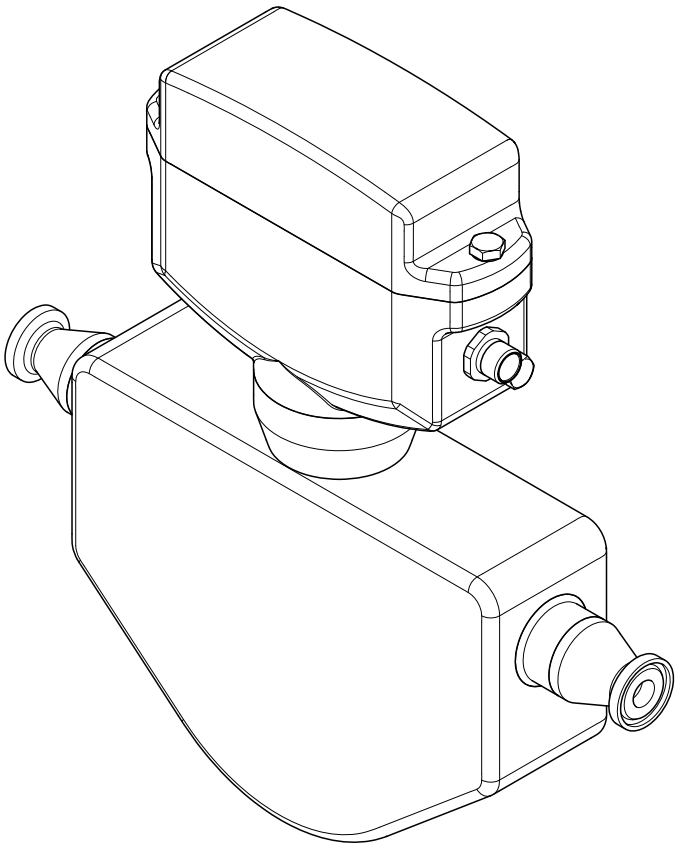
BA01320D/06/EN/02.15
71291283

Valid as of version
03.00.zz (Device firmware)

Operating Instructions
Dosimass
Modbus RS485

Coriolis flowmeter



Endress+Hauser
People for Process Automation

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

Table of contents

1 Document information

1.1 Document function

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

1.2 Symbols used

1.2.1 Safety symbols

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

1.2.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
⎓	Direct current	~	Alternating current
⎓ ~	Direct current and alternating current	⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective 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** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.

Symbol	Meaning
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
1., 2., 3. ...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.4 Symbols in graphics

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

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.

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

Applicator®, FieldCare®, DeviceCare®
Registered or registration-pending trademarks of the Endress+Hauser Group

2 Basic safety instructions

2.1 Requirements for the personnel

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

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

2.2 Designated use

Application and media
The measuring device described in these Instructions is intended only for flow measurement of liquids and gases.

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

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

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media against which the process-wetted materials are adequately resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section → 6.
- Protect the measuring device permanently against corrosion from environmental influences.

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 measuring tube due to corrosive or abrasive fluids or from environmental conditions.
Housing breakage due to mechanical overload possible!
- Verify the compatibility of the process fluid with the measuring tube material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within 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. 20 K due to the power consumption of the electronic components. Hot process fluids passing through the measuring device will further increase the surface temperature of the housing. The surface of the sensor, in particular, can reach temperatures which are close to the fluid temperature.

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

2.3 Workplace safety

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

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

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

2.4 Operational safety

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

Conversions to the device

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

Repair

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

2.5 Product safety

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

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

2.6 IT security

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

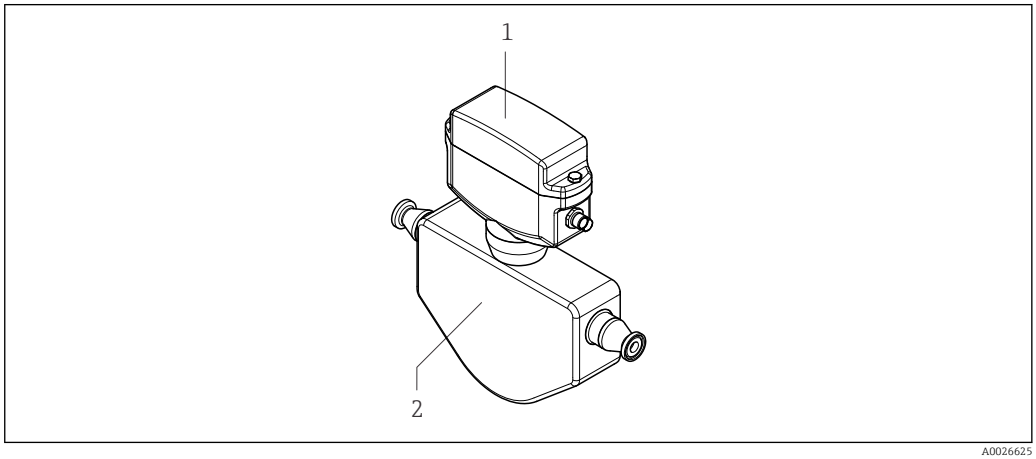
IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Product description

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

3.1 Product design



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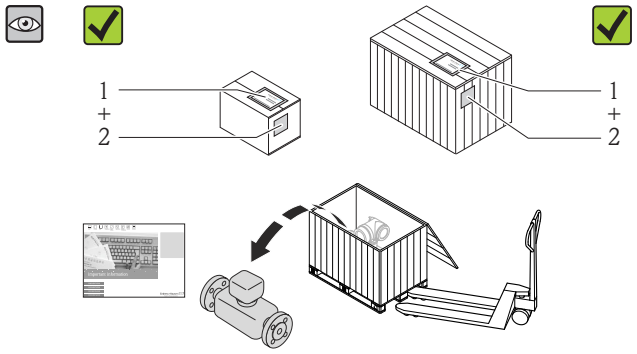
1 *Important components of the measuring device*

1 Transmitter
2 Sensor

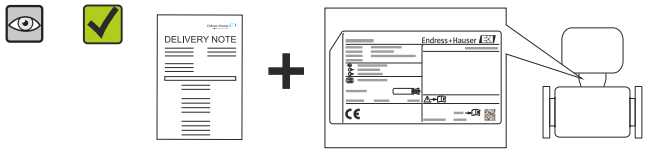
4 Incoming acceptance and product identification

4.1 Incoming acceptance

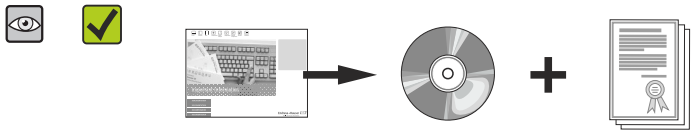


Are the order codes on the delivery note (1) and the product sticker (2) identical?

Are the goods undamaged?



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



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

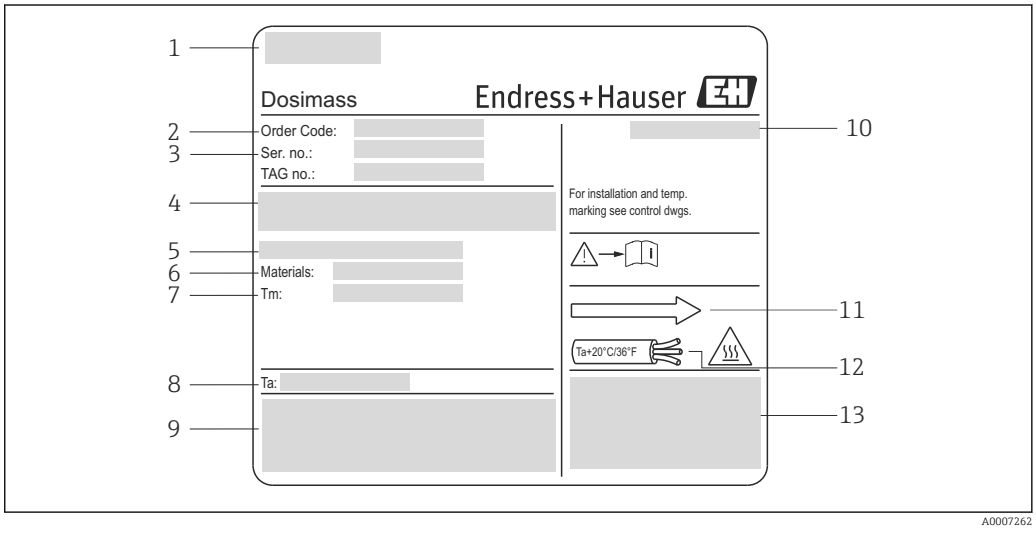
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification"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

4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The chapters "Additional standard documentation on the device" → 6 and "Supplementary device-dependent documentation" → 7
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Sensor nameplate



2 *Example of a sensor nameplate*

1 *Manufacturing location*
2 *Order code: see the specifications on the order confirmation for the meanings of the individual letters and digits*
3 *Serial number*
4 *Supply voltage and power consumption*
5 *Process connection*
6 *Wetted materials*
7 *Maximum process temperature*
8 *Permitted ambient temperature range*
9 *Space reserved for additional information on the device version (approvals, certificates, etc.)*
10 *Degree of protection*
11 *Flow direction*
12 *Cable temperature*
13 *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 +).

4.2.2 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.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature: −40 to +80 °C (−40 to +176 °F),
preferably at +20 °C (+68 °F)

5.2 Transporting the product

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

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.

5.3 Packaging disposal

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

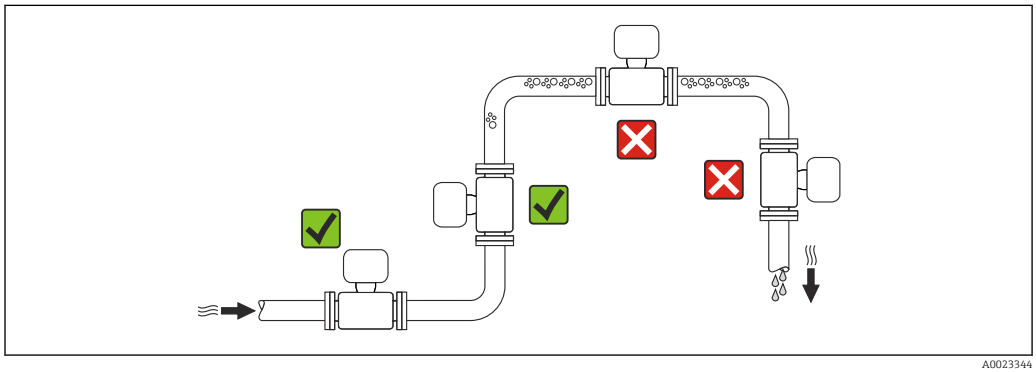
6 Installation

6.1 Installation conditions

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

6.1.1 Mounting position

Mounting location

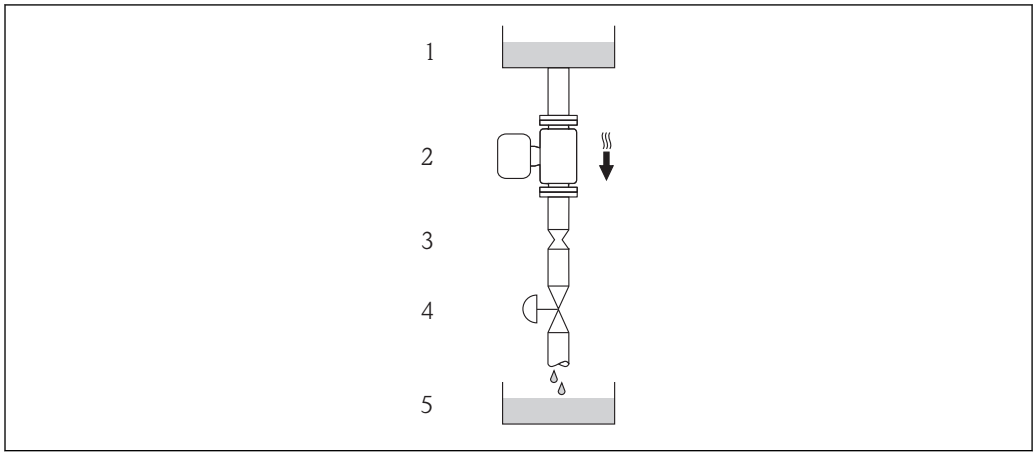


A0023344

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

However, the following installation suggestion allows for installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



A0015596

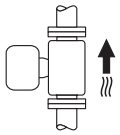
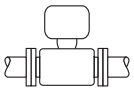
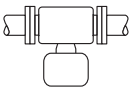
3 *Installation in a down pipe (e.g. for batching applications)*

1 *Supply tank*
2 *Sensor*
3 *Orifice plate, pipe restriction*
4 *Valve*
5 *Batching tank*

DN		Ø orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
8	3/8	6	0.24
15	1/2	10	0.40
25	1	14	0.55

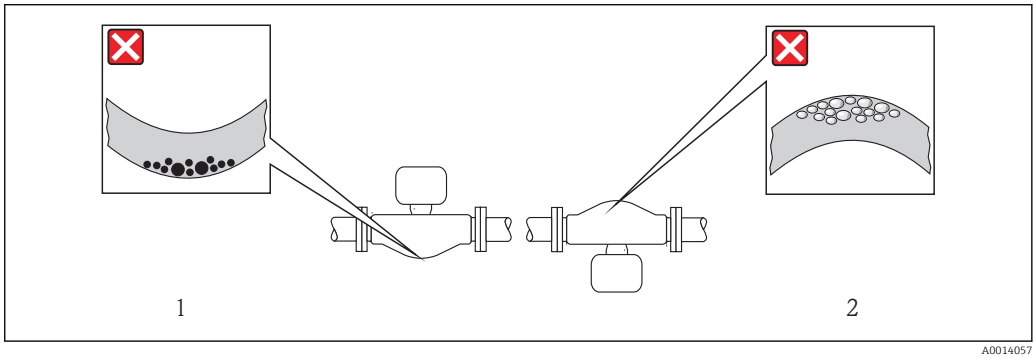
Orientation

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).

Orientation			Recommendation
A	Vertical orientation	 A0015591	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ 1) Exception: → 4, 17
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ 2) Exception: → 4, 17
D	Horizontal orientation, transmitter head at side	 A0015592	✗

1) Applications with low process temperatures may reduce the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

If a sensor is installed horizontally with a curved measuring tube, match the position of the sensor to the fluid properties.



A0014057

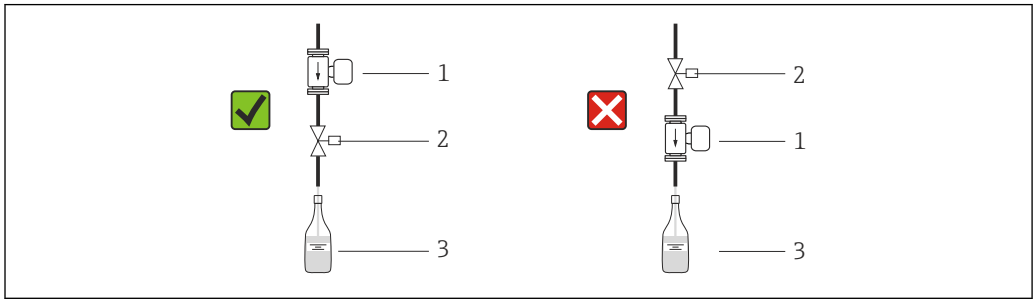
4 *Orientation of sensor with curved measuring tube*

1 Avoid this orientation for fluids with entrained solids: Risk of solids accumulating.
2 Avoid this orientation for outgassing fluids: Risk of gas accumulating.

Valves

Never install the sensor downstream from a filling valve. If the sensor is completely empty this corrupts the measured value.

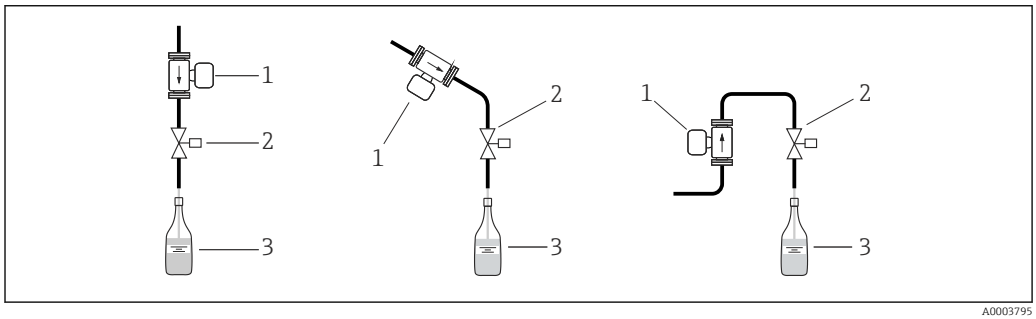
Correct measurement is only possible if the pipe is completely full. Perform sample fillings before commencing filling in production.



1 Measuring device
2 Filling valve
3 Container

Filling systems

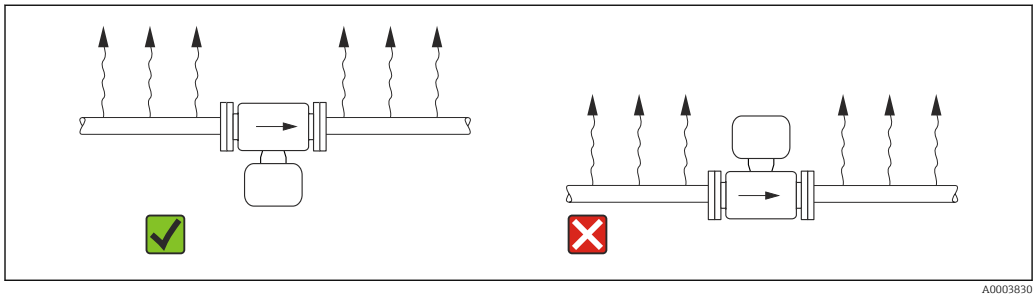
The pipe system must be completely full to ensure optimum measurement.



5 Filling system

1 Measuring device
2 Filling valve
3 Container

High temperatures

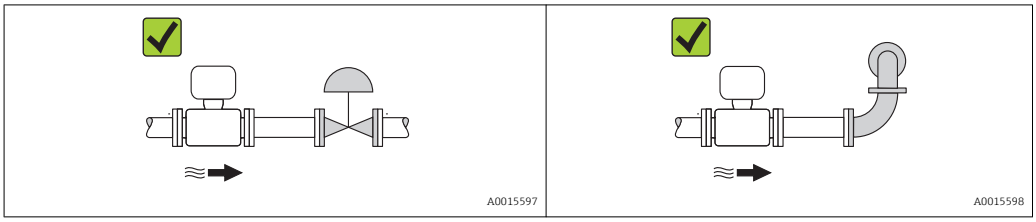


6 Recommended orientation in the event of strong heat formation

To prevent the electronics from overheating in the event of strong heat formation (e.g. CIP or SIP cleaning process), install the measuring device with the transmitter part pointing downwards.

Inlet and outlet runs

No special precautions need to be taken for fittings which create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs → 19.



Installation dimensions

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

6.1.2 Requirements from environment and process

Ambient temperature range

Measuring device	−40 to +60 °C (−40 to +140 °F) (Sensor, transmitter) Install the measuring device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.

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.

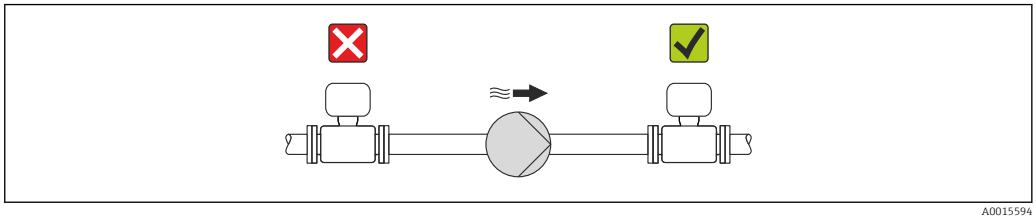
System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

Cavitation is caused if the pressure drops below the vapor pressure:
- In liquids that have a low boiling point (e.g. hydrocarbons, solvents, liquefied gases)
- In suction lines

▶ Ensure the system pressure is sufficiently high to prevent cavitation and outgassing.

For this reason, the following mounting locations are recommended:
- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)



Thermal insulation

In the case of some fluids, it is important that the heat radiated from the sensor to the transmitter is kept to a minimum. A wide range of materials can be used for the required insulation.

The connection adapter between the sensor and transmitter must always be kept free. Note that a certain orientation might be required, depending on the medium temperature → 17.

For information on the permitted ambient temperature range

NOTICE

Electronics overheating on account of thermal insulation!

- Observe maximum permitted insulation height of the transmitter neck so that the transmitter head is completely free.

Heating

NOTICE

Electronics can overheat due to elevated ambient temperature!

- Observe maximum permitted ambient temperature for the transmitter .
- Depending on the fluid temperature, take the device orientation requirements into account .

NOTICE

Danger of overheating when heating

- Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F)
- Ensure that convection takes place on a sufficiently large scale at the transmitter neck.
- Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Heating options

If a fluid requires that no heat loss should occur at the sensor, users can avail of the following heating options:

- Electrical heating, e.g. with electric band heaters
- Via pipes carrying hot water or steam
- Via heating jackets

Using an electrical trace heating system

If heating is regulated via phase angle control or pulse packages, magnetic fields can affect the measured values (= for values that are greater than the values approved by the EN standard (sine 30 A/m)).

For this reason, the sensor must be magnetically shielded: the housing can be shielded with tin plates or electric sheets without a privileged direction (e.g. V330-35A).

The sheet must have the following properties:

- Relative magnetic permeability μr ≥ 300
- Plate thickness d ≥ 0.35 mm (d ≥ 0.014 in)

Vibrations

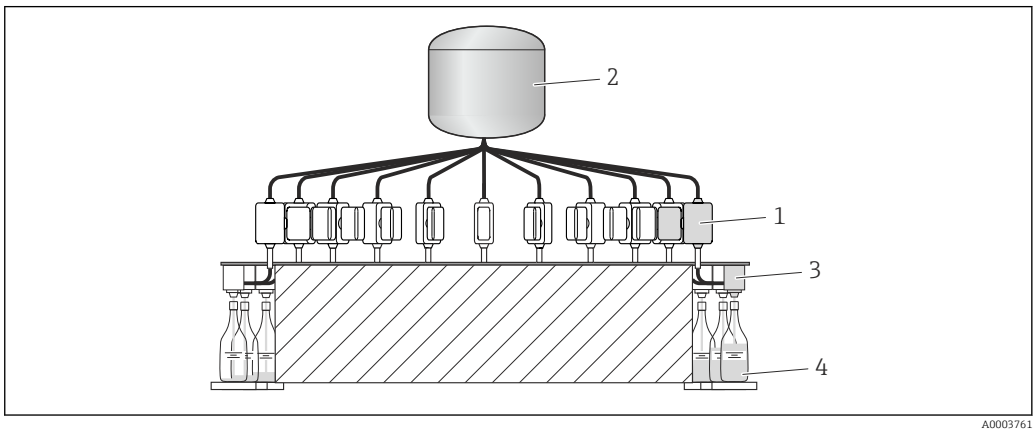
The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

6.1.3 Special mounting instructions

Information for filling systems

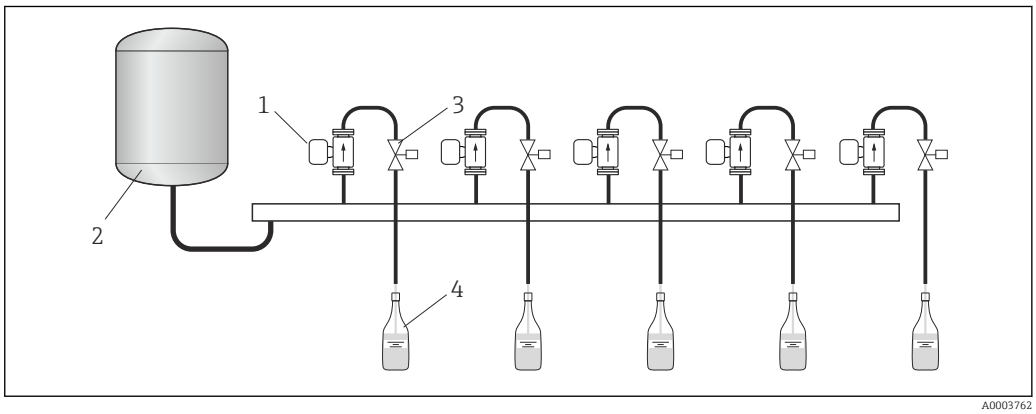
Correct measurement is possible only if the piping is completely filled. We therefore recommend that some test batches be carried out prior to production batching.

Circular filling system



1 Measuring device
2 Tank
3 Batching valve
4 Vessel

Linear filling system



1 Measuring device
2 Tank
3 Batching valve
4 Vessel

Zero point adjustment

The **Sensor adjustment** submenu contains parameters required for zero point adjustment.

NOTICE

All Dosimass measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions .

Therefore, a zero point adjustment is generally not required for the Dosimass!

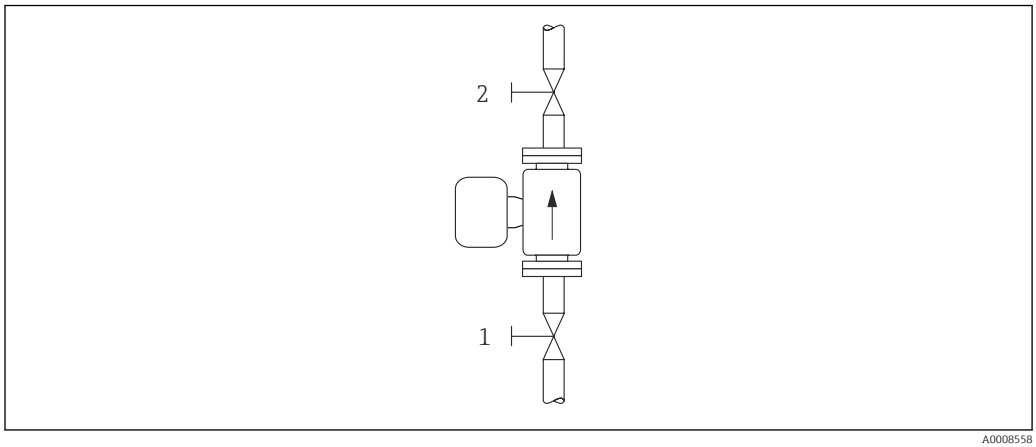
- ▶ Experience shows that a zero point adjustment is advisable only in special cases.
- ▶ When maximum accuracy is required and flow rates are very low.
- ▶ Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

Detailed information on reference conditions→ 70

Prerequisites for zero point adjustment

Note the following points before performing the adjustment:

- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- A zero point adjustment takes place when the measuring tubes are completely filled and there is zero flow (v = 0 m/s (0 ft/s)). For this purpose, shut-off valves (for example) can be provided upstream or downstream from the sensor, or existing valves and gate valves may be used.
  - Normal operation → Valves 1 and 2 open
  - Zero point adjustment with pump pressure → Valve 1 open and valve 2 closed
  - Zero point adjustment without pump pressure → Valve 1 closed and valve 2 open



7

Performing the zero point adjustment

1. Let the system run until normal operating conditions are present.
2. Stop the flow (v = 0 m/s (0 ft/s)).
3. Check the shutoff valves for leaks.
4. Check the necessary process pressure.
5. Perform the adjustment using the ZERO POINT ADJUSTMENT → 43 function.

6.2 Mounting the measuring device

6.2.1 Required tools

For process connections, use the appropriate installation tool.

6.2.2 Preparing the measuring device

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

6.2.3 Mounting the 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.

- ▶ Ensure that the direction of the arrow on the nameplate of the sensor matches the flow direction of the fluid.

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the chapter on "Pressure-temperature ratings" of the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping → 🖹 17?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Are the securing screw and securing clamp tightened securely?	❑

7 Electrical connection

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

7.1 Connection conditions

7.1.1 Requirements for connecting cable

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

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

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

Signal cable

Cables are not included in the scope of delivery; they can be ordered as an accessory → 65.

Status input and switch output (batch)

Standard installation cable is sufficient.

Modbus RS485

- The electrical connection of the shield to the device housing must be properly implemented (e.g. using a knurled nut).
- Observe the following with regard to cable loading:
  - Voltage drop due to the cable length and cable type.
  - Valve performance.

Total length of cable in the Modbus network ≤ 50 m

Use a shielded cable.

Example:
Terminated device plug with cable: Lumberg RKWTH 8-299/10

Total length of cable in the Modbus network > 50 m

Use shielded twisted pair cable for RS485 applications.

Example:
- Cable: Belden item no. 9842 (for 4-wire version, the same cable can be used for the power supply)
- Terminated device plug: Lumberg RKCS 8/9 (shieldable version)

7.1.2 Terminal assignment

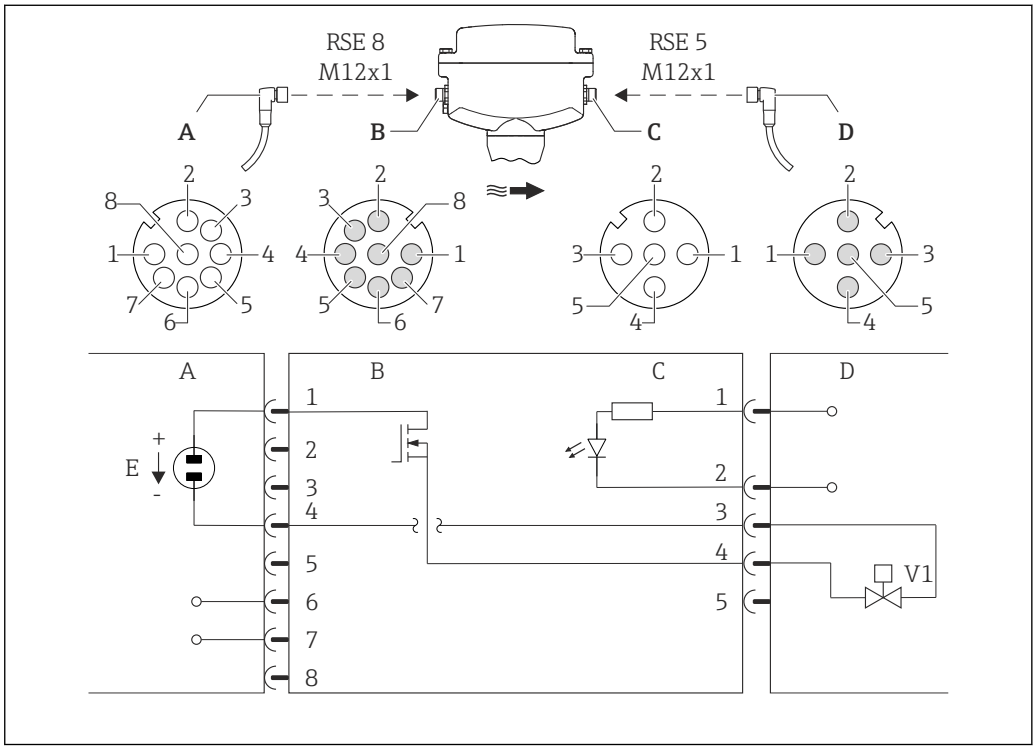
Connection is solely by means of device plug:

There are different device versions available. Order code for "Output, input":
- Option 4: Modbus RS485, 1 status output (batch),1 status input → 25
- Option 5: Modbus RS485, 2 status outputs (batch),1 status input → 26

7.1.3 Pin assignment, device plug

Device version: Modbus RS485, status output and status input

Order code for "Output, input", option 4:
Modbus RS485, 1 switch output (batch), 1 status input



8 *Connection to device*

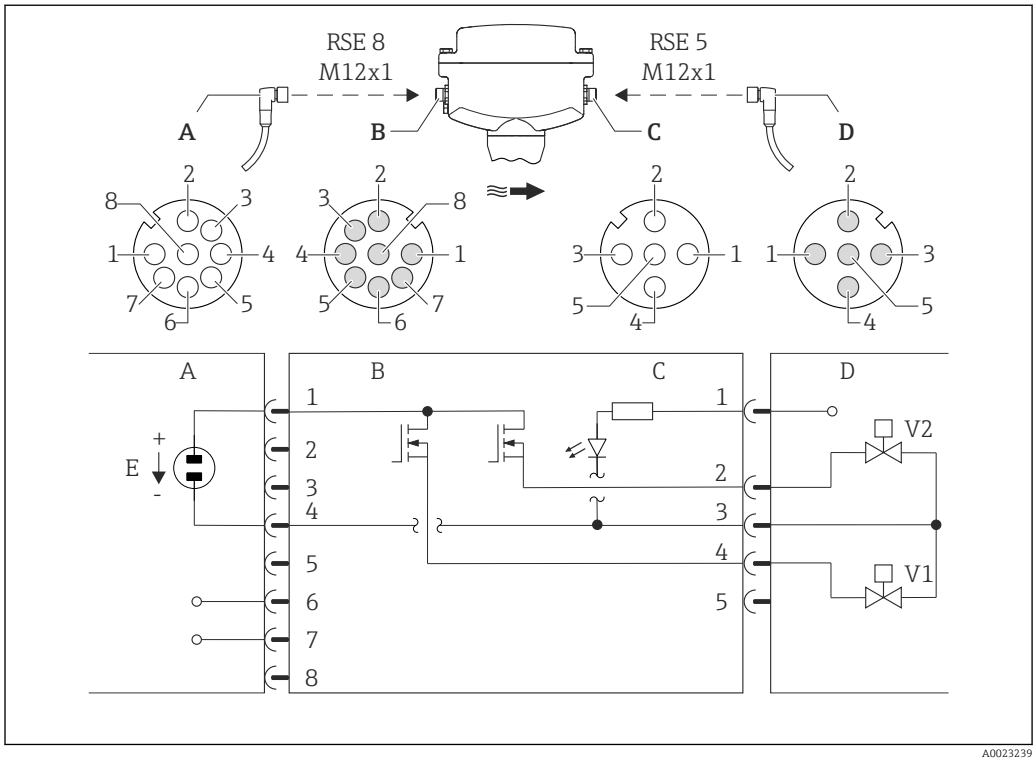
A Coupling: Supply voltage, Modbus RS485
B Connector: Supply voltage, Modbus RS485
C Coupling: Switch output (batch), status input
D Connector: Switch output (batch), status input
E PELV or SELV power supply
V1 Valve 1 (batch)
1 to 8 Pin assignment

Pin assignment

Connection: Coupling (A) – Connector (B)			Connection: Coupling (C) – Connector (D)		
Pin	**Assignment**		**Pin**	**Assignment**	
1	L+	Supply voltage	1	+	Status input
2	+	Service interface RX	2	–	Status input
3	+	Service interface TX	3	–	Switch output (batch)
4	L-	Supply voltage	4	+	Switch output (batch)
5		Not assigned	5		Not assigned
6	A	Modbus RS485			
7	B	Modbus RS485			
8	–	Service interface GND			

Device version: Modbus RS485 , 2 status outputs and status input

Order code for "Output, input", option 5:
Modbus RS485, 2 switch outputs (batch), 1 status input



9 *Connection to device*

A Coupling: Supply voltage, Modbus RS485
B Connector: Supply voltage, Modbus RS485
C Coupling: Switch outputs (batch), status input
D Connector: Switch outputs (batch), status input
E PELV or SELV power supply
V1 Valve (batch), level 1
V2 Valve (batch), level 2
1 to 8 Pin assignment

Pin assignment

Connection: Coupling (A) – Connector (B)			Connection: Coupling (C) – Connector (D)		
Pin	Assignment		Pin	Assignment	
1	L+	Supply voltage	1	+	Status input
2	+	Service interface RX	2	+	Switch output (batch) 2
3	+	Service interface TX	3	–	Switch outputs, status input
4	L-	Supply voltage	4	+	Switch output (batch) 1
5		Not assigned	5		Not assigned
6	A	Modbus RS485			
7	B	Modbus RS485			
8	–	Service interface GND			

7.1.4 Requirements for the supply unit

Supply voltage

DC 24 V (nominal voltage: DC 20 to 30 V)

- The power unit must be tested to ensure that it meets safety requirements (e.g. PELV, SELV).
- The supply voltage must not exceed a maximum short-circuit current of 50 A.

7.2 Connecting the measuring device

NOTICE

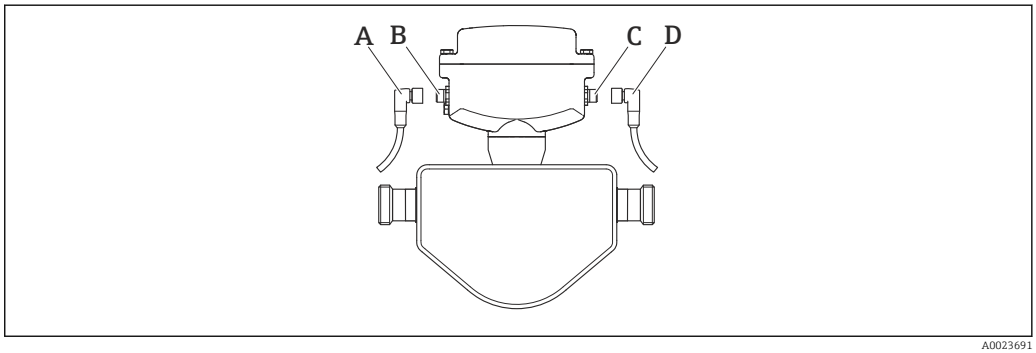
Limitation of electrical safety due to incorrect connection!

- ▶ Have electrical connection work carried out by correspondingly trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.

7.2.1 Connecting the transmitter

Connection by means of device plug

Connection is solely by means of device plug.



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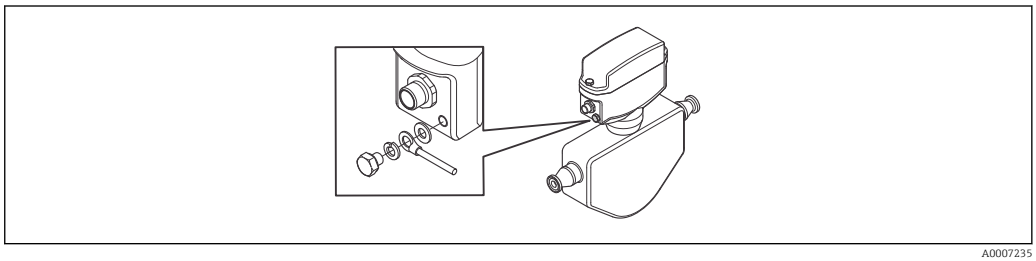
A, C Coupling
B, D Plug

Grounding

Grounding is by means of a cable socket.



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7.3 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:

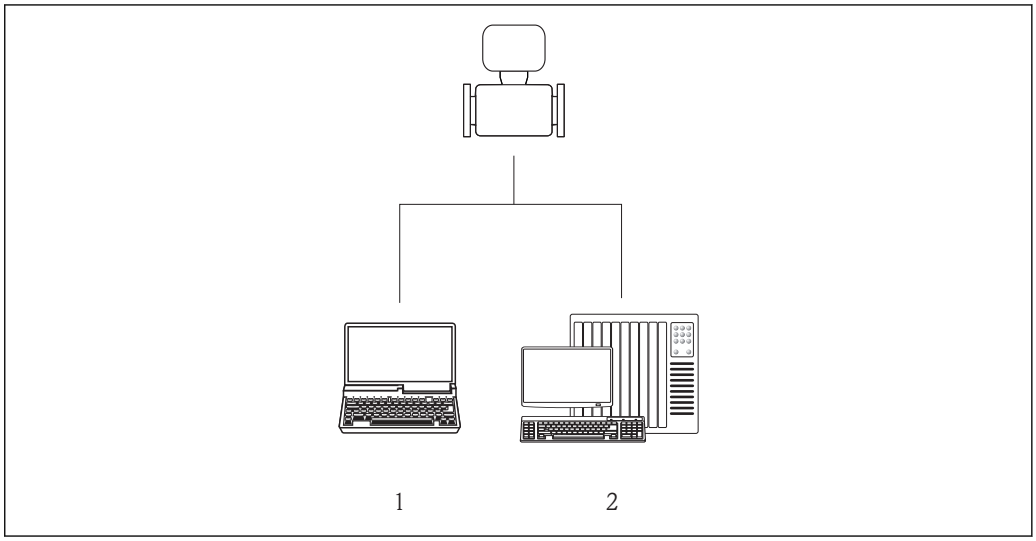
▶ Tighten all device plugs.

7.4 Post-connection check

Is the device undamaged (visual inspection)?	❑
Does the supply voltage in the system match the specifications on the device's nameplate?	❑
Do the cables used comply with the necessary specifications?	❑
Are the maximum values for voltage and current at the pulse and status output being observed? → 🖹 68	❑

8 Operation options

8.1 Overview of operating options



1 Computer with "FieldCare" or "DeviceCare" operating tool
2 Automation system (e.g. PLC)

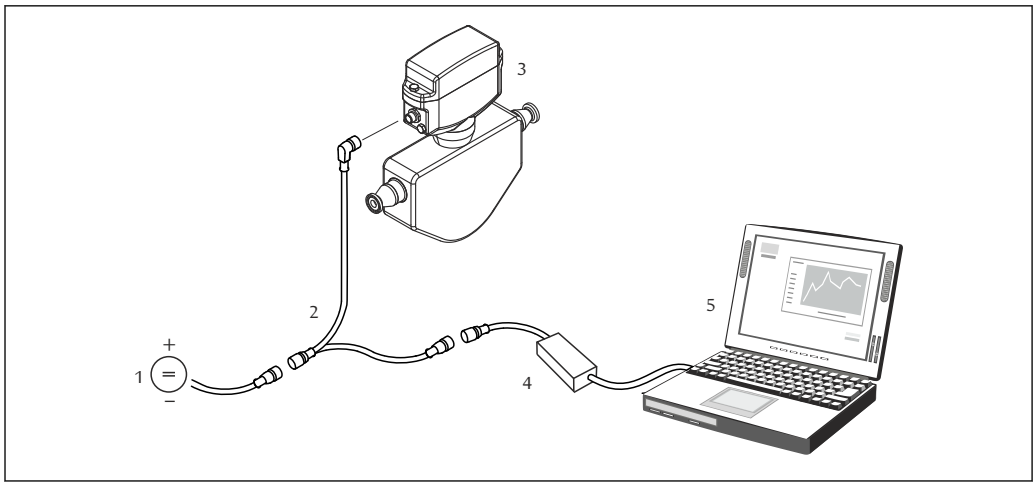
8.2 Access to the operating menu via the operating tool

8.2.1 Connecting the operating tool

Via service adapter and Commubox FXA291

Operation and configuration can be performed using the Endress+Hauser FieldCare or DeviceCare service and configuration software.

The device is connected to the USB port of the computer via the service adapter and Commubox FXA291.



1 *Supply voltage 24 V DC*
2 *Service adapter*
3 *Dosimass*
4 *Commubox FXA291*
5 *Computer with "FieldCare" or "DeviceCare" operating tool*

The service adapter, cable and Commubox FXA291 are not included in the delivery. These components can be ordered as accessories → 65.

8.2.2 FieldCare

Function scope

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

Access is via:
Service adapter and Commubox FXA291 → 29

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

For details, see Operating Instructions BA00027S and BA00059S

Source for device description files

See data → 32

Establishing a connection

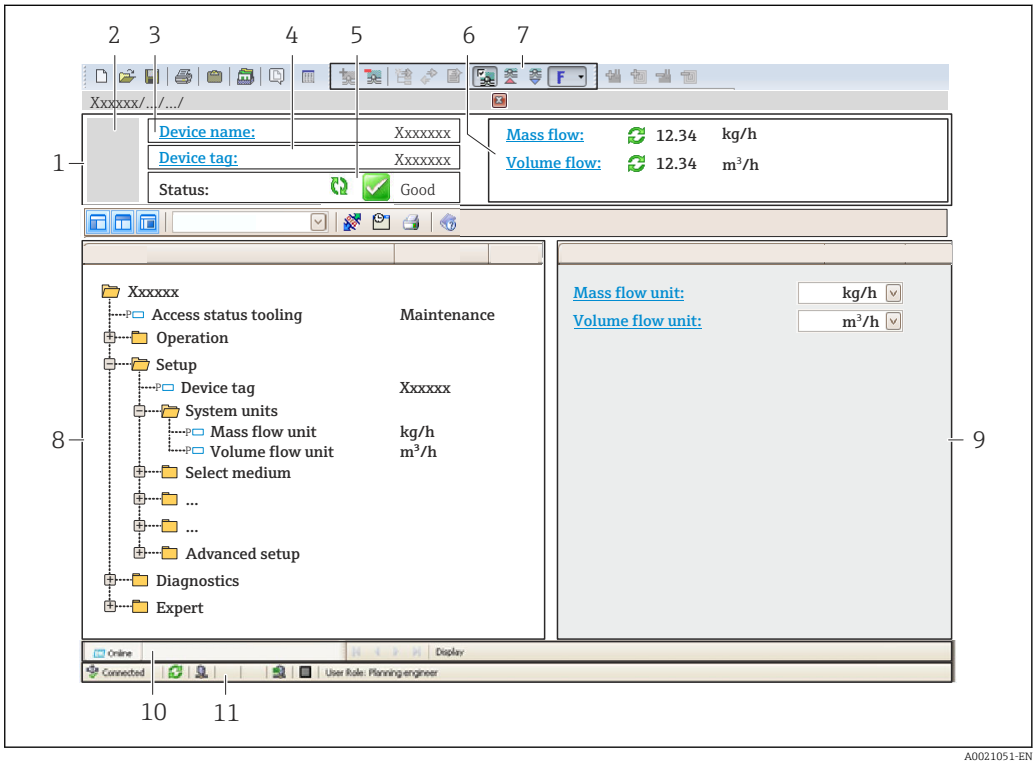
Service adapter, Commubox FXA291 and "FieldCare" operating tool

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication FXA291** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication FXA291** and select the **Add device** option in the context menu that opens.

5. Select the desired device from the list and press **OK** to confirm.
6. Establish the online connection to the device.

For details, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Tag name*
5 *Status area with status signal*
6 *Display area for current measured values*
7 *Edit toolbar with additional functions such as save/restore, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

8.2.3 DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs) it presents a convenient, comprehensive solution.

For details, see Innovation Brochure IN01047S

Source for device description files

See data → 32

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	03.00.zz	▪ On the title page of the Operating instructions ▪ On transmitter nameplate ▪ Firmware version **Diagnostics** menu → **Device information** submenu → **Firmware version** parameter
Release date of firmware version	05.2015	---

For an overview of the different firmware versions for the device → 61

9.1.2 Operating tools

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

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

9.2 Modbus RS485 information

9.2.1 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 mass 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

Code	Name	Description	Application
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	
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 → 33	Write multiple device parameters Example: ▪ Mass flow unit ▪ Mass unit
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

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

9.2.2 Register information

For an overview of Modbus-specific information relating to the individual device parameters: Description of device parameters.

9.2.3 Response time

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

9.2.4 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.

10 Commissioning

10.1 Function check

Before commissioning the measuring device:

▶ Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 23
- "Post-connection check" checklist → 28

10.2 Switching on the measuring device

▶ The function check has been completed successfully.
Switch on the supply voltage.
↳ The measuring device runs through internal test functions.

The device is operational and operation commences.

If the device does not start up successfully, depending on the cause, a diagnostic message is displayed in the system asset management tool "FieldCare" .

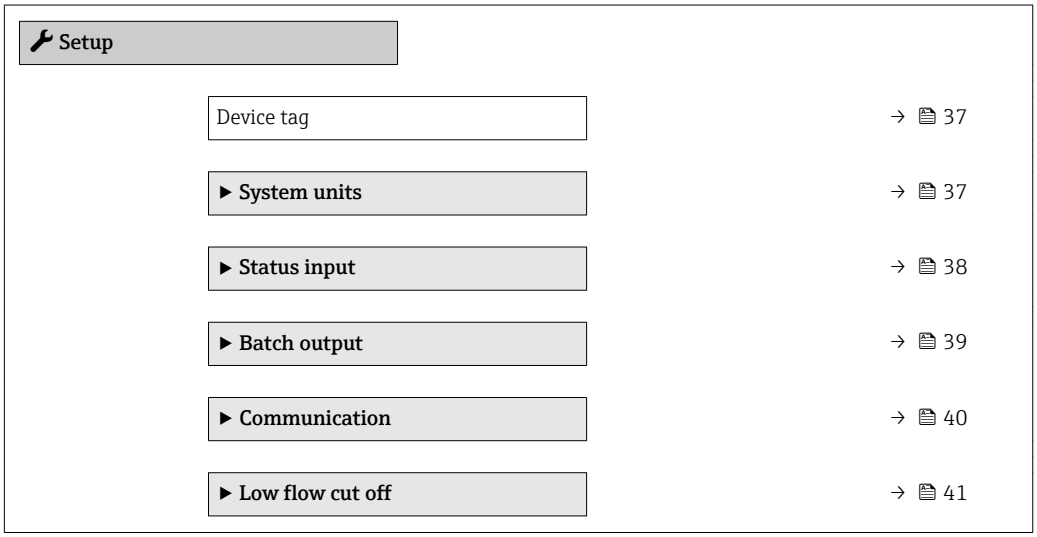
10.3 Establishing a connection via FieldCare

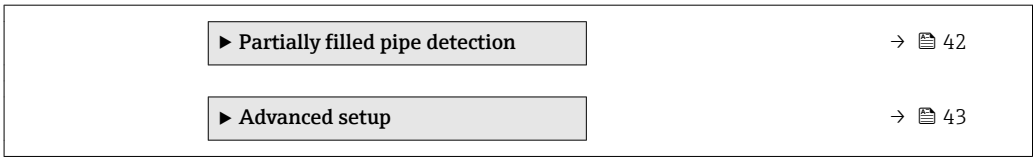
- For FieldCare connection → 29
- For establishing a connection via FieldCare → 30
- For FieldCare user interface → 31

10.4 Configuring the measuring device

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

Navigation
"Setup" menu





10.4.1 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.
- Enter the tag name in the "FieldCare" operating tool → 31

Navigation
"Setup" menu → Device tag

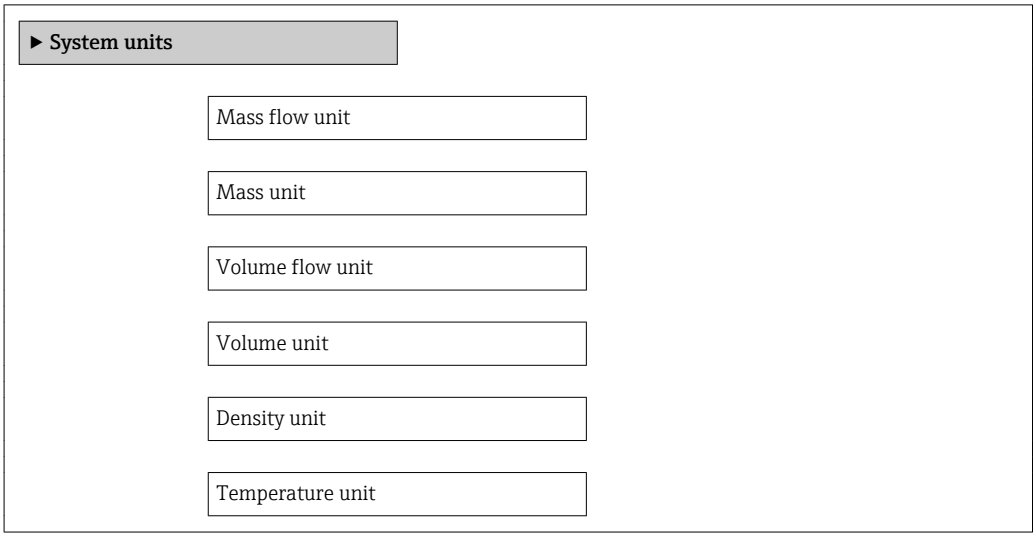
Parameter overview with brief description

Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 16 characters such as letters, numbers or special characters (e.g. @, %, /).	Dosimass

10.4.2 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
Mass flow unit	Select mass flow unit. *Result* The selected unit applies for: ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ g/s ▪ oz/s
Mass unit	Select mass unit.	Unit choose list	Country-specific: ▪ g ▪ oz
Volume flow unit	Select volume flow unit. *Result* The selected unit applies for: ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ ml/s ▪ fl oz/s (us)
Volume unit	Select volume unit.	Unit choose list	Country-specific: ▪ ml ▪ fl oz (us)
Density unit	Select density unit. *Result* The selected unit applies for: ▪ Simulation process variable ▪ Density adjustment (**Expert** menu)	Unit choose list	Country-specific: ▪ kg/l ▪ g/cm³
Temperature unit	Select temperature unit. *Result* The selected unit applies for: ▪ Maximum value ▪ Minimum value ▪ Temperature	Unit choose list	Country-specific: ▪ °C ▪ °F

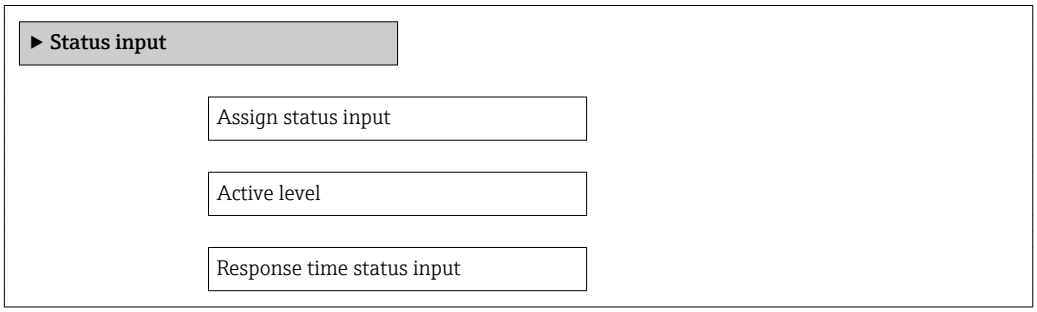
10.4.3 Configuring the status input

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

Structure of the submenu



Parameter overview with brief description

Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Assign status input	Start condition for a batching process: ▪ There is no diagnostic message from the **Alarm** category. ▪ The batch quantity must be > **0**. ▪ The **Batching** option is selected in the **Switch output function** parameter.	Select function for the status input.	▪ Off ▪ Start batch ▪ Start & stop batch ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override	Off
Active level	–	Define input signal level at which the assigned function is triggered.	▪ High ▪ Low	High
Response time status input	–	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	10 to 200 ms	50 ms

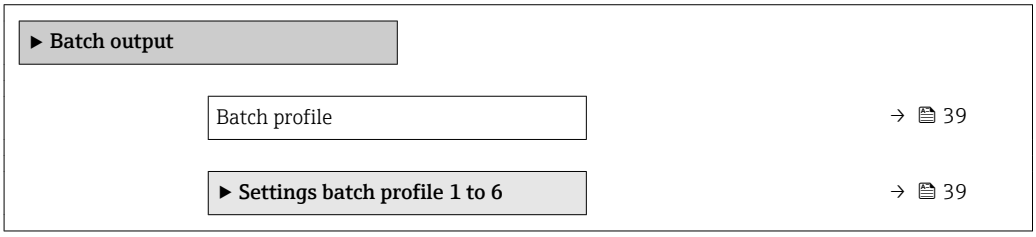
10.4.4 Configuring the switch output (batch)

A batch profile (1 to 6) can be assigned to the switch output (batch) in the **Batch output** submenu.

The individual batch profiles are configured in the **Settings batch profile 1 to 6** submenu.

Navigation

"Setup" menu → Batch output



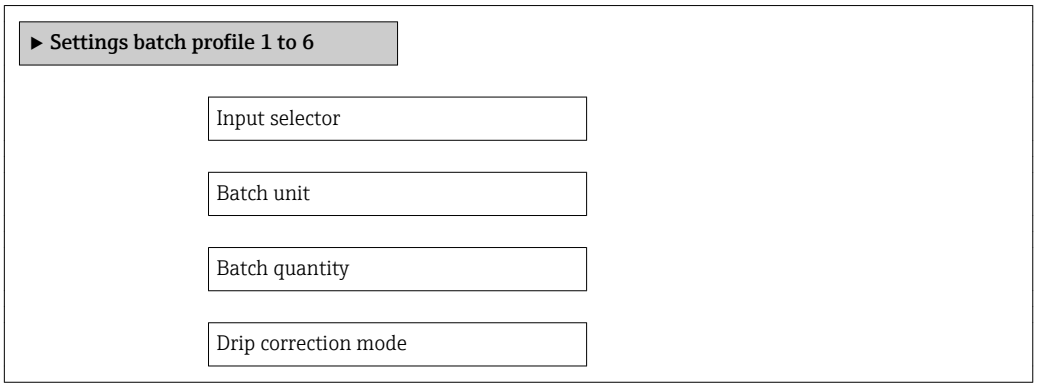
Parameter overview with brief description

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

Batch profile settings

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

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



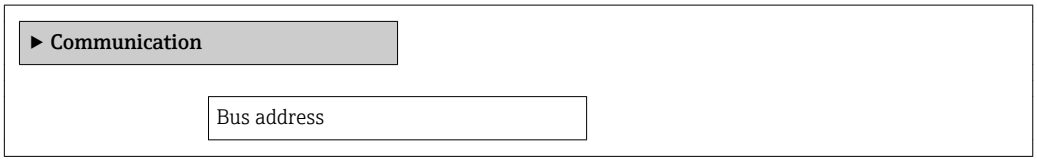
Parameter overview with brief description

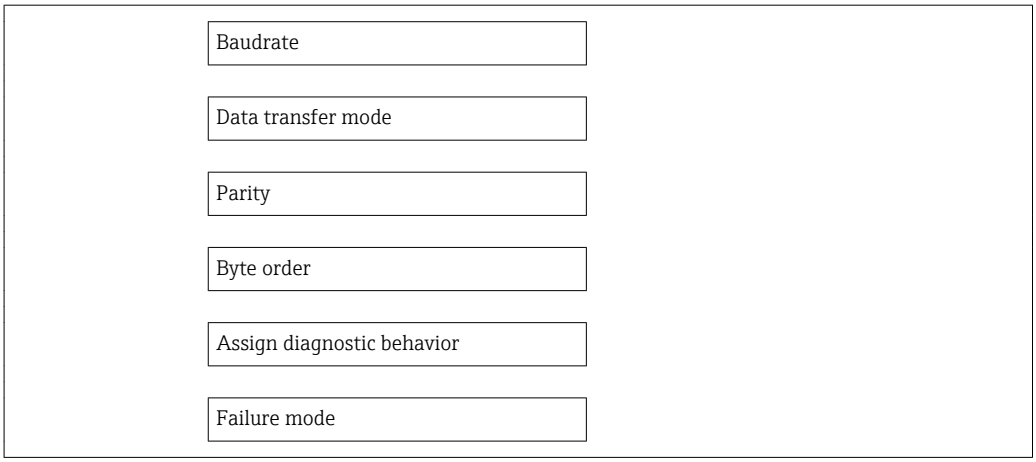
Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Input selector	–	Select a process variable for batch profile.	▪ Off ▪ Mass flow ▪ Volume flow	Mass flow
Batch unit	One of the following options is selected in the **Input selector** parameter: ▪ Mass flow ▪ Volume flow	Select unit for process variable of the batch profile. *Result* The selected unit applies for: ▪ Batch quantity ▪ Fixed compensation quantity ▪ Batch unit	Unit choose list	Depending on country: ▪ g (Mass flow) ▪ oz (Mass flow)
Batch quantity	One of the following options is selected in the **Input selector** parameter: ▪ Mass flow ▪ Volume flow	Enter a quantity of selected process variable for batch profile. *Dependency* The unit is taken from: **Batch unit** parameter	Positive floating-point number	Depending on country: ▪ 0 g ▪ 0 oz
Drip correction mode	One of the following options is selected in the **Input selector** parameter: ▪ Mass flow ▪ Volume flow	Select a drip correction.	▪ Off ▪ Fixed time ▪ Fixed time or low flow cut off	Off

10.4.5 Configuring the communication interface

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

Navigation
"Setup" menu → Communication





Parameter overview with brief description

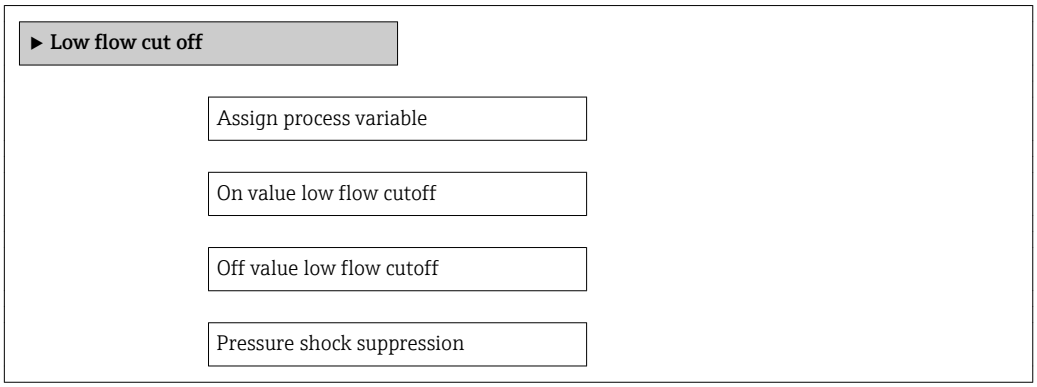
Parameter	Description	User entry / Selection	Factory setting
Bus address	Enter device address.	1 to 247	247
Baudrate	Define data transfer speed.	▪ 1200 BAUD ▪ 2400 BAUD ▪ 4800 BAUD ▪ 9600 BAUD ▪ 19200 BAUD ▪ 38400 BAUD ▪ 57600 BAUD ▪ 115200 BAUD	19200 BAUD
Data transfer mode	Select data transfer mode.	▪ ASCII ▪ RTU	RTU
Parity	Select parity bits.	Picklist **ASCII** option: ▪ 0 = **Even** option ▪ 1 = **Odd** option Picklist **RTU** option: ▪ 0 = **Even** option ▪ 1 = **Odd** option ▪ 2 = **None / 1 stop bit** option ▪ 3 = **None / 2 stop bits** option	Even
Byte order	Select byte transmission sequence.	▪ 0-1-2-3 ▪ 3-2-1-0 ▪ 1-0-3-2 ▪ 2-3-0-1	1-0-3-2
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	▪ Off ▪ Alarm or warning ▪ Warning ▪ Alarm	Alarm
Failure mode	Select measured value output behavior when a diagnostic message occurs via Modbus communication. NaN [1]	▪ NaN value ▪ Last valid value	NaN value

1) Not a Number

10.4.6 Low flow cut off

The **Low flow cut off** submenu contains the parameters that must be set in order to configure the low flow cut off.

Navigation
"Setup" menu → Low flow cut off



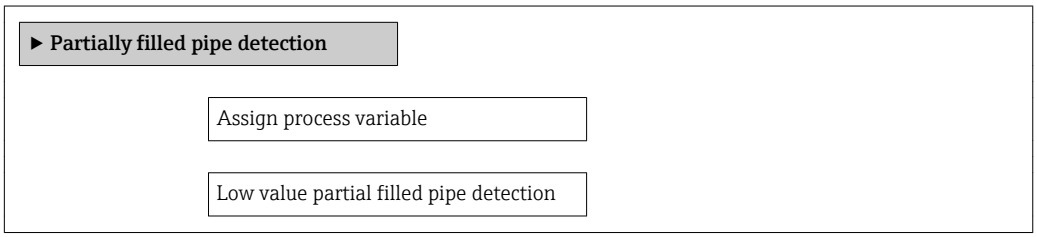
Parameter overview with brief description

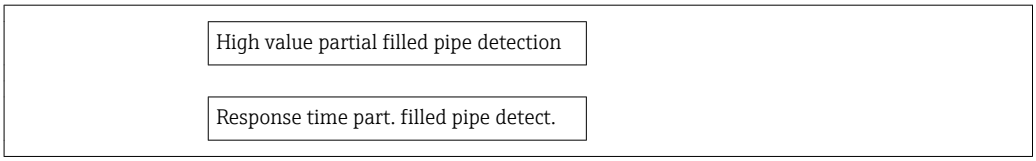
Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Mass flow ▪ Volume flow	Mass flow
On value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 42): ▪ Mass flow ▪ Volume flow	Enter on value for low flow cut off.	Positive floating-point number	For liquids: depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 42): ▪ Mass flow ▪ Volume flow	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 42): ▪ Mass flow ▪ Volume flow	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.4.7 Detection of partially filled pipes

The **Partially filled pipe detection** submenu contains parameters required for configuring partially filled pipe detection.

Navigation
"Setup" menu → Partially filled pipe detection





Parameter overview with brief description

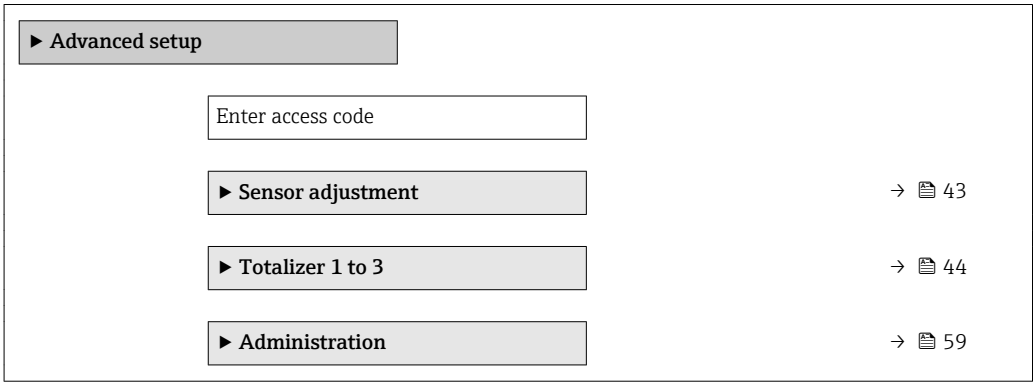
Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for partially filled pipe detection.	▪ Off ▪ Density	Off
Low value partial filled pipe detection	The **Density** option is selected in the **Assign process variable** parameter.	Enter lower limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depending on country: ▪ 200 kg/m³ ▪ 12.5 lb/ft³
High value partial filled pipe detection	The **Density** option is selected in the **Assign process variable** parameter.	Enter upper limit value for deactivating partialy filled pipe detection.	Signed floating-point number	Depending on country: ▪ 6 000 kg/m³ ▪ 374.6 lb/ft³
Response time part. filled pipe detect.	In the **Assign process variable** parameter, the **Density** option is selected.	Enter time before diagnostic message is displayed for partially filled pipe detection.	0 to 100 s	1 s

10.5 Advanced settings

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

Navigation

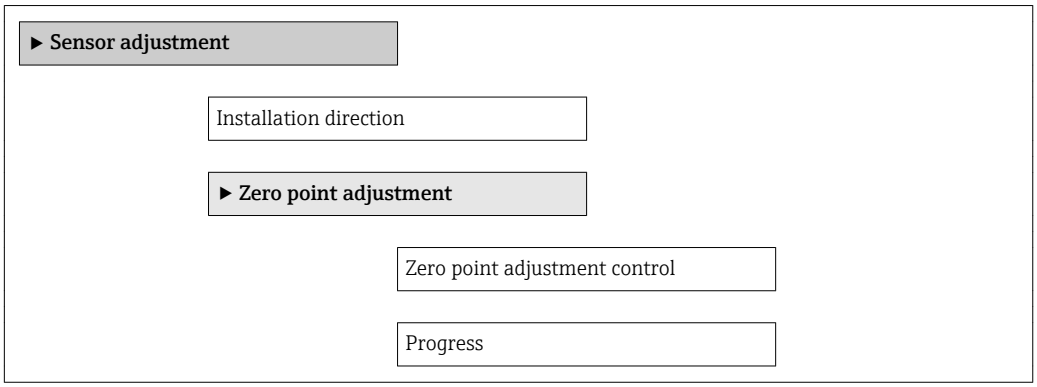
"Setup" menu → Advanced setup



10.5.1 Sensor adjustment

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

Navigation
"Setup" menu → Advanced setup → Sensor adjustment



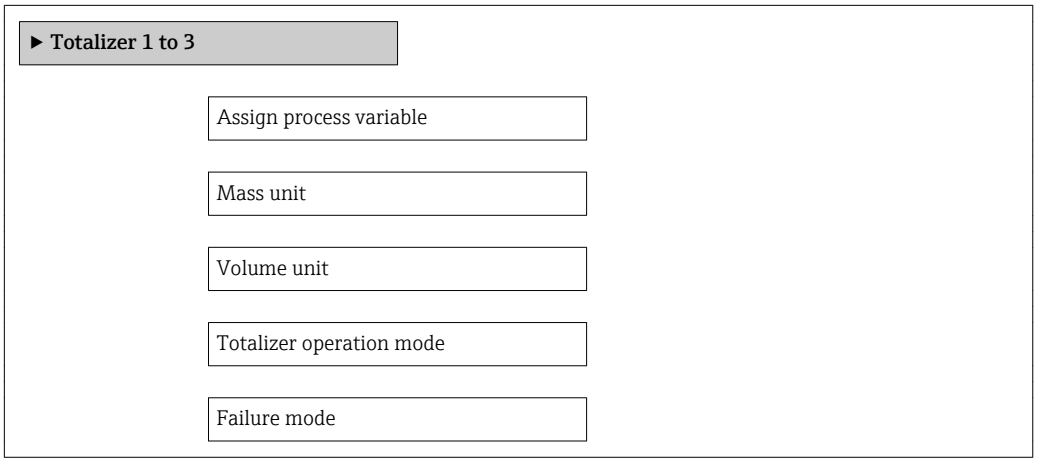
Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ Flow in arrow direction ▪ Flow against arrow direction	Flow in arrow direction
Zero point adjustment control	Start zero point adjustment.	▪ Cancel ▪ Busy ▪ Zero point adjust failure ▪ Start	Cancel
Progress	Shows the progress of the process.	0 to 100 %	–

10.5.2 Configuring the totalizer

The totalizer in question can be configured in the **Totalizer 1 to 3** submenu.

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



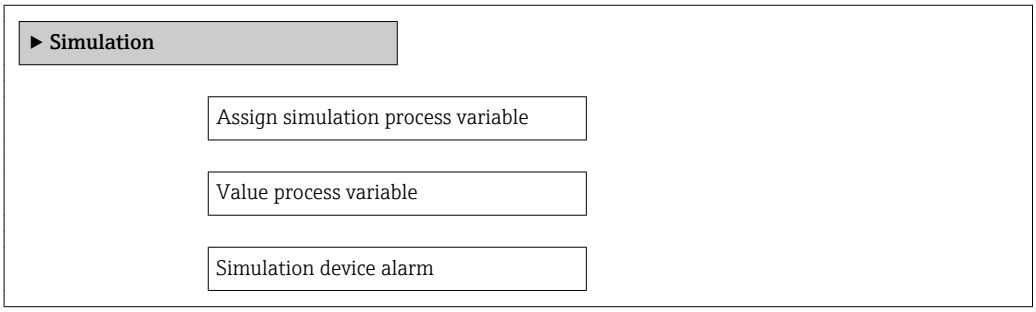
Parameter overview with brief description

Parameter	Prerequsite	Description	Selection	Factory setting
Assign process variable	–	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow	Mass flow
Mass unit	The **Mass flow** option is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu.	Select mass unit.	Unit choose list	Depending on country: ▪ g ▪ oz
Volume unit	The **Volume flow** option is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu.	Select volume unit.	Unit choose list	Depending on country: ▪ ml ▪ fl oz (us)
Totalizer operation mode	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

10.6 Simulation

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

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Density ▪ Temperature	Off
Value process variable	One of the following options is selected in the **Assign simulation process variable** parameter (→ 🖹 46): ▪ Mass flow ▪ Volume flow ▪ Density ▪ Temperature	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Simulation device alarm	–	Switch the device alarm on and off.	▪ Off ▪ On	Off

11 Operation

11.1 Reading device locking status

Device active write protection: **Locking status** parameter

Navigation
"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Temporarily locked	Write access to the parameters is temporarily lock due to device-internal processing (e.g. data upload/download, reset). Once the internal processing has been completed, the parameters can be changed once again.

Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Locking status	Indicates the write protection with the highest priority that is currently active.	Temporarily locked	Temporarily locked

11.2 Reading access authorization status on operating software

Displaying active access authorization: **Access status tooling** parameter

Navigation
"Operation" menu → Access status tooling

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.	▪ Operator ▪ Maintenance	Maintenance

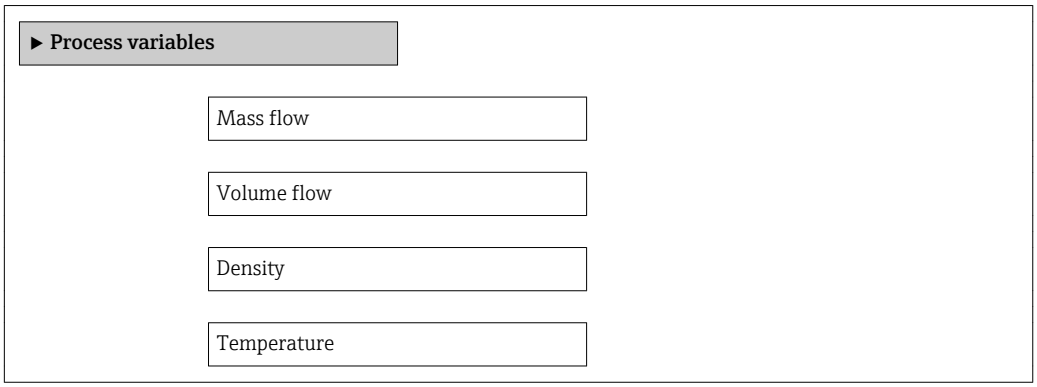
11.3 Reading measured values

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

11.3.1 Process variables

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

Navigation
"Diagnostics" menu → Measured values → Process variables



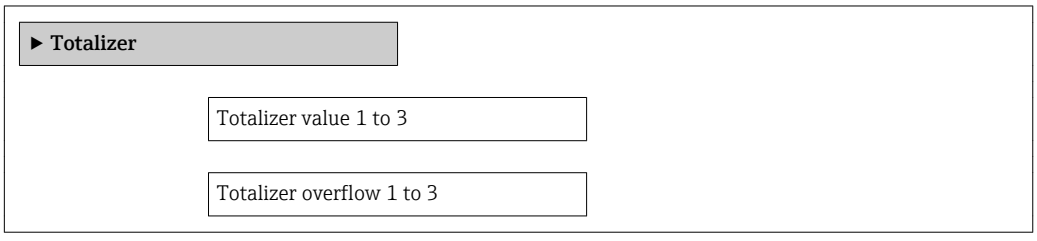
Parameter overview with brief description

Parameter	Description	User interface
Mass flow	Displays the mass flow currently measured. *Dependency* The unit is taken from the **Mass flow unit** parameter	Signed floating-point number
Volume flow	Displays the volume flow currently calculated. *Dependency* The unit is taken from the **Volume flow unit** parameter	Signed floating-point number
Density	Shows the density currently measured. *Dependency* The unit is taken from: **Density unit** parameter	Signed floating-point number
Temperature	Shows the medium temperature currently measured. *Dependency* The unit is taken from: **Temperature unit** parameter	Signed floating-point number

11.3.2 Totalizer

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

Navigation
"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

Parameter	Prerequsite	Description	User interface
Totalizer value	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Displays the current totalizer overflow.	Integer with sign

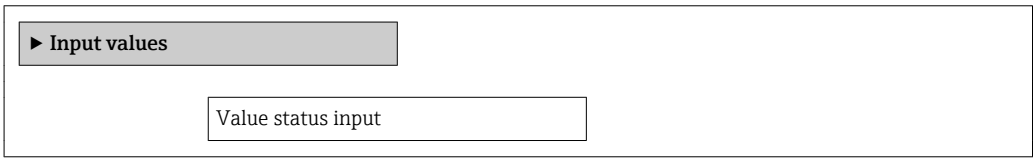
11.3.3 Input values

The **Input values** submenu guides you systematically to the individual input values.

Navigation

"Diagnostics" menu → Measured values → Input values

Structure of the submenu



Parameter overview with brief description

Parameter	Description	User interface
Value status input	Shows the current input signal level.	▪ High ▪ Low

11.4 Performing a totalizer reset

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

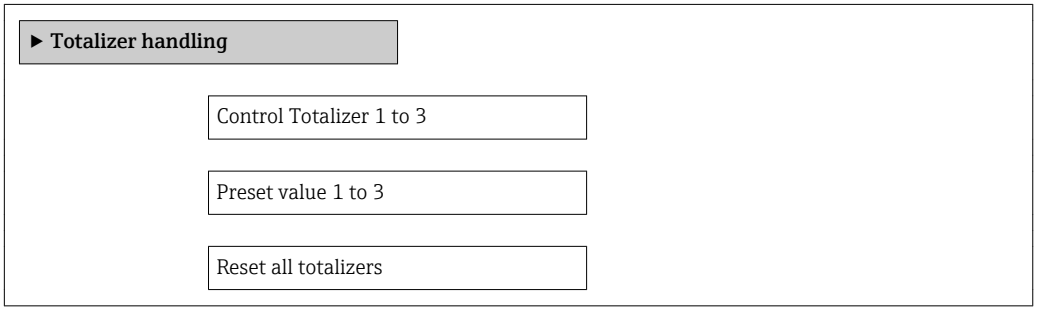
Function scope of the "Control Totalizer" parameter

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

Function scope of the "Reset all totalizers" parameter

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

Navigation
"Operation" menu → Totalizer handling



Parameter overview with brief description

Parameter	Prerequsite	Description	Selection / User entry	Factory setting
Control Totalizer	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	Totalize
Preset value	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 45) of the **Totalizer 1 to 3** submenu: ▪ Volume flow ▪ Mass flow	Specify start value for totalizer. *Dependency* The unit of the selected process variable is specified for the totalizer in the **Assign process variable** parameter. If the following is selected in the **Assign process variable** parameter: ▪ **Volume flow** option: **Volume flow unit** parameter ▪ **Mass flow** option: **Mass flow unit** parameter	Signed floating-point number	Country-specific: ▪ 0 kg ▪ 0 lb
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

11.5 Batching control

The **Batching** submenu contains all the parameters required for batching control.

Navigation
"Operation" submenu → Batching

Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Batch control	Switch the batch on and off.	▪ Start ▪ Stop	Stop
Batch counter	Shows number of passed batch procedures.	Positive integer	–
Last batch quantity	Shows total quantity of last batch. *Dependency* The unit is taken from: **Batch unit** parameter	Signed floating-point number	–
Quantity last drip	Shows drip quantity of last batch. *Dependency* The unit is taken from: **Batch unit** parameter	Signed floating-point number	–
Current drip correction quantity	Shows the drip correction quantity of current batch. *Dependency* The unit is taken from: **Batch unit** parameter	Signed floating-point number	–

Parameter	Description	Selection / User interface	Factory setting
Overall batching quantity	Shows the total quantity of all passed batch procedures of current profile. *Dependency* The unit is taken from: **Batch unit** parameter	Signed floating-point number	–
Overflow number overall batch. quantity	Shows how often an overflow of the overall batching quantity has occured.	–32 000.0 to 32 000.0	–
Switch output function 1 to 2	Select function for the switch output.	▪ Close ▪ Open ▪ Batching	▪ Batching (Switch output function 1) ▪ Open (Switch output function 2)
Switch status 1 to 2	Display the current status of the switch output.	▪ Closed ▪ Open	–
Reset overall batching quantity	Reset the total quantity of all passed batch procedures to 0.	▪ Reset ▪ Cancel	Cancel

12 Diagnostics and troubleshooting

12.1 General troubleshooting

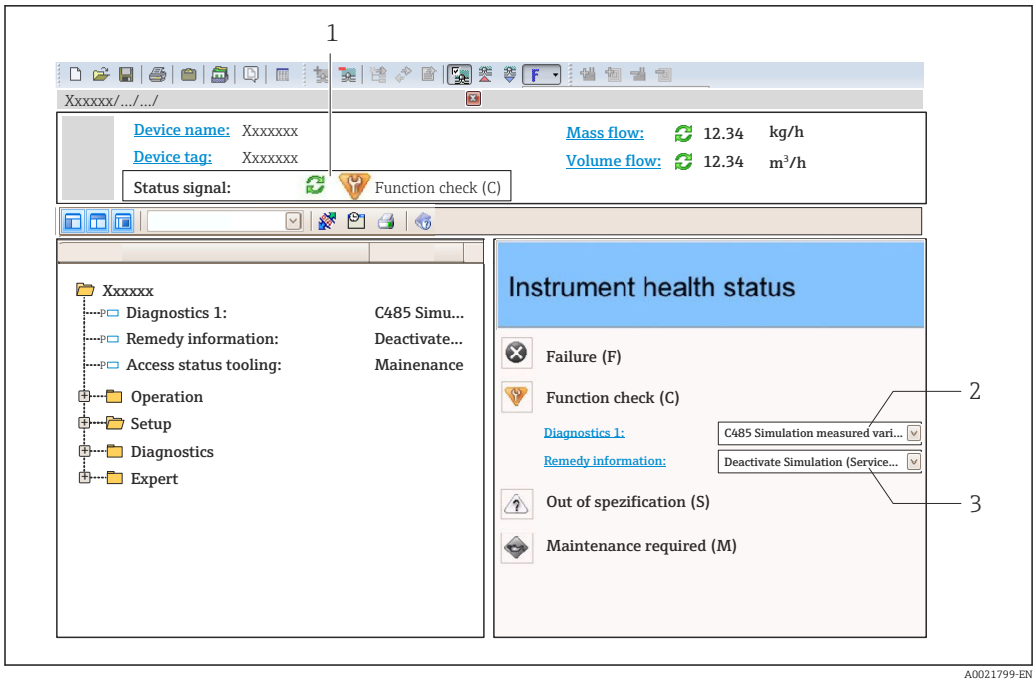
For access

Problem	Possible causes	Remedy
No write access to parameters	Current user role has limited access authorization	Check access authorization status .
No connection via Modbus RS485	Device plug connected incorrectly	Check the pin assignment of the device plug .
No connection via Modbus RS485	Modbus RS485 cable incorrectly terminated	Check the terminating resistor .
No connection via Modbus RS485	Incorrect settings for the communication interface	Check the Modbus RS485 configuration .
No connection via service adapter	Incorrect configuration of USB interface on PC or driver not installed correctly.	Observe the documentation for the Commubox. FXA291: Document "Technical Information" TI00405C

12.2 Diagnostic information in FieldCare

12.2.1 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.

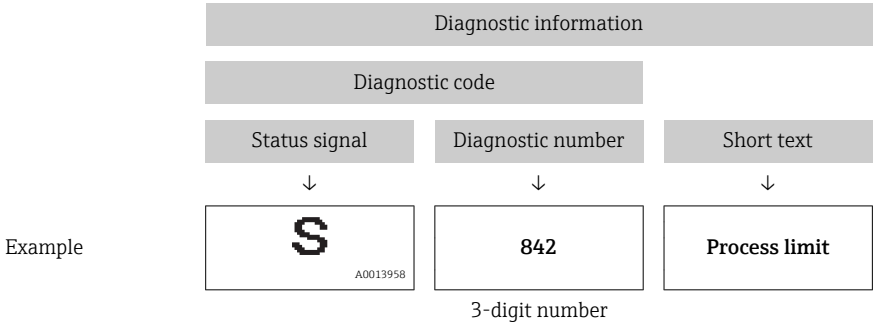


1 *Status area with status signal*
2 *Diagnostic information* → 🖹 *54*
3 *Remedy information with Service ID*

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostics** menu:
- Via parameter
- Via submenu → 🖹 58

Diagnostic information

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



12.2.2 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.

12.3 Diagnostic information via communication interface

12.3.1 Reading out diagnostic information

Diagnostic information can be read out via Modbus RS485 register addresses.

- Via register address **6821** (data type = string): diagnosis code, e.g. F270
- Via register address **6859** (data type = integer): diagnosis number, e.g. 270

For an overview of diagnostic events with diagnosis number and diagnosis code → 56

12.3.2 Configuring error response mode

Error response mode for Modbus RS485 communication can be configured in the **Communication** submenu using 2 parameters.

Navigation path
"Setup" menu → Communication

Parameter overview with brief description

Parameter	Description	Options	Factory setting
Assign diagnostic behavior	Select diagnostic behavior for MODBUS communication.	▪ Off ▪ Alarm or warning ▪ Warning ▪ Alarm	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 value ▪ Last valid value NaN ≡ not a number	NaN value

12.4 Adapting the diagnostic information

12.4.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for certain 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 diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is entered in the Event logbook (events list) submenu only and is not displayed in alternation with the measured value display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.5 Overview of diagnostic information

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 55

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
022	Sensor temperature	1. Change main electronic module 2. Change sensor	F	Alarm
046	Sensor limit exceeded	1. Inspect sensor 2. Check process condition	S	Alarm [1)]
062	Sensor connection	1. Change main electronic module 2. Change sensor	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
140	Sensor signal	1. Check or change main electronics 2. Change sensor	S	Alarm [1)]
190	Special event 1	Contact service	F	Alarm
191	Special event 5	Contact service	F	Alarm
192	Special event 9	Contact service	F	Alarm [1)]
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
274	Main electronic failure	Change electronic	S	Warning [1)]
311	Electronic failure	1. Reset device 2. Contact service	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
390	Special event 2	Contact service	F	Alarm
391	Special event 6	Contact service	F	Alarm
392	Special event 10	Contact service	F	Alarm [1]
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
590	Special event 3	Contact service	F	Alarm
591	Special event 7	Contact service	F	Alarm
592	Special event 11	Contact service	F	Alarm [1]
Diagnostic of process				
834	Process temperature too high	Reduce process temperature	S	Warning [1]
835	Process temperature too low	Increase process temperature	S	Warning [1]
862	Partly filled pipe	1. Check for gas in process 2. Adjust detection limits	S	Warning
910	Tubes not oscillating	1. Check electronic 2. Inspect sensor	F	Alarm
912	Medium inhomogeneous	1. Check process cond. 2. Increase system pressure	S	Warning [1]
912	Inhomogeneous		S	Warning [1]
913	Medium unsuitable	1. Check process conditions 2. Check electronic modules or sensor	S	Alarm [1]
948	Tube damping too high	Check process conditions	S	Warning
990	Special event 4	Contact service	F	Alarm
991	Batch time exceeded	Check process conditions	F	Warning [1]
991	Special event 8	Contact service	F	Alarm
991	Maximum flow rate exceeded	Check process conditions	F	Warning [1]
992	Special event 12	Contact service	F	Alarm [1]

1) Diagnostic behavior can be changed.

12.6 Pending diagnostic events

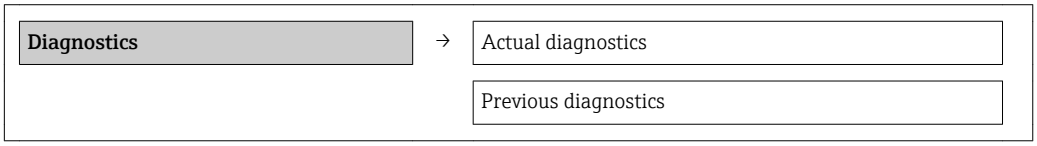
The **Diagnostics** menu provides the option of displaying the current and previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
Via the DeviceCare and FieldCare operating tool→ 54

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu
→ 58

Navigation
"Diagnostics" menu

Structure of the submenu



Parameter overview with brief description

Parameter	Prerequsite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its 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	Two diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.

12.7 Diagnostic list

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

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

To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 54

12.8 Event logbook

12.8.1 Event history

To call up the measures to rectify a diagnostic event:
Via "FieldCare" operating tool → 54

For filtering the displayed event messages → 59

12.8.2 Filtering the event logbook

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

Navigation path
"Diagnostics" menu → Event logbook → Filter options

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

12.8.3 Overview of information events

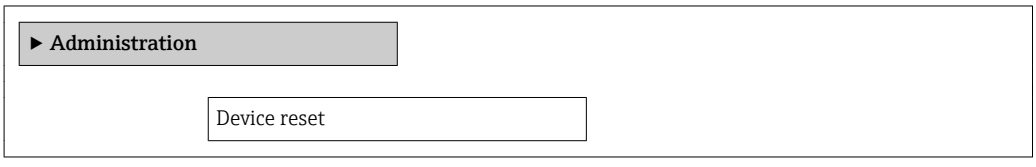
Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	--------(Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1111	Density adjust failure
I1151	History reset
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok

12.9 Resetting the measuring device

The device can be reset in the**Administration** submenu.

Navigation
"Expert" menu → System → Administration



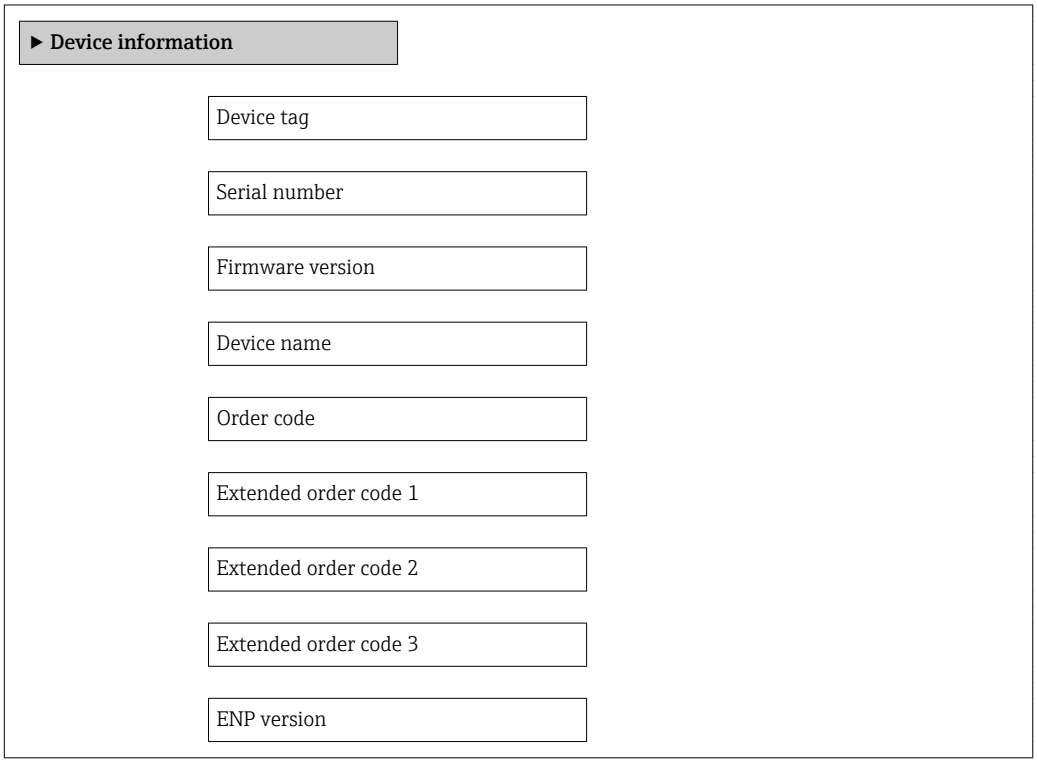
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device	Cancel

12.10 Device information

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

Navigation
"Diagnostics" menu → Device information



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Display the name for the measuring point.	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)	Dosimass
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string with the following format: xx.yy.zz	03.00
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Dosimass	–
Order code	Shows the device order code. It can be found in the "Order code" field on the nameplate.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code. It can be found in the "Ext. ord. cd." field on the nameplate.	Character string	–

Parameter	Description	User interface	Factory setting
Extended order code 2	Shows the 2nd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).		2.02.00

12.11 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
09.2015	03.00.zz	Option **A**	No change in firmware	Operating Instructions	BA01320D/06/EN/02.15
08.2014	03.00.zz	Option **A**	▪ Original firmware ▪ Can be operated via FieldCare and DeviceCare	Operating Instructions	BA01320D/06/EN/01.14

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 Downloads area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 8RE
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

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

13.1.2 Interior cleaning

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 .

13.2 Measuring and test equipment

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

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

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

13.3 Endress+Hauser services

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

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

14 Repair

14.1 General notes

Repair and conversion concept
The Endress+Hauser repair and conversion concept provides for the following:
- The measuring device cannot be converted.
- If the measuring device is defective, the entire device is replaced.
- It is possible to replace seals.

Information on replacing wear parts (seals)
Please note the following when replacing wear parts:
- Use only original Endress+Hauser spare parts.
- Replace the part according to the Installation Instructions.
- Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter in the **Device information** submenu → 60.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

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

14.4 Return

The measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the device.

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

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

14.5.2 Disposing of the measuring device

⚠ WARNING

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

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

Observe the following notes during disposal:

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

15 Accessories

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

15.1 Communication-specific accessories

Accessories	Description
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
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S
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 the "Technical Information" document TI405C/07
Adapter connection	Adapter connections for installation on other electrical connections: ▪ Adapter FXA291 (order number: 71035809) ▪ Adapter RSE8 (order number: 50107169) RSE8 connection jack, 8-pin adapter (RSE8), 24 V DC, pulse, status ▪ Adapter RSE5 (order number: 50107168) RSE8 connection jack, 5-pin adapter (RSE5), 24 V DC, pulse, status ▪ Adapter RSE4 (order number: 50107167) RSE8 connection jack, 4-pin adapter (RSE4), 24 V DC, pulse
Connecting cable RSE8	Cable RKWTN8-56/5 P92, length: 5 m (Order number: 50107895)

15.2 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all data required to determine 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 throughout 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 information is available for every measuring device over time entire life cycle, such as the Device status, spare parts, device-specific documentation. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.

FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S
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

16 Technical data

16.1 Application

The measuring device is suitable for flow measurement of liquids and gases only.

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

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

16.2 Function and system design

Measuring principle

Mass flow measurement based on the Coriolis measuring principle

Measuring system

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

For information on the structure of the measuring device → 11→ 11

16.3 Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

Volume flow

Measuring range

Flow values in SI units

DN [mm]	Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$ [kg/h]
8	0 to 2 000
15	0 to 6 500
25	0 to 18 000

Flow values in US units

DN [in]	Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$ [lb/min]
3/8	0 to 73.50
½	0 to 238.9
1	0 to 661.5

To calculate the measuring range, use the *Applicator* product selection tool → 65

Recommended measuring range

"Flow limit" section → 73

Operable flow range

Over 1000 : 1.

Flow rates above the preset full scale value are not overridden by the electronics unit, with the result that the totalizer values are registered correctly.

Input signal

Status input

The batching process is controlled by the automation system via the device's status input.

Maximum input values	▪ DC 30 V ▪ 6 mA
Response time	Adjustable: 10 to 200 ms
Input signal level	▪ Low level: 0 to 1.5 V ▪ High level: 3 to 30 V
Assignable functions	▪ Off ▪ Start batching process ▪ Start and stop batching process ▪ Reset totalizers 1-3 separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

Modbus RS485

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

Switch output (batch: valve control)

Depending on the device version, the device has one or two switch outputs.

Switch output	
Version	Active, open emitter
Maximum input values	▪ DC 30 V ▪ 500 mA
Switching behavior	Binary, conductive or non-conductive

Number of switching cycles	Unlimited
Assignable functions	▪ Open ▪ Closed ▪ Batching

Signal on alarm

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

Modbus RS485

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

- Device version: Modbus RS485, 1 switch output (batch), 1 status input
  (Order code for "Output, input": option 4)
  Switch outputs (batch) and status input on supply potential
- Device version: Modbus RS485, 2 switch outputs (batch), 1 status input
  (Order code for "Output, input", option 5:)
  – Switch outputs (batch) on supply potential.
  – Status input, galvanically isolated.

Protocol-specific data

Modbus RS485

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 → 78

16.5 Power supply

Terminal assignment

→ 24

Pin assignment, device plug

→ 25

Supply voltage

DC 24 V (nominal voltage: DC 20 to 30 V)

- The power unit must be tested to ensure that it meets safety requirements (e.g. PELV, SELV).
- The supply voltage must not exceed a maximum short-circuit current of 50 A.

Power consumption

3.5 W

Current consumption

Order code for "Output, input":	Maximum Current consumption
Option **4**: Modbus RS485, 1 switch output (batch), 1 status input	175 mA + 500 mA [1]
Option **5**: Modbus RS485, 2 switch outputs (batch), 1 status input	175 mA + 1000 mA [1]

1) Additional 500 mA per switch output (batch) used.

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

Power supply failure

- Totalizers stop at the last value measured.
- Error messages (incl. total operated hours) are stored.

Electrical connection

→ 27

Potential equalization

Requirements

No special measures for potential equalization are required.

For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

Cable specification

→ 24

16.6 Performance characteristics

Reference operating conditions

Error limits based on ISO 11631

- Water at +15 to +45 °C (+59 to +113 °F) at2 to 6 bar (29 to 87 psi)
- Specifications as per calibration protocol
- Accuracy based on accredited calibration rigs that are traced to ISO 17025.

To obtain measured errors, use the *Applicator* sizing tool → 65→ 78

Maximum measured error

o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

Base accuracy

Mass flow and volume flow (liquids)
- ±0.15 % o.r.
- ±0.30 % ± [(zero point stability : measured value) · 100] % o.r.
- ±5 % ± [(zero point stability : measured value) · 100] % o.r.

Density (liquids)
- Reference operating conditions: ±0.0005 g/cm³
- Field density calibration: ±0.0005 g/cm³
  (after field density calibration under process conditions)
- Standard density calibration: ±0.02 g/cm³
  (valid over the entire temperature range and density range)

Temperature
±0.5 °C ± 0.005 · T °C (±0.9 °F ± 0.003 · (T − 32) °F)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
8	⅜	0.20	0.007
15	½	0.65	0.024
25	1	1.80	0.066

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
8	2 000	200	100	40	20	4
15	6 500	650	325	130	65	13
25	18 000	1 800	900	360	180	36

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
⅜	73.50	7.350	3.675	1.470	0.735	0.147
½	238.9	23.89	11.95	4.778	2.389	0.478
1	661.5	66.15	33.08	13.23	6.615	1.323

Repeatability

Base repeatability

Dosing time [s]	Standard deviation [%]
≥ 0.75	0.2
≥ 1.5	0.1
≥ 3.0	0.05

Density (liquids)
±0.00025 g/cm³

Temperature
±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (T–32) °F)

Response time
The response time depends on the configuration (damping).

Influence of medium temperature

Mass flow
If there is a differential between the temperature during zero point adjustment and the process temperature, the typical measured error of the sensor is ±0.0003 % of the full scale value/°C (±0.00015 % of the full scale value/°F).

Temperature
±0.005 · T °C (± 0.005 · (T – 32) °F)

Influence of medium pressure
A difference between the calibration pressure and process pressure does not affect accuracy.

16.7 Installation

"Mounting requirements"

16.8 Environment

Ambient temperature range

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
All components apart from the display modules:
–40 to +80 °C (–40 to +176 °F), preferably at +20 °C (+68 °F)

Degree of protection
As standard: IP67, type 4X enclosure

Shock resistance
As per IEC/EN 60068-2-31

Vibration resistance
Acceleration up to 1 g, 10 to 150 Hz, based on IEC/EN 60068-2-6

Interior cleaning
- Cleaning in place (CIP)
- Sterilization in place (SIP)

Observe the maximum medium temperatures → 73

Electromagnetic compatibility (EMC)
According to IEC/EN 61326

For details, refer to the Declaration of Conformity.

16.9 Process

Medium temperature range	**Sensor** −40 to +125 °C (−40 to +257 °F) **Cleaning** +150 °C (+302 °F) / 60 min for CIP and SIP processes **Seals** No internal seals
Medium pressure range (nominal pressure)	max. 40 bar (580 psi), depending on process connection
Density	0 to 5 000 kg/m³ (0 to 312 lb/cf)
Pressure-temperature ratings	An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document
Secondary containment pressure rating	The housing does not have pressure vessel classification. For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section
Flow limit	Select the nominal diameter by optimizing between the required flow range and permissible pressure loss. For an overview of the full scale values for the measuring range, see the "Measuring range" section → 67 ▪ The minimum recommended full scale value is approx. 1/20 of the maximum full scale value ▪ For the most common applications, 20 to 50 % of the maximum full scale value can be considered ideal ▪ Select a low full scale value for abrasive media (e.g. liquids with entrained solids): Flow velocity < 1 m/s (< 3 ft/s).
Pressure loss	To calculate the pressure loss, use the *Applicator* sizing tool → 78
Heating	NOTICE **Electronics can overheat due to elevated ambient temperature!** ▶ Observe maximum permitted ambient temperature for the transmitter . ▶ Depending on the fluid temperature, take the device orientation requirements into account . NOTICE **Danger of overheating when heating** ▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F) ▶ Ensure that convection takes place on a sufficiently large scale at the transmitter neck. ▶ Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

Heating options

If a fluid requires that no heat loss should occur at the sensor, users can avail of the following heating options:
- Electrical heating, e.g. with electric band heaters
- Via pipes carrying hot water or steam
- Via heating jackets

Using an electrical trace heating system

If heating is regulated via phase angle control or pulse packages, magnetic fields can affect the measured values (= for values that are greater than the values approved by the EN standard (sine 30 A/m)).

For this reason, the sensor must be magnetically shielded: the housing can be shielded with tin plates or electric sheets without a privileged direction (e.g. V330-35A).

The sheet must have the following properties:
- Relative magnetic permeability μr ≥ 300
- Plate thickness d ≥ 0.35 mm (d ≥ 0.014 in)

Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

16.10 Mechanical construction

Design, dimensions

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

Weight

Compact version

Weight in SI units

DN [mm]	Weight [kg]
8	3.5
15	4.0
25	4.5

Weight in US units

DN [in]	Weight [lbs]
⅜	7.7
½	8.8
1	9.9

Materials

Transmitter housing

- Acid and alkali-resistant outer surface
- Stainless steel 1.4308 (304)

Device plugs

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

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel 1.4301 (304)

Measuring tubes

Stainless steel, 1.4539 (904L)

Process connections

- Flanges according to EN (DIN):
  Stainless steel, 1.4404 (316/316L)
- Flanges according to DIN 32676:
  Stainless steel, 1.4435 (316L)
- All other process connections:
  Stainless steel, 1.4404 (316L)

List of all available process connections → 76

Surface quality (parts in contact with medium)

- Ra_{max} = 0.4 µm (16 µin)
- Ra_{max} = 0.8 µm (32 µin)

Seals

Welded process connections without internal seals

Process connections

Flanges
EN 1092-1 (DIN 2512N)

Tri-Clamp (OD tubes)
BS4825-3

Clamp with compression fitting
DIN 32676

Threaded adapter
- DIN 11851
- SMS 1145
- ISO 2853
- DIN 11864-1 Form A

For information on the different materials used in the process connections → 75

16.11 Operability

Local operation

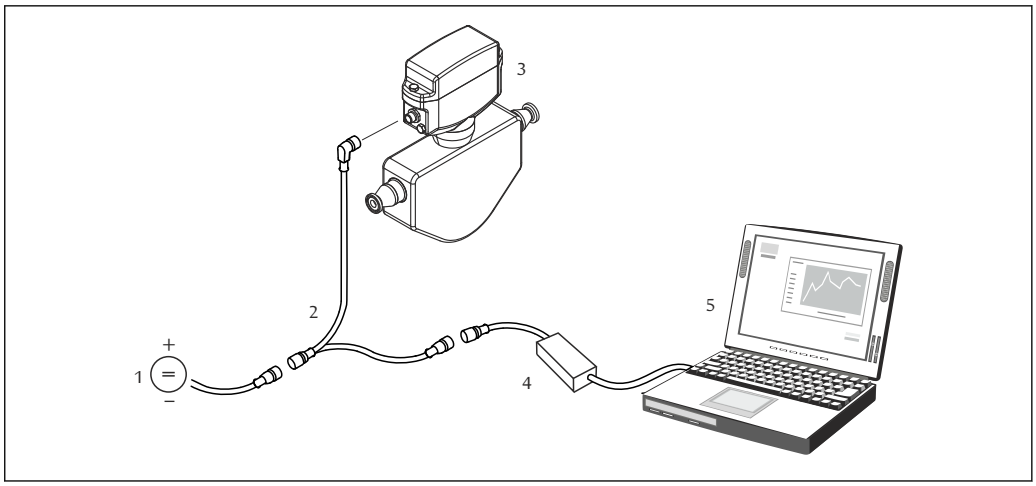
This device cannot be operated locally using a display or operating elements.

Remote operation

Via service adapter and Commubox FXA291

The Endress+Hauser service and configuration software FieldCare or DeviceCare can be used for operation and configuration.

The device is connected by means of a service adapter and a Commubox FXA291 to the computer's USB interface.



1 Supply voltage 24 V DC
2 Service adapter
3 Dosimass
4 Commubox FXA291
5 Computer with "FieldCare" or "DeviceCare" operating tool

The service adapter, cable and Commubox FXA291 are not included in the delivery. These components can be ordered as accessories → 65.

16.12 Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-Tick symbol	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Hygienic compatibility	3A approval
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).
- EN 61000-4-3 (IEC 1000-4-3)
  Operating behavior A with shielded connecting cable possible (shielding connected as short as possible on both sides), otherwise operating behavior B
- NAMUR NE 21
  Electromagnetic compatibility of industrial process and laboratory control equipment
- CAN/CSA C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements

16.13 Accessories

Overview of accessories available for order → 65

16.14 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
Dosimass	KA00043D

Description of device parameters

Measuring device	Documentation code
	Modbus RS485 option 4 and 5
Dosimass	GP01047D

Technical Information

Measuring device	Documentation code
Dosimass	TI00065D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX Ex nA	XA00079D
cCSAus	FES0232

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