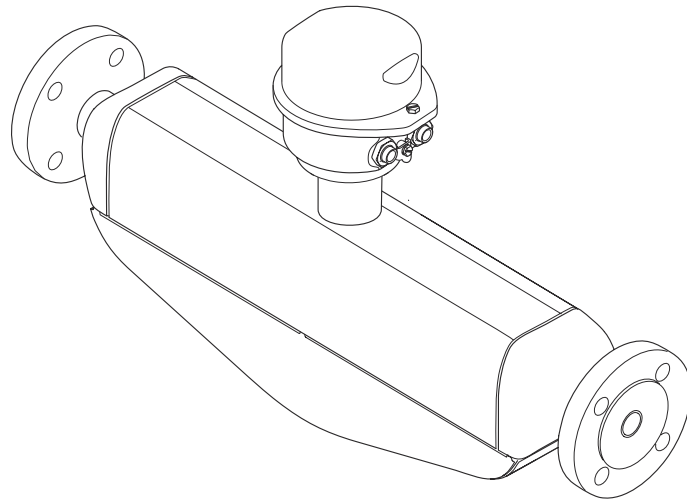


Operating Instructions

Proline Promass S 100

Coriolis flowmeter
HART



- 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	About this document	6	6.2	Mounting the measuring device	23
1.1	Document function	6	6.2.1	Required tools	23
1.2	Symbols used	6	6.2.2	Preparing the measuring device	24
1.2.1	Safety symbols	6	6.2.3	Mounting the measuring device	24
1.2.2	Electrical symbols	6	6.2.4	Turning the display module	24
1.2.3	Tool symbols	6	6.3	Post-installation check	25
1.2.4	Symbols for certain types of information	7	7	Electrical connection	26
1.2.5	Symbols in graphics	7	7.1	Connection conditions	26
1.3	Documentation	7	7.1.1	Required tools	26
1.3.1	Standard documentation	8	7.1.2	Requirements for connecting cable	26
1.3.2	Supplementary device-dependent documentation	8	7.1.3	Terminal assignment	27
1.4	Registered trademarks	8	7.1.4	Pin assignment, device plug	28
			7.1.5	Preparing the measuring device	28
2	Basic safety instructions	9	7.2	Connecting the measuring device	28
2.1	Requirements for the personnel	9	7.2.1	Connecting the transmitter	29
2.2	Designated use	9	7.2.2	Ensure potential equalization	30
2.3	Workplace safety	10	7.3	Special connection instructions	31
2.4	Operational safety	10	7.3.1	Connection examples	31
2.5	Product safety	10	7.4	Ensuring the degree of protection	33
2.6	IT security	11	7.5	Post-connection check	33
3	Product description	12	8	Operation options	35
3.1	Product design	12	8.1	Overview of operating options	35
3.1.1	Device version with HART communication type	12	8.2	Structure and function of the operating menu	36
4	Incoming acceptance and product identification	13	8.2.1	Structure of the operating menu	36
4.1	Incoming acceptance	13	8.2.2	Operating philosophy	37
4.2	Product identification	13	8.3	Access to the operating menu via the web browser	38
4.2.1	Transmitter nameplate	14	8.3.1	Function range	38
4.2.2	Sensor nameplate	15	8.3.2	Prerequisites	38
4.2.3	Symbols on measuring device	16	8.3.3	Establishing a connection	39
5	Storage and transport	17	8.3.4	Logging on	40
5.1	Storage conditions	17	8.3.5	User interface	41
5.2	Transporting the product	17	8.3.6	Disabling the Web server	42
5.2.1	Measuring devices without lifting lugs	17	8.3.7	Logging out	42
5.2.2	Measuring devices with lifting lugs	18	8.4	Access to the operating menu via the operating tool	43
5.2.3	Transporting with a fork lift	18	8.4.1	Connecting the operating tool	43
5.3	Packaging disposal	18	8.4.2	Field Xpert SFX350, SFX370	44
6	Installation	19	8.4.3	FieldCare	44
6.1	Installation conditions	19	8.4.4	DeviceCare	46
6.1.1	Mounting position	19	8.4.5	AMS Device Manager	46
6.1.2	Requirements from environment and process	21	8.4.6	SIMATIC PDM	46
6.1.3	Special mounting instructions	23	8.4.7	Field Communicator 475	46
			9	System integration	47
			9.1	Overview of device description files	47
			9.1.1	Current version data for the device	47
			9.1.2	Operating tools	47
			9.2	Measured variables via HART protocol	47
			9.3	Other settings	49

10	Commissioning	52		
10.1	Function check	52		
10.2	Setting the operating language	52		
10.3	Configuring the measuring device	52		
10.3.1	Defining the tag name	52		
10.3.2	Selecting and setting the medium	54		
10.3.3	Configuring the current output	56		
10.3.4	Configuring the pulse/frequency/ switch output	58		
10.3.5	Configuring the HART input	66		
10.3.6	Configuring the output conditioning	67		
10.3.7	Configuring the low flow cut off	70		
10.3.8	Configuring the partial filled pipe detection	71		
10.4	Advanced settings	72		
10.4.1	Using the parameter to enter the access code	72		
10.4.2	Setting the system units	72		
10.4.3	Calculated values	74		
10.4.4	Carrying out a sensor adjustment	75		
10.4.5	Configuring the totalizer	76		
10.4.6	Carrying out additional display configurations	78		
10.4.7	Using parameters for device administration	81		
10.5	Simulation	81		
10.6	Protecting settings from unauthorized access	83		
10.6.1	Write protection via access code	83		
10.6.2	Write protection via write protection switch	84		
11	Operation	85		
11.1	Reading the device locking status	85		
11.2	Adjusting the operating language	85		
11.3	Configuring the display	85		
11.4	Reading measured values	85		
11.4.1	"Measured variables" submenu	85		
11.4.2	"Totalizer" submenu	87		
11.4.3	Output values	88		
11.5	Adapting the measuring device to the process conditions	89		
11.6	Performing a totalizer reset	89		
11.6.1	Function scope of the "Control Totalizer" parameter	90		
11.6.2	Function scope of the "Reset all totalizers" parameter	90		
12	Diagnostics and troubleshooting	91		
12.1	General troubleshooting	91		
12.2	Diagnostic information via light emitting diodes	92		
12.2.1	Transmitter	92		
12.3	Diagnostic information in the Web browser	93		
12.3.1	Diagnostic options	93		
12.3.2	Calling up remedy information	94		
12.4	Diagnostic information in DeviceCare or FieldCare	94		
12.4.1	Diagnostic options	94		
12.4.2	Calling up remedy information	95		
12.5	Adapting the diagnostic information	96		
12.5.1	Adapting the diagnostic behavior	96		
12.5.2	Adapting the status signal	96		
12.6	Overview of diagnostic information	97		
12.7	Pending diagnostic events	100		
12.8	Diagnostic list	100		
12.9	Event logbook	101		
12.9.1	Reading out the event logbook	101		
12.9.2	Filtering the event logbook	101		
12.9.3	Overview of information events	101		
12.10	Resetting the measuring device	102		
12.10.1	Function scope of the "Device reset" parameter	103		
12.11	Device information	103		
12.12	Firmware history	105		
13	Maintenance	106		
13.1	Maintenance tasks	106		
13.1.1	Exterior cleaning	106		
13.1.2	Interior cleaning	106		
13.2	Measuring and test equipment	106		
13.3	Endress+Hauser services	106		
14	Repairs	107		
14.1	General notes	107		
14.1.1	Repair and conversion concept	107		
14.1.2	Notes for repair and conversion	107		
14.2	Spare parts	107		
14.3	Endress+Hauser services	107		
14.4	Return	107		
14.5	Disposal	108		
14.5.1	Removing the measuring device	108		
14.5.2	Disposing of the measuring device	108		
15	Accessories	109		
15.1	Device-specific accessories	109		
15.1.1	For the sensor	109		
15.2	Communication-specific accessories	109		
15.3	Service-specific accessories	110		
15.4	System components	111		
16	Technical data	112		
16.1	Application	112		
16.2	Function and system design	112		
16.3	Input	112		
16.4	Output	113		
16.5	Power supply	116		
16.6	Performance characteristics	117		
16.7	Installation	121		
16.8	Environment	121		
16.9	Process	121		
16.10	Mechanical construction	123		

16.11 Operability	125
16.12 Certificates and approvals	127
16.13 Application packages	128
16.14 Accessories	129
16.15 Documentation	129
Index	131





1 About this document

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













1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
	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 Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> ▪ Inner ground terminal: Connects the protective earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.




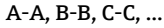



1.2.3 Tool symbols

Symbol	Meaning
	Allen key
	Open-ended wrench



1.2.4 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.
	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Notice or individual step to be observed.
	Series of steps.
	Result of a step.
	Help in the event of a problem.
	Visual inspection.

1.2.5 Symbols in graphics

Symbol	Meaning
	Item numbers
	Series of steps
	Views
	Sections
	Hazardous area
	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 *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	<p>Planning aid for your device</p> <p>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.</p>
Sensor Brief Operating Instructions	<p>Guides you quickly to the 1st measured value - Part 1</p> <p>The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device.</p> <ul style="list-style-type: none"> ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	<p>Guides you quickly to the 1st measured value - Part 2</p> <p>The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value).</p> <ul style="list-style-type: none"> ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	<p>Reference for your parameters</p> <p>The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.</p>

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

Microsoft®

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

TRI-CLAMP®

Registered trademark of Ladish & Co., Inc., Kenosha, USA

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 starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- ▶ Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

2.2 Designated use


Application and media

The measuring device described in these Brief Operating Instructions is intended only for flow measurement of liquids.

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 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:

- ▶ Keep within the specified pressure and temperature range.
- ▶ Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- ▶ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- ▶ Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- ▶ If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section →  7.
- ▶ 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 due to corrosive or abrasive fluids!

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

NOTICE**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**⚠ WARNING**

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

- ▶ For elevated fluid temperatures, 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:

- ▶ Due to the increased risk of electric shock, gloves must be worn.

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 EU directives listed in the device-specific EU 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

3.1.1 Device version with HART communication type



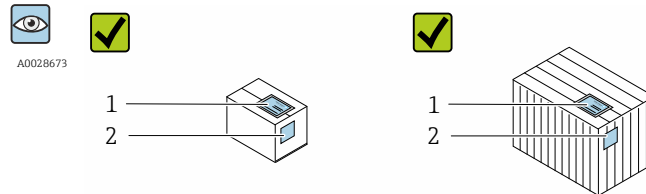
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1 Important components of a measuring device

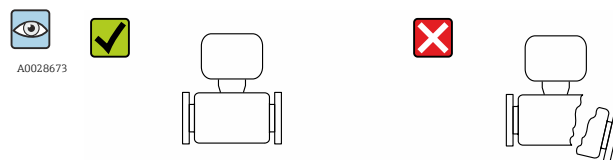
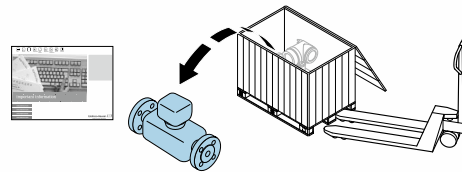
- 1 Sensor
- 2 Transmitter housing
- 3 Main electronics module
- 4 Transmitter housing cover
- 5 Transmitter housing cover (version for optional onsite display)
- 6 Onsite display (optional)
- 7 Main electronics module (with bracket for optional onsite display)

4 Incoming acceptance and product identification

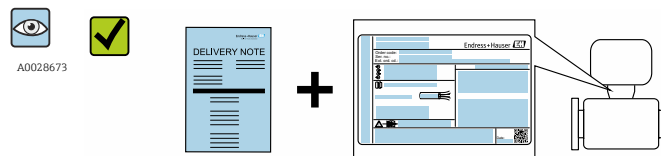
4.1 Incoming acceptance



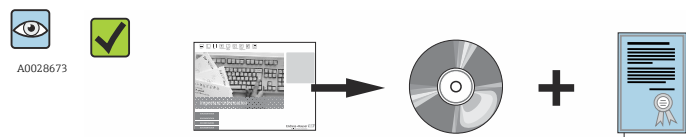
Are the order codes on the delivery note (1) and the product sticker (2) identical?





Are the goods undamaged?



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



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

-  If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section →  14.

4.2 Product identification

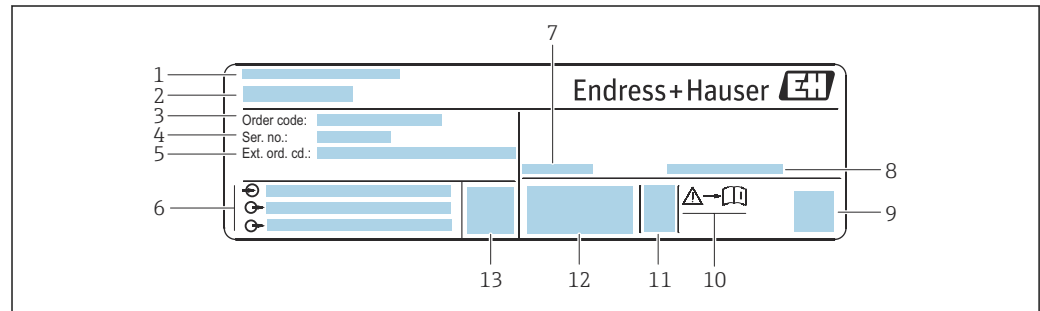
The following options are available for identification of the measuring device:

- 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" → 8 and "Supplementary device-dependent documentation" → 8
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Transmitter nameplate




2 Example of a transmitter nameplate


- 1 Manufacturing location
- 2 Name of the transmitter
- 3 Order code
- 4 Serial number (ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Electrical connection data, e.g. available inputs and outputs, supply voltage
- 7 Permitted ambient temperature (T_a)
- 8 Degree of protection
- 9 2-D matrix code
- 10 Document number of safety-related supplementary documentation
- 11 Manufacturing date: year-month
- 12 CE mark, C-Tick
- 13 Firmware version (FW)

4.2.2 Sensor nameplate



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 3 Example of a sensor nameplate

- 1 Name of the sensor
- 2 Manufacturing location
- 3 Order code
- 4 Serial number (ser. no.)
- 5 Extended order code (Ext. ord. cd.)
- 6 Nominal diameter of the sensor; flange nominal diameter/nominal pressure; sensor test pressure; medium temperature range; material of measuring tube and manifold; sensor-specific information: e.g. pressure range of secondary containment, wide-range density specification (special density calibration)
- 7 Approval information for explosion protection, Pressure Equipment Directive and degree of protection
- 8 Flow direction
- 9 Manufacturing date: year-month
- 10 2-D matrix code
- 11 Document number of safety-related supplementary documentation →  130
- 12 CE mark, C-Tick
- 13 Surface roughness
- 14 Permitted ambient temperature (T_a)




Order code

The measuring device is reordered using the order code.

Extended order code

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

4.2.3 Symbols on measuring device

Symbol	Meaning
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	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 →  121

5.2 Transporting the product

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



A0029252

-  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.

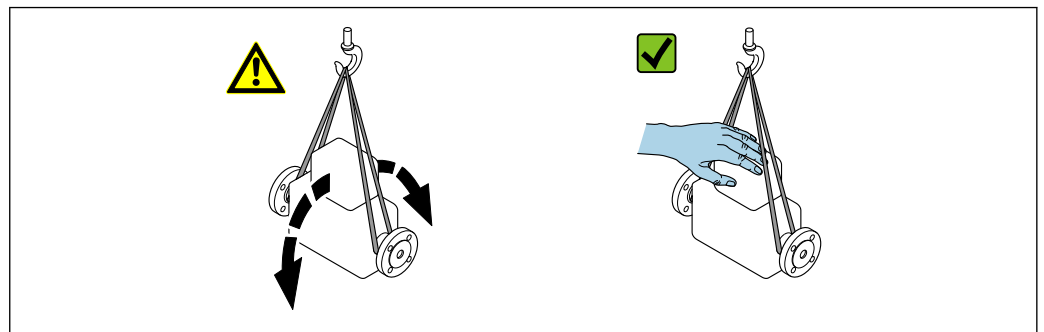
5.2.1 Measuring devices without lifting lugs

WARNING

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

Risk of injury if the measuring device slips.

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



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5.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

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

5.2.3 Transporting with a fork lift

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

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

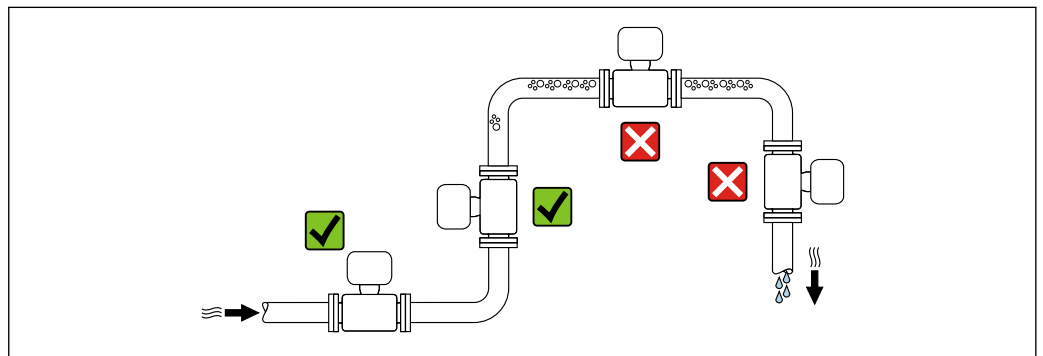
6 Installation

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



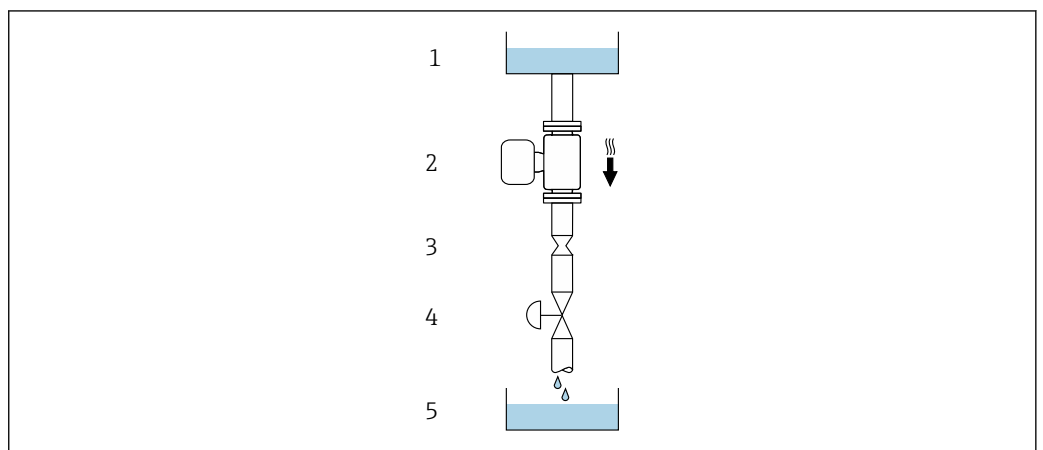
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To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:

- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

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.



A0028773

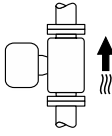
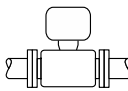
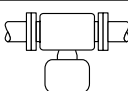
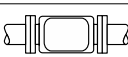
4 Installation in a down pipe (e.g. for batching applications)

- 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
40	1 1/2	22	0.87
50	2	28	1.10

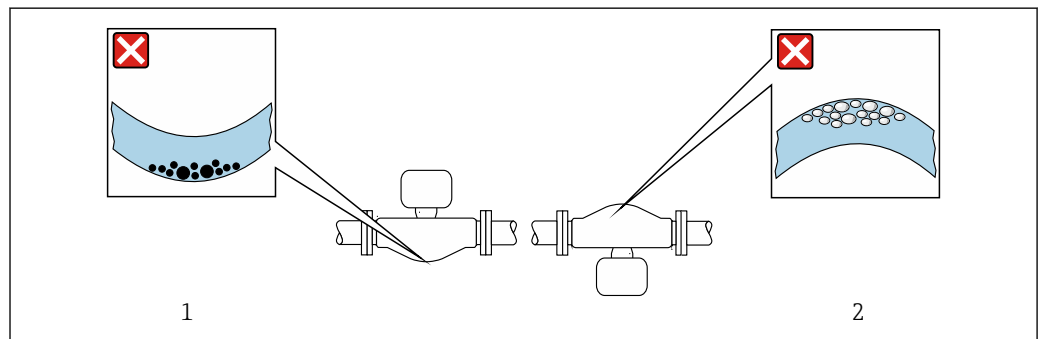
Orientation

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 at top	 A0015589
C	Horizontal orientation, transmitter at bottom	 A0015590
D	Horizontal orientation, transmitter at side	 A0015592

- 1) Applications with low process temperatures may decrease 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.



5 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.

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 → 21.



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	<ul style="list-style-type: none"> ▪ -40 to +60 °C (-40 to +140 °F) ▪ Order code for "Test, certificate", option JM: -50 to +60 °C (-58 to +140 °F)
------------------	--

- ▶ If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

System pressure

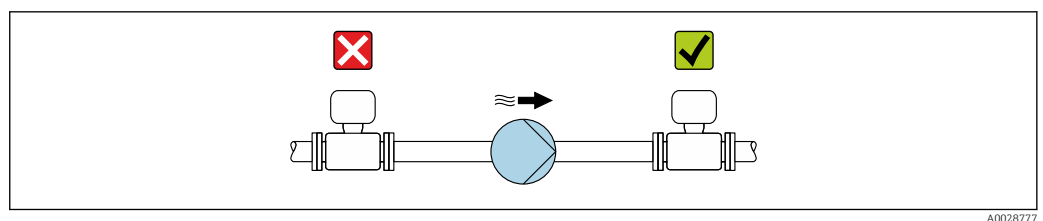
It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas.

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 to keep the heat radiated from the sensor to the transmitter to a low level. A wide range of materials can be used for the required insulation.

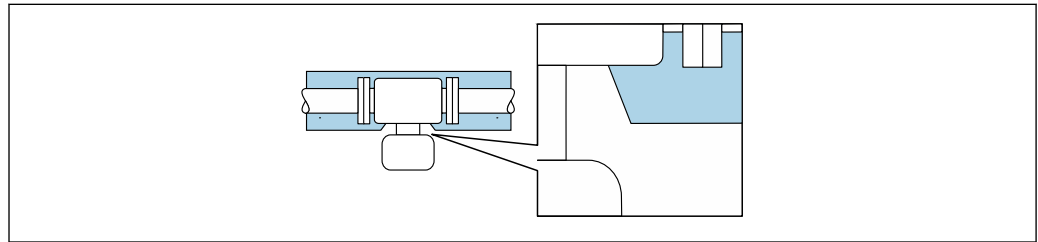
The following device versions are recommended for versions with thermal insulation:

Version with extended neck for insulation:

Order code for "Sensor option", option **CG** with an extended neck length of 105 mm (4.13 in).

NOTICE**Electronics overheating on account of thermal insulation!**

- ▶ Recommended orientation: horizontal orientation, transmitter housing pointing downwards.
- ▶ Do not insulate the transmitter housing .
- ▶ Maximum permissible temperature at the lower end of the transmitter housing: 80 °C (176 °F)
- ▶ Thermal insulation with extended neck free: the insulation is omitted around the extended neck. We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.



A0034391

6 Thermal insulation with extended neck 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 permitted 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 $\mu_r \geq 300$
- Plate thickness $d \geq 0.35$ mm ($d \geq 0.014$ in)

Vibrations

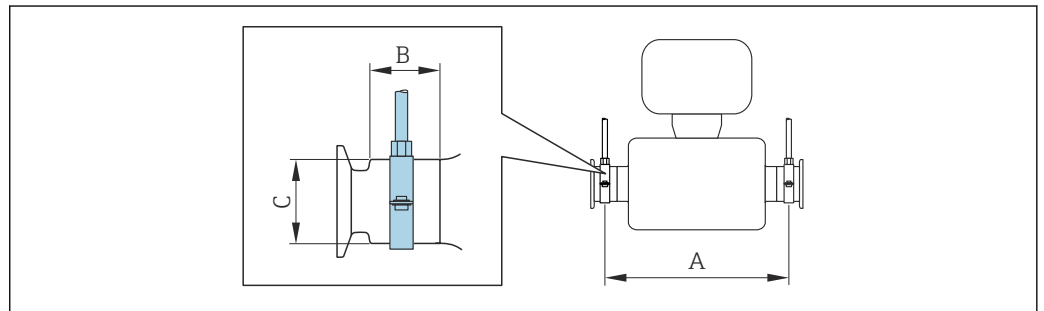
The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

6.1.3 Special mounting instructions

Securing with mounting clamp in the case of hygiene connections

It is not necessary to provide additional support for the sensor for operational performance purposes. If, however, additional support is required for installation purposes, the following dimensions must be observed.

Use mounting clamp with lining between clamp and measuring instrument.



A0030298

DN		A		B		C	
[mm]	[in]	[mm]	[in]	[mm]	[in]	[mm]	[in]
8	$\frac{3}{8}$	298	11.73	33	1.3	28	1.1
15	$\frac{1}{2}$	402	15.83	33	1.3	28	1.1
25	1	542	21.34	33	1.3	38	1.5
40	1 $\frac{1}{2}$	658	25.91	36.5	1.44	56	2.2
50	2	772	30.39	44.1	1.74	75	2.95

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → ☰ 117. Therefore, a zero point adjustment in the field is generally not required.

Experience shows that zero point adjustment is advisable only in special cases:

- To achieve maximum measuring accuracy even with low flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

6.2 Mounting the measuring device

6.2.1 Required tools

For sensor

For flanges and other process connections: Corresponding mounting tools

6.2.2 Preparing the measuring device

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

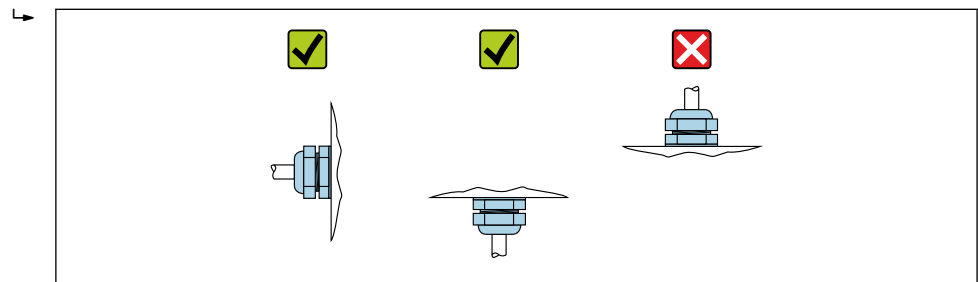
6.2.3 Mounting the measuring device

⚠ 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.

1. Ensure that the direction of the arrow on the nameplate of the sensor matches the flow direction of the fluid.
2. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



A0029263

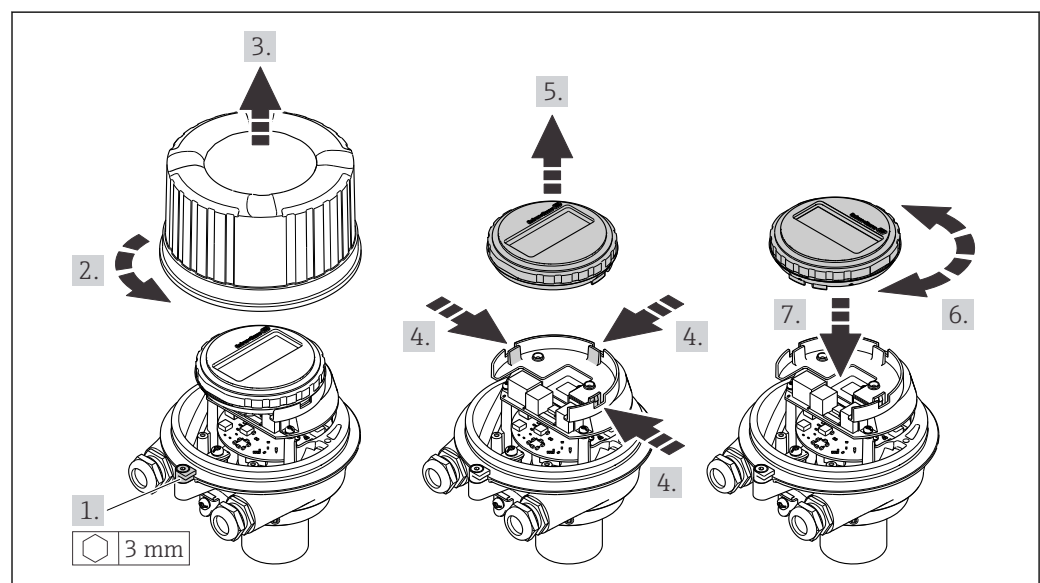
6.2.4 Turning the display module

The local display is only available with the following device version:

Order code for "Display; Operation", option **B**: 4-line; lit, via communication

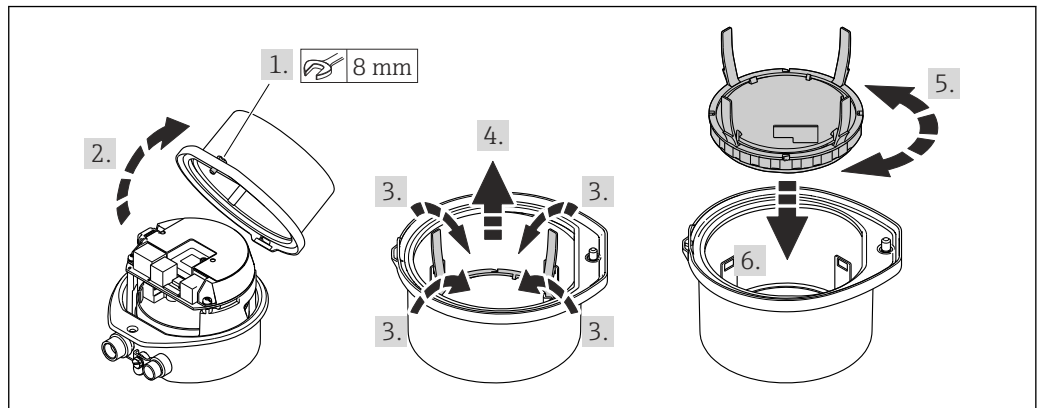
The display module can be turned to optimize display readability.

Aluminum housing version, AlSi10Mg, coated



A0023192

Compact and ultra-compact housing version, hygienic, stainless



A0023195

6.3 Post-installation check

Is the device undamaged (visual inspection)?	<input type="checkbox"/>
Does the measuring device conform to the measuring point specifications? For example: <ul style="list-style-type: none"> ▪ Process temperature → ☰ 121 ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range → ☰ 112 	<input type="checkbox"/>
Has the correct orientation for the sensor been selected ? <ul style="list-style-type: none"> ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids) 	<input type="checkbox"/>
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping → ☰ 20?	<input type="checkbox"/>
Are the measuring point identification and labeling correct (visual inspection)?	<input type="checkbox"/>
Is the device adequately protected from precipitation and direct sunlight?	<input type="checkbox"/>
Are the securing screw and securing clamp tightened securely?	<input type="checkbox"/>

7 Electrical connection

NOTICE

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.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 16 A) should be integrated into the system installation.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp (on aluminum housing): Allen screw 3 mm
- For securing screw (for stainless steel housing): open-ended wrench 8 mm
- Wire stripper
- When using stranded cables: crimper for wire end ferrule

7.1.2 Requirements for connecting cable

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

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Cable diameter

- Cable glands supplied:
M20 × 1.5 with cable \varnothing 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
Wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)




7.1.3 Terminal assignment

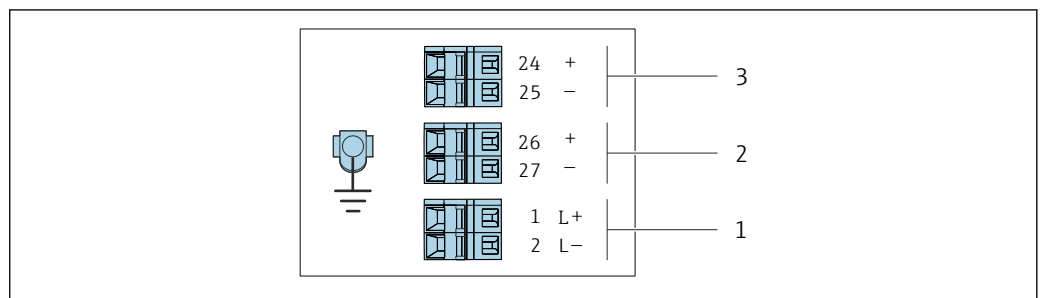
Transmitter

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

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

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

Order code "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Outputs	Power supply	
Options A, B	Terminals	Terminals	<ul style="list-style-type: none"> ▪ Option A: coupling M20x1 ▪ Option B: thread M20x1 ▪ Option C: thread G ½" ▪ Option D: thread NPT ½"
Options A, B	Device plugs →  28	Terminals	<ul style="list-style-type: none"> ▪ Option L: plug M12x1 + thread NPT ½" ▪ Option N: plug M12x1 + coupling M20 ▪ Option P: plug M12x1 + thread G ½" ▪ Option U: plug M12x1 + thread M20
Options A, B, C	Device plugs →  28	Device plugs →  28	Option Q : 2 x plug M12x1
Order code for "Housing": <ul style="list-style-type: none"> ▪ Option A: compact, coated aluminum ▪ Option B: compact, hygienic, stainless ▪ Option C: ultra-compact, hygienic, stainless 			



A0016888

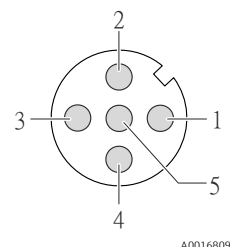
 7 Terminal assignment 4-20 mA HART with pulse/frequency/switch output

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

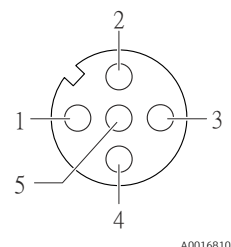
Order code "Output"	Terminal number					
	Power supply		Output 1		Output 2	
	2 (L-)	1 (L+)	27 (-)	26 (+)	25 (-)	24 (+)
Option B	DC 24 V		4-20 mA HART (active)		Pulse/frequency/switch output (passive)	
Order code for "Output": Option B : 4-20 mA HART with pulse/frequency/switch output						

7.1.4 Pin assignment, device plug

Supply voltage

	Pin	Assignment	
	1	L+	DC 24 V
	2		Not assigned
	3		Not assigned
	4	L-	DC 24 V
	5		Grounding/shielding
Coding		Plug/socket	
A		Plug	

Device plug for signal transmission (device side)

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

7.1.5 Preparing the measuring device

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

- Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
Observe requirements for connecting cables → 26.

7.2 Connecting the measuring device

NOTICE

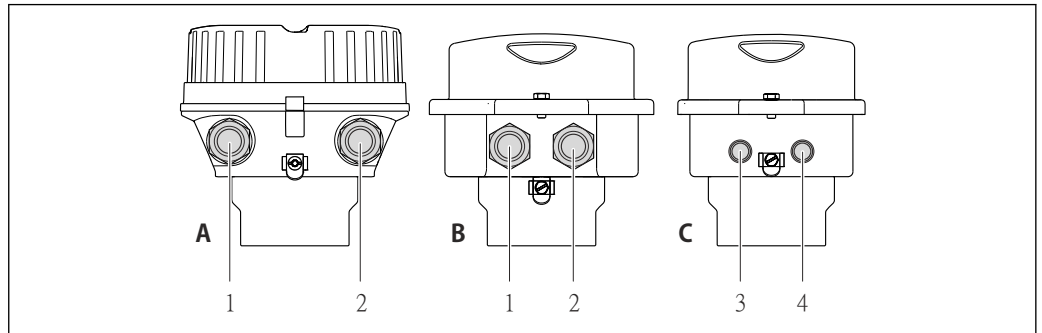
Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by appropriately trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⊕ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.
- The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

7.2.1 Connecting the transmitter

The connection of the transmitter depends on the following order codes:

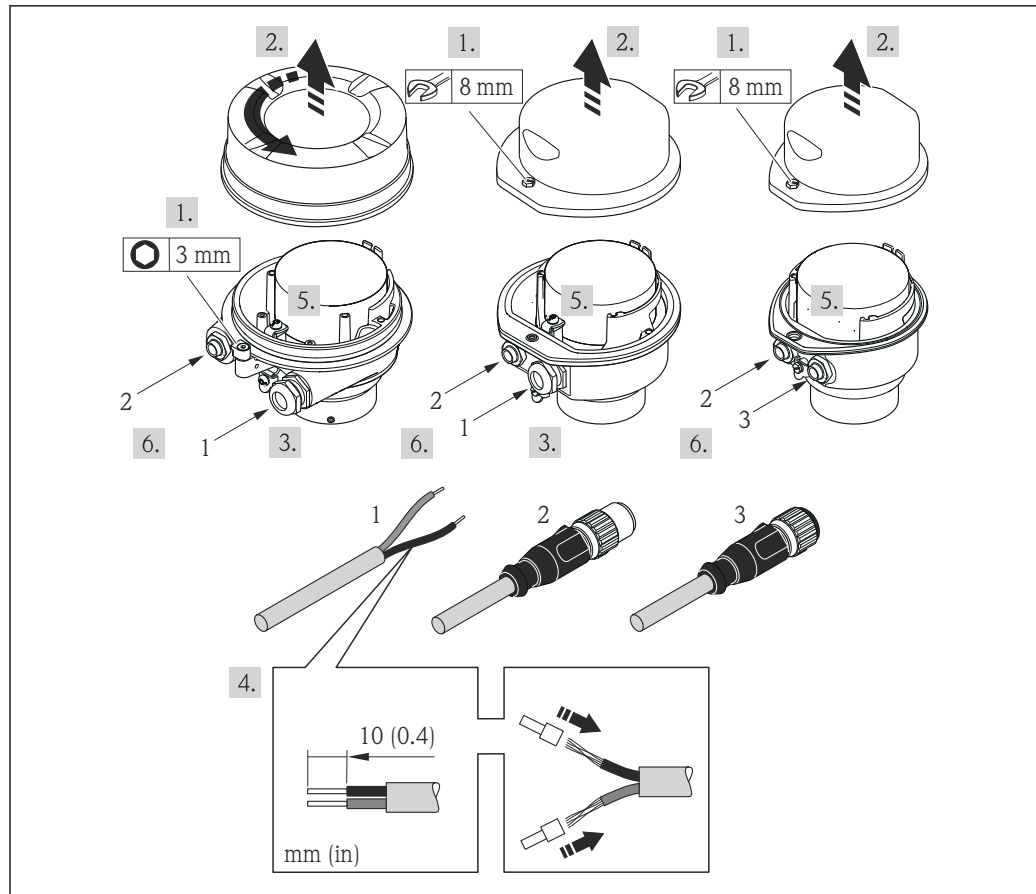
- Housing version: compact or ultra-compact
- Connection version: device plug or terminals



A0016924

8 Housing versions and connection versions

- A Compact, coated aluminum
- B Compact hygienic, stainless or compact, stainless
- 1 Cable entry or device plug for signal transmission
- 2 Cable entry or device plug for supply voltage
- C Ultra-compact hygienic, stainless or ultra-compact, stainless
- 3 Device plug for signal transmission
- 4 Device plug for supply voltage



A0017844

9 Device versions with connection examples

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

i Depending on the housing version disconnect the local display from the main electronics module: Operating Instructions for the device .

- Connect the cable in accordance with the terminal assignment or the device plug pin assignment .

7.2.2 Ensure potential equalization

Requirements

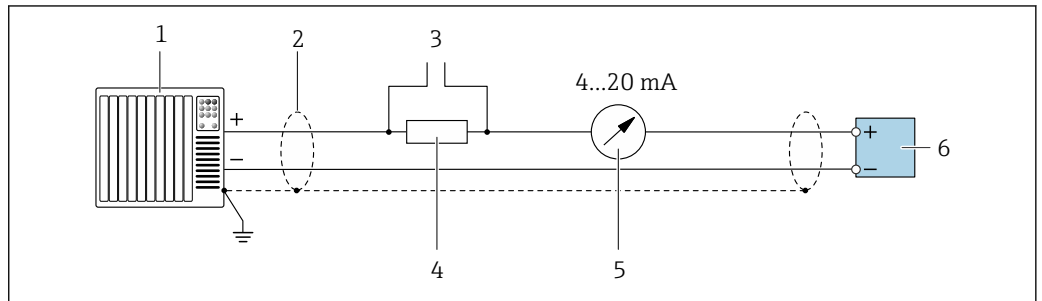
No special measures for potential equalization are required.

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

7.3 Special connection instructions

7.3.1 Connection examples

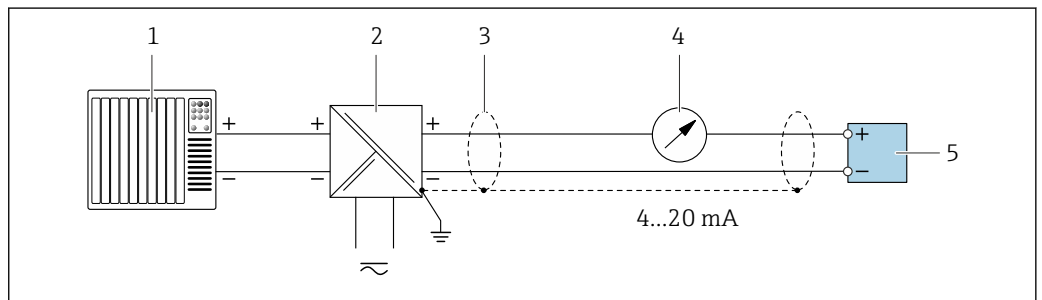
Current output 4 to 20 mA HART



A0029055

10 Connection example for 4 to 20 mA HART current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 3 Connection for HART operating devices → 43
- 4 Resistor for HART communication ($\geq 250 \Omega$): observe maximum load
- 5 Analog display unit: observe maximum load
- 6 Transmitter

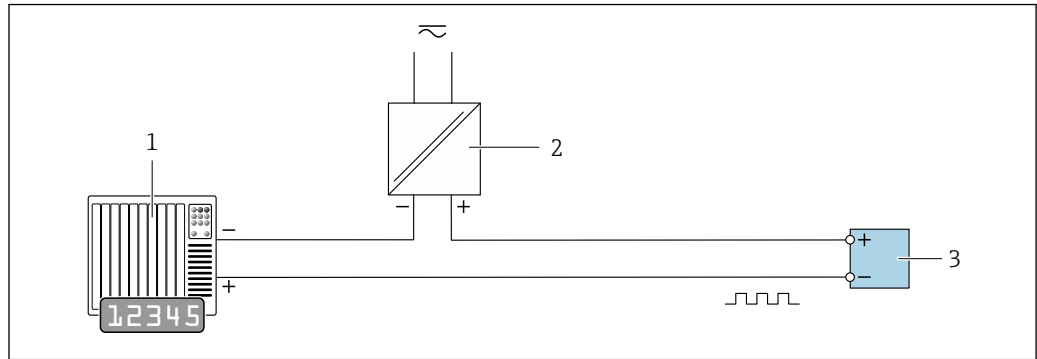


A0028762

11 Connection example for 4 to 20 mA HART current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply
- 3 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 4 Analog display unit: observe maximum load
- 5 Transmitter

Pulse/frequency output

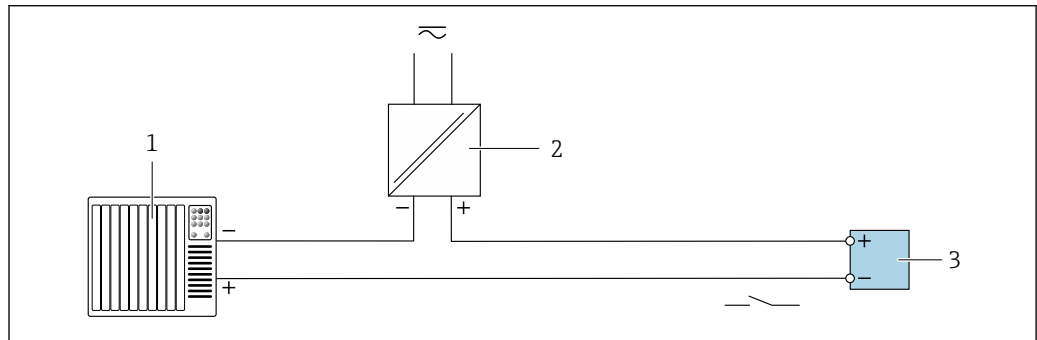


A0028761

12 Connection example for pulse/frequency output (passive)

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values

Switch output

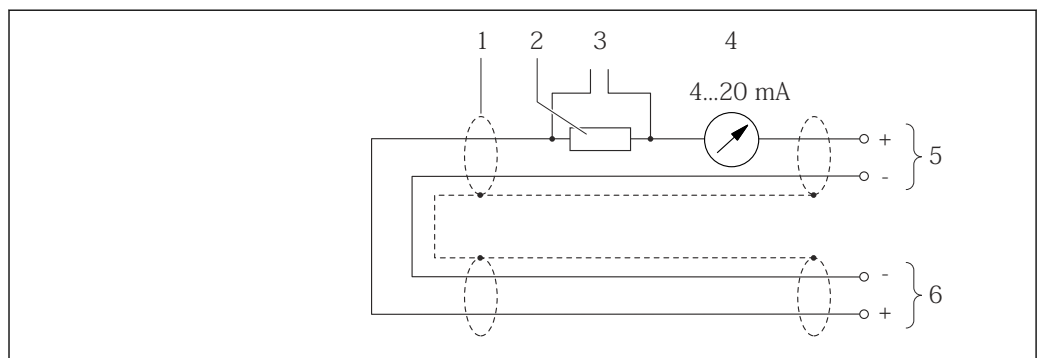


A0028760

13 Connection example for switch output (passive)

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values

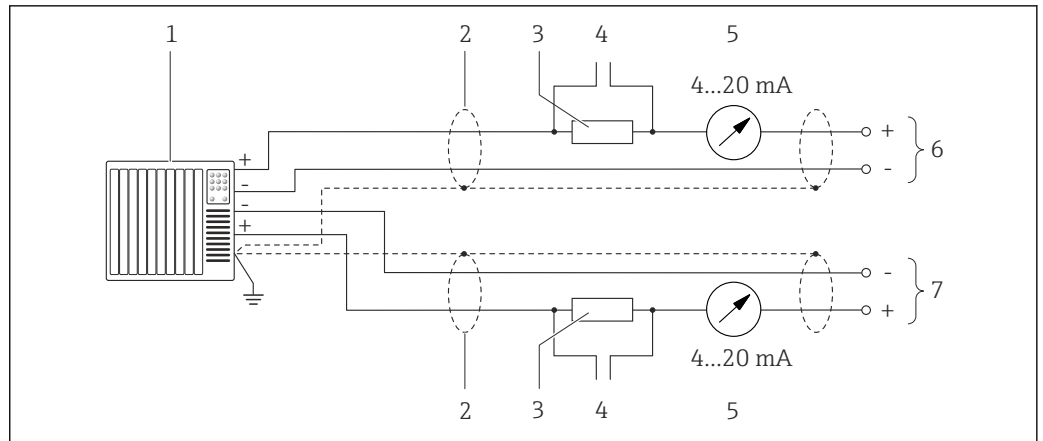
HART input



A0019828

14 Connection example for HART input (burst mode) via current output (active)

- 1 Cable shield, observe cable specifications
- 2 Resistor for HART communication ($\geq 250 \Omega$): observe maximum load → 113
- 3 Connection for HART operating devices → 126
- 4 Analog display unit
- 5 Transmitter
- 6 Sensor for external measured variable



A0019830

15 Connection example for HART input (master mode) via current output (active)

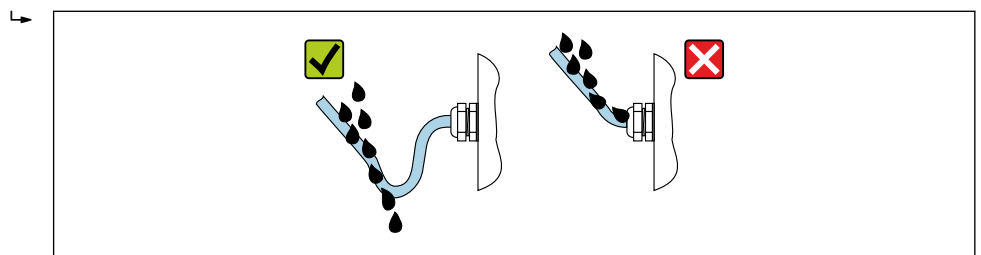
- 1 Automation system with current input (e.g. PLC).
Prerequisite: automation system with HART version 6, HART commands 113 and 114 can be processed.
- 2 Cable shield, observe cable specifications
- 3 Resistor for HART communication ($\geq 250 \Omega$): observe maximum load → 113
- 4 Connection for HART operating devices → 126
- 5 Analog display unit
- 6 Transmitter
- 7 Sensor for external measured variable

7.4 Ensuring the degree of protection

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

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

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



A0029278

6. Insert dummy plugs into unused cable entries.

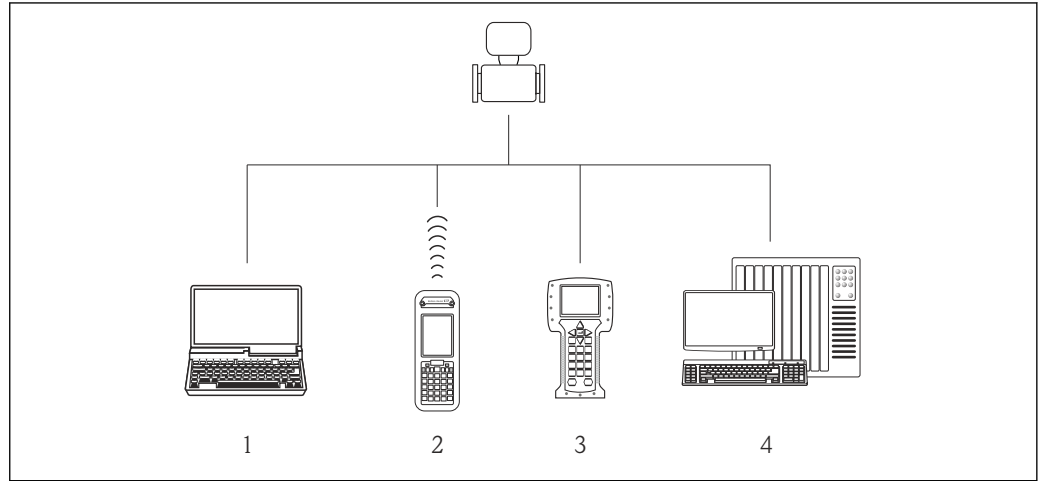
7.5 Post-connection check

Are cables or the device undamaged (visual inspection)?	<input type="checkbox"/>
Do the cables used meet the requirements → 26?	<input type="checkbox"/>
Do the cables have adequate strain relief?	<input type="checkbox"/>

Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 33 ?	<input type="checkbox"/>
Depending on the device version: are all the device plugs firmly tightened ?	<input type="checkbox"/>
Does the supply voltage match the specifications on the transmitter nameplate ?	<input type="checkbox"/>
Is the terminal assignment → 27 or pin assignment of the connector → 28 correct?	<input type="checkbox"/>
If supply voltage is present, is the power LED on the electronics module of the transmitter lit green → 12?	<input type="checkbox"/>
Depending on the device version, is the securing clamp or fixing screw firmly tightened?	<input type="checkbox"/>

8 Operation options

8.1 Overview of operating options




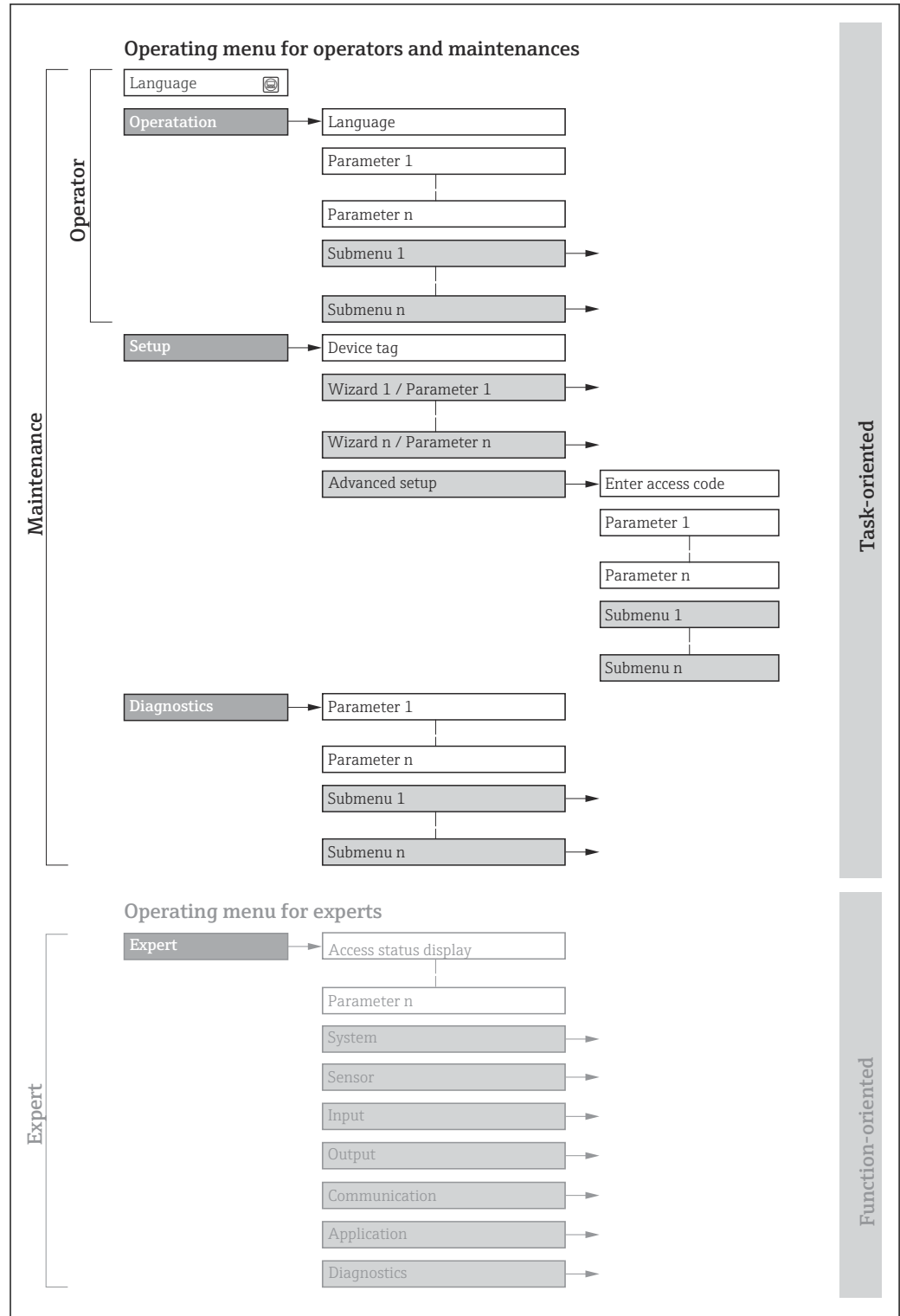
A0019598

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


8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

 For an overview of the operating menu for experts: "Description of Device Parameters" document supplied with the device



A0018237-EN

 16 Schematic structure of the operating menu

8.2.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	Role "Operator", "Maintenance" Tasks during operation: <ul style="list-style-type: none"> ▪ Configuring the operational display ▪ Reading measured values 	<ul style="list-style-type: none"> ▪ Defining the operating language ▪ Defining the Web server operating language ▪ Resetting and controlling totalizers
Operation			<ul style="list-style-type: none"> ▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		"Maintenance" role Commissioning: <ul style="list-style-type: none"> ▪ Configuration of the measurement ▪ Configuration of the outputs 	Submenus for fast commissioning: <ul style="list-style-type: none"> ▪ Set the system units ▪ Define the medium ▪ Configure the outputs ▪ Configuring the operational display ▪ Define the output conditioning ▪ Set the low flow cut off ▪ Configure partial and empty pipe detection Advanced setup <ul style="list-style-type: none"> ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configure the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		"Maintenance" role Fault elimination: <ul style="list-style-type: none"> ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation 	Contains all parameters for error detection and analyzing process and device errors: <ul style="list-style-type: none"> ▪ Diagnostic list Contains up to 5 currently pending diagnostic messages. ▪ Event logbook Contains event messages that have occurred. ▪ Device information Contains information for identifying the device. ▪ Measured values Contains all current measured values. ▪ Heartbeat The functionality of the device is checked on demand and the verification results are documented. ▪ Simulation Is used to simulate measured values or output values.
Expert	function-oriented	Tasks that require detailed knowledge of the function of the device: <ul style="list-style-type: none"> ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases 	Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: <ul style="list-style-type: none"> ▪ System Contains all higher-order device parameters which do not concern the measurement or the communication interface. ▪ Sensor Configuration of the measurement. ▪ Output Configuring of the analog current outputs as well as the pulse/frequency and switch output. ▪ Communication Configuration of the digital communication interface and the Web server. ▪ Application Configure the functions that go beyond the actual measurement (e.g. totalizer). ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to the operating menu via the web browser

8.3.1 Function range

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) . In addition to the measured values, status information on the device is also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.



For additional information on the Web server, refer to the Special Documentation for the device

8.3.2 Prerequisites

Computer hardware

Interface	The computer must have an RJ45 interface.
Connection	Standard Ethernet cable with RJ45 connector.
Screen	Recommended size: ≥12" (depends on the screen resolution)

Computer software

Recommended operating systems	Microsoft Windows 7 or higher. Microsoft Windows XP is supported.
Web browsers supported	<ul style="list-style-type: none"> ▪ Microsoft Internet Explorer 8 or higher ▪ Microsoft Edge ▪ Mozilla Firefox ▪ Google Chrome ▪ Safari

Computer settings

User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.).
Proxy server settings of the Web browser	The Web browser setting <i>Use a Proxy Server for Your LAN</i> must be deselected .
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter <code>http://XXX.XXX.X.XXX/basic.html</code> in the address line of the Web browser, e.g. <code>http://192.168.1.212/basic.html</code> . A fully functional but simplified version of the operating menu structure starts in the Web browser.
Network connections	Only the active network connections to the measuring device should be used. Switch off all other network connections such as WLAN.



In the event of connection problems: → 91

Measuring device: Via CDI-RJ45 service interface

Device	CDI-RJ45 service interface
Measuring device	The measuring device has an RJ45 interface.
Web server	Web server must be enabled; factory setting: ON For information on enabling the Web server → 42

8.3.3 Establishing a connection

Via service interface (CDI-RJ45)

Preparing the measuring device

Configuring the Internet protocol of the computer

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

IP address of the device: 192.168.1.212 (factory setting)

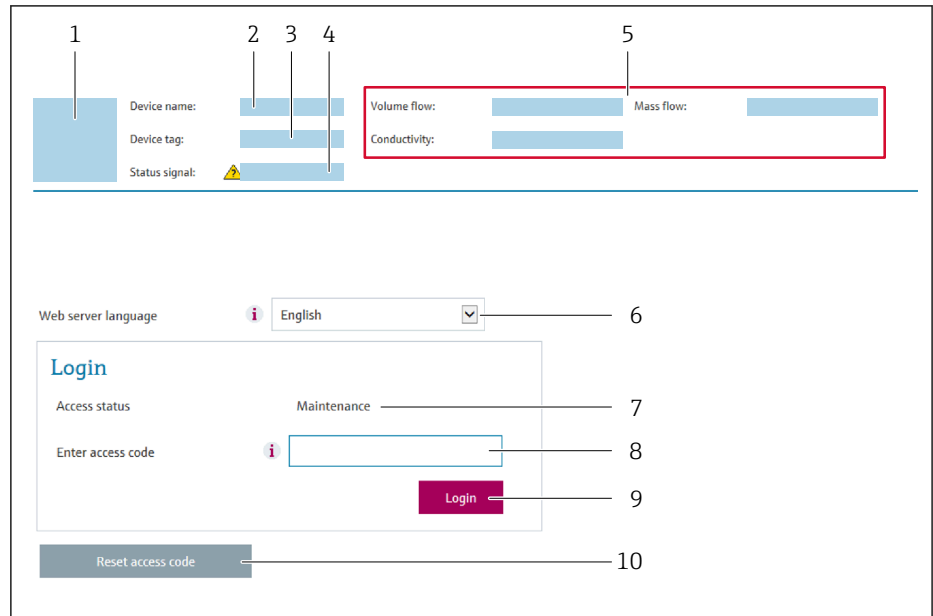
1. Switch on the measuring device.
2. Connect to the computer using a cable .
3. If a 2nd network card is not used, close all the applications on the notebook.
 - ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

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

Starting the Web browser

1. Start the Web browser on the computer.

2. Enter the IP address of the Web server in the address line of the Web browser:
192.168.1.212
↳ The login page appears.



A0029417

- 1 Picture of device
- 2 Device name
- 3 Device tag (→ 53)
- 4 Status signal
- 5 Current measured values
- 6 Operating language
- 7 User role
- 8 Access code
- 9 Login
- 10 Reset access code

i If a login page does not appear, or if the page is incomplete → 91

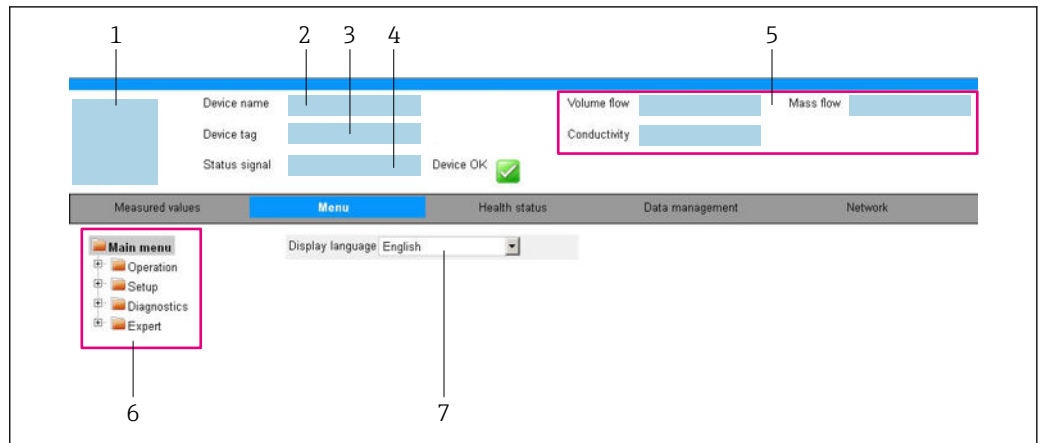
8.3.4 Logging on

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

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

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

8.3.5 User interface




- 1 Picture of device
- 2 Device name
- 3 Device tag
- 4 Status signal
- 5 Current measured values
- 6 Navigation area
- 7 Local display language

Header

The following information appears in the header:

- Device tag
- Device status with status signal → 📄 93
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring device
Menu	<ul style="list-style-type: none"> ■ Access to the operating menu from the measuring device ■ The structure of the operating menu is the same as for the operating tools  For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	Data exchange between PC and measuring device: <ul style="list-style-type: none"> ■ Device configuration: <ul style="list-style-type: none"> ■ Load settings from the device (XML format, save configuration) ■ Save settings to the device (XML format, restore configuration) ■ Logbook - Export Event logbook (.csv file) ■ Documents - Export documents: <ul style="list-style-type: none"> ■ Export backup data record (.csv file, create documentation of the measuring point configuration) ■ Verification report (PDF file, only available with the "Heartbeat Verification" application package)
Network configuration	Configuration and checking of all the parameters required for establishing the connection to the measuring device: <ul style="list-style-type: none"> ■ Network settings (e.g. IP address, MAC address) ■ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

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

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:

- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.3.6 Disabling the Web server

The Web server of the measuring device can be switched on and off as required using the **Web server functionality** parameter.

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection
Web server functionality	Switch the Web server on and off.	<ul style="list-style-type: none"> ▪ Off ▪ On

Function scope of the "Web server functionality" parameter


Option	Description
Off	<ul style="list-style-type: none"> ▪ The web server is completely disabled. ▪ Port 80 is locked.
On	<ul style="list-style-type: none"> ▪ The complete functionality of the web server is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.


Enabling the Web server

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

- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

8.3.7 Logging out

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

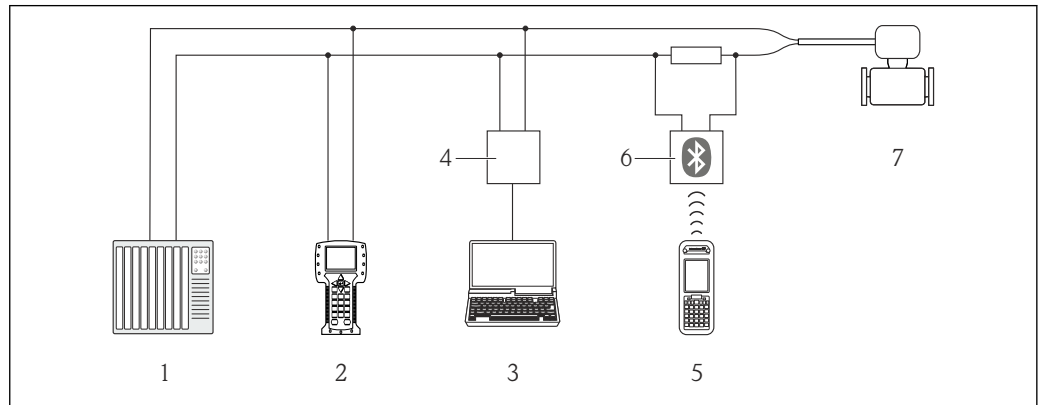
1. Select the **Logout** entry in the function row.
 - ↳ The home page with the Login box appears.
2. Close the Web browser.
3. If no longer needed:
 - Reset modified properties of the Internet protocol (TCP/IP) →  39.

8.4 Access to the operating menu via the operating tool

8.4.1 Connecting the operating tool

Via HART protocol

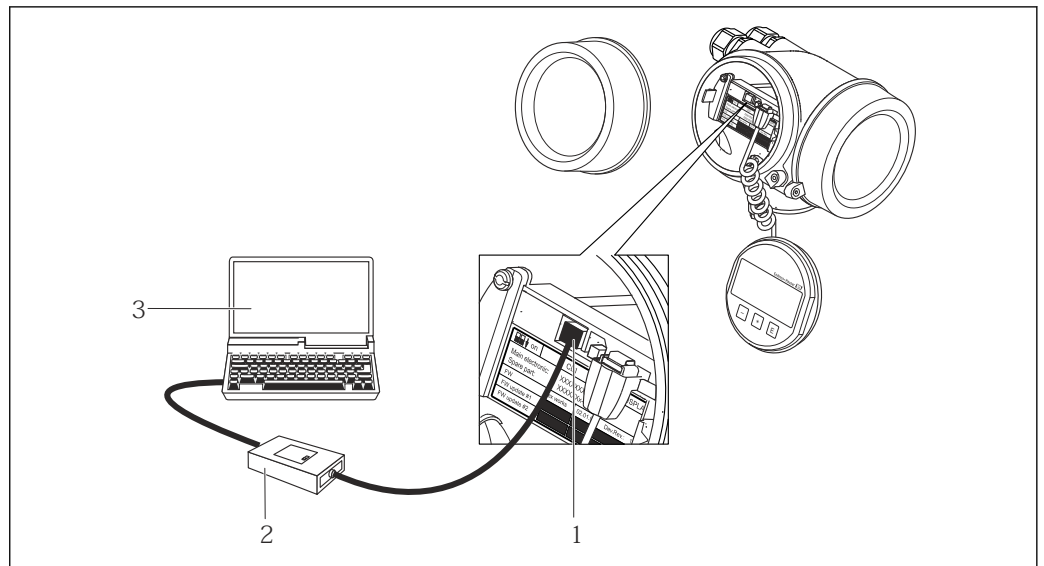
This communication interface is available in device versions with a HART output.



17 Options for remote operation via HART protocol

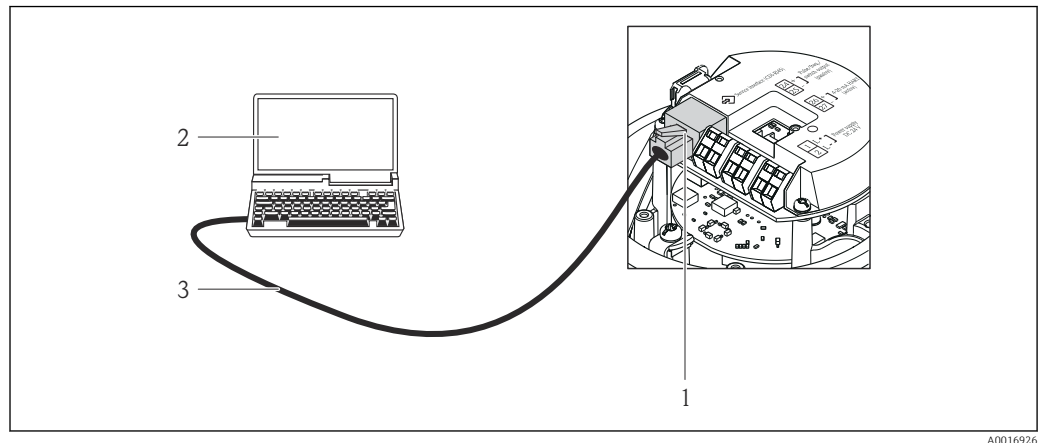
- 1 Control system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 4 Commubox FXA195 (USB)
- 5 Field Xpert SFX350 or SFX370
- 6 VIATOR Bluetooth modem with connecting cable
- 7 Transmitter


Via service interface (CDI)



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

Via service interface (CDI-RJ45)

HART


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

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

8.4.2 Field Xpert SFX350, SFX370

Function range

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

 For details, see Operating Instructions BA01202S

Source for device description files


See information →  47

8.4.3 FieldCare

Function scope


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

Access is via:

- HART protocol →  126
- CDI-RJ45 service interface

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 additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

Source for device description files

See information →  47

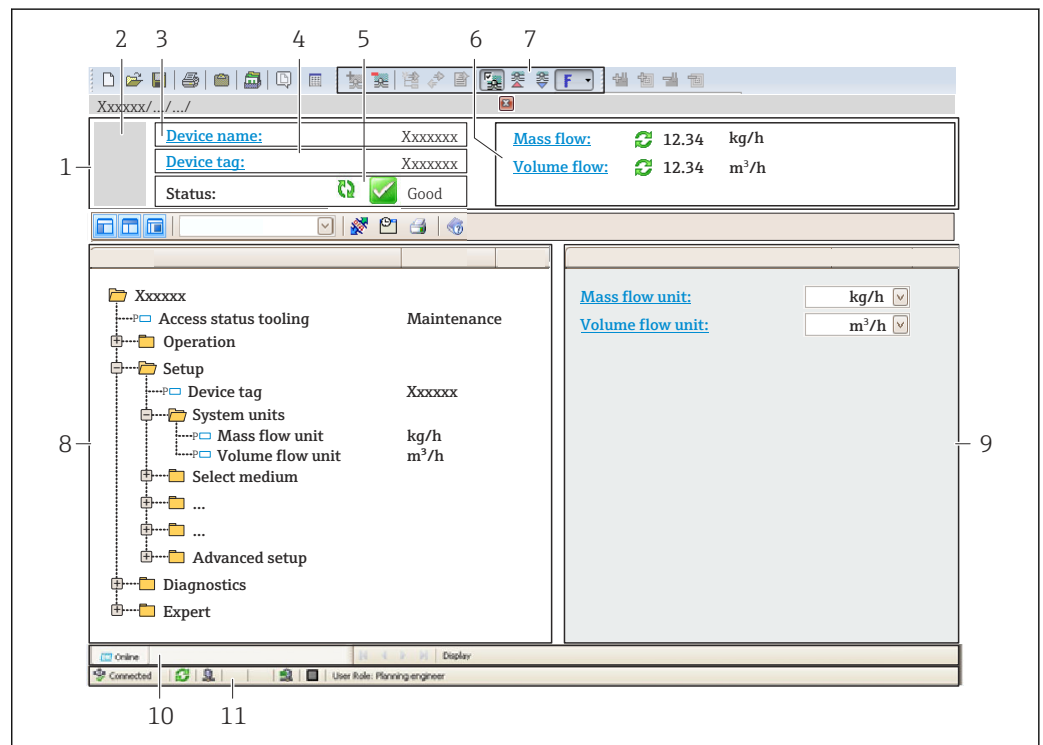
Establishing a connection

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



For additional information, see Operating Instructions BA00027S and BA00059S

User interface



A0021051-EN

- 1 Header
- 2 Picture of device
- 3 Device name
- 4 Tag name
- 5 Status area with status signal → 93
- 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

8.4.4 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 information →  47

8.4.5 AMS Device Manager

Function scope

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

Source for device description files


See data →  47

8.4.6 SIMATIC PDM

Function scope

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

Source for device description files


See data →  47

8.4.7 Field Communicator 475

Function scope

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

Source for device description files

See data →  47

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.01.zz	<ul style="list-style-type: none"> ▪ On the title page of the Operating Instructions ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	10.2014	---
Manufacturer ID	0x11	Manufacturer ID Diagnostics → Device information → Manufacturer ID
Device type ID	0x4A	Device type Diagnostics → Device information → Device type
HART protocol revision	7	---
Device revision	2	<ul style="list-style-type: none"> ▪ On the transmitter nameplate ▪ Device revision Diagnostics → Device information → Device revision

 For an overview of the different firmware versions for the device →  105

9.1.2 Operating tools

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

Operating tool via HART protocol	Sources for obtaining device descriptions
FieldCare	<ul style="list-style-type: none"> ▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	<ul style="list-style-type: none"> ▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
<ul style="list-style-type: none"> ▪ Field Xpert SFX350 ▪ Field Xpert SFX370 	Use update function of handheld terminal
AMS Device Manager (Emerson Process Management)	www.endress.com → Download Area
SIMATIC PDM (Siemens)	www.endress.com → Download Area
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal

9.2 Measured variables via HART protocol

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

Dynamic variables	Measured variables (HART device variables)
Primary dynamic variable (PV)	Mass flow
Secondary dynamic variable (SV)	Totalizer 1
Tertiary dynamic variable (TV)	Density
Quaternary dynamic variable (QV)	Temperature

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

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

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

Measured variables for PV (primary dynamic variable)

- Off
- Mass flow
- Volume flow
- Corrected volume flow
- Density
- Reference density
- Temperature
- Electronic temperature
- Oscillation frequency 0
- Frequency fluctuation 0
- Oscillation damping 0
- Oscillation damping fluctuation 0
- Signal asymmetry
- Exciter current 0

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)

- Mass flow
- Volume flow
- Corrected volume flow
- Density
- Reference density
- Temperature
- Electronic temperature
- Oscillation frequency
- Oscillation amplitude
- Oscillation damping
- Signal asymmetry
- External pressure
- Totalizer 1...3



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

Heartbeat Technology application package

Additional measured variables are available with the Heartbeat Technology application package:

- Carrier pipe temperature
- Oscillation amplitude 0

Device variables

The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:

- 0 = mass flow
- 1 = volume flow
- 2 = corrected volume flow
- 3 = density
- 4 = reference density
- 5 = temperature
- 6 = totalizer 1
- 7 = totalizer 2
- 8 = totalizer 3
- 13 = target mass flow
- 14 = carrier mass flow
- 15 = concentration

9.3 Other settings

Burst mode functionality in accordance with HART 7 Specification:



Navigation

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

▶ Burst configuration

▶ Burst configuration 1 to n

Burst mode 1 to n	→ 50
Burst command 1 to n	→ 50
Burst variable 0	→ 50
Burst variable 1	→ 50
Burst variable 2	→ 50
Burst variable 3	→ 50
Burst variable 4	→ 50
Burst variable 5	→ 50
Burst variable 6	→ 50
Burst variable 7	→ 50
Burst trigger mode	→ 50
Burst trigger level	→ 51

Min. update period	→  51
Max. update period	→  51

Parameter overview with brief description

Parameter	Description	Selection / User entry
Burst mode 1 to n	Activate the HART burst mode for burst message X.	<ul style="list-style-type: none"> ▪ Off ▪ On
Burst command 1 to n	Select the HART command that is sent to the HART master.	<ul style="list-style-type: none"> ▪ Command 1 ▪ Command 2 ▪ Command 3 ▪ Command 9 ▪ Command 33 ▪ Command 48
Burst variable 0	For HART command 9 and 33: select the HART device variable or the process variable.	<ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Sensor integrity ▪ Pressure ▪ HART input ▪ Percent of range ▪ Measured current ▪ Primary variable (PV) ▪ Secondary variable (SV) ▪ Tertiary variable (TV) ▪ Quaternary variable (QV) ▪ Not used
Burst variable 1	For HART command 9 and 33: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 2	For HART command 9 and 33: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 3	For HART command 9 and 33: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 4	For HART command 9: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 5	For HART command 9: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 6	For HART command 9: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst variable 7	For HART command 9: select the HART device variable or the process variable.	See the Burst variable 0 parameter.
Burst trigger mode	Select the event that triggers burst message X.	<ul style="list-style-type: none"> ▪ Continuous ▪ Window ▪ Rising ▪ Falling ▪ On change



Parameter	Description	Selection / User entry
Burst trigger level	Enter the burst trigger value. Together with the option selected in the Burst trigger mode parameter the burst trigger value determines the time of burst message X.	Positive floating-point number
Min. update period	Enter the minimum time span between two burst commands of burst message X.	Positive integer
Max. update period	Enter the maximum time span between two burst commands of burst message X.	Positive integer

* Visibility depends on order options or device settings

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 →  25
 - "Post-connection check" checklist →  33

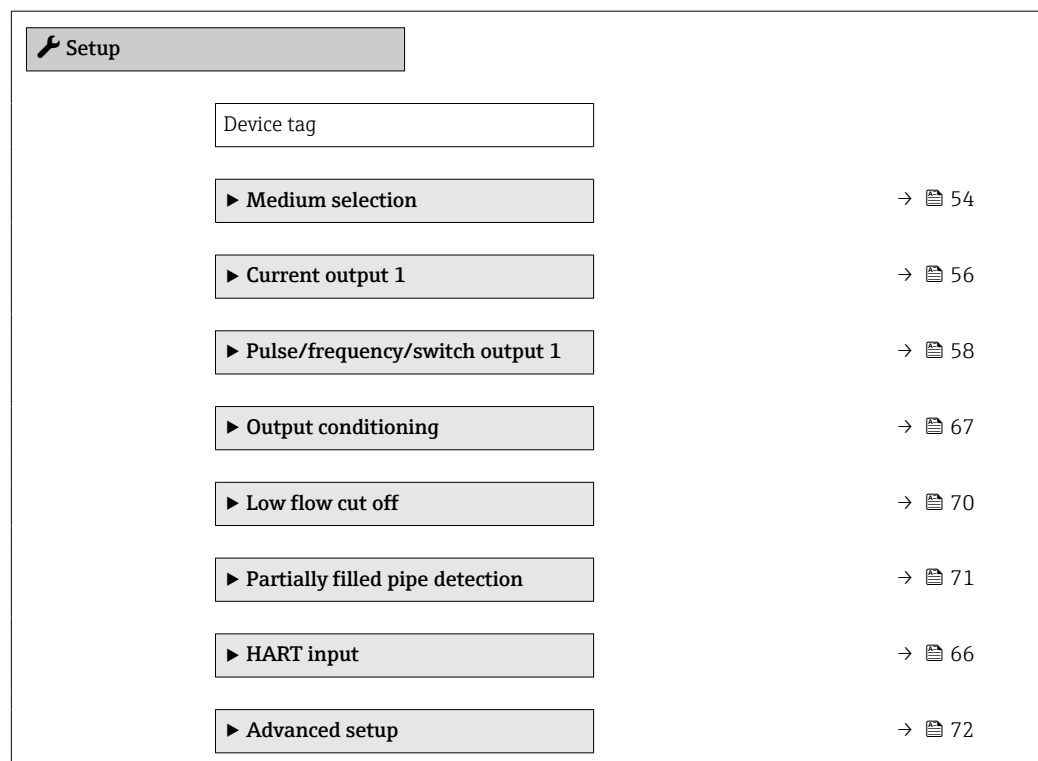
10.2 Setting the operating language

Factory setting: English or ordered local language

The operating language can be set in FieldCare, DeviceCare or via the Web server:
Operation → Display language



10.3 Configuring the measuring device

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



10.3.1 Defining the tag name

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

 Enter the tag name in the "FieldCare" operating tool →  45

Navigation

"Setup" menu → Device tag

Parameter overview with brief description

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

10.3.2 Selecting and setting the medium

The **Select medium** wizard submenu contains parameters that must be configured in order to select and set the medium.

Navigation

"Setup" menu → Medium selection

▶ Medium selection	
Select medium	→ 55
Select gas type	→ 55
Reference sound velocity	→ 55
Temperature coefficient sound velocity	→ 55
Pressure compensation	→ 55
Pressure value	→ 55
External pressure	→ 55

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Select medium	–	Select medium type.	Liquid	–
Select gas type	The Gas option is selected in the Select medium parameter.	Select measured gas type.	<ul style="list-style-type: none"> ■ Air ■ Ammonia NH3 ■ Argon Ar ■ Sulfur hexafluoride SF6 ■ Oxygen O2 ■ Ozone O3 ■ Nitrogen oxide NOx ■ Nitrogen N2 ■ Nitrous oxide N2O ■ Methane CH4 ■ Hydrogen H2 ■ Helium He ■ Hydrogen chloride HCl ■ Hydrogen sulfide H2S ■ Ethylene C2H4 ■ Carbon dioxide CO2 ■ Carbon monoxide CO ■ Chlorine Cl2 ■ Butane C4H10 ■ Propane C3H8 ■ Propylene C3H6 ■ Ethane C2H6 ■ Others 	–
Reference sound velocity	In the Select gas type parameter, the Others option is selected.	Enter sound velocity of gas at 0 °C (32 °F).	1 to 99999.9999 m/s	–
Temperature coefficient sound velocity	The Others option is selected in the Select gas type parameter.	Enter temperature coefficient for the gas sound velocity.	Positive floating-point number	0 (m/s)/K
Pressure compensation	–	Select pressure compensation type.	<ul style="list-style-type: none"> ■ Off ■ Fixed value ■ External value 	–
Pressure value	The Fixed value option is selected in the Pressure compensation parameter.	Enter process pressure to be used for pressure correction.	Positive floating-point number	–
External pressure	The External value option is selected in the Pressure compensation parameter.		Positive floating-point number	–

10.3.3 Configuring the current output

The **Current output** submenu guides you systematically through all the parameters that have to be set for configuring the current output.

Navigation

"Setup" menu → Current output 1

Structure of the submenu

▶ Current output 1	
Assign current output	→ 57
Current span	→ 57
0/4 mA value	→ 57
20 mA value	→ 57
Failure mode	→ 58
Failure current	→ 58

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign current output	–	Select process variable for current output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Oscillation amplitude 0 * ■ Frequency fluctuation 0 ■ Oscillation damping 0 ■ Tube damping fluctuation 0 ■ Signal asymmetry ■ Exciter current 0 	–
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	<ul style="list-style-type: none"> ■ 4...20 mA NAMUR ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA ■ Fixed current 	Country-specific: <ul style="list-style-type: none"> ■ 4...20 mA NAMUR ■ 4...20 mA US
0/4 mA value	One of the following options is selected in the Current span parameter (→ 57): <ul style="list-style-type: none"> ■ 4...20 mA NAMUR ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA 	Enter 4 mA value.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ■ 0 kg/h ■ 0 lb/min
20 mA value	One of the following options is selected in the Current span parameter (→ 57): <ul style="list-style-type: none"> ■ 4...20 mA NAMUR ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA 	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Failure mode	<p>One of the following options is selected in the Assign current output parameter (→ 57):</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Oscillation amplitude 0 * ▪ Frequency fluctuation 0 ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 <p>One of the following options is selected in the Current span parameter (→ 57):</p> <ul style="list-style-type: none"> ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA 	Define output behavior in alarm condition.	<ul style="list-style-type: none"> ▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Defined value 	–
Failure current	The Defined value option is selected in the Failure mode parameter.	Enter current output value in alarm condition.	0 to 22.5 mA	–

* Visibility depends on order options or device settings

10.3.4 Configuring the pulse/frequency/switch output

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

Navigation

"Setup" menu → Pulse/frequency/switch output 1

Structure of the "Pulse/frequency/switch output 1" submenu

▶ Pulse/frequency/switch output 1	
Operating mode	→ 60
Assign pulse output	→ 60
Assign frequency output	→ 61
Switch output function	→ 65
Assign diagnostic behavior	→ 65

Assign limit	→ 65
Assign flow direction check	→ 65
Assign status	→ 65
Value per pulse	→ 60
Pulse width	→ 60
Failure mode	→ 60
Minimum frequency value	→ 61
Maximum frequency value	→ 62
Measuring value at minimum frequency	→ 62
Measuring value at maximum frequency	→ 63
Failure mode	→ 64
Failure frequency	→ 64
Switch-on value	→ 65
Switch-off value	→ 66
Failure mode	→ 66
Invert output signal	→ 60

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output 1

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	<ul style="list-style-type: none"> ■ Pulse ■ Frequency ■ Switch 	–
Assign pulse output	The Pulse option is selected in the Operating mode parameter.	Select process variable for pulse output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	–
Value per pulse	In the Operating mode parameter, the Pulse option is selected, and one of the following options is selected in the Assign pulse output parameter (→ 60): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	In the Operating mode parameter, the Pulse option is selected, and one of the following options is selected in the Assign pulse output parameter (→ 60): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	Define time width of the output pulse.	0.05 to 2 000 ms	–
Failure mode	In the Operating mode parameter, the Pulse option is selected, and one of the following options is selected in the Assign pulse output parameter (→ 60): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	Define output behavior in alarm condition.	<ul style="list-style-type: none"> ■ Actual value ■ No pulses 	–
Invert output signal	–	Invert the output signal.	<ul style="list-style-type: none"> ■ No ■ Yes 	–

* Visibility depends on order options or device settings



Configuring the frequency output



Navigation

"Setup" menu → Pulse/frequency/switch output 1

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	<ul style="list-style-type: none"> ■ Pulse ■ Frequency ■ Switch 	–
Assign frequency output	The Frequency option is selected in the Operating mode parameter (→ 60).	Select process variable for frequency output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Frequency fluctuation 0 ■ Oscillation amplitude 0 * ■ Oscillation damping 0 ■ Tube damping fluctuation 0 ■ Signal asymmetry ■ Exciter current 0 	–
Minimum frequency value	In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→ 61): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Frequency fluctuation 0 ■ Oscillation amplitude 0 * ■ Oscillation damping 0 ■ Oscillation damping fluctuation 0 ■ Signal asymmetry ■ Exciter current 0 	Enter minimum frequency.	0.0 to 10000.0 Hz	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Maximum frequency value	In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→  61): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Enter maximum frequency.	0.0 to 10 000.0 Hz	–
Measuring value at minimum frequency	In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→  61): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Enter measured value for minimum frequency.	Signed floating-point number	Depends on country and nominal diameter

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Measuring value at maximum frequency	<p>In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→  61):</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Damping output	<p>In the Operating mode parameter the Frequency option is selected and in the Assign frequency output parameter (→  61) one of the following options is selected:</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Set reaction time for output signal to fluctuations in the measured value.	0 to 999.9 s	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Failure mode	In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→ 61): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Define output behavior in alarm condition.	<ul style="list-style-type: none"> ▪ Actual value ▪ Defined value ▪ 0 Hz 	–
Failure frequency	In the Operating mode parameter, the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→ 61): <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * ▪ Density ▪ Reference density ▪ Concentration * ▪ Temperature ▪ Carrier pipe temperature * ▪ Electronic temperature ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 * ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Signal asymmetry ▪ Exciter current 0 	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	–
Invert output signal	–	Invert the output signal.	<ul style="list-style-type: none"> ▪ No ▪ Yes 	–

* Visibility depends on order options or device settings

Configuring the switch output

Navigation

"Setup" menu → Pulse/frequency/switch output 1

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	<ul style="list-style-type: none"> ■ Pulse ■ Frequency ■ Switch 	–
Switch output function	The Switch option is selected in the Operating mode parameter.	Select function for switch output.	<ul style="list-style-type: none"> ■ Off ■ On ■ Diagnostic behavior ■ Limit ■ Flow direction check ■ Status 	–
Assign diagnostic behavior	<ul style="list-style-type: none"> ■ In the Operating mode parameter, the Switch option is selected. ■ In the Switch output function parameter, the Diagnostic behavior option is selected. 	Select diagnostic behavior for switch output.	<ul style="list-style-type: none"> ■ Alarm ■ Alarm or warning ■ Warning 	–
Assign limit	<ul style="list-style-type: none"> ■ The Switch option is selected in the Operating mode parameter. ■ The Limit option is selected in the Switch output function parameter. 	Select process variable for limit function.	<ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow[*] ■ Carrier mass flow[*] ■ Density ■ Reference density ■ Concentration[*] ■ Temperature ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Measuring tube damping 	–
Assign flow direction check	<ul style="list-style-type: none"> ■ The Switch option is selected in the Operating mode parameter. ■ The Flow direction check option is selected in the Switch output function parameter. 	Select process variable for flow direction monitoring.	<ul style="list-style-type: none"> ■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow 	–
Assign status	<ul style="list-style-type: none"> ■ The Switch option is selected in the Operating mode parameter. ■ The Status option is selected in the Switch output function parameter. 	Select device status for switch output.	<ul style="list-style-type: none"> ■ Partially filled pipe detection ■ Low flow cut off 	–
Switch-on value	<ul style="list-style-type: none"> ■ In the Operating mode parameter, the Switch option is selected. ■ In the Switch output function parameter, the Limit option is selected. 	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ■ 0 kg/h ■ 0 lb/min
Switch-on delay	<ul style="list-style-type: none"> ■ The Switch option is selected in the Operating mode parameter. ■ The Limit option is selected in the Switch output function parameter. 	Define delay for the switch-on of status output.	0.0 to 100.0 s	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Switch-off value	<ul style="list-style-type: none"> ▪ In the Operating mode parameter, the Switch option is selected. ▪ In the Switch output function parameter, the Limit option is selected. 	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ▪ 0 kg/h ▪ 0 lb/min
Switch-off delay	<ul style="list-style-type: none"> ▪ The Switch option is selected in the Operating mode parameter. ▪ The Limit option is selected in the Switch output function parameter. 	Define delay for the switch-off of status output.	0.0 to 100.0 s	–
Failure mode	–	Define output behavior in alarm condition.	<ul style="list-style-type: none"> ▪ Actual status ▪ Open ▪ Closed 	–
Invert output signal	–	Invert the output signal.	<ul style="list-style-type: none"> ▪ No ▪ Yes 	–

* Visibility depends on order options or device settings

10.3.5 Configuring the HART input


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

Navigation

"Setup" menu → HART input

► HART input	
Capture mode	→ 67
Device ID	→ 67
Device type	→ 67
Manufacturer ID	→ 67
Burst command	→ 67
Slot number	→ 67
Timeout	→ 67
Failure mode	→ 67
Failure value	→ 67

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Capture mode	–	Select capture mode via burst or master communication.	<ul style="list-style-type: none"> ■ Off ■ Burst network ■ Master network 	–
Device ID	The Master network option is selected in the Capture mode parameter.	Enter device ID of external device.	6-digit value: <ul style="list-style-type: none"> ■ Via local operation: enter as hexadecimal or decimal number ■ Via operating tool: enter as decimal number 	–
Device type	In the Capture mode parameter, the Master network option is selected.	Enter device type of external device.	2-digit hexadecimal number	0x00
Manufacturer ID	The Master network option is selected in the Capture mode parameter.	Enter manufacture ID of external device.	2-digit value: <ul style="list-style-type: none"> ■ Via local operation: enter as hexadecimal or decimal number ■ Via operating tool: enter as decimal number 	–
Burst command	The Burst network option or the Master network option are selected in the Capture mode parameter.	Select command to read in external process variable.	<ul style="list-style-type: none"> ■ Command 1 ■ Command 3 ■ Command 9 ■ Command 33 	–
Slot number	The Burst network option or the Master network option is selected in the Capture mode parameter.	Define position of external process variable in burst command.	1 to 4	–
Timeout	The Burst network option or the Master network option is selected in the Capture mode parameter.	Enter deadline for process variable of external device.  If the waiting time is exceeded, the F410 Data transfer diagnostic message is displayed.	1 to 120 s	–
Failure mode	In the Capture mode parameter, the Burst network option or Master network option is selected.	Define behavior if external process variable is missed.	<ul style="list-style-type: none"> ■ Alarm ■ Last valid value ■ Defined value 	–
Failure value	The following conditions are met: <ul style="list-style-type: none"> ■ In the Capture mode parameter, the Burst network option or Master network option is selected. ■ In the Failure mode parameter, the Defined value option is selected. 	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	–

10.3.6 Configuring the output conditioning

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

Navigation

"Setup" menu → Output conditioning

Structure of the "Output conditioning" submenu

► Output conditioning	
Assign current output	→ 68
Damping output 1	→ 68
Measuring mode output 1	→ 68
Assign frequency output	→ 69
Damping output 1	→ 69
Measuring mode output 1	→ 69
Assign pulse output	→ 69
Measuring mode output 1	→ 69
Operating mode totalizer 1	→ 69

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign current output	–	Select process variable for current output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Oscillation amplitude 0 * ■ Frequency fluctuation 0 ■ Oscillation damping 0 ■ Tube damping fluctuation 0 ■ Signal asymmetry ■ Exciter current 0
Damping output	–	Set reaction time for output signal to fluctuations in the measured value.	0 to 999.9 s
Measuring mode output	–	Select measuring mode for output.	<ul style="list-style-type: none"> ■ Forward flow ■ Forward/Reverse flow ■ Reverse flow compensation

Parameter	Prerequisite	Description	Selection / User entry
Assign frequency output	The Frequency option is selected in the Operating mode parameter (→ 60).	Select process variable for frequency output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Frequency fluctuation 0 ■ Oscillation amplitude 0 * ■ Oscillation damping 0 ■ Tube damping fluctuation 0 ■ Signal asymmetry ■ Exciter current 0
Damping output	–	Set reaction time for output signal to fluctuations in the measured value.	0 to 999.9 s
Measuring mode output	–	Select measuring mode for output.	<ul style="list-style-type: none"> ■ Forward flow ■ Forward/Reverse flow ■ Reverse flow ■ Reverse flow compensation
Assign pulse output	The Pulse option is selected in the Operating mode parameter.	Select process variable for pulse output.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow *
Measuring mode output	–	Select measuring mode for output.	<ul style="list-style-type: none"> ■ Forward flow ■ Forward/Reverse flow ■ Reverse flow ■ Reverse flow compensation
Operating mode totalizer	–	Select totalizer calculation mode.	<ul style="list-style-type: none"> ■ Net flow total ■ Forward flow total ■ Reverse flow total

* Visibility depends on order options or device settings

10.3.7 Configuring the 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

► Low flow cut off	
Assign process variable	→ 70
On value low flow cutoff	→ 70
Off value low flow cutoff	→ 70
Pressure shock suppression	→ 70

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow 	–
On value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 70): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow 	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 70): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow 	Enter off value for low flow cut off.	0 to 100.0 %	–
Pressure shock suppression	One of the following options is selected in the Assign process variable parameter (→ 70): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow 	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	–

10.3.8 Configuring the partial filled pipe detection

The **Partially filled pipe detection** submenu contains parameters that have to be set for configuring empty pipe detection.

Navigation

"Setup" menu → Partially filled pipe detection

▶ **Partially filled pipe detection**


Assign process variable	→ 71
Low value partial filled pipe detection	→ 71
High value partial filled pipe detection	→ 71
Response time part. filled pipe detect.	→ 71

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign process variable	–	Select process variable for partially filled pipe detection.	<ul style="list-style-type: none"> ▪ Off ▪ Density ▪ Reference density
Low value partial filled pipe detection	One of the following options is selected in the Assign process variable parameter (→ 71): <ul style="list-style-type: none"> ▪ Density ▪ Reference density 	Enter lower limit value for deactivating partially filled pipe detection.	Signed floating-point number
High value partial filled pipe detection	One of the following options is selected in the Assign process variable parameter (→ 71): <ul style="list-style-type: none"> ▪ Density ▪ Reference density 	Enter upper limit value for deactivating partially filled pipe detection.	Signed floating-point number
Response time part. filled pipe detect.	One of the following options is selected in the Assign process variable parameter (→ 71): <ul style="list-style-type: none"> ▪ Density ▪ Reference density 	Enter time before diagnostic message is displayed for partially filled pipe detection.	0 to 100 s

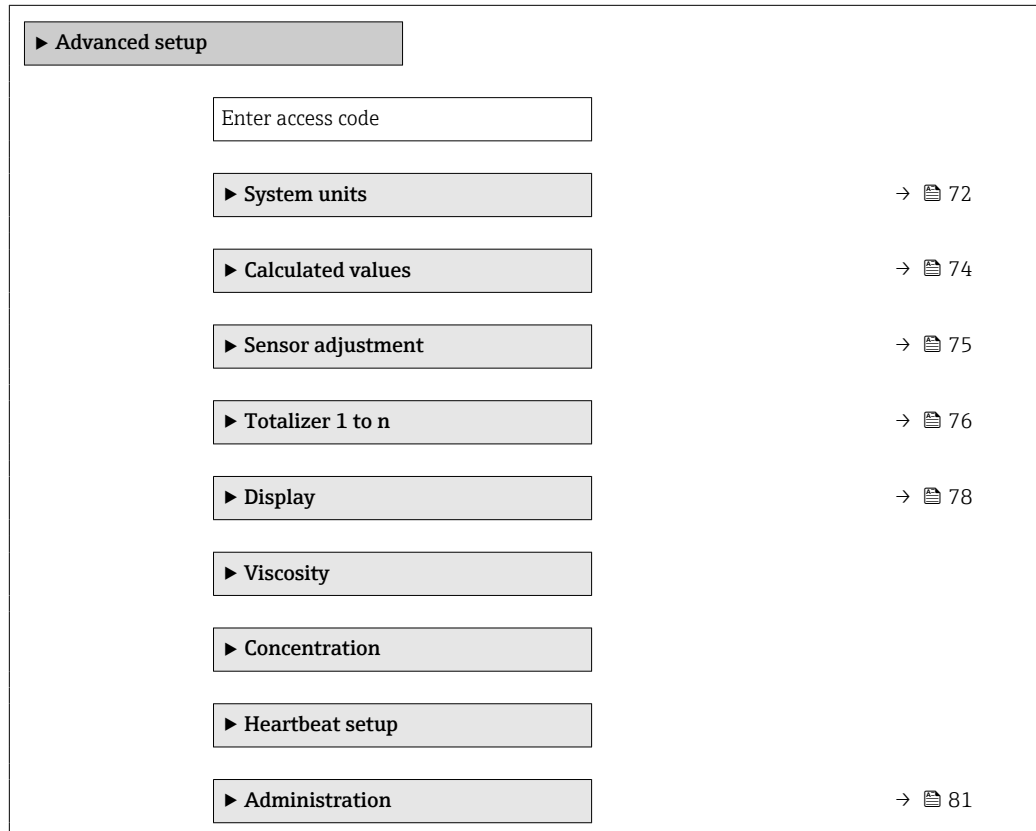
10.4 Advanced settings

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

 The number of submenus can vary depending on the device version, e.g. viscosity is available only with the Promass I.

Navigation

"Setup" menu → Advanced setup



10.4.1 Using the parameter to enter the access code

Navigation


"Setup" menu → Advanced setup

Parameter overview with brief description

Parameter	Description	User entry
Enter access code	Enter access code to disable write protection of parameters.	0 to 9999

10.4.2 Setting the system units

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

 Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation

"Setup" menu → Advanced setup → System units

► System units	
Mass flow unit	→ 73
Mass unit	→ 73
Volume flow unit	→ 73
Volume unit	→ 73
Corrected volume flow unit	→ 73
Corrected volume unit	→ 74
Density unit	→ 74
Reference density unit	→ 74
Temperature unit	→ 74
Pressure unit	→ 74

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Mass flow unit	Select mass flow unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ■ Output ■ Low flow cut off ■ Simulation process variable 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ kg/h ■ lb/min
Mass unit	Select mass unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ kg ■ lb
Volume flow unit	Select volume flow unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ■ Output ■ Low flow cut off ■ Simulation process variable 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ l/h ■ gal/min (us)
Volume unit	Select volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ l (DN > 150 (6"): m³ option) ■ gal (us)
Corrected volume flow unit	Select corrected volume flow unit. <i>Result</i> The selected unit applies for: Corrected volume flow parameter (→ 86)	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ NI/h ■ Sft³/min

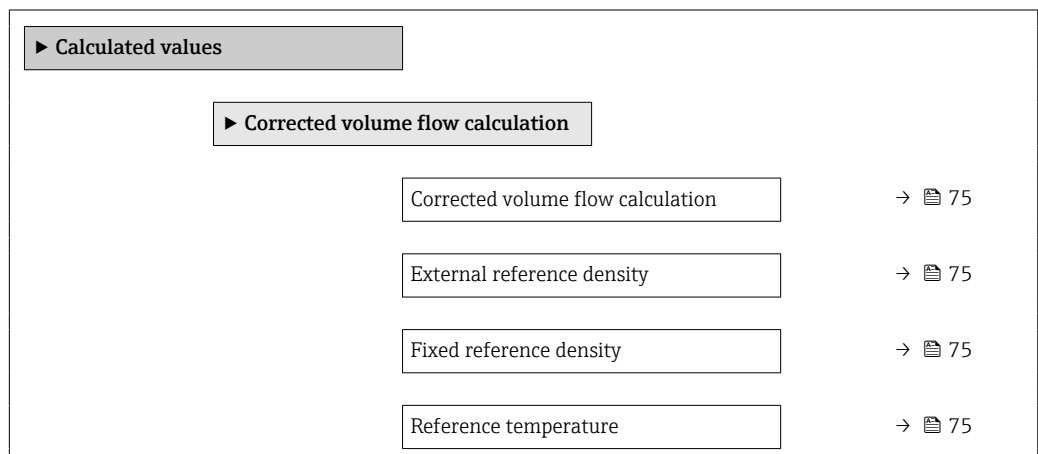
Parameter	Description	Selection	Factory setting
Corrected volume unit	Select corrected volume unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ NI ▪ Sft³
Density unit	Select density unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Output ▪ Simulation process variable ▪ Density adjustment (Expert menu) 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ kg/l ▪ lb/ft³
Reference density unit	Select reference density unit.	Unit choose list	Country-dependent <ul style="list-style-type: none"> ▪ kg/NI ▪ lb/Sft³
Temperature unit	Select temperature unit. <i>Result</i> The selected unit applies for: <ul style="list-style-type: none"> ▪ Electronic temperature parameter (6053) ▪ Maximum value parameter (6051) ▪ Minimum value parameter (6052) ▪ External temperature parameter (6080) ▪ Maximum value parameter (6108) ▪ Minimum value parameter (6109) ▪ Carrier pipe temperature parameter (6027) ▪ Maximum value parameter (6029) ▪ Minimum value parameter (6030) ▪ Reference temperature parameter (1816) ▪ Temperature parameter 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ °C ▪ °F
Pressure unit	Select process pressure unit. <i>Result</i> The unit is taken from: <ul style="list-style-type: none"> ▪ Pressure value parameter (→ ⓘ 55) ▪ External pressure parameter (→ ⓘ 55) ▪ Pressure value 	Unit choose list	Country-specific: <ul style="list-style-type: none"> ▪ bar a ▪ psi a

10.4.3 Calculated values

The **Calculated values** submenu contains parameters for calculating the corrected volume flow.

Navigation

"Setup" menu → Advanced setup → Calculated values



Linear expansion coefficient	→ 75
Square expansion coefficient	→ 75

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Corrected volume flow calculation	–	Select reference density for calculating the corrected volume flow.	<ul style="list-style-type: none"> ■ Fixed reference density ■ Calculated reference density ■ Reference density by API table 53 	–
External reference density	–	Shows external reference density.	Floating point number with sign	–
Fixed reference density	The Fixed reference density option is selected in the Corrected volume flow calculation parameter parameter.	Enter fixed value for reference density.	Positive floating-point number	–
Reference temperature	The Calculated reference density option is selected in the Corrected volume flow calculation parameter.	Enter reference temperature for calculating the reference density.	–273.15 to 99999 °C	Country-specific: <ul style="list-style-type: none"> ■ +20 °C ■ +68 °F
Linear expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter parameter.	Enter linear, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	–
Square expansion coefficient	The Calculated reference density option is selected in the Corrected volume flow calculation parameter parameter.	For media with a non-linear expansion pattern: enter the quadratic, medium-specific expansion coefficient for calculating the reference density.	Signed floating-point number	–

10.4.4 Carrying out a sensor adjustment

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

Navigation

"Setup" menu → Advanced setup → Sensor adjustment

▶ Sensor adjustment	
Installation direction	→ 76
▶ Zero point adjustment	→ 76

Parameter overview with brief description

Parameter	Description	Selection
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	<ul style="list-style-type: none"> ■ Flow in arrow direction ■ Flow against arrow direction

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 117. Therefore, a zero point adjustment in the field is generally not required.

Experience shows that zero point adjustment is advisable only in special cases:

- To achieve maximum measuring accuracy even with low flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

Navigation

"Setup" menu → Advanced setup → Sensor adjustment → Zero point adjustment

▶ Zero point adjustment

Zero point adjustment control

→ 76

Progress

→ 76

Parameter overview with brief description

Parameter	Description	Selection / User interface	Factory setting
Zero point adjustment control	Start zero point adjustment.	<ul style="list-style-type: none"> ■ Cancel ■ Busy ■ Zero point adjust failure ■ Start 	–
Progress	Shows the progress of the process.	0 to 100 %	–

10.4.5 Configuring the totalizer

In the "Totalizer 1 to n" submenu the individual totalizer can be configured.

Navigation

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

▶ Totalizer 1 to n

Assign process variable

→ 77

Unit totalizer

→ 77

Totalizer operation mode

→ 77

Failure mode

→ 77

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable	–	Select process variable for totalizer.	<ul style="list-style-type: none"> ■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow[*] ■ Carrier mass flow[*] 	–
Unit totalizer	One of the following options is selected in the Assign process variable parameter (→ 77) of the Totalizer 1 to n submenu: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow[*] ■ Carrier mass flow[*] 	Select process variable totalizer unit.	Unit choose list	Country-specific: <ul style="list-style-type: none"> ■ kg ■ lb
Totalizer operation mode	One of the following options is selected in the Assign process variable parameter (→ 77) of the Totalizer 1 to n submenu: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow[*] ■ Carrier mass flow[*] 	Select totalizer calculation mode.	<ul style="list-style-type: none"> ■ Net flow total ■ Forward flow total ■ Reverse flow total 	–
Failure mode	One of the following options is selected in the Assign process variable parameter (→ 77) of the Totalizer 1 to n submenu: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow[*] ■ Carrier mass flow[*] 	Define totalizer behavior in alarm condition.	<ul style="list-style-type: none"> ■ Stop ■ Actual value ■ Last valid value 	–

* Visibility depends on order options or device settings

10.4.6 Carrying out additional display configurations

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

Navigation

"Setup" menu → Advanced setup → Display

► Display	
Format display	→ 79
Value 1 display	→ 79
0% bargraph value 1	→ 79
100% bargraph value 1	→ 79
Decimal places 1	→ 79
Value 2 display	→ 79
Decimal places 2	→ 79
Value 3 display	→ 80
0% bargraph value 3	→ 80
100% bargraph value 3	→ 80
Decimal places 3	→ 80
Value 4 display	→ 80
Decimal places 4	→ 80
Display language	→ 80
Display interval	→ 80
Display damping	→ 80
Header	→ 80
Header text	→ 80
Separator	→ 80
Backlight	

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	<ul style="list-style-type: none"> ■ 1 value, max. size ■ 1 bargraph + 1 value ■ 2 values ■ 1 value large + 2 values ■ 4 values 	–
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	<ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * ■ Density ■ Reference density * ■ Concentration * ■ Temperature ■ Carrier pipe temperature * ■ Electronic temperature ■ Oscillation frequency 0 ■ Oscillation amplitude 0 * ■ Frequency fluctuation 0 ■ Oscillation damping 0 ■ Tube damping fluctuation 0 ■ Tube damping fluctuation 1 ■ Signal asymmetry ■ Exciter current 0 ■ None ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Current output 1 	–
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ■ 0 kg/h ■ 0 lb/min
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the Value 1 display parameter.	Select the number of decimal places for the display value.	<ul style="list-style-type: none"> ■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx 	–
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the Value 1 display parameter	–
Decimal places 2	A measured value is specified in the Value 2 display parameter.	Select the number of decimal places for the display value.	<ul style="list-style-type: none"> ■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx 	–

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the Value 1 display parameter (→ 79)	–
0% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ■ 0 kg/h ■ 0 lb/min
100% bargraph value 3	A selection was made in the Value 3 display parameter.	Enter 100% value for bar graph display.	Signed floating-point number	–
Decimal places 3	A measured value is specified in the Value 3 display parameter.	Select the number of decimal places for the display value.	<ul style="list-style-type: none"> ■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx 	–
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the Value 1 display parameter (→ 79)	–
Decimal places 4	A measured value is specified in the Value 4 display parameter.	Select the number of decimal places for the display value.	<ul style="list-style-type: none"> ■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx 	–
Display language	A local display is provided.	Set display language.	<ul style="list-style-type: none"> ■ English ■ Deutsch * ■ Français * ■ Español * ■ Italiano * ■ Nederlands * ■ Portuguesa * ■ Polski ■ русский язык (Russian) * ■ Svenska * ■ Türkçe * ■ 中文 (Chinese) * ■ 日本語 (Japanese) * ■ 한국어 (Korean) * ■ Bahasa Indonesia * ■ tiếng Việt (Vietnamese) * ■ čeština (Czech) * 	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	–
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	–
Header	A local display is provided.	Select header contents on local display.	<ul style="list-style-type: none"> ■ Device tag ■ Free text 	–
Header text	In the Header parameter, the Free text option is selected.	Enter display header text.	Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /)	–
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	<ul style="list-style-type: none"> ■ . (point) ■ , (comma) 	. (point)

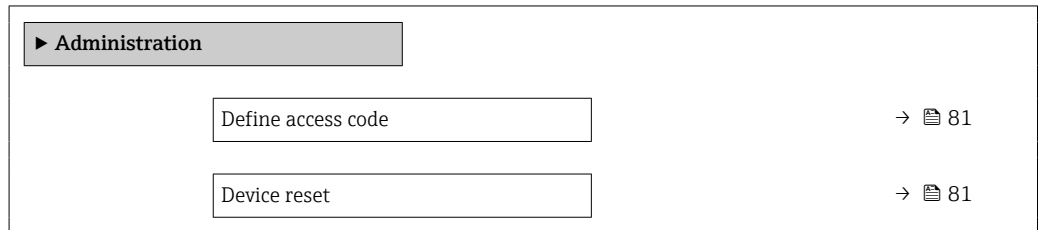
* Visibility depends on order options or device settings

10.4.7 Using parameters for device administration

The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation

"Setup" menu → Advanced setup → Administration



Parameter overview with brief description

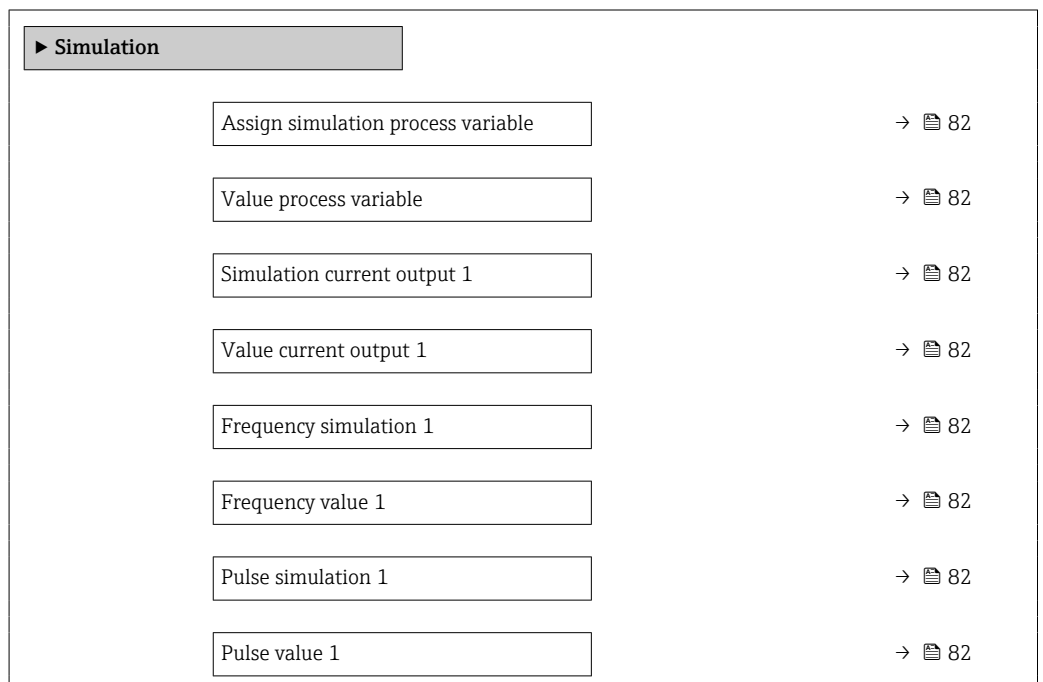
Parameter	Description	User entry / Selection
Define access code	Define release code for write access to parameters.	0 to 9999
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	<ul style="list-style-type: none"> ■ Cancel ■ To delivery settings ■ Restart device






10.5 Simulation

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





Navigation

"Diagnostics" menu → Simulation



Switch output simulation 1	→  82
Switch status 1	→  83
Simulation device alarm	→  83
Diagnostic event category	→  83
Simulation diagnostic event	→  83

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	<ul style="list-style-type: none"> ■ Off ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Concentration * ■ Target mass flow * ■ Carrier mass flow *
Value process variable	One of the following options is selected in the Assign simulation process variable parameter (→  82): <ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature ■ Concentration * ■ Target mass flow * ■ Carrier mass flow * 	Enter the simulation value for the selected process variable.	Depends on the process variable selected
Simulation current output 1	–	Switch the simulation of the current output on and off.	<ul style="list-style-type: none"> ■ Off ■ On
Value current output 1	In the Simulation current output parameter, the On option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA
Frequency simulation 1	In the Operating mode parameter, the Frequency option is selected.	Switch the simulation of the frequency output on and off.	<ul style="list-style-type: none"> ■ Off ■ On
Frequency value 1	In the Frequency simulation parameter, the On option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz
Pulse simulation 1	In the Operating mode parameter, the Pulse option is selected.	Set and switch off the pulse output simulation.  For Fixed value option: Pulse width parameter (→  60) defines the pulse width of the pulses output.	<ul style="list-style-type: none"> ■ Off ■ Fixed value ■ Down-counting value
Pulse value 1	In the Pulse simulation parameter (→  82), the Down-counting value option is selected.	Enter the number of pulses for simulation.	0 to 65 535
Switch output simulation 1	In the Operating mode parameter, the Switch option is selected.	Switch the simulation of the switch output on and off.	<ul style="list-style-type: none"> ■ Off ■ On

Parameter	Prerequisite	Description	Selection / User entry
Switch status 1	In the Switch output simulation parameter (→ 82) Switch output simulation 1 to n parameter Switch output simulation 1 to n parameter, the On option is selected.	Select the status of the status output for the simulation.	<ul style="list-style-type: none"> ▪ Open ▪ Closed
Simulation device alarm	–	Switch the device alarm on and off.	<ul style="list-style-type: none"> ▪ Off ▪ On
Diagnostic event category	–	Select a diagnostic event category.	<ul style="list-style-type: none"> ▪ Sensor ▪ Electronics ▪ Configuration ▪ Process
Simulation diagnostic event	–	Select a diagnostic event for the simulation process that is activated.	<ul style="list-style-type: none"> ▪ Off ▪ Diagnostic event picklist (depends on the category selected)

* Visibility depends on order options or device settings

10.6 Protecting settings from unauthorized access

The following options exist for protecting the configuration of the measuring device from unintentional modification after commissioning:

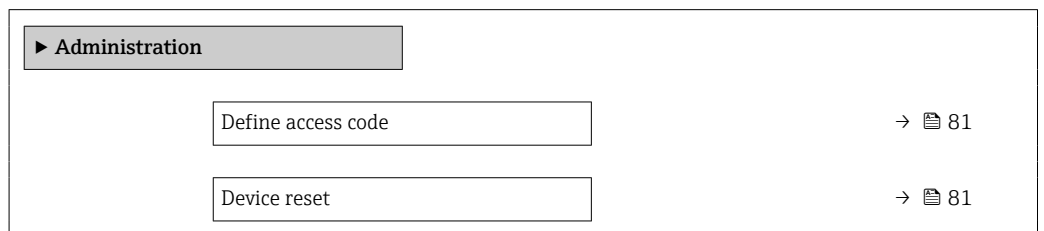
- Write protection via access code for Web browser → 83
- Write protection via write protection switch → 84

10.6.1 Write protection via access code

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


Navigation


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



Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter.
2. Define a max. 16-digit numeric code as an access code.
3. Enter the access code again in the to confirm the code.
 - ↳ The Web browser switches to the login page.

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

- 
 - If parameter write protection is activated via an access code, it can also only be deactivated via this access code .
 - The user role with which the user is currently logged on via Web browser is indicated by the **Access status tooling** parameter. Navigation path: Operation → Access status tooling


10.6.2 Write protection via write protection switch

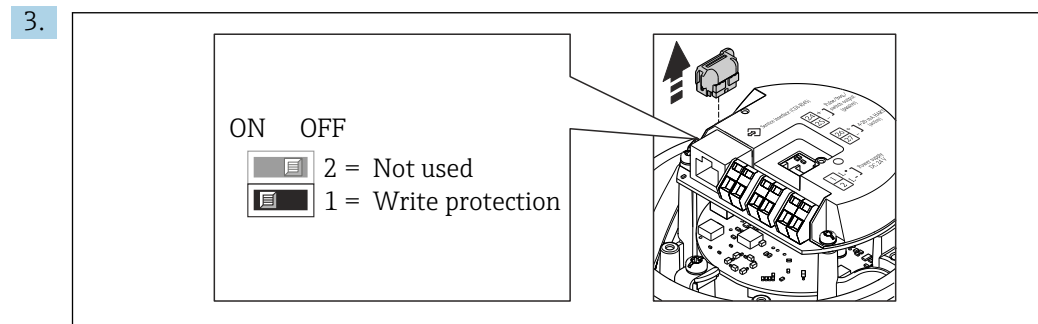
The write protection switch makes it possible to block write access to the entire operating menu with the exception of the following parameters:

- External pressure
- External temperature
- Reference density
- All parameters for configuring the totalizer

The parameter values are now read only and cannot be edited any more:

- Via service interface (CDI)
- Via HART protocol

1. Depending on the housing version, loosen the securing clamp or fixing screw of the housing cover.
2. Depending on the housing version, unscrew or open the housing cover and disconnect the local display from the main electronics module where necessary
→  126.



Disconnect the T-DAT from the main electronics module.

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

11 Operation

11.1 Reading the device locking status

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


Navigation


"Operation" menu → Locking status

Function scope of "Locking status" parameter

Options	Description
Hardware locked	The locking switch (DIP switch) for locking the hardware is activated on the main electronic module. This prevents write access to the parameters .
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc.). Once the internal processing has been completed, the parameters can be changed once again.


11.2 Adjusting the operating language

 Detailed information:

- To configure the operating language →  52
- For information on the operating languages supported by the measuring device

11.3 Configuring the display

Detailed information:




On the advanced settings for the local display →  78

11.4 Reading measured values

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

Navigation

"Diagnostics" menu → Measured values

▶ Measured values	
▶ Process variables	→  85
▶ Totalizer	→  87
▶ Output values	→  88

11.4.1 "Measured variables" submenu

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




Navigation

"Diagnostics" menu → Measured values → Measured variables

► Measured variables	
Mass flow	→ 86
Volume flow	→ 86
Corrected volume flow	→ 86
Density	→ 86
Reference density	→ 87
Temperature	→ 87
Pressure value	→ 87
Concentration	→ 87
Target mass flow	→ 87
Carrier mass flow	→ 87

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Mass flow	–	Displays the mass flow currently measured. <i>Dependency</i> The unit is taken from the Mass flow unit parameter (→ 73).	Signed floating-point number
Volume flow	–	Displays the volume flow currently calculated. <i>Dependency</i> The unit is taken from the Volume flow unit parameter (→ 73).	Signed floating-point number
Corrected volume flow	–	Displays the corrected volume flow currently calculated. <i>Dependency</i> The unit is taken from the Corrected volume flow unit parameter (→ 73).	Signed floating-point number
Density	–	Shows the density currently measured. <i>Dependency</i> The unit is taken from the Density unit parameter (→ 74).	Signed floating-point number

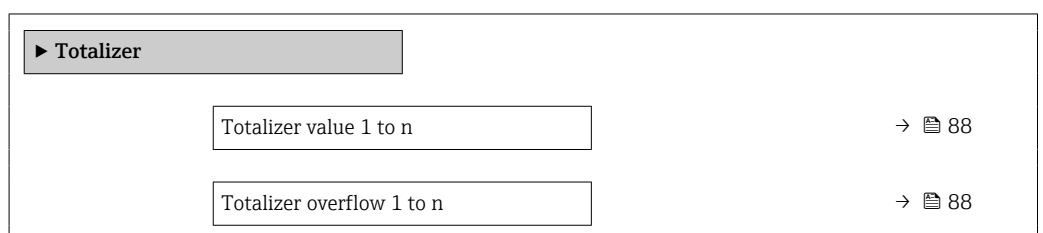
Parameter	Prerequisite	Description	User interface
Reference density	–	Displays the reference density currently calculated. <i>Dependency</i> The unit is taken from the Reference density unit parameter (→ 74).	Signed floating-point number
Temperature	–	Shows the medium temperature currently measured. <i>Dependency</i> The unit is taken from the Temperature unit parameter (→ 74).	Signed floating-point number
Pressure value	–	Displays either a fixed or external pressure value. <i>Dependency</i> The unit is taken from the Pressure unit parameter (→ 74).	Signed floating-point number
Concentration	For the following order code: "Application package", option ED "Concentration"  The software options currently enabled are displayed in the Software option overview parameter.	Displays the concentration currently calculated. <i>Dependency</i> The unit is taken from the Concentration unit parameter.	Signed floating-point number
Target mass flow	With the following conditions: ▪ Order code for "Application package", option ED "Concentration" ▪ The WT-% option or the User conc. option is selected in the Concentration unit parameter.  The software options currently enabled are displayed in the Software option overview parameter.	Displays the target fluid mass flow currently measured. <i>Dependency</i> The unit is taken from the Mass flow unit parameter (→ 73).	Signed floating-point number
Carrier mass flow	With the following conditions: ▪ Order code for "Application package", option ED "Concentration" ▪ The WT-% option or the User conc. option is selected in the Concentration unit parameter.  The software options currently enabled are displayed in the Software option overview parameter.	Displays the carrier fluid mass flow currently measured. <i>Dependency</i> The unit is taken from the Mass flow unit parameter (→ 73).	Signed floating-point number

11.4.2 "Totalizer" submenu

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	Prerequisite	Description	User interface
Totalizer value 1 to n	One of the following options is selected in the Assign process variable parameter (→ 77) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow 1 to n	One of the following options is selected in the Assign process variable parameter (→ 77) Totalizer 1 to n submenu: <ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Target mass flow * ■ Carrier mass flow * 	Displays the current totalizer overflow.	Integer with sign

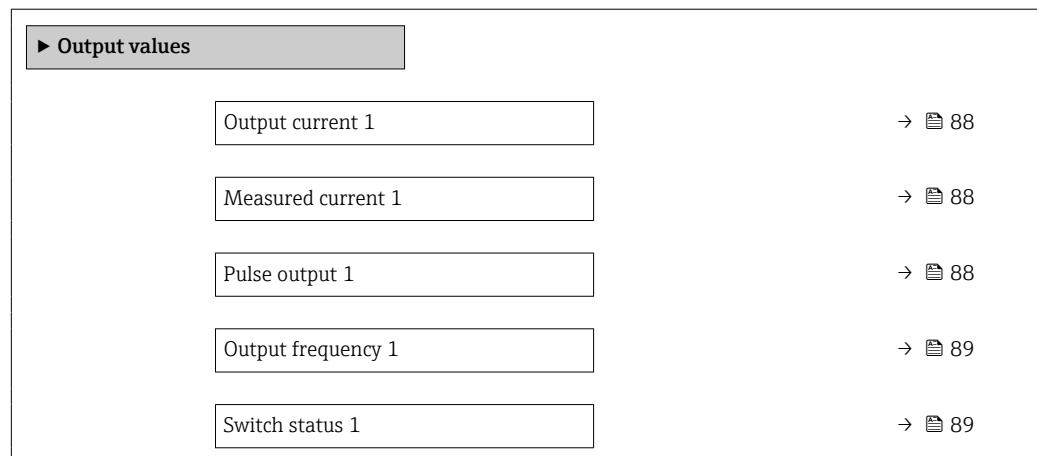
* Visibility depends on order options or device settings

11.4.3 Output values

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

Navigation

"Diagnostics" menu → Measured values → Output values





Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Output current 1	-	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current 1	-	Displays the current value currently measured for the current output.	0 to 30 mA
Pulse output 1	In the Operating mode parameter, the Pulse option is selected.	Displays the pulse frequency currently output.	Positive floating-point number

Parameter	Prerequisite	Description	User interface
Output frequency 1	In the Operating mode parameter, the Frequency option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz
Switch status 1	The Switch option is selected in the Operating mode parameter.	Displays the current switch output status.	<ul style="list-style-type: none"> ▪ Open ▪ Closed

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu (→  52)
- Advanced settings using the **Advanced setup** submenu (→  72)




11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:


- Control Totalizer
- Reset all totalizers

Navigation

"Operation" menu → Totalizer handling

▶ Totalizer handling	
Control Totalizer 1 to n	→  90
Preset value 1 to n	→  90
Reset all totalizers	→  90

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer 1 to n	One of the following options is selected in the Assign process variable parameter (→ 77) of the Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * 	Control totalizer value.	<ul style="list-style-type: none"> ▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize 	–
Preset value 1 to n	One of the following options is selected in the Assign process variable parameter (→ 77) of the Totalizer 1 to n submenu: <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Target mass flow * ▪ Carrier mass flow * 	Specify start value for totalizer. <i>Dependency</i>  The unit of the selected process variable is specified for the totalizer in the Unit totalizer parameter (→ 77).	Signed floating-point number	Country-specific: <ul style="list-style-type: none"> ▪ 0 kg ▪ 0 lb
Reset all totalizers	–	Reset all totalizers to 0 and start.	<ul style="list-style-type: none"> ▪ Cancel ▪ Reset + totalize 	–

* Visibility depends on order options or device settings

11.6.1 Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started or continues running.
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 from the Preset value parameter and the totaling process is restarted.





11.6.2 Function scope of the "Reset all totalizers" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display


Error	Possible causes	Solution
Local display dark and no output signals	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage .
Local display dark and no output signals	The polarity of the supply voltage is wrong.	Correct the polarity.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective.	Order spare part → 107.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	<ul style="list-style-type: none"> ▪ Set the display brighter by simultaneously pressing  + . ▪ Set the display darker by simultaneously pressing  + .
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 107.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	<ul style="list-style-type: none"> ▪ Check the cable and the connector between the main electronics module and display module. ▪ Order spare part → 107.

For output signals

Error	Possible causes	Solution
Green power LED on the main electronics module of the transmitter is dark	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage .
Device measures incorrectly.	Configuration error or device is operated outside the application.	<ol style="list-style-type: none"> 1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the OFF position → 84.
No connection via HART protocol	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly. Observe the maximum load .

Error	Possible causes	Solution
No connection via HART protocol	Commubox <ul style="list-style-type: none"> Connected incorrectly Configured incorrectly Drivers not installed correctly USB interface on computer configured incorrectly 	Observe the documentation for the Commubox.  FXA195 HART: Document "Technical Information" T100404F
Not connecting to Web server	Web server disabled	Using the "FieldCare" or "DeviceCare" operating tool, check whether the Web server of the measuring device is enabled, and enable it if necessary →  42 .
	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) →  39. 2. Check the network settings with the IT manager.
Not connecting to Web server	Incorrect IP address	Check the IP address: 192.168.1.212 →  39
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct Web browser version →  38. 2. Clear the Web browser cache and restart the Web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No or incomplete display of contents in the Web browser	<ul style="list-style-type: none"> JavaScript not enabled JavaScript cannot be enabled 	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

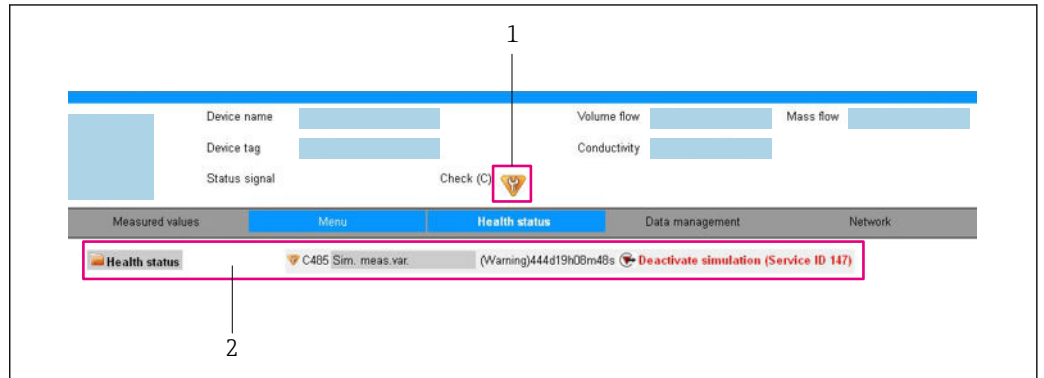
Different LEDs in the transmitter provide information on the device status.

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

12.3 Diagnostic information in the Web browser

12.3.1 Diagnostic options

Any faults detected by the measuring device are displayed in the Web browser on the home page once the user has logged on.



- 1 Status area with status signal
- 2 Diagnostic information → 93 and remedial measures with Service ID

i In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:

- Via parameter
- Via submenu → 100

Status signals

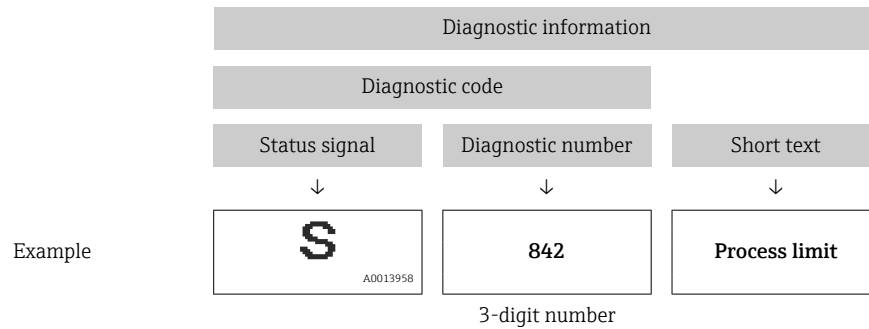
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	Function check The device is in service mode (e.g. during a simulation).
	Out of specification The device is operated: <ul style="list-style-type: none"> ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter 20 mA value)
	Maintenance required Maintenance is required. The measured value is still valid.

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

Diagnostic information

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



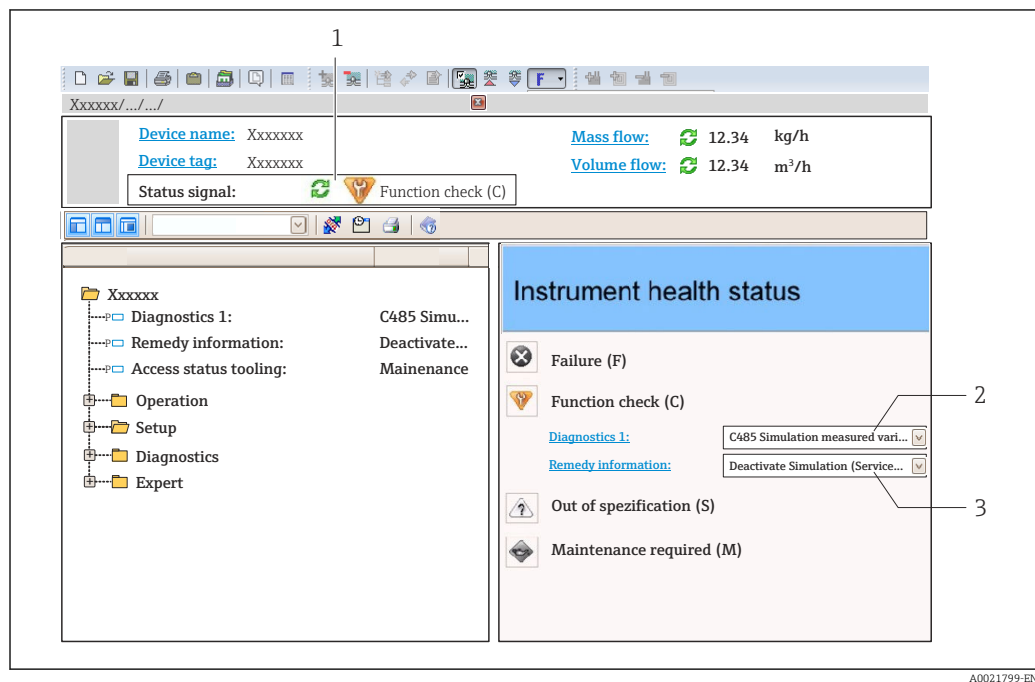
12.3.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

12.4 Diagnostic information in DeviceCare or FieldCare

12.4.1 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 → 93
- 3 Remedy information with Service ID


i In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:

- Via parameter
- Via submenu → 100

Status signals

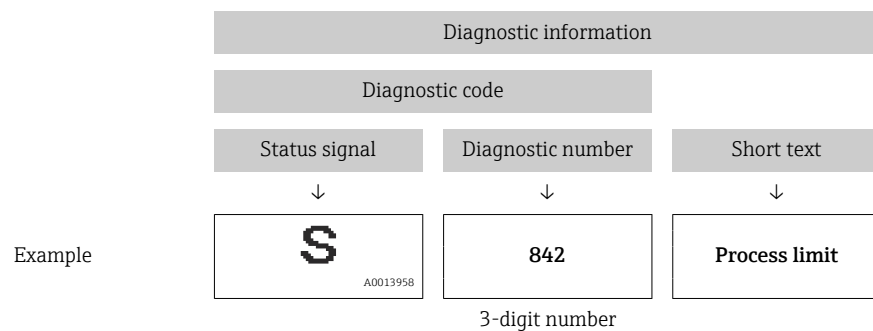
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	Function check The device is in service mode (e.g. during a simulation).
	Out of specification The device is operated: <ul style="list-style-type: none"> ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter 20 mA value)
	Maintenance required Maintenance is required. The measured value is still valid.

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

Diagnostic information

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



12.4.2 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.

12.5 Adapting the diagnostic information

12.5.1 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 specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior

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

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

12.5.2 Adapting the status signal

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





Expert → Communication → Diagnostic event category

Available status signals

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

Symbol	Meaning
F A0013956	Failure A device error is present. The measured value is no longer valid.
C A0013959	Function check The device is in service mode (e.g. during a simulation).
S A0013958	Out of specification The device is being operated: <ul style="list-style-type: none"> ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter 20 mA value)
M A0013957	Maintenance required Maintenance is required. The measured value is still valid.
N A0023076	Has no effect on the condensed status.

12.6 Overview of diagnostic information

-  The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.
-  In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information →  96
-  In the case of some items of diagnostic information, the diagnostic behavior can be changed. Change the diagnostic information

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
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
144	Measuring error too high	1. Check or change sensor 2. Check process conditions	F	Alarm
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				
201	Device failure	1. Restart device 2. Contact service	F	Alarm
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change electronic modules	F	Alarm
262	Module connection	1. Check module connections 2. Change main electronics	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
274	Main electronic failure	Change electronic	S	Warning
283	Memory content	1. Reset device 2. Contact service	F	Alarm


Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
311	Electronic failure	1. Reset device 2. Contact service	F	Alarm
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
375	I/O communication failed	1. Restart device 2. Change main electronic module	F	Alarm
382	Data storage	1. Insert DAT module 2. Change DAT module	F	Alarm
383	Memory content	1. Restart device 2. Check or change DAT module 3. Contact service	F	Alarm
390	Special event 2	Contact service	F	Alarm
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
431	Trim 1	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1	1. Check process 2. Check current output settings	S	Warning ¹⁾
442	Frequency output	1. Check process 2. Check frequency output settings	S	Warning ¹⁾
443	Pulse output	1. Check process 2. Check pulse output settings	S	Warning ¹⁾
453	Flow override	Deactivate flow override	C	Warning
484	Simulation failure mode	Deactivate simulation	C	Alarm
485	Simulation measured variable	Deactivate simulation	C	Warning
491	Simulation current output 1	Deactivate simulation	C	Warning
492	Simulation frequency output	Deactivate simulation frequency output	C	Warning
493	Simulation pulse output	Deactivate simulation pulse output	C	Warning
494	Switch output simulation	Deactivate simulation switch output	C	Warning
495	Simulation diagnostic event	Deactivate simulation	C	Warning
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
590	Special event 3	Contact service	F	Alarm




Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
591	Special event 7	Contact service	F	Alarm
592	Special event 11	Contact service	F	Alarm ¹⁾
Diagnostic of process				
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
830	Sensor temperature too high	Reduce ambient temp. around the sensor housing	S	Warning
831	Sensor temperature too low	Increase ambient temp. around the sensor housing	S	Warning
832	Electronic temperature too high	Reduce ambient temperature	S	Warning ¹⁾
833	Electronic temperature too low	Increase ambient temperature	S	Warning ¹⁾
834	Process temperature too high	Reduce process temperature	S	Warning ¹⁾
835	Process temperature too low	Increase process temperature	S	Warning ¹⁾
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning
843	Process limit	Check process conditions	S	Warning
862	Partly filled pipe	1. Check for gas in process 2. Adjust detection limits	S	Warning
882	Input signal	1. Check input configuration 2. Check external device or process conditions	F	Alarm
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
912	Inhomogeneous		S	Warning
913	Medium unsuitable	1. Check process conditions 2. Check electronic modules or sensor	S	Alarm
944	Monitoring failed	Check process conditions for Heartbeat Monitoring	S	Warning
948	Tube damping too high	Check process conditions	S	Warning
990	Special event 4	Contact service	F	Alarm
991	Special event 8	Contact service	F	Alarm
992	Special event 12	Contact service	F	Alarm ¹⁾



1) Diagnostic behavior can be changed.

12.7 Pending diagnostic events

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






 To call up the measures to rectify a diagnostic event:

- Via Web browser →  94
- Via "FieldCare" operating tool →  95
- Via "DeviceCare" operating tool →  95


 Other pending diagnostic events can be displayed in the **Diagnostic list** submenu →  100

Navigation

"Diagnostics" menu

 Diagnostics	
Actual diagnostics	→  100
Previous diagnostics	→  100
Operating time from restart	→  100
Operating time	→  100

Parameter overview with brief description





Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occurred 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.
Operating time from restart	-	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m) and seconds (s)
Operating time	-	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)

12.8 Diagnostic list

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

Navigation path

Diagnostics → Diagnostic list

-  To call up the measures to rectify a diagnostic event:
- Via Web browser →  94
 - Via "FieldCare" operating tool →  95
 - Via "DeviceCare" operating tool →  95

12.9 Event logbook



12.9.1 Reading out the event logbook

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




Navigation pathDiagnostics menu → **Event logbook** submenu → Event list





A maximum of 20 event messages can be displayed in chronological order.

The event history includes entries for:

- Diagnostic events →  97
- Information events →  101

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

- Diagnostic event
 - : Occurrence of the event
 - : End of the event
- Information event
 - : Occurrence of the event

-  To call up the measures to rectify a diagnostic event:
- Via Web browser →  94
 - Via "FieldCare" operating tool →  95
 - Via "DeviceCare" operating tool →  95

-  For filtering the displayed event messages →  101

12.9.2 Filtering the event logbook

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

Navigation path

Diagnostics → Event logbook → Filter options

Filter categories


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

12.9.3 Overview of information events


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

Info number	Info name
I1000	----- (Device ok)
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1110	Write protection switch changed
I1111	Density adjust failure
I1137	Electronic changed
I1151	History reset
I1155	Reset electronic temperature
I1157	Memory error event list
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1209	Density adjustment ok
I1221	Zero point adjust failure
I1222	Zero point adjustment ok
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module reset detected
I1335	Firmware changed
I1361	Web server: login failed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1446	Device verification active
I1447	Record application reference data
I1448	Application reference data recorded
I1449	Recording application ref. data failed
I1450	Monitoring off
I1451	Monitoring on
I1457	Failed: Measured error verification
I1459	Failed: I/O module verification
I1460	Failed: Sensor integrity verification
I1461	Failed: Sensor verification
I1462	Failed: Sensor electronic module verific.

12.10 Resetting the measuring device

Using the **Device reset** parameter (→  81) it is possible to reset the entire device configuration or some of the configuration to a defined state.

12.10.1 Function scope of the "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	<p>Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.</p> <p> This option is not visible if no customer-specific settings have been ordered.</p>
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.















12.11 Device information



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

Navigation






"Diagnostics" menu → Device information

▶ Device information

Device tag	→  104
Serial number	→  104
Firmware version	→  104
Device name	→  104
Order code	→  104
Extended order code 1	→  104
Extended order code 2	→  104
Extended order code 3	→  104
ENP version	→  104
Device revision	→  104
Device ID	→  104
Device type	→  104
Manufacturer ID	→  104
IP address	→  104

Subnet mask	→  105
Default gateway	→  105


Parameter overview with brief description


Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	–
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 in the format xx.yy.zz	–
Device name	Shows the name of the transmitter.  The name can be found on the nameplate of the transmitter.	Max. 32 characters such as letters or numbers.	–
Order code	Shows the device order code.  The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.	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.  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 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).	Character string	–
Device revision	Shows the device revision with which the device is registered with the HART Communication Foundation.	2-digit hexadecimal number	–
Device ID	Enter device ID of external device.	6-digit hexadecimal number	–
Device type	Displays the device type with which the measuring device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x4A
Manufacturer ID	Displays the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x11 (for Endress+Hauser)
IP address	Displays the IP address of the Web server of the measuring device.	4 octet: 0 to 255 (in the particular octet)	–


Parameter	Description	User interface	Factory setting
Subnet mask	Displays the subnet mask.	4 octet: 0 to 255 (in the particular octet)	–
Default gateway	Displays the default gateway.	4 octet: 0 to 255 (in the particular octet)	–

12.12 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
04.2013	01.00.00	Option 76	Original firmware	Operating Instructions	BA01193D/06/EN/01.13
10.2014	01.01.zz	Option 70	<ul style="list-style-type: none"> ▪ In accordance with HART 7 Specification ▪ Integration of optional local display ▪ New unit "Beer Barrel (BBL)" ▪ Monitoring of measuring tube damping ▪ Simulation of diagnostic events ▪ External verification of current and PFS output via Heartbeat application package ▪ Fixed value for simulation pulses 	Operating Instructions	BA01193D/06/EN/02.14

 It is possible to flash the firmware to the current version or the previous version using the service interface.

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

 The manufacturer's information is available:

- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
 - Product root, e.g. 8E1B
The product root is the first part of the order code: see the nameplate on the device.
 - 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
→  121.


Observe the following point for cleaning with pigs:

Observe the inside diameter of the measuring tube and process connection.

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.

List of some of the measuring and testing equipment: →  109

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 Repairs

14.1 General notes

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:

- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

14.1.2 Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:

- ▶ Use only original Endress+Hauser spare parts.
- ▶ Carry out the repair according to the Installation Instructions.
- ▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶ Document every repair and each conversion and enter them into the *W@M* life cycle management database.


14.2 Spare parts

W@M Device Viewer (www.endress.com/deviceviewer):

All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.



Measuring device serial number:

- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→  104) in the **Device information** submenu.

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.

⚠ WARNING

Danger to persons from process conditions.

- ▶ Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

⚠ WARNING

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

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

Observe the following notes during disposal:


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

15 Accessories







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



15.1 Device-specific accessories

15.1.1 For the sensor



Accessories	Description
Heating jacket	<p>Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser.</p> <p> For details, see Operating Instructions BA00099D</p>

15.2 Communication-specific accessories



Accessories	Description
Commubox FXA195 HART	<p>For intrinsically safe HART communication with FieldCare via the USB interface.</p> <p> For details, see "Technical Information" TI00404F</p>
Commubox FXA291	<p>Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.</p> <p> For details, see the "Technical Information" document TI405C/07</p>
HART Loop Converter HMX50	<p>Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.</p> <p> For details, see "Technical Information" TI00429F and Operating Instructions BA00371F</p>
Wireless HART adapter SWA70	<p>Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.</p> <p> For details, see Operating Instructions BA00061S</p>
Fieldgate FXA320	<p>Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser.</p> <p> For details, see "Technical Information" TI00025S and Operating Instructions BA00053S</p>
Fieldgate FXA520	<p>Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser.</p> <p> For details, see "Technical Information" TI00025S and Operating Instructions BA00051S</p>

Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART devices and can be used in non-hazardous areas.  For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART devices and can be used in the non-hazardous area and in the hazardous area.  For details, see Operating Instructions BA01202S

15.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: <ul style="list-style-type: none"> Choice of measuring devices for industrial requirements Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. Graphic illustration of the calculation results Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: <ul style="list-style-type: none"> Via the Internet: https://wapps.endress.com/applicator As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
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

15.4 System components

Accessories	Description
Memograph M graphic data manager	<p>The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.</p> <p> For details, see "Technical Information" TI00133R and Operating Instructions BA00247R</p>
iTEMP	<p>The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature.</p> <p> For details, see "Fields of Activity", FA00006T</p>

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	One device version is available: compact version, transmitter and sensor form a mechanical unit. For information on the structure of the device

16.3 Input

Measured variable	<p>Direct measured variables</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Density ▪ Temperature <p>Calculated measured variables</p> <ul style="list-style-type: none"> ▪ Volume flow ▪ Corrected volume flow ▪ Reference density
-------------------	---

Measuring range	Measuring ranges for liquids			
	DN		Measuring range full scale values $\dot{m}_{\min(F)}$ to $\dot{m}_{\max(F)}$	
	[mm]	[in]	[kg/h]	[lb/min]
	8	$\frac{3}{8}$	0 to 2 000	0 to 73.50
	15	$\frac{1}{2}$	0 to 6 500	0 to 238.9
	25	1	0 to 18 000	0 to 661.5
	40	$1\frac{1}{2}$	0 to 45 000	0 to 1 654
	50	2	0 to 70 000	0 to 2 573

Measuring ranges for gases

The full scale values depend on the density of the gas and can be calculated with the formula below:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_G : X$$

$\dot{m}_{\max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{\max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{\max(G)} < \dot{m}_{\max(F)}$	$\dot{m}_{\max(G)}$ can never be greater than $\dot{m}_{\max(F)}$
ρ_G	Gas density in [kg/m ³] at operating conditions

	DN		x [kg/m ³]
	[mm]	[in]	
	8	$\frac{3}{8}$	60
	15	$\frac{1}{2}$	80
	25	1	90
	40	$1\frac{1}{2}$	90
	50	2	90

Calculation example for gas

- Sensor: Promass S, DN 50
- Gas: Air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 70 000 kg/h
- x = 90 kg/m³ (for Promass S, DN 50)

Maximum possible full scale value:

$$\dot{m}_{\max(G)} = \dot{m}_{\max(F)} \cdot \rho_G : x = 70\,000 \text{ kg/h} \cdot 60.3 \text{ kg/m}^3 : 90 \text{ kg/m}^3 = 46\,900 \text{ kg/h}$$

Recommended measuring range

"Flow limit" section →  122

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.



16.4 Output

Output signal

Current output

Current output	4-20 mA HART (active)
Maximum output values	<ul style="list-style-type: none"> ■ DC 24 V (no flow) ■ 22.5 mA
Load	0 to 700 Ω
Resolution	0.38 μA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Mass flow ■ Volume flow ■ Corrected volume flow ■ Density ■ Reference density ■ Temperature <p> The range of options increases if the measuring device has one or more application packages.</p>

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	<ul style="list-style-type: none"> ▪ DC 30 V ▪ 25 mA
Voltage drop	For 25 mA: ≤ DC 2 V
Pulse output	
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	<ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow
Frequency output	
Output frequency	Adjustable: 0 to 10 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	<ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature <p> The range of options increases if the measuring device has one or more application packages.</p>
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature ▪ Totalizer 1-3 ▪ Flow direction monitoring ▪ Status <ul style="list-style-type: none"> ▪ Partially filled pipe detection ▪ Low flow cut off <p> The range of options increases if the measuring device has one or more application packages.</p>

Signal on alarm

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

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): <ul style="list-style-type: none"> ▪ Minimum value: 3.6 mA ▪ Maximum value: 22 mA ▪ Defined value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value
---------------------	---

HART

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

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Actual value ▪ Defined value: 0 to 12 500 Hz ▪ 0 Hz
Switch output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Current status ▪ Open ▪ Closed

Local display

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

 Status signal as per NAMUR recommendation NE 107

Operating tool

- Via digital communication:
HART protocol
- Via service interface

Plain text display	With information on cause and remedial measures
---------------------------	---

Web browser

Plain text display	With information on cause and remedial measures
---------------------------	---


Low flow cut off

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

Galvanic isolation The following connections are galvanically isolated from each other:

- Outputs
- Power supply

Protocol-specific data **HART**

- For information on the device description files
- For information on the dynamic variables and measured variables (HART device variables) →  47

16.5 Power supply

Terminal assignment (Verweisziel existiert nicht, aber @y.link.required=true')

Pin assignment, device plug

Supply voltage **Transmitter**

For device version with all communication types except Modbus RS485 intrinsically safe: DC 20 to 30 V

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

Power consumption *Transmitter*

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

Current consumption **Transmitter**

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

Power supply failure

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

Electrical connection

Potential equalization No special measures for potential equalization are required.

Terminals **Transmitter**



Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries	<ul style="list-style-type: none"> ■ Cable gland: M20 × 1.5 with cable ϕ6 to 12 mm (0.24 to 0.47 in) ■ Thread for cable entry: <ul style="list-style-type: none"> ■ NPT 1/2" ■ G 1/2" ■ M20
---------------	---

Cable specification

16.6 Performance characteristics

Reference operating conditions	<ul style="list-style-type: none"> ■ Error limits based on ISO 11631 ■ Water with +15 to +45 °C (+59 to +113 °F) at 2 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 →  129

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

Base accuracy

Mass flow and volume flow (liquids)

±0.10 %

Mass flow (gases)

±0.50 % o.r.

 Design fundamentals →  120

Density (liquids)

- Reference conditions: ±0.0005 g/cm³
- Standard density calibration: ±0.01 g/cm³
(valid over the entire temperature range and density range)
- Wide-range density specification (order code for "Application package", option EF "Special density and concentration") : ±0.002 g/cm³ (valid range for special density calibration: 0.0 to 2 g/cm³, +5 to +80 °C (+41 to +176 °F))

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	3/8	0.20	0.007
15	1/2	0.65	0.024
25	1	1.80	0.066
40	1 1/2	4.50	0.165
50	2	7.0	0.257

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	2000	200	100	40	20	4
15	6500	650	325	130	65	13
25	18000	1800	900	360	180	36
40	45000	4500	2250	900	450	90
50	70000	7000	3500	1400	700	140

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]
$\frac{3}{8}$	73.50	7.350	3.675	1.470	0.735	0.147
$\frac{1}{2}$	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
1½	1654	165.4	82.70	33.08	16.54	3.308
2	2573	257.3	128.7	51.46	25.73	5.146

Accuracy of outputs

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

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

Current output

Accuracy	Max. $\pm 0.05\%$ o.f.s. or $\pm 5\ \mu\text{A}$
-----------------	--

Pulse/frequency output

Accuracy	Max. $\pm 50\ \text{ppm}$ o.r.
-----------------	--------------------------------

Repeatability

o.r. = of reading; $1\ \text{g}/\text{cm}^3 = 1\ \text{kg}/\text{l}$; T = medium temperature



Base repeatability

Mass flow and volume flow (liquids)

$\pm 0.05\%$ o.r.

Mass flow (gases)

$\pm 0.25\%$ o.r.

 Design fundamentals →  120

Density (liquids)

$\pm 0.00025\ \text{g}/\text{cm}^3$

Temperature

$\pm 0.25\ ^\circ\text{C} \pm 0.0025 \cdot T\ ^\circ\text{C}$ ($\pm 0.45\ ^\circ\text{F} \pm 0.0015 \cdot (T-32)\ ^\circ\text{F}$)

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

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

Current output

Temperature coefficient	Max. ±50 ppm/°C o.f.s. or ±1 µA/°C
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Pulse/frequency output

Temperature coefficient	Max. ±50 ppm o.r. /100 °C
-------------------------	---------------------------

Influence of medium temperature


Mass flow and volume flow

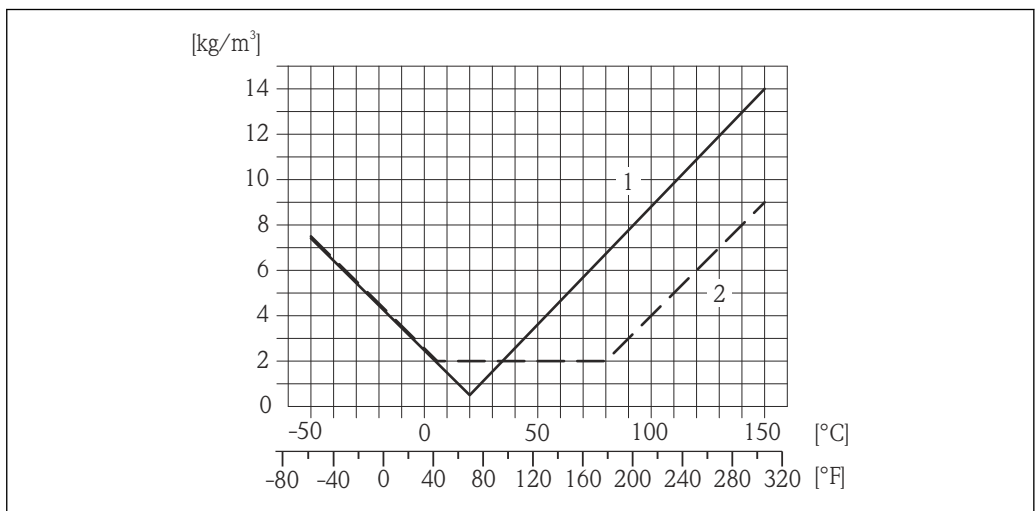
When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is ±0.0002 % of the full scale value/°C (±0.0001 % of the full scale value/°F).

Density

When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is ±0.0001 g/cm³ /°C (±0.00005 g/cm³ /°F). Field density calibration is possible.

Wide-range density specification (special density calibration)

If the process temperature is outside the valid range →  117 the measured error is ±0.0001 g/cm³ /°C (±0.00005 g/cm³ /°F)



- 1 Field density calibration, for example at +20 °C (+68 °F)
- 2 Special density calibration

Temperature

±0.005 · T °C (± 0.005 · (T - 32) °F)

Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

o.r. = of reading

DN		[% o.r./bar]	[% o.r./psi]
[mm]	[in]		
8	3/8	-0.002	-0.0001
15	1/2	-0.006	-0.0004
25	1	-0.005	-0.0003
40	1 1/2	-0.005	-0.0003
50	2	-0.005	-0.0003

Design fundamentals

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

BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r.

MeasValue = measured value; ZeroPoint = zero point stability

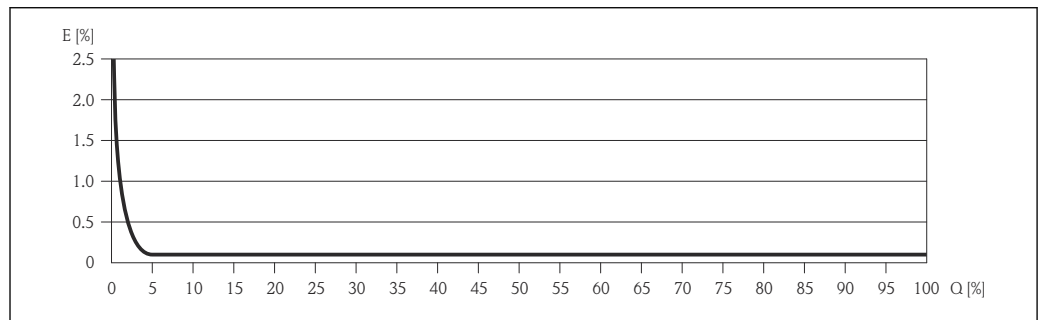
Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021332</small>	$\pm \text{BaseAccu}$ <small>A0021339</small>
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ <small>A0021333</small>	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021334</small>

Calculation of the maximum repeatability as a function of the flow rate

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021335</small>	$\pm \text{BaseRepeat}$ <small>A0021340</small>
$< \frac{1/2 \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ <small>A0021336</small>	$\pm 1/2 \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ <small>A0021337</small>

Example for max. measured error



A0016709

E Error: Maximum measured error as % o.r. (example)
 Q Flow rate as %

Design fundamentals → 120

16.7 Installation

"Mounting requirements"

16.8 Environment

Ambient temperature range

Storage temperature -50 to +60 °C (-58 to +140 °F) (Order code for "Test, certificate", option JM)

Climate class DIN EN 60068-2-38 (test Z/AD)

Degree of protection

Transmitter and sensor

- As standard: IP66/67, type 4X enclosure
- With the order code for "Sensor options", option **CM**: IP69K can also be ordered
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

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

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

Interior cleaning

- Sterilization in place (SIP)
- Cleaning in place (CIP)
- Cleaning with pigs

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)



For details refer to the Declaration of Conformity.

16.9 Process

Medium temperature range

Sensor

-50 to +150 °C (-58 to +302 °F)

Seals

No internal seals

Medium density 0 to 5 000 kg/m³ (0 to 312 lb/cf)


Pressure-temperature ratings




An overview of the material load diagrams (pressure/temperature diagrams) for the process connections is provided in the "Technical Information" document.

Sensor housing

The sensor housing is filled with dry nitrogen gas and protects the electronics and mechanics inside.

 If a measuring tube fails (e.g. due to process characteristics like corrosive or abrasive fluids), the fluid will initially be contained by the sensor housing.

If the sensor is to be purged with gas (gas detection), it should be equipped with purge connections.

 Do not open the purge connections unless the containment can be filled immediately with a dry, inert gas. Use only low pressure to purge.

Maximum pressure: 5 bar (72.5 psi)


Burst pressure of the sensor housing

The following sensor housing burst pressures are only valid for standard devices and/or devices equipped with closed purge connections (not opened/as delivered).

If a device fitted with purge connections (order code for "Sensor option", option CH "Purge connection") is connected to the purge system, the maximum pressure is determined by the purge system itself or by the device, depending on which component has the lower pressure classification.


The sensor housing burst pressure refers to a typical internal pressure which is reached prior to mechanical failure of the sensor housing and which was determined during type testing. The corresponding type test declaration can be ordered with the device (order code for "Additional approval", option LN "Sensor housing burst pressure, type test").


DN		Sensor housing burst pressure	
[mm]	[in]	[bar]	[psi]
8	3/8	190	2755
15	1/2	175	2538
25	1	165	2392
40	1 1/2	152	2204
50	2	103	1494

 For information on the dimensions: see the "Mechanical construction" section of the "Technical Information" document



Flow limit

Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.

 For an overview of the measuring range full scale values, see the "Measuring range" section →  112

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- In most applications, 20 to 50 % of the maximum full scale value can be considered ideal
- Select a lower full scale value for abrasive substances (such as liquids with entrained solids): flow velocity <1 m/s (<3 ft/s).
- For gas measurement the following rules apply:
 - The flow velocity in the measuring tubes should not exceed half the sonic velocity (0.5 Mach).
 - The maximum mass flow depends on the density of the gas: formula →  112

Pressure loss

 To calculate the pressure loss, use the *Applicator* sizing tool →  129

16.10 Mechanical construction

Design, dimensions



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

Weight

All values (weight exclusive of packaging material) refer to devices with EN/DIN PN 40 flanges. Weight specifications including transmitter: order code for "Housing", option A "Compact, aluminum coated".

Weight in SI units


DN [mm]	Weight [kg]
8	11
15	13
25	19
40	35
50	58

Weight in US units

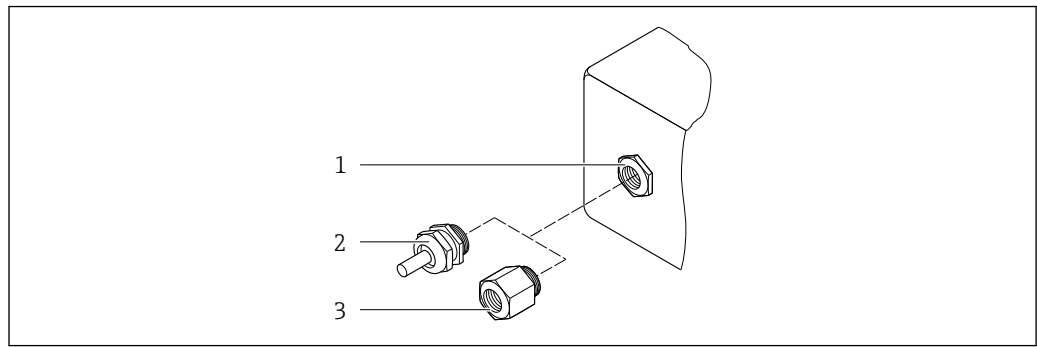
DN [in]	Weight [lbs]
3/8	24
1/2	29
1	42
1 1/2	77
2	128

Materials

Transmitter housing

- Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **B** "Compact, hygienic, stainless":
Hygienic version, stainless steel 1.4301 (304)
- Order code for "Housing", option **C** "Ultra-compact, hygienic, stainless":
Hygienic version, stainless steel 1.4301 (304)
- Window material for optional local display (→  125):
 - For order code for "Housing", option **A**: glass
 - For order code for "Housing", option **B** and **C**: plastic

Cable entries/cable glands



A0020640

19 Possible cable entries/cable glands

- 1 Female thread M20 × 1.5
- 2 Cable gland M20 × 1.5
- 3 Adapter for cable entry with female thread G ½" or NPT ½"

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

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

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

Order code for "Housing", option B "Compact, hygienic, stainless"

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

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Stainless steel, 1.4404 (316L)
Adapter for cable entry with female thread G ½"	
Adapter for cable entry with female thread NPT ½"	

Device plug

Electrical connection	Material
Plug M12x1	<ul style="list-style-type: none"> ■ 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)
- Stainless steel, 1.4435 (316L)

Process connections

Flange according to EN 1092-1 (DIN 2501)/ASME B16.5/JIS B2220:	Stainless steel, 1.4404 (316/316L)
All other process connections:	Stainless steel, 1.4435 (316L)



Available process connections → 125

Seals

Welded process connections without internal seals

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

Safety Barrier Promass 100

Housing: Polyamide

Process connections

- Fixed flange connections:
 - EN 1092-1 (DIN 2501) flange
 - EN 1092-1 (DIN 2512N) flange
 - ASME B16.5 flange
 - JIS B2220 flange
 - DIN 11864-2 Form A flange, DIN 11866 series A, flange with notch
- Clamp connections:
 - Tri-Clamp (OD tubes), DIN 11866 series C
 - DIN 11864-3 Form A clamp, DIN 11866 series A, with notch
 - DIN 32676 clamp, DIN 11866 series A
 - ISO 2852 clamp, ISO 2037
- Thread:
 - DIN 11851 thread, DIN 11866 series A
 - SMS 1145 thread
 - ISO 2853 thread, ISO 2037
 - DIN 11864-1 Form A thread, DIN 11866 series A



Process connection materials

Surface roughness

All data relate to parts in contact with fluid. The following surface roughness quality can be ordered.

- $Ra_{max} = 0.76 \mu\text{m}$ (30 μin)
- $Ra_{max} = 0.38 \mu\text{m}$ (15 μin)

16.11 Operability

Local display

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

Display element

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

Disconnecting the local display from the main electronics module

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

"Compact, aluminum coated" housing version

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

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

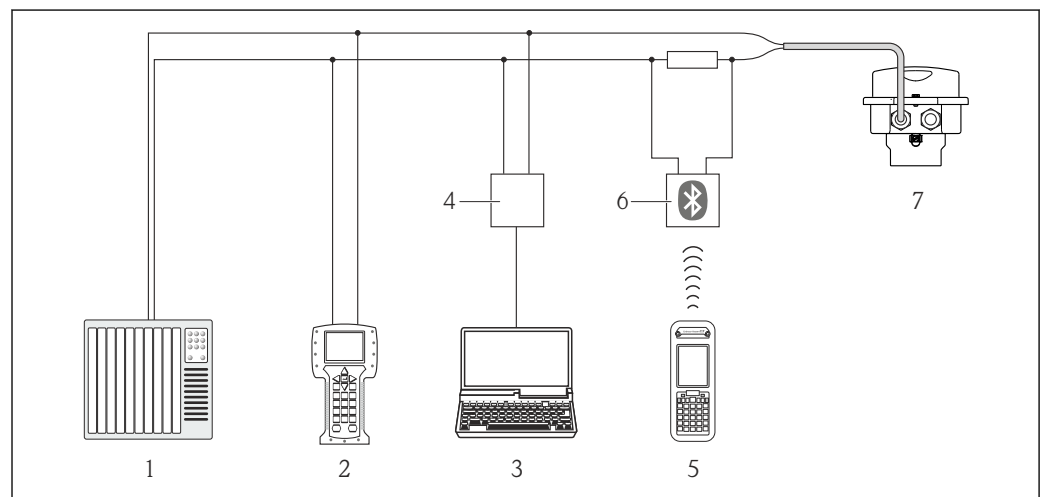
1. Press in the side latches of the local display.
2. Remove the local display from the main electronics module. Pay attention to the length of the connecting cable when doing so.

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

Remote operation

Via HART protocol

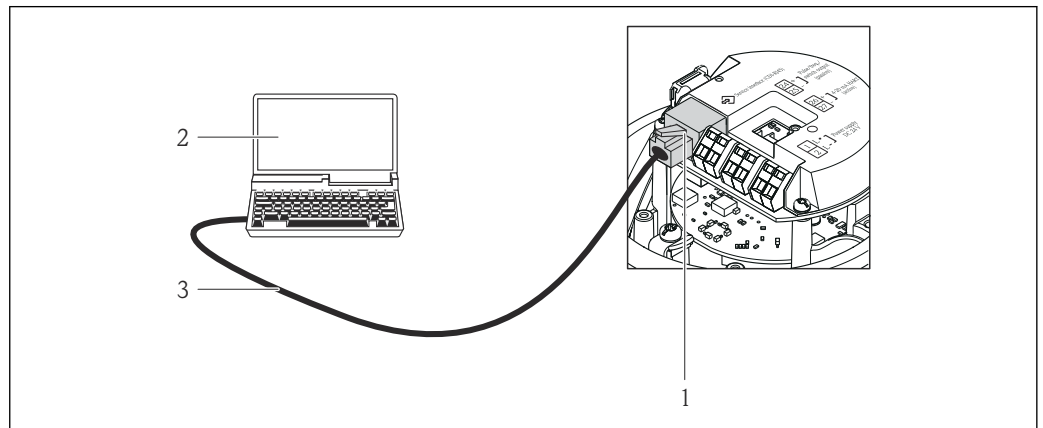
This communication interface is present in the following device version:
 Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output



20 Options for remote operation via HART protocol

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

Service interface

Service interface (CDI-RJ45)*HART*

A0016926

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

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

Languages

Can be operated in the following languages:

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

16.12 Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.

Hygienic compatibility

- 3A approval
- EHEDG-tested

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)
- IEC/EN 60068-2-6
Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326
Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 80
The application of the pressure equipment directive to process control devices
- NAMUR NE 105
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
Self-monitoring and diagnosis of field devices
- NAMUR NE 131
Requirements for field devices for standard applications
- NAMUR NE 132
Coriolis mass meter

16.13 Application packages

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

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



Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	<p>Heartbeat Monitoring: Continuously supplies monitoring data, which are characteristic of the measuring principle, for an external condition monitoring system. This makes it possible to:</p> <ul style="list-style-type: none"> ▪ Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the product quality, e.g. gas pockets. <p>Heartbeat Verification: Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process.</p> <ul style="list-style-type: none"> ▪ Access via onsite operation or other operating interfaces, such as FieldCare for instance. ▪ Documentation of device functionality within the framework of manufacturer specifications, for proof testing for instance. ▪ End-to-end, traceable documentation of the verification results, including report. ▪ Makes it possible to extend calibration intervals in accordance with operator's risk assessment.


Concentration

Package	Description
Concentration measurement and special density	<p>Calculation and outputting of fluid concentrations Many applications use density as a key measured value for monitoring quality or controlling processes. The device measures the density of the fluid as standard and makes this value available to the control system. The "Special Density" application package offers high-precision density measurement over a wide density and temperature range particularly for applications subject to varying process conditions. With the help of the "Concentration Measurement" application package, the measured density is used to calculate other process parameters:</p> <ul style="list-style-type: none"> ▪ Temperature-compensated density (reference density). ▪ Percentage mass of the individual substances in a two-phase fluid. (Concentration in %). ▪ Fluid concentration is output with special units (°Brix, °Baumé, °API, etc.) for standard applications. <p>The measured values are output via the digital and analog outputs of the device.</p>

16.14 Accessories

 Overview of accessories available for order →  109

16.15 Documentation

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

- 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
Promass S 100	KA01119D

Technical Information

Measuring device	Documentation code
Promass S 100	TI01037D

Supplementary device-dependent documentation




Safety Instructions

Contents	Documentation code
ATEX/IECEX Ex i	XA00159D
ATEX/IECEX Ex nA	XA01029D
cCSAus IS	XA00160D
INMETRO Ex i	XA01219D
INMETRO Ex nA	XA01220D
NEPSI Ex i	XA01249D
NEPSI Ex nA	XA01262D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD00142D
Concentration Measurement	SD01152D
Heartbeat Technology	SD01153D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory →  109  Overview of accessories available for order →  109

Index

A

Accuracy	117
Adapting the diagnostic behavior	96
Adapting the status signal	96
Ambient temperature	
Influence	119
AMS Device Manager	46
Function	46
Application	112
Application packages	128
Applicator	112
Approvals	127

B

Burst Mode	49
------------	----

C

C-Tick symbol	127
Cable entries	
Technical data	117
Cable entry	
Degree of protection	33
CE mark	10, 127
Certificates	127
Check	
Installation	25
Checklist	
Post-connection check	33
Post-installation check	25
Cleaning	
Cleaning in place (CIP)	106
Exterior cleaning	106
Interior cleaning	106
Sterilization in place (SIP)	106
Cleaning in place (CIP)	121
Climate class	121
Commissioning	52
Advanced settings	72
Configuring the measuring device	52
Communication-specific data	47
Connecting cable	26
Connecting the measuring device	28
Connection	
see Electrical connection	
Connection preparations	28
Connection tools	26
Current consumption	116

D

Declaration of Conformity	10
Define access code	83
Degree of protection	33, 121
Design	
Measuring device	12
Design fundamentals	
Maximum measured error	120

Repeatability	120
Designated use	9
Device components	12
Device description files	47
Device documentation	
Supplementary documentation	8
Device locking, status	85
Device name	
Sensor	15
Transmitter	14
Device repair	107
Device revision	47
Device type ID	47
DeviceCare	46
Device description file	47
Diagnostic information	
Design, description	93, 95
DeviceCare	94
FieldCare	94
Light emitting diodes	92
Overview	97
Remedial measures	97
Web browser	93
Diagnostic list	100
DIP switches	
see Write protection switch	
Disabling write protection	83
Display values	
For locking status	85
Disposal	108
Document	
Function	6
Symbols used	6
Document function	6
Down pipe	19

E

Electrical connection	
Commubox FXA195	126
Commubox FXA195 (USB)	43
Commubox FXA291	43
Degree of protection	33
Field Communicator	126
Field Communicator 475	43
Field Xpert SFX350/SFX370	43
Handheld terminals	126
Measuring device	26
Operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)	43
Operating tools	126
Via HART protocol	43, 126
Via service interface (CDI-RJ45)	43
Via service interface (CDI)	43
VIATOR Bluetooth modem	43
Web server	43
Electromagnetic compatibility	121

- Enabling write protection 83
- Endress+Hauser services
 - Maintenance 106
 - Repair 107
- Error messages
 - see Diagnostic messages
- Event list 101
- Event logbook 101
- Ex approval 127
- Extended order code
 - Sensor 15
 - Transmitter 14
- Exterior cleaning 106
- F**
- Field Communicator
 - Function 46
- Field Communicator 475 46
- Field of application
 - Residual risks 10
- Field Xpert
 - Function 44
- Field Xpert SFX350 44
- FieldCare 44
 - Device description file 47
 - Establishing a connection 45
 - Function 44
 - User interface 45
- Filtering the event logbook 101
- Firmware
 - Release date 47
 - Version 47
- Firmware history 105
- Flow direction 20, 24
- Flow limit 122
- Function check 52
- Function range
 - Field Xpert 44
- Function scope
 - AMS Device Manager 46
 - Field Communicator 46
 - Field Communicator 475 46
 - SIMATIC PDM 46
- Functions
 - see Parameter
- G**
- Galvanic isolation 116
- H**
- Hardware write protection 84
- HART input
 - Settings 66
- HART protocol
 - Device variables 47
 - Measured variables 47
- Hygienic compatibility 127
- I**
- I/O electronics module 12, 29
- Identifying the measuring device 13
- Incoming acceptance 13
- Influence
 - Ambient temperature 119
 - Medium pressure 119
 - Medium temperature 119
- Information on the document 6
- Inlet runs 21
- Input 112
- Inspection
 - Received goods 13
- Inspection check
 - Connection 33
- Installation 19
- Installation conditions
 - Down pipe 19
 - Inlet and outlet runs 21
 - Installation dimensions 21
 - Mounting location 19
 - Orientation 20
 - Sensor heating 22
 - System pressure 21
 - Thermal insulation 21
 - Vibrations 23
- Installation dimensions 21
- Interior cleaning 106, 121
- L**
- Languages, operation options 127
- Low flow cut off 115
- M**
- Main electronics module 12
- Maintenance tasks 106
- Manufacturer ID 47
- Manufacturing date 14, 15
- Materials 123
- Maximum measured error 117
- Measured variables
 - see Process variables
- Measuring and test equipment 106
- Measuring device
 - Configuration 52
 - Conversion 107
 - Design 12
 - Disposal 108
 - Mounting the sensor 24
 - Preparing for electrical connection 28
 - Preparing for mounting 24
 - Removing 108
 - Repairs 107
- Measuring principle 112
- Measuring range
 - Calculation example for gas 113
 - For gases 112
 - For liquids 112
- Measuring range, recommended 122
- Measuring system 112
- Medium density 121

- Medium pressure
 - Influence 119
- Medium temperature
 - Influence 119
- Menu
 - Diagnostics 100
 - Operation 85
 - Setup 52
- Menus
 - For measuring device configuration 52
 - For specific settings 72
- Mounting dimensions
 - see Installation dimensions
- Mounting location 19
- Mounting preparations 24
- Mounting tools 23
- N**
- Nameplate
 - Sensor 15
 - Transmitter 14
- O**
- Operable flow range 113
- Operating menu
 - Menus, submenus 36
 - Structure 36
 - Submenus and user roles 37
- Operating philosophy 37
- Operation 85
- Operation options 35
- Operational safety 10
- Order code 14, 15
- Orientation (vertical, horizontal) 20
- Outlet runs 21
- Output 113
- Output signal 113
- P**
- Packaging disposal 18
- Parameter settings
 - Administration (Submenu) 81
 - Advanced setup (Submenu) 72
 - Burst configuration 1 to n (Submenu) 49
 - Calculated values (Submenu) 74
 - Current output 1 (Submenu) 56
 - Device information (Submenu) 103
 - Diagnostics (Menu) 100
 - Display (Submenu) 78
 - HART input (Submenu) 66
 - Low flow cut off (Wizard) 70
 - Measured variables (Submenu) 85
 - Medium selection (Submenu) 54
 - Output conditioning (Wizard) 67
 - Output values (Submenu) 88
 - Partially filled pipe detection (Wizard) 71
 - Pulse/frequency/switch output 1 (Submenu) 59, 60, 64
 - Sensor adjustment (Submenu) 75
 - Setup (Menu) 52
 - Simulation (Submenu) 81
 - System units (Submenu) 72
 - Totalizer (Submenu) 87
 - Totalizer 1 to n (Submenu) 76
 - Totalizer handling (Submenu) 89
 - Web server (Submenu) 42
 - Zero point adjustment (Submenu) 76
- Performance characteristics 117
- Post-connection check (checklist) 33
- Post-installation check 52
- Post-installation check (checklist) 25
- Potential equalization 30, 116
- Power consumption 116
- Power supply failure 116
- Pressure Equipment Directive 128
- Pressure loss 122
- Pressure-temperature ratings 121
- Process connections 125
- Process variables
 - Calculated 112
 - Measured 112
- Product safety 10
- Protecting parameter settings 83
- R**
- Reading measured values 85
- Recalibration 106
- Reference operating conditions 117
- Registered trademarks 8
- Remote operation 126
- Repair of a device 107
- Repairs 107
 - Notes 107
- Repeatability 118
- Replacement
 - Device components 107
- Requirements for personnel 9
- Response time 119
- Return 107
- S**
- Safety 9
- Seals
 - Medium temperature range 121
- Sensor
 - Medium temperature range 121
 - Mounting 24
- Sensor heating 22
- Sensor housing 122
- Serial number 14, 15
- Service interface (CDI-RJ45) 127
- Setting the operating language 52
- Settings
 - Adapting the measuring device to the process conditions 89
 - Administration 81
 - Advanced display configurations 78
 - Current output 56

- Device reset 102
- Device tag 52
- HART input 66
- Low flow cut off 70
- Medium 54
- Operating language 52
- Output conditioning 67
- Partial filled pipe detection 71
- Pulse output 59
- Pulse/frequency/switch output 58, 60
- Resetting the totalizer 89
- Sensor adjustment 75
- Simulation 81
- Switch output 64
- System units 72
- Totalizer 76
- Totalizer reset 89
- Shock resistance 121
- Signal on alarm 114
- SIMATIC PDM 46
 - Function 46
- Software release 47
- Spare part 107
- Spare parts 107
- Special connection instructions 31
- Standards and guidelines 128
- Status signals 93, 95
- Sterilization in place (SIP) 121
- Storage conditions 17
- Storage temperature 17
- Structure
 - Operating menu 36
- Submenu
 - Administration 81
 - Advanced setup 72
 - Burst configuration 1 to n 49
 - Calculated values 74
 - Current output 1 56
 - Device information 103
 - Display 78
 - Event list 101
 - HART input 66
 - Measured values 85
 - Measured variables 85
 - Medium selection 54
 - Output values 88
 - Overview 37
 - Process variables 74
 - Pulse/frequency/switch output 1 58, 59, 60, 64
 - Sensor adjustment 75
 - Simulation 81
 - System units 72
 - Totalizer 87
 - Totalizer 1 to n 76
 - Totalizer handling 89
 - Web server 42
 - Zero point adjustment 76
- Supply voltage 116
- Surface roughness 125
- System design
 - Measuring system 112
 - see Measuring device design
- System integration 47
- System pressure 21
- T**
- Technical data, overview 112
- Temperature range
 - Medium temperature 121
 - Storage temperature 17
- Terminal assignment 27, 29
- Terminals 116
- Thermal insulation 21
- Tools
 - Electrical connection 26
 - For mounting 23
 - Transport 17
- Totalizer
 - Configuration 76
- Transmitter
 - Connecting the signal cables 29
 - Turning the display module 24
- Transporting the measuring device 17
- Troubleshooting
 - General 91
- Turning the display module 24
- U**
- Use of the measuring device
 - Borderline cases 9
 - Incorrect use 9
 - see Designated use
- User interface
 - Current diagnostic event 100
 - Previous diagnostic event 100
- User roles 37
- V**
- Version data for the device 47
- Vibration resistance 121
- Vibrations 23
- W**
- W@M 106, 107
- W@M Device Viewer 13, 107
- Weight
 - SI units 123
 - Transport (notes) 17
 - US units 123
- Wizard
 - Define access code 83
 - Low flow cut off 70
 - Output conditioning 67
 - Partially filled pipe detection 71
- Workplace safety 10
- Write protection
 - Via access code 83
 - Via write protection switch 84
- Write protection switch 84



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