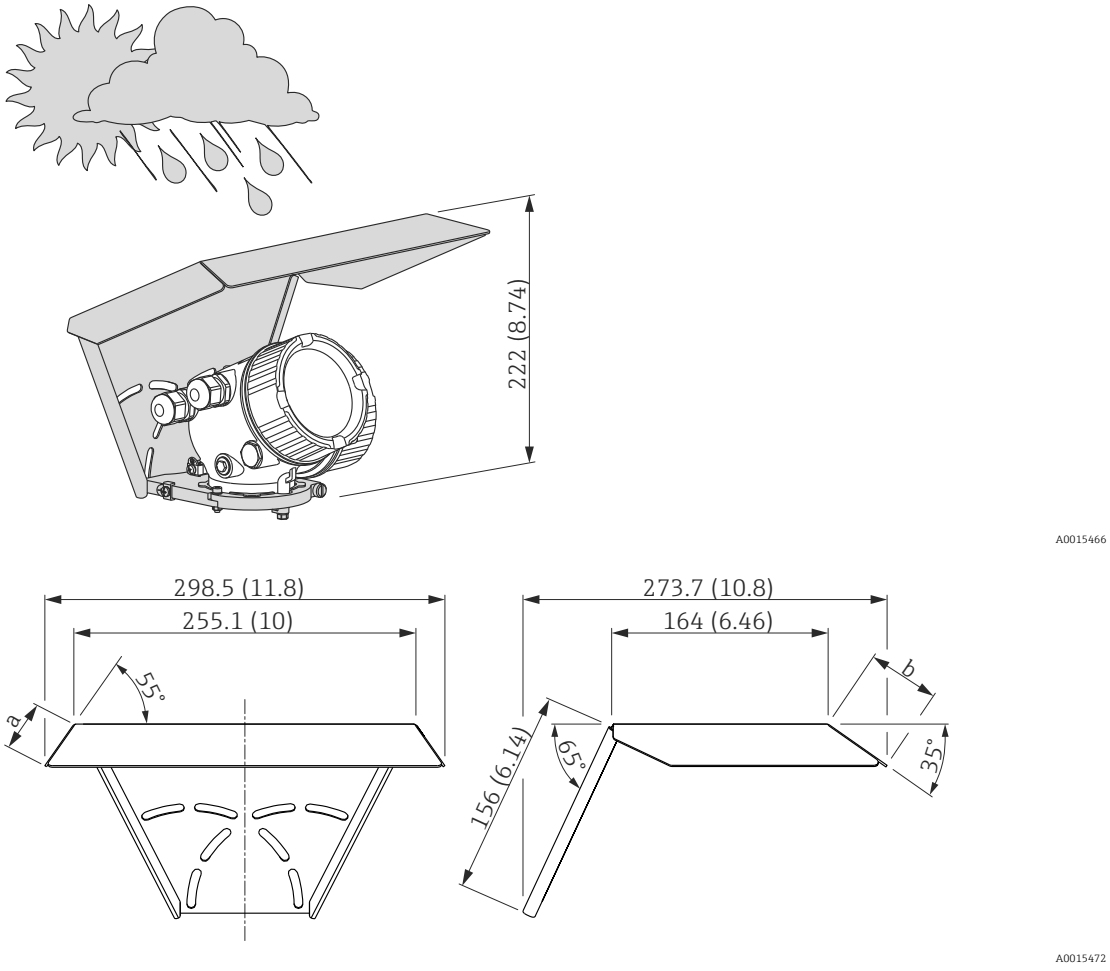
## 13.4 Disposal

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

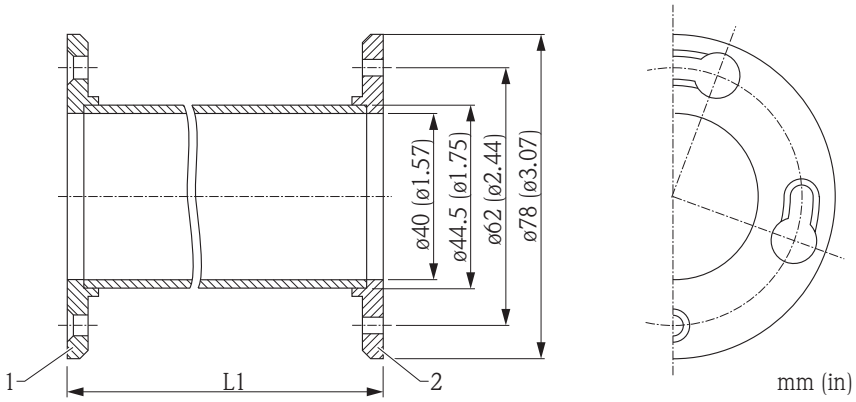
# 14 Accessories

## 14.1 Device-specific accessories

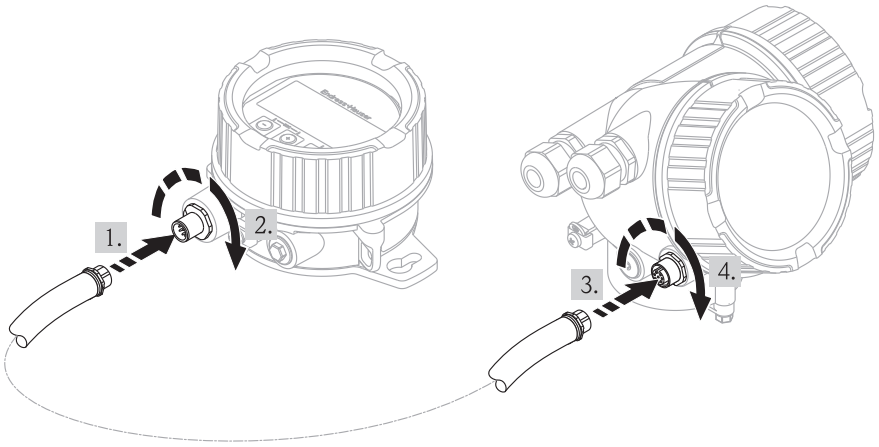
### 14.1.1 Weather protection cover

| Accessory | Description |
|---|---|
| Weather protection cover | <br>*25 Weather protection cover; Dimensions: mm (in)*<br>*a 37,8 mm (1,5 in)*<br>*b 54 mm (2,1 in)*<br>The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover").<br>Alternatively, it can be separately ordered as an accessory; order code 71162242. |

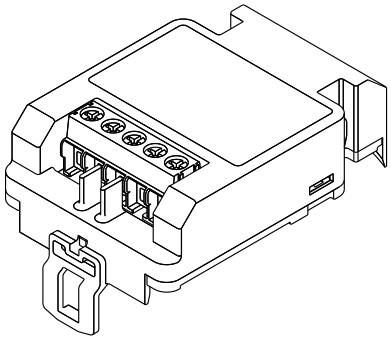
### 14.1.2 Antenna extension FAR10 (for FMR54)

| Accessory | Description |
|---|---|
| Antenna extension FAR10 (for FMR54) | <br>A0018879<br>*1 Instrument connection*<br>*2 Horn connection*<br>**Material:**<br>▪ 316L (1.4404)<br>▪ Alloy B2<br>▪ Alloy C4<br>**Length L1:**<br>▪ 100 mm (4 in)<br>▪ 200 mm (8 in)<br>▪ 300 mm (12 in)<br>▪ 400 mm (16 in)<br>Detailed ordering information is available from the following sources:<br>▪ In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product<br>▪ From your Endress+Hauser Sales Center: www.endress.com/worldwide |

### 14.1.3 Remote display FHX50

| Accessory | Description |
|---|---|
| Remote display FHX50 |  A0019128<br>▪ Material:<br>– Plastics PBT<br>– 316L<br>▪ Ingress protection: IP68 / NEMA 6P and IP66 / NEMA 4x<br>▪ Suitable for the display modules:<br>– SD02 (push buttons)<br>– SD03 (touch control)<br>▪ Connection cable:<br>– Cable with M12 plug; supplied with the FHX50; up to 30 m (98 ft)<br>– Customer supplied standard cable; up to 60 m (196 ft)<br>▪ Ambient temperature: −40 to 80 °C (−40 to 176 °F)<br>▪ If the remote display is to be used, the device must be ordered in the version "Prepared for display FHX50" (feature 030, option L or M). For the FHX50, on the other hand, the option A: "Prepared for display FHX50" has to be selected in feature 050: "Option Measurement Device".<br>▪ If a device has not been ordered in the version "Prepared for display FHX50", but is nevertheless to be equipped with an FHX50, it is essential to select the option B: "Not prepared for display FHX50" in feature 050: "Option Measurement Device" of the FHX50. In this case, a retrofit kit, needed to prepare the device for the remote display, is supplied together with the FHX50.<br>For transmitters with approval, application of the FHX50 may be restricted. A device may only be retrofitted with the FHX50 if option L or M ("Prepared for FHX50") is quoted under *Basic specifications*, position 4 "Display, operation" in the associated Safety Instructions (XA).<br>In addition to this, observe the Safety Instructions (XA) of the FHX50.<br>Do not retrofit transmitters with:<br>▪ approval for use in areas with combustible dusts (Dust-Ex approval)<br>▪ type of protection Ex nA<br>For details refer to the document SD01007F. |

### 14.1.4 Overvoltage protection

| Accessory | Description |
|---|---|
| Overvoltage protection for 2-wire-devices<br>OVP10 (1 channel)<br>OVP20 (2 channel) | <br>A0021734<br>**Technical data**<br>▪ Resistance per channel: 2 * 0.5 $\Omega_{max}$<br>▪ Threshold DC voltage: 400 to 700 V<br>▪ Threshold impulse voltage: < 800 V<br>▪ Capacitance at 1 MHz: < 1.5 pF<br>▪ Nominal arrest impulse voltage (8/20 µs): 10 kA<br>▪ Suited for wire cross-sections: 0.2 to 2.5 $mm^2$ (24 to 14 AWG)<br>**Ordering with device**<br>The overvoltage protection module is preferably ordered with the device. See product structure, feature 610 "Accessory mounted", option NA "Overvoltage protection". Separate ordering of the module is only necessary if a device is to retrofitted with the overvoltage protection.<br>**Order code for retrofitting**<br>▪ For 1-channel devices (feature 020, option A)<br>OVP10: 71128617<br>▪ For 2-channel devices (feature 020, option B, C, E or G)<br>OVP20 : 71128619<br>**Hosuing lid for retrofitting**<br>In order to keep the necessary safety distances, the housing lid needs to be replaced if the device is retrofitted with the overvoltage protection. Depending on the housing type, the order code of the suitable lid is as follows:<br>▪ GT18 housing: Lid 71185516<br>▪ GT19 housing: Lid 71185518<br>▪ GT20 housing: Lid 71185516<br>**Restrictions for retrofitting**<br>Depending on the approval of the transmitter the usage of the OVP module may be restricted. A device may only be retrofitted with an OVP module if the option *NA* (overvoltage protection) is quoted unter *Optional Specifications* in the Safety Instructions (XA) pertaining to the device.<br>For details refer to SD01090F. |

### 14.1.5 Gas-tight feedthrough

| Accessory | Description |
|---|---|
| Gas-tight feedthrough | Chemically inert glass feedthrough; prevents migration of gases into the electronics housing.<br>To be ordered with the device: product structure, feature 610 "Accessory Mounted", option NC "Gas-tight feedthrough" |

## 14.2 Communication-specific accessories

| Accessory | Description |
|---|---|
| Commubox FXA195 HART | For intrinsically safe HART communication with FieldCare via the USB interface.<br>For details refer to Technical Information TI00404F |

| Accessory | Description |
|---|---|
| Commubox FXA291 | Connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a computer.<br>Order code: 51516983<br>For details refer to Technical Information TI00405C |

| Accessory | Description |
|---|---|
| HART Loop Converter HMX50 | Evaluates the dynamic HART variables and converts them to analog current signals or limit values.<br>Order code: 71063562<br>For details refer to Technical Information TI00429F and Operating Instructions BA00371F |

| Accessory | Description |
|---|---|
| WirelessHART Adapter SWA70 | Connects field devices to a WirelessHART network.<br>The WirelessHART adapter can be mounted directly at a HART device and is easly integrated into an existing HART network. It ensures safe data transmission and can be operated in parallel with other wireless networks.<br>For details refer to Operating Instructions BA00061S |

| Accessory | Description |
|---|---|
| Fieldgate FXA320 | Gateway for remote monitoring of connected 4-20mA measuring devices via web browser.<br>For details refer to Technical Information TI00025S and Operating Instructions BA00053S |

| Accessory | Description |
|---|---|
| Fieldgate FXA520 | Gateway for remote diagnosis and parametrization of connected HART measuring devices via web browser.<br>For details refer to Technical Information TI00025S and Operating Instructions BA00051S |

| Accessory | Description |
|---|---|
| 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**.<br>For details, see Operating Instructions BA01202S |

| Accessory | Description |
|---|---|
| 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**.<br>For details, see Operating Instructions BA01202S |

## 14.3 Service-specific accessories

| Accessory | Description |
|---|---|
| FieldCare | Endress+Hauser's FDT-based Plant Asset Management tool.<br>Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices.<br>For details refer to Operating Instructions BA00027S and BA00059S. |

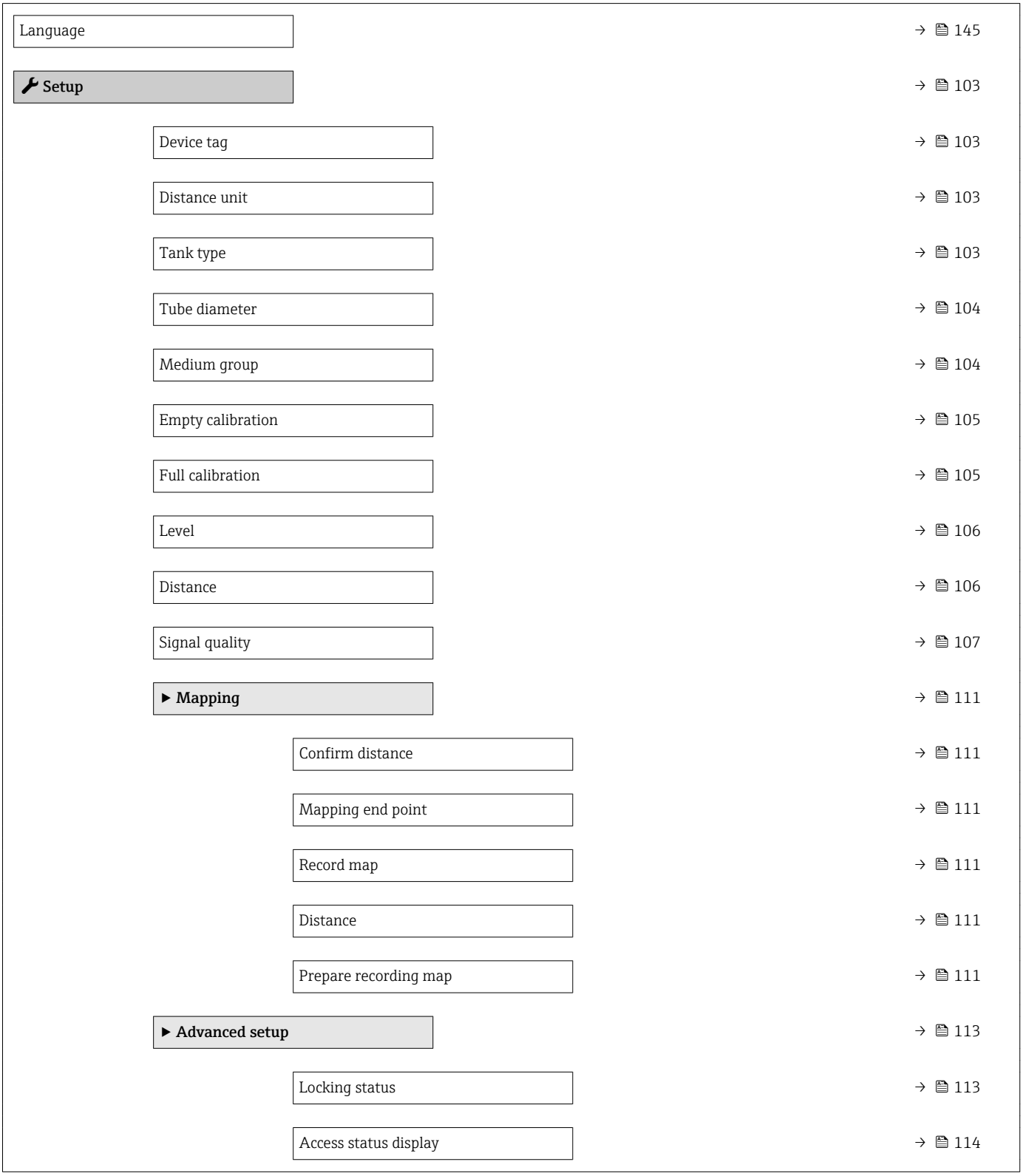
## 14.4 System components

| Accessory | Description |
|---|---|
| Graphic Data Manager Memograph M | The graphic data manager Memograph M provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick.<br>For details refer to Technical Information TI00133R and Operating Instructions BA00247R |
| RN221N | Active barrier with power supply for safe separation of 4 to 20 mA current circuits. Provides bi-directional HART transmission.<br>For details refer to Technical Information TI00073R and Operating Instructions BA00202R |
| RNS221 | Transmitter supply for 2-wire sensors or transmitters exclusively for non-Ex areas. Provides bi-directional communication using the HART communication sockets.<br>For details refer to Technical Information TI00081R and Operating Instructions KA00110R |

# 15 Operating menu

## 15.1 Overview of the operating menu (display module)

*Navigation* Operating menu



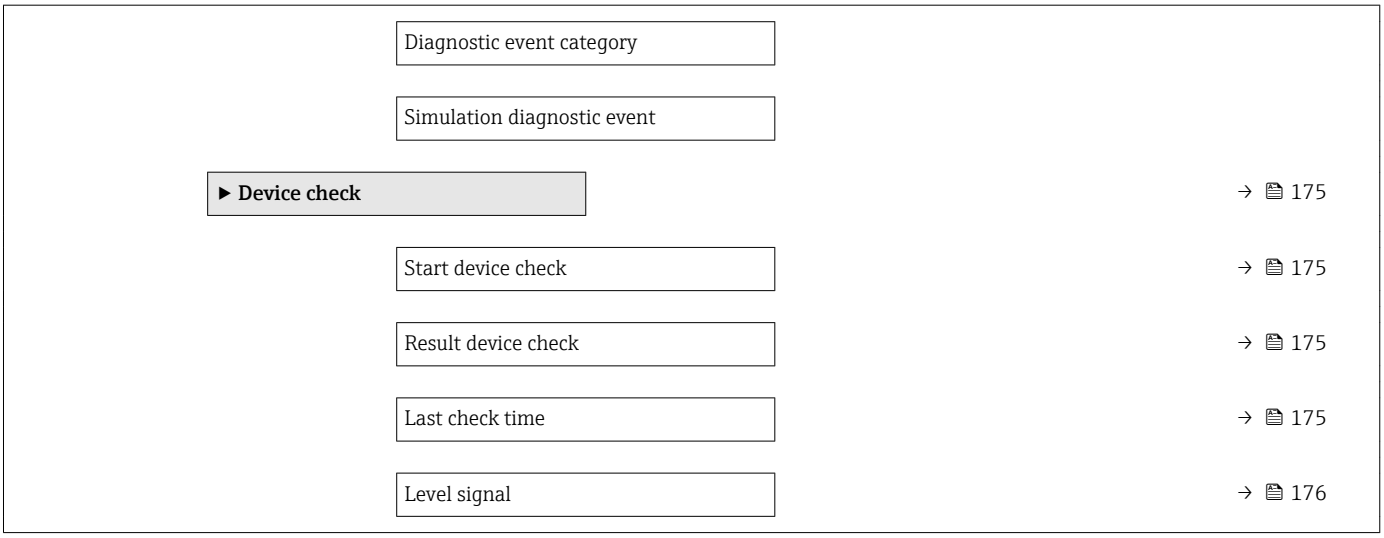
- Enter access code → 114
- ▶ **Level** → 115
  - Medium type → 115
  - Medium property → 115
  - Max. filling speed liquid → 116
  - Max. draining speed liquid → 116
  - Advanced process conditions → 116
  - Level unit → 117
  - Blocking distance → 117
  - Level correction → 118
  - Tank/silo height → 118
- ▶ **Linearization** → 121
  - Linearization type → 123
  - Unit after linearization → 124
  - Free text → 125
  - Maximum value → 126
  - Diameter → 126
  - Intermediate height → 126
  - Table mode → 127
  - ▶ **Edit table**
    - Level → 128
    - Customer value → 129
  - Activate table → 129
- ▶ **Safety settings** → 131
  - Output echo lost → 131

- Value echo lost → 131
- Ramp at echo lost → 132
- Blocking distance → 117
- ▶ **SIL/WHG confirmation** → 134
- ▶ **Deactivate SIL/WHG** → 135
  - Reset write protection → 135
  - Code incorrect → 135
- ▶ **Current output 1 to 2** → 136
  - Assign current output → 136
  - Current span → 137
  - Fixed current → 137
  - Damping output → 138
  - Failure mode → 138
  - Failure current → 139
  - Output current 1 to 2 → 139
- ▶ **Switch output** → 140
  - Switch output function → 140
  - Assign status → 140
  - Assign limit → 141
  - Assign diagnostic behavior → 141
  - Switch-on value → 141
  - Switch-on delay → 143
  - Switch-off value → 143
  - Switch-off delay → 143
  - Failure mode → 144

| | | |
|---|---|---|
| | Switch status | → 144 |
| | Invert output signal | → 144 |
| ▶ **Display** | | → 145 |
| | Language | → 145 |
| | Format display | → 145 |
| | Value 1 to 4 display | → 147 |
| | Decimal places 1 to 4 | → 147 |
| | Display interval | → 148 |
| | Display damping | → 148 |
| | Header | → 148 |
| | Header text | → 149 |
| | Separator | → 149 |
| | Number format | → 149 |
| | Decimal places menu | → 150 |
| | Backlight | → 150 |
| | Contrast display | → 151 |
| ▶ **Configuration backup display** | | → 152 |
| | Operating time | → 152 |
| | Last backup | → 152 |

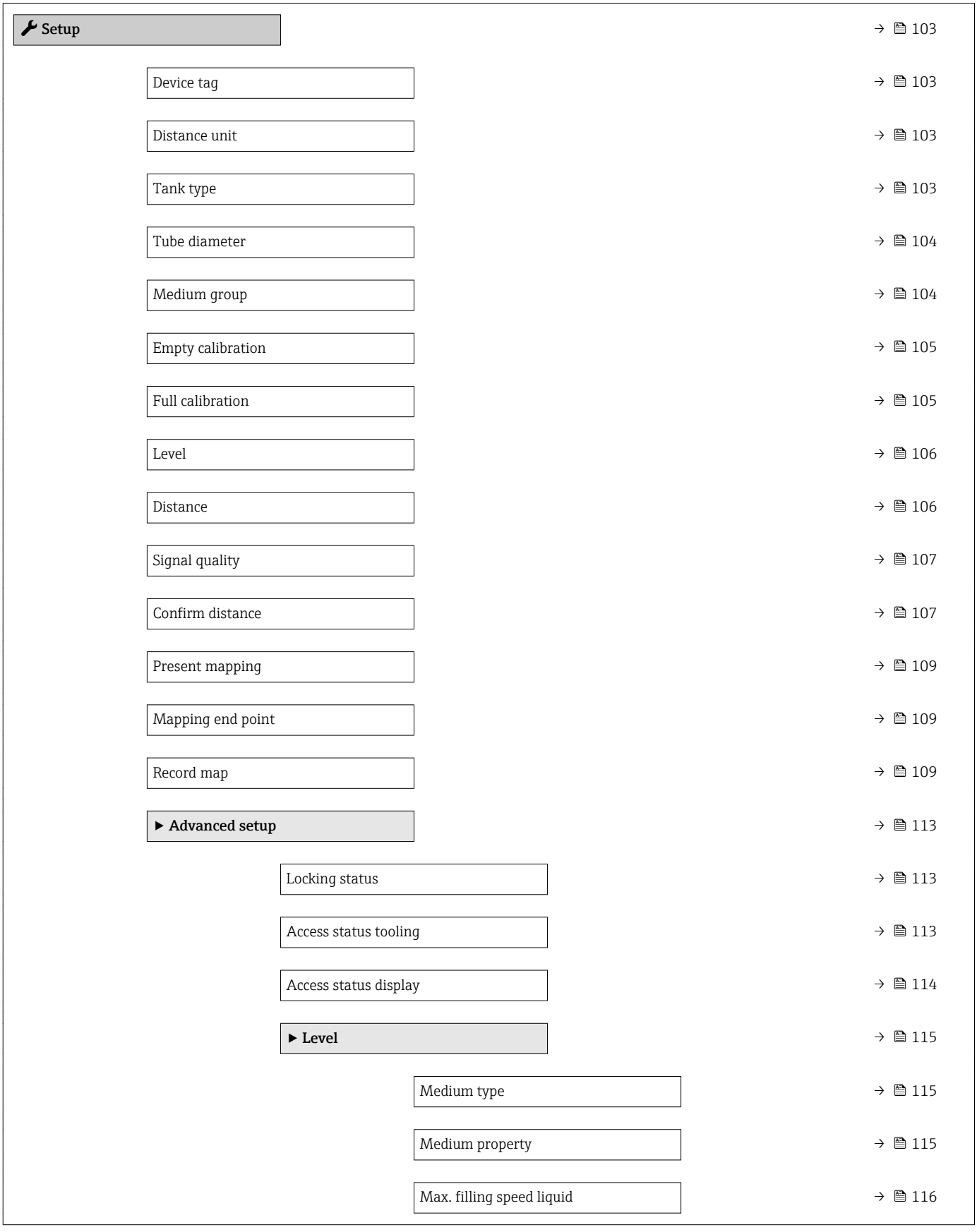
- Configuration management → 152
- Comparison result → 153
- ▶ **Administration** → 155
  - ▶ **Define access code** → 157
    - Define access code → 157
    - Confirm access code → 157
  - Device reset → 155
- **Diagnostics** → 158
  - Actual diagnostics → 158
  - Previous diagnostics → 158
  - Operating time from restart → 159
  - Operating time → 152
  - ▶ **Diagnostic list** → 160
    - Diagnostics 1 to 5 → 160
  - ▶ **Event logbook** → 161
    - Filter options → 161
    - ▶ **Event list** → 161
  - ▶ **Device information** → 162
    - Device tag → 162
    - Serial number → 162
    - Firmware version → 162
    - Device name → 162
    - Order code → 163
    - Extended order code 1 to 3 → 163
    - Device revision → 163

- Device ID → 163
- Device type → 164
- Manufacturer ID → 164
- ▶ **Measured values** → 165
  - Distance → 106
  - Level linearized → 125
  - Output current 1 to 2 → 139
  - Measured current 1 → 166
  - Terminal voltage 1 → 166
  - Electronic temperature → 166
- ▶ **Data logging** → 167
  - Assign channel 1 to 4 → 167
  - Logging interval → 167
  - Clear logging data → 168
  - ▶ **Display channel 1 to 4** → 169
- ▶ **Simulation** → 171
  - Assign measurement variable → 172
  - Value process variable → 172
  - Simulation current output 1 to 2 → 172
  - Value current output 1 to 2 → 173
  - Switch output simulation → 173
  - Switch status → 173
  - Simulation device alarm → 174


Diagnostic event category
Simulation diagnostic event
► Device check
→ 175
Start device check
→ 175
Result device check
→ 175
Last check time
→ 175
Level signal
→ 176

## 15.2 Overview of the operating menu (operating tool)

*Navigation* Operating menu



| | |
|---|---|
| Max. draining speed liquid | → 116 |
| Advanced process conditions | → 116 |
| Level unit | → 117 |
| Blocking distance | → 117 |
| Level correction | → 118 |
| Tank/silo height | → 118 |
| ▶ **Linearization** | → 121 |
| Linearization type | → 123 |
| Unit after linearization | → 124 |
| Free text | → 125 |
| Level linearized | → 125 |
| Maximum value | → 126 |
| Diameter | → 126 |
| Intermediate height | → 126 |
| Table mode | → 127 |
| Table number | → 128 |
| Level | → 128 |
| Level | → 129 |
| Customer value | → 129 |
| Activate table | → 129 |
| ▶ **Safety settings** | → 131 |
| Output echo lost | → 131 |
| Value echo lost | → 131 |
| Ramp at echo lost | → 132 |
| Blocking distance | → 117 |

▶ **SIL/WHG confirmation** → 134

▶ **Deactivate SIL/WHG** → 135

Reset write protection → 135

Code incorrect → 135

▶ **Current output 1 to 2** → 136

Assign current output → 136

Current span → 137

Fixed current → 137

Damping output → 138

Failure mode → 138

Failure current → 139

Output current 1 to 2 → 139

▶ **Switch output** → 140

Switch output function → 140

Assign status → 140

Assign limit → 141

Assign diagnostic behavior → 141

Switch-on value → 141

Switch-on delay → 143

Switch-off value → 143

Switch-off delay → 143

Failure mode → 144

Switch status → 144

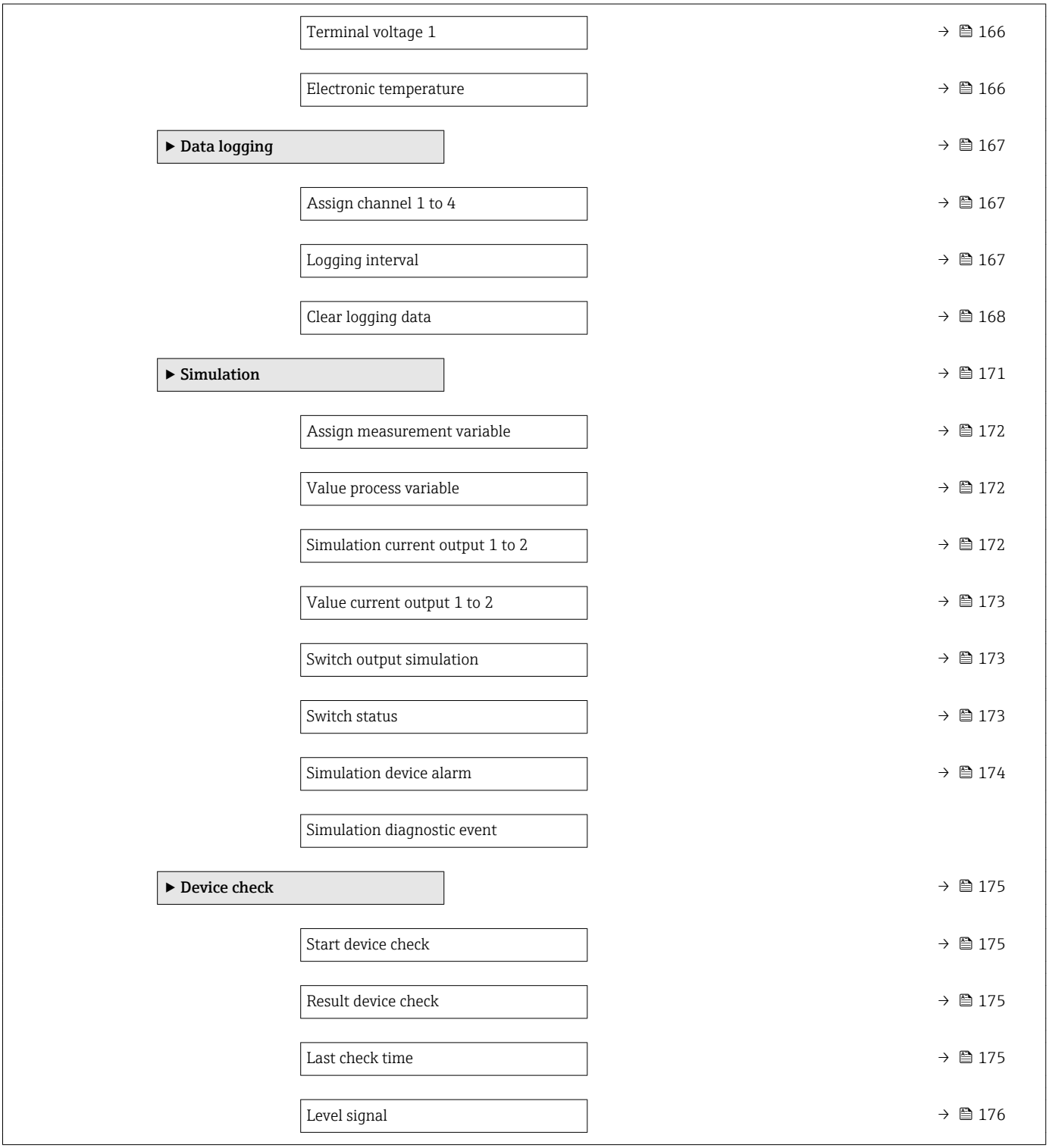
Invert output signal → 144

- ▶ **Display** → 145
  - Language → 145
  - Format display → 145
  - Value 1 to 4 display → 147
  - Decimal places 1 to 4 → 147
  - Display interval → 148
  - Display damping → 148
  - Header → 148
  - Header text → 149
  - Separator → 149
  - Number format → 149
  - Decimal places menu → 150
  - Backlight → 150
  - Contrast display → 151
- ▶ **Configuration backup display** → 152
  - Operating time → 152
  - Last backup → 152
  - Configuration management → 152
  - Backup state → 153
  - Comparison result → 153
- ▶ **Administration** → 155
  - Define access code → 157
  - Device reset → 155

**Diagnostics** → 158

- Actual diagnostics → 158

- Timestamp → 158
- Previous diagnostics → 158
- Timestamp → 159
- Operating time from restart → 159
- Operating time → 152
- ▶ **Diagnostic list** → 160
  - Diagnostics 1 to 5 → 160
  - Timestamp 1 to 5 → 160
- ▶ **Device information** → 162
  - Device tag → 162
  - Serial number → 162
  - Firmware version → 162
  - Device name → 162
  - Order code → 163
  - Extended order code 1 to 3 → 163
  - Device revision → 163
  - Device ID → 163
  - Device type → 164
  - Manufacturer ID → 164
- ▶ **Measured values** → 165
  - Distance → 106
  - Level linearized → 125
  - Output current 1 to 2 → 139
  - Measured current 1 → 166


Terminal voltage 1 → 166
Electronic temperature → 166
▶ Data logging → 167
Assign channel 1 to 4 → 167
Logging interval → 167
Clear logging data → 168
▶ Simulation → 171
Assign measurement variable → 172
Value process variable → 172
Simulation current output 1 to 2 → 172
Value current output 1 to 2 → 173
Switch output simulation → 173
Switch status → 173
Simulation device alarm → 174
Simulation diagnostic event
▶ Device check → 175
Start device check → 175
Result device check → 175
Last check time → 175
Level signal → 176

## 15.3 "Setup" menu

- : Marks the navigation path to the parameter via the display and operating module.
- : Marks the navigation path to the parameter via an operating tool (e.g. FieldCare).
- : Marks parameters which can be locked via the software locking → 50.

*Navigation* Setup

### Device tag

**Navigation** Setup → Device tag

**Description** Enter the name for the measuring point.

**Factory setting** FMR5x

### Distance unit

**Navigation** Setup → Distance unit

**Description** Select distance unit.

**Selection**

| *SI units* | *US units* |
|---|---|
| ▪ mm | ▪ ft |
| ▪ m | ▪ in |

**Factory setting** m

### Tank type

**Navigation** Setup → Tank type

**Prerequsite** **Medium type (→ 115) = Liquid**

**Description** Select tank type.

**Selection**

- Bypass / pipe
- Stilling well
- Workbench test
- Open channel
- Sphere
- Storage vessel

- Process vessel standard
- Process vessel with agitator
- Wave guide antenna

**Factory setting** Depending on the antenna

**Additional information** Depending on the antenna some of the options mentioned above may not be available or there may be additional options.

## Tube diameter

**Navigation** Setup → Tube diameter

**Prerequisite** **Tank type (→ 103)** = **Bypass / pipe**

**Description** Specify diameter of bypass or stilling well.

**User entry** 0 to 9.999 m

**Factory setting** 0 m

## Medium group

**Navigation** Setup → Medium group

**Prerequisite** **Medium type (→ 115)** = **Liquid**

**Description** Select medium group.

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

**Factory setting** Others

**Additional information** This parameter roughly specifies the dielectric constant (DC) of the medium. For a more detailed definition of the DC use the **Medium property** parameter (→ 115).

The **Medium group** parameter presets the **Medium property** parameter (→ 115) as follows:

| Medium group | Medium property (→ 115) |
|---|---|
| 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

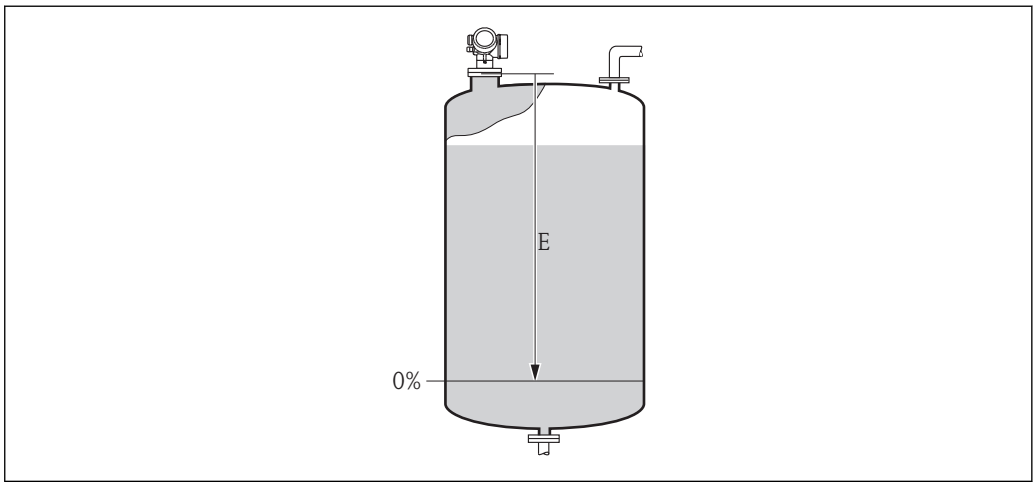
**Navigation** Setup → Empty calibr.

**Description** Specify the distance E between the process connection and the minimum level (0%). This defines the starting point of the measuring range.

**User entry** Depending on the antenna

**Factory setting** Depending on the antenna

**Additional information**




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

The measuring range starts at the point at which the radar beam hits the tank or silo bottom. In the case of dished boiler ends or conical outlets levels below this point can not be measured.

## Full calibration

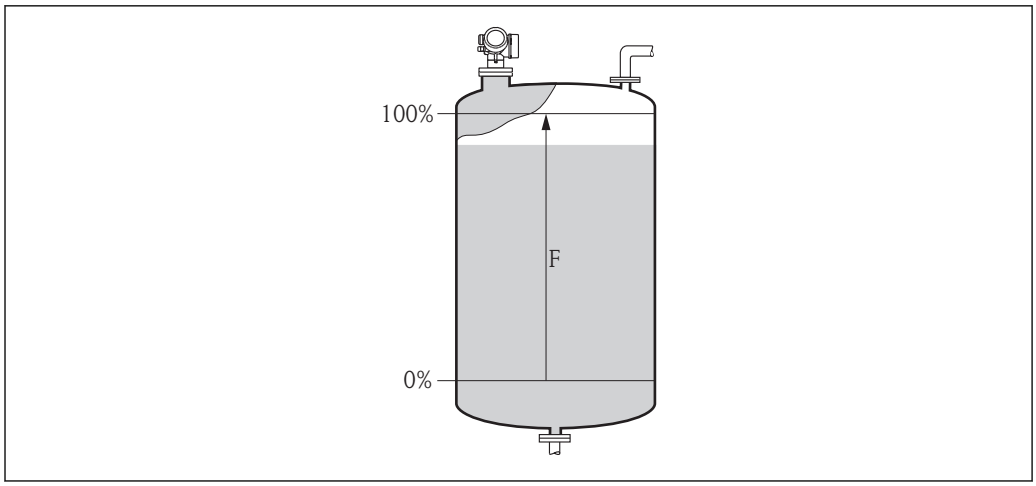
**Navigation** Setup → Full calibr.

**Description** Specify the distance F between the minimum level (0%) and the maximum level (100%).

**User entry** Depending on the antenna

**Factory setting** Depending on the antenna

**Additional information**



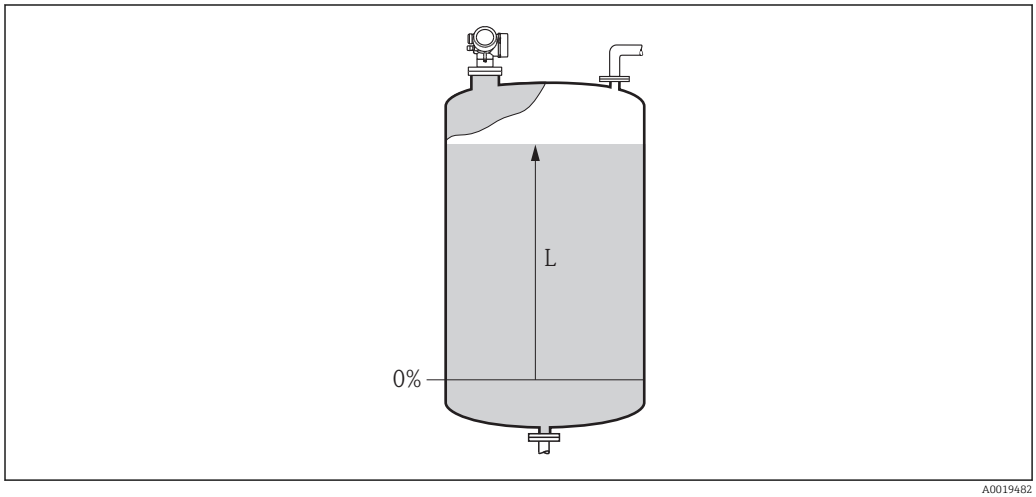

27 *Full calibration (F) for level measurements in liquids*

## Level

**Navigation** Setup → Level

**Description** Displays measured level L (before linearization).

**Additional information**




28 *Level in case of liquid measurements*

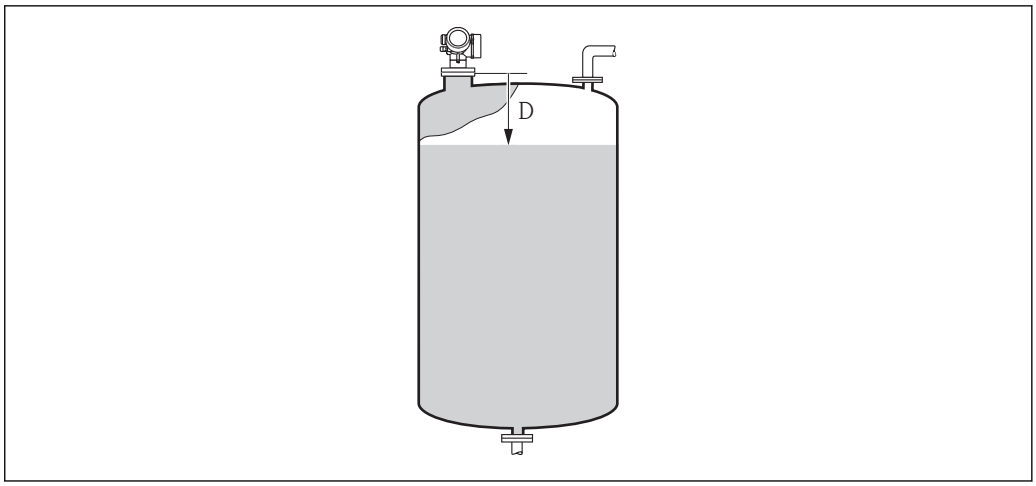
The unit is defined in the **Level unit** parameter (→ 117).

## Distance

**Navigation** Setup → Distance

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

**Additional information**




*29 Distance for liquid measurements*

The unit is defined in the **Distance unit** parameter (→ 103).

## Signal quality

**Navigation** Setup → Signal quality

**Description** Displays the signal quality of the level echo.

**Additional information**

**Meaning of the display options**
- **Strong**
  The evaluated echo exceeds the threshold by at least 10 dB.
- **Medium**
  The evaluated echo exceeds the threshold by at least 5 dB.
- **Weak**
  The evaluated echo exceeds the threshold by less than 5 dB.
- **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 echo or the tank bottome echo. To differentiate between these two, the quality of the tank bottom echo 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 (→ 131) = Alarm**.
- S941, if another option has been selected in **Output echo lost (→ 131)**.

## 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 [7]
- Distance too big [7]
- Tank empty
- Factory map

**Factory setting**

Distance unknown

**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 (→ 109). In this case it is not necessary to confirm the distance.
- **Distance ok**
  To be selected if the measured distance matches the actual distance. The device performs a mapping.
- **Distance unknown**
  To be selected if the actual distance is unknown. A mapping can not be performed in this case.
- **Distance too small**
  To be selected if the measured distance is smaller than the actual distance. The device searches for the next echo and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
- **Distance too big** [8]
  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 as defined by the **Tank/silo height** parameter (→ 118). By default, **Tank/silo height** = **Empty calibration**.
  Take into account that in case of conical outlets, for example, a measurement is only possible up to the point at which the radar hits the bottom of the tank or silo. If the **Tank empty** option is used, **Empty calibration (→ 105)** and **Tank/silo height** may not reach below this point as otherwise the empty signal is suppressed.
- **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.

7) Visibility depends on order options or device settings
8) Only available for "Expert → Sensor → Echo tracking → **Evaluation mode** parameter" = "Short time history" or "Long time history"

## 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 (→ 107)** = **Manual map** or **Distance too small**

**Description** Specify new end of the mapping.

**User entry** 0.1 to 999 999.9 m

**Factory setting** 0.1 m

**Additional information** This parameter defines up to which distance the new mapping is to be recorded. The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or the threaded connection.

For reference purposes the **Present mapping** parameter (→ 109) is displayed together with this parameter. It indicates up to which distance a mapping has already been recorded.

## Record map

**Navigation** Setup → Record map

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

**Description** Start recording of the map.

**Selection**
- No
- Record map
- Overlay map
- Factory map
- Delete partial map

**Factory setting** No

**Additional information**

**Meaning of the options**

- **No**
  The map is not recorded.
- **Record map**
  The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing ☑.
- **Overlay map**
  The new mapping curve is generated by overlaying the old and the current envelope curves.
- **Factory map**
  The factory map stored in the ROM of the device is used.
- **Delete partial map**
  The mapping curve is deleted up to **Mapping end point (→ 109)**.

### 15.3.1 "Mapping" wizard

The **Mapping** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the mapping are located directly in the **Setup** menu (→ 103).

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

*Navigation* Setup → Mapping

**Confirm distance**

**Navigation** Setup → Mapping → Confirm distance

**Description** → 107

**Mapping end point**

**Navigation** Setup → Mapping → Map. end point

**Description** → 109

**Record map**

**Navigation** Setup → Mapping → Record map

**Description** → 109

**Distance**

**Navigation** Setup → Mapping → Distance

**Description** → 106

**Prepare recording map**

**Navigation** Setup → Mapping → Prepare rec. map

**Description** Indicates the progress of the recording of the map.

**User interface**

- Init. recording
- In progress
- Finished

## 15.3.2 "Advanced setup" submenu

*Navigation* Setup → Advanced setup

### Locking status

**Navigation** Setup → Advanced setup → Locking status

**Description** Indicates the write protection with the highest priority that is currently active.

**User interface**
- Hardware locked
- SIL locked
- WHG locked
- Temporarily locked

**Additional information**

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

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

### Access status tooling

**Navigation** Setup → Advanced setup → Access stat.tool

**Description** Indicates access authorization to parameters via operating tool (e.g. FieldCare).

**User interface**
- Operator
- Maintenance
- Service

**Additional information**

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

If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→ 113).

## Access status display

**Navigation** Setup → Advanced setup → Access stat.disp

**Prerequisite** The device has a local display.

**Description** Indicates access authorization to parameters via local display.

**User interface**
- Operator
- Maintenance
- Service

**Additional information**

If a symbol appears in front of a parameter, the parameter cannot be changed via the local display with the current access authorization.

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

If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter (→ 113).

## Enter access code

**Navigation** Setup → Advanced setup → Ent. access code

**Description** Enter access code to disable write protection of parameters.

**User entry** 0 to 9 999

**Additional information**
- For local operation, the customer-specific access code, which has been defined in the **Define access code** parameter (→ 155), has to be entered.
- If an incorrect access code is entered, the user retains his current access authorization.
- The write protection affects all parameters marked with the -symbol in this document. On the local display, the -symbol in front of a parameter indicates that the parameter is write-protected.
- If no key is pressed for 10 min, or the user switches from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s.

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

### "Level" submenu

*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** FMR50, FMR51, FMR52, FMR53, FMR54: **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

**Description** Specify relative dielectric constant $\varepsilon_r$ of the medium.

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

**Factory setting** Dependent on **Medium type (→ 115)** and **Medium group (→ 104)**.

**Additional information** *Dependency on "Medium type" and "Medium group"*

| Medium type (→ 115) | Medium group (→ 104) | Medium property |
|---|---|---|
| Solid | | Unknown |
| Liquid | Water based (DC >= 4) | DC 4 ... 7 |
| | Others | Unknown |

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

### Max. filling speed liquid

**Navigation** Setup → Advanced setup → Level → Max. fill liquid

**Prerequsite** **Medium type (→ 115)** = **Liquid**

**Description** Select expected maximum filling speed.

**Selection**
- Slow < 1cm (0,4in) /min
- Medium < 10cm (4in) /min
- Standard < 1m (40in) /min
- Fast < 2m (80in) /min
- Very fast > 2m (80in) /min
- No filter / test

**Factory setting** Depending on the **Tank type** parameter (→ 103)

**Additional information** **Max. filling speed liquid** is preset by **Tank type (→ 103)**. It can, however, be adjusted to the process in the vessel at any time. If **Tank type (→ 103)** is changed again at a later point of time, it may be necessary to repeat the fine adjustment.

### Max. draining speed liquid

**Navigation** Setup → Advanced setup → Level → Max drain liquid

**Prerequsite** **Medium type (→ 115)** = **Liquid**

**Description** Select expected maximum draining speed.

**Selection**
- Slow < 1cm (0,4in) /min
- Medium < 10cm (4in) /min
- Standard < 1m (40in) /min
- Fast < 2m (80in) /min
- Very fast > 2m (80in) /min
- No filter / test

**Factory setting** Depending on the **Tank type** parameter (→ 103)

**Additional information** **Max. draining speed liquid (→ 116)** is preset by **Tank type (→ 103)**. It can, however, be adjusted to the process in the vessel at any time. If **Tank type (→ 103)** is changed again at a later point of time, it may be necessary to repeat the fine adjustment.

### Advanced process conditions

**Navigation** Setup → Advanced setup → Level → Adv. conditions

**Description** Specify additional process conditions (if required).

**Selection**
- Foam (>5cm/0,16ft)
- Changing DC values

**Factory setting**
None

**Additional information**
*"Foam (>5cm/0,16ft)" option*

This option makes sure that no tank history is used which has been recorded while foam was present at the surface and thus is no reliable map of the tank property. To achieve this, the setting **Evaluation mode** = **Long time history** is deactivated.

The **Foam (>5cm/0,16ft)** option is only available for liquid applications (FMR50, FMR51, FMR52, FMR53, FMR54).

*"Changing DC values" option*

A tank history which has been recorded with **Evaluation mode** = **Long time history** is only valid for a fixed dielectric constant. The **Changing DC values** option disables the setting **Evaluation mode** = **Long time history** and thus avoids wrong measuring values in the case of a changing dielectric constant.

The **Changing DC values** option is only available for liquid applications (FMR50, FMR51, FMR52, FMR53, FMR54).

## Level unit

**Navigation**
Setup → Advanced setup → Level → Level unit

**Description**
Select level unit.

**Selection**

*SI units*
- %
- m
- mm

*US units*
- ft
- in

**Factory setting**
%

**Additional information**
The level unit may differ from the distance unit defined in the **Distance unit** parameter (→ 103):
- The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 105)** and **Full calibration (→ 105)**).
- The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

## Blocking distance

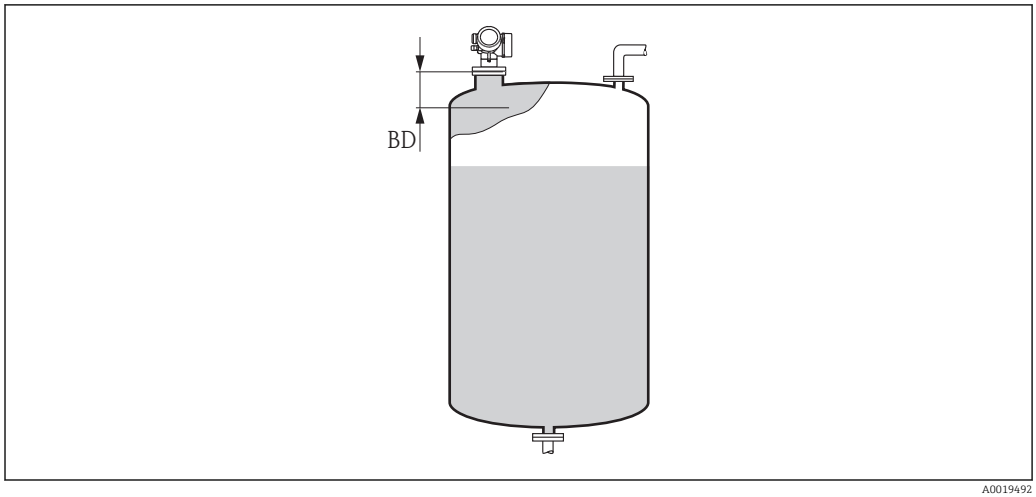
**Navigation**
Setup → Advanced setup → Level → Blocking dist.

**Description**
Specify blocking distance BD.

**User entry**
0 to 200 m

**Factory setting**
FMR50, FMR51, FMR53, FMR54: antenna length

**Additional information** No echos are evaluated within the blocking distance BD. Therefore, BD can be used to suppress interference echos in the vicinity of the antenna.




*30 Blocking distance (BD) for liquid measurements*

## Level correction

**Navigation** Setup → Advanced setup → Level → Level correction

**Description** Specify level correction (if required).

**User entry** −200 000.0 to 200 000.0 %

**Factory setting** 0.0 %

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

## Tank/silo height

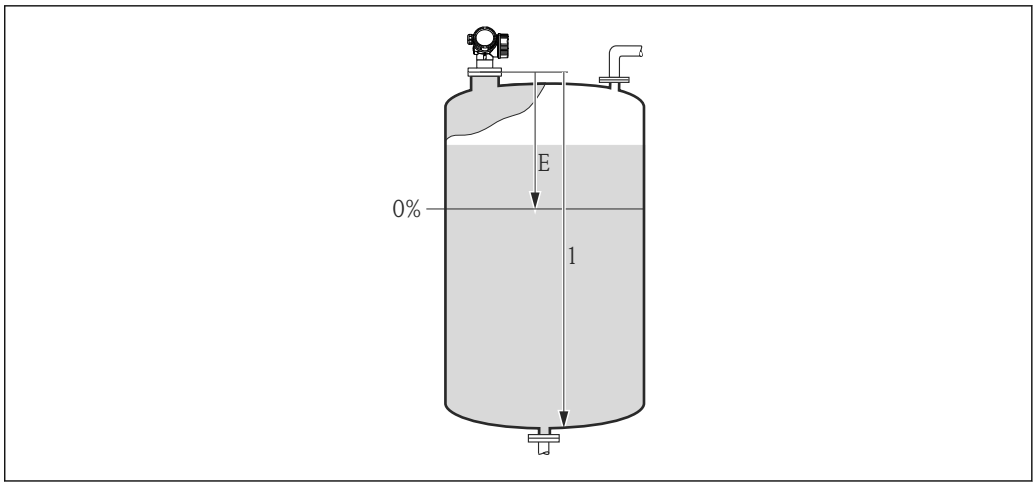
**Navigation** Setup → Advanced setup → Level → Tank/silo height

**Description** Specify total height of the tank or silo as measured from the process connection.

**User entry** −999.9999 to 999.9999 m

**Factory setting** **Empty calibration (→ 105)**

**Additional information** If the parametrized measuring range (**Empty calibration (→ 105)**) differs significantly from the tank or silo height, it is recommended to enter the tank or silo height. Example: Continuous level monitoring in the upper third of a tank or silo.

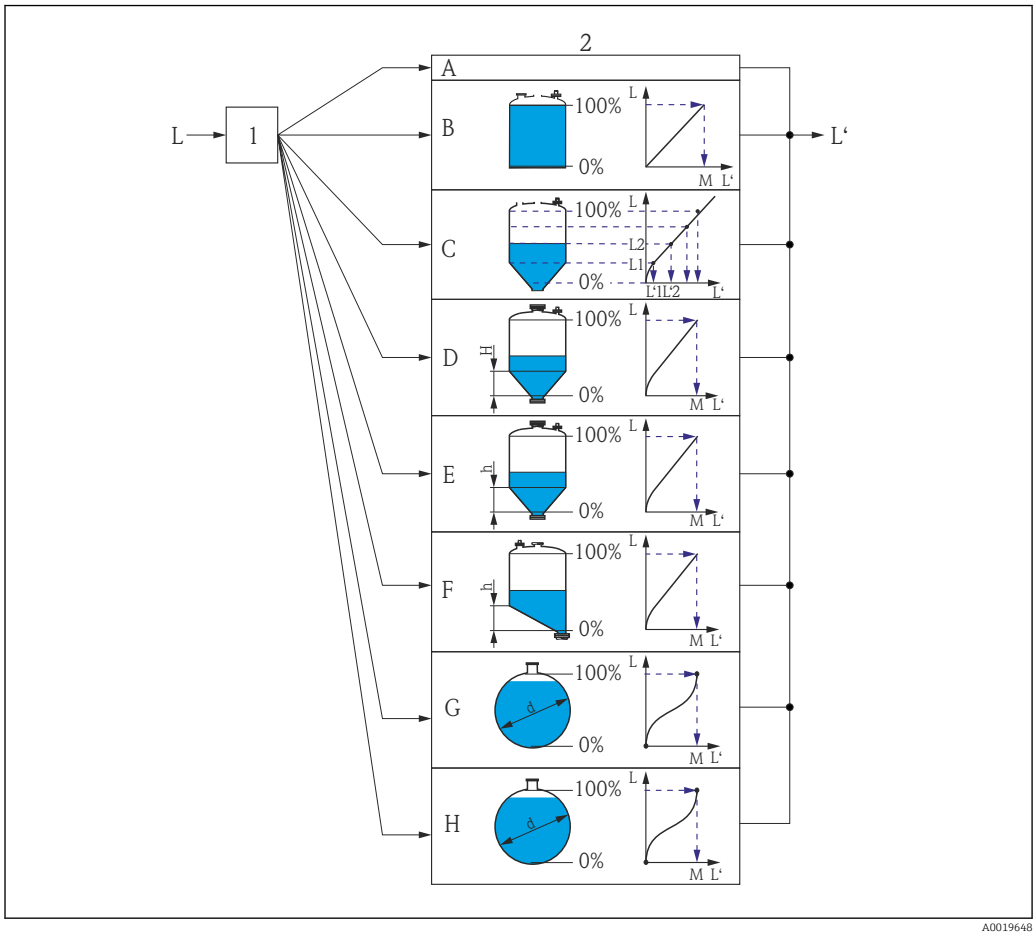



*31 "Tank/silo height" parameter (→ 118)' for measurements in liquids*

*E Empty calibration (→ 105)*
*1 Tank/silo height (→ 118)*

For tanks with conical outlet, **Tank/silo height** should not be changed as in this type of applications **Empty calibration (→ 105)** is usually **not** << the tank or silo height.

## "Linearization" submenu

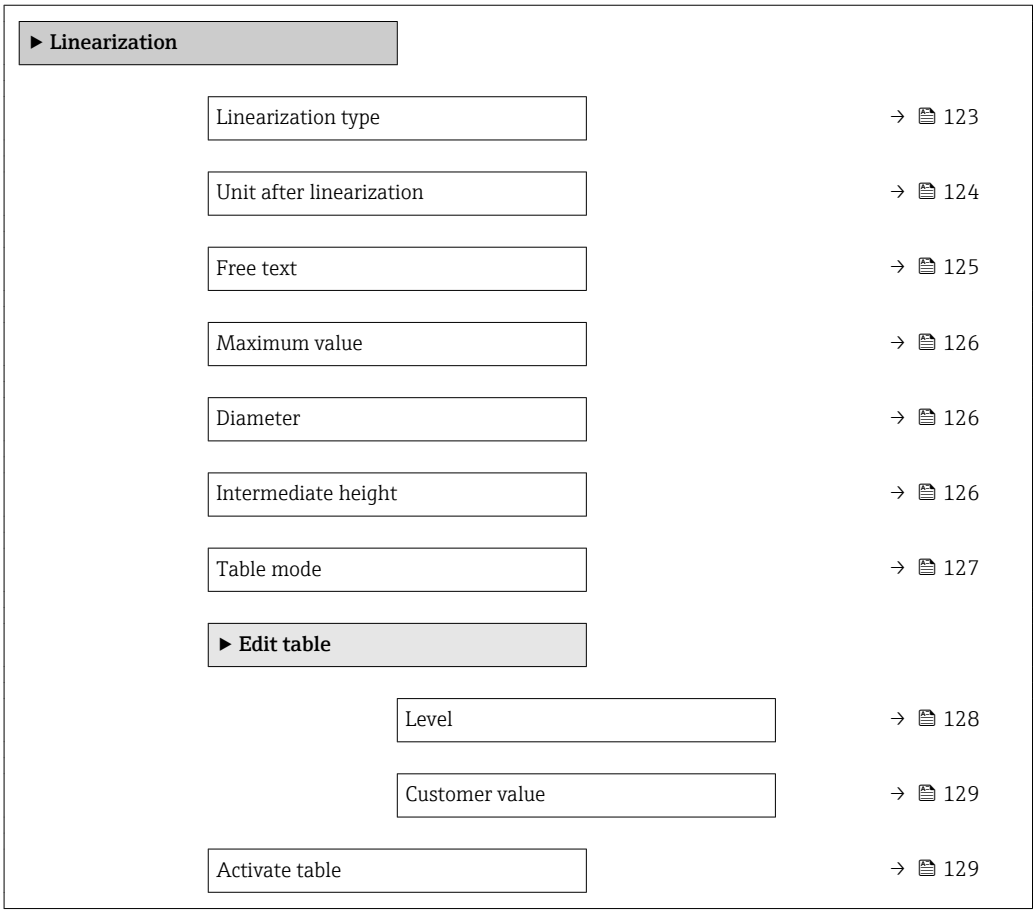



32 *Linearization: Transformation of the level and (if relevant) the interface height into a volume or weight; the transformation is dependent on the shape of the vessel.*

*1 Selection of linearization type and unit*
*2 Configuration of the linearization*
*A Linearization type (→ 123) = None*
*B Linearization type (→ 123) = Linear*
*C Linearization type (→ 123) = Table*
*D Linearization type (→ 123) = Pyramid bottom*
*E Linearization type (→ 123) = Conical bottom*
*F Linearization type (→ 123) = Angled bottom*
*G Linearization type (→ 123) = Horizontal cylinder*
*H Linearization type (→ 123) = Sphere*
*L Level before linearization (measured in distance units)*
*L' Level linearized (→ 125) (corresponds to volume or weight)*
*M Maximum value (→ 126)*
*d Diameter (→ 126)*
*h Intermediate height (→ 126)*

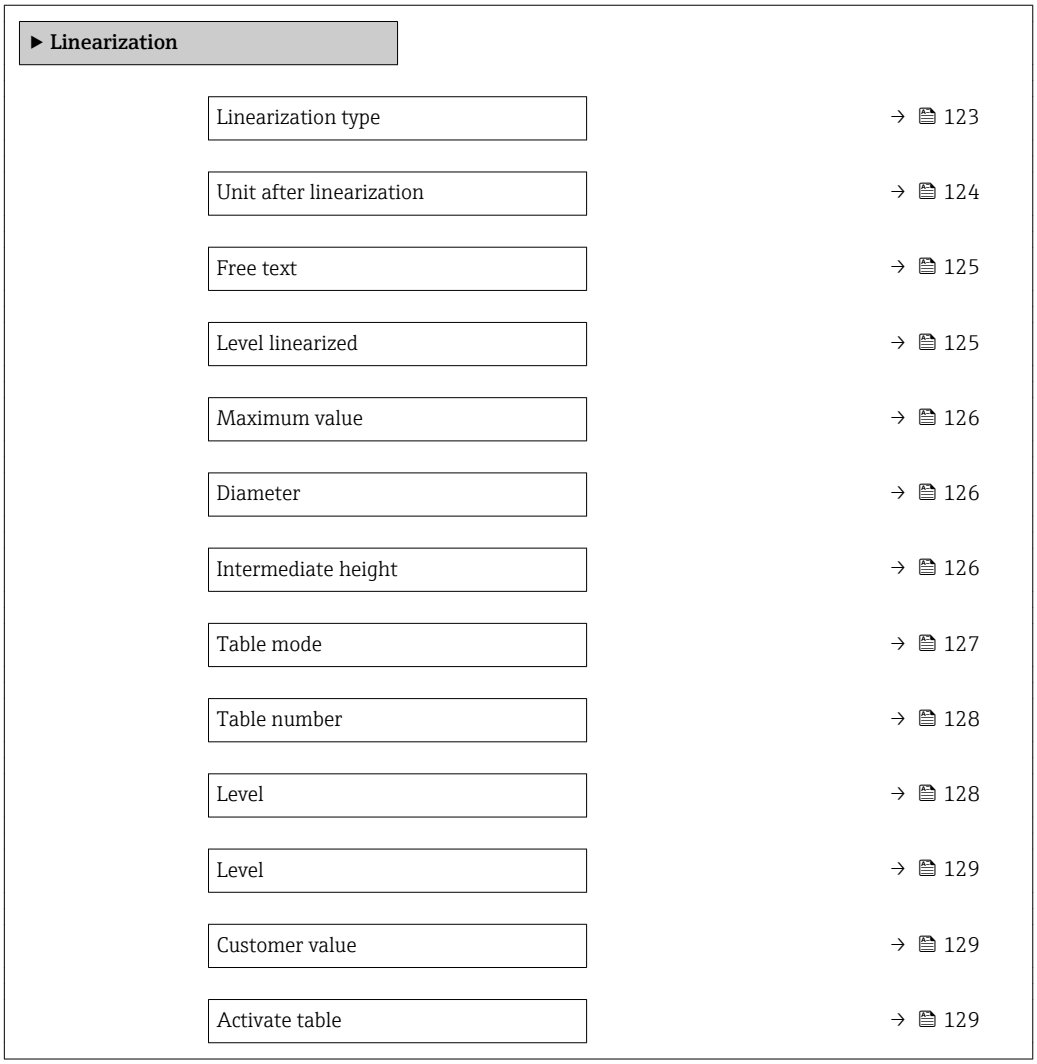
*Structure of the submenu on the display module*

*Navigation* Setup → Advanced setup → Linearization



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

*Navigation* Setup → Advanced setup → Linearization



*Description of parameters*

*Navigation* Setup → Advanced setup → Linearization

## Linearization type

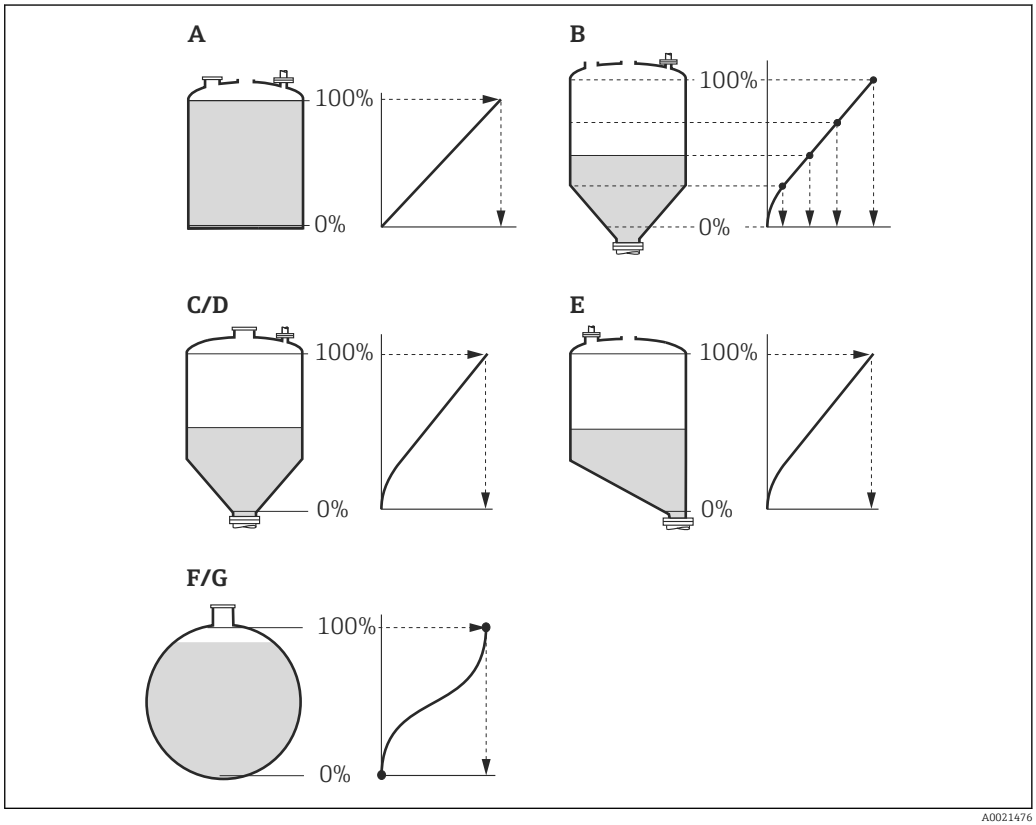
**Navigation** Setup → Advanced setup → Linearization → Lineariz. type

**Description** Select linearization type.

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

**Factory setting** None

**Additional information**




*33 Linearization types*

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

**Meaning of the options**

- **None**
  The level is transmitted in the level unit without linearization.
- **Linear**
  The output value (volume/weight) is directly proportional to the level L. This is valid, for example, for vertical cylinders. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
- **Table**
  The relationship between the measured level L and the output value (volume/weight) is given by a linearization table consisting of up to 32 pairs of values "level - volume" or "level - weight", respectively. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Table mode (→ 🖹 127)**
  – For each table point: **Level (→ 🖹 128)**
  – For each table point: **Customer value (→ 🖹 129)**
  – **Activate table (→ 🖹 129)**
- **Pyramid bottom**
  The output value corresponds to the volume or weight in a silo with pyramid bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
  – **Intermediate height (→ 🖹 126)**: The height of the pyramid
- **Conical bottom**
  The output value corresponds to the volume or weight in a tank with conical bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
  – **Intermediate height (→ 🖹 126)**: The height of the conical part of the tank
- **Angled bottom**
  The output value corresponds to the volume or weight in a silo with an angled bottom. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
  – **Intermediate height (→ 🖹 126)**: Height of the angled bottom
- **Horizontal cylinder**
  The output value corresponds to the volume or weight in a horizontal cylinder. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
  – **Diameter (→ 🖹 126)**
- **Sphere**
  The output value corresponds to the volume or weight in a spherical tank. The following additional parameters have to be specified:
  – **Unit after linearization (→ 🖹 124)**
  – **Maximum value (→ 🖹 126)**: Maximum volume or weight
  – **Diameter (→ 🖹 126)**

## Unit after linearization

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

**Prerequsite** **Linearization type (→ 🖹 123)** ≠ None

**Description** Select unit of the lineaized value.

**Selection**

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

*US units*
- lb
- UsGal
- $ft^3$

*Imperial units*
impGal

*Custom-specific units*
Free text

**Factory setting**

%

**Additional information**

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

It is also possible to configure a distance-to-distance linearization, i.e. a transformation from the level unit to a different distance unit. To do so, select the **Linear** linearization mode. In order to define the new level unit, select the **Free text** option in the **Unit after linearization** parameter and enter the required unit into the **Free text** parameter (→ 125).

## Free text

**Navigation**

Setup → Advanced setup → Linearization → Free text

**Prerequsite**

**Unit after linearization (→ 124) = Free text**

**Description**

Enter unit symbol.

**User entry**

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

**Factory setting**

Free text

## Level linearized

**Navigation**

Setup → Advanced setup → Linearization → Level linearized

**Description**

Displays linearized level.

**Additional information**

The unit is defined by the **Unit after linearization** parameter → 124.

## Maximum value

**Navigation** Setup → Advanced setup → Linearization → Maximum value

**Prerequsite** **Linearization type (→ 123)** has one of the following values:
- Linear
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cylinder
- Sphere

**Description** Specify the maximum content of the vessel (100%) measured in the units after linearization.

**User entry** −50 000.0 to 50 000.0 %

**Factory setting** 100.0 %

## Diameter

**Navigation** Setup → Advanced setup → Linearization → Diameter

**Prerequsite** **Linearization type (→ 123)** has one of the following values:
- Horizontal cylinder
- Sphere

**Description** Specify tank diameter.

**User entry** 0 to 9 999.999 m

**Factory setting** 2 m

**Additional information** The unit is defined in the **Distance unit** parameter (→ 103).

## Intermediate height

**Navigation** Setup → Advanced setup → Linearization → Intermed. height

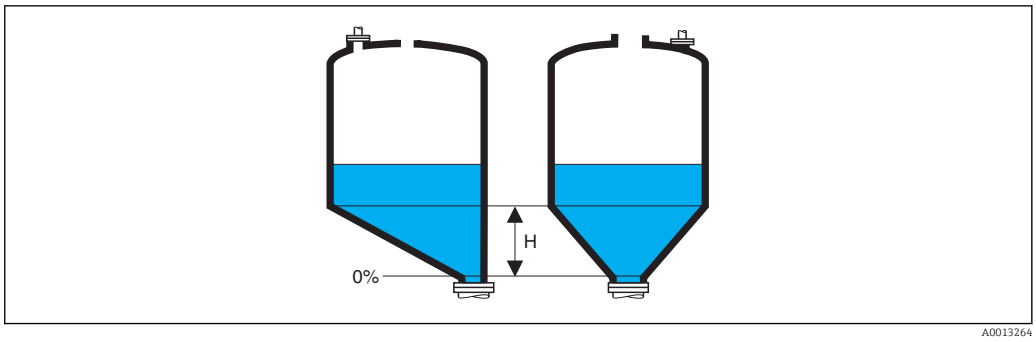
**Prerequsite** **Linearization type (→ 123)** has one of the following values:
- Pyramid bottom
- Conical bottom
- Angled bottom

**Description** Specify intermediate height H.

**User entry** 0 to 200 m

**Factory setting** 0 m

**Additional information**




*H Intermediate height*

The unit is defined in the **Distance unit** parameter (→ 103).

## Table mode

**Navigation** Setup → Advanced setup → Linearization → Table mode

**Prerequisite** **Linearization type (→ 123) = Table**

**Description** Select editing mode of the linearization table.

**Selection**
- Manual
- Semiautomatic [9)]
- Clear table
- Sort table

**Factory setting** Manual

**Additional information**

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

9) 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 (→ 105)** and **Full calibration (→ 105)** 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 (→ 127)** = **Clear table**). Then enter a new table.

**How to enter the table**
- Via FieldCare
  The table points can be entered via the **Table number (→ 128)**, **Level (→ 128)** and **Customer value (→ 129)** 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 (→ 117) beforehand.

If a decreasing table is entered, the values for 20 mA and 4 mA of the current output are interchanged. That means: 20 mA refers to the lowest level, whereas 4 mA refers to the highest level. If required, the current output can be inverted in the **Measuring mode** parameter.

## Table number

**Navigation** Setup → Advanced setup → Linearization → Table number

**Prerequisite** **Linearization type (→ 123)** = **Table**

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

**User entry** 1 to 32

**Factory setting** 1

## Level (Manual)

**Navigation** Setup → Advanced setup → Linearization → Level

**Prerequisite**
- **Linearization type (→ 123)** = **Table**
- **Table mode (→ 127)** = **Manual**

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

**User entry** Signed floating-point number

**Factory setting** 0 %

## Level (Semiautomatic)

**Navigation** Setup → Advanced setup → Linearization → Level

**Prerequsite**
- **Linearization type (→ 123)** = **Table**
- **Table mode (→ 127)** = **Semiautomatic**

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

## Customer value

**Navigation** Setup → Advanced setup → Linearization → Customer value

**Prerequsite** **Linearization type (→ 123)** = **Table**

**Description** Enter linearized value for the table point.

**User entry** Signed floating-point number

**Factory setting** 0 %

## Activate table

**Navigation** Setup → Advanced setup → Linearization → Activate table

**Prerequsite** **Linearization type (→ 123)** = **Table**

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

**Selection**
- Disable
- Enable

**Factory setting** Disable

**Additional information**

**Meaning of the options**

- **Disable**
  The measured level is not linearized.
  If **Linearization type (→ 123)** = **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** Define the behavior of the output signal in case of a lost echo.

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

**Factory setting** Last valid value

**Additional information**

**Meaning of the options**
- **Last valid value**
  The last valid value is kept in the case of a lost echo.
- **Ramp at echo lost**
  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 (→ 132).
- **Value echo lost**
  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter (→ 131).
- **Alarm**
  In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter (→ 138)

## Value echo lost

**Navigation** Setup → Advanced setup → Safety sett. → Value echo lost

**Prerequsite** **Output echo lost (→ 131) = Value echo lost**

**Description** Define output value in case of a lost echo.

**User entry** 0 to 200 000.0 %

**Factory setting** 0.0 %

**Additional information** Use the unit which has been defined for the measured value output:
- without linearization: **Level unit (→ 117)**
- with linearization: **Unit after linearization (→ 124)**

## Ramp at echo lost

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

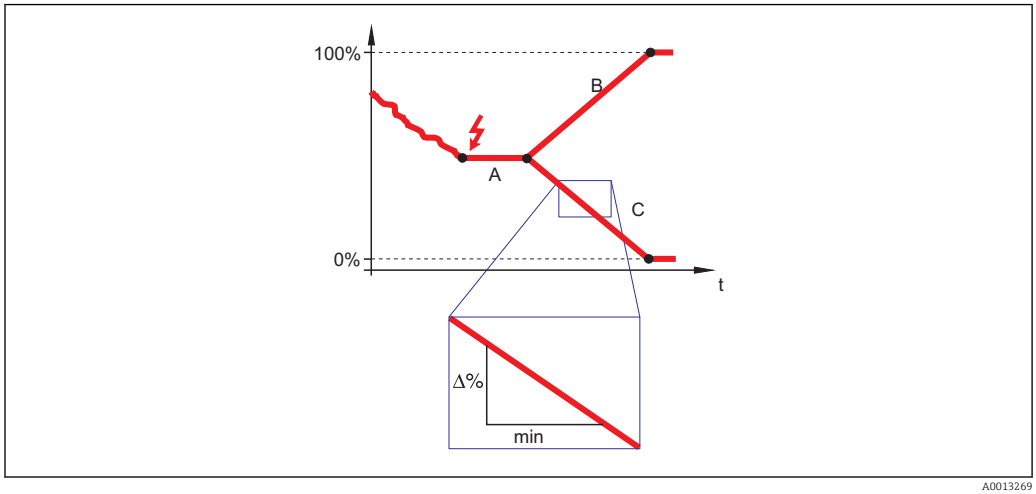
**Prerequisite** **Output echo lost (→ 131) = Ramp at echo lost**

**Description** Define the slope of the ramp in the case of a lost echo.

**User entry** Signed floating-point number

**Factory setting** 0.0 %/min

**Additional information**




*A Delay time echo lost*
*B Ramp at echo lost (→ 132) (positive value)*
*C Ramp at echo lost (→ 132) (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

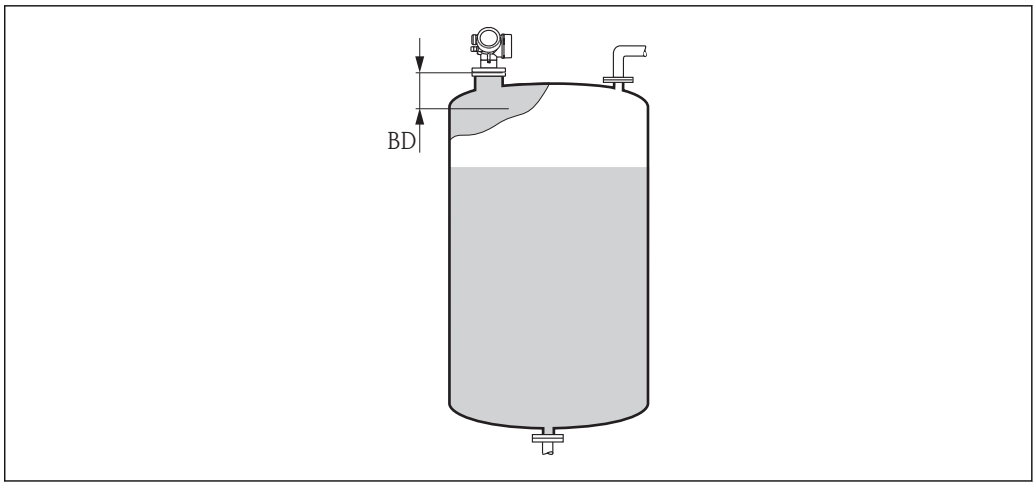
**Navigation** Setup → Advanced setup → Safety sett. → Blocking dist.

**Description** Specify blocking distance BD.

**User entry** 0 to 200 m

**Factory setting** FMR50, FMR51, FMR53, FMR54: antenna length

**Additional information** No echos are evaluated within the blocking distance BD. Therefore, BD can be used to suppress interference echos in the vicinity of the antenna.




34 *Blocking distance (BD) for liquid measurements*

**"SIL/WHG confirmation" wizard**

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

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

*Navigation* Setup → Advanced setup → SIL/WHG confirm.

### "Deactivate SIL/WHG" wizard

*Navigation* Setup → Advanced setup → Deactiv. SIL/WHG

### Reset write protection

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

**Description** Enter unlocking code.

**User entry** 0 to 65 535

**Factory setting** 0

### Code incorrect

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

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

**Selection**
- Reenter code
- Abort sequence

**Factory setting** Reenter code

### "Current output 1 to 2" submenu

The **Current output 2** submenu (→ 136) is only available for devices with two current outputs.

*Navigation* Setup → Advanced setup → Curr.output 1 to 2

## Assign current output 1 to 2

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Assign curr.

**Description** Select process variable for current output.

**Selection**
- Level linearized
- Distance
- Electronic temperature
- Relative echo amplitude
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2
- Area of incoupling

**Factory setting**
- Current output 1: Level linearized
- Current output 2 [10]: Relative echo amplitude

**Additional information** *Definition of the current range for the process variables*

| Process variable | 4 mA value | 20 mA value |
|---|---|---|
| Level linearized | 0 % [1] or the associated linearized value | 100 % [2] or the associated linearized value |
| Distance | 0 (i.e. level is at the reference point) | **Empty calibration (→ 105)** (i.e. level is at 0 %) |
| Electronic temperature | −50 °C (−58 °F) | 100 °C (212 °F) |
| Relative echo amplitude | 0 dB | 150 dB |
| Analog output adv. diagnostics 1/2 | depending on the parametrization of the Advanced Diagnostics | |
| Area of incoupling | 0 | 100 |

1) the 0% level is defined by **Empty calibration** parameter (→ 105)
2) The 100% level is defined by **Full calibration** parameter (→ 105)

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

This can be done by the following parameters:
- Expert → Output → Curr.output 1 to 2 → Turn down
- Expert → Output → Curr.output 1 to 2 → 4 mA value
- Expert → Output → Curr.output 1 to 2 → 20 mA value

10) only for devices with two current outputs

## Current span

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Current span

**Description** Select current range for process variable and alarm signal.

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

**Factory setting** 4...20 mA NAMUR

**Additional information** *Meaning of the options*

| Option | Current range for process variable | Lower alarm signal level | Upper alarm signal level |
|---|---|---|---|
| 4...20 mA | 4 to 20.5 mA | < 3.6 mA | > 21.95 mA |
| 4...20 mA NAMUR | 3.8 to 20.5 mA | < 3.6 mA | > 21.95 mA |
| 4...20 mA US | 3.9 to 20.8 mA | < 3.6 mA | > 21.95 mA |
| Fixed current | Constant current, defined in the **Fixed current** parameter (→ 137). | | |

- In the case of an error, the output current assumes the value defined in the **Failure mode** parameter (→ 138).
- If the meausred value is out of the measuring range, diagnostic message **Current output** is issued.

In a HART multidrop loop only one device can use the analog current to transmit a signal. For all other devices one must set:
- **Current span** = **Fixed current**
- **Fixed current (→ 137)** = **4 mA**

## Fixed current

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Fixed current

**Prerequsite** **Current span (→ 137)** = **Fixed current**

**Description** Define constant value of the current.

**User entry** 4 to 22.5 mA

**Factory setting** 4 mA

## Damping output

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Damping out.

**Description** Define time constant τ for the damping of the output current.

**User entry** 0.0 to 999.9 s

**Factory setting** 0.0 s

**Additional information** Fluctuations of the measured value affect the output current with an exponential delay, the time constant τ of which is defined in this parameter. With a small time constant the output reacts immediately to changes of the measrued value. With a big time constant the reaction of the output is more delayed. For τ = 0 (factory setting) there is no damping.

## Failure mode

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Failure mode

**Prerequsite** **Current span (→ 137) ≠ Fixed current**

**Description** Select behavior of the output current in case of an error.

**Selection**
- Min.
- Max.
- Last valid value
- Actual value
- Defined value

**Factory setting** Max.

**Additional information**

**Meaning of the options**
- **Min.**
  The current output adopts the value of the lower alarm level according to the **Current span** parameter (→ 137).
- **Max.**
  The current output adopts the value of the upper alarm level according to the **Current span** parameter (→ 137).
- **Last valid value**
  The current remains constant at the last value it hat before the error occurred.
- **Actual value**
  The output current follows the actual measured value; the error is ignored.
- **Defined value**
  The output current assumes the value defined in the **Failure current** parameter (→ 139).

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

## Failure current

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Failure current

**Prerequsite** **Failure mode (→ 138)** = **Defined value**

**Description** Enter current output value in alarm condition.

**User entry** 3.59 to 22.5 mA

**Factory setting** 22.5 mA

## Output current 1 to 2

**Navigation** Setup → Advanced setup → Curr.output 1 to 2 → Output curr. 1 to 2

**Description** Displays calculated output current.

### "Switch output" submenu

*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

**Factory setting** Off

**Additional information**

**Meaning of the options**
- **Off**
  The output is always open (non-conductive).
- **On**
  The output is always closed (conductive).
- **Diagnostic behavior**
  The output is normally closed and is only opened if a diagnostic event is present. The **Assign diagnostic behavior** parameter (→ 141) 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 (→ 141)**
  – **Switch-on value (→ 141)**
  – **Switch-off value (→ 143)**
- **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 (→ 140).

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

## Assign status

**Navigation** Setup → Advanced setup → Switch output → Assign status

**Prerequsite** **Switch output function (→ 140) = Digital Output**

**Description** Select device status for switch output.

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

**Factory setting** Off

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

## Assign limit

**Navigation** Setup → Advanced setup → Switch output → Assign limit

**Prerequsite** **Switch output function (→ 140) = Limit**

**Description** Select process variable for limit monitoring.

**Selection**
- Off
- Level linearized
- Distance
- Terminal voltage
- Electronic temperature
- Relative echo amplitude
- Area of incoupling

**Factory setting** Off

## Assign diagnostic behavior

**Navigation** Setup → Advanced setup → Switch output → Assign diag. beh

**Prerequsite** **Switch output function (→ 140) = Diagnostic behavior**

**Description** Select diagnostic behavior for switch output.

**Selection**
- Alarm
- Alarm or warning
- Warning

**Factory setting** Alarm

## Switch-on value

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

**Prerequsite** **Switch output function (→ 140) = Limit**

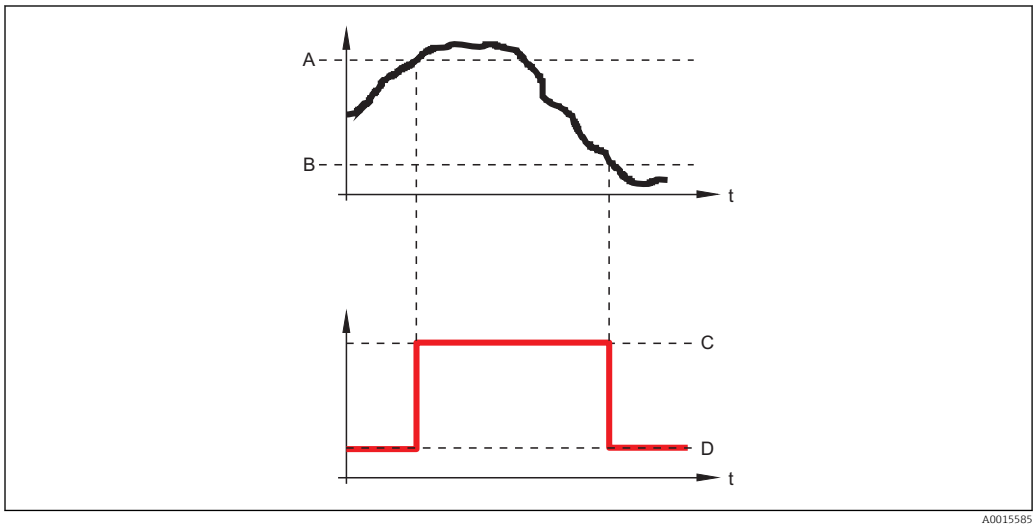
**Description** Enter measured value for the switch-on point.

**User entry** Signed floating-point number

**Factory setting** 0

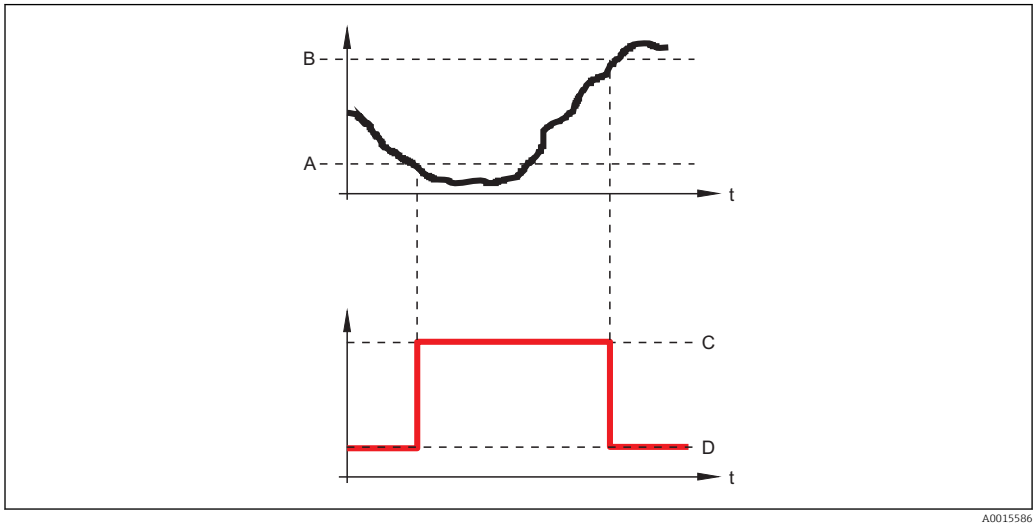
**Additional information** The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters:

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




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

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




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

## Switch-on delay

**Navigation** Setup → Advanced setup → Switch output → Switch-on delay

**Prerequsite**
- **Switch output function (→ 140) = Limit**
- **Assign limit (→ 141) ≠ Off**

**Description** Define switch-on delay.

**User entry** 0.0 to 100.0 s

**Factory setting** 0.0 s

## Switch-off value

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

**Prerequsite** **Switch output function (→ 140) = Limit**

**Description** Enter measured value for the switch-off point.

**User entry** Signed floating-point number

**Factory setting** 0

**Additional information** The switching behavior depends on the relative position of the **Switch-on value** and **Switch-off value** parameters; description: see the **Switch-on value** parameter (→ 141).

## Switch-off delay

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

**Prerequsite**
- **Switch output function (→ 140) = Limit**
- **Assign limit (→ 141) ≠ Off**

**Description** Define switch-off delay.

**User entry** 0.0 to 100.0 s

**Factory setting** 0.0 s

## Failure mode

**Navigation** Setup → Advanced setup → Switch output → Failure mode

**Description** Define output behavior in alarm condition.

**Selection**
- Actual status
- Open
- Closed

**Factory setting** Open

## Switch status

**Navigation** Setup → Advanced setup → Switch output → Switch status

**Description** Displays the current state of the switch output.

## Invert output signal

**Navigation** Setup → Advanced setup → Switch output → Invert outp.sig.

**Description** Specify whether the output signal is to be inverted.

**Selection**
- No
- Yes

**Factory setting** No

**Additional information**

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

### "Display" submenu

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

*Navigation* Setup → Advanced setup → Display

## Language

**Navigation** Setup → Advanced setup → Display → Language

**Description** Set display language.

**Selection**
- English
- Deutsch [11)]
- Français [11)]
- Español [11)]
- Italiano [11)]
- Nederlands [11)]
- Portuguesa [11)]
- Polski [11)]
- русский язык (Russian) [11)]
- Svenska [11)]
- Türkçe [11)]
- 中文 (Chinese) [11)]
- 日本語 (Japanese) [11)]
- 한국어 (Korean) [11)]
- العَرَبيّة (Arabic) [11)]
- Bahasa Indonesia [11)]
- ภาษาไทย (Thai) [11)]
- tiếng Việt (Vietnamese) [11)]
- čeština (Czech) [11)]

**Factory setting** The additional language selected in feature 500 of the product structure.
If no additional language has been selected: **English**

**Additional information** The **English** option can be selected in every device. One additional operating language can be selected in the product structure when ordering a device (feature 500 "Additional Operation Language") and will be selectable in the **Language** parameter.

## Format display

**Navigation** Setup → Advanced setup → Display → Format display

**Description** Select how measured values are shown on the display.

11) Visibility depends on order options or device settings

**Selection**

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

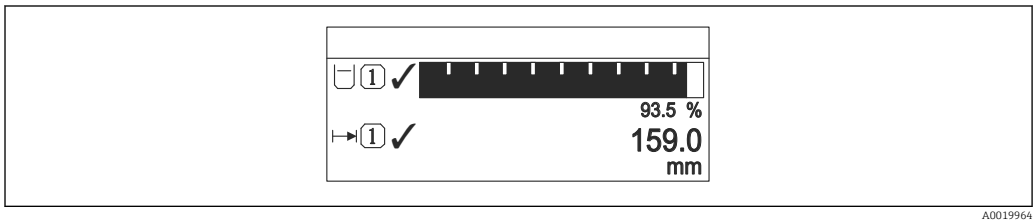
**Factory setting**

1 value, max. size

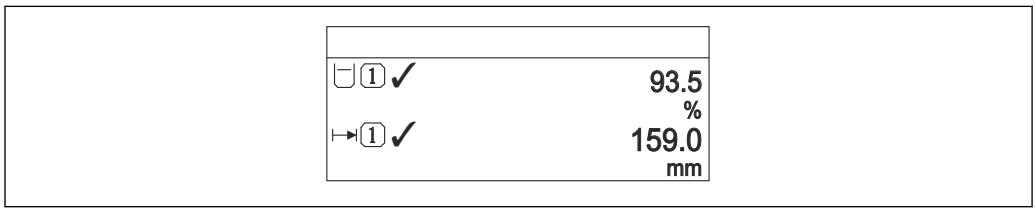
**Additional information**



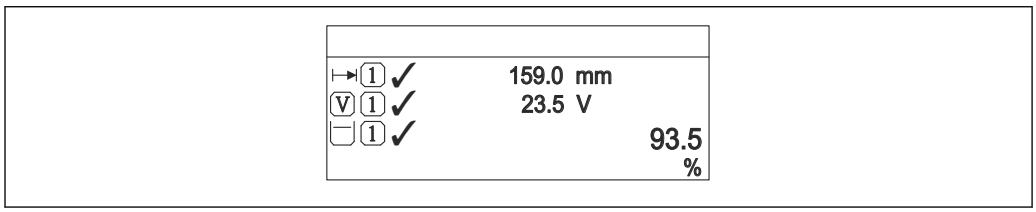

35 *"Format display" = "1 value, max. size"*



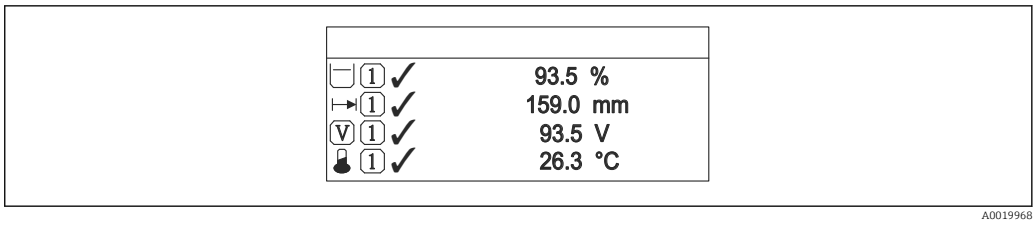

36 *"Format display" = "1 bargraph + 1 value"*




37 *"Format display" = "2 values"*




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




39 *"Format display" = "4 values"*

- The **Value 1 to 4 display** → 147 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 (→ 148).

## 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**
- None [12]
- Level linearized
- Distance
- Current output 1 [13]
- Measured current
- Current output 2
- Terminal voltage
- Electronic temperature
- Absolute echo amplitude
- Relative echo amplitude
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2
- Area of incoupling

**Factory setting**
- Value 1 display: Level linearized
- Value 2 display: None
- Value 3 display: None
- 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.

12) can not be selected for the 'Value 1 display" parameter.
13) "Visibility depends on order options or device settings"

**Selection**
- x
- x.x
- x.xx
- x.xxx
- x.xxxx

**Factory setting** x.xx

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

## Display interval

**Navigation** Setup → Advanced setup → Display → Display interval

**Description** Set time measured values are shown on display if display alternates between values.

**User entry** 1 to 10 s

**Factory setting** 5 s

**Additional information** This parameter is only relevant if the number of selected measuring values exceeds the number of values the selected display format can display simultaneously.

## Display damping

**Navigation** Setup → Advanced setup → Display → Display damping

**Description** Define display reaction time to fluctuations in the measured value.

**User entry** 0.0 to 999.9 s

**Factory setting** 0.0 s

## Header

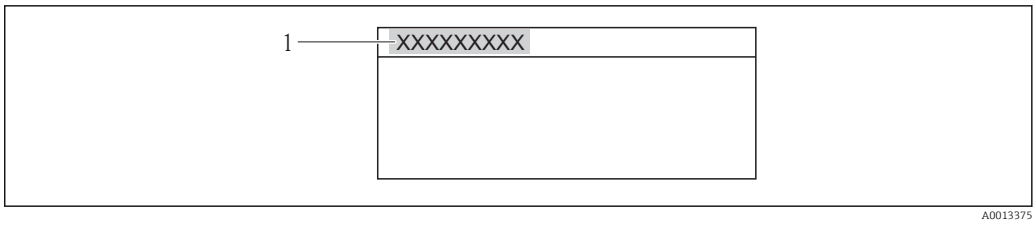
**Navigation** Setup → Advanced setup → Display → Header

**Description** Select header contents on local display.

**Selection**
- Device tag
- Free text

**Factory setting** Device tag

**Additional information**




*1 Position of the header text on the display*

*Meaning of the options*

- **Device tag**
  Is defined in the **Device tag** parameter (→ 103).
- **Free text**
  Is defined in the **Header text** parameter (→ 149).

## Header text

**Navigation** Setup → Advanced setup → Display → Header text

**Prerequsite** **Header (→ 148) = Free text**

**Description** Enter display header text.

**Factory setting** ----------

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

## Separator

**Navigation** Setup → Advanced setup → Display → Separator

**Description** Select decimal separator for displaying numerical values.

**Selection**
- .
- ,

**Factory setting** .

## Number format

**Navigation** Setup → Advanced setup → Display → Number format

**Description** Choose number format for the display.

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

**Factory setting** Decimal

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

## Decimal places menu

**Navigation** Setup → Advanced setup → Display → 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

**Factory setting** x.xxxx

**Additional information**
- Is only valid for numbers in the operating menu (e.g. **Empty calibration**, **Full calibration**), but not for the measured value display. The number of decimal places for the measured value display is defined in the **Decimal places 1 to 4** → 147 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

**Factory setting** Disable

**Additional information**

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

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

## Contrast display

**Navigation** Setup → Advanced setup → Display → Contrast display

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

**User entry** 20 to 80 %

**Factory setting** Dependent on the display.

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

**User interface** Days (d), hours (h), minutes (m), seconds (s)

**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.

**User interface** Days (d), hours (h), minutes (m), seconds (s)

### 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

**Factory setting** Cancel

**Additional information**

**Meaning of the options**

- **Cancel**
  No action is executed and the user exits the parameter.
- **Execute backup**
  A backup copy of the current device configuration in the HistoROM (built-in in the device) is saved to the display module of the device.
- **Restore**
  The last backup copy of the device configuration is copied from the display module to the HistoROM of the device.
- **Duplicate**
  The transmitter configuration is duplicated to another device using the transmitter display module. The following parameters, which characterize the individual measuring point are **not** included in the transmitted configuration:
  – HART date code
  – HART short tag
  – HART message
  – HART descriptor
  – HART address
  – Device tag
  – Medium type
- **Compare**
  The device configuration saved in the display module is compared to the current device configuration of the HistoROM. The result of this comparison is displayed in the **Comparison result** parameter (→ 153).
- **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** Displays the comparison result between the device and the display.

**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 (→ 152)** = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Configuration management (→ 152)** = **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

**Factory setting** 0

**Additional information**

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

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

Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 114).

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

For display operation: The new access code is only valid after it has been confirmed in the **Confirm access code** parameter (→ 157).

## Device reset

**Navigation** Setup → Advanced setup → Administration → Device reset

**Description** Select to which state the device is to be reset.

**Selection**

- Cancel
- To factory defaults
- To delivery settings
- Of customer settings
- To transducer defaults
- Restart device

**Factory setting** Cancel

**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** → 155

**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

**Factory setting** 0

## 15.4 "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

**Description** Displays timestamp for the **Actual diagnostics** parameter (→ 158).

**User interface** Days (d), hours (h), minutes (m), seconds (s)

### 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

**Description** Displays timestamp for the **Previous diagnostics** parameter (→ 158).

**User interface** Days (d), hours (h), minutes (m), seconds (s)

### Operating time from restart

**Navigation** Diagnostics → Time fr. restart

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

**User interface** Days (d), hours (h), minutes (m), seconds (s)

### Operating time

**Navigation** Diagnostics → Operating time

**Description** Indicates how long the device has been in operation.

**User interface** Days (d), hours (h), minutes (m), seconds (s)

**Additional information** *Maximum time*
9 999 d ( ≈ 27 years)

### 15.4.1 "Diagnostic list" submenu

*Navigation* Diagnostics → Diagnostic list

**Diagnostics 1 to 5**

**Navigation** Diagnostics → Diagnostic list → Diagnostics 1 to 5

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

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

**Timestamp 1 to 5**

**Navigation** Diagnostics → Diagnostic list → Timestamp

**Description** Displays timestamp for the **Diagnostics 1 to 5** parameter (→ 160).

**User interface** Days (d), hours (h), minutes (m), seconds (s)

### 15.4.2 "Event logbook" submenu

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

*Navigation* Diagnostics → Event logbook

**Filter options**

**Navigation** Diagnostics → Event logbook → Filter options

**Description** Select category (status signal) whose event messages are displayed in the events list.

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

**Factory setting** All

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

**"Event list" submenu**

The **Event list** submenu displays the history of past events of the category selected in the **Filter options** parameter (→ 161). A maximum of 20 events are displayed in chronological order. If the advanced HistoROM functionality has been activated in the device, the event list may comprise up to 100 entries.

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

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

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

*Navigation* Diagnostics → Event logbook → Event list

### 15.4.3 "Device information" submenu

*Navigation* Diagnostics → Device info

**Device tag**

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

**Description** Enter the name for the measuring point.

**Factory setting** FMR5x

**Serial number**

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

**Description** Displays serial number of the device.

**Additional information**

**Uses of the serial number**
- To identify the device quickly, e.g. when contacting Endress+Hauser.
- To obtain specific information on the device using the Device Viewer: www.endress.com/deviceviewer

The serial number is also indicated on the nameplate.

**Firmware version**

**Navigation** Diagnostics → Device info → Firmware version

**Description** Indicates the installed 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

**Description** Displays device name.

### Order code

**Navigation** Diagnostics → Device info → Order code

**Description** Displays order code of the device.

**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 to 3

**Description** Displays the three parts of the extended order code.

**Additional information** The extended order code indicates the version of all the features of the product structure and thus uniquely identifies the device.

### Device revision

**Navigation** Diagnostics → Device info → Device revision

**Description** Displays the device revision registered for this device at the HART Communication Foundation.

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

### Device ID

**Navigation** Diagnostics → Device info → Device ID

**Description** Displays Device ID.

**Additional information** In addition to the Device type and Manufacturer ID, the Device ID is part of the unique device identification (Unique ID) which characterizes each HART device unambiguously.

### Device type

**Navigation** Diagnostics → Device info → Device type

**Description** Displays the device type with which the device is registered with the the HART Communication Foundation.

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

### Manufacturer ID

**Navigation** Diagnostics → Device info → Manufacturer ID

**Description** Displays the manufactured ID with which the device is registered with the HART Communication Foundation.

### 15.4.4 "Measured values" submenu

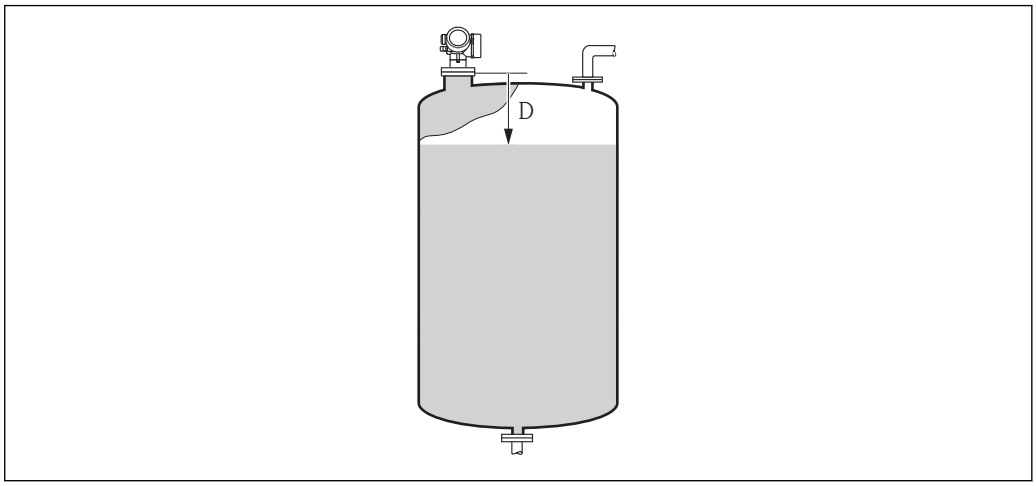
*Navigation* Diagnostics → Measured val.

**Distance**

**Navigation** Diagnostics → Measured val. → Distance

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

**Additional information**




*40 Distance for liquid measurements*

The unit is defined in the **Distance unit** parameter (→ 103).

**Level linearized**

**Navigation** Diagnostics → Measured val. → Level linearized

**Description** Displays linearized level.

**Additional information** The unit is defined by the **Unit after linearization** parameter → 124.

**Output current 1 to 2**

**Navigation** Diagnostics → Measured val. → Output curr. 1 to 2

**Description** Displays calculated output current.

### Measured current 1

**Navigation** Diagnostics → Measured val. → Measur. curr. 1

**Prerequsite** Only available for current output 1

**Description** Displays the measured value of the output current.

### Terminal voltage 1

**Navigation** Diagnostics → Measured val. → Terminal volt. 1

**Description** Dipslays terminal voltage at the current output.

### Electronic temperature

**Navigation** Diagnostics → Measured val. → Electronic temp.

**Description** Displays the current temperature of the electronics.

**Additional information** The unit is defined in the **Temperature unit** parameter.

### 15.4.5 "Data logging" submenu

The **Data logging** submenu is only available if the advanced functionality of the HistoROM has been activated in the device.

*Navigation* Diagnostics → Data logging

**Assign channel 1 to 4**

**Navigation** Diagnostics → Data logging → Assign chan. 1 to 4

**Description** Allocate a process variable to the respective data logging channel.

**Selection**
- Off
- Level linearized
- Distance
- Current output 1
- Measured current
- Current output 2 [14)]
- Terminal voltage
- Electronic temperature
- Absolute echo amplitude
- Relative echo amplitude
- Area of incoupling
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2

**Factory setting** Off

**Additional information** A total of 500 measured values can be logged. This means:
- 500 data points if 1 logging channel is used
- 250 data points if 2 logging channels are used
- 166 data points if 3 logging channels are used
- 125 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 500, 250, 166 or 125 measured values are always in the log (ring memory principle).

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

**Logging interval**

**Navigation** Diagnostics → Data logging → Logging interval

**Description** Define logging interval $t_{log}$.

**User entry** 1.0 to 3 600.0 s

14) Visibility depends on order options or device settings

**Factory setting** 30.0 s

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

- If 1 logging channel is used: $T_{log} = 500 \cdot t_{log}$
- If 2 logging channels are used: $T_{log} = 250 \cdot t_{log}$
- If 3 logging channels are used: $T_{log} = 166 \cdot t_{log}$
- If 4 logging channels are used: $T_{log} = 125 \cdot t_{log}$

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**
- $T_{log} = 500 \cdot 1\ s = 500\ s \approx 8.5\ min$
- $T_{log} = 500 \cdot 10\ s = 5\,000\ s \approx 1.5\ h$
- $T_{log} = 500 \cdot 80\ s = 40\,000\ s \approx 11\ h$
- $T_{log} = 500 \cdot 3\,600\ s = 1\,800\,000\ s \approx 20\ d$

## Clear logging data

**Navigation** Diagnostics → Data logging → Clear logging

**Description** Initiate a deletion of the complete logging memory.

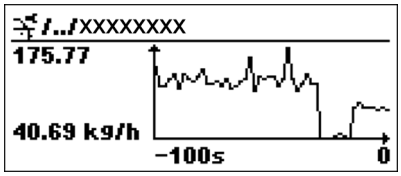
**Selection**
- Cancel
- Clear data

**Factory setting** Cancel

### "Display channel 1 to 4" submenu

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

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




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

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

*Navigation* Diagnostics → Data logging → Displ.channel 1 to 4

### 15.4.6 "Simulation" submenu

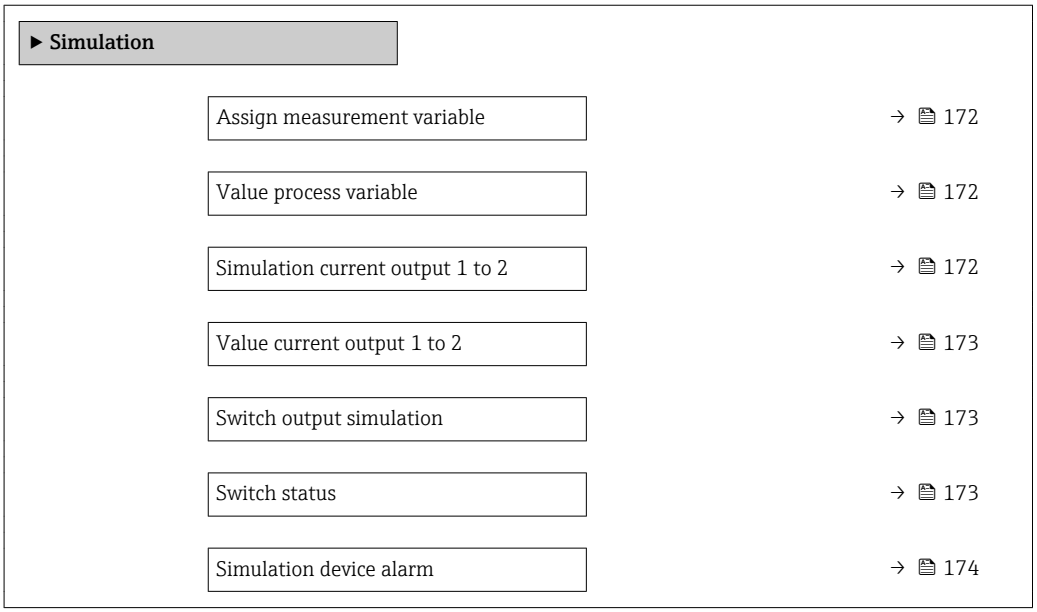
The **Simulation** submenu is used to simulate specific measuring values or other conditions. This helps to check the correct configuration of the device and connected control units.

*Conditions which can be simulated*

| Condition to be simulated | Associated parameters |
|---|---|
| Specific value of a process variable | ▪ Assign measurement variable (→ 🖹 172)<br>▪ Value process variable (→ 🖹 172) |
| Specific value of the output current | ▪ Simulation current output (→ 🖹 172)<br>▪ Value current output (→ 🖹 173) |
| Specific state of the switch output | ▪ Switch output simulation (→ 🖹 173)<br>▪ Switch status (→ 🖹 173) |
| Existence of an alarm | Simulation device alarm (→ 🖹 174) |

### 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.

**Description** Selct process variable to be simulated.

**Selection**
- Off
- Level
- Level linearized

**Factory setting** Off

**Additional information**
- The value of the variable to be simulated is defined in the **Value process variable** parameter (→ 172).
- If **Assign measurement variable ≠ Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

## Value process variable

**Navigation** Expert → Diagnostics → Simulation → Value proc. var.

**Prerequsite** **Assign measurement variable (→ 172) ≠ Off**

**Description** Specify value of the process value being simulated.

**User entry** Signed floating-point number

**Factory setting** 0

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

## Simulation current output 1 to 2

**Navigation** Expert → Diagnostics → Simulation → Sim.curr.out. 1 to 2

**Description** Switch the simulation of the current output on or off.

**Selection**
- Off
- On

**Factory setting** Off

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

## Value current output 1 to 2

**Navigation** Expert → Diagnostics → Simulation → Value curr.out 1 to 2

**Prerequsite** **Simulation current output (→ 172) = On**

**Description** Enter current value for the simulation

**User entry** 3.59 to 22.5 mA

**Factory setting** 3.59 mA

**Additional information** The current output assumes the value specified in this parameter. In this way, users can verify the correct adjustment of the current output and the correct function of connected control units.

## Switch output simulation

**Navigation** Expert → Diagnostics → Simulation → Switch sim.

**Description** Switch the simulation of the switch output on or off.

**Selection**
- Off
- On

**Factory setting** Off

## Switch status

**Navigation** Expert → Diagnostics → Simulation → Switch status

**Prerequsite** **Switch output simulation (→ 173) = On**

**Description** Define the switch state to be simulated.

**Selection**
- Open
- Closed

**Factory setting** Open

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

## Simulation device alarm

**Navigation** Expert → Diagnostics → Simulation → Sim. alarm

**Description** Switch alarm simulation on or off.

**Selection**
- Off
- On

**Factory setting** Off

**Additional information** When selecting the **On** option, the device generates an alarm. This helps to check the correct output behavior of the device in the case of an alarm.

An active simulation is indicated by the diagnostic message **C484 Simulation failure mode**.

### 15.4.7 "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

**Factory setting** No

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

**Result device check**

**Navigation** Diagnostics → Device check → Result 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.

## Level signal

**Navigation** Diagnostics → Device check → Level signal

**Prerequsite** 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.

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