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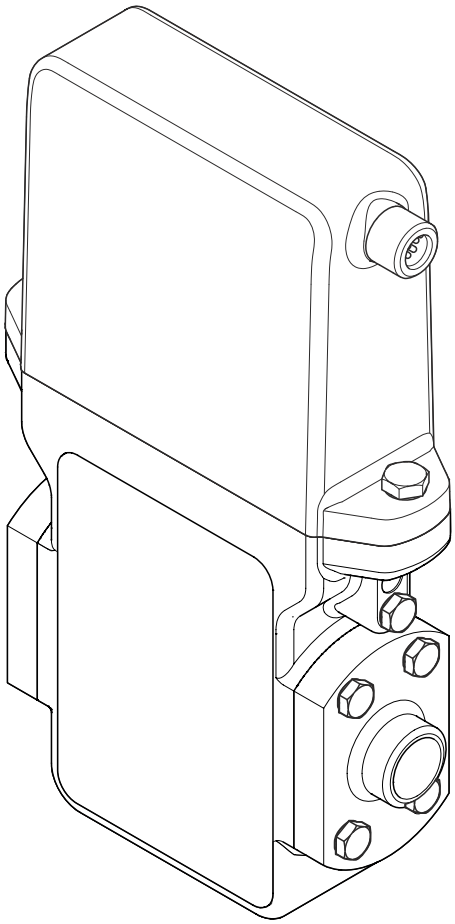
Valid as of version
03.00.zz (Device firmware)

Operating Instructions
Dosimag
Modbus RS485

Electromagnetic flowmeter



Endress+Hauser
People for Process Automation

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

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1 Document information

1.1 Document function

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

1.2 Symbols used

1.2.1 Safety symbols

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

1.2.2 Electrical symbols

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

1.2.3 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Indicates procedures, processes or actions that are permitted.
	**Preferred** Indicates procedures, processes or actions that are preferred.
	**Forbidden** Indicates procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Reference to page** Refers to the corresponding page number.
	**Reference to graphic** Refers to the corresponding graphic number and page number.
1. , 2. , 3. ...	**Series of steps**
	Result of a sequence of actions
	**Help in the event of a problem**
	**Visual inspection**

1.2.4 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 the non-hazardous area.

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

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

For a detailed list of the individual documents along with the documentation code

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.
Modbus RS485 register information	**Reference for Modbus RS485 register information** The document provides Modbus-specific information for each individual parameter in the operating menu.

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

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

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

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

TRI-CLAMP ®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

Applicator®, DeviceCare®, FieldCare®
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

2.2.1 Application and media

The flowmeter described in these Operating Instructions may only be used for flow measurement of conductive liquids in closed pipes. A minimum conductivity of 10 µS/cm is required to measure demineralized water. Most liquids can be measured as of a minimum conductivity of 5 µS/cm, e.g.:

- Milk, beer, wine, mineral water, yogurt, molasses etc.
- Cleaning agents, body care products
- Acids, alkalis, pastes, pulp

Incorrect use

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

⚠ WARNING

Danger of breakage of the sensor due to corrosive or abrasive fluids!

- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Observe the specified pressure and temperature range.

Verification for borderline cases:

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

Residual risks

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

Possible burn hazard due to fluid temperatures!

- For elevated fluid temperature, ensure protection against contact to prevent burns.

2.3 Workplace safety

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

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

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

2.4 Operational safety

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

Conversions to the device

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

Repair

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

2.5 Product safety

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

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

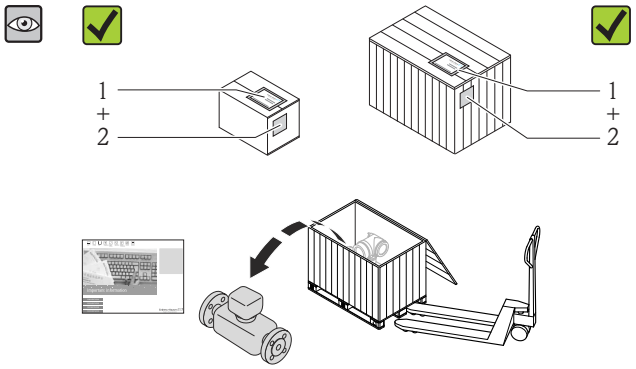
2.6 IT security

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

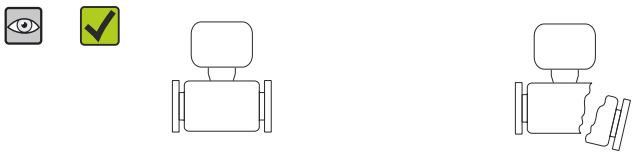
IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Incoming acceptance and product identification

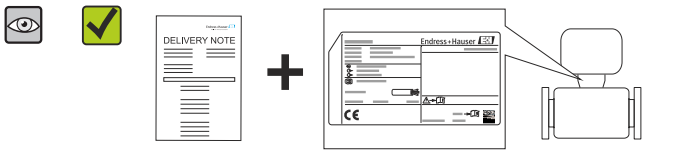
3.1 Incoming acceptance



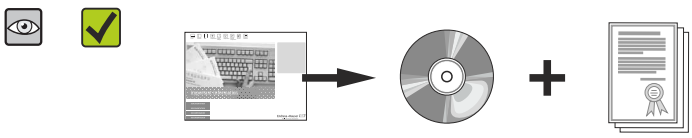
Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?



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



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

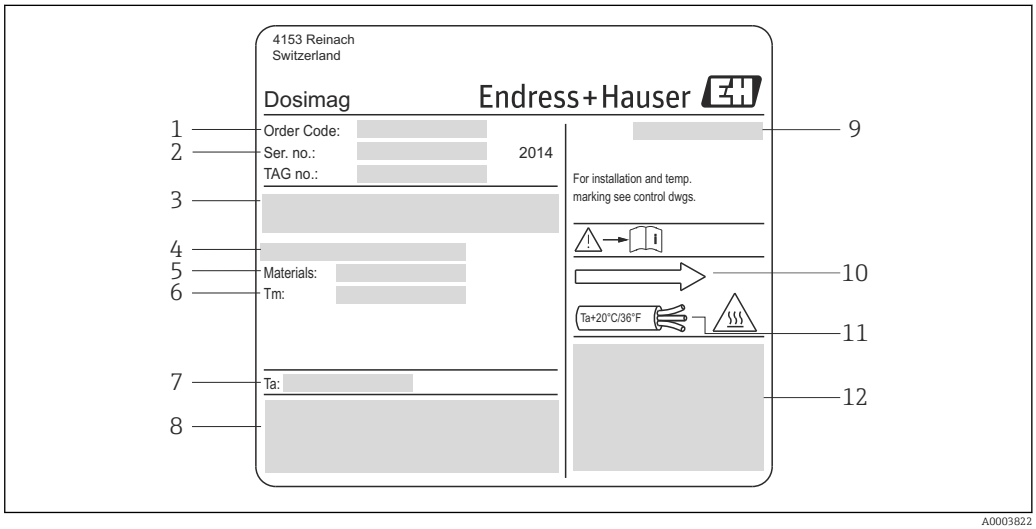
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! In such cases, the technical documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section (→ 11).

3.2 Product identification

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

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

3.2.1 Sensor nameplate



1 *Example of sensor nameplate*

1 *Order code: see the specifications on the order confirmation for the meanings of the individual letters and digits*
2 *Serial number*
3 *Supply voltage and power consumption*
4 *Process connection*
5 *Wetted materials*
6 *Maximum process temperature*
7 *Permitted ambient temperature range*
8 *Space reserved for additional information on the device version (approvals, certificates, etc.)*
9 *Degree of protection*
10 *Flow direction*
11 *Cable temperature*
12 *Space reserved for additional information on the device version (approvals, certificates, etc.)*

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 +).

3.2.2 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.

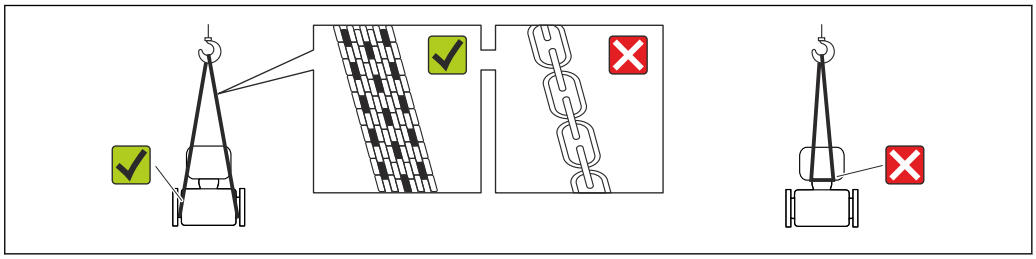
4 Storage and transport

4.1 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(→ 62)

4.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.



A0015604

Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

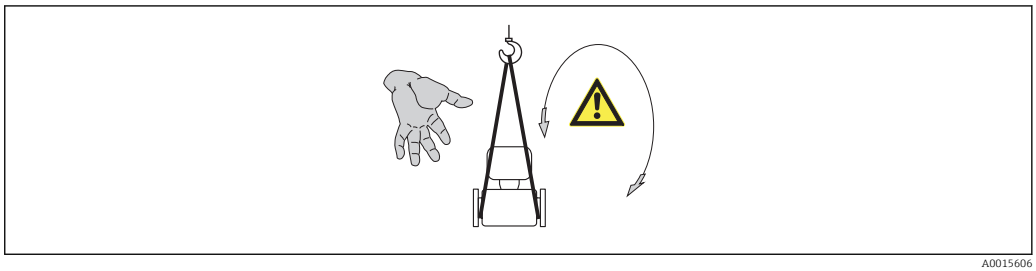
4.2.1 Measuring devices without lifting lugs

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 against slipping or turning.
- ▶ Observe the weight specified on the packaging (stick-on label).



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4.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

- ▶ Only use the lifting lugs fitted on the device or flanges to transport the device.
- ▶ The device must always be secured at two lifting lugs at least.

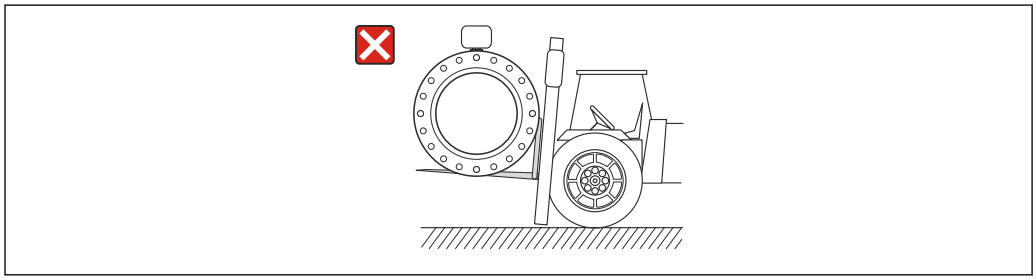
4.2.3 Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

⚠ CAUTION

Risk of damaging the magnetic coil

- ▶ If transporting by forklift, do not lift the sensor by the metal casing.
- ▶ This would buckle the casing and damage the internal magnetic coils.



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4.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

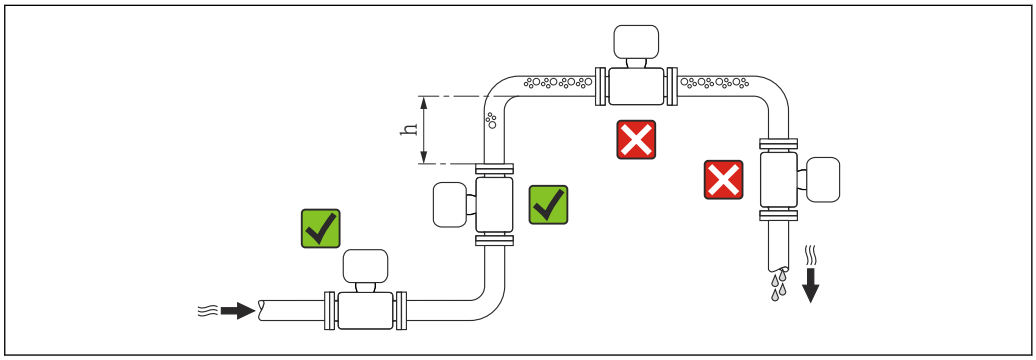
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; 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

5 Installation

5.1 Installation conditions

5.1.1 Mounting position

Mounting location



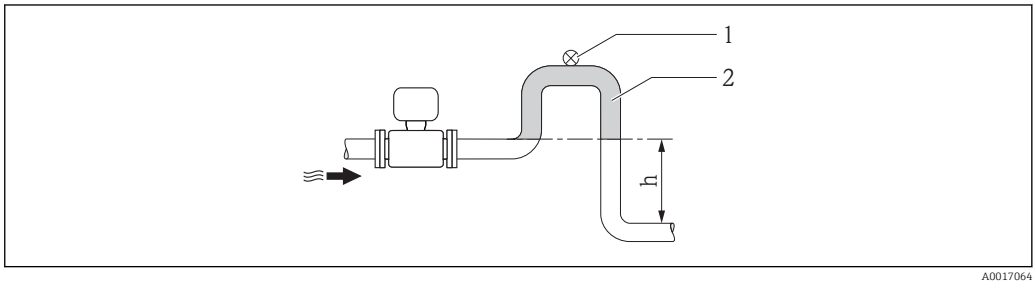
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

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

Installation in down pipes

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

For information on the liner's resistance to partial vacuum (→ 63)

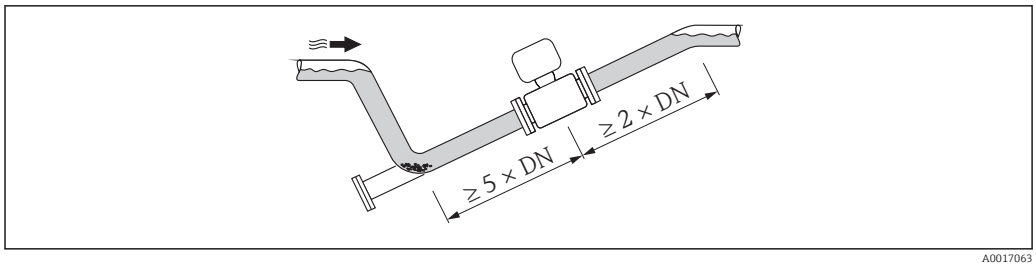


2 *Installation in a down pipe*

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.



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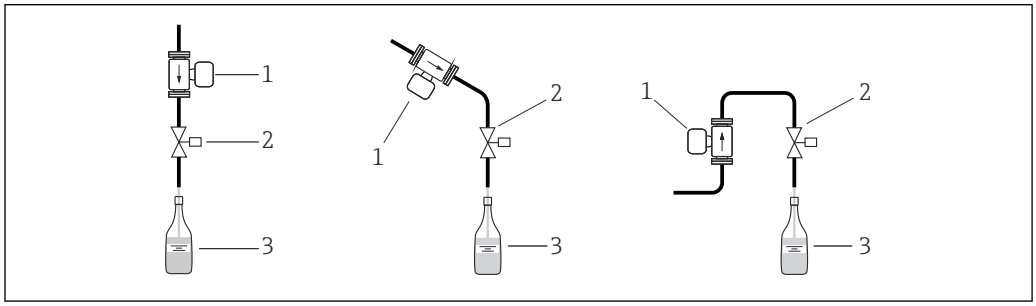
Orientation

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.

Batching systems

Optimum measurement takes place when the pipe system is completely filled with the medium.



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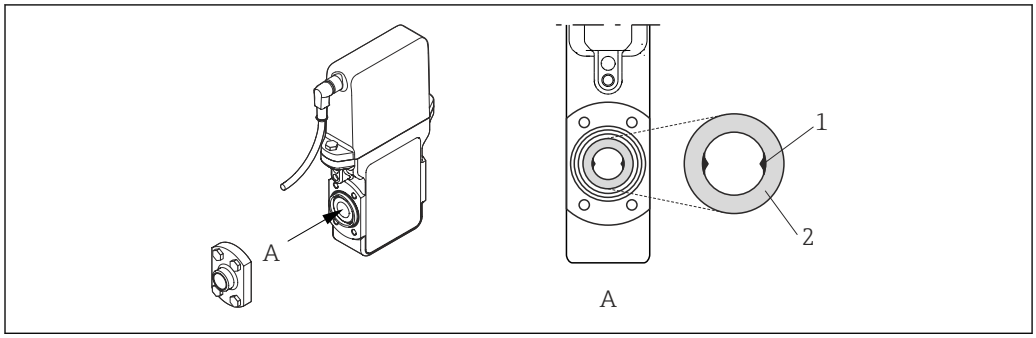
3 Batching system

1 Measuring device
2 Batch valve
3 Vessel

Horizontal

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



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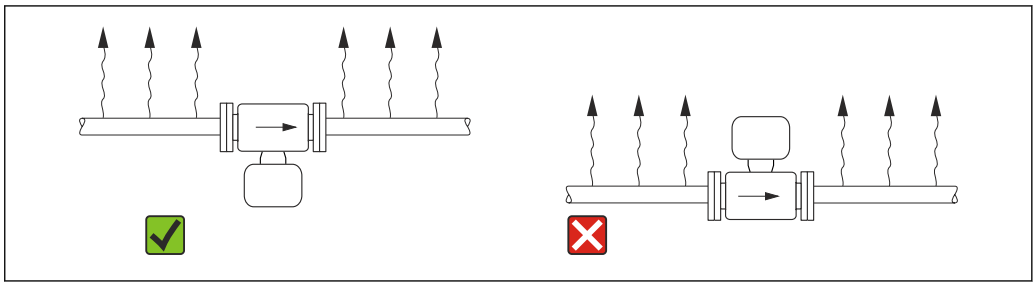
4 Horizontal installation

1 Measuring electrodes
2 Liner

In the event of extreme heating (e.g. for CIP or SIP cleaning processes), we recommend you install the measuring device in such a way that the transmitter part is pointing downwards. This reduces the risk of the electronic components overheating.

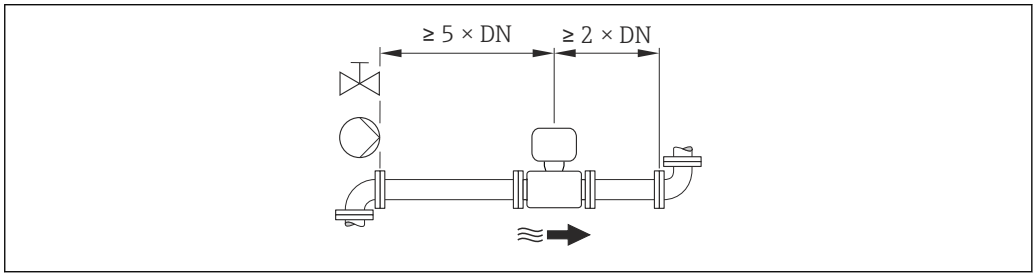


5 *Recommended orientation in the event of extreme heating*

Inlet and outlet runs

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

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



Installation dimensions

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

5.1.2 Requirements from environment and process

Ambient temperature range

Transmitter	−40 to +60 °C (−40 to +140 °F)
Sensor	−40 to +60 °C (−40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner (→ 63).

Temperature tables

SI units

	°C				
	T5 [100 °C]	**T4 [135 °C]**	**T3 [200 °C]**	**T2 [300 °C]**	**T1 [450 °C]**
Ambient temperature T_a	60	50	45	45	45
Maximum medium temperature T_m	70	105	130	130	130

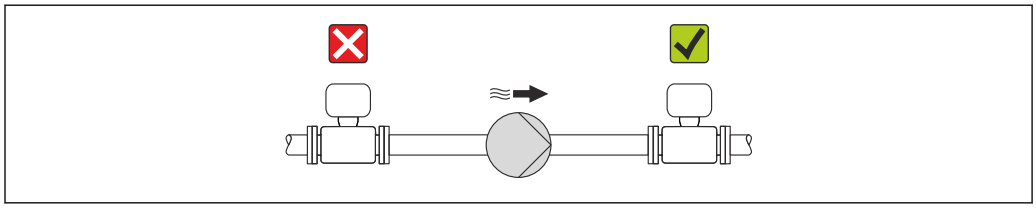
US units

	°F				
	T5 [212 °F]	**T4 [275 °F]**	**T3 [392 °F]**	**T2 [572 °F]**	**T1 [842 °F]**
Ambient temperature T_a	140	122	113	113	113
Maximum medium temperature T_m	158	221	266	266	266

The minimum **medium temperature** is –20 °C (–4 °F).

The minimum **ambient temperature** is –40 °C (–40 °F).

System pressure



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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.

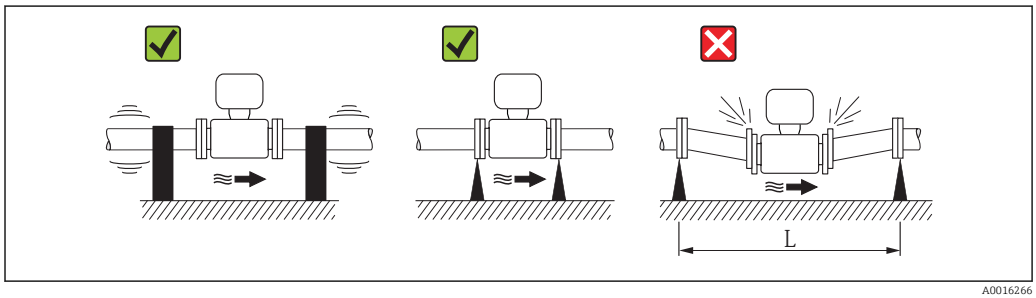
- For information on the liner's resistance to partial vacuum (→ 63)
- Information on the shock resistance of the measuring system (→ 62)
- Information on the vibration resistance of the measuring system (→ 63)

Vibrations

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

Information on the shock resistance of the measuring system (→ 62)

Information on the vibration resistance of the measuring system (→ 63)



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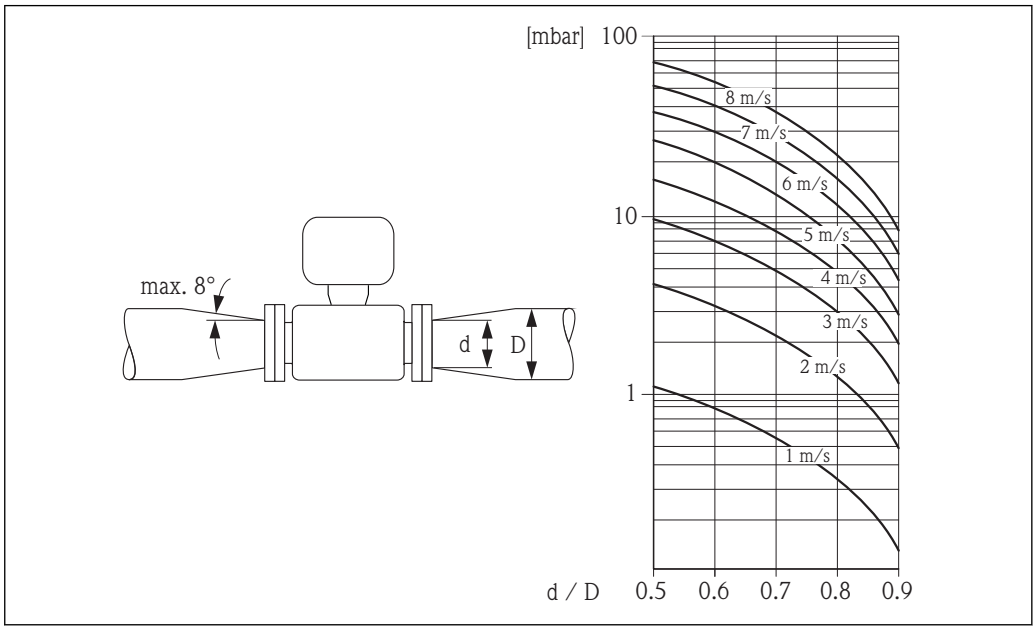
6 *Measures to avoid device vibrations (L > 10 m (33 ft))*

Adapters

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

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

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



5.2 Mounting the measuring device

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.

5.2.1 Installation

The sensor is supplied to order, with or without pre-installed process connections. Ready-mounted process connections are fixed to the sensor with 4 hexagonal-headed bolts.

The sensor may need to be supported or additionally secured depending on the application and pipe length.

5.2.2 Welding the sensor into the pipe (welding connections)

WARNING

Risk of destroying the electronics!

- Make sure that the welding system is not grounded via the sensor or transmitter.

1. Tack-weld the sensor to secure it in the pipe. A suitable welding aid can be ordered separately as an accessory .
2. Release the screws on the process connection flange and remove the sensor, along with the seal, from the pipe.
3. Weld the process connection into the pipe.

4. Reinstall the sensor in the pipe, and in doing so make sure that the seal is clean and in the right position.

- If thin-walled pipes carrying food are welded correctly, the seal is not damaged by the heat even when mounted. However, it is recommended to disassemble the sensor and seal.
- It must be possible to open the pipe by approx. 8 mm (0.31 in) in total to permit disassembly.

5.2.3 Cleaning with pigs

It is essential to take the internal diameters of the measuring tube and process connection into account when cleaning with pigs. All the dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document.

5.2.4 Seals

When mounting the process connections, make sure that the seals in question are dry, clean, undamaged and correctly centered.

- The screws must be firmly tightened. The process connection forms a metal connection with the sensor, which ensures a defined compression of the seal.
- Depending on the application the seals should be replaced periodically, particularly if molded seals are used (aseptic version)!
  The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.
  Replacement seals can be ordered as an accessory.

5.2.5 Nominal diameter and flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 1 to 4 m/s (3.28 to 13.12 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.56 ft/s): for abrasive fluids such as cleaning agents etc.
- v > 2 m/s (6.56 ft/s): for fluids producing buildup such as liquids that contain oil and sugar

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

Flow characteristic values in SI units

Nominal diameter	Recommended flow	Factory settings	
	Maximum full scale value	Pulse value	Low flow cut off (v ~ 0.04 m/s)
[mm]	[l/s]	[ml]	[ml/s]
4	0.14	0.005	0.5
8	0.5	0.02	2
15K [1)]	1.2	0.1	7
15	1.66	0.1	7

1) Conical version (corresponds to DN 12)

Flow characteristic values in US units

Nominal diameter [in]	Recommended flow Maximum full scale value [gal/s]	Factory settings Pulse value [oz fl]	Factory settings Low flow cut off (v ~ 0.13 ft/s) [oz fl/s]
5/32	0.035	0.0002	0.02
5/16	0.13	0.001	0.08
½K [1)]	0.32	0.004	0.25
½	0.44	0.004	0.25

1) Conical version (corresponds to DN 12)

5.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature (→ 🖹 63) ▪ Process pressure(→ 🖹 64) ▪ Ambient temperature (→ 🖹 62) ▪ Measuring range	❑
Horizontal position of the measuring electrode plane?(→ 🖲 4, 🖹 16)	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping ?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the measuring device adequately protected against vibration (attachment, support)?(→ 🖹 18)	❑
Are the inlet and outlet runs to respected?(→ 🖹 17)	❑

6 Electrical connection

6.1 Connection conditions

⚠ WARNING

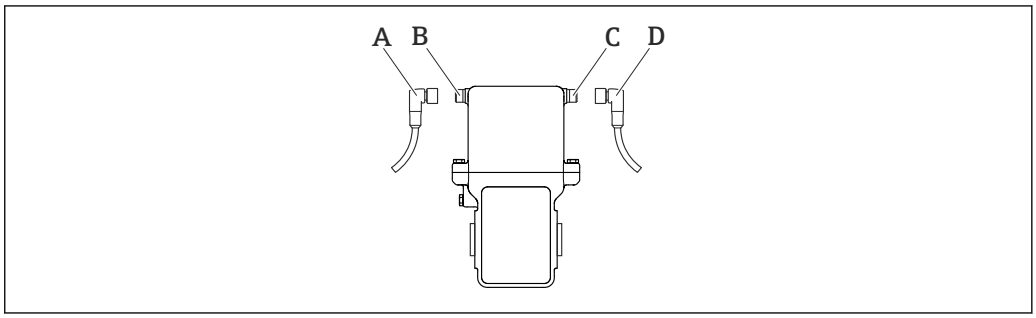
Risk of electric shock.

- ▶ 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.
- ▶ Observe grounding concept of the plant.
- ▶ Never mount or wire the measuring device while it is connected to the supply voltage.
- ▶ Before the supply voltage is applied, connect the protective ground to the measuring device.

6.2 Connecting the measuring device

6.2.1 Pin and socket assignment

Modbus RS485/batching option (option 4 and 5)

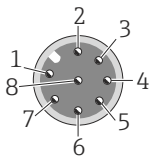


7 *Connections for Modbus RS485/batching option (option 4 and 5)*

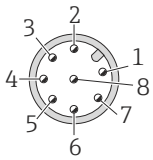
Option 4 and 5: Modbus RS485/batching option

RSE8 M12 × 1

A



B

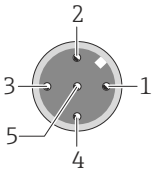


Pin	Assignment	
1	L+	Supply voltage: 24 V_{DC} nominal voltage (20 to 30 V_{DC}), 4.5 W (+500 mA per batch output)
2	+	RX service interface (may not be connected during normal operation)
3	+	TX service interface (may not be connected during normal operation)
4	L-	Supply voltage: 24 V_{DC} nominal voltage (20 to 30 V_{DC}), 4.5 W (+500 mA per batch output)
5		N.C.
6	A	Modbus RS485
7	B	Modbus RS485
8	–	GND service interface (may not be connected during normal operation)
Coding	**Plug/socket**	
A	A: Socket B: Plug	

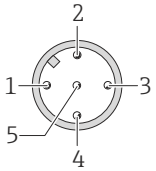
Option 4: Modbus RS485/1 batch output

RSE5 M12 × 1

C



D

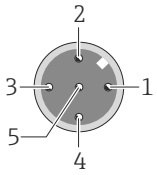


Pin	Assignment	
1	+	AUX
2	–	AUX
3	–	Batch output
4	+	Batch output
5		N.C.
Coding	**Plug/socket**	
A	C: Socket D: Plug	

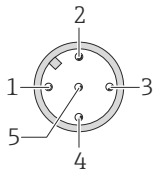
Option 5: Modbus RS485/2 batch outputs

RSE5 M12 × 1

C



D



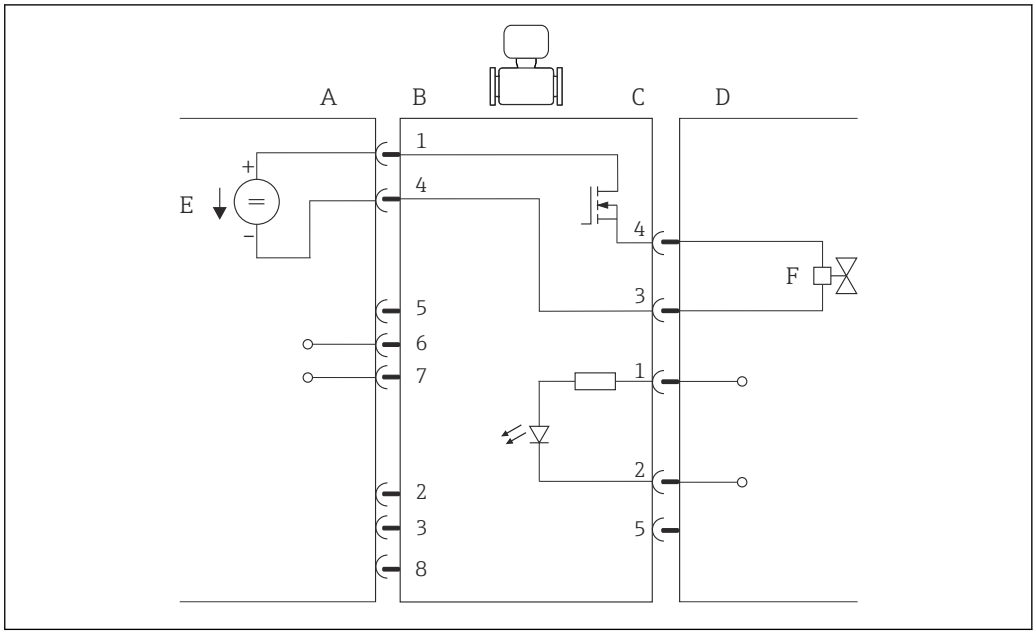
Pin	Assignment	
1	+	AUX
2	+	Batch output 2
3	–	Batch / AUX
4	+	Batch output 1
5		N.C.
Coding	**Plug/socket**	
A	C: Socket D: Plug	

The measuring device may only be connected to SELV, PELV or CLASS 2 circuits. This applies to both the power supply and the outputs.

6.2.2 Electrical connection

M12 socket × 1 for supply voltage and signal outputs.

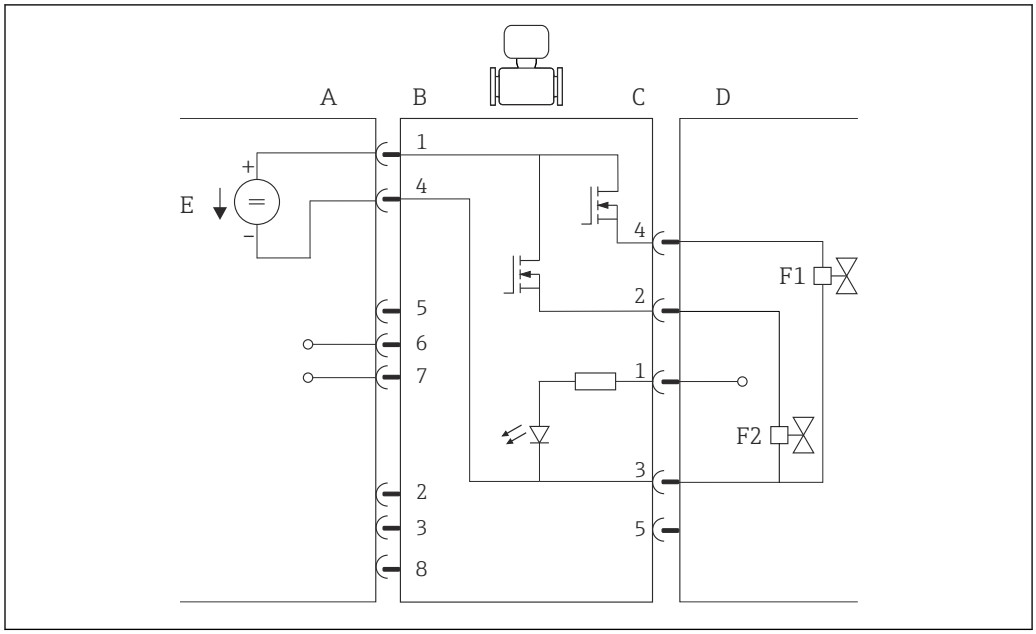
Connection option 4



8 *Batch option with 1 valve*

A Socket, input
B Connector, input
B.1 Supply voltage +
B.2 Service interface
B.3 Service interface
B.4 Supply voltage –
B.5 N.C.
B.6 Modbus A
B.7 Modbus B
B.8 Service interface
C Socket, batch output
C.1 AUX +
C.2 AUX –
C.3 Batch –
C.4 Batch output +
C.5 N.C.
D Connector, batch output
E PELV or SELV power supply
F Valve

Connection option 5

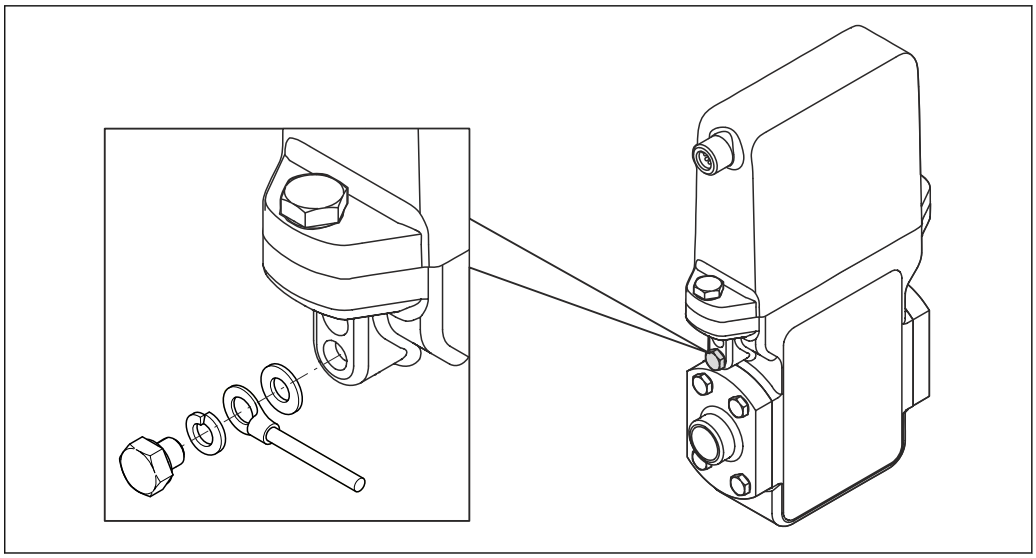


9 *Batch option with 2 valves*

A Socket, input
B Connector, input
B.1 Supply voltage +
B.2 Service interface
B.3 Service interface
B.4 Supply voltage –
B.5 N.C.
B.6 Modbus A
B.7 Modbus B
B.8 Service interface
C Socket, batch output
C.1 AUX +
C.2 Batch output 2 +
C.3 AUX - / batch 1 and 2 –
C.4 Batch output 1 +
C.5 N.C.
D Connector, batch output
E PELV or SELV power supply
F1 Valve 1
F2 Valve 2

Ground connection

The ground connection is via a cable lug that must be mechanically connected to the ground connection of the measuring device.



10 Ground connection

6.2.3 Cable specifications

Use connecting cables with a cross-section of at least 0.25 mm² (0.0004 in²) (e.g. AWG23). The temperature specification of the cable must be at least 20 °C (68 °F) higher than the maximum ambient temperature in the application.

6.2.4 Potential equalization

No special measures for potential equalization are required.

6.3 Ensuring the degree of protection

The measuring device fulfills all the requirements for IP67 degree of protection, Type 4X enclosure.

To guarantee IP67 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.

6.4 Post-connection check

Is the device undamaged (visual inspection)?	❑
Does the supply voltage in the system match the data on the nameplate of the device? (→ 1, 11)	❑
Do the cables used meet the necessary specifications?	❑
Are the maximum values for voltage and current observed at the pulse and status output? (→ 58)	❑
Do the cables have adequate strain relief?	❑
Is the cable type route completely isolated? Without loops and cross-overs?	❑
Are the power supply and signal cables correctly connected?	❑

7 Operation options

7.1 Overview of operation options

7.1.1 Configuration

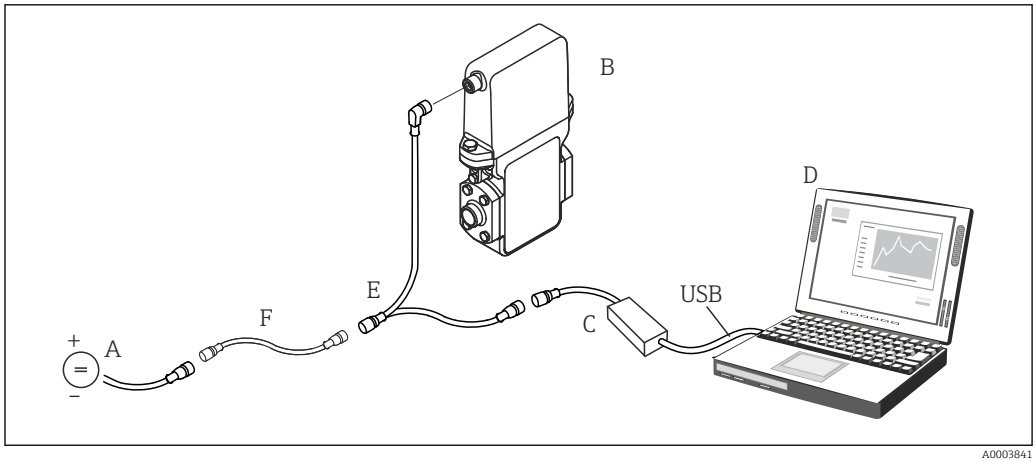
Customer-specific configuration with DeviceCare and FieldCare

The device is operated via the DeviceCare and FieldCare operating programs. DeviceCare and FieldCare are universal service and configuration programs from Endress+Hauser. Connection is by means of the service adapter with an FXA291 service interface.

More information on DeviceCare and FieldCare and the operation of these programs is available in the online help.

DeviceCare and FieldCare can be used for the following:

- Configuration of device functions
- Data backup of device parameters
- Measuring-point documentation



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11 *Connection to DeviceCare and/or FieldCare*

A Supply voltage 24 V DC
B Dosimag
C Service interface FXA291
D Computer with DeviceCare and/or FieldCare software
E Service adapter
F Adapter for pin reduction(→ 55)

DeviceCare and FieldCare

Operating tool	Sources for obtaining device descriptions
DeviceCare and FieldCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)

To ensure the correct operation of the DeviceCare and FieldCare programs, the computer running the programs must meet certain minimum requirements with regard to hardware and software. The minimum requirements are listed on the Endress+Hauser website www.endress.com.

8 System integration

8.1 Overview of device description files

8.1.1 Operating tools

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

Operating tool via service interface (CDI)	Sources for obtaining device descriptions
DeviceCare and FieldCare	▪ www.endress.com → Download Area ▪ CD–ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)

8.2 Modbus RS485 information

8.2.1 Function codes

Function codes are used to define which read or write action is carried out via the Modbus protocol. The measuring device supports the following function codes:

Code	Name	Description	Application
03	Read holding register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read and write access Example: Read volume flow
04	Read input register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read access Example: Read totalizer value
06	Write single registers	Master writes a new value to **one** Modbus register of the measuring device. Use function code 16 to write multiple registers with just 1 telegram.	Write only 1 device parameter Example: reset totalizer
08	Diagnostics	Master checks the communication connection to the measuring device. The following "Diagnostics codes" are supported: ▪ Sub-function 00 = Return query data (loopback test) ▪ Sub-function 02 = Return diagnostics register	

Code	Name	Description	Application
16	Write multiple registers	Master writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map (→ 30)	Write multiple device parameters
23	Read/Write multiple registers	Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters Example: ▪ Read mass flow ▪ Reset totalizer
43	Read device identification	Establish automatic connection with the measuring device (SCAN).	The measuring device returns the following information: ▪ Software version ▪ Vendor name ▪ Product code ▪ MajorMinorRevision

Broadcast messages are only allowed with function codes 06, 16 and 23.

8.2.2 Register information

For an overview on Modbus-specific information of the individual device parameters, please refer to the additional document on Modbus RS485 register information (→ 67)

8.2.3 Response time

Response time of the measuring device to the request telegram of the Modbus master: typically 3 to 5 ms

8.2.4 Modbus data map

Function of the Modbus data map

The device offers a special memory area, the Modbus data map (for a maximum of 16 device parameters), to allow users to call up multiple device parameters via Modbus RS485 and not only individual device parameters or a group of consecutive device parameters.

Grouping of device parameters is flexible and the Modbus master can read or write to the entire data block simultaneously with a single request telegram.

Structure of the Modbus data map

The Modbus data map consists of two data sets:
- Scan list: Configuration area
  The device parameters to be grouped are defined in a list in that their Modbus RS485 register addresses are entered in the list.
- Data area
  The measuring device reads out the register addresses entered in the scan list cyclically and writes the associated device data (values) to the data area.

For an overview of device parameters with their individual Modbus register address, please refer to the additional document on Modbus RS485 register information

Scan list configuration

For configuration, the Modbus RS485 register addresses of the device parameters to be grouped must be entered in the scan list. Please note the following basic requirements of the scan list:

Max. entries	16 device parameters
Supported device parameters	Only parameters with the following characteristics are supported: ▪ Access type: read or write access ▪ Data type: float or integer

Configuring the scan list via FieldCare

Carried out using the operating menu of the measuring device:
Expert → Communication → Modbus data map → Scan list register 0 -15

Scan list	
No.	**Configuration register**
0	Scan list register 0
...	...
15	Scan list register 15

Configuring the scan list via Modbus RS485

Carried out using register addresses 5001 - 5016

Scan list			
No.	**Modbus RS485 register**	**Data type**	**Configuration register**
0	5001	Integer	Scan list register 0
...	...	Integer	...
15	5016	Integer	Scan list register 15

Reading out data via Modbus RS485

The Modbus master accesses the data area of the Modbus data map to read out the current values of the device parameters defined in the scan list.

Master access to data area	Via register addresses 5051-5081

Data area			
Device parameter value	**Modbus RS485 register**	**Data type***	**Access****
Value of scan list register 0	5051	Integer/float	Read/write
Value of scan list register 1	5053	Integer/float	Read/write
Value of scan list register ...	...	...	...
Value of scan list register 15	5081	Integer/float	Read/write

***** Data type depends on the device parameters entered in the scan list.
****** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.

9 Commissioning

9.1 Function check

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

- "Post-installation check" checklist (→ 21)
- "Post-connection check" checklist (→ 27)

9.2 Switching on the measuring device

If the post-installation checks have been performed successfully, switch on the supply voltage. The device is now operational.

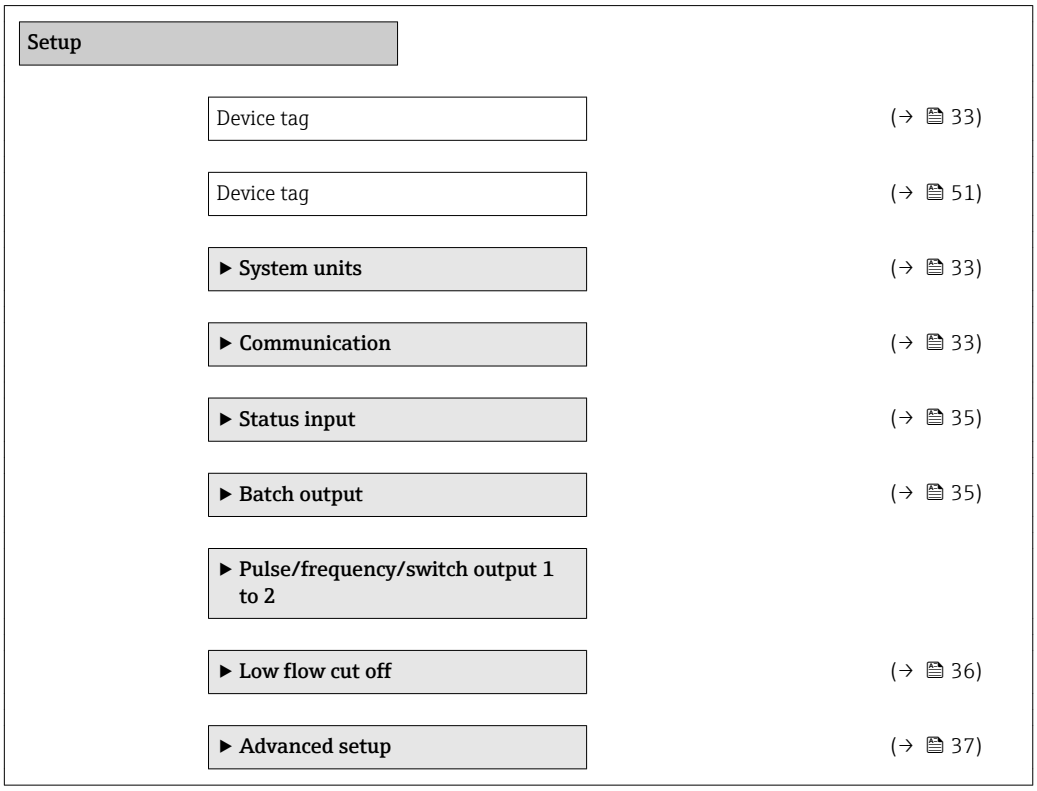
The measuring device performs a number of post switch-on self-tests. Measuring mode commences as soon as startup completes.

If startup fails, an error message to this effect is displayed in the DeviceCare or FieldCare operating program, depending on the cause.

9.3 Configuring the measuring device

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

Navigation
"Setup" menu



9.3.1 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.

The number of characters displayed depends on the characters used.

Navigation
"Setup" menu → Device tag

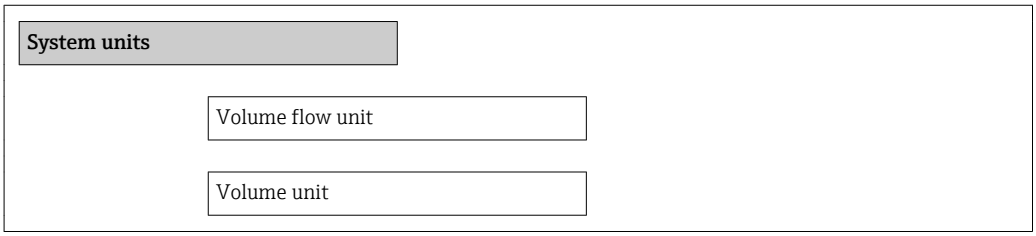
Parameter overview with brief description

Parameter	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. @, %, /).	Dosimag

9.3.2 Setting the system units

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

Navigation
"Setup" menu → System units



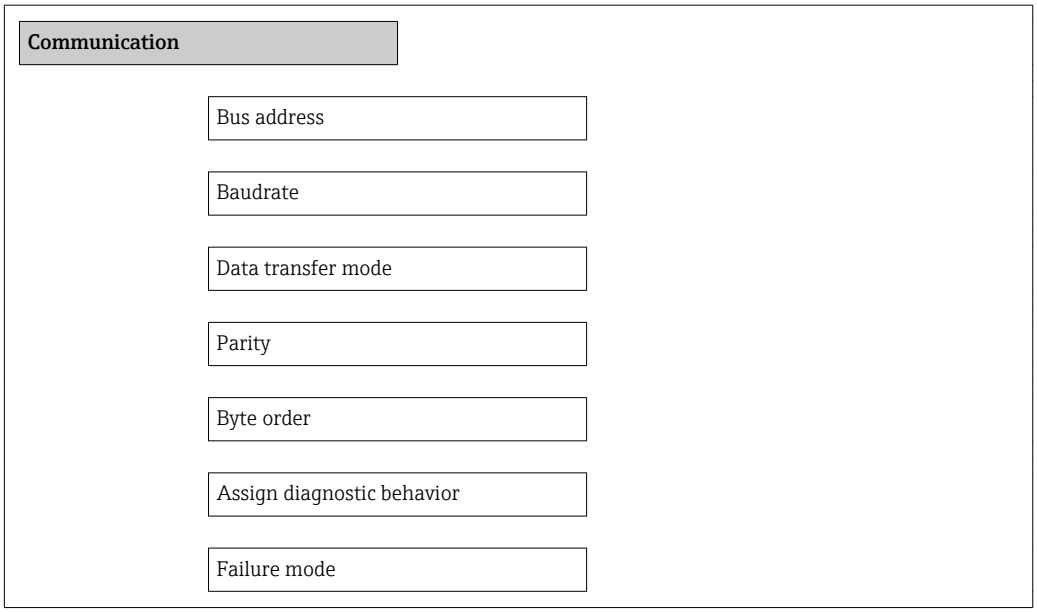
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ 138 = l/h ▪ 16 = gal/min (us)
Volume unit	Select volume unit. **Result** The selected unit is taken from: **Volume flow unit** parameter	Unit choose list	Country-specific: ▪ 41 = l ▪ 40 = gal (us)

9.3.3 Configuring the communication interface (option 4 and 5)

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



Parameter overview with brief description

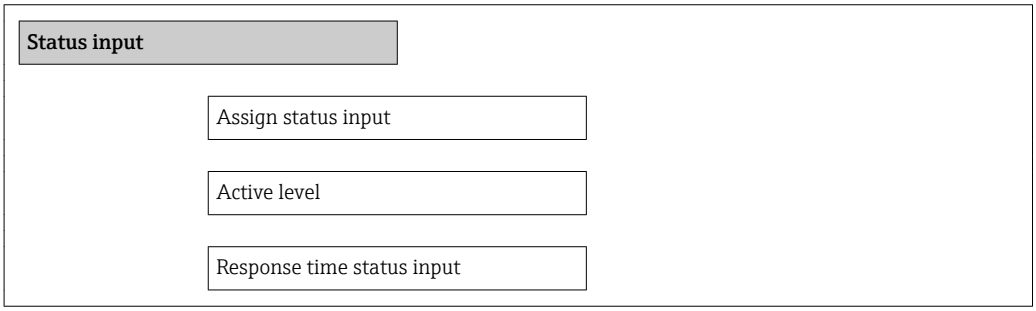
Parameter	Description	User entry / Selection	Factory setting
Bus address	Enter device address.	1 to 247	247
Baudrate	Define data transfer speed.	▪ 0 = 1200 BAUD ▪ 1 = 2400 BAUD ▪ 2 = 4800 BAUD ▪ 3 = 9600 BAUD ▪ 4 = 19200 BAUD ▪ 5 = 38400 BAUD ▪ 6 = 57600 BAUD ▪ 7 = 115200 BAUD	4 = 19200 BAUD
Data transfer mode	Select data transfer mode.	▪ ASCII Transmission of data in the form of readable ASCII characters. Error protection via LRC. ▪ RTU Transmission of data in binary form. Error protection via CRC16.	0 = RTU
Parity	Select parity bits.	ASCII picklist ▪ 0 = even ▪ 1 = odd RTU picklist ▪ 0 = even ▪ 1 = odd ▪ 2 = no parity bit/1 stop bit ▪ 3 = no parity bit/2 stop bits	0 = Even
Byte order	Select byte transmission sequence.	▪ 0 = 0-1-2-3 ▪ 1 = 3-2-1-0 ▪ 3 = 1-0-3-2 ▪ 2 = 2-3-0-1	3 = 1-0-3-2

Parameter	Description	User entry / Selection	Factory setting
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	▪ 0 = Off ▪ 3 = Alarm or warning ▪ 1 = Warning ▪ 2 = Alarm	2 = Alarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. This parameter operates in accordance with the option selected in the **Assign diagnostic behavior** parameter. NaN: not a number	▪ 0 = NaN value ▪ 1 = Last valid value	0 = NaN value

9.3.4 Configuring the status input (option 4 and 5)

The **Status input** submenu guides you systematically through all the parameters that have to be set for configuring the input.

Navigation
"Setup" menu → Status input



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Assign status input	Select the function for the status input.	▪ 0 = Off ▪ 6 = Start batch ▪ 7 = Start & stop batch ▪ 3 = Reset totalizer 1 ▪ 4 = Reset totalizer 2 ▪ 5 = Reset totalizer 3 ▪ 2 = Reset all totalizers ▪ 1 = Flow override	0 = Off
Active level	Specify the input signal level at which the assigned function is triggered.	▪ 10 = High ▪ 9 = Low	10 = High
Response time status input	Specify the minimum amount of time the input signal level must be present before the selected function is triggered.	10 to 200 ms	50 ms

9.3.5 Batch output (option 4 and 5)

The **"Batch output" submenu** contains all the parameters that must be configured for the configuration of the batch output.

Navigation
"Setup" menu → Batch output → Batch profile

Parameter overview with brief description

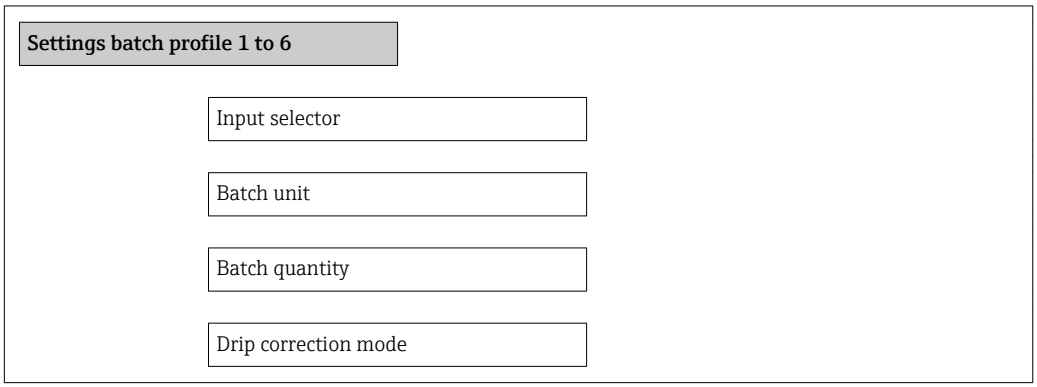
Parameter	Description	Selection	Factory setting
Batch profile	Select suitable profile for fluid configured by customer.	▪ 0 = Profile 1 ▪ 1 = Profile 2 ▪ 2 = Profile 3 ▪ 3 = Profile 4 ▪ 4 = Profile 5 ▪ 5 = Profile 6	0 = Profile 1

Batch profile settings

The **"Settings batch profile 1 to 6" submenu** contains all the parameters that must be configured for the configuration of the batch profiles.

Navigation

"Setup" menu → Batch output → Settings batch profile 1 to 6



Parameter overview with brief description

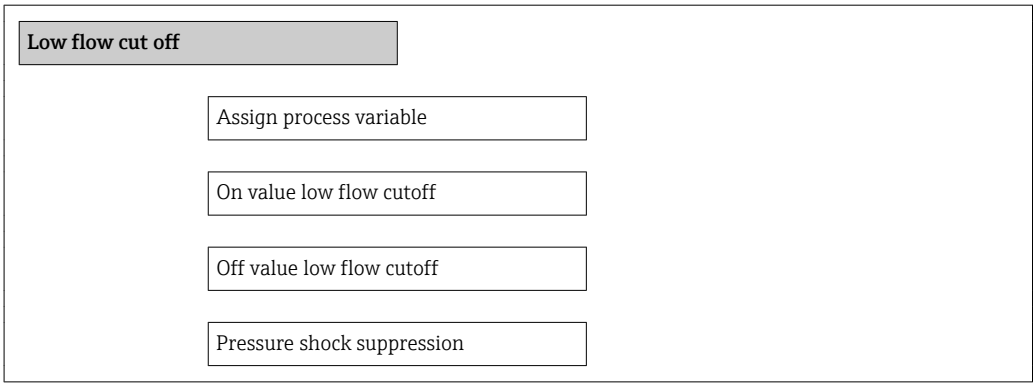
Parameter	Description	Selection / User entry	Factory setting
Input selector	Select a process variable for batch profile.	▪ 0 = Off ▪ 1 = Volume flow	0 = Off
Batch unit	Select unit for process variable of the batch profile.	Unit choose list	4 = l
Batch quantity	Enter a quantity of selected process variable for batch profile.	Signed floating-point number	0 l
Drip correction mode	Select a drip correction.	▪ 0 = Off ▪ 1 = Fixed time ▪ 2 = Fixed time or low flow cut off	0 = Off

9.3.6 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



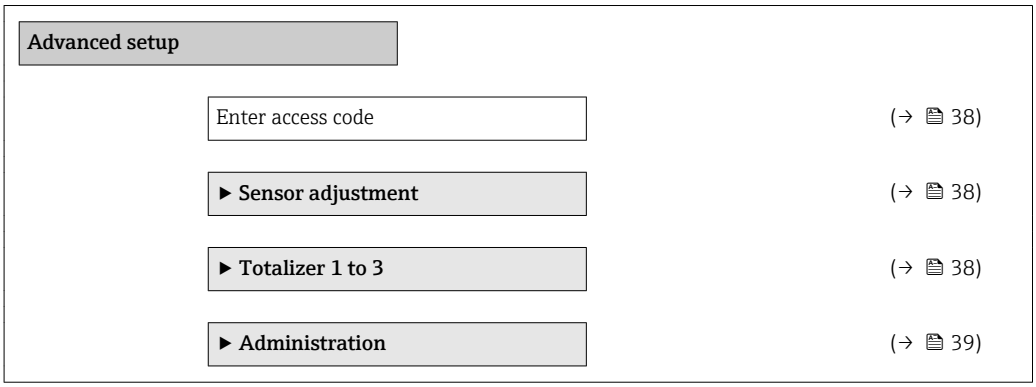
Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Assign process variable	Select process variable for low flow cut off.	▪ 0 = Off ▪ 1 = Volume flow	1 = Volume flow
On value low flow cutoff	Enter on value for low flow cut off.	Signed floating-point number	0 l/h
Off value low flow cutoff	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

9.4 Advanced settings

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

Navigation
"Setup" menu → Advanced setup



9.4.1 Enter access code

With the **Enter access code** parameter it is possible to disable parameter write protection by entering the user-specific access code.

Navigation
"Setup" menu → Advanced setup

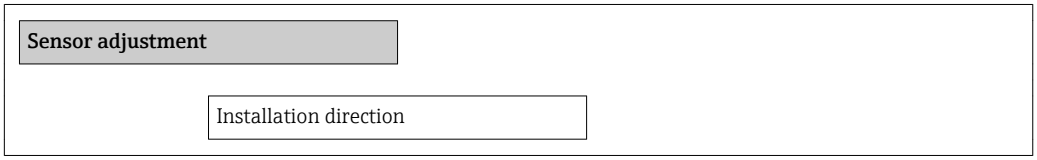
Parameter overview with brief description

Parameter	Description	User entry	Factory setting
Enter access code	Enter access code to disable write protection of parameters.	0 to 9 999	0

9.4.2 Sensor adjustment

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

Navigation
"Setup" menu → Advanced setup → Sensor adjustment



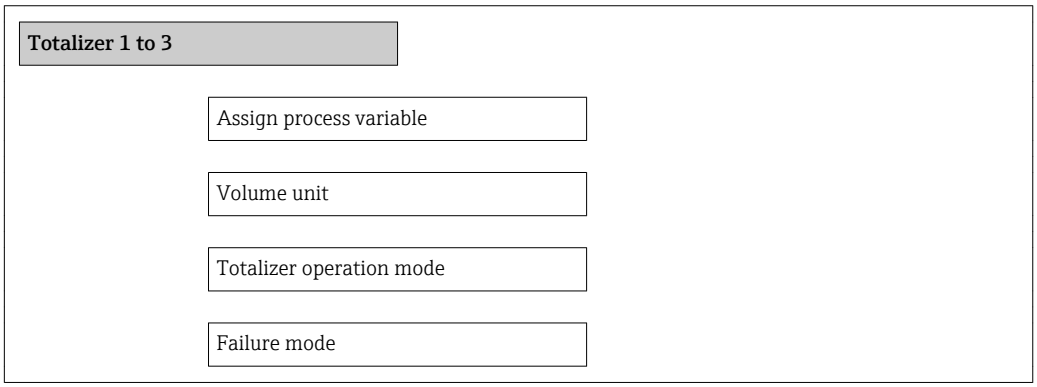
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ 0 = Flow in arrow direction ▪ 1 = Flow against arrow direction	0 = Flow in arrow direction

9.4.3 Configuring the totalizer

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

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



Parameter overview with brief description

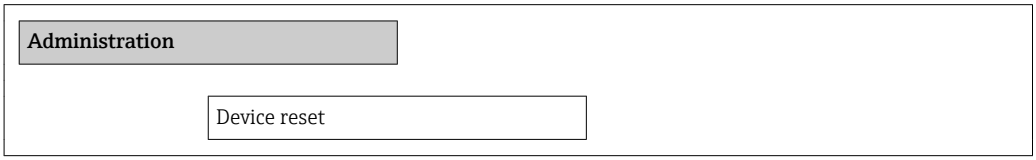
Parameter	Description	Selection	Factory setting
Assign process variable	Select process variable for totalizer.	▪ 0 = Off ▪ 1 = Volume flow	1 = Volume flow
Volume unit	Select volume unit.	Unit choose list	2 = m^3

Parameter	Description	Selection	Factory setting
Totalizer operation mode	Select totalizer calculation mode.	▪ 0 = Net flow total ▪ 1 = Forward flow total ▪ 2 = Reverse flow total	0 = Net flow total
Failure mode	Define totalizer behavior in alarm condition.	▪ 0 = Stop ▪ 1 = Actual value ▪ 2 = Last valid value	0 = Stop

9.4.4 Resetting the measuring device

In the **"Administration" submenu** it is possible to reset the device.

Navigation
"Expert" menu → System → Administration



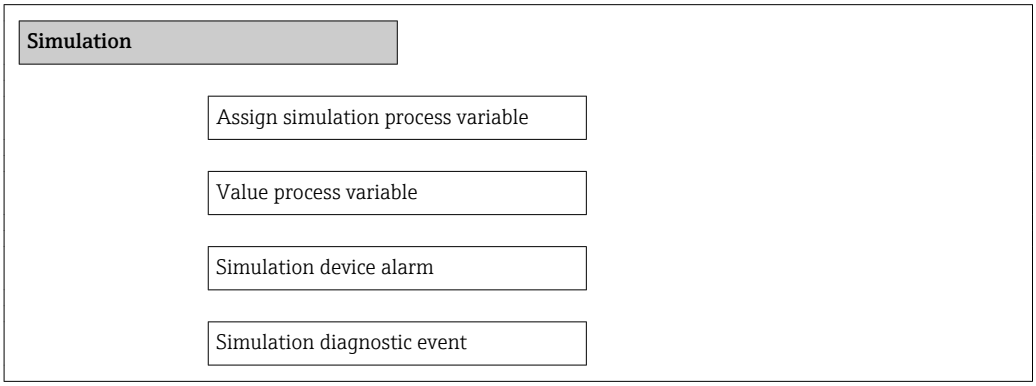
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Restart or reset device manually.	▪ 0 = Cancel ▪ 2 = To delivery settings ▪ 1 = Restart device	0 = Cancel

9.5 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



Parameter overview with brief description

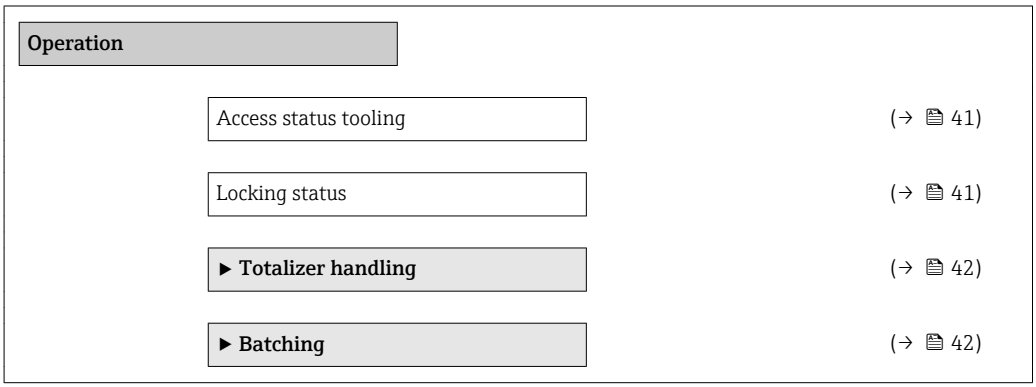
Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ 0 = Off ▪ 1 = Volume flow	0 = Off
Value process variable	A process variable is selected in the **Assign simulation process 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.	▪ 0 = Off ▪ 1 = On	0 = Off
Simulation diagnostic event	–	Enter service ID of diagnostic event to simulate this event.	Positive integer	65 533

10 Operation

10.1 Operation

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

Navigation
"Operation" menu



10.1.1 Operating software access authorization

The following access authorization can be configured with the **Access status tooling** parameter.

Navigation
"Operation" menu

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Access status tooling	Shows the access authorization to the parameters via the operating tool.	▪ 0 = Operator ▪ 1 = Maintenance ▪ 2 = Service ▪ 3 = Production ▪ 4 = Development	1 = Maintenance

10.1.2 Reading the device locking status

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

Navigation
"Operation" menu

Parameter overview with brief description

Parameter	Description	User interface
Locking status	Indicates the write protection with the highest priority that is currently active.	▪ 256 = Hardware locked ▪ 512 = Temporarily locked

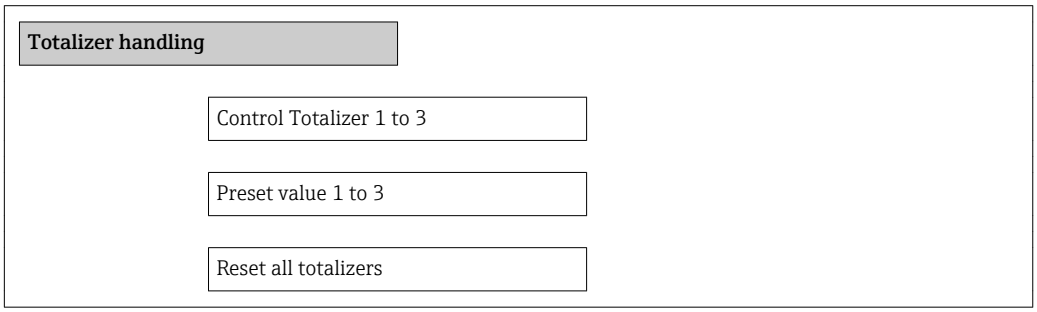
10.2 Totalizer operation

The **Totalizer handling** submenu contains all the parameters that are needed for the totalizer.

10.2.1 Control totalizer

The **Totalizer handling** submenu contains all the parameters that are needed for totalizer control.

Navigation
"Operation" menu → Totalizer handling



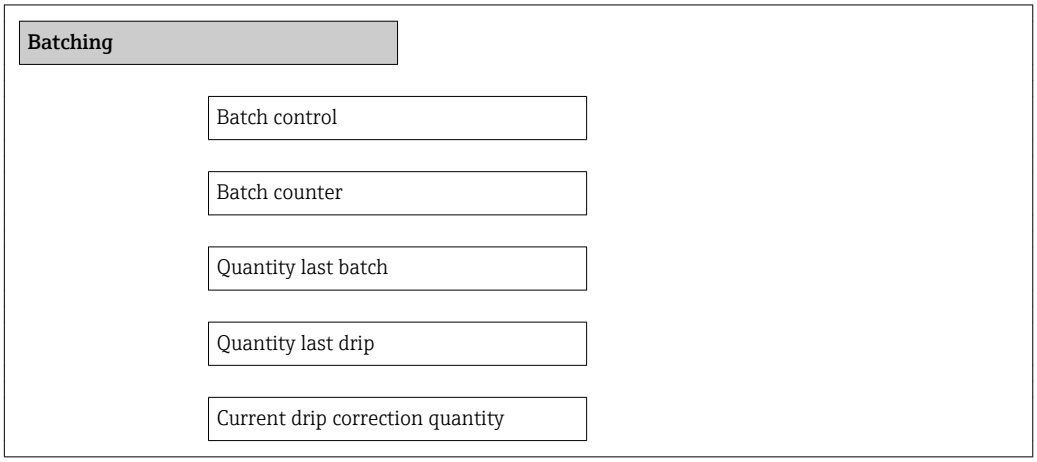
Parameter overview with brief description

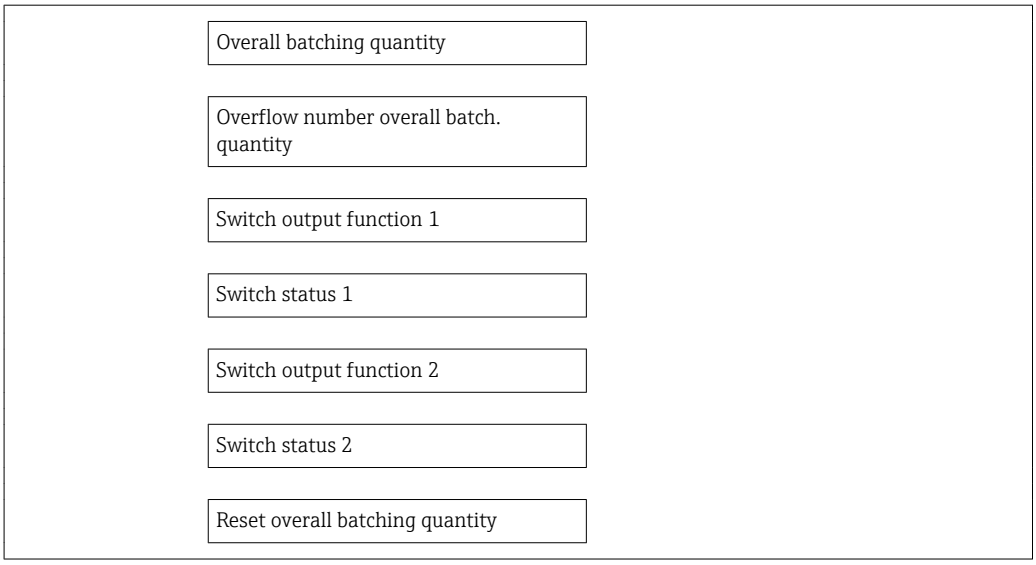
Parameter	Description	Selection / User entry	Factory setting
Control Totalizer 1 to 3	Control totalizer value.	▪ 0 = Totalize ▪ 3 = Reset + hold ▪ 2 = Preset + hold ▪ 1 = Reset + totalize ▪ 4 = Preset + totalize	0 = Totalize
Preset value 1 to 3	Specify start value for totalizer.	Signed floating-point number	0 m^3
Reset all totalizers	Reset all totalizers to 0 and start.	▪ 0 = Cancel ▪ 1 = Reset + totalize	0 = Cancel

10.2.2 Batching control

The **Batching** submenu contains all the parameters that are needed for batching control.

Navigation
"Operation" menu → Batching





Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Batch control	Switch the batch on and off.	▪ 6 = Start ▪ 0 = Stop	0 = Stop
Batch counter	Shows number of passed batch procedures.	Positive integer	0
Quantity last batch	Shows total quantity of last batch.	Signed floating-point number	0 l
Quantity last drip	Shows drip quantity of last batch.	Signed floating-point number	0 l
Current drip correction quantity	Shows the drip correction quantity of current batch.	Signed floating-point number	0 l
Overall batching quantity	Shows the total quantity of all passed batch procedures of current profile.	Signed floating-point number	0 l
Overflow number overall batch. quantity	Shows how often an overflow of the overall batching quantity has occured.	−32 000.0 to 32 000.0	0
Switch output function 1		▪ 2 = Close ▪ 1 = Open ▪ 0 = Batching	1 = Open
Switch status 1	Select status of switch output.	▪ 2 = Closed ▪ 1 = Open	1 = Open
Reset overall batching quantity	Reset the total quantity of all passed batch procedures to 0.	▪ 3 = Reset ▪ 0 = Cancel	0 = Cancel

11 Diagnostics and troubleshooting

11.1 General troubleshooting

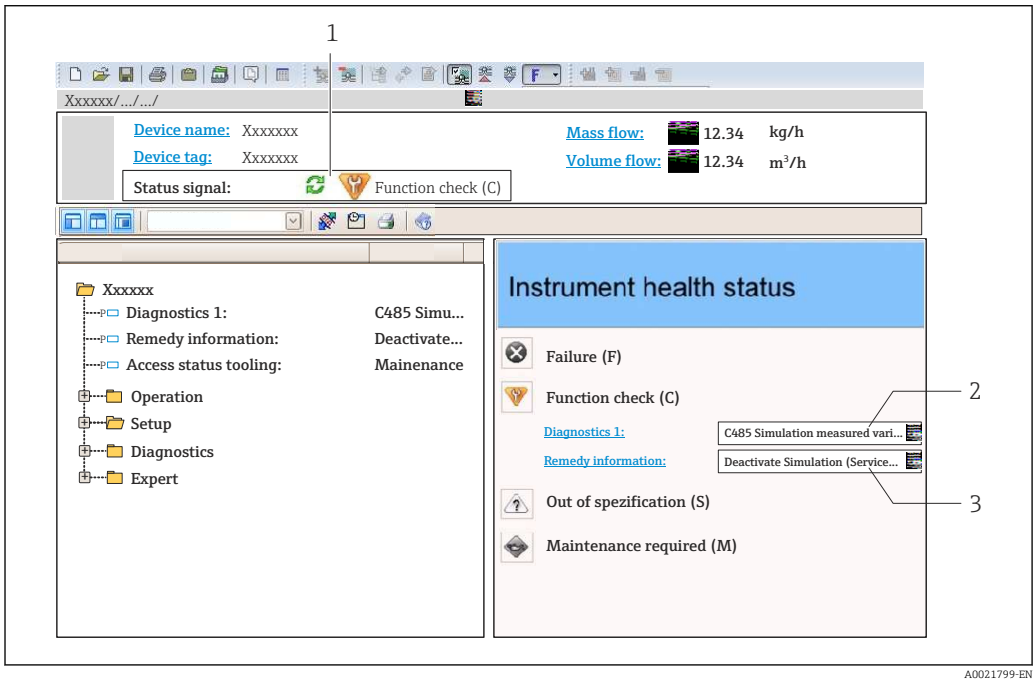
11.1.1 For access

Problem	Possible causes	Remedy
No write access to parameters	Write protection enabled	Check the locking status(→ 🖹 41).
No connection via Modbus RS485	Modbus RS485 bus cable connected incorrectly	Check the terminal assignment (→ 🖹 23).
No connection via Modbus RS485	Connector connected incorrectly	Check the pin assignment of the device plug(→ 🖹 23).
No connection via Modbus RS485	Modbus RS485 cable incorrectly terminated	Check terminating resistor .
No connection via Modbus RS485	Incorrect settings for the communication interface	Check the Modbus RS485 configuration (→ 🖹 33).
No connection via service interface	Incorrect configuration of USB interface on PC or driver not installed correctly.	Observe the documentation for the Commubox. FXA291: Document "Technical Information" TI00405C

11.2 Diagnostics information in DeviceCare and FieldCare

11.2.1 Diagnostic options

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



1 *Status area with status signal*
2 *Diagnostic information*
3 *Remedial measures with Service ID*

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
- Via parameters
- Via submenu (→ 48)

11.2.2 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.

11.3 Adapting the diagnostic information

11.3.1 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 diagnostic information in the **Diagnostic behavior** submenu .

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

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

Options	Description
Alarm	Measurement is interrupted. Measured value output via Modbus RS485 and totalizers assume the defined alarm condition. A diagnostic message is generated.
Warning	Measurement is resumed. Measured value output via Modbus RS485 and totalizers are not affected. A diagnostics 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.

11.4 Overview of diagnostic information

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

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Adapt the diagnostic information (→ 45)

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
004	Sensor	1. Change sensor 2. Contact service	S	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
062	Sensor connection	1.Check sensor connections 2.Contact service	F	Alarm
082	Data storage	1. Check module connections 2. Contact service	F	Alarm
083	Memory content	1. Restart device 2. Contact service	F	Alarm
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
281	Electronic initialization	Firmware update active, please wait!	F	Alarm
311	Electronic failure	1. Reset device 2. Contact service	F	Alarm
322	Electronic drift	1.Perform verification manually 2.Change electronic	S	Warning
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
411	Up-/download active	Up-/download active, please wait	C	Warning
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
442	Frequency output 1 to 2	1. Check process 2. Check frequency output settings	S	Warning [1)]
443	Pulse output 1 to 2	1. Check process 2. Check pulse output settings	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Simulation failure mode	Deactivate simulation	C	Alarm
485	Simulation measured variable	Deactivate simulation	C	Warning
500	Electrode difference voltage too high	1. Check process cond. 2. Increase system pressure	F	Alarm
Diagnostic of process				
832	Electronic temperature too high	Reduce ambient temperature	S	Warning [1)]
833	Electronic temperature too low	Increase ambient temperature	S	Warning [1)]
834	Process temperature too high	Reduce process temperature	S	Warning [1)]
835	Process temperature too low	Increase process temperature	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
937	EMC interference	Change main electronic module	S	Warning [1]
938	EMC interference	1. Check ambient conditions regarding EMC influence 2. Change main electronic module	F	Alarm
991	Batch time exceeded	Check process conditions	F	Warning [1]
991	Maximum flow rate exceeded	Check process conditions	F	Warning [1]

1) Diagnostic status is changeable.

11.4.1 Process errors without message

Symptoms	Remedial measures
Measured-value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	▪ Check whether there are gas bubbles in the fluid. ▪ Activate the "LOW FLOW CUTOFF" function, i.e. enter or increase the value for the switching point.
The fault cannot be rectified or some other fault not described above has occurred. Contact the E+H service organization responsible.	The following options are available for tackling problems of this nature: ▪ Request the services of an Endress+Hauser service technician. Be ready with the following information when requesting the services of a service technician from customer service: – Brief description of the fault – Nameplate specifications (→ 1, 11): order code and serial number ▪ Returning devices to Endress+Hauser Make sure to comply with the procedures on how to return a measuring device. (→ 53)

11.4.2 Response of outputs to errors

The failsafe mode of the pulse, frequency and status output can be set differently via the DeviceCare or FieldCare operating program.

Error response mode of the pulse and status output	
Output	**Failsafe mode**
Pulse output	The failsafe mode of the pulse output can be set differently using the DeviceCare or FieldCare operating program: FALLBACK VALUE Signal output → No pulses ACTUAL VALUE Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement Notice messages do not have any effect on the pulse output! See information on.
Frequency output	The failsafe mode of the frequency output can be set differently using the DeviceCare or FieldCare operating program.
Status output	The assignment of the status output can be defined via the DeviceCare or FieldCare operating program. In the event of a fault, notice message or power supply failure → the status output is not conductive

11.4.3 Software history

Date	Software version	Changes to software	Operating Instructions
01.08.2014	3.00.zz	▪ Original software ▪ Compatible with DeviceCare and FieldCare	13.14 Batch versions: 01.14
01.05.2006	2.02.00	New functionality: ▪ Automatic pulse width ▪ On-value and off-value status output	71026628/05.06
15.07.2005	2.01.00	Additional "symmetry" option for pulse output	50107137/10.05
01.12.2003	1.00.00	▪ Original software ▪ Compatible with Fieldtool	–

11.5 Pending diagnostic events

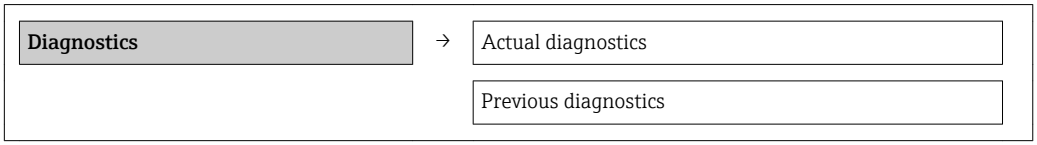
The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
Via DeviceCare and FieldCare operating tool (→ 45)

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu(→ 48)

Navigation
"Diagnostics" menu

Structure of the submenu



Parameter overview with brief description

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

11.6 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 "FieldCare" operating tool (→ 45)

11.7 Event logbook

11.7.1 Event history

To call up the measures to rectify a diagnostic event:
Via DeviceCare and FieldCare operating tool (→ 45)

For filtering the displayed event messages (→ 49)

11.7.2 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)

11.7.3 Overview of information events

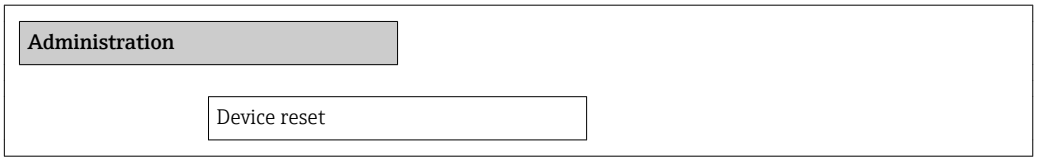
Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1151	History reset

11.8 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.

Navigation
"Setup" menu → Advanced setup → Administration → Device reset



Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Restart or reset device manually.	▪ 0 = Cancel ▪ 2 = To delivery settings ▪ 1 = Restart device	0 = Cancel

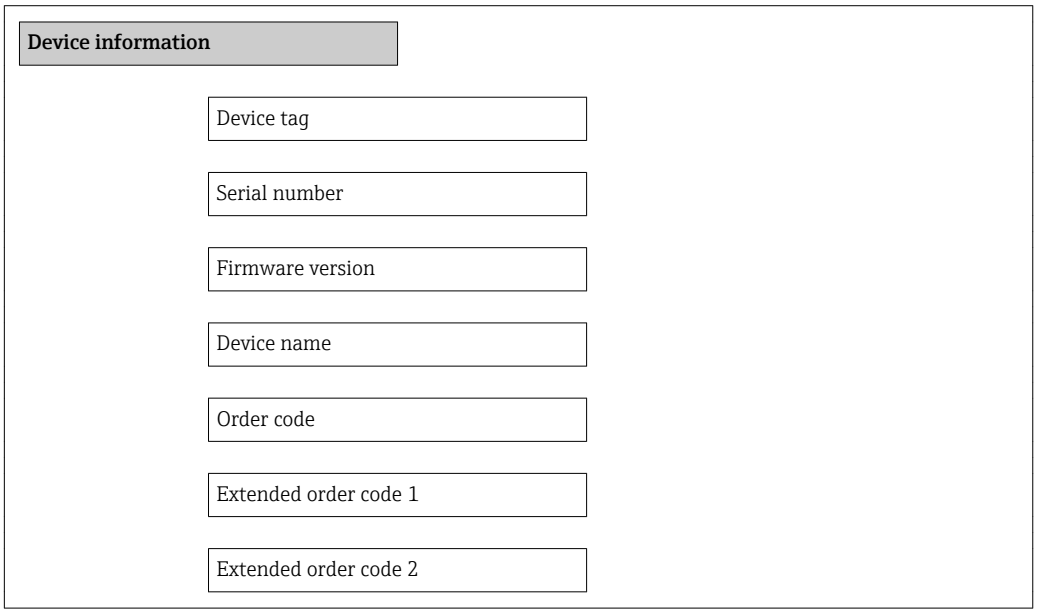
11.8.1 Function scope of "Device reset" parameter

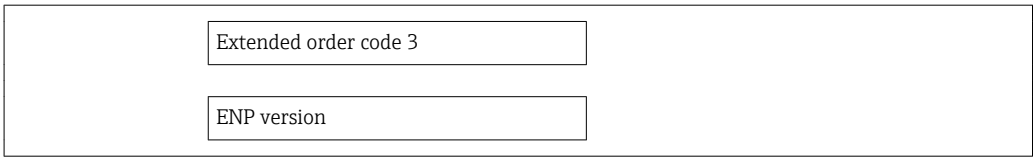
Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting. This option is not visible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

11.9 Device information

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

Navigation
"Diagnostics" menu → Device information





Parameter overview with brief description

Parameter	Description	User entry / User interface	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)	Dosimag
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	03.00
Device name	Displays the name of the transmitter.	Character string composed of letters, numbers and certain punctuation marks.	Dosimag
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

11.10 Firmware history

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:
  - Text search: Manufacturer's information
  - Search range: documentation

12 Maintenance

12.1 Maintenance tasks

No special maintenance work is required.

12.1.1 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.

12.1.2 Interior cleaning

Observe the following points for CIP and SIP cleaning:
- Use only cleaning agents to which the process-wetted materials are adequately resistant.
- Observe the maximum permitted medium temperature for the measuring device .

12.1.3 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) (→ 55)

12.2 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.

12.3 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.

13 Repair

13.1 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.

13.2 Spare parts

Measuring device serial number:
Can be read out via the **Serial number** parameter in the **Device information** submenu .

13.3 Endress+Hauser services

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

13.4 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

13.5 Disposal

13.5.1 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.

13.5.2 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.

14 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.

14.1 Device-specific accessories

14.1.1 For the sensor

Accessories	Description
Seal set	For regular replacement of the seals on the process connections.
Housing seal	To seal the transmitter
Mounting kit	Consists of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals

14.2 Communication-specific accessories

Accessories	Description
Adapter connection	Adapter connections for installing on other electrical connections
RSE8 adapter	RSE8 connection jack, 8-pin adapter (RSE8), 24 V DC, pulse, status
RSE5 adapter	RSE8 connection jack, 5-pin adapter (RSE5), 24 V DC, pulse, status
RSE4 adapter	RSE8 connection jack, 4-pin adapter (RSE4), 24 V DC, pulse
FXA 291	Service interface connecting cable from the device to the PC for using the “DeviceCare” operating software
RSE8 supply cable	RKWTN8-56/5 P92 cable

14.3 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.
DeviceCare and 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
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

15 Technical data

15.1 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.

15.2 Function and system design

Measuring principle

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

Measuring system

For information on the structure of the device, see the Technical Information

15.3 Input

Measured variable

Direct measured variables

Volume flow (proportional to induced voltage)

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

Flow characteristic values in SI units

Nominal diameter	Recommended flow	Factory settings	
	Maximum full scale value	Pulse value	Low flow cut off (v ~ 0.04 m/s)
[mm]	[l/s]	[ml]	[ml/s]
4	0.14	0.005	0.5
8	0.5	0.02	2
15K [1)]	1.2	0.1	7
15	1.66	0.1	7

1) Conical version (corresponds to DN 12)

Flow characteristic values in US units

Nominal diameter	Recommended flow	Factory settings	
	Maximum full scale value	Pulse value	Low flow cut off (v ~ 0.13 ft/s)
[in]	[gal/s]	[oz fl]	[oz fl/s]
5/32	0.035	0.0002	0.02
5/16	0.13	0.001	0.08

Nominal diameter [in]	Recommended flow Maximum full scale value [gal/s]	Factory settings Pulse value [oz fl]	Factory settings Low flow cut off (v ~ 0.13 ft/s) [oz fl/s]
½K [1)]	0.32	0.004	0.25
½	0.44	0.004	0.25

1) Conical version (corresponds to DN 12)

Recommended measuring range

"Flow limit" section (→ 64)

Operable flow range

Over 1000 : 1

Status input

Assignable functions	▪ Off ▪ Start batch ▪ Start & stop batch ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override
Response time	Range of adjustment: 10 to 200 ms
Active level	▪ High ▪ Low
Value status input	Displays the current input signal level of the status input.

15.4 Output

Output signal

Switch output (option 4 and 5)

Switch output	
Assignable functions	▪ Open ▪ Closed ▪ Batching
Switch status	▪ Open ▪ Closed

Batch output (option 4 and 5)

Batch control	Functions: ▪ Start ▪ Stop
Quantity last batch	Total measured quantity including the drip quantity of the last batch. Unit: selected unit
Time last batch	Duration of the last batch up to the end of drip quantity measurement. Unit: s
Close time last batch	Closing duration for the last batch from the switch-off time up to the end of drip quantity measurement. Unit: ms

Quantity last drip	Drip quantity of the last batch Unit: selected unit
Current drip correction quantity	Drip correction quantity for the next batch Unit: selected unit
Overall batching quantity	Total of all measured batching processes Unit: selected unit
Batch counter	Number of batching processes Unit: number
Reset overall batching quantity	Functions: ▪ Resetting ▪ Cancel
Batch profile	Functions: Profile 1 to 6
Assignable measured variables	Functions ▪ Off ▪ Volume flow
Batch quantity	Set the batch quantity. Input range: 0 to X Unit: selected unit
Fixed compensation quantity	Set the fixed compensation quantity. Input range: X to X Unit: selected unit
Batch unit	Functions: ▪ cm^3 ▪ dm^3 ▪ m^3 ▪ ml ▪ l ▪ hl ▪ ml ▪ af ▪ ft^3 ▪ fl oz (us) ▪ gal (us) ▪ Mgal ▪ bbl (us) ▪ bbl (imp) ▪ gal (imp) ▪ Mgal (imp) ▪ g ▪ kg ▪ lb ▪ User mass ▪ User vol. ▪ kgal (us)
Drip correction mode	Functions: ▪ Off ▪ Low flow cutoff or fixed time ▪ Fixed time
Measuring time drip quantity	Input range: 0.01 to 100 s
Filter depth drip median	Functions: ▪ Off ▪ Median 3 ▪ Median 5 ▪ Median 7
Average drip correction quantity	Input range: 1 to 100
Batch levels	Functions: ▪ One-level ▪ Two-level ▪ One-level and blow out

Start level 2	Input range: 0 to 100 %
Stop level 2	Input range: 100 to 0 %
Blow out delay	Input range: 1 to 100 s
Blow out duration	Input range: 1 to 100 s
Maximum batch time	Input range: 1 to 1 000 000 s
Maximum flow rate	Set the maximum flow. Input range: 0 to X Unit: selected unit
Disable time pressure shock suppression	Input range: 0 to 100 s

Modbus RS485 (option 4 and 5)

Physical interface	In accordance with EIA/TIA-485-A standard

Signal on alarm

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

Modbus RS485 (option 4 and 5)

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

Low flow cut off

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

Galvanic isolation

- Option 4: batch output at supply potential.
- Option 5: batch outputs and auxiliary input at supply potential.

Protocol-specific data

Modbus RS485 (option 4 and 5)

Protocol	Modbus Applications Protocol Specification V1.1
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers ▪ 43: Read device identification
Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD

Data transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information

15.5 Power supply

Pin assignment

(→ 22)

Supply voltage

Transmitter and sensor

24 V_{DC} Nominal voltage (20 to 30 V_{DC})

- The power supply may not exceed a maximum short-circuit current of 50 A.
- The measuring device may only be connected to SELV, PELV or CLASS 2 circuits.

Power consumption

Transmitter and sensor

DC: max. 4.5 W (incl. sensor) + 500 mA per batch output

Switch-on current: max. 1 A (< 6 ms)

Electrical connection

(→ 22)

Potential equalization

(→ 27)

In the case of devices for hazardous areas, pay attention to the information in the Ex-specific supplementary documentation.

Cable specification

(→ 27)

15.6 Performance characteristics

Reference operating conditions

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

Installation
- Inlet run > 10x DN
- Outlet run > 5x 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
- ±0.25 % o.r. ± 1 to 4 m/s (3.3 to 13 ft/s) or
- ±0.5 % o.r. ± 1 mm/s (0.04 in/s) or
- ±5 % o.r.

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

Accuracy of outputs

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

Repeatability

o.r. = of reading

DN 15 (200 ml/s), DN 8 (50 ml/s), DN 4 (10 ml/s); 400 µS/cm

Batch time "t_a" [s]	Relative standard deviation in relation to the batched volume [%]
1.5 s < t_a < 3 s	0.4
3 s < t_a < 5 s	0.2
5 s < t_a	0.1

DN 15K (200 ml/s); 400 µS/cm

Batch time "t_a" [s]	Relative standard deviation in relation to the batched volume [%]
1.5 s < t_a < 3 s	0.25
3 s < t_a < 5 s	0.12
5 s < t_a	0.08

15.7 Installation

"Mounting requirements" (→ 15)

15.8 Environment

Ambient temperature range

(→ 17)

Temperature tables

Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

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: IP67, type 4X enclosure

Shock resistance

Acceleration up to 2 g following IEC 60068-2-6

Vibration resistance	Acceleration up to 2 g following IEC 60068-2-6
Interior cleaning	▪ Cleaning in place (CIP) ▪ Sterilization in place (SIP)
Electromagnetic compatibility (EMC)	According to IEC/EN 61326 For details refer to the Declaration of Conformity.

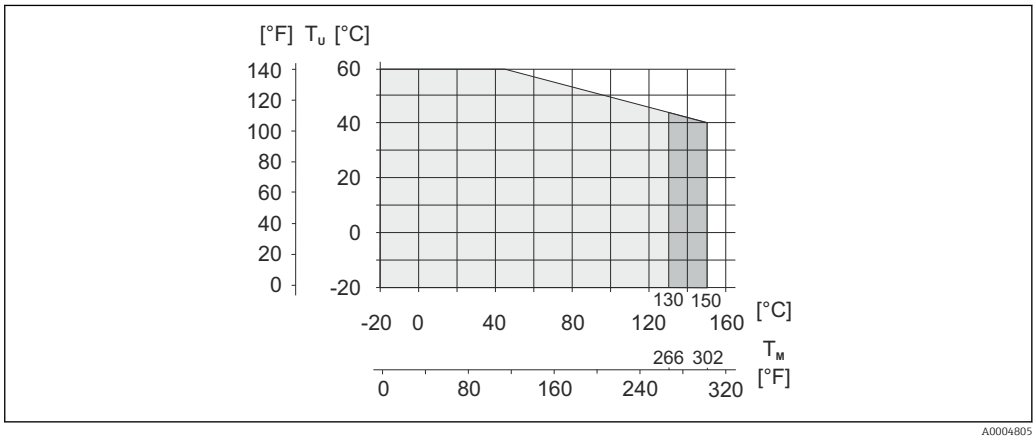
15.9 Process

Medium temperature range

- Sensor:−20 to +130 °C (−4 to +266 °F)
- Cleaning: +150 °C (+302 °F) / 60 min for CIP and SIP processes

Seals:

- EPDM: −20 to +130 °C (−4 to +266 °F) (max. +150 °C (302 °F) for cleaning
- Silicon:−20 to +130 °C (−4 to +266 °F)
- Viton:0 to +150 °C (+32 to +302 °F)



A0004805

T_U Ambient temperature

T_M Medium temperature

Light-gray area: standard fluid temperature range

Dark-gray area: fluid temperature range for cleaning

Conductivity

- ≥ 5 µS/cm for liquids in general
- 10 µS/cm for demineralized water

Pressure-temperature ratings

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

Pressure tightness

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+150 °C (+302 °F)
4 to 15	5/32 to ½	< 1 mbar (0.402 inH_2O) (0)	< 1 mbar (0.402 inH_2O) (0)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. cleaning agent)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. liquids that contain oil and sugar)

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

For an overview of the measuring range full scale values, see the "Measuring range" section

Pressure loss

- For DN 8 (5/16") and DN 15 (½") 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 (→ 18)

System pressure

(→ 18)

Vibrations

(→ 18)

15.10 Mechanical construction

Design, dimensions

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

Weight

Compact version

Weight in SI units

DN [mm]	Weight [kg]
4	2.8
8	2.8
15	2.8

Weight in US units

DN [in]	Weight [lbs]
5/32	6.17
5/16	6.17
½	6.17

Materials

Transmitter housing

Stainless steel 1.4308 (304)

Transmitter and sensor housing

Acid-resistant and alkali-resistant external surface, stainless steel 1.4308 (304)

Measuring tube

Stainless steel 1.4301 (304)

Liner

PFA

Process connections

- Weld-in nipple: 1.4404 (316L)
- Weld-in nipple, aseptic: 1.4404 (316L)
- Tri-Clamp: 1.4404 (316L)

List of all available process connections (→ 65)

Seals

Molded seal (EPDM, silicone, Viton)

Fitted electrodes	▪ Standard: stainless steel 1.4435 (316L) ▪ Optional: Alloy C22, 2.4602 (UNS N06022)
Process connections	With aseptic molded seal: ▪ Weld-in nipple (DIN 11850, ODT / SMS) ▪ Tri-Clamp (L14 AM7) For information on the materials of the process connections (→ 65)

15.11 Operability

Local display	The measuring device does not have a display or display elements.
Remote operation	Operation takes place via Endress+Hauser's DeviceCare and FieldCare configuration and service programs. This can be used to configure functions and read off measured values. In the case of measuring devices with the batching option it is also possible to configure and read measured values via Modbus.

15.12 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 measuring device is 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.

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

ATEX

Currently, the following versions for use in hazardous areas are available:

Ex nA

Category	Type of protection
II3G	Ex nA IIC T5-T1 Gc

cCSAus

Currently, the following versions for use in hazardous areas are available:

NI

Category	Type of protection
Class I Division 2 Groups ABCD	NI (non-incendive version)

Sanitary compatibility

- 3A approval and EHEDG-certified
- Seals → in conformity with FDA

Pressure Equipment Directive

- With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC.
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- CSA-C22.2 No. 142-M1987
  Process Control Equipment
- CAN/CSA-C22.2 No. 1010.1-92
  Safety Requirements for Electrical Equipment for Measuring, Control and Laboratory Use. Pollution degree 2, Installation Category I
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category I

15.13 Accessories

Overview of accessories available for order (→ 55)

15.14 Supplementary documentation

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

Standard documentation

Brief Operating Instructions

Measuring device	Documentation code
Dosimag	KA01175D

Technical Information

Measuring device	Documentation code
Dosimag	TI00066D

Supplementary device-dependent documentation

Safety Instructions

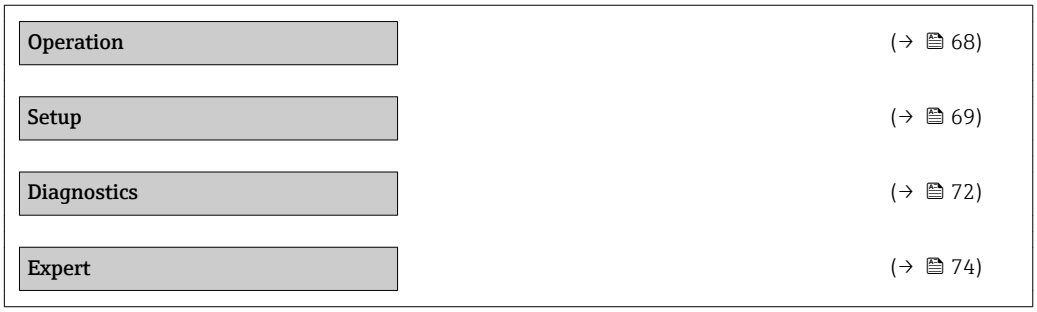
Contents	Documentation code
ATEX Ex nA	XA01332D
cCSAus NI	FES0231

Special Documentation

Contents	Documentation code
Modbus RS485 Register Information	SD01148D

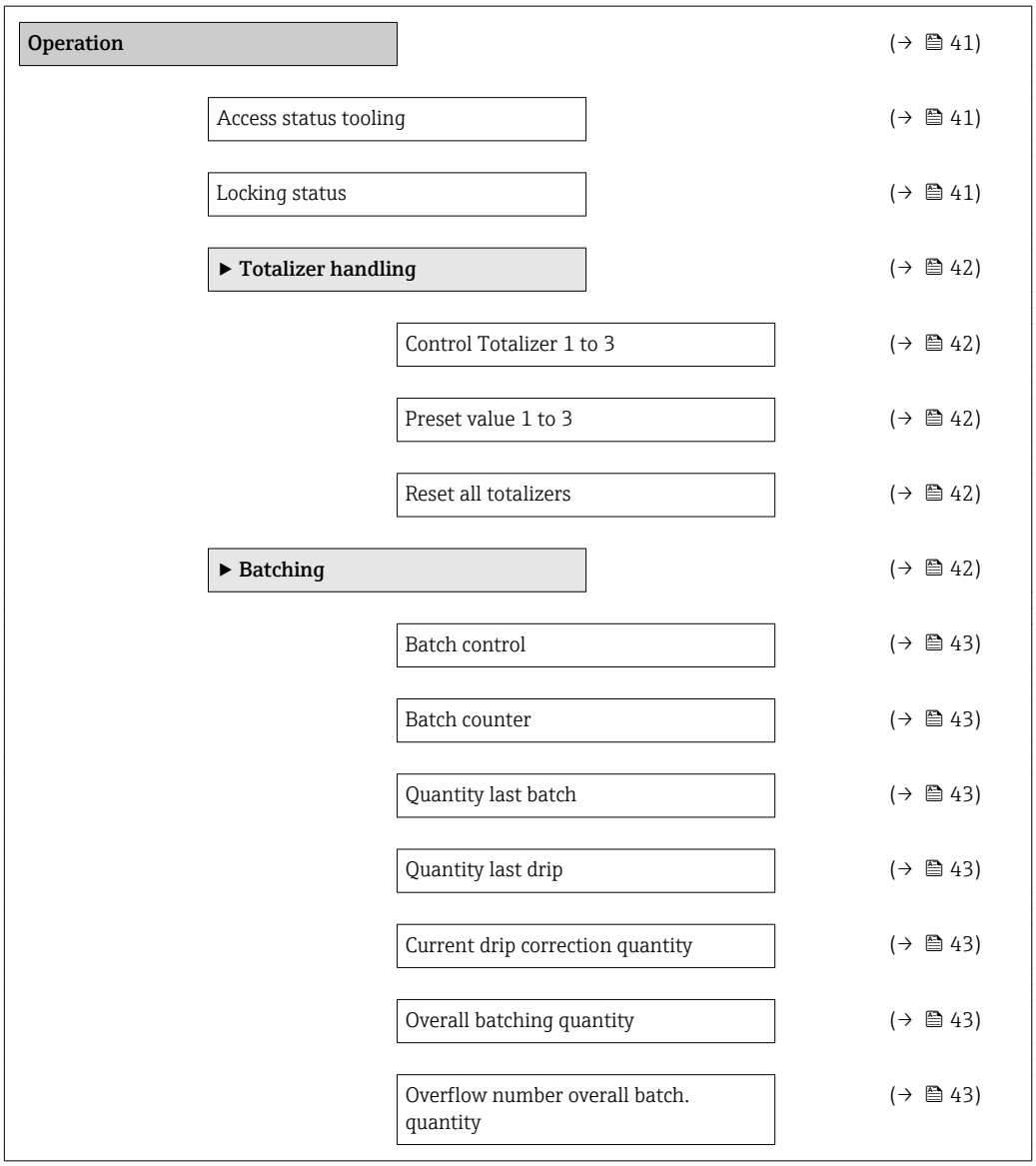
16 Appendix

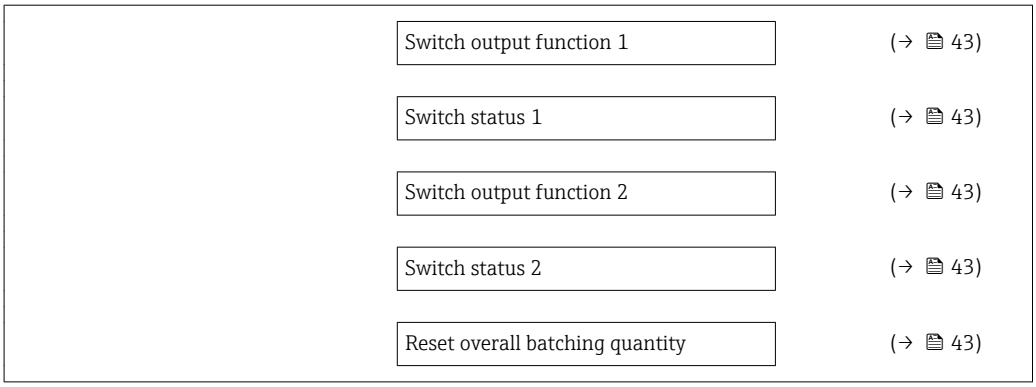
16.1 Overview of the operating menu



16.1.1 "Operation" menu

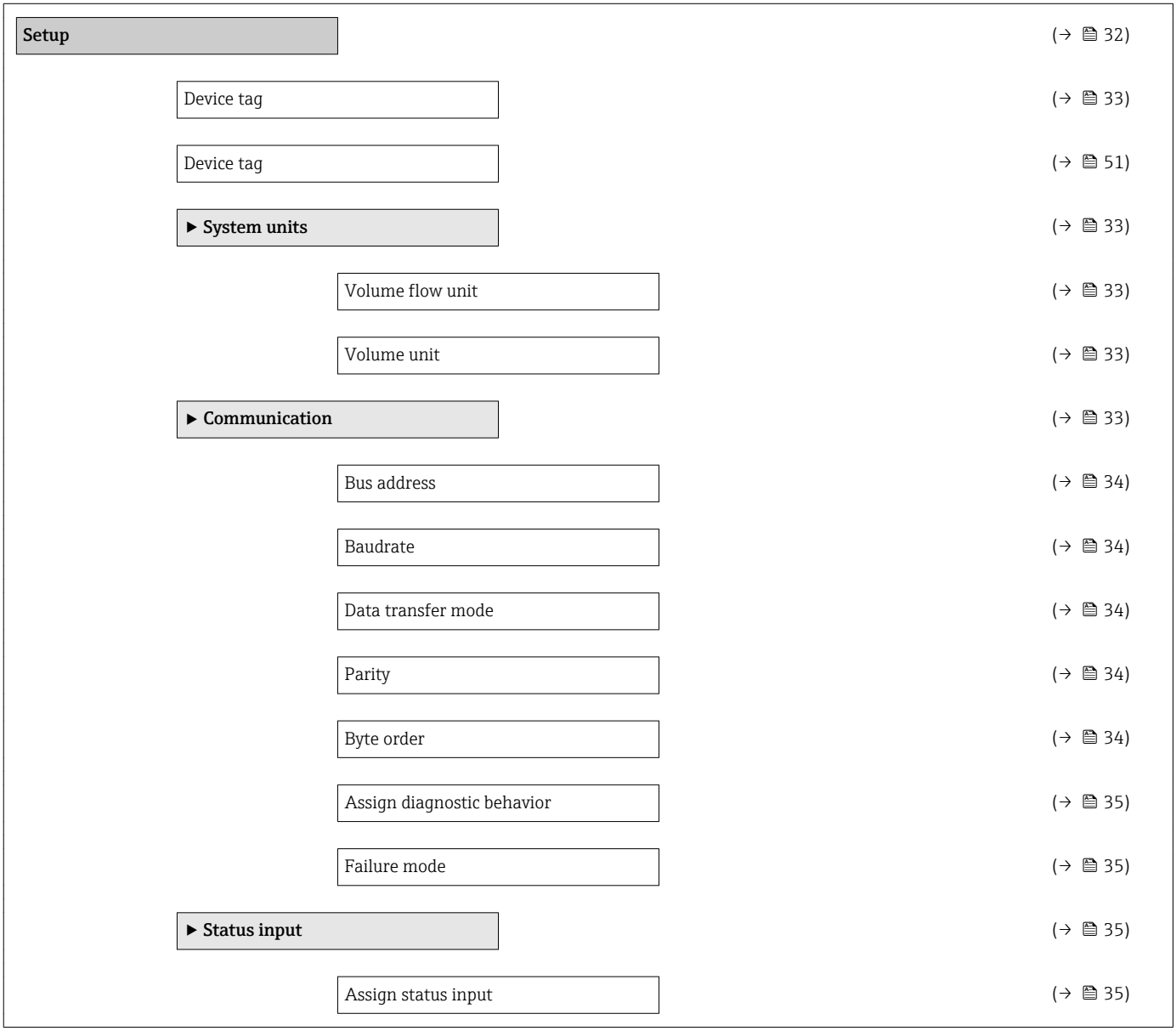
Navigation Operation





16.1.2 "Setup" menu

Navigation Setup



Active level (→ 35)

Response time status input (→ 35)

▶ **Batch output** (→ 35)

Batch profile (→ 36)

▶ **Settings batch profile 1 to 6** (→ 36)

Input selector (→ 36)

Batch unit (→ 36)

Batch quantity (→ 36)

Drip correction mode (→ 36)

▶ **Pulse/frequency/switch output 1 to 2**

Operating mode

Channel 2

Assign pulse output

Assign frequency output

Switch output function

Assign diagnostic behavior

Assign limit

Assign flow direction check

Assign status

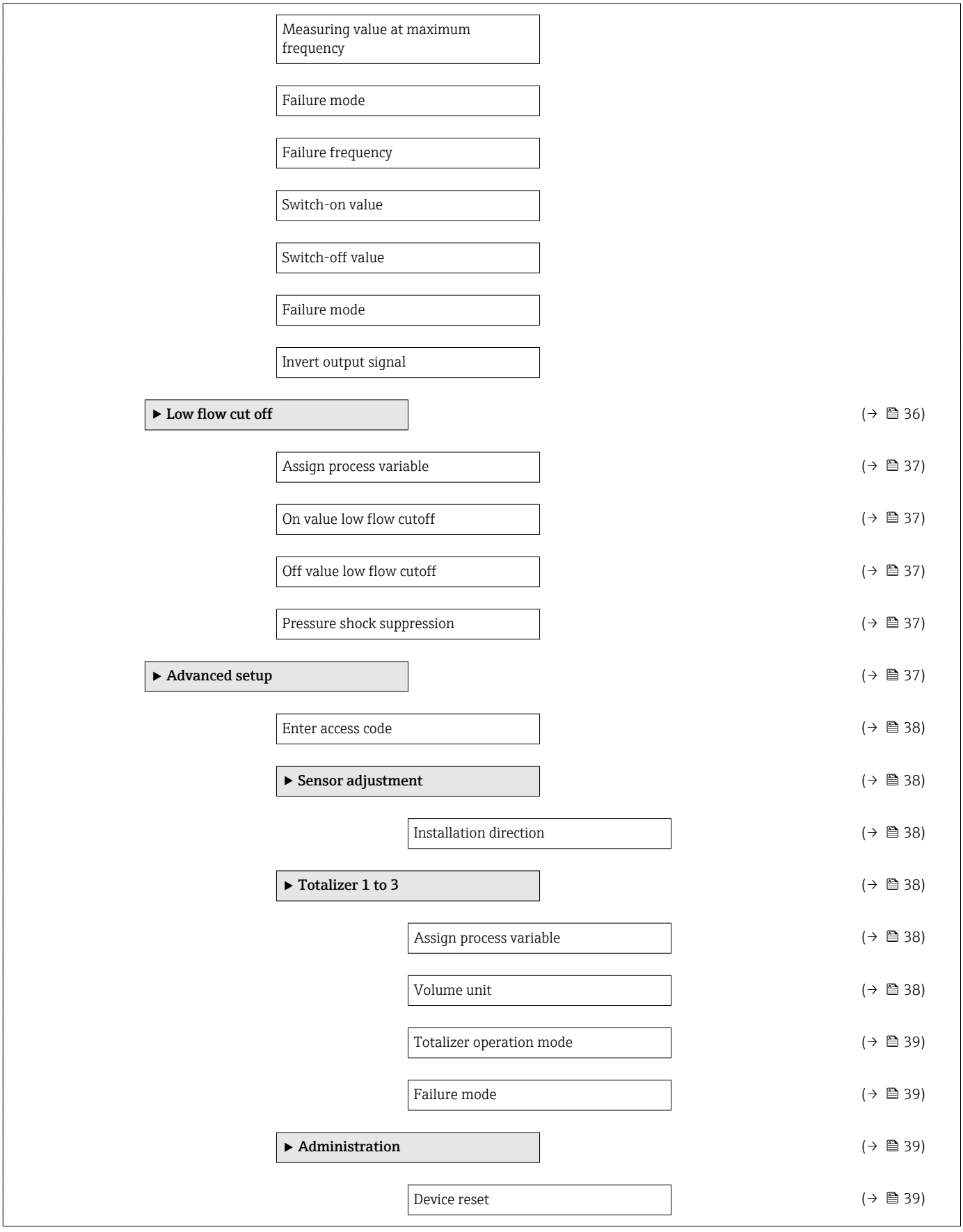
Value per pulse

Pulse width

Failure mode

Minimum frequency value

Maximum frequency value


Measuring value at maximum frequency
Failure mode
Failure frequency
Switch-on value
Switch-off value
Failure mode
Invert output signal
▶ Low flow cut off (→ 36)
Assign process variable (→ 37)
On value low flow cutoff (→ 37)
Off value low flow cutoff (→ 37)
Pressure shock suppression (→ 37)
▶ Advanced setup (→ 37)
Enter access code (→ 38)
▶ Sensor adjustment (→ 38)
Installation direction (→ 38)
▶ Totalizer 1 to 3 (→ 38)
Assign process variable (→ 38)
Volume unit (→ 38)
Totalizer operation mode (→ 39)
Failure mode (→ 39)
▶ Administration (→ 39)
Device reset (→ 39)

16.1.3 "Diagnostics" menu

Navigation Diagnostics

- **Diagnostics** (→ 48)
  - Actual diagnostics (→ 48)
  - Timestamp
  - Previous diagnostics (→ 48)
  - Timestamp
  - Operating time from restart
  - Operating time
  - **▶ Diagnostic list**
    - Diagnostics 1
    - Timestamp
    - Diagnostics 2
    - Timestamp
    - Diagnostics 3
    - Timestamp
    - Diagnostics 4
    - Timestamp
    - Diagnostics 5
    - Timestamp
  - **▶ Event logbook**
    - Filter options
    - Clear event list
  - **▶ Device information** (→ 50)
    - Device tag (→ 51)

- Serial number (→ 51)
- Firmware version (→ 51)
- Device name (→ 51)
- Order code (→ 51)
- Extended order code 1 (→ 51)
- Extended order code 2 (→ 51)
- Extended order code 3 (→ 51)
- ENP version (→ 51)
- ▶ **Measured values**
  - ▶ **Process variables**
    - Volume flow
  - ▶ **Input values**
    - Value status input
  - ▶ **Output values**
    - Pulse output
    - Output frequency
    - Switch status
  - ▶ **Totalizer** (→ 38)
    - Totalizer value 1 to 3
    - Totalizer overflow 1 to 3
- ▶ **Simulation** (→ 39)
  - Assign simulation process variable (→ 40)
  - Value process variable (→ 40)
  - Simulation device alarm (→ 40)
  - Simulation diagnostic event (→ 40)

16.1.4 "Expert" menu

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

Navigation Expert

Expert

"System" submenu

Navigation Expert → System

System

- ▶ **Diagnostic handling**
  - Alarm delay
  - ▶ **Diagnostic behavior**
    - Assign behavior of diagnostic no. 442
    - Assign behavior of diagnostic no. 443
    - Assign behavior of diagnostic no. 991
    - Assign behavior of diagnostic no. 937
- ▶ **Administration** (→ 39)
  - Device reset (→ 39)
  - Confirm defaulted parameter
  - Defaulted parameter
  - DATVersion
  - Permanent storage
  - Device tag (→ 33)

"Sensor" submenu

Navigation Expert → Sensor

- **Sensor**
  - **▶ Measured values**
    - **▶ Process variables**
      - Volume flow
    - **▶ Totalizer** (→ 38)
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      - Totalizer overflow 1 to 3
    - **▶ Input values**
      - Value status input
    - **▶ Output values**
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      - Output frequency
      - Switch status
      - Output frequency
      - Pulse output
      - Switch status
  - **▶ System units** (→ 33)
    - Volume flow unit (→ 33)
    - Volume unit (→ 33)
    - Date/time format
    - **▶ User-specific units**
      - User volume text
      - User volume factor

- ▶ **Process parameters**
  - Flow override
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    - Assign process variable (→ 37)
    - On value low flow cutoff (→ 37)
    - Off value low flow cutoff (→ 37)
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  - Integration time
  - Measuring period
  - Binomial filter depth
  - Median filter depth
  - Filter time constant
  - ▶ **Process variable adjustment**
    - Volume flow offset
    - Volume flow factor
- ▶ **Calibration**
  - Nominal diameter
  - Calibration factor
  - Zero point
  - Calibration date/time
  - Calibration factor
  - ▶ **Logbook**
    - Calibration counter

Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
Calibration date/time
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Calibration date/time
Calibration factor
Calibration factor
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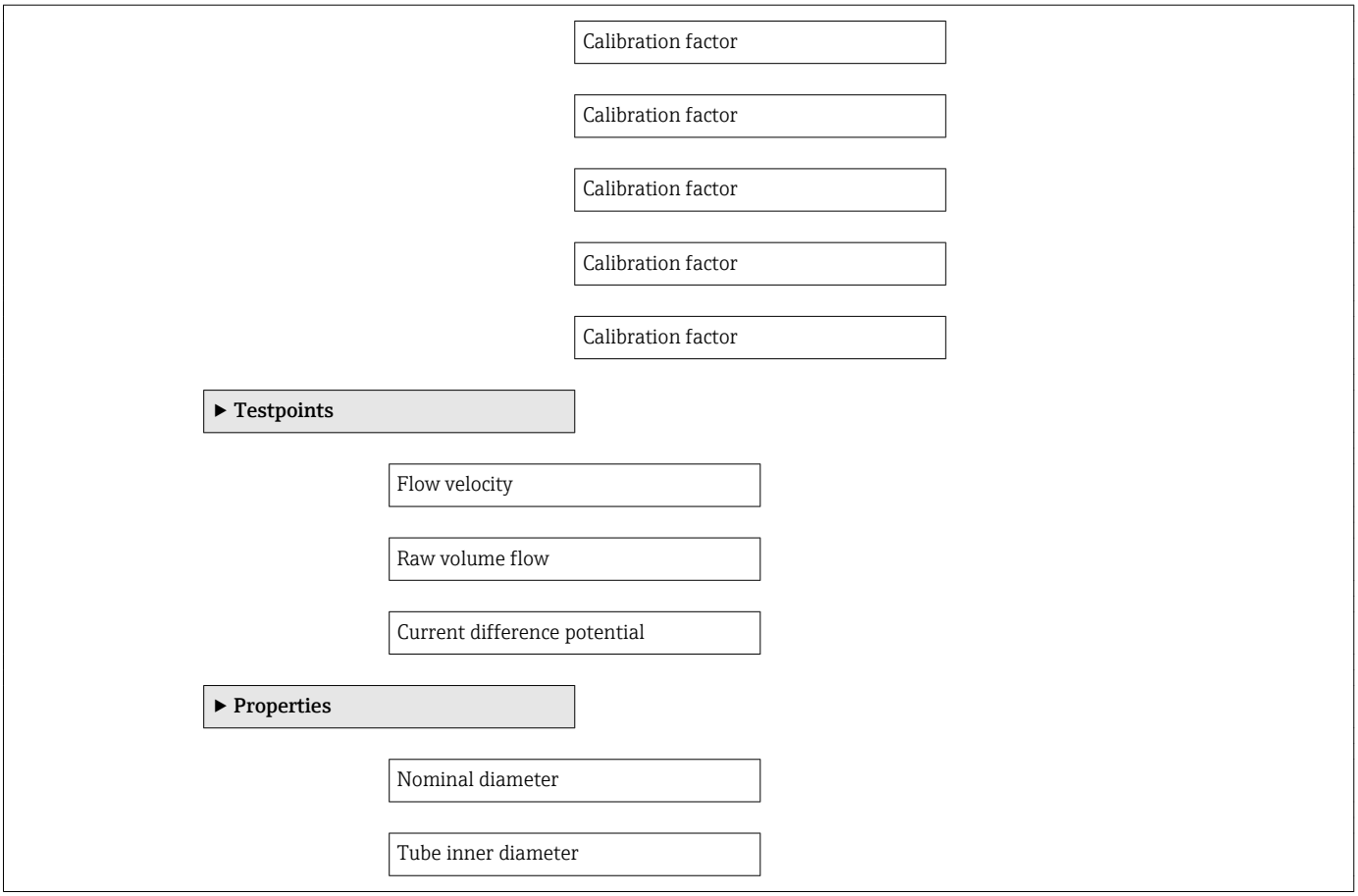
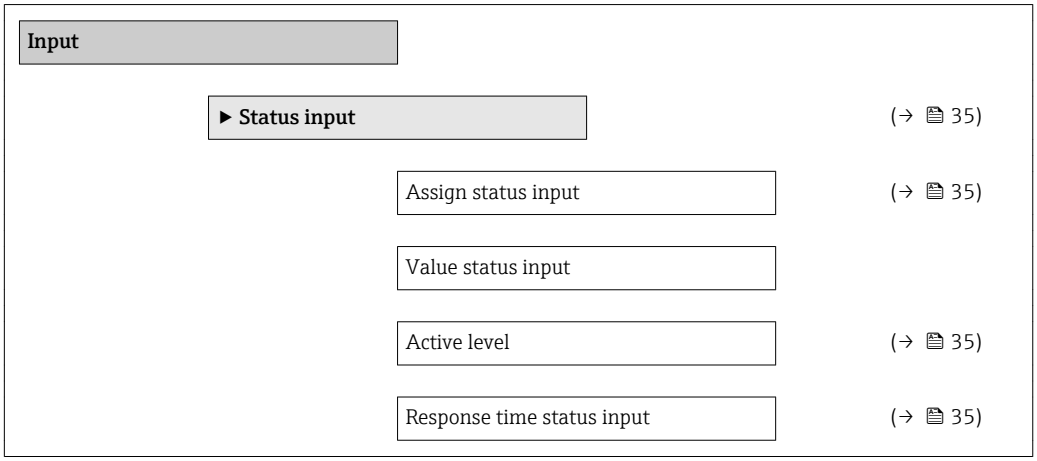
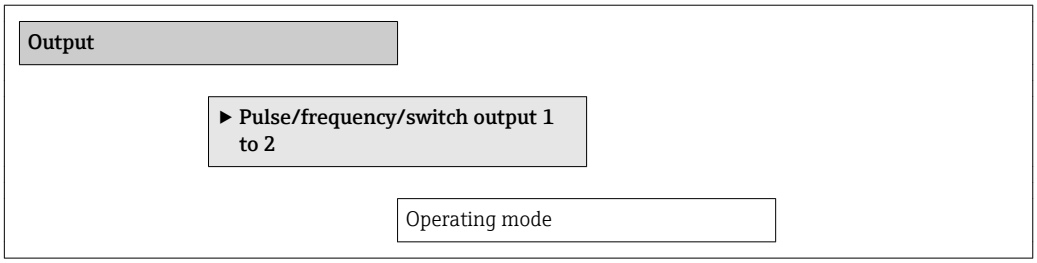
Calibration factor
Calibration factor
Calibration factor



"Current input" submenu

Navigation Expert → Input → Current input





Channel 2

Assign pulse output

Value per pulse

Pulse width

Measuring mode

Failure mode

Pulse output

Assign frequency output

Minimum frequency value

Maximum frequency value

Measuring value at maximum frequency

Measuring mode

Damping output

Failure mode

Failure frequency

Output frequency

Switch output function

Assign diagnostic behavior

Assign limit

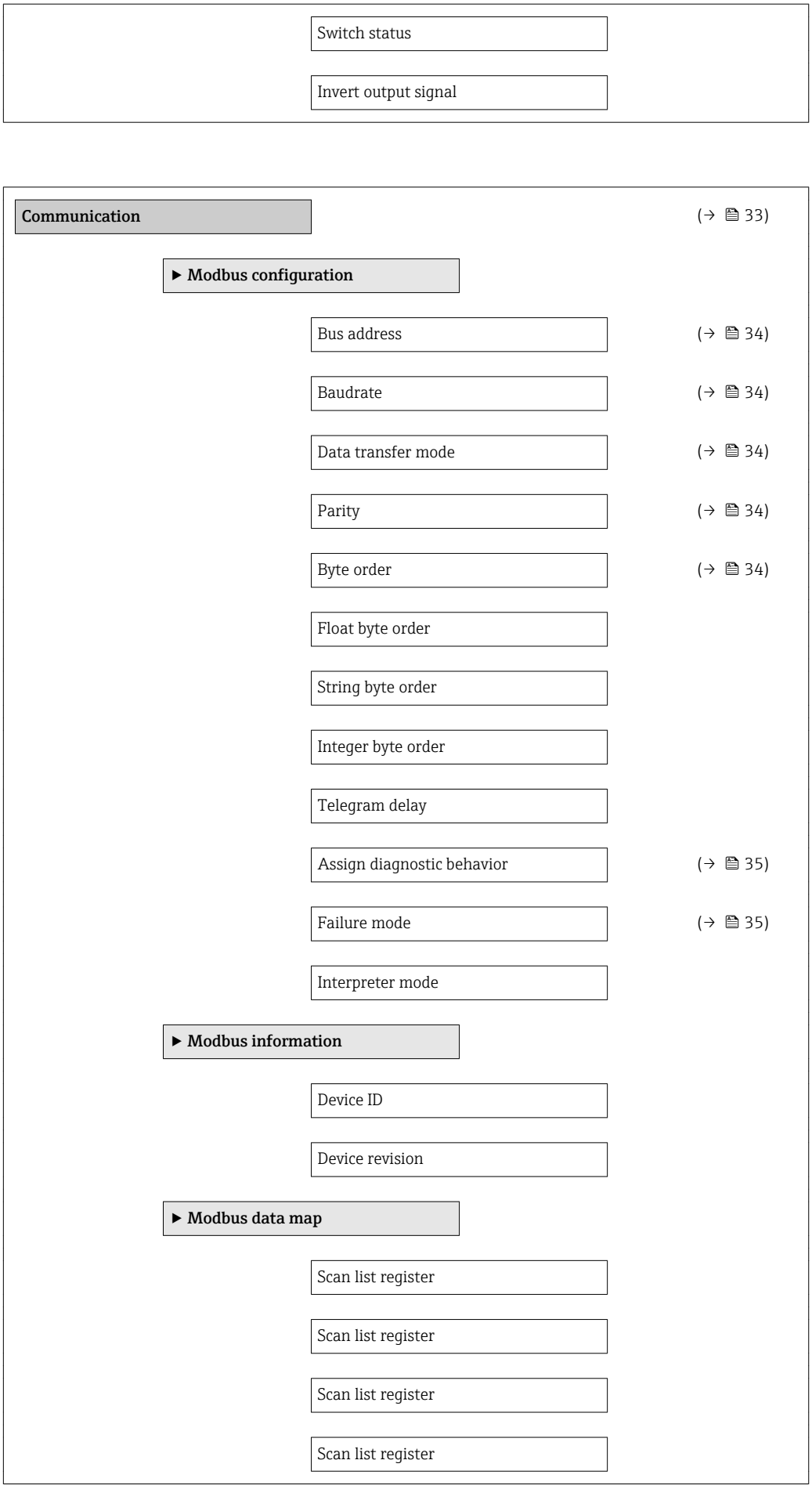
Switch-on value

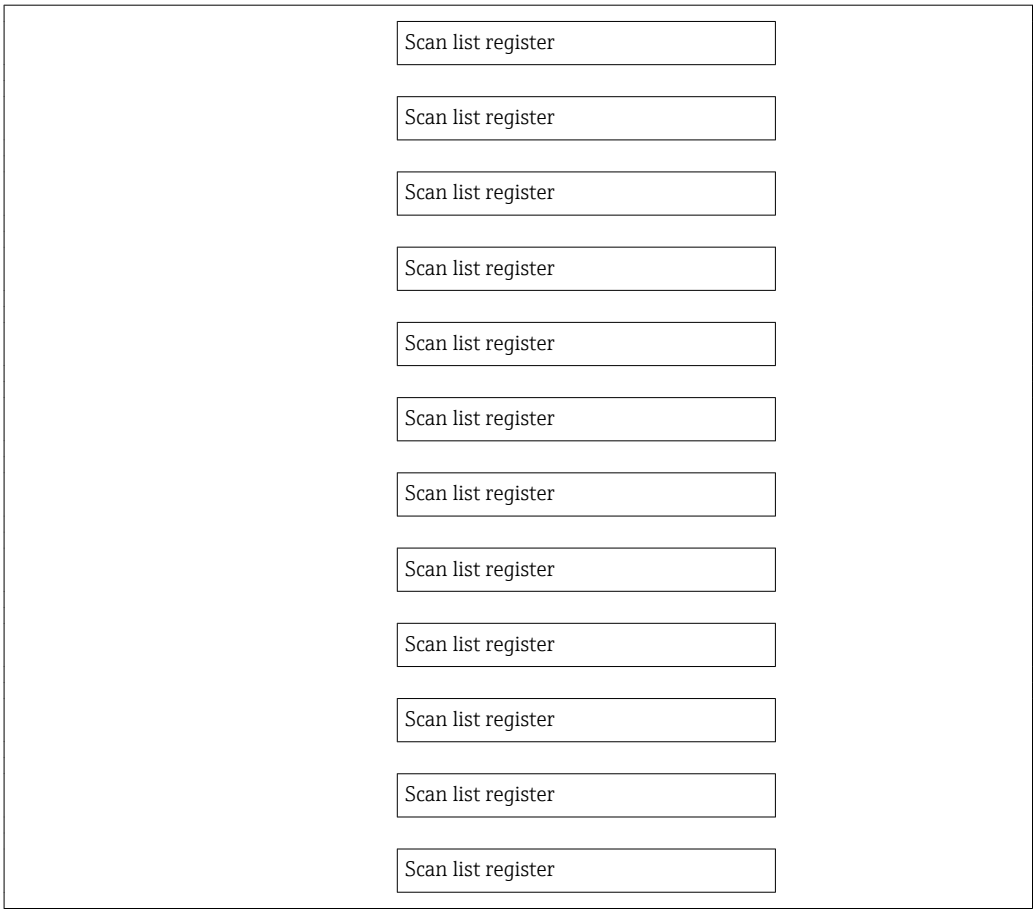
Switch-off value

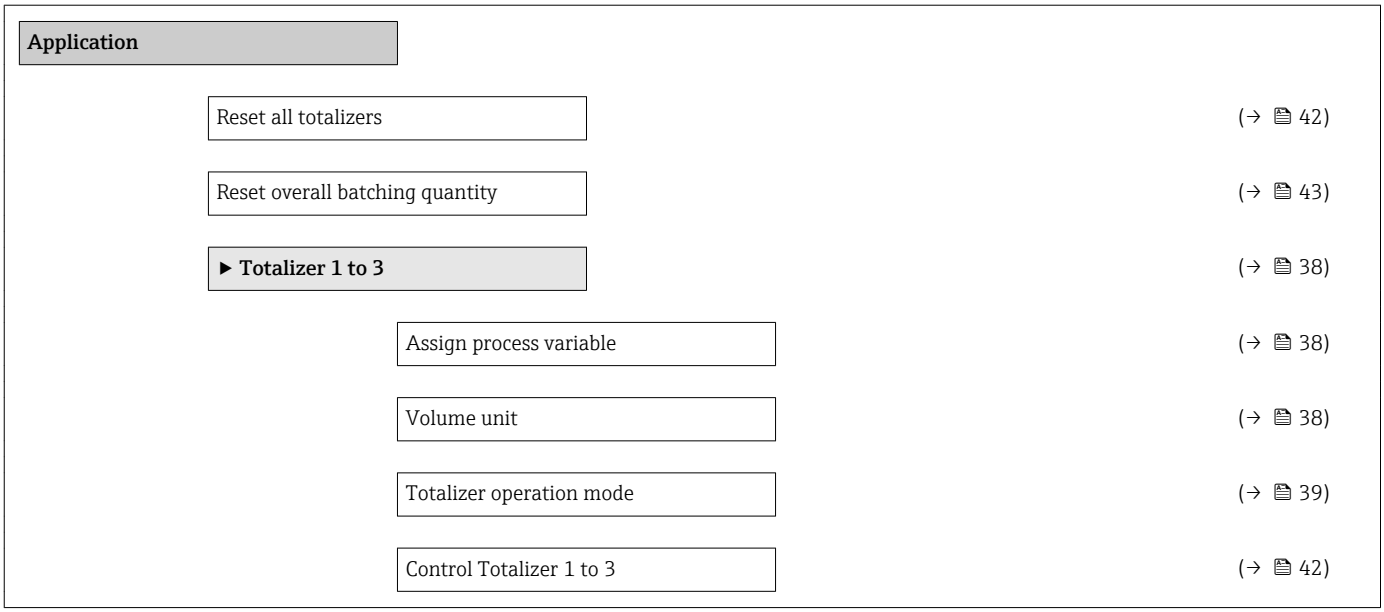
Assign flow direction check

Assign status

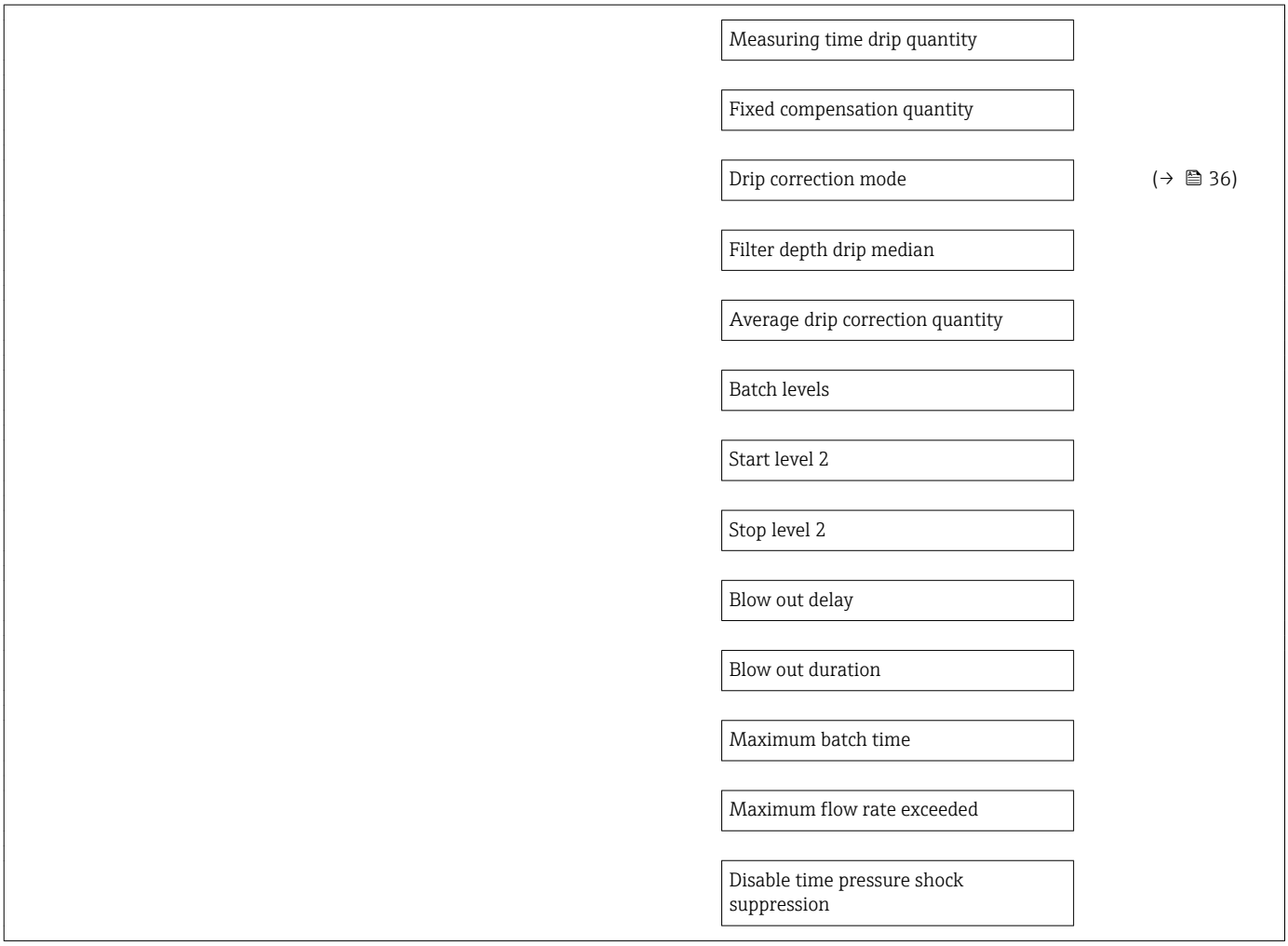
Failure mode

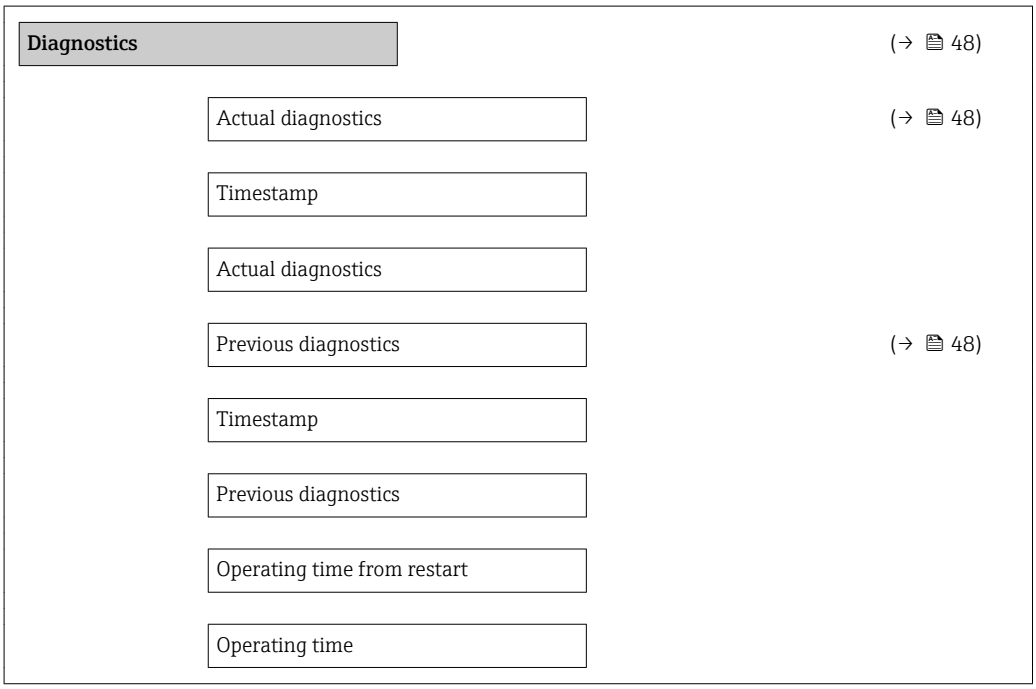

Switch status
Invert output signal
Communication
(→ 33)
► Modbus configuration
Bus address
(→ 34)
Baudrate
(→ 34)
Data transfer mode
(→ 34)
Parity
(→ 34)
Byte order
(→ 34)
Float byte order
String byte order
Integer byte order
Telegram delay
Assign diagnostic behavior
(→ 35)
Failure mode
(→ 35)
Interpreter mode
► Modbus information
Device ID
Device revision
► Modbus data map
Scan list register
Scan list register
Scan list register
Scan list register

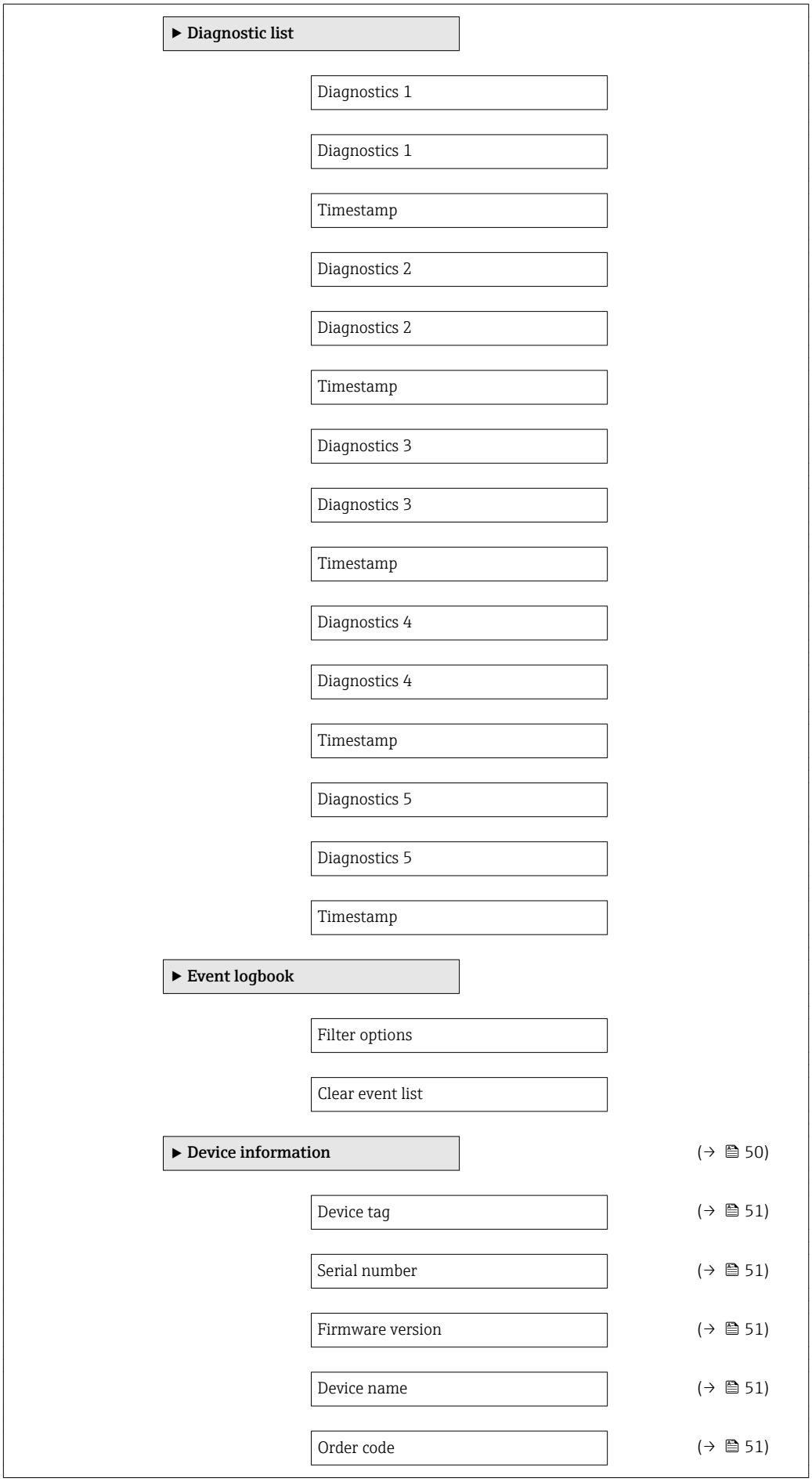

Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register
Scan list register

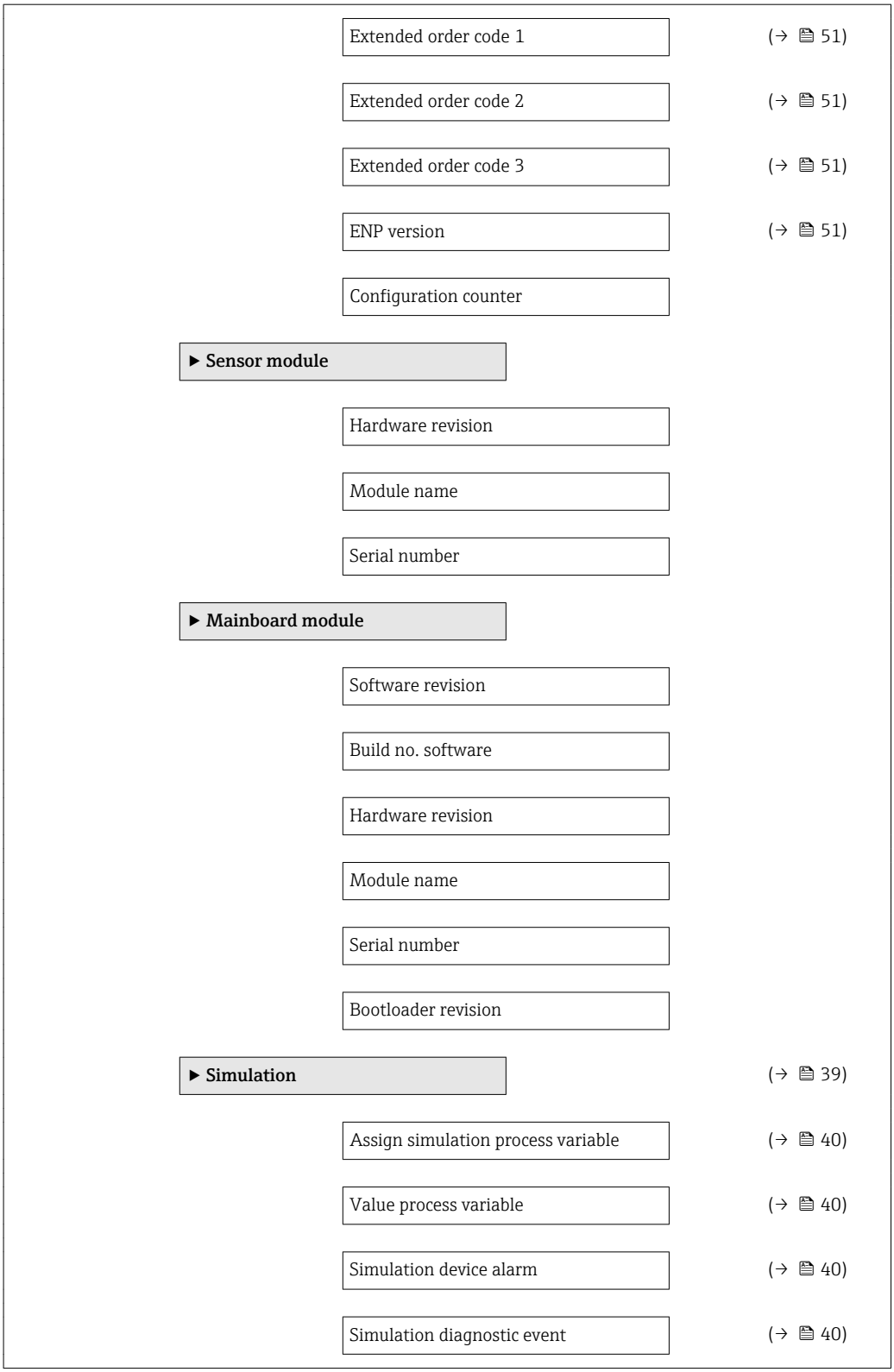

Application
Reset all totalizers
(→ 42)
Reset overall batching quantity
(→ 43)
▶ Totalizer 1 to 3
(→ 38)
Assign process variable
(→ 38)
Volume unit
(→ 38)
Totalizer operation mode
(→ 39)
Control Totalizer 1 to 3
(→ 42)

- Preset value 1 to 3 (→ 42)
- Failure mode (→ 39)
- ▶ **Batching** (→ 42)
  - ▶ **Operation** (→ 41)
    - Batch control (→ 43)
    - Batch counter (→ 43)
    - Quantity last batch (→ 43)
    - Quantity last drip (→ 43)
    - Time last batch
    - Close time last batch
    - Current drip correction quantity (→ 43)
    - Overall batching quantity (→ 43)
    - Overflow number overall batch. quantity (→ 43)
    - Batch unit
    - Switch output function 1 (→ 43)
    - Switch status 1 (→ 43)
    - Switch output function 2 (→ 43)
    - Switch status 2 (→ 43)
  - ▶ **Configuration**
    - Batch profile (→ 36)
    - ▶ **Settings batch profile 1 to 6** (→ 36)
      - Input selector (→ 36)
      - Batch unit (→ 36)
      - Batch quantity (→ 36)


Measuring time drip quantity
Fixed compensation quantity
Drip correction mode
(→ 36)
Filter depth drip median
Average drip correction quantity
Batch levels
Start level 2
Stop level 2
Blow out delay
Blow out duration
Maximum batch time
Maximum flow rate exceeded
Disable time pressure shock suppression


Diagnostics
(→ 48)
Actual diagnostics
(→ 48)
Timestamp
Actual diagnostics
Previous diagnostics
(→ 48)
Timestamp
Previous diagnostics
Operating time from restart
Operating time


▶ Diagnostic list
Diagnostics 1
Diagnostics 1
Timestamp
Diagnostics 2
Diagnostics 2
Timestamp
Diagnostics 3
Diagnostics 3
Timestamp
Diagnostics 4
Diagnostics 4
Timestamp
Diagnostics 5
Diagnostics 5
Timestamp
▶ Event logbook
Filter options
Clear event list
▶ Device information
(→ 50)
Device tag
(→ 51)
Serial number
(→ 51)
Firmware version
(→ 51)
Device name
(→ 51)
Order code
(→ 51)


Extended order code 1
(→ 51)
Extended order code 2
(→ 51)
Extended order code 3
(→ 51)
ENP version
(→ 51)
Configuration counter
▶ Sensor module
Hardware revision
Module name
Serial number
▶ Mainboard module
Software revision
Build no. software
Hardware revision
Module name
Serial number
Bootloader revision
▶ Simulation
(→ 39)
Assign simulation process variable
(→ 40)
Value process variable
(→ 40)
Simulation device alarm
(→ 40)
Simulation diagnostic event
(→ 40)

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