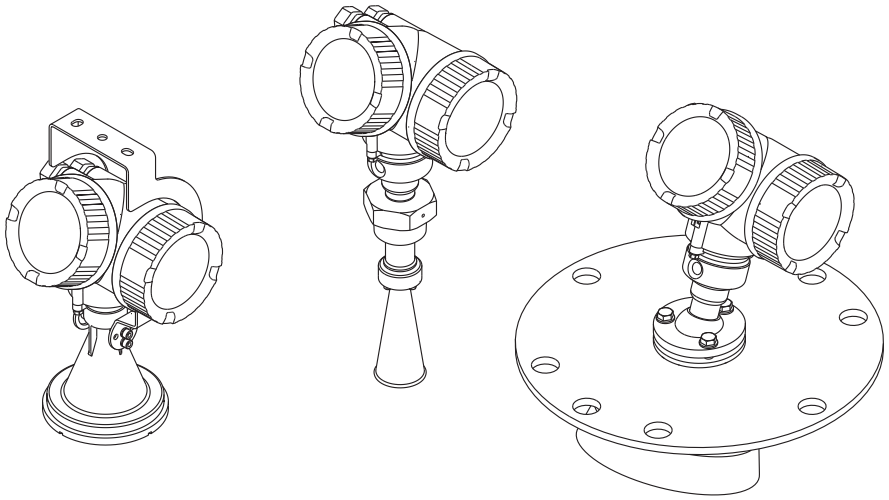
BA01048F/00/EN/02.13
71217573

Valid as of version
01.01.zz

Operating Instructions
Micropilot FMR56, FMR57

Level radar
Level measurement in bulk solids

HART COMMUNICATION PROTOCOL



Endress+Hauser
People for Process Automation

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 Document conventions

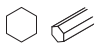
1.2.1 Safety symbols

Symbol	Meaning
 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Tool symbols

Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver
 A0011219	Cross-head screwdriver
 A0011221	Allen key
 A0011222	Hexagon wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.
1. , 2. , 3. …	**Series of steps**
✔	**Result of a sequence of actions**
 A0013562	**Help in the event of a problem**

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

Symbol	Meaning
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous location.

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 Additional documentation

Document	Purpose and content of the document
Technical Information TI01042F (FMR56, FMR57)	**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 KA01102F (FMR56/FMR57, 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 GP01014F (FMR5x, 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.

The document types listed are available:
- On the CD supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

1.3.1 Safety Instructions (XA)

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

Feature 010	Approval	Available for	Safety Instructions HART	Safety Instructions PROFIBUS FOUNDATION Fieldbus
BA	ATEX: II 1 G Ex ia IIC T6 Ga	▪ FMR56 ▪ FMR57	XA00677F	XA00685F
BB	ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb	▪ FMR56 ▪ FMR57	XA00677F	XA00685F
BC	ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb	▪ FMR56 ▪ FMR57	XA00680F	XA00688F
BD	ATEX: II 1/2/3 G Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc	FMR57	XA00678F	XA00686F
BE	ATEX: II 1 D Ex ta IIIC T500 xx°C Da	▪ FMR56 ▪ FMR57	XA00682F	XA00690F

Feature 010	Approval	Available for	Safety Instructions HART	Safety Instructions PROFIBUS FOUNDATION Fieldbus
BF	ATEX: II 1/2 D Ex ta IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00682F	XA00690F
BG	ATEX: II 3 G Ex nA IIC T6-T1 Gc	▪ FMR56 ▪ FMR57	XA00679F	XA00687F
BH	ATEX: II 3 G Ex ic IIC T6-T1 Gc	▪ FMR56 ▪ FMR57	XA00679F	XA00687F
BL	ATEX: II 1/2/3 G Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc	FMR57	XA00678F	XA00686F
B2	ATEX: II 1/2 G Ex ia IIC T6-T1 Ga/Gb ATEX: II 1/2 D Ex ia IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00683F	XA00691F
B3	ATEX: II 1/2 G Ex d [ia] IIC T6-T1 Ga/Gb ATEX: II 1/2 D Ex ta IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00684F	XA00692F
IA	IECEx: Ex ia IIC T6-T1 Ga	▪ FMR56 ▪ FMR57	XA00677F	XA00685F
IB	IECEx: Ex ia IIC T6-T1 Ga/Gb	▪ FMR56 ▪ FMR57	XA00677F	XA00685F
IC	IECEx: Ex d [ia] IIC T6-T1 Ga/Gb	▪ FMR56 ▪ FMR57	XA00680F	XA00688F
ID	IECEx: Ex ic [ia Ga] IIC T6-T1 Ga/Gb/Gc	FMR57	XA00678F	XA00686F
IE	IECEx: Ex ta IIIC T_{500} xx°C Da	▪ FMR56 ▪ FMR57	XA00682F	XA00690F
IF	IECEx: Ex ta IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00682F	XA00690F
IG	IECEx: Ex nA IIC T6-T1 Gc	▪ FMR56 ▪ FMR57	XA00679F	XA00687F
IH	IECEx: Ex ic IIC T6-T1 Gc	▪ FMR56 ▪ FMR57	XA00679F	XA00687F
IL	IECEx: Ex nA [ia Ga] IIC T6-T1 Ga/Gb/Gc	FMR57	XA00678F	XA00686F
I2	IECEx: Ex ia IIC T6-T1 Ga/Gb IECEx: Ex ia IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00683F	XA00691F
I3	IECEx: Ex d [ia] IIC T6-T1 Ga/Gb IEXEx: Ex ta IIIC Txx°C Da/Db	▪ FMR56 ▪ FMR57	XA00684F	XA00692F

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

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

Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex marking
BE	L oder M	ATEX II 1D Ex ta [ia] IIIC T_{500} xx°C Da
BF	L oder M	ATEX II 1/2 D Ex ta [ia Db] IIIC Txx°C Da/Db
BG	L oder M	ATEX II 3G Ex nA [ia Ga] IIC T6 Gc
BH	L oder M	ATEX II 3G Ex ic [ia Ga] IIC T6 Gc
B3	L oder M	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 oder M	IECEx Ex ta [ia] IIIC T500 xx°C Da

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

Feature 010 ("Approval")	Feature 030 ("Display, Operation")	Ex marking
IF	L oder M	IECEx ta [ia Db] IIIC Txx°C Da/Db
IG	L oder M	IECEx Ex nA [ia Ga] IIC T6 Gc
IH	L oder M	IECEx Ex ic [ia Ga] IIC T6 Gc
I3	L oder M	IECEx Ex d [ia] IIC T6 Ga/Gb, IECEx Ex ta [ia Db] IIIC Txx°C Da/Db

2 Basic safety instructions

2.1 Requirements for the personnel

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

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

2.2 Designated use

Application and measured materials
The measuring device described in these Operating Instructions is intended for the continuous, contactless level measurement of mainly bulk solids. The device can also be freely mounted outside closed metal vessels because of its operating frequency of about 26 GHz, a maximum radiated pulsed power of 23.3 mW and an average power output of 0.076 mW. Operation is completely harmless to humans and animals.

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

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

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

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

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

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

2.3 Workplace safety

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

2.4 Operational safety

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

Conversions to the device

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

Repair

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

Hazardous area

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

2.5 Product safety

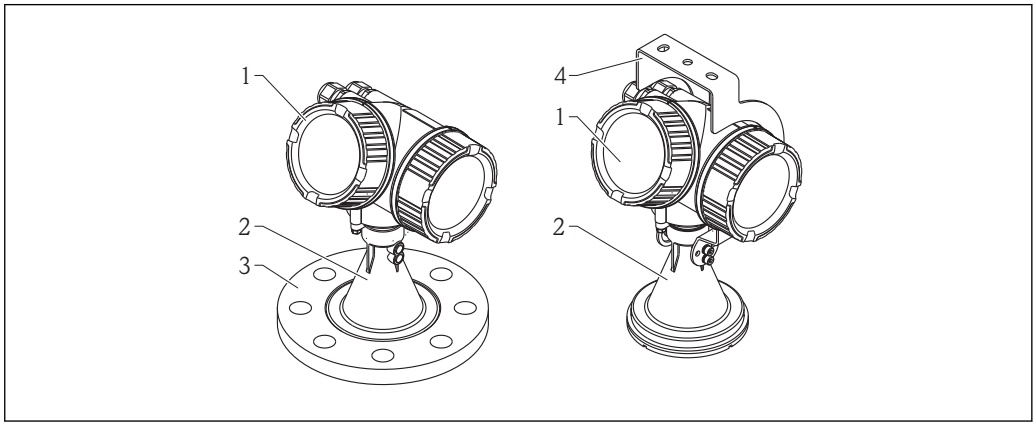
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate.

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

3 Product description

3.1 Product design

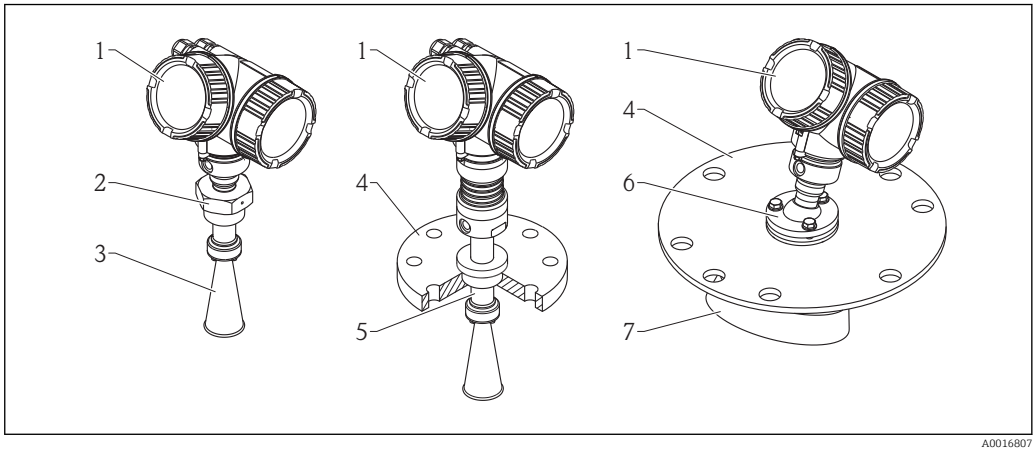
3.1.1 Micropilot FMR56



1 Design of the Micropilot FMR56 (26 GHz)

1 Electronics housing
2 Horn 80mm/100 mm (3in/4in), PP cladded
3 Flange
4 Mounting bracket

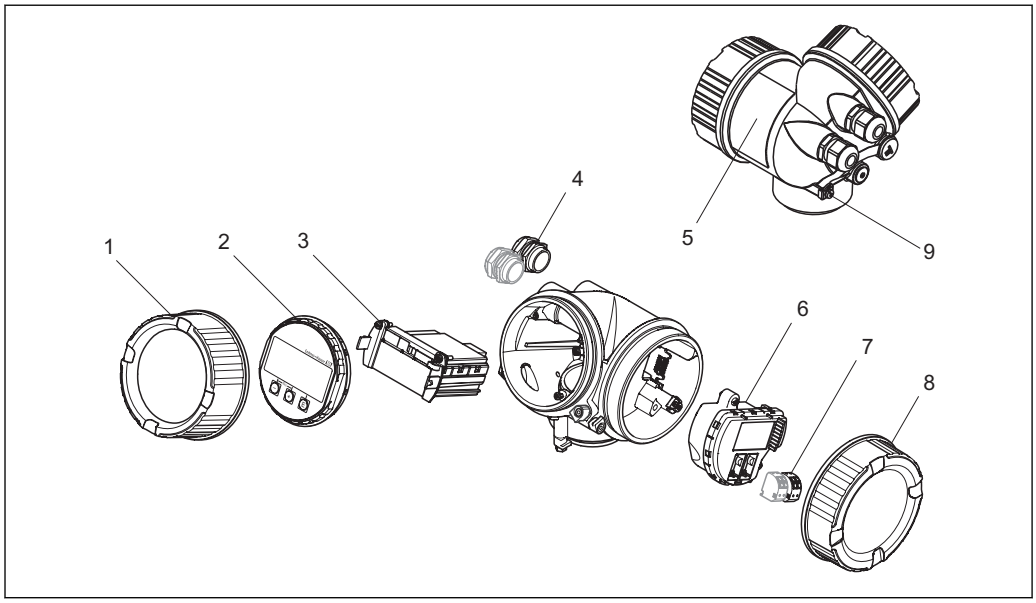
3.1.2 Micropilot FMR57



2 Design of the Micropilot FMR57 (26 GHz)

1 Electronics housing
2 Process connection (Thread)
3 Horn antenna
4 Flange
5 Antenna extension
6 Alignment device
7 Parabolic antenna

3.1.3 Electronics housing



3 Design of the electronics housing

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

3.2 Registered trademarks

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

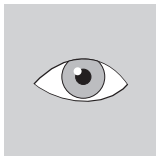
KALREZ®, VITON®
Registered trademark of DuPont Performance Elastomers L.L.C., Wilmington, USA

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

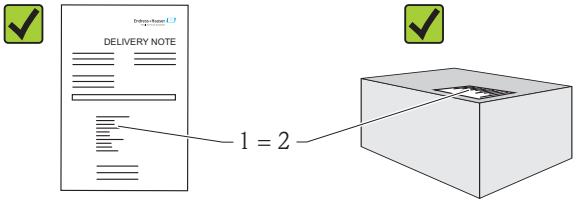
TRI CLAMP®
Registered trademark of Alfa Laval Inc., Kenosha, USA

4 Incoming acceptance and product identification

4.1 Incoming acceptance

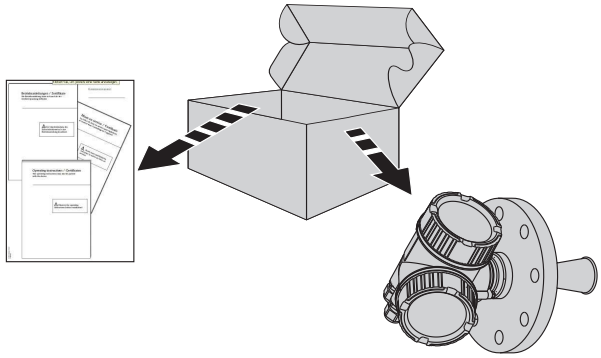


A0013696

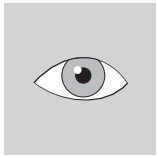


A0016870

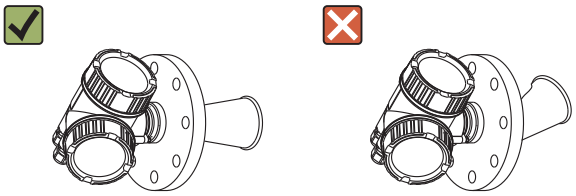
Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?



A0016871

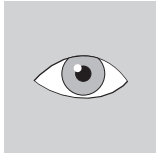


A0013696

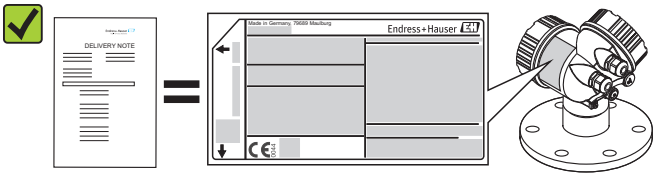


A0016872

Are the goods undamaged?

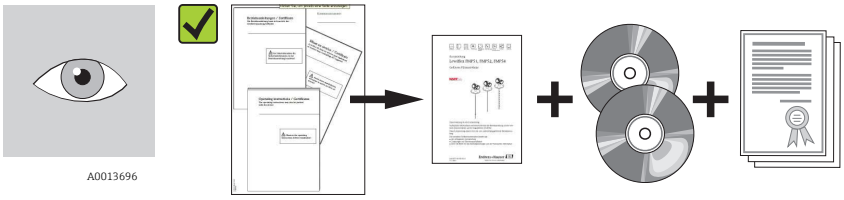


A0013696



A0014038

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



A0013696

A0014037

Are the CD-ROMs (product documentation, operating tool) and documentation present?
If required (see nameplate): Are the Safety Instructions (XA) present?

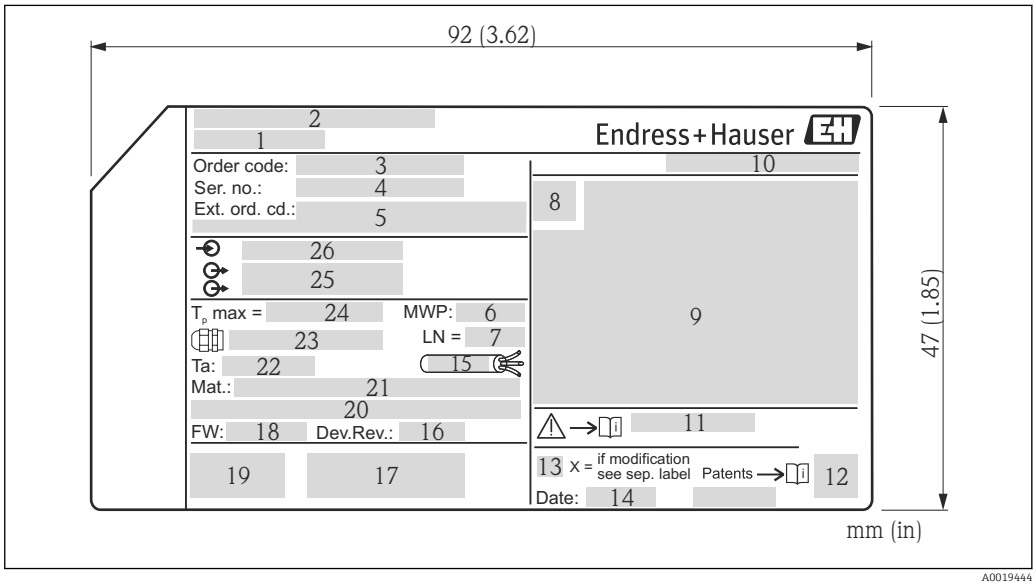
If one of the conditions does not comply, contact your Endress+Hauser distributor.

4.2 Product identification

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

For an overview of the scope of the Technical Documentation provided, refer to the following: enter serial numbers from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)

4.2.1 Nameplate



4 *Nameplate of the Micropilot*

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

Only 33 digits of the extended order code can be indicated on the nameplate. If the extended order code exceeds 33 digits, the rest will not be shown. However, the complete extended order code can be viewed in the operating menu of the device (Diagnostics → Device info → Extended order code 1/2/3).

5 Storage, Transport

5.1 Storage conditions

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

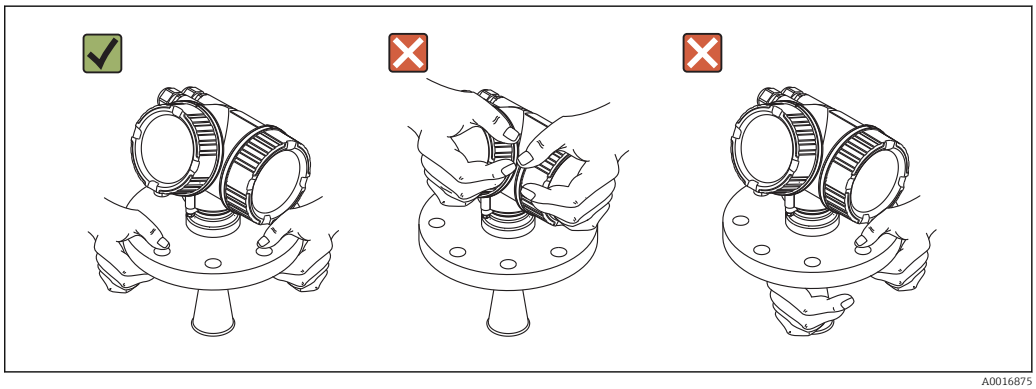
5.2 Transport product to the measuring point

NOTICE

Housing or antenna horn may be damaged or break away.

Risk of injury!

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

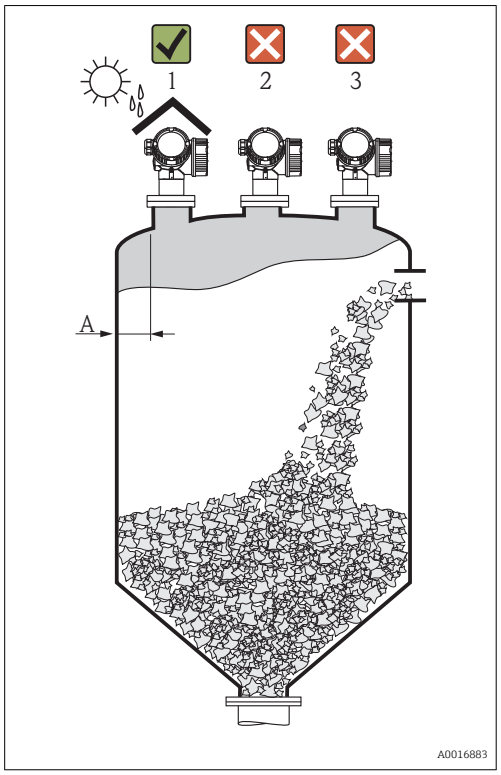


A0016875

6 Installation

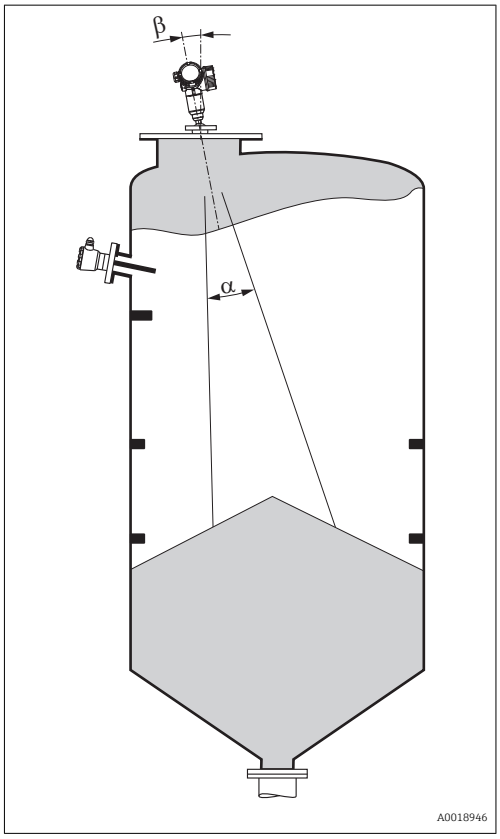
6.1 Installation conditions

6.1.1 Mounting position



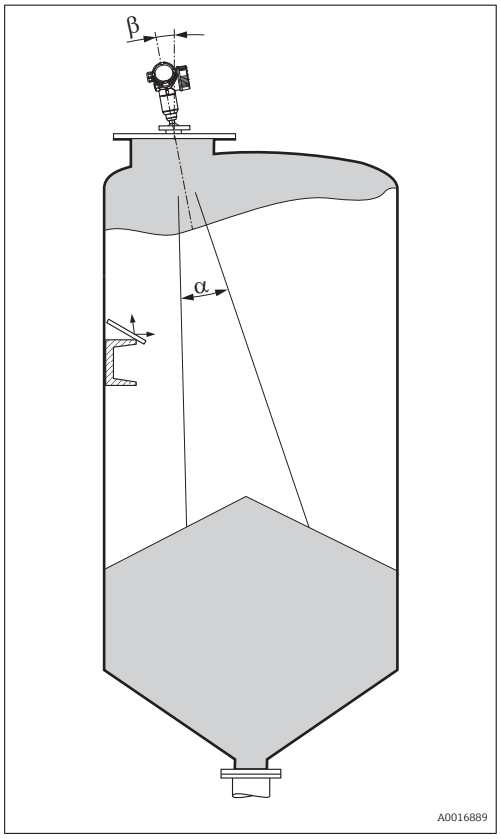
- Recommended distance **A** from wall to outer edge of nozzle: ~ 1/6 of vessel diameter.
  Nevertheless the device should not be installed closer than 20 cm (7.87 in) to the vessel wall.
  If the wall of the vessel is not smooth (corrugated metal, welding seams, irregularities etc.) the distance from the wall should be kept as large as possible.
  If necessary, use an alignment device to prevent interference reflections from the wall (→ 33).
- Not in the center (2), as interference can cause signal loss.
- Not above the fill stream (3).
- It is recommended to us a weather protection cover (1) in order to protect the device from direct sun or rain.
- In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna (→ 34).

6.1.2 Vessel installations



Avoid any installations (limit switches, temperature sensors, braces etc.) inside the signal beam. Take into account the beam angle (→ 🖹 23):

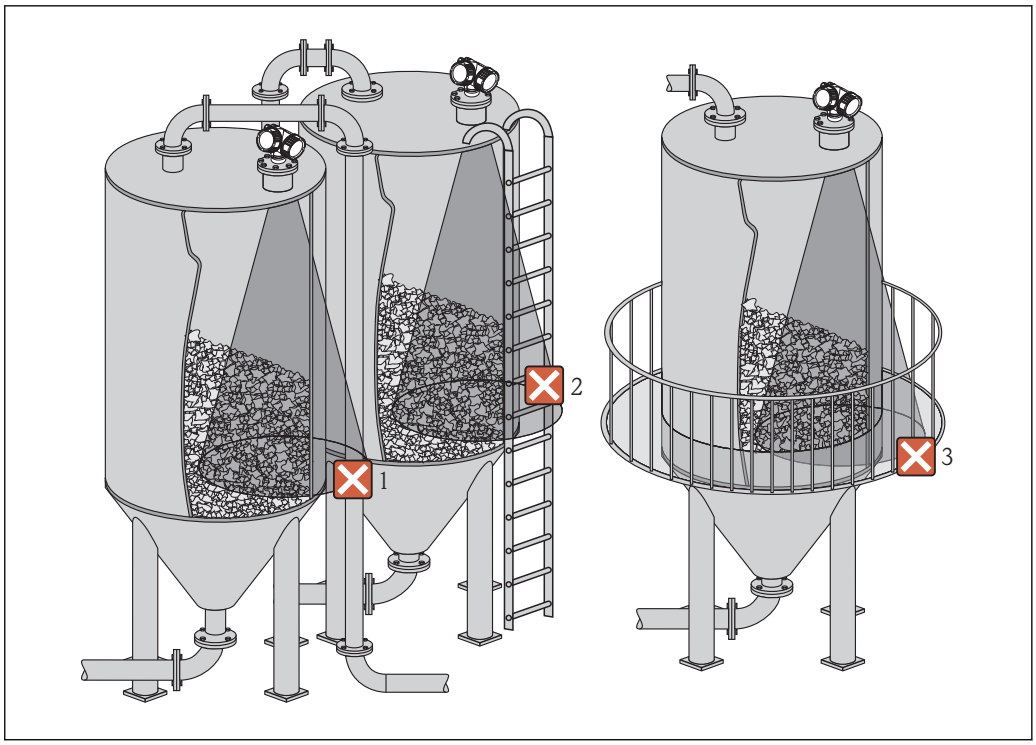
6.1.3 Reduction of interference echoes



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

6.1.4 Measurement in a plastic vessel

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

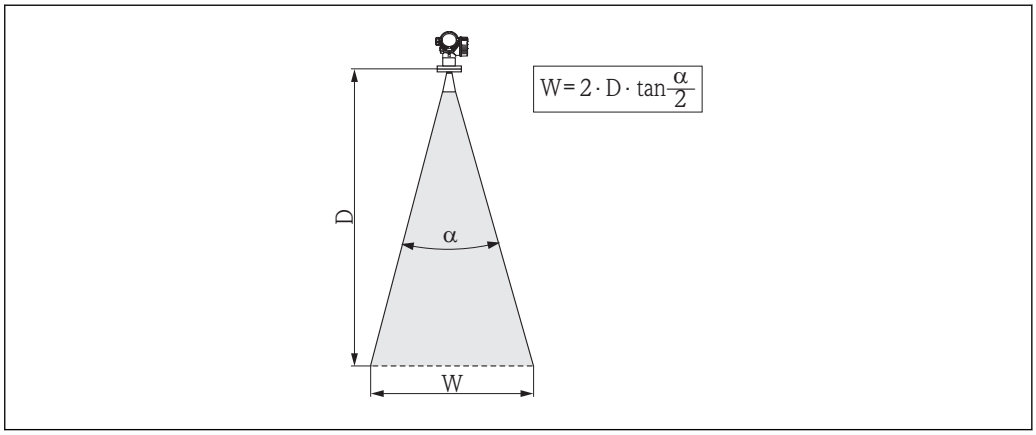


A0017125

6.1.5 Optimization options

- Antenna size
  The bigger the antenna, the smaller the beam angle α and the fewer interference echoes (→ 🖹 23).
- Mapping
  The measurement can be optimized by means of electronic suppression of interference echoes.
  See the **Confirm distance** parameter (→ 🖹 68).
- Antenna alignment
  Take into account the marker on the flange or threaded connection (→ 🖹 26).
- Metallic screens mounted at a slope
  They spread the radar signals and can, therefore, reduce interference echoes.
- Variable flange seal (FMR56)
  Using the variable flange seal, the device can be aligned in the direction of the product surface. For details refer to Operating Instructions BA01048F, chapter "Accessories".
- Alignment device for FMR57
  In FMR57 with alignment device, the sensor can be optimally aimed within the vessel and thus interference echoes can be avoided. The maximum angle β is ±15°.
  In particular, sensor alignment serves to:
  – prevent interference reflections
  – extend the maximum possible measuring range in conical outlets

6.1.6 Beam angle



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

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

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

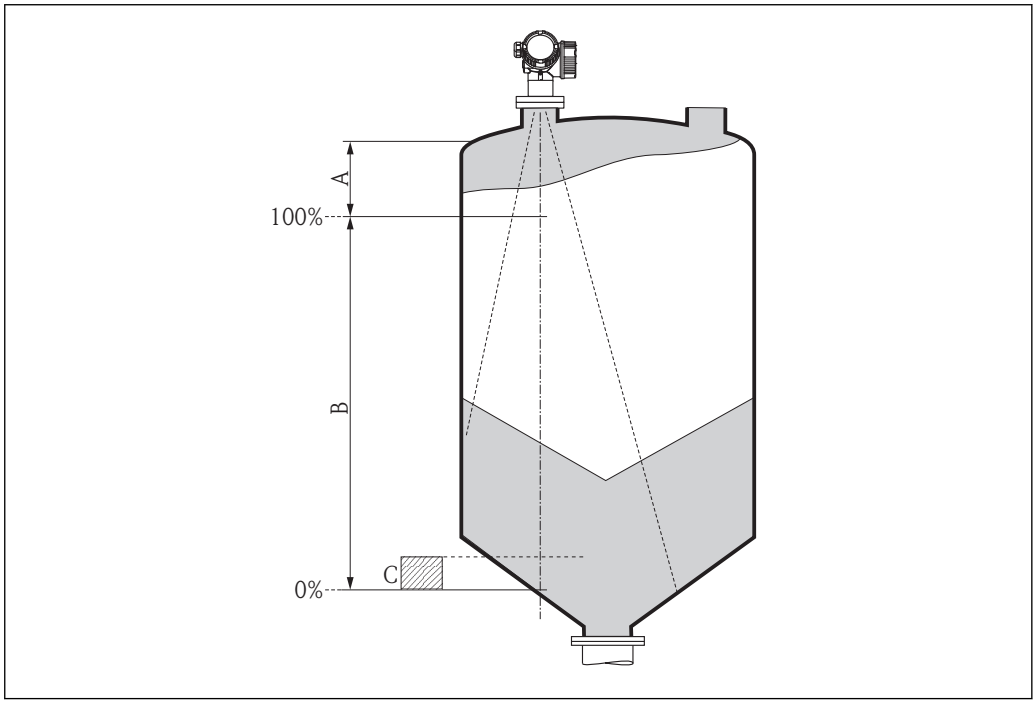
FMR56		
Antenna size	80 mm (3 in)	100 mm (4 in)
Beam angle α	10°	8°
Measuring distance (D)	**Beamwidth diameter (W)**	
3 m (9.8 ft)	0.53 m (1.7 ft)	0.42 m (1.4 ft)
6 m (20 ft)	1.05 m (3.4 ft)	0.84 m (2.8 ft)
9 m (30 ft)	1.58 m (5.2 ft)	1.26 m (4.1 ft)
12 m (39 ft)	2.1 m (6.9 ft)	1.68 m (5.5 ft)
15 m (49 ft)	2.63 m (8.6 ft)	2.10 m (6.9 ft)
20 m (66 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
25 m (82 ft)	4.37 m (14 ft)	3.50 m (11 ft)
30 m (98 ft)	5.25 m (17 ft)	4.20 m (14 ft)

FMR57 - Horn antenna		
Antenna size	80 mm (3 in)	100 mm (4 in)
Beam angle α	10°	8°
Measuring distance (D)	**Beamwidth diameter W**	
5 m (16 ft)	0.87 m (2.9 ft)	0.7 m (2.3 ft)
10 m (33 ft)	1.75 m (5.7 ft)	1.4 m (4.6 ft)
15 m (49 ft)	2.62 m (8.6 ft)	2.1 m (6.9 ft)
20 m (66 ft)	3.50 m (11 ft)	2.80 m (9.2 ft)
30 m (98 ft)	5.25 m (17 ft)	4.20 m (14 ft)
40 m (131 ft)	7.00 m (23 ft)	5.59 m (18 ft)
50 m (164 ft)	8.75 m (29 ft)	6.99 m (23 ft)

FMR57 - Parabolic antenna		
Antenna size	200 mm (8 in)	250 mm (10 in)
Beam angle α	4°	3,5°
Measuring distance (D)	**Beamwidth diameter W**	
5 m (16 ft)	0.35 m (1.1 ft)	0.30 m (1 ft)
10 m (33 ft)	0.70 m (2.3 ft)	0.61 m (2 ft)
15 m (49 ft)	1.05 m (3.4 ft)	0.92 m (3 ft)
20 m (66 ft)	1.40 m (4.6 ft)	1.22 m (4 ft)
30 m (98 ft)	2.10 m (6.9 ft)	1.83 m (6 ft)
40 m (131 ft)	2.79 m (9.2 ft)	2.44 m (8 ft)
50 m (164 ft)	3.50 m (11 ft)	3.06 m (10 ft)
60 m (197 ft)	4.19 m (14 ft)	3.70 m (12 ft)
70 m (230 ft)	4.90 m (16 ft)	4.28 m (14 ft)

6.2 Measuring conditions

- The measuring range begins, where the beam hits the bottom. Particularly with conical outlets the level cannot be detected below this point. The maximum measuring range can be increased in such applications by using an alignment device (→ 33).
- In case of media with a low dielectric constant (ε_r = 1.5 to 2.5) [2], the bottom can be visible through the medium at low levels. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** above the bottom (see figure).
- In principle it is possible to measure up to the tip of the antenna with Micropilot. However, due to considerations regarding abrasion and build-up and depending on the orientation of the product surface (angle of repose), the end of the measuring range should be at a distance of **A** (see figure) from the tip of the antenna. If required, and if some conditions (high DC value, flat angle of repose) are met, shorter distances can be achieved.



A0016916

Device	A [mm (in)]	C [mm (in)]
FMR56	400(15.7)	50 to 150(1.97 to 5.91)
FMR57		

2) Dielectric constants of important media commonly used in the industry are summarized in the document SD106F, which can be downloaded from the Endress+Hauser web page (www.endress.com).

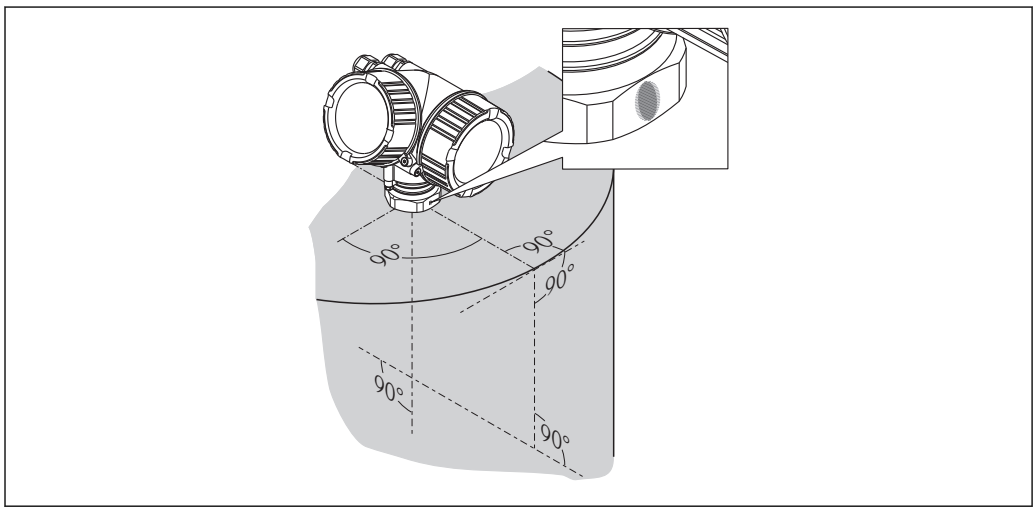
6.3 Installation in vessel (free space)

6.3.1 Horn antenna with slip-on flange (FMR56)

Alignment

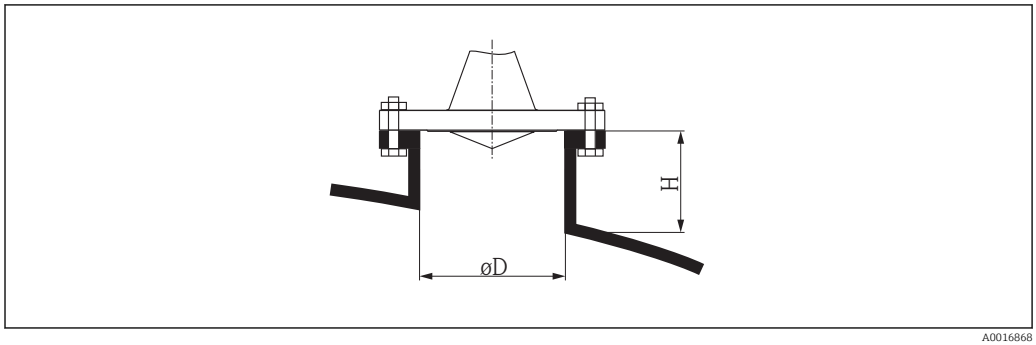
When using the Micropilot with a slip-on flange in explosion-hazardous areas, strictly observe all specifications in the relevant Safety Instructions (XA).

- Align the antenna vertically to the product surface.
  Optionally, a variable flange seal, which is available as an accessory, can be used for alignment (see Technical Information BA01048F, chapter "Accessories").
- A marking at the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



A0019434

Nozzle mounting

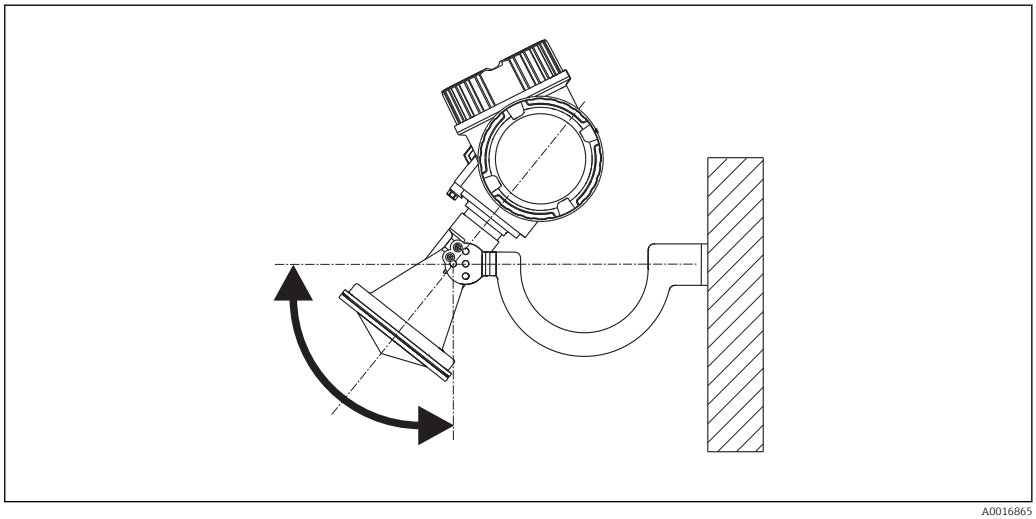


A0016868

6 Nozzle height and diameter for horn antenna with slip-on flange (FMR50/FMR56)

Antenna size	80 mm (3 in)			100 mm (3.94 in)	
D	80 mm (3.15 in)	100 mm (3.94 in)	150 mm (5.91 in)	100 mm (3.94 in)	150 mm (5.91 in)
H	< 500 mm (19.7 in)	< 500 mm (19.7 in)	< 500 mm (19.7 in)	< 500 mm (19.7 in)	< 500 mm (19.7 in)

6.3.2 Horn antenna with mounting bracket (FMR56)



7 *Installation of the horn antenna with mounting bracket (FMR50/FMR56)*

Align the antenna vertically to the product surface using the mounting bracket.

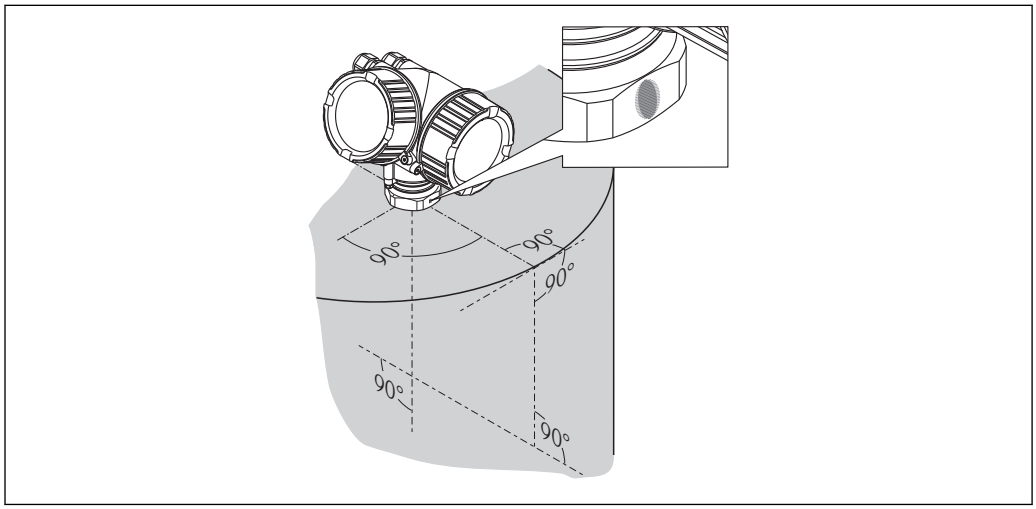
NOTICE

The mounting bracket has no conductive connection to the transmitter housing.
Danger of electrostatic charge
- ► Connect the mounting bracket to the local potential equalization system.

6.3.3 Horn antenna (FMR57)

Alignment

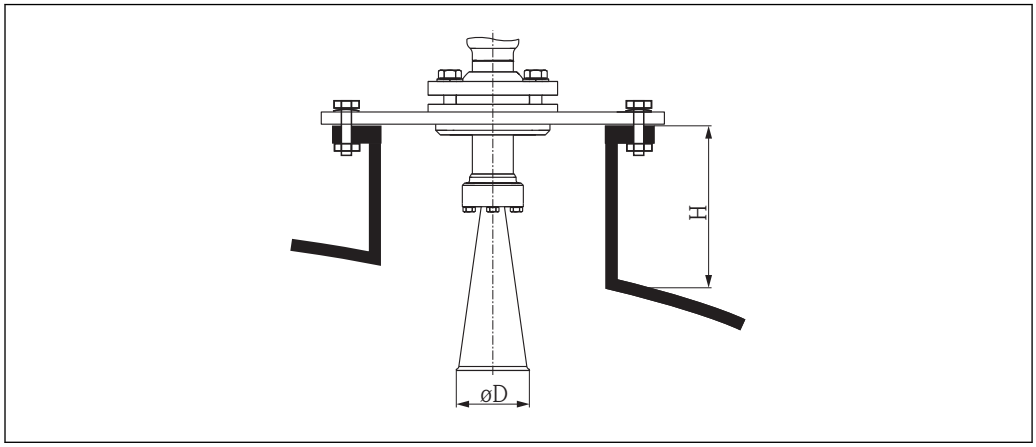
- Ideally, the horn antenna should be installed vertically. To avoid interference reflections or for optimum alignment within the vessel, the Micropilot with optional alignment device can be inclined by 15° in all directions (→ 33).
- A marking at the boss enables alignment of the antenna. This marking must be aligned towards the tank wall as well as possible.



A0019434

Nozzle mounting

The horn antenna should protrude from the nozzle. If this is not possible for mechanical reasons, larger nozzle heights can be accepted.



A0016825

8 Nozzle height and diameter for the horn antenna (FMR57)

Antenna size	80 mm (3 in)	100 mm (4 in)
D	75 mm (2.95 in)	95 mm (3.74 in)
H without antenna extension	< 260 mm (10.2 in)	< 480 mm (18.9 in)

Please contact Endress+Hauser for applications with higher nozzle.

Threaded connection

- Tighten with the hexagonal nut only.
- Tool : Hexagonal wrench 60 mm
- Maximum permissible torque: 60 Nm (44 lbf ft)

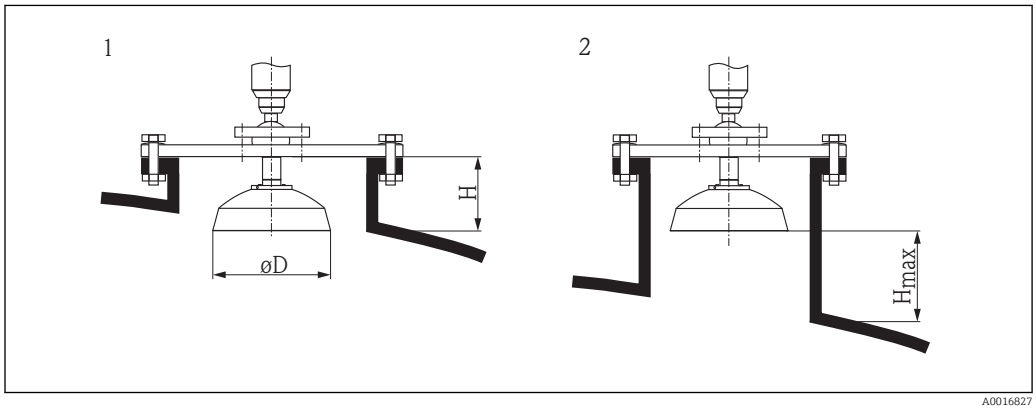
6.3.4 Parabolic antenna (FMR57)

Alignment

Ideally, the parabolic antenna should be installed vertically. To avoid interference reflections or for optimum alignment within the vessel, the Micropilot with optional alignment device can be swiveled by 15° in all directions (→ 33).

Nozzle mounting

- Ideally, the parabolic antenna should protrude from the nozzle (1). Particularly when using the alignment device, please ensure that the parabolic reflector is protruding from the nozzle/roof so as not to inhibit alignment.
- For applications with higher nozzle it may be necessary to install the parabolic antenna completely in the nozzle (2).
  The maximum height of the nozzle (H_{max}) to the parabolic mirror should not exceed 500 mm (19.7 in). Interfering edges within the nozzle should be avoided.



9 Nozzle mounting of Micropilot FMR57 with parabolic antenna

1 Antenna protrudes from the nozzle
2 Antenna completely within the nozzle

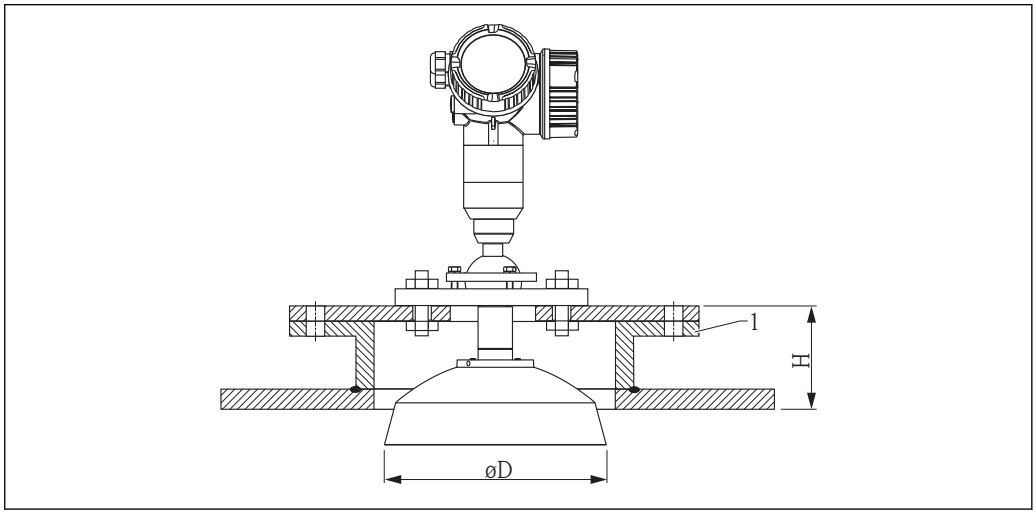
Antenna size	200 mm (8 in)	250 mm (10 in)
D	173 mm (6.81 in)	236 mm (9.29 in)
H without antenna extension	< 50 mm (1.97 in)	< 50 mm (1.97 in)

Examples for installation with small flange

If the flange is smaller than the parabolic reflector, the device can be mounted in one of the following ways:

- Standard installation (→ 31)
  This requires dismantling of the parabolic reflector (→ 32)
- Installation with hinged flange (→ 31)

Standard installation



A0018874

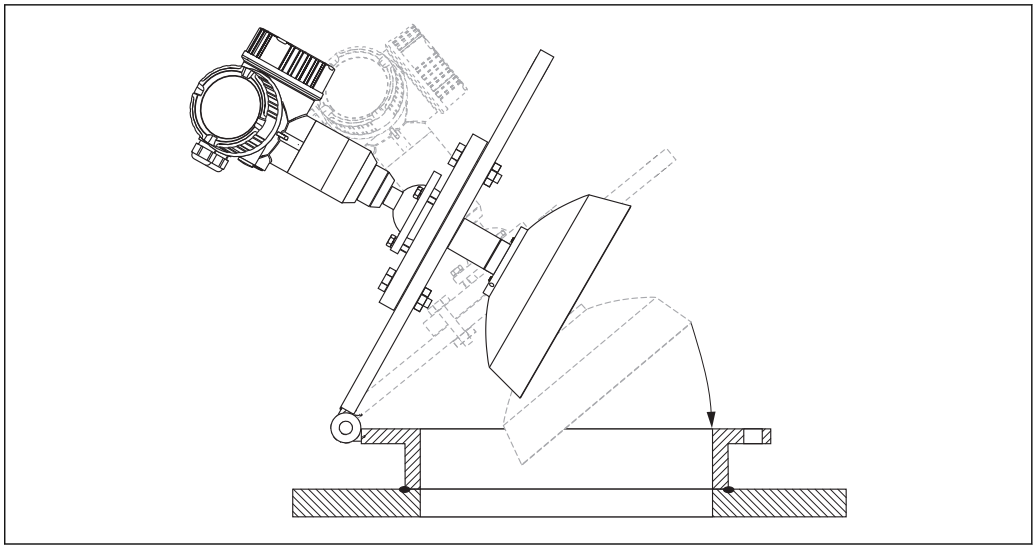
1 Nozzle

Antenna size	ϕD	H [1]
200 mm (8 in)	173 mm (6.81 in)	< 50 mm (1.96 in)
250 mm (10 in)	236 mm (9.29 in)	< 50 mm (1.96 in)

1) without antenna extension

Installation with hinged flange

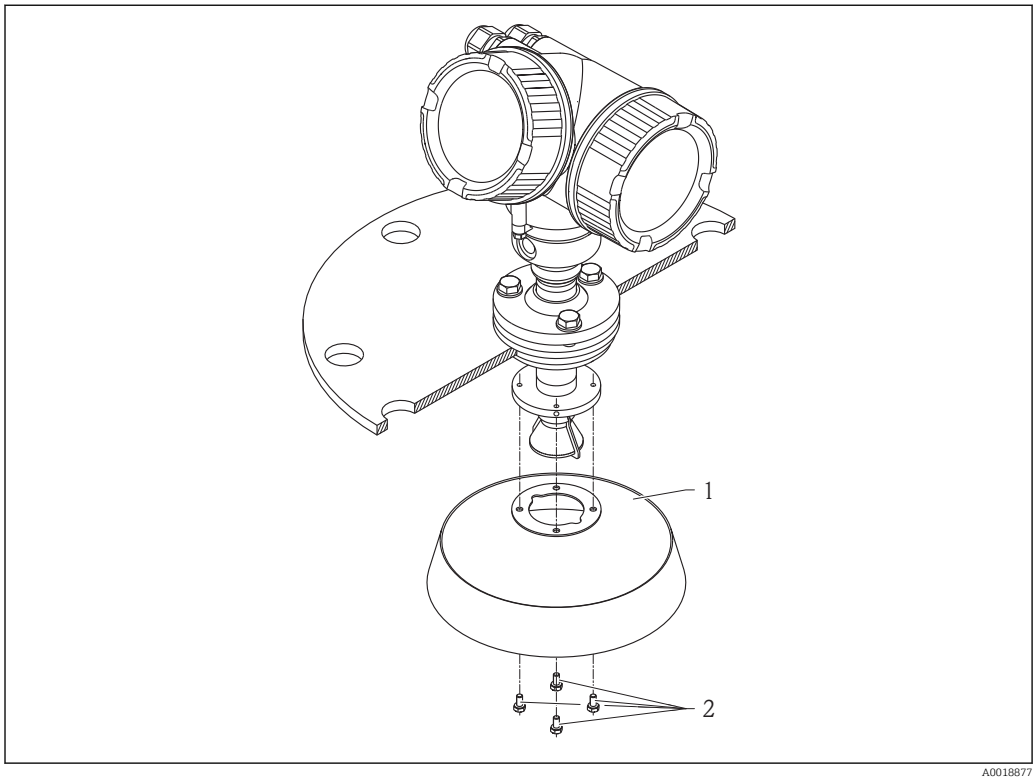
At hinged flanges, the length of the antenna must be taken into account.



A0018878

Dismantling the parabolic reflector

For installation in a nozzle, the parabolic reflector can be dismantled:

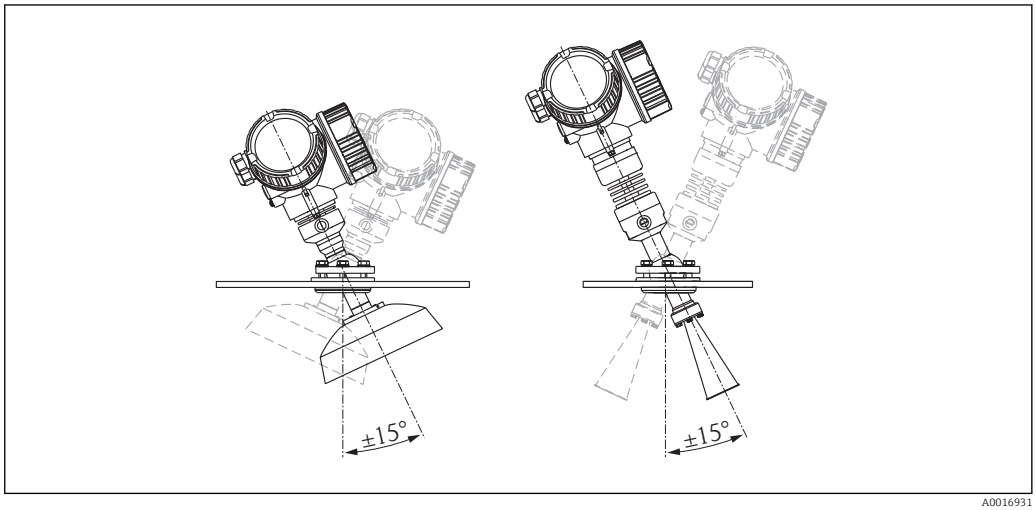


1 Parabolic reflector
2 4 bolts; torque: 3 Nm (2,2 lbf ft)

6.3.5 Alignment device for FMR57

Using the alignment device it is possible to tilt the antenna axis by up to 15° in all directions. The alignment device is used for the optimum alignment of the radar beam with the bulk solids surface.

Product structure: Feature 100 "Process connection", options XCJ, XEJ, XFJ



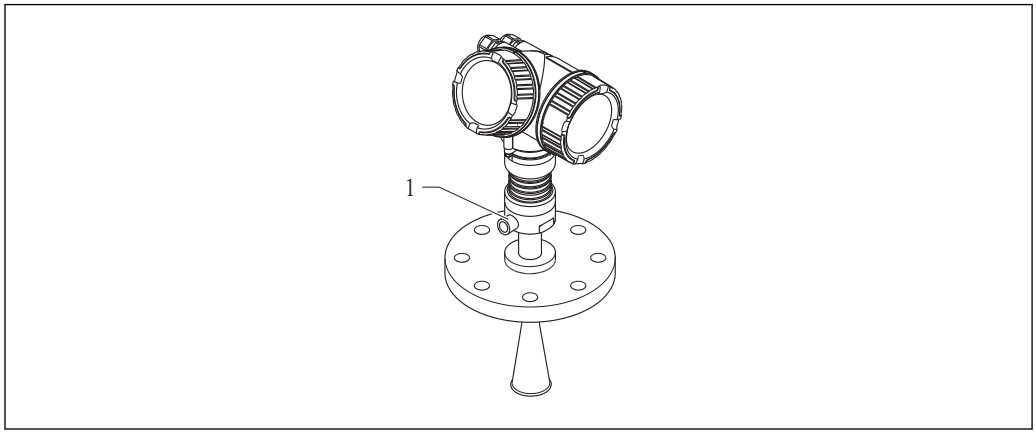
10 Micropilot FMR57 with alignment device

Align antenna axis:

1. Loosen screws.
2. Align antenna axis (up to. ± 15° in all directions).
3. Tighten screws with 15 Nm (11 lbf ft).

6.3.6 Integrated air purge connection for FMR57

In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna. Pulsed operation is recommended.



11 Micropilot FMR57 with air purge connection

1 Air purge connection NPT¼ or G¼

Pressure range of the purge air

- **Pulsed operation**:
  max. 6 bar (87 psi)
- **Permanent operation**:
  200 to 500 mbar (3 to 7.25 psi)

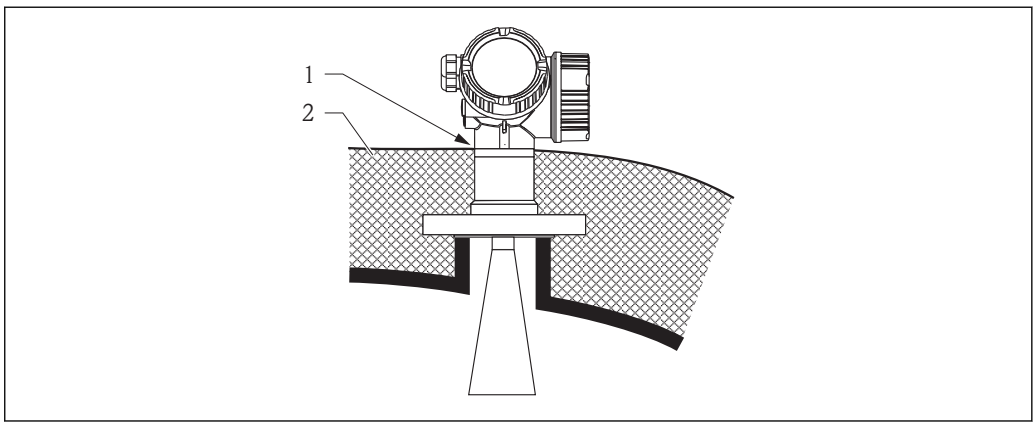
Connection of the purge air

- Tools:
  – open-end wrench 13mm (G 1/4)
  – open-end wrench 14 mm (NPT)
  – open end wrench 17 mm (NPT "adapter")
- min. torque: 6 Nm (4.4 lbf ft)
- max. torque: 7 Nm (5.2 lbf ft)

Make sure to use dry purge air.

In general, air purging should only be used as much as necessary, since too much air purging may cause mechanical damage (abrasion).

6.4 Vessels with heat insulation

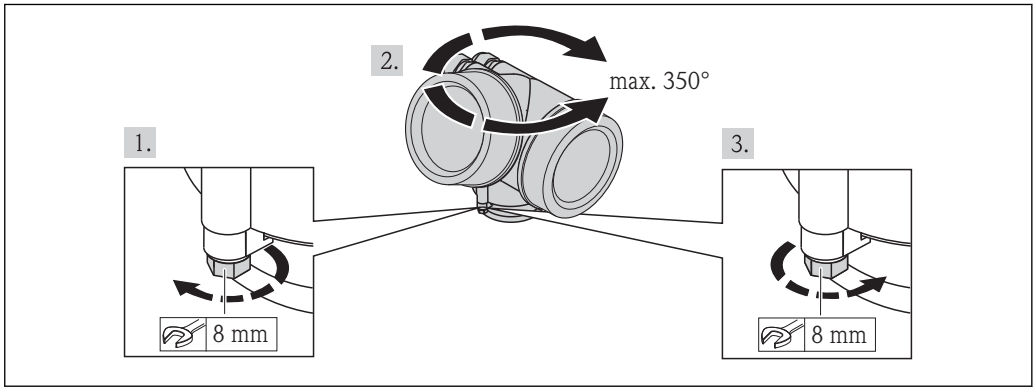


A0019142

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

6.5 Turning the transmitter housing

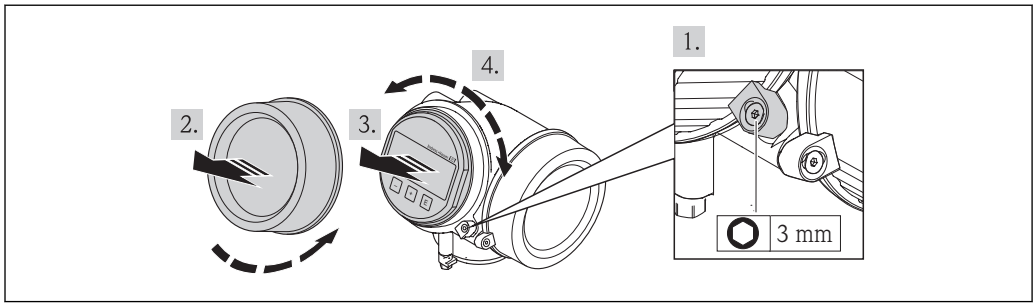
To provide easier access to the connection compartment or display module, the transmitter housing can be turned:



A0013713

1. Unscrew the securing screw using an open-ended wrench.
2. Rotate the housing in the desired direction.
3. Tighten the securing screw (1,5 Nm for plastics housing; 2,5 Nm for aluminium or stainless steel housing).

6.6 Turning the display module



A0013905

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

6.7 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 Cable specification

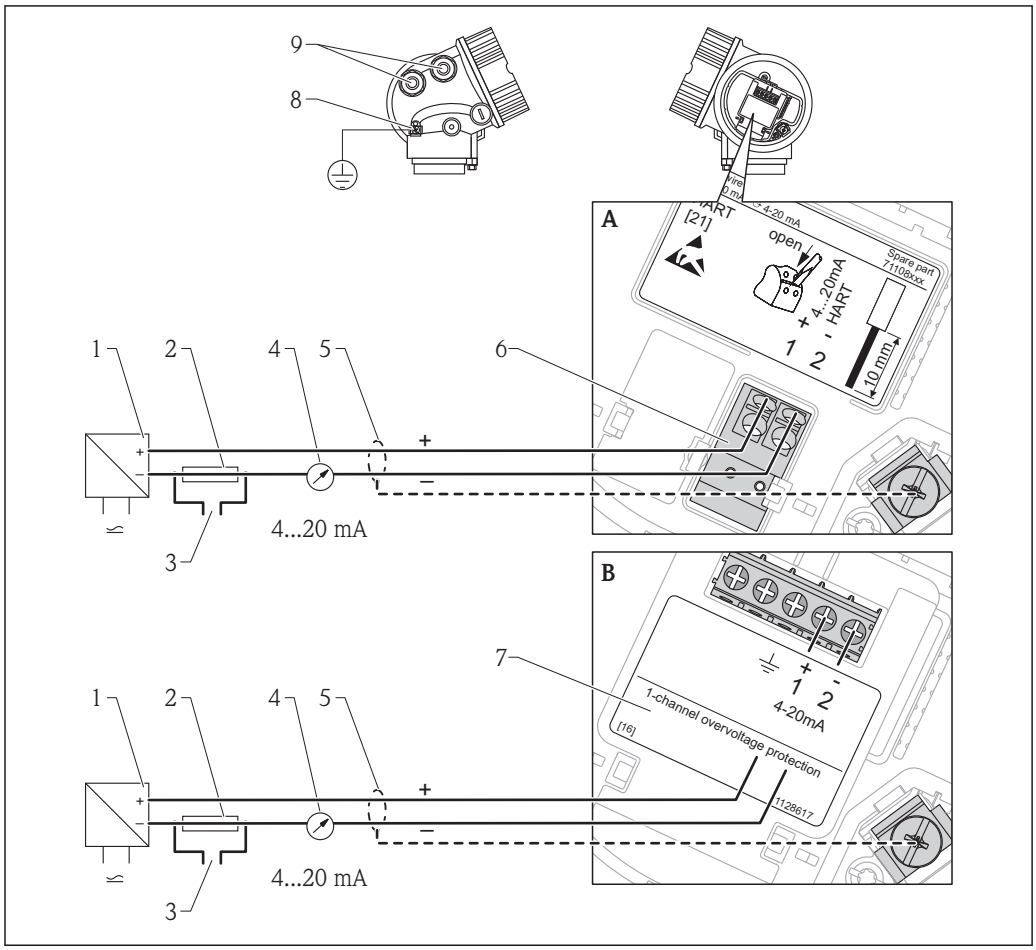
- Minimum cross-section: See the "Terminal" specification in the Technical Information for the device.
- For ambient temperature $T_U \geq 60$ °C (140 °F): use cable for temperature T_U +20 K.

HART

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

7.1.2 Terminal assignment

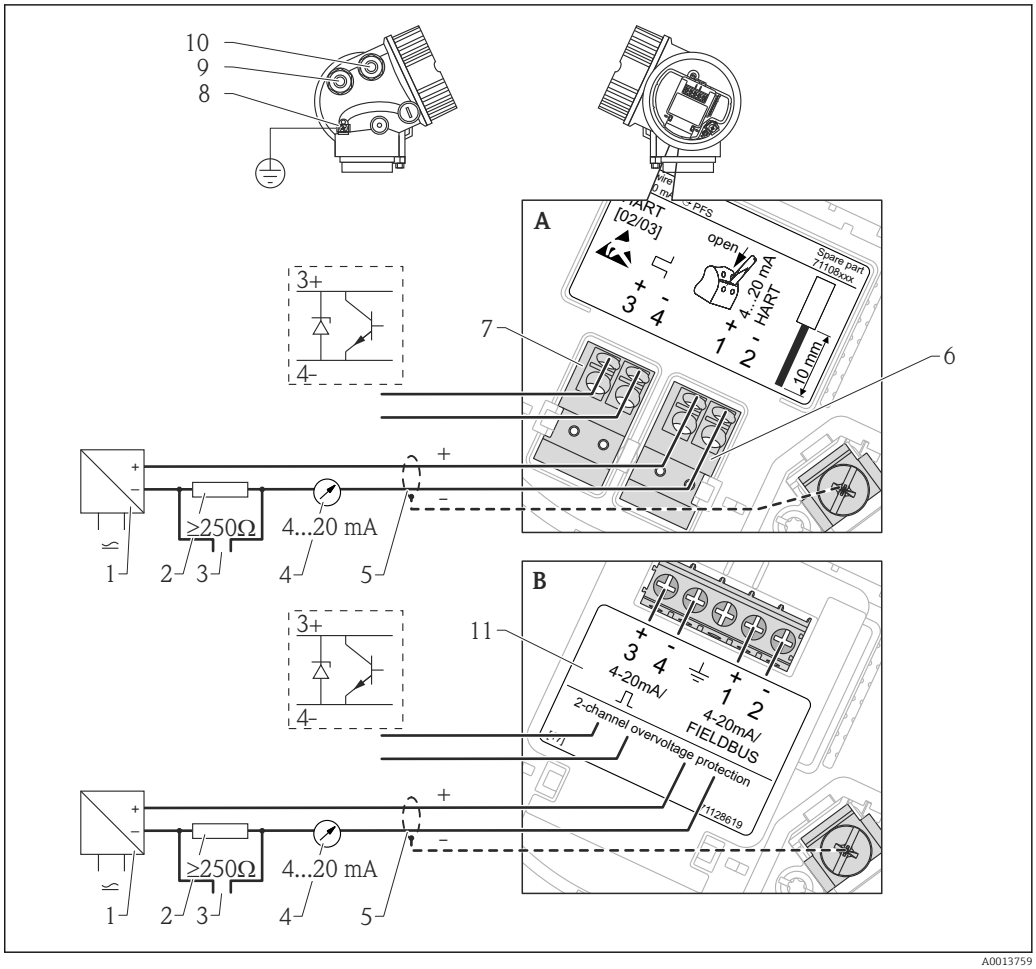
2-wire: 4-20mA HART



12 Terminal assignment 2-wire; 4-20mA HART

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage (→ 45)
2 HART communication resistor (≥250 Ω): Observe maximum load (→ 45)
3 Connection for Commubox FXA195 or FieldXpert SFX100 (via VIATOR Bluetooth modem)
4 Analog display device: Observe maximum load (→ 45)
5 Cable screen; observe cable specification (→ 37)
6 Terminals for 4-20mA HART (passive)
7 Overvoltage protection module
8 Terminal for potential equalization line
9 Cable entry

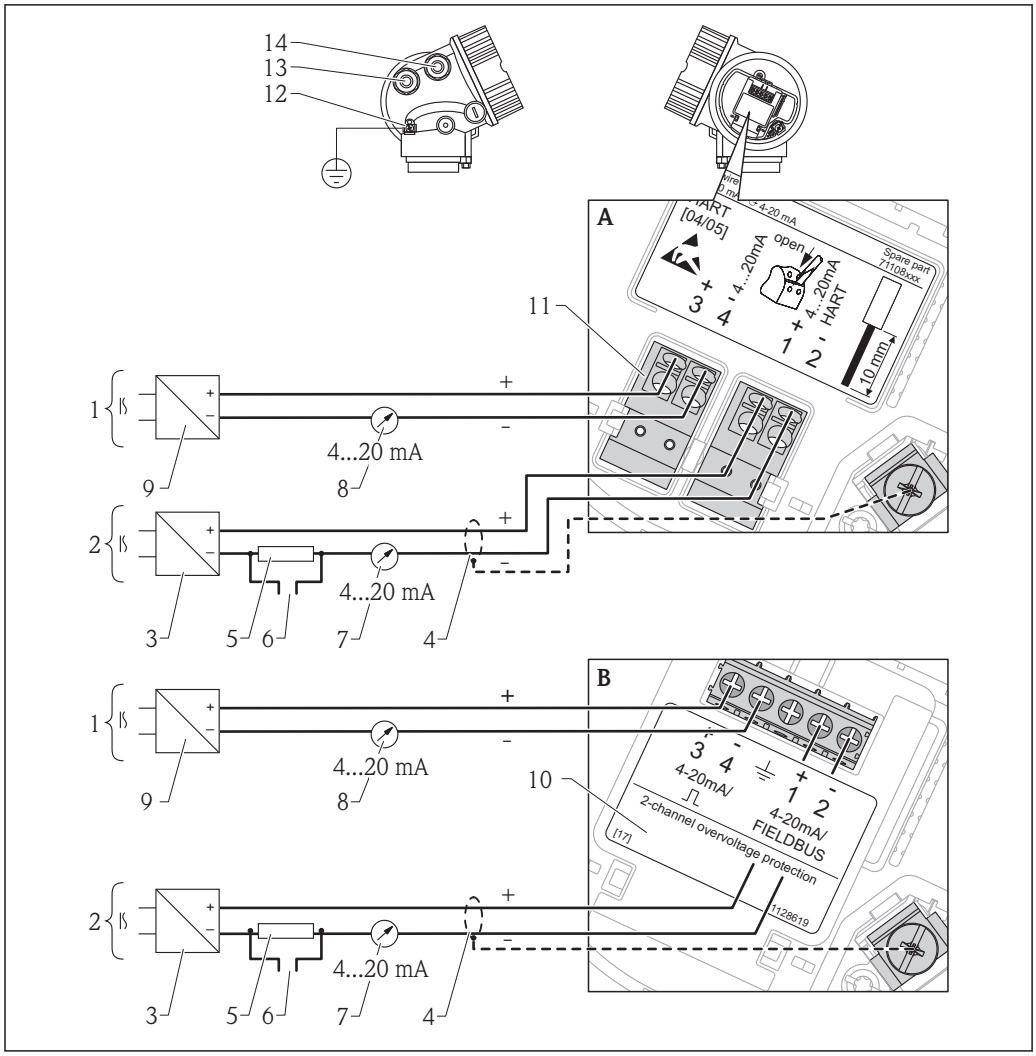
2-wire: 4-20mA HART, switch output



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

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Active barrier with power supply (e.g. RN221N): Observe terminal voltage (→ 45)
2 HART communication resistor (≥250 Ω): Observe maximum load (→ 45)
3 Connection for Commubox FXA195 or FieldXpert SFX100 (via VIATOR Bluetooth modem)
4 Analog display device: Observe maximum load (→ 45)
5 Cable screen; observe cable specification (→ 37)
6 Terminals for 4-20mA HART (passive)
7 Terminals for switch output (open collector)
8 Terminal for potential equalization line
9 Cable entry for 4-20mA HART line
10 Cable entry for switch output line
11 Overvoltage protection module

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

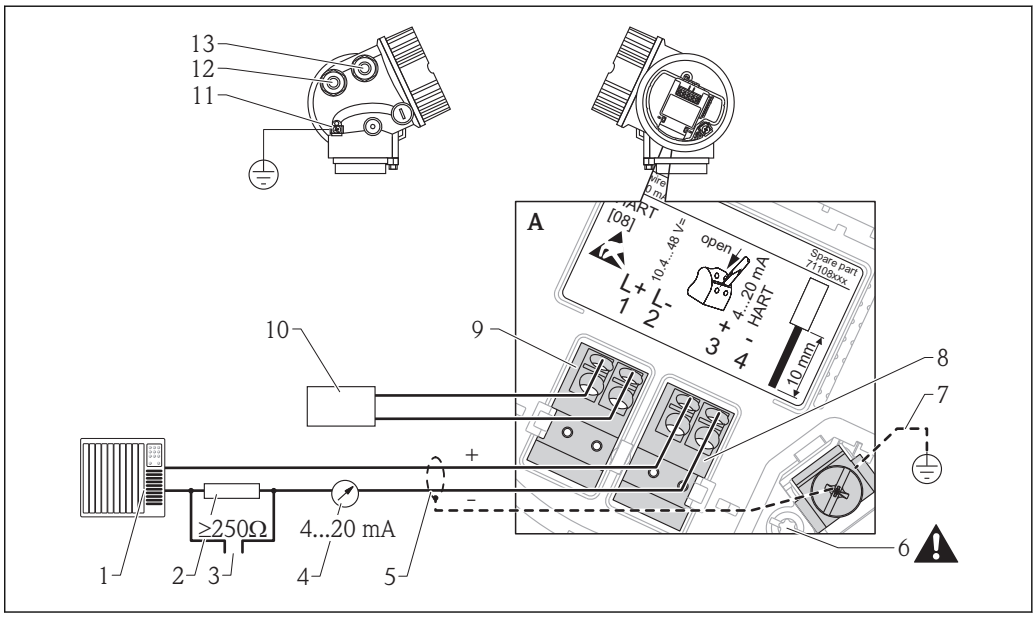


14 *Terminal assignment 2-wire, 4-20 mA HART, 4...20mA*

A Without integrated overvoltage protection
B With integrated overvoltage protection
1 Connection current output 2
2 Connection current output 1
3 Supply voltage for current output 1 (e.g. RN221N); Observe terminal voltage (→ 45)
4 Cable screen; observe cable specification (→ 37)
5 HART communication resistor (≥ 250 Ω): Observe maximum load (→ 45)
6 Connection for Commubox FXA195 or FieldXpert SFX100 (via VIATOR Bluetooth modem)
7 Analog display device ; observe maximum load (→ 45)
8 Analog display device ; observe maximum load (→ 45)
9 Supply voltage for current output 2 (e.g. RN221N); Obesrve terminal voltage (→ 45)
10 Overvoltage protection module
11 Terminals for current output 2
12 Terminal for the potential equalization line
13 Cable entry for current output 1
14 Cable entry for current output 2

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

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



A0011340

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

1 *Evaluation unit, e.g. PLC*
2 *HART communication resistor (≥250 Ω): Observe maximum load (→ 47)*
3 *Connection for Commubox FXA195 or FieldXpert SFX100 (via VIATOR Bluetooth modem)*
4 *Analog display device: Observe maximum load (→ 47)*
5 *Signal cable including screening (if required), observe cable specification (→ 37)*
6 *Protective connection; do not disconnect!*
7 *Protective earth, observe cable specification (→ 37)*
8 *Terminals for 4...20mA HART (active)*
9 *Terminals for supply voltage*
10 *Supply voltage: Observe terminal voltage (→ 47), observe cable specification (→ 37)*
11 *Terminal for potential equalization*
12 *Cable entry for signal line*
13 *Cable entry for power supply*

⚠ CAUTION

To ensure electrical safety:

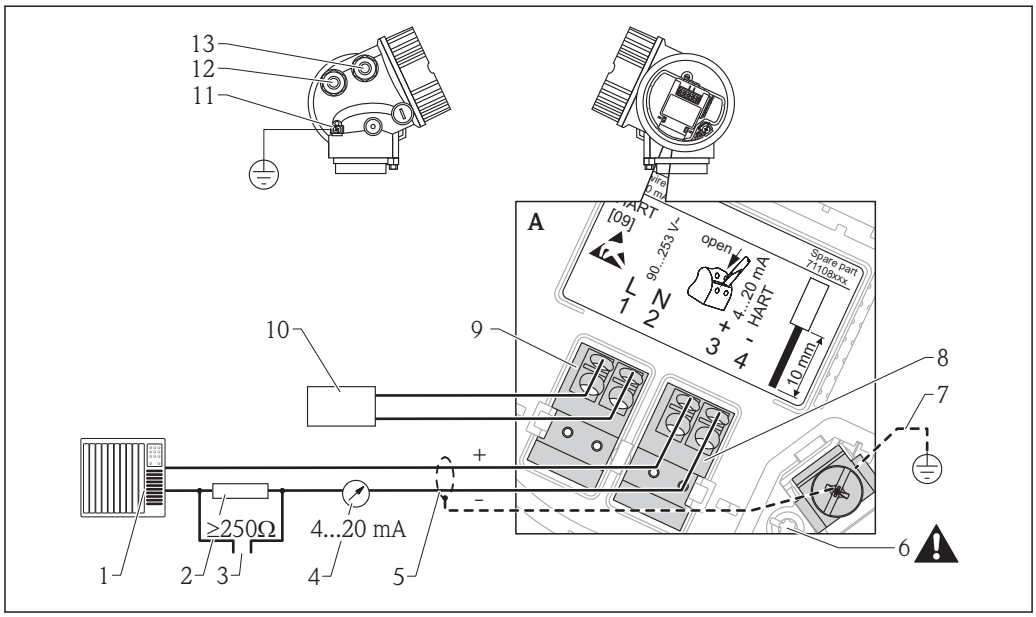
- Do not disconnect the protective connection (7).
- Disconnect the supply voltage before disconnecting the protective earth (8).

Connect protective earth to the internal ground terminal (8) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (12).

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

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

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



A0018965

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

1 *Evaluation unit, e.g. PLC*
2 *HART communication resistor (≥250 Ω): Observe maximum load (→ 47)*
3 *Connection for Commubox FXA195 or FieldXpert SFX100 (via VIATOR Bluetooth modem)*
4 *Analog display device: Observe maximum load (→ 47)*
5 *Signal cable including screening (if required), observe cable specification (→ 37)*
6 *Protective connection; do not disconnect!*
7 *Protective earth, observe cable specification (→ 37)*
8 *Terminals for 4...20mA HART (active)*
9 *Terminals for supply voltage*
10 *Supply voltage: Observe terminal voltage (→ 47), observe cable specification (→ 37)*
11 *Terminal for potential equalization*
12 *Cable entry for signal line*
13 *Cable entry for power supply*

⚠ CAUTION

To ensure electrical safety:

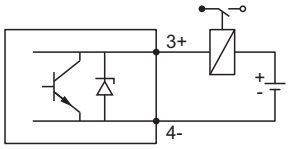
- ▶ Do not disconnect the protective connection (7).
- ▶ Disconnect the supply voltage before disconnecting the protective earth (8).

Connect protective earth to the internal ground terminal (8) before connecting the supply voltage. If necessary, connect the potential matching line to the external ground terminal (12).

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

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

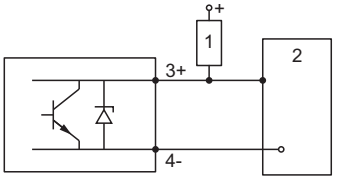
Connection examples for the switch output



A0015909

17 Connection of a relay

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



A0015910

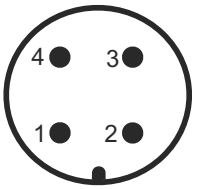
18 Connection of a digital input

1 Pull-up resistor
2 Digital input

7.1.3 Device plug connectors

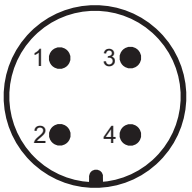
For the versions with fieldbus plug connector (M12 or 7/8"), the signal line can be connected without opening the housing.

Pin assignment of the M12 plug connector



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

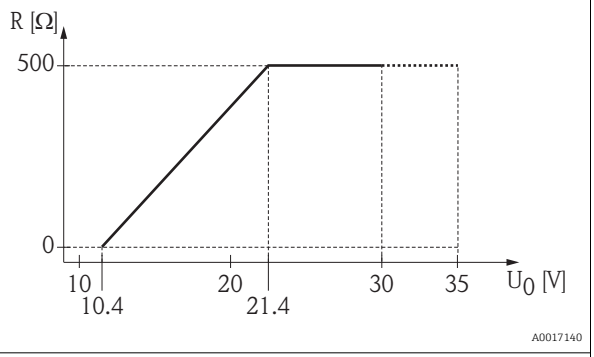
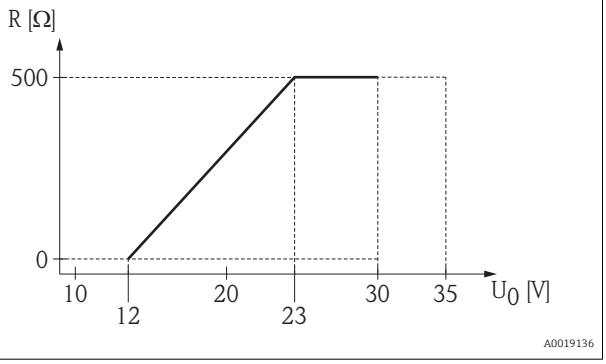
Pin assignment of the 7/8" plug connector



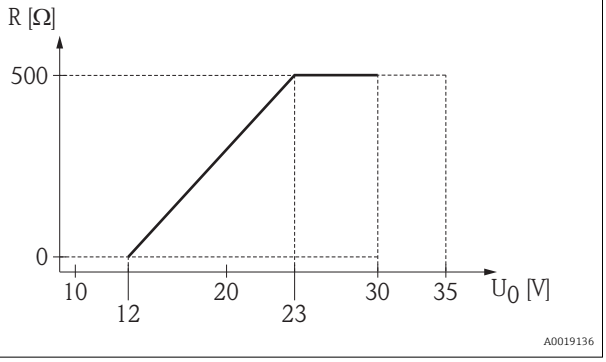
Pin	Meaning
1	Signal -
2	Signal +
3	Screen
4	Not connected

7.1.4 Supply voltage

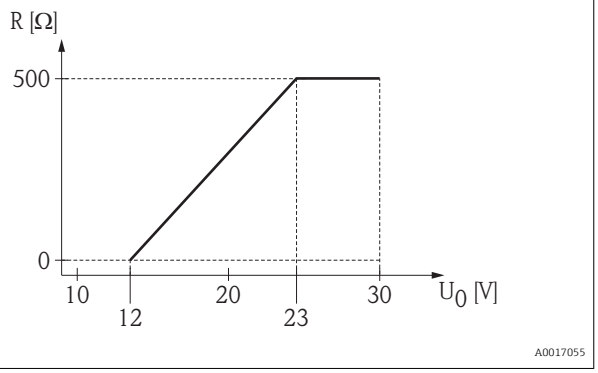
2-wire, 4-20mA HART, passive

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

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

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

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

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

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

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

4-wire, 4-20mA HART, active

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

1) Feature 020 of the product structure

7.1.5 Overvoltage protection

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

Integrated overvoltage protection

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

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

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

External overvoltage protection

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

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

7.2 Connecting the measuring device

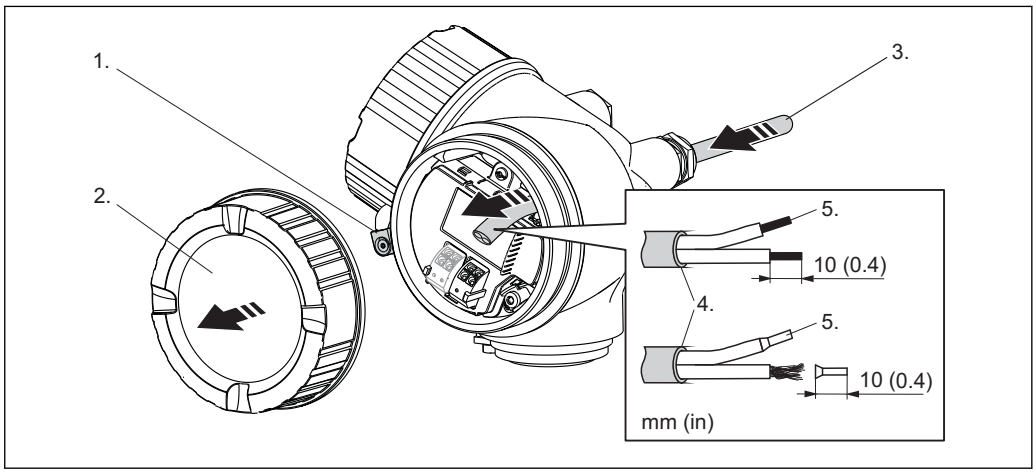
⚠ WARNING

Explosion hazard!

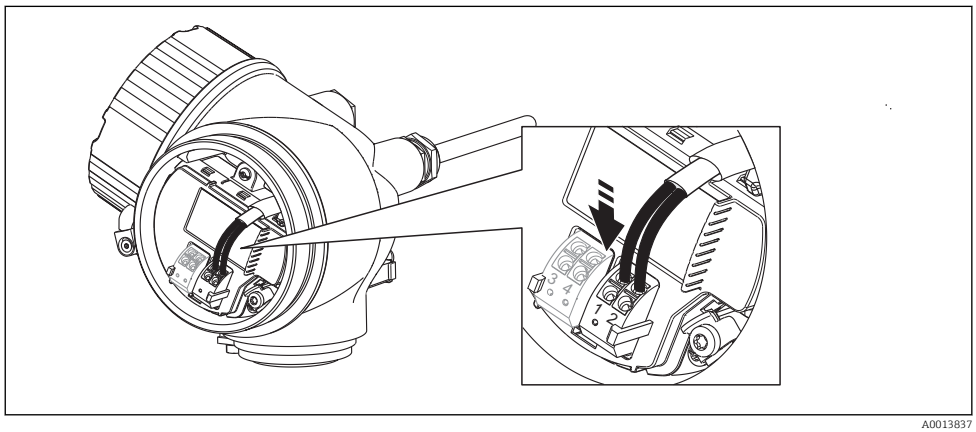
- ▶ Comply with the relevant national standards.
- ▶ Observe the specifications in the Safety Instructions (XA).
- ▶ Only use the specified cable glands.
- ▶ Check whether the supply voltage matches the specifications on the nameplate.
- ▶ Before connecting the device: Switch the supply voltage off.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

Required tools and accessories:

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



A0012619

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

A0013837

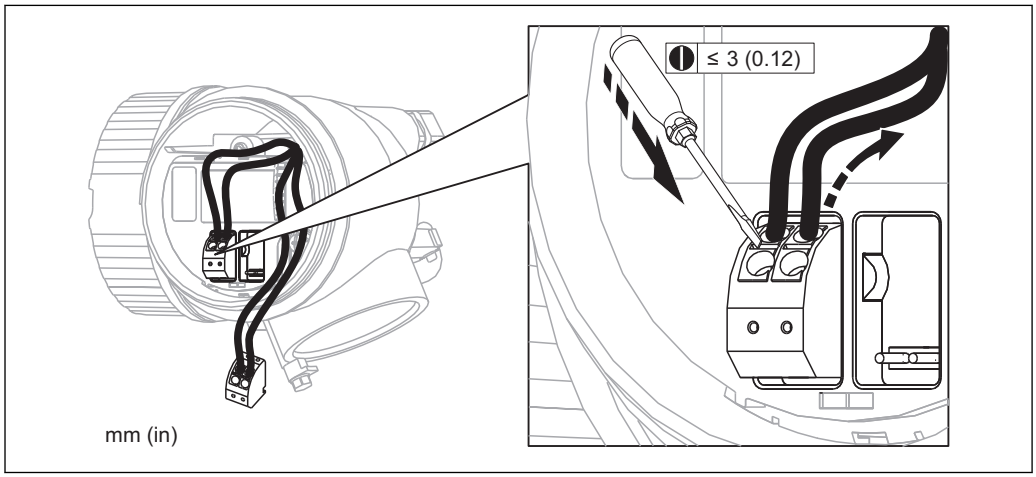
Connect the cable in accordance with the terminal assignment (→ 38).

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

Pluggable spring-force terminals

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

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



A0013661

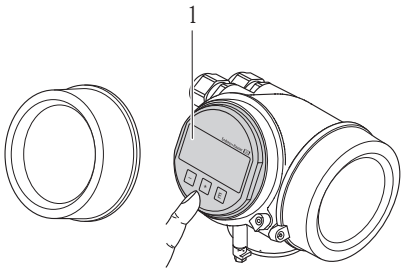
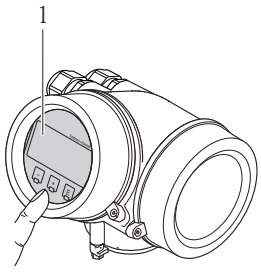
7.3 Post-connection check

❍	Are cables or the device undamaged (visual inspection)?
❍	Do the cables comply with the requirements?
❍	Do the cables have adequate strain relief?
❍	Are all cable glands installed, firmly tightened and correctly sealed?
❍	Does the supply voltage match the specifications on the transmitter nameplate?
❍	Is the terminal assignment correct (→ 🖹 38)?
❍	If required: Is the protective earth connected correctly (→ 🖹 38)?
❍	If supply voltage is present: Is the device ready for operation and do values appear on the display module?
❍	Are all housing covers installed and firmly tightened?
❍	Is the securing clamp tightened correctly?

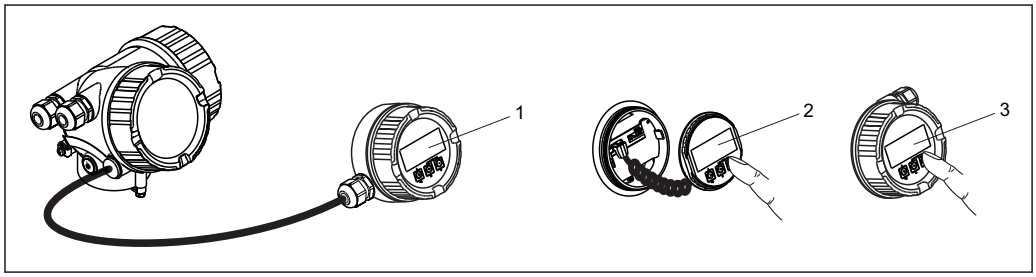
8 Operation options

8.1 Overview

8.1.1 Local operation

Order code for "Display; Operation", option **C** "SD02"	Order code for "Display; Operation", option **E** "SD03" (in preparation)
	
1 Operation with pushbuttons	*1 Operation with touch control*

8.1.2 Operation with remote display and operating module FHX50

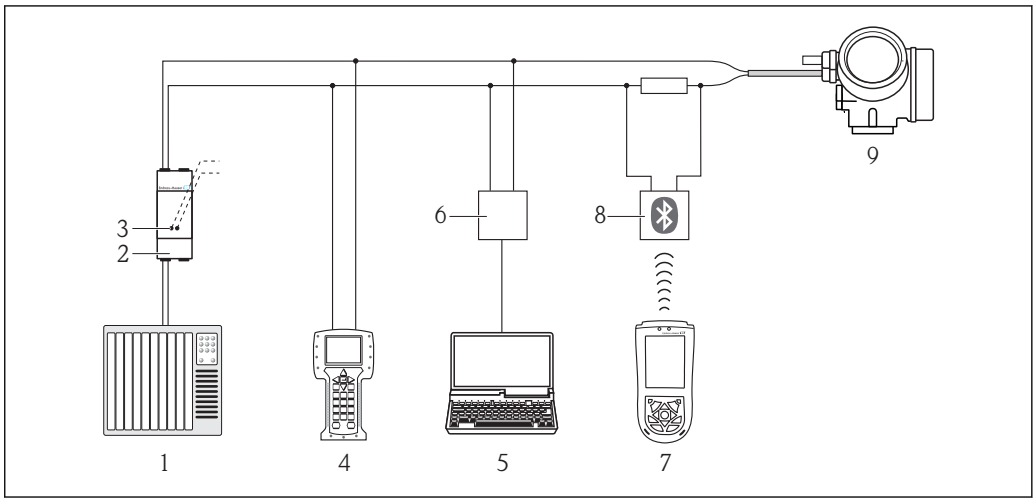


19 FHX50 operating options

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

8.1.3 Remote operation

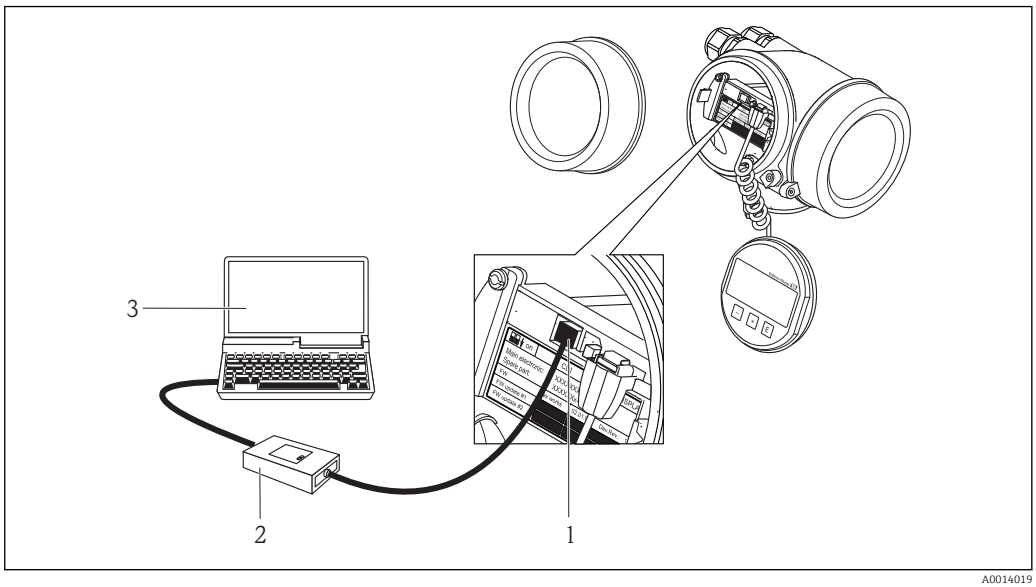
Via HART protocol



20 *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 375, 475*
5 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
6 *Commubox FXA191 (RS232) or FXA195 (USB)*
7 *Field Xpert SFX100*
8 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Via service interface (CDI)



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

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

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

1) In case of operation via operating tools (e.g. FieldCare), the "Language" parameter is located at "Setup → Advanced Setup → Display"
2) On entering the "Expert" menu, a 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 (→ 56).

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.
Navigation path: Setup → Advanced Setup → Access status display

8.2.3 Write protection via access code

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

Define access code

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

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

If no key is pressed for 10 minutes in the navigation and editing mode, the device automatically locks the write-protected parameters. If the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after 60 s.

- If write access is activated via access code, it can be also be deactivated only via the access code (→ 🖹 56).
- In the "Description of Device Parameters" documents, each write-protected parameter is identified with the 🔒-symbol.

8.2.4 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a device-specific access code and its value cannot be changed at the moment using the local display (→ 🖹 56).

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

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

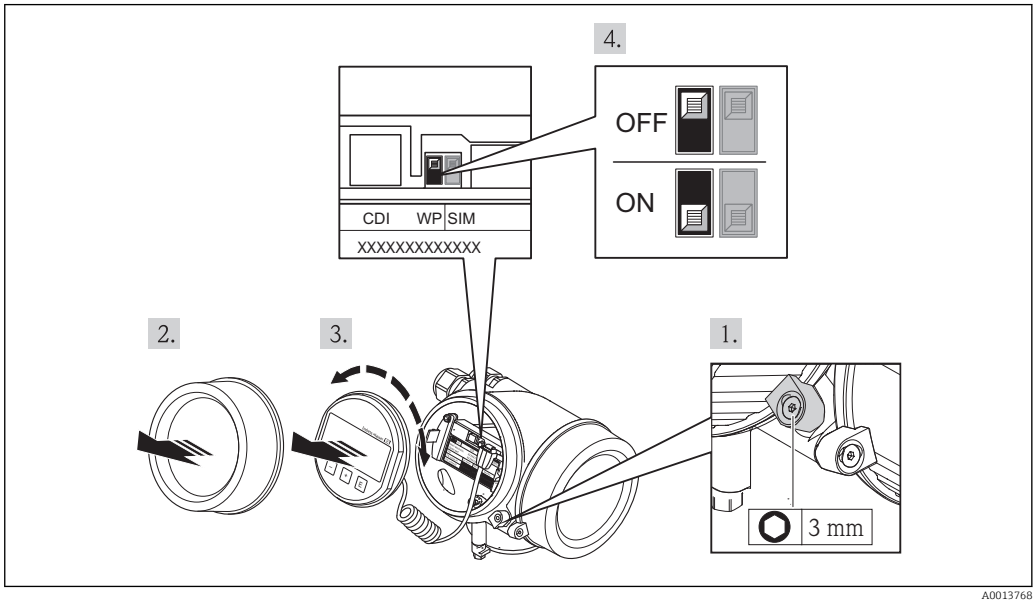
8.2.5 Deactivation of the write protection via access code

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

8.2.6 Write protection via lock switch

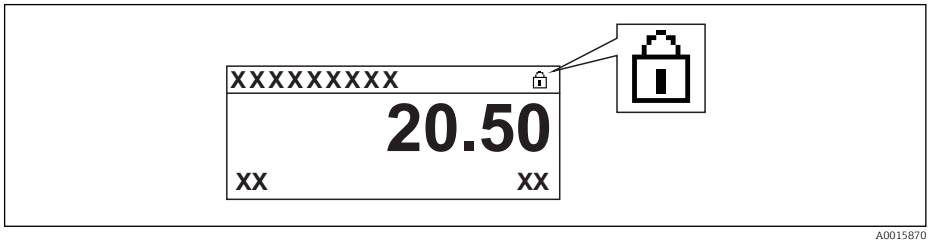
Unlike write protection via device-specific access code, this allows write access to the entire operating menu - other than the **Contrast display** parameter - to be locked.

The values of the parameters are still visible, but can no longer be changed (except for **Contrast display**), either via the local display, CDI interface or bus protocol.



A0013768

1. Loosening the securing clamp.
2. Unscrewing the electronics compartment cover.
3. Pull out the display module with a gentle rotation movement.
4. Installing the lock switch (WP) on the main electronics module in the ON position enables the hardware write protection. Installing the lock switch (WP) on the main electronics module in the OFF position (factory setting) disables the hardware write protection.
   ↳ If the hardware write protection is enabled, the 🔒-symbol appears in the header of the measured value display and in the navigation view in front of the parameters.



A0015870

   If the hardware write protection is disabled, the 🔓-symbol disappears in the header of the measured value display and in the navigation view in front of the parameters.
5. Feed the spiral cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment in the desired direction until it engages.
6. Screw the electronics compartment cover closed and tighten the securing clamp.

8.2.7 Enabling and disabling the keypad lock

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

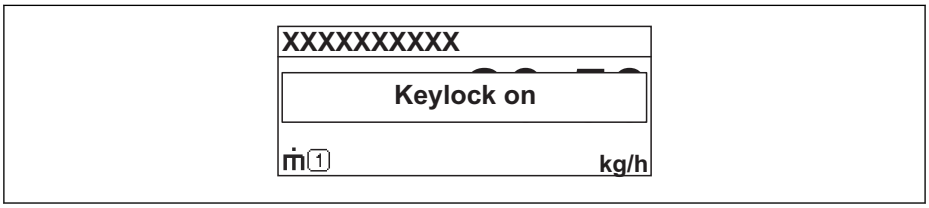
Keypad lock for display module SD02 (push buttons)

The keypad lock is enabled and disabled in the same way:

The user is in the measured value display.

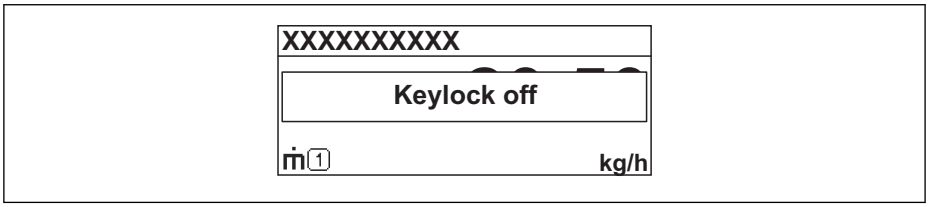
▶ By simultaneously pressing the ⊟ + ⊞ + Ⓔ keys.

↳ After enabling the keypad lock:



A0014000-EN

After disabling the keypad lock:



A0014001-EN

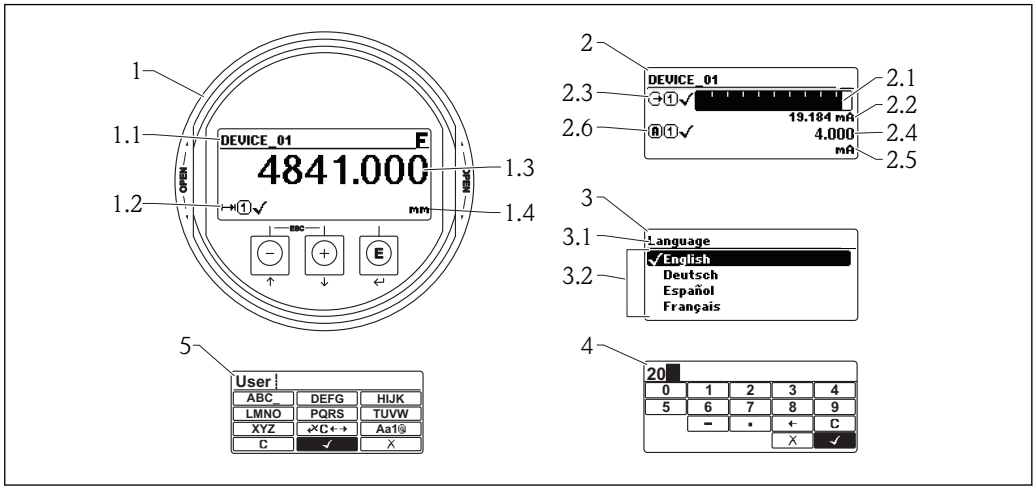
When attempting to access the operating menu while the keylock is enabled, the message "Keylock on" also appears.

Keypad lock for display module SD03 (optical keys)

in preparation

8.3 Display and operating module

8.3.1 Display appearance



A0012635

21 Appearance of the display and operation module for on-site operation

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

Display symbols for the submenus

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

Status signals

F A0013956	**"Failure"** A device error is present. The measured value is no longer valid.
C A0013959	**"Function check"** The device is in service mode (e.g. during a simulation).
S A0013958	**"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 A0013957	**"Maintenance required"** Maintenance is required. The measured value is still valid.

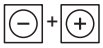
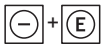
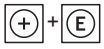
Display symbols for the locking state

Symbol	Meaning
 A0011978	**Display parameter** Marks display-only parameters which can not be edited.
 A0011979	**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.

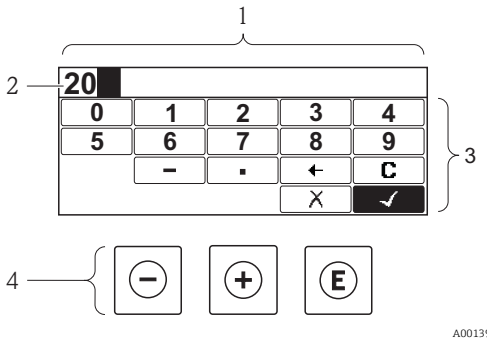
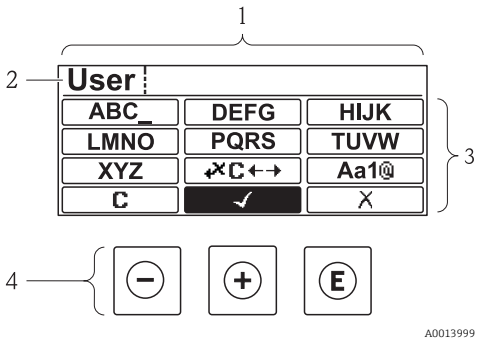
Measured value symbols

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

8.3.2 Operating elements

Key	Meaning
 A0013969	**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).
 A0013970	**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).
 A0013952	**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.
 A0013971	**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.
 A0013953	**Minus/Enter key combination (press and hold down the keys simultaneously)** Reduces the contrast (brighter setting).
 A0013954	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
 A0013955	**Minus/Plus/Enter key combination (press and hold down the keys simultaneously)** *For measured value display* Enables or disables the keypad lock.

8.3.3 Entering numbers and text

Numeric editor	Text editor
	

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

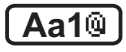
Input mask

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

Numeric editor symbols

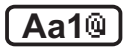
Symbol	Meaning
 A0013998	Selection of numbers from 0 to 9.
 A0016619	Inserts decimal separator at the input position.
 A0016620	Inserts minus sign at the input position.
 A0013985	Confirms selection.
 A0016621	Moves the input position one position to the left.
 A0013986	Exits the input without applying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

Text editor symbols

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

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

Operating symbols in the numeric editor		
 A0013985	 A0016621	 A0013986
Confirms selection.	Moves the input position one position to the left.	Exits the input without applying the changes.
 A0016619	 A0016620	 A0014040
Inserts decimal separator at the input position.	Inserts minus sign at the input position.	Clears all entered characters.

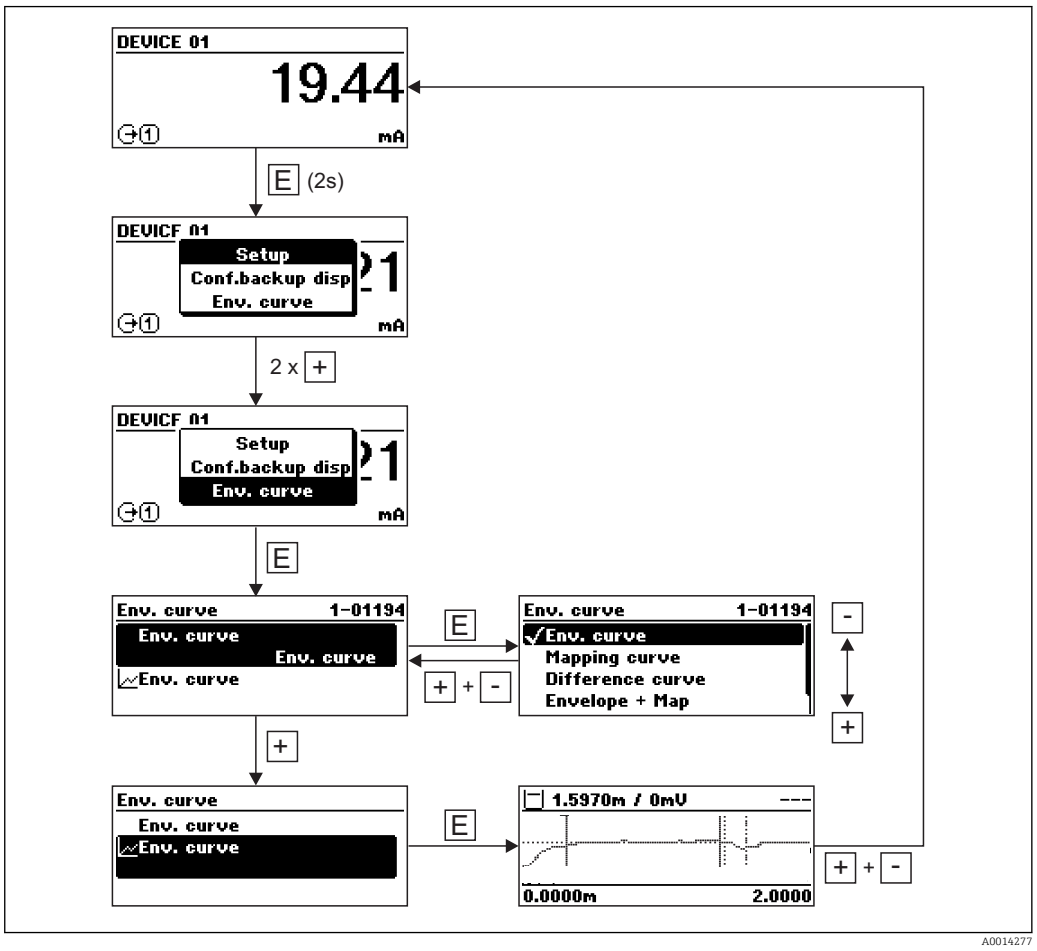
Operating symbols in the text editor		
 A0013985	 A0013987	 A0013986
Confirms selection.	Switches to the selection of the correction tools.	Exits the input without applying the changes.
 A0014040	 A0013981	
Clears all entered characters.	Toggle ▪ Between upper-case and lower-case letters ▪ For entering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

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

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

8.3.4 Envelope curve on the display and operating module

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



9 System integration via HART protocol

9.1 Overview of the Device Description files (DD)

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

9.2 Measured values via HART protocol

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

Device variable	Measuring value
Primary device variable (PV)	Level linearized
Secondary device variable (SV)	Distance
Third device variable (TV)	Absolute echo amplitude
Fourth device variable (QV)	Relative echo amplitude

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

10 Commissioning

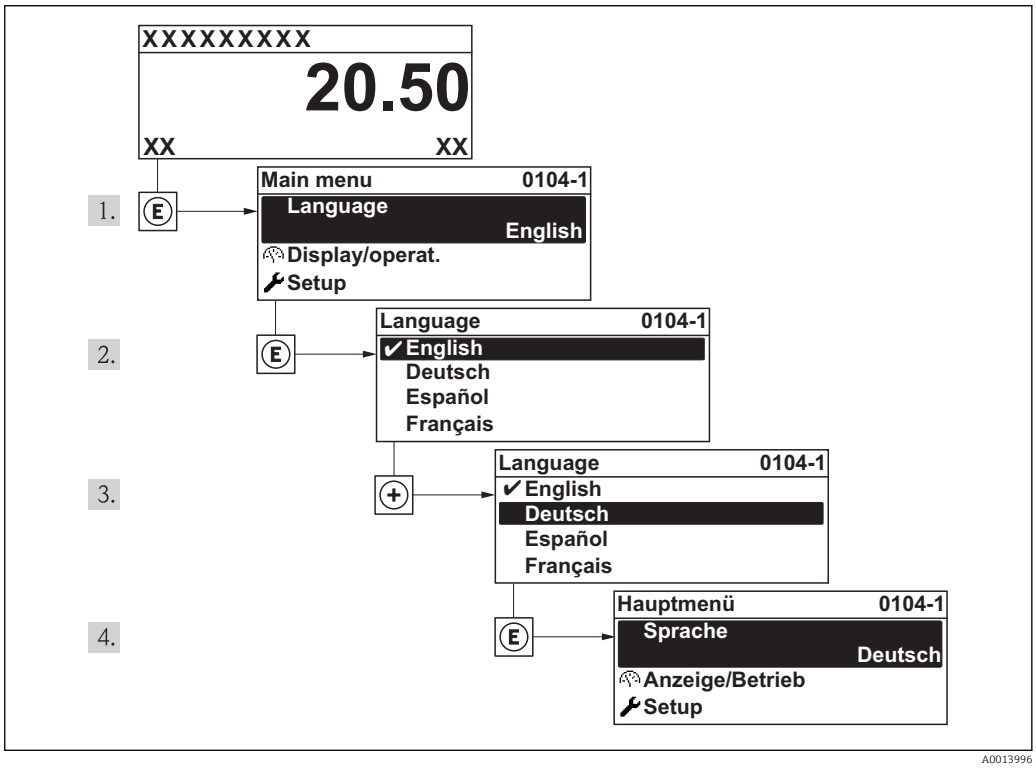
10.1 Installation and function check

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

- Checklist "Post-installation check" (→ 36)
- Checklist "Post-connection check" (→ 51)

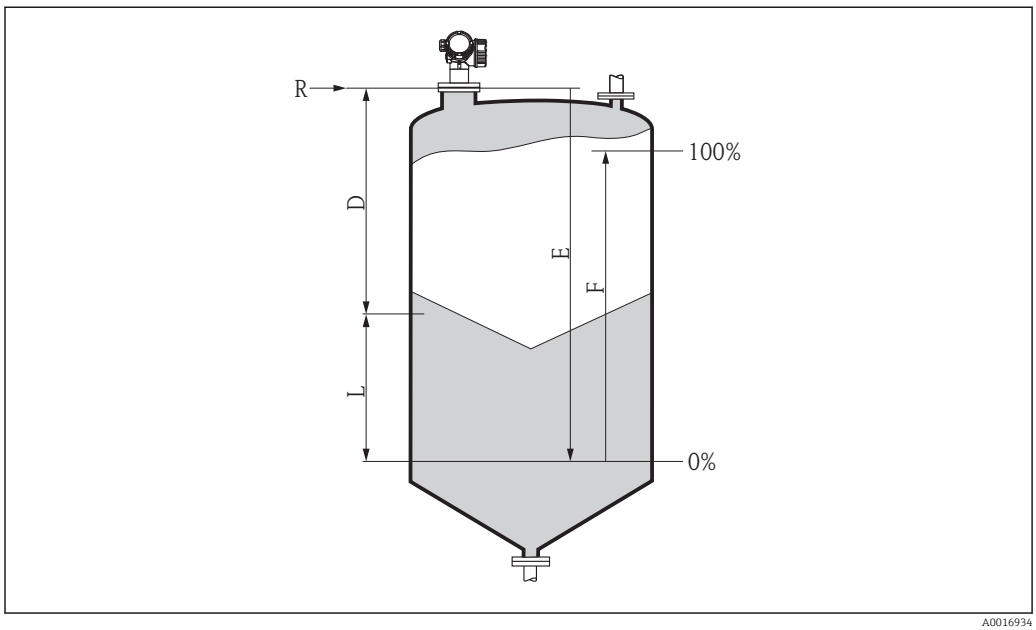
10.2 Setting the operating language

Factory setting: English or ordered local language



22 *Taking the example of the local display*

10.3 Configuration of a level measurement



1. **Setup → Device tag** (→ 94)
   ↳ Enter device tag.
2. **Setup → Distance unit** (→ 94)
   ↳ Select distance unit.
3. **Setup → Bin type** (→ 95)
   ↳ Select bin type.
4. **Setup → Max. filling speed solid** (→ 95)
   ↳ Enter maximum expected filling speed.
5. **Setup → Max. draining speed solid** (→ 95)
   ↳ Enter maximum expected draining speed.
6. **Setup → Empty calibration** (→ 96)
   ↳ Enter empty distance E (Distance from reference point R to the 0% level) [3].
7. **Setup → Full calibration** (→ 96)
   ↳ Enter full distance F (Distance from the 0% to the 100% level).
8. **Setup → Level** (→ 97)
   ↳ Indicates the measrued level L.
9. **Setup → Distance** (→ 97)
   ↳ Indicates the measured distance from the reference point R to the level L.
10. **Setup → Signal quality** (→ 98)
    ↳ Indicates the quality of the evaluated level echo.
11. **Setup → Mapping → Confirm distance** (→ 99)
    ↳ Compare distance indicated on the display to real distance in order to start the recording of an interference echo map.
12. **Setup → Advanced setup →Level → Level unit** (→ 103)
    ↳ Select level unit: %, m, mm, ft, in (Factory setting: %)

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

It is strongly recommended to adjust the maximum filling and draining speed to the actual process.

10.4 Configurationof the on-site display

10.4.1 Factory settings of the on-site display

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

10.4.2 Adjustment of the on-site display

The on-site display can be adjusted in the following menu:

Setup → ADvanced setup → Display (→ 🖹 121)

10.5 Configuration of the current outputs

10.5.1 Factory setting of the current outputs

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

1) for devices with 2 current outputs

10.5.2 Adjustment of the current outputs

The current outputs can be adjusted in the following menus:

Basic settings
Setup → Advanced setup → Current output 1/2 (→ 🖹 113)

Advanced settings
Expert → Output → Current output 1/2; see document "Description of Device parameters": GP01014F (HART)

10.6 Protection of the settings against unauthorized changes

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

- Write protection via parameter settings (→ 🖹 56)
- Write protection via locking switch (→ 🖹 57)

11 Diagnostics and troubleshooting

11.1 General trouble shooting

11.1.1 General errors

Error	Possible cause	Remedial action
Device does not respond.	Supply voltage does not match the value indicated on the nameplate.	Connect the correct voltage.
	The polarity of the supply voltage is wrong.	Correct the polarity.
	The cables do not contact the terminals properly.	Ensure electrical contact between the cable and the terminal.
Values on the display invisible	Contrast setting is too weak or too strong.	▪ Increase contrast by pressing ⊞ and Ⓔ simultaneously. ▪ Decrease contrast by pressing ⊟ and Ⓔ simultaneously.
	The plug of the display cable is not connected correctly.	Connect the plug correctly.
	Display is defective.	Replace display.
"Communication error" is indicated on the display when starting the device or connecting the display	Electromagnetic interference	Check grounding of the device.
	Broken display cable or display plug.	Exchange display.
Output current < 3.6 mA	Signal cable connection incorrect.	Check connection.
	Electronics is defective.	Replace electronics.
HART communication does not function.	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω)correctly (→ 🖹 38).
	Commubox connected incorrectly.	Connect Commubox correctly (→ 🖹 53).
	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 parameterization and adjust it if necessary (see table below).

11.1.2 Parametrization errors

Error	Possible cause	Remedy
Measured value incorrect	If measured distance (**Setup → Distance**) matches the real distance: Calibration error	▪ Check and adjust **Setup → Empty calibration** if necessary. ▪ Check and adjust **Setup → Full calibration** if necessary. ▪ Check and adjust linearization if necessary (**Setup → Advanced Setup → Linearization**).
	Wrong level correction	Enter correct value in **Setup → Advanced Setup → Level → Level correction**.
	If measured distance (**Setup → Distance**) does not match the real distance: Interference echo	Carry out tank mapping (**Setup → Mapping**).

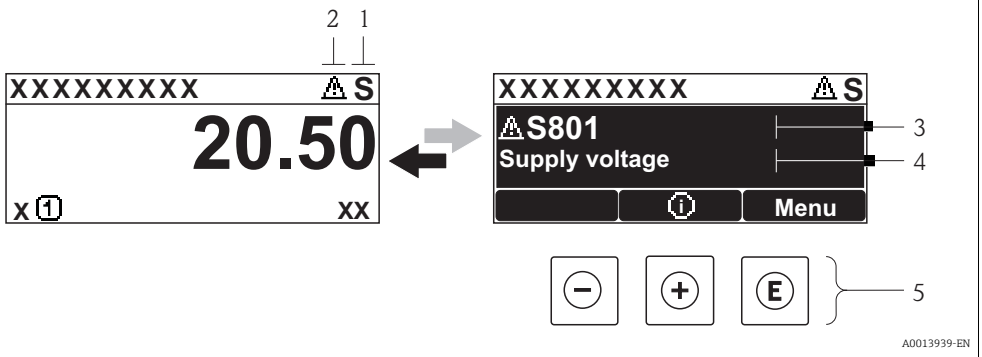
Error	Possible cause	Remedy
No change of measured value on filling / emptying	Interference echo from installations, nozzle or build-up on the antenna.	▪ Carry out tank mapping (**Setup → Mapping**). ▪ If possible, align antenna in the direction of the solid surface in order to prevent interference echoes. ▪ If necessary, clean antenna (purge air). ▪ If necessary, select a better mounting position and/or larger antenna.
During filling/emptying or measurement, the measured value jumps sporadically to a higher level.	Signal is weakened (e.g. by fluidisation of the surface, extreme dust formation) - the interference echoes are sometimes stronger. Strong build-up, filling stream in path of beam.	▪ Carry out tank mapping (**Setup → Mapping**). ▪ Increase integration time (**Expert → Sensor → Distance → Integration time**) ▪ Optimize alignment of antenna ▪ If necessary, select a better mounting position and/or larger antenna. ▪ If necessary, clean antenna (purge air).
Error message F941 or S941 "Echo lost"	Level echo is too weak. Possible causes: ▪ Fluidisation of the surface ▪ Extreme dust formation ▪ Angle or repose	▪ Optimize alignment of antenna ▪ If necessary, select a better mounting position and/or larger antenna.
Measured values jumps to higher levels and remains there.	▪ Build-up at container ▪ Build-up at antenna ▪ Strong condensate formation at antenna	▪ Periodic cleaning ▪ Carry out tank mapping (**Setup → Mapping**). ▪ Increase integration time (**Expert → Sensor → Distance → Integration time**) ▪ Optimize alignment of antenna ▪ If necessary, select a better mounting position and/or larger antenna.
Device displays a level when the tank is empty.	Interference echo	Carry out mapping over entire measuring range when the silo is empty (**Setup → Mapping**).
Wrong slope of the level throughout the complete measuring range	Bin property or process propertis incorrect	▪ Select the correct option in **Setup → Bin type** ▪ Enter the actual values in **Max filling speed solid** and **Max. draining speed solid** (both in the **Setup** menu).

11.2 Diagnostic information on local display

11.2.1 Diagnostic message

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

Measured value display in alarm condition	Diagnostic message



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

Status signals

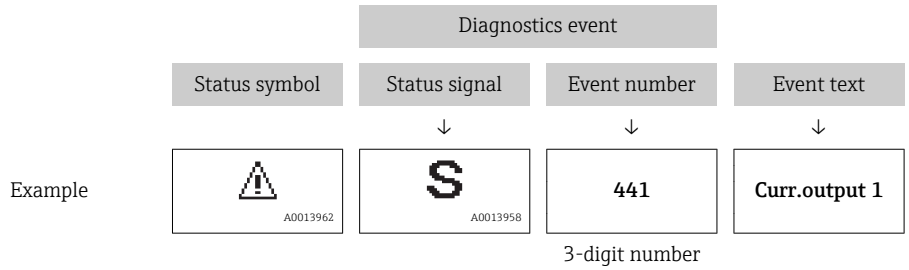
F A0013956	**"Failure"** A device error is present. The measured value is no longer valid.
C A0013959	**"Function check"** The device is in service mode (e.g. during a simulation).
S A0013958	**"Out of specification"** The device is operated: ▪ Outside of its technical specifications (e.g. during startup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

Status symbol (symbol for event level)

A0013961	**"Alarm" status** The measurement is interrupted. The signal outputs take on the defined alarm condition. A diagnostic message is generated.
A0013962	**"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.



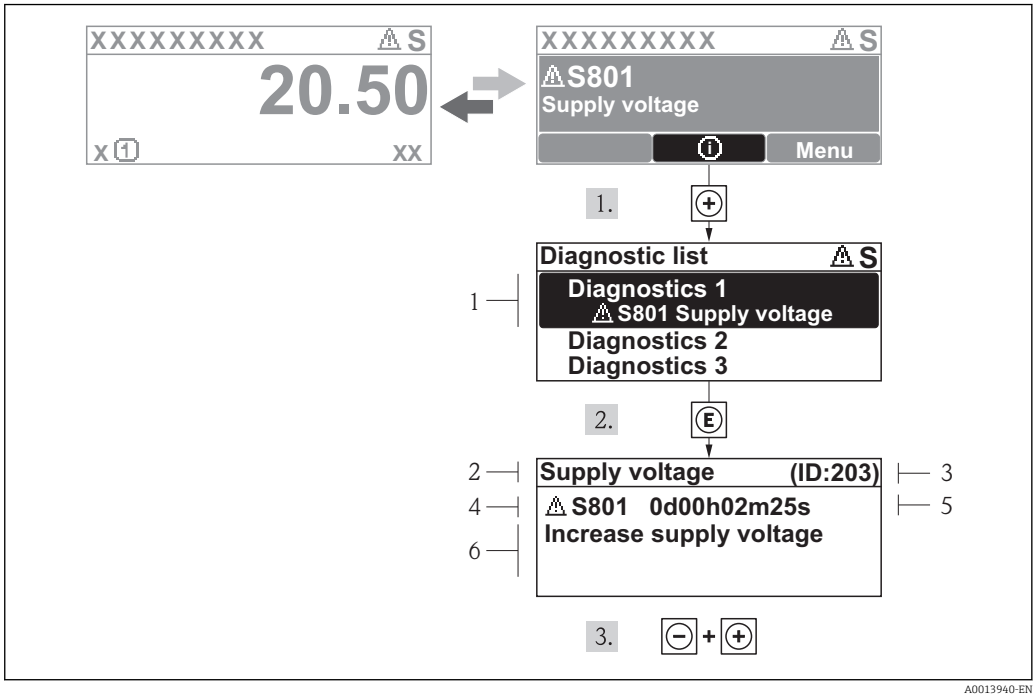
If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in the **Diagnostics list** submenu (→ 134).

Past diagnostic messages that are no longer pending are shown in the **Event logbook** submenu (→ 135).

Operating elements

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

11.2.2 Calling up remedial measures



23 Message for remedial measures

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

The user is in the diagnostic message.

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

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

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

11.3 Diagnostic event in the operating tool

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

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

Calling up remedial measures

1. Navigate to the "Diagnostics" menu.
   ↳ In the "Actual diagnostics" parameter, the diagnostic event is shown with event text.
2. On the right in the display range, hover the cursor over the "Actual diagnostics" parameter.
   ↳ A tool tip with remedial measures for the diagnostic event appears.

11.4 Diagnostic list

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

Navigation path
Diagnostics → Diagnostics 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.

About the structure of the remedial measure message (→ 🖹 75)

11.5 Ovewrview of diagnostic information

11.5.1 Sensor element failures

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
F002	Sensor unknown	1. Check sensor 2. Change sensor	Alarm
F022	Temperature sensor	1. Change main electronic module 2. Change sensor	Alarm
F082	Data storage	1. Change main electronic module 2. Change sensor	Alarm
F083	Sensor memory content	1. Restart device 2. Restore S-Dat data 3. Change sensor	Alarm

11.5.2 Electronic failures

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
F242	Software incompatible	1. Check software 2. Flash or change main electronics module	Alarm
F252	Modules incompatible	1. Check electronic odules 2. Change I/O or main electronic module	Alarm

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
F261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O module or main elecronics	Alarm
F262	Module connection	1. Check module connections 2. Change electronic modules	Alarm
F270	Main electronic failure	Change main electronic module	Alarm
F271	Main electronic failure	1. Restart device 2. Change main electronic module	Alarm
F272	Main electronic failure	1. Restart device 2. Contact service	Alarm
F273	Main electronic failure	1. Emergency operation via display 2. Change main electronics	Alarm
F275	I/O module failure	Change I/O module	Alarm
F276	I/O module failure	1. Restart device 2. Change I/O module	Alarm
F282	Electronic memory	1. Restart device 2. Contact service	Alarm
F283	Memory content	1. Transfer data or reset device 2. Contact service	Alarm
F311	Electronic failure	1. Transfer date or reset device 2. Contact service	Alarm
M311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact service	

11.5.3 Configuration failures

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
F410	Data transfer	1. Check connection 2. Retry data transfer	Alarm
C411	Up-/Download	Up-/download active, please wait	Warning
C431	Trim	Carry out trim	Warning
F435	Linearization	Check linearization table	Alarm
F437	Configuration incompatible	1. Restart device 2. Contact service	Alarm
M438	Data set	1. Check data set file 2. Chekc device configuration 3. Up- and download new configuration	Warning
S441	Current output	1. Check process 2. Check current output settings	Warning
F484	Simulation failure mode	Deactivate simulation	Alarm
C485	Simulation measured value	Dectivate simulation	Warning
C491	Simulation current output	Deactivate simulation	Warning
C494	Simulation switch output	Deactivat simulation switch output	Warning

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
C585	Simulation distance	Deactivate simulation	Warning
C586	Record map	Recording of mapping: please wait	Warning

11.5.4 Process induced failures

Diagnostic event		Maintenance instructions	Error behavior
Code	Description		
F801	Energy too low	Increase supply voltage	Warning
M803	Current loop	1. Check wiring 2. Change I/O module	Alarm
F825	Operating temperature	1. Check ambient temperature 2. Check process temperature	Alarm
S825	Operating temperature	1. Check ambient temperature 2. Check process temperature	Warning
S921	Change of reference	1. Check reference configuration 2. Check pressure 3. Check sensor	Warning/ Alarm
S941	Echo lost	Check parameter "DC value"	Warning/ Alarm
S942	In safety distance	1. Check level 2. Check safety distance 3. Reset self holding	Warning/ Alarm
S943	In blocking distance	Reduced accuracy: check level	Warning
M950	Advanced diagnostics occured	Maintain your diagnostic event	Warning
S968	Level limited	1. Check level 2. Check limit parameters	Warning
F970	Linearization	1. Check level 2. Check linearization settings	Alarm

11.6 Event logbook

11.6.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Events list** submenu.

Navigation path
Diagnostics → Event logbook → Events list

A maximum of 20 event messages can be displayed in chronological order. If the advanced HistoROM function is enabled in the device (order option), up to 100 entries can be displayed.

The event history includes entries for:
- Diagnostic events
- Information events

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

Calling up and closing the remedial measures

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

11.6.2 Filtering the event logbook

Using the **Filter options** parameter, you can define which category of event messages is displayed in the **Events 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 (I)

11.6.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnose list.

Information event	Event text
I1000	-------- (device OK)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Trend data deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1185	Display backup done
I1186	Restore via display done

Information event	Event text
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed

11.7 Firmware-Historie

Date	Firmware version	Modifications	Documentation (FMR56/FMR57, HART)			
			CD-ROM	Operating Instructions	Description of Parameters	Technical Information
12.2012	01.00.zz	Original software	CD00521F/00/A2/01.12	BA01048F/00/EN/01.12	GP01014F/00/EN/01.12	TI01042F/00/EN/01.12

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

12 Maintenance

The measuring device requires no special maintenance.

12.1 Exterior cleaning

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

12.2 Replacing seals

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

13 Repairs

13.1 General information on repairs

13.1.1 Repair concept

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

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

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

13.1.2 Repairs to Ex-approved devices

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

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

13.1.3 Replacement of an electronics module

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

13.1.4 Replacement of a device

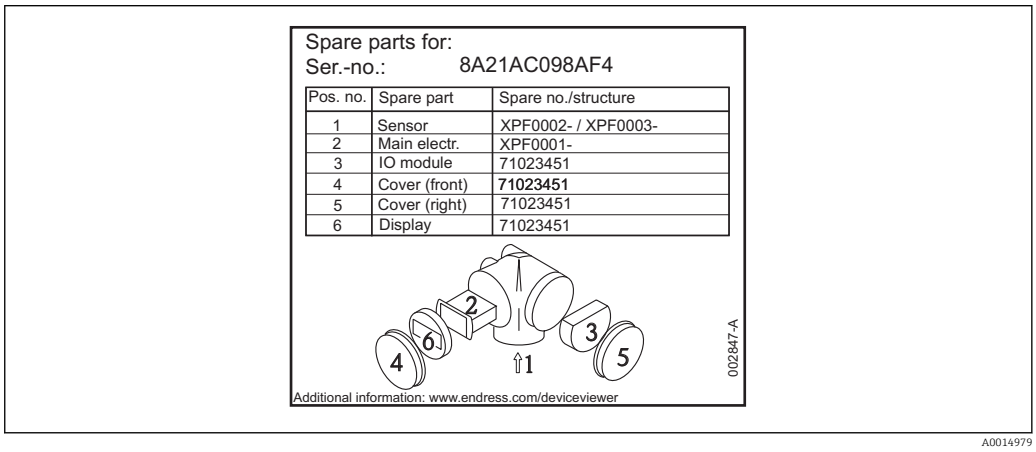
After a complete device or electronic module has been replaced, the parameters can be downloaded into the instrument again in one of the following ways:

- Via the display module
  Condition: The configuration of the old device has been saved in the display module (→ 🖹 128).
- Via FieldCare
  Condition: The configuration of the old device has been saved to the computer via FieldCare.

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

13.2 Spare parts

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



24 Example for spare part nameplate in connection compartment cover

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

13.3 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

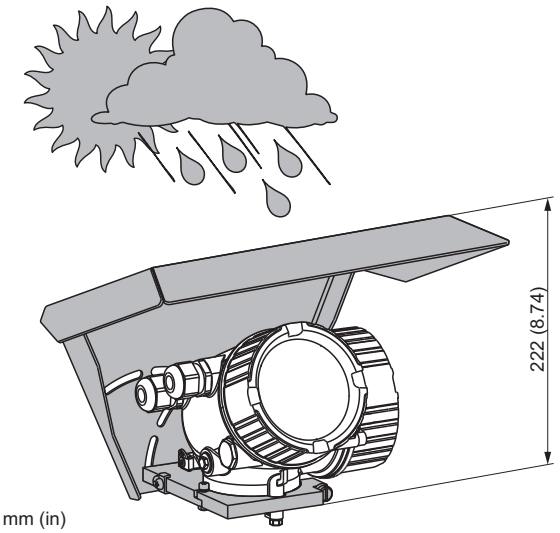
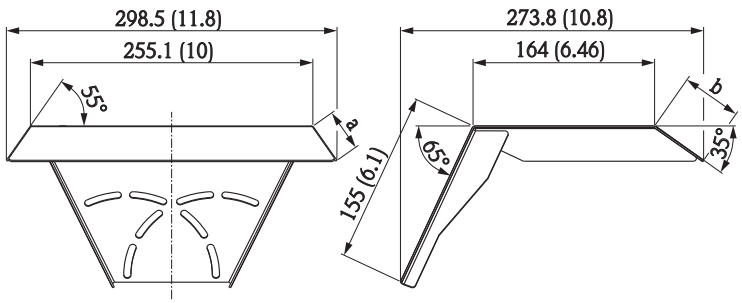
To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at
www.services.endress.com/return-material

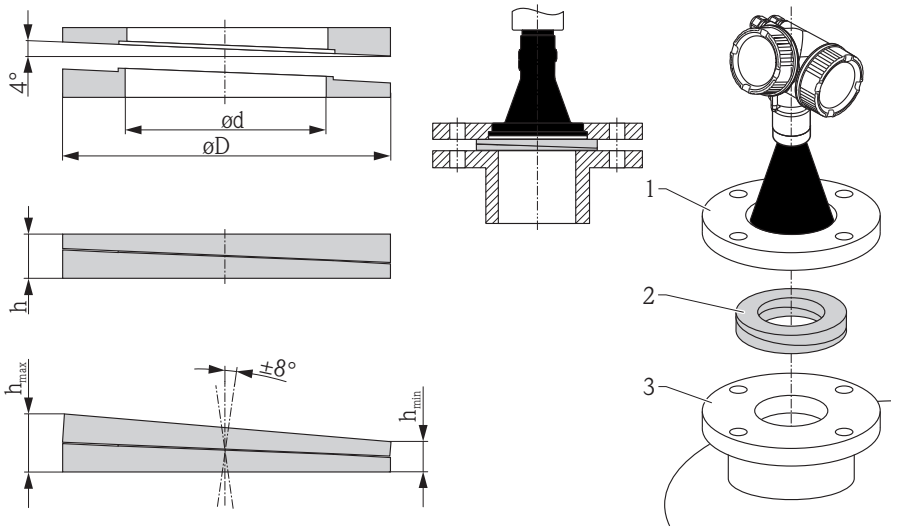
13.4 Disposal

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

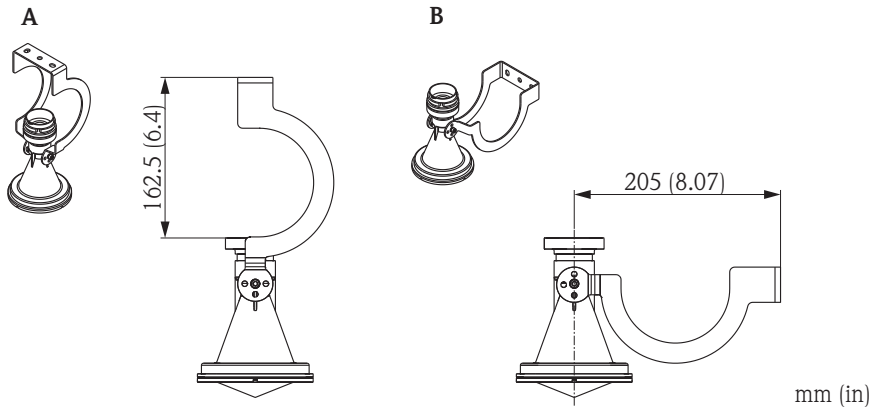
14 Accessories

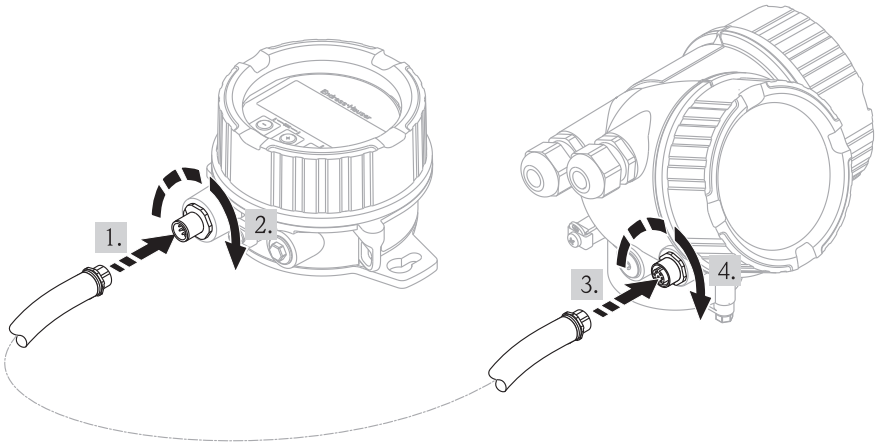
14.1 Device-specific accessories

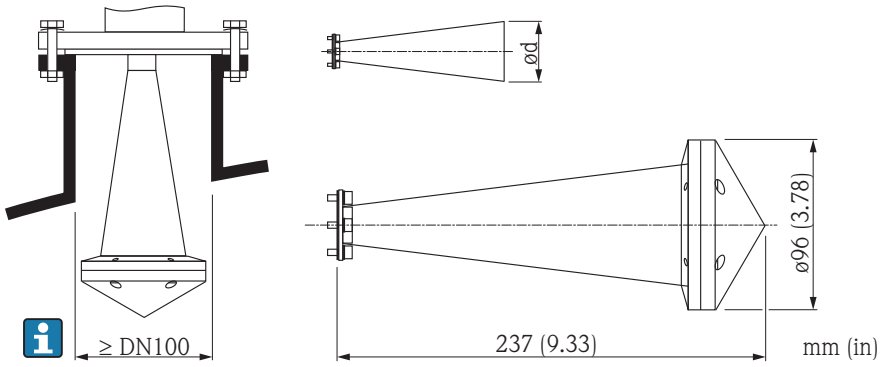
Accessory	Description
Weather protection cover	 mm (in) A0015466  mm (in) A0015472 *a* 37.8 mm (1.49 in) *b* 54 mm (2.13 in) The weather protection cover can be ordered together with the device (product structure, feature 620 "Accessory Enclosed", option PB "Weather Protection Cover"). Alternatively, it can be separately ordered as an accessory; order code 71132889.

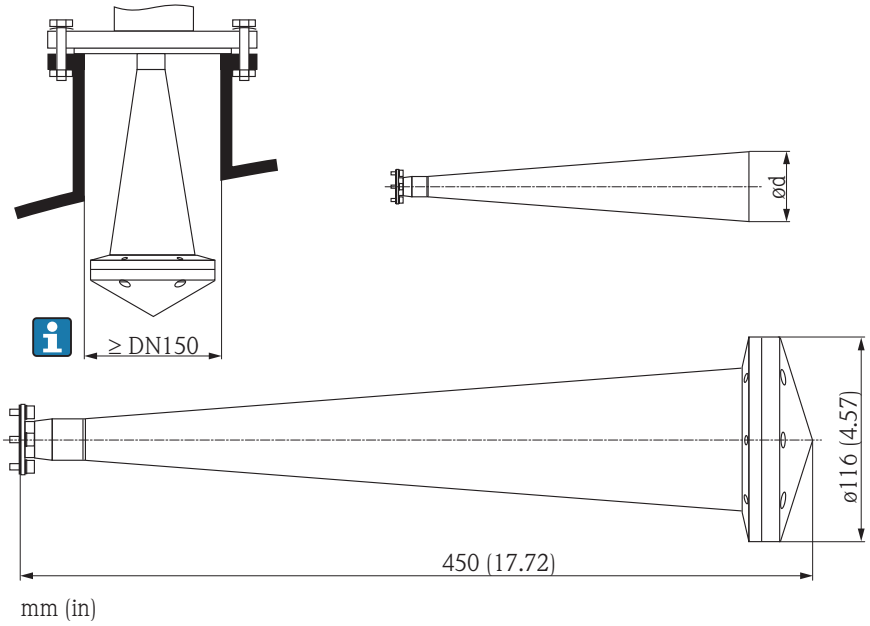
Accessory	Description
Variable flange seal for FMR50/FMR56	 A0018871 *1 UNI slip-on flange* *2 Variable flange seal* *3 Nozzle* The material and process conditions of the adjustable flange seal must fit the process properties (temperature, pressure, resistance).

Variable flange seal	DN80	DN100	DN150
Order code	71074263	71074264	71074265
compatible with	▪ DN80 PN10-40 ▪ ANSI3" 150lbs ▪ JIS 10K 80A	▪ DN100 PN10-40 ▪ ANSI 4" 150lbs ▪ JIS 10K 100A	▪ DN150 PN10-40 ▪ ANSI 6"150lbs ▪ JIS 10K 150A
Material	EPDM		
Process pressure	−0.1 to 0.1 bar (−1.45 to 1.45 psi)		
Process temperature	−40 to +80 °C (−40 to +176 °F)		
D	142 mm (5.59 in)	162 mm (6.38 in)	218 mm (8.58 in)
d	89 mm (3.5 in)	115 mm (4.53 in)	169 mm (6.65 in)
h	22 mm (0.87 in)	23.5 mm (0.93 in)	26.5 mm (1.04 in)
h_{min}	14 mm (0.55 in)	14 mm (0.55 in)	14 mm (0.55 in)
h_{max}	30 mm (1.18 in)	33 mm (1.3 in)	39 mm (1.45 in)

Accessory	Description
Mounting bracket for wall or ceiling mounting of FMR50/FMR56	 25 *Mounting bracket for FMR50/FMR56 with horn antenna* *A Mounting at ceiling* *B Mounting at wall* Material – Mounting bracket: 304 (1.4301) – Screws: A2 – Nordlock washer: A4

Accessory	Description
Remote display FHX50	 ▪ Material: – Plastics PBT – 316L (in preparation) ▪ Suitable for the display modules: – SD02 (push buttons) – SD03 (touch control) (in preparation) ▪ Connection cable: – Cable with M12 plug; supplied with the FHX50; up to 30 m (98 ft) – Customer supplied standard cable; up to 60 m (196 ft) ▪ If the remote display is to be used, the Micropilot must be ordered in the version "Prepared for display FHX50" (feature 030, option L or M). For the FHX50, on the other hand, the option A: "Prepared for display FHX50" has to be selected in feature 050: "Option Measurement Device". ▪ If a Micropilot has not been ordered in the version "Prepared for display FHX50", but is nevertheless to be equipped with an FHX50, it is essential to select the option B: "Not prepared for display FHX50" in feature 050: "Option Measurement Device" of the FHX50. In this case, a retrofit kit, needed to prepare the Micropilot for the remote display, is supplied together with the FHX50. For details refer to the document SD01007F.

Accessory	Description
Horn protection for 80 mm (3 in) horn antenna	 A0019143 For details please refer to the Mounting Instructions SD01084F. **Process conditions** ▪ Maximum vessel pressure: 0.5 bar (7.252 psi) ▪ Maximum process temperature: 130 °C (266 °F) Danger of explosion Avoid electrostatic charging of the horn protection.

Accessory	Description
Horn protection for 100 mm (4 in) horn antenna	 A0019144 For details please refer to the Mounting Instructions SD01084F. **Process conditions** ▪ Maximum vessel pressure: 0.5 bar (7.252 psi) ▪ Maximum process temperature: 130 °C (266 °F) Danger of explosion Avoid electrostatic charging of the horn protection.

14.2 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. 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. 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

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

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

Accessory	Description
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote parametrization and measured value inspection via the HART output or via FOUNDATION Fieldbus . For details refer to Operating Instructions BA00060S

14.3 Service-specific accessories

Accessory	Description
FieldCare	Endress+Hauser's 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. For details refer to Operating Instructions BA00027S and BA00059S.

14.4 System components

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

15 Overview of the operating menu

Language	(→ 94)

Setup →	Device tag	(→ 94)
	Distance unit	(→ 94)
	Bin type	(→ 95)
	Max. filling speed solid	(→ 95)
	Max. draining speed solid	(→ 95)
	Empty calibration	(→ 96)
	Full calibration	(→ 96)
	Level	(→ 97)
	Distance	(→ 97)
	Signal quality	(→ 98)

Setup →	**Mapping →**	Confirm distance	(→ 99)
		Mapping end point	(→ 100)
		Record map	(→ 100)

Setup →	**Advanced setup →**	Locking status	(→ 100)
		Access status display	(→ 101)
		Enter access code	(→ 101)

Setup →	**Advanced setup →**	**Level →**	Medium type	(→ 102)
			Medium property	(→ 102)
			Advanced process conditions	(→ 102)
			Level unit	(→ 103)
			Blocking distance	(→ 103)
			Level correction	(→ 104)
			Tank/silo height	(→ 104)

Setup →	**Advanced setup →**	**Linearization →**	Linearization type	(→ 105)
			Unit linearized	(→ 105)
			Free text	(→ 106)
			Maximum value	(→ 106)
			Diameter	(→ 107)
			Intermediate height	(→ 107)
			Table mode	(→ 108)
			Table number	(→ 108)
			Level	(→ 108)
			Customer value	(→ 109)
			Activate table	(→ 109)

Setup →	**Advanced setup →**	**Safety settings →**	Output echo lost	(→ 110)
			Value echo lost	(→ 110)
			Ramp echo lost	(→ 110)
			Blocking distance	(→ 103)

Setup →	**Advanced setup →**	**SIL/WHG confirmation →**		(→ 112)

Setup →	**Advanced setup →**	**Deactivate SIL/WHG →**		(→ 112)

Setup →	**Advanced setup →**	**Current output 1/2 →**	Assign current output	(→ 113)
			Current span	(→ 113)
			Fixed current	(→ 114)
			Damping	(→ 114)
			Failure mode	(→ 115)
			Failure current	(→ 115)
			Output current 1/2	(→ 116)

Setup →	**Advanced setup →**	**Switch output →**	Switch output function	(→ 116)
			Assign status	(→ 116)
			Assign limit	(→ 117)
			Assign diagnostic level	(→ 117)
			Switch-on value	(→ 117)
			Switch-on delay	(→ 119)
			Switch-off value	(→ 117)
			Switch-off delay	(→ 119)
			Failure mode	(→ 119)
			Switch status	(→ 119)
			Invert output signal	(→ 120)

Setup →	**Advanced setup →**	**Display →**	Language	(→ 94)
			Format display	(→ 121)
			Value 1 display	(→ 123)
			Decimal places 1	(→ 123)
			Value 2 display	(→ 123)
			Decimal places 2	(→ 123)
			Value 3 display	(→ 123)
			Decimal places 3	(→ 123)
			Value 4 display	(→ 123)
			Decimal places 4	(→ 123)
			Display interval	(→ 124)
			Display damping	(→ 124)
			Header	(→ 124)

			Header text	(→ 125)
			Separator	(→ 125)
			Number format	(→ 126)
			Decimal places menu	(→ 126)
			Backlight	(→ 126)
			Contrast display	(→ 127)

Setup →	**Advanced setup →**	**Configuration backup display →**	Operating time	(→ 128)
			Last backup	(→ 128)
			Configuration management	(→ 128)
			Camparison result	(→ 129)

Setup →	**Advanced setup →**	**Administration→**	Device reset	(→ 132)
			Define access code	(→ 131)
			Confirm access code	(→ 131)

Diagnostics →	Actual diagnostics			(→ 134)
	Previous diagnostics			(→ 133)
	Operating time from restart			(→ 133)
	Operating time			(→ 128)

Diagnostics →	**Diagnostics list →**	Diagnostics 1		(→ 134)
		Diagnostics 2		(→ 134)
		Diagnostics 3		(→ 134)
		Diagnostics 4		(→ 134)
		Diagnostics 5		(→ 134)

Diagnostics →	**Event logbook →**	Filter options		(→ 135)
		Event list		(→ 135)

Diagnostics →	**Device information →**	Device tag		(→ 137)
		Serial number		(→ 137)
		Firmware version		(→ 137)
		Device name		(→ 137)
		Order code		(→ 138)
		Extended order code 1		(→ 138)
		Extended order code 2		(→ 138)
		Extended order code 3		(→ 138)

Diagnostics →	**Measured value →**	Distance		(→ 97)
		Level linearized		(→ 139)

		Output current 1/2	(→ 116)
		Measured current 1	(→ 139)
		Terminal voltage 1	(→ 139)
		Switch status	(→ 119)
		Electronic temperature	(→ 139)

Diagnostics →	**Data logging →** (in Vorbereitung)	Assign channel 1	(→ 140)
		Assign channel 2	(→ 140)
		Assign channel 3	(→ 140)
		Assign channel 4	(→ 140)
		Logging interval	(→ 140)
		Clear logging data	(→ 141)
		Display channel 1	(→ 141)
		Display channel 2	(→ 141)
		Display channel 3	(→ 141)
		Display channel 4	(→ 141)

Diagnostics →	**Simulation →**	Assign measurement variable	(→ 143)
		Value process variable	(→ 143)
		Swtich output simulation	(→ 143)
		Switch status	(→ 144)
		Simulation current output 1/2	(→ 144)
		Value current output 1/2	(→ 144)
		Simulation device alarm	(→ 145)

Diagnostics →	**Device check →**	Start device check	(→ 146)
		Result device check	(→ 146)
		Last check time	(→ 146)
		Level signal	(→ 146)

Experte	The "Expert" menu is described in the document GP01014F ("Description of device parameters").

16 Description of device parameters

- : 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 (→ 56).

Language

Navigation Language

Description Set display language

Options
- English
- One additional operating language (see product structuture, feature 500, "Additional Operation Language")

Factory setting English

16.1 "Setup" menu

Device tag

Navigation Setup → Device tag

Description Enter tag for measuring point

Input range Up to 32 alphanumerical characters

Factory setting FMR5x

Distance unit

Navigation Setup → Distance unit

Description Length unit for distance calculation

Options
- mm
- m
- ft
- in

Factory setting m

Bin type

Navigation Setup → Bin type

Description Defines the bin property

Options
- Bin / pile
- Buffer silo (fast)
- Crusher / belt
- Silo
- Workbench test

Factory setting Silo

Max. filling speed solid

Navigation Setup → Max. filling speed solid

Prerequisite **Medium type** = **Solid**

Description Select maximum expected filling speed.

Options
- Very slow < 0.5m (1.6ft) /h
- Slow < 1 m (3.3ft) /h
- Standard < 2m (6,5ft) /h
- Medium < 4m (13ft) /h
- Fast < 8m (26ft) /h
- Very fast > 8m (26ft) /h
- No filter / test

Factory setting Standard < 2m (6,5ft) /h

Additional information It is strongly recommended to adjust the maximum filling speed to the actual process.

Max. draining speed solid

Navigation Setup → Max. draining speed solid

Prerequisite **Medium type** = **Solid**

Description Select maximum expected draining speed.

Options
- Very slow < 0.5m (1.6ft) /h
- Slow < 1 m (3.3ft) /h
- Standard < 2m (6,5ft) /h
- Medium < 4m (13ft) /h
- Fast < 8m (26ft) /h
- Very fast > 8m (26ft) /h
- No filter / test

Factory setting Standard < 2m (6,5ft) /h

Additional information It is strongly recommended to adjust the maximum draining speed to the actual process.

Empty calibration

Navigation Setup → Empty calibration

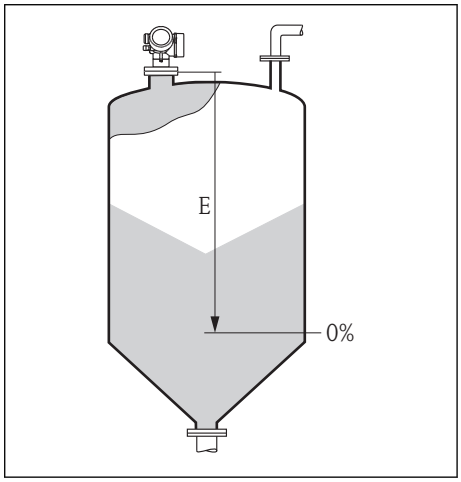
Description Distance process connection to min. level

Input range 0 to 100 m (0 to 328 ft)

Factory setting
- FMR56: 30 m (98 ft)
- FMR57: 70 m (230 ft)

A different value can be defined when ordering the device.

Additional information The empty calibration E is the distance between the reference point (lower edge of the flange or threaded connection) and the minimum level (0%).



Full calibration

Navigation Setup → Full calibration

Description Span: max. level - min. level

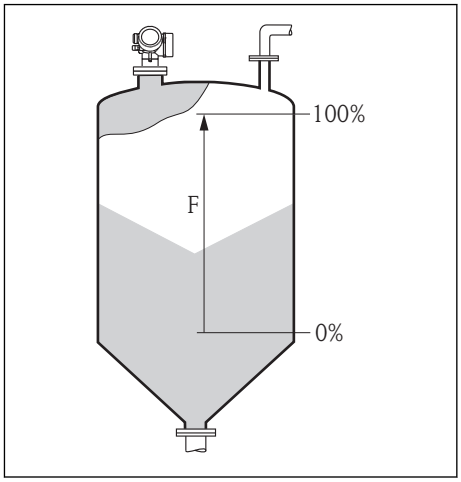
Input range 0.001 to 100 m (0.003 to 328 ft)

Factory setting

Empty calibration - Blocking distance
A different value can be defined when ordering the device.

Additional information

The full calibration F is the distance between the minimum level (0%) and the maximum level (100%).



A0019489

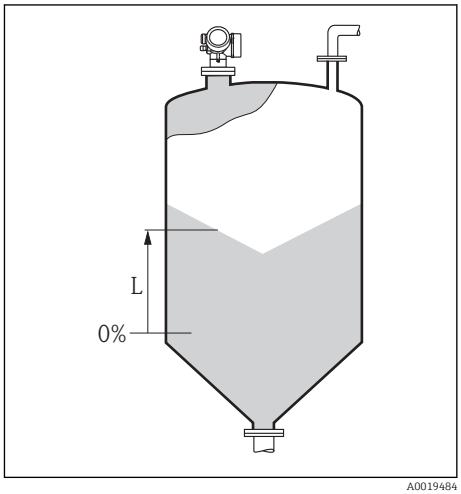
Level

Navigation

Setup → Level

Description

Displays the measured level L (before linearization)



A0019484

Zusätzliche Information

The value is displayed in the selected "Level unit" (→ 103).

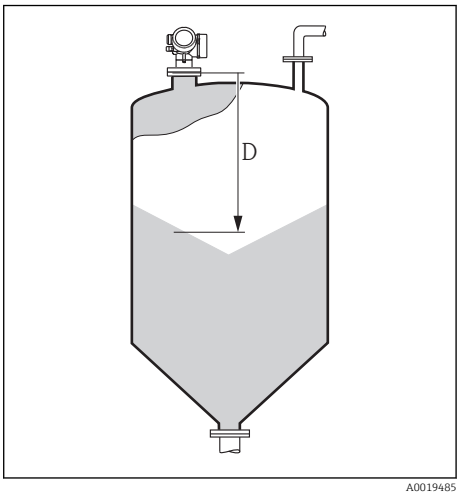
Distance

Navigation

Setup → Distance

Description

Displays the measured distance D from the reference point (lower edge of the flange or threaded connection) to the level.



Additional information

The value is displayed in the selected "Level unit" (→ 103).

Signal quality

Navigation

Setup → Signal quality

Description

Displays the signal quality

Display options

- Strong
- Medium
- Weak
- No signal

Additional information

In case of a lost echo (**No signal**), the device generates the following error message:
- F941 if the **Alarm** option has been selected in the **Output echo lost** parameter (→ 110)
- S941 if another option has been selected in the **Output echo lost** parameter (→ 110).

16.1.1 "Mapping" sequence

Confirm distance

Navigation Setup → Mapping → Confirm distance

Description Confirmation whether the measured distance matches the actual distance. Depending on the selection, the device automatically determines the range over which the mapping will be recorded.

Options
- Manual map
- Distance ok
- Distance unknown
- Distance too small
- Distance too big [1)]
- Tank empty
- Factory map

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

Factory setting Distance unknown

Additonal information Check whether the displayed distance matches the actual distance. Depending on the selection, the device automatically determines the range over which the mapping will be recorded.

For reference purposes the measured distance is displayed together with this parameter.

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. 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 and quits the sequence ("End of sequence" appears on the display).
- Distance unknown
  To be selected if the actual distance is unknown. A mapping can not be performed and the device quits the sequence ("End of sequence" appears on the display).
- Distance too small
  To be selected if the measured distance is smaller than the actual distance. The device searches the next echo and returns to the **Confirm distance** parameter. The new distance is displayed. The comparison must be repeated until the displayed distance matches the actual distance. If this is the case, the recording of the map can be started by selecting **Distance ok**.
- Distance too big
  To be selected if the measured distance is bigger than 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.
- Tank empty
  To be selected if the tank is completely empty. The device records a mapping covering the complete length of the probe and quits the sequence ("End of sequence" appears on the display).
- 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.

Mapping end point

Navigation Setup → Mapping → Map. end point

Prerquisite **Confirm distance** = **Manual map** or **Distance too samll**.

Description New end point of mapping

Input range 0.1 m (0.33 ft) ... Tanks /silo height [1)]

1) Parameter: "Expert → Sensor → Level → Tank/silo height"

Factory setting 1 m (3.3 ft)

Additional information This parameter defines up to which distance the new mapping is to be recorded.
The distance is measured from the reference point, i.e. from the lower edge of the mounting flange or the threaded connection.
For reference purposes the **Present mapping** parameter is displayed together with this parameter. **Present mapping** states up to which distance a mapping has already been recorded.

Record map

Navigation Setup → Mapping → Record map

Prerequisites **Confirm distance** = **Manual map** or **Distance too small**.

Description Starts the recording of the map.

Options
- No
- Record map
- Overlay map
- Factory map
- Delete partial map

Factory setting No

16.1.2 "Advanced setup" submenu

Locking status

Navigation Setup → Advanced setup → Status Verrieg.

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

Display options
- Hardware locked
- Cust. trans. active
- WHG locked
- Temporarily locked

Additional information
The 🔒-symbol appears in front of parameters that cannot be modified since they are write-protected.

Access status display

Navigation Setup → Advanced setup → Access status display

Prerquisite Only visible for devices with operating and display module (SD02 or SD03)

Description Indicates access authorization to parameters via local display

Display options
- Operator
- Maintenance
- Service

Additional information
- The access authorization can be changed via the **Enter access code** parameter (→ 101).
- 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 (→ 100).
- If a🔒 symbol appears in front of a parameter, the parameter cannot be changed via the local display with the current access authorization.

Enter access code

Navigation Setup → Advanced setup → Enter access code

Description Enter access code to disable write protection

Input range 0 to 9 999

Additional information For local operation, the customer-specific access code defined in the **Setup → Advanced setup → Administration → Define access code** sequence 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 the document.
On the local display, the 🔒-symbol in front of a parameter indicates that the parameter is write-protected.
If no key is pressed for 10 minutes, or the user goes from the navigation and editing mode back to the measured value display mode, the device automatically locks the write-protected parameters after another 60 s .

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

The "Level" submenu

Medium type

Navigation Setup → Advanced Setup → Level → Medium type

Description Indication of the medium type

Display options
- Liquid
- Solid

Factory setting Solid

Medium property

Navigation Setup → Advanced Setup → Level → Medium property

Description DC: Dielectric constant

Options
- Unknown
- DC 1.4 to 1.6
- DC 1.6 to 1.9
- DC 1.9 to 2.5
- DC 2.5 to 4
- DC 4 to 7
- DC 7 to 15
- DC > 15

Factory setting Unknown

Additonal information Dielectric constants of important media commonly used in the industry are summarized in the document SD106F, which can be downloaded from the Endress +Hauser web page (www.endress.com).

Advanced process conditions

Navigation Setup → Advanced setup → Level → Advanced process conditions

Description Defines additional process conditions (if necessary)

Options
- None
- Weak signal
- Many obstacles
  This option is not recommended for liquids.
- Changing DC values

Factory setting None

Level unit

Navigation Setup → Advanced setup → Level → Level unit

Description Defines the level unit

Options
- %
- m
- mm
- ft
- in

Factory setting %

Additional information The level unit may differ from the distance unit as defined in the **Distance unit** parameter (→ 94):
- The distance unit is used for the basic calibration ("Empty calibration" and "Full calibration").
- The level unit is used to display the (unlinearized) level.

Blocking distance

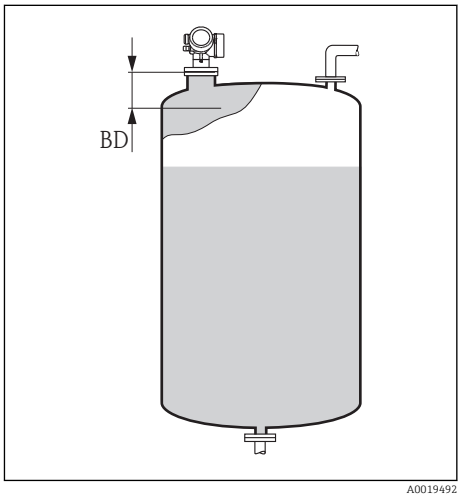
Navigation Setup → Advanced setup → Level → Blocking dist.
Setup → Advanced setup → Safety settings → Blocking dist.

Description Area in which measurement is impossible.

Input range 0 to 200 m (0 to 656 ft)

Factory setting Antenna length + 400 mm (15.7 in)

Additional information No echos are evaluated within the blocking distance UB. Therefore, UB can be used to suppress interference echos close to the antenna.



A0019492

Level correction

Navigation Setup → Advanced setup → Level → Level correction

Description Defines a level correction

Input range
Depending on the selected level unit:
- -100,0 to 100,0 %
- -200,0 to +200,0 m
- -656,2 to +656,2 ft
- -7874,0 to +7874,0 inch
- -200.000,0 to +200.000,0 mm

Factory setting 0%

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

Tank/silo height

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

Description Total height of the tank/silo, as measured from the process connection

Input range –999.999 to +999.999 m (–3 280 to +3 280 ft)

Factory setting Empty calibration

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

The "Linearization" submenu

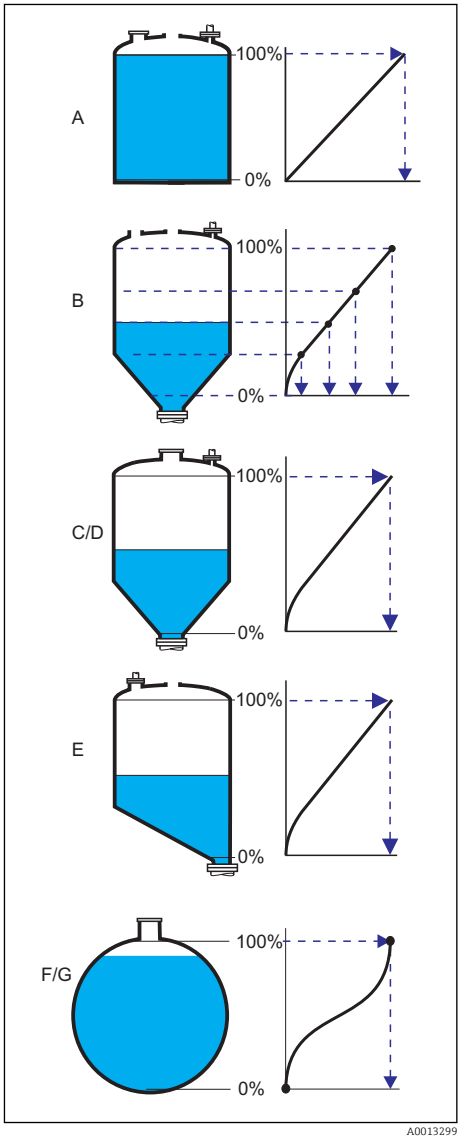
Linearization type

Navigation Setup → Advanced setup → Linearization → Linearization type

Description Defines the type of linearization

Options

- None
  The level is transmitted without linearization.
- Linear (A)
- Table (B)
- Pyramid bottom (C)
- Conical bottom (D)
- Angled bottom (E)
- Horizontal cylinder (F)
- Sphere (G)



A0013299

Factory setting None

Unit linearized

Navigation Setup → Advanced setup → Linearization → Unit linearized

Prerequisite Only visible if a linearization has been selected (i.e. **Linearization type** ≠ **None**)

Description Defines the unit of the linearized value.

Options
- Free text
- t
- lb
- ton
- kg
- impGal
- UsGal
- ft^3
- cm^3
- dm^3
- m^3
- hl
- l
- %

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.

Free text

Navigation Setup → Advanced setup → Linearization → Free text

Prerequisite Only visible for **Unit lienarized** = **Free text**.

Description Definiton of the unit

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

Factory setting **Free text**

Maximum value

Navigation Setup → Advanced setup → Linearization → Maximum value

Prerequisite Only visible if one of the following linearization types has been selected:
- Linear
- Pyramid bottom
- Conical bottom
- Angled bottom
- Horizontal cylinder
- Sphere

Description Definition of the maximum content of the vessel (100%), as measured in the **Unit linearized**.

Input range -50000 ... +50000

Factory setting 100

Diameter

Navigation Setup → Advanced setup → Linearization → Diameter

Prerequisite Only visible if one of the following linearization types has been selected:
- Horizontal cylinder
- Sphere

Description Definition of the tank diameter

Input range 0 ... 9999.999 m (32808 ft)

Factory setting 2 m (6.6 ft)

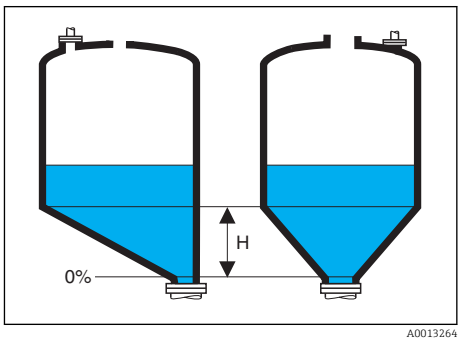
Additional information The value must be specified in the selected distance unit (→ 94) .

Intermediate height

Navigation Setup → Advanced setup → Linearization → Intermediate height

Prerequisite Only visible if one of the following linearization types has been selected:
- Pyramid bottom
- Conical bottom
- Angled bottom

Description Definition of the intermediate height H



A0013264

Input range 0 to 200 m (0 to 656 ft)

Factory setting 0 m (0 ft)

Additional information The value must be specified in the selected distance unit (→ 94) .

Table mode

Navigation Setup → Advanced setup → Linearization → Table mode

Prerequisite Only visible if the "Table" linearization type has been selected.

Description Defines the method used to enter linearization points into the table.

Options
- Manual
  The level and the associated linearized value are entered manually for each linearization point.
- Semi-automatic
  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.

Factory setting Manual

Additional information 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.

If a decreasing table is intered and if the measured value is transitted via the current output, it may be necessary to invert the direction of the current output: **Expert → Output → Current output → Measuring mode** = **Inverted**.

Table number

Navigation Setup → Advanced setup → Linearization → Table number

Prerequisite Only visible if the "Table" linearization type has been selected.

Description Index of the linearization point which is entered in the subsequent parameters.

Input range 1 … 32

Factory setting 1

Level

Navigation Setup → Advanced setup → Linearization → Level

Prerequisite Only visible if the "Table" linearization type has been selected.

Description Definition or display of the (unlinearized) level of the respective linearization point.

Input range Depending on the parametrized measuring range. See the parameters **Empty calibration** (→ 🖹 96) and **Full calibration** (→ 🖹 96).

Factory setting 0

Additional information For **Table mode** = **Manual**: **Level** is a writable parameter.
For **Table mode** = **Semi-automatic**: **Level** is a read-only parameter.

Customer value

Navigation Setup → Advanced setup → Linearization → Customer value

Prerequisite Only visible if the "Table" linearization type has been selected.

Description Specification of the linearized value of the respective linearization point.

Input range $-3{,}0 \times 10^{38}$ ... $+3{,}0 \times 10^{38}$

Factory setting 0

Activate table

Navigation Setup → Advanced setup → Linearization → Activate table

Prerequisite Only visible if the "Table" linearization type has been selected.

Description Enables or disables the linearization table.

Options
- Disable
  A linearization is not calculated. If the **Linearization type** parameter has been set to **Table**, the error message F435 is generated.
- Enable
  The measured value is linearized according to the table before being sent to the output.

Factory setting Disable

Additional information When editing the table, this parameter is automatically reset to the **Disable** option. After finishing the editing procedure it must be set to the **Enable** option again.

The "Safety settings" submenu

Output echo lost

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

Description Defines the output signal in the case of a lost echo.

Options
- Last valid value
  The last valid value is kept in the case of a lost echo.
- Ramp at echo lost
  In the case of a lost echo the output value is continously shifted towards 0% or 100%. The slope of the ramp is defined in the **Ramp echo lost** parameter.
- Value echo lost
  In the case of a lost echo the output assumes the value defined in the **Value echo lost** parameter.
- Alarm
  In the case of a lost echo the device generates an alarm.

Factory settings Last valid value

Value echo lost

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

Prerequisite Only visible if the **Value echo lost** option has been selected in the **Output echo lost** parameter.

Description Defines the constant output value in the case of a lost echo.

Input range 0 to 200000

Factory setting 0

Additional information The unit is the same as for the output value:
- Without linearization: As defined in the **Level unit** parameter (→ 103).
- With linearization: As defined in the **Unit linearized** parameter (→ 105).

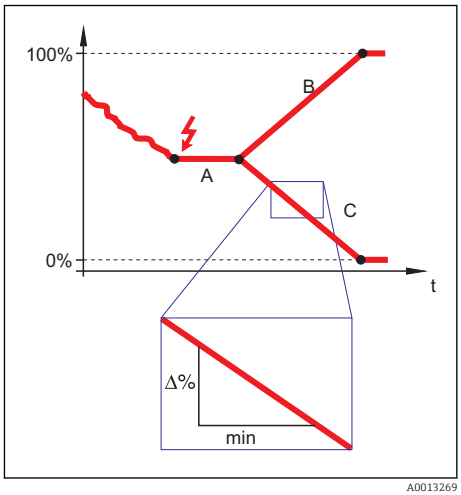
Ramp at echo lost

Navigation Setup → Advanced setup → Safety settings → Ramp at echo lost

Prerequisite Only visible if the **Ramp echo lost** option has been selected in the **Output echo lost** parameter.

Description

Defines the slope of the ramp in the case of a lost echo.



A Delay echo lost
B Ramp echo lost (positive value)
C Ramp echo lost (negative value)

Input range

-9999999,0 to + 9999999,0 %/min

Factory setting

0 %/min

Additional information

- 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	(→ 103)	

The "SIL/WHG confirmation" sequence

The "SIL/WHG confirmation" sequence 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** sequence is required to lock the device according to SIL or WHG.

For details refer to the "Functional Safety Manual", SD01087F which describes the locking procedure and the parameters of the sequence.

The "Deactivate SIL/WHG" sequence

The "Deactivate SIL/WHG" sequence 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 in the SIL- or WHG-locked state.

The **Deactivate SIL/WHG** sequence is required to unlock the device if it has been locked according to SIL or WHG.

For details refer to the "Functional Safety Manual", SD01087F which describes the unlocking procedure and the parameters of the sequence.

The "Current output 1"/"Current output 2" submenus [4)]

Assign current output

Navigation
Setup → Advanced setup → Curr. output 1 → Assign current output
Setup → Advanced setup → Curr. output 2 → Assign current output

Description
Select process variable for current output

Options
- Level linearized
- Distance
- Electronic temperature
  (-50 °C / -58 °F = 4mA; 100 °C / 212 °F = 20 mA)
- Relative echo amplitude
  (0 dB = 4 mA; 150 dB = 20 mA)
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2

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

1) only for devices with 2 current outputs

Current span

Navigation
Setup → Advanced setup → Current output 1 → Current span
Setup → Advanced setup → Current output 2 → Current span

Description
Select current range for process value output and upper/lower level for alarm signal.

- In the event of an error, the current output adopts the value defined in the **Failure mode** parameter (→ 115).
- If the measured value is outside the measuring range, the device displays the message **S441 Current output**.
  The measuring range is defined by the **Empty calibration** (4 mA) (→ 96) and **Full calibration** (20 mA) (→ 96) parameters.

Options
- 4 to 20 mA NAMUR
- 4 to 20 mA US
- 4 to 20 mA
- Fixed current

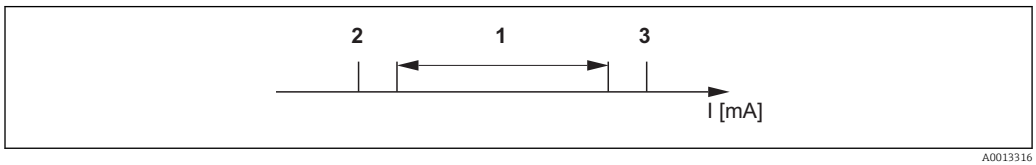
Factory setting
4 to 20 mA NAMUR

4) The "Current output 2" submenu is only available for devices with two current outputs.

Additional information

Fixed current
The current value is set via the **Fixed current** parameter (→ 🖹 114).

Example
Shows the relationship between the current span for the output of the process variable and the lower and upper alarm levels.



I Current
1 Current span for process value
2 Lower level for signal on alarm
3 Upper level for signal on alarm

Options	1	2	3
4 to 20 mA NAMUR	3.8 to 20.5 mA	≤ 3.6 mA	> 21.95 mA
4 to 20 mA US	3.9 to 20.8 mA US	≤ 3.6 mA	> 21.95 mA
4 to 20 mA	4 to 20.5 mA	≤ 3.6 mA	> 21.95 mA

Fixed current

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

Condition
Only visible if the **Fixed current** option has been selected in the **Current span** parameter.

Description
Defines the fixed value of the current.

Input range
4 to 22.5 mA

Factory setting
4.0 mA

Damping

Navigation
Setup → Advanced setup → Current output 1/2→ Damping

Description
Defines the time constant for the damping of the output current.

Input range
0 to 999.9 s

Factory setting
0 s (i.e.: no damping)

Additional information Fluctuations of the measured value affect the output current with an exponential delay, the time constant 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.

Failure mode

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

Prerequisite One of the following options is selected in the **Current span** parameter (→ 113):
- 4 to 20 mA NAMUR
- 4 to 20 mA US
- 4 to 20 mA

Description Select alarm condition for current oputput value.

Options
- Min.
  The current output adopts the value of the lower level for signal on alarm.
- Max.
  The current output adopts the value of the upper level for signal on alarm.
- Last valid value
  The current output is based on the last measured value that was valid before the error occurred.
- Actual value
  The current output is based on the actual measured value on the basis of the current measurement; the error is ignored.
- Defined value
  The current output value is defined in the **Failure current** parameter (→ 115).

Factory setting Max.

Additional information This setting does not affect the error response mode of other outputs and totalizers. This is specified in separate parameters.

Min. and Max.

With this setting, the signal on alarm level is specified using the **Current span** parameter (→ 113).

Failure current

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

Prerequisite The **Defined value** option is selected in the **Failure mode** parameter (→ 115).

Description Enter current output value in alarm condition

Input range 3.6 to 22.5 mA

Factory setting 22.5 mA

Output current 1 / Output current 2

Navigation
Setup → Advanced setup → Curr. output 1 → Output curr. 1
Diagnostics → Measured value → Output curr. 1
Setup → Advanced setup → Curr. output 2 → Output curr. 2
Diagnostics → Measured value → Output curr. 2

Description Displays the output current in mA.

"Switch output" submenu

Switch output function

Navigation Setup → Advanced setup → Switch output → Switch output function

Description Select function for switch output

Options
- Off
  The output is always open (not 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 level** (→ 117)parameter determines at which type of event the output is opened.
- Limit
  The output is normally closed and is only opened if a measured varaible exceeds or falls below a defined limit. The limit values are defined by the parameters **Assign limit** (→ 117), **Switch-on value** (→ 117) and **Switch-off value** (→ 117).
- 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.

Factory setting Off

Additional information The **On** and **Off** settings can be used to simulate the switch output.

Assign status

Navigation Setup → Advanced setup → Switch output → Assign status

Prerequisite Only visible for **Switch output function** = **Digital output**.

Description Select device status for switch output

Options
- Off
- Digital output AD 1
- Digital output AD 2

Factory setting Off

Assign limit

Navigation Setup → Advanced setup → Switch output → Assign limit

Prerequisite Only visible for **Switch output function** = **Limit**.

Description Defines the variable to be checked for limit transgression and allocates it to the switch output.

Options
- Off
- Level linearized
- Distance
- Terminal voltage
- Electronic temperature
- Relative echo amplitude

Factory setting Off

Assign diagnostic level

Navigation Setup → Advanced setup → Switch output → Assign diagnostic level

Prerequisite Only visible for **Switch output function** = **Event level**.

Description Defines to which class of diagnostic events the output reacts.

Options
- Alarm
- Alarm or warning
- Warning

Factory setting Alarm

Switch-on value
Switch-off value

Navigation Setup → Advanced setup → Switch output → Switch-on value / Switch-off value

Prerequisite Only visible for **Switch output function** = **Limit** and **Assign limit** ≠ **Off**.

Description Define the switch-on point and switch-off point for the limit evaluation.

Input range

Depending on the selected measuring variable (Parameter **Assign limit**).

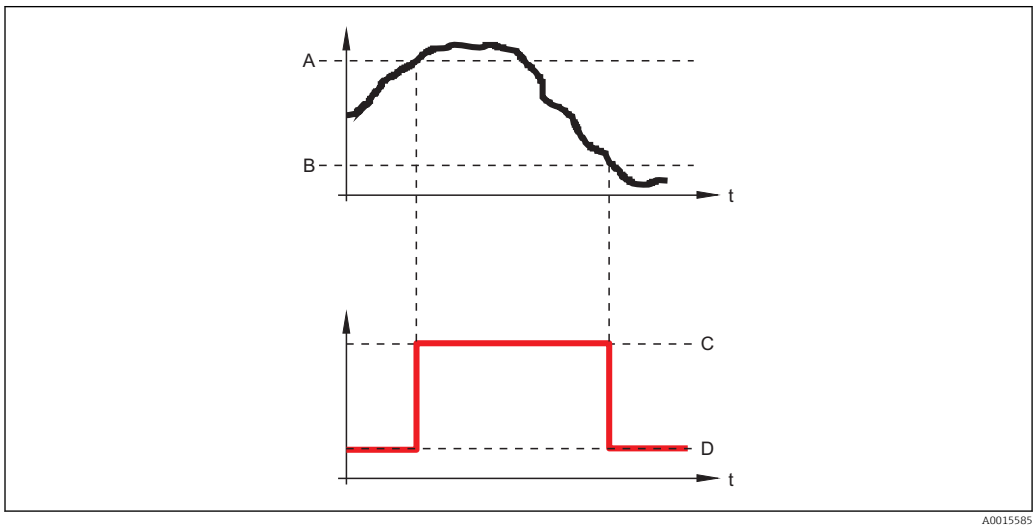
Factory setting

Depending on the selected measuring variable (Parameter **Assign limit**).

Additional information

The switching behavior depends on the relative position of the two switch points.

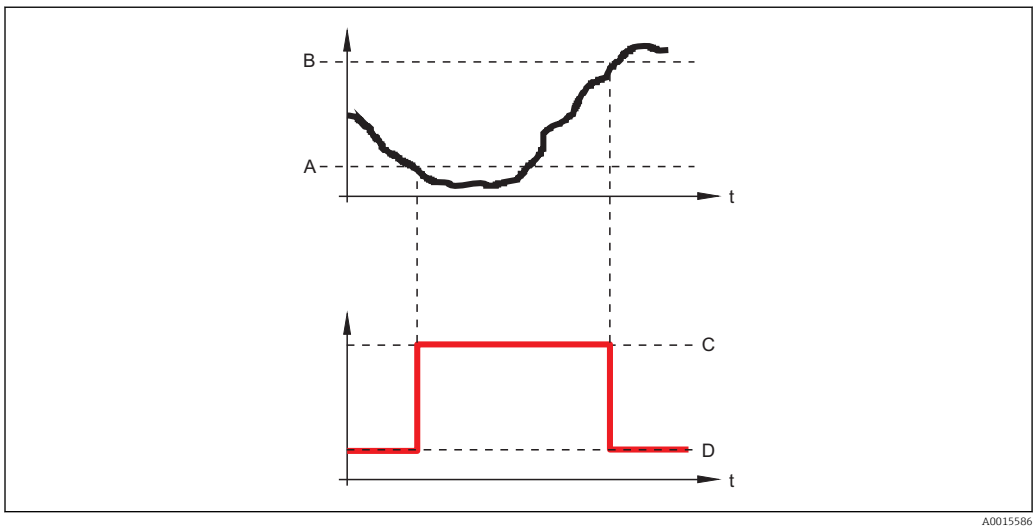
Switch-on point > Switch-off point:
The output is closed if the measured value exceeds the switch-on point.
The output is opened if the measured value falls below the switch-off point.



A0015585

A Switch-on point
B Switch-off point
C Output closed
D Output opened

Switch-on point < Switch-off point:
The output is closed if the measured value falls below the switch-on point.
The output is opened if the measured value exceeds the switch-off point.



A0015586

A Switch-on point
B Switch-off point
C Output closed
D Output opened

Switch-on delay

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

Prerequisite Only visible for **Switch output function** = **Limit** and **Assign limit** ≠ **Off**.

Description Defines the delay for the switching on of the output.

Input range 0 to 100 s

Factory setting 0 s

Switch-off delay

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

Prerequisite Only visible for **Switch output function** = **Limit** and **Assign limit** ≠ **Off**.

Description Defines the delay for the switching off of the output.

Input range 0 to 100 s

Factory setting 0 s

Failure mode

Navigation Setup → Advanced setup → Switch output → Failure mode

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

Options
- Actual status
  The switch output remains in the state it was in when the error occurred
- Open
- Closed

Factory setting Open

Switch status

Navigation Setup → Advanced setup → Switch output → Switch status
Diagnostics → Measured value → Switch status

Description Indicates the current state of the switch output.

Display options

- Open
- Closed

Invert output signal

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

Description Allows to invert the behavior of the switch output.

Options

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

The "Display" submenu

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

Language	(→ 94)	

Format display

Navigation Setup → Advanced Setup → Display → Format display

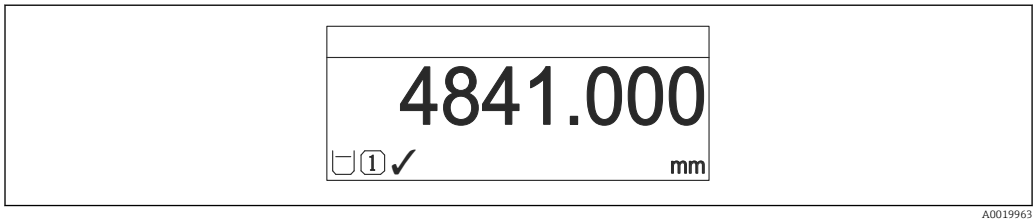
Description Select how measured values are shown on the display.

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

Factory setting 1 value, max. size

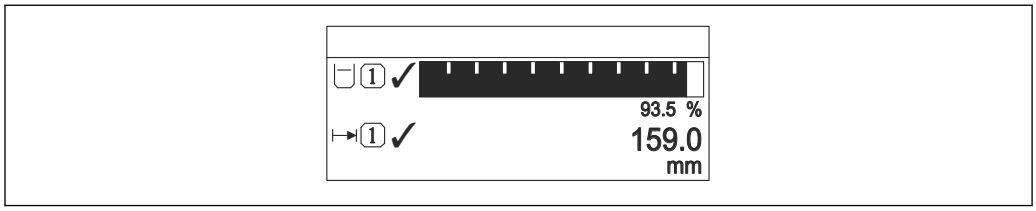
Additional information

1 value, max. size



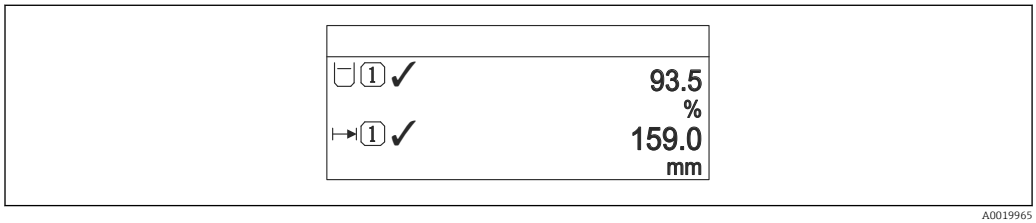
A0019963

1 bargraph + 1 value



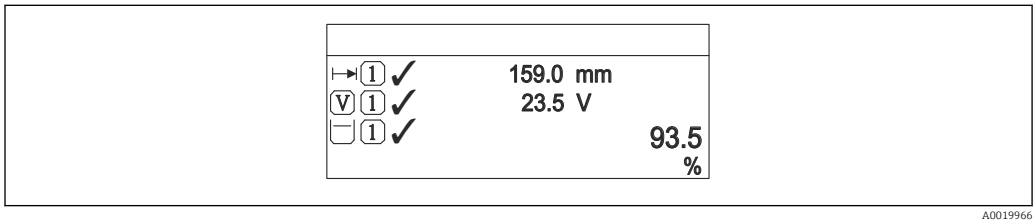
A0019964

2 values



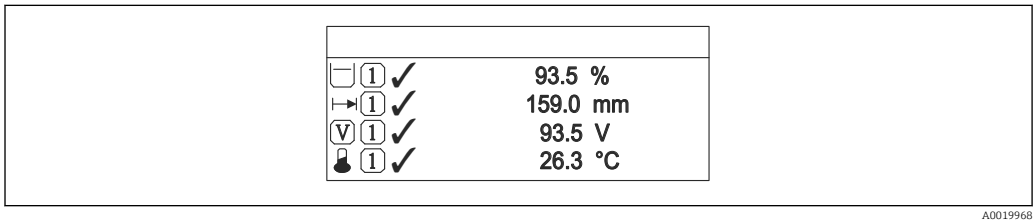
A0019965

1 value large + 2 values



A0019966

4 values



A0019968

- The **Value 1 display - Value 4 display** parameters are used to specify what measured values are shown on the display and in what order (→ 123).
- If more measured values are specified than the display mode selected permits, the values alternate on the device display. The display time until the next change is configured using the **Display interval** parameter (→ 124).

Value 1 display
Value 2 display
Value 3 display
Value 4 display

Navigation Setup → Advanced setup → Display → Value 1/2/3/4 display

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

Options
- None [1)]
- Level linearized
- Distance
- Current output 1
- Measured current
- Current output 2 (only for devices with 2 current outputs)
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Analog output advanced diagnostics 1
- Analog output advanced diagnostics 2

1) Can not be selected for "Value 1 display".

Factory setting
- Value 1 display: Level linearized
- Value 2 display: None
- Value 3 display: None
- Value 4 display: None

Additional information The **Format display** parameter is used to specify how many measured values are displayed simultaneously and how (→ 121).

Decimal places 1
Decimal places 2
Decimal places 3
Decimal places 4

Navigation Setup → Advanced setup → Display → Decimal places 1/2/3/4

Prerequisite A measured value is specified in the **Value 1/2/3/4 display** parameter (→ 123).

Description Select the number of decimal places for the display value.

Options
- x
- x.x
- x.xx
- x.xxx
- x.xxxx

Factory setting x.xx

Additional information This 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.

Input range 1 to 10 s

Facotry setting 5 s

Additional information An alternating display only occurs automatically if the number of measured values defined exceeds the number of values the selected display format can display simultaneously.

- The **Value 1 display - Value 4 display** parameters are used to specify what measured values are shown on the display (→ 123).
- The display format of the displayed measured values is specified using the **Format display** parameter (→ 121).

Display damping

Navigation Setup → Advanced setup → Display → Display damping

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

Input range 0 to 999 s

Factory setting 0 s

Header

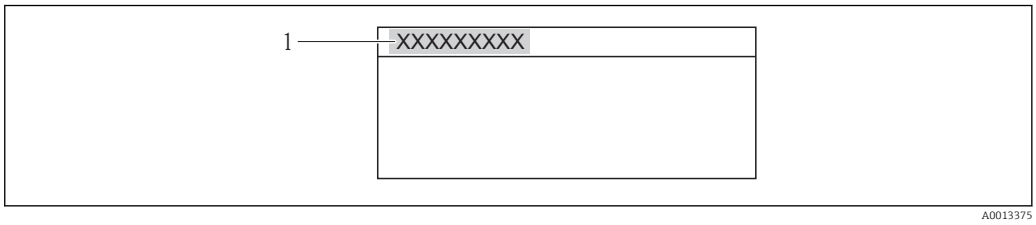
Navigation Setup → Advanced setup → Display → Header

Description Select header contents on local display

Options
- Device tag
- Free text

Factory setting Device tag

Additional information



1 Position of the header text on the display

Device tag
Is defined in the **Device tag** parameter (→ 94).

Free text
Is defined in the **Header text** parameter (→ 125).

Header text

Navigation Setup → Advanced setup → Display → Header text

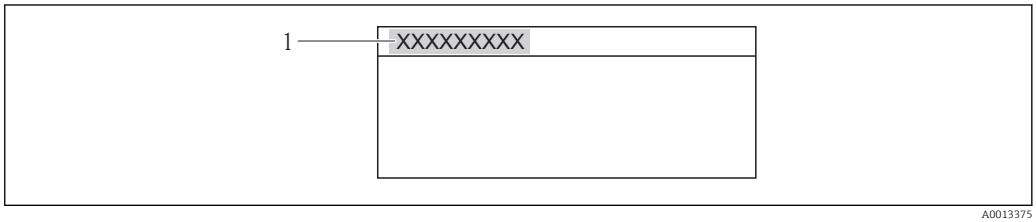
Prerequisite The **Free text** option is selected in the **Header** parameter (→ 124).

Description Enter display header text

Input range Max. 12 characters, such as letters, numbers or special characters (e.g. @, %, /)

Factory setting - - - - - - - - - - - - -

Additional information



1 Position of the header text on the display

User entry
The number of characters displayed depends on the characters used.

Separator

Navigation Setup → Advanced setup → Display → Separator

Description Select decimal separator for displaying numerical values

Options
- . (point)
- , (comma)

Factory setting . (point)

Number format

Navigation Setup → Advanced setup → Display → Number format

Description Choose number format for the display

Options
- Decimal
- ft-in-1/16" (Only valid for distance units)

Factory setting Decimal

Decimal places menu

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

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

Options
- x
- x.x
- x.xx
- x.xxx
- x.xxxx

Factory setting x.xxxx

Additional information This parameter only determines the representation of numbers within the operating menu (e.g. **Empty calibration**, **Full calibration**). It does not affect the measured value representation.
For measured values, the number of decimal places is defined in the **Decimal places 1** to **Decimal places 4** parameters (→ 123).

Backlight

Navigation Setup → Advanced setup → Display → Backlight

Prerequisite Only visible if the display module SD03 with optical keys is connected (SD02 with push buttons does not have a backlight).

Description Switch the local display backlight on and off.

Options
- Disable
- Enable

Factory setting Disable

Additional information Irrespective 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 Display/operation → Contrast display

Description Adjust local display contrast setting to ambient conditions.

Input range 20 to 80 %

Factory setting 30 %

Additional information Set the contrast via push-buttons:
- Brighter: press the ⊖ Ⓔ buttons simultaneously
- Darker: press the ⊕ Ⓔ buttons simultaneously

The "Configuration backup display" submenu

The **Configuration backup display** 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.

Operating time

Navigation Setup → Advanced setup → Conf. backup display → Operating time
Diagnostics → Operating time

Description Indicates how long the device has been in operation.

Display format Days (d), hours (h), minutes (m) and seconds (s)

Additional information *Display*
The maximum number of days is 9999, which is equivalent to 27 years.

Last backup

Navigation Setup → Advanced setup → Conf. backup display → Last backup

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

Display format Days (d), hours (h), minutes (m) and seconds (s)

Configuration management

Navigation Setup → Advanced setup → Conf. backup display → Config. managem.

Description Select action for managing the device data in the display module.

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.
- Compare
  The device configuration saved in the display module is compared to the current device configuration of the HistoROM.
- Clear backup data
  The backup copy of the device configuration is deleted from the display module of the device.

Factory setting

Cancel

Additional information

Compare
The comprison result can be viewed in the **Comparison result** parameter (→ 129).

If **Restore** is selected, all parameters are transmitted. If **Duplicate** is selected all parameters but the following are transmitted:

- HART date code
- HART short tag
- HART message
- HART descriptor
- Final assembly number
- HART address
- Device tag
- Medium type
- Sensor type

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

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

Comparison result

Navigation

Setup → Advanced setup → Conf. backup display → Compar. result

Description

Comparison between present device data and display backup

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 comparison is impossible due to incompatibility.

Additional information

The comparison is started via the **Compare settings** option in the **Configuration management** parameter (→ 128).

The "Administration" submenu

The "Define access code" sequence [5)]

Define access code

Navigation Setup → Advanced setup → Administration → Define access code → Define access code

Description Define user-specific access code in order to protect the device against unintended changes via the display module.

Input range 0 to 9 999

Factory setting 0

Additional information

User entry
A message is displayed if the access code is not in the input range.

Factory setting
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 role of *Maintenance* .

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

Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→ 101).

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

For display operation: The new access code is only valid after it has been confirmed in the **Confirm access code** parameter and after the user has returned to the main screen (measured value display).

Confirm access code

Navigation Setup → Advanced setup → Administration → Define access code → Confirm access code

Description Confirm the access code by repeating the value entered in the **Define access code** parameter.

Input range 0 to 9 999

Factory setting 0

5) This sequence only exists for operation via the display module. For operation via operating software (e.g. FieldCare), the "Define access code" parameter is located directly in the "Administration" submenu.

Further parameters

Device reset

Navigation Setup → Advanced Setup → Administration → Device reset

Description Use this function to reset the device configuration - either entirely or in part - to a defined state.

Options
- Cancel
  No action is executed and the user exits the parameter.
- To factory defaults
  Every parameter is reset to the order-code specific factory setting.
- To delivery settings
  Every parameter is reset to the delivery setting. The delivery setting may differ from the factory default if customer specific settings have been ordered.
- Of customer settings
  Every customer parameter is reset to its factory setting. Service parameters, however, retain their current value.
- Restart device
  The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration is not modified.

Factory setting Cancel

16.2 The "Diagnostics" menu

Actual diagnostics

Navigation Diagnostics → Actual diagnos.

Description Use this function to display the current diagnostics message. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.

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

Display format Symbol for event behavior, diagnostics event, time the event occurred and event text

Additional information *User interface*

Example for display format:
⚠S441 01d4h12min30s
Current output 1

Previous diagnostics

Navigation Diagnostics → Prev. diagnsotics

Description Use this function to display the diagnostics message last displayed before the current message. This condition can still apply.

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

Additional information *User interface*

Example for display format:
⚠C411 01d5h14min20s
Upload/download active

Operating time from restart

Navigation Diagnostics → Operatint time fr. restart

Description Use this function to display the time the device has been in operation since the last device restart.

Display format Days (d), hours (h), minutes (m) and seconds (s)

Operating time

(→ 128)

16.2.1 "Diagnsotics list" submenu

Up to 5 diagnostics messages currently pending are displayed in this submenu. If more than 5 messages are pending, the messages with the highest priority are shown on the display.

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

Information on diagnostics measures in the device and an overview of all the diagnostics messages: (→ 🖹 73)

Diagnsotics 1
Diagnsotics 2
Diagnsotics 3
Diagnsotics 4
Diagnsotics 5

Navigation

Diagnostics → Diagnose list → Diagnostics 1
Diagnostics → Diagnose list → Diagnostics 2
Diagnostics → Diagnose list → Diagnostics 3
Diagnostics → Diagnose list → Diagnostics 4
Diagnostics → Diagnose list → Diagnostics 5

Description

Use this function to display the current diagnostics messages with the highest priority to the fifth-highest priority.

Display format

Symbol for event behavior, diagnostics event, time the event occurred and event text

Additional information

User interface

Example 1 for display format:
⚠S441 01d4h12min30s
Current output 1

Example 2 for display format:
⊗F276 10d8h12min22s
I/O module error

16.2.2 The "Event logbook" submenu

Filter options

Navigation Diagnostics → Event logbook → Filter options

Description Use this function to select the category (status signal) whose event messages are displayed in the events list.

The status signals are categorized according to NAMUR NE 107: F = failure, M = maintenance request, C = function check, S = out of specification

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

Factory setting All

Event list

Navigation Diagnostics → Event logbook → Event list

Description Use this function to display the history of event messages of the category selected in the **Filter options** parameter (→ 135). A maximum of 20 event messages are displayed in chronological order. If the advanced HistoROM function is enabled in the device, the event list can contain up to 100 entries.

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

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

Display format
- For event messages in category I (status signal): status signal, event number, time event occurred, event text
- For event messages in category F, M, C, S (status signal): diagnostics event, status symbol, time event occurred, event text

Additional information

User interface

Example 1 for display format:
I 1091 → 24d12h13m00s
Configuration modified

Example 2 for display format:
S441 → 01d4h12min30s
Current output 1

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

16.2.3 "Device information" submenu

Device tag

Navigation Diagnostics → Device info → Device tag

Description Enter tag for measuring point

Display Max. 32-digit character string comprising letters, numbers or special characters (e.g. @, %, /)

Factory setting FMR5x

Serial number

Navigation Diagnostics → Device info → Serial number

Description Use this function to view the serial number of the device. It can also be found on the nameplate.

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

Display Max. 11-digit character string comprising letters and numbers

Firmware version

Navigation Diagnostics → Device info → Firmware version

Description Use this function to view the device firmware version installed.

Display Max. 6-digit character string in the format xx.yy.zz

Device name

Navigation Diagnostics → Device info → Device name

Description Use this function to view the name of the transmitter. It can also be found on the nameplate of the transmitter.

Order code

Navigation Diagnostics → Device info → Order code

Description Use this function to view the order code of the device. It can also be found on the nameplate. The order code is generated by a one-to-one transformation from the extended order code, which defines all the device features of the product structure. In contrast, the device features can not be read directly from the order code.

Uses of the order code
- To order an identical spare device.
- To identify the device quickly and easily, e.g. when contacting Endress+Hauser.

Extended order code 1
Extended order code 2
Extended order code 3

Navigation
Diagnostics → Device info → Extended order code 1
Diagnostics → Device info → Extended order code 2
Diagnostics → Device info → Extended order code 3

Description Use this function to display the first, second or third part of the extended order code. On account of length restrictions, the extended order code is split into a maximum of 3 parameters.
The extended order code indicates the selected options of all the features of the product structure for the device and thus uniquely identifies the device. It can also be found on the nameplate.

Uses of the extended order code
- To order an identical spare device.
- To check the ordered device features against the shipping note.

16.2.4 "Measured value" submenu

Distance	(→ 97)

Level linearized

Navigation	Diagnostics → Measured val. → Level linearized
Description	Displays the linearized level.
Additional information	The level is displayed in the **Unit linearized** (→ 105).

Output current 1 / Output current 2	(→ 116)

Measured current 1

Navigation	Diagnostics → Measured val. → Measured current 1
Description	Use this function to view the current value of the current output currently measured.

Terminal voltage 1

Navigation	Diagnostics → Measured val. → Terminal volt. 1
Description	Use this function to view the current terminal voltage that is present at the current output.

Switch status	(→ 119)

Electronic temperature

Navigation	Diagnostics → Measured val. → Electronic temperature
Description	Indicates the currently measured temperature of the electronics

16.2.5 "Data logging" submenu

This submenu is only available if the advanced functionality of the HistoROM has been activated in the device.

Das Menü wird nur angezeigt, wenn im Gerät die erweiterter Funktion des HistoROM freigeschaltet ist.

Assign channel 1
Assign channel 2
Assign channel 3
Assign channel 4

Navigation

Diagnostics → Data logging → Assign channel 1
Diagnostics → Data logging → Assign channel 2
Diagnostics → Data logging → Assign channel 3
Diagnostics → Data logging → Assign channel 4

Description

Use this function to assign a process variable to the data logging channel.

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

If the maximum number of data points is reached, the oldest data points in the data log are cyclically overwritten in such a way that the last 500, 250, 166 or 125 measured values are always in the log (ring memory principle).

The log contents are cleared if the option selected is changed.

Options

- Off
- Level
- Distance
- Current output 1
- Measured current
- Current output 2 (only for devices with two current outputs)
- Terminal voltage
- Electronics temperature
- Absolute echo amplitude
- Relative echo amplitude
- Area of incopupling
- Analog output adv. diagnostics 1
- Analog output adv. diagnostics 2

Factory setting

Off

Logging interval

Navigation

Diagnostics → Data logging → Logging interval

Description

Definition of the logging interval t_{log} for data logging. This defines the interval between the individual data points in the data log, and thus the maximum loggable process time T_{log}:

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

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

The log contents are cleared if the length of the logging interval is changed.

Input range

1.0 to 3 600.0 s

Factory setting

10.0 s

Additional information

Example
If 1 logging channel is used:

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

Clear logging data

Navigation

Diagnostics → Data logging → Clear logging data

Description

Use this function to clear the entire logging data.

Options

- Cancel
  The data are not cleared. All the data are retained.
- Clear data
  The logging data are cleared. The logging process starts from scratch.

Factory setting

Cancel

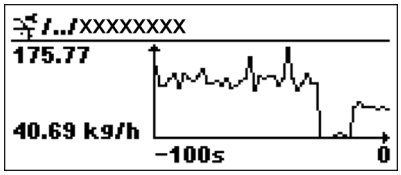
Display channel 1
Display channel 2
Display channel 3
Display channel 4

Navigation

Diagnostics → Data logging → Display channel 1
Diagnostics → Data logging → Display channel 2
Diagnostics → Data logging → Display channel 3
Diagnostics → Data logging → Display channel 4

Description

Use this function to view the measured value trend for the logging channel in the form of a chart.



A0013859

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

The process variable whose measured value curve is displayed is specified in the **Assign channel 1 - Assign channel 4** parameter (→ 140).

Additional information

After calling up one of these parameters a diagram appears which shows the change of the respective measured value in the course of time. By pressing ⊞ and ⊟ simultaneously the diagram can be quitted and the display returns to the operating menu.

16.2.6 "Simulation" submenu

Assignment of measured variable

Navigation Diagnostics → Simulation → Assign. meas. var.

Description Use this function to select a process variable for the simulation process that is activated. The display alternates between the measured value and a diagnostics message of the *"function check" category (C)* while simulation is in progress:

The simulation value of the selected process variable is defined in the **Value process variable** parameter (→ 143).

Options
- Off
- Level
- Level linearized

Factory setting Off

Value process variable

Navigation Diagnostics → Simulation → Value proc. var.

Prerequisite One of the following options is selected in the **Assignment of measured variable** parameter :
- Level
- Level linearized

Description Use this function to enter a simulation value for the selected process variable. Subsequent 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.

Input range Depends on the process variable selected

Factory setting The current value of the selected process variable (at the moment the simulation is activated).

Switch output simulation

Navigation Diagnostics → Simulation → Switch output simulation

Description Use this parameter to activate or deactivate the simulation of the switch output.

Options
- Off
- On

Factory setting Off (i.e. no simulation)

Additional information The switch output can also be simulated by selecting the **On** or **Off** option in **Setup → Advanced setup → Switch output → Switch output function**.

Switch status

Navigation Diagnostics → Simulation → Switch status

Prerequisite Only visible for **Switch output simulation** = **On**.

Options
- Open
- Closed

Factory settings Open

Simulation current output 1
Simulation current output 2

Navigation
Diagnostics → Simulation → Sim.curr.out. 1
Diagnostics → Simulation → Sim.curr.out. 2 (for devices with 2 current outputs)

Description Use this function to switch simulation of the current output on and off. The display alternates between the measured value and a diagnostics message of the *"function check" category (C)* while simulation is in progress:

The simulation value is defined in the **Value current output 1-2** parameter (→ 144).

Options
- On
  Current simulation is active.
- Off
  Current simulation is switched off. The device is in normal measuring mode or another process variable is being simulated.

Factory setting Off

Value current output 1
Value current output 2

Navigation
Diagnostics → Simulation → Value curr.out. 1
Diagnostics → Simulation → Value curr.out. 2 (only for devices with 2 current outputs)

Prerequisite The **On** option is selected in the **Simulation current output 1-2** parameter .

Description Use this function to enter a current value for the simulation. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.

Input range 3.6 to 22.5 mA

Factory setting Current value at the moment the simulation is activated.

Simulation device alarm

Navigation Diagnostics → Simulation → Sim. alarm

Description Use this function to switch the device alarm on and off. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.
The display alternates between the measured value and a diagnostics message of the *"function check" category (C)* while simulation is in progress:

Options
- On
- Off

Factory setting Off

16.2.7 The "Device check" submenu

Start device check

Navigation Diagnostics → Device check → Start device check

Description Start of a device check.

Options
- No
  No device check is performed.
- Yes
  A device check is performed.

If the error S941 "Echo lost" is present, a device check is not possible. First you have to eliminte the cause of this error.

Factory setting No

Result device check

Navigation Diagnostics → Device check → Result device check

Description Indicates the result of the device check.

Display
- Installation ok
- 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

Last check time

Navigation Diagnostics → Device check → Last check time

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

Additional information *Display format*
Days (d), hours (h), minutes (m), seconds (s): 0000d00h00m00s

Level signal

Navigation Diagnostics → Device check → Level signal

Prerequisite Only visible if a device check has been performed.

Description Displays the result of the device check for the level signal.

Display options
- Check not done
- Check not ok
  Check the mounting position of the device and the dielectric constant of the medium.
- Check ok

Index

www.addresses.endress.com

Endress+Hauser

People for Process Automation