Operating Instructions
Proline Promag P 100
Profibus DP

Electromagnetic flowmeter

Endress+Hauser [EH]

People for Process Automation
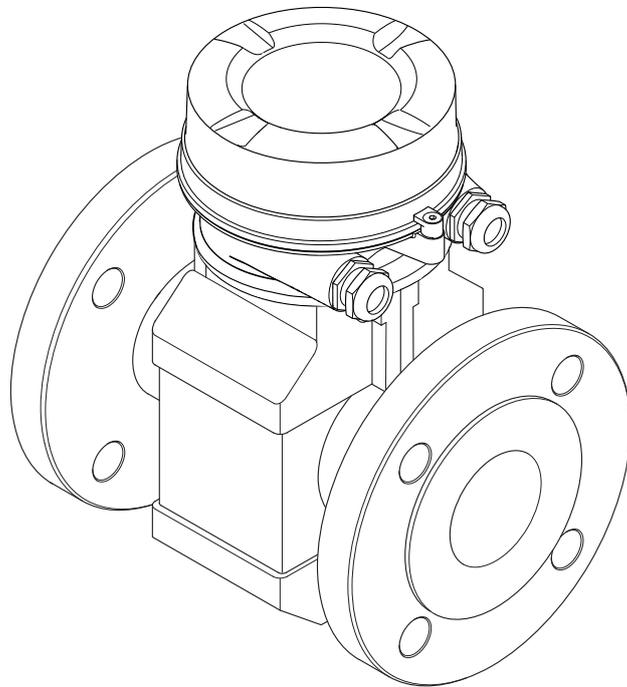
- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific 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 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
⚠ WARNING A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
⚠ CAUTION A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

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

1.2.3   Tool symbols

Symbol	Meaning
A0011221	Allen key
A0011222	Open-ended wrench

1.2.4   Symbols for certain types of information

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

1.2.5   Symbols in graphics

Symbol	Meaning
1, 2, 3,...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
A0013441	Flow direction
A0011187	**Hazardous area** Indicates a hazardous area.
A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

1.3   Documentation

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

For a detailed list of the individual documents along with the documentation code
(→ 🖺 108)

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

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

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 device documentation provided (on the CD-ROM) is absolutely essential.

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.

Endress+Hauser can be contacted to provide support in performing this task.

3   Product description

3.1   Product design

3.1.1   Device version with PROFIBUS DP communication type
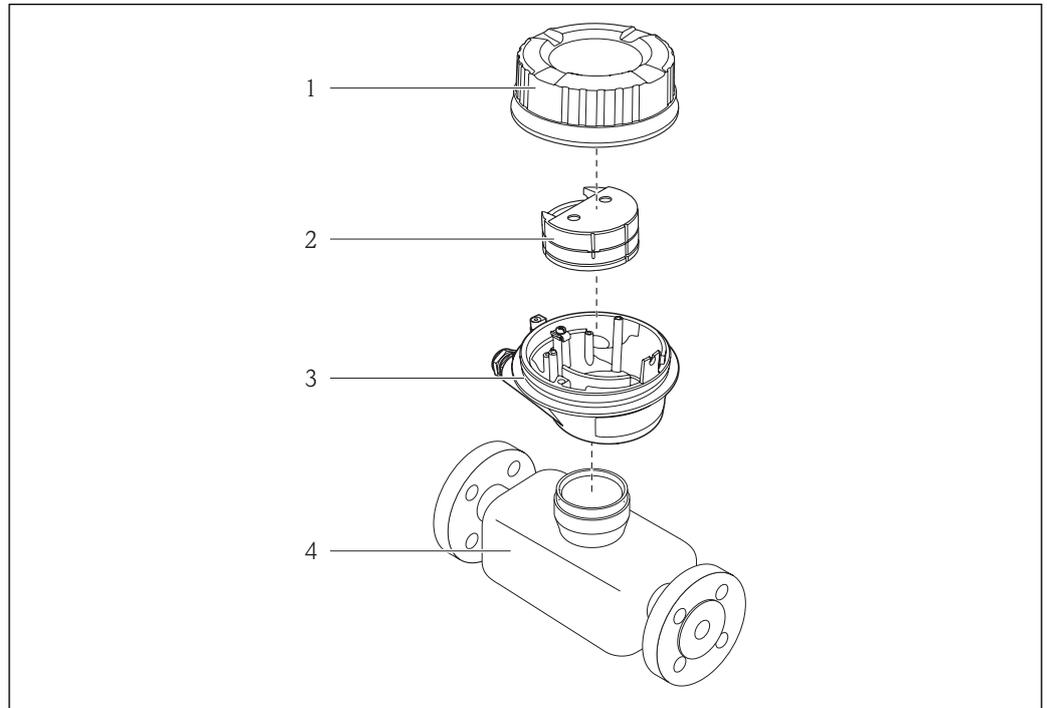
A0017609

🖾 *1   Important components of a measuring device*

1   Transmitter housing cover
2   Main electronics module
3   Transmitter housing
4   Sensor

4 Incoming acceptance and product identification

4.1 Incoming acceptance
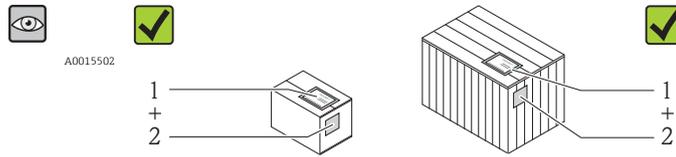
Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
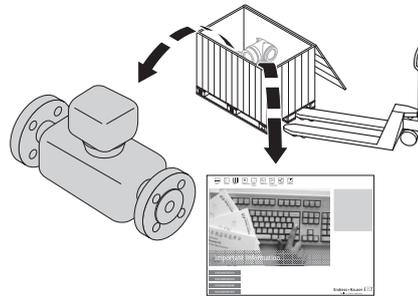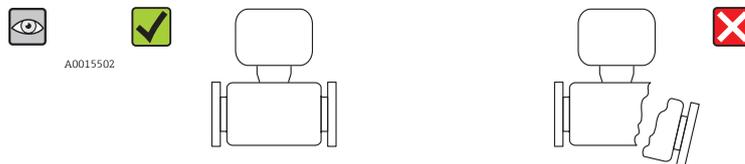
Are the goods undamaged?
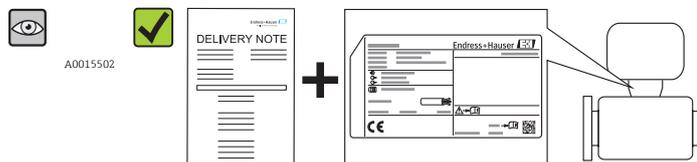
Do the nameplate data match the ordering information on the delivery note?
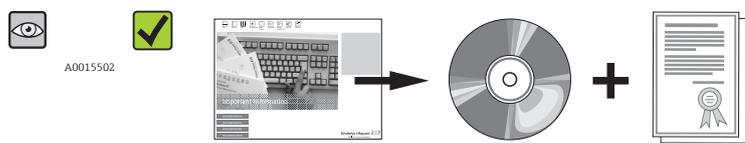
Is the CD-ROM with the Technical Documentation and documents present?

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

4.2   Product identification

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

For an overview of the scope of the Technical Documentation provided, refer to the following:
- The "Additional standard documentation on the device" (→ 📖 7) and "Supplementary device-dependent documentation" (→ 📖 7) sections
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)

4.2.1   Transmitter nameplate
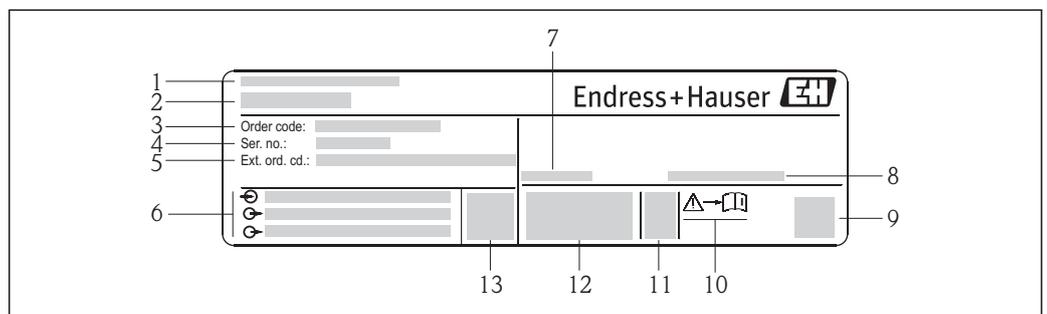
🖾 *2   Example of a transmitter nameplate*

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
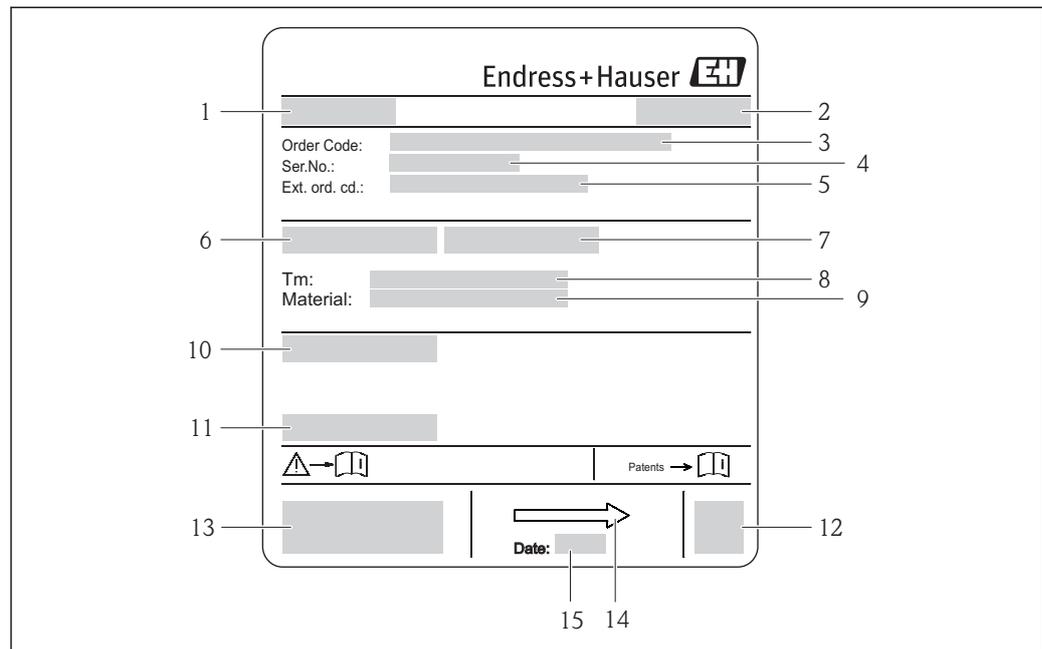
⊠ 3   Example of sensor nameplate

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   Fluid 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(→ 🖺 100)

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.
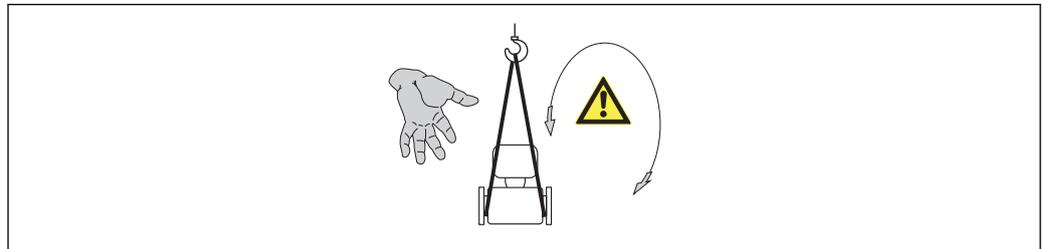
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Observe the following notes during transport:
- Transport the measuring device to the measuring point in the original packaging.
- Lifting gear
  - Webbing slings: Do not use chains, as they could damage the housing.
  - For wood crates, the floor 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   Installation

6.1   Installation conditions

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

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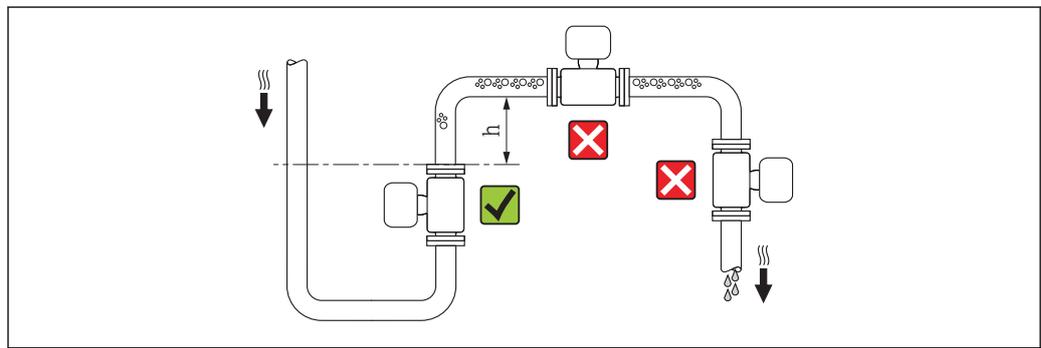
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To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
• Highest point of a pipeline.
• Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

Install a siphon or 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, which could cause air pockets.

For information on the liner's resistance to partial vacuum (→ 🖹 101)
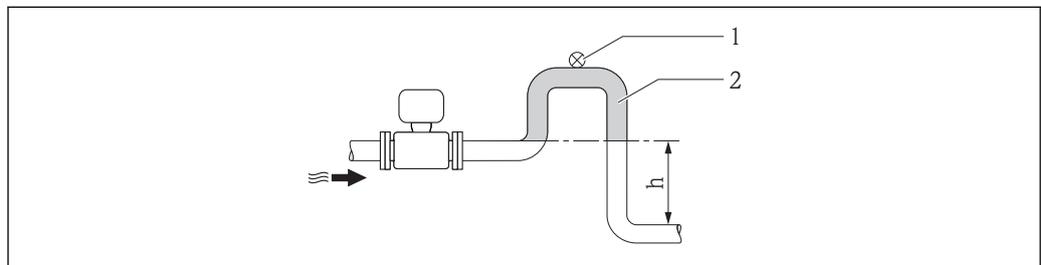
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🖻 4   *Installation in a down pipe*

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.

- Do not install the sensor at the lowest point in the drain: risk of solids accumulating.
- It is advisable to install a cleaning valve.
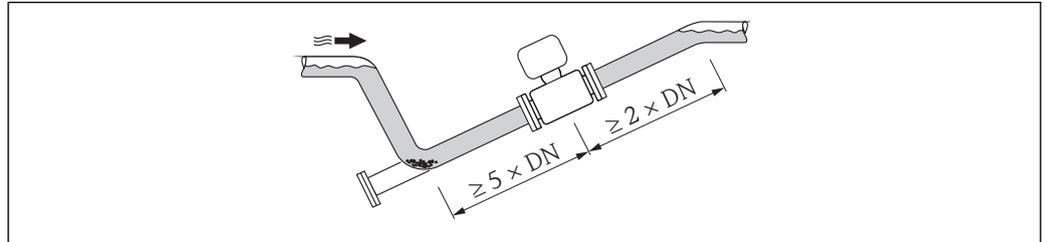
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Orientation

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

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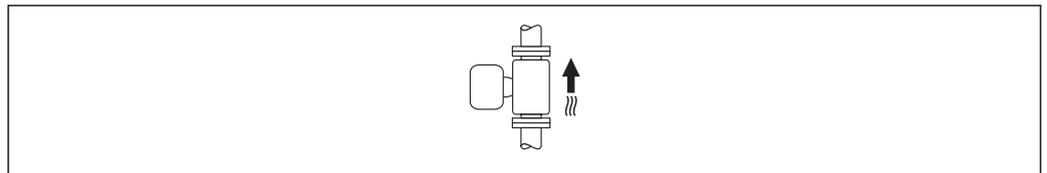
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Horizontal

The measuring electrode plane must be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

With horizontal orientation, 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.
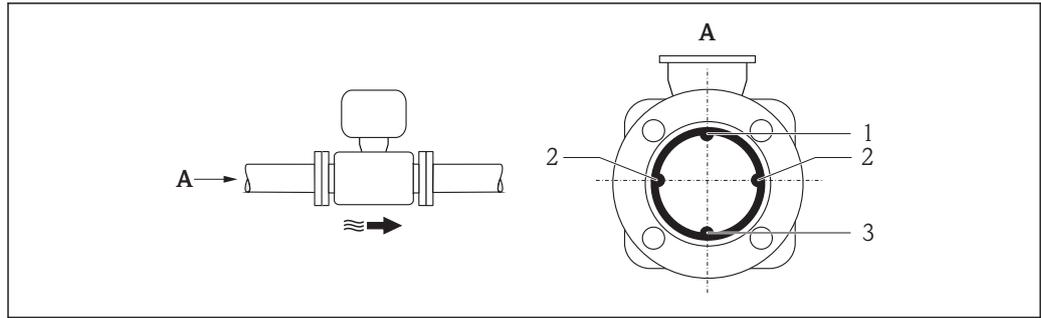
⊠ 5   *Horizontal orientation*

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

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:
• Inlet run ≥ 5 × DN
• Outlet run ≥ 2 × DN
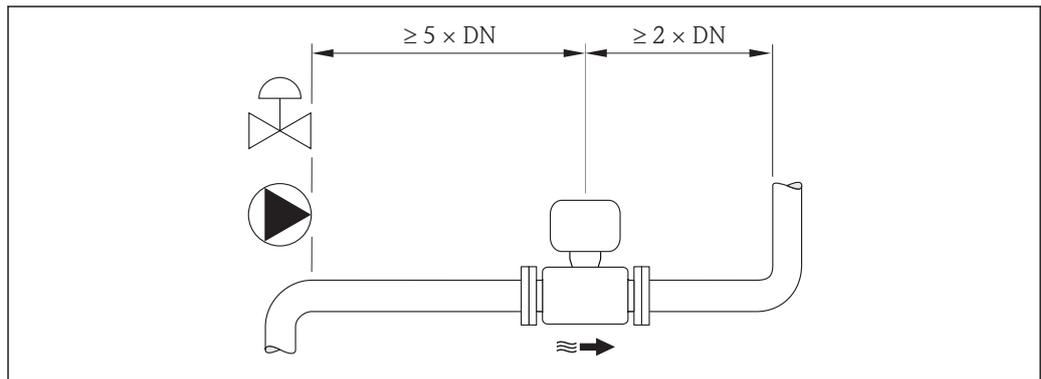
Installation dimensions

📖 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 ℃ (−40 to +140 ℉)
Sensor	• Flange material carbon steel: −10 to +60 ℃ (+14 to +140 ℉) • Flange material stainless steel: −40 to +60 ℃ (−40 to +140 ℉)
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 (→ 🖹 101)
- For information on the measuring system's resistance to vibration and shock (→ 🖹 100), (→ 🖹 100)
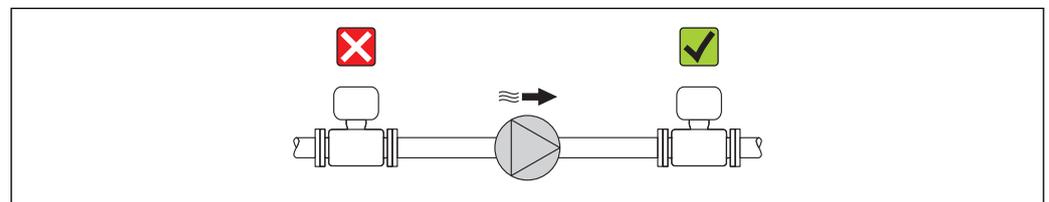
A0015594

Vibrations

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

For information on the permitted resistance to vibration and shock (→ 🖹 100), (→ 🖹 100)
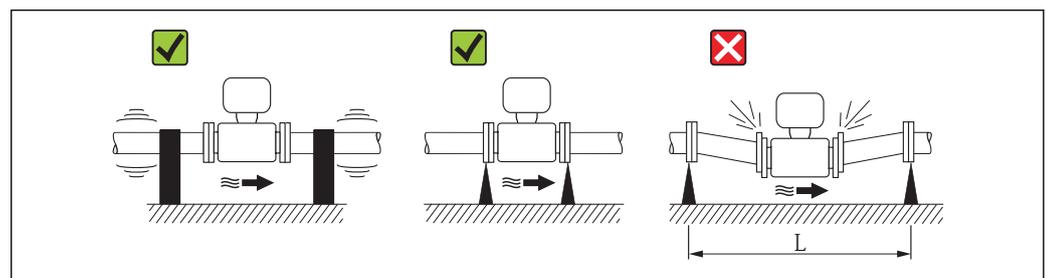
A0016266

🖻 *6   Measures to prevent vibration of the device*

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.
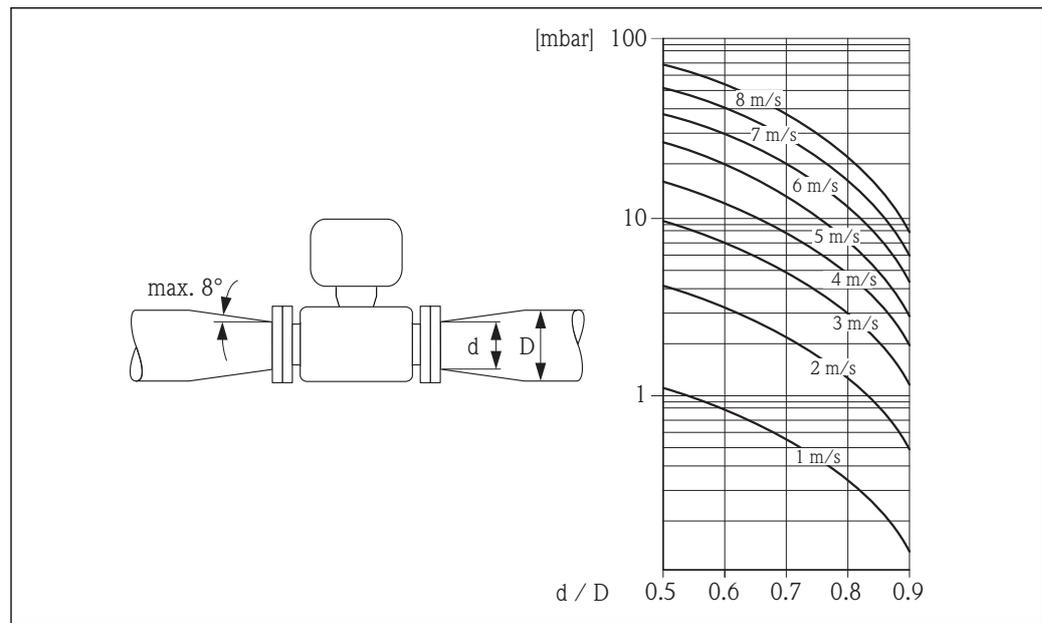
A0016359

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 (→ 🕮 24).

5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.

   ↳
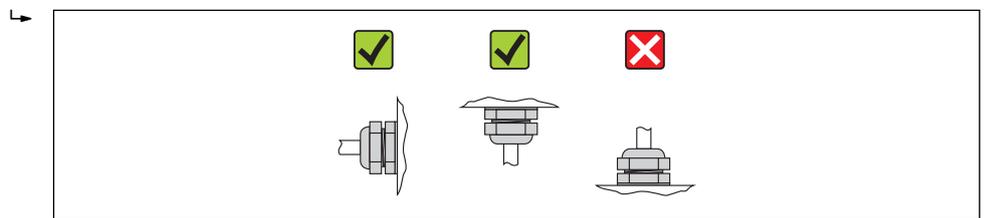
A0013964

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 (→ 🕮 32).

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

Screw tightening torques for AS 4087, PN 16

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

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 (→ 🕮 19)? • 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 (→ 🕮 19)?	❏
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

ℹ 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 ℃ (−40 ℉) to +80 ℃ (+176 ℉)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

PROFIBUS DP

The IEC 61158 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ωat a measuring frequency of 3 to 20 MHz
Cable capacitance	<30 pF/m
Wire cross-section	>0.34 mm^2 (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shielding	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable ⌀6 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

PROFIBUS DP connection version for use in non-hazardous areas and Zone 2/Div. 2

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

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"
	Output	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			
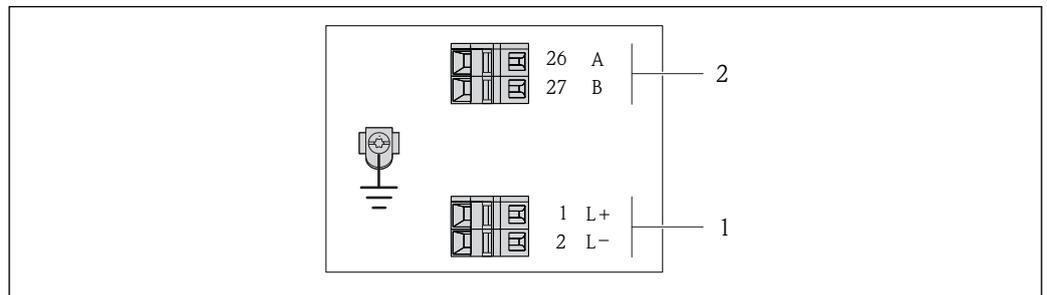
A0019528

☒ *7   PROFIBUS DP terminal assignment*

1   Power supply: DC 24 V
2   PROFIBUS DP

Order code for "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	27 (B)	26 (A)
Option **L**	DC 24 V		PROFIBUS DP	
Order code for "Output": Option **L**: PROFIBUS DP, for use in non-hazardous areas and Zone 2/div. 2				

7.1.4 Pin assignment, device plug

PROFIBUS DP

Supply voltage for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2 (on the device side)

	Pin		Assignment	Coding	Plug/socket
	1	L+	DC24 V	A	Plug
	2				
	3				
A0016809	4	L-	DC24 V		
	5		Grounding/shielding		
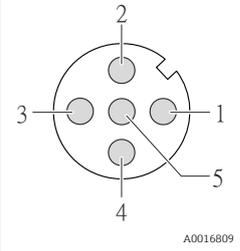
PROFIBUS DP, non-hazardous area and Zone 2/Div. 2 (on the device side)

	Pin		Assignment	Coding	Plug/socket
	1			B	Socket
	2	A	PROFIBUS DP		
	3				
	4	B	PROFIBUS DP		
A0016811	5		Grounding/shielding		
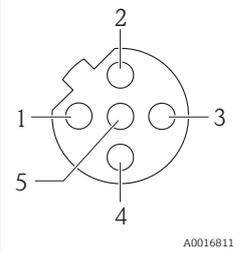
7.1.5 Preparing the measuring device

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 (→ 🕮 28).

3. If measuring device is delivered with cable glands:
   Observe cable specification (→ 🕮 28).

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 characteristics:
- Housing version: compact or ultra-compact
- Connection version: device plug or terminals
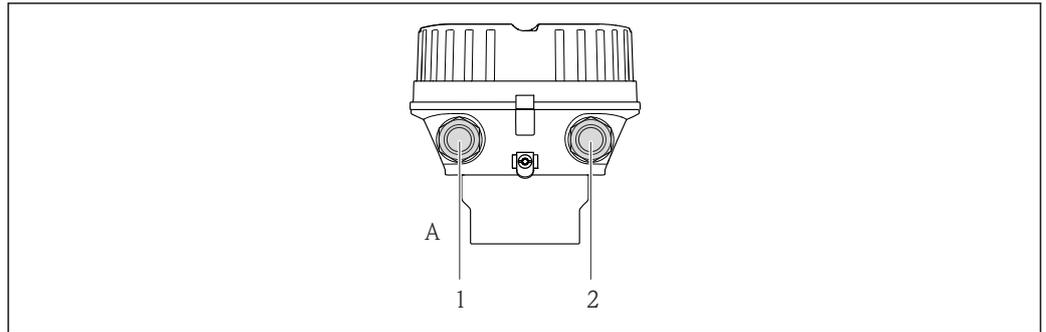
A0019824

🖼 *8   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
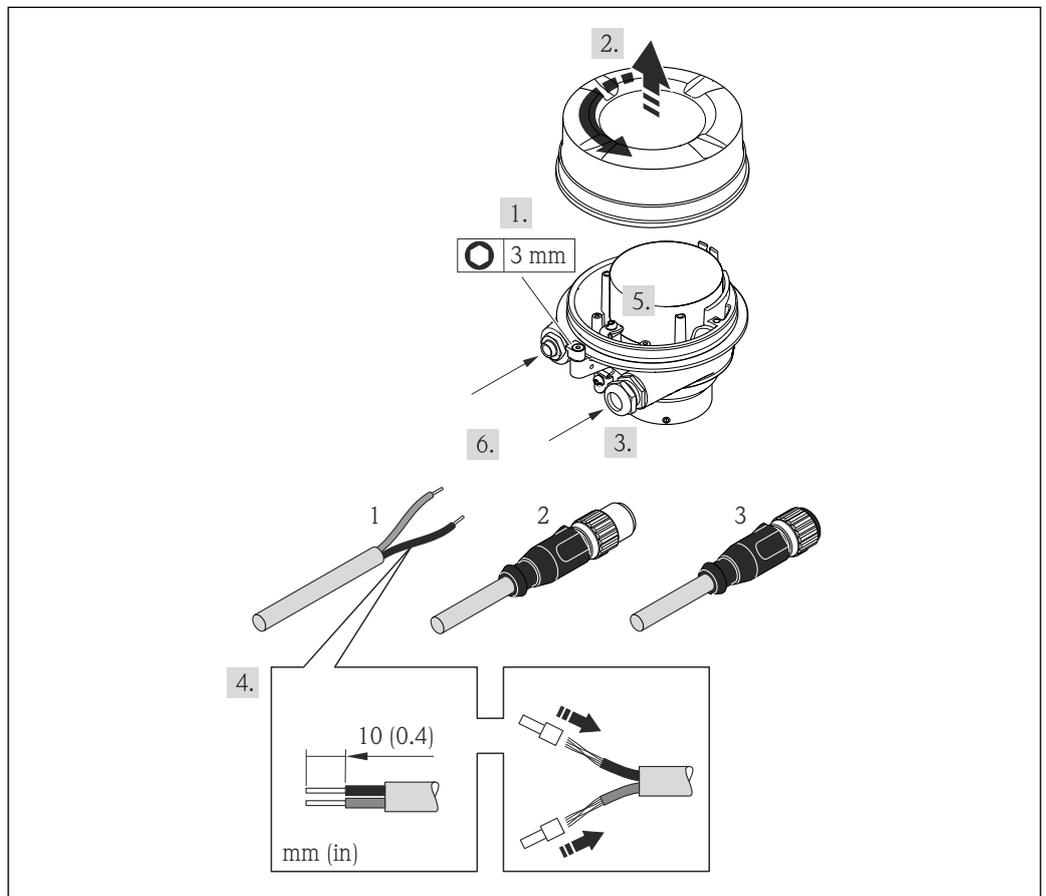
A0019823

🖼 *9   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.

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 (→ 🕮 30).

6. Depending on the device version: tighten the cable glands or plug in the device plug and tighten (→ 🕮 30).

7. **WARNING!** Housing degree of protection 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
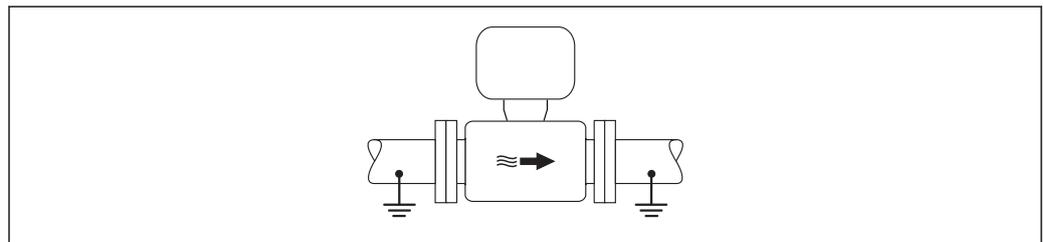
🖻 *10 Potential equalization via measuring tube*

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

DN ≤ 300   DN ≥ 350
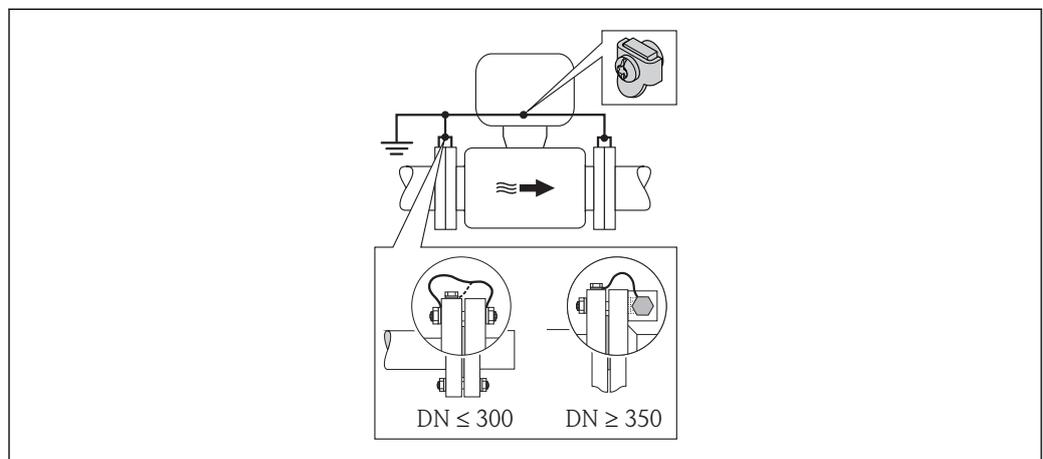
🖻 *11 Potential equalization via ground terminal and pipe flanges*

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

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 (→ 🖹 24).

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
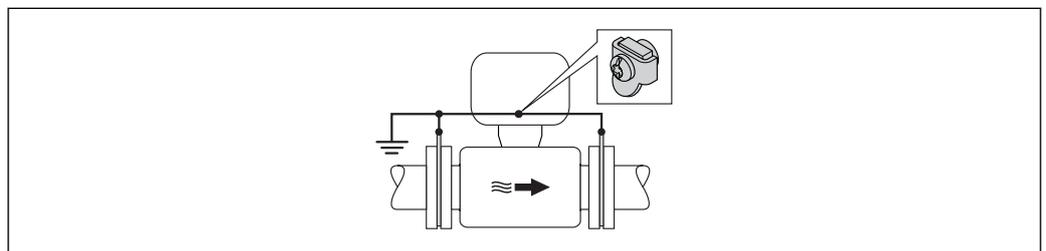
A0016318

🖼 *12   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.

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

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
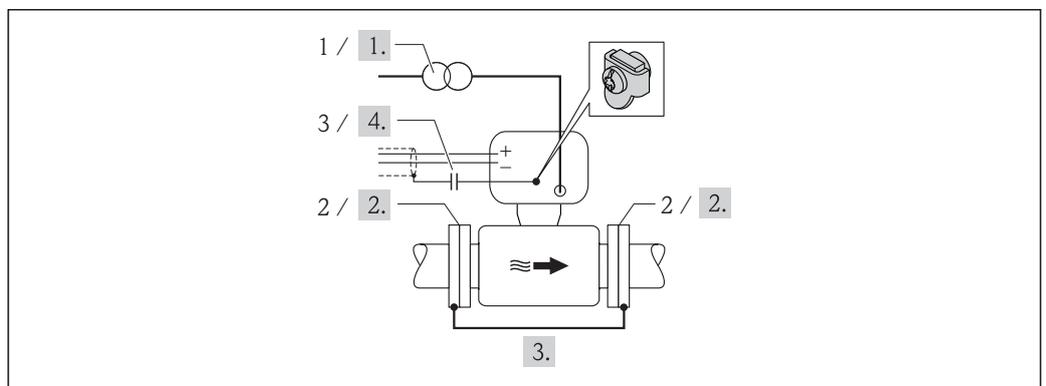
A0016319

🖼 *13   Potential equalization and cathodic protection*

1   Isolation transformer power supply
2   Electrically isolated from the pipe
3   Capacitor

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

1. Connect the measuring device to the power supply such that it is floating in relation to the protective ground.

2. Install the sensor in the pipe in a way that provides electrical insulation.

3. Connect the two flanges of the pipe to one another via a ground cable.

4. Guide the shield of the signal lines through a capacitor.

7.3 Special connection instructions

7.3.1 Connection examples

PROFIBUS DP

A0021429
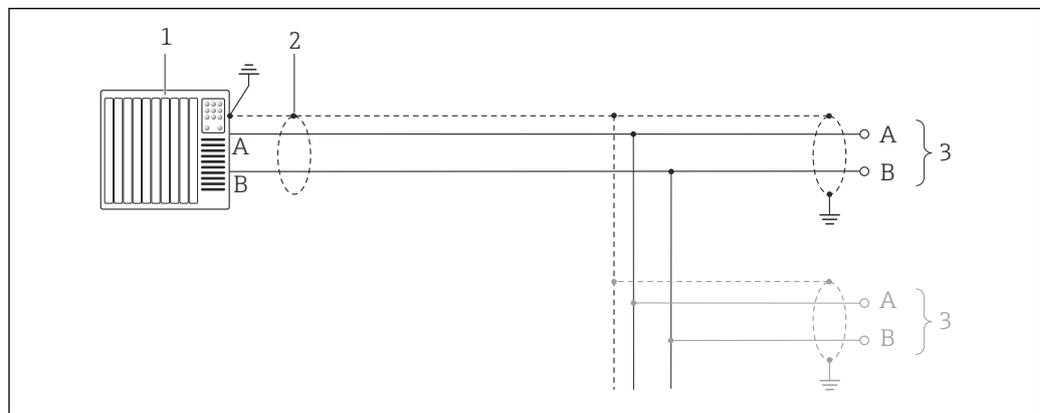
🔲 *14   Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2*

1   Control system (e.g. PLC)
2   Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications (→ 🔲 28)
3   Distribution box
4   Transmitter

ℹ️ If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

7.4 Hardware settings

7.4.1 Setting the device address

PROFIBUS DP

The address must always be configured for a PROFIBUS DP/PA device. The valid address range is between 1 and 126. In a PROFIBUS DP/PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the device address 126 and with the software addressing method.

Setting the address

A0021265
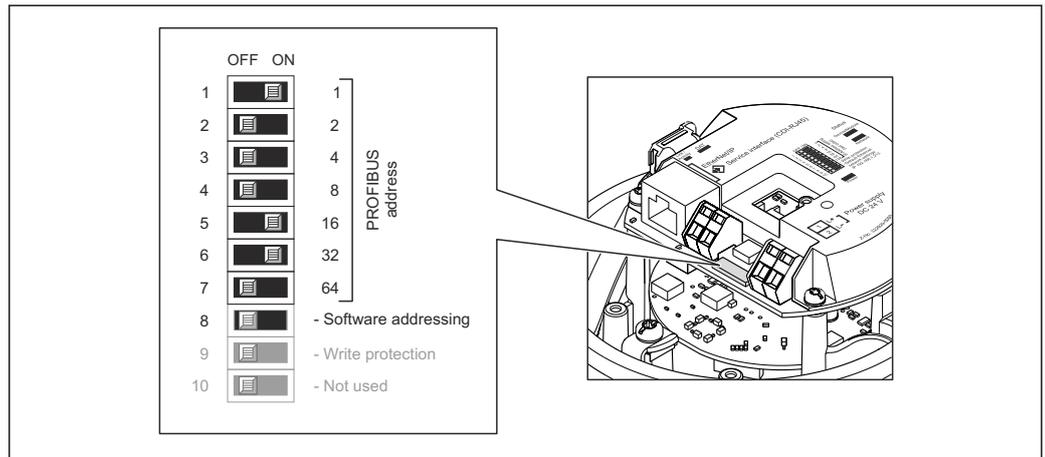
⊞ *15   Addressing using DIP switches on the I/O electronics module*

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.

3. Disable software addressing via DIP switch 8 (OFF).

4. Set the desired device address via the corresponding DIP switches 1 to 7.
   ↳ Example (→ ⊞ 15, 🖺 35): 1 + 16 + 32 = device address 49

   The device demands rebooting after 10 s. After rebooting, hardware addressing is enabled with the configured IP address.

5. Reverse the removal procedure to reassemble the transmitter.

7.4.2   Enabling the terminating resistor

PROFIBUS DP

To avoid incorrect communication transmission caused by impedance mismatch, terminate the PROFIBUS DP cable correctly at the start and end of the bus segment.

- If the device is operated with a baud rate of 1.5 MBaud and under:
  For the last transmitter on the bus, terminate via DIP switch 2 (bus termination) and DIP switch 1 and 3 (Bus polarisation). Setting: ON – ON – ON (→ ⊞ 16, 🖺 36).
- For baud rates > 1.5 MBaud:
  Due to the capacitance load of the user and the line reflections generated as a result, ensure that an external bus terminator is used.

  It is generally advisable to use an external bus terminator as the entire segment can fail if a device that is terminated internally is defective.
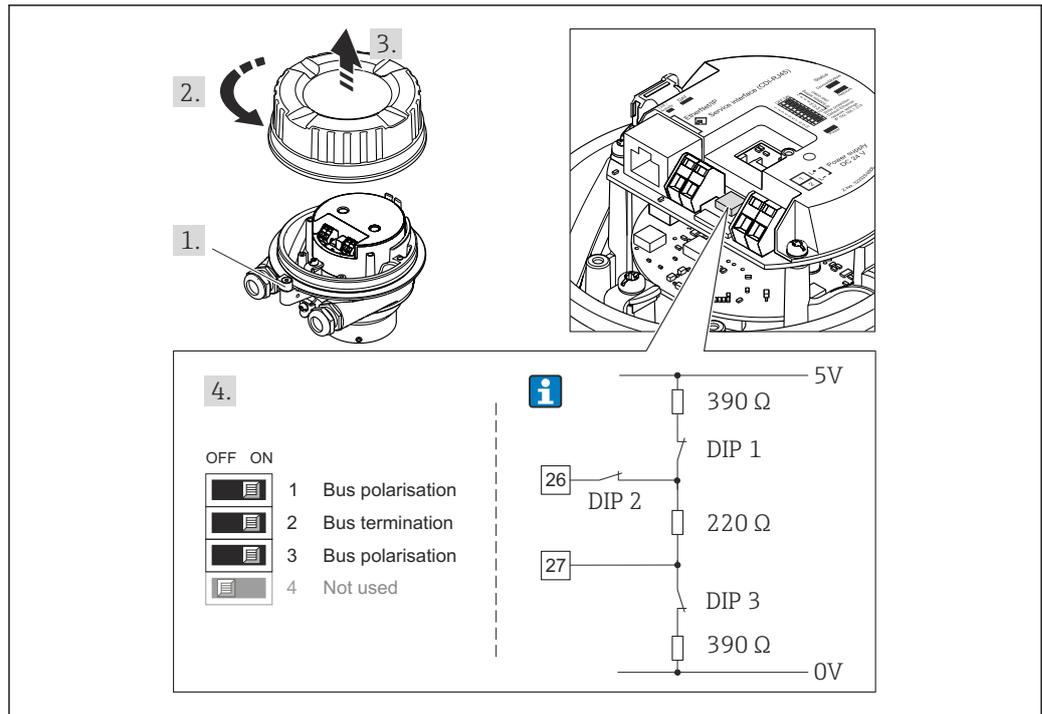
⊠ *16   Termination using DIP switches on the I/O electronics module (for baud rates < 1.5 MBaud)*

7.5   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").
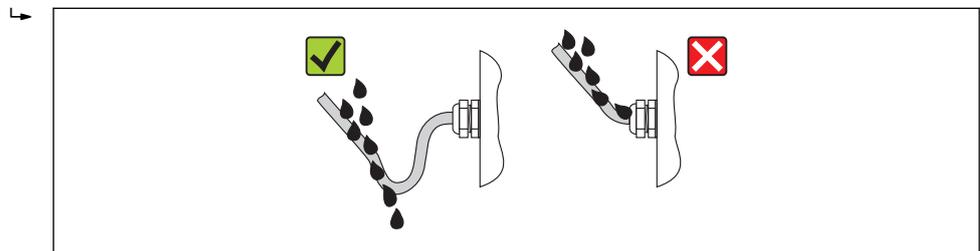
5. Insert dummy plugs into unused cable entries.

7.6   Post-connection check

Are cables or the device undamaged (visual inspection)?	❏
Do the cables comply with the requirements (→ 🕮 28)?	❏
Do the cables have adequate strain relief?	❏

Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" (→ 🖹 36) ?	❑
Depending on the device version: are all the device plugs firmly tightened (→ 🖹 30)?	❑
Does the supply voltage match the specifications on the transmitter nameplate (→ 🖹 98)?	❑
Is the terminal assignment or the pin assignment of the device plug (→ 🖹 30) 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 (→ 🖹 32)?	❑
Depending on the device version, is the securing clamp or fixing screw firmly tightened?	❑

8 Operation options

8.1 Overview of operation options
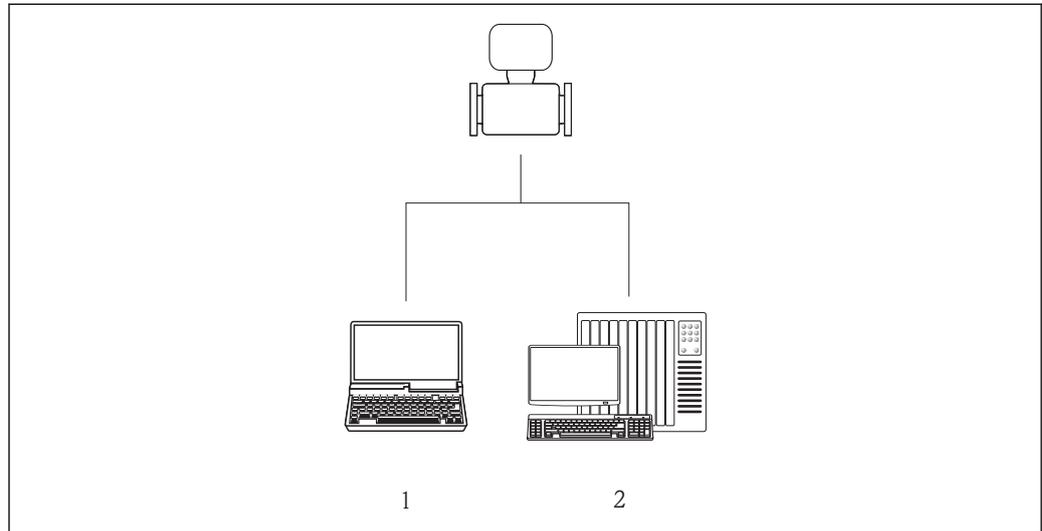
A0017760

1   Computer with Web browser (e.g. Internet Explorer) or with "FieldCare" operating tool
2   Automation system, e.g. "RSLogix" (Rockwell Automation) and work station for measuring device operation
*   with Add-on Profile Level 3 for "RSLogix 5000" software (Rockwell Automation)*

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
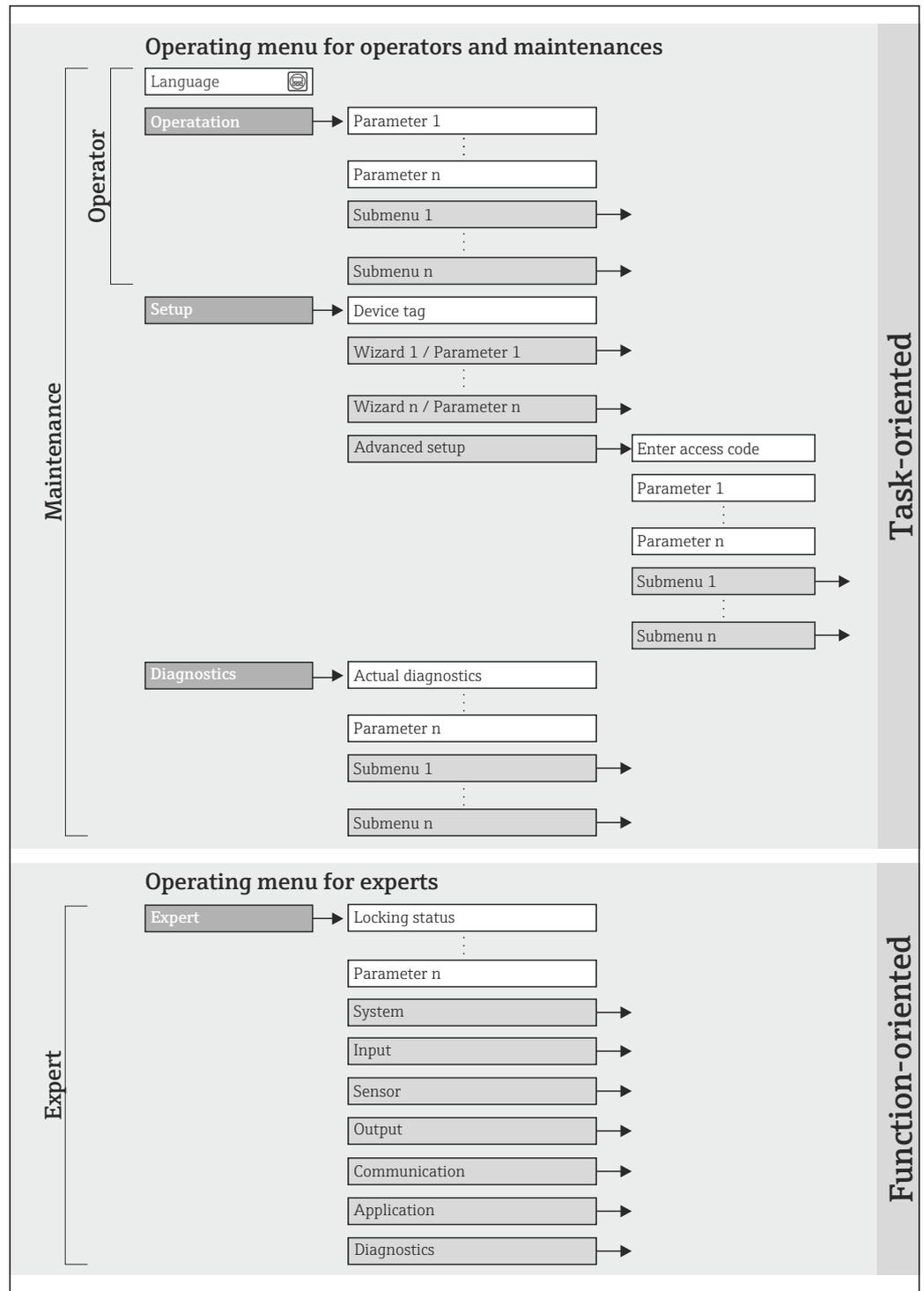
🖾 17   Schematic structure of the operating menu

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. • **"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 (→ 🕮 43)

Software of the computer

Web browsers supported	• Microsoft Internet Explorer 7.x, 8.x, 9.x
	• Mozilla Firefox 4.x, 5.x, 8.x
	• Google chrome 15.x
Recommended operating systems	• Windows XP
	• Windows 7
User rights for TCP/IP settings	Admin rights required (e.g. for changing the 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 0.0.0.0

1. Switch on the measuring device and connect to the computer via the cable (→ 🕮 44).

2. 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.
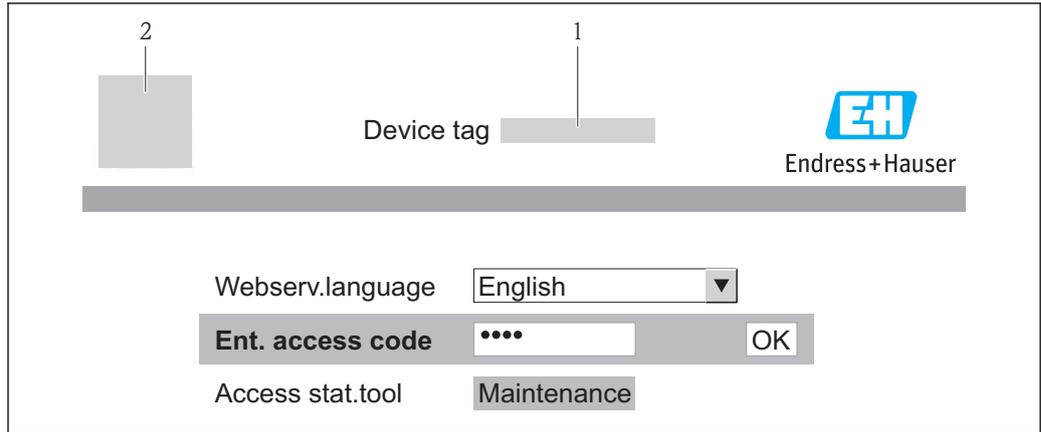
1   Device tag (→ 🖹 48)
2   Picture of device

If a login page does not appear, or if the page is incomplete

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 (→ 🖹 56)

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

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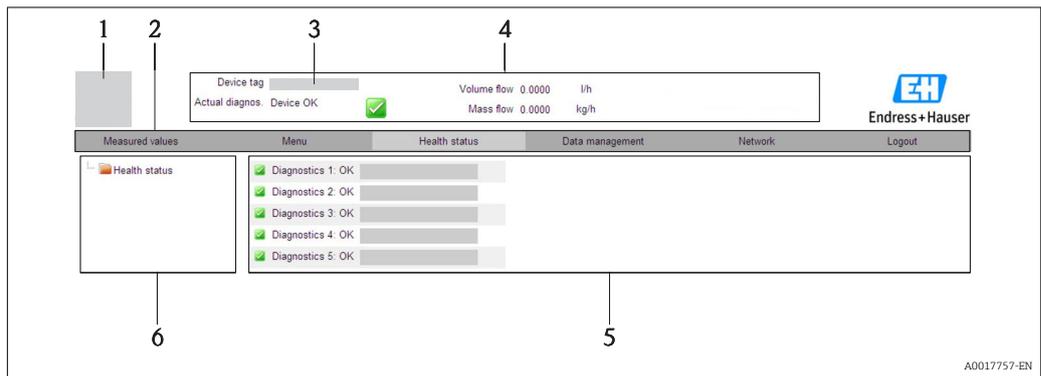
1   Picture of device
2   Function row with 6 functions
3   Device tag
4   Header
5   Working area
6   Navigation area

Header

The following information appears in the header:
- Device tag (→ 🖹 48)
- Device status with status signal (→ 🖹 64)
- Current measured values (→ 🖹 59)

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 backup)
	  – Save the configuration to the device (XML format)
	  – Export the event list (.csv file)
	  – Export parameter settings (.csv file, create documentation of the measuring point)
	  – Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
	• Upload the EDS system file from the device

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

Parameters	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. Click on **Logout**.
   ↳ 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 (→ 🖺 41).

8.4   Access to the operating menu via the operating tool

8.4.1   Connecting the operating tool

Via service interface (CDI-RJ45)

A0021270
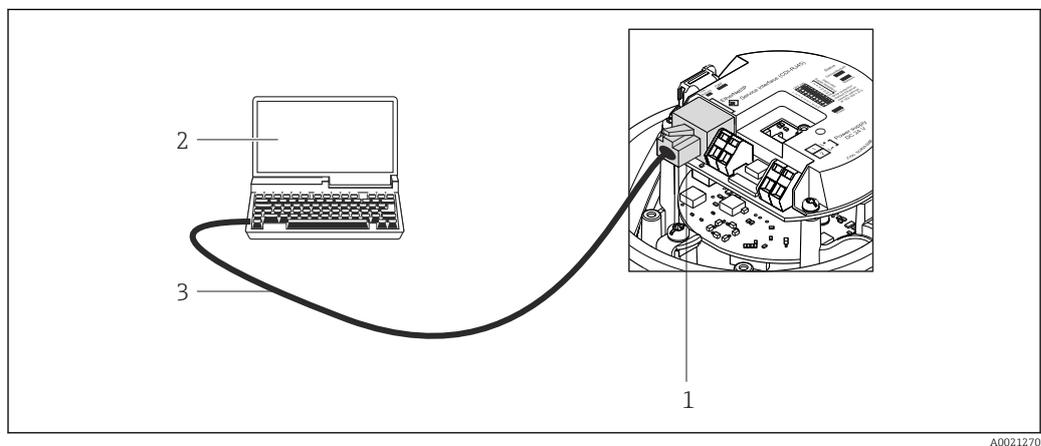
🖃 *18   Connection for order code for "Output", option L: PROFIBUS DP*

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   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:
Service interface CDI-RJ45 (→ 🖺 44)

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 (→ 🖺 46)

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

A0021051-EN
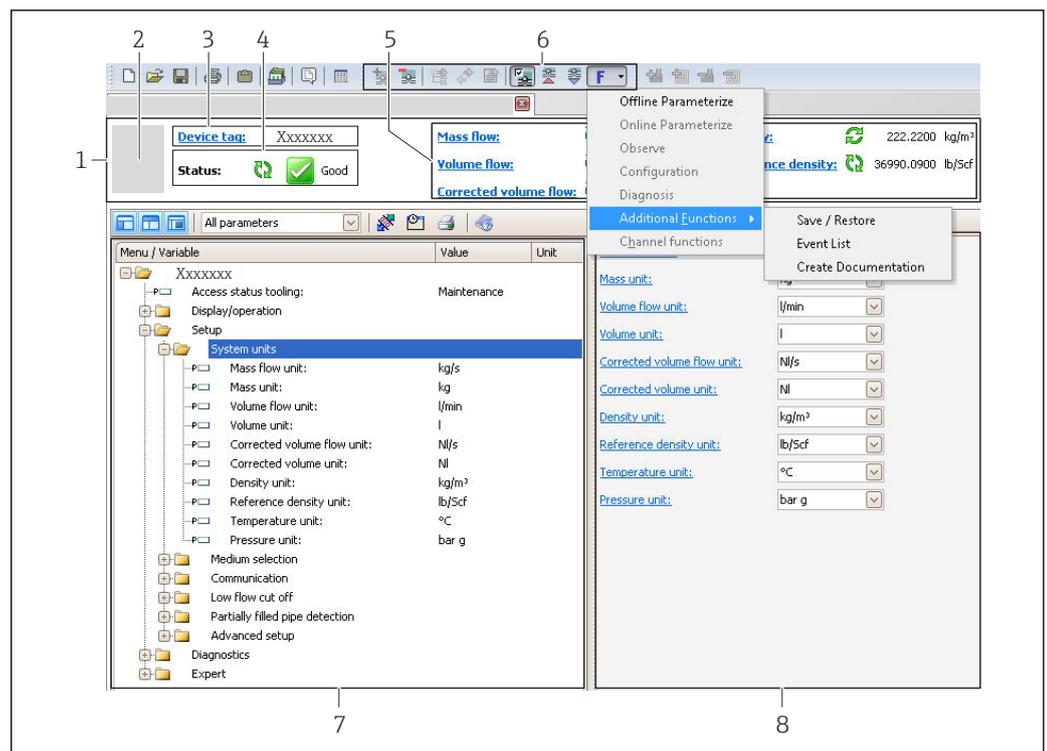
1   Header
2   Picture of device
3   Device tag (→ 🖹 48)
4   Status area with status signal (→ 🖹 64)
6   Display area for current measured values
5   Event list with additional functions such as save/load, events list and document creation
7   Navigation area with operating menu structure
8   Working area

9 System integration

9.1 Overview of device description files

9.1.1 Operating tools

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

Operating tool via PROFIBUS protocol	Sources for obtaining device descriptions
FieldCare	• www.endress.com → Download Area • CD–ROM (contact Endress+Hauser) • DVD (contact Endress+Hauser)

9.2 Device master file (GSD)

In order to integrate field devices into a bus system, the PROFIBUS system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transmission rate.

These data are available in the device master file (GSD) which is provided to the PROFIBUS Master when the communication system is commissioned. In addition device bit maps, which appear as icons in the network structure, can also be integrated.

With the Profile 3.0 device master file (GSD) it is possible to exchange field devices made by different manufacturers without having to reconfigure.

Generally speaking two different GSD versions are possible with Profile 3.0 and higher.

- Before configuring, the user must decide which GSD should be used to operate the system.
- The setting can be changed via a Class 2 master.

9.2.1 Manufacturer-specific GSD

This GSD guarantees the unrestricted functionality of the measuring device. Device-specific process parameters and functions are therefore available.

Manufacturer-specific GSD	ID number	File name
PROFIBUS DP	0x1561	EH3x1561.gsd

The fact that the manufacturer-specific GSD should be used is specified in the **Ident number selector** parameter**Manufacturer** option.

Where to acquire the manufacturer-specific GSD:

www.endress.com → Download Area

9.2.2 Profile GSD

Differs in terms of the number of Analog Input blocks (AI) and the measuring principles. If a system is configured with a Profile GSD, it is possible to exchange devices made by

different manufacturers. However, it is essential to ensure that the order of the cyclic process values is correct.

ID number	Supported blocks	Supported channels
0x9740	• 1 Analog Input • 1 Totalizer	• Channel Analog Input: volume flow • Channel totalizer: volume flow
0x9741	• 2 Analog Input • 1 Totalizer	• Channel Analog Input 1: volume flow • Channel Analog Input 2: mass flow • Channel totalizer: volume flow
0x9742	• 3 Analog Input • 1 Totalizer	• Channel Analog Input 1: volume flow • Channel Analog Input 2: mass flow • Channel Analog Input 2: corrected volume flow • Channel totalizer: volume flow

The Profile GSD that is to be used is specified in the **Ident number selector** parameter by selecting the **Profile 0x9740** option, **Profile 0x9741** option or **Profile 0x9742** option.

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 (→ 🖺 36)

10.2   Establishing a connection via FieldCare

- For FieldCare connection (→ 🖺 44)
- For establishing a connection via FieldCare (→ 🖺 45)
- For FieldCare user interface (→ 🖺 45)

10.3   Configuring the measuring device

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

Structure of the "Setup" menu

Setup	→	System units	(→ 🖺 48)
		Communication	(→ 🖺 50)
		Analog inputs	(→ 🖺 51)
		Low flow cut off	(→ 🖺 51)
		Empty pipe detection	(→ 🖺 53)
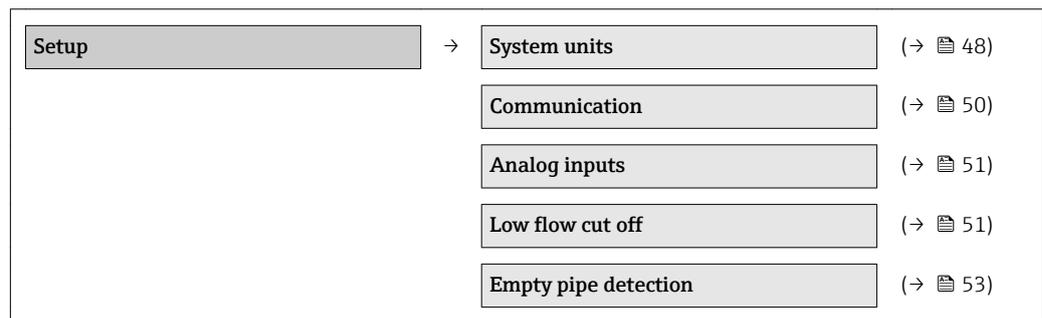
10.3.1   Defining the tag name

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.

ℹ The number of characters displayed depends on the characters used.

ℹ For information on the tag name in the "FieldCare" operating tool (→ 🖺 45)

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

Parameters	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag 100 DP

10.3.2   Setting the system units

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

Navigation

"Setup" menu → System units

System units	→	Volume flow unit
		Volume unit
		Conductivity unit
		Temperature unit
		Mass flow unit
		Mass unit
		Density unit
		Corrected volume flow unit
		Corrected volume unit

Parameter overview with brief description

Parameters	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)
Conductivity unit	Select conductivity unit. *Result* The selected unit applies for: 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

Parameters	Description	Selection	Factory setting
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

10.3.3 Configuring the communication interface

The **"Communication" submenu** guides you systematically through all the parameters that have to be configured for selecting and setting the communication interface.

Navigation
"Setup" menu → Communication

Structure of the submenu
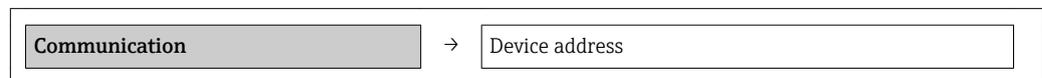
Communication	→	Device address

Parameter overview with brief description

Parameters	Description	User entry	Factory setting
Device address	Enter device address.	0 to 126	126

10.3.4 Configuring the analog inputs

The **Analog inputs** submenu guides you systematically to the individual **Analog input 1 to 8** submenu. From here you get to the parameters of the individual analog input.

Navigation
"Setup" menu → Analog inputs → Analog input 1 to 8

Structure of the submenu

Analog inputs	→	Analog input 1 to 8	→	Channel
				PV filter time
				Fail safe type
				Fail safe value

Parameter overview with brief description

Parameters	Description	Selection / User entry	Factory setting
Channel	Select the process variable.	• Volume flow • Mass flow • Corrected volume flow • Flow velocity • Conductivity • Corrected conductivity • Temperature • Electronic temperature	Volume flow
PV filter time	Specify a time to suppress signal peaks. During the specified time the totalizer does not respond to an erratic increase in the process variable.	Positive floating-point number	0
Fail safe type	Select the failure mode.	• Fail safe value • Fallback value • Off	Off
Fail safe value	Specify the value to be output when an error occurs.	Signed floating-point number	0

10.3.5 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

Low flow cut off	→	Assign process variable
		On value low flow cutoff
		Off value low flow cutoff
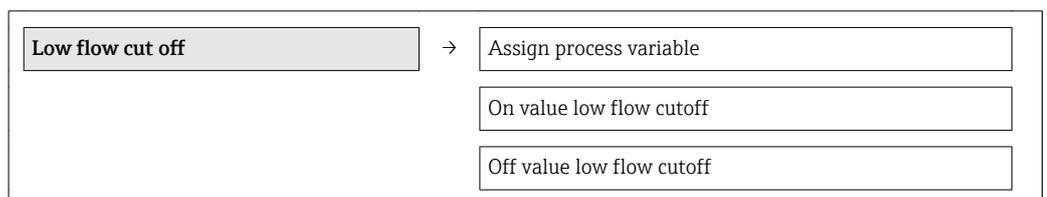
			Pressure shock suppression	

Parameter overview with brief description

Parameters	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

10.3.6   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
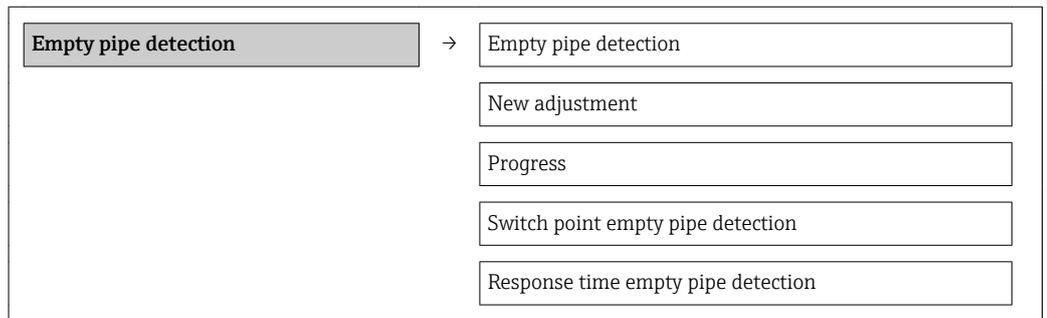
Empty pipe detection	→	Empty pipe detection
		New adjustment
		Progress
		Switch point empty pipe detection
		Response time empty pipe detection

Parameter overview with brief description

Parameters	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

Structure of the submenu

Empty pipe detection	→	Empty pipe detection
		New adjustment
		Progress
		Switch point empty pipe detection
		Response time empty pipe detection
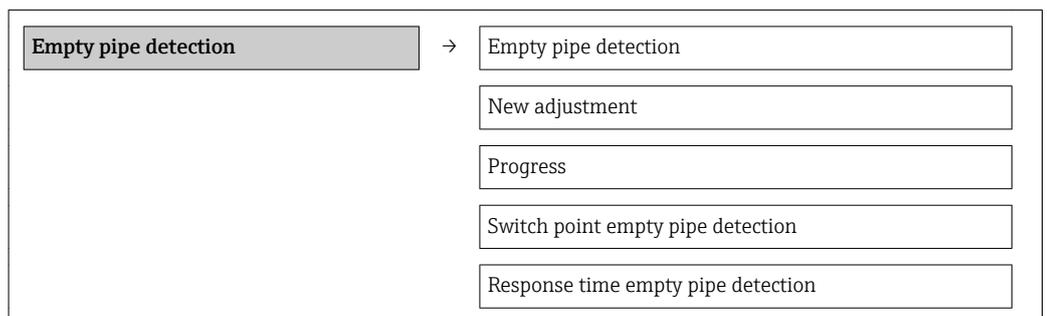
10.4   Advanced settings

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

"Setup" menu → Advanced setup

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

Advanced setup	→	Enter access code	
		Sensor adjustment	(→ 🗎 54)
		Totalizer 1 to 3	(→ 🗎 54)
		Electrode cleaning circuit	(→ 🗎 55)
		Administration	
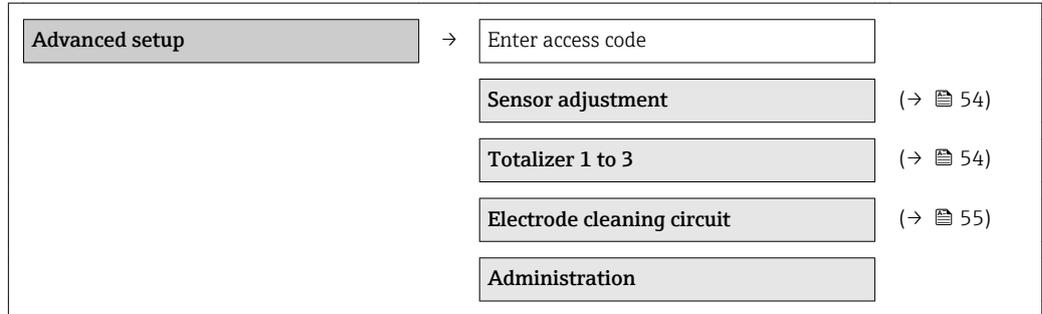
10.4.1   Carrying out a sensor adjustment

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

Parameters	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

10.4.2   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

Totalizer 1 to 3	→	Assign process variable
		Unit totalizer
		Control Totalizer
		Totalizer operation mode
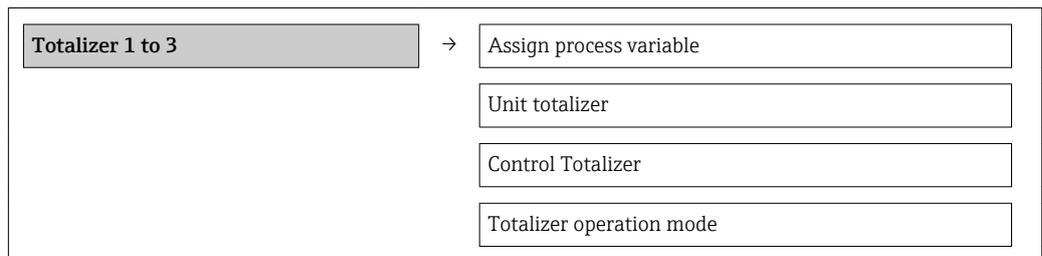
	Failure mode		

Parameter overview with brief description

Parameters	Description	Selection	Factory setting
Assign process variable	Assignment of a process variable to the totalizer.	• Volume flow • Mass flow • Corrected volume flow	Volume flow
Unit totalizer		Unit choose list	m³
Control Totalizer	Control totalizer value.	• Totalize • Reset + hold • Preset + hold	Totalize
Totalizer operation mode		• Net flow total • Forward flow total • Reverse flow total • Last valid value	Net flow total
Failure mode		• Stop • Actual value • Last valid value	Actual value

10.4.3   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
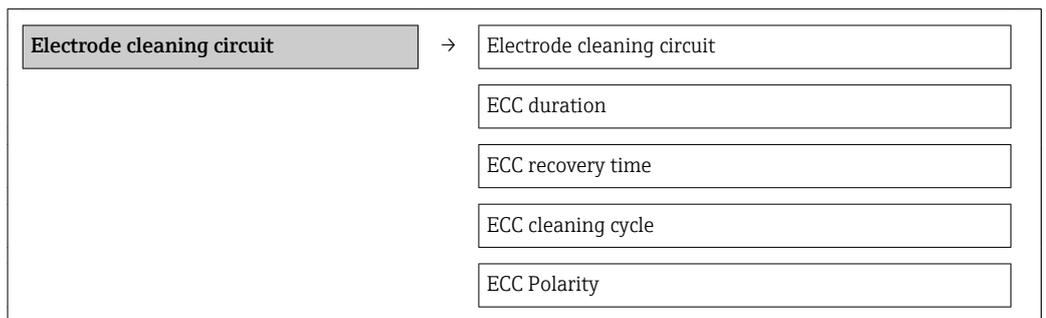
Electrode cleaning circuit	→	Electrode cleaning circuit
		ECC duration
		ECC recovery time
		ECC cleaning cycle
		ECC Polarity

Parameter overview with brief description

Parameters	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

Parameters	Description	Selection / User entry / User interface	Factory setting
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

10.5   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

Simulation	→	Assign simulation process variable
		Value process variable
		Simulation device alarm
		Simulation diagnostic event

Parameter overview with brief description

Parameters	Prerequsite	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 device alarm	–	Switch the device alarm on and off.	• Off • On	Off
Simulation diagnostic event	–	Enter the diagnostic number for the diagnostic event.	Positive integer	65 533

10.6   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 (→ 🖺 56)
• Write protection via write protection switch (→ 🖺 57)

10.6.1   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
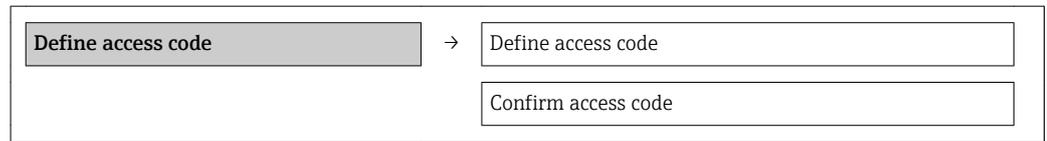
Defining the access code via the Web browser

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.

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

[i] 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

10.6.2 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-RJ45)
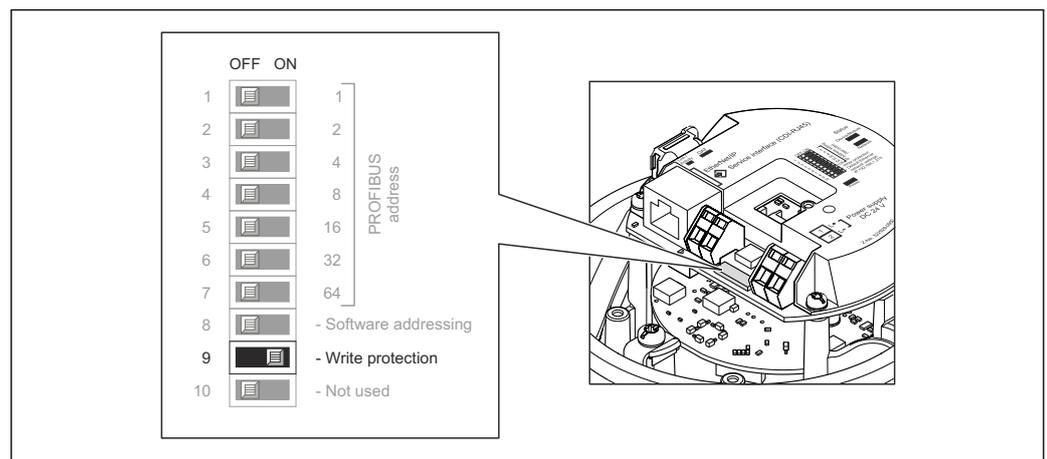
A0021262

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.

3. 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(→ 🕮 59); if disabled: the **Locking status** parameter does not display any option (→ 🕮 59)

4. 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**.

"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The write protection switch (DIP switch) for hardware locking is activated on the I/O electronics module. This prevents write access to the parameters (→ 🕮 57).
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc). 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

Process variables	→	Volume flow
		Mass flow
		Conductivity
		Corrected volume flow
		Temperature
		Corrected conductivity
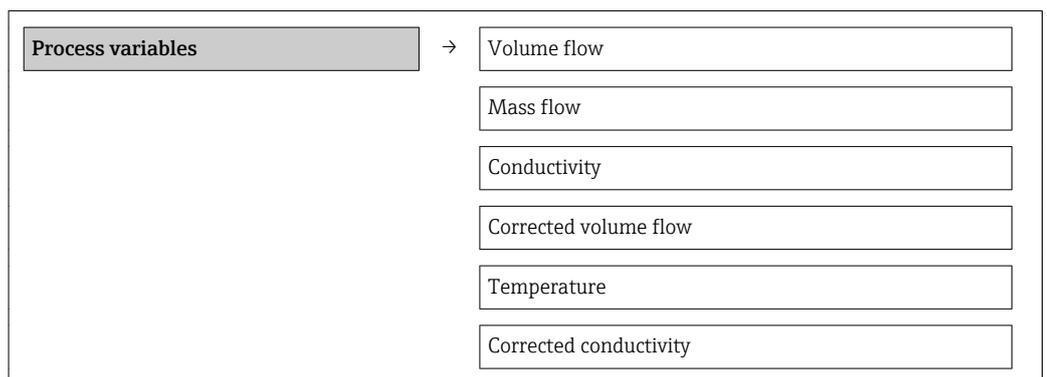
Structure of the submenu

Parameter overview with brief description

Parameters	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.	Positive floating-point number

Parameters	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
Corrected conductivity	Displays the steam quality 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

Totalizer	→	Assign process variable
		Totalizer status (Hex)
		Totalizer status
		Totalizer status (Hex)

Parameter overview with brief description

Parameters	Prerequsite	Description	Selection / User entry / User interface	Factory setting
Assign process variable	–	Assignment of a process variable to the totalizer.	• Volume flow • Mass flow • Corrected volume flow	Volume flow
Totalizer status (Hex)	–	Displays the current status value (hex) of the totalizer.	0 to 255	128
Totalizer status	–	Displays the current totalizer status.	• Good • Uncertain • Bad	Good
Totalizer value	In the **Assign process variable** parameter one of the following options is selected: • Volume flow • Mass flow • Corrected volume flow • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference	Displays the current totalizer counter value.	Signed floating-point number	0 m³

11.3 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the **Setup** menu(→ 🖺 48)
- Advanced settings using the **Advanced setup** submenu(→ 🖺 54)

11.4   Performing a totalizer reset

In the **Operation** submenu the totalizers are reset:
Control Totalizer 1 to 3

Navigation
"Operation" menu → Operation

Structure of the submenu
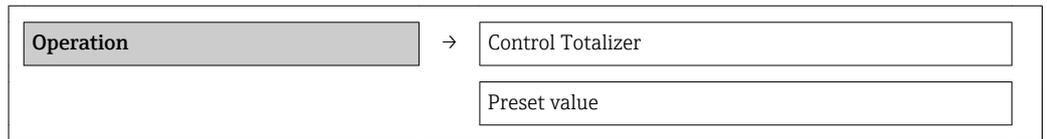
Operation	→	Control Totalizer
		Preset value

Parameter overview with brief description

Parameters	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 m³

11.4.1   Function scope of "Control Totalizer " parameter

Options	Description
Totalize	The totalizer is started.
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 1 to 3** parameter.

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 (→ 🖹 30).
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 (→ 🖹 57).
No connection via PROFIBUS DP	PROFIBUS DP bus cable connected incorrectly	Check the terminal assignment .
No connection via PROFIBUS DP	Device plug connected incorrectly	Check the pin assignment of the device plug (→ 🖹 30).
No connection via PROFIBUS DP	PROFIBUS DP cable incorrectly terminated	Check terminating resistor (→ 🖹 35).
Not connecting to Web server	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) (→ 🖹 41). 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 (→ 🖹 43).
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 (→ 🖹 41). 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
Alarm	Off	Device status is ok
	Flashing red	A device error of diagnostic behavior "Warning" has occurred
	Red	• A device error of diagnostic behavior "Alarm" has occurred • Boot loader is active
Communication	Flashing white	PROFIBUS DP 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 (→ 🖺 64)
2   Diagnostic information (→ 🖺 64)(→ 🖺 64)
3   Remedial measures with Service ID

ℹ️ Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
• Via parameters
• Via submenu (→ 🖺 85)

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)
◇ A0017276	**Maintenance required** Maintenance is required. The measured value is still valid.

ℹ 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.

	Diagnostic information	
	Diagnostic code	
Status signal	Diagnostic number	Short text
↓	↓	↓
S A0013958	842	**Process limit**

Example

3-digit number
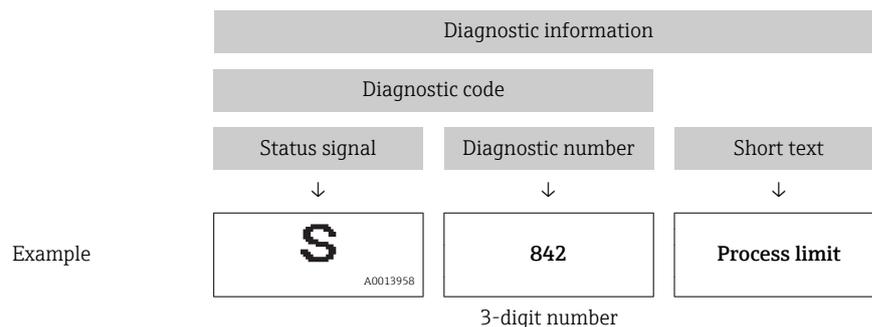
12.3.2   Calling up remedy information

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.

ℹ️   Diagnostic behavior in accordance with Specification PROFIBUS Profile 3.02, Condensed Status.

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

Available diagnostic behaviors

The following diagnostic behaviors can be assigned:

Diagnostic behavior	Description
Alarm	Measurement is interrupted. The totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	Measurement is resumed. Measured value output via PROFIBUS DP 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.

Displaying the measured value status

If the Analog Input, Digital Input and Totalizer function blocks are configured for cyclic data transmission, the device status is coded as per PROFIBUS Profile Specification 3.02 and transmitted along with the measured value to the PROFIBUS Master (Class 1) via the coding byte (byte 5). The coding byte is split into three segments: Quality, Quality Substatus and Limits.
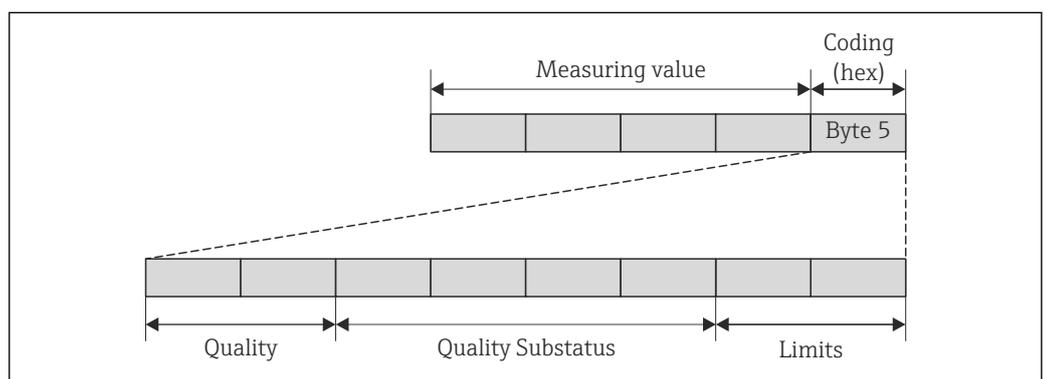
19   Structure of the coding byte

The content of the coding byte depends on the configured failsafe mode in the particular function block. Depending on which failsafe mode has been configured, status information in accordance with PROFIBUS Profile Specification 3.02 is transmitted to the PROFIBUS Master (Class 1) via the coding byte.

Determining the measured value status and device status via the diagnostic behavior

When the diagnostic behavior is assigned, this also changes the measured value status and device status for the diagnostic information. The measured value status and device status depend on the choice of diagnostic behavior and the group in which the diagnostic information is located. The measured value status and device status are firmly assigned to the particular diagnostic behavior and cannot be changed individually.

The diagnostic information is grouped as follows:
• Diagnostic information pertaining to the sensor: diagnostic number 000 to 199
  (→ 🖹 66)
• Diagnostic information pertaining to the electronics: diagnostic number 200 to 399
  (→ 🖹 66)
• Diagnostic information pertaining to the configuration: diagnostic number 400 to 599
  (→ 🖹 66)
• Diagnostic information pertaining to the process: diagnostic number 800 to 999
  (→ 🖹 67)

Depending on the group in which diagnostic information is located, the following measured value status and device status are firmly assigned to the particular diagnostic behavior:

Diagnostic information pertaining to the sensor (diagnostic no.: 000 to 199)

Diagnostic behavior (configurable)	Measured value status (fixed assignment)				Device diagnostics (fixed assignment)
	Quality	Quality Substatus	Coding (hex)	Category (NE107)	
Alarm	BAD	Maintenance alarm	0x24 to 0x27	F (Failure)	Maintenance alarm
Warning	GOOD	Maintenance demanded	0xA8 to 0xAB	M (Maintenance)	Maintenance demanded
Logbook entry only	GOOD	ok	0x80 to 0x8E	–	–
Off					

Diagnostic information pertaining to the electronics (diagnostic no.: 200 to 399)

Diagnostic behavior (configurable)	Measured value status (fixed assignment)				Device diagnostics (fixed assignment)
	Quality	Quality Substatus	Coding (hex)	Category (NE107)	
Alarm	BAD	Maintenance alarm	0x24 to 0x27	F (Failure)	Maintenance alarm
Warning					
Logbook entry only	GOOD	ok	0x80 to 0x8E	–	–
Off					

Diagnostic information pertaining to the configuration (diagnostic no.: 400 to 599)

Diagnostic behavior (configurable)	Measured value status (fixed assignment)				Device diagnostics (fixed assignment)
	Quality	Quality Substatus	Coding (hex)	Category (NE107)	
Alarm	BAD	Function Check	0x3C to 0x3F	C (Check)	Function check
Warning	GOOD	Function check	0xBC to 0xBF	–	–
Logbook entry only					
Off					

Diagnostic information pertaining to the process (diagnostic no.: 800 to 999)

Diagnostic behavior (configurable)	Measured value status (fixed assignment)				Device diagnostics (fixed assignment)
	Quality	Quality Substatus	Coding (hex)	Category (NE107)	
Alarm	BAD	Process related	0x28 to 0x2B	F (Failure)	Invalid process condition
Warning	UNCERTAIN	Process related	0x78 to 0x7B	S (Out of specification)	Invalid process condition
Logbook entry only	GOOD	ok	0x80 to 0x8E	–	–
Off					

12.5   Overview of diagnostic information

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

12.5.1   Diagnostics for the sensor

Diagnostic no. 022   **Message: F022 Sensor temperature**

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Change main electronics module. • Change sensor.		

Diagnostic no. 044   **Message: *044 Sensor drift**

Measured value status		Measured variables concerned
Quality:	GOOD	• Density
Quality Substatus:	Maintenance demanded	• Mass flow
Coding (hex):	0xA8	• Reference density
Category (NE107):	S (Out of specification)	• Corrected volume flow
Diagnostic behavior, configurable (→ 📖 65)		• Temperature
Warning (factory setting)		
Remedial measures		
• Check or change main electronics module. • Change sensor.		

Diagnostic no. 046   **Message: *046 Sensor limit**

Measured value status		Measured variables concerned
Quality:	GOOD	• Density
Quality Substatus:	Maintenance demanded	• Mass flow
Coding (hex):	0xA8	• Reference density
Category (NE107):	S (Out of specification)	• Corrected volume flow
Diagnostic behavior, configurable (→ 📖 65)		• Volume flow
Warning (factory setting)		
Remedial measures		
• Check sensor. • Check process conditions.		

Diagnostic no. 062   Message: F062 Sensor connection

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Change main electronics module. • Change sensor.		

Diagnostic no. 082   Message: F082 Data storage

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Check module connections. • Contact service.		

Diagnostic no. 083   Message: F083 Memory content

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Restart the device. • Contact service.		

Diagnostic no. 144   Message: *144 Measuring error too high

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Mass flow • Reference density • Corrected volume flow • Temperature
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	

Category (NE107):	F (Failure)
Diagnostic behavior, configurable (→ 🕮 65)	
Alarm (factory setting)	
Remedial measures	
• Check or change sensor. • Check process conditions.	

Diagnostic no. 190   Message: F190 Special event 1

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 191   Message: F191 Special event 5

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 192   Message: *192 Special event 9

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Mass flow • Reference density • Corrected volume flow • Temperature
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior, configurable (→ 🕮 65)		
Alarm (factory setting)		
Remedial measures		
Contact service.		

12.5.2 Diagnostics for the electronics

Diagnostic no. 201

Message: F201 Device failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Restart the device. • Contact service.		

Diagnostic no. 242

Message: F242 Software incompatible

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Check software. • Flash or change main electronic module.		

Diagnostic no. 252

Message: *252 Modules incompatible

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior, configurable (→ 🖺 65)		
Alarm (factory setting)		
Remedial measures		
• Check electronic modules. • Change electronics modules.		

Diagnostic no. 262

Message: F262 Module connection

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available

Quality Substatus:	Maintenance alarm, more diagnosis available
Coding (hex):	0x24
Category (NE107):	F (Failure)
Diagnostic behavior:	Alarm
Remedial measures	
• Check module connections. • Change main electronics.	

Diagnostic no. 270   Message: F270 Main electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Change main electronics.		

Diagnostic no. 271   Message: F271 Main electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Restart the device. • Change main electronics module.		

Diagnostic no. 272   Message: F272 Main electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		

- Restart the device.
- Contact service.

Diagnostic no. 273   Message: F273 Main electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Replace electronics.		

Diagnostic no. 274   Message: *274 Main electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	- Mass flow
Quality Substatus:	Maintenance alarm, more diagnosis available	- Corrected volume flow - Volume flow
Coding (hex):	0x24	
Category (NE107):	S (Out of specification)	
Diagnostic behavior, configurable (→ 🖺 65)		
Warning (factory setting)		
Remedial measures		
Replace electronics.		

Diagnostic no. 283   Message: F283 Memory content

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
- Reset device. - Contact service.		

Diagnostic no. 311   Message: F311 Electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available

Quality Substatus:	Maintenance alarm, more diagnosis available
Coding (hex):	0x24
Category (NE107):	F (Failure)
Diagnostic behavior:	Alarm
Remedial measures	

- Reset device.
- Contact service.

Diagnostic no. 311   Message: M311 Electronic failure

Measured value status		Measured variables concerned
Quality:	BAD	- Density
Quality Substatus:	Maintenance alarm, more diagnosis available	- Partially filled pipe detection - Low flow cut off
Coding (hex):	0x24	- Mass flow - Status value pulse/freq./switch output
Category (NE107):	M (Maintenance)	- Reference density
Diagnostic behavior:	Warning	- Corrected volume flow - Temperature
Remedial measures		- Volume flow

- Do not reset device.
- Contact service.

Diagnostic no. 382   Message: F382 Data storage

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		

- Insert DAT module.
- Replace DAT module.

Diagnostic no. 383   Message: F383 Memory content

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		

- Restart the device.
- Check or replace DAT module.
- Contact service.

Diagnostic no. 390   Message: F390 Special event 2

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 391   Message: F391 Special event 6

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 392   Message: *392 Special event 10

Measured value status		Measured variables concerned
Quality:	BAD	• Density
Quality Substatus:	Maintenance alarm, more diagnosis available	• Mass flow • Reference density
Coding (hex):	0x24	• Corrected volume flow
Category (NE107):	F (Failure)	• Temperature
Diagnostic behavior, configurable (→ 🕮 65)		
Alarm (factory setting)		
Remedial measures		
Contact service.		

12.5.3   Diagnostics for the configuration

Diagnostic no. 410   Message: F410 Data transfer

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Check connection. • Retry data transfer.		

Diagnostic no. 411   **Message: C411 Up-/download active**

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Function check	
Coding (hex):	0x3C	
Category (NE107):	C (Check)	
Diagnostic behavior:	Warning	
Remedial measures		
Up-/download active: Wait until the up-/download is complete.		

Diagnostic no. 411   **Message: C411 Up-/download active**

Measured value status		Measured variables concerned
Quality:	GOOD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Function check	
Coding (hex):	0x3C	
Category (NE107):	C (Check)	
Diagnostic behavior:	Warning	
Remedial measures		
Up-/download active: Wait until the up-/download is complete.		

Diagnostic no. 437   **Message: F437 Configuration incompatible**

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	

Remedial measures
• Restart the device. • Contact service.

Diagnostic no. 438   Message: M438 Dataset

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Maintenance demanded	
Coding (hex):	0x68	
Category (NE107):	M (Maintenance)	
Diagnostic behavior:	Warning	
Remedial measures		
• Check data set file. • Check device configuration. • Up- and download new configuration.		

Diagnostic no. 453   Message: C453 Flow override

Measured value status		Measured variables concerned
Quality:	GOOD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Function check	
Coding (hex):	0xBC	
Category (NE107):	C (Check)	
Diagnostic behavior:	Warning	
Remedial measures		
Deactivate flow override.		

Diagnostic no. 484   Message: C484 Simulation failsafe mode

Measured value status		Measured variables concerned
Quality:	BAD	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Function check	
Coding (hex):	0x3C	
Category (NE107):	C (Check)	
Diagnostic behavior:	Alarm	
Remedial measures		
Deactivate simulation.		

Diagnostic no. 485   Message: C485 Simulation process variable

Measured value status		Measured variables concerned
Quality:	GOOD	• Density • Partially filled pipe detection • Low flow cut off
Quality Substatus:	Function check	

Coding (hex):	0xBC	• Mass flow
Category (NE107):	C (Check)	• Status value pulse/freq./switch output
		• Reference density
Diagnostic behavior:	Warning	• Corrected volume flow
Remedial measures		• Temperature
Deactivate simulation.		• Volume flow

Diagnostic no. 590   Message: F590 Special event 3

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	M (Maintenance)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 591   Message: F591 Special event 7

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	M (Maintenance)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 592   Message: *592 Special event 11

Measured value status		Measured variables concerned
Quality:	BAD	• Density
Quality Substatus:	Function check	• Mass flow
Coding (hex):	0x3C	• Reference density
Category (NE107):	F (Failure)	• Corrected volume flow
Diagnostic behavior, configurable (→ 🖹 65)		• Temperature
Alarm (factory setting)		
Remedial measures		
Contact service.		

12.5.4 Diagnostics for the process

Diagnostic no. 825   **Message: S825 Operating temperature**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	All the measured variables available
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	
Diagnostic behavior:	Warning	
Remedial measures		
• Check ambient temperature. • Check process temperature.		

Diagnostic no. 825   **Message: F825 Operating temperature**

Measured value status		Measured variables concerned
Quality:	BAD	All the measured variables available
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x28	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Check ambient temperature. • Check process temperature.		

Diagnostic no. 830   **Message: *830 Ambient temperature**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Mass flow • Reference density • Corrected volume flow • Temperature
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	
Diagnostic behavior, configurable (→ 🕮 65)		
Warning (factory setting)		
Remedial measures		
Reduce the ambient temp. around the sensor housing.		

Diagnostic no. 831   **Message: *831 Ambient temperature**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Mass flow • Reference density • Corrected volume flow • Temperature
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	

| **Diagnostic behavior**, configurable (→ 🖹 65) |
| Warning (factory setting) |
| **Remedial measures** |
| Reduce the ambient temp. around the sensor housing. |

Diagnostic no. 832   Message: ***832 Ambient temperature too high**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	
Diagnostic behavior, configurable (→ 🖹 65)		
Warning (factory setting)		
Remedial measures		
Reduce ambient temperature.		

Diagnostic no. 833   Message: ***833 Ambient temperature too low**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Partially filled pipe detection • Low flow cut off • Mass flow • Status value pulse/freq./switch output • Reference density • Corrected volume flow • Volume flow
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	
Diagnostic behavior, configurable (→ 🖹 65)		
Warning (factory setting)		
Remedial measures		
Increase ambient temperature.		

Diagnostic no. 834   Message: ***834 Process temperature too high**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density • Mass flow • Reference density • Corrected volume flow • Temperature • Volume flow
Quality Substatus:	Process related, no maintenance	
Coding (hex):	0x78	
Category (NE107):	S (Out of specification)	
Diagnostic behavior, configurable (→ 🖹 65)		
Warning (factory setting)		
Remedial measures		
Reduce process temperature.		

Diagnostic no. 835   Message: ***835 Process temperature too low**

Measured value status	Measured variables concerned

Quality:	UNCERTAIN	• Density
Quality Substatus:	Process related, no maintenance	• Mass flow
Coding (hex):	0x78	• Reference density
		• Corrected volume flow
Category (NE107):	S (Out of specification)	• Temperature
Diagnostic behavior, configurable (→ 🕮 65)		• Volume flow
Warning (factory setting)		
Remedial measures		
Increase process temperature.		

Diagnostic no. 842   **Message: S842 Process limit**

Measured value status		Measured variables concerned
Quality:	GOOD	• Density
Quality Substatus:	Ok	• Partially filled pipe detection
		• Low flow cut off
Coding (hex):	0x80	• Mass flow
Category (NE107):	S (Out of specification)	• Status value pulse/freq./switch output
		• Reference density
Diagnostic behavior:	Warning	• Corrected volume flow
		• Temperature
Remedial measures		• Volume flow
Low flow cut off active: Check settings for low flow cut off.		

Diagnostic no. 843   **Message: S843 Process limit**

Measured value status		Measured variables concerned
Quality:	GOOD	• Density
Quality Substatus:	Ok	• Partially filled pipe detection
		• Low flow cut off
Coding (hex):	0x80	• Mass flow
Category (NE107):	S (Out of specification)	• Status value pulse/freq./switch output
		• Reference density
Diagnostic behavior:	Warning	• Corrected volume flow
		• Temperature
Remedial measures		• Volume flow
Check process conditions.		

Diagnostic no. 862   **Message: *862 Partly filled pipe**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density
Quality Substatus:	Process related, no maintenance	• Partially filled pipe detection
		• Low flow cut off
Coding (hex):	0x78	• Mass flow
Category (NE107):	S (Out of specification)	• Status value pulse/freq./switch output
		• Reference density
Diagnostic behavior, configurable (→ 🕮 65)		• Corrected volume flow
		• Temperature
Warning (factory setting)		• Volume flow
Remedial measures		

- Check for gas in process.
- Check detection limits.

Diagnostic no. 882   **Message: S882 Input signal**

Measured value status		Measured variables concerned
Quality:	BAD	• Density
Quality Substatus:	Maintenance alarm, more diagnosis available	• Mass flow • Reference density
Coding (hex):	0x24	• Corrected volume flow • Volume flow
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
• Check input configuration. • Check pressure sensor or process conditions.		

Diagnostic no. 910   **Message: F910 Measuring tube does not vibrate**

Measured value status		Measured variables concerned
Quality:	BAD	• Density
Quality Substatus:	Maintenance alarm	• Partially filled pipe detection
Coding (hex):	0x24	• Low flow cut off • Mass flow
Category (NE107):	F (Failure)	• Status value pulse/freq./switch output • Reference density
Diagnostic behavior:	Alarm	• Corrected volume flow
Remedial measures		• Temperature • Volume flow
• Check electronics. • Check sensor.		

Diagnostic no. 912   **Message: *912 Inhomogeneous**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density
Quality Substatus:	Process related, no maintenance	• Partially filled pipe detection
Coding (hex):	0x78	• Low flow cut off • Mass flow
Category (NE107):	S (Out of specification)	• Status value pulse/freq./switch output
Diagnostic behavior, configurable (→ 🖹 65)		• Reference density • Corrected volume flow
Warning (factory setting)		• Temperature
Remedial measures		• Volume flow
• Check process conditions. • Increase system pressure.		

Diagnostic no. 913   **Message: *913 Inhomogeneous**

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density

Quality Substatus:	Process related, no maintenance
Coding (hex):	0x78
Category (NE107):	S (Out of specification)
Diagnostic behavior, configurable (→ 🖺 65)	
Warning (factory setting)	
Remedial measures	
• Check process conditions. • Check electronic modules or sensor.	

- • Mass flow
- • Reference density
- • Corrected volume flow
- • Temperature
- • Volume flow

Diagnostic no. 944   Message: *944 Monitoring failed

Measured value status		Measured variables concerned
Quality:	UNCERTAIN	• Density
Quality Substatus:	Process related, no maintenance	• Mass flow • Reference density
Coding (hex):	0x78	• Corrected volume flow
Category (NE107):	S (Out of specification)	• Temperature
Diagnostic behavior, configurable (→ 🖺 65)		
Warning (factory setting)		
Remedial measures		
Check process conditions for Heartbeat Monitoring.		

Diagnostic no. 990   Message: *990 Special event 4

Measured value status		Measured variables concerned
Quality:	BAD	–
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 991   Message: *991 Special event 8

Measured value status		Measured variables concerned
Quality:	BAD	–
Quality Substatus:	Maintenance alarm, more diagnosis available	
Coding (hex):	0x24	
Category (NE107):	F (Failure)	
Diagnostic behavior:	Alarm	
Remedial measures		
Contact service.		

Diagnostic no. 992   **Message: *992 Special event 12**

Measured value status		Measured variables concerned
Quality:	BAD	• Density
Quality Substatus:	Process related, no maintenance	• Mass flow
Coding (hex):	0x28	• Reference density
Category (NE107):	F (Failure)	• Corrected volume flow • Temperature
Diagnostic behavior, configurable (→ 🗎 65)		
Alarm (factory setting)		
Remedial measures		
Contact service.		

12.6   Pending diagnostic events

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

ℹ️ To call up the measures to rectify a diagnostic event:
  • Via Web browser
  • Via "FieldCare" operating tool (→ 🗎 64)

ℹ️ Other pending diagnostic events can be displayed in the **Diagnostic list** submenu(→ 🗎 85)

Navigation
"Diagnostics" menu

Structure of the submenu

Diagnostics	→	Actual diagnostics
		Previous diagnostics

Parameter overview with brief description

Parameters	Prerequsite	Description	User interface	Factory setting
Actual diagnostics	1 diagnostic event has occurred.	Displays the current diagnostic event along with the diagnostic information. ℹ️ 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 (→ 🖹 64)

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 which contains a maximum of 20 message entries. This list can be displayed via FieldCare if necessary.

Navigation path
Event list: **F**→ Tool box→ Additional functions

For information on the event list, see the FieldCare user interface

This event history includes entries for:
• Diagnostic events (→ 🖹 68)
• Information events (→ 🖹 86)

In addition to the operation time of its occurrence and possible troubleshooting measures, 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

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

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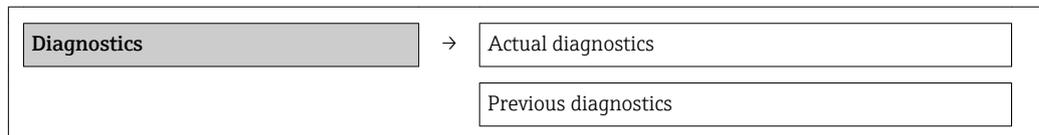"Diagnostics" menu → Event logbook → Events list

To call up the measures to rectify a diagnostic event:
• Via Web browser
• Via "FieldCare" operating tool (→ 🖹 64)

For filtering the displayed event messages (→ 🖹 85)

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
I1111	Density adjust failure
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
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1361	Wrong web server login
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1446	Device verification active
I1447	Record application reference data
I1448	Application reference data recorded
I1449	Recording application ref. data failed
I1450	Monitoring off
I1451	Monitoring on
I1457	Failed:Measured error verification
I1459	Failed: I/O module verification
I1460	Failed: Sensor integrity 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

Device information	→	Device tag
		Serial number
		Firmware version
		Device name
		Order code
		Extended order code 1
		Extended order code 2
		Extended order code 3
		ENP version
		IP address
		Subnet mask

			Default gateway	

Parameter overview with brief description

Parameters	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 DP
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	01.00
Device name	Displays the name of the transmitter.	Character string composed of letters, numbers and certain punctuation marks.	Promag 100 DP
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
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)	192.168.1.212

12.11 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
09.2013	01.01.00	Option **78**	Original firmware	Operating Instructions	BA01238D/06/EN/01.13

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) (→ 🕮 108)

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

W@M Device Viewer (www.endress.com/deviceviewer):
All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

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 (→ 🖺 87).

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 FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see "Technical Information" TI00405C
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

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 data manager provides information on all the 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 • Corrected electrical conductivity
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 **Recommended measuring range** "Flow limit" section (→ 🖺 102)
Operable flow range	Over 1000 : 1
Input signal	**Fieldbuses** 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 via Modbus RS485, EtherNet/IP or HART input: • Process pressure or fluid temperature to increase accuracy (e.g. external values from Cerabar M, Cerabar S or iTEMP) • Reference density for calculating the corrected volume flow

16.4   Output

Output signal

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud

Signal on alarm

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

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02

Operating tool

- Via digital communication:
  PROFIBUS DP
- Via service interface

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

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1561
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: • www.endress.com • www.profibus.org

Output values (from measuring device to automation system)	**Analog input 1 to 8** • Mass flow • Volume flow • Corrected volume flow • Target mass flow • Carrier mass flow • Density • Reference density • Concentration • Dynamic viscosity • Kinematic viscosity • Temp. compensated dynamic viscosity • Temp. compensated kinematic viscosity • Temperature • Carrier pipe temperature • Electronics temperature • Oscillation frequency • Oscillation amplitude • Frequency fluctuation • Oscillation damping • Tube damping fluctuation • Signal asymmetry • Exciter current **Digital input 1 to 2** • Partially filled pipe detection • Low flow cut off **Totalizer 1 to 3** • Mass flow • Volume flow • Corrected volume flow

Input values
(from automation system to measuring device)
	Analog output 1 to 3 (fixed assignment)
	• Pressure
	• Temperature
	• Reference density
	
	Digital output 1 to 3 (fixed assignment)
	• Digital output 1: switch positive zero return on/off
	• Digital output 2: perform zero point adjustment
	• Digital output 3: switch switch output on/off
	
	Totalizer 1 to 3
	• Totalize
	• Reset and hold
	• Preset and hold
	• Stop
	• Operating mode configuration:
	  – Net flow total
	  – Forward flow total
	  – Reverse flow total

Supported functions	• Identification & Maintenance Simplest device identification on the part of the control system and nameplate • PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download • Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	• DIP switches on the I/O electronics module • Via operating tools (e.g. FieldCare)

16.5   Power supply

Terminal assignment   (→ 🕮 29)

Pin assignment, device plug	(→ 🕮 30)

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 **L**: PROFIBUS DP	3.5 W

Current consumption

Transmitter

Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **L**: PROFIBUS DP	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

(→ 🕮 30)

Potential equalization

(→ 🕮 32)

Terminals

Transmitter
Spring terminals for wire cross-sections0.5 to 2.5 mm² (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

(→ 🕮 28)

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.
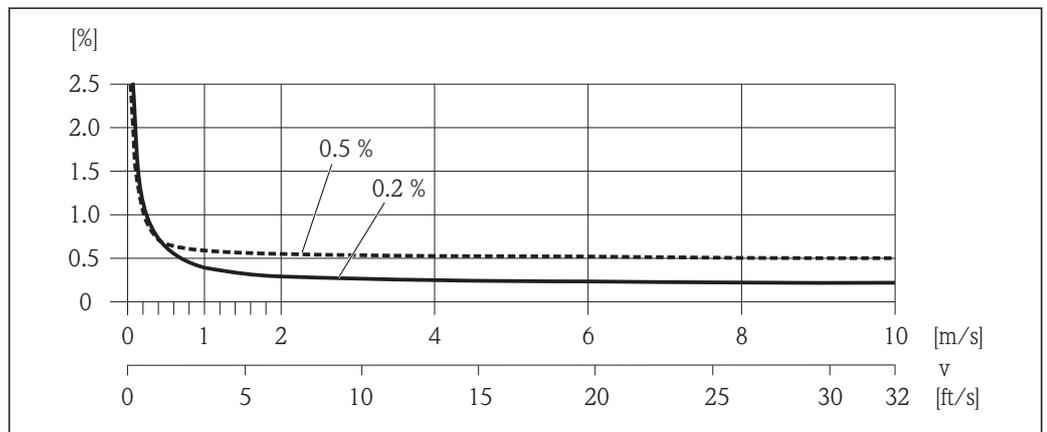
🖾 20   Maximum measured error in % o.r.

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

16.7   Installation

"Mounting requirements" (→ 🖹 18)

16.8   Environment

Ambient temperature range	(→ 🖹 20)

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

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)
	• Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784

The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

16.9   Process

Medium temperature range	• −20 to +150 °C (−4 to +302 °F) for PFA, DN 25 to 200 (1 to 8")
	• −20 to +180 °C (−4 to +356 °F) for PFA high-temperature, DN 25 to 200 (1 to 8")
	• −40 to +130 °C (−40 to +266 °F) for PTFE, DN 15 to 600 (½ to 24")

A0019742
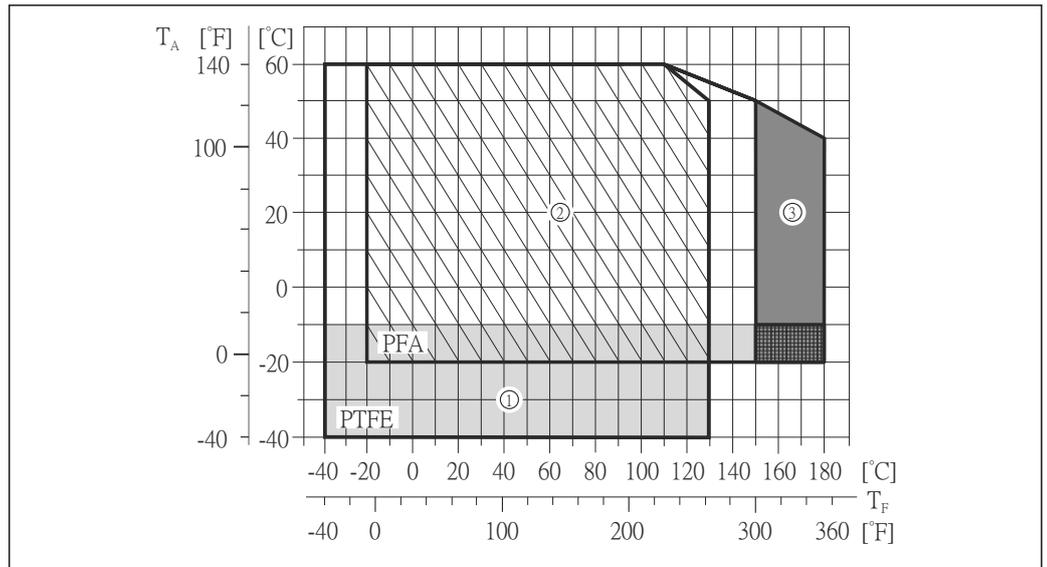
T$_A$	Ambient temperature
T$_F$	Medium temperature
1	Gray area: the ambient temperature range of –10 to –40 °C (–14 to –40 °F) applies to stainless flanges only
2	Hatched area: harsh environment and IP68 only up to +130 °C (+266 °F)
3	Dark-gray area: high-temperature version with insulation

Conductivity	≥ 5 µS/cm for liquids in general

Pressure-temperature ratings	📖 An overview of the material load diagrams (pressure/temperature curves) for the process connections is provided in the "Technical Information" document for the device on the CD-ROM provided.

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 flow velocity 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)

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 🖺 95)

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 (→ 🖺 22)

System pressure

(→ 🖺 21)

Vibrations

(→ 🖺 21)

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":
Coated aluminum AlSi10Mg

Cable entries/cable glands
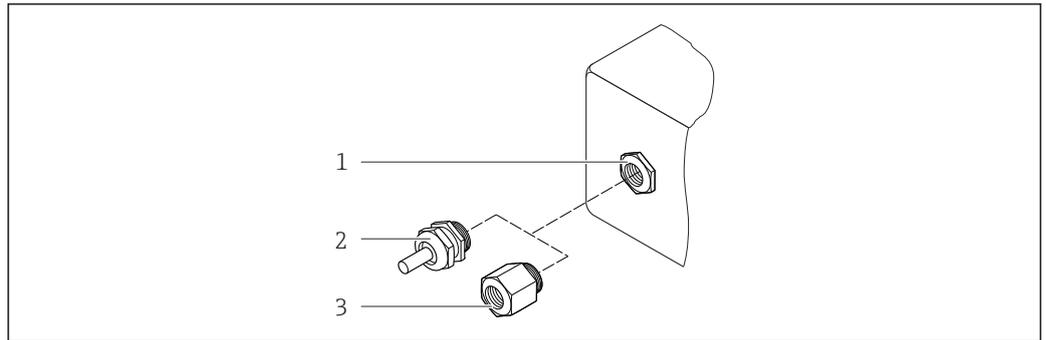
21   Possible cable entries/cable glands

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) or 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)
1.4571 (316L), C22, FE 410W B [1], S235JRG2

ASME B16.5
A105, F316L [1)]

JIS B2220
1.0425 (316L) [1)], HII, S235JRG2

AS 2129 Table E
- DN 25 (1"): A105 or S235JRG2
- DN 40 (1 ½"): A105 or S275JR

AS 4087 PN 16
A105 or S275JR

ℹ️ List of all available process connections (→ 🔖 106)

Electrodes

1.4435 (316L), Alloy C22, platinum, tantalum, titanium

Seals

In accordance with DIN EN 1514-1

Accessories

Ground disks

1.4435 (316L), Alloy C22, tantalum, titanium

Fitted electrodes	Measuring electrodes, reference electrodes and electrodes for empty pipe detection: • Standard: 1.4435 (316L), Alloy C22, platinum, tantalum • Optional: only measuring electrodes made from platinum or tantalum
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 ℹ️ For information on the materials of the process connections (→ 🔖 105)
Surface roughness	Electrodes with 1.4435 (304L), Alloy C22, platinum, tantalum: ≤ 0.3 to 0.5 µm (11.8 to 19.7 in) (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)

16.11   Operability

Remote operation	**PROFIBUS DP network** Operation of the measuring device via a computer with a PROFIBUS network card.

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

Service interface (CDI-RJ45)

Operation of the measuring device with the service interface (CDI-RJ45) via:
• Web browser
• "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"

Languages	Can be operated in the following languages: Via "FieldCare" operating tool: English, German, French, Spanish, Italian, Dutch, Chinese, Japanese

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.
Certification PROFIBUS	**PROFIBUS interface** The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications: • Certified in accordance with PROFIBUS PA Profile 3.02 • The device can also be operated with certified devices of other manufacturers (interoperability)
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 by housing (IP code) • EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. • 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.

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 interfaces (requires no on-site presence). • Ideal solution for recurring device checks (SIL). • End-to-end, traceable documentation of the verification results and verification report. • Extension of calibration intervals.

16.14 Accessories

Overview of accessories available for order (→ 🖺 93)

16.15 Documentation

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

Standard documentation

Communication	Document type	Documentation code
- - - -	Brief Operating Instructions	KA01143D
- - - -	Technical Information	TI01102D

Supplementary device-dependent documentation

Document type	Approval	Documentation code
Safety Instructions	ATEX/IECEx Ex nA	XA01090D
Special Documentation	Information on the Pressure Equipment Directive	SD01056D
Special Documentation	Heartbeat Technology	SD01149D
Installation Instructions		Specified for each individual accessory (→ 🕮 93) 📖 Overview of accessories available for order (→ 🕮 93)

17   Appendix

17.1   Overview of the operating menu

The following table provides 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	→	Operation	(→ 🕮 110)
		Setup	(→ 🕮 110)
		Diagnostics	(→ 🕮 112)
		Expert	(→ 🕮 114)

17.1.2   "Operation" menu

Operation	→		
Access status tooling			
Locking status			(→ 🕮 59)
	Operation	→	(→ 🕮 61)
	Control Totalizer		(→ 🕮 55)
	Preset value		(→ 🕮 61)

17.1.3   "Setup" menu

Setup	→		(→ 🕮 48)
Device tag			(→ 🕮 48)
	System units	→	(→ 🕮 48)
	Volume flow unit		(→ 🕮 49)
	Volume unit		(→ 🕮 49)
	Conductivity unit		(→ 🕮 49)
	Temperature unit		(→ 🕮 49)
	Mass flow unit		(→ 🕮 49)
	Mass unit		(→ 🕮 49)

	Density unit		(→ 🖺 50)
	Corrected volume flow unit		(→ 🖺 50)
	Corrected volume unit		(→ 🖺 50)
	Communication →		(→ 🖺 34)
	Device address		(→ 🖺 34)
	Analog inputs →		(→ 🖺 51)
		Analog input 1 to 4 →	(→ 🖺 51)
		Channel	(→ 🖺 51)
		PV filter time	(→ 🖺 51)
		Fail safe type	(→ 🖺 51)
		Fail safe value	(→ 🖺 51)
	Low flow cut off →		
	Assign process variable		(→ 🖺 52)
	On value low flow cutoff		(→ 🖺 52)
	Off value low flow cutoff		(→ 🖺 52)
	Pressure shock suppression		(→ 🖺 52)
	Empty pipe detection →		(→ 🖺 53)
	Empty pipe detection		(→ 🖺 53)
	New adjustment		(→ 🖺 53)
	Progress		(→ 🖺 53)
	Switch point empty pipe detection		(→ 🖺 53)
	Response time part. filled pipe detect.		(→ 🖺 53)
	Advanced setup →		(→ 🖺 54)
	Enter access code		(→ 🖺 56)
		Sensor adjustment →	(→ 🖺 54)
		Installation direction	(→ 🖺 54)
		Totalizer 1 to 3 →	(→ 🖺 54)
		Assign process variable	(→ 🖺 55)
		Unit totalizer	(→ 🖺 55)
		Control Totalizer	(→ 🖺 55)

		Totalizer operation mode		(→ 🖹 55)
		Failure mode		(→ 🖹 55)
		Electrode cleaning circuit	→	(→ 🖹 55)
		Electrode cleaning circuit		(→ 🖹 55)
		ECC duration		(→ 🖹 55)
		ECC recovery time		(→ 🖹 55)
		ECC cleaning cycle		(→ 🖹 56)
		ECC Polarity		(→ 🖹 56)
		Administration	→	
		Define access code		(→ 🖹 56)
		Device reset		(→ 🖹 87)

17.1.4   "Diagnostics" menu

Diagnostics (→ 🖹 112) →			(→ 🖹 62)
Actual diagnostics			(→ 🖹 85)
Timestamp			
Previous diagnostics			(→ 🖹 85)
Timestamp			
Operating time from restart			(→ 🖹 85)
Operating time			(→ 🖹 0)
	Diagnostic list →		(→ 🖹 85)
	Diagnostics 1 to 5		(→ 🖹 85)
	Timestamp 1 to 5		
	Event logbook →		(→ 🖹 85)
	Filter options		(→ 🖹 85)
	Device information →		(→ 🖹 87)
	Device tag		(→ 🖹 88)
	Serial number		(→ 🖹 88)
	Firmware version		(→ 🖹 88)
	Device name		(→ 🖹 88)

	Order code				(→ 🗎 88)
	Extended order code 1 to 3				(→ 🗎 88)
	ENP version				(→ 🗎 88)
	IP address				(→ 🗎 88)
	Subnet mask				(→ 🗎 88)
	Default gateway				(→ 🗎 88)
	Measured values	→			
			Process variables	→	(→ 🗎 59)
			Volume flow		(→ 🗎 59)
			Mass flow		(→ 🗎 59)
			Conductivity		(→ 🗎 59)
			Corrected volume flow		(→ 🗎 60)
			Temperature		(→ 🗎 60)
			Corrected conductivity		(→ 🗎 60)
			Totalizer 1 to 3	→	(→ 🗎 60)
			Assign process variable		(→ 🗎 55)
			Totalizer value 1 to 3		(→ 🗎 60)
			Totalizer status 1 to 3		(→ 🗎 60)
			Totalizer status (Hex) 1 to 3		(→ 🗎 60)
	Analog inputs	→			(→ 🗎 51)
			Analog input 1 to 8	→	(→ 🗎 51)
			Channel		(→ 🗎 51)
			Out value		
			Out status		
			Out status		
	Heatbeat [1]	→			(→ 🗎 109)
		→	**Performing verification**	→	
			Year		
			Month		
			Day		
			Hour		

AM/PM	
Minute	
Start verification	
Progress	
Status	
Overall result	
Verification results	→
Date/time	
Verification ID	
Operating time	
Overall result	
Sensor	
Sensor integrity	
Sensor electronic module	
I/O module	
Monitoring results	→
Noise	
Coil current shot time	
Reference electrode potential against PE	

Simulation	→

Assign simulation process variable
Value process variable
Simulation device alarm

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

17.1.5   "Expert" menu

Overview "Expert" menu

Expert	→	(→ 🖺 40)
Locking status (0004)		(→ 🖺 59)
Access status tooling		(→ 🖺 57)
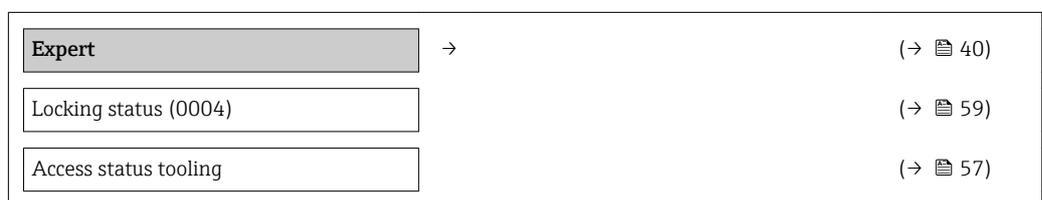
Enter access code (0092)		
	System	(→ 🕮 115)
	Sensor	(→ 🕮 116)
	Communication	(→ 🕮 118)
	Analog inputs	(→ 🕮 120)
	Discrete inputs	(→ 🕮 122)
	Analog outputs	(→ 🕮 122)
	Discrete outputs	(→ 🕮 124)
	Application	(→ 🕮 125)
	Diagnostics	(→ 🕮 126)

"System" submenu

System	→		
	Diagnostic handling	→	(→ 🕮 62)
	Alarm delay		
		Diagnostic behavior	
		Assign behavior of diagnostic no. 531	
		Assign behavior of diagnostic no. 832	
		Assign behavior of diagnostic no. 833	
		Assign behavior of diagnostic no. 834	
		Assign behavior of diagnostic no. 835	
		Assign behavior of diagnostic no. 862	
		Assign behavior of diagnostic no. 937	
		Assign behavior of diagnostic no. 302	
	Administration	→	
	Define access code		(→ 🕮 56)
	Device reset		(→ 🕮 87)
	Activate SW option		

	Software option overview	

"Sensor" submenu

Sensor	→					
	Measured values	→				(→ 🗎 59)
			Process variables	→		(→ 🗎 59)
			Volume flow			(→ 🗎 59)
			Mass flow			(→ 🗎 59)
			Conductivity			(→ 🗎 59)
			Corrected volume flow			(→ 🗎 60)
			Temperature			(→ 🗎 60)
			Corrected conductivity			(→ 🗎 60)
			Totalizer 1 to 3	→		(→ 🗎 60)
			Totalizer value 1 to 3			(→ 🗎 60)
			Totalizer status (Hex) 1 to 3			(→ 🗎 60)
			Totalizer status 1 to 3			(→ 🗎 60)
	System units	→				(→ 🗎 48)
	Volume flow unit					(→ 🗎 49)
	Volume unit					(→ 🗎 49)
	Conductivity unit					(→ 🗎 49)
	Temperature unit					(→ 🗎 49)
	Mass flow unit					(→ 🗎 49)
	Mass unit					(→ 🗎 49)
	Density unit					(→ 🗎 50)
	Corrected volume flow unit					(→ 🗎 50)
	Corrected volume unit					(→ 🗎 50)
	Date/time format					
	Process parameters	→				(→ 🗎 48)
	Filter options					
	Flow damping					
	Flow override					

Conductivity damping		
Temperature damping		
Conductivity measurement		

Low flow cut off →		
Assign process variable		(→ 🗎 52)
On value low flow cutoff		(→ 🗎 52)
Off value low flow cutoff		(→ 🗎 52)
Pressure shock suppression		(→ 🗎 52)
Empty pipe detection →		
Empty pipe detection		(→ 🗎 53)
Switch point empty pipe detection		(→ 🗎 53)
Response time part. filled pipe detect.		(→ 🗎 53)
New adjustment		(→ 🗎 53)
Progress		(→ 🗎 53)
Empty pipe adjust value		
Full pipe adjust value		
Measured value EPD		
Electrode cleaning circuit →		(→ 🗎 55)
Electrode cleaning circuit		(→ 🗎 55)
ECC duration		(→ 🗎 55)
ECC recovery time		(→ 🗎 55)
ECC cleaning cycle		(→ 🗎 56)
ECC Polarity		(→ 🗎 56)

External compensation →	
Temperature source	
External temperature	
Density source	
External density	
Fixed density	

Reference density	
Sensor adjustment	→
Installation direction	(→ 🖺 54)
Integration time	
Measuring period	

Process variable adjustment	→
Volume flow offset	
Volume flow factor	
Mass flow offset	
Mass flow factor	
Conductivity offset	
Conductivity factor	
Corrected volume flow offset	
Corrected volume flow factor	
Temperature offset	
Temperature factor	

Calibration	→
Nominal diameter	
Calibration factor	
Zero point	
Conductivity calibration factor	

"Communication" submenu

Communication	→
PROFIBUS DP configuration	→	(→ 🖺 50)
Address mode (1468)	
Device address (1462)	(→ 🖺 50)
Ident number selector (1461)	
PROFIBUS DP info	→

	Status PROFIBUS Master Config (1465)	
	PROFIBUS ident number (1464)	
	Profile version (1463)	
	Base current (1466)	
	Baudrate	
	Is Master Online	
	Physical block	→
	Device tag (1496)	(→ 🗎 48)
	Static revision (1495)	
	Strategy (1494)	
	Alert key (1473)	
	Target mode (1497)	
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1)   Order code for "Application package", option EB "Heartbeat Verification", see the Special Documentation for the device

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