Operating Instructions
Levelflex FMP56, FMP57 HART

Guided wave radar

HART
COMMUNICATION PROTOCOL

Endress+Hauser

People for Process Automation
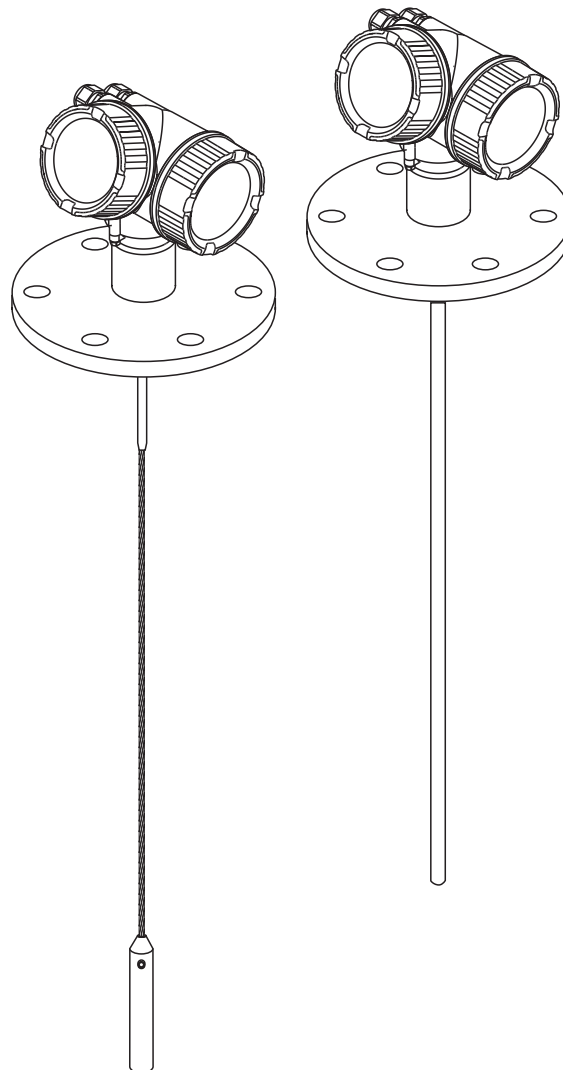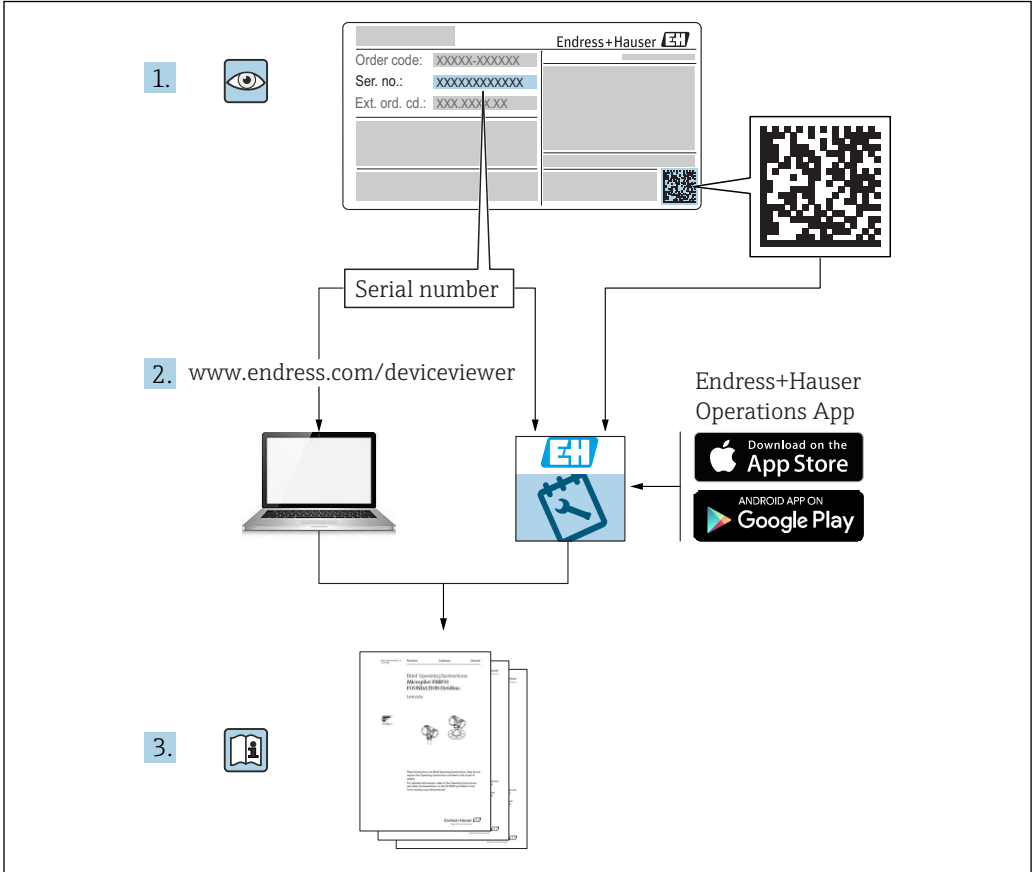
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Table of contents

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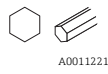
Symbol	Meaning
⚠ DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
⚠ WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
⚠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

1.2.2   Electrical symbols

Symbol	Meaning
⎓	Direct current
∼	Alternating current
≅	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: • Inner ground terminal: Connects the protectiv earth to the mains supply. • Outer ground terminal: Connects the device to the plant grounding system.

1.2.3   Tool symbols

Symbol	Meaning
A0013442	Torx screwdriver
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 Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
▶	Notice or individual step to be observed.
1. , 2. , 3. ...	Series of steps.
↳	Result of a step.
	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 Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates the non-hazardous area.

1.2.6   Symbols at the device

Symbol	Meaning
⚠ → 🗎	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
▭	**Temperature resistance of the connection cables** Specifies the minimum value of the temperature resistance of the connection cables.

1.3   Supplementary documentation

Document	Purpose and content of the document
Technical Information TI01004F (FMP56, FMP57)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions KA01061F (FMP56/FMP57, HART)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Description of Device Parameters GP01000F (FMP5x, HART)	**Reference for your parameters** 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.
Special documentation SD00326F	**Functional Safety Manual** The document is part of the Operating Instructions and serves as a reference for application-specific parameters and notes.
Special documentation SD01872F	**Manual for Heartbeat Verification and Heartbeat Monitoring** The document contains descriptions of the additonal parameters and technical data which are available with the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.

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.

1.4   Terms and abbreviations

Term/abbreviation	Explanation
BA	Document type "Operating Instructions"
KA	Document type "Brief Operating Instructions"
TI	Document type "Technical Information"
SD	Document type "Special Documentation"
XA	Document type "Safety Instructions"
PN	Nominal pressure
MWP	Maximum Working Pressure The MWP can also be found on the nameplate.
ToF	Time of Flight
FieldCare	Scalable software tool for device configuration and integrated plant asset management solutions
DeviceCare	Universal configuration software for Endress+Hauser HART, PROFIBUS, FOUNDATION Fieldbus and Ethernet field devices
DTM	Device Type Manager
DD	Device Description for HART communication protocol
ε_r (DC value)	Relative dielectric constant
Operating tool	The term "operating tool" is used in place of the following operating software: • FieldCare / DeviceCare, for operation via HART communication and PC • SmartBlue (app), for operation using an Android or iOS smartphone or tablet.
BD	Blocking Distance; no signals are analyzed within the BD.
PLC	Programmable Logic Controller
CDI	Common Data Interface
PFS	Pulse Frequence Status (Switching output)

1.5 Registered trademarks

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Registered trademark of the FieldComm Group, Austin, USA

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

2 Basic safety instructions

2.1 Requirements for the personnel

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

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

2.2 Designated use

Application and measured materials

The measuring device described in these Operating Instructions is intended only for level measurement of bulk solids. Depending on the version ordered the device can also measure potentially explosive, flammable, poisonous and oxidizing materials.

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
- ▶ Calculated process variables: Volume or mass in arbitrarily shaped vessels (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 ℃ (176 ℉) 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 it is safe to operate. It meets general safety standards and legal requirements.

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

2.5.1   CE mark

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

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

2.5.2   EAC conformity

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

Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.

2.6 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 010	Approval	Available for	Feature 020: "Power Supply; Output"				
			A [1]	B [2]	C [3]	E [4]/G [5]	K [6]/L [7]
BA	ATEX II 1G Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA00496F	XA01125F	XA01126F	XA00516F	-
BB	ATEX II 1/2G Ex ia IIC T6 Ga/Gb	▪ FMP56 ▪ FMP57	XA00496F	XA01125F	XA01126F	XA00516F	-
BE	ATEX II 1D Ex t IIIC Da	▪ FMP56 ▪ FMP57	XA00501F	XA00501F	XA00501F	XA00521F	XA00501F
BF	ATEX II 1/2D Ex t IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00501F	XA00501F	XA00501F	XA00521F	XA00501F
BG	ATEX II 3G Ex nA IIC T6 Gc	▪ FMP56 ▪ FMP57	XA00498F	XA01130F	XA01131F	XA00518F	XA01132F
BH	ATEX II 3G Ex ic IIC T6 Gc	▪ FMP56 ▪ FMP57	XA00498F	XA01130F	XA01131F	XA00518F	-
B2	ATEX II 1/2G Ex ia IIC T6 Ga/Gb, 1/2D Ex ia IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00502F	XA00502F	XA00502F	XA00522F	-
B3	ATEX II 1/2G Ex d[ia] IIC T6 Ga/Gb, 1/2 D Ex t IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00503F	XA00503F	XA00503F	XA00523F	XA01136F
CD	CSA C/US DIP Cl.II,III Div.1 Gr.E-G	▪ FMP56 ▪ FMP57	XA00529F	XA00529F	XA00529F	XA00570F	XA00529F
C2	CSA C/US IS Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex ia	▪ FMP56 ▪ FMP57	XA00530F	XA00530F	XA00530F	XA00571F	XA00530F
C3	CSA C/US XP Cl.I,II,III Div.1 Gr.A-G, NI Cl.1 Div.2, Ex d	▪ FMP56 ▪ FMP57	XA00529F	XA00529F	XA00529F	XA00570F	XA00529F
FB	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, NI Cl.1 Div.2	▪ FMP56 ▪ FMP57	XA00531F	XA00531F	XA00531F	XA00573F	XA00531F
FD	FM XP Cl.I,II,III Div.1 Gr.A-G, AEx d, NI Cl.1 Div.2	▪ FMP56 ▪ FMP57	XA00532F	XA00532F	XA00532F	XA00572F	XA00532F
FE	FM DIP Cl.II,III Div.1 Gr.E-G	▪ FMP56 ▪ FMP57	XA00532F	XA00532F	XA00532F	XA00572F	XA00532F
GA	EAC Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA01380F	XA01380F	XA01380F	XA01381F	XA01380F
GB	EAC Ex ia IIC T6 Ga/Gb	▪ FMP56 ▪ FMP57	XA01380F	XA01380F	XA01380F	XA01381F	XA01380F
IA	IEC Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA00496F	XA01125F	XA01126F	XA00516F	-
IB	IEC Ex ia IIC T6 Ga/Gb	▪ FMP56 ▪ FMP57	XA00496F	XA01125F	XA01126F	XA00516F	-
IE	IEC Ex t IIIC Da	▪ FMP56 ▪ FMP57	XA00501F	XA00501F	XA00501F	XA00521F	XA00501F
IF	IEC Ex t IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00501F	XA00501F	XA00501F	XA00521F	XA00501F
IG	IEC Ex nA IIC T6 Gc	▪ FMP56 ▪ FMP57	XA00498F	XA01130F	XA01131F	XA00518F	XA01132F
IH	IEC Ex ic IIC T6 Gc	▪ FMP56 ▪ FMP57	XA00498F	XA01130F	XA01131F	XA00518F	-
I2	IEC Ex ia IIC T6 Ga/Gb, Ex ia IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00502F	XA00502F	XA00502F	XA00522F	-

Feature 010	Approval	Available for	Feature 020: "Power Supply; Output"				
			A [1]	B [2]	C [3]	E [4]/G [5]	K [6]/L [7]
I3	IEC Ex d [ia] IIC T6 Ga/Gb, Ex t IIIC Da/Db	▪ FMP56 ▪ FMP57	XA00503F	XA00503F	XA00503F	XA00523F	XA01136F
JC	JPN Ex d[ia] IIC T4 Ga/Gb	▪ FMP56 ▪ FMP57	-	-	XA01718F	-	-
KA	KC Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA01169F	-	XA01169F	-	-
KB	KC Ex ia IIC T6 Ga/Gb	▪ FMP56 ▪ FMP57	XA01169F	-	XA01169F	-	-
MA	INMETRO Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA01038F	XA01038F	XA01038F	-	XA01038F
ME	INMETRO Ex t IIIC Da	▪ FMP56 ▪ FMP57	XA01043F	XA01043F	XA01043F	-	XA01043F
MH	INMETRO Ex ic IIC T6 Gc	▪ FMP56 ▪ FMP57	XA01040F	XA01040F	XA01040F	-	XA01040F
NA	NEPSI Ex ia IIC T6 Ga	▪ FMP56 ▪ FMP57	XA00634F	XA00634F	XA00634F	XA00640F	XA00634F
NB	NEPSI Ex ia IIC T6 Ga/Gb	▪ FMP56 ▪ FMP57	XA00634F	XA00634F	XA00634F	XA00640F	XA00634F
NF	NEPSI DIP A20/21 T85...90oC IP66	▪ FMP56 ▪ FMP57	XA00637F	XA00637F	XA00637F	XA00643F	XA00637F
NG	NEPSI Ex nA II T6 Gc	▪ FMP56 ▪ FMP57	XA00635F	XA00635F	XA00635F	XA00641F	XA00635F
NH	NEPSI Ex ic IIC T6 Gc	▪ FMP56 ▪ FMP57	XA00635F	XA00635F	XA00635F	XA00641F	XA00635F
N2	NEPSI Ex ia IIC T6 Ga/Gb, Ex iaD 20/21 T85...90℃	▪ FMP56 ▪ FMP57	XA00638F	XA00638F	XA00638F	XA00644F	XA00638F
N3	NEPSI Ex d[ia] IIC T6 Ga/Gb, DIP A20/21 T85...90℃ IP66	▪ FMP56 ▪ FMP57	XA00639F	XA00639F	XA00639F	XA00645F	XA00639F
8A	FM/CSA IS+XP Cl.I,II,III Div.1 Gr.A-G	▪ FMP56 ▪ FMP57	XA00531F XA00532F	XA00531F XA00532F	XA00531F XA00532F	XA00572F XA00573F	XA00531F XA00532F

1) A: 2-wire; 4-20mA HART
2) B: 2-wire; 4-20mA HART, switch output
3) C: 2-wire; 4-20mA HART, 4-20mA
4) E: 2-wire; FOUNDATION Fieldbus, switch output
5) G: 2-wire; PROFIBUS PA, switch output
6) K: 4-wire 90-253VAC; 4-20mA HART
7) L: 4-wire 10,4-48VDC; 4-20mA HART

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

2.6.1 Ex-marking in case of connected FHX50 remote display

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
BE	L, M or N	ATEX II 1D Ex ta [ia] IIIC T$_{500}$ xx°C Da
BF	L, M or N	ATEX II 1/2 D Ex ta [ia Db] IIIC Txx°C Da/Db
BG	L, M or N	ATEX II 3G Ex nA [ia Ga] IIC T6 Gc
BH	L, M or N	ATEX II 3G Ex ic [ia Ga] IIC T6 Gc
B3	L, M or N	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb, ATEX II 1/2D Ex ta [ia Db] IIIC Txx°C Da/Db
IE	L, M or N	IECEx Ex ta [ia] IIIC T500 xx°C Da
IF	L, M or N	IECEx ta [ia Db] IIIC Txx°C Da/Db
IG	L, M or N	IECEx Ex nA [ia Ga] IIC T6 Gc
IH	L, M or N	IECEx Ex ic [ia Ga] IIC T6 Gc
I3	L, M or N	IECEx Ex d [ia] IIC T6 Ga/Gb, IECEx Ex ta [ia Db] IIIC Txx°C Da/Db

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

3   Product description
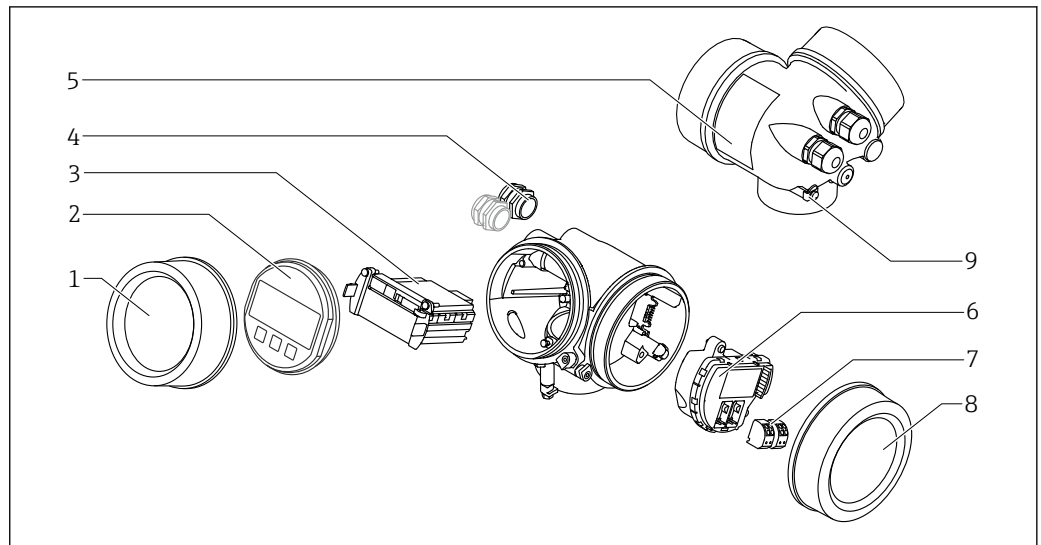
3.1   Product design

3.1.1   Levelflex FMP56/FMP57
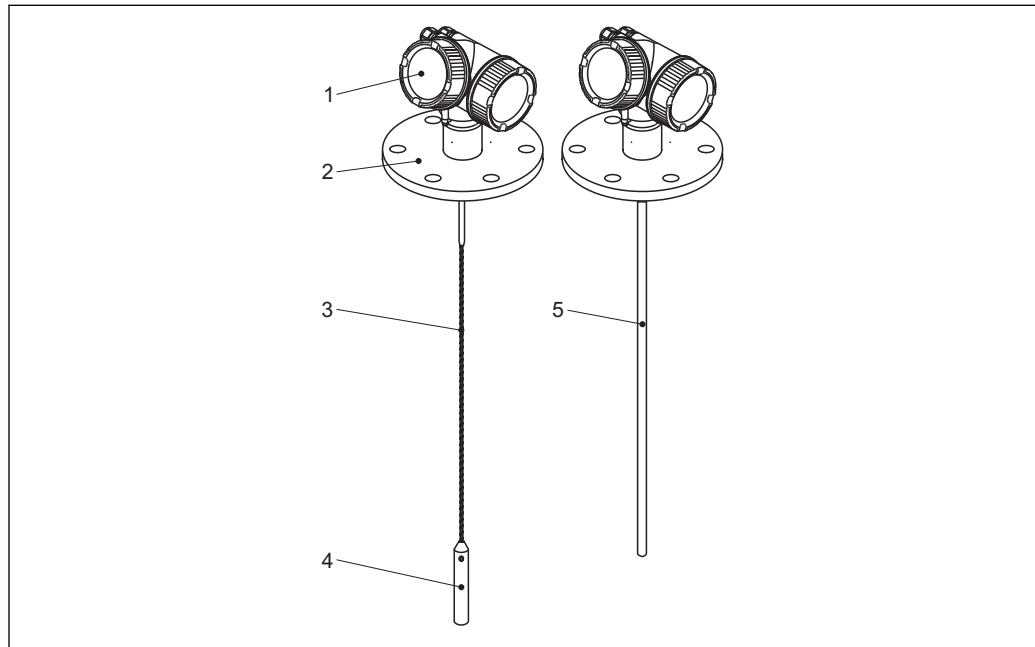
🖼 1   Design of the Levelflex

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

3.1.2   Electronics housing

⊡ *2*   *Design of the electronics housing*

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

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods check the following:
• Are the order codes on the delivery note and the product sticker identical?
• Are the goods undamaged?
• Do the nameplate data match the ordering information on the delivery note?
• If required (see nameplate): Are the Safety Instructions (XA) 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
• 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.

4.2.1   Nameplate
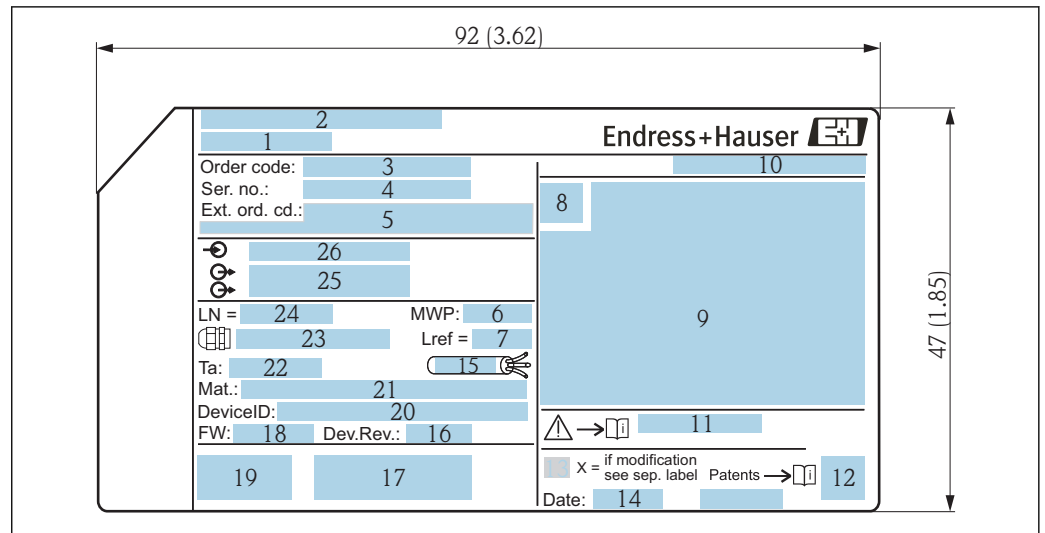
🔲 *3   Nameplate of the Levelflex; Dimensions: mm (in)*

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   Gas phase compensation: reference distance
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   2-D matrix code (QR code)
13   Modification mark
14   Manufacturing date: year-month
15   Permitted temperature range for cable
16   Device revision (Dev.Rev.)
17   Additional information about the device version (certificates, approvals, communication): e.g. SIL, PROFIBUS
18   Firmware version (FW)
19   CE mark, C-Tick
20   DeviceID
21   Material in contact with process
22   Permitted ambient temperature (T_a)
23   Size of the thread of the cable glands
24   Length of probe
25   Signal outputs
26   Operating voltage

ℹ️ 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 in the **Extended order code 1 to 3** parameter.

5 Storage, Transport

5.1 Storage conditions

- Permitted storage temperature: −40 to +80 ℃ (−40 to +176 ℉)
- Use the original packaging.

## 5.2 Transport product to the measuring point

⚠ WARNING

Housing or probe 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 probe 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).
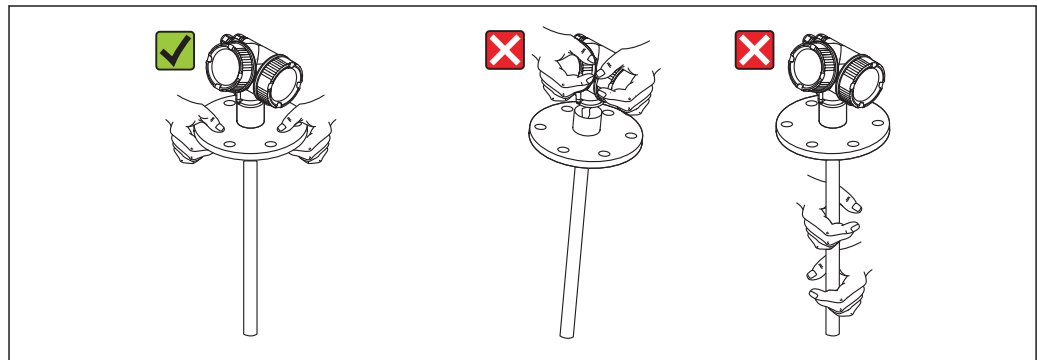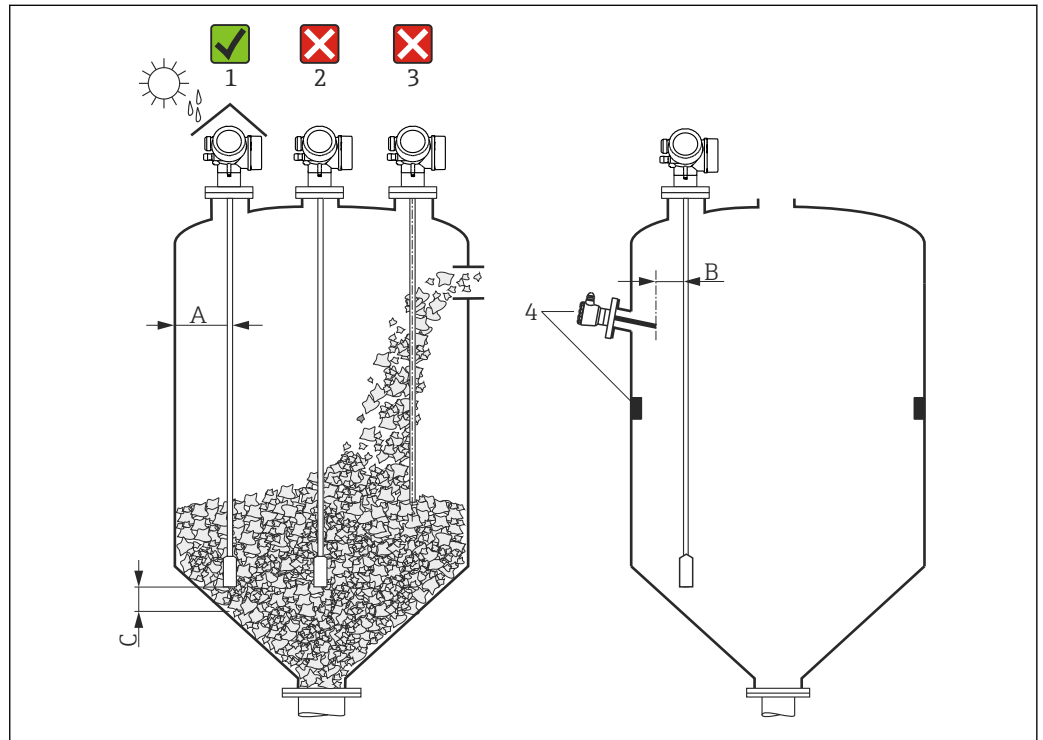

A0013920
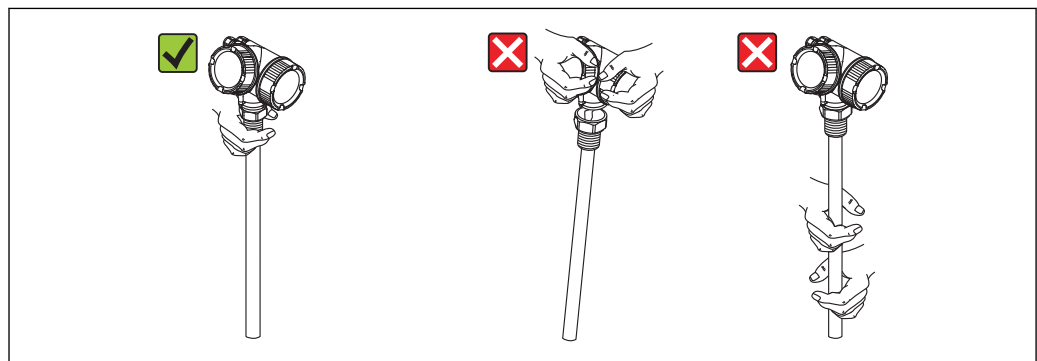
A0014264

6   Mounting

6.1   Mounting requirements

6.1.1   Suitable mounting position

🖼 4   *Mounting requirements for Levelflex*

Mounting distances

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

Additional conditions

- When mounting in the open, a weather protection cover (1) may be installed to protect the device against extreme weather conditions.
- In metallic vessels: Preferably do not mount the probe in the center of the vessel (2), as this would lead to increased interference echoes.
  If a central mounting position can not be avoided, it is crucial to perform an interference echo suppresion(mapping) after the commissioning of the device.
- Do not mount the probe in the filling curtain (3).
- Avoid buckling the rope probe during installation or operation (e.g. through product movement against silo wall) by selecting a suitable mounting location.
- Check the probe regularly for defects.

With suspended rope probes (probe end not fixed at the bottom) the distance between the probe rope and internal fittings in the tank must not fall below 300 mm (12") during the entire process. A sporadic contact between the probe weight and the cone of the vessel, however, does not influence the measurement as long as the dielectric constant of the medium is at least DC = 1.8.

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

6.1.2   Applications with restricted mounting space

Mounting with remote sensor

The device version with a remote sensor is suited for applications with restricted mounting space. In this case the electronics housing is mounted at a separate position from which it is easier accessible.
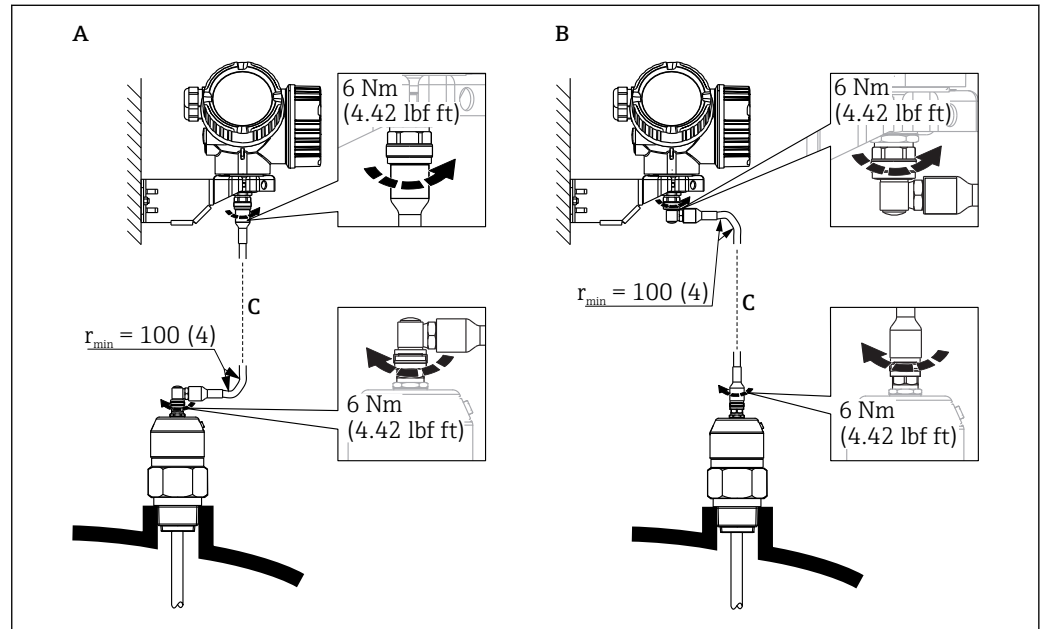
A0014794

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

- Product structure, feature 600 "Probe Design":
  - Option MB "Sensor remote, 3m/9ft cable"
  - Option MC "Sensor remote, 6m/18ft cable"
  - Option MB "Sensor remote, 9m/27ft cable"
- The remote cable is supplied with these device versions
  Minimum bending radius: 100 mm (4 inch)
- A mounting bracket for the electronics housing is supplied with these device versions.
  Mounting options:
  - Wall mounting
  - Pipe mounting; diameter: 42 to 60 mm (1-1/4 to 2 inch)
- The connection cable has got one straight and one angled plug (90°). Depending on the local conditions the angled plug can be connected at the probe or at the electronics housing.

📋 Probe, electronics and connection cable are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

6.1.3   Notes on the mechanical load of the probe

Tensile load limit of rope probes

Sensor	Feature 060	Probe	Tensile load limit [kN]	Max. rupture load [kN] [1]
FMP56	LA, LB	Rope 4mm (1/6") 316	12	20
	NB, NE	Rope 6mm (1/4") PA>Steel	12	20
FMP57	LA, LB	Rope 4mm (1/6") 316	12	20
	LC, LD	Rope 6mm (1/4") 316	30	42
	NB, NE	Rope 6mm (1/4") PA>Steel	12	20
	NC, NF	Rope 8mm (1/3") PA>Steel	30	42

1)   The ceiling of the silo must be designed to withstand this load.

Tensile load

Bulk solids exert tensile forces on rope probes whose height increases with:

- the length of the probe, i.e. max. cover
- the bulk density of the product,
- the silo diameter and
- the diameter of the probe rope

Since the tensile forces are also heavily dependent on the viscosity of the product, a higher safety factor is necessary for highly viscous products and if there is a risk of cornice buildup. In critical cases it is better to use a 6 mm rope instead of a 4 mm one.

The same forces also act on the silo cover. On a fixed rope, the tensile forces are definitely greater, but this can not be calculated. Observe the tensile strength of the probes.

Options for reducing the tensile forces:
- Shorten the probe.
- If the maximum tensile load is exceeded, check whether it would be possible to use a non-contact Ultrasonic or Level-Radar device.

The following diagrams show typical loads for frequently occurring bulk solids as reference values. The calculation is performed for the following conditions:

- Calculation according to DIN 1055, Part 6 for the cylindrical part of the silo.
- Suspended probe (probe end not fixed at the bottom)
- Free-flowing bulk solid, i.e. mass flow. A calculation for core flow is not possible. In the event of collapsing cornices, considerably higher loads can occur.
- The specification for tensile forces contains the safety factor 2 (in addition to the safety factors already taken into account by DIN 1055), which compensates for the normal fluctuation range in pourable bulk solids.
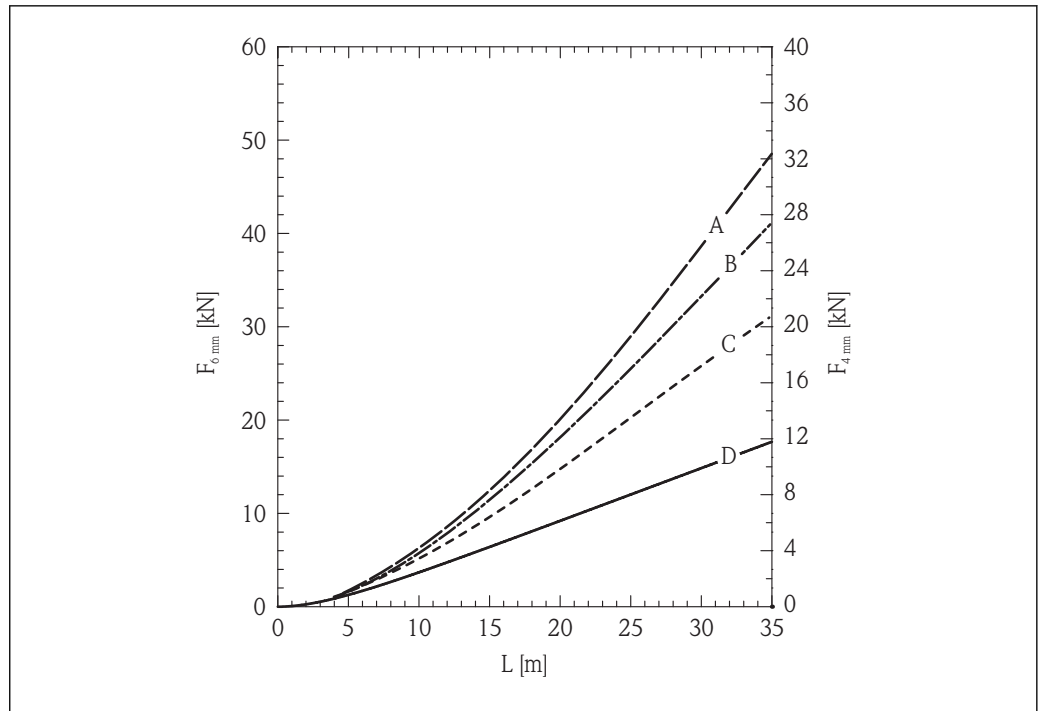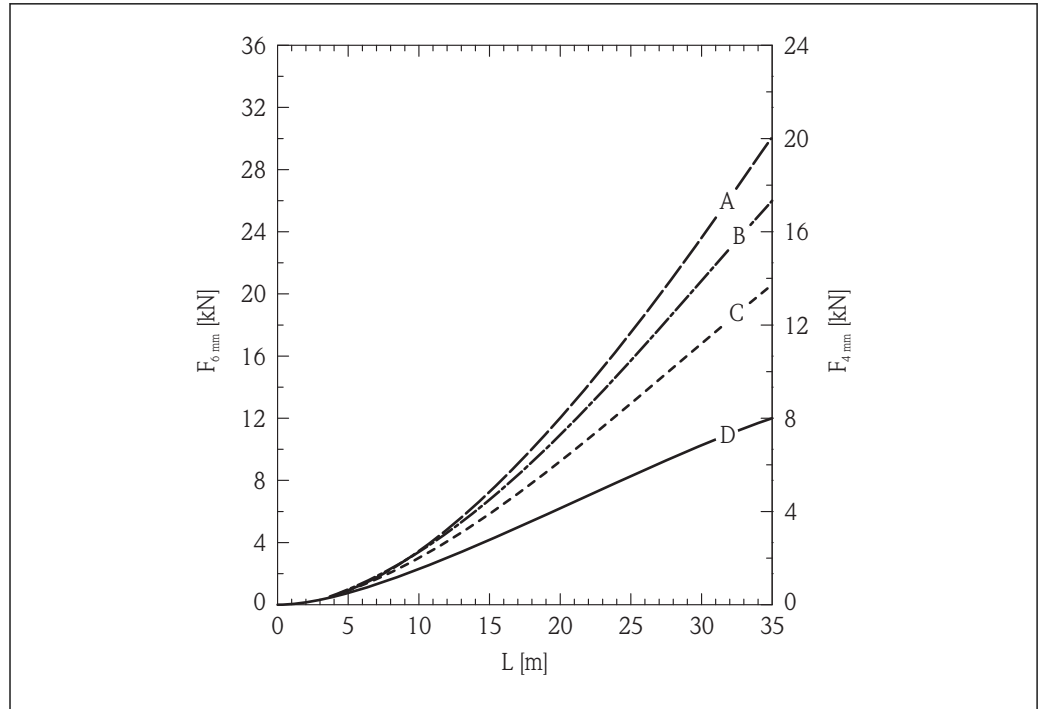
⊡ 5   Silica sand in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm
(0,24 in) and 4mm (0,16 in)

A   Silo diameter 12 m (40 ft)
B   Silo diameter 9 m (30 ft)
C   Silo diameter 6 m (20 ft)
D   Silo diameter 3 m (10 ft)
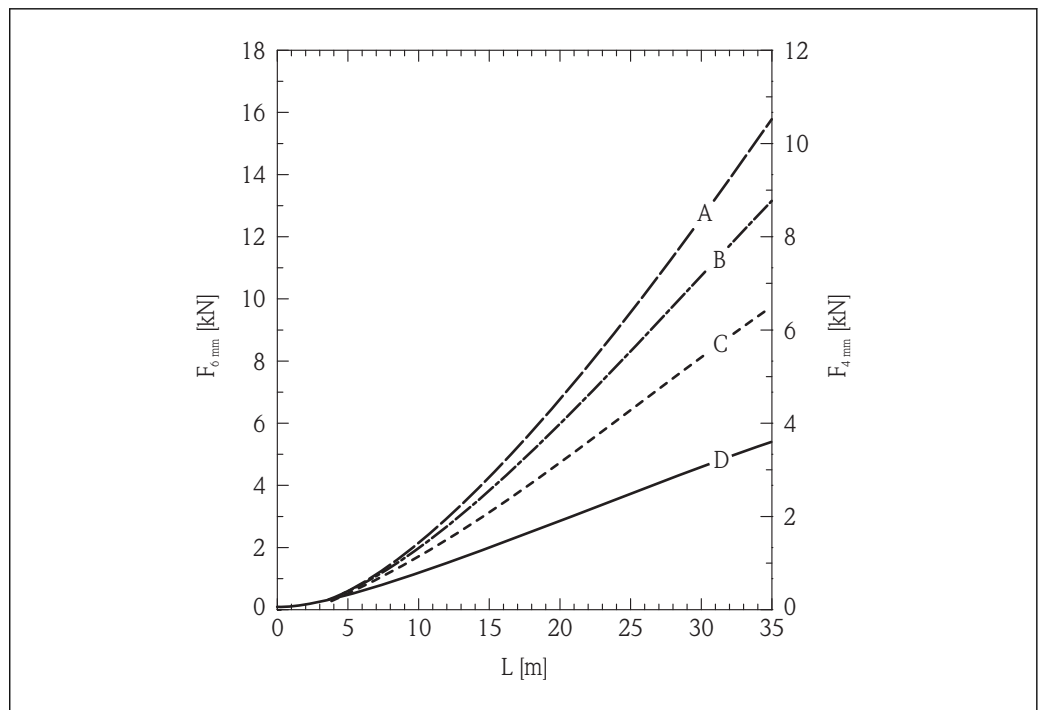
⊡ 6   Polyethylene pellets in silo with smooth metallic walls; tensile load as a function of level L for rope
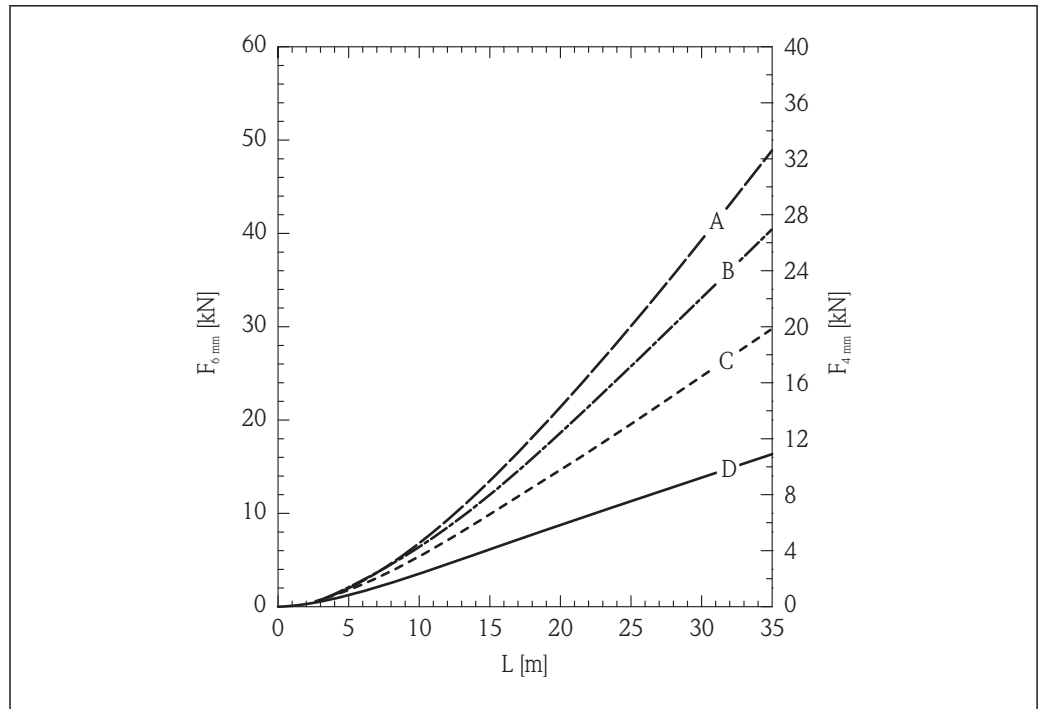*diameters 6mm (0,24 in) and 4mm (0,16 in)*

A   Silo diameter 12 m (40 ft)
B   Silo diameter 9 m (30 ft)
C   Silo diameter 6 m (20 ft)
D   Silo diameter 3 m (10 ft)

7   Wheat in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

A   Silo diameter 12 m (40 ft)
B   Silo diameter 9 m (30 ft)
C   Silo diameter 6 m (20 ft)
D   Silo diameter 3 m (10 ft)

8   Cement in silo with smooth metallic walls; tensile load as a function of level L for rope diameters 6mm (0,24 in) and 4mm (0,16 in)

A   Tank diameter 12 m (40 ft)
B   Tank diameter 9 m (30 ft)
C   Tank diameter 6 m (20 ft)
D   Tank diameter 3 m (10 ft)

Bending strength of rod probes

Sensor	Feature 060	Probe	Bending strength [Nm]
FMP57	AE, AF	Rod 16mm (0.63") 316L	30

6.1.4   Notes on the process connection

Probes are mounted to the process connection with threaded connections or flanges. If during this installation there is the danger that the probe end moves so much that it touches the tank floor or cone at times, the probe must, if necessary, be shortened and fixed down → 🖹 32.

Threaded connection
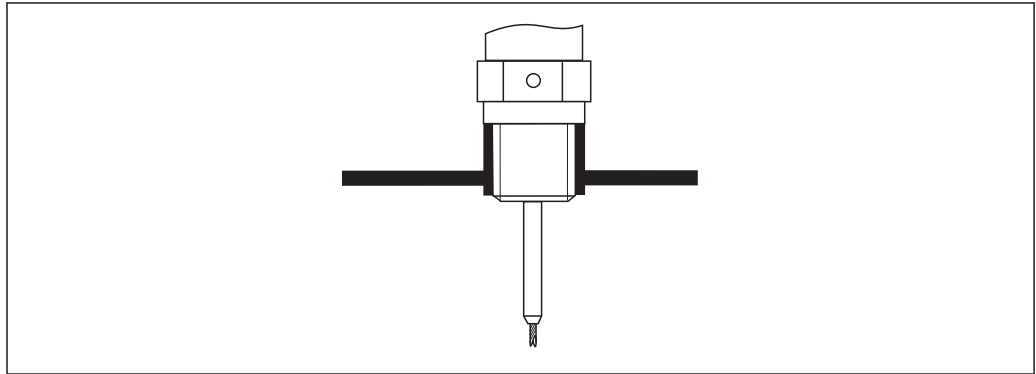
 🖾 9   *Mounting with threaded connection; flush with the container ceiling*

Seal

The thread as well as the type of seal comply to DIN 3852 Part 1, screwed plug form A.

They can be sealed with the following types of sealing rings:

- Thread G3/4": According to DIN 7603 with the dimensions 27 x 32 mm
- Thread G1-1/2": According to DIN 7603 with the dimensions 48 x 55 mm

Please use a sealing ring according to this standard in the form A, C or D and of a material that is resistant to the application.

Nozzle mounting
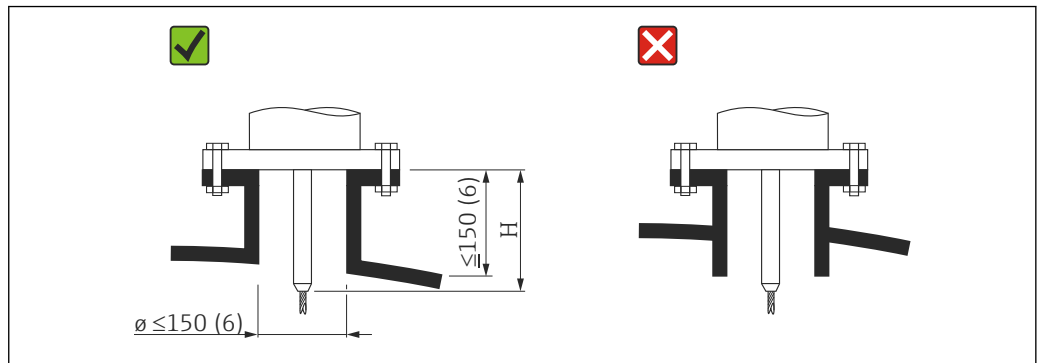
H   Length of the center rod or the rigid part of the rope probe

Length H of the rigid part of the rope probe

Probe	H
FMP56, Φ rope 4 mm (0.16 in)	94 mm (3.7 in)
FMP57, Φ rope 4 mm (0.16 in)	120 mm (4.7 in)
FMP57, Φ rope 6 mm (0.24 in)	135 mm (5.3 in)

- Permissible nozzle diameter: ≤ 150 mm (6 in).
  For larger diameters the near range measuring capability may be reduced.
  For nozzles ≥ DN300: → 🗎 31.
- Permissible nozzle height [2]: ≤ 150 mm (6 in).
  For a larger height the near range measuring capability may be reduced.
  Larger nozzle heights may be possible in special cases (see section "Rod extension/centering HMP40 for FMP57").
- The end of the nozzle should be flush with the tank ceiling in order to avoid ringing effects.

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

---

2)   Larger nozzle heights on request

Rod extension/centering HMP40 for FMP57

For FMP57 with rope probes the rod extension/centering HMP 40 is available as an accessory → 🖹 112. It has to be used if otherwise the probe rope comes into contact with the lower edge of the nozzle.

For FMP57 with rope probes the rod extension/centering HMP 40 is available as an accessory. It has to be used if otherwise the probe rope comes into contact with the lower edge of the nozzle.

This accessory consists of the extension rod corresponding to the nozzle height, on which a centering disk is also mounted if the nozzles are narrow or when working in bulk solids. This component is delivered separately from the device. Please order the probe length correspondingly shorter.

Centering disks with small diameters (DN40 and DN50) may only be used if there is no significant build-up in the nozzle above the disk. The nozzle must not become clogged by the product.

Installation in nozzles ≥ DN300

If installation in ≥ 300mm/12" nozzles is unavoidable, installation must be carried out in accordance with the following sketch.
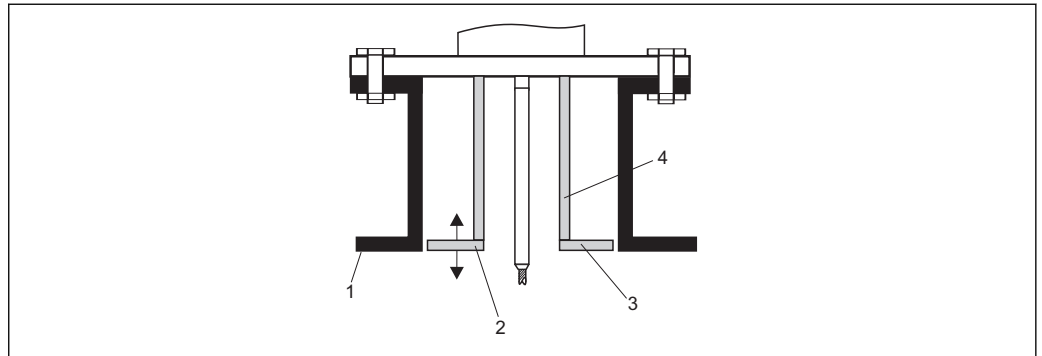
A0014199

1   Lower edge of the nozzle
2   Approx. flush with the lower edge of the nozzle (± 50 mm/2")
3   Plate
4   Pipe Φ 150 to 180 mm (6 to 7 inch)

Nozzle diameter	Plate diameter
300 mm (12")	280 mm (11")
≥ 400 mm (16")	≥ 350 mm (14")

6.1.5   Securing the probe

Securing rope probes
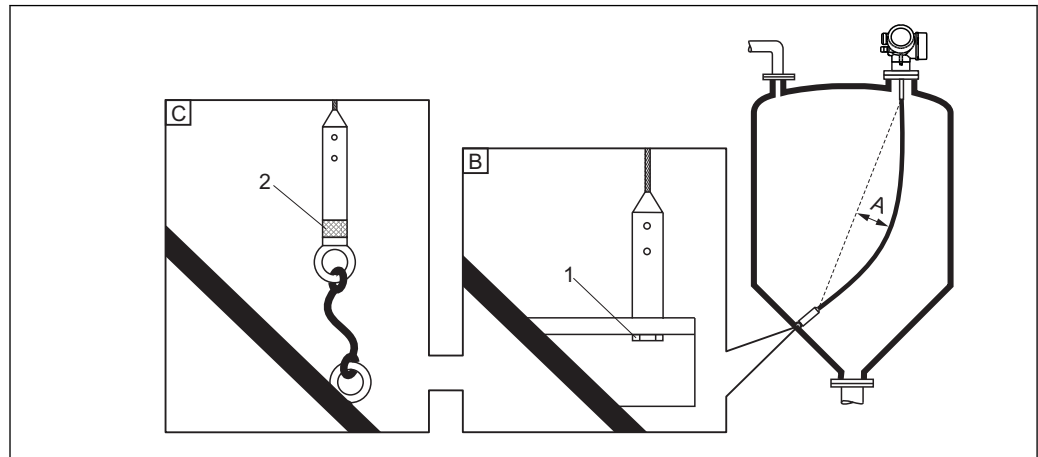
A   Sag of the rope: ≥ 1 cm per 1m of the probe length (0.12 inch per 1 ft of the probe length)
B   Reliably grounded end of probe
C   Reliably isolated end of probe
1:   Mounting and contact with a bolt
2   Mounting kit isolated

- The end of the probe needs to be secured under the following conditions:
  - if otherwise the probe sporadically comes into contact with the wall of the vessel, the outlet cone, internal fittings or other parts of the installation.
  - if otherwise the probe sporadically gets close to a concrete wall (minimum distance 0.5 m / 20 inch).
- The end of probe can be secured at its internal thread
  - rope 4 mm (1/6"), 316: M 14
  - rope 6 mm (1/4"), 316: M 20
  - rope 6mm (1/4"), PA>steel: M14
  - rope 8mm (1/3"), PA>steel: M20
- Preferably use the 6 mm (1/4") rope probe due to the higher tensile strength when fixing a rope probe.
- The fixing must be either reliably grounded or reliably insulated. If it is not possible to mount the probe weight with a reliably insulated connection, it can be secured using an isolated eyelet, which is available as an accessory.
- In the case of a grounded fixing the search for a positive end-of-probe signal must be activated. Otherwise an automatic probe length correction is impossible.
  Navigation: Expert → Sensor → EOP evaluation → EOP search mode
  Setting: **Positive EOP** option
- In order to prevent an extremely high tensile load (e.g. due to thermal expansion) and the risk of rope crack, the rope has to be slack. Make the rope longer than the required measuring range such that there is a sag in the middle of the rope that is ≥ 1cm/(1 m rope length) [0.12 inch/(1 ft rope length)].
  Tensile load limit of rope probes: → 🖺 24

Securing rod probes

- For WHG approvals: For probe lengths ≥ 3 m (10 ft) a support is required.
- In general, rod probes must be supported if there is a horizontal flow (e.g. from an agitator) or in the case of strong vibrations.
- Rod probes may only be supported at the end of the probe.
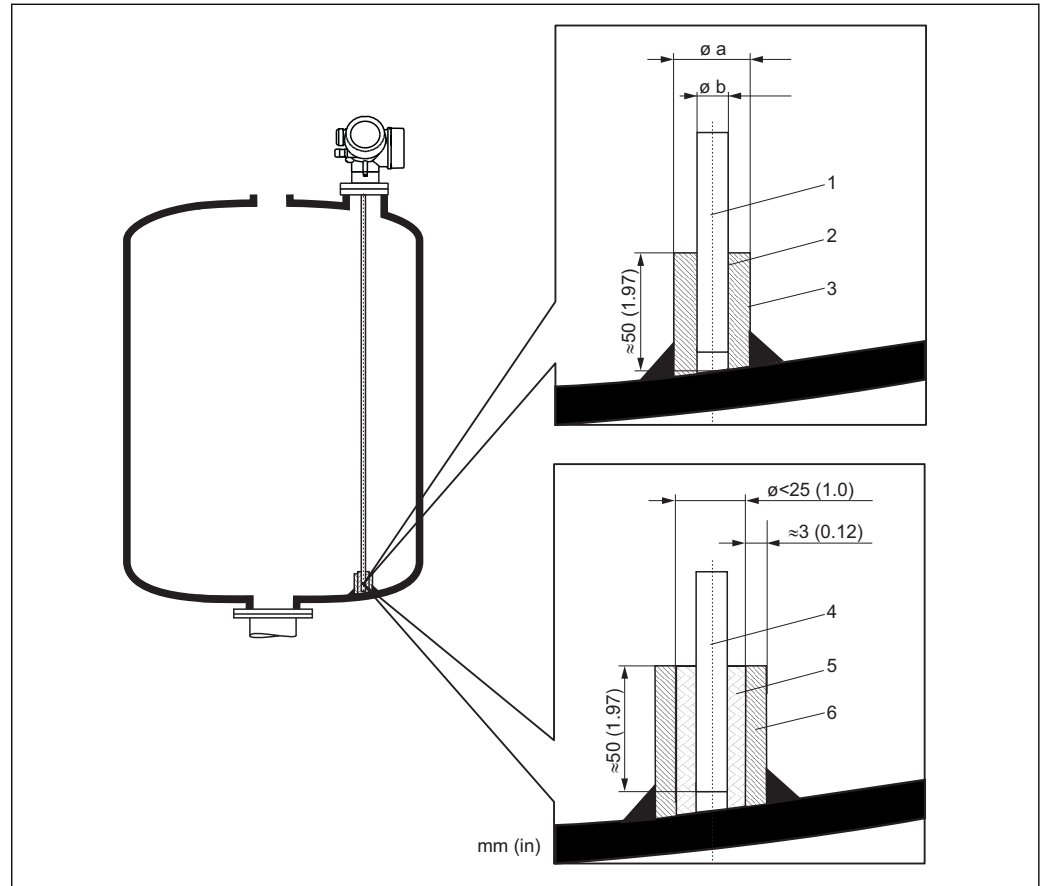
1   Probe rod, uncoated
2   Sleeve bored tight to ensure electrical contact between the rod and sleeve!
3   Short metal pipe, e.g. welded in place
4   Probe rod, coated
5   Plastic sleeve, e.g. PTFE, PEEK or PPS
6   Short metal pipe, e.g. welded in place

> **NOTICE**
> **Poor grounding of the end of probe may cause measuring errors.**
> ▶ Apply a narrow sleeve which has good electrical contact to the probe.

> **NOTICE**
> **Welding may damage the main electronics module.**
> ▶ Before welding: Ground the probe and dismount electronics.

6.1.6   Special mounting conditions

Concrete silos

Installation, for example, into a thick concrete ceiling should be made flush with the lower edge. Alternatively, the probe can also be installed into a pipe that must not protrude over the lower edge of the silo ceiling. The pipe should be kept at a minimum length.
Installation suggestions see diagram.
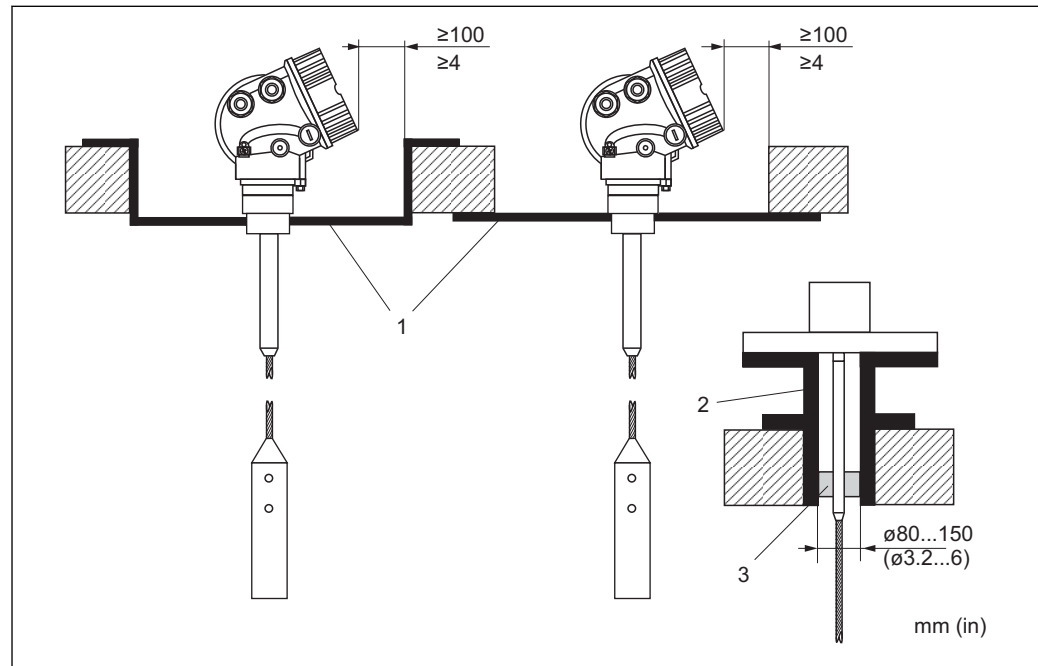
A0014138

1   Metal sheet
2   Metal tube
3   Extension rod / Centering HMP40 (see "Accessories")

Note for installations with rod extension/center washer (accessories): Strong dust generation can lead to build-up behind the center washer. This can cause an interference signal. For other installation possibilities please contact Endress+Hauser.

Installation from the side
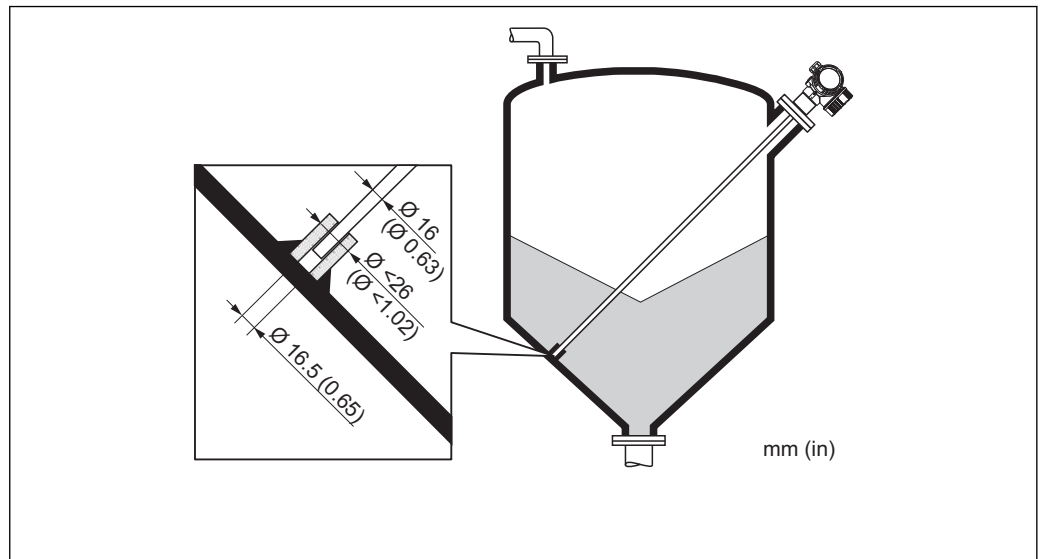
- If installation from above is not possible, the Levelflex can also be mounted from the side.
- In this case, always fix the rope probe → 🖺 32 .
- Support rod probe if the lateral loadbearing capacity is exceeded → 🖺 27. Only fix rod probes at the probe end → 🖺 32.

Non-metallic vessels
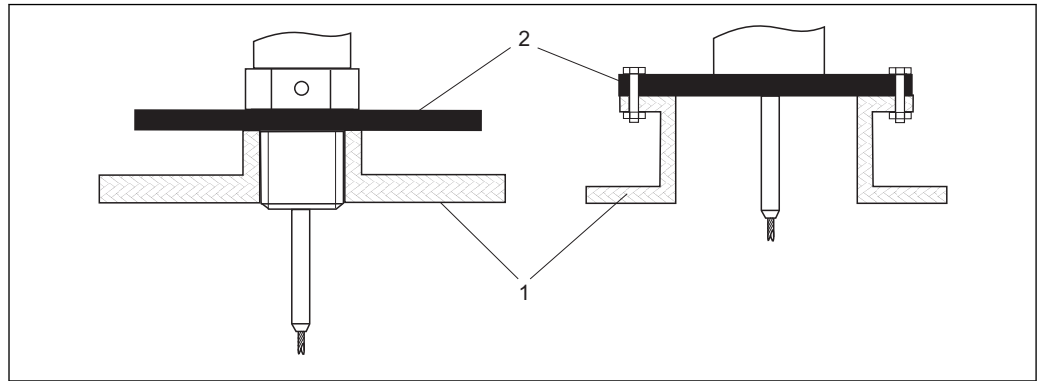
A0012527

1   Non-metallic vessel
2   Metal sheet or metal flange

To ensure reliable measurements in non-metallic vessels:
• Select an instrument version with metal flange (minimum size DN50/2").
• Or: mount a metal sheet with a diameter of at least 200 mm (8 in) to the probe at the process connection. Its orientation must be perpendicular to the probe.

Vessels with heat insulation

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 points labeled "MAX" in the drawings.
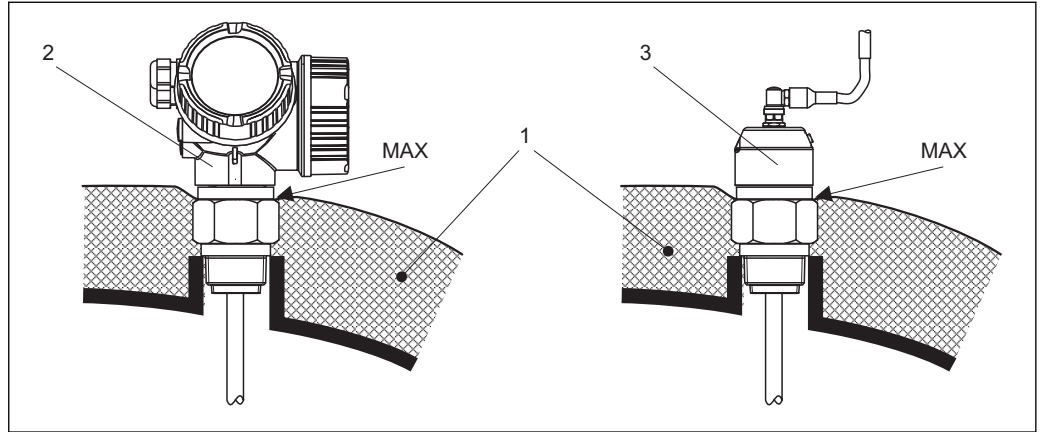
⚙ 10   *Process connection with thread - FMP56, FMP57*

1   Tank insulation
2   Compact device
3   Sensor remote (feature 600)
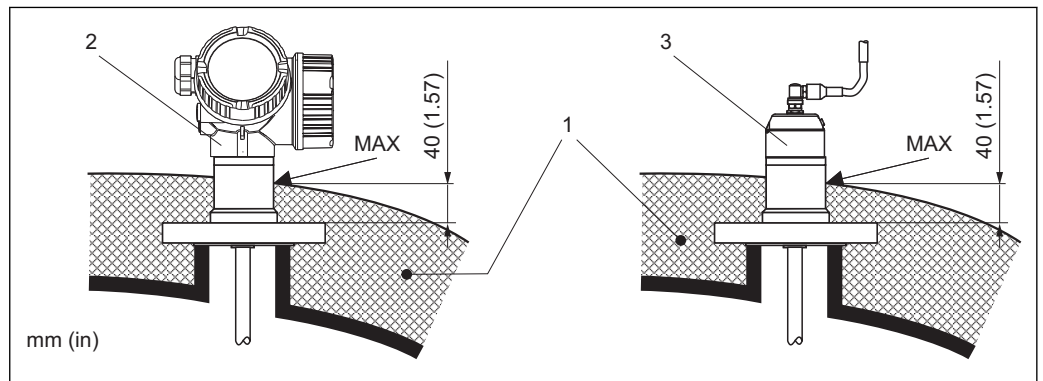
⚙ 11   *Process connection with flange - FMP57*

1   Tank insulation
2   Compact device
3   Sensor remote (feature 600)

6.2 Mounting the device

6.2.1 Required mounting tools

- For mounting thread 3/4": Hexagonal wrench 36 mm
- For mounting thread 1-1/2": Hexagonal wrench 55 mm
- To shorten rod or coax probes: Saw
- To shorten rope probes:
  – Allen key AF 3 mm (for 4mm ropes) or AF 4 mm (for 6 mm ropes)
  – Saw or bolt cutter
- For flanges and other process connections: appropriate mounting tools
- To turn the housing: Hexagonal wrench 8 mm

6.2.2 Shortening the probe

Shortening rod probes

Rod probes must be shortened if the distance to the container floor or outlet cone is less than 10 mm (0.4 in). The rods of a rod probe are shortened by sawing at the bottom end.

ℹ Rod probes of FMP52 can **not** be shortened as they are coated.

Shortening rope probes

Rope probes must be shortened if the distance to the container floor or outlet cone is less than 150 mm (6 in).
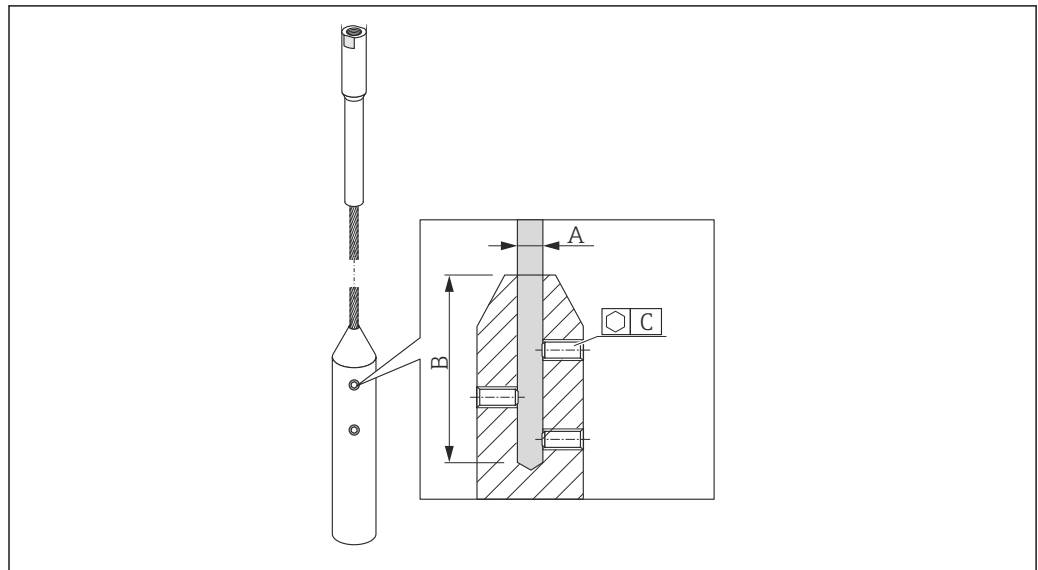
A0021693

Rope material	A	B	C	Torque for set screws
316	4 mm (0.16 in)	40 mm (1.6 in)	3 mm	5 Nm (3.69 lbf ft)
316	6 mm (0.24 in)	55 mm (2.2 in)	4 mm	15 Nm (11.06 lbf ft)
PA > steel	6 mm (0.24 in)	40 mm (1.6 in)	3 mm	5 Nm (3.69 lbf ft)
PA > steel	8 mm (0.31 in)	55 mm (2.2 in)	4 mm	15 Nm (11.06 lbf ft)

1. Using an Allen key, loosen the set screws at the end-of-probe weight. Note: The set screws have got a clamping coating in order to prevent accidental loosening. Thus an increased torque might be necessary to loosen them.

2. Remove released rope from the weight.

3. Measure off new rope length.

4. Wrap adhesive tape around the rope at the point to be shortened to prevent it from fanning out.

5. Saw off the rope at a right angle or cut it off with a bolt cutter.

6. Insert the rope completely into the weight.

7. Screw the set screws into place. Due to the clamping coating of the setscrews application of a screw locking fluid is not necessary.

Entering the new probe length

After shortening the probe:

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

2.
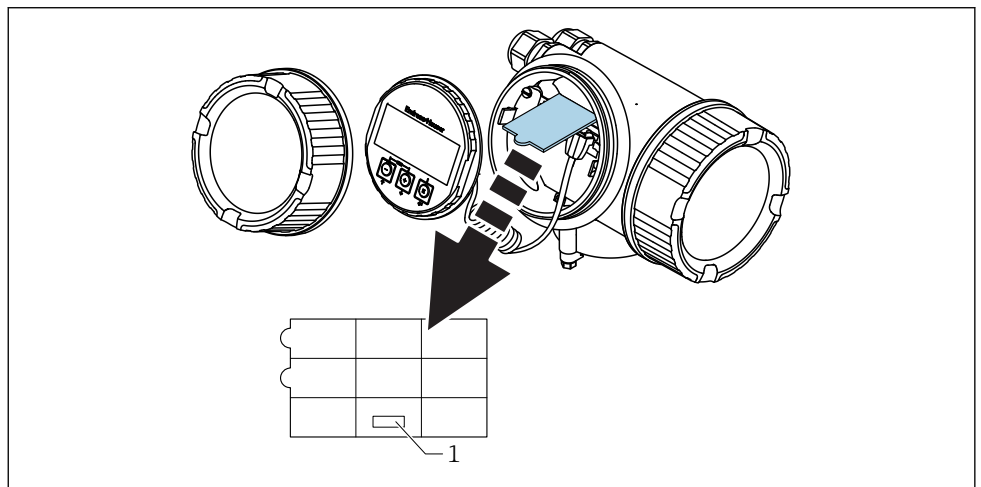
1   Field for the new probe length

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

6.2.3   Mounting the device

Mounting devices with thread
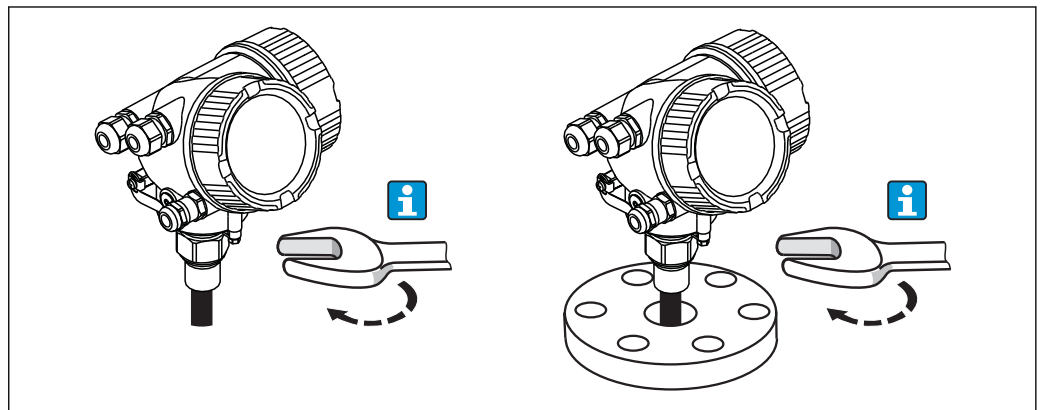
Devices with mounting thread are screwed into a welding boss or a flange and are usually also secured with these.

ℹ️ • Tighten with the hexagonal nut only:
  – Thread 3/4": Hexagonal wrench 36 mm
  – Thread 1-1/2": Hexagonal wrench 55 mm
  • Maximum permissible torque:
  – Thread 3/4": 45 Nm
  – Thread 1-1/2": 450 Nm
  • Recommended torque when using the supplied aramid fibre seal and a process pressure of 40 bar (580 psi):
  – Thread 3/4": 25 Nm
  – Thread 1-1/2": 140 Nm
  • When installing in metal containers, take care to ensure good metallic contact between the process connection and container.

Flange mounting

If a seal is used, be sure to use unpainted metal bolts to ensure good electrical contact between probe flange and process flange.

Mounting rope probes

NOTICE

Electrostatic discharges may damage the electronics.

▶ Earth the housing before lowering the rope into the vessel.
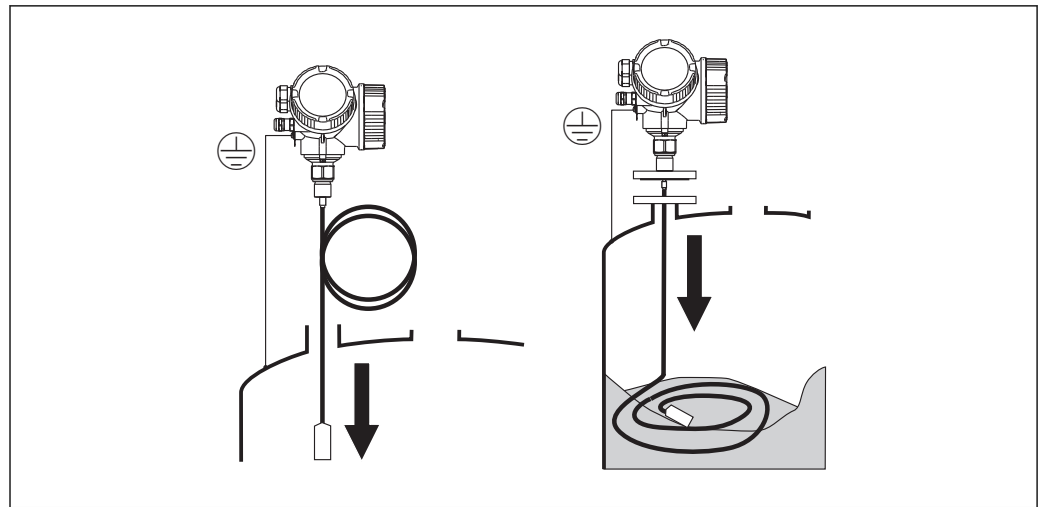
A0012529

When lowering the rope probe into the vessel, observe the following:

• Uncoil rope and lower it slowly and carefully into the vessel.
• Do not kink the rope.
• Avoid any backlash, since this might damage the probe or the vessel fittings.

ℹ️ Mounting rope probes in a partially full silo

It is not always possible to empty a silo which is already in operation. If a minimum of 2/3 of the silo is empty, it is possible to install the probe into the partially filled silo. If possible, make a visual check after the installation to see that the rope has not tangled or is lying such that it can knot when the level falls. Before full accuracy is obtained the probe rope must hang fully extended.

6.2.4 Mounting the "Sensor remote" version

ⓘ This section is only valid for devices of the version "Probe Design" = "Sensor remote" (feature 600, option MB/MC/MD).

For the version "Probe design" = "Sensor remote" the following is supplied:

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

⚠ CAUTION

The plugs of the connection cable may be damaged by mechanical stress.
▸ Mount the probe and the electronics housing tightly before connecting the cable.
▸ Lay the cable such that it is not exposed to mechanical stress. Minimum bending radius: 100 mm (4").
▸ When connecting the cable: Connect the straight plug before the angled one. Torque for both coupling nuts: 6 Nm.

ⓘ Probe, electronics and connection cable are adjusted to match each other. They are marked by a common serial number. Only components with the same serial number shall be connected to each other.

ⓘ If the measuring point is exposed to strong vibrations, an additional locking compound (e.g. Loctite 243) can be applied at the plug connectors.

Mounting the electronics housing
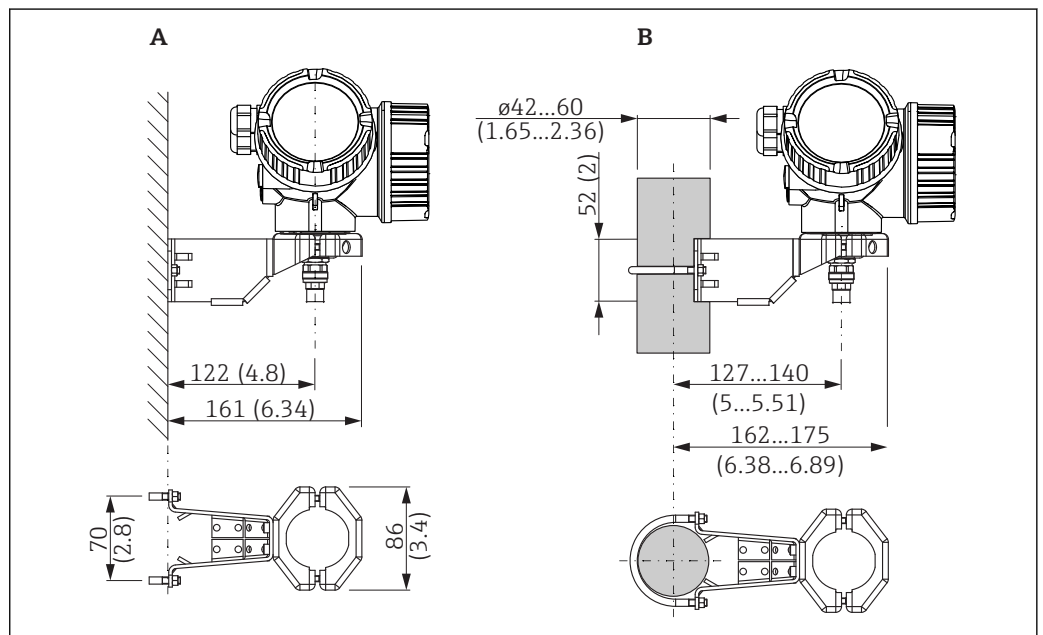
🔲 *12   Mounting the electronics housing using the mounting bracket; dimensions: mm (in)*

A   Wall mounting
B   Pipe mounting

Connecting the cable

Required tools:
Open-end wrench 18AF
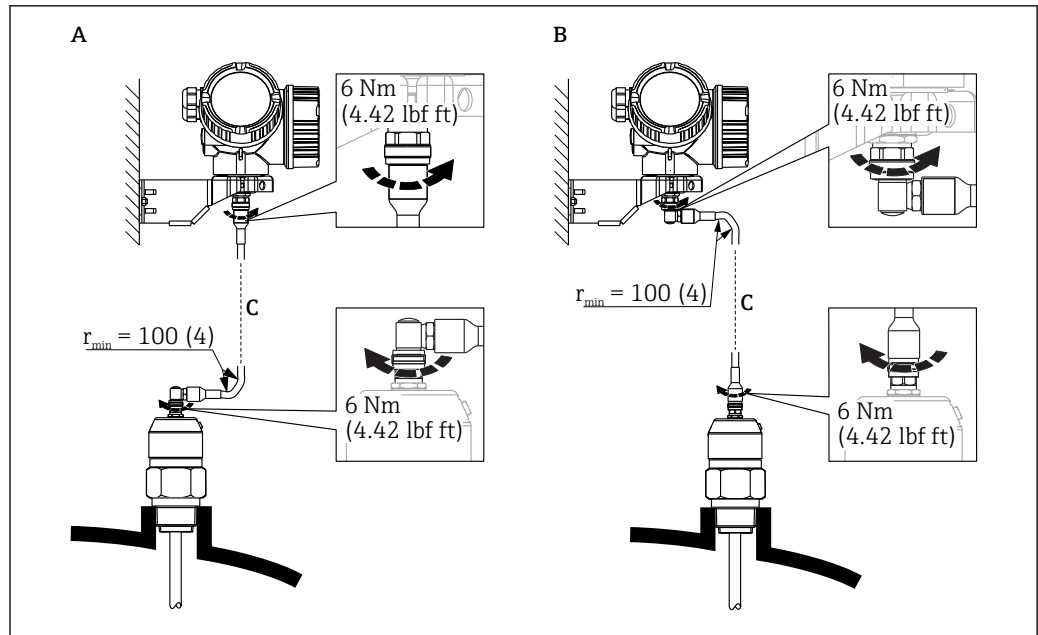
13   Connecting the cable. There are the following possibilities:

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

6.2.5   Turning the transmitter housing

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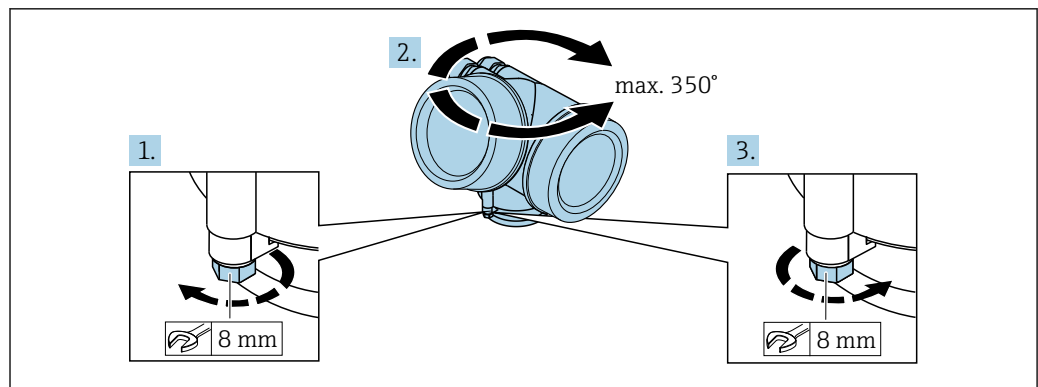
1. Unscrew the securing screw using an open-ended wrench.

2. Rotate the housing in the desired direction.

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

6.2.6   Turning the display

Opening cover
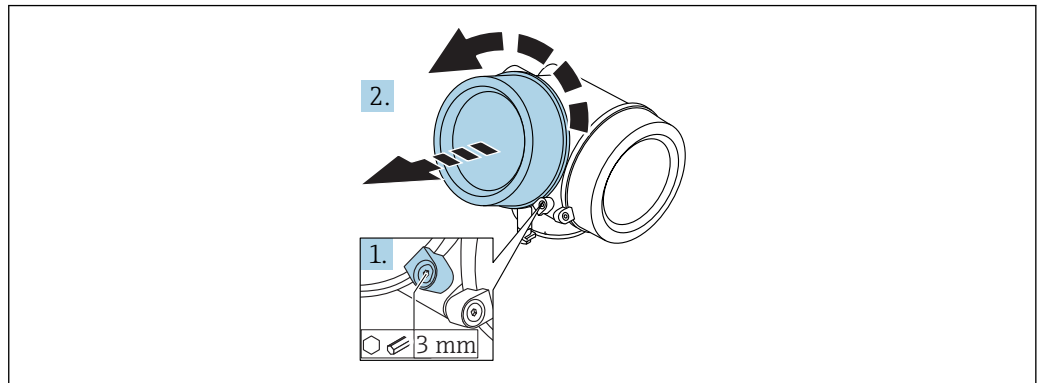
A0021430

1. Loosen the screw of the securing clamp of the electronics compartment cover using an Allen key (3 mm) and turn the clamp 90 ° counterclockwise.

2. Unscrew cover and check lid gasket, replace if necessary.

Turning the display module
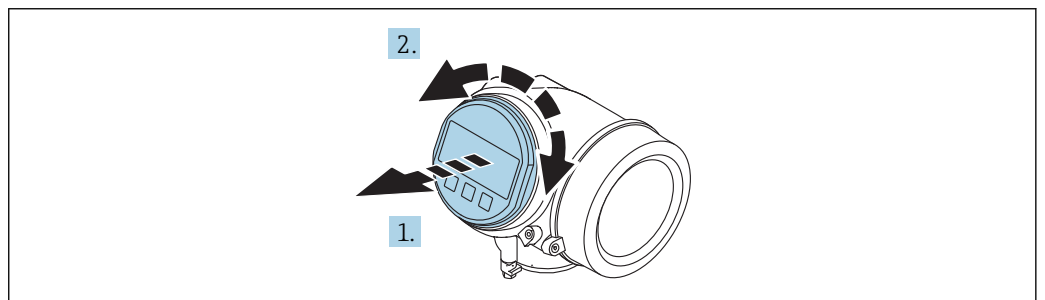
A0036401

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

2. Rotate the display module to the desired position: max. 8 × 45 ° in each direction.

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

Closing electronics compartment cover
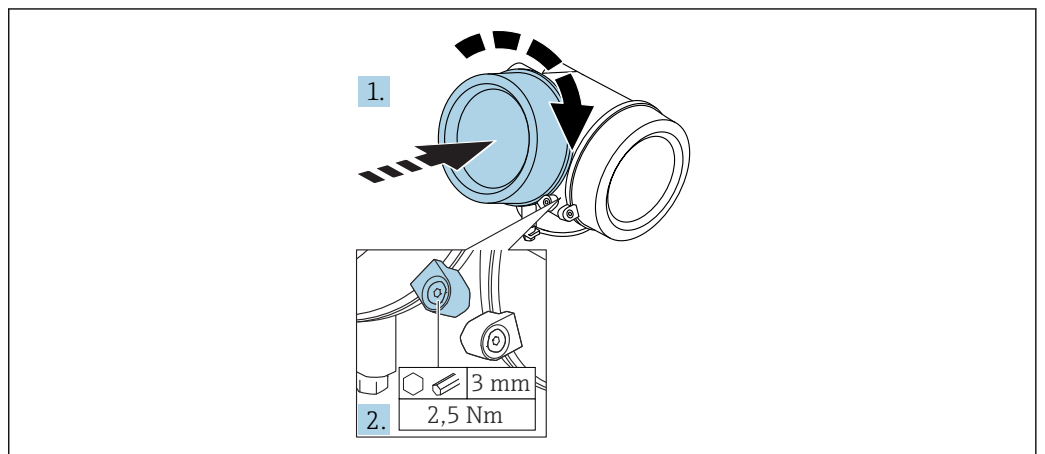
A0021451

1. Screw back firmly electronics compartment cover.

2. Turning securing clamp 90 ° clockwise and tighten the clamp with 2.5 Nm using the Allen key (3 mm).

6.3   Post-installation check

○	Is the device undamaged (visual inspection)?
○	Does the device conform to the measuring point specifications? For example: • Process temperature • Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document) • Ambient temperature range • 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

Terminal assignment 2-wire: 4-20 mA HART
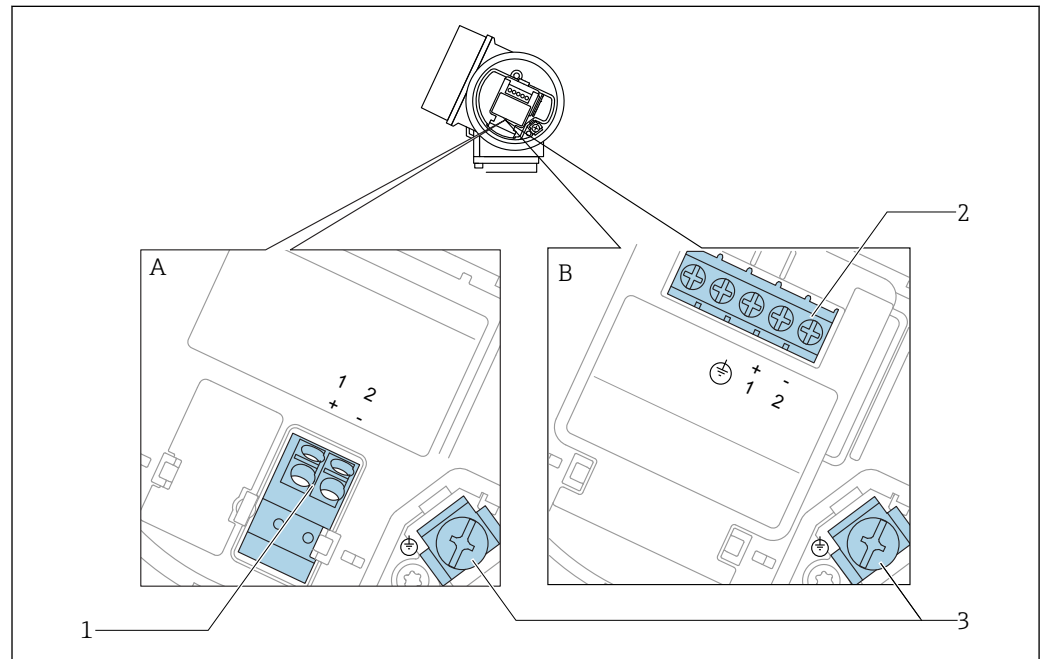
▣ 14   Terminal assignment 2-wire: 4-20 mA HART

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

Block diagram 2-wire: 4-20 mA HART
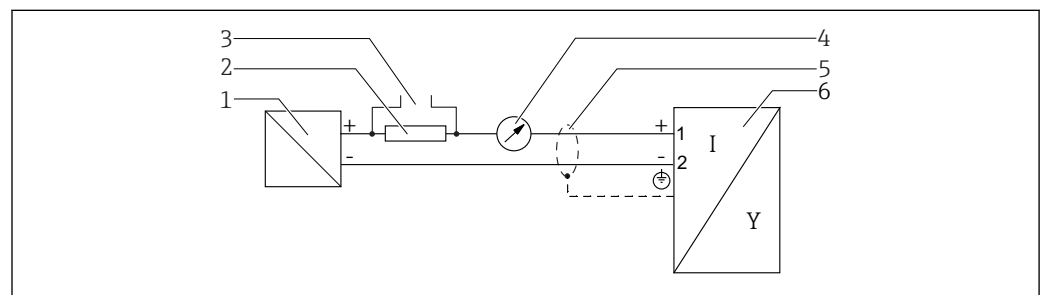
▣ 15   Block diagram 2-wire: 4-20 mA HART

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   Measuring device

Terminal assignment 2-wire: 4-20 mA HART, switch output
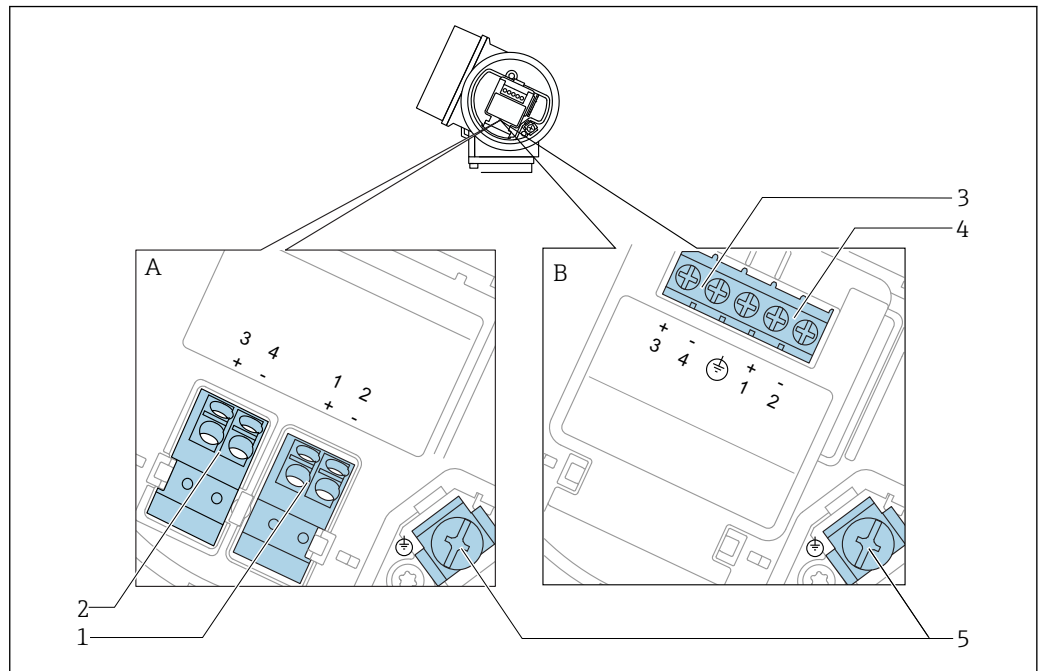
A0036500

🖼 *16   Terminal assignment 2-wire: 4-20 mA HART, switch output*

A   Without integrated overvoltage protection
B   With integrated overvoltage protection
1   Connection 4-20 mA HART passive: terminals 1 and 2, without integrated overvoltage protection
2   Connection switch output (Open Collector): terminals 3 and 4, without integrated overvoltage protection
3   Connection switch output (Open Collector): terminals 3 and 4, with integrated overvoltage protection
4   Connection 4-20 mA HART passive: terminals 1 and 2, with integrated overvoltage protection
5   Terminal for cable screen

Block diagram 2-wire: 4-20 mA HART, switch output
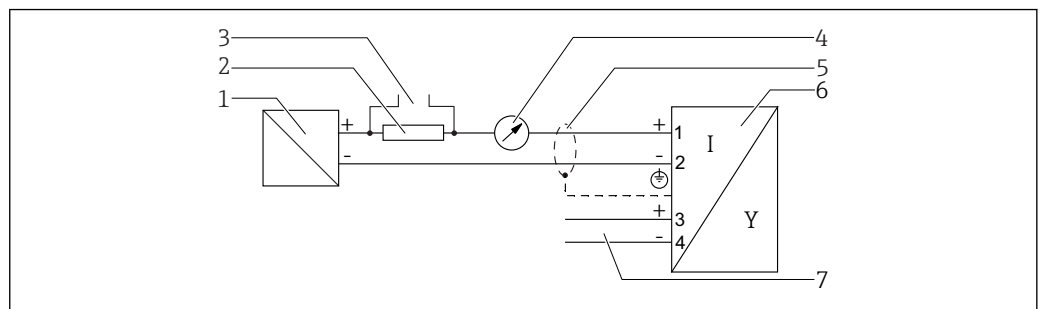
A0036501

🖼 *17   Block diagram 2-wire: 4-20 mA HART, switch output*

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   Measuring device
7   Switch output (Open Collector)

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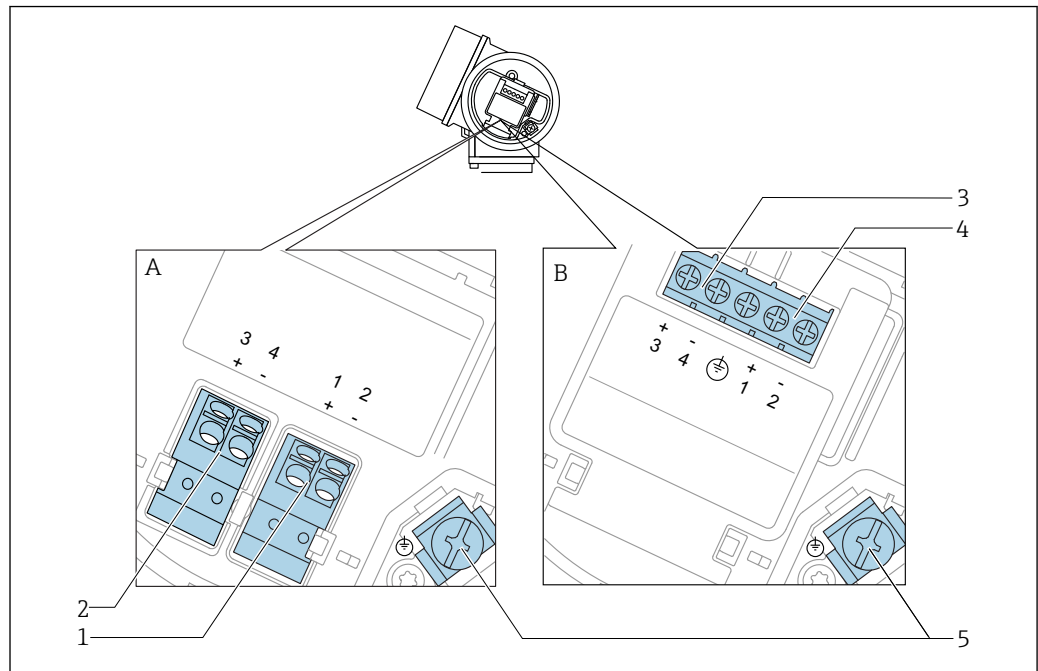
⊡ 18   Terminal assignment 2-wire: 4-20 mA HART, 4-20 mA

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

Block diagram 2-wire: 4-20 mA HART, 4-20 mA
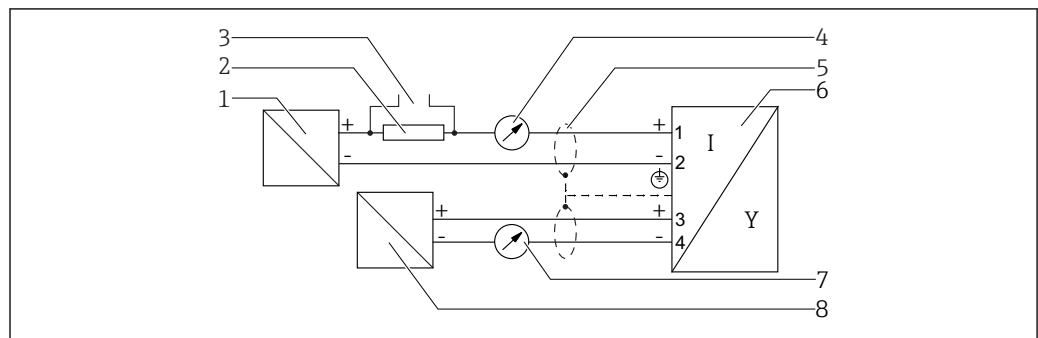
⊡ 19   Block diagram 2-wire: 4-20 mA HART, 4-20 mA

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   Measuring device
7   Analog display device; observe maximum load
8   Active barrier with power supply (e.g. RN221N), current output 2; observe terminal voltage

Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V$_{DC}$)
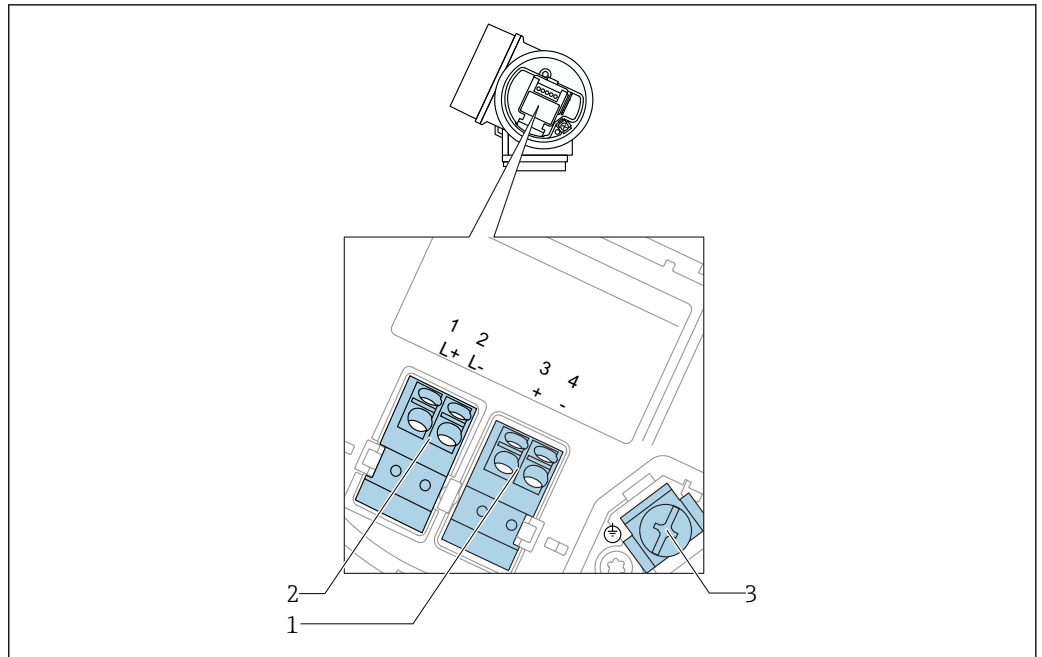
20   Terminal assignment 4-wire: 4-20 mA HART (10.4 to 48 V$_{DC}$)

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

Block diagram 4-wire: 4-20 mA HART (10.4 to 48 V$_{DC}$)
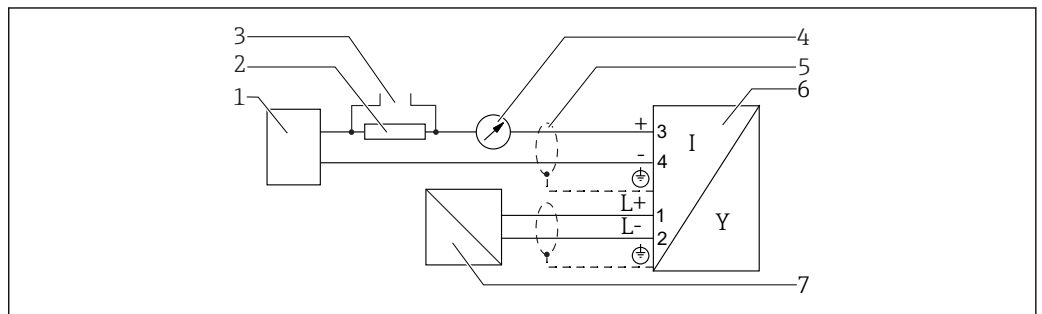
21   Block diagram 4-wire: 4-20 mA HART (10.4 to 48 V$_{DC}$)

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   Cable screen; observe cable specification
6   Measuring device
7   Supply voltage; observe terminal voltage, observe cable specification

Terminal assignment 4-wire: 4-20 mA HART (90 to 253 V$_{AC}$)
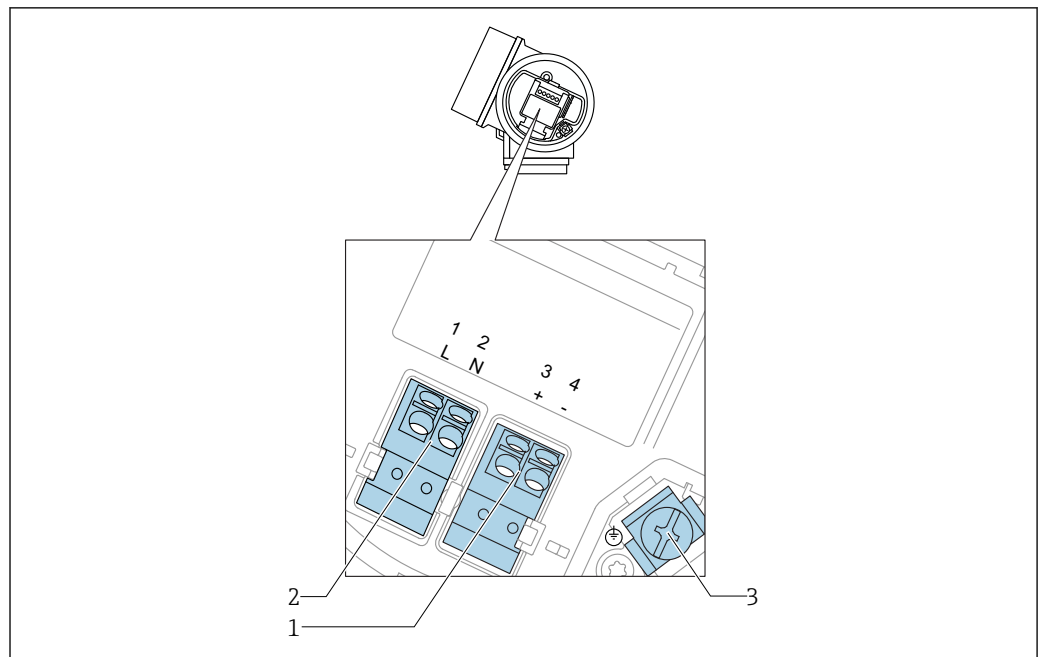
A0036519

⊠ *22   Terminal assignment 4-wire: 4-20 mA HART (90 to 253 V$_{AC}$)*

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

⚠ CAUTION

To ensure electrical safety:

▸ Do not disconnect the protective connection.
▸ Disconnect the supply voltage before disconnecting the protective earth.

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

ℹ 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.

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

Block diagram 4-wire: 4-20 mA HART (90 to 253 V$_{AC}$)
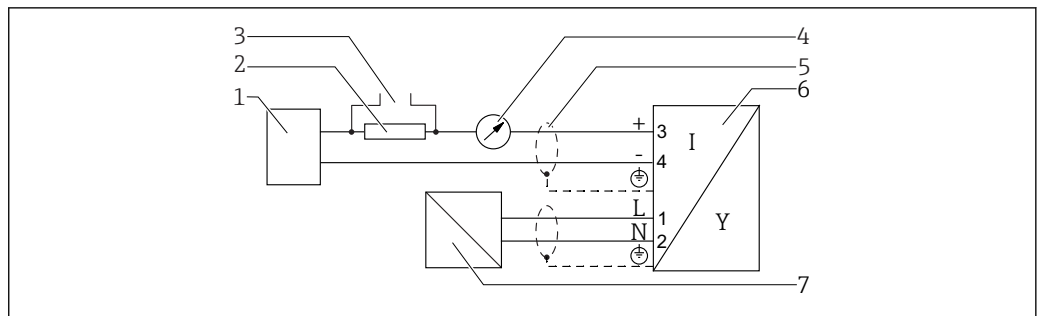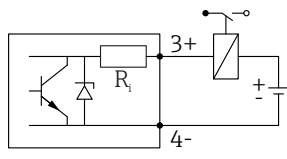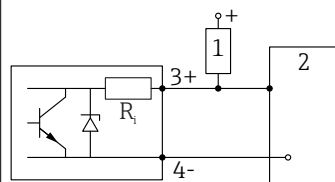
A0036527

⊡ *23   Block diagram 4-wire: 4-20 mA HART (90 to 253 V$_{AC}$)*

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   Cable scree; observe cable specification
6   Measuring device
7   Supply voltage; observe terminal voltage, observe cable specification

Connection examples for the switch output

24   Connection of a relay

A0015909

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

25   Connection of a digital input

A0015910

| 1 | Pull-up resistor |
| 2 | Digital input |

For optimum interference immunity we recommend to connect an external resistor (internal resistance of the relay or Pull-up resistor) of < 1 000 Ω.

7.1.2   Cable specification

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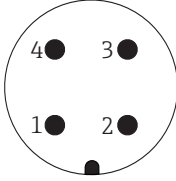
HART

- 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.
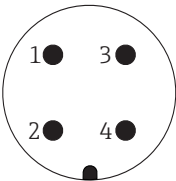
7.1.3 Device plug connectors

ℹ️ 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
4● 3●	1	Signal +
	2	not connected
1● 2●	3	Signal -
A0011175	4	Ground

Pin assignment of the 7/8" plug connector

	Pin	Meaning
1● 3●	1	Signal -
	2	Signal +
2● 4●	3	Not connected
A0011176	4	Screen

7.1.4   Power supply

2-wire, 4-20mA HART, passive

2-wire; 4-20mA HART [1]

"Approval" [2]	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U_0 at the supply unit
• Non-Ex • Ex nA • Ex ic • CSA GP	11.5 to 35 V [3] [4]	A0035511
Ex ia / IS	11.5 to 30 V [4]	
• Ex d / XP • Ex ic[ia] • Ex tD / DIP	13.5 to 30 V [4] [5]	A0034969

1)   Feature 020 of the product structure: option A
2)   Feature 010 of the product structure
3)   For ambient temperatures $T_a \leq$ -30 ℃ (-22 ℉) a minimum voltage of 14 V is required for the sartup of the device at the minimum error current (3,6 mA). For ambient temperatures $T_a \geq$ 60 ℃ (140 ℉) a minimum voltage of 12V is required for the sartup of the device at the minimum error current (3,6 mA). The startup current can be parametrized. If the device is operated with a fixed current I ≥ 4,5 mA (HART multidrop mode), a voltage of U ≥ 11,5 V is sufficient throughout the entire range of ambient temperatures.
4)   If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.
5)   For ambient temperatures $T_a \leq$ -20 ℃ (-4 ℉) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).

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

"Approval" [2]	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U_0 at the supply unit
• Non-Ex • Ex nA • Ex nA[ia] • Ex ic • Ex ic[ia] • Ex d[ia] / XP • Ex ta / DIP • CSA GP	13.5 to 35 V [3] [4]	
• Ex ia / IS • Ex ia + Ex d[ia] / IS + XP	13.5 to 30 V [3] [4]	

1) Feature 020 of the product structure: option B
2) Feature 010 of the product structure
3) For ambient temperatures $T_a \leq$ -30 ℃ (-22 ℉) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
4) If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.

2-wire; 4-20mA HART, 4-20mA [1]

"Approval" [2]	Terminal voltage U at the device	Maximum load R, depending on the supply voltage U_0 at the supply unit
any	**Channel 1:** 13.5 to 30 V [3] [4] [5]	
	Channel 2: 12 to 30 V	

1) Feature 020 of the product structure: option C
2) Feature 010 of the product structure
3) For ambient temperatures $T_a \leq$ -30 ℃ (-22 ℉) a minimum voltage of 16 V is required for the startup of the device at the minimum error current (3.6 mA).
4) For ambient temperatures $T_a \leq$ -40 ℃ (-40 ℉), the maximum terminal voltage must be restricted to U ≤ 28 V.
5) If the Bluetooth modem is used, the minimum supply voltage increases by 2 V.

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), an overvoltage protection module has to be installed.

Integrated overvoltage protection module

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

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

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

External overvoltage protection module

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

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

7.2   Connecting the measuring device

⚠ **WARNING**

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

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

7.2.1 Opening connection compartment cover
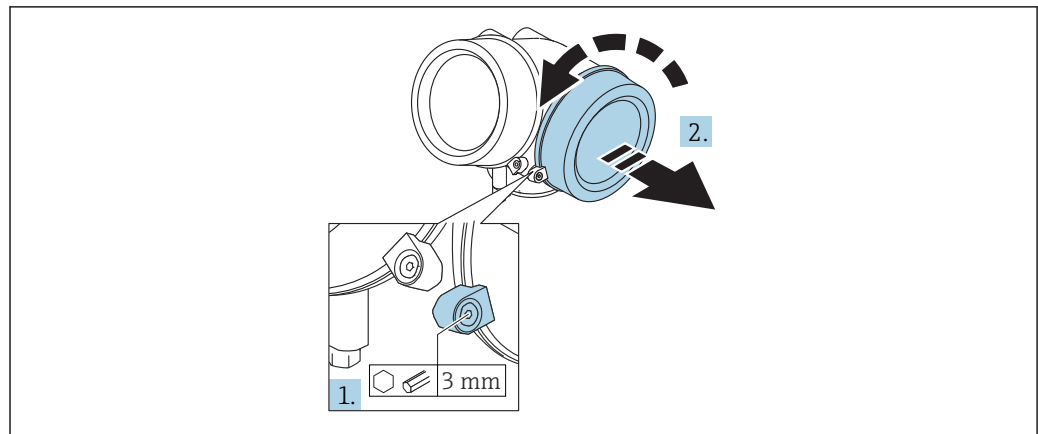
A0021490

1. Loosen the screw of the securing clamp of the connection compartment cover using an Allen key (3 mm) and turn the clamp 90 ° clockwise.

2. Afterwards unscrew connection compartment cover and check lid gasket, replace if necessary.

7.2.2 Connecting
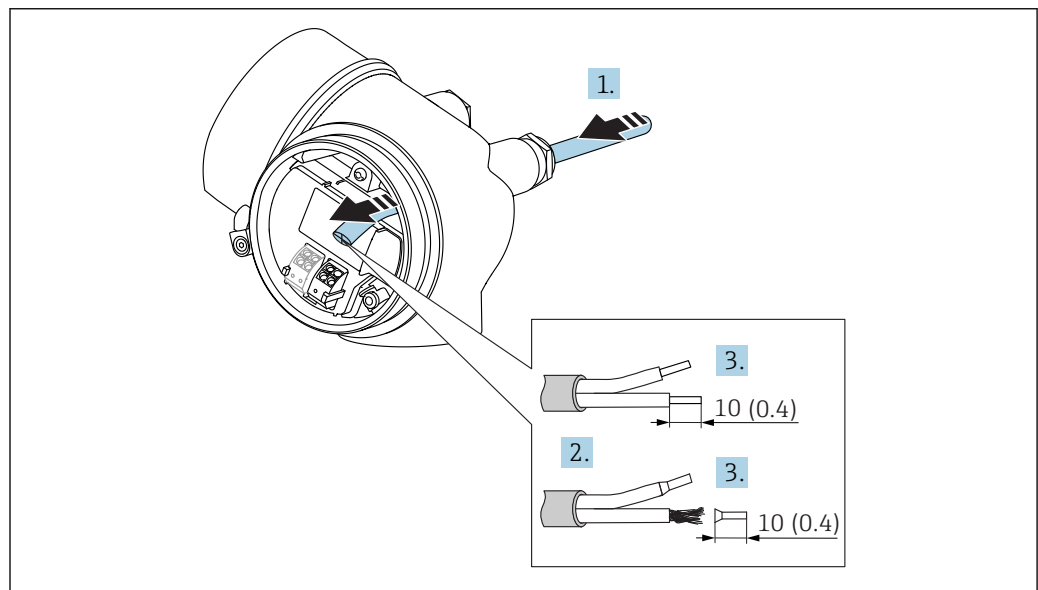
A0036418

🖾 26   *Dimensions: mm (in)*

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

2. Remove the cable sheath.

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

4. Firmly tighten the cable glands.

5. Connect the cable in accordance with the terminal assignment.
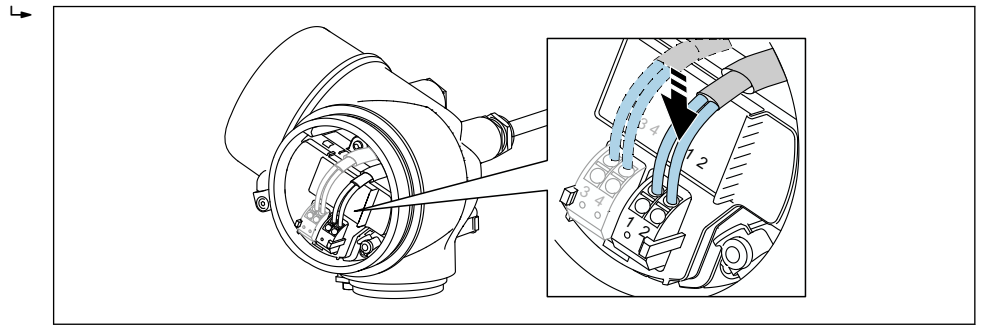
A0034682

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

7.2.3   Plug-in spring-force terminals

In the case of devices without integrated overvoltage protection, electrical connection is via plug-in spring-force terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.
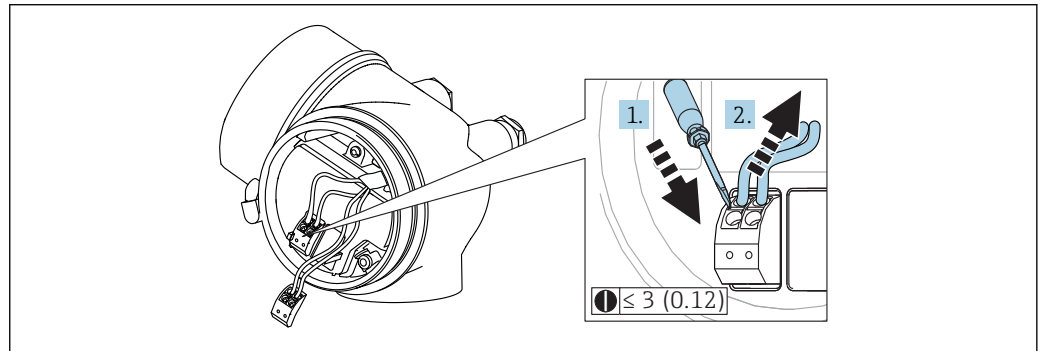
A0013661

🖼 27   *Dimensions: mm (in)*

To remove cables from the terminal:

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

2. while simultaneously pulling the cable end out of the terminal.

7.2.4   Closing connection compartment cover
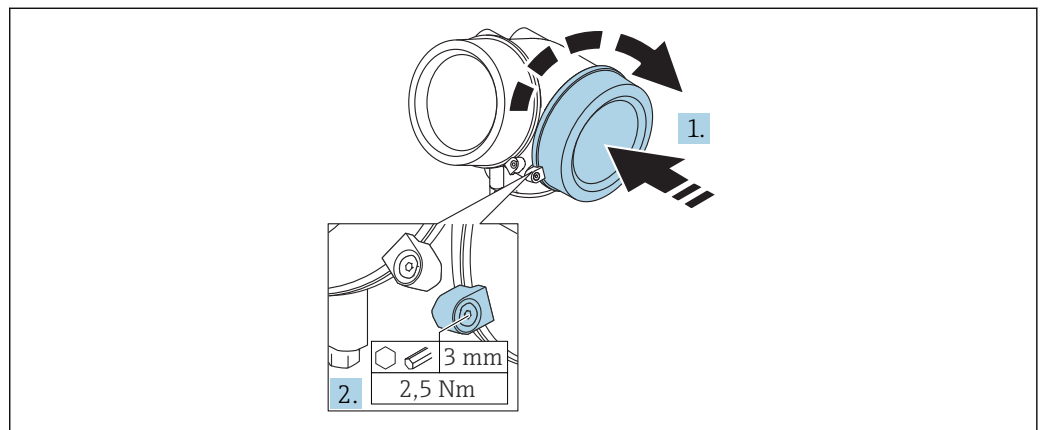
A0021491

1. Screw back firmly connection compartment cover.

2. Turning securing clamp 90 ° counterclockwise and tighten the clamp with
   2.5 Nm (1.84 lbf ft) again using the Allen key (3 mm).
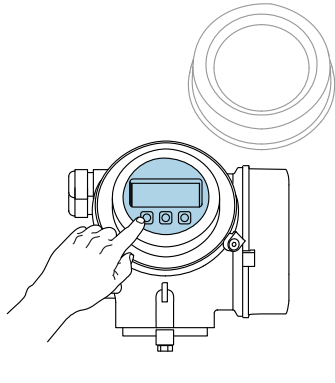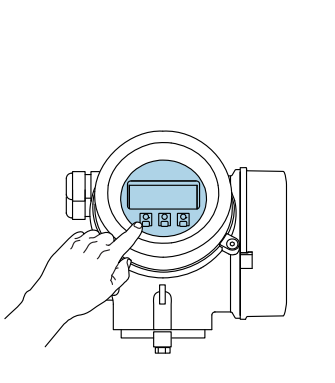
7.3   Post-connection check

❑	Is the device or cable undamaged (visual check)?
❑	Do the cables comply with the requirements ?
❑	Do the cables have adequate strain relief?
❑	Are all cable glands installed, securely tightened and leak-tight?
❑	Does the supply voltage match the specifications on the nameplate?
❑	Is the terminal assignment correct?
❑	If required: Has protective ground connection been established ?
❑	If supply voltage is present, is the device ready for operation and do values appear on the display module?
❑	Are all housing covers installed and securely tightened?
❑	Is the securing clamp tightened correctly?

8   Operation options

8.1   Overview

8.1.1   Local operation

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

8.1.2 Operation with remote display and operating module FHX50
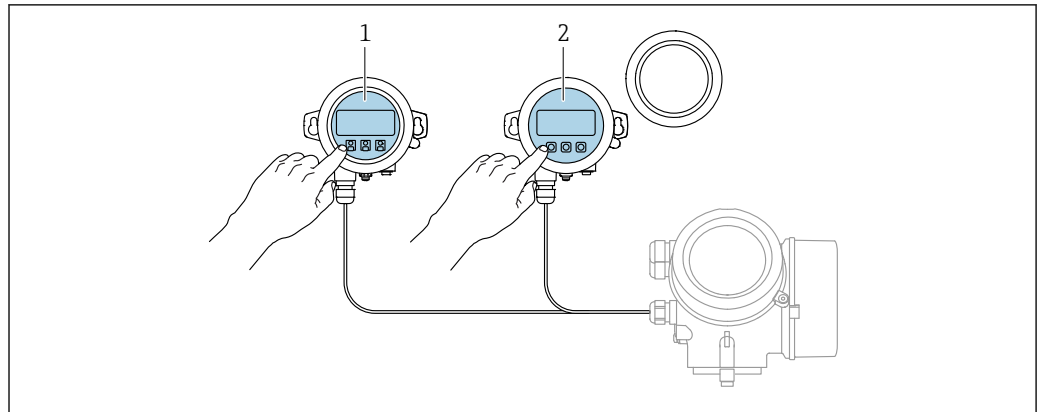
▣ 28 FHX50 operating options

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

8.1.3 Operation via Bluetooth® wireless technology

Requirements
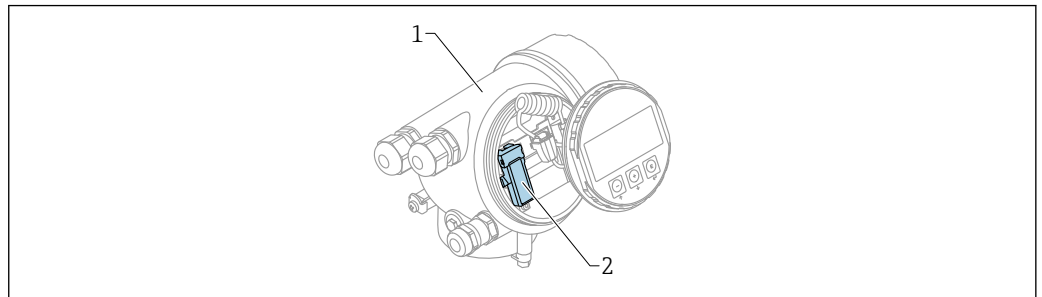
▣ *29   Device with Bluetooth module*

1   Electronics housing of the device
2   Bluetooth module

This operation option is only available for devices with Bluetooth module. There are the following options:
- The device has been ordered with a Bluetooth module:
  Feature 610 "Accessory Mounted", option NF "Bluetooth"
- The Bluetooth module has been ordered as an accessory (ordering number: 71377355) and has been mounted. See Special Documentation SD02252F.

Operation via SmartBlue (app)
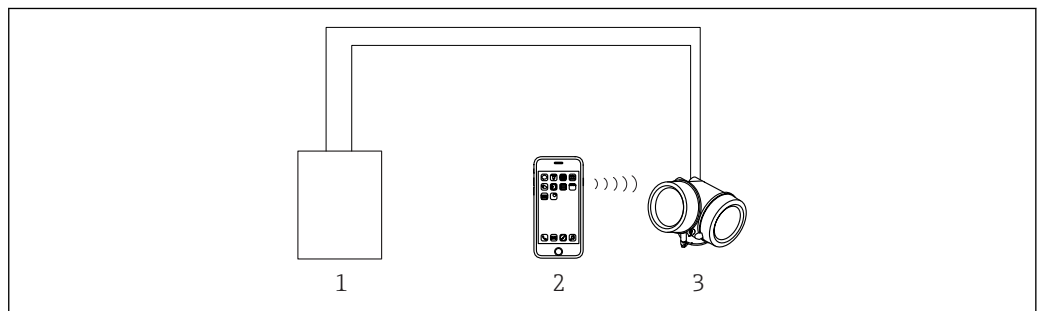
▣ *30   Operation via SmartBlue (app)*

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

8.1.4 Remote operation
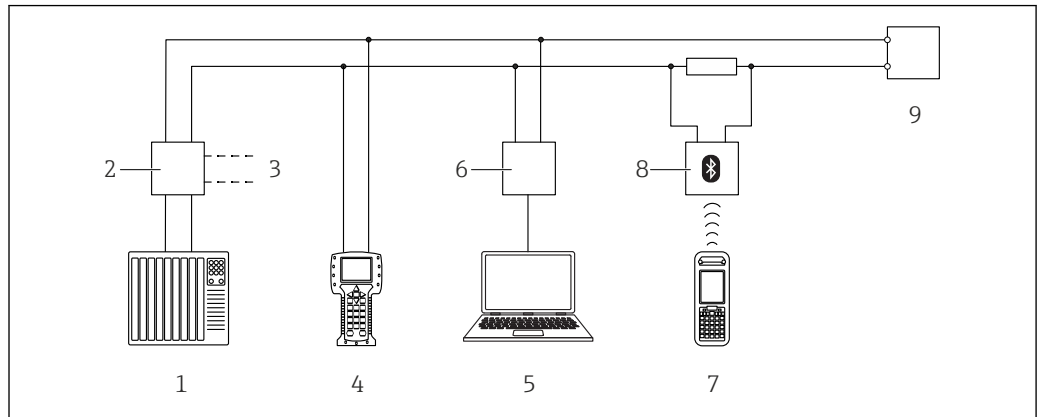
Via HART protocol

🖼 31 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. DeviceCare/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

DeviceCare/FieldCare via service interface (CDI)
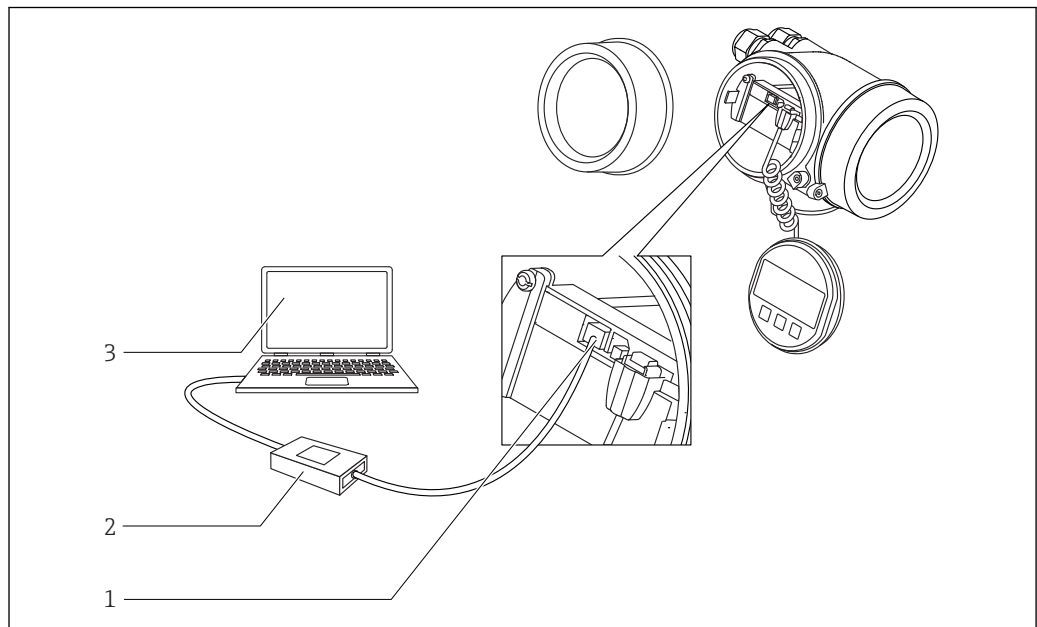
🖼 32 DeviceCare/FieldCare via service interface (CDI)

1 Service interface (CDI) of the instrument (= Endress+Hauser Common Data Interface)
2 Commubox FXA291
3 Computer with DeviceCare/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
Commissioning [2]		Launches the interactive wizard for guided commissioning. Additional settings generally do not need to be made in the other menus when the wizard is finished.
Setup	Parameter 1 ... Parameter N	Once values have been set for these parameters, the measurement should generally be completely configured.
	Advanced setup	Contains additional submenus and parameters: • to adapt the device to special measuring conditions. • to process the measured value (scaling, linearization). • to configure the signal output.
Diagnostics	**Diagnostic list**	Contains up to 5 currently active error messages.
	Event logbook [3]	Contains the last 20 messages (which are no longer active).
	Device information	Contains information for identifying the device.
	Measured values	Contains all current measured values.
	Data logging	Contains the history of the individual measuring values.
	Simulation	Is used to simulate measured values or output values.
	Device check	Contains all parameters needed to check the measurement capability of the device.
	Heartbeat [4]	Contains all the wizards for the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.
Expert [5] Contains all parameters of the device (including those that are already in one of the other menus). This menu is organized according to the function blocks of the device. The parameters of the Expert menu are described in: GP01000F (HART)	System	Contains all higher-order device parameters that do not concern the measurement or measured value communication.
	Sensor	Contains all parameters needed to configure the measurement.
	Output	• Contains all parameters needed to configure the current output. • Contains all parameters needed to configure the switch output (PFS).

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

1)   If operating via operating tools (e.g. FieldCare), the "Language" parameter is located under "Setup →
     Advanced setup → Display"
2)   Only if operating via an FDT/DTM system
3)   only available with local operation
4)   only available if operating via DeviceCare or FieldCare
5)   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 → 🖻 67.

Access authorization to parameters

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

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

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

8.2.3 Data access - Security

Write protection via access code

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

Define access code via local display

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

2. Define a max. 4-digit numeric code as an access code.

3. Repeat the 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 → 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.

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

- If write access is activated via access code, it can be also be deactivated only via the access code → 🖻 68.
- In the "Description of Device Parameters" documents, each write-protected parameter is identified with the 🔒-symbol.

Disabling write protection via access code

If the ⌨-symbol appears 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 → 🖹 67.

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

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

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

Deactivation of the write protection via access code

Via local display

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

2. Enter **0000**.

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

Via an operating tool (e.g. FieldCare)

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

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

Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for 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
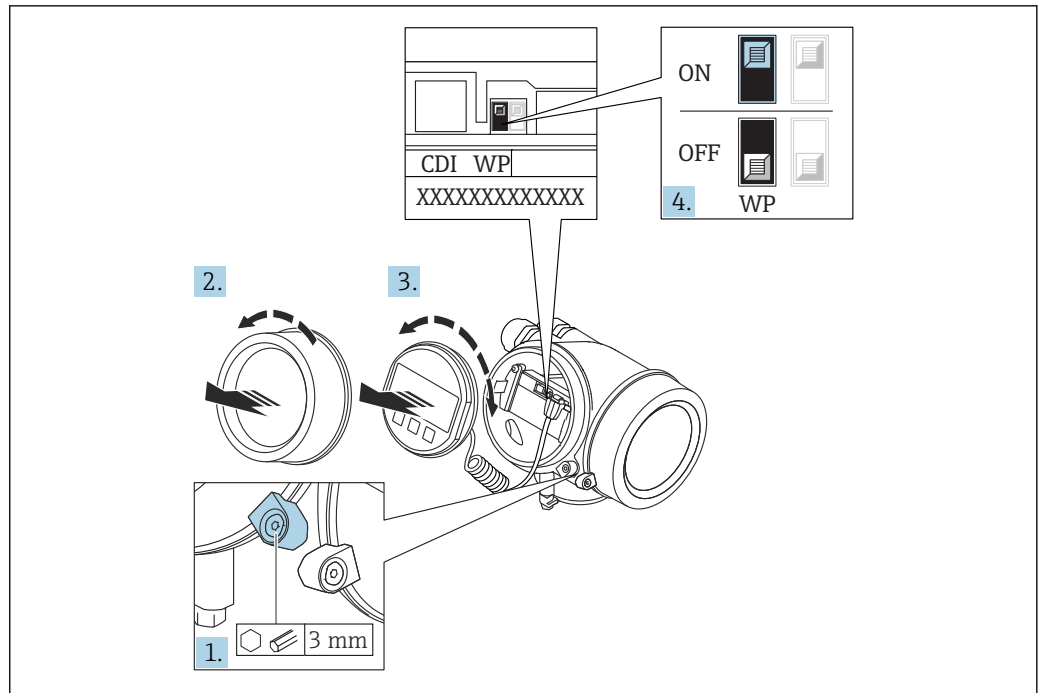
1. Loosen the securing clamp.

2. Unscrew the electronics compartment cover.

3. Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.
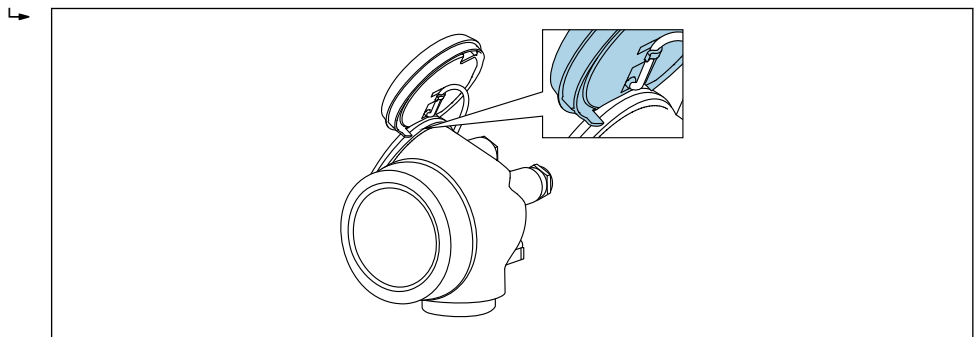
4. Setting the write protection switch (WP) on the main electronics module to the **ON** position enables hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.

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

A0015870
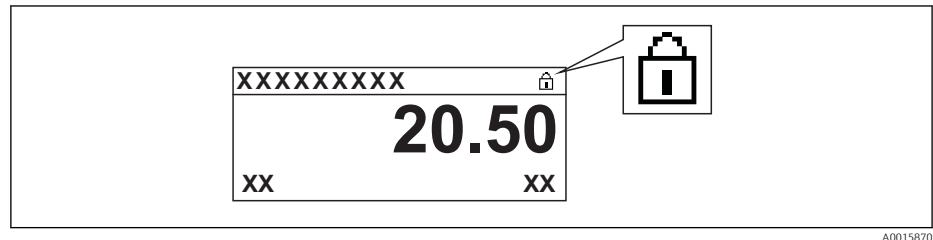
   If the hardware write protection is disabled: No option is displayed in the **Locking status** parameter. On the local display, the ⓐ-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

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

6. Reverse the removal procedure to reassemble the transmitter.

Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

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

Switching on the keypad lock

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

To activate the keylock manually:

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

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

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

Switching off the keypad lock

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

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

Bluetooth® wireless technology

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

8.3   Display and operating module

8.3.1   Display appearance
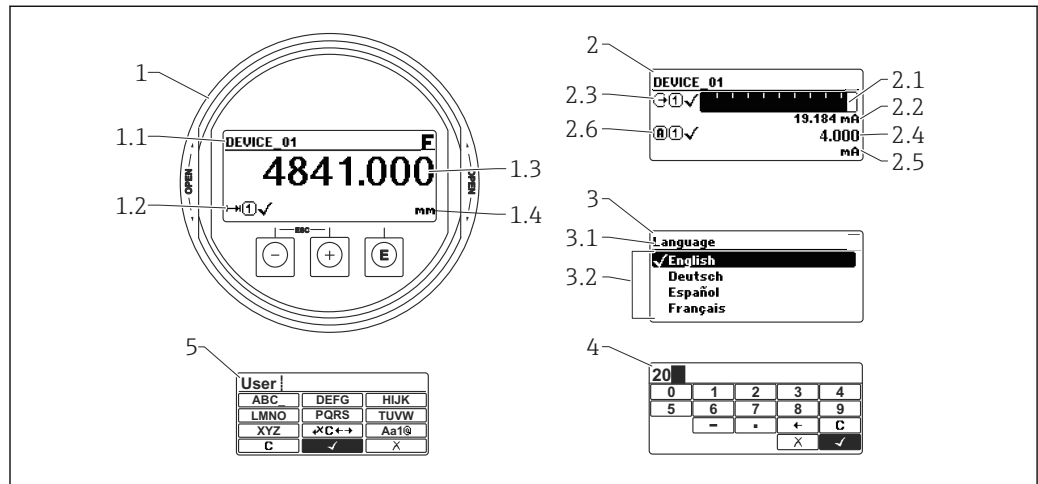
⊞ 33   Appearance of the display and operation module for on-site operation

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
A0018367	**Display/operation** Is displayed: • in the main menu next to the selection "Display/operation" • in the header, if you are in the "Display/operation" menu
A0018364	**Setup** Is displayed: • in the main menu next to the selection "Setup" • in the header, if you are in the "Setup" menu
A0018365	**Expert** Is displayed: • in the main menu next to the selection "Expert" • in the header, if you are in the "Expert" menu
A0018366	**Diagnostics** Is displayed: • in the main menu next to the selection "Diagnostics" • in the header, if you are in the "Diagnostics" menu

Status signals

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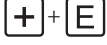
Display symbols for the locking state

Symbol	Meaning
A0013148	**Display parameter** Marks display-only parameters which can not be edited.
A0013150	**Device locked** • In front of a parameter name: The device is locked via software and/or hardware. • In the header of the measured value screen: The device is locked via hardware.

Measured value symbols

Symbol	Meaning
Measured values	
A0032892	**Level**
A0032893	**Distance**
A0032908	**Current output**
A0032894	**Measured current**
A0032895	**Terminal voltage**
A0032896	**Temperature of the electronics or the sensor**
Measuring channels	
A0032897	**Measuring channel 1**
A0032898	**Measuring channel 2**
Status of the measured value	
A0018361	**Status "Alarm"** The measurment is interrupted. The output assumes the defined alarm value. A diagnostic message is generated.
A0018360	**Status "Warning"** The device continues measuring. A diagnostic message is generated.

8.3.2   Operating elements

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

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

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

⊟+Ⓔ A0032910	**Minus/Enter key combination (press and hold down the keys simultaneously)** Reduces the contrast (brighter setting).
⊞+Ⓔ A0032911	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).

8.3.3 Entering numbers and text

Numeric editor	Text editor
A0013941	A0013999

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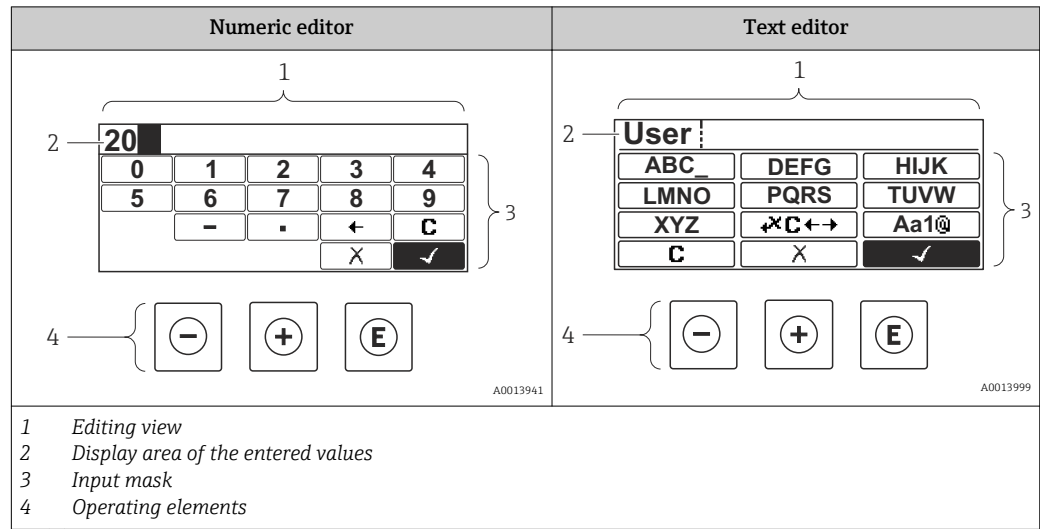
Input mask

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

Numeric editor symbols

Symbol	Meaning
0 ... **9** 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.
C A0014040	Clears all entered characters.

Text editor symbols

Symbol	Meaning
ABC_ ... **XYZ** A0013997	Selection of letters from A to Z
Aa1@ A0013981	Toggle • Between upper-case and lower-case letters • For entering numbers • For entering special characters

Symbol	Meaning
✓ A0013985	Confirms selection.
⚡C←→ A0013987	Switches to the selection of the correction tools.
✗ A0013986	Exits the input without applying the changes.
C A0014040	Clears all entered characters.

Correction symbols under ⚡C←→

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

8.3.4 Opening the context menu

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

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

Opening and closing the context menu

The user is in the operational display.

1. Press E for 2 s.
   - ↳ The context menu opens.
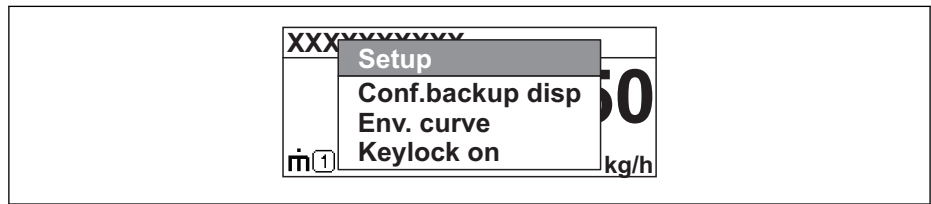
2. Press − + + simultaneously.
   - ↳ The context menu is closed and the operational display appears.

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:
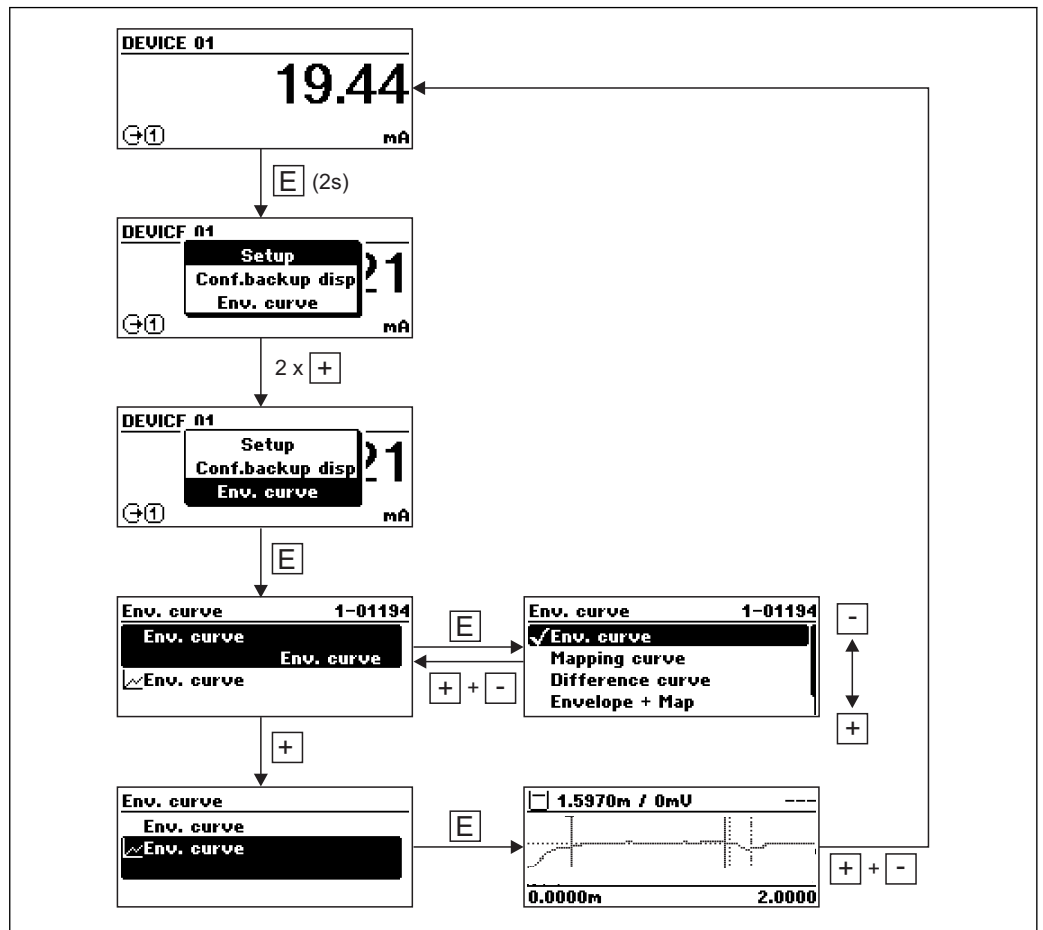
A0014277

9 Device integration via the HART protocol

9.1 Overview of the Device Description files (DD)

HART

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

9.2 HART device variables and measuring values

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

Device variables for level measurements

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

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

10 Commissioning via SmartBlue (app)

10.1 Requirements

Device requirements
Commissioning via SmartBlue is only possible if the device has a Bluetooth module.

System requirements SmartBlue
SmartBlue is available as download for Android devices from the Google Play Store and for iOS devices from the iTunes Store.
- iOS devices:
  iPhone 4S or higher from iOS9.0; iPad2 or higher from iOS9.0; iPod Touch 5th generation or higher from iOS9.0
- Devices with Android:
  from Android 4.4 KitKat and *Bluetooth*® 4.0

Initial password
The ID of the Bluetooth module serves as the initial password used to establish the first connection to the device. It can be found:
- on the information sheet which is supplied with the device. This serial number specific sheet is also stored in W@M.
- on the nameplate of the Bluetooth module.
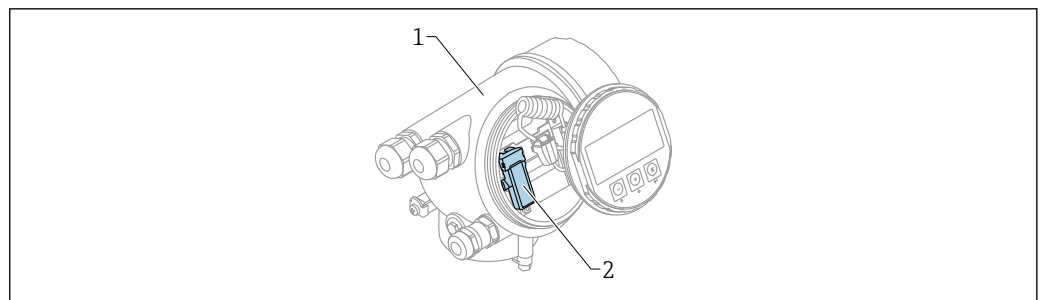
34 Device with Bluetooth module

1   Electronics housing of the device
2   Nameplate of the Bluetooth module; the ID on this nameplate serves as initial password.

All login data (including the password changed by the user) are not stored in the device but in the Bluetooth module. This must be taken into account when the module is removed from one device and inserted into a different device.

10.2 Commissioning

Download and install SmartBlue

1. To download the app, scan the QR code or enter "SmartBlue" in the search field
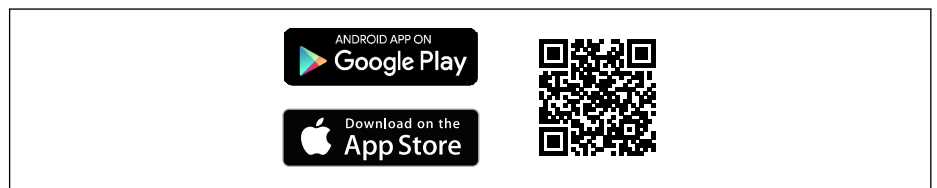
35 Download link

2. Start SmartBlue

36   SmartBlue pictogram

3. Select device from displayed livelist (available devices only)
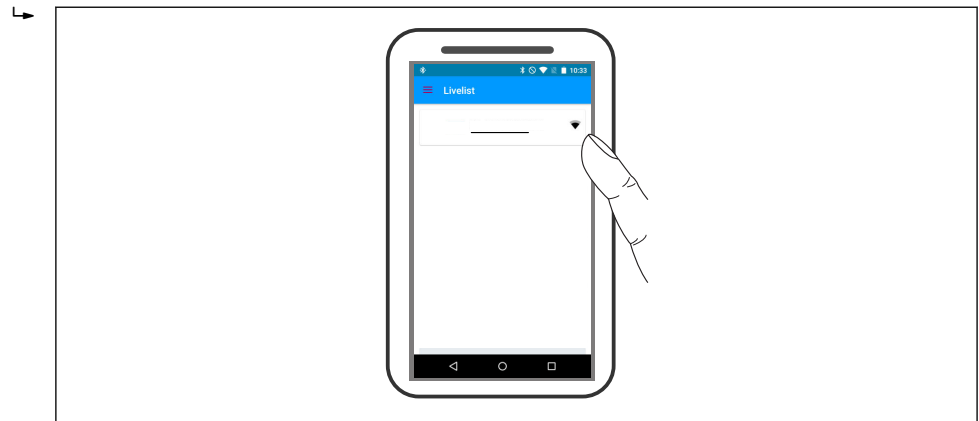
37   Livelist

Only one point-to-point connection can be established between **one** sensor and **one** smartphone or tablet.

4. Perform login
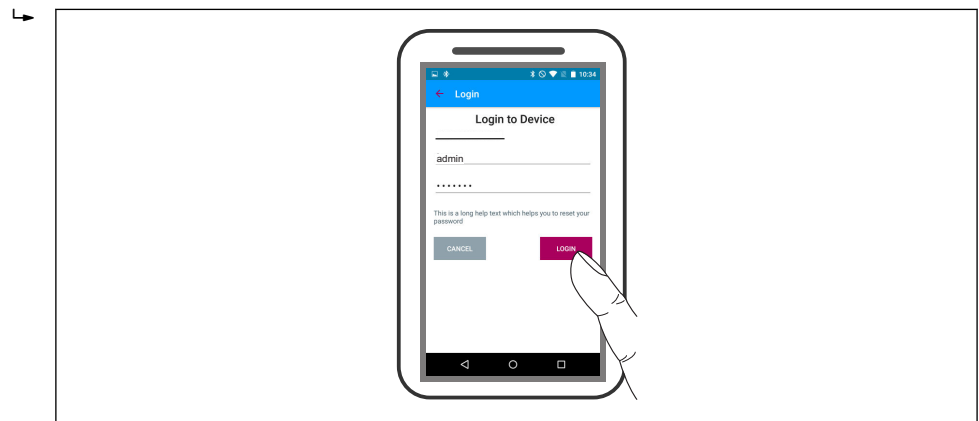
38   Login

5. Enter user name -> admin

6. Enter initial password -> ID of the Bluetooth module

7. Change the password after logging in for the first time

8. By wiping from the side, additional information (e.g. main menu) can be dragged into the image
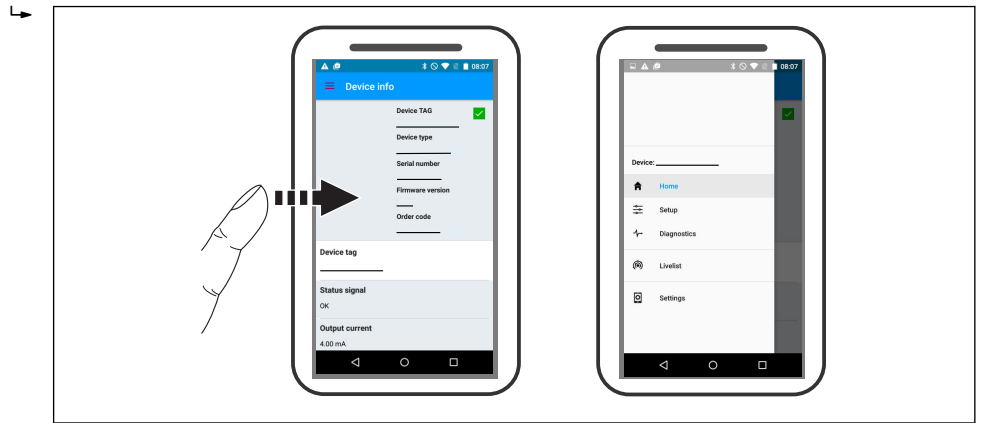
39   Main menu

Envelope curves can be displayed and recorded

Additionally to the envelope curve, the following values are displayed:
- D = Distance
- L = Level
- A = Absolute amplitude

- In the case of screenshots, the displayed section (zoom function) is saved
- In video sequences, always the whole area without zoom function is saved

It is also possible to send envelope curves (video sequences) using the relevant smartphone or tablet functions.
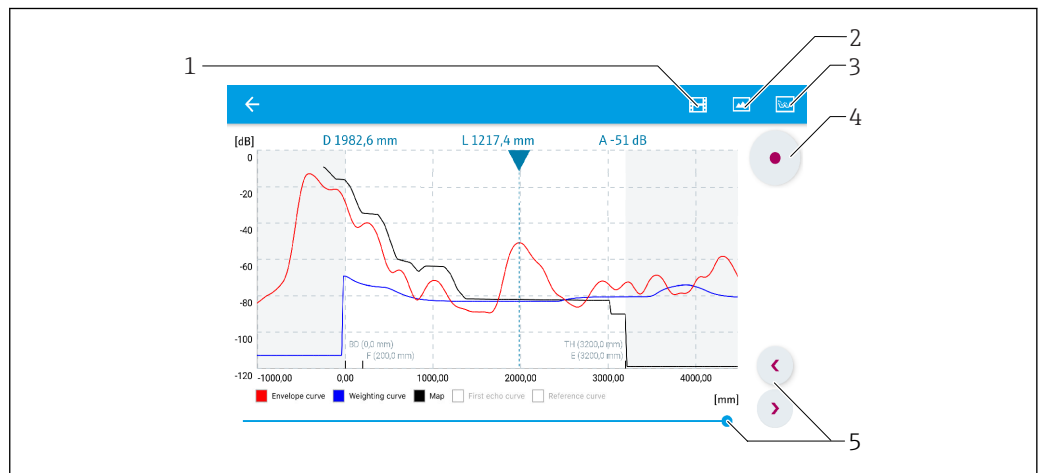
40   Envelope curve display (example) in SmartBlue; Android view

1   Record video
2   Create screenshot
3   Navigation to mapping menu
4   Start / stop video recording
5   Move time on time axis
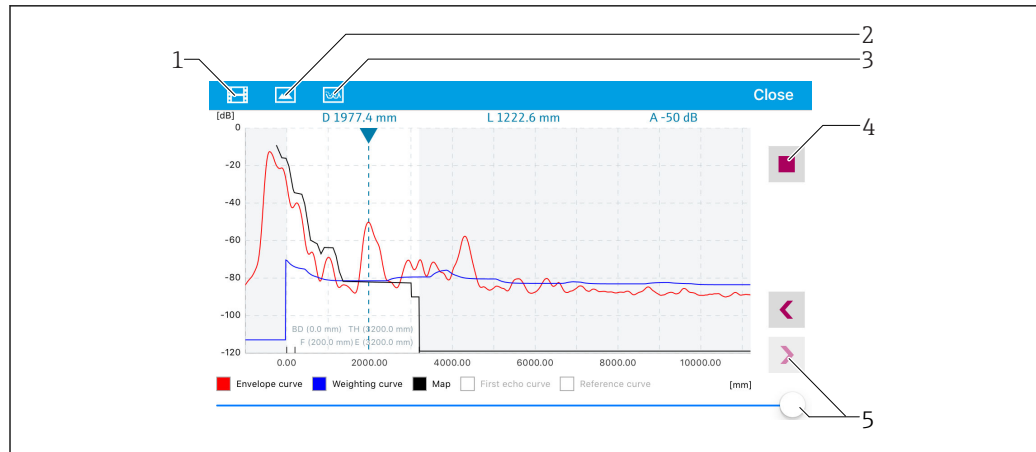
41   *Envelope curve display (example) in SmartBlue; IoS view*

1   *Record video*
2   *Create screenshot*
3   *Navigation to mapping menu*
4   *Start / stop video recording*
5   *Move time on time axis*

11   Commissioning via wizard

A wizard guiding the user through the initial setup is available in FieldCare and DeviceCare [3].

1. Connect the device to FieldCare or DeviceCare → 🖹 64.

2. Open the device in FieldCare or DeviceCare.
   ↳ The dashboard (home page) of the device appears:

A0025866
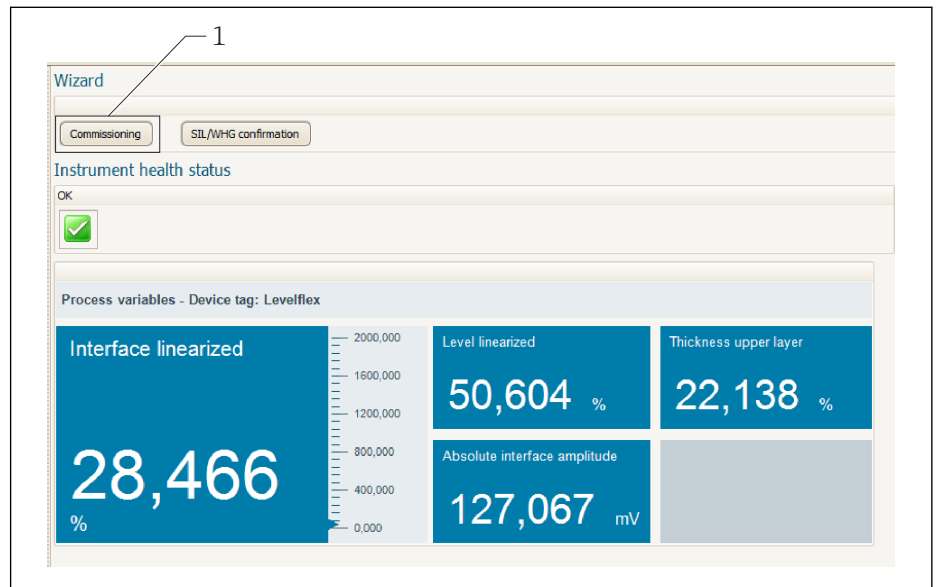
1   "Commissioning" button calls up the wizard.

3. Click on "Commissioning" to call up the wizard.

4. Enter or select the appropriate value for each parameter. These values are immediately written to the device.

5. Click "Next" to switch to the next page.

6. After finishing the last page, click "End of sequence" to close the wizard.

ℹ If the wizard is cancelled before all necessary parameters have been set, the device may be in an undefined state. A reset to the default settings is recommended in this case.

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3)   DeviceCare is available for download at www.software-products.endress.com. The download requires a registration in the Endress+Hauser software portal.

12   Commissioning via operating menu

12.1   Installation and function check

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

- Checklist "Post-installation check" → 🖹 45
- Checklist "Post-connection check" → 🖹 60

12.2   Setting the operating language

Factory setting: English or ordered local language
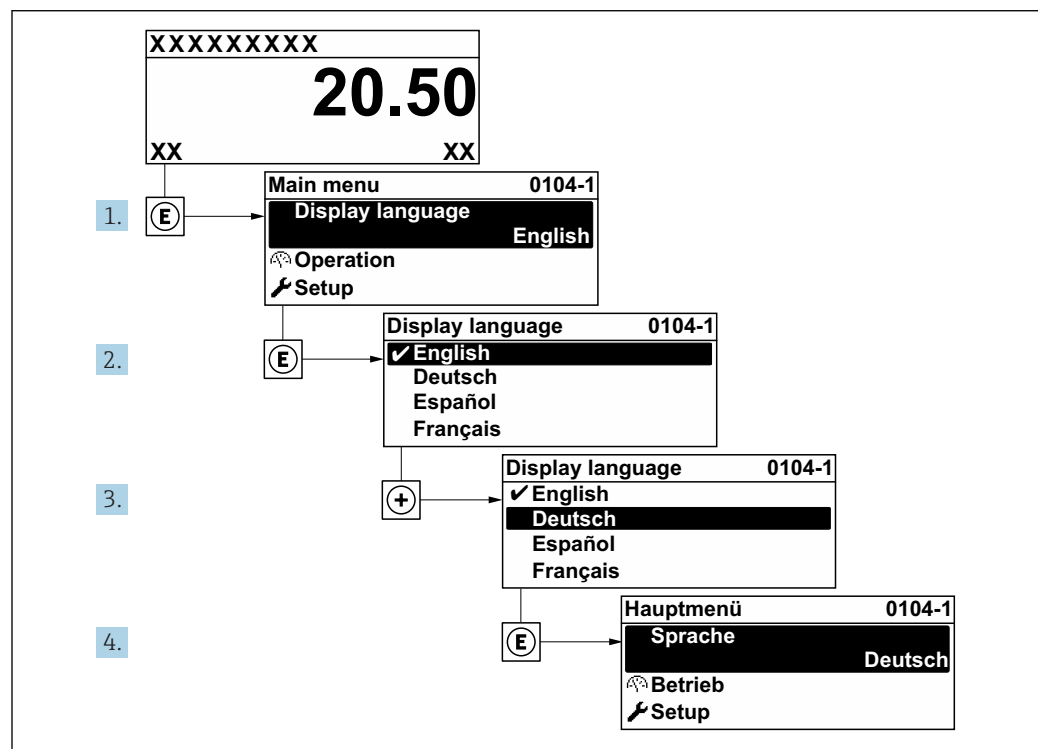
🖾 *42   Using the example of the local display*

12.3   Configuration of a level measurement
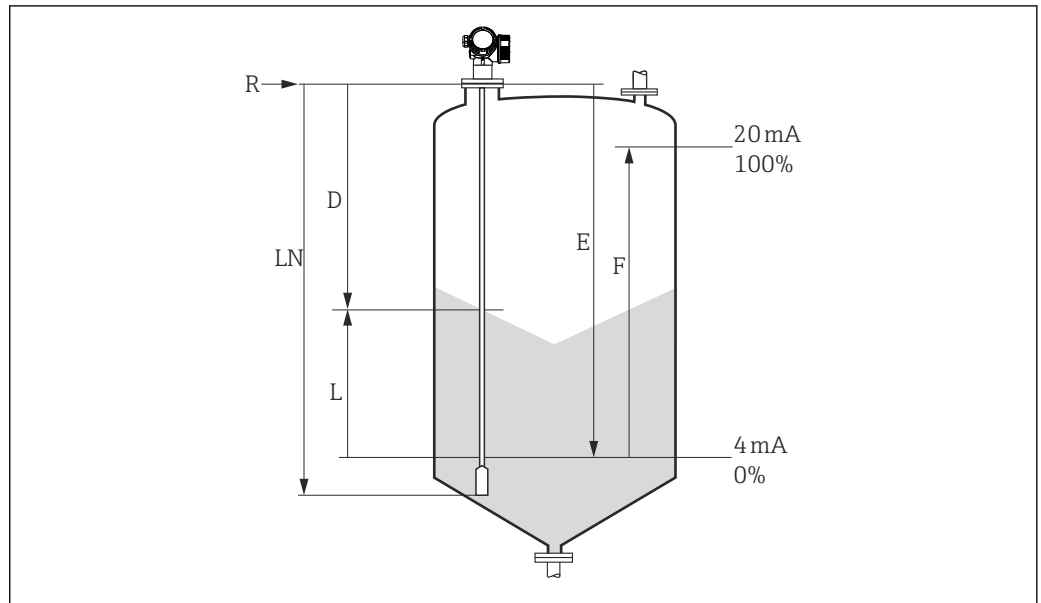
A0012838

⊞ *43*   *Configuration parameters for level measurements in solids*

LN   *Length of probe*
R   *Reference point of the measurement*
D   *Distance*
L   *Level*
E   *Empty calibration (= Zero point)*
F   *Full calibration (= Span)*

ℹ️ If for rope probes the DC value is less than 7, then measurement is not possible in the area of the straining weight. In these cases, the maximum recommended value for the empty calibration E is *LN* - 250 mm (*LN* - 10 in).

1. Setup → Device tag
    ↳ Enter tag for measuring point.

2. Navigate to: Setup → Distance unit
    ↳ Select distance unit.

3. Navigate to: Setup → Bin type
    ↳ Select bin type.

4. Navigate to: Setup → Empty calibration
    ↳ Enter the distance E between the reference point R and the minimum level (0%).

5. Navigate to: Setup → Full calibration
    ↳ Enter distance F between the minimum (0%) and maximum (100%) level.

6. Navigate to: Setup → Level
    ↳ Displays the measured level L.

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

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

9. For operation via local display:
    Navigate to: Setup → Mapping → Confirm distance
    ↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve if required.

10. For operation via operating tool:

Navigate to: Setup → Confirm distance

↳ Compare the displayed distance to the real distance in order to start the recording of the mapping curve if required.

12.4   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 → 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 or 01.01.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:
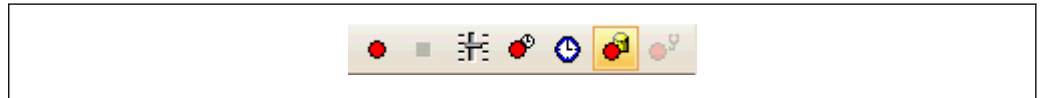
44   The "Load Reference Curve" function

12.5 Configuration of the on-site display

12.5.1 Factory settings of the on-site display for level measurements

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

12.5.2 Adjustment of the on-site display

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

12.6   Configuration of the current outputs

12.6.1   Factory setting of the current outputs for level measurements

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]	Relative echo amplitude	0 mV	2 000 mV

1)   for devices with 2 current outputs

12.6.2   Adjustment of the current outputs

The current outputs can be adjusted in the following submenus:

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" GP01000F

12.7 Configuration management

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

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

Meaning of the options
- **Cancel**
  No action is executed and the user exits the parameter.
- **Execute backup**
  A backup copy of the current device configuration 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 → 🖺 190 will not restore the original status..

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

12.8   Protection of the settings against unauthorized changes

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

- Via parameter settings (software locking) → 🖹 67
- Via locking switch (hardware locking) → 🖹 68

13   Diagnostics and troubleshooting

13.1   General trouble shooting

13.1.1   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. • Decrease contrast by pressing ⊟ and Ⓔ simultaneously.
	The plug of the display cable is not connected correctly.	Connect the plug correctly.
	Display is defective.	Replace display.
"Communication error" is indicated on the display when starting the device or connecting the display	Electromagnetic interference	Check grounding of the device.
	Broken display cable or display plug.	Replace display.
Duplicating of the parameters from one device to another via the display doesn't work. Only the "Save" and "Abort" options are available.	Display with backup is not recognized if no data backup has been performed at the device before.	Connect display (with the backup) and restart the device.
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.
	Commubox connected incorrectly.	Connect Commubox correctly.
	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.
Device not accessible via SmartBlue	No Bluetooth connection	Enable Bluetooth function onsmartphone or tablet.
	Device already linked to another smartphone / tablet	Disconnect device from smartphone/tablet.
	Bluetooth module not connected.	Connect Bluetooth module (see SD02252F).
Login via SmartBlue not possible	Device is being put into operation for the first time	Enter initial password (ID of the Bluetooth module) and change.
Device cannot be operated via SmartBlue	Incorrect password entered	Enter correct password
	Password forgotten	Contact Endress+Hauser Service (www.addresses.endress.com)

13.1.2   Error - SmartBlue operation

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

13.1.3   Parametrization errors

Parametrization errors for level measurements

Error	Possible cause	Remedial action
Measured value wrong	If measured distance(Setup → Distance) matches the real distance: Calibration error	• Check and adjust the **Empty calibration** parameter (→ 🖹 139) if necessary. • Check and adjust the **Full calibration** parameter (→ 🖹 139) if necessary. • Check and adjust linearization if necessary (**Linearization** submenu (→ 🖹 154)).
	If measured distance (Setup → Distance) does not match the real distance: An interference echo affects the measurement.	Perform mapping (**Confirm distance** parameter (→ 🖹 142)).
No change of the measured value when emptying/filling the tank	An interference echo affects the measurement.	Perform mapping (**Confirm distance** parameter (→ 🖹 142)).
	Build-up at the probe.	Clean the probe.
	Error in the echo tracking	Deactivate echo tracking (Expert → Sensor → Echo tracking → Evaluation mode = **History off**).
The diagnostic message **Echo lost** appears after switching on the supply voltage.	Noise level to high during initialization phase.	Enter **Empty calibration** parameter (→ 🖹 139) again.
Device displays a level when the tank is empty.	Incorrect probe length	• Carry out probe length correction (**Confirm probe length** parameter (→ 🖹 169)). • Carry out mapping over entire probe while the tank is empty (**Confirm distance** parameter (→ 🖹 142)).
Wrong slope of the level in the entire measuring range	Wrong bin property selected.	Set **Bin type** parameter (→ 🖹 138) correctly.

13.2   Diagnostic information on local display

13.2.1   Diagnostic message

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

Measured value display in alarm condition	Diagnostic message

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

Status signals

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

Status symbol (symbol for event level)

	"Alarm" status The measurement is interrupted. The signal outputs take on the defined alarm condition. A diagnostic message is generated.
	"Warning" status 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.

	Diagnostics event		
Status symbol	Status signal	Event number	Event text
	↓	↓	↓
Example ⚠	**S** A0032904	441	**Curr.output 1**
		3-digit number	
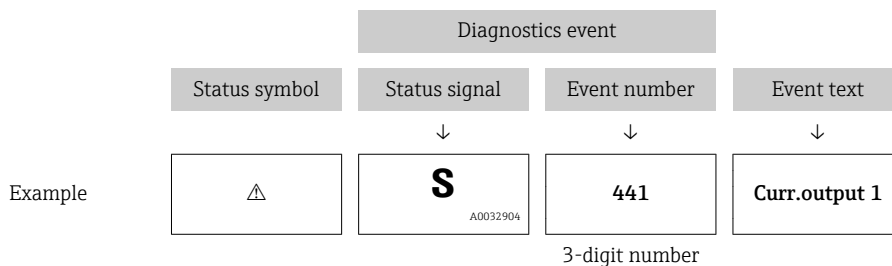
If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in the **Diagnostic list** submenu.

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

Operating elements

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

13.2.2 Calling up remedial measures
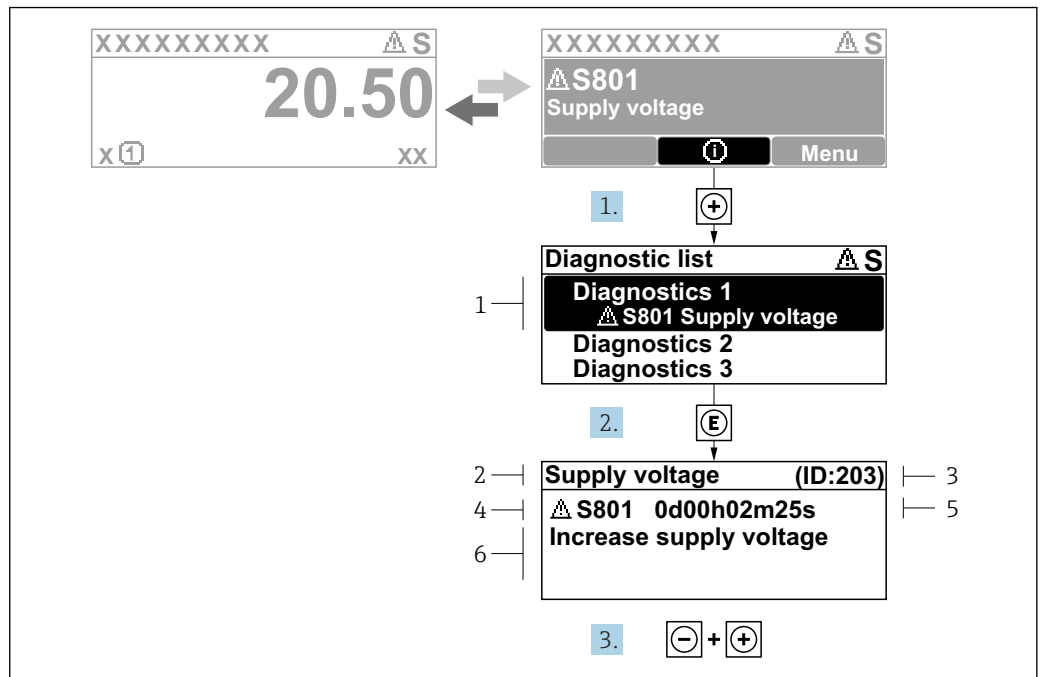
A0029431-EN

⊞ *45* *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.

13.3   Diagnostic event in the operating tool

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

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

A: Via the operating menu

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

2. On the right in the display range, hover the cursor over the **Actual diagnostics** parameter.

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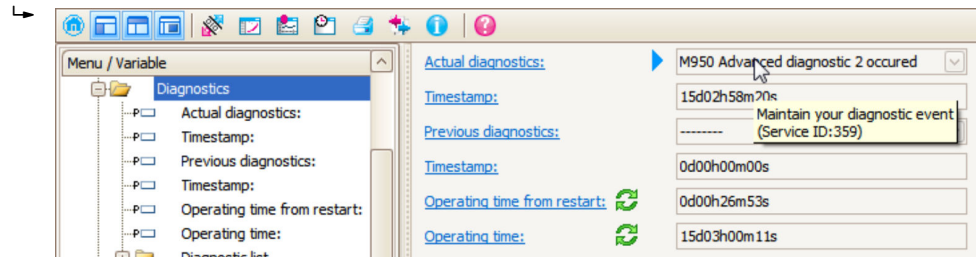
   A tool tip with remedial measures for the diagnostic event appears.

B: Via the "Create documentation" function

1.
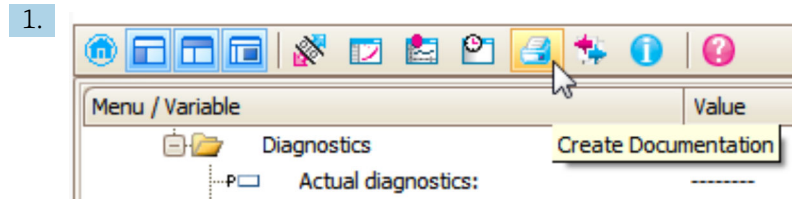
Select the "Create documentation" function.

2.
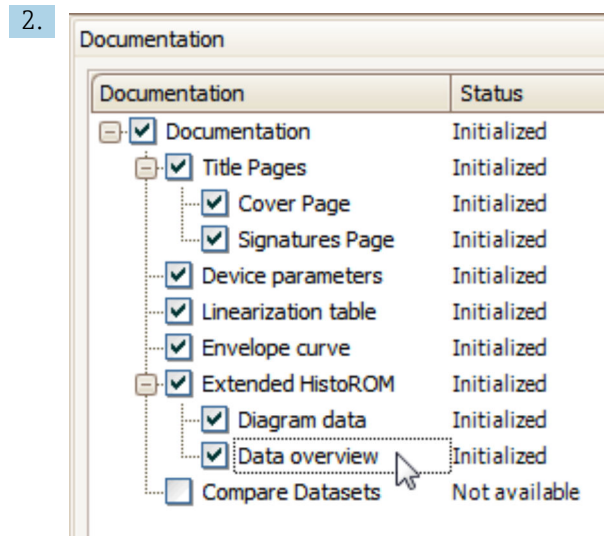
Make sure "Data overview" is marked.

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

C: Via the "Eventlist / Extended HistoROM" function

1.
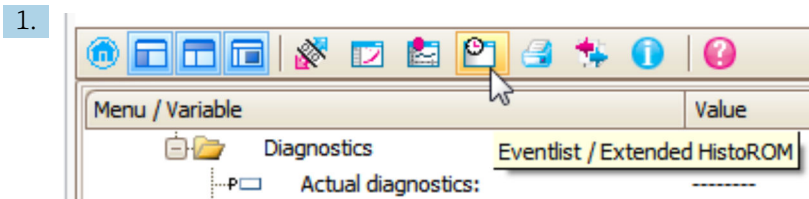
Select the "Eventlist / Extended HistoROM" function.

2.

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

13.4   Diagnostic list

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

Navigation path
Diagnostics → Diagnostic list

Calling up and closing the remedial measures

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

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

13.5 List of diagnostic events

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
003	Broken probe detected	1. Check map 2. Check sensor	F	Alarm
046	Build-up detected	Clean sensor	F	Alarm
104	HF cable	and check sealing 1. Dry HF cable connection 2. Change HF cable	F	Alarm
105	HF cable	1. Tighten HF cable connection 2. Check sensor 3. Change HF cable	F	Alarm
106	Sensor	1. Check sensor 2. Check HF cable 3. Contact service	F	Alarm
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check if correct electronic modul is plugged 2. Replace electronic module	F	Alarm
261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
262	Module connection	1. Check module connections 2. Change electronic modules	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	1. Emergency operation via display 2. Change main electronics	F	Alarm
275	I/O module defective	Change I/O module	F	Alarm
276	I/O module faulty	1. Restart device 2. Change I/O module	F	Alarm
276	I/O module faulty		F	Alarm
282	Data storage	1. Restart device 2. Contact service	F	Alarm
283	Memory content	1. Transfer data or reset device 2. Contact service	F	Alarm
311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact service	M	Warning
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download active	Up-/download active, please wait	C	Warning
412	Processing download	Download active, please wait	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
431	Trim 1 to 2	Carry out trim	C	Warning
435	Linearization	Check linearization table	F	Alarm
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1 to 2	1. Check process 2. Check current output settings	S	Warning
484	Failure mode simulation	Deactivate simulation	C	Alarm
485	Simulation measured value	Deactivate simulation	C	Warning
491	Current output 1 to 2 simulation	Deactivate simulation	C	Warning
494	Switch output simulation	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation	Deactivate simulation	C	Warning
585	Simulation distance	Deactivate simulation	C	Warning
Diagnostic of process				
801	Energy too low	Increase supply voltage	S	Warning
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
825	Operating temperature	1. Check ambient temperature 2. Check process temperature	S	Warning
825	Operating temperature		F	Alarm
921	Change of reference	1. Check reference configuration 2. Check pressure 3. Check sensor	S	Warning
936	EMC interference	Check installation on EMC	F	Alarm
941	Echo lost	Check parameter 'DC value'	F	Alarm [1]
942	In safety distance	1. Check level 2. Check safety distance 3. Reset self holding	S	Alarm [1]
943	In blocking distance	Reduced accuracy Check level	S	Warning
944	Level range	Reduced accuracy Level at process connection	S	Warning
950	Advanced diagnostic 1 to 2 occured	Maintain your diagnostic event	M	Warning [1]

1)   Diagnostic behavior can be changed.

13.6   Event logbook

13.6.1   Event history

A chronological overview of the event messages that have occurred is provided in the **Event list** submenu [4].

Navigation path
Diagnostics → Event logbook → Event list

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

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

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

Calling up and closing the remedial measures

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

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

13.6.2   Filtering the event logbook

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

Navigation path
Diagnostics → Event logbook → Filter options

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

13.6.3   Overview of information events

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

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

Info number	Info name
I1092	Embedded HistoROM deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off

13.7 Firmware history

Date	Firmware version	Modifications	Documentation (FMP56, FMP57, HART)		
			Operating Instructions	Description of Parameters	Technical Information
07.2010	01.00.zz	Original software	BA01004F/00/EN/05.10	GP01000F/00/EN/05.10	TI01004F/00/EN/05.10
01.2011	01.01.zz	• SIL integrated • Improvements and bugfixes • additional languages	• BA01004F/00/EN/10.10 • BA01004F/00/EN/13.11 • BA01004F/00/EN/14.12	• GP01000F/00/EN/10.10 • GP01000F/00/EN/13.11	• TI01004F/00/EN/10.10 • TI01004F/00/EN/13.11 • TI01004F/00/EN/14.12 • TI01004F/00/EN/15.12
02.2014	01.02.zz	• Support of SD03 • additional languages • HistoROM functionality enhanced • "Advanced Diagnostic" function block integrated • Improvements and bugfixes	• BA01004F/00/EN/15.13 • BA01004F/00/EN/16.14	• GP01000F/00/EN/14.13 • GP01000F/00/EN/15.14	• TI01004F/00/EN/16.13 • TI01004F/00/EN/17.14
04.2016	01.03.zz	• Update to HART 7 • All 17 operating languages available in the device • Improvements and bugfixes	• BA01004F/00/EN/17.16 • BA01004F/00/EN/18.16 [1] • BA01004F/00/EN/20.18 [2]	GP01000F/00/EN/16.16	• TI01004F/00/EN/18.16 • TI01004F/00/EN/20.16 [1] • TI01004F/00/EN/22.18 [2]

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

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

14   Maintenance

The measuring device requires no special maintenance.

14.1   Exterior cleaning

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

15   Repairs

15.1   General information on repairs

15.1.1   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.

15.1.2   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.

15.1.3   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).

15.1.4   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 → 🖩 187.
• 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.

15.2   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.
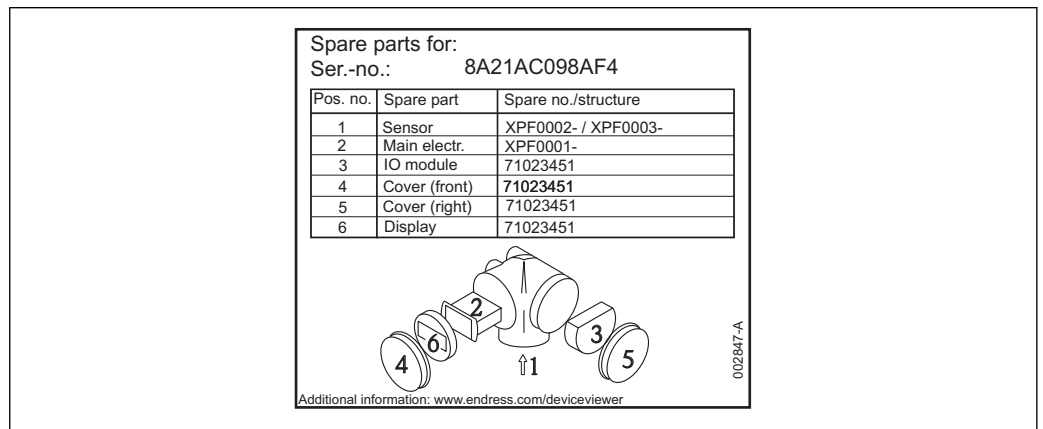
 46   Example for spare part nameplate in connection compartment cover

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.

15.3   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
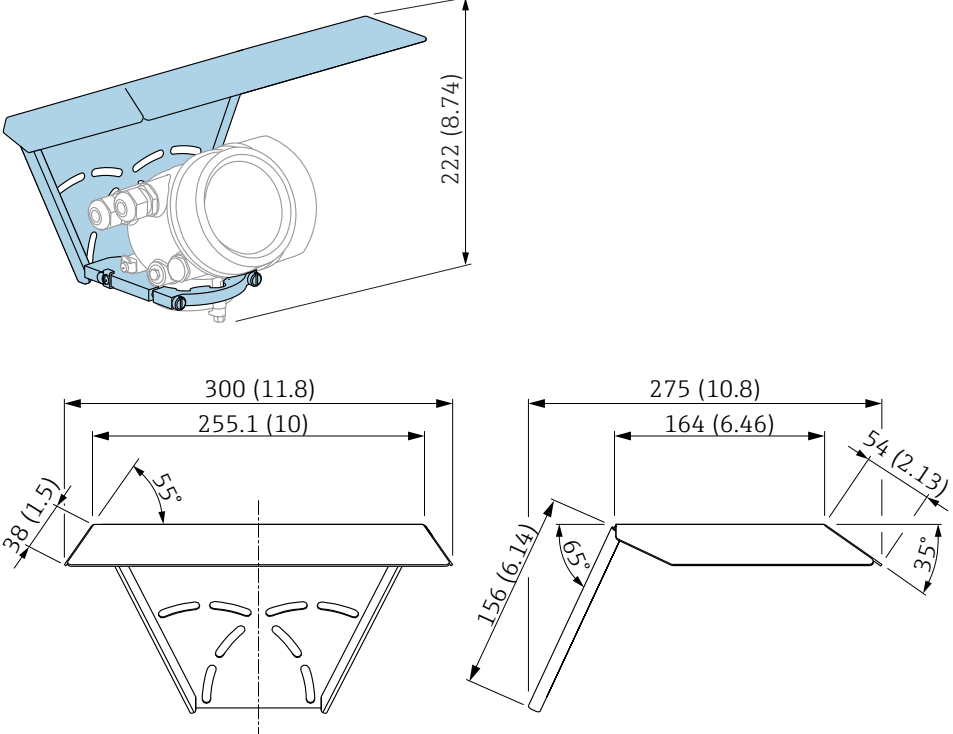
15.4   Disposal

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

16   Accessories

16.1   Device-specific accessories

16.1.1   Weather protection cover

Accessory	Description
Weather protection cover	 *47 Weather protection cover; Dimensions: mm (in)* ℹ️ The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover"). Alternatively, it can be separately ordered as an accessory; order code 71162242.

16.1.2   Mounting bracket for the electronics housing
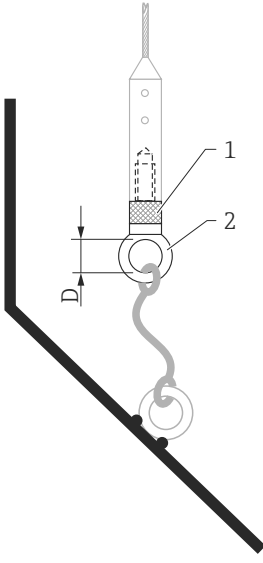
Accessory	Description
Mounting bracket for the electronics housing	⊞ 48 *Mounting bracket for the electronics housing; Dimensions: mm (in)* *A Wall mounting* *B Pipe mounting* ℹ️ For the "Sensor remote" device version (see feature 060 of the product structure), the mounting bracket is part of the delivery. If required, it can also be ordered as an accessory (order code 71102216).
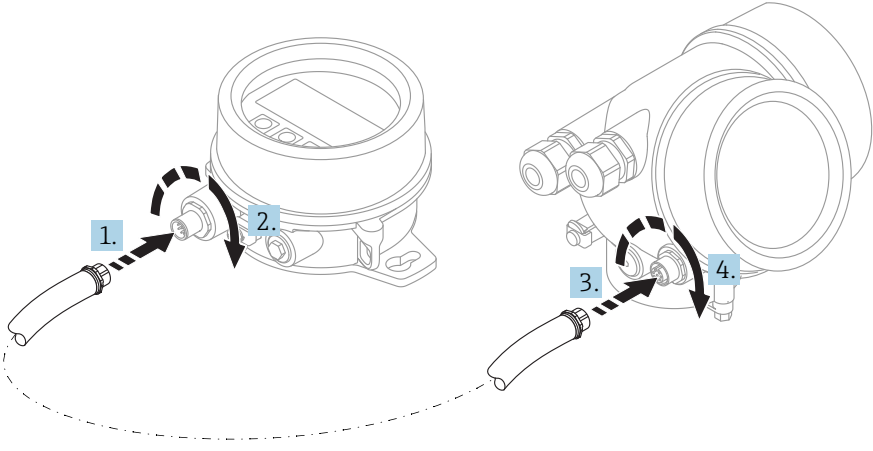
16.1.3   Extension rod / centering HMP40

Accessory	Description

Extension rod / centering HMP40
 	
• can be used for: FMP57
• Admissible temperature at lower nozzle edge:
  – without center washer: no limitation
  – with center washer: -40 to 150 ℃ (-40 to 302 ℉)
• Additional information: SD01002F
	
	A0013597
	
	1 Nozzle height
	2 Extension rod
	3 Center washer

010	Approval:
A	A: Non-hazardous area
M	M: FM DIP Cl.II Div.1 Gr.E-G N.I., zone 21,22
P	P: CSA DIP Cl.II Div.1 Gr.G + coal dust N.I.
S	S: FM Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2,20,21,22
U	U: CSA Cl.I, II, III Div.1 Gr.A-G N.I., zone 0,1,2
1	1: ATEX II 1G
2	2: ATEX II 1D

020	Extension rod; nozzle height:
1	115mm; 150-250mm / 6-10"
2	215mm; 250-350mm / 10-14"
3	315mm; 350-450mm / 14-18"
4	415mm; 450-550mm / 18-22"
9	Special version, TSP-no. to be spec.

030	Center washer:
A	Not selected
B	DN40 / 1-1/2", inside-d. = 40-45mm, PPS
C	DN50 / 2", inside-d. = 50-57mm, PPS
D	DN80 / 3", inside-d. = 80-85mm, PPS
E	DN80 / 3", inside-d. = 76-78mm, PPS
G	DN100 / 4", inside-d. = 100-110mm, PPS
H	DN150 / 6", inside-d. = 152-164mm, PPS
J	DN200 / 8", inside-d. = 210-215mm, PPS
K	DN250 / 10", inside-d. = 253-269mm, PPS
Y	Special version, TSP-no. to be spec.

16.1.4   Mounting kit, isolated
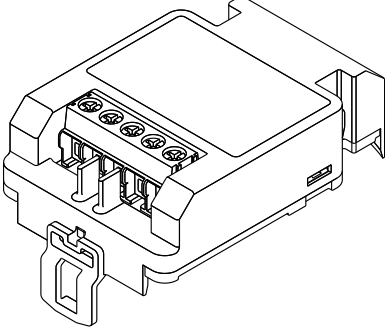
Accessory	Description
Mounting kit, isolated can be used for • FMP56 • FMP57	 A0013586 ⊠ *49 Scope of supply of the mounting kit:* *1 Insulating sleeve* *2 Eye-bolt* For reliably insulated fixing of the probe. Maximum process temperature: 150 ℃ (300 ℉) For rope probes 4 mm ($\frac{1}{6}$ in) or 6 mm (1/4 in) with PA>steel: • Diameter D = 20 mm (0.8 in) • Order-No.: 52014249 For rope probes 6 mm ($\frac{1}{4}$ in) or 8 mm (1/3 in) with PA>steel: • Diameter D = 25 mm (1 in) • Order-No.: 52014250 Due to the risk of electrostatic charge, the insulating sleeve is not suitable for use in hazardous areas. In these cases the fixing must be reliably grounded. 🛈 The mounting kit can also be ordered directly with the device (see the Levelflex product structure, feature 620 "Accessory Enclosed", option PG "Mounting kit, isolated, rope").

16.1.5   Remote display FHX50

Accessories	Description

Remote display FHX50	A0019128
	
	• Material:
	  – Plastic PBT
	  – 316L/1.4404
	  – Aluminum
	• Degree of protection: IP68 / NEMA 6P and IP66 / NEMA 4x
	• Suitable for display modules:
	  – SD02 (push buttons)
	  – SD03 (touch control)
	• Connecting cable:
	  – Cable supplied with device up to 30 m (98 ft)
	  – Standard cable supplied by customer up to 60 m (196 ft)
	• Ambient temperature range: –40 to 80 ℃ (–40 to 176 ℉)
	• Ambient temperature range (option): –50 to 80 ℃ (–58 to 176 ℉) [1]
	
	ℹ • If the remote display should be used, order the device version "Prepared for display FHX50" (feature 030, version L, M or N). For the FHX50, you must select option A: "Prepared for display FHX50" under feature 050 "Measuring device version".
	• If the device version "Prepared for display FHX50" was not originally ordered and a FHX50 display is to be retrofitted, you must select version B "Not prepared for display FHX50" under feature 050: "Measuring device version" when ordering the FHX50. In this case, a retrofit kit for the device is supplied with the FHX50. The kit can be used to prepare the device so that the FHX50 can be used.
	
	ℹ Use of the FHX50 may be restricted for transmitters with an approval. A device can only be retrofitted with the FHX50 if the option L, M or N ("Prepared for FHX50") is listed under *Basic specifications*, item 4 "Display, operation" in the Safety Instructions (XA) for the device.
	Also pay attention to the Safety Instructions (XA) of the FHX50.
	
	ℹ Retrofitting is not possible on transmitters with:
	• An approval for use in areas with flammable dust (dust ignition-proof approval)
	• Ex nA type of protection
	
	ℹ For details, see document SD01007F.

1)   This range is valid if option JN "Ambient temperature transmitter –50 ℃ (–58 ℉)" has been selected in ordering feature 580 "Test, Certificate". If the temperature is permanently below –40 ℃ (–40 ℉), failure rates may be increased.

16.1.6   Overvoltage protection

Accessory	Description
Overvoltage protection for 2-wire-devices OVP10 (1 channel) OVP20 (2 channel)	A0021734 **Technical data** • Resistance per channel: $2 * 0.5 \, \Omega_{max}$ • 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 • Suited for wire cross-sections: 0.2 to 2.5 mm^2 (24 to 14 AWG) **Ordering with device** 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. **Order code for retrofitting** • For 1-channel devices (feature 020, option A) OVP10: 71128617 • For 2-channel devices (feature 020, option B, C, E or G) OVP20 : 71128619 **Hosuing lid for retrofitting** 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: • GT18 housing: Lid 71185516 • GT19 housing: Lid 71185518 • GT20 housing: Lid 71185516 **Restrictions for retrofitting** 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 under *Optional Specifications* in the Safety Instructions (XA) pertaining to the device. For details refer to SD01090F.

16.1.7 Bluetooth module for HART devices

Accessory	Description
Bluetooth module	A0036493 • Quick and easy commissioning via SmartBlue (app) • No additional tools or adapters required • Signal curve via SmartBlue (app) • Encrypted single point-to-point data transmission (tested by Fraunhofer institue) and password protected communication via Bluetooth® wireless technology • Range under reference conditions: > 10 m (33 ft) ⓘ When using the Bluetooth module the minimum supply voltage increases by up to 3 V. ⓘ **Ordering with device** The Bluetooth module is preferably ordered with the device. See product structure, feature 610 "Accessory Mounted", option NF "Bluetooth". A separate order is only necessary in case of retrofitting. ⓘ **Order code for retrofitting** Bluetooth module (BT10): 71377355 ⓘ **Restrictions in case of retrofitting** Depending on the approval of the transmitter, application of the Bluetooth module may be restricted. A device may only be retrofitted with a Bluetooth module if the option *NF* (Bluetooth) is listed in the associated Safety Instructions (XA) under *Optional specifications*. ⓘ For details refer to SD02252F.

16.2   Communication-specific accessories

Accessory	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. 📖 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. Order code: 51516983 📖 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. Order code: 71063562 📖 For details refer to Technical Information TI00429F and Operating Instructions BA00371F

Accessory	Description
WirelessHART Adapter SWA70	Connects field devices to a WirelessHART network. 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. 📖 For details refer to Operating Instructions BA00061S

Accessories	Description
Connect Sensor FXA30/FXA30B	Fully integrated, battery-powered gateway for simple applications with SupplyCare Hosting. Up to 4 field devices with 4 to 20 mA communication (FXA30/FXA30B), serial Modbus (FXA30B) or HART (FXA30B) can be connected. With its robust design and ability to run for years on the battery, it is ideal for remote monitoring in isolated locations. Version with LTE (USA, Canada and Mexico only) or 3G mobile transmission for worldwide communication. 📖 For details, see "Technical Information" TI01356S and Operating Instructions BA01710S.

Accessories	Description
Fieldgate FXA42	Fieldgates enable communication between connected 4 to 20 mA, Modbus RS485 and Modbus TCP devices and SupplyCare Hosting or SupplyCare Enterprise. The signals are transmitted either via Ethernet TCP/IP, WLAN or mobile communications (UMTS). Advanced automation capabilities are available, such as an integrated Web-PLC, OpenVPN and other functions. 📖 For details, see "Technical Information" TI01297S and Operating Instructions BA01778S.

Accessories	Description
SupplyCare Enterprise SCE30B	Inventory management software that visualizes levels, volumes, masses, temperatures, pressures, densities or other tank parameters. The parameters are recorded and transmitted by means of gateways of the type Fieldgate FXA42. This Web-based software is installed on a local server and can also be visualized and operated with mobile terminals such as a smartphone or tablet. 📖 For details, see "Technical Information" TI01228S and Operating Instructions BA00055S

Accessories	Description
SupplyCare Hosting SCH30	Inventory management software that visualizes levels, volumes, masses, temperatures, pressures, densities or other tank parameters. The parameters are recorded and transmitted by means of gateways of the type Fieldgate FXA42, FXA30 and FXA30B. SupplyCare Hosting is offered as a hosting service (Software as a Service, SaaS). In the Endress+Hauser portal, the user is provided with the data over the Internet. 📖 For details, see "Technical Information" TI01229S and Operating Instructions BA00050S.

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**. 📖 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**. 📖 For details, see Operating Instructions BA01202S

16.3 Service-specific accessories

Accessory	Description
DeviceCare SFE100	Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus devices 📖 Technical Information TI01134S ℹ️ • DeviceCare is available for download at www.software-products.endress.com. The download requires a registration in the Endress+Hauser software portal. • Alternatively, a DeviceCare DVD can be ordered with the device. Product structure: Feature 570 "Service", Option IV "Tooling DVD (DeviceCare Setup)".
FieldCare SFE500	FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. 📖 Technical Information TI00028S

16.4   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. 📖 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. 📖 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. 📖 For details refer to Technical Information TI00081R and Operating Instructions KA00110R

17   Operating menu

17.1   Overview of the operating menu (SmartBlue)

Navigation   ⊠   SmartBlue

🔧 Setup	→ 🗎 138
Device tag	→ 🗎 138
Distance unit	→ 🗎 138
Bin type	→ 🗎 138
Empty calibration	→ 🗎 139
Full calibration	→ 🗎 139
Level	→ 🗎 140
Distance	→ 🗎 140
Signal quality	→ 🗎 141
Confirm distance	→ 🗎 142
Present mapping	→ 🗎 143
Mapping end point	→ 🗎 143
Record map	→ 🗎 143
▸ Advanced setup	→ 🗎 146
Locking status	→ 🗎 146
Access status tooling	→ 🗎 146
Enter access code	→ 🗎 147
▸ Level	→ 🗎 148
Medium type	→ 🗎 148
Medium property	→ 🗎 148
Process property	→ 🗎 149

	Advanced process conditions	→ 🗎 150
	Level unit	→ 🗎 151
	Blocking distance	→ 🗎 151
	Level correction	→ 🗎 152
▶ Linearization		→ 🗎 154
	Linearization type	→ 🗎 156
	Unit after linearization	→ 🗎 157
	Free text	→ 🗎 158
	Level linearized	→ 🗎 158
	Maximum value	→ 🗎 159
	Diameter	→ 🗎 159
	Intermediate height	→ 🗎 159
	Table mode	→ 🗎 160
	Table number	→ 🗎 161
	Level	→ 🗎 161
	Level	→ 🗎 162
	Customer value	→ 🗎 162
	Activate table	→ 🗎 162
▶ Probe settings		→ 🗎 168
	Probe grounded	→ 🗎 168
	Present probe length	→ 🗎 168
	Confirm probe length	→ 🗎 169
▶ Safety settings		→ 🗎 163
	Output echo lost	→ 🗎 163
	Value echo lost	→ 🗎 163

		Ramp at echo lost		→ 🕮 164
		Blocking distance		→ 🕮 151
	‣ Current output 1 to 2			→ 🕮 171
		Assign current output		→ 🕮 171
		Current span		→ 🕮 172
		Fixed current		→ 🕮 172
		Damping output		→ 🕮 173
		Failure mode		→ 🕮 173
		Failure current		→ 🕮 174
		Output current 1 to 2		→ 🕮 174
	‣ Switch output			→ 🕮 175
		Switch output function		→ 🕮 175
		Assign status		→ 🕮 176
		Assign limit		→ 🕮 176
		Assign diagnostic behavior		→ 🕮 176
		Switch-on value		→ 🕮 177
		Switch-on delay		→ 🕮 178
		Switch-off value		→ 🕮 178
		Switch-off delay		→ 🕮 179
		Failure mode		→ 🕮 179
		Switch status		→ 🕮 179
		Invert output signal		→ 🕮 179
↻ Diagnostics				→ 🕮 193
	Actual diagnostics			→ 🕮 193
	Timestamp			→ 🕮 193

Previous diagnostics		→ 🕮 193
Timestamp		→ 🕮 194
Operating time from restart		→ 🕮 194
Operating time		→ 🕮 187
▸ Diagnostic list		→ 🕮 195
	Diagnostics 1 to 5	→ 🕮 195
	Timestamp 1 to 5	→ 🕮 195
▸ Measured values		→ 🕮 200
	Distance	→ 🕮 140
	Level linearized	→ 🕮 158
	Output current 1 to 2	→ 🕮 174
	Measured current 1	→ 🕮 201
	Terminal voltage 1	→ 🕮 201
▸ Device information		→ 🕮 197
	Device tag	→ 🕮 197
	Serial number	→ 🕮 197
	Firmware version	→ 🕮 197
	Device name	→ 🕮 197
	Order code	→ 🕮 198
	Extended order code 1 to 3	→ 🕮 198
	Device revision	→ 🕮 198
	Device ID	→ 🕮 198

	Device type	→ 🕮 199
	Manufacturer ID	→ 🕮 199
▶ Simulation		→ 🕮 206
	Assign measurement variable	→ 🕮 207
	Process variable value	→ 🕮 207
	Current output 1 to 2 simulation	→ 🕮 207
	Value current output 1 to 2	→ 🕮 208
	Switch output simulation	→ 🕮 208
	Switch status	→ 🕮 208
	Device alarm simulation	→ 🕮 209

17.2   Overview of the operating menu (display module)

Navigation   Operating menu

Language	→ 🖪 181
🔧 **Setup**	→ 🖪 138
Device tag	→ 🖪 138
Distance unit	→ 🖪 138
Bin type	→ 🖪 138
Empty calibration	→ 🖪 139
Full calibration	→ 🖪 139
Level	→ 🖪 140
Distance	→ 🖪 140
Signal quality	→ 🖪 141
‣ **Mapping**	→ 🖪 145
Confirm distance	→ 🖪 145
Mapping end point	→ 🖪 145
Record map	→ 🖪 145
Distance	→ 🖪 145
‣ **Advanced setup**	→ 🖪 146
Locking status	→ 🖪 146
Access status display	→ 🖪 147
Enter access code	→ 🖪 147
‣ **Level**	→ 🖪 148
Medium type	→ 🖪 148
Medium property	→ 🖪 148
Process property	→ 🖪 149

		Advanced process conditions	→ 🕮 150
		Level unit	→ 🕮 151
		Blocking distance	→ 🕮 151
		Level correction	→ 🕮 152
‣ Linearization			→ 🕮 154
		Linearization type	→ 🕮 156
		Unit after linearization	→ 🕮 157
		Free text	→ 🕮 158
		Maximum value	→ 🕮 159
		Diameter	→ 🕮 159
		Intermediate height	→ 🕮 159
		Table mode	→ 🕮 160
	‣ Edit table		
		Level	→ 🕮 161
		Customer value	→ 🕮 162
		Activate table	→ 🕮 162
‣ Safety settings			→ 🕮 163
		Output echo lost	→ 🕮 163
		Value echo lost	→ 🕮 163
		Ramp at echo lost	→ 🕮 164
		Blocking distance	→ 🕮 151
‣ SIL/WHG confirmation			→ 🕮 166
‣ Deactivate SIL/WHG			→ 🕮 167
		Reset write protection	→ 🕮 167
		Code incorrect	→ 🕮 167

‣ **Probe settings**		→ 🗎 168
	Probe grounded	→ 🗎 168
	‣ Probe length correction	→ 🗎 170
		Confirm probe length	→ 🗎 170
		Present probe length	→ 🗎 170
‣ **Current output 1 to 2**		→ 🗎 171
	Assign current output	→ 🗎 171
	Current span	→ 🗎 172
	Fixed current	→ 🗎 172
	Damping output	→ 🗎 173
	Failure mode	→ 🗎 173
	Failure current	→ 🗎 174
	Output current 1 to 2	→ 🗎 174
‣ **Switch output**		→ 🗎 175
	Switch output function	→ 🗎 175
	Assign status	→ 🗎 176
	Assign limit	→ 🗎 176
	Assign diagnostic behavior	→ 🗎 176
	Switch-on value	→ 🗎 177
	Switch-on delay	→ 🗎 178
	Switch-off value	→ 🗎 178
	Switch-off delay	→ 🗎 179
	Failure mode	→ 🗎 179
	Switch status	→ 🗎 179
	Invert output signal	→ 🗎 179

‣ Display		→ 🕮 181
	Language	→ 🕮 181
	Format display	→ 🕮 181
	Value 1 to 4 display	→ 🕮 183
	Decimal places 1 to 4	→ 🕮 183
	Display interval	→ 🕮 183
	Display damping	→ 🕮 184
	Header	→ 🕮 184
	Header text	→ 🕮 185
	Separator	→ 🕮 185
	Number format	→ 🕮 185
	Decimal places menu	→ 🕮 185
	Backlight	→ 🕮 186
	Contrast display	→ 🕮 186
‣ Configuration backup display		→ 🕮 187
	Operating time	→ 🕮 187
	Last backup	→ 🕮 187

	Configuration management	→ 🖹 187
	Comparison result	→ 🖹 188
▸ Administration		→ 🖹 190
	▸ Define access code	→ 🖹 192
		Define access code	→ 🖹 192
		Confirm access code	→ 🖹 192
	Device reset	→ 🖹 190

⌕ Diagnostics		→ 🖹 193
Actual diagnostics		→ 🖹 193
Previous diagnostics		→ 🖹 193
Operating time from restart		→ 🖹 194
Operating time		→ 🖹 187
▸ Diagnostic list		→ 🖹 195
	Diagnostics 1 to 5	→ 🖹 195
▸ Event logbook		→ 🖹 196
	Filter options	→ 🖹 196
	▸ Event list	→ 🖹 196
▸ Device information		→ 🖹 197
	Device tag	→ 🖹 197
	Serial number	→ 🖹 197
	Firmware version	→ 🖹 197
	Device name	→ 🖹 197
	Order code	→ 🖹 198
	Extended order code 1 to 3	→ 🖹 198
	Device revision	→ 🖹 198

Device ID		→ 🕮 198
Device type		→ 🕮 199
Manufacturer ID		→ 🕮 199
▶ Measured values		→ 🕮 200
	Distance	→ 🕮 140
	Level linearized	→ 🕮 158
	Output current 1 to 2	→ 🕮 174
	Measured current 1	→ 🕮 201
	Terminal voltage 1	→ 🕮 201
▶ Data logging		→ 🕮 202
	Assign channel 1 to 4	→ 🕮 202
	Logging interval	→ 🕮 203
	Clear logging data	→ 🕮 203
	▶ Display channel 1 to 4	→ 🕮 204
▶ Simulation		→ 🕮 206
	Assign measurement variable	→ 🕮 207
	Process variable value	→ 🕮 207
	Current output 1 to 2 simulation	→ 🕮 207
	Value current output 1 to 2	→ 🕮 208
	Switch output simulation	→ 🕮 208
	Switch status	→ 🕮 208
	Device alarm simulation	→ 🕮 209
▶ Device check		→ 🕮 210
	Start device check	→ 🕮 210
	Result device check	→ 🕮 210

Last check time	→ 🕮 210
Level signal	→ 🕮 211
Launch signal	→ 🕮 211

17.3 Overview of the operating menu (operating tool)

Navigation   🔲   Operating menu

‣ **Display**		→ 🗏 181
	Language	→ 🗏 181
	Format display	→ 🗏 181
	Value 1 to 4 display	→ 🗏 183
	Decimal places 1 to 4	→ 🗏 183
	Display interval	→ 🗏 183
	Display damping	→ 🗏 184
	Header	→ 🗏 184
	Header text	→ 🗏 185
	Separator	→ 🗏 185
	Number format	→ 🗏 185
	Decimal places menu	→ 🗏 185
	Backlight	→ 🗏 186
	Contrast display	→ 🗏 186
‣ **Configuration backup display**		→ 🗏 187
	Operating time	→ 🗏 187
	Last backup	→ 🗏 187
	Configuration management	→ 🗏 187
	Backup state	→ 🗏 188
	Comparison result	→ 🗏 188
‣ **Administration**		→ 🗏 190
	Define access code	→ 🗏 192
	Device reset	→ 🗏 190
🖫 **Diagnostics**			→ 🗏 193
	Actual diagnostics		→ 🗏 193

Timestamp		→ 🕮 193
Previous diagnostics		→ 🕮 193
Timestamp		→ 🕮 194
Operating time from restart		→ 🕮 194
Operating time		→ 🕮 187
‣ Diagnostic list		→ 🕮 195
	Diagnostics 1 to 5	→ 🕮 195
	Timestamp 1 to 5	→ 🕮 195
‣ Device information		→ 🕮 197
	Device tag	→ 🕮 197
	Serial number	→ 🕮 197
	Firmware version	→ 🕮 197
	Device name	→ 🕮 197
	Order code	→ 🕮 198
	Extended order code 1 to 3	→ 🕮 198
	Device revision	→ 🕮 198
	Device ID	→ 🕮 198
	Device type	→ 🕮 199
	Manufacturer ID	→ 🕮 199
‣ Measured values		→ 🕮 200
	Distance	→ 🕮 140
	Level linearized	→ 🕮 158
	Output current 1 to 2	→ 🕮 174
	Measured current 1	→ 🕮 201
	Terminal voltage 1	→ 🕮 201

17.4   "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.

Navigation   🔘🗒   Setup

Device tag   🔒

Navigation	🔘🗒 Setup → Device tag
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.
Factory setting	FMP5x

Distance unit   🔒

Navigation	🔘🗒 Setup → Distance unit
Description	Used for the basic calibration (Empty / Full).

Selection

SI units
- mm
- m

US units
- ft
- in

Factory setting   m

Bin type   🔒

Navigation	🔘🗒 Setup → Bin type
Prerequisite	Medium type (→ 🗎 148) = Solid
Description	Specify bin type.

Selection
- Concrete
- Plastic wood
- Metallic
- Aluminium

Factory setting   Metallic

Empty calibration	🔒

Navigation	🖩🖵	Setup → Empty calibration

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

User entry	Depending on the probe

Factory setting	Depending on the probe

Additional information
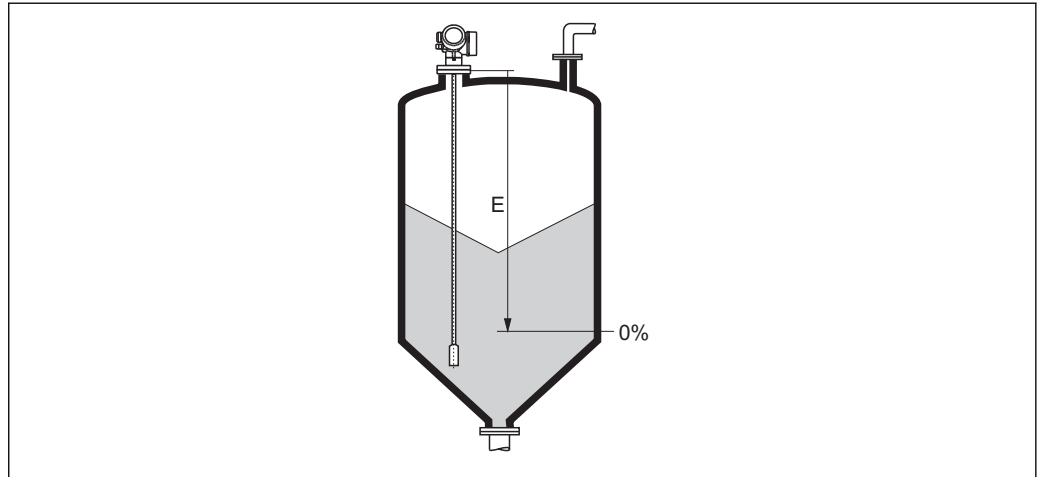
☑ 50   Empty calibration (E) for level measurements in bulk solids.

Full calibration	🔒

Navigation	🖩🖵	Setup → Full calibration

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

User entry	Depending on the probe

Factory setting	Depending on the probe
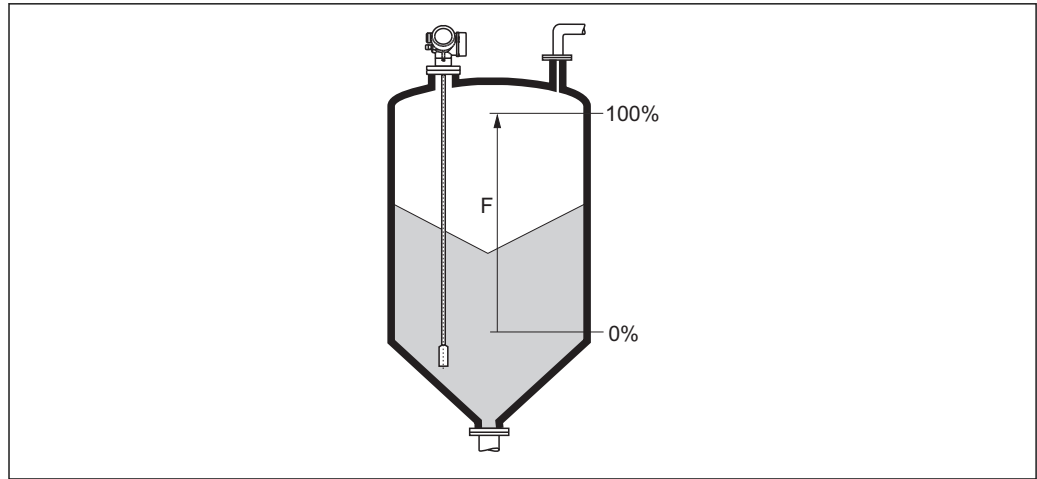
Additional information

51   Full calibration (F) for level measurements in bulk solids

Level	

Navigation   ⌨▣ Setup → Level

Description   Displays measured level L_L (before linearization).

Additional information
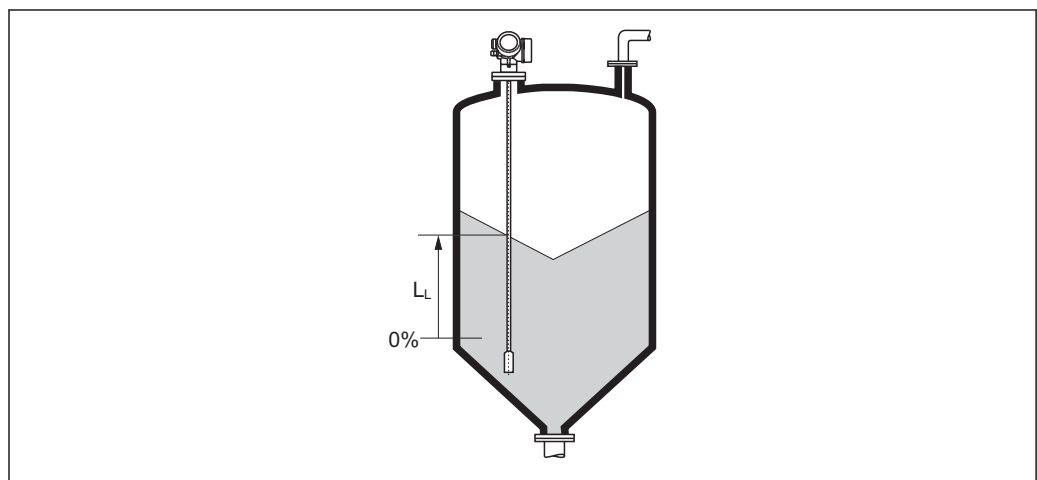
52   Level in case of bulk solid measurements

The unit is defined in the **Level unit** parameter (→ 🖺 151).

Distance	

Navigation   ⌨▣ Setup → Distance

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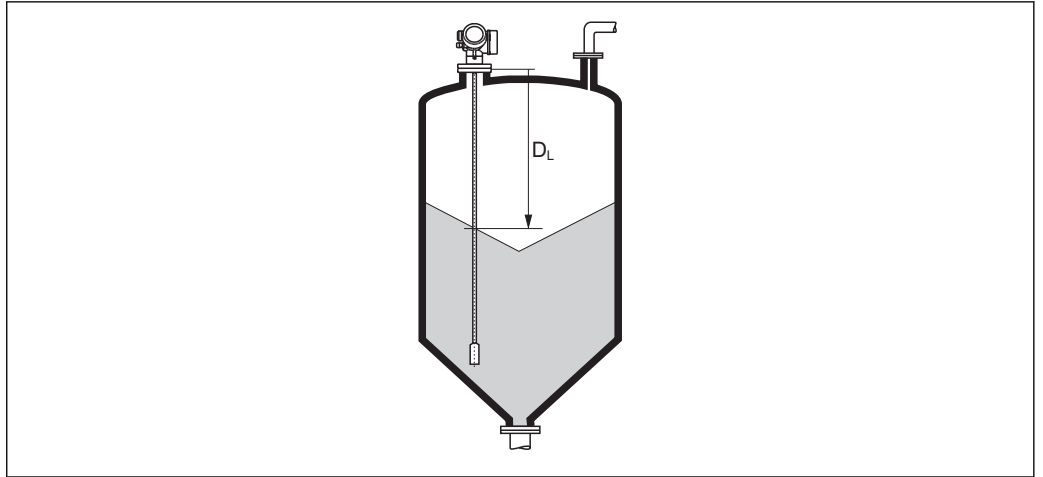
Additional information

❐ 53   Distance for bulk solid measurements

The unit is defined in the **Distance unit** parameter (→ 🗏 138).

Signal quality

Navigation	⊞⊟ Setup → Signal quality
Description	Displays the signal quality of the evaluated echo.
Additional information	**Meaning of the display options**

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

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

In case of a lost echo (**Signal quality = No signal**) the device generates the following error message:
- F941, for **Output echo lost** (→ 🗏 163) = Alarm.
- S941, if another option has been selected in **Output echo lost** (→ 🗏 163).

---

[5]   Of these two echos the one with the lower quality is indicated.

Confirm distance	⌾

Navigation	▣	Setup → Confirm distance

Description	Specify, whether the measured distance matches the real distance.
	Depending on the selection the device automatically sets the range of mapping.

Selection	• Manual map
	• Distance ok
	• Distance unknown
	• Distance too small *
	• Distance too big *
	• Tank empty
	• Delete map

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 (→ 🖹 143). 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** [6]
  To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter. The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **Distance ok**.
- **Tank empty**
  To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range.
  To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range minus **Map gap to LN**.
- **Factory map**
  To be selected if the present mapping curve (if one exists) is to be deleted. The device returns to the **Confirm distance** parameter and a new mapping can be recorded.

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

🛈 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.

---

* Visibility depends on order options or device settings
6) 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 → Mapping end point

Prerequisite   Confirm distance (→ 🖺 142) = **Manual map** or **Distance too small**

Description   Specify new end of the mapping.

User entry   0 to 200 000.0 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.

                     ℹ️ For reference purposes the **Present mapping** parameter (→ 🖺 143) 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 (→ 🖺 142) = **Manual map** or **Distance too small**

Description   Start recording of the map.

Selection   ▪ No
                     ▪ Record map
                     ▪ Delete 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 ☑.
- **Delete map**
  The mapping (if one exists) is deleted and the device displays the recalculated measured distance and the mapping range. When operating via the local display, these values must be confirmed by pressing ☑.

17.4.1 "Mapping" wizard

ℹ️ The **Mapping** wizard is only available when operating via the local display. When operating via an operating tool, all parameters concerning the mapping are located directly in the **Setup** menu (→ 🗎 138).

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

Navigation   🖳   Setup → Mapping

Confirm distance   🔒

Navigation	🖳 Setup → Mapping → Confirm distance
Description	→ 🗎 142

Mapping end point   🔒

Navigation	🖳 Setup → Mapping → Mapping end point
Description	→ 🗎 143

Record map   🔒

Navigation	🖳 Setup → Mapping → Record map
Description	→ 🗎 143

Distance

Navigation	🖳 Setup → Mapping → Distance
Description	→ 🗎 140

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

ℹ️ 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 status tooling
Description	Shows the access authorization to the parameters via the operating tool.
Additional information	ℹ️ The access authorization can be changed via the **Enter access code** parameter (→ 🕮 147).

ℹ️ 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 (→ 🕮 146).

Access status display

Navigation   ⌾   Setup → Advanced setup → Access status display

Prerequisite   The device has a local display.

Description   Indicates access authorization to parameters via local display.

Additional information   ℹ️   The access authorization can be changed via the **Enter access code** parameter
                                       (→ 🗎 147).

                                ℹ️   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 (→ 🗎 146).

Enter access code

Navigation   ⌨   Setup → Advanced setup → Enter access code

Description   Enter access code to disable write protection of parameters.

User entry   0 to 9999

Additional information   • For local operation, the customer-specific access code, which has been defined in the
                                  Define access code parameter (→ 🗎 190), 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.

                                ℹ️   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   FMP56, FMP57: **Solid**

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

Medium property   🔒

Navigation   💻🗒   Setup → Advanced setup → Level → Medium property

Prerequisite   EOP level evaluation ≠ Fix DC

Description   Specify relative dielectric constant ε_r of the medium.

Selection   • Unknown
                        • DC 1.4 … 1.6
                        • DC 1.6 … 1.9
                        • DC 1.9 … 2.5
                        • DC 2.5 … 4
                        • DC 4 … 7
                        • DC 7 … 15
                        • DC > 15

Factory setting   Dependent on **Medium type** (→ 📄 148) and **Medium group**.

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

Medium type (→ 🖹 148)	Medium group	Medium property
Solid		Unknown
Liquid	Water based (DC >= 4)	DC 4 … 7
	Others	Unknown

ℹ️ 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)

ℹ️ For **EOP level evaluation** = **Fix DC**, the exact dielectric constant has to be entered into the **DC value** parameter. Therefore, the **Medium property** parameter is not available in this case.

Process property   🔒

Navigation   ⊞⊟ Setup → Advanced setup → Level → Process property

Description   Specify typical rate of level change.

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

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

Factory setting   Standard < 1 m (40in) /min

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

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

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

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

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

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

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

Advanced process conditions   🔒

Navigation   ⊞⊟ Setup → Advanced setup → Level → Advanced process conditions

Description   Specify additional process conditions (if required).

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

Factory setting   None

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

Level unit	🔒

Navigation	🎛️🖥️ 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 (→ 🖹 138):

• The unit defined in the **Distance unit** parameter is used for the basic calibration (**Empty calibration (→ 🖹 139)** and **Full calibration (→ 🖹 139)**).
• The unit defined in the **Level unit** parameter is used to display the (unlinearized) level.

Blocking distance	🔒

Navigation	🎛️🖥️ Setup → Advanced setup → Level → Blocking distance
Description	Specify upper blocking distance UB.
User entry	0 to 200 m
Factory setting	• For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) • For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge
Additional information	Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

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

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

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

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

⊡ 54   Blocking distance (UB) for bulk solid 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).

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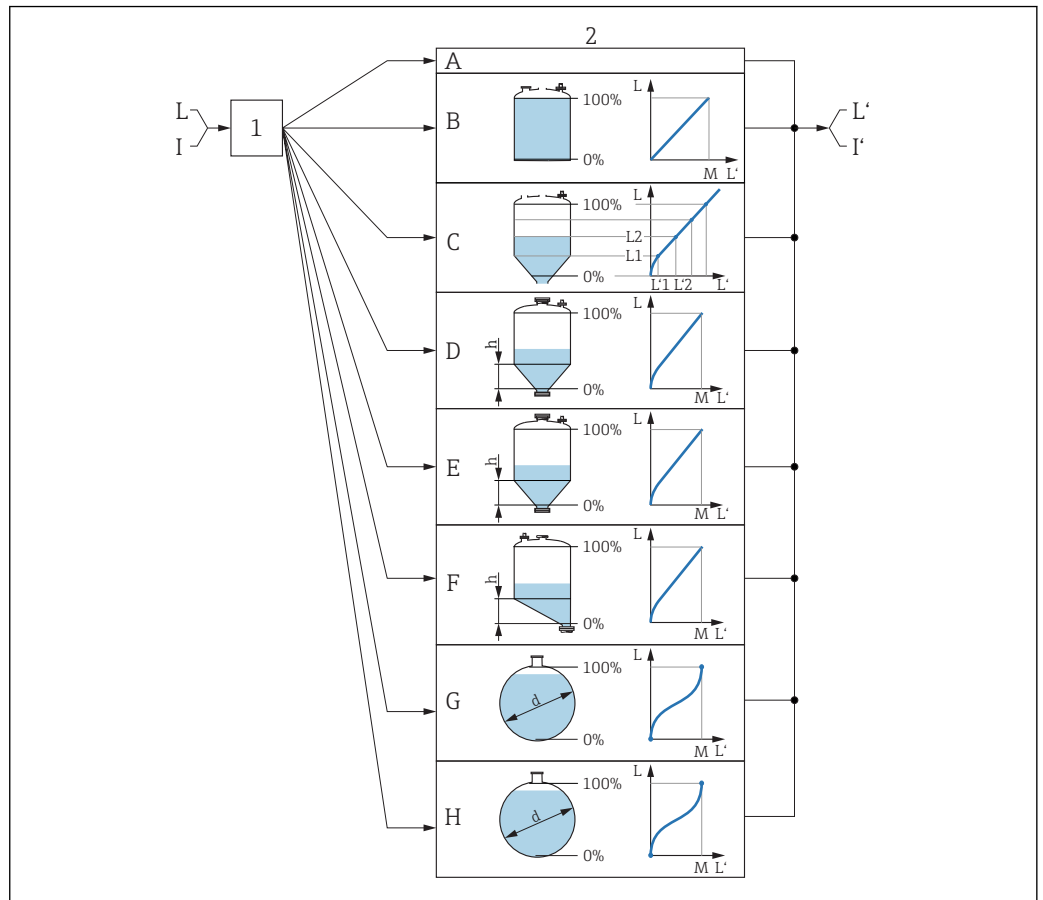
⚆ 55   *Linearization: Transformation of the level and (if relevant) the interface height into a volume or weight; the transformation is dependent on the shape of the vessel.*

1   Selection of linearization type and unit
2   Configuration of the linearization
A   Linearization type (→ 🗎 156) = None
B   Linearization type (→ 🗎 156) = Linear
C   Linearization type (→ 🗎 156) = Table
D   Linearization type (→ 🗎 156) = Pyramid bottom
E   Linearization type (→ 🗎 156) = Conical bottom
F   Linearization type (→ 🗎 156) = Angled bottom
G   Linearization type (→ 🗎 156) = Horizontal cylinder
H   Linearization type (→ 🗎 156) = Sphere
I   For "Operating mode" = "Interface" or "Interface with capacitance": Interface before linearization (measured in distance units)
I' For "Operating mode" = "Interface" or "Interface with capacitance": Interface after linearization (corresponds to volume or weight)
L   Level before linearization (measured in distance units)
L' Level linearized (→ 🗎 158) (corresponds to volume or weight)
M   Maximum value (→ 🗎 159)
d   Diameter (→ 🗎 159)
h   Intermediate height (→ 🗎 159)

Structure of the submenu on the display module

Navigation   Setup → Advanced setup → Linearization

‣ Linearization		
	Linearization type	→ 🖹 156
	Unit after linearization	→ 🖹 157
	Free text	→ 🖹 158
	Maximum value	→ 🖹 159
	Diameter	→ 🖹 159
	Intermediate height	→ 🖹 159
	Table mode	→ 🖹 160
	‣ Edit table	
	Level	→ 🖹 161
	Customer value	→ 🖹 162
	Activate table	→ 🖹 162

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

Navigation   ▣   Setup → Advanced setup → Linearization

‣ Linearization	
Linearization type	→ 🗏 156
Unit after linearization	→ 🗏 157
Free text	→ 🗏 158
Level linearized	→ 🗏 158
Maximum value	→ 🗏 159
Diameter	→ 🗏 159
Intermediate height	→ 🗏 159
Table mode	→ 🗏 160
Table number	→ 🗏 161
Level	→ 🗏 161
Level	→ 🗏 162
Customer value	→ 🗏 162
Activate table	→ 🗏 162

Description of parameters

Navigation   ⓘ⊟   Setup → Advanced setup → Linearization

| Linearization type | 🔒 |

Navigation   ⓘ⊟   Setup → Advanced setup → Linearization → Linearization type

Description   Select linearization type.

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

Factory setting   None

Additional information
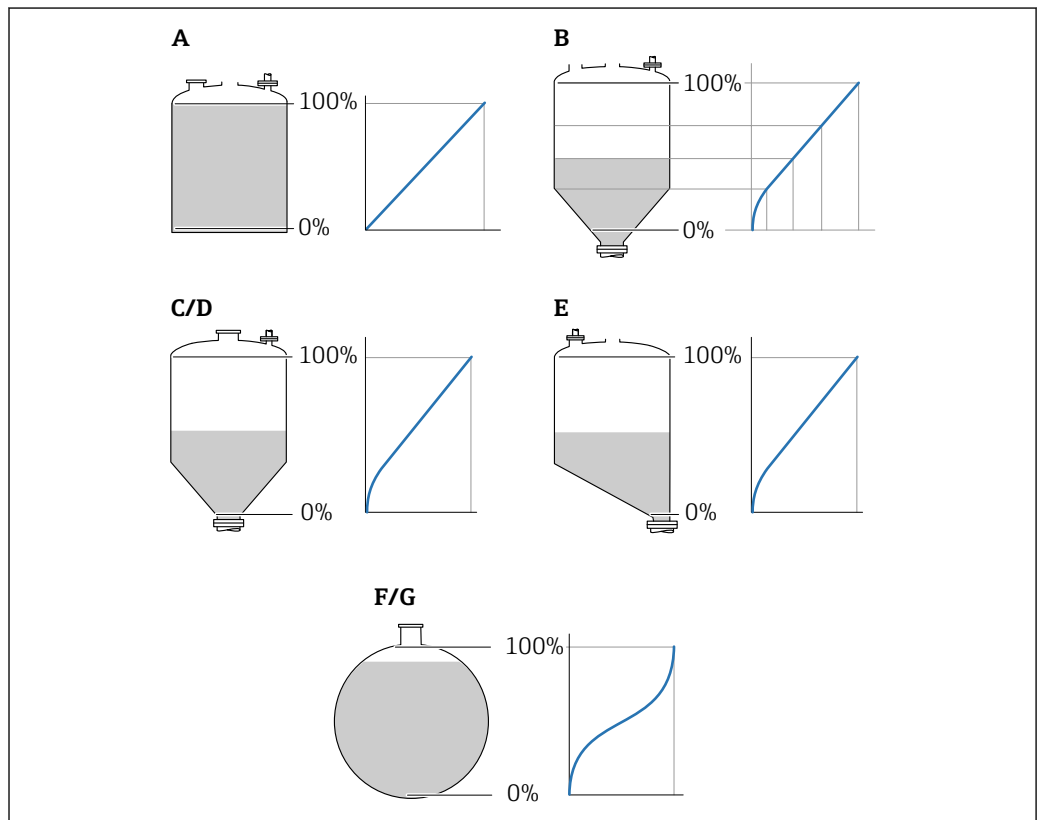
🖻 56   Linearization types

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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): 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** (→ 🖺 157)
  – **Table mode** (→ 🖺 160)
  – For each table point: **Level** (→ 🖺 161)
  – For each table point: **Customer value** (→ 🖺 162)
  – **Activate table** (→ 🖺 162)
- **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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): Maximum volume or weight
  – **Intermediate height** (→ 🖺 159): 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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): Maximum volume or weight
  – **Intermediate height** (→ 🖺 159): 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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): Maximum volume or weight
  – **Intermediate height** (→ 🖺 159): 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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): Maximum volume or weight
  – **Diameter** (→ 🖺 159)
- **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** (→ 🖺 157)
  – **Maximum value** (→ 🖺 159): Maximum volume or weight
  – **Diameter** (→ 🖺 159)

Unit after linearization	🔏

Navigation 🔘🖥 Setup → Advanced setup → Linearization → Unit after linearization

Prerequisite **Linearization type** (→ 🖺 156) ≠ None

Description Select unit of the lineaized value.

Selection	*SI units*	*US units*	*Imperial units*
	• STon	• lb	impGal
	• t	• UsGal	
	• kg	• ft³	
	• cm³	• ft	
	• dm³	• in	
	• m³		
	• hl		
	• l		
	• %		
	• mm		
	• m		

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.

ℹ️ 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 (→ 🔲 158).

Free text   🔒

Navigation   Setup → Advanced setup → Linearization → Free text

Prerequisite   Unit after linearization (→ 🔲 157) = **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   ℹ️ The unit is defined by the **Unit after linearization** parameter → 🔲 157.

Maximum value	🔒

Navigation	🔘🔲 Setup → Advanced setup → Linearization → Maximum value
Prerequisite	**Linearization type (→ 🗎 156)** has one of the following values: • Linear • Pyramid bottom • Conical bottom • Angled bottom • Horizontal cylinder • Sphere
Description	Linearized value corresponding to a level of 100%.
User entry	–50 000.0 to 50 000.0 %
Factory setting	100.0 %

Diameter	🔒

Navigation	🔘🔲 Setup → Advanced setup → Linearization → Diameter
Prerequisite	**Linearization type (→ 🗎 156)** has one of the following values: • Horizontal cylinder • Sphere
Description	Diameter of the cylindrical or spherical tank.
User entry	0 to 9 999.999 m
Factory setting	2 m
Additional information	The unit is defined in the **Distance unit** parameter (→ 🗎 138).

Intermediate height	🔒

Navigation	🔘🔲 Setup → Advanced setup → Linearization → Intermediate height
Prerequisite	**Linearization type (→ 🗎 156)** has one of the following values: • Pyramid bottom • Conical bottom • Angled bottom
Description	Height of the pyramid, conical or angled bottom.
User entry	0 to 200 m
Factory setting	0 m

Additional information
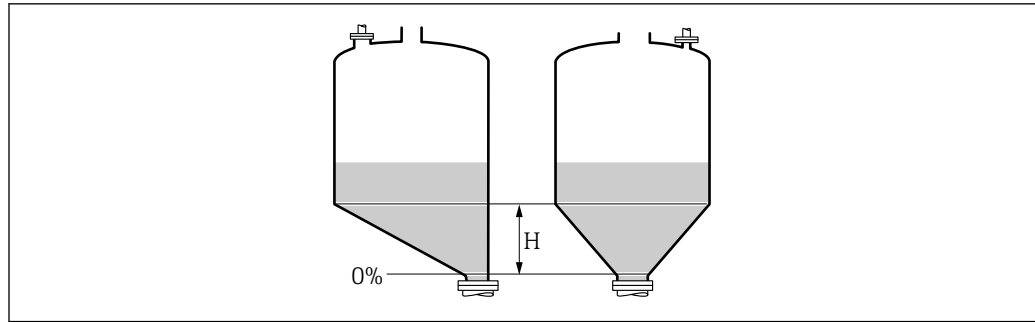
A0013264

H   Intermediate height

The unit is defined in the **Distance unit** parameter (→ 🗎 138).

Table mode	🔒

Navigation	🔘🔲 Setup → Advanced setup → Linearization → Table mode

Prerequisite   Linearization type (→ 🗎 156) = **Table**

Description   Select editing mode of the linearization table.

Selection   • Manual
                           • Semiautomatic
                           • 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.

                           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.

                           ℹ️ Before entering a linearization table, the values for **Empty calibration** (→ 🗎 139)
                               and **Full calibration** (→ 🗎 139) 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**
                               (→ 🗎 160) = **Clear table**). Then enter a new table.

How to enter the table
- Via FieldCare
  The table points can be entered via the **Table number** (→ 🖺 161), **Level** (→ 🖺 161) and **Customer value** (→ 🖺 162) parameters. As an alternative, the graphic table editor may be used: Device Operation → Device Functions → Additional Functions → Linearization (Online/Offline)
- Via local display
  Select the **Edit table** submenu to call up the graphic table editor. The table is displayed and can be edited line by line.

ℹ The factory setting for the level unit is "%". If you want to enter the linearization table in physical units, you must select the appropriate unit in the **Level unit** parameter (→ 🖺 151) beforehand.

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

Table number   🔒

Navigation	🖳 Setup → Advanced setup → Linearization → Table number
Prerequisite	**Linearization type** (→ 🖺 156) = **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** (→ 🖺 156) = **Table** • **Table mode** (→ 🖺 160) = **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
Prerequisite	• **Linearization type (→ 🖺 156)** = **Table** • **Table mode (→ 🖺 160)** = **Semiautomatic**
Description	Displays measured level (value before linearization). This value is transmitted to the table.

Customer value	🔒

Navigation	⊟ Setup → Advanced setup → Linearization → Customer value
Prerequisite	**Linearization type (→ 🖺 156)** = **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
Prerequisite	**Linearization type (→ 🖺 156)** = **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 (→ 🖺 156)** = **Table** at the same time, the device issues error message F435. • **Enable** The measured level is linearized according to the table. ℹ 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* | 圖圖 | Setup → Advanced setup → Safety settings |

Output echo lost

| Navigation | 圖圖 | Setup → Advanced setup → Safety settings → Output echo lost |

Description   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** [7]
  In the case of a lost echo the output value is continously shifted towards 0% or 100%.
  The slope of the ramp is defined in the **Ramp at echo lost** parameter (→ 🖺 164).
- **Value echo lost** [7]
  In the case of a lost echo the output assumes the value defined in the **Value echo lost**
  parameter (→ 🖺 163).
- **Alarm**
  In the case of a lost echo the device generates an alarm; see the **Failure mode** parameter
  (→ 🖺 173)

Value echo lost

| Navigation | 圖圖 | Setup → Advanced setup → Safety settings → Value echo lost |

Prerequisite   Output echo lost (→ 🖺 163) = Value echo lost

Description   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** (→ 🖺 151)
- with linearization: **Unit after linearization** (→ 🖺 157)

---

7)   Only visible if "Linearization type (→ 🖺 156)" = "None"

## Ramp at echo lost																											🔒

Navigation	💻📱 Setup → Advanced setup → Safety settings → Ramp at echo lost
Prerequisite	Output echo lost (→ 📖 163) = **Ramp at echo lost**
Description	Slope of the ramp in the case of a lost echo
User entry	Signed floating-point number
Factory setting	0.0 %/min

Additional information
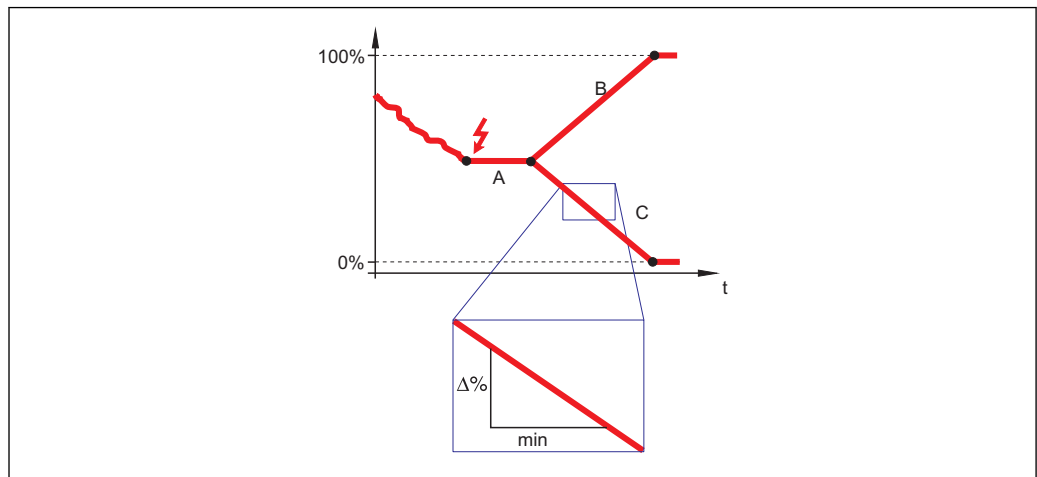
A0013269

A   Delay time echo lost
B   Ramp at echo lost (→ 📖 164) (positive value)
C   Ramp at echo lost (→ 📖 164) (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 settings → Blocking distance
Description	Specify upper blocking distance UB.
User entry	0 to 200 m
Factory setting	• For rod and rope probes up to 8 m (26 ft): 200 mm (8 in) • For rod and rope probes above 8 m (26 ft): 0.025 * Sondenlänge
Additional information	Signals in the upper blocking distance are only evaluated if they have been outside the blocking distance when the device was switched on and move into the blocking distance

due to a level change during operation. Signals which are already in the blocking distance when the device is switched on, are ignored.

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

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

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

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

🖼 *57   Blocking distance (UB) for bulk solid 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 confirmation

"Deactivate SIL/WHG" wizard

ℹ️ The **Deactivate SIL/WHG** wizard (→ 🖹 167) is only visible if the device is SIL-locked or WHG-locked. For details refer to the "Functional Safety Manual" of the respective device.

Navigation   ⓢ⌨   Setup → Advanced setup → Deactivate SIL/WHG

Reset write protection   ⓐ

Navigation	ⓢ⌨ Setup → Advanced setup → Deactivate SIL/WHG → Reset write protection
Description	Enter unlocking code.
User entry	0 to 65 535
Factory setting	0

Code incorrect   ⓐ

Navigation	ⓢ⌨ Setup → Advanced setup → Deactivate 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

"Probe settings" submenu

The **Probe settings** submenu helps to ensure that the end of probe signal within the envelope curve is correctly assigned by the evaluation algorithm. The assignment is correct if the length of probe indicated by the device matches the acutal lenght of the probe. The automatic probe length correction can only be performed if the probe is installed in the vessel and is completely uncovered (no medium). For partially filled vessels and if the probe length is known, select **Confirm probe length (→ 🖺 169)** = **Manual input** in order to enter the value manually.

> ℹ️ If a mapping (interference echo suppression) has been recorded after shortening the probe, it is no longer possible to perform an automatic probe length correction. In this case there are two options:
> • Delete the map using the **Record map** parameter (→ 🖺 143) before performing the automatic probe length correction. After the probe length correction, a new map can be recorded using the **Record map** parameter (→ 🖺 143).
> • Alternative: Select **Confirm probe length (→ 🖺 169)** = **Manual input** and enter the probe length manually into the **Present probe length** parameter → 🖺 168.

> ℹ️ An automatic probe length correction is only possible after the correct option has been selected in the **Probe grounded** parameter (→ 🖺 168).

Navigation　　　🔳🔲　Setup → Advanced setup → Probe settings

Probe grounded   🔒

Navigation	🔳🔲　Setup → Advanced setup → Probe settings → Probe grounded
Prerequisite	**Operating mode = Level**
Description	Specify whether the probe is grounded.
Selection	• No • Yes
Factory setting	No

Present probe length   🔒

Navigation	🔲　Setup → Advanced setup → Probe settings → Present probe length
Description	• In most cases: Displays the length of the probe according to the currently measured end-of-probe signal. • For **Confirm probe length (→ 🖺 169)** = **Manual input**: Enter actual length of probe.
User entry	0 to 200 m
Factory setting	4 m

Confirm probe length	ⓐ

Navigation	⊟	Setup → Advanced setup → Probe settings → Confirm probe length

Description	Select, whether the value displayed in the **Present probe length** parameter → 🖹 168 matches the actual length of the probe. Based on this input, the device performs a probe length correction.

Selection	• Probe length OK • Probe length too small • Probe length too big • Probe covered • Manual input • Probe length unknown

Factory setting	Probe length OK

Additional information	**Meaning of the options** • **Probe length OK** To be selected if the indicated length is correct. An adjustment is not required. The device quits the sequence. • **Probe length too small** To be selected if the displayed length is smaller than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is displayed in the **Present probe length** parameter → 🖹 168. This procedure has to be repeated until the displayed value matches the actual length of the probe. • **Probe length too big** To be selected if the displayed length is bigger than the actual length of the probe. A different end of probe signal is allocated and the newly calculated length is indicated in the **Present probe length** parameter → 🖹 168. This procedure has to be repeated until the displayed value matches the actual length of the probe. • **Probe covered** To be selected if the probe is (partially or completely) covered. A probe length correction is impossible in this case. The device quits the sequence. • **Manual input** To be selected if no automatic probe length correction is to be performed. Instead, the actual length of the probe must be entered manually into the **Present probe length** parameter → 🖹 168 [8]. • **Probe length unknown** To be selected if the acutal length of the probe is unknown. A probe length correction is impossible in this case and the device quits the sequence. .

---

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

"Probe length correction" wizard

ℹ️ The **Probe length correction** wizard is only available when operating via the local
    display. When operating via an operating tool, all parameters concerning the probe
    length correction are located directly in the **Probe settings** submenu (→ 🖺 168).

Navigation   🔘🖳 Setup → Advanced setup → Probe settings → Probe length
                                 correction

Confirm probe length   🔒

Navigation   🔘   Setup → Advanced setup → Probe settings → Probe length correction → Confirm
                                 probe length

Description   → 🖺 169

Present probe length   🔒

Navigation   🔘🖳 Setup → Advanced setup → Probe settings → Probe length correction → Present
                                 probe length

Description   → 🖺 168

"Current output 1 to 2" submenu

The **Current output 2** submenu (→ 🗎 171) is only available for devices with two current outputs.

Navigation   🔲🔳   Setup → Advanced setup → Current output 1 to 2

Assign current output 1 to 2	🔒

Navigation   🔲🔳   Setup → Advanced setup → Current output 1 to 2 → Assign current output

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

Factory setting   **For level measurements**
- Current output 1: Level linearized
- Current output 2 [9)]: Level linearized

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

Process variable	4 mA value	20 mA value
Level linearized	0 % [1)] or the associated linearized value	100 % [2)] or the associated linearized value
Distance	0 (i.e. level is at the reference point)	**Empty calibration** (→ 🗎 139) (i.e. level is at 0 %)
Electronic temperature	−50 ℃ (−58 ℉)	100 ℃ (212 ℉)
Relative echo amplitude	0 mV	2 000 mV
Analog output adv. diagnostics 1/2	depending on the parametrization of the Advanced Diagnostics	

1)   the 0% level is defined by **Empty calibration** parameter (→ 🗎 139)
2)   The 100% level is defined by **Full calibration** parameter (→ 🗎 139)

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

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

---

9)   only for devices with two current outputs

Current span	🔒

Navigation	🔊🔲 Setup → Advanced setup → Current output 1 to 2 → Current span

Description
Determines the current range used to transmit the measured value. '4...20mA': Measured variable: 4 ...20 mA '4...20mA NAMUR': Measured variable: 3.8 ... 20.5 mA '4...20mA US': Measured variable: 3.9 ... 20.8 mA 'Fixed current': Measured variable transmitted via HART only Note: Currents below 3.6 mA or above 21.95 mA can be used to signal an alarm.

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

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 (→ 🕮 172).		

ℹ️ • In the case of an error, the output current assumes the value defined in the **Failure mode** parameter (→ 🕮 173).
• If the meausred value is out of the measuring range, diagnostic message **Current output** is issued.

ℹ️ 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** (→ 🕮 172) = **4 mA**

Fixed current	🔒

Navigation	🔊🔲 Setup → Advanced setup → Current output 1 to 2 → Fixed current

Prerequisite
Current span (→ 🕮 172) = **Fixed current**

Description
Define constant value of the output current.

User entry
4 to 22.5 mA

Factory setting
4 mA

Damping output	ⓐ

Navigation	ⓐⓑ Setup → Advanced setup → Current output 1 to 2 → Damping output
Description	Reaction time of the output signal on fluctuation in the measured value.
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 → Current output 1 to 2 → Failure mode
Prerequisite	Current span (→ 🖺 172) ≠ **Fixed current**
Description	Defines which current the output assumes in the case of an error. 'Min.': < 3.6mA 'Max.': > 21.95mA 'Last valid value': Last valid value before occurrence of the error. 'Actual value': Output current is equal to the measured value; error is ignored. 'Defined value': User defined value.
Selection	• Min. • Max. • Last valid value • Actual value • Defined value
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 (→ 🖺 172). • **Max.** The current output adopts the value of the upper alarm level according to the **Current span** parameter (→ 🖺 172). • **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 (→ 🖺 174). ℹ 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 → Current output 1 to 2 → Failure current
Prerequisite	**Failure mode (→ 🖺 173)** = **Defined value**
Description	Defines which current the output assumes in case of an error.
User entry	3.59 to 22.5 mA
Factory setting	22.5 mA

Output current 1 to 2

Navigation	🗒🖵 Setup → Advanced setup → Current output 1 to 2 → Output current 1 to 2
Description	Shows the actual calculated value of the output current.

"Switch output" submenu

ℹ️ The **Switch output** submenu (→ 🗏 175) is only visible for devices with switch output. [10]

Navigation   🗐🗏   Setup → Advanced setup → Switch output

Switch output function	🔒

Navigation	🗐🗏 Setup → Advanced setup → Switch output → Switch output function
Description	Defines the function of the switch output. 'Off' The switch output is always open (non-conductive) 'On' The switch output is always closed (conductive). 'Diagnostic behavior' The switch output is normally closed and is only opened if a diagnostic event is present. 'Limit' The switch output is normally closed and is only opened if a measured variable exceeds a defined limit. 'Digital output' The switch output is controlled by one of the digital output blocks of the device.
Selection	• Off • On • Diagnostic behavior • Limit • Digital Output
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 (→ 🗏 176) 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** (→ 🗏 176) – **Switch-on value** (→ 🗏 177) – **Switch-off value** (→ 🗏 178) • **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 (→ 🗏 176). ℹ️ The **Off** and **On** options can be used to simulate the switch output.

---

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

Assign status	🔒

Navigation	🔘🖥 Setup → Advanced setup → Switch output → Assign status

Prerequisite   Switch output function (→ 🖿 175) = **Digital 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

Prerequisite   Switch output function (→ 🖿 175) = **Limit**

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

Factory setting   Off

Assign diagnostic behavior	🔒

Navigation	🔘🖥 Setup → Advanced setup → Switch output → Assign diagnostic behavior

Prerequisite   Switch output function (→ 🖿 175) = **Diagnostic behavior**

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

---

*   Visibility depends on order options or device settings

Selection	• Alarm • Alarm or warning • Warning

Factory setting	Alarm

Switch-on value	🔒

Navigation	🔘🔲 Setup → Advanced setup → Switch output → Switch-on value

Prerequisite	**Switch output function** (→ 🖹 175) = **Limit**

Description	Defines the switch-on point. The output is closed if the assigned process variable rises above this point.

User entry	Signed floating-point number

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**.
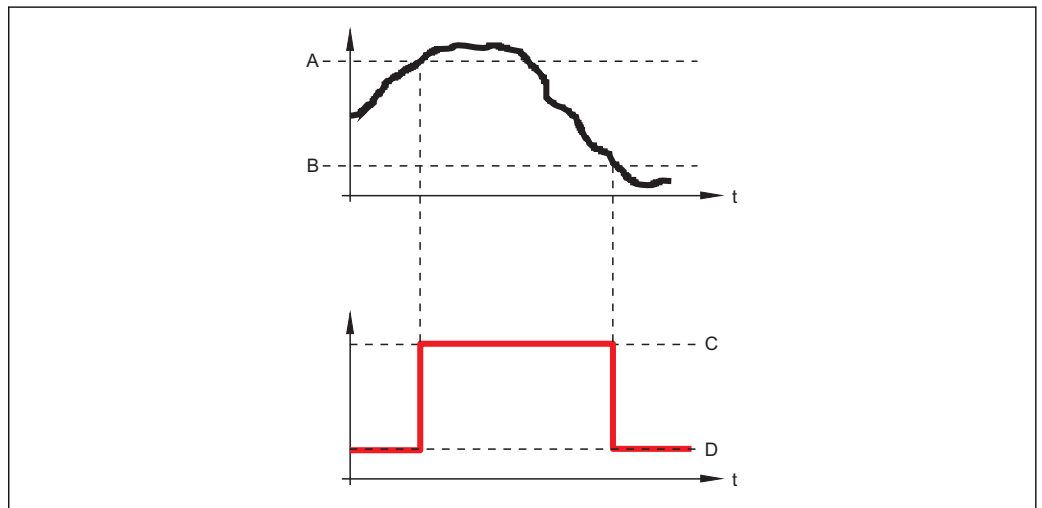
A0015585

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

Switch-on value < Switch-off value
– The output is closed if the measured value is smaller than **Switch-on value**.
– The output is opened if the measured value is larger than **Switch-off value**.
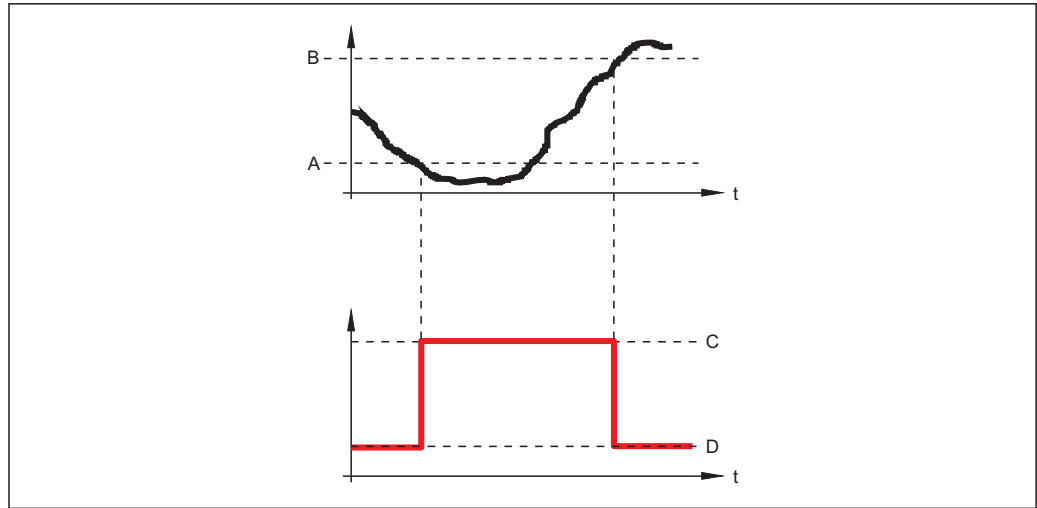
A0015586

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

Switch-on delay   ⓐ

Navigation	ⓐⓔ Setup → Advanced setup → Switch output → Switch-on delay
Prerequisite	• Switch output function (→ 🖺 175) = **Limit** • Assign limit (→ 🖺 176) ≠ **Off**
Description	Defines the delay applied before the output is switched on.
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
Prerequisite	Switch output function (→ 🖺 175) = **Limit**
Description	Defines the switch-off point. The output is opened if the assigned process variable falls below this point.
User entry	Signed floating-point number
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 (→ 🖺 177).

Switch-off delay	⌧

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

Prerequisite   • Switch output function (→ ⌾ 175) = **Limit**
                              • Assign limit (→ ⌾ 176) ≠ **Off**

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

User entry   0.0 to 100.0 s

Factory setting   0.0 s

Failure mode	⌧

Navigation   ⌨⌧ Setup → Advanced setup → Switch output → Failure mode

Prerequisite   Switch output function (→ ⌾ 175) = **Limit** or **Digital Output**

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

Selection   • Actual status
                              • Open
                              • Closed

Factory setting   Open

Additional information

Switch status	

Navigation   ⌨⌧ Setup → Advanced setup → Switch output → Switch status

Description   Current status of the switch output.

Invert output signal	⌧

Navigation   ⌨⌧ Setup → Advanced setup → Switch output → Invert output signal

Description   'No' The switch output behaves as per its parameter setting. 'Yes' The switching behavior is
                              inverted as compared to its parameter setting.

Selection   • No
                              • Yes

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 * • Français * • Español * • Italiano * • Nederlands * • Portuguesa * • Polski * • русский язык (Russian) * • Svenska * • Türkçe * • 中文 (Chinese) * • 日本語 (Japanese) * • 한국어 (Korean) * • Bahasa Indonesia * • tiếng Việt (Vietnamese) * • čeština (Czech) *
Factory setting	The language selected in feature 500 of the product structure. If no language has been selected: **English**
Additional information	

Format display	

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

---

*   Visibility depends on order options or device settings

Additional information
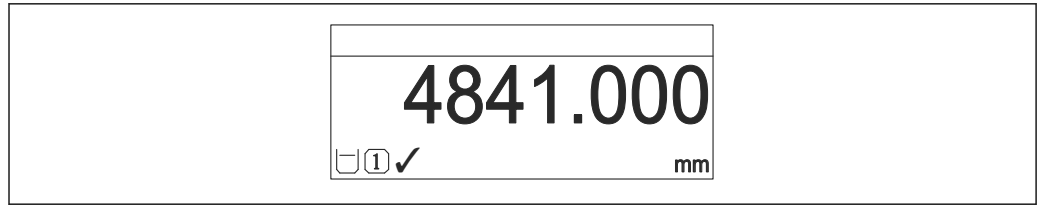
A0019963

🖻 *58   "Format display" = "1 value, max. size"*
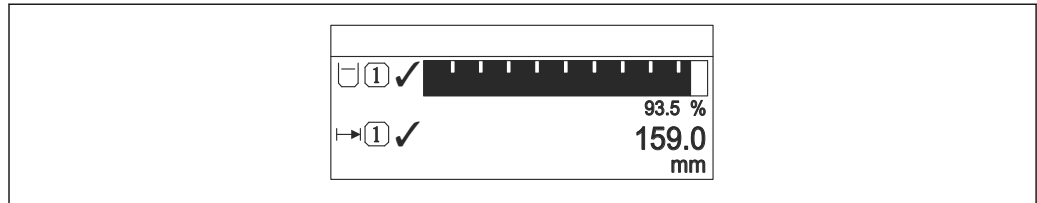
A0019964

🖻 *59   "Format display" = "1 bargraph + 1 value"*
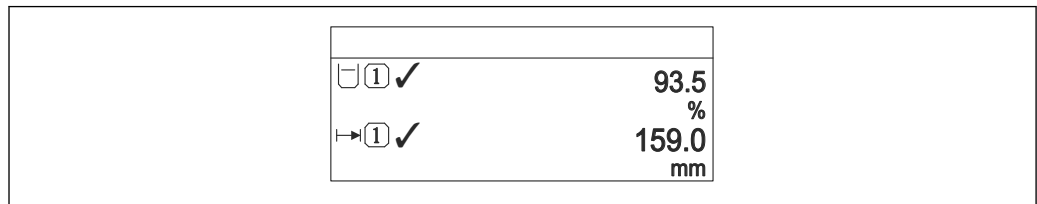
A0019965

🖻 *60   "Format display" = "2 values"*
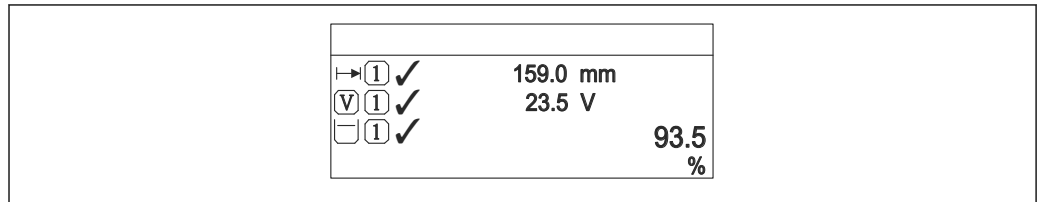
A0019966

🖻 *61   "Format display" = "1 value large + 2 values"*
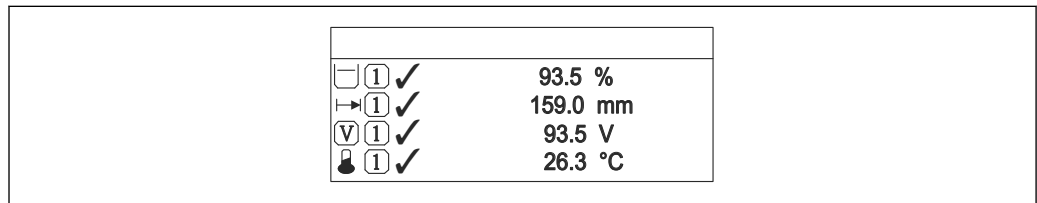
A0019968

🖻 *62   "Format display" = "4 values"*

- The **Value 1 to 4 display** → 🖺 183 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 (→ 🖺 183).

Value 1 to 4 display	🔒

Navigation	�📟 Setup → Advanced setup → Display → Value 1 display

Description	Select the measured value that is shown on the local display.

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

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

Decimal places 1 to 4	🔒

Navigation	�📟 Setup → Advanced setup → Display → Decimal places 1

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

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

---

* Visibility depends on order options or device settings

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	Set 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	
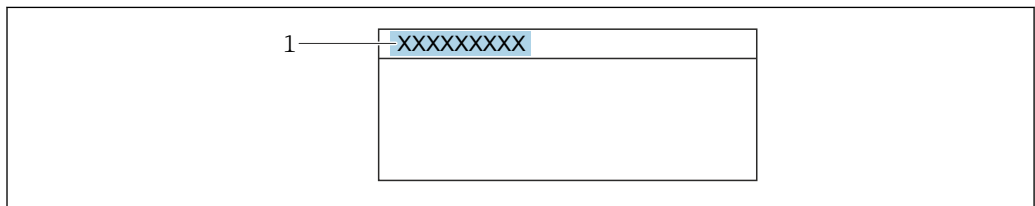
1   Position of the header text on the display

Meaning of the options

• **Device tag**
  Is defined in the **Device tag** parameter (→ 🔲 138)
• **Free text**
  Is defined in the **Header text** parameter (→ 🔲 185)

Header text	⌂

Navigation	🔘🔲 Setup → Advanced setup → Display → Header text
Prerequisite	Header (→ 🔲 184) = 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 → Decimal 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** → 🖹 183 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.

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

Contrast display

Navigation	🔘🔲 Setup → Advanced setup → Display → Contrast display

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

User entry	20 to 80 %

Factory setting	Dependent on the display.

Additional information
ℹ️ Setting the contrast via push-buttons:
• Darker: press the 🔘🔲 buttons simultaneously.
• Brighter: press the 🔘🔲 buttons simultaneously.

"Configuration backup display" submenu

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

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

Navigation   ⓘⓘ   Setup → Advanced setup → Configuration backup display

---

Operating time

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

Last backup

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

Configuration management   🔒

Navigation	ⓘⓘ Setup → Advanced setup → Configuration backup display → Configuration management
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 (→ 🖿 188).
	• **Clear backup data**
	The backup copy of the device configuration is deleted from the display module of the device.

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

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

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

Backup state

Navigation	⊞⊟ Setup → Advanced setup → Configuration backup display → Backup state
Description	Displays which backup action is currently in progress.

Comparison result

Navigation	⊞⊟ Setup → Advanced setup → Configuration backup display → Comparison result
Description	Comparison between present device data and display backup.

Additional information   Meaning of the display options
- **Settings identical**

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

  The current device configuration of the HistoROM is not identical to the backup copy in the display module.
- **No backup available**

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

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

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

  The data sets are incompatible and can not be compared.

To start the comparison, set **Configuration management** (→ 🖺 187) = **Compare**.

If the transmitter configuration has been duplicated from a different device by **Configuration management** (→ 🖺 187) = **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 → Define access code
Description		Define release code for write access to parameters.
User entry		0 to 9 999
Factory setting		0
Additional information	ℹ️	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.
	ℹ️	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.
	ℹ️	Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 🖺 147).
	ℹ️	Please contact your Endress+Hauser Sales Center if you lose your access code.
	ℹ️	For display operation: The new access code is only valid after it has been confirmed in the **Confirm access code** parameter (→ 🖺 192).

Device reset		🔒

Navigation	⧉⊟	Setup → Advanced setup → Administration → Device reset
Description		Reset the device configuration - either entirely or in part - to a defined state.
Selection		• Cancel • To factory defaults • To delivery settings • Of customer settings • To transducer defaults • Restart device
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

ℹ️ 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 → Define access code

---

Define access code   🔐

Navigation	📧 Setup → Advanced setup → Administration → Define access code → Define access code
Description	→ 🔖 190

Confirm access code   🔐

Navigation	📧 Setup → Advanced setup → Administration → Define access code → Confirm access code
Description	Confirm the entered access code.
User entry	0 to 9999
Factory setting	0

17.5 "Diagnostics" menu

Navigation   ⊠⊡   Diagnostics

Actual diagnostics

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

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

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

Timestamp

Navigation	⊡ Diagnostics → Timestamp
Description	Displays the timestamp for the currently active diagnostic message.

Previous diagnostics

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

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

Timestamp

Navigation   ▣   Diagnostics → Timestamp

Description   Shows the timestamp of the previous diagnostic message.

Operating time from restart

Navigation   ▣▣   Diagnostics → Operating time from restart

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

Operating time

Navigation   ▣▣   Diagnostics → Operating time

Description   Indicates how long the device has been in operation.

Additional information *Maximum time*

                        9 999 d (≈ 27 years)

17.5.1 "Diagnostic list" submenu

Navigation   Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation	Diagnostics → Diagnostic list → Diagnostics 1
Description	Display the current diagnostics messages with the highest to fifth-highest priority.
Additional information	The display consists of: • Symbol for event behavior • Code for diagnostic behavior • Operating time of occurrence • Event text

---

Timestamp 1 to 5

Navigation	Diagnostics → Diagnostic list → Timestamp
Description	Timestamp of the diagnostic message.

17.5.2   "Event logbook" submenu

ℹ️ 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	Define which category of event messages is shown in the Events list submenu.
Selection	• All • Failure (F) • Function check (C) • Out of specification (S) • Maintenance required (M) • Information (I)
Factory setting	All
Additional information	ℹ️ • 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 (→ 🖺 196). A maximum of 100 events are displayed in chronological order.

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

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

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

Navigation   ▣   Diagnostics → Event logbook → Event list

17.5.3   "Device information" submenu

Navigation   ⊞⊟   Diagnostics → Device information

Device tag

Navigation   ⊞⊟   Diagnostics → Device information → Device tag

Description   Enter the name for the measuring point.

Factory setting   FMP5x

Serial number

Navigation   ⊞⊟   Diagnostics → Device information → Serial number

Description   Shows the serial number of the measuring device.

Additional information   ℹ️ **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

                        ℹ️ The serial number is also indicated on the nameplate.

Firmware version

Navigation   ⊞⊟   Diagnostics → Device information → Firmware version

Description   Shows the device firmware version installed.

User interface   xx.yy.zz

Additional information   ℹ️ For firmware versions differing only in the last two digits ("zz") there is no difference
                        concerning functionality or operation.

Device name

Navigation   ⊞⊟   Diagnostics → Device information → Device name

Description   Shows the name of the transmitter.

Order code	🔒

Navigation	◎🔲 Diagnostics → Device information → Order code
Description	Shows the device order code.
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 information → Extended order code 1
Description	Display 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 information → Device revision
Description	Shows the device revision with which the device is registered with the HART Communication Foundation.
Additional information	The device revision is used to allocate the correct Device Description file (DD) to the device.

Device ID

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

Device type

Navigation	⊞⊟ Diagnostics → Device information → Device type
Description	Shows the device type with which the measuring device is registered with the HART Communication Foundation.
Additional information	The device type is needed to allocate the suitable Device Description (DD) to the device.

Manufacturer ID

Navigation	⊞⊟ Diagnostics → Device information → Manufacturer ID
Description	Use this function to view the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.
User interface	2-digit hexadecimal number
Factory setting	0x11 (for Endress+Hauser)

17.5.4   "Measured values" submenu

Navigation   Diagnostics → Measured values

Distance

Navigation   Diagnostics → Measured values → Distance

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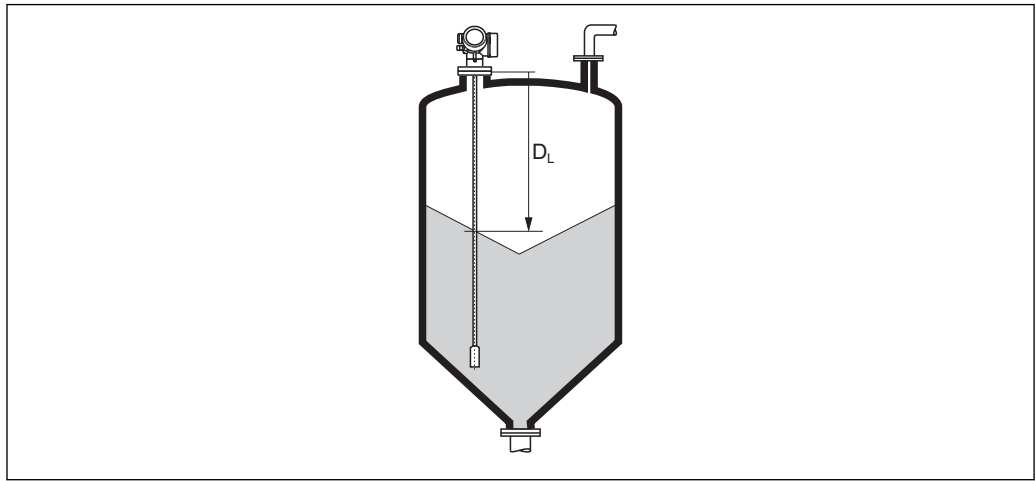
Additional information

63   Distance for bulk solid measurements

The unit is defined in the **Distance unit** parameter (→ 🖺 138).

Level linearized

Navigation   Diagnostics → Measured values → Level linearized

Description   Displays linearized level.

Additional information   The unit is defined by the **Unit after linearization** parameter → 🖺 157.

Output current 1 to 2

Navigation   Diagnostics → Measured values → Output current 1 to 2

Description   Shows the actual calculated value of the output current.

Measured current 1

Navigation	⊞⊟	Diagnostics → Measured values → Measured current 1

Prerequisite   Only available for current output 1

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

Terminal voltage 1

Navigation	⊞⊟	Diagnostics → Measured values → Terminal voltage 1

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

17.5.5 "Data logging" submenu

Navigation   ⌨️🖥️   Diagnostics → Data logging

Assign channel 1 to 4	🔒

Navigation	⌨️🖥️ Diagnostics → Data logging → Assign channel 1 to 4

Description	Assign a process variable to logging channel.

Selection

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

Factory setting   Off

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

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

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

---

* Visibility depends on order options or device settings

Logging interval	🔒

Navigation	⊡	Diagnostics → Data logging → Logging interval
	▤	Diagnostics → Data logging → Logging interval

Description   Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory.

User entry   1.0 to 3 600.0 s

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

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

ℹ The logged data are deleted if this parameter is changed.

Example

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

Clear logging data	🔒

Navigation	⊡	Diagnostics → Data logging → Clear logging data
	▤	Diagnostics → Data logging → Clear logging data

Description   Clear the entire logging data.

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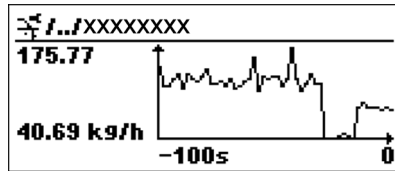
- x-axis: depending on the number of selected channels, 250 to 1000 measured values of a process variable are displayed.
- y-axis: covers the approximate measured value span and constantly adapts this to the measurement.

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

Navigation   ⧉⧠   Diagnostics → Data logging → Display channel 1 to 4

17.5.6 "Simulation" submenu

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

Conditions which can be simulated

Condition to be simulated	Associated parameters
Specific value of a process variable	• Assign measurement variable (→ 🗎 207) • Process variable value (→ 🗎 207)
Specific value of the output current	• Current output simulation (→ 🗎 207) • Value current output (→ 🗎 208)
Specific state of the switch output	• Switch output simulation (→ 🗎 208) • Switch status (→ 🗎 208)
Existence of an alarm	Device alarm simulation (→ 🗎 209)
Existence of a specific diagnostic message	Diagnostic event simulation (→ 🗎 209)

Structure of the submenu

Navigation   ◙   Expert → Diagnostics → Simulation

‣ Simulation		
Assign measurement variable	→ 🖺 207
Process variable value	→ 🖺 207
Current output 1 to 2 simulation	→ 🖺 207
Value current output 1 to 2	→ 🖺 208
Switch output simulation	→ 🖺 208
Switch status	→ 🖺 208
Device alarm simulation	→ 🖺 209
Diagnostic event simulation	→ 🖺 209

Description of parameters

Navigation　　　　@国 Expert → Diagnostics → Simulation

Assign measurement variable   ⊠

Navigation	@国 Expert → Diagnostics → Simulation → Assign measurement variable
Selection	• Off • Level • Interface * • Thickness upper layer * • Level linearized • Interface linearized • Thickness linearized
Factory setting	Off
Additional information	• The value of the variable to be simulated is defined in the **Process variable value** parameter (→ 🗎 207). • If **Assign measurement variable** ≠ **Off**, a simulation is active. This is indicated by a diagnotic message of the *Function check (C)* category.

Process variable value   ⊠

Navigation	@国 Expert → Diagnostics → Simulation → Process variable value
Prerequisite	**Assign measurement variable** (→ 🗎 207) ≠ **Off**
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.

Current output 1 to 2 simulation   ⊠

Navigation	@国 Expert → Diagnostics → Simulation → Current output 1 to 2 simulation
Description	Switch the simulation of the current output on and off.
Selection	• Off • On

---

* Visibility depends on order options or device settings

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 current output 1 to 2

Prerequisite	**Current output simulation (→ 🖺 207) = On**

Description	Defines the value of the simulated output current.

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 output simulation

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

Selection	• Off • On

Factory setting	Off

Switch status

Navigation	🔘🔲 Expert → Diagnostics → Simulation → Switch status

Prerequisite	**Switch output simulation (→ 🖺 208) = On**

Description	Current status of the switch output.

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.

Device alarm simulation	🔒

Navigation   🔘🔲 Expert → Diagnostics → Simulation → Device alarm simulation

Description   Switch the device alarm on and 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 **Failure mode simulation**.

Diagnostic event simulation	🔒

Navigation   🔘🔲 Expert → Diagnostics → Simulation → Diagnostic event simulation

Description   Select the diagnostic event to be simulated. Note: To terminate the simulation, select 'Off'.

Factory setting   Off

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

17.5.7 "Device check" submenu

Navigation   ⌷⌷⌷   Diagnostics → Device check

Start device check	⌷

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

Launch signal	

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

17.5.8 "Heartbeat" submenu

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

Detailed description
SD01872F

Navigation   Diagnostics → Heartbeat

Index

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