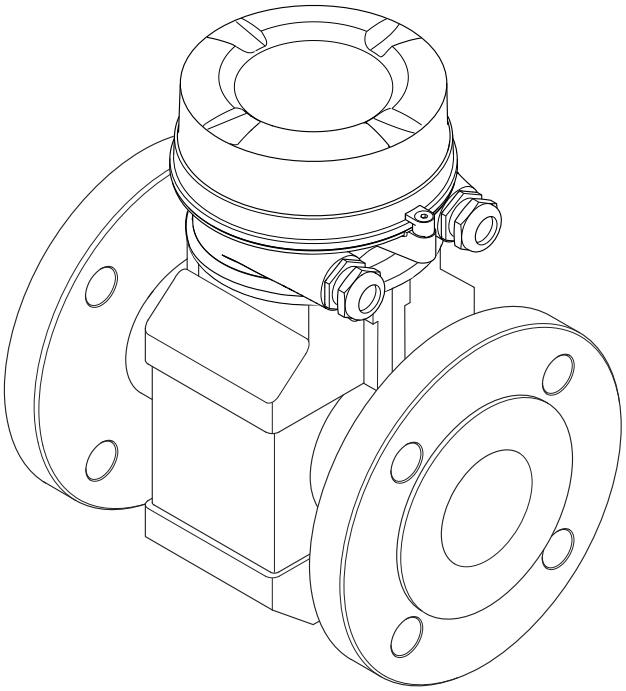
BA01172D/06/EN/02.14
71249920

Valid as of version
01.00.zz (Device firmware)

Operating Instructions
Proline Promag P 100 HART

Electromagnetic flowmeter



Endress+Hauser
People for Process Automation

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser Sales Center will supply you with current information and updates to these Instructions.

Table of contents

1 Document information

1.1 Document function

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

1.2 Symbols used

1.2.1 Safety symbols

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

1.2.2 Electrical symbols

Symbol	Meaning
⎓	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
~	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
⎓ ~	**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.
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊜	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**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
	Allen key
	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Indicates procedures, processes or actions that are permitted.
	**Preferred** Indicates procedures, processes or actions that are preferred.
	**Forbidden** Indicates procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Reference to page** Refers to the corresponding page number.
	**Reference to graphic** Refers to the corresponding graphic number and page number.
	Series of steps
	Result of a sequence of actions
	**Help in the event of a problem**
	**Visual inspection**

1.2.5 Symbols in graphics

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

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The CD-ROM provided for the device (depending on the device version, the CD-ROM might not be part of the delivery!)
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

For a detailed list of the individual documents along with the documentation code (→ 109)

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**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	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.3.2 Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.4 Registered trademarks

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

Microsoft®
Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

Applicator®, FieldCare®, Field Xpert™, HistoROM®, Heartbeat Technology™
Registered or registration-pending trademarks of the Endress+Hauser Group

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 media
Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or in applications where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media against which the process-wetted materials are adequately resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section (→ 🖹 7).

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

⚠ WARNING
Danger of breakage of the sensor due to corrosive or abrasive fluids!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Observe the specified pressure and temperature range.

Verification for borderline cases:
- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks
The external surface temperature of the housing can increase by max. 10 K due to the power consumption of the electronic components. Hot process fluids passing through the measuring device will further increase the surface temperature of the housing. The surface of the sensor, in particular, can reach temperatures which are close to the fluid temperature.

Possible burn hazard due to fluid temperatures!
- For elevated fluid temperature, ensure protection against contact 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.

For welding work on the piping:
- Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:
- It is recommended to wear gloves on account of the higher risk of electric shock.

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 Endress+Hauser.

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 Endress+Hauser only.

2.5 Product safety

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

It meets general safety standards and legal requirements. 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.

2.6 IT security

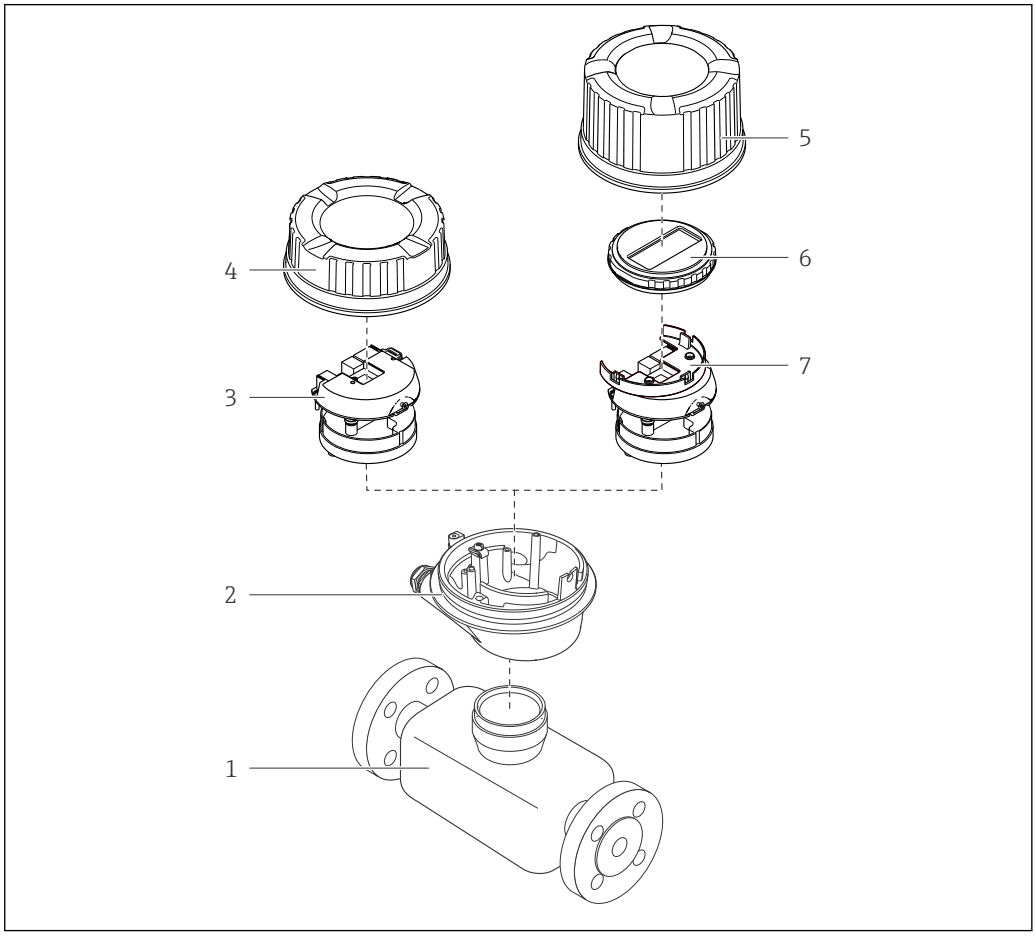
We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Product description

3.1 Product design

3.1.1 Device version with HART communication type

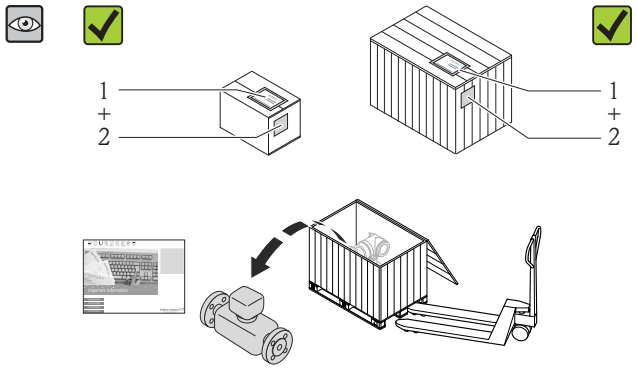


1 *Important components of a measuring device*

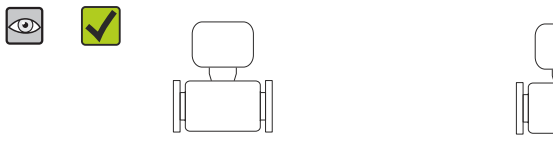
1 *Sensor*
2 *Transmitter housing*
3 *Main electronics module*
4 *Transmitter housing cover*
5 *Transmitter housing cover (version for optional onsite display)*
6 *Onsite display (optional)*
7 *Main electronics module (with bracket for optional onsite display)*

4 Incoming acceptance and product identification

4.1 Incoming acceptance

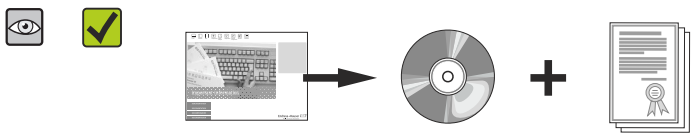


Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?

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



Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?

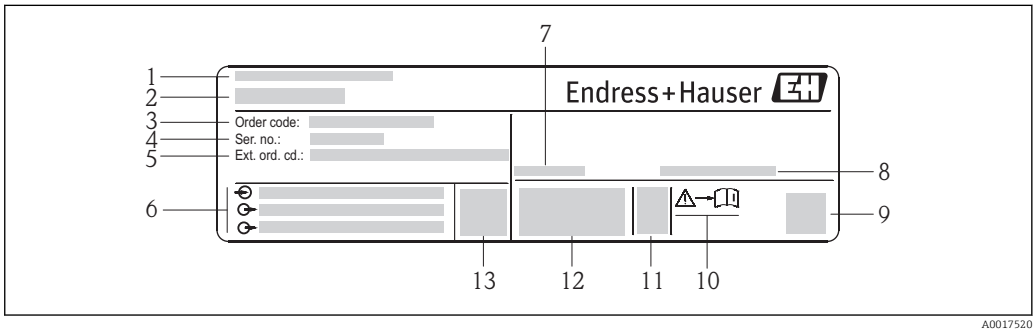
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! In such cases, the technical documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section (→ 13).

4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The chapters "Additional standard documentation on the device" (→ 7) and "Supplementary device-dependent documentation" (→ 7)
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

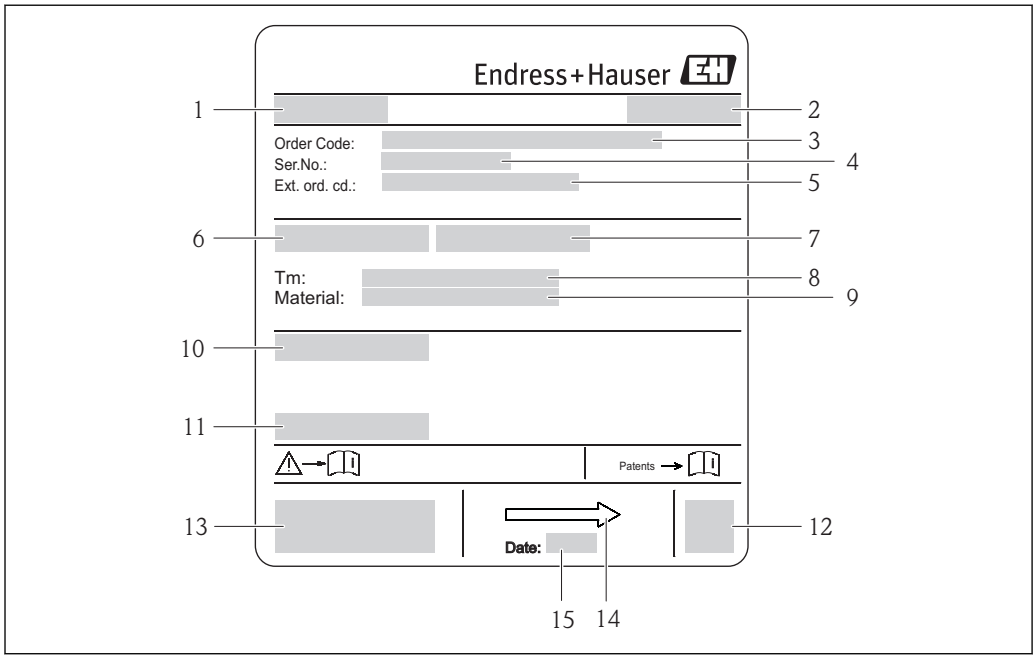
4.2.1 Transmitter nameplate



2 *Example of a transmitter nameplate*

1 *Manufacturing location*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number*
5 *Extended order code*
6 *Electrical connection data, e.g. available inputs and outputs, supply voltage*
7 *Permitted ambient temperature range (T_a)*
8 *Degree of protection*
9 *2-D matrix code*
10 *Document number of safety-related supplementary documentation*
11 *Manufacturing date: year-month*
12 *CE mark, C-Tick*
13 *Firmware version (FW)*

4.2.2 Sensor nameplate



3 *Example of sensor nameplate*

1 *Name of the sensor*
2 *Manufacturing location*
3 *Order code*
4 *Serial number (Ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Nominal diameter of sensor*
7 *Test pressure of the sensor*
8 *Medium temperature range*
9 *Material of lining and electrodes*
10 *Degree of protection: e.g. IP, NEMA*
11 *Permitted ambient temperature (T_a)*
12 *2-D matrix code*
13 *CE mark, C-Tick*
14 *Flow direction*
15 *Manufacturing date: year-month*

Order code

The measuring device is reordered using the order code.

Extended order code

- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

4.2.3 Symbols on measuring device

Symbol	Meaning
⚠	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

5.1 Storage conditions

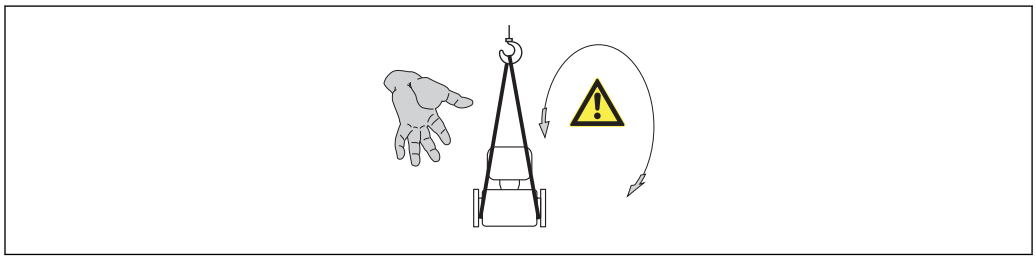
Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the lining.
- Store in a dry and dust-free place.
- Do not store outdoors.
- Storage temperature(→ 99)

5.2 Transporting the product

WARNING

Center of gravity of the measuring device is higher than the suspension points of the webbing slings.

Risk of injury if the measuring device slips.
- ▶ Secure the measuring device from rotating or slipping.
- ▶ Observe the weight specified on the packaging (stick-on label).
- ▶ Observe the transport instructions on the stick-on label on the electronics compartment cover.



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- Transport the measuring device to the measuring point in the original packaging.
- Lifting gear
  - Webbing slings: Do not use chains, as they could damage the housing.
  - For wood crates, the floor structure enables these to be loaded lengthwise or broadside using a forklift.
- Use the webbing slings to lift the measuring device at the process connections; do not lift at the transmitter housing.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

5.3 Packaging disposal

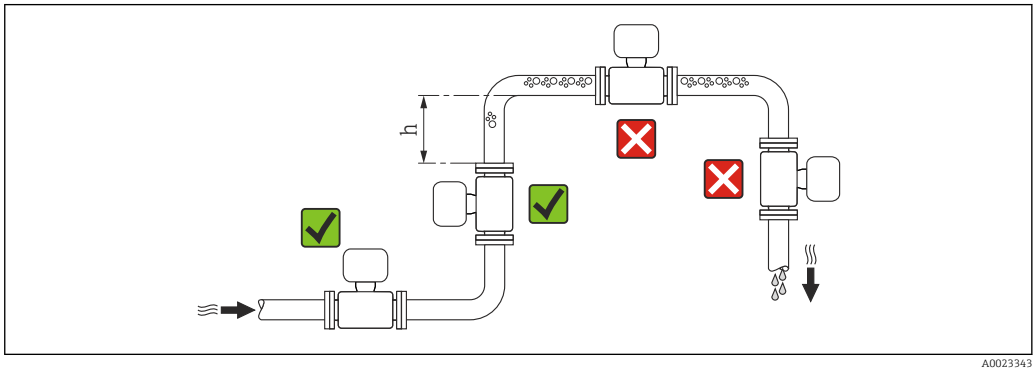
All packaging materials are environmentally friendly and 100% recyclable:
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Dunnage: Paper cushion

6 Mounting

6.1 Installation conditions

6.1.1 Mounting position

Mounting location



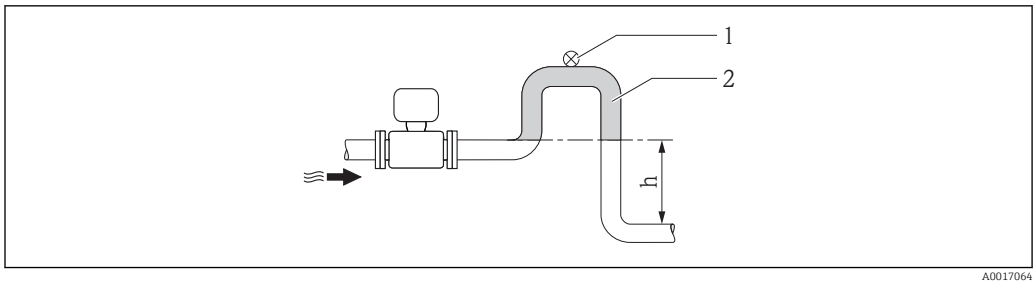
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.

For information on the liner's resistance to partial vacuum (→ 100)



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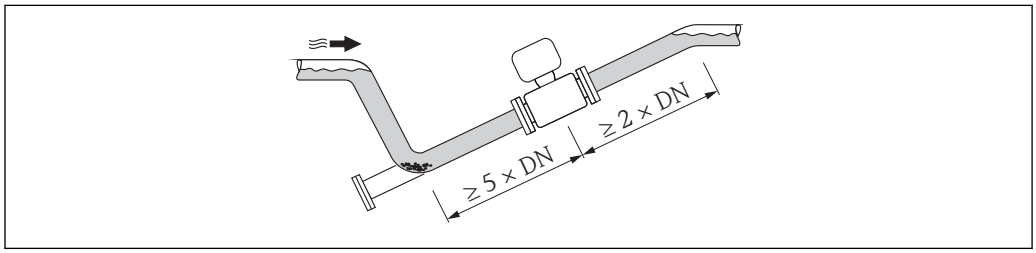
4 Installation in a down pipe

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.



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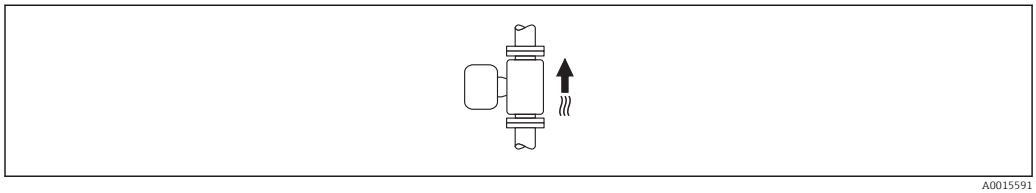
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

Vertical



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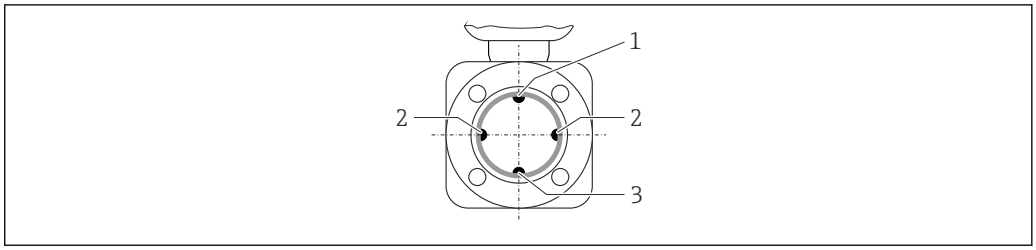
This is the optimum for self-emptying piping systems and for use in conjunction with empty pipe detection.

Horizontal



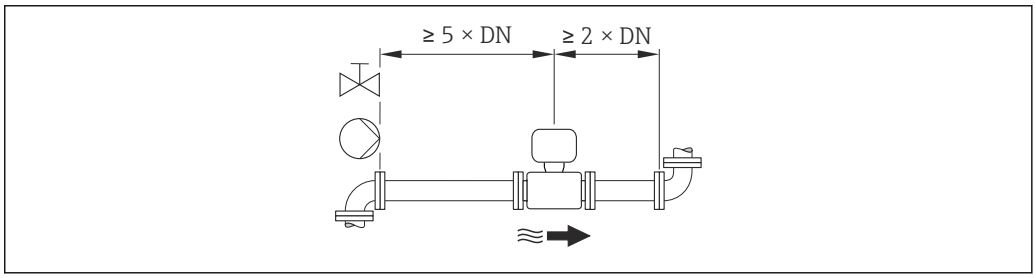
1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

- The measuring electrode plane must be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- The empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



Installation dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

6.1.2 Requirements from environment and process

Ambient temperature range

Transmitter	−40 to +60 °C (−40 to +140 °F)
Sensor	▪ Process connection material, carbon steel: −10 to +60 °C (+14 to +140 °F) ▪ Process connection material, stainless steel: −40 to +60 °C (−40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner (→ 🖹 100).

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

Temperature tables

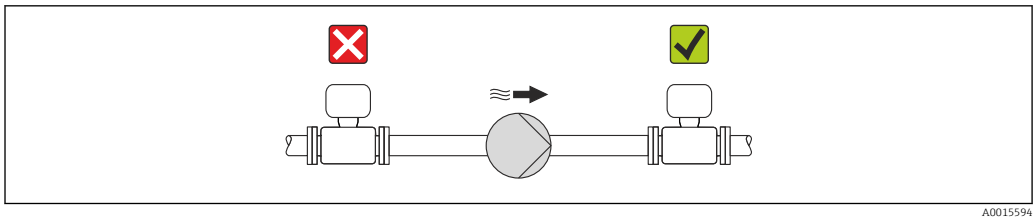
SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
30	50	95	130	150	150	150
50	–	95	130	150	150	150
60	–	95	110	110	110	110

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
86	122	203	266	302	302	302
122	–	203	266	302	302	302
140	–	203	230	230	230	230

System pressure



Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

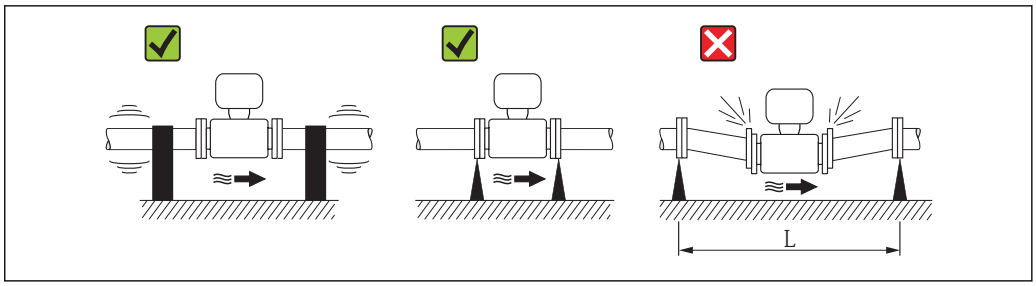
- For information on the liner's resistance to partial vacuum (→ 100)
- Information on the shock resistance of the measuring system (→ 99)
- Information on the vibration resistance of the measuring system (→ 99)

Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

Information on the shock resistance of the measuring system (→ 99)

Information on the vibration resistance of the measuring system (→ 99)



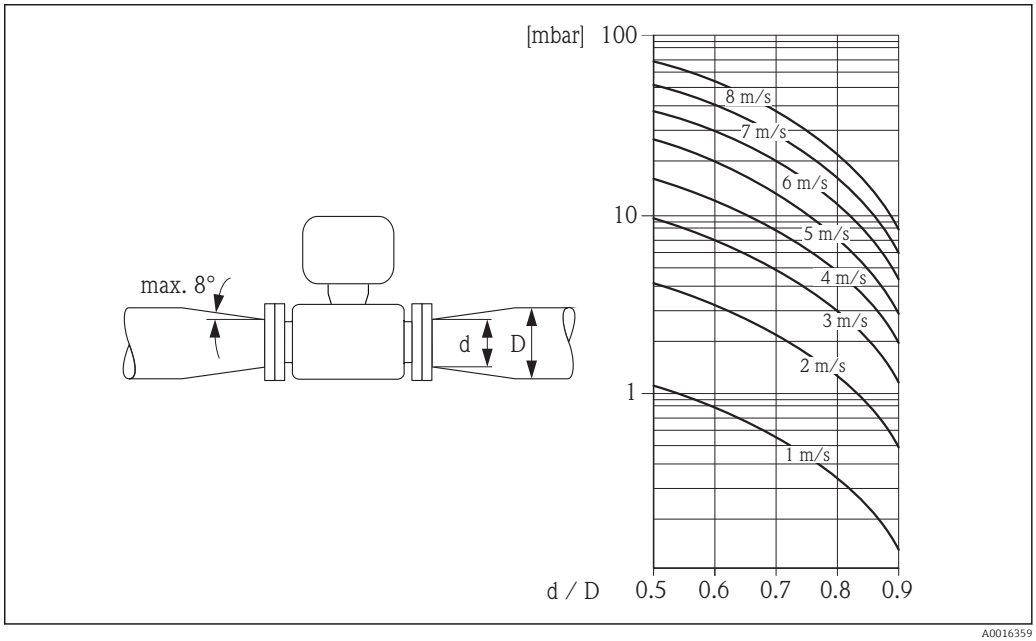
5 *Measures to avoid device vibrations (L > 10 m (33 ft))*

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

The nomogram only applies to liquids with a viscosity similar to that of water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



6.2 Mounting the measuring device

6.2.1 Required tools

For sensor

For flanges and other process connections:
- Screws, nuts, seals etc. are not included in the scope of supply and must be provided by the customer.
- Appropriate mounting tools

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. Remove stick-on label on the electronics compartment cover.

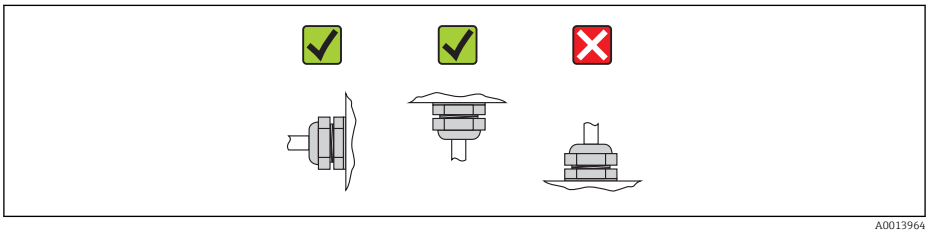
6.2.3 Mounting the sensor

⚠ WARNING

Danger due to improper process sealing!

- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the gaskets are clean and undamaged.
- ▶ Install the gaskets correctly.

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
2. To ensure compliance with device specifications, install the measuring device between the pipe flanges in a way that it is centered in the measurement section.
3. If using ground disks, comply with the Installation Instructions provided.
4. Observe required screw tightening torques (→ 📄 23).
5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



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Mounting the seals

⚠ CAUTION

An electrically conductive layer could form on the inside of the measuring tube!

Risk of measuring signal short circuit.

- ▶ Do not use electrically conductive sealing compounds such as graphite.

Comply with the following instructions when installing seals:

- When mounting the process connections, make sure that the seals concerned are clean and centered correctly.
- For DIN flanges: only use seals according to DIN EN 1514-1.
- For "PFA" lining: additional seals are **always** required.
- For "PTFE" lining: generally additional seals are **not** required.

Mounting the ground cable/ground disks

Comply with the information on potential equalization and detailed mounting instructions for the use of ground cables/ground disks (→ 📄 31).

Screw tightening torques

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Screw tightening torques for EN 1092-1 (DIN 2501), PN 40/25

Nominal diameter	Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm]	
[mm]	[bar]	[mm]	PTFE	PFA
15	PN 40	4 × M12	11	–
25	PN 40	4 × M12	26	20
32	PN 40	4 × M16	41	35
40	PN 40	4 × M16	52	47
50	PN 40	4 × M16	65	59
65 [1)]	PN 16	8 × M16	43	40
65	PN 40	8 × M16	43	40
80	PN 16	8 × M16	53	48
80	PN 40	8 × M16	53	48
100	PN 16	8 × M16	57	51
100	PN 40	8 × M20	78	70
125	PN 16	8 × M16	75	67
125	PN 40	8 × M24	111	99
150	PN 16	8 × M20	99	85
150	PN 40	8 × M24	136	120
200	PN 10	8 × M20	141	101
200	PN 16	12 × M20	94	67
200	PN 25	12 × M24	138	105
250	PN 10	12 × M20	110	–
250	PN 16	12 × M24	131	–
250	PN 25	12 × M27	200	–
300	PN 10	12 × M20	125	–
300	PN 16	12 × M24	179	–
300	PN 25	16 × M27	204	–
350	PN 10	16 × M20	188	–
350	PN 16	16 × M24	254	–
350	PN 25	16 × M30	380	–
400	PN 10	16 × M24	260	–
400	PN 16	16 × M27	330	–
400	PN 25	16 × M33	488	–
450	PN 10	20 × M24	235	–
450	PN 16	20 × M27	300	–
450	PN 25	20 × M33	385	–
500	PN 10	20 × M24	265	–
500	PN 16	20 × M30	448	–

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			PTFE	PFA
500	PN 25	20 × M33	533	–
600	PN 10	20 × M27	345	–
600 [1)]	PN 16	20 × M33	658	–
600	PN 25	20 × M36	731	–

1) Designed acc. to EN 1092-1 (not to DIN 2501)

Screw tightening torques for ASME B16.5, Class 150/300

Nominal diameter		Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm] ([lbf · ft])	
[mm]	[in]	[psi]	[in]	PTFE	PFA
15	½	Class 150	4 × ½	6 (4)	– (–)
15	½	Class 300	4 × ½	6 (4)	– (–)
25	1	Class 150	4 × ½	11 (8)	10 (7)
25	1	Class 300	4 × 5/8	14 (10)	12 (9)
40	1 ½	Class 150	4 × ½	24 (18)	21 (15)
40	1 ½	Class 300	4 × ¾	34 (25)	31 (23)
50	2	Class 150	4 × 5/8	47 (35)	44 (32)
50	2	Class 300	8 × 5/8	23 (17)	22 (16)
80	3	Class 150	4 × 5/8	79 (58)	67 (49)
80	3	Class 300	8 × ¾	47 (35)	42 (31)
100	4	Class 150	8 × 5/8	56 (41)	50 (37)
100	4	Class 300	8 × ¾	67 (49)	59 (44)
150	6	Class 150	8 × ¾	106 (78)	86 (63)
150	6	Class 300	12 × ¾	73 (54)	67 (49)
200	8	Class 150	8 × ¾	143 (105)	109 (80)
250	10	Class 150	12 × 7/8	135 (100)	– (–)
300	12	Class 150	12 × 7/8	178 (131)	– (–)
350	14	Class 150	12 × 1	260 (192)	– (–)
400	16	Class 150	16 × 1	246 (181)	– (–)
450	18	Class 150	16 × 1 1/8	371 (274)	– (–)
500	20	Class 150	20 × 1 1/8	341 (252)	– (–)
600	24	Class 150	20 × 1 ¼	477 (352)	– (–)

Screw tightening torques for JIS B2220, 10/20K

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			PTFE	PFA
25	10K	4 × M16	32	27
25	20K	4 × M16	32	27
32	10K	4 × M16	38	–
32	20K	4 × M16	38	–
40	10K	4 × M16	41	37

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			PTFE	PFA
40	20K	4 × M16	41	37
50	10K	4 × M16	54	46
50	20K	8 × M16	27	23
65	10K	4 × M16	74	63
65	20K	8 × M16	37	31
80	10K	8 × M16	38	32
80	20K	8 × M20	57	46
100	10K	8 × M16	47	38
100	20K	8 × M20	75	58
125	10K	8 × M20	80	66
125	20K	8 × M22	121	103
150	10K	8 × M20	99	81
150	20K	12 × M22	108	72
200	10K	12 × M20	82	54
200	20K	12 × M22	121	88
250	10K	12 × M22	133	–
250	20K	12 × M24	212	–
300	10K	16 × M22	99	–
300	20K	16 × M24	183	–

Screw tightening torques for AS 2129, Table E

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm] PTFE
25	4 × M12	21
50	4 × M16	42

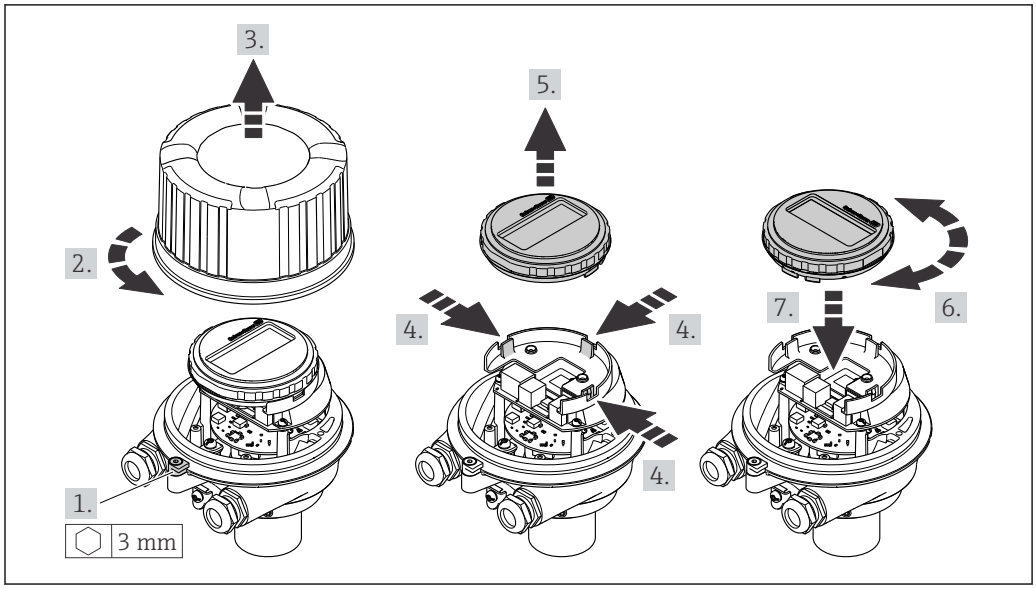
Screw tightening torques for AS 4087, PN 16

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm] PTFE
50	4 × M16	42

6.2.4 Turning the display module

The display module can be turned to optimize display readability.

Aluminum housing version, AlSi10Mg, coated



6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping ?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Have the fixing screws been tightened with the correct tightening torque?	❑

7 Electrical connection

The measuring device does not have an internal circuit breaker. For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp (on aluminum housing): Allen screw3 mm
- For securing screw (for stainless steel housing): open-ended wrench 8 mm
- Wire stripper
- When using stranded cables: crimping tool for ferrule

7.1.2 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

- −40 °C (−40 °F) to +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output

For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Φ6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
  Wire cross-sections 0.5 to 2.5 mm^2 (20 to 14 AWG)

7.1.3 Terminal assignment

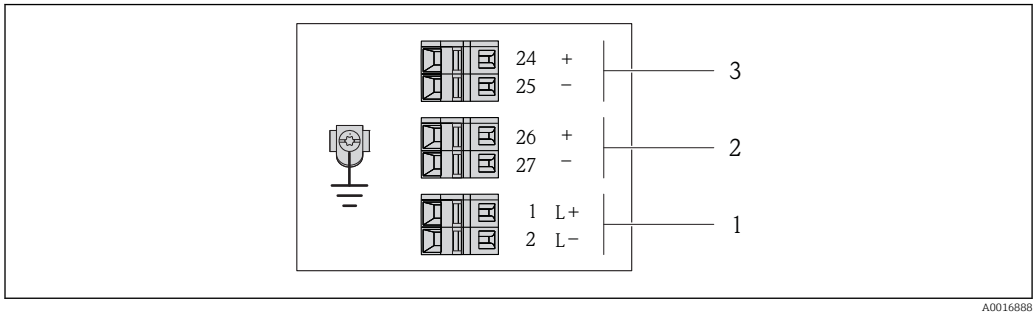
Transmitter

Connection version 4-20 mA HART with pulse/frequency/switch output

Order code for "Output", option **B**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Outputs	Power supply	
Option **A**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Option **A**	Device plug	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Option **A**	Device plug	Device plug	Option **Q**: 2 x plug M12x1
Order code for "Housing": Option **A**: compact, coated aluminum			



6 Terminal assignment 4-20 mA HART with pulse/frequency/switch output

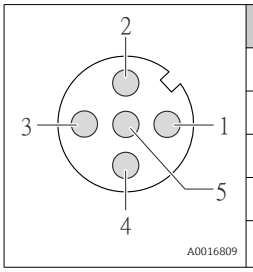
1 Power supply: DC 24 V
2 Output 1: 4-20 mA HART (active)
3 Output 2: pulse/frequency/switch output (passive)

Order code for "Output"	Terminal number					
	Power supply		Output 1		Output 2	
	2 (L-)	1 (L+)	27 (–)	26 (+)	25 (–)	24 (+)
Option **B**	DC 24 V		4-20 mA HART (active)		Pulse/frequency/switch output (passive)	
Order code for "Output": Option **B**: 4-20 mA HART with pulse/frequency/switch output						

7.1.4 Pin assignment, device plug

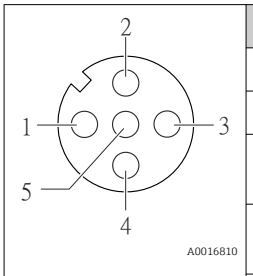
4-20 mA HART with pulse/frequency/switch output

Device plug for supply voltage (device side)



Pin	Assignment		Coding	Plug/socket
1	L+	DC24 V	A	Plug
2				
3				
4	L-	DC24 V		
5		Grounding/shielding		

Device plug for signal transmission (device side)



Pin	Assignment		Coding	Plug/socket
1	+	4-20 mA HART (active)	A	Socket
2	-	4-20 mA HART (active)		
3	+	Pulse/frequency/switch output (passive)		
4	-	Pulse/frequency/switch output (passive)		
5		Grounding/shielding		

7.1.5 Preparing the measuring device

1. Remove dummy plug if present.
2. **NOTICE!** Insufficient sealing of the housing! Operational reliability of the measuring device could be compromised. Use suitable cable glands corresponding to the degree of protection.
   If measuring device is delivered without cable glands:
   Provide suitable cable gland for corresponding connecting cable (→ 27).
3. If measuring device is delivered with cable glands:
   Observe cable specification (→ 27).

7.2 Connecting the measuring device

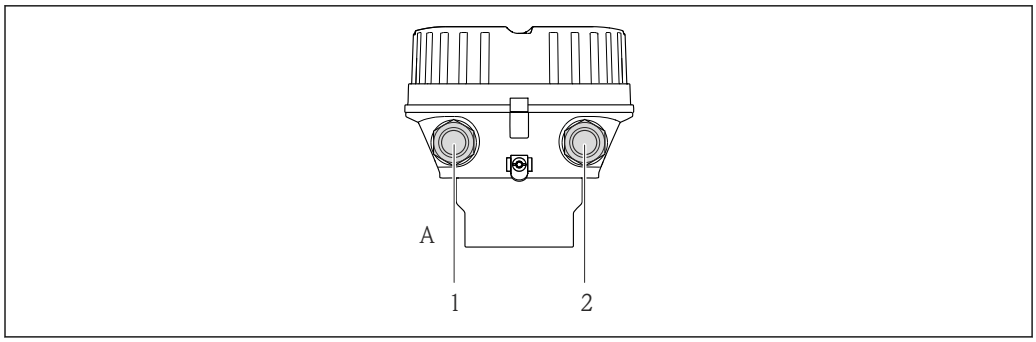
NOTICE

Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

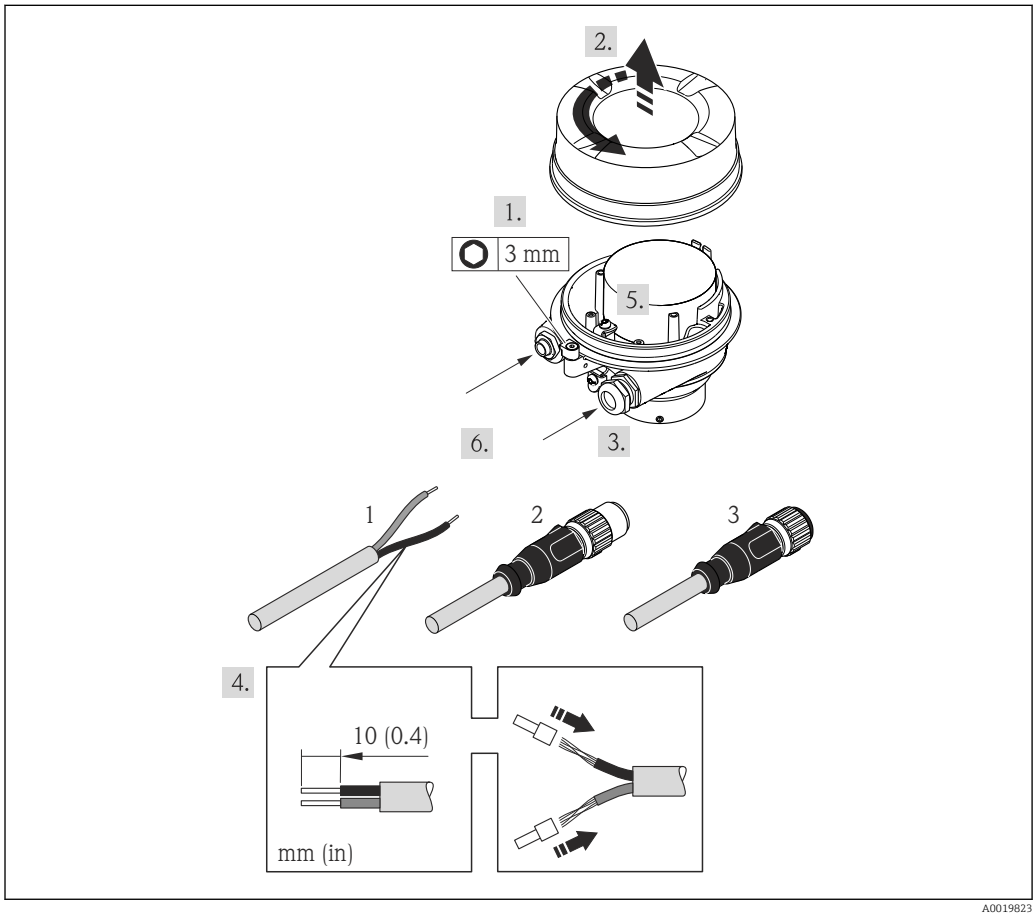
7.2.1 Connecting the transmitter

The connection of the transmitter depends on the following order codes:
- Housing version: compact or ultra-compact
- Connection version: device plug or terminals



7 Device versions and connection versions

A Housing version: compact, aluminum coated
1 Cable entry or device plug for signal transmission
2 Cable entry or device plug for supply voltage



8 Device versions with connection examples

1 Cable
2 Device plug for signal transmission
3 Device plug for supply voltage

For device version with device plug: only pay attention to Step 6.

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version, unscrew or open the housing cover and disconnect the local display from the main electronics module where necessary (→ 106).
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 and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the cable in accordance with the terminal assignment or the device plug pin assignment .
6. Depending on the device version: tighten the cable glands or plug in the device plug and tighten .
7. **WARNING!** Housing degree of protection may be voided due to insufficient sealing of the housing. Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.
   Reverse the removal procedure to reassemble the transmitter.

7.2.2 Ensuring potential equalization

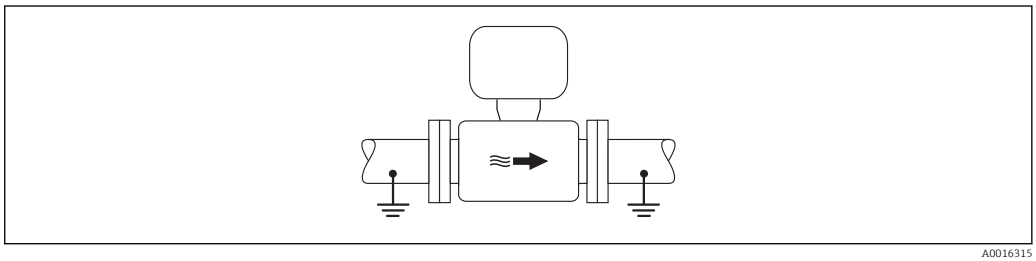
⚠ CAUTION

Electrode damage can result in the complete failure of the device!

- ▶ Make sure that the fluid and sensor have the same electrical potential.
- ▶ Pay attention to internal grounding concepts in the company.
- ▶ Pay attention to the pipe material or grounding.

Connection examples for standard situations

Metal, grounded pipe



A0016315

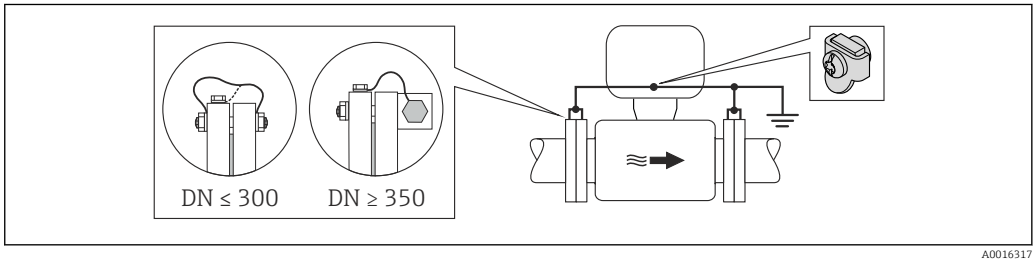
9 *Potential equalization via measuring tube*

Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least6 mm^2 (0.0093 in^2)



A0016317

10 *Potential equalization via ground terminal and pipe flanges*

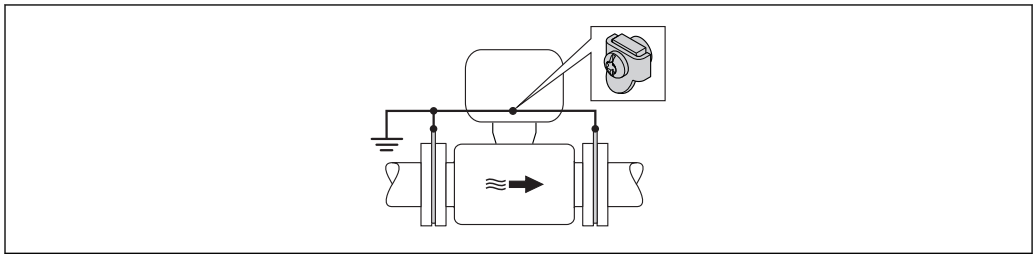
1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.

2. If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws. If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe torques (→ 🖹 23).
3. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose.

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least6 mm² (0.0093 in²)



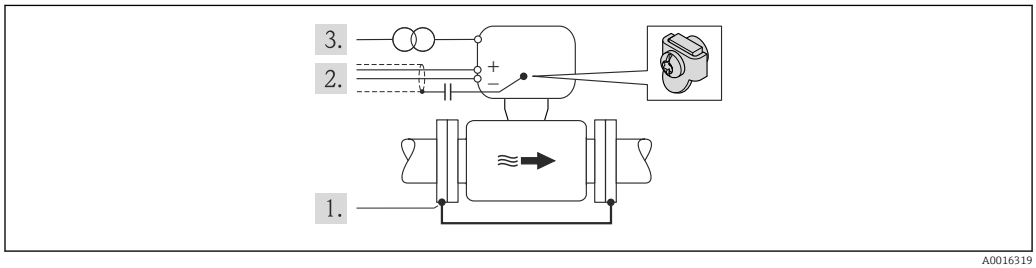
11 Potential equalization via ground terminal and ground disks

1. Connect the ground disks to the ground terminal via the ground cable.
2. Connect the ground disks to ground potential.

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment

Ground cable	Copper wire, at least6 mm² (0.0093 in²)



Prerequisite: The sensor is installed in the pipe in a way that provides electrical insulation.

1. Connect the two flanges of the pipe to one another via a ground cable.
2. Guide the shield of the signal lines through a capacitor.
3. Connect the measuring device to the power supply such that it is floating in relation to the protective ground (isolation transformer).

7.3 Special connection instructions

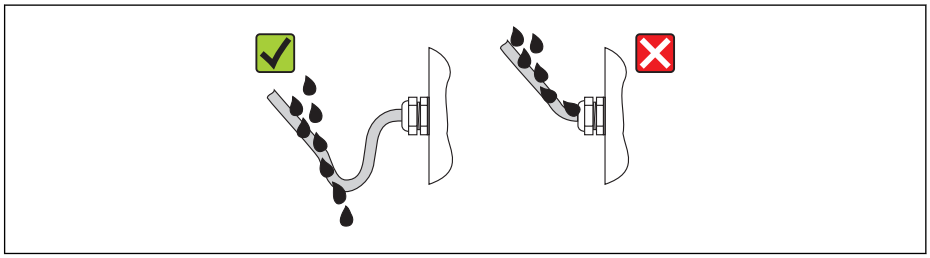
7.3.1 Connection examples

7.4 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.

To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws and screw covers.
3. Firmly tighten the cable glands.
4. To ensure that moisture does not enter the cable entry, route the cable so that it loops down before the cable entry ("water trap").



A0013960

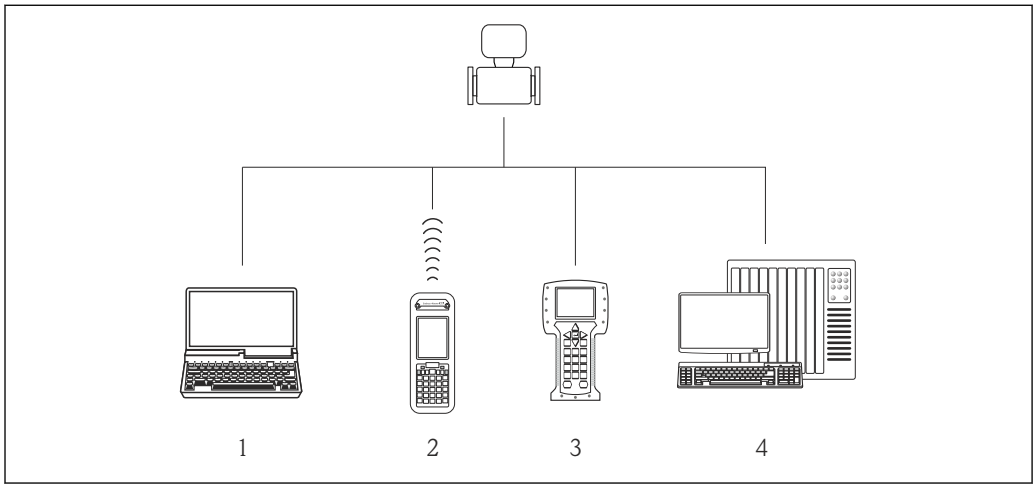
5. Insert dummy plugs into unused cable entries.

7.5 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables comply with the requirements (→ 🖹 27)?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" (→ 🖹 33) ?	❑
Depending on the device version: are all the device plugs firmly tightened (→ 🖹 29)?	❑
Does the supply voltage match the specifications on the transmitter nameplate (→ 🖹 97)?	❑
Is the terminal assignment or the pin assignment of the device plug correct?	❑
If supply voltage is present, is the power LED on the electronics module of the transmitter lit green (→ 🖹 11)?	❑
Is the potential equalization established correctly (→ 🖹 31)?	❑
Depending on the device version, is the securing clamp or fixing screw firmly tightened?	❑

8 Operation options

8.1 Overview of operation options

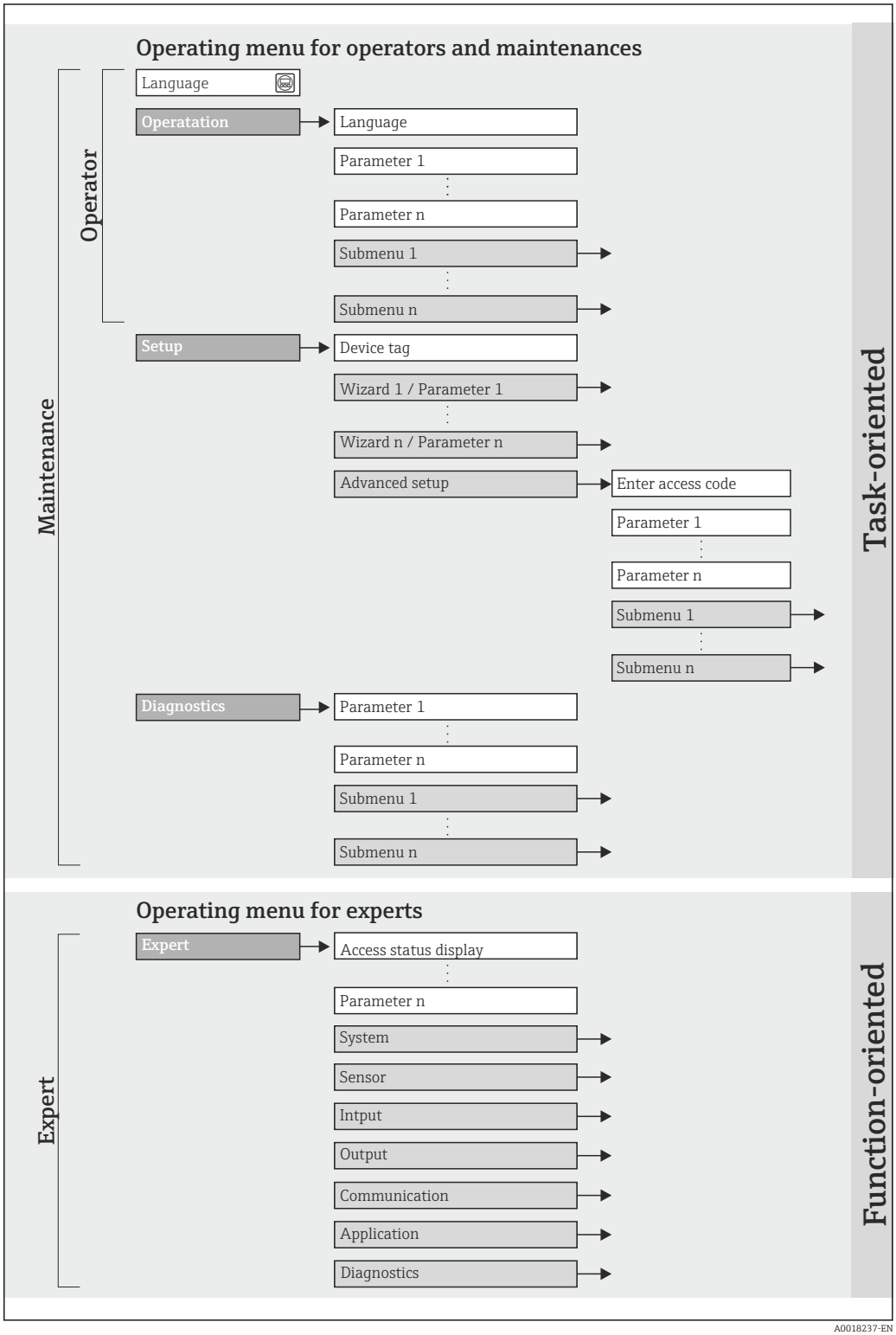


1 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
2 *Field Xpert SFX350 or SFX370*
3 *Field Communicator 475*
4 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu with menus and parameters



12 *Schematic structure of the operating menu*

8.2.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles. Each user role corresponds to typical tasks within the device lifecycle.

Menu		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: ▪ Configuring the operational display ▪ Reading measured values	Defining the operating language
Operation			▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: ▪ Configuration of the measurement ▪ Configuration of the inputs and outputs	**"Advanced setup" submenu:** ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuration of electrode cleaning (optional) ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Fault elimination: ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ▪ **"Diagnostic list" submenu** Contains up to 5 currently pending diagnostic messages. ▪ **"Event logbook" submenu** Contains up to 20 or 100 (order option " Extended HistoROM") event messages that have occurred. ▪ **"Device information" submenu** Contains information for identifying the device. ▪ **"Measured values" submenu** Contains all current measured values. ▪ **"Data logging" submenu (order option "Extended HistoROM")** Storage and visualization of up to 1000 measured values ▪ **"Heartbeat Technology" submenu** The functionality of the device is checked on demand and the verification results are documented. ▪ **"Simulation" submenu** Is used to simulate measured values or output values.
Expert	function-oriented	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases	Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: ▪ **"System" submenu** Contains all higher-order device parameters that do not pertain either to measurement or the measured value communication. ▪ **"Sensor" submenu** Configuration of the measurement. ▪ **"Application" submenu** Configuration of the functions that go beyond the actual measurement (e.g. totalizer). ▪ **"Diagnostics" submenu** Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to the operating menu via the Web browser

8.3.1 Function range

Thanks to the integrated Web server the device can be operated and configured via a Web browser. In addition to the measured values, status information on the device is also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

8.3.2 Prerequisites

Hardware

Connecting cable	Standard Ethernet cable with RJ45 connector
Computer	RJ45 interface
Measuring device:	Web server must be enabled; factory setting: ON For information on enabling the Web server (→ 39)

Software of the computer

Web browsers supported	▪ Microsoft Internet Explorer (min. 8.x) ▪ Mozilla Firefox ▪ Google chrome
Recommended operating systems	▪ Windows XP ▪ Windows 7
User rights for TCP/IP settings	User rights required for TCP/IP settings (e.g. for changes to IP address, subnet mask)
Computer configuration	▪ JavaScript is enabled ▪ If JavaScript cannot be enabled, enter http://XXX.XXX.X.XXX/basic.html in the address line of the Web browser, e.g. http://192.168.1.212/basic.html. A fully functional but simplified version of the operating menu structure starts in the Web browser.

When installing a new firmware version:
To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**.

8.3.3 Establishing a connection

Configuring the Internet protocol of the computer

The following information refers to the default Ethernet settings of the device.

IP address of the device: 192.168.1.212 (factory setting)

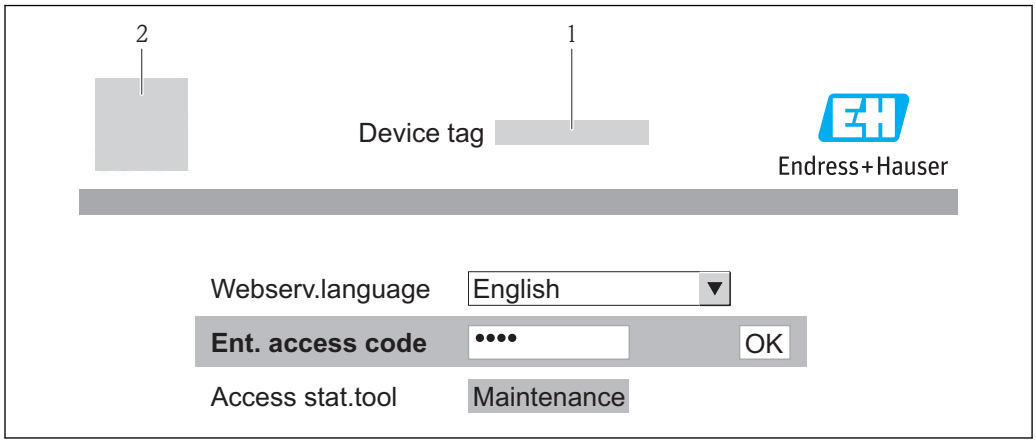
IP address	192.168.1.XXX; for XXX all numerical values except: 0, 212 and 255 → e.g. 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212 or leave cells empty

1. Switch on the measuring device and connect to the computer via the cable (→ 41).
2. If a 2nd network card is not used: all the applications on the notebook should be closed, or all the applications that require the Internet or network, such as e-mail, SAP applications, Internet or Windows Explorer, i.e. close all open Internet browsers.
3. Configure the properties of the Internet protocol (TCP/IP) as defined in the table above.

Starting the Web browser

1. Start the Web browser on the computer.
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212

The login page appears.



1 *Device tag (→ 49)*
2 *Picture of device*

If a login page does not appear, or if the page is incomplete (→ 75)

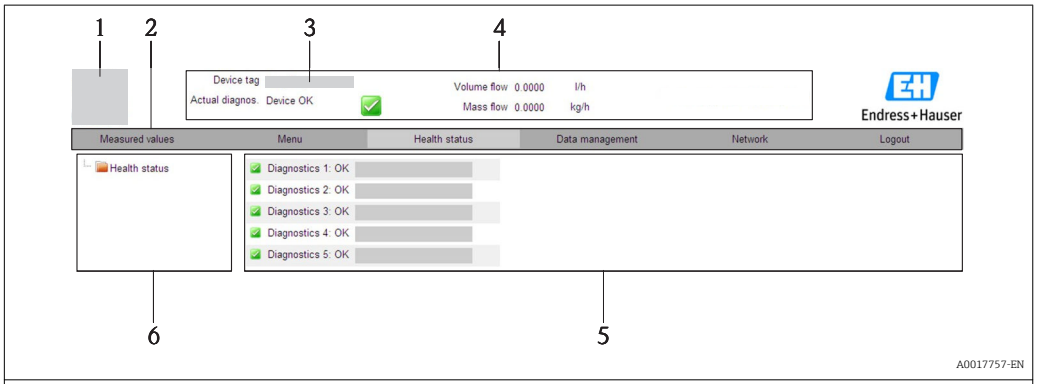
8.3.4 Logging on

1. Select the preferred operating language for the Web browser.
2. Enter the access code.
3. Press **OK** to confirm your entry.

Access code	0000 (factory setting); can be changed by customer (→ 69)

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

8.3.5 User interface



1 *Picture of device*
2 *Function row with 6 functions*
3 *Device tag*
4 *Header*
5 *Working area*
6 *Navigation area*

Header

The following information appears in the header:
- Device tag (→ 🖹 49)
- Device status with status signal (→ 🖹 77)
- Current measured values (→ 🖹 71)

Function row

Functions	Meaning
Measured values	The measured values of the device are displayed
Menu	Access to the operating menu structure of the device, same as for the operating tool
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	Data exchange between PC and measuring device: – Upload the configuration from the device (XML format, create configuration back-up) – Save the configuration to the device (XML format, restore configuration) – Export the event list (.csv file) – Export parameter settings (.csv file, create documentation of the measuring point configuration) – Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
Network configuration	Configuration and checking of all the parameters required for establishing the connection to the device: ▪ Network settings (e.g. IP address, MAC address) ▪ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:
- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.3.6 Disabling the Web server

The Web server for the measuring device can enabled and disabled as required via the **Web server functionality** parameter.

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On	On

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
Via "FieldCare" operating tool

8.3.7 Logging out

Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

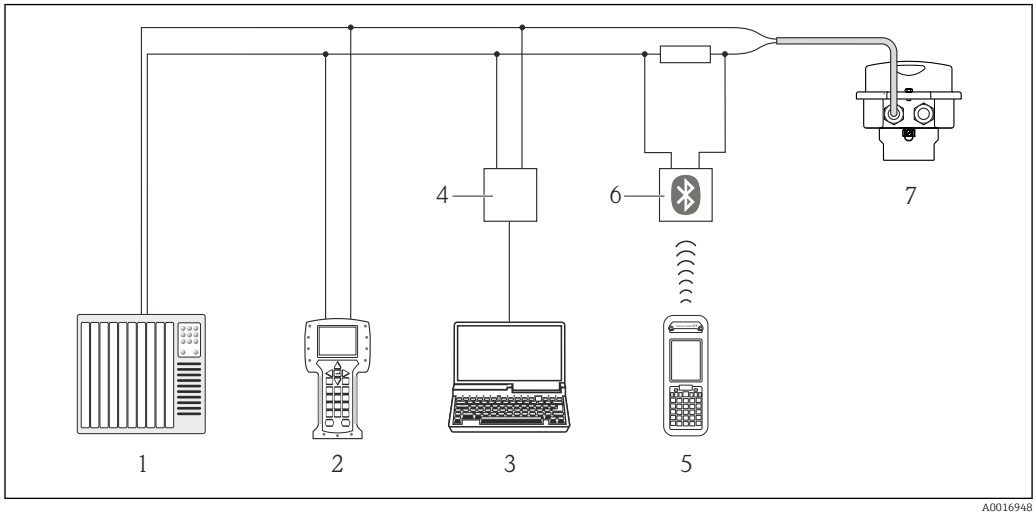
1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. Reset the modified properties of the Internet protocol (TCP/IP) if they are no longer needed (→ 37).

8.4 Access to the operating menu via the operating tool

8.4.1 Connecting the operating tool

Via HART protocol

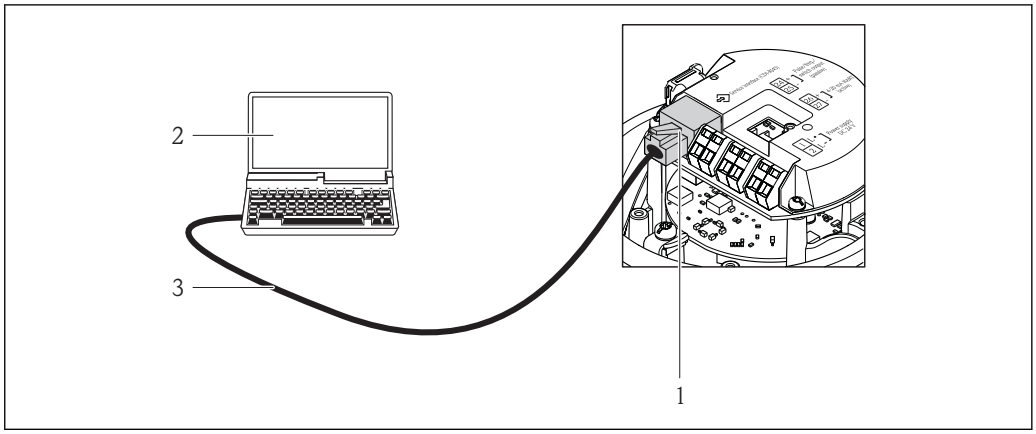
This communication interface is present in the following device version:
Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output



13 *Options for remote operation via HART protocol*

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

Via service interface (CDI-RJ45)



14 Connection for the order code for "Output", option B: 4-20 mA HART, pulse/frequency/switch output

1 Service interface (CDI -RJ45) of the measuring device with access to the integrated Web server
2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"
3 Standard Ethernet connecting cable with RJ45 plug

8.4.2 Field Xpert SFX350, SFX370

Function scope

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the **non-Ex area** (SFX350, SFX370) and the **Ex area** (SFX370).

For details, see Operating Instructions BA01202S

Source for device description files

See data (→ 45)

8.4.3 FieldCare

Function scope

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

Access takes place via:
- HART protocol (→ 40)
- Service interface CDI-RJ45 (→ 41)

Typical functions:
- Configuring parameters of transmitters
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

For details, see Operating Instructions BA00027S and BA00059S

Source for device description files

See data (→ 45)

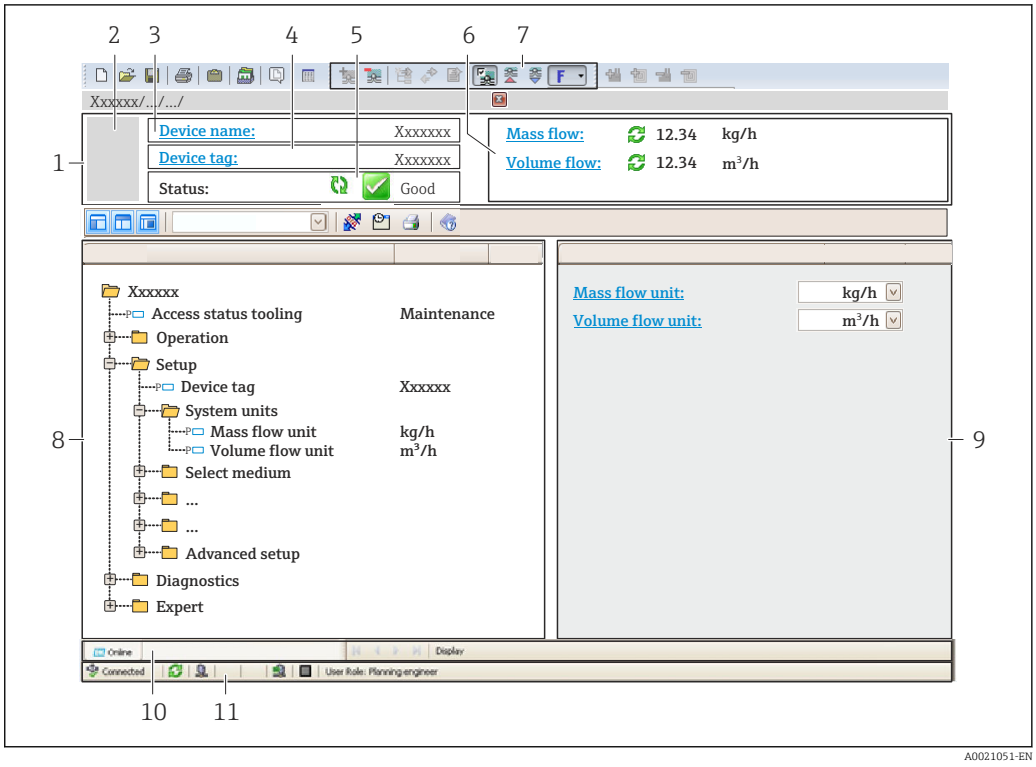
Establishing a connection

Via service interface (CDI-RJ45)

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field and press **Enter** to confirm: 192.168.1.212 (factory setting); if the IP address is not known .
7. Establish the online connection to the device.

For details, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Device tag (→ 49)*
5 *Status area with status signal (→ 77)*
6 *Display area for current measured values*
7 *Event list with additional functions such as save/load, events list and document creation*
8 *Navigation area with operating menu structure*
9 *Operating range*
10 *Range of action*
11 *Status area*

8.4.4 AMS Device Manager

Function scope

Program from Emerson Process Management for operating and configuring measuring devices via HART protocol.

Source for device description files

See data (→ 45)

8.4.5 SIMATIC PDM

Function scope

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via HART protocol.

Source for device description files

See data (→ 45)

8.4.6 Field Communicator 475

Function scope

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

Source for device description files

See data (→ 45)

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.01.zz	▪ On the title page of the Operating instructions ▪ On transmitter nameplate(→ 🖹 12) ▪ Parameter **firmware version** Diagnostics → Device info→ Firmware version
Release date of firmware version	06.2014	---
Manufacturer ID	0x11	**Manufacturer ID** parameter Diagnostics → Device info→ Manufacturer ID
Device type ID	0x3A	**Device type** parameter Diagnostics → Device info → Device type
HART protocol revision	7	---
Device revision	2	▪ On transmitter nameplate(→ 🖹 12) ▪ **Device revision** parameter Diagnostics → Device info → Device revision

9.1.2 Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tool via HART protocol	Sources for obtaining device descriptions
▪ Field Xpert SFX350 ▪ Field Xpert SFX370	Use update function of handheld terminal
FieldCare	▪ www.endress.com → Download Area ▪ CD–ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
AMS Device Manager (Emerson Process Management)	www.endress.com → Download Area
SIMATIC PDM (Siemens)	www.endress.com → Download Area
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal

9.2 Measured variables via HART protocol

The following measured variables (HART device variables) are assigned to the dynamic variables at the factory:

Dynamic variables	Measured variables (HART device variables)
Primary dynamic variable (PV)	Volume flow
Secondary dynamic variable (SV)	Totalizer 1
Tertiary dynamic variable (TV)	Totalizer 2
Quaternary dynamic variable (QV)	Totalizer 3

The assignment of the measured variables to the dynamic variables can be modified and assigned as desired via local operation and the operating tool using the following parameters:

- Expert → Communication → HART output → Output → Assign PV
- Expert → Communication → HART output → Output → Assign SV
- Expert → Communication → HART output → Output → Assign TV
- Expert → Communication → HART output → Output → Assign QV

The following measured variables can be assigned to the dynamic variables:

Measured variables for PV (primary dynamic variable)
- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Corrected conductivity
- Temperature
- Electronic temperature

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Corrected conductivity
- Temperature
- Electronic temperature
- Totalizer 1
- Totalizer 2
- Totalizer 3

The range of options increases if the measuring device has one or more application packages.

Device variables
The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:
- 0 = volume flow
- 1 = mass flow
- 2 = corrected volume flow
- 3 = flow velocity
- 4 = conductivity
- 5 = corrected conductivity
- 6 = temperature
- 7 = electronic temperature
- 8 = totalizer 1
- 9 = totalizer 2
- 10 = totalizer 3

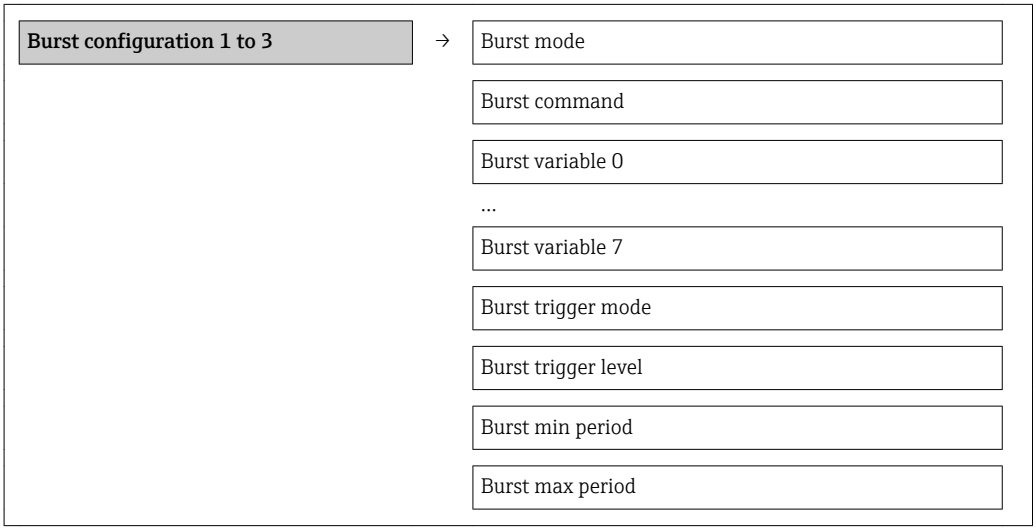
9.3 Other settings

9.3.1 Burst mode functionality in accordance with HART 7 Specification

Navigation

"Expert" menu → Communication → HART output → Burst configuration → Burst configuration 1 to 3

Structure of the submenu



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Burst mode #	Activation of the HART burst mode for burst message X. An external pressure or temperature sensor must also be in the Burst mode.	▪ Off ▪ On	Off
Burst command #	Select the HART command that is sent to the HART master. ▪ **Command 1** option: Read out the primary variable. ▪ **Command 2** option: Read out the current and the main measured value as a percentage. ▪ **Command 3** option: Read out the dynamic HART variables and the current. ▪ **Command 9** option: Read out the dynamic HART variables including the related status. ▪ **Command 33** option: Read out the dynamic HART variables including the related unit. ▪ **Command 48** option: Read out the complete device diagnostics.	▪ Command 1 ▪ Command 2 ▪ Command 3 ▪ Command 9 ▪ Command 33 ▪ Command 48	Command 2

Parameter	Description	Selection / User entry	Factory setting
Burst variable 0	Assignment of the individual HART variables (PV, SV, TV, QV) and assignment of the process variables available in the device to the HART command.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density ▪ Temperature ▪ HART input ▪ Percent Of Range ▪ Measured current ▪ Primary variable (PV) ▪ Secondary variable (SV) ▪ Tertiary variable (TV) ▪ Quaternary variable (QV) ▪ Not used	Volume flow
Burst variable 1	See burst variable 0.	See burst variable 0.	Not used
Burst variable 2	See burst variable 0.	See burst variable 0.	Not used
Burst variable 3	See burst variable 0.	See burst variable 0.	Not used
Burst variable 4	See burst variable 0.	See burst variable 0.	Not used
Burst variable 5	See burst variable 0.	See burst variable 0.	Not used
Burst variable 6	See burst variable 0.	See burst variable 0.	Not used
Burst variable 7	See burst variable 0.	See burst variable 0.	Not used
Burst trigger mode	Use this function to select the event that triggers burst message X. ▪ **Continuous** option: The message is triggered in a time-controlled manner, at least observing the time interval defined in the **Burst min period** parameter. ▪ **Window** option: The message is triggered if the specified measured value has changed by the value in the **Burst trigger level** parameter. ▪ **Rising** option: The message is triggered if the specified measured value exceeds the value in the **Burst trigger level** parameter. ▪ **Falling** option: The message is triggered if the specified measured value drops below the value in the **Burst trigger level** parameter. ▪ **On change** option: The message is triggered if the measured value changes.	▪ Continuous ▪ Window ▪ Rising ▪ Falling ▪ On change	Continuous
Burst trigger level	For entering the burst trigger value. Together with the option selected in the **Burst trigger mode** parameter the burst trigger value determines the time of burst message X.	Positive floating-point number	2.0E-38
Min. update period	Use this function to enter the minimum time span between two burst commands of burst message X.	Positive integer	1 000 ms
Max. update period	Use this function to enter the maximum time span between two burst commands of burst message X.	Positive integer	2 000 ms

10 Commissioning

10.1 Function check

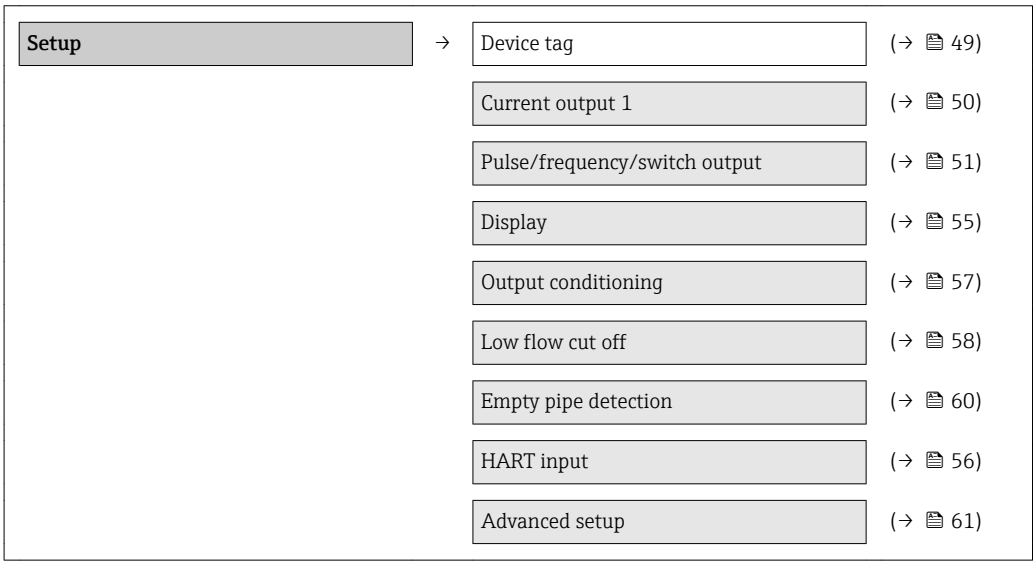
Before commissioning the device, make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist (→ 26)
- "Post-connection check" checklist (→ 33)

10.2 Configuring the measuring device

The **Setup** menu with its submenus contains all the parameters needed for standard operation.

Structure of the "Setup" menu



10.2.1 Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and thus change the factory setting.

The number of characters displayed depends on the characters used.

For information on the tag name in the "FieldCare" operating tool (→ 43)

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

Parameter	Description	User entry	Factory setting
Device tag	Enter tag for measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag

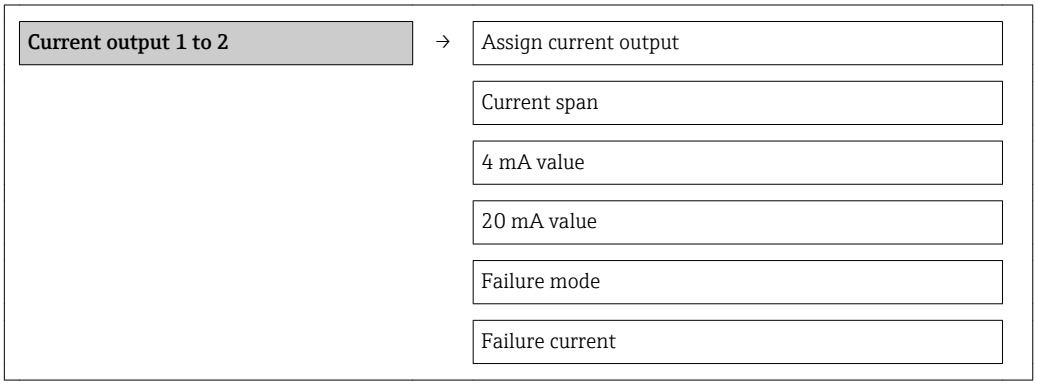
10.2.2 Configuring the current output

The **"Current output 2" submenu** contains all the parameters that must be configured for the configuration of the current output.

Navigation

"Setup" menu → Current output 1 to 2

Structure of the submenu



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Assign current output	Select process variable for current output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature	Volume flow
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Current span	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA ▪ Fixed current	4...20 mA NAMUR
0/4 mA value	Enter 4 mA value.	Signed floating-point number	0 l/h
20 mA value	Enter 20 mA value.	Signed floating-point number	0.025 l/h

Parameter	Description	Selection / User entry	Factory setting
Failure mode	Define output behavior in alarm condition.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Defined value	Max.
Failure current	Enter current output value in alarm condition.	3.59^{-3} to 22.5^{-3} mA	22.5 mA

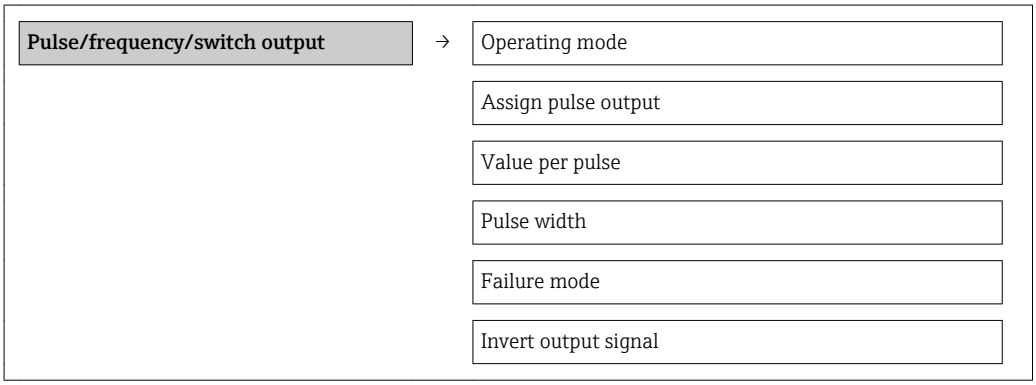
10.2.3 Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output 1** submenu contains all the parameters that must be configured for the configuration of the selected output type.

Pulse output

Navigation
"Setup" menu → Pulse/frequency/switch output

Structure of the submenu for the pulse output



Parameter overview with brief description

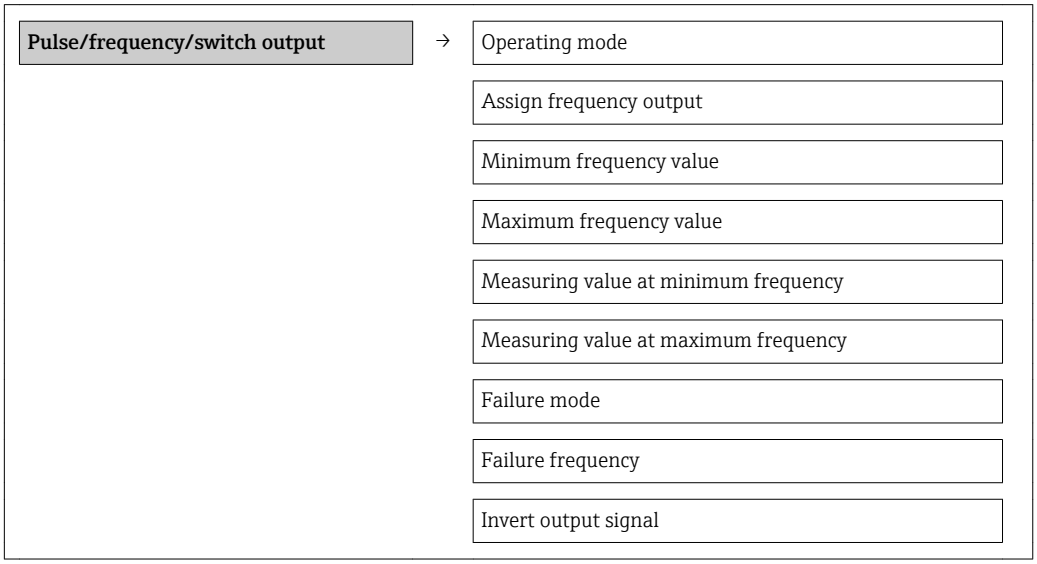
Parameter	Description	Selection / User entry	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Assign pulse output	Select process variable for pulse output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Off
Mass unit	Select mass unit. *Result* The selected unit is taken from: **Mass flow unit** parameter	Unit choose list	Country-specific: ▪ kg ▪ lb
Volume unit	Select volume unit. **Result** The selected unit is taken from: **Volume flow unit** parameter	Unit choose list	Country-specific: ▪ l ▪ gal (us)
Value per pulse	Enter measured value at which a pulse is output.	Signed floating-point number	0
Pulse width	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms

Parameter	Description	Selection / User entry	Factory setting
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

Frequency output

Navigation
"Setup" menu → Pulse/frequency/switch output

Structure of the submenu for the frequency output



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Assign frequency output	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature	Off
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min

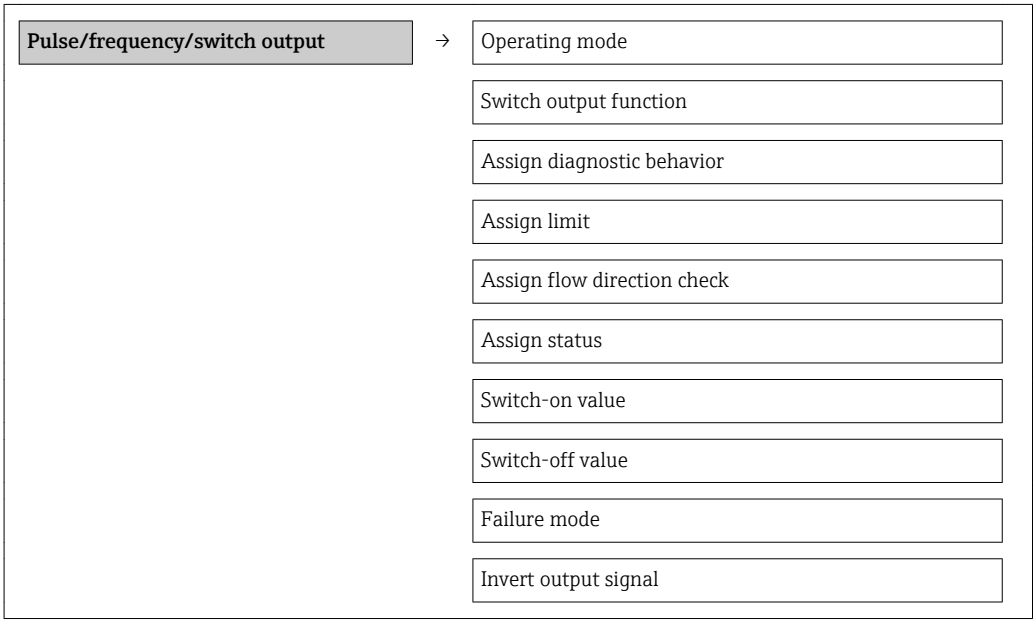
Parameter	Description	Selection / User entry	Factory setting
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Minimum frequency value	Enter minimum frequency.	0.0 to 10 000.0 Hz	0.0 Hz
Maximum frequency value	Enter maximum frequency.	0.0 to 10 000.0 Hz	10 000.0 Hz
Measuring value at minimum frequency	Enter measured value for minmum frequency.	Signed floating-point number	0
Measuring value at maximum frequency	Enter measured value for maximum frequency.	Signed floating-point number	0
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	0.0 Hz
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

Switch output

Navigation

"Setup" menu → Pulse/frequency/switch output

Structure of the submenu for the switch output



Parameter overview with brief description

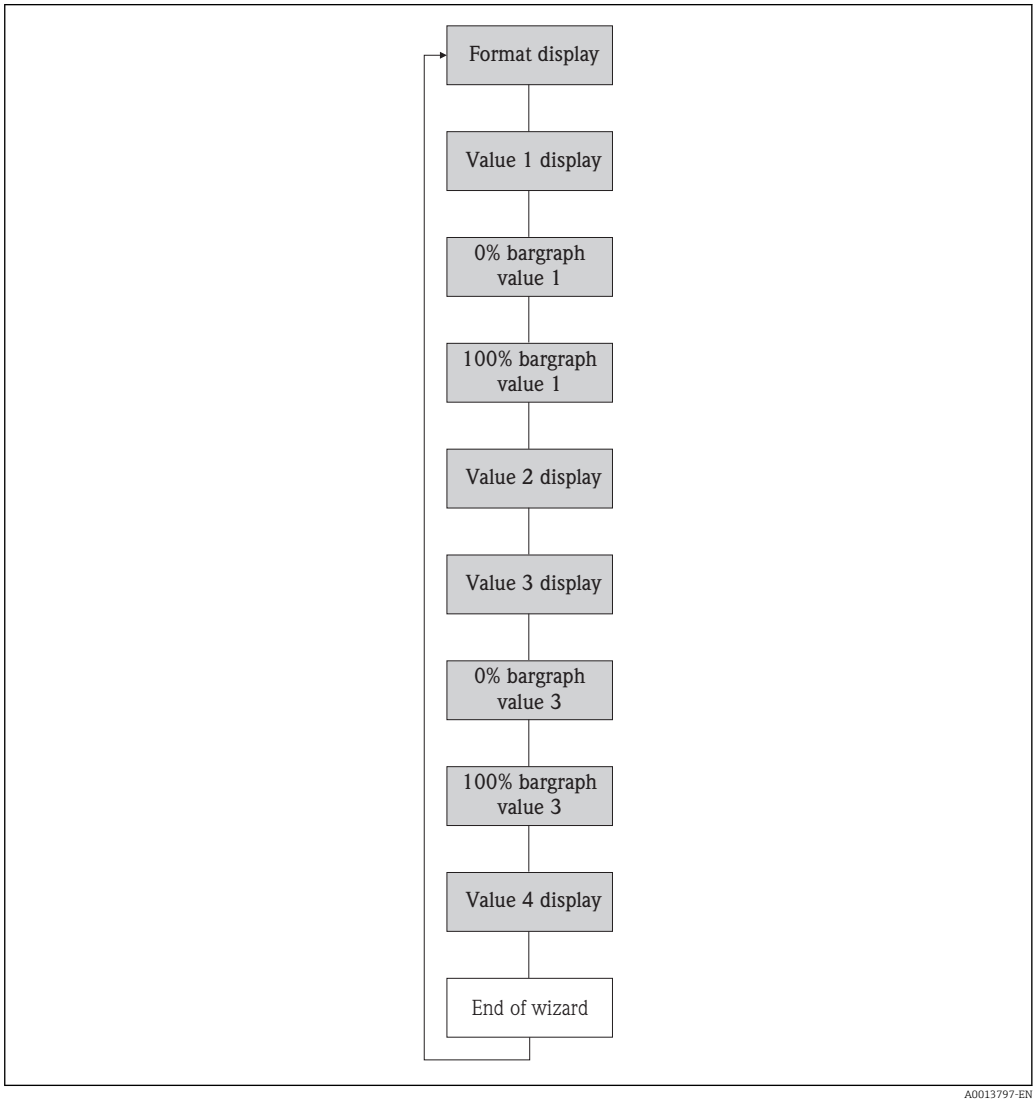
Parameter	Description	Selection / User entry	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Switch output function	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Off
Assign diagnostic behavior	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign limit	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Temperature ▪ Electronic temperature	Volume flow
Assign flow direction check	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign status	Select device status for switch output.	▪ Empty pipe detection ▪ Low flow cut off	Empty pipe detection
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Unit totalizer	Select process variable totalizer unit.	Unit choose list	l
Switch-on value	Enter measured value for the switch-on point.	Signed floating-point number	0 l/h
Switch-off value	Enter measured value for the switch-off point.	Signed floating-point number	0 l/h
Switch-on delay	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Switch-off delay	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Failure mode	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

10.2.4 Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

Navigation
"Setup" menu → Display

Structure of the wizard



15 *"Display" wizard in the "Setup" menu*

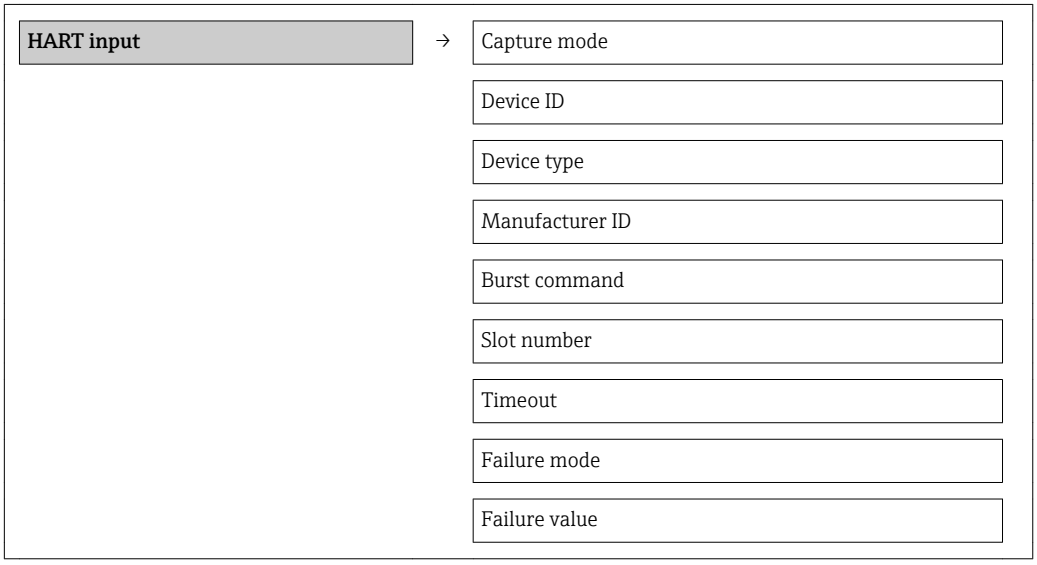
Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Format display	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ None	Volume flow
0% bargraph value 1	Enter 0% value for bar graph display.	Signed floating-point number	0 l/h
100% bargraph value 1	Enter 100% value for bar graph display.	Signed floating-point number	0.025 l/h
Value 2 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None
Value 3 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None
0% bargraph value 3	Enter 0% value for bar graph display.	Signed floating-point number	0
100% bargraph value 3	Enter 100% value for bar graph display.	Signed floating-point number	0
Value 4 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None

10.2.5 Configuring the HART input

The **HART input** submenu contains all the parameters that must be configured for the configuration of the HART input.

Navigation
"Expert" menu → Communication → HART input → Configuration



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Capture mode	Select capture mode via burst or master communication.	▪ Off ▪ Burst network ▪ Master network	Off
Manufacturer ID	Enter manufacture ID of external device.	0 to 255	0
Device ID	Enter device ID of external device.	Positive integer	0
Device type	Enter device type of external device.	0 to 255	0
Burst command	Select command to read in external process variable.	▪ Command 1 ▪ Command 3 ▪ Command 9 ▪ Command 33	Command 1
Slot number	Define position of external process variable in burst command.	1 to 4	1
Timeout	Enter deadline for process variable of external device. If the deadline is exceeded, diagnostic message **F410 data transmission** is output.	1 to 120 s	5 s
Failure mode	Define behavior if external process variable is missed.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

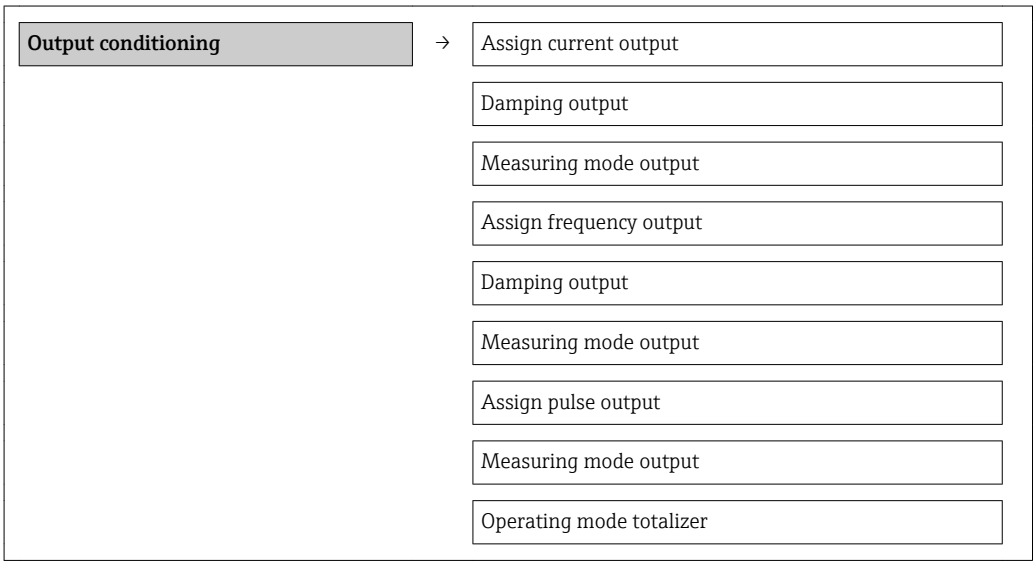
10.2.6 Configuring the output conditioning

The **Output conditioning** wizard contains all the parameters that must be configured for the configuration of output conditioning.

Navigation

"Setup" menu → Output conditioning

Structure of the submenu for output conditioning



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Assign current output	Select process variable for current output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature	Volume flow
Damping output 1	Set reaction time for output signal to fluctuations in the measured value.	0 to 999.9 s	1 s
Measuring mode output 1	Select measuring mode for output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow compensation	Forward flow
Assign frequency output	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature	Off
Damping output 1	Set reaction time for output signal to fluctuations in the measured value.	0 to 999.9 s	1 s
Measuring mode output 1	Select measuring mode for output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	Forward flow
Assign pulse output	Select process variable for pulse output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Off
Measuring mode output 1	Select measuring mode for output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	Forward flow
Operating mode totalizer #	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total

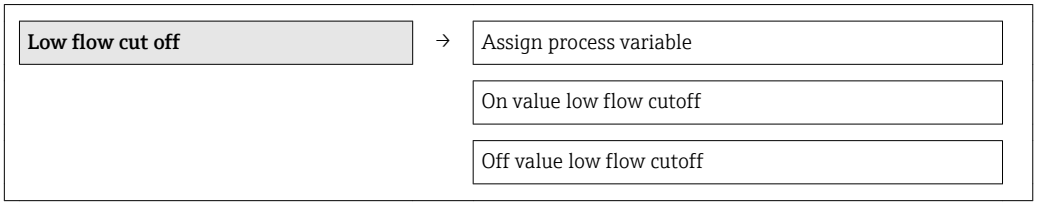
10.2.7 Configuring the low flow cut off

The **Low flow cut off** submenu contains parameters that must be configured for the configuration of low flow cut off.

Navigation

"Setup" menu → Low flow cut off

Structure of the submenu



	Pressure shock suppression

Parameter overview with brief description

Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
On value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter: ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter on value for low flow cut off.	Signed floating-point number	For liquids: depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter: ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter: ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

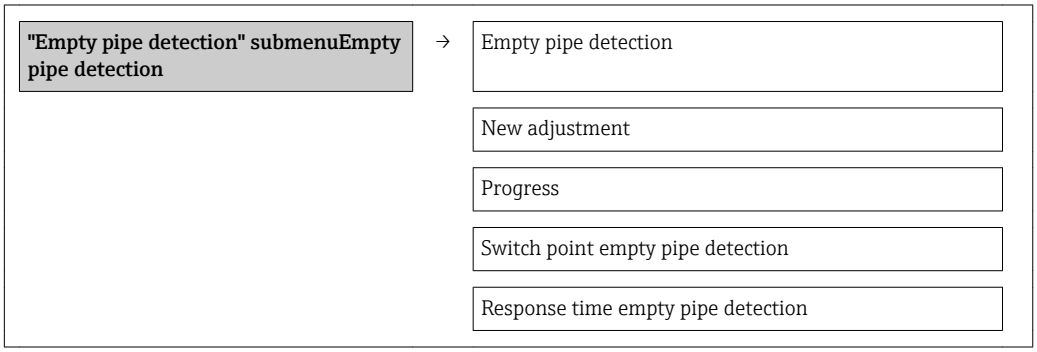
10.2.8 Configuring empty pipe detection

The **Empty pipe detection** submenu contains parameters that must be configured for the configuration of low flow cut off.

Navigation

"Setup" menu → Empty pipe detection

Structure of the submenu



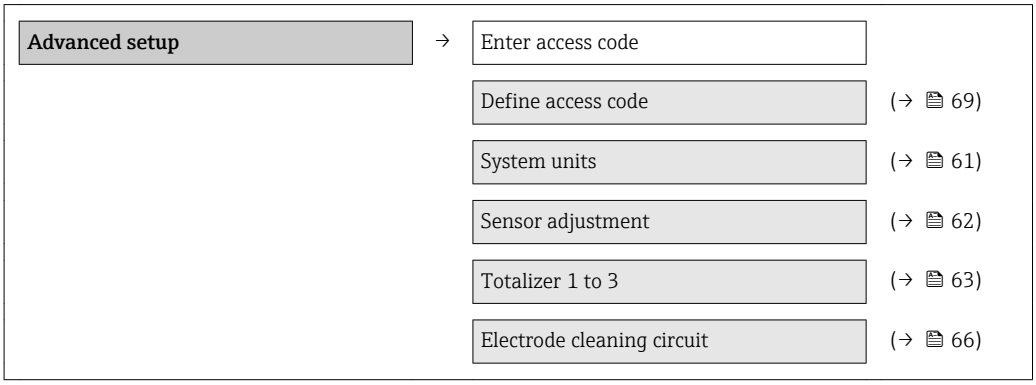
Parameter overview with brief description

Parameter	Prerequsite	Description	Selection / User interface / User entry	Factory setting
Empty pipe detection	–	Switch empty pipe detection on and off.	▪ Off ▪ On	Off
New adjustment	–	Select type of adjustment.	▪ Cancel ▪ Empty pipe adjust ▪ Full pipe adjust	Cancel
Progress	–		▪ Ok ▪ Busy ▪ Not ok	–
Switch point empty pipe detection	–	Enter hysteresis in %, below this value the measuring tube will detected as empty.	0 to 100 %	10 %
Response time empty pipe detection	One of the following options is selected in the **Assign process variable** parameter: ▪ Density ▪ Reference density	Enter the time before diagnostic message S862 "Pipe empty" is displayed for empty pipe detection.	0 to 100 s	1 s

10.3 Advanced settings

The **Advanced setup** submenu with its submenus contains parameters for specific settings.

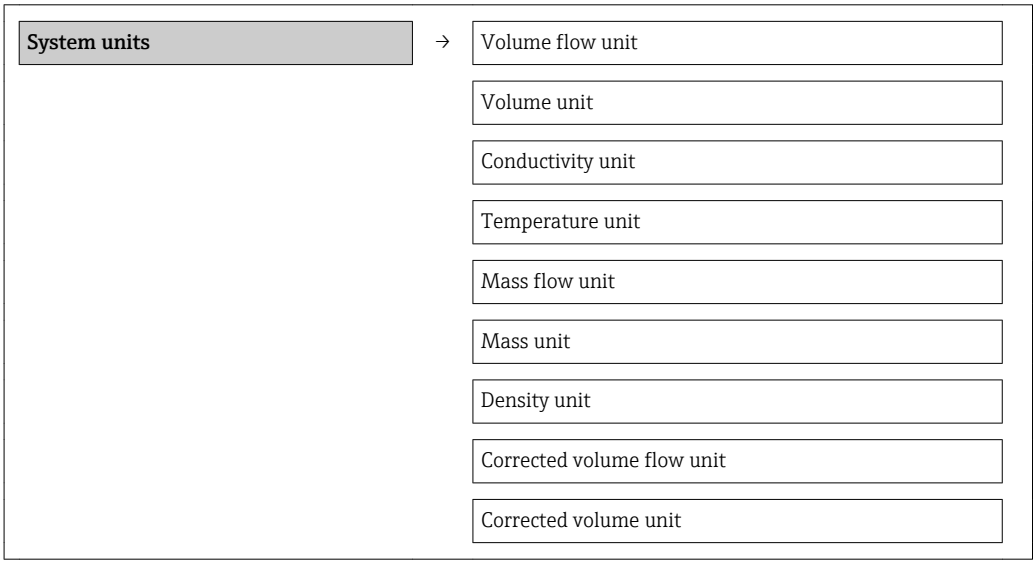
Overview of the parameters and submenus in the "Advanced setup" submenu



10.3.1 Setting the system units

In the **System units** submenu the units of all the measured values can be set.

Navigation
"Setup" menu → System units



Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Volume unit	Select volume unit. **Result** The selected unit is taken from: **Volume flow unit** parameter	Unit choose list	Country-specific: ▪ l ▪ gal (us)

Parameter	Description	Selection	Factory setting
Conductivity unit	Select conductivity unit. *Result* The selected unit applies for: ▪ Current output ▪ Frequency output ▪ Switch output ▪ Simulation process variable	Unit choose list	µS/cm
Temperature unit	Select temperature unit. *Result* The selected unit applies for: ▪ Output ▪ Reference temperature ▪ Simulation process variable	Unit choose list	Country-specific: ▪ °C (Celsius) ▪ °F (Fahrenheit)
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Mass unit	Select mass unit. *Result* The selected unit is taken from: **Mass flow unit** parameter	Unit choose list	Country-specific: ▪ kg ▪ lb
Density unit	Select density unit. *Result* The selected unit applies for: ▪ Output ▪ Simulation process variable ▪ Density adjustment (in **Expert** menu)	Unit choose list	Country-specific: ▪ kg/l ▪ lb/ft³
Corrected volume flow unit	Select corrected volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ Nl/h ▪ Sft³/h
Corrected volume unit	Select corrected volume unit. **Result** The selected unit is taken from: **Corrected volume flow unit** parameter	Unit choose list	Country-specific: ▪ Nl ▪ Sft³

10.3.2 Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation

"Setup" menu → Advanced setup → Sensor adjustment

Structure of the submenu

Sensor adjustment	→	Installation direction

Parameter overview with brief description

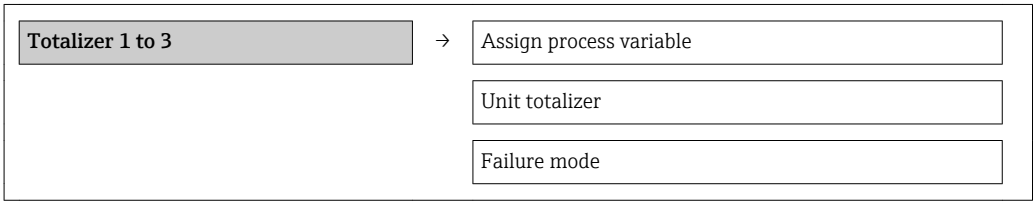
Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ Flow in arrow direction ▪ Flow against arrow direction	Flow in arrow direction

10.3.3 Configuring the totalizer

In the **"Totalizer 1 to 3" submenu** the individual totalizers can be configured.

Navigation

"Setup" menu → Advanced setup → Totalizer 1 to 3



Parameter overview with brief description

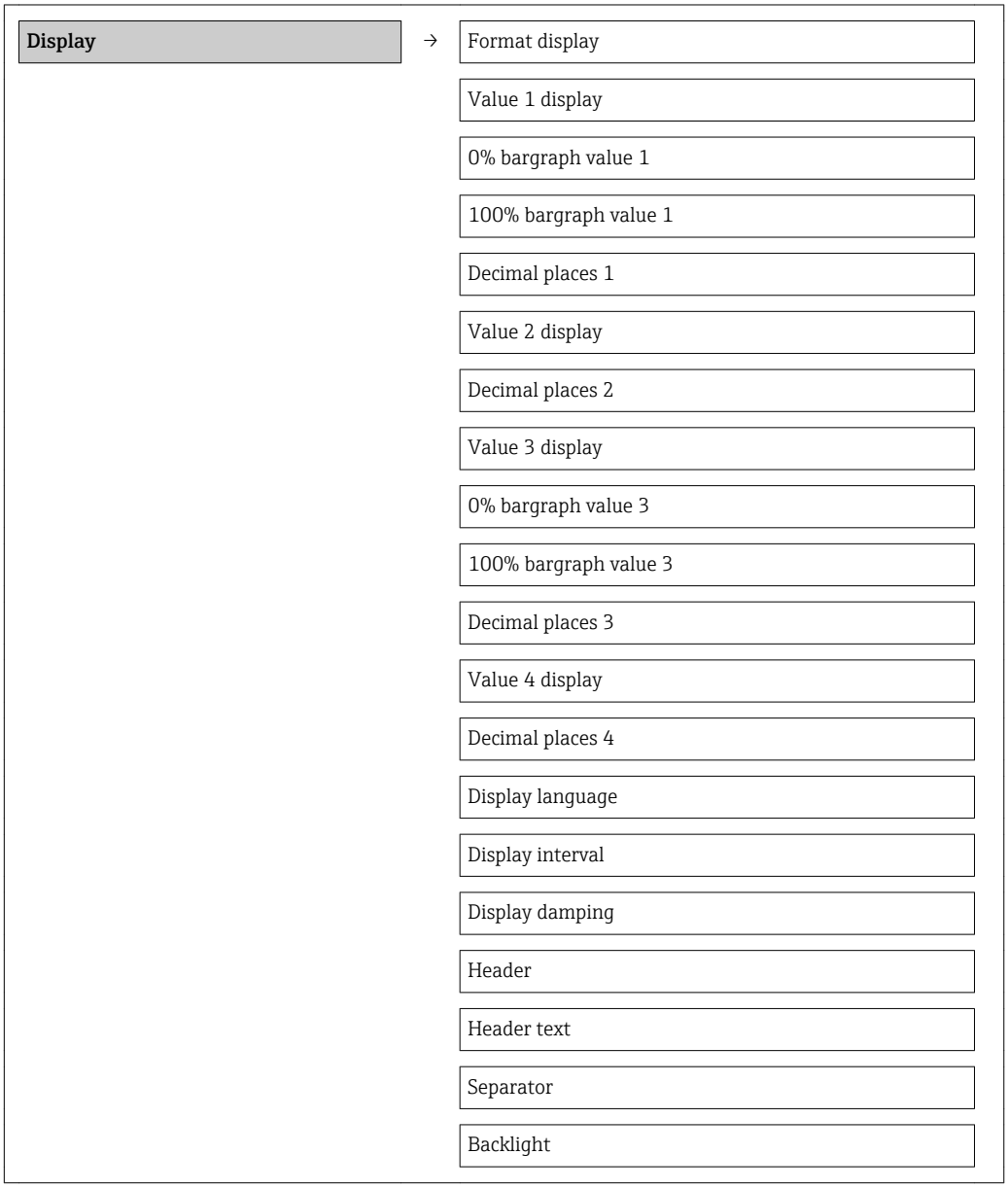
Parameter	Description	Selection	Factory setting
Assign process variable	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Unit totalizer	Select process variable totalizer unit.	Unit choose list	l
Totalizer operation mode	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

10.3.4 Carrying out additional display configurations

In the **"Display" submenu** you can set all the parameters involved in the configuration of the local display.

Navigation
"Setup" menu → Advanced setup → Display

Structure of the submenu



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Format display	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ None	Volume flow
0% bargraph value 1	Enter 0% value for bar graph display.	Signed floating-point number	0 l/h
100% bargraph value 1	Enter 100% value for bar graph display.	Signed floating-point number	0.025 l/h
Decimal places 1	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None
Decimal places 2	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 3 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None
0% bargraph value 3	Enter 0% value for bar graph display.	Signed floating-point number	0
100% bargraph value 3	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 3	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	Select the measured value that is shown on the local display.	Picklist (see 1st display value)	None
Decimal places 4	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx

Parameter	Description	Selection / User entry	Factory setting
Display language	Set display language.	▪ English ▪ Deutsch ▪ Français ▪ Español ▪ Italiano ▪ Nederlands ▪ Portuguesa ▪ Polski ▪ русский язык (Russian) ▪ Svenska ▪ Türkçe ▪ 中文 (Chinese) ▪ 日本語 (Japanese) ▪ 한국어 (Korean) ▪ العَرَبِيّة (Arabic) ▪ Bahasa Indonesia ▪ ภาษาไทย (Thai) ▪ tiếng Việt (Vietnamese) ▪ čeština (Czech)	English (alternatively, the ordered language is preset in the device)
Display interval	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	Enter display header text.		----------
Separator	Select decimal separator for displaying numerical values.	▪ . ▪ ,	.
Backlight	Switch the local display backlight on and off.	▪ Disable ▪ Enable	Enable

10.3.5 Performing electrode cleaning

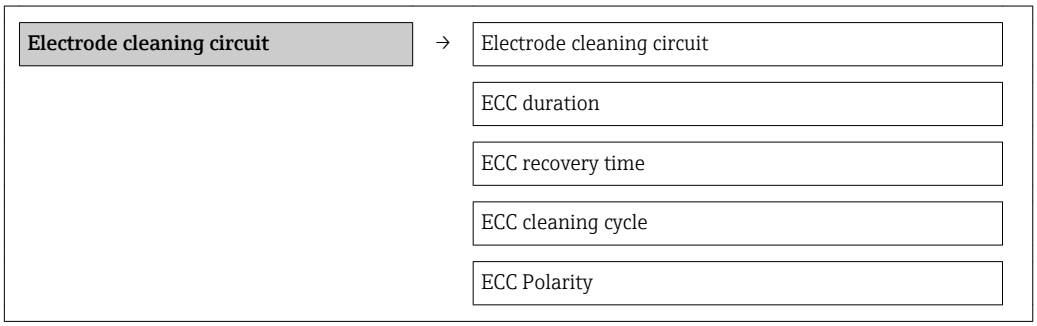
The **Electrode cleaning circuit** submenu contains parameters that must be configured for the configuration of electrode cleaning.

The submenu is only available if the device was ordered with electrode cleaning.

Navigation

"Setup" menu → Advanced setup → Electrode cleaning circuit

Structure of the submenu



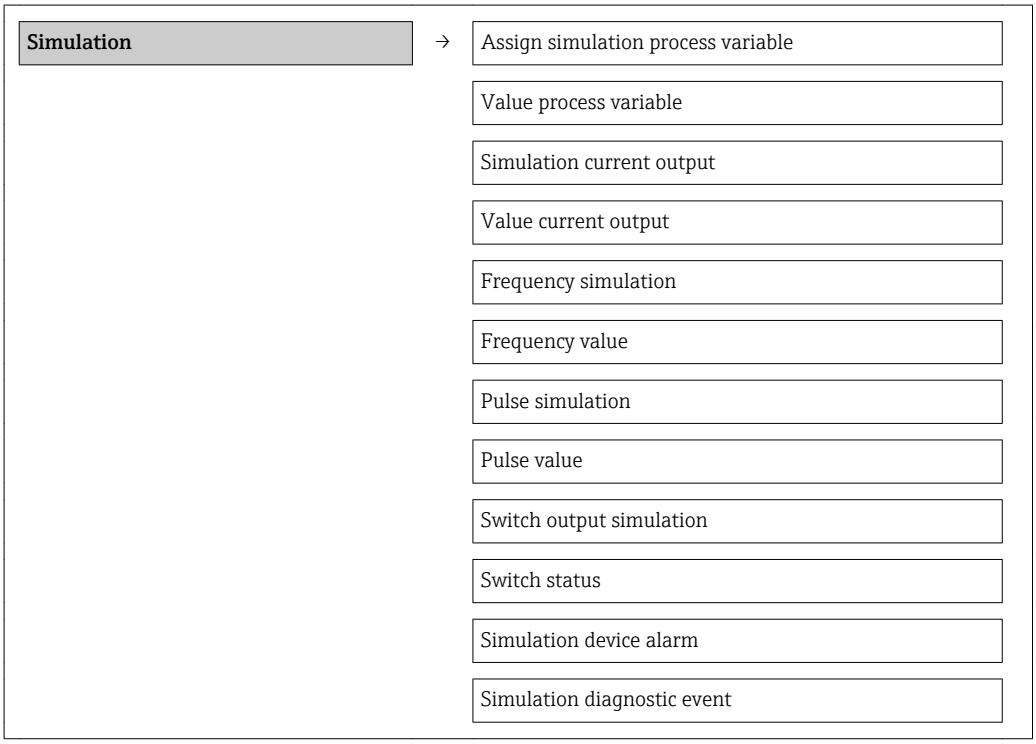
Parameter overview with brief description

Parameter	Description	Selection / User entry / User interface	Factory setting
Electrode cleaning circuit	Enable the cyclic electrode cleaning circuit.	▪ Off ▪ On	Off
ECC duration	Enter the duration of electrode cleaning in seconds.	0.01 to 30 s	2 s
ECC recovery time	Define recovery time after electrode cleaning. During this time the current output values will be held at last valid value.	1 to 3.0^{+38} s	60 s
ECC cleaning cycle	Enter the pause duration between electrode cleaning cycles.	0.5 to 168 h	0.5 h
ECC Polarity	Select the polarity of the electrode cleaning circuit.	▪ Positive ▪ Negative	Positive

10.4 Simulation

The **"Simulation" submenu** enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Conductivity ▪ Corrected conductivity ▪ Temperature	Off
Value process variable	A process variable is selected in the **Assign simulation process variable** parameter.	Enter the simulation value for the selected process variable.	Signed floating-point number	0
Simulation current output 1	–	Switch simulation of the current output on and off.	▪ Off ▪ On	Off
Value current output 1	The **On** option is selected in the **Current output simulation** parameter.	Enter the current value for simulation.	3.59^{-3} to 22.5^{-3} mA	3.59 mA
Frequency simulation 1	–	Switch simulation of the frequency output on and off.	▪ Off ▪ On	Off
Frequency value 1	The **On** option is selected in the **Frequency output simulation** parameter.	Enter the frequency value for simulation.	0.0 to 12 500.0 Hz	0.0 Hz
Pulse simulation 1	The **Down-count. val.** option is selected in the **Simulation pulse output** parameter.	Switch simulation of the pulse output on and off. If the **Fixed value** option is selected, the **Pulse width** parameter defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off
Pulse value 1	The **Down-count. val.** option is selected in the **Simulation pulse output** parameter.	Enter the number of pulses for simulation.	0 to 65 535	0
Switch output simulation 1	–	Switch simulation of switch output on and off.	▪ Off ▪ On	Off
Switch status 1	The **On** option is selected in the **Switch output simulation** parameter.	Select the status of the status output for the simulation.	▪ Open ▪ Closed	Open
Simulation device alarm	–	Switch the device alarm on and off.	▪ Off ▪ On	Off
Simulation diagnostic event	–	Switch simulation of the diagnostic event on and off. For the simulation, you can choose from the diagnostic events of the category selected in the **Diagnostic event category** parameter.	▪ Off ▪ Picklist Diagnostic events (depends on the selected category)	Off

10.5 Protecting settings from unauthorized access

The following options exist for protecting the configuration of the measuring device from unintentional modification after commissioning:
- Write protection via access code for Web browser (→ 69)
- Write protection via write protection switch (→ 69)

10.5.1 Write protection via access code

With the customer-specific access code, access to the measuring device via the Web browser is protected, as are the parameters for the measuring device configuration.

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

Structure of the submenu

Define access code	→	Define access code
		Confirm access code

Defining the access code via the Web browser

1. Navigate to the **Enter access code** parameter.
2. Define a max. 4-digit numeric code as an access code.
3. Enter the access code again to confirm the code.
   ↳ The Web browser switches to the login page.

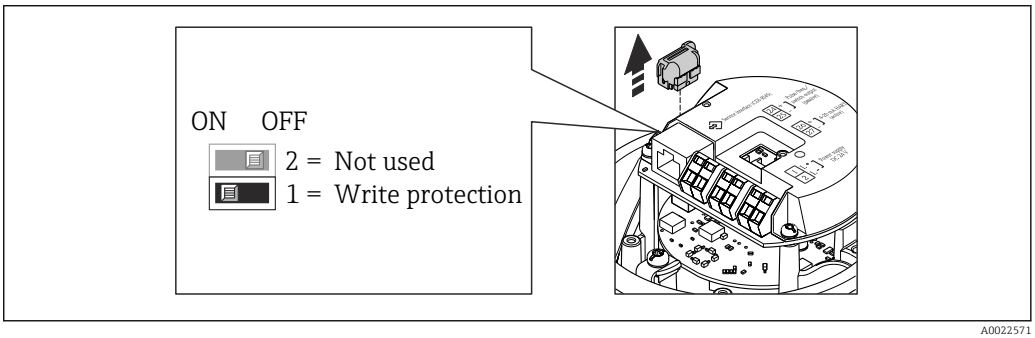
If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

The user role with which the user is currently logged on via the Web browser is indicated by the **Access status tooling** parameter. Navigation path: Operation → Access status tooling

10.5.2 Write protection via write protection switch

The write protection switch makes it possible to block write access to the entire operating menu with the exception of the following parameters:
- External pressure
- External temperature
- Reference density
- All parameters for configuring the totalizer

The parameter values are now read only and cannot be edited any more:
- Via service interface (CDI)
- Via HART protocol



A0022571

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version, unscrew or open the housing cover and disconnect the local display from the main electronics module where necessary (→ 106).
3. Disconnect the T-DAT from the main electronics module.

4. Setting the write protection switch on the main electronics module to the ON position enables the hardware write protection. Setting the write protection switch on the main electronics module to the OFF position (factory setting) disables the hardware write protection.
   ↳ If hardware write protection is enabled: the **Locking status** parameter displays the **Hardware locked** option(→ 🖹 71); if disabled, the **Locking status** parameter does not display any option (→ 🖹 71)
5. Reverse the removal procedure to reassemble the transmitter.

11 Operation

11.1 Reading device locking status

The write protection types that are currently active can be determined using the **Locking status** parameter.

Navigation
"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The locking switch (DIPswitch) for locking the hardware is activated on the main electronic module. This prevents write access to the parameters (→ 🖹 69).
Temporarily locked	Due to internal processing in the device (e.g. up-/downloading of data, reset), write access to the parameters is blocked for a short time. Once the internal processing has been completed, the parameters can be changed once again.

11.2 Reading measured values

Using the **Measured values** submenu , it is possible to read all the measured values.

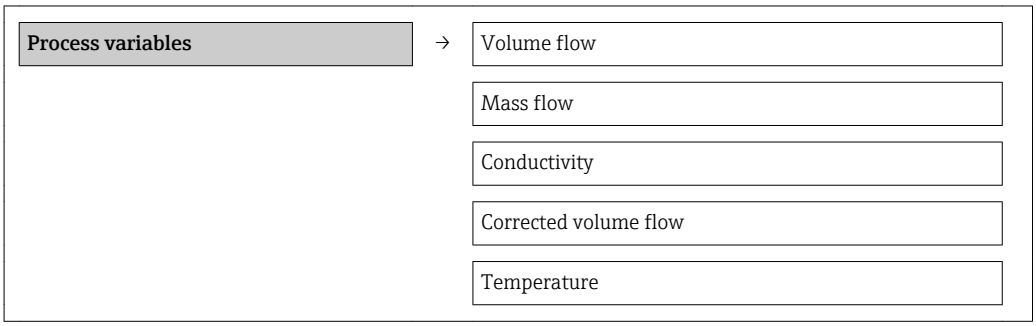
"Diagnostics" menu → Measured values

11.2.1 Process variables

The **Process variables** submenu contains all the parameters needed to display the current measured values for every process variable.

Navigation
"Diagnostics" menu → Measured values → Process variables

Structure of the submenu



Structure of the submenu

Parameter overview with brief description

Parameter	Description	User interface
Volume flow	Displays the volume flow currently measured.	Signed floating-point number
Mass flow	Displays the mass flow currently calculated.	Signed floating-point number
Conductivity	Displays the corrected volume flow currently calculated.	Signed floating-point number

Parameter	Description	User interface
Corrected volume flow	Displays the temperature currently measured.	Signed floating-point number
Temperature	Displays the saturated steam pressure currently calculated.	Positive floating-point number

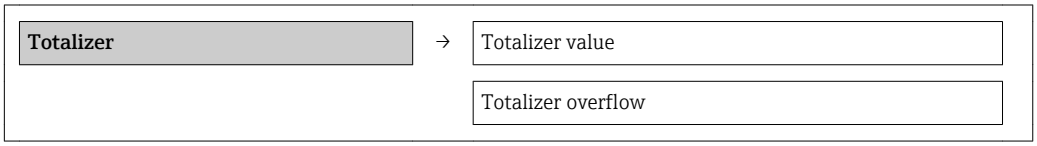
11.2.2 Totalizer

The **"Totalizer" submenu** contains all the parameters needed to display the current measured values for every totalizer.

Navigation

"Diagnostics" menu → Measured values → Totalizer

Structure of the submenu



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Totalizer value 1	Displays the current totalizer counter value.	Signed floating-point number	0 l
Totalizer overflow 1	Displays the current totalizer overflow.	–32 000.0 to 32 000.0	0

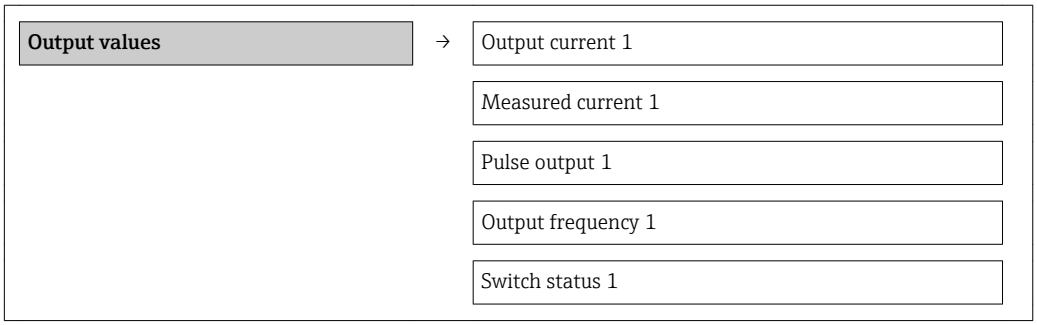
11.2.3 Output values

The **"Output values" submenu** contains all the parameters needed to display the current measured values for every output.

Navigation

"Diagnostics" menu → Measured values → Output values

Structure of the submenu



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Output current 1	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA	3.59 mA
Measured current 1	Displays the current value currently measured for the current output.	0 to 30 mA	0 mA

Parameter	Description	User interface	Factory setting
Pulse output 1	Displays the value currently measured for the pulse output.	Positive floating-point number	0 Hz
Output frequency 1	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz	0.0 Hz
Switch status 1	Displays the current switch output status.	▪ Open ▪ Closed	Open

11.3 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the **Setup** menu(→ 🖹 49)
- Advanced settings using the **Advanced setup** submenu(→ 🖹 61)

11.4 Performing a totalizer reset

In the **Operation** submenu the totalizers are reset:
- Control Totalizer
- Reset all totalizers

Function scope of "Control Totalizer " parameter

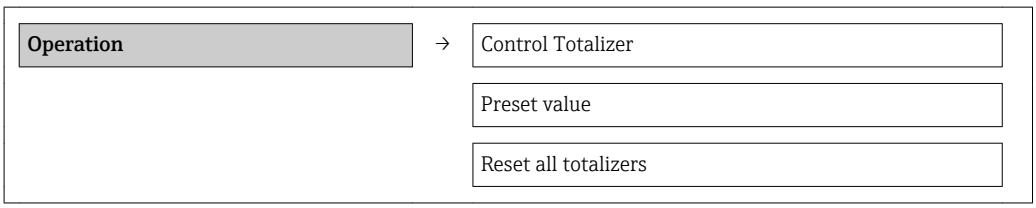
Options	Description
Totalize	The totalizer is started.
Stop	Totalizing is stopped.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to its defined start value from the **Preset value** parameter.
Reset + totalize	The totalizer is reset to 0 and the totaling process is restarted.
Preset + totalize	The totalizer is set to the defined start value in **Preset value** parameterand the totaling process is restarted.

Function scope of "Reset all totalizers" parameter

Options	Description
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

Navigation
"Operation" menu → Operation

Structure of the submenu



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Control Totalizer #	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize	Totalize
Preset value #	Specify start value for totalizer.	Signed floating-point number	0 l
Reset all totalizers	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For output signals

Problem	Possible causes	Remedy
Green power LED on the main electronics module of the transmitter is dark	Supply voltage does not match that specified on the nameplate.	Apply the correct supply voltage (→ 🖹 29).
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Problem	Possible causes	Remedy
No write access to parameters	Hardware write protection enabled	Set the write protection switch on the main electronics module to the OFF position (→ 🖹 69).
No connection via HART protocol	Missing or incorrectly installed communication resistor.	Install the communication resistor (250 Ω) correctly. Observe the maximum load (→ 🖹 94).
No connection via HART protocol	Commubox ▪ Connected incorrectly ▪ Configured incorrectly ▪ Drivers not installed correctly ▪ USB interface on computer configured incorrectly	Observe the documentation for the Commubox. FXA195 HART: Document "Technical Information" TI00404F
Not connecting to Web server	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) (→ 🖹 37). 2. Check the network settings with the IT manager.
Not connecting to Web server	Web server disabled	Via the "FieldCare" operating tool check whether the Web server of the measuring device is enabled and enable it if necessary (→ 🖹 39).
No or incomplete display of contents in the Web browser	▪ JavaScript not enabled ▪ JavaScript cannot be enabled	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
Web browser frozen and operation no longer possible	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct Web browser version (→ 🖹 37). 2. Clear the Web browser cache and restart the Web browser.
Content of Web browser incomplete or difficult to read	Unsuitable view settings.	Change the font size/display ratio of the Web browser.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

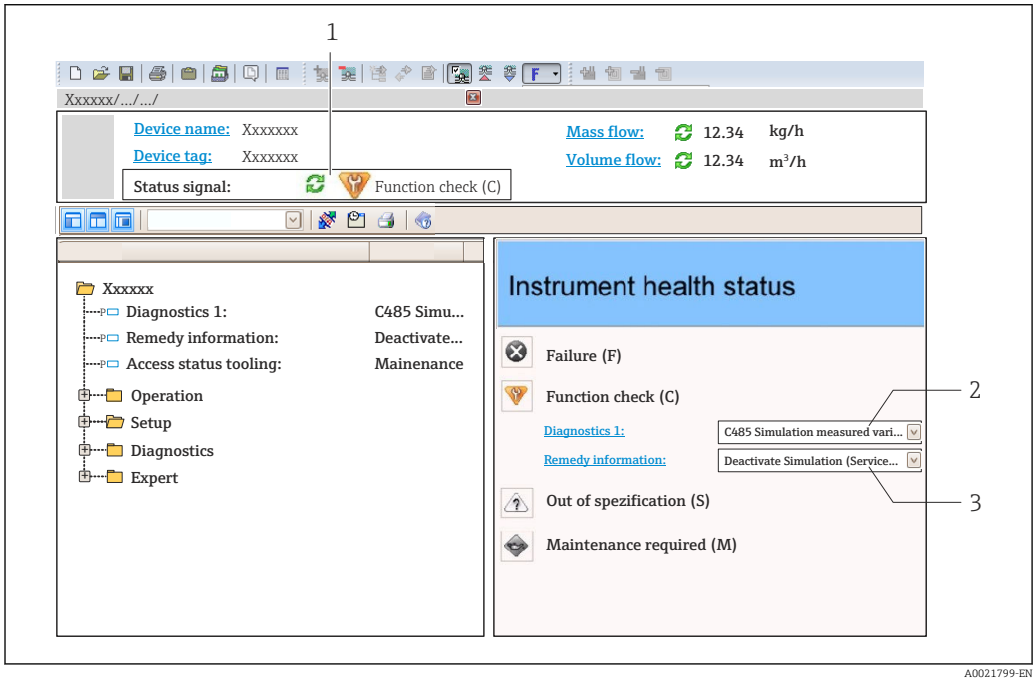
Various light emitting diodes (LEDs) on the main electronics module of the transmitter provide information on device status.

LED	Color	Meaning
Power	Off	Supply voltage is off or too low
	Green	Supply voltage is ok
Link/Activity	Orange	Link available but no activity
	Flashing orange	Activity present
Communication	Flashing white	HART communication is active.

12.3 Diagnostic information in FieldCare

12.3.1 Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.



1 *Status area with status signal*
2 *Diagnostic information (→ 77)*
3 *Remedial measures with Service ID*

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
- Via parameters (→ 81)
- Via submenu (→ 82)

Status signals

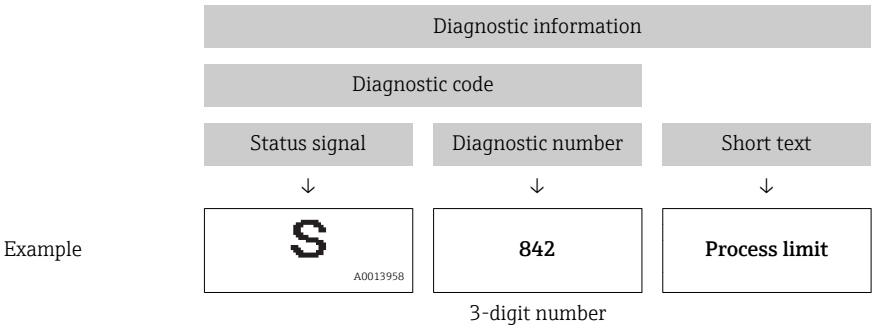
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
 A0017271	**Failure** A device error has occurred. The measured value is no longer valid.
 A0017278	**Function check** The device is in service mode (e.g. during a simulation).
 A0017277	**Out of specification** The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
 A0017276	**Maintenance required** Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault.



12.3.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
  Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
  Remedy information can be called up in the working area of the user interface.

The user is in the **Diagnostics** menu.

1. Call up the desired parameter.
2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

12.4 Adapting the diagnostic information

12.4.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for certain diagnostics information in the **Diagnostic behavior** submenu .

"Expert" menu → System → Diagnostic handling → Diagnostic behavior

You can assign the following options to the diagnostic number as the diagnostic behavior:

Options	Description
Alarm	Measurement is interrupted. Signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is entered in the Event logbook (events list) submenu only and is not displayed in alternation with the measured value display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.4.2 Adapting the status signal

Each item of diagnostic information is assigned a specific status signal at the factory. The user can change this assignment for certain diagnostic information in the **Diagnostic event category** submenu .

"Expert" menu → Communication → Diagnostic event category

Available status signals

Configuration as per HART 7 Specification (Condensed Status), in accordance with NAMUR NE107.

Symbol	Meaning
 A0013956	**Failure** A device error has occurred. The measured value is no longer valid.
 A0013959	**Function check** The device is in service mode (e.g. during a simulation).
A0013958	**Out of specification** The device is being operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
 A0013957	**Maintenance required** Maintenance is required. The measured value is still valid.
 A0023076	Has no effect on the condensed status.

12.5 Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Adapt the diagnostic information (→ 78)

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
004	Sensor	1. Change sensor 2. Contact service	S	Alarm
022	Sensor temperature	1.Change main electronic module 2.Change sensor	F	Alarm
043	Sensor short circuit	1.Check sensor and cable 2.Change sensor or cable	S	Warning
062	Sensor connection	1.Check sensor connections 2.Contact service	F	Alarm
082	Data storage	1. Check module connections 2. Contact service	F	Alarm
083	Memory content	1. Restart device 2. Contact service	F	Alarm
190	Special event 1	Contact service	F	Alarm
Diagnostic of electronic				
201	Device failure	1. Restart device 2. Contact service	F	Alarm
222	Electronic drift	Change main electronic module	F	Alarm
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change electronic modules	F	Alarm
261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
262	Module connection	1. Check module connections 2. Change main electronics	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
281	Electronic initialization	Firmware update active, please wait!	F	Alarm
283	Memory content	1. Reset device 2. Contact service	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning
311	Electronic failure	1. Reset device 2. Contact service	F	Alarm
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
322	Electronic drift	1.Perform verification manually 2.Change electronic	S	Warning
375	I/O communication failed	1. Restart device 2. Change main electronic module	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
382	Data storage	1. Insert DAT module 2. Change DAT module	F	Alarm
383	Memory content	1. Restart device 2. Check or change DAT module 3. Contact service	F	Alarm
390	Special event 2	Contact service	F	Alarm
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download active	Up-/download active, please wait	C	Warning
431	Trim 1	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1	1. Check process 2. Check current output settings	S	Warning [1)]
442	Frequency output	1. Check process 2. Check frequency output settings	S	Warning [1)]
443	Pulse output	1. Check process 2. Check pulse output settings	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Simulation failure mode	Deactivate simulation	C	Alarm
485	Simulation measured variable	Deactivate simulation	C	Warning
491	Simulation current output 1	Deactivate simulation	C	Warning
492	Simulation frequency output	Deactivate simulation frequency output	C	Warning
493	Simulation pulse output	Deactivate simulation pulse output	C	Warning
494	Switch output simulation	Deactivate simulation switch output	C	Warning
495	Simulation diagnostic event	Deactivate simulation	C	Warning
500	Electrode 1 potential exceeded	1. Check process cond. 2. Increase system pressure	F	Alarm
500	Electrode difference voltage too high	1. Check process cond. 2. Increase system pressure	F	Alarm
530	Electrode cleaning is running	1. Check process cond. 2. Increase system pressure	C	Warning
531	Empty pipe detection	Execute EPD adjustment	S	Warning
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
590	Special event 3	Contact service	F	Alarm
Diagnostic of process				
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
832	Electronic temperature too high	Reduce ambient temperature	S	Warning [1]
833	Electronic temperature too low	Increase ambient temperature	S	Warning [1]
834	Process temperature too high	Reduce process temperature	S	Warning [1]
835	Process temperature too low	Increase process temperature	S	Warning [1]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning
862	Empty pipe	1. Check for gas in process 2. Adjust empty pipe detection	S	Warning
882	Input signal	1. Check input configuration 2. Check external device or process conditions	F	Alarm
937	EMC interference	Change main electronic module	S	Warning [1]
938	EMC interference	1. Check ambient conditions regarding EMC influence 2. Change main electronic module	F	Alarm
990	Special event 4	Contact service	F	Alarm

1) Diagnostic status is changeable.

12.6 Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

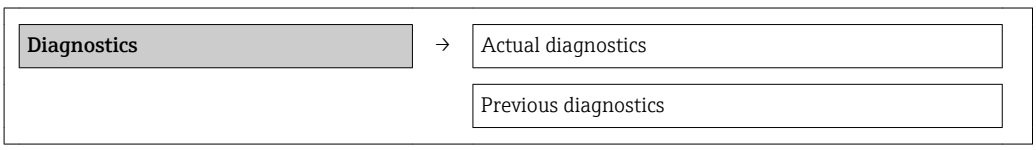
To call up the measures to rectify a diagnostic event:
- Via Web browser
- Via "FieldCare" operating tool (→ 77)

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu(→ 82)

Navigation

"Diagnostics" menu

Structure of the submenu



Parameter overview with brief description

Parameter	Prerequsite	Description	User interface	Factory setting
Actual diagnostics	1 diagnostic event has occurred.	Displays the current diagnostic event along with the diagnostic information. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol for diagnostic behavior, diagnostic code and short message.	–
Previous diagnostics	2 diagnostic events have already occurred.	Displays the diagnostic event that occurred prior to the current diagnostic event along with the diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.	–

12.7 Diagnostic list

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

Navigation path
Diagnostics menu→**Diagnostic list** submenu

To call up the measures to rectify a diagnostic event:
- Via Web browser
- Via "FieldCare" operating tool (→ 77)

12.8 Event logbook

12.8.1 Event history

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

Navigation path
"Diagnostics" menu → Event logbook → Events list

The event history includes entries for:
- Diagnostic events (→ 78)
- Information events (→ 83)

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

To call up the measures to rectify a diagnostic event:
- Via Web browser
- Via "FieldCare" operating tool (→ 77)

For filtering the displayed event messages (→ 83)

12.8.2 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" menu → Event logbook → Filter options

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

12.8.3 Overview of information events

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

Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1155	Reset electronic temperature
I1157	Memory error event list
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module reset detected
I1335	Firmware changed
I1351	Empty pipe detection adjustment failure
I1353	Empty pipe detection adjustment ok
I1361	Wrong web server login
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1457	Failed:Measured error verification
I1459	Failed: I/O module verification

Info number	Info name
I1461	Failed: Sensor verification
I1462	Failed:Sensor electronic module verific.

12.9 Resetting the measuring device

Using the **Device reset** parameter it is possible to reset the entire device configuration or some of the configuration to a defined state.

"Setup" menu → Advanced setup → Administration

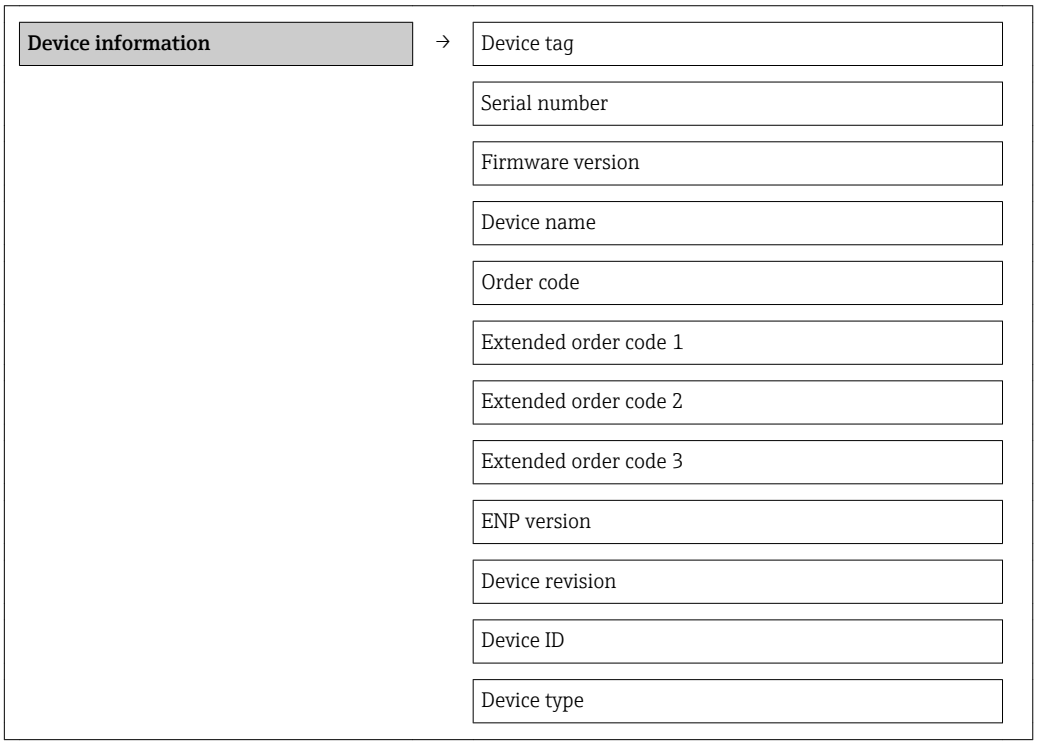
Function scope of "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting. This option is not visible if no customer-specific settings have been ordered.
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 remains unchanged.
History reset	Every parameter is reset to its factory setting.

12.10 Device information

The **Device information** submenu contains all the parameters that display different information for identifying the device.

Navigation
"Diagnostics" menu → Device information



	Manufacturer ID
	IP address
	Subnet mask
	Default gateway

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Enter tag for measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)	Promag 100
Serial number	Displays the serial number of the measuring device.	Max. 11-digit character string comprising letters and numbers.	79AFFF16000
Firmware version	Displays the device firmware version installed.	Character string with the following format: xx.yy.zz	01.01
Device name	Displays the name of the transmitter.	Character string composed of letters, numbers and certain punctuation marks.	Promag 100
Order code	Displays the device order code.	Character string composed of letters, numbers and certain punctuation marks	–
Extended order code 1	Displays the 1st part of the extended order code.	Character string	–
Extended order code 2	Displays the 2nd part of the extended order code.	Character string	-
Extended order code 3	Displays the 3rd part of the extended order code.	Character string	-
ENP version	Displays the version of the electronic nameplate.	Character string in the format xx.yy.zz	2.02.00
Device revision	Displays the device revision with which the device is registered with the HART Communication Foundation.	0 to 255	2
Device ID	Displays the device ID for identifying the device in a HART network.	Positive integer	6-digit hexadecimal number
Device type	Displays the device type with which the measuring device is registered with the HART Communication Foundation.	0 to 255	58
Manufacturer ID	Displays the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.	0 to 255	17
IP address	Displays the IP address of the Web server of the measuring device.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
Subnet mask	Displays the subnet mask.	4 octet: 0 to 255 (in the particular octet)	255.255.255.0
Default gateway	Displays the default gateway.	4 octet: 0 to 255 (in the particular octet)	0.0.0.0

12.11 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
04.2013	01.00.00	Option **76**	Original firmware	Operating Instructions	BA01172D/06/EN/01.13
06.2014	01.01.zz	Option **70**	▪ In accordance with HART 7 Specification ▪ Integration of optional onsite display ▪ New unit "Beer Barrel (BBL)" ▪ Simulation of diagnostic events ▪ External verification of the current and PFS output via the Heartbeat application package ▪ Fixed value for simulation pulses	Operating Instructions	BA01172D/06/EN/02.14

Flashing the firmware to the current version or to the previous version is possible via the service interface (CDI) .

For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download
- Specify the following details:
  - Product root: e.g. 5H1B
  - Text search: Manufacturer's information
  - Search range: documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

13.1.2 Interior cleaning

No interior cleaning is planned for the device.

13.1.3 Replacing seals

The sensor's seals (particularly aseptic molded seals) must be replaced periodically.

The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

Replacement seals (accessory) (→ 109)

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

For a list of some of the measuring and test equipment, refer to the "Accessories" chapter of the "Technical Information" document for the device.

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repair

14.1 General notes

Repair and conversion concept
The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by correspondingly trained customers.
- Certified devices can be converted into other certified devices by Endress+Hauser Service or at the factory only.

Notes for repair and conversion
For repair and modification of a measuring device, observe the following notes:
- Use only original Endress+Hauser spare parts.
- Carry out the repair according to the Installation Instructions.
- Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter in the **Device information** submenu (→ 84).

14.3 Endress+Hauser services

Contact your Endress+Hauser Sales Center for information on services and spare parts.

14.4 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

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the device.
2. **WARNING!** Danger to persons from process conditions. Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

Carry out the mounting and connection steps from the chapters "Mounting the measuring device" and "Connecting the measuring device" in the logically reverse sequence. Observe the safety instructions.

14.5.2 Disposing of the measuring device

⚠ WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- ▶ Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

15 Accessories

Various accessories, which can be ordered with the device or subsequently from Endress +Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Ground cable	Set, consisting of two ground cables for potential equalization.

15.1.2 For the sensor

Accessories	Description
Ground disks	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S

Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

15.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

15.4 System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

16 Technical data

16.1 Application

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are adequately resistant.

16.2 Function and system design

Measuring principle

Electromagnetic flow measurement on the basis of *Faraday's law of magnetic induction*.

Measuring system

One device version is available: compact version, transmitter and sensor form a mechanical unit.

For information on the structure of the device (→ 🖹 11)

16.3 Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: 5 to 10 000 µS/cm/cm

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
125	–	220 to 7 500	1850	15	30
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h
200	8	35 to 1 100 m³/h	300 m³/h	0.05 m³	5 m³/h
250	10	55 to 1 700 m³/h	500 m³/h	0.05 m³	7.5 m³/h
300	12	80 to 2 400 m³/h	750 m³/h	0.1 m³	10 m³/h
350	14	110 to 3 300 m³/h	1 000 m³/h	0.1 m³	15 m³/h
400	16	140 to 4 200 m³/h	1 200 m³/h	0.15 m³	20 m³/h
450	18	180 to 5 400 m³/h	1 500 m³/h	0.25 m³	25 m³/h
500	20	220 to 6 600 m³/h	2 000 m³/h	0.25 m³	30 m³/h
600	24	310 to 9 600 m³/h	2 500 m³/h	0.3 m³	40 m³/h

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
½	15	1.0 to 27	6	0.1	0.15
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1200	10	15
10	250	250 to 7 500	1500	15	30
12	300	350 to 10 600	2400	25	45
14	350	500 to 15 000	3600	30	60
16	400	600 to 19 000	4800	50	60
18	450	800 to 24 000	6000	50	90
20	500	1 000 to 30 000	7500	75	120
24	600	1 400 to 44 000	10500	100	180

Recommended measuring range

"Flow limit" section (→ 101)

Operable flow range Over 1000 : 1

Input signal

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:
- Operating pressure to increase accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section (→ 91)

It is recommended to read in external measured values to calculate the following measured variables:
Corrected volume flow

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

16.4 Output

Output signal

Current output

Current output	4-20 mA HART (active)
Maximum output values	▪ DC 24 V (no flow) ▪ 22.5 mA
Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC 30 V ▪ 25 mA
Voltage drop	For 25 mA: ≤ DC 2 V
Pulse output	
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable

Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow
Frequency output	
Output frequency	Adjustable: 0 to 10 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): ▪ Minimum value: 3.6 mA ▪ Maximum value: 22 mA ▪ Defined value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

HART

Device diagnostics	Device condition can be read out via HART Command 48

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ Defined value: 0 to 12 500 Hz ▪ 0 Hz
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Local display

Plain text display	With information on cause and remedial measures
Backlight	Red backlighting indicates a device error.

Status signal as per NAMUR recommendation NE 107

Operating tool

- Via digital communication:
  HART protocol
- Via service interface

Plain text display	With information on cause and remedial measures

Web browser

Plain text display	With information on cause and remedial measures

Low flow cut off

The switch points for low flow cut off are user-selectable.

Galvanic isolation

The following connections are galvanically isolated from each other:
- Outputs
- Power supply

Protocol-specific data

HART

- For information on the device description files (→ 45)
- For information on the dynamic variables and measured variables (HART device variables) (→ 45)

16.5 Power supply

Terminal assignment

(→ 28)

Pin assignment, device plug (→ 29)

Supply voltage

Transmitter

For device version with all communication types: DC 20 to 30 V

The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

Power consumption

Transmitter

Order code for "Output"	Maximum Power consumption
Option **B**: 4-20mA HART, pulse/frequency/switch output	3.5 W

Current consumption

Transmitter

Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **B**: 4-20mA HART, pul./freq./switch output	145 mA	18 A (<0.125 ms)

Power supply failure

- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection (→ 29)

Potential equalization (→ 31)

Terminals

Transmitter
Spring terminals for wire cross-sections0.5 to 2.5 mm^2 (20 to 14 AWG)

Cable entries

- Cable gland: M20 × 1.5 with cable ⌀6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

Cable specification (→ 27)

16.6 Performance characteristics

Reference operating conditions

In accordance with DIN EN 29104
- Fluid temperature: +28±2 °C (+82±4 °F)
- Ambient temperature range: +22±2 °C (+72±4 °F)
- Warm-up period:30 min

Installation
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

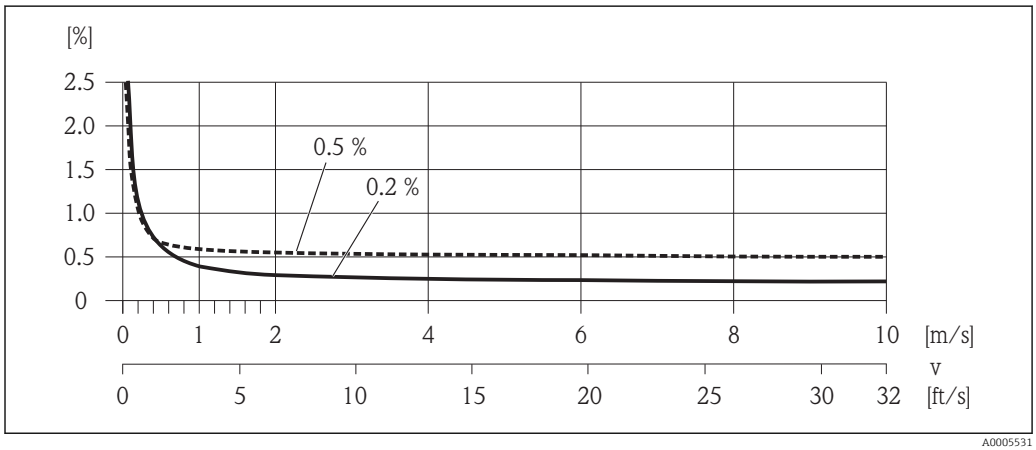
Maximum measured error

Error limits under reference operating conditions

o.r. = of reading

Volume flow
- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

Fluctuations in the supply voltage do not have any effect within the specified range.



16 *Maximum measured error in % o.r.*

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

o.r. = of reading; o.f.s. = of full scale value

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

Current output

Accuracy	Max. ±0.05 % o.f.s. or ±5 µA

Pulse/frequency output

Accuracy	Max. ±50 ppm o.r.

Repeatability

o.r. = of reading

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity
Max. ±5 % o.r.

Temperature measurement response time	T_{90} < 15 s
Influence of ambient temperature	o.r. = of reading; o.f.s. = of full scale value **Current output** **Temperature coefficient**: Max. ±50 ppm/°C o.f.s. or ±1 µA/°C **Pulse/frequency output** **Temperature coefficient**: Max. ±50 ppm o.r. /100 °C

16.7 Installation

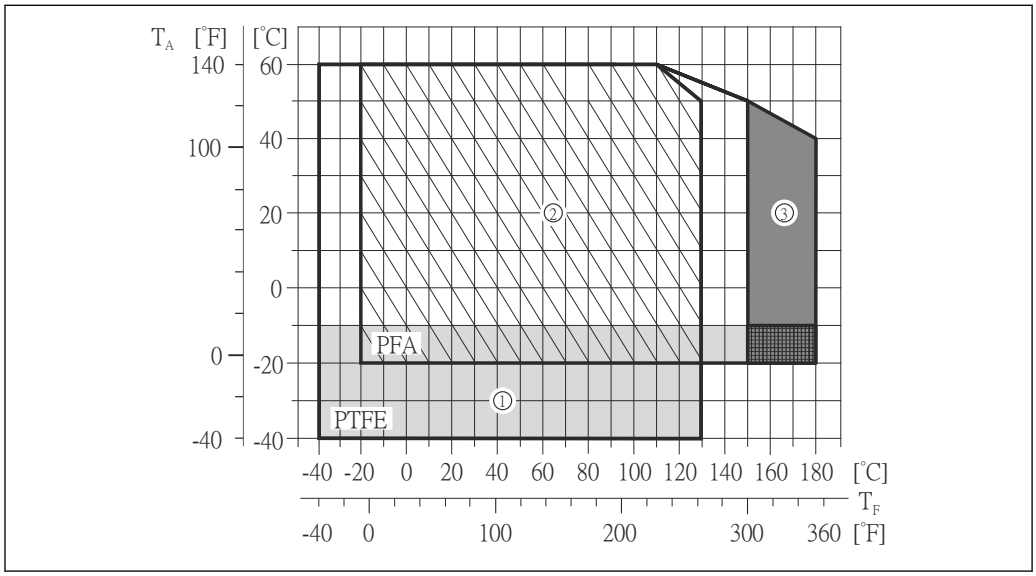
"Mounting requirements" (→ 17)

16.8 Environment

Ambient temperature range	(→ 19)
Storage temperature	The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors. ▪ Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures. ▪ Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner. ▪ If protection caps or protective covers are mounted these should never be removed before installing the measuring device.
Degree of protection	**Transmitter and sensor** ▪ As standard: IP66/67, type 4X enclosure ▪ With the order code for "Sensor options", option **CM**: IP69K can also be ordered ▪ When housing is open: IP20, type 1 enclosure ▪ Display module: IP20, type 1 enclosure
Shock resistance	As per IEC/EN 60068-2-31
Vibration resistance	Acceleration up to 2 g following IEC 60068-2-6
Mechanical load	▪ Protect the transmitter housing against mechanical effects, such as shock or impact. ▪ Never use the transmitter housing as a ladder or climbing aid.
Electromagnetic compatibility (EMC)	▪ As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) ▪ Complies with emission limits for industry as per EN 55011 (Class A) For details refer to the Declaration of Conformity.

16.9 Process

Medium temperature range



T_A Ambient temperature

T_F Medium temperature

1 Gray area: the ambient and fluid temperature range of −10 to −40 °C (−14 to −40 °F) applies to stainless flanges only

2 Hatched area: harsh environment and IP68 only up to +130 °C (+266 °F)

3 Dark-gray area: high-temperature version with insulation

Conductivity

≥ 5 µS/cm for liquids in general

Pressure-temperature ratings

An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document

Pressure tightness

"–" = no specifications possible

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 to +180 °C (+212 to +356 °F)
25	1	0 (0)	0 (0)	0 (0)
32	–	0 (0)	0 (0)	0 (0)
40	1 ½	0 (0)	0 (0)	0 (0)
50	2	0 (0)	0 (0)	0 (0)
65	–	0 (0)	–	0 (0)
80	3	0 (0)	–	0 (0)
100	4	0 (0)	–	0 (0)
125	–	0 (0)	–	0 (0)
150	6	0 (0)	–	0 (0)
200	8	0 (0)	–	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
15	½	0 (0)	0 (0)	0 (0)	100 (1.45)
25	1	0 (0)	0 (0)	0 (0)	100 (1.45)
32	–	0 (0)	0 (0)	0 (0)	100 (1.45)
40	1 ½	0 (0)	0 (0)	0 (0)	100 (1.45)
50	2	0 (0)	0 (0)	0 (0)	100 (1.45)
65	–	0 (0)	–	40 (0.58)	130 (1.89)
80	3	0 (0)	–	40 (0.58)	130 (1.89)
100	4	0 (0)	–	135 (1.96)	170 (2.47)
125	–	135 (1.96)	–	240 (3.48)	385 (5.58)
150	6	135 (1.96)	–	240 (3.48)	385 (5.58)
200	8	200 (2.90)	–	290 (4.21)	410 (5.95)
250	10	330 (4.79)	–	400 (5.80)	530 (7.69)
300	12	400 (5.80)	–	500 (7.25)	630 (9.14)
350	14	470 (6.82)	–	600 (8.70)	730 (10.6)
400	16	540 (7.83)	–	670 (9.72)	800 (11.6)
450	18	No negative pressure permitted!			
500	20				
600	24				

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludges)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 92)

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 21)

System pressure

(→ 20)

Vibrations

(→ 20)

16.10 Mechanical construction

Design, dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

Weight

Compact version

- Including the transmitter
- High-temperature version + 1.5 kg (3.31 lbs)
- Weight specifications apply to standard pressure ratings and without packaging material.

Weight in SI units

Nominal diameter		EN (DIN), AS [1]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
15	½	PN 40	4.5	Class 150	4.5	10K	4.5
25	1	PN 40	5.3	Class 150	5.3	10K	5.3
32	–	PN 40	6	Class 150	–	10K	5.3
40	1 ½	PN 40	7.4	Class 150	7.4	10K	6.3
50	2	PN 40	8.6	Class 150	8.6	10K	7.3
65	–	PN 16	10	Class 150	–	10K	9.1
80	3	PN 16	12	Class 150	12	10K	10.5
100	4	PN 16	14	Class 150	14	10K	12.7
125	–	PN 16	19.5	Class 150	–	10K	19
150	6	PN 16	23.5	Class 150	23.5	10K	22.5
200	8	PN 10	43	Class 150	43	10K	39.9
250	10	PN 10	63	Class 150	73	10K	67.4
300	12	PN 10	68	Class 150	108	10K	70.3
350	14	PN 10	103	Class 150	173		
400	16	PN 10	118	Class 150	203		
450	18	PN 10	159	Class 150	253		
500	20	PN 10	154	Class 150	283		
600	24	PN 10	206	Class 150	403		

1) For flanges to AS, only DN 25 and 50 are available.

Weight in US units

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
15	½	Class 150	9.92
25	1	Class 150	11.7
40	1 ½	Class 150	16.3
50	2	Class 150	19.0
80	3	Class 150	26.5
100	4	Class 150	30.9
150	6	Class 150	51.8
200	8	Class 150	94.8
250	10	Class 150	161.0
300	12	Class 150	238.1
350	14	Class 150	381.5

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
400	16	Class 150	447.6
450	18	Class 150	557.9
500	20	Class 150	624.0
600	24	Class 150	888.6

Measuring tube specification

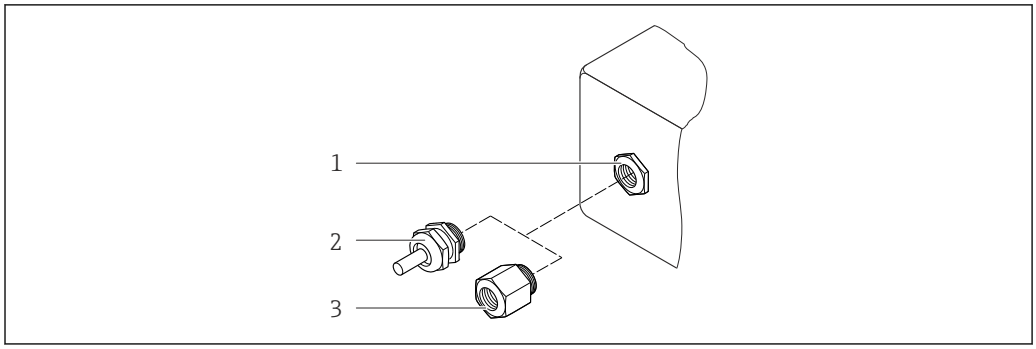
Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
15	½	PN 40	Class 150	–	–	20K	–	–	15	0.59
25	1	PN 40	Class 150	Table E	–	20K	23	0.91	26	1.02
32	–	PN 40	–	–	–	20K	32	1.26	35	1.38
40	1 ½	PN 40	Class 150	–	–	20K	36	1.42	41	1.61
50	2	PN 40	Class 150	Table E	PN 16	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3	PN 16	Class 150	–	–	10K	75	2.95	80	3.15
100	4	PN 16	Class 150	–	–	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6	PN 16	Class 150	–	–	10K	154	6.06	156	6.14
200	8	PN 10	Class 150	–	–	10K	201	7.91	202	7.95
250	10	PN 10	Class 150	–	–	10K	–	–	256	10.1
300	12	PN 10	Class 150	–	–	10K	–	–	306	12.0
350	14	PN 10	Class 150	–	–	–	–	–	337	13.3
400	16	PN 10	Class 150	–	–	–	–	–	387	15.2
450	18	PN 10	Class 150	–	–	–	–	–	432	17.0
500	20	PN 10	Class 150	–	–	–	–	–	487	19.2
600	24	PN 10	Class 150	–	–	–	–	23	593	23.3

Materials

Transmitter housing

Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated

Cable entries/cable glands



17 Possible cable entries/cable glands

1 Cable entry in transmitter housing, wall-mount housing or connection housing with internal thread M20 x 1.5
2 Cable gland M20 x 1.5
3 Adapter for cable entry with internal thread G ½" or NPT ½"

Order code for "Housing", option A "Compact, coated aluminum"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Nickel-plated brass
Adapter for cable entry with internal thread G ½"	
Adapter for cable entry with internal thread NPT ½"	

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

- DN 15 to 300 (½ to 12"): coated aluminum AlSi10Mg
- DN 350 to 600 (14 to 24"): carbon steel with protective varnish

Measuring tubes

Stainless steel, 1.4301/304/1.4306/304L; for flanges made of carbon with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Liner

- PFA
- PTFE

Process connections

EN 1092-1 (DIN 2501)
Stainless steel, 1.4571 (F316L); carbon steel, FE410WB [1)]/S235JRG2; Alloy C22, 2.4602 (UNS N06022)

ASME B16.5
Stainless steel, F316L; carbon steel, A105 [1)]

JIS B2220
Stainless steel, 1.0425 (F316L) [1)]; carbon steel, S235JRG2/HII

AS 2129 Table E
- DN 25 (1"): carbon steel, A105/S235JRG2
- DN 40 (1 ½"): carbon steel, A105/S275JR

AS 4087 PN 16
Carbon steel, A105/S275JR

List of all available process connections (→ 105)

Electrodes

Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium

Seals

In accordance with DIN EN 1514-1

Accessories

Ground disks

Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum; titanium

Fitted electrodes	Measuring electrodes, reference electrodes and electrodes for empty pipe detection: ▪ Standard: stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum, titanium ▪ Optional: only platinum measuring electrodes
Process connections	▪ EN 1092-1 (DIN 2501): DN ≤ 300 (12") form A, DN ≥ 350 (14") flat face; dimensions as per DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 only as per EN 1092-1 ▪ ASME B16.5 ▪ JIS B2220 ▪ AS 2129 Table E ▪ AS 4087 PN 16 For information on the materials of the process connections (→ 104)
Surface roughness	Stainless steel electrodes, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium: ≤ 0.3 to 0.5 µm (11.8 to 19.7 µin) (All data relate to parts in contact with fluid) Liner with PFA: ≤ 0.4 µm (15.7 µin) (All data relate to parts in contact with fluid)

1) DN 15 to 300 (½ to 12") with Al/Zn protective coating; DN 350 to 600 (14 to 24") with protective varnish

16.11 Operability

Local display

The local display is only available with the following device version:
Order code for "Display; Operation", option **B**: 4-line; via communication

Display element

- 4-line liquid crystal display with 16 characters per line.
- White background lighting; switches to red in event of device errors.
- Format for displaying measured variables and status variables can be individually configured.
- Permitted ambient temperature for the display: −20 to +60 °C (−4 to +140 °F). The readability of the display may be impaired at temperatures outside the temperature range.

Disconnecting the local display from the main electronics module

In the case of the "Compact, aluminum coated" housing version, the local display must only be disconnected manually from the main electronics module. In the case of the "Compact, hygienic, stainless" and "Ultra compact, hygienic, stainless" housing versions, the local display is integrated in the housing cover and is disconnected from the main electronics module when the housing cover is opened.

"Compact, aluminum coated" housing version

The local display is plugged onto the main electronics module. The electronic connection between the local display and main electronics module is established via a connecting cable.

For some work performed on the measuring device (e.g. electrical connection), it is advisable to disconnect the local display from the main electronics module:

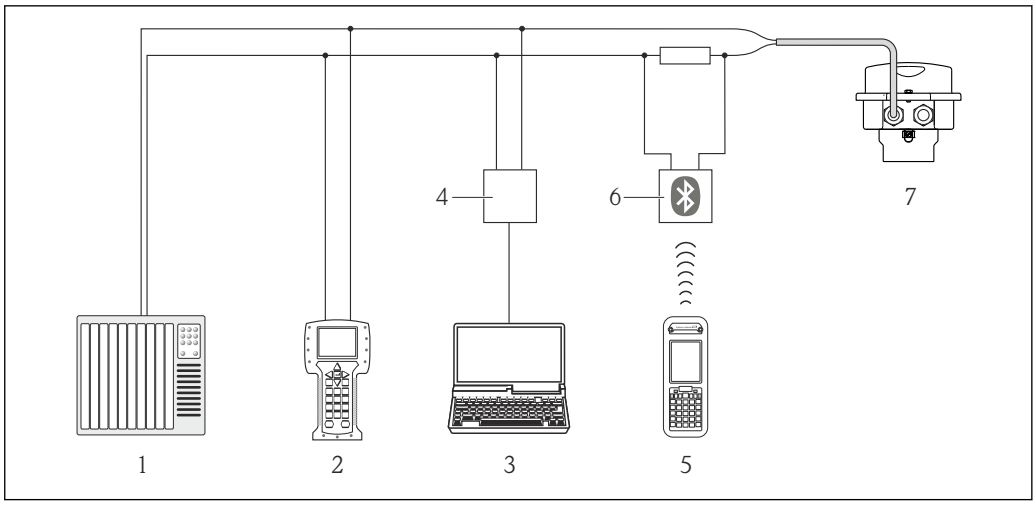
1. Press in the side latches of the local display.
2. Remove the local display from the main electronics module. Pay attention to the length of the connecting cable when doing so.

Once the work is completed, plug the local display back on.

Remote operation

Via HART protocol

This communication interface is present in the following device version:
Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output



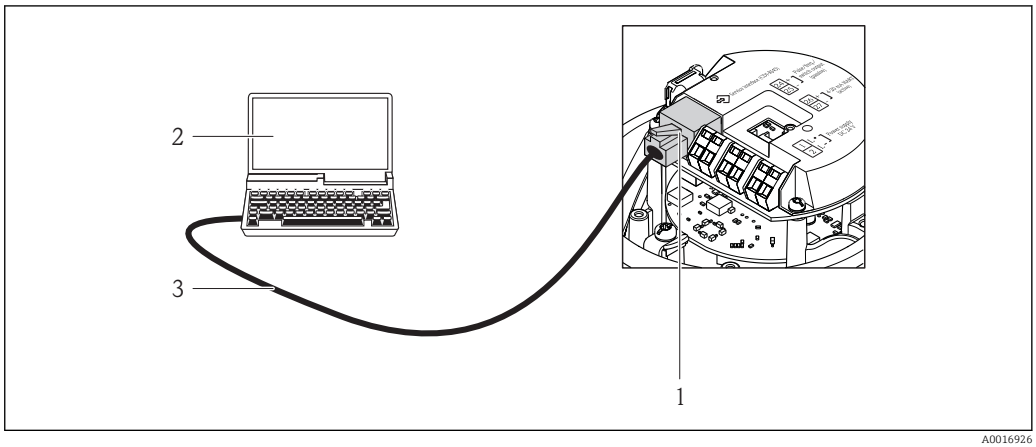
18 *Options for remote operation via HART protocol*

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

Service interface

Service interface (CDI-RJ45)

HART



19 *Connection for the order code for "Output", option B: 4-20 mA HART, pulse/frequency/switch output*

1 *Service interface (CDI -RJ45) of the measuring device with access to the integrated Web server*
2 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"*
3 *Standard Ethernet connecting cable with RJ45 plug*

Languages

Can be operated in the following languages:
- Via "FieldCare" operating tool:
  English, German, French, Spanish, Italian, Chinese, Japanese
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech

16.12 Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-Tick symbol	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Pressure Equipment Directive	▪ With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC. ▪ Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.
Other standards and guidelines	▪ EN 60529 Degrees of protection provided by enclosures (IP code) ▪ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use ▪ IEC/EN 61326 Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements). ▪ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment ▪ NAMUR NE 32 Data retention in the event of a power failure in field and control instruments with microprocessors ▪ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal. ▪ NAMUR NE 53 Software of field devices and signal-processing devices with digital electronics ▪ NAMUR NE 105 Specifications for integrating fieldbus devices in engineering tools for field devices ▪ NAMUR NE 107 Self-monitoring and diagnosis of field devices ▪ NAMUR NE 131 Requirements for field devices for standard applications

16.13 Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered from Endress+Hauser either directly with the device or subsequently. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**Heartbeat Monitoring:** Continuously supplies monitoring data, which are characteristic of the measuring principle, for an external condition monitoring system. This makes it possible to: ▪ Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the product quality, e.g. gas pockets. **Heartbeat Verification:** Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process. ▪ Access via onsite operation or other operating interfaces, such as FieldCare for instance. ▪ Documentation of device functionality within the framework of manufacturer specifications, for proof testing for instance. ▪ End-to-end, traceable documentation of the verification results, including report. ▪ Makes it possible to extend calibration intervals in accordance with operator's risk assessment.

16.14 Accessories

Overview of accessories available for order (→ 90)

16.15 Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The CD-ROM provided for the device (depending on the device version, the CD-ROM might not be part of the delivery!)
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

Standard documentation

Brief Operating Instructions

Measuring device	Documentation code
Promag P 100	KA01143D

Technical Information

Measuring device	Documentation code
Promag P 100	TI01102D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex nA	XA01090D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01056D
Heartbeat Technology	SD01149D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Overview of accessories available for order (→ 90)

17 Appendix

17.1 Overview of the operating menu

The following tables provide an overview of the entire operating menu structure with menus and parameters. The page reference indicates where a description of the parameter can be found in the manual.

***** = The submenu only appears if it has been additionally ordered ("Technical Information", Section "Application packages").

17.1.1 Main menu

Main menu	→	Display language	(→ 66)
		Operation	(→ 111)
		Setup	(→ 112)
		Diagnostics	(→ 117)
		Expert	(→ 119)

17.1.2 "Operation" menu

Operation	→		
Display language			(→ 66)
Web server language			
Access status display			
Access status tooling			
Locking status			(→ 68)
	Display	→	(→ 55)
	Format display		(→ 56)
	Contrast display		
	Backlight		(→ 66)
	Display interval		(→ 66)
	Totalizer handling	→	(→ 73)
	Control Totalizer 1 to 3		(→ 74)
	Preset value 1 to 3		(→ 74)
	Reset all totalizers		(→ 73)

17.1.3 "Setup" menu

Setup	→	(→ 49)
Device tag		(→ 49)
Current output 1	→	
Assign current output		(→ 50)
Mass flow unit		(→ 50)
Volume flow unit		(→ 50)
Conductivity unit		(→ 62)
Density unit		(→ 62)
Current span		(→ 50)
0/4 mA value		(→ 50)
20 mA value		(→ 50)
20 mA value		(→ 50)
0/4 mA value		(→ 50)
Failure mode		(→ 51)
Failure current		(→ 51)
Pulse/frequency/switch output	→	(→ 51)
Operating mode		(→ 51)
Assign pulse output		(→ 51)
Assign frequency output		(→ 52)
Switch output function		(→ 54)
Assign diagnostic behavior		(→ 54)
Assign limit		(→ 54)
Assign flow direction check		(→ 54)
Assign status		(→ 54)
Mass flow unit		(→ 50)
Mass unit		(→ 51)
Volume flow unit		(→ 50)
Conductivity unit		(→ 62)
Volume unit		(→ 51)

	Density unit		(→ 62)
	Unit totalizer		(→ 54)
	Unit totalizer		(→ 54)
	Unit totalizer		(→ 54)
	Value per pulse		(→ 51)
	Pulse width		(→ 51)
	Failure mode		(→ 52)
	Minimum frequency value		(→ 53)
	Maximum frequency value		(→ 53)
	Maximum frequency value		(→ 53)
	Minimum frequency value		(→ 53)
	Measuring value at minimum frequency		(→ 53)
	Measuring value at maximum frequency		(→ 53)
	Measuring value at maximum frequency		(→ 53)
	Measuring value at minimum frequency		(→ 53)
	Failure mode		(→ 53)
	Failure frequency		(→ 53)
	Switch-on value		(→ 54)
	Switch-off value		(→ 54)
	Switch-off value		(→ 54)
	Switch-on value		(→ 54)
	Switch-on delay		(→ 54)
	Switch-off delay		(→ 54)
	Failure mode		(→ 54)
	Invert output signal		(→ 52)
	Display	→	(→ 55)
	Format display		(→ 56)
	Value 1 display		(→ 56)

0% bargraph value 1		(→ 56)
100% bargraph value 1		(→ 56)
Value 2 display		(→ 56)
Value 3 display		(→ 56)
0% bargraph value 3		(→ 56)
100% bargraph value 3		(→ 56)
Value 4 display		(→ 56)
Output conditioning	→	(→ 57)
Assign current output		(→ 50)
Damping output 1		(→ 58)
Measuring mode output 1		(→ 58)
Assign frequency output		(→ 52)
Damping output 1		(→ 58)
Measuring mode output 1		(→ 58)
Assign pulse output		(→ 51)
Measuring mode output 1		(→ 58)
Low flow cut off	→	
Assign process variable		(→ 59)
On value low flow cutoff		(→ 59)
Off value low flow cutoff		(→ 59)
Pressure shock suppression		(→ 59)
Empty pipe detection	→	(→ 60)
Empty pipe detection		(→ 60)
New adjustment		(→ 60)
Progress		(→ 60)
Switch point empty pipe detection		(→ 60)
Response time part. filled pipe detect.		(→ 60)
HART input	→	(→ 56)
Capture mode		(→ 57)

Device ID			(→ 57)
Device type			(→ 57)
Manufacturer ID			(→ 57)
Burst command			(→ 57)
Slot number			(→ 57)
Timeout			(→ 57)
Failure mode			(→ 57)
Failure value			(→ 57)
Advanced setup	→		(→ 61)
Enter access code			(→ 69)
	System units	→	(→ 61)
	Volume flow unit		(→ 50)
	Volume unit		(→ 51)
	Conductivity unit		(→ 62)
	Temperature unit		(→ 62)
	Mass flow unit		(→ 50)
	Mass unit		(→ 51)
	Density unit		(→ 62)
	Corrected volume flow unit		(→ 62)
	Corrected volume unit		(→ 62)
	Sensor adjustment	→	(→ 62)
	Installation direction		(→ 63)
	Totalizer 1 to 3	→	(→ 63)
	Assign process variable		(→ 63)
	Unit totalizer		(→ 54)
	Totalizer operation mode		(→ 63)
	Failure mode		(→ 63)
	Display	→	(→ 64)
	Format display		(→ 56)
	Value 1 display		(→ 56)
	0% bargraph value 1		(→ 56)

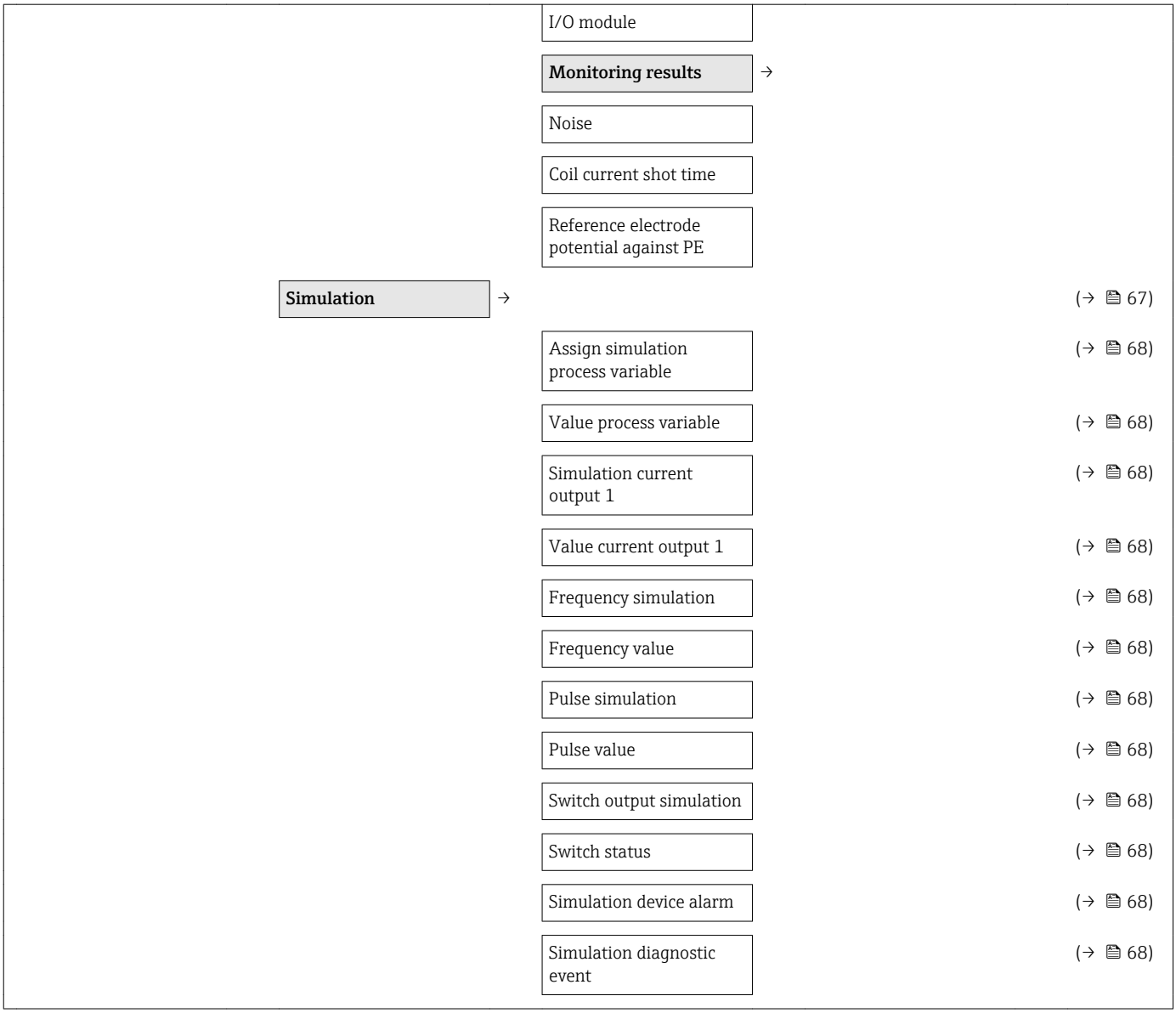
	100% bargraph value 1			(→ 56)
	Decimal places 1			(→ 65)
	Value 2 display			(→ 56)
	Decimal places 2			(→ 65)
	Value 3 display			(→ 56)
	0% bargraph value 3			(→ 56)
	100% bargraph value 3			(→ 56)
	Decimal places 3			(→ 65)
	Value 4 display			(→ 56)
	Decimal places 4			(→ 65)
	Display language			(→ 66)
	Display interval			(→ 66)
	Display damping			(→ 66)
	Header			(→ 66)
	Header text			(→ 66)
	Separator			(→ 66)
	Backlight			(→ 66)
	Electrode cleaning circuit [1]	→		(→ 66)
	Electrode cleaning circuit			(→ 67)
	ECC duration			(→ 67)
	ECC recovery time			(→ 67)
	ECC cleaning cycle			(→ 67)
	ECC Polarity			(→ 67)
	Administration	→		
			Define access code	→ (→ 69)
			Define access code	(→ 69)
			Confirm access code	(→ 69)
	Device reset			(→ 84)

1) Order code for "Application package", option EC "ECC electrode cleaning"

17.1.4 "Diagnostics" menu

- **Diagnostics** → (→ 75)
  - Actual diagnostics (→ 82)
  - Previous diagnostics (→ 82)
  - Operating time from restart (→ 82)
  - Operating time (→ 0)
  - **Diagnostic list** → (→ 82)
    - Diagnostics 1 to 5 (→ 82)
  - **Event logbook** → (→ 82)
    - Filter options (→ 83)
  - **Device information** → (→ 84)
    - Device tag (→ 85)
    - Serial number (→ 85)
    - Firmware version (→ 85)
    - Device name (→ 85)
    - Order code (→ 85)
    - Extended order code 1 to 3 (→ 85)
    - ENP version (→ 85)
    - Device revision (→ 85)
    - Device ID (→ 85)
    - Device type (→ 85)
    - Manufacturer ID (→ 85)
    - IP address (→ 85)
    - Subnet mask (→ 85)
    - Default gateway (→ 85)
  - **Measured values** →
    - **Process variables** → (→ 71)
      - Volume flow (→ 71)
      - Mass flow (→ 71)
      - Conductivity (→ 71)

		Corrected volume flow	(→ 72)
		Temperature	(→ 72)
		Totalizer 1 to 3 →	(→ 72)
		Totalizer value 1 to 3	(→ 72)
		Totalizer overflow 1 to 3	(→ 72)
		Output values →	(→ 72)
		Output current 1	(→ 72)
		Measured current 1	(→ 72)
		Pulse output 1	(→ 73)
		Output frequency 1	(→ 73)
		Switch status 1	(→ 73)
Heartbeat [1] →			(→ 110)
		Performing verification →	
		Year	
		Month	
		Day	
		Hour	
		AM/PM	
		Minute	
		External device information	
		Start verification	
		Progress	
		Status	
		Overall result	
		Verification results →	
		Date/time	
		Verification ID	
		Operating time	
		Overall result	
		Sensor	
		Sensor electronic module	

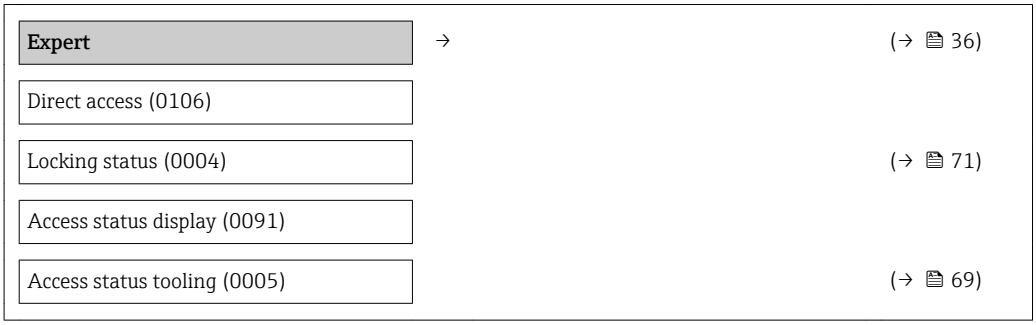


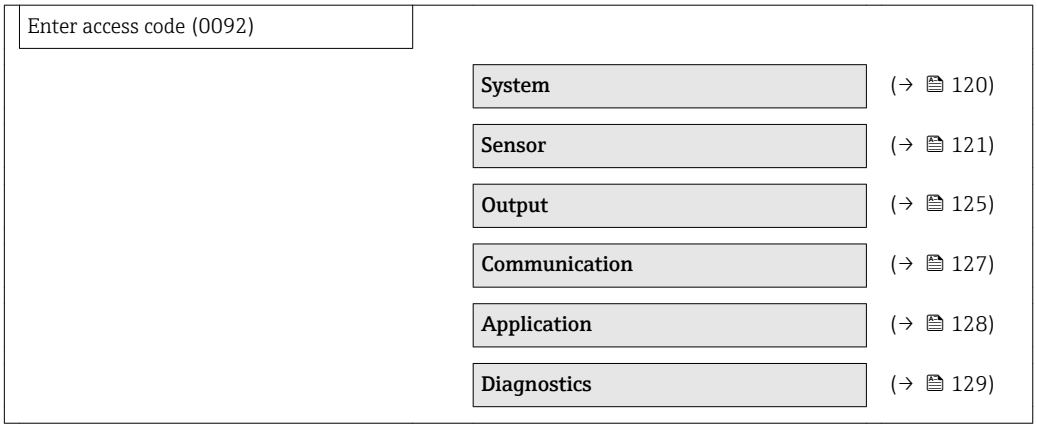
1) Order code for "Application package", option EB "Heartbeat Verification + Monitoring", see the Special Documentation for the device

17.1.5 "Expert" menu

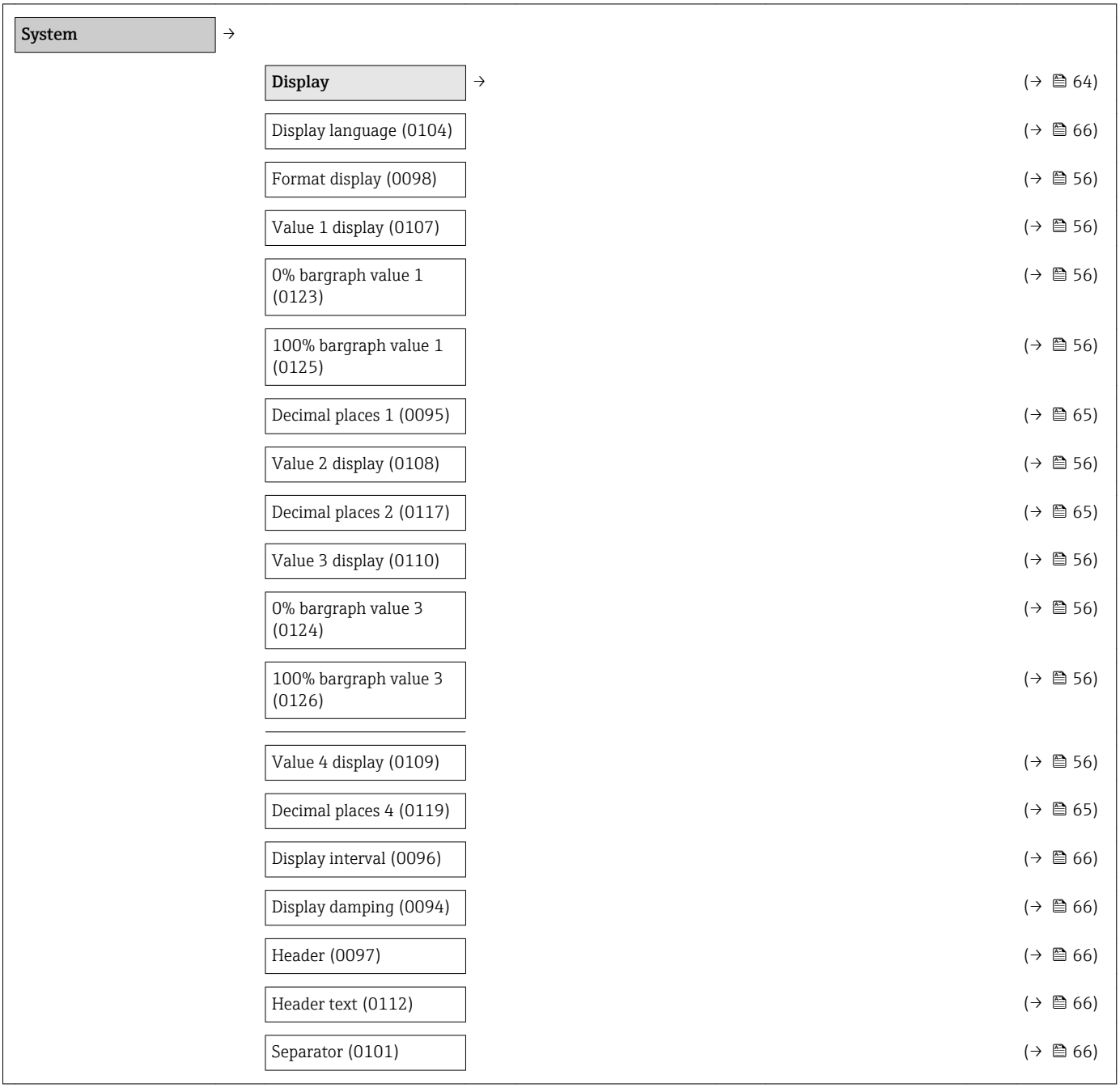
The following tables provide an overview of the **Expert** menu (→ 119) with its submenus and parameters. The direct access code to the parameter is given in brackets. The page reference indicates where a description of the parameter can be found in the manual.

Overview "Expert" menu





"System" submenu



- Contrast display (0105)
- Backlight (0111) (→ 66)
- Access status display (0091)
- **Diagnostic handling** → (→ 75)
  - Alarm delay (0651)
  - **Diagnostic behavior** →
    - Assign behavior of diagnostic no. 531 (0741)
    - Assign behavior of diagnostic no. 832 (0681)
    - Assign behavior of diagnostic no. 833 (0682)
    - Assign behavior of diagnostic no. 834 (0700)
    - Assign behavior of diagnostic no. 835 (0702)
    - Assign behavior of diagnostic no. 862 (0745)
    - Assign behavior of diagnostic no. 937 (0743)
    - Assign behavior of diagnostic no. 302 (0739)
- **Administration** →
  - Define access code (0093) (→ 69)
  - Device reset (0000) (→ 84)
  - Activate SW option (0029)
  - Software option overview (0015)

"Sensor" submenu

- **Sensor** →
  - **Measured values** → (→ 71)

		Process variables →	(→ 71)
		Volume flow (1847)	(→ 71)
		Mass flow (1838)	(→ 71)
		Conductivity (1850)	(→ 71)
		Corrected volume flow (1851)	(→ 72)
		Temperature (1853)	(→ 72)
		Totalizer 1 to 3 →	(→ 72)
		Totalizer value 1 to 3 (0911–1 to 3)	(→ 72)
		Totalizer overflow 1 to 3 (0910–1 to 3)	(→ 72)
		Output values →	(→ 72)
		Output current 1 (0361)	(→ 72)
		Measured current 1 (0366)	(→ 72)
		Pulse output 1 (0456)	(→ 73)
		Output frequency 1 (0471)	(→ 73)
		Switch status 1 (0461)	(→ 73)
System units →			(→ 61)
Volume flow unit (0553)			(→ 50)
Volume unit (0563)			(→ 51)
Conductivity unit (0582)			(→ 62)
Temperature unit (0557)			(→ 62)
Mass flow unit (0554)			(→ 50)
Mass unit (0574)			(→ 51)
Density unit (0555)			(→ 62)
Corrected volume flow unit (0558)			(→ 62)
Corrected volume unit (0575)			(→ 62)
Date/time format (2812)			
User-specific units →			
		User volume text (0567)	

- User volume offset (0569)
- User volume factor
- User mass text
- User mass offset (0562)
- User mass factor (0561)

Process parameters → (→ 49)

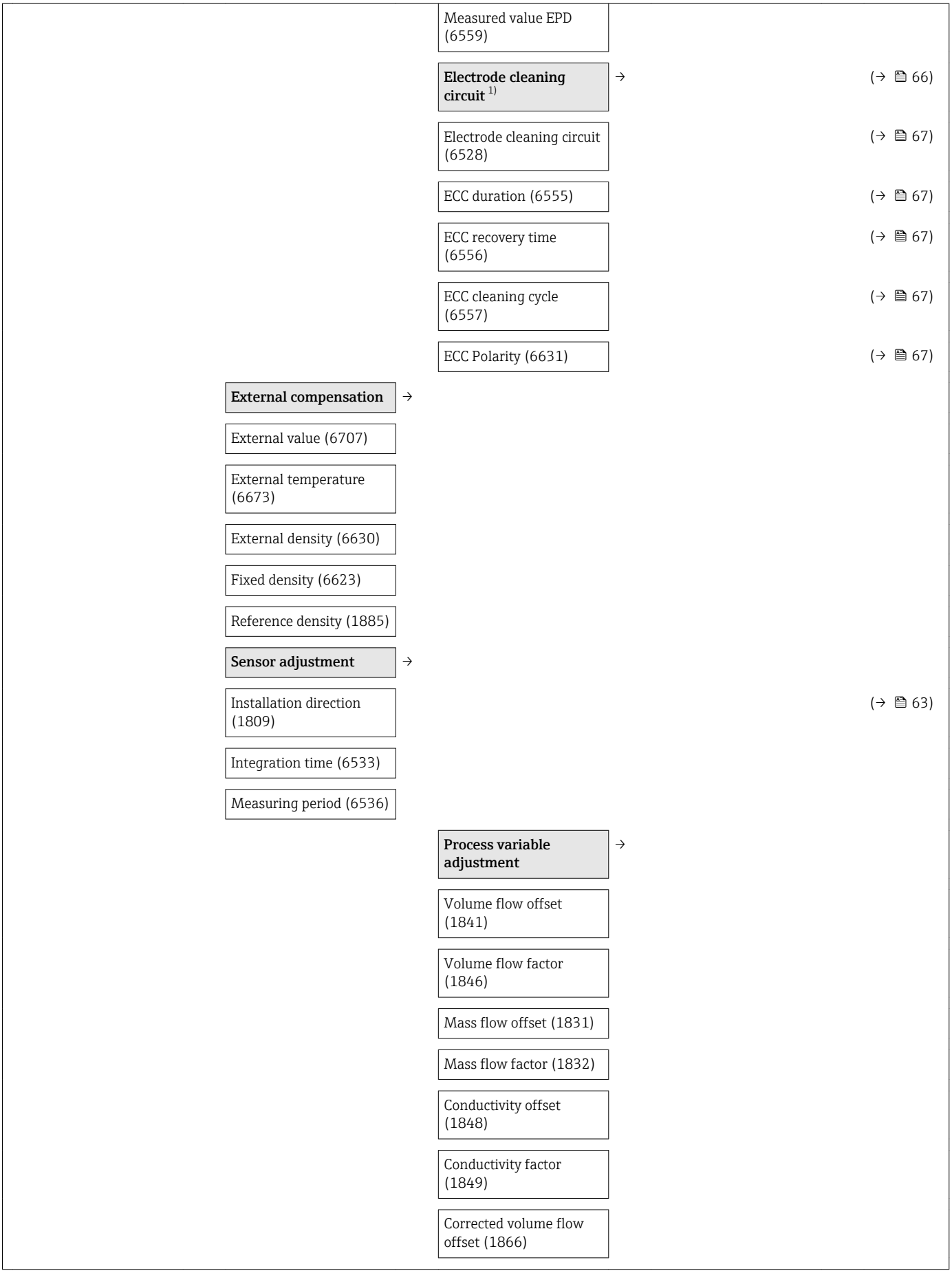
- Filter options (6710)
- Flow damping (6661)
- Flow override (1839)
- Conductivity damping (1803)
- Temperature damping (1886)
- Conductivity measurement (6514)

Low flow cut off →

- Assign process variable (1837) (→ 59)
- On value low flow cutoff (1805) (→ 59)
- Off value low flow cutoff (1804) (→ 59)
- Pressure shock suppression (1806) (→ 59)

Empty pipe detection →

- Empty pipe detection (1860) (→ 60)
- Switch point empty pipe detection (6562) (→ 60)
- Response time part. filled pipe detect. (1859) (→ 60)
- New adjustment (6560) (→ 60)
- Progress (6571) (→ 60)
- Empty pipe adjust value (6527)
- Full pipe adjust value (6548)


Measured value EPD (6559)
Electrode cleaning circuit 1) → (→ 66)
Electrode cleaning circuit (6528) (→ 67)
ECC duration (6555) (→ 67)
ECC recovery time (6556) (→ 67)
ECC cleaning cycle (6557) (→ 67)
ECC Polarity (6631) (→ 67)
External compensation →
External value (6707)
External temperature (6673)
External density (6630)
Fixed density (6623)
Reference density (1885)
Sensor adjustment →
Installation direction (1809) (→ 63)
Integration time (6533)
Measuring period (6536)
Process variable adjustment →
Volume flow offset (1841)
Volume flow factor (1846)
Mass flow offset (1831)
Mass flow factor (1832)
Conductivity offset (1848)
Conductivity factor (1849)
Corrected volume flow offset (1866)

		Corrected volume flow factor (1867)	
		Temperature offset (1870)	
		Temperature factor (1871)	
	Calibration	→	
	Nominal diameter (2807)		
	Calibration factor (6025)		
	Zero point (6195)		
	Conductivity calibration factor (6718)		

1) Order code for "Application package", option EC "ECC electrode cleaning"

"Output" submenu

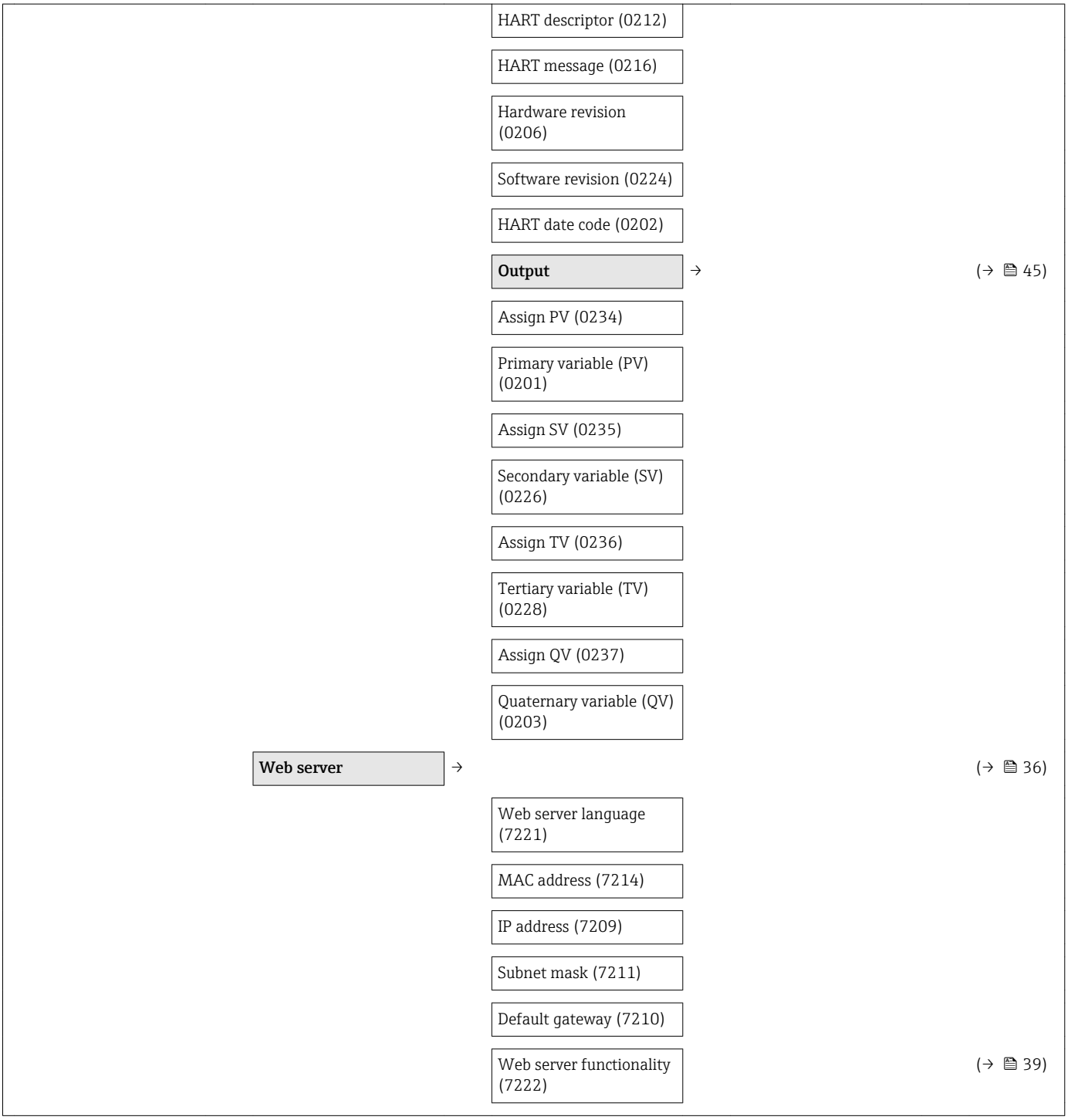
Output	→	**Current output 1**	→ (→ 50)
		Assign current output (0359)	(→ 50)
		Current span (0353)	(→ 50)
		Fixed current (0365)	
		0/4 mA value (0367)	(→ 50)
		20 mA value (0372)	(→ 50)
		Measuring mode (0351)	
		Damping output (0363)	(→ 58)
		Response time (0378)	
		Failure mode (0364)	(→ 51)
		Failure current (0352)	(→ 51)
		Output current 1 (0361)	(→ 72)
		Measured current 1 (0366)	(→ 72)
		Pulse/frequency/switch output 1 →	(→ 51)
		Operating mode (0469)	(→ 51)
		Assign pulse output (0460)	(→ 51)
		Value per pulse (0455)	(→ 51)

Pulse width (0452)	(→ 51)
Measuring mode (0351)	
Failure mode (0480)	(→ 52)
Pulse output 1 (0456)	(→ 73)
Assign frequency output (0478)	(→ 52)
Minimum frequency value (0453)	(→ 53)
Maximum frequency value (0454)	(→ 53)
Measuring value at minimum frequency (0476)	(→ 53)
Measuring value at maximum frequency (0475)	(→ 53)
Measuring mode (0479)	
Damping output	
Response time (0491)	
Failure mode (0451)	(→ 53)
Failure frequency (0474)	(→ 53)
Output frequency 1 (0471)	(→ 73)
Switch output function (0481)	(→ 54)
Assign diagnostic behavior (0482)	(→ 54)
Assign limit (0483)	(→ 54)
Switch-on value (0466)	(→ 54)
Switch-off value (0464)	(→ 54)
Assign flow direction check (0484)	(→ 54)
Assign status (0485)	(→ 54)
Switch-on delay (0467)	(→ 54)
Switch-off delay (0465)	(→ 54)
Failure mode (0486)	(→ 54)
Switch status 1 (0461)	(→ 73)

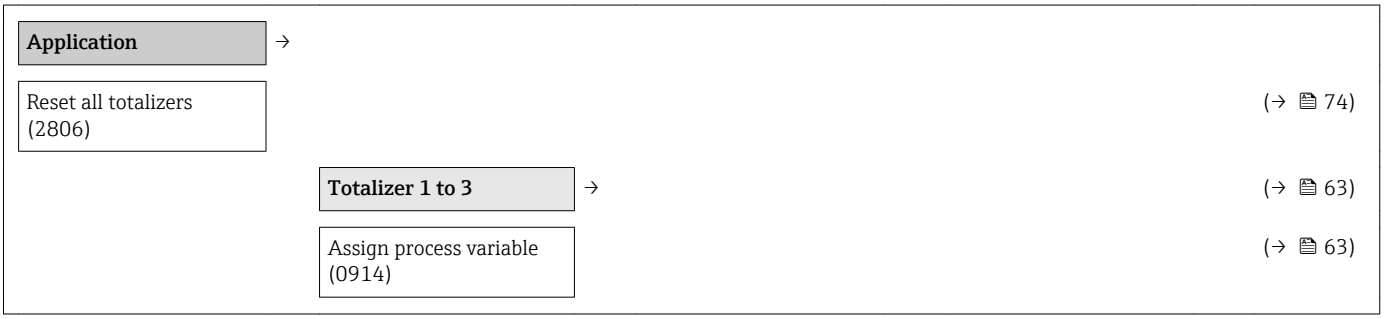
	Invert output signal (0470)		(→ 52)

"Communication" submenu

Communication →			
	HART input →		(→ 56)
		Configuration →	
		Capture mode (7001)	(→ 57)
		Device ID (7007)	(→ 57)
		Device type (7008)	(→ 57)
		Manufacturer ID (7009)	(→ 57)
		Burst command (7006)	(→ 57)
		Slot number (7010)	(→ 57)
		Timeout (7005)	(→ 57)
		Failure mode (7011)	(→ 57)
		Failure value (7012)	(→ 57)
		Input	
		Value (7003)	
		Status (7004)	
	HART output →		(→ 45)
		Configuration →	
		Burst mode (0208)	
		Burst command (0207)	
		HART address (0219)	
		No. of preambles (0217)	
		HART short tag (0220)	
		Information →	(→ 84)
		Device revision (0204)	(→ 85)
		Device ID (0221)	(→ 85)
		Device type (0222)	(→ 85)
		Manufacturer ID (0223)	(→ 85)
		HART revision (0205)	(→ 45)



"Application" submenu



Unit totalizer (0915)		(→ 54)
Totalizer operation mode		(→ 63)
Control Totalizer 1 to 3 (0912–1 to 3)		(→ 74)
Preset value 1 to 3 (0913–1 to 3)		(→ 74)
Failure mode (0901)		(→ 63)
Concentration	→	
Concentration unit		
User concentration text		
User concentration factor		
User concentration offset		
A 0		
A 1 to 4		
B 1 to 3		

"Diagnostics" submenu

Diagnostics	→	(→ 75)
Actual diagnostics (0691)		(→ 82)
Timestamp (0667)		
Previous diagnostics (0690)		(→ 82)
Timestamp (0672)		
Operating time from restart (0653)		(→ 82)
Operating time (0652)		(→ 82)
Diagnostic list	→	(→ 82)
Diagnostics 1 to 5 (0692–1 to 5)		(→ 82)
Timestamp 1 to 5 (0683–1 to 5)		
Event logbook	→	(→ 82)
Filter options (0705)		(→ 83)
Device information	→	(→ 84)

- Device tag (0011) (→ 85)
- Serial number (0009) (→ 85)
- Firmware version (0010) (→ 85)
- Device name (0013) (→ 85)
- Order code (0008) (→ 85)
- Extended order code 1 to 3 (0023–1 to 3) (→ 85)
- Configuration counter (0233)
- ENP version (0012) (→ 85)
- **Min/max values** →
  - Reset min/max values (6151)
  - **Main electronic temperature** →
    - Minimum value (6547)
    - Maximum value (6545)
  - **Temperature** →
    - Minimum value (6030)
    - Maximum value (6029)
- **Heartbeat** [1] → (→ 110)
  - **Heartbeat base settings** →
    - Plant operator (2754)
    - Location (2751)
    - **Performing verification** →
      - Year (2846)
      - Month (2845)
      - Day (2842)
      - Hour (2843)
      - AM/PM (2813)
      - Minute (2844)
      - External device information (12101)
      - Start verification (12127)

		Progress (2808)	
		Status (12153)	
		Overall result (12149)	
		Verification results →	
		Date/time (12142)	
		Verification ID (12141)	
		Operating time (12126)	
		Overall result (12149)	
		Sensor (12152)	
		Sensor electronic module (12151)	
		I/O module (12145)	
		Monitoring results →	
		Noise (12158)	
		Coil current shot time (12150)	
		Reference electrode potential against PE (12155)	
Simulation →			(→ 67)
		Assign simulation process variable (1810)	(→ 68)
		Value process variable (1811)	(→ 68)
		Simulation current output 1 (0354)	(→ 68)
		Value current output 1 (0355)	(→ 68)
		Frequency simulation (0472–1 to #)	(→ 68)
		Frequency value (0473–1 to #)	(→ 68)
		Pulse simulation (0458–1 to #)	(→ 68)
		Pulse value (0459–1 to #)	(→ 68)
		Switch output simulation (0462–1 to #)	(→ 68)

	Switch status (0463–1 to #)	(→ 68)
	Simulation device alarm (0654)	(→ 68)
	Simulation diagnostic event (0737)	(→ 68)

1) Order code for "Application package", option EB "Heartbeat Verification + Monitoring", see the Special Documentation for the device

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