Valid as of version 01.02.zz (Device firmware) Products

Solutions Services

Operating Instructions Proline Prowirl D 200 PROFIBUS PA

Vortex flowmeter







- 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 organization will supply you with current information and updates to this manual.

Table of contents

l	About this document		6.2	Installing the device	
l.1 l.2	Document function	6 6		 6.2.2 Preparing the measuring device 6.2.3 Installing the sensor 6.2.4 Installing the transmitter of the 	26
	1.2.2 Electrical symbols				27
	1.2.4 Tool symbols			6.2.5 Turning the transmitter housing6.2.6 Turning the display module	
	1.2.5 Symbols for certain types of information		6.3	Post-mounting check	
1.3	Documentation	8	7	Electrical connection	
l.4	Registered trademarks	8	7.1 7.2	Electrical safety	
2	Safety instructions	9		7.2.1 Required tools	30
2.1	Requirements for the personnel			7.2.2 Requirements for connection cable7.2.3 Connecting cable for remote version .	
2.2		9		7.2.4 Terminal assignment	
2.3	Workplace safety			7.2.5 Pin assignment of device plug	32
2.4 2.5	Operational safety			7.2.6 Shielding and grounding	
2.6	IT security			7.2.7 Requirements for the supply unit	
2.7	Device-specific IT security 1		7.3	7.2.8 Preparing the measuring instrument. Connecting the device	34 35
	2.7.1 Protecting access via hardware write		7.5	7.3.1 Connecting the compact version	
	protection			7.3.2 Connecting the remote version	36
	2.7.2 Protecting access via a password 1 2.7.3 Access via fieldbus		7.4		41
	Z.7.5 Access via liciubus 1	1	7.5	7.4.1 Requirements	
3	Product description	2	7.5 7.6	Ensuring the degree of protection Post-connection check	
3.1	Product design		7.0	rost connection thetr	42
7.1	rioduct design	۷	8	Operation options	43
1	Incoming acceptance and product		8.1	Overview of operation options	43
	identification 1	3	8.2	Structure and function of the operating menu	44
¥.1	Incoming acceptance 1			8.2.1 Structure of the operating menu	44
4.2	Product identification			8.2.2 Operating philosophy	45
	4.2.1 Transmitter nameplate		8.3	Access to operating menu via local display	46
	4.2.2 Sensor nameplate			8.3.1 Operational display	
	1.2.5 Symbols on the device	,			48
5	Storage and transport 18	8		8.3.3 Editing view	
	5			8.3.5 Opening the context menu	
5.1 5.2	Storage conditions			8.3.6 Navigating and selecting from list	53
7.2	5.2.1 Measuring devices without lifting			8.3.7 Calling the parameter directly	53
	lugs	8		8.3.8 Calling up help text	54
	5.2.2 Measuring devices with lifting lugs 1			8.3.9 Changing the parameters	55
- 0	5.2.3 Transporting with a fork lift 1			authorization	56
5.3	Packaging disposal 1	9		8.3.11 Disabling write protection via access	20
5	Installation 20	0		code	56
5.1	Installation requirements 2	0		lock	57
	6.1.1 Installation position 2		8.4	Access to the operating menu via the	
	6.1.2 Environmental and process			operating tool	57
	requirements 2	3		8.4.1 Connecting the operating tool	57

	8.4.2 FieldCare 58 8.4.3 DeviceCare 60 8.4.4 SIMATIC PDM 61	11.3 11.4	Configuring the display	129
9	System integration 62		11.4.2 Totalizer	132 133
9.1	Overview of device description files 62 9.1.1 Current version data for the device 62	11.5	Adapting the measuring device to the process conditions	133
9.2	9.1.2 Operating tools	11.6 11.7	Performing a totalizer reset	133 134
,.2	9.2.1 Manufacturer-specific GSD 63 9.2.2 Profile GSD 63	12	Diagnostics and troubleshooting	138
	9.2.3 Compatibility with other Endress	12.1	General troubleshooting	
	+Hauser measuring devices 63	12.2	Diagnostic information on local display	
9.3	Cyclic data transmission 64 9.3.1 Block model 64		12.2.1 Diagnostic message	140 142
	9.3.1 Block model 64 9.3.2 Description of the modules 65	12.3	Diagnostic information in FieldCare or DeviceCare	142
10	Commissioning		12.3.1 Diagnostic options	
	_		12.3.2 Calling up remedy information	144
LO.1	Function check	12.4	Adapting the diagnostic information	144
LO.2 LO.3	Switching on the measuring device		12.4.1 Adapting the diagnostic behavior	
LO.3 LO.4	Configuring the measuring device	12.5	Overview of diagnostic information	147
	10.4.1 Defining the tag name		12.5.1 Diagnostic of sensor	147
	10.4.2 Selecting and setting the medium 74		12.5.2 Diagnostic of electronic	150 160
	10.4.3 Setting the system units		12.5.4 Diagnostic of process	168
	10.4.4 Configuring the analog inputs 79		12.5.5 Operating conditions for displaying	100
	10.4.5 Configuring the local display 80		the following diagnostics	
	10.4.6 Configuring communication		information	176
	interface		12.5.6 Emergency mode in event of	
	10.4.7 Configuring the low flow cut off 82		temperature compensation	176
L0.5	Advanced settings	12.6	Pending diagnostic events	177
	10.5.1 Setting the medium properties 85 10.5.2 Performing external compensation 99	12.7	Diagnostic list	177
	10.5.2 Ferrorming external compensation	12.8	Event logbook	178
	10.5.4 Configuring the pulse/frequency/		12.8.1 Reading out the event logbook	
	switch output 102		12.8.2 Filtering the event logbook	178
	10.5.5 Configuring the totalizer 109	12.9	12.8.3 Overview of information events Resetting the measuring device	179 180
	10.5.6 Carrying out additional display	12.9	12.9.1 Function scope of the "Device reset"	100
	configurations 111		parameter	180
	10.5.7 Configuration management 113	12.10	Device information	180
	10.5.8 Using parameters for device		Firmware history	182
10.6	administration			
L0.6	Simulation	13	Maintenance	183
L0.7	Protecting settings from unauthorized access 118 10.7.1 Write protection via access code 118	13.1	Maintenance tasks	
	10.7.1 Write protection via access code	15.1	13.1.1 Exterior cleaning	183
8.01	Application-specific commissioning 120		13.1.3 Replacing seals	183
	10.8.1 Steam application 120	13.2	Measuring and test equipment	
	10.8.2 Liquid application 121	13.3	Endress+Hauser services	183
	10.8.3 Gas applications 122			
	10.8.4 Calculation of the measured	14	Repair	184
	variables	14.1	General notes	184
		14.1	14.1.1 Repair and conversion concept	
l1	Operation		14.1.2 Notes for repair and conversion	184
11.1	Reading the device locking status 129	14.2	Spare parts	184
11.2	Adjusting the operating language 129	14.3	Endress+Hauser services	185
		1		

14.4 14.5	Return	185 185 185 186
15	Accessories	187
15.1	Device-specific accessories	187 187 188
15.2	Service-specific accessories	188
15.3	System components	189
1.0	m 1 : 11 :	100
16	Technical data	190
16.1	Application	190
16.2	Function and system design	190
16.3	Input	190
16.4	Output	197
16.5	Power supply	200
16.6	Performance characteristics	202
16.7	Installation	204
16.8	Environment	205
16.9	Process	206
	Mechanical construction	207
	Operability	213
	Certificates and approvals	214
	Application packages	216
	Accessories	216
16.15	Documentation	216
Index	· · · · · · · · · · · · · · · · · · ·	219

1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

⚠ 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

A CAUTION

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
	Direct current
~	Alternating current
$\overline{\sim}$	Direct current and alternating current
≐	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Potential equalization connection (PE: Protective earth) Ground terminals that must be connected to ground prior to establishing any other connections.
	 The ground terminals are located on the interior and exterior of the device: Interior ground terminal: potential equalization connection is connected to the supply network. Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Communication-specific symbols

Symbol	Meaning
ि	Wireless Local Area Network (WLAN) Communication via a wireless, local network.
*	Bluetooth Wireless data transmission between devices over a short distance via radio technology.

1.2.4 Tool symbols

Symbol	Meaning
0	Flat-blade screwdriver
06	Allen key
Ó	Open-end wrench

1.2.5 Symbols for certain types of information

Symbol	Meaning
✓	Permitted Procedures, processes or actions that are permitted.
V	Preferred Procedures, processes or actions that are preferred.
X	Forbidden Procedures, processes or actions that are forbidden.
i	Tip Indicates additional information.
Ţ <u>i</u>	Reference to documentation
A ⁻	Reference to page
	Reference to graphic
>	Notice or individual step to be observed
1., 2., 3	Series of steps
L	Result of a step
?	Help in the event of a problem
	Visual inspection

1.2.6 Symbols in graphics

Symbol	Meaning
1, 2, 3,	Item numbers
1., 2., 3.,	Series of steps
A, B, C,	Views
A-A, B-B, C-C,	Sections
EX	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:

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Your reference document The 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.
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

1.4 Registered trademarks

PROFIBUS®

Registered trademark of the PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization), Karlsruhe, Germany

KALREZ®, VITON®

Registered trademarks of DuPont Performance Elastomers L.L.C., Wilmington, DE USA

Registered trademark of Garlock Sealing Technologies, Palmyar, NY, USA

2 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 Intended use

Application and media

The measuring instrument described in this manual is intended only for the flow measurement of liquids, gases and vapors.

Depending on the version ordered, the measuring instrument can also be used to measure potentially explosive ¹⁾, flammable, toxid and oxidizing media.

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

To ensure that the measuring instrument is in perfect condition during operation:

- ▶ Only use the measuring instrument in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- ▶ Using 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 instrument only for media to which the process-wetted materials are sufficiently resistant.
- ▶ Keep within the specified pressure and temperature range.
- ► Keep within the specified ambient temperature range.
- ► Protect the measuring instrument 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 and ambient conditions!

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

¹⁾ Not applicable for IO-Link measuring instruments

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

A CAUTION

Risk of hot or cold burns! The use of media and electronics with high or low temperatures can produce hot or cold surfaces on the device.

► Mount suitable touch protection.

2.3 Workplace safety

When working on and with the device:

▶ Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

Damage to the device!

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!

▶ If modifications are nevertheless required, consult with the manufacturer.

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 the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It 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. The manufacturer confirms this by affixing the CE mark.

2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

2.7 Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater inoperation safety if used correctly. The following list provides an overview of the most important functions:

2.7.1 Protecting access via hardware write protection

Write access to the parameters of the device via the local display or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the main electronics module). When hardware write protection is enabled, only read access to the parameters is possible.

2.7.2 Protecting access via a password

A password can be used to protect against write access to the device parameters.

This controls write access to the device parameters via the local display or other operating tools (e.g. FieldCare, DeviceCare) and, in terms of functionality, corresponds to hardware write protection. If the CDI service interface is used, read access is only possible by first entering the password.

User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code ($\rightarrow \equiv 118$).

When the device is delivered, the device does not have an access code and is equivalent to 0000 (open).

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning for safety reasons.
- Follow the general rules for generating a secure password when defining and managing the access code and network key.
- The user is responsible for the management and careful handling of the access code and network key.
- For information on configuring the access code or on what to do if you lose the password, for example, see "Write protection via access code" → 🖺 118.

2.7.3 Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

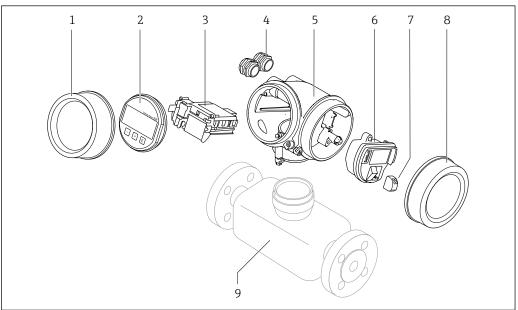
3 Product description

The device consists of a transmitter and a sensor.

Two device versions are available:

- Compact version transmitter and sensor form a mechanical unit.
- Remote version transmitter and sensor are mounted in separate locations.

3.1 Product design



A004882

- 1 Electronics compartment cover
- 2 Display module
- 3 Main electronics module
- 4 Cable glands
- 5 Transmitter housing (incl. HistoROM)
- 6 I/O electronics module
- 7 Terminals (plug-in spring terminals)
- 8 Connection compartment cover
- 9 Sensor

12

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

- 1. Check the packaging for damage.
 - Report all damage immediately to the manufacturer. Do not install damaged components.
- 2. Check the scope of delivery using the delivery note.
- 3. Compare the data on the nameplate with the order specifications on the delivery note.
- 4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.
- If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

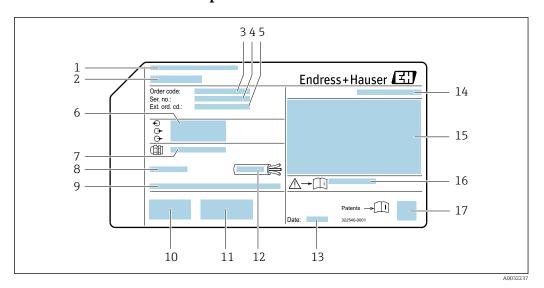
The device can be identified in the following ways:

- Nameplate
- Order code with details of the device features on the delivery note
- Enter the serial numbers from the nameplates in the *Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial numbers from the nameplates into the *Endress+Hauser Operations app* or scan the DataMatrix code on the nameplate with the *Endress+Hauser Operations app*: all the information about the device is displayed.

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

- The "Additional standard device documentation" and "Supplementary device-dependent documentation" sections
- The 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 DataMatrix code on the nameplate.

4.2.1 Transmitter nameplate



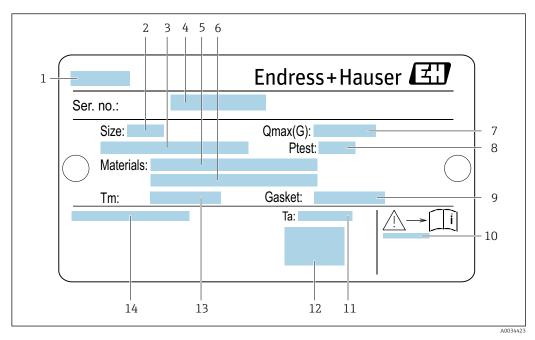
■ 1 Example of a transmitter nameplate

- 1 Manufacturer address/certificate holder
- 2 Name of the transmitter
- 3 Order code
- 4 Serial number
- 5 Extended order code
- 6 Electrical connection data, e.g. available inputs and outputs, supply voltage
- 7 Type of cable glands
- 8 Permitted ambient temperature (T_a)
- 9 Firmware version (FW) from the factory
- 10 CE mark, RCM-Tick mark
- 11 Additional information on version: certificates, approvals
- 12 Permitted temperature range for cable
- 13 Date of manufacture: year-month
- 14 Degree of protection
- 15 Approval information for explosion protection
- 16 Document number of safety-related supplementary documentation
- 17 2-D matrix code

14

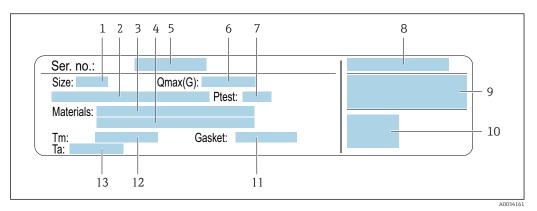
4.2.2 Sensor nameplate

Order code for "Housing" option B "GT18 dual compartment, 316L, compact" and option K "GT18 dual compartment, 316L, remote"



- **2** Example of a sensor nameplate
- 1 Name of sensor
- 2 Nominal diameter of sensor
- 3 Flange nominal diameter/nominal pressure
- 4 Serial number (Ser. no.)
- 5 Measuring tube material
- 6 Measuring tube material
- 7 Maximum permitted volume flow (gas/steam): $Q_{max} \rightarrow \square 191$
- 8 Test pressure of the sensor: OPL
- 9 Seal material
- 11 Ambient temperature range
- 12 CE mark
- 13 Medium temperature range
- 14 Degree of protection

Order code for "Housing" option C "GT20 dual compartment, aluminum, coated, compact"

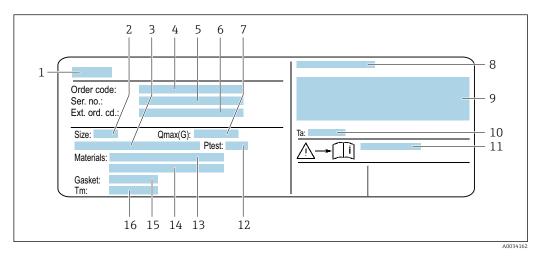


■ 3 Example of a sensor nameplate

- 1 Nominal diameter of sensor
- 2 Flange nominal diameter/nominal pressure
- 3 Measuring tube material
- 4 Measuring tube material
- 5 Serial number (Ser. no.)
- 6 Maximal permitted volume flow (gas/steam)
- 7 Test pressure of the sensor
- 8 Degree of protection
- Approval information for explosion protection and Pressure Equipment Directive $\Rightarrow 217$
- 10 CE mark
- 11 Seal material
- 12 Medium temperature range
- 13 Ambient temperature range

16

Order code for "Housing" option J "GT20 dual compartment, aluminum, coated, remote"



■ 4 Example of a sensor nameplate

- 1 Name of sensor
- 2 Nominal diameter of sensor
- 3 Flange nominal diameter/nominal pressure
- 4 Order code
- 5 Serial number (Ser. no.)
- 6 Extended order code (ext. ord. cd.)
- 7 Maximal permitted volume flow (gas/steam)
- 8 Degree of protection
- 9 Approval information for explosion protection and Pressure Equipment Directive
- 10 Ambient temperature range
- 11 Document number of safety-related supplementary documentation → 🖺 217
- 12 Test pressure of the sensor
- 13 Measuring tube material
- 14 Measuring tube material
- 15 Seal material
- 16 Medium temperature range

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 approvalrelated 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 the device

Symbol	Meaning
\triangle	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. Please consult the documentation for the measuring instrument to discover the type of potential danger and measures to avoid it.
[i	Reference to documentation Refers to the corresponding device documentation.
	Protective ground connection A terminal that must be connected to the ground prior to establishing any other connections.

5 Storage and transport

5.1 Storage conditions

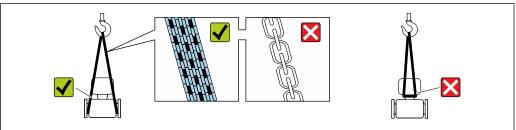
Observe the following notes for storage:

- ▶ 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. Avoid unacceptably high surface temperatures.
- ► Store in a dry and dust-free place.
- ▶ Do not store outdoors.

Storage temperature: -50 to +80 °C (-58 to +176 °F)

5.2 Transporting the product

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



A002925

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.

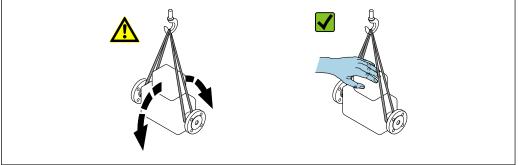
5.2.1 Measuring devices without lifting lugs

MARNING

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).



A0029214

5.2.2 Measuring devices with lifting lugs

A 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:

- Outer packaging of device Stretch wrap made of polymer in accordance with EU Directive 2002/95/EC (RoHS)
- Packaging
 - Wood crate treated in accordance with ISPM 15 standard, confirmed by IPPC logo
 - Cardboard box in accordance with European packaging guideline 94/62/EC, recyclability confirmed by Resy symbol
- Transport material and fastening fixtures
 - Disposable plastic pallet
 - Plastic straps
 - Plastic adhesive strips
- Filler material

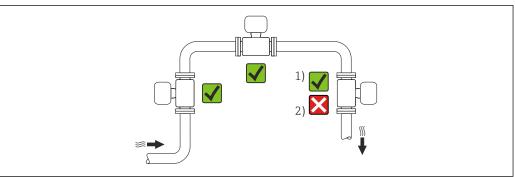
Paper pads

6 Installation

6.1 Installation requirements

6.1.1 Installation position

Mounting location



A00421

- 1 Installation suitable for gases and steam
- 2 Installation not suitable for liquids

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).

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. Therefore, please note the following:

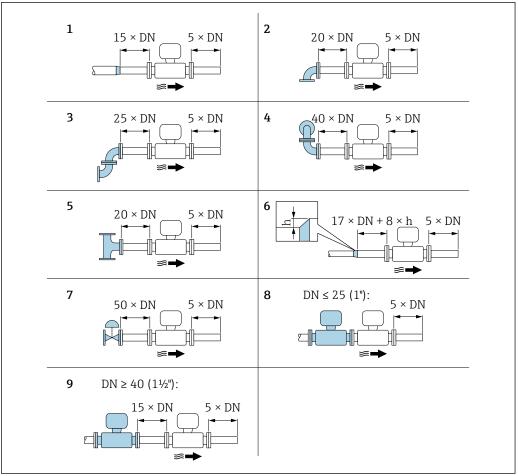
Orientation		Recommendation		
			Compact version	Remote version
A	Vertical orientation (liquids)	↑ A0015591	1)	
A	Vertical orientation (dry gases)	A0015591		
В	Horizontal orientation, transmitter head up	A0015589	2)	

	Orientation	Recommendation		
			Compact version	Remote version
С	Horizontal orientation, transmitter head down	A0015590	√ √ ³⁾	✓ ✓
D	Horizontal orientation, transmitter head at side	A0015592		

- 1) In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (Fig. A). Disruption in flow measurement!
- In the case of hot media (e.g. steam or medium temperature (TM) \geq 200 °C (392 °F): orientation C or D
- 3) In the case of very cold media (e.g. liquid nitrogen): orientation B or D

Inlet and outlet runs

To attain the specified level of accuracy of the measuring instrument, the inlet and outlet runs mentioned below must be maintained at the very minimum.



A00191

■ 5 Minimum inlet and outlet runs with various flow obstructions

- h Difference in expansion
- 1 Reduction by one nominal diameter size
- 2 Single elbow (90° elbow)
- 3 Double elbow ($2 \times 90^{\circ}$ elbows, opposite)
- 4 Double elbow 3D ($2 \times 90^{\circ}$ elbows, opposite, not on one plane)
- 5 T-piece
- 6 Extension
- 7 Control valve
- 8 Two measuring instruments in a row where DN \leq 25 (1"): directly flange on flange
- Two measuring instruments in a row where DN \geq 40 (1½"): for spacing, see graphic

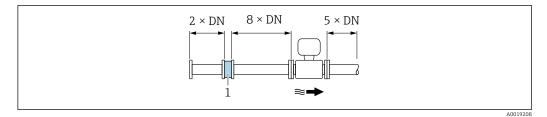


- If there are several flow disturbances present, the longest specified inlet run must be maintained.

Flow conditioner

If the inlet runs cannot be observed, the use of a flow conditioner is recommended.

The flow conditioner is fitted between two pipe flanges and centered by the mounting bolts. Generally this reduces the inlet run needed to $10 \times DN$ with full measurement accuracy.



Flow conditioner

The pressure loss for flow conditioners is calculated as follows:

 $\Delta p \text{ [mbar]} = 0.0085 \cdot \rho \text{ [kg/m}^3] \cdot v^2 \text{ [m/s]}$

Example for steam
p = 10 bar abs.
$t = 240 ^{\circ}\text{C} \rightarrow \rho = 4.39 \text{kg/m}^3$
v = 40 m/s
$\Delta p = 0.0085 \cdot 4.39 \cdot 40^{2} = 59.7 \text{ mbar}$

Example for H ₂ O condensate (80 °C)		
$\rho = 965 \text{ kg/m}^3$		
v = 2.5 m/s		
$\Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3 \text{ mbar}$		

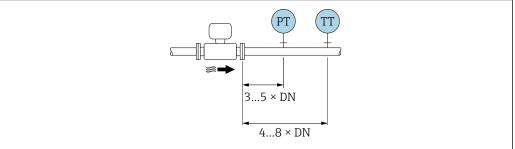
 ρ : density of the process medium v: average flow velocity abs. = absolute



For the dimensions of the flow conditioner, see the "Technical Information" document, "Mechanical construction" section

Outlet runs when installing external devices

If installing an external device, observe the specified distance.



PT Pressure

TT Temperature device

Installation dimensions



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

6.1.2 Environmental and process requirements

Ambient temperature range

Compact version

Measuring instrument	Non-hazardous area:	-40 to +80 °C (-40 to +176 °F)
	Ex i, Ex nA, Ex ec:	−40 to +70 °C (−40 to +158 °F)

	Ex d, XP:	-40 to +60 °C (-40 to +140 °F)	
	Ex d, Ex ia:	-40 to +60 °C (-40 to +140 °F)	
Local display		-40 to +70 °C (-40 to +158 °F) 1)	

1) At temperatures below -20 °C (-4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.

Remote version

Transmitter	Non-hazardous area:	-40 to +80 °C (-40 to +176 °F)
	Ex i, Ex nA, Ex ec:	-40 to +80 °C (-40 to +176 °F)
	Ex d:	-40 to +60 °C (-40 to +140 °F)
	Ex d, Ex ia:	-40 to +60 °C (-40 to +140 °F)
Sensor	Non-hazardous area:	-40 to +85 °C (-40 to +185 °F)
	Ex i, Ex nA, Ex ec:	−40 to +85 °C (−40 to +185 °F)
	Ex d:	−40 to +85 °C (−40 to +185 °F)
	Ex d, Ex ia:	-40 to +85 °C (-40 to +185 °F)
Local display		-40 to +70 °C (-40 to +158 °F) ¹⁾

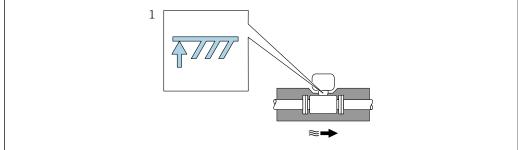
- 1) At temperatures < -20 °C (-4 °F), depending on the physical characteristics involved, it may no longer be possible to read the liquid crystal display.
- ► If operating outdoors:

 Avoid direct sunlight, particularly in warm climatic regions.

Thermal insulation

For optimum temperature measurement and mass calculation, heat transfer at the sensor must be avoided for some fluids. This can be ensured by installing thermal insulation. A wide range of materials can be used for the required insulation.

The maximum insulation height permitted is illustrated in the diagram:



A001921

- 1 Maximum insulation height
- ▶ When insulating, 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.

24

NOTICE

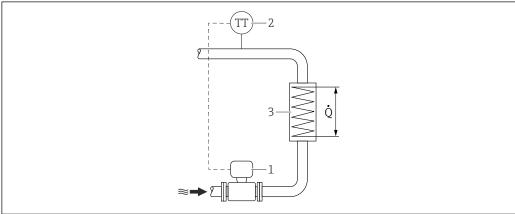
Electronics overheating on account of thermal insulation!

- Observe the maximum permitted insulation height of the transmitter neck so that the transmitter head and/or the connection housing of the remote version is completely free
- ▶ Observe information on the permissible temperature ranges .
- ▶ Note that a certain orientation might be required, depending on the fluid temperature .

Installation for delta heat measurements

The second temperature measurement is taken using a separate temperature sensor. The measuring instrument reads in this value via a communication interface.

- In the case of saturated steam delta heat measurements, the measuring instrument must be installed on the steam side.
- In the case of water delta heat measurements, the device can be installed on the cold or warm side.



A0019209

- 6 Layout for delta heat measurement of saturated steam and water
- 1 Measuring instrument
- 2 Temperature sensor
- 3 Heat exchanger
- Q Heat flow

Installation in steam systems

The device has been tested for dynamic pressure surges of up to 300 bar (4350 psi) by condensation-induced water hammer (CIWH). Despite the robust and reinforced design, the following best practice recommendations for steam applications apply to prevent damage from condensation-induced water hammer.

- 1. Ensure sufficient and constant condensate drainage from the pipes by using correctly dimensioned and well-maintained steam traps. These are generally installed every 30 to 50 m (100 to 165 in) in horizontal pipes or at ground points.
- 2. The steam lines must have an adequate gradient of at least 1% in the direction of the steam flow to ensure that the condensate is directed to the steam traps at the drain points
- 3. If the system is shut down, they must be drained completely.
- 4. Avoid pipe configurations that cause accumulations of standing water.
- 5. Slowly increase the static pressure and steam flow rate when starting up the system.
- 6. Make sure steam does not come into contact with significantly cooler condensate.

Protective cover

A protective cover is available as an accessory for the device. It is used to protect against direct sunlight, precipitation and ice.

When installing the protective cover, a minimum upward clearance must be maintained: 222 mm (8.74 in)

The protective cover can be ordered via the product structure together with the device: Order code for "Accessories enclosed" option PB "Protective cover"

ho Ordered separately as an accessory ightarrow 🖺 187

6.2 Installing the device

6.2.1 Required tools

For transmitter

- For turning the transmitter housing: Open-ended wrench8 mm
- For opening the securing clamps: Allen key3 mm

For sensor

For flanges and other process connections: Use a suitable mounting tool.

6.2.2 Preparing the measuring device

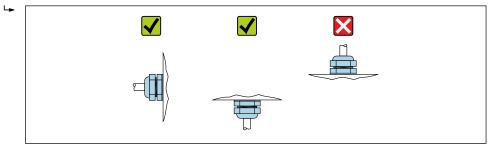
- 1. Remove all remaining transport packaging.
- 2. Remove any protective covers or protective caps present from the sensor.
- 3. Remove stick-on label on the electronics compartment cover.

6.2.3 Installing the sensor

WARNING

Danger due to improper process sealing!

- ► Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ► Ensure that the seals are clean and undamaged.
- ► Secure the seals correctly.
- 1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
- 2. To ensure compliance with device specifications, install the measuring instrument between the pipe flanges in a way that it is centered in the measurement section.
- 3. Install the measuring instrument or turn the transmitter housing so that the cable entries do not point upwards.



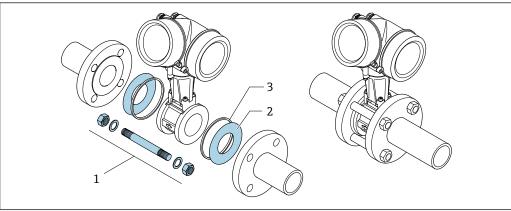
A002926

Mounting set for disc (wafer version)

The centering rings supplied are used to mount and center the wafer-style devices.

A mounting set comprises:

- Tie rods
- Seals
- Nuts
- Washers



- **₽** 7 Mounting set for wafer version
- Nut, washer, tie rod
- 2
- Centering ring (is supplied with the measuring instrument)

A mounting set can be ordered separately $\rightarrow \triangleq 187$.

6.2.4 Installing the transmitter of the remote version

A CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature.
- If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

A CAUTION

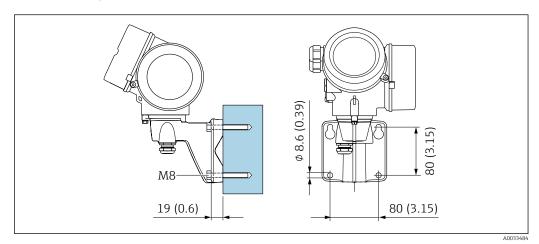
Excessive force can damage the housing!

▶ Avoid excessive mechanical stress.

The transmitter of the remote version can be mounted in the following ways:

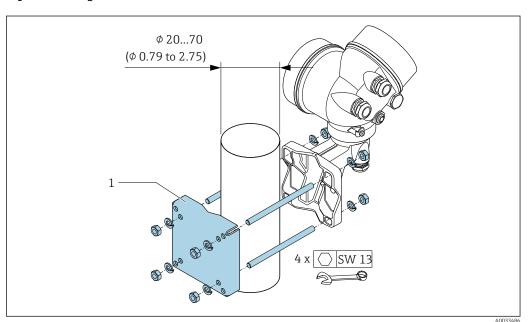
- Wall mounting
- Pipe mounting

Wall mounting



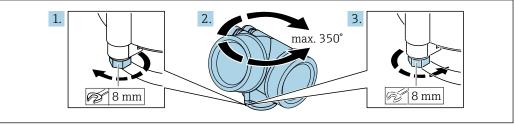
8 mm (in)

Pipe mounting



⊕ 9 mm (in)

6.2.5 Turning the transmitter housing



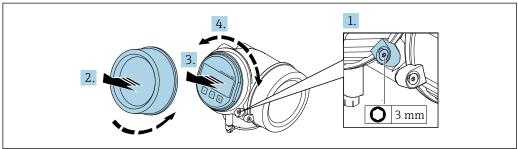
A00322

- 1. Loosen the securing screw.
- 2. Turn the housing to the desired position.

3. Firmly tighten the securing screw.

6.2.6 Turning the display module

The display module can be turned to optimize display readability and operability.



A0032238

- 1. Loosen the securing clamp of the electronics compartment cover using an Allen key.
- 2. Unscrew cover of the electronics compartment from the transmitter housing.
- 3. Optional: pull out the display module with a gentle rotational movement.
- 4. Turn the display module to the desired position: Max. $8 \times 45^{\circ}$ in each direction.
- 5. Without display module pulled out:
 Allow display module to engage at desired position.
- 6. With display module pulled out:

 Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.
- 7. Reassemble the transmitter in the reverse order.

6.3 Post-mounting check

Is the device undamaged (visual inspection)?	
Does the measuring instrument correspond to the measuring point specifications? For example: Process temperature → 🖺 206 Process pressure (refer to the section on "Pressure/temperature ratings" in the "Technical Information" document) Ambient temperature Measuring range → 🖺 191	
Has the correct orientation been selected for the sensor → 🗎 20? According to sensor type As per medium temperature As per medium properties (outgassing, with entrained solids)	
Does the arrow on the sensor match the direction of flow of the medium → ■ 20?	
Is the tag name and labeling correct (visual inspection)?	
Is the device sufficiently protected from precipitation and direct sunlight?	
Are the securing screw and securing clamp tightened securely?	
Has the maximum permitted insulation height been observed?	

7 Electrical connection

7.1 Electrical safety

In accordance with applicable national regulations.

7.2 Connecting requirements

7.2.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

7.2.2 Requirements for connection cable

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

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.

Signal cable

Pulse/frequency/switch output

Standard installation cable is sufficient.

PROFIBUS PA

Shielded twisted-pair cable. Cable type A is recommended.



See https://www.profibus.com "PROFIBUS Installation Guidelines".

Cable diameter

- Cable glands supplied:
 - M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
- Plug-in spring terminals for device version without integrated overvoltage protection: wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

7.2.3 Connecting cable for remote version

Connecting cable (standard)

Standard cable	$2\times2\times0.5~\text{mm}^2$ (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) $^{1)}$
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85 %

Cable length	5 m (15 ft), 10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: -50 to $+105$ °C (-58 to $+221$ °F); when cable can move freely: -25 to $+105$ °C (-13 to $+221$ °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (armored)

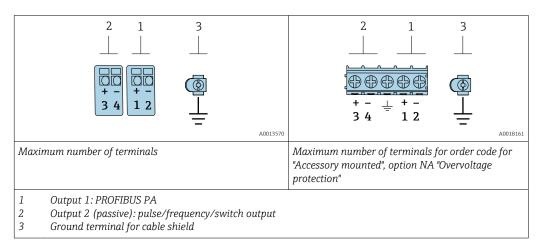
Cable, armored	$2\times2\times0.34~mm^2$ (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath $^{1)}$
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Galvanized copper-braid, opt. density approx. 85%
Strain relief and reinforcement	Steel-wire braid, galvanized
Cable length	10 m (30 ft), 20 m (60 ft), 30 m (90 ft)
Continuous operating temperature	When mounted in a fixed position: -50 to $+105$ °C (-58 to $+221$ °F); when cable can move freely: -25 to $+105$ °C (-13 to $+221$ °F)

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

7.2.4 Terminal assignment

Transmitter

Connection version for PROFIBUS PA, pulse/frequency/switch output



Order code for "Output"	Terminal numbers				
	Output 1		Output 1 Output 2		out 2
	1 (+)	2 (-)	3 (+)	4 (-)	
Option G 1) 2)	PROFIBUS PA		Pulse/frequenc	y/switch output sive)	

- 1) Output 1 must always be used; output 2 is optional.
- 2) PROFIBUS PA with integrated reverse polarity protection.

7.2.5 Pin assignment of device plug

		Pin		Assignment	Coding	Plug/socket
2 /	3	1	+	PROFIBUS PA +	A	Plug
1	- 4	2		Grounding		
7	7/	3	-	PROFIBUS PA -		
		4		Not used		

7.2.6 Shielding and grounding

Optimal electromagnetic compatibility (EMC) of the fieldbus system can be guaranteed only if the system components and, in particular, the lines are shielded and the shield forms as complete a cover as possible. A shield coverage of 90 % is ideal.

- 1. To ensure optimal EMC protection, connect the shield to the reference ground as often as possible.
- 2. For reasons concerning explosion protection, it is recommended that grounding be dispensed with.

To comply with both requirements, there are basically three different types of shielding in the fieldbus system:

- Shielding at both ends
- Shielding at one end on the feed side with capacitance termination at the field device
- Shielding at one end on the feed side

Experience shows that the best results with regard to EMC are achieved in most cases in installations with one-sided shielding on the feed side (without capacitance termination at the field device). Appropriate measures with regard to input wiring must be taken to allow unrestricted operation when EMC interference is present. These measures have been taken into account for this device. Operation in the event of disturbance variables as per NAMUR NE21 is thus quaranteed.

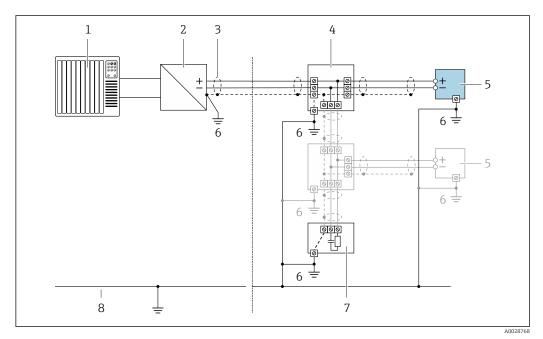
- 1. Observe national installation requirements and quidelines during installation.
- 2. Where there are large differences in potential between the individual grounding points,
 - connect only one point of the shielding directly to the reference ground.
- 3. In systems without potential equalization, the cable shielding of fieldbus systems should be grounded on one side only, for example at the fieldbus supply unit or at safety barriers.

NOTICE

In systems without potential matching, the multiple grounding of the cable shield causes mains frequency equalizing currents!

Damage to the bus cable shield.

- Only ground the bus cable shield to either the local ground or the protective ground at one end.
- Insulate the shield that is not connected.



■ 10 Connection example for PROFIBUS PA

- 1 Automation system (e.g. PLC)
- 2 PROFIBUS PA segment coupler
- 3 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 4 T-box
- 5 Measuring instrument
- 6 Local grounding
- 7 Bus terminator
- 8 Potential equalization conductor

7.2.7 Requirements for the supply unit

Supply voltage

Transmitter

An external power supply is required for each output.

The following supply voltage values apply for the outputs available:

Supply voltage for a compact version without a local display 1)

Order code for "Output; input"	Minimum terminal voltage ²⁾	Maximum Terminal voltage
Option G : PROFIBUS PA, pulse/frequency/switch output	≥ DC 9 V	DC 32 V

- 1) In event of external supply voltage of the PROFIBUS DP/PA coupler
- 2) The minimum terminal voltage increases if local operation is used: see the following table

Increase of minimum terminal voltage with local operation

Order code for "Display; operation"	Increase in minimum Terminal voltage
Option C : Local operation SD02	+ DC 1 V
Option E: Local operation SD03 with lighting (backlighting not used)	+ DC 1 V
Option E: Local operation SD03 with lighting (backlighting used)	+ DC 3 V

7.2.8 Preparing the measuring instrument

Carry out the steps in the following order:

- 1. Mount the sensor and transmitter.
- 2. Sensor connection housing: Connect connecting cable.
- 3. Transmitter: Connect connecting cable.
- 4. Transmitter: Connect cable for supply voltage.

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 →

 30.

7.3 Connecting the device

NOTICE

An incorrect connection compromises electrical safety!

- ▶ Only properly trained specialist staff may perform electrical connection work.
- ▶ Observe applicable federal/national installation codes and regulations.
- ► Comply with local workplace safety regulations.
- ► Always connect the protective ground cable ⊕ before connecting additional cables.
- ► When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.
- ► The power unit must be safety-approved (e.g. SELV/PELV protection class II limited power).

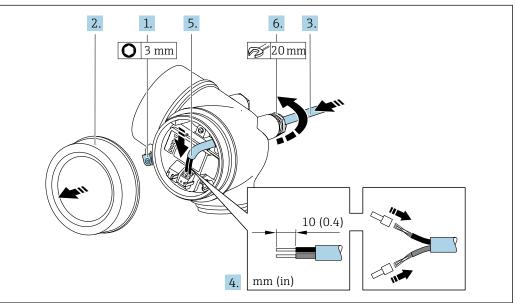
7.3.1 Connecting the compact version

Connecting the transmitter

The connection of the transmitter depends on the following order code: "Electrical connection":

- Option A, B, C, D: terminals
- Option I: device plug

Connection via terminals



A004882

- 1. Loosen the securing clamp of the connection compartment cover.
- 2. Unscrew the connection compartment cover.
- 3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
- 4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
- 5. Connect cable in accordance with terminal assignment $\rightarrow \triangleq 32$.

6. **A WARNING**

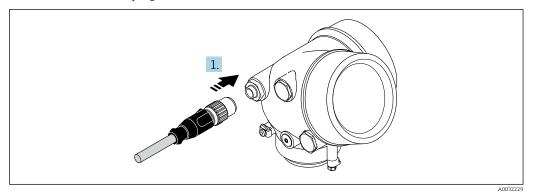
Housing degree of protection may be voided due to insufficient sealing of the housing.

Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

Firmly tighten the cable glands.

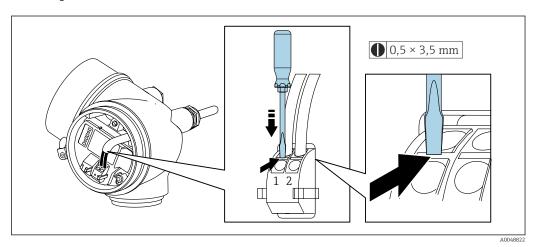
7. Reassemble the transmitter in the reverse order.

Connection via device plug



▶ Plug in the device plug and tighten firmly.

Removing a cable



➤ To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes while simultaneously pulling the cable end out of the terminal.

7.3.2 Connecting the remote version

A WARNING

Risk of damaging electronic components!

- ► Connect the sensor and transmitter to the same potential equalization.
- ▶ Only connect the sensor to a transmitter with the same serial number.

The following sequence of steps is recommended:

- 1. Mount the sensor and transmitter.
- 2. Connect the .

- 3. Connect the transmitter.
- How the connecting cable is connected in the transmitter housing depends on the measuring instrument approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:

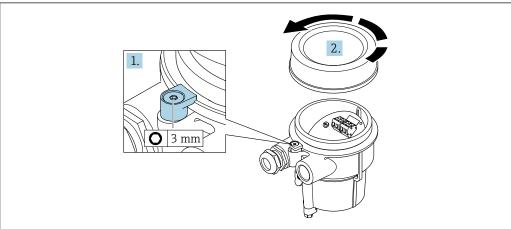
- Order code for "Electrical connection", option B, C, D, 6
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable

In the following versions, an M12 device connector is used for connection in the transmitter housing:

- All other approvals
- Use of connecting cable (standard)

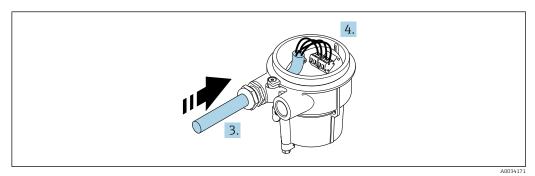
Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connecting the sensor connection housing



A003416

- 1. Loosen the securing clamp.
- 2. Unscrew the housing cover.



■ 11 Sample graphic

Connecting cable (standard, reinforced)

3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

- 4. Wire the connecting cable:
 - ► Terminal 1 = brown cable

Terminal 2 = white cable

Terminal 3 = yellow cable

Terminal 4 = green cable

- 5. Connect the cable shield via the cable strain relief.
- 6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 7. Reverse the removal procedure to reassemble the connection housing.

Connecting cable (option "mass pressure-/temperature-compensated")

- 3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
- 4. Wire the connecting cable:
 - ► Terminal 1 = brown cable

Terminal 2 =white cable

Terminal 3 = green cable

Terminal 4 = red cable

Terminal 5 = black cable

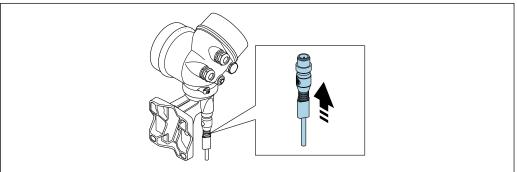
Terminal 6 = yellow cable

Terminal 7 = blue cable

- 5. Connect the cable shield via the cable strain relief.
- 6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 7. Reverse the removal procedure to reassemble the connection housing.

Connecting the transmitter

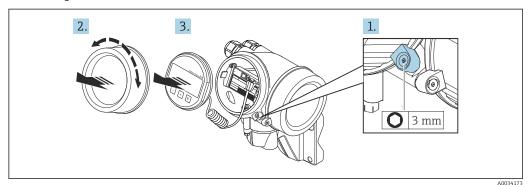
Connecting transmitter via plug



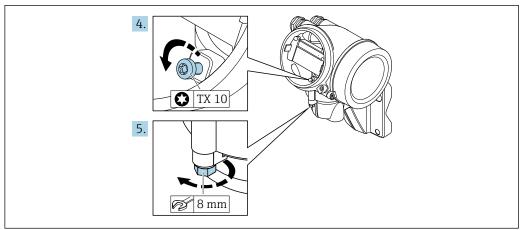
A0034172

► Connect the plug.

Connecting transmitter via terminals

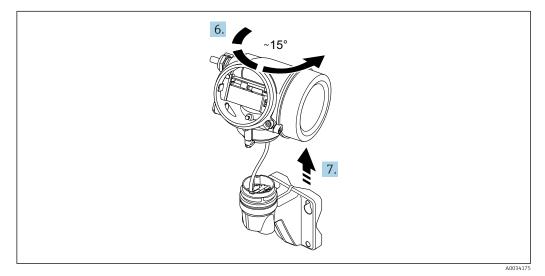


- 1. Loosen the securing clamp of the electronics compartment cover.
- 2. Unscrew the electronics compartment cover.
- 3. Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.



A003417

- 4. Loosen the locking screw of the transmitter housing.
- 5. Loosen the securing clamp of the transmitter housing.



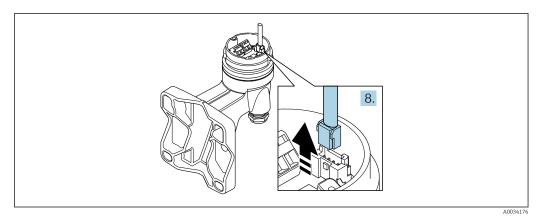
- 12 Sample graphic
- 6. Turn the transmitter housing to the right until it reaches the marking.

7. NOTICE

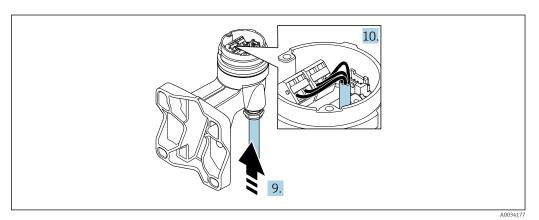
The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!

▶ Pay attention to the signal cable when lifting the transmitter housing!

Lift the transmitter housing.



■ 13 Sample graphic



■ 14 Sample graphic

Connecting cable (standard, reinforced)

- 8. Disconnect the signal cable from the connection board of the wall housing . by pressing in the locking clip on the connector. Remove the transmitter housing.
- 9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
- 10. Wire the connecting cable:
 - ► Terminal 1 = brown cable
 - Terminal 2 = white cable
 - Terminal 3 = yellow cable
 - Terminal 4 = green cable
- 11. Connect the cable shield via the cable strain relief.
- 12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 13. Reverse the removal procedure to reassemble the transmitter housing.

Connecting cable (option "mass pressure-/temperature-compensated")

- 8. Disconnect both signal cables from the connection board of the wall housing. by pressing in the locking clip on the connector. Remove the transmitter housing.
- 9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
- 10. Wire the connecting cable:
 - ► Terminal 1 = brown cable
 - Terminal 2 = white cable
 - Terminal 3 = green cable
 - Terminal 4 = red cable
 - Terminal 5 = black cable
 - Terminal 6 = yellow cable
 - Terminal 7 = blue cable
- 11. Connect the cable shield via the cable strain relief.
- 12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
- 13. Reverse the removal procedure to reassemble the transmitter housing.

7.4 Potential equalization

7.4.1 Requirements

For potential equalization:

- Pay attention to in-house grounding concepts
- Take account of operating conditions, such as the pipe material and grounding
- Connect the medium, sensor and transmitter to the same electric potential
- Use a ground cable with a minimum cross-section of 6 mm² (10 AWG) and a cable lug for potential equalization connections

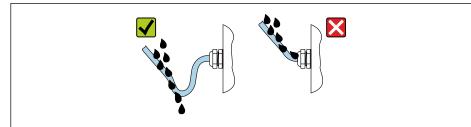
7.5 Ensuring the degree of protection

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

To guarantee the degree of protection IP66/67, 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

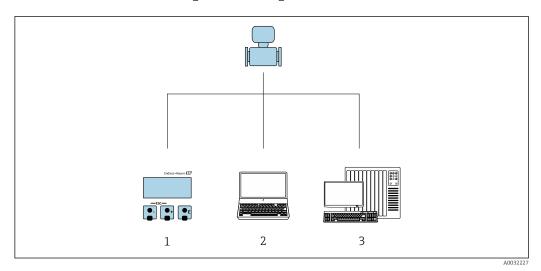
6. The cable glands supplied do not ensure housing protection when not in use. They must therefore be replaced by dummy plugs corresponding to the housing protection.

7.6 Post-connection check

Are the device and cable undamaged (visual inspection)?	
Do the cables used comply with the requirements $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
Are the mounted cables strain relieved?	
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap" $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
Depending on the device version: are all the device plugs firmly tightened $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
Only for remote version: Is the sensor connected to the right transmitter? Check the serial number on the nameplate of the sensor and transmitter.	
Does the supply voltage match the specifications on the transmitter nameplate ?	
Is the terminal assignment correct ?	
If supply voltage is present, do values appear on the display module?	
Are all housing covers installed and firmly tightened?	
Is the securing clamp securely tightened?	
Have the screws for the cable strain relief been tightened using the correct tightening torque → 1 36?	

Operation options 8

Overview of operation options 8.1



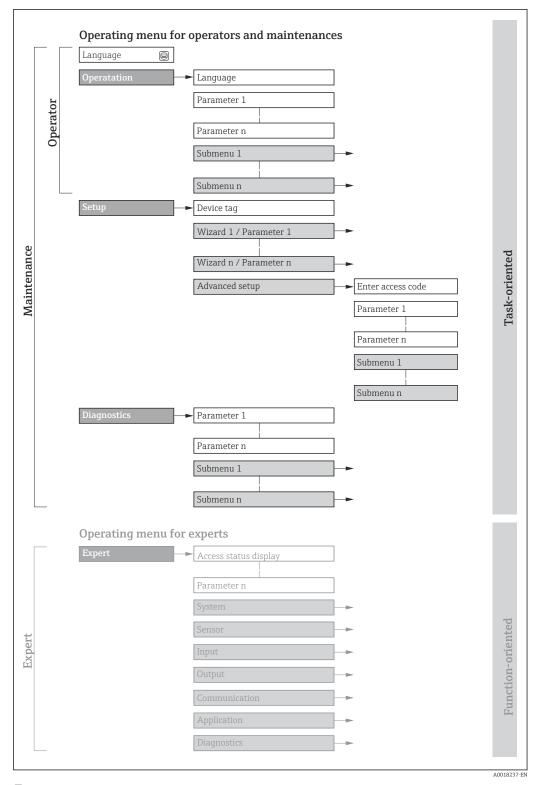
Local operation via display module Computer with operating tool (e.g. FieldCare, SIMATIC PDM)

Automation 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: see the "Description of Device Parameters" document supplied with the device



 $\blacksquare 15$ Schematic structure of the operating menu

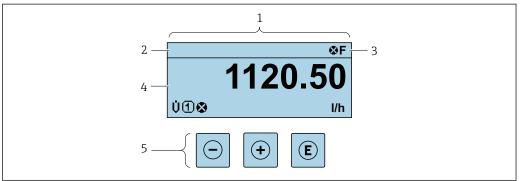
8.2.2 Operating philosophy

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

Menu/pa	arameter	User role and tasks	Content/meaning
Language	Task- oriented	Role "Operator", "Maintenance" Tasks during operation:	Defining the operating languageResetting and controlling totalizers
Operation		Configuration of the operational displayReading measured values	 Configuration of the operational display (e.g. display format, display contrast) Resetting and controlling totalizers
Setup		"Maintenance" role Commissioning: Configuration of the measurement Configuration of the inputs and outputs	Wizards for fast commissioning: Configuring the system units Definition of the medium Configuration of the current input Configuring the outputs Configuration of the operational display Definition of output conditioning Configuring the low flow cut off Advanced setup For more customized configuration of the measurement (adaptation to special measuring conditions) Configuration of totalizers Administration (define access code, reset measuring device)
Diagnostics		"Maintenance" role Troubleshooting: Diagnostics and elimination of process and device errors Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: Diagnostic list 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. Analog inputs Is used to display the analog input. Data logging submenu with the "Extended HistoROM" order option Storage and visualization of measured values Heartbeat Technology Verification of device functionality on request and documentation of verification results Simulation Used to simulate measured values or output values.
Expert	Function- oriented	Tasks that require detailed knowledge of the function of the device: Commissioning measurements under difficult conditions Optimal adaptation of the measurement to difficult conditions Detailed configuration of the communication interface Error diagnostics in difficult cases	Contains all of the device parameters and allows direct access to these by means of an access code. The structure of this menu is based on the function blocks of the device: System Contains all higher-level device parameters that do not affect measurement or measured value communication Sensor Configuration of the measurement. Output Configuration of the pulse/frequency/switch output Communication Configuration of the digital communication interface Submenus for function blocks (e.g. "Analog Inputs") Configuration of function blocks Application Configuration of 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 operating menu via local display

8.3.1 Operational display



A002934

- 1 Operational display
- 2 Tag name \rightarrow $\stackrel{\triangle}{=}$ 72
- 3 Status area
- 4 Display area for measured values (up to 4 lines)
- 5 Operating elements $\rightarrow \implies 51$

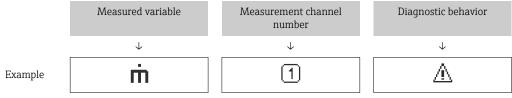
Status area

The following symbols appear in the status area of the operational display at the top right:

- Status signals → 🖺 140
 - **F**: Failure
 - **C**: Function check
 - **S**: Out of specification
 - M: Maintenance required
- Diagnostic behavior → 🖺 141
 - 🐼: Alarm
 - <u>M</u>: Warning
- 🖆: Locking (the device is locked via the hardware)
- +: Communication (communication via remote operation is active)

Display area

In the display area, each measured value is prefaced by certain symbol types for further description:



Appears only if a diagnostics event is present for this measured variable.

Measured variables

Symbol	Meaning
Ü	Volume flow

The number and display format of the measured variables can be configured via the **Format display** parameter ($\rightarrow \implies 81$).

Totalizer

Symbol	Meaning
Σ	Totalizer The measurement channel number indicates which of the three totalizers is displayed.

Measurement channel numbers

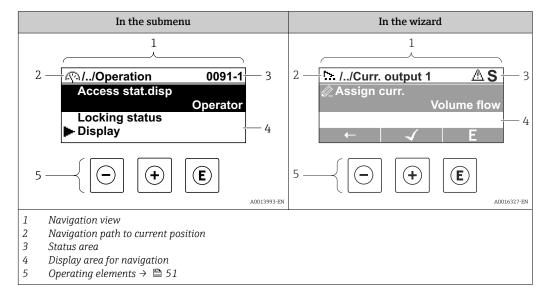
Symbol	Meaning
14	Measurement channel 1 to 4 The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).

Diagnostic behavior

Symbol	Meaning
8	 Alarm Measurement is interrupted. Signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red.
Δ	 Warning Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.

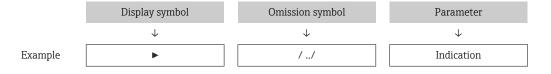
8.3.2 Navigation view



Navigation path

The navigation path to the current position is displayed at the top left in the navigation view and consists of the following elements:

- The display symbol for the menu/submenu (►) or the wizard (►).
- An omission symbol (/ ../) for operating menu levels in between.
- Name of the current submenu, wizard or parameter



Status area

The following appears in the status area of the navigation view in the top right corner:

- In the submenu
 - The direct access code to the parameter (e.g., 0022-1)
 - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard

If a diagnostic event is present, the diagnostic behavior and status signal

For information on the diagnostic behavior and status signal $\rightarrow \triangleq 140$ For information on the function and entry of the direct access code $\rightarrow \triangleq 53$

Display area

Menus

Symbol	Meaning
P	Operation Is displayed: In the menu next to the "Operation" selection At the left in the navigation path in the Operation menu

۶	Setup Is displayed: In the menu next to the "Setup" selection At the left in the navigation path in the Setup menu
ત	Diagnosis Is displayed: ■ In the menu next to the "Diagnostics" selection ■ At the left in the navigation path in the Diagnostics menu
₹.	Expert Is displayed: In the menu next to the "Expert" selection At the left in the navigation path in the Expert menu

Submenus, wizards, parameters

Symbol	Meaning
•	Submenu
55.	Wizards
Ø.	Parameters within a wizard No display symbol exists for parameters in submenus.

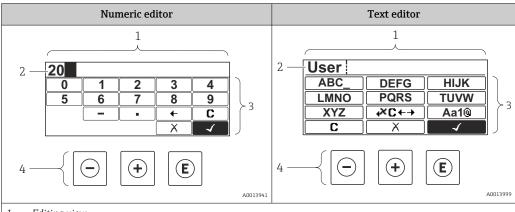
Locking procedure

Symbol	Meaning
û	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. By a user-specific access code By the hardware write protection switch

Wizards

Symbol	Meaning
-	Switches to the previous parameter.
√	Confirms the parameter value and switches to the next parameter.
Е	Opens the editing view of the parameter.

Editing view 8.3.3



- Editing view
- Display area of the entered values
- 1 2 3 4 Input mask
- *Operating elements* $\rightarrow \blacksquare 51$

Input screen

The following input symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0	Selection of numbers from 0 to 9
9	
·	Inserts a decimal separator at the cursor position.
_	Inserts a minus sign at the cursor position.
4	Confirms the selection.
+	Moves the input position one position to the left.
X	Exits the input without applying the changes.
С	Clears all entered characters.

Text editor

Symbol	Meaning
Aa1@	Toggle Between upper-case and lower-case letters For entering numbers For entering special characters
ABC_ XYZ	Selection of letters from A to Z.
abc _ xyz	Selection of letters from a to z.
····^ ~&	Selection of special characters.
4	Confirms the selection.
€XC←→	Switches to the selection of the correction tools.
X	Exits the input without applying the changes.
С	Clears all entered characters.

Text correction under $\swarrow c \leftrightarrow \rightarrow$

Symbol	Meaning
C	Clears all entered characters.

\rightarrow	Moves the input position one position to the right.
€	Moves the input position one position to the left.
₹ X	Deletes one character immediately to the left of the input position.

8.3.4 Operating elements

Operating key	Meaning
	Minus key
	In menu, submenu Moves the selection bar upwards in a picklist
	In wizards Goes to previous parameter
	In the text and numeric editor In the input screen, moves the selection bar to the left (backwards)
	Plus key
	In menu, submenu Moves the selection bar downwards in a picklist
(+)	In wizards Goes to the next parameter
	In the text and numeric editor In the input screen, moves the selection bar to the right (forwards)
	Enter key
	In the operational display Pressing the key for 2 s opens the context menu.
	In menu, submenuPressing the key briefly:
	 Opens the selected menu, submenu or parameter. Starts the wizard.
	 If help text is open, closes the help text of the parameter.
E	Pressing the key for 2 s in a parameter:If present, opens the help text for the function of the parameter.
	In wizards Opens the editing view of the parameter and confirms the parameter value
	In the text and numeric editor
	Pressing the key briefly:Opens the selected group.
	 Carries out the selected action. Pressing the key for 2 s confirms the edited parameter value.
	Escape key combination (press keys simultaneously)
	In menu, submenu
	Pressing the key briefly:Exits the current menu level and takes you to the next higher level.
	 If help text is open, closes the help text of the parameter.
	 Pressing the key for 2 s returns you to the operational display ("home position"). In wizards
	Exits the wizard and takes you to the next higher level
	In the text and numeric editor Closes the text or numeric editor without applying changes.
(+) + (E)	Plus/Enter key combination (press and hold down the keys simultaneously)
	Increases the contrast (darker setting).
	Minus/Plus/Enter key combination (press the keys simultaneously)
	In the operational display Enables or disables the keypad lock (only SD02 display module).

8.3.5 Opening the context menu

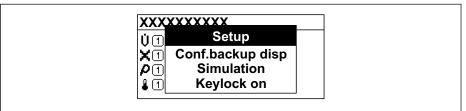
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Configuration backup display
- Simulation

Calling up and closing the context menu

The user is in the operational display.

- 1. Press the \Box and \Box keys for longer than 3 seconds.
 - ► The context menu opens.



A0034284-

- 2. Press \Box + \pm simultaneously.
 - └─ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

- 1. Open the context menu.
- 2. Press ± to navigate to the desired menu.
- 3. Press 🗉 to confirm the selection.
 - ► The selected menu opens.

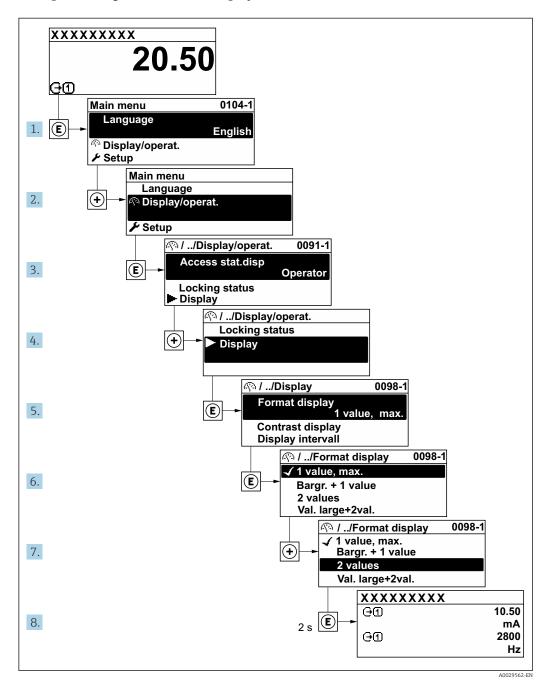
52

8.3.6 Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation.

For an explanation of the navigation view with symbols and operating elements $\Rightarrow \triangleq 48$

Example: Setting the number of displayed measured values to "2 values"



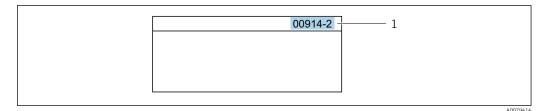
8.3.7 Calling the parameter directly

A parameter number is assigned to every parameter to be able to access a parameter directly via the onsite display. Entering this access code in the **Direct access** parameter calls up the desired parameter directly.

Navigation path

Expert → Direct access

The direct access code consists of a 5-digit number (at maximum) and the channel number, which identifies the channel of a process variable: e.g. 00914-2. In the navigation view, this appears on the right-hand side in the header of the selected parameter.



1 Direct access code

Note the following when entering the direct access code:

- The leading zeros in the direct access code do not have to be entered. Example: Enter "914" instead of "00914"
- If no channel number is entered, channel 1 is opened automatically.
 Example: Enter 00914 → Assign process variable parameter
- If a different channel is opened: Enter the direct access code with the corresponding channel number.

Example: Enter **00914-2** → **Assign process variable** parameter

For the direct access codes of the individual parameters, see the "Description of Device Parameters" document for the device

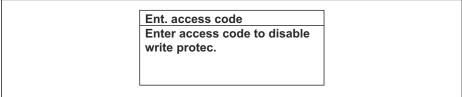
8.3.8 Calling up help text

Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

- 1. Press E for 2 s.
 - ► The help text for the selected parameter opens.



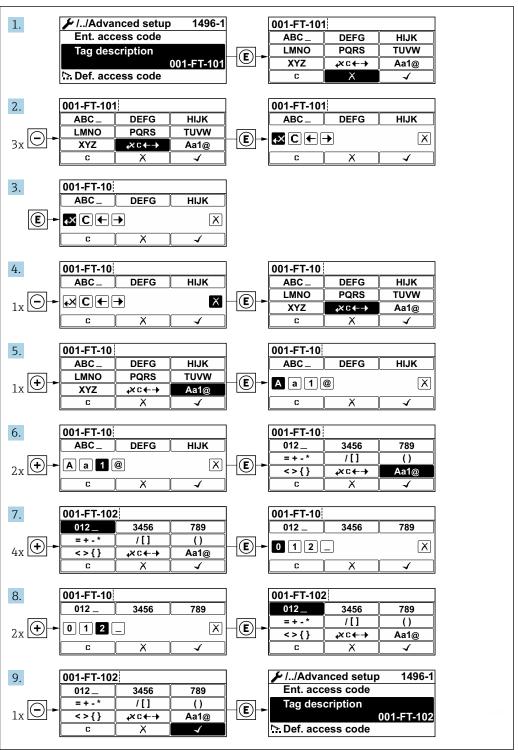
A0014002-EN

- 16 Example: Help text for parameter "Enter access code"
- 2. Press \Box + \pm simultaneously.
 - ► The help text is closed.

8.3.9 Changing the parameters

For a description of the editing view - consisting of the text editor and numeric editor - with symbols $\rightarrow \implies 49$, for a description of the operating elements $\rightarrow \implies 51$

Example: Changing the tag name in the "Tag description" parameter from 001-FT-101 to 001-FT-102



A0029563-EN

A message is displayed if the value entered is outside the permitted value range.

Ent. access code
Invalid or out of range input
value
Min:0
Max:9999

A0014049-EN

8.3.10 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access .

Defining access authorization for user roles

An access code is not yet defined when the device is delivered from the factory. Access authorization (read and write access) to the device is not restricted and corresponds to the "Maintenance" user role.

- ▶ Define the access code.
 - The "Operator" user role is redefined in addition to the "Maintenance" user role. Access authorization differs for the two user roles.

Access authorization to parameters: "Maintenance" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	V	V
After an access code has been defined.	V	✓ 1)

1) The user only has write access after entering the access code.

Access authorization to parameters: "Operator" user role

Access code status	Read access	Write access
After an access code has been defined.	V	_ 1)

- Despite the defined access code, certain parameters can always be modified and thus are excluded from the write protection as they do not affect the measurement: write protection via access code
- The user role with which the user is currently logged on is indicated by the **Access** status display parameter. Navigation path: Operation → Access status display

8.3.11 Disabling write protection via access code

If the @-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation $\rightarrow @$ 118.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter via the respective access option.

- 1. After you press ⑤, the input prompt for the access code appears.
- 2. Enter the access code.
 - The
 ☐-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

The keypad lock is switched on and off via the context menu.

Switching on the keypad lock

- For the SD03 display only
 - The keypad lock is switched on automatically:
 - If the device has not been operated via the display for > 1 minute.
 - Each time the device is restarted.

To activate the keylock manually:

- 1. The device is in the measured value display.
 - Press the \Box and \Box keys for 3 seconds.
 - ► A context menu appears.
- 2. In the context menu select the **Keylock on** option.
 - └ The keypad lock is switched on.
- If the user attempts to access the operating menu while the keypad lock is active, the **Keylock on** message appears.

Switching off the keypad lock

- ► The keypad lock is switched on. Press the □ and □ keys for 3 seconds.
 - ► The keypad lock is switched off.

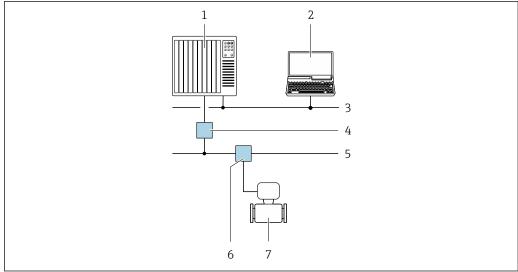
8.4 Access to the operating menu via the operating tool

The structure of the operating menu in the operating tools is the same as for operation via the local display.

8.4.1 Connecting the operating tool

Via PROFIBUS PA network

This communication interface is available in device versions with PROFIBUS PA.

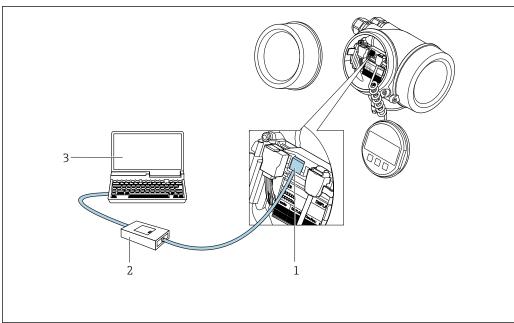


A0028838

Options for remote operation via PROFIBUS PA network

- 1 Automation system
- 2 Computer with PROFIBUS network card
- 3 PROFIBUS DP network
- 4 Segment coupler PROFIBUS DP/PA
- 5 PROFIBUS PA network
- 6 T-box
- 7 Measuring instrument

Via service interface (CDI)



A003405

- Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring instrument
- 2 Commubox FXA291
- 3 Computer with operating tool (e.g. FieldCare or DeviceCare) and (CDI) DeviceDTM

8.4.2 FieldCare

Function range

FDT-based (Field Device Technology) plant asset management tool from Endress+Hauser. It can configure all smart field units 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:

- CDI service interface → 🖺 58

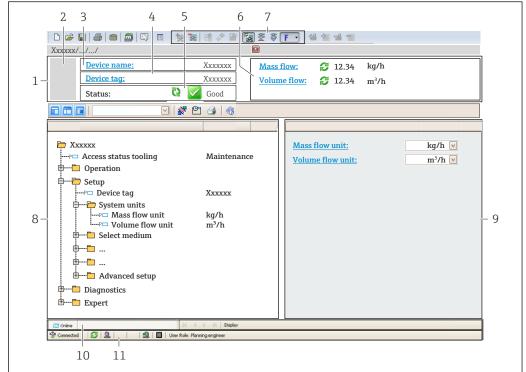
Typical functions:

- Transmitter parameter configuration
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook
- Operating Instructions BA00027SOperating Instructions BA00059S
- Source for device description files $\rightarrow \triangleq 62$

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: 192.168.1.212 and press **Enter** to confirm.
- 7. Establish the online connection to the device.
- Operating Instructions BA00027S
 - Operating Instructions BA00059S

User interface



A0021051-EN

- 1 Header
- 2 Picture of device
- 3 Device name
- 4 Tag name
- 5 Status area with status signal $\rightarrow \square$ 143
- 6 Display area for current measured values
- 7 Editing toolbar with additional functions such as save/load, event list and create documentation
- 8 Navigation area with operating menu structure
- 9 Work area
- 10 Action area
- 11 Status area

8.4.3 DeviceCare

Function range

Tool for connecting and configuring 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.

Innovation brochure IN01047S

Source for device description files $\rightarrow \triangleq 62$

8.4.4 **SIMATIC PDM**

Function range

Standardized, vendor-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via the PROFIBUS PA protocol.



Source for device description files \rightarrow $\stackrel{\triangle}{=}$ 62

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.01.02	 On the title page of the Operating Instructions On the transmitter nameplate Firmware version parameter Diagnostics → Device information → Firmware version
Release date of firmware version	01.2018	
Manufacturer ID	0x11	Manufacturer ID parameter Diagnostics → Device information → Manufacturer ID
Device type ID	0x1564	Device type parameter Diagnostics → Device information → Device type
Profile version	3.02	

For an overview of the different firmware versions for the device

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 PROFIBUS protocol	Sources for obtaining device descriptions
FieldCare	 www.endress.com → Download Area CD-ROM (contact Endress+Hauser) DVD (contact Endress+Hauser)
DeviceCare	 www.endress.com → Download Area CD-ROM (contact Endress+Hauser) DVD (contact Endress+Hauser)
SIMATIC PDM (Siemens)	www.endress.com → Download Area

9.2 Device master file (GSD)

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

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

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

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

Before configuring, the user must decide which GSD should be used to operate the

• The setting can be changed via a Class 2 master.

9.2.1 Manufacturer-specific GSD

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

Manufacturer-specific GSD	ID number	File name
PROFIBUS PA	0x1564	EH3x1564.gsd

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



Where to acquire the manufacturer-specific GSD:

www.endress.com → Downloads area

9.2.2 Profile GSD

Differs in terms of the number of Analog Input blocks (AI) and the measured values. If a system is configured with a Profile GSD, it is possible to exchange devices made by different manufacturers. However, it is essential to ensure that the order of the cyclic process values is correct.

ID number	Supported blocks	Supported channels
0x9740	1 Analog Input1 Totalizer	Channel Analog Input: volume flowChannel totalizer: volume flow
0x9741	2 Analog Input1 Totalizer	 Channel Analog Input 1: volume flow Channel Analog Input 2: mass flow Channel totalizer: volume flow
0x9742	3 Analog Input1 Totalizer	 Channel Analog Input 1: volume flow Channel Analog Input 2: mass flow Channel Analog Input 3: corrected volume flow Channel totalizer: volume flow

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

9.2.3 Compatibility with other Endress+Hauser measuring devices

The Prowirl 200 PROFIBUS PA guarantees compatibility during cyclic data exchange with the automation system (Class 1 master) for the following measuring devices:

- Prowirl 72 PROFIBUS PA (Profile version 3.0, ID number 0x153B)
- Prowirl 73 PROFIBUS PA (Profile version 3.0, ID number 0x153C)

It is possible to replace these measuring devices with a Prowirl 200 PROFIBUS PA without the need to reconfigure the PROFIBUS network in the automation unit even though the names and ID numbers of the measuring devices differ. Once replaced, the device is either identified automatically (factory setting) or device identification can be set manually.

Automatic identification (factory setting)

The Prowirl 200 PROFIBUS PA automatically identifies the measuring device configured in the automation system (Prowirl 72 PROFIBUS PA or Prowirl 73 PROFIBUS PA) and makes the same input and output data and measured value status information available for cyclic data exchange.

Automatic identification is set in the **Ident number selector** parameter using the **Auto** option (factory setting).

Manual setting

The manual setting is made in the **Ident number selector** parameter via the option Prowirl 72 (0x153B) or Prowirl 73 (0x153C).

Afterwards, the Prowirl 200 PROFIBUS PA makes the same input and output data and measured status information available for cyclic data exchange.



- If the Prowirl 200 PROFIBUS PA is acyclically configured via an operating program (Class 2 master), access is directly via the block structure or the parameters of the measuring device.
- If parameters have been changed in the device to be replaced (Prowirl 72 PROFIBUS PA or Prowirl 73 PROFIBUS PA) (parameter setting no longer corresponds to the original factory setting), these parameters must be changed accordingly in the new replacement Prowirl 200 PROFIBUS PA via an operating program (Class 2 master). *Example*

The setting for low flow cut off has been changed from mass flow (factory setting) to corrected volume flow in a Prowirl 72 PROFIBUS PA currently in operation. This device is now replaced by a Prowirl 200 PROFIBUS PA device. After replacing the device, the assignment for the low flow cut off must be changed manually in the Prowirl 200 PROFIBUS, i.e. to corrected volume flow, to ensure the measuring device behaves identically.

Replacing the measuring devices without changing the GSD file or restarting the controller

In the procedure described below, the device can be replaced without interrupting ongoing operation or restarting the controller. However with this procedure the measuring device is not fully integrated!

- 1. Replace the measuring device Prowirl 72 or 73 PROFIBUS PA by a Prowirl 200 PROFIBUS PA device.
- 2. Set the device address: The same device address that was set for the Prowirl 72, Prowirl 73 or PROFIBUS PA Profile GSD must be used.
- 3. Connect the Prowirl 200 PROFIBUS PA.

If the factory setting had been changed on the replaced device (Prowirl 72 or Prowirl 73), the following settings may need to be changed:

- 1. Configuration of the application-specific parameters.
- 2. Choice of process variables to be transmitted via the CHANNEL parameter in the Analog Input or Totalizer function block.
- 3. Setting of the units for the process variables.

9.3 Cyclic data transmission

Cyclic data transmission when using the device master file (GSD).

9.3.1 Block model

The block model shows which input and output data the measuring device makes available for cyclic data exchange. Cyclic data exchange takes place with a PROFIBUS master (Class 1), e.g. a control system.

	Measur	ing device			Control system
	Analog Input block 1 to 4	→ 🖺 65	Output value AI	\rightarrow	
Transducer Block	T 1. 1. 1. 1. 2	P ((Output value TOTAL	→	PROFIBUS PA
Diock	Totalizer block 1 to 3	→ 🖺 66	Controller SETTOT	+	

	Configuration MODETOT	←
Analog Output block 1 $\rightarrow \stackrel{\triangle}{=} 68$	Input values AO	←
Discrete Input block 1 to 2 \rightarrow $\stackrel{\triangle}{=}$ 69	Output values DI	\rightarrow
Discrete Output block 1 to $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	Input values DO	+

Defined order of modules

The measuring device works as a modular PROFIBUS slave. In contrast to a compact slave, a modular slave has a variable design and consists of several individual modules. The device master file (GSD) contains a description of the individual modules (input and output data) along with their individual properties.

The modules are permanently assigned to the slots, i.e. when configuring the modules, the order and the arrangement of the modules must be respected.

Slot	Module	Function block
14	AI	Analog Input block 1 to 4
5	TOTAL or SETTOT_TOTAL or SETOT_MODETOT_TOTAL.	Totalizer block 1
6		Totalizer block 2
7		Totalizer block 3
8	AO	Analog Output block 1
910	DI	Discrete Input block 1 to 2
1113 DO		Discrete Output block 1 to 3

To optimize the data throughput rate of the PROFIBUS network, it is advisable to only configure modules that are processed in the PROFIBUS master system. If this results in gaps between the configured modules, these gaps must be assigned to the EMPTY MODULE.

9.3.2 Description of the modules

The data structure is described from the perspective of the PROFIBUS master:

- Input data: Are sent from the measuring device to the PROFIBUS master.
- Output data: Are sent from the PROFIBUS master to the measuring device.

AI module (Analog Input)

Transmit an input variable from the measuring device to the PROFIBUS master (Class 1).

The selected input variable, along with the status, is cyclically transmitted to the PROFIBUS Master (Class 1) via the AI module. The input variable is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the input variable.

Four Analog Input blocks are available (slot 1 to 4).

Selection: input variable

The input variable can be determined using the **Channel** parameter.

Channel	Input variable
7	Temperature
9	Volume flow
11	Mass flow

Channel	Input variable	
13	Corrected volume flow	
14	Density	
22	Pressure	
37	Flow velocity	
38	Energy flow	
45	Calculated saturated steam pressure	
46	Total mass flow	
49	Heat flow difference	
50	Reynolds number	
51	Specific volume	
52	Degree of overheating	

Factory setting

Function block	Factory setting	
AI 1	Volume flow	
AI 2	Mass flow	
AI 3	Corrected volume flow	
AI 4	Density	

Data structure

Input data of Analog Input

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measure	Measured value: floating point number (IEEE 754)			

TOTAL module

Transmit a totalizer value from the measuring device to the PROFIBUS master (Class 1).

A selected totalizer value, along with the status, is cyclically transmitted to a PROFIBUS Master (Class 1) via the TOTAL module. The totalizer value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the totalizer value.

Three Totalizer blocks are available (slot 5 to 7).

Selection: totalizer value

The totalizer value can be specified using the CHANNEL parameter.

Channel	Input variable	
9	Volume flow	
11	Mass flow	
13	Corrected volume flow	
38	Energy flow	
46	Total mass flow	
47	Condensate mass flow	
49	Heat flow difference	

Factory setting

Function block	Factory setting: TOTAL
Totalizer 1, 2 and 3	Volume flow

Data structure

Input data of TOTAL

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status

SETTOT_TOTAL module

The module combination consists of the SETTOT and TOTAL functions:

- SETTOT: Control the totalizers via the PROFIBUS master.
- TOTAL: Transmit totalizer value, along with the status, to the PROFIBUS master.

Three Totalizer blocks are available (slot 5 to 7).

Selection: control totalizer

Channel	Value SETTOT	Control totalizer
0 0		Totalize
1 1		Resetting
2	2	Adopt totalizer initial setting

Factory setting

Function block	Factory setting: Value SETTOT (meaning)	
Totalizer 1, 2 and 3	0 (totalizing)	

Data structure

Output data of SETTOT

Byte 1	
Control variable 1	

Input data of TOTAL

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)				Status

SETTOT_MODETOT_TOTAL module

The module combination consists of the SETTOT, MODETOT and TOTAL functions:

- SETTOT: Control the totalizers via the PROFIBUS master.
- MODETOT: Configure the totalizers via the PROFIBUS master.
- TOTAL: Transmit totalizer value, along with the status, to the PROFIBUS master.

Three Totalizer blocks are available (slot 5 to 7).

Selection: totalizer configuration

Channel	MODETOT value	Totalizer configuration
0	0	Balancing
1	1	Balance the positive flow
2	2	Balance the negative flow
3	3	Stop totalizing

Factory setting

Function block	Factory setting: Value MODETOT (meaning)
Totalizer 1, 2 and 3	0 (balancing)

Data structure

Output data of SETTOT and MODETOT

Byte 1	Byte 2
Control variable 1: SETTOT	Control variable 2: MODETOT

Input data of TOTAL

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)		EEE 754)	Status	

AO module (Analog Output)

Transmit a compensation value from the PROFIBUS master (Class 1) to the measuring device.

A compensation value, along with the status, is cyclically transmitted from the PROFIBUS Master (Class 1) to the measuring device via the AO module. The compensation value is depicted in the first four bytes in the form of a floating point number as per the IEEE 754 standard. The fifth byte contains standardized status information pertaining to the compensation value.

One Analog Output block is available (slot 8).

Assigned compensation values

A compensation value is permanently assigned to the individual Analog Output blocks.

CHANNEL	Function block	Compensation value
1507	AO 1	External compensation 1)

1) The compensation values must be transmitted to the device in the SI basic unit

The selection is made via: Expert \rightarrow Sensor \rightarrow External compensation

Data structure

Output data of Analog Output

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Measured value: floating point number (IEEE 754)			Status	

DI module (Discrete Input)

Transmit discrete input values from the measuring device to the PROFIBUS master (Class 1). Discrete input values are used by the measuring device to transmit the state of device functions to the PROFIBUS master (Class 1).

The DI module cyclically transmits the discrete input value, along with the status, to the PROFIBUS Master (Class 1). The discrete input value is depicted in the first byte. The second byte contains standardized status information pertaining to the input value.

Two Discrete Input blocks are available (slot 9 to 10).

Selection: device function

The device function can be specified using the CHANNEL parameter.

CHANNEL	Device function	Factory setting: Status (meaning)
893	Switch output state	
895	Low flow cut off	0 (device function not active) 1 (device function active)
1430	Status verification 1)	, ,

1) Only available with the "Heartbeat Verification" application package

Function block	Factory setting
DI 1	Switch output state
DI 2	Low flow cut off

Data structure

Input data of Discrete Input

Byte 1		Byte 2	
Discret	:e	Status	

DO module (Discrete Output)

Transmit discrete output values from the PROFIBUS master (Class 1) to the measuring device. Discrete output values are used by the PROFIBUS master (Class 1) to enable and disable device functions.

The DO module cyclically transmits the discrete output value, along with the status, to the measuring device. The discrete output value is depicted in the first byte. The second byte contains standardized status information pertaining to the output value.

Three Discrete Output blocks are available (slot 11 to 13).

Assigned device functions

A device function is permanently assigned to the individual Discrete Output blocks.

CHANNEL	Function block	Device function	Values: control (meaning)
891	DO 1	Flow override	• 0 (disable device function)
1429	DO 2	Start verification 1)	■ 1 (enable device function)

1) Only available with the Heartbeat Verification application package

Data structure

Output data of Discrete Output

Byte 1	Byte 2
Discrete	Status

EMPTY_MODULE module

This module is used to assign empty spaces arising from modules not being used in the slots .

The measuring device works as a modular PROFIBUS slave. In contrast to a compact slave, a modular PROFIBUS slave has a variable design and consists of several individual modules. The GSD file contains a description of the individual modules along with their individual properties.

The modules are permanently assigned to the slots. When configuring the modules, it is absolutely essential to observe the sequence/arrangement of the modules. Any gaps between the configured modules must be filled with the EMPTY MODULE.

10 Commissioning

10.1 **Function check**

Before commissioning the measuring device:

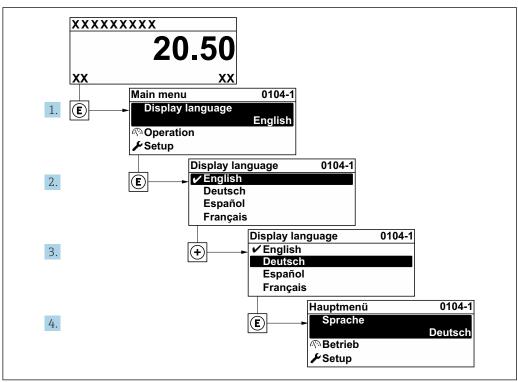
- ▶ Make sure that the post-installation and post-connection checks have been performed.
- "Post-installation check" checklist → 🗎 29
- "Post-connection check" checklist → 🖺 42

10.2 Switching on the measuring device

- ▶ After a successful function check, switch on the measuring device.
 - After a successful startup, the local display switches automatically from the startup display to the operational display.
- If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" $\rightarrow \blacksquare 138$.

10.3 Setting the operating language

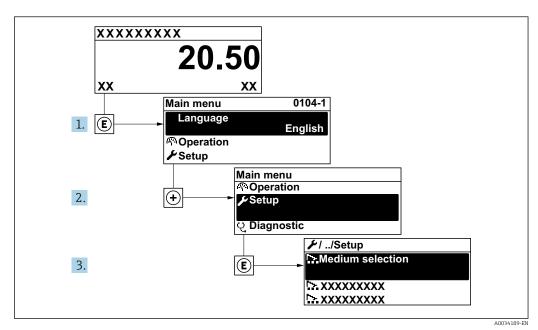
Factory setting: English or ordered local language



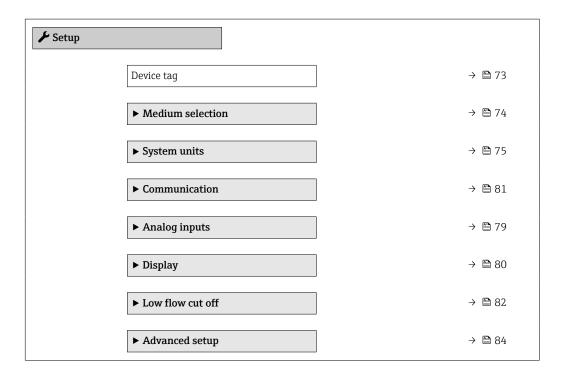
■ 18 Taking the example of the local display

10.4 Configuring the measuring device

- The **Setup** menu with its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu

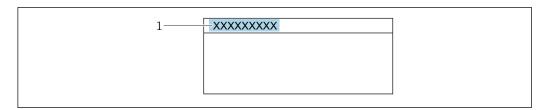


■ 19 Taking the example of the local display



10.4.1 Defining the tag name

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



■ 20 Header of the operational display with tag name

1 Tag name

Enter the tag name in the "FieldCare" operating tool \rightarrow $\stackrel{\triangle}{=}$ 60

Navigation

"Setup" menu \rightarrow Device tag

Parameter overview with brief description

Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Prowirl 200 PA

10.4.2 Selecting and setting the medium

The **Medium selection** wizard systematically guides the user through all the parameters that must be configured in order to select and set the medium.

Navigation

"Setup" menu \rightarrow Medium selection

► Medium selection	
Select medium	→ 🖺 74
Select gas type	→ 🖺 74
Select liquid type	→ 🗎 74
Fixed process pressure	→ 🖺 75
Enthalpy calculation	→ 🖺 75
Density calculation	→ 🖺 75
Enthalpy type	→ 🖺 75

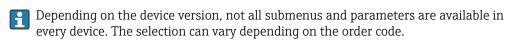
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Select medium	-	Select medium type.	GasLiquidSteam	Steam
Select gas type	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Gas option is selected in the Select medium parameter parameter.	Select measured gas type.	 Single gas Gas mixture Air Natural gas User-specific gas 	User-specific gas
Select liquid type	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Liquid option is selected in the Select medium parameter parameter.	Select measured liquid type.	 Water LPG (Liquefied Petroleum Gas) User-specific liquid 	Water

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Fixed process pressure	The following conditions are met: Order code for "Sensor version", Option "Mass flow (integrated temperature measurement)" In the External value parameter (→ Pressure option is not selected.	Enter fixed value for process pressure. Dependency The unit is taken from the Pressure unit parameter. For detailed information on the calculation of the measured variables with steam: → 125	0 to 250 bar abs.	0 bar abs.
Enthalpy calculation	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" In the Select medium parameter, the Gas option is selected and in the Select gas type parameter, the Natural gas option is selected.	Select the norm the enthalpy calculation is based on.	■ AGA5 ■ ISO 6976	AGA5
Density calculation	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected.	Select the norm the density calculation is based on.	 AGA Nx19 ISO 12213-2 ISO 12213-3 	AGA Nx19
Enthalpy type	The following conditions are met: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the User-specific liquid option is selected.	Define which kind of enthalpy is used.	HeatCalorific value	Heat

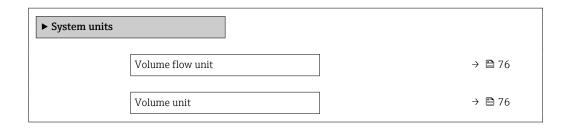
10.4.3 Setting the system units

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



Navigation

"Setup" menu \rightarrow System units



Mass flow unit	→ 🖺 76
Mass unit	→ 🗎 76
Corrected volume flow unit	→ 🖺 77
Corrected volume unit	→ 🖺 77
Pressure unit	→ 🖺 77
Temperature unit	→ 🗎 77
Energy flow unit	→ 🖺 77
Energy unit	→ 🖺 77
Calorific value unit	→ 🖺 77
Calorific value unit	→ 🖺 78
Velocity unit	→ 🖺 78
Density unit	→ 🖺 78
Specific volume unit	→ 🖺 78
Dynamic viscosity unit	→ 🖺 78
Length unit	→ 🗎 78

Parameter	Prerequisite	Description	Selection	Factory setting
Volume flow unit	-	Select volume flow unit. Result The selected unit applies for: Output Low flow cut off Simulation process variable	Unit choose list	Country-specific: m³/h ft³/min
Volume unit	-	Select volume unit.	Unit choose list	Country-specific: m³ ft³
Mass flow unit	-	Select mass flow unit. Result The selected unit applies for: Output Low flow cut off Simulation process variable	Unit choose list	Country-specific: kg/h lb/min
Mass unit	-	Select mass unit.	Unit choose list	Country-specific: • kg • lb

Parameter	Prerequisite	Description	Selection	Factory setting
Corrected volume flow unit	-	Select corrected volume flow unit. Result The selected unit applies for: Corrected volume flow parameter (→ 130)	Unit choose list	Country-specific: Nm³/h Sft³/h
Corrected volume unit	-	Select corrected volume unit.	Unit choose list	Country-specific: Nm³ Sft³
Pressure unit	With order code for "Sensor version": option "Mass (integrated temperature measurement)"	Select process pressure unit. Result The unit is taken from: Calculated saturated steam pressure Atmospheric pressure Maximum value Fixed process pressure Pressure Reference pressure	Unit choose list	Country-specific: • bar • psi
Temperature unit		Select temperature unit. Result The selected unit applies for: Temperature Maximum value Minimum value Maximum value Maximum value Minimum value Minimum value Minimum value Minimum value Minimum value Reference combustion temperature Reference temperature Reference temperature Saturation temperature	Unit choose list	Country-specific:
Energy flow unit	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Select energy flow unit. Result The selected unit applies for: Heat flow difference parameter Energy flow parameter	Unit choose list	Country-specific: kW Btu/h
Energy unit	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Select energy unit.	Unit choose list	Country-specific: • kWh • Btu
Calorific value unit	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Gross calorific value volume option or the Net calorific value volume option is selected in the Calorific value type parameter.	Select calorific value unit. Result The selected unit applies for: Reference gross calorific value	Unit choose list	Country-specific: • kJ/Nm³ • Btu/Sft³

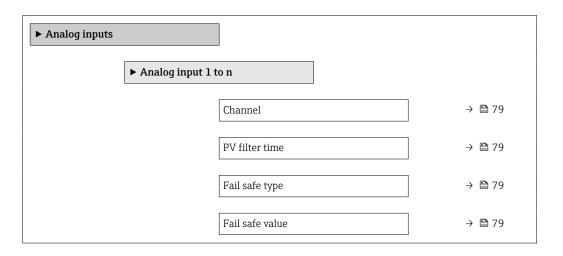
Parameter	Prerequisite	Description	Selection	Factory setting
Calorific value unit (Mass)	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Gross calorific value mass option or the Net calorific value mass option is selected in the Calorific value type parameter.	Select calorific value unit.	Unit choose list	Country-specific: • kJ/kg • Btu/lb
Velocity unit	-	Select velocity unit. Result The selected unit applies for: Flow velocity Maximum value	Unit choose list	Country-specific: m/s ft/s
Density unit	-	Select density unit. Result The selected unit applies for: Output Simulation process variable	Unit choose list	Country-specific: • kg/m³ • lb/ft³
Specific volume unit	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Select the unit for the specific volume. Result The selected unit applies for: Specific volume	Unit choose list	Country-specific: m³/kg ft³/lb
Dynamic viscosity unit	-	Select dynamic viscosity unit. Result The selected unit applies for: Dynamic viscosity parameter (gases) Dynamic viscosity parameter (liquids)	Unit choose list	Pas
Length unit	-	Select length unit for nominal diameter. Result The selected unit applies for: Inlet run Mating pipe diameter	Unit choose list	Country-specific: mm in

10.4.4 Configuring the analog inputs

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

Navigation

"Setup" menu \rightarrow Analog inputs



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Channel		Select the process variable.	 Volume flow Mass flow Corrected volume flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Energy flow difference Reynolds number Density* Pressure* Specific volume Degrees of superheat* 	Volume flow
PV filter time	_	Specify the time to suppress signal peaks. During the specified time the analog input does not respond to an erratic increase in the process variable.	Positive floating- point number	0
Fail safe type	-	Select the failure mode.	Fail safe valueFallback valueOff	Off
Fail safe value	In Fail safe type parameter, the Fail safe value option is selected.	Specify the values to be output when an error occurs.	Signed floating-point number	0

^{*} Visibility depends on order options or device settings

10.4.5 Configuring the local display

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

Navigation

"Setup" menu → Display



Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	 1 value, max. size 1 bargraph + 1 value 2 values 1 value large + 2 values 4 values 	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	■ Volume flow ■ Corrected volume flow ■ Mass flow ■ Flow velocity ■ Temperature ■ Calculated saturated steam pressure* ■ Total mass flow* ■ Condensate mass flow* ■ Energy flow* ■ Heat flow difference* ■ Reynolds number* ■ Density* ■ Pressure* ■ Specific volume* ■ Degrees of superheat* ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: 0 m³/h 0 ft³/h
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
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	None
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 (→ 🖺 81)	None
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 m³/h • 0 ft³/h
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	0
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 (→ 🖺 81)	None

^{*} Visibility depends on order options or device settings

10.4.6 Configuring communication interface

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

Navigation

"Setup" menu → Communication



Parameter overview with brief description

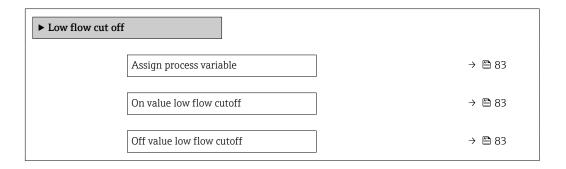
Parameter	Description	User entry	Factory setting
Device address	Enter device address.	0 to 126	126

10.4.7 Configuring the low flow cut off

The **Low flow cut off** wizard systematically guides the user through all the parameters that must be set to configure low flow cut off.

Navigation

"Setup" menu \rightarrow Low flow cut off



82

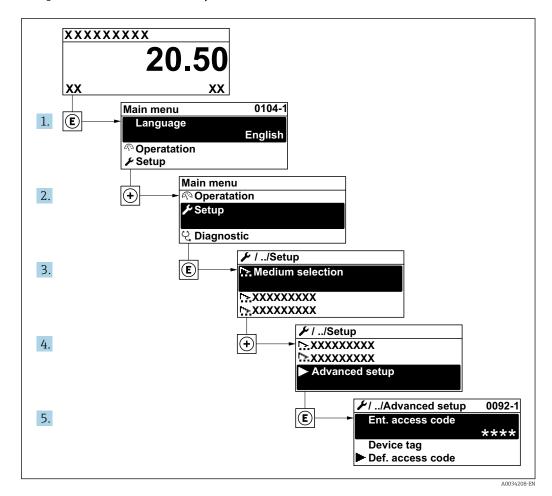
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	-	Select process variable for low flow cut off.	 Off Volume flow Corrected volume flow Mass flow Reynolds number * 	Off
On value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 🖺 83): Volume flow Corrected volume flow Mass flow Reynolds number *	Enter on value for low flow cut off.	Positive floating- point number	0
Off value low flow cutoff	One of the following options is selected in the Assign process variable parameter (→ 🖺 83): Volume flow Corrected volume flow Mass flow Reynolds number *	Enter off value for low flow cut off.	0 to 100.0 %	50 %

Visibility depends on order options or device settings

10.5 Advanced settings

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

Navigation to the "Advanced setup" submenu



The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation

"Setup" menu \rightarrow Advanced setup

► Advanced setup	
Enter access code	
► Medium properties	→ 🖺 85
► External compensation	→ 🖺 99
► Sensor adjustment	→ 🖺 101
► Pulse/frequency/switch output	→ 🖺 102

► Totalizer 1 to n	→ 🖺 109
► Display	→ 🖺 111
► Heartbeat setup	
► Configuration backup display	→ 🖺 113
► Administration	→ 🖺 115

10.5.1 Setting the medium properties

In the **Medium properties** submenu the reference values for the measuring application can be set.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Medium properties

► Medium properties	
Enthalpy type	→ 🖺 86
Calorific value type	→ 🖺 86
Reference combustion temperature	→ 🖺 86
Reference density	→ 🖺 86
Reference gross calorific value	→ 🖺 86
Reference pressure	→ 🖺 87
Reference temperature	→ 🖺 87
Reference Z-factor	→ 🖺 87
Linear expansion coefficient	→ 🖺 87
Relative density	→ 🖺 87
Specific heat capacity	→ 🖺 87
Calorific value	→ 🖺 88
Z-factor	→ 🖺 88
Dynamic viscosity	→ 🖺 88

Dynamic viscosity → 🖺 88

► Gas composition → 🖺 88

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Enthalpy type	The following conditions are met: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the User-specific liquid option is selected.	Define which kind of enthalpy is used.	HeatCalorific value	Heat
Calorific value type	The Calorific value type parameter is visible.	Select calculation based on gross calorific value or net calorific value.	 Gross calorific value volume Net calorific value volume Gross calorific value mass Net calorific value mass 	Gross calorific value mass
Reference combustion temperature	The Reference combustion temperature parameter is visible.	Enter reference combustion temperature to calculate the natural gas energy value. Dependency The unit is taken from the Temperature unit parameter	−200 to 450 °C	20 °C
Reference density	The following conditions are met: In the Select gas type parameter, the User-specific gas option is selected. Or In the Select liquid type parameter, the Water option or User-specific liquid option is selected.	Enter fixed value for reference density. Dependency The unit is taken from the Density unit parameter	0.01 to 15 000 kg/m ³	1000 kg/m³
Reference gross calorific value	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-3 option is selected.	Enter reference gross calorific value of the natural gas. Dependency The unit is taken from the Calorific value unit parameter	Positive floating- point number	50 000 kJ/Nm³

86

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Reference pressure	The following conditions are met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" The Gas option is selected in the Select medium parameter parameter.	Enter reference pressure for the calulation of the reference density. Dependency The unit is taken from the Pressure unit parameter.	0 to 250 bar	1.01325 bar
Reference temperature	The following conditions are met: The Gas option is selected in the Select medium parameter. Or The Liquid option is selected in the Select medium parameter.	Enter reference temperature for calculating the reference density. Dependency The unit is taken from the Temperature unit parameter	−200 to 450 °C	20°C
Reference Z-factor	In the Select gas type parameter, the User-specific gas option is selected.	Enter real gas constant Z for gas under reference conditions.	0.1 to 2	1
Linear expansion coefficient	The following conditions are met: The Liquid option is selected in the Select medium parameter. The User-specific liquid option is selected in the Select liquid type parameter.	Enter linear, medium-specific expansion coefficient for calculating the reference density.	1.0 · 10 ⁻⁶ to 2.0 · 10 ⁻³	2.06 · 10-4
Relative density	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-3 option is selected.	Enter a relative density of the natural gas.	0.55 to 0.9	0.664
Specific heat capacity	The following conditions are met: Selected medium: In the Select gas type parameter, the Userspecific gas option is selected. Or In the Select liquid type parameter, the Userspecific liquid option is selected. In the Enthalpy type parameter, the Heat option is selected.	Enter the specific heat capacity of the medium. Dependency The unit is taken from the Specific heat capacity unit parameter	0 to 50 kJ/(kgK)	4.187 kJ/(kgK)

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Calorific value	The following conditions are met: Selected medium: In the Select gas type parameter, the Userspecific gas option is selected. Or In the Select liquid type parameter, the Userspecific liquid option is selected. In the Enthalpy type parameter, the Calorific value option is selected. In the Calorific value type parameter, the Gross calorific value volume option or Gross calorific value mass option is selected.	Enter gross calorific value to calculate the energy flow.	Positive floating-point number	50 000 kJ/kg
Z-factor	In the Select gas type parameter, the User-specific gas option is selected.	Enter real gas constant Z for gas under operation conditions.	0.1 to 2.0	1
Dynamic viscosity (Gases)	The following conditions are met: Order code for "Sensor version", Option "Volume" or Option "Volume high temperature" The Gas option or the Steam option is selected in the Select medium parameter. or The User-specific gas option is selected in the Select gas type parameter.	Enter fixed value for dynamic viscosity for a gas/steam. Dependency The unit is taken from the Dynamic viscosity unit parameter.	Positive floating- point number	0.015 cP
Dynamic viscosity (Liquids)	The following conditions are met: Order code for "Sensor version", Option "Volume" or Option "Volume high temperature" The Liquid option is selected in the Select medium parameter parameter. or The User-specific liquid option is selected in the Select liquid option is selected in the Select liquid option is selected in the Select liquid type parameter.	Enter fixed value for dynamic viscosity for a liquid. Dependency The unit is taken from the Dynamic viscosity unit parameter.	Positive floating- point number	1 cP

Configuring the gas composition

In the ${\bf Gas\ composition}$ submenu the gas composition for the measuring application can be set.

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Medium properties \rightarrow Gas composition

► Gas composition	1	
	Gas type	→ 🖺 91
	Gas mixture	→ 🖺 91
	Mol% Ar	→ 🖺 92
	Mol% C2H3Cl	→ 🖺 92
	Mol% C2H4	→ 🖺 92
	Mol% C2H6	→ 🖺 92
	Mol% C3H8	→ 🖺 93
	Mol% CH4	→ 🖺 93
	Mol% Cl2	→ 🗎 93
	Mol% CO	→ 🖺 93
	Mol% CO2	→ 🖺 94
	Mol% H2	→ 🖺 94
	Mol% H2O	→ 🖺 94
	Mol% H2S	→ 🖺 94
	Mol% HCl	→ 🖺 95
	Mol% He	→ 🖺 95
	Mol% i-C4H10	→ 🖺 95
	Mol% i-C5H12	→ 🖺 95
	Mol% Kr	→ 🖺 95
	Mol% N2	→ 🖺 96
	Mol% n-C10H22	→ 🖺 96
	Mol% n-C4H10	→ 🖺 96

Mol% n-C5H12	→ 🖺 97
Mol% n-C6H14	→ 🖺 97
Mol% n-C7H16	→ 🖺 97
Mol% n-C8H18	→ 🖺 97
Mol% n-C9H2O	→ 🗎 97
Mol% Ne	→ 🖺 98
Mol% NH3	→ 🗎 98
Mol% O2	→ 🗎 98
Mol% SO2	→ 🖺 98
Mol% Xe	→ 🖺 98
Mol% other gas	→ 🖺 99
Relative humidity	→ 🖺 99

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Gas type	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Single gas option is selected.	Select measured gas type.	 Hydrogen H2 Helium He Neon Ne Argon Ar Krypton Kr Xenon Xe Nitrogen N2 Oxygen O2 Chlorine Cl2 Ammonia NH3 Carbon monoxide CO Carbon dioxide CO2 Sulfur dioxide SO2 Hydrogen sulfide H2S Hydrogen chloride HCI Methane CH4 Ethane C2H6 Propane C3H8 Butane C4H10 Ethylene C2H4 Vinyl Chloride C2H3Cl 	Methane CH4
Gas mixture	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected.	Select measured gas mixture.	 Hydrogen H2 Helium He Neon Ne Argon Ar Krypton Kr Xenon Xe Nitrogen N2 Oxygen O2 Chlorine Cl2 Ammonia NH3 Carbon monoxide CO Carbon dioxide CO2 Sulfur dioxide SO2 Hydrogen sulfide H2S Hydrogen chloride HCI Methane CH4 Ethane C2H6 Propane C3H8 Butane C4H10 Ethylene C2H4 Vinyl Chloride C2H3Cl Others 	Methane CH4

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% Ar	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Argon Ar option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% C2H3Cl	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Vinyl Chloride C2H3Cl option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% C2H4	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Ethylene C2H4 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% C2H6	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Ethane C2H6 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% C3H8	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Propane C3H8 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% CH4	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Methane CH4 option is selected. Or In the Select gas type parameter, the Natural gas option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	100 %
Mol% Cl2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Chlorine CI2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% CO	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Carbon monoxide CO option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% CO2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Carbon dioxide CO2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% H2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Hydrogen H2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the AGA Nx19 option is not selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% H2O	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% H2S	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Hydrogen sulfide H2S option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% HCl	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Hydrogen chloride HCl option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% He	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Helium He option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% i-C4H10	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% i-C5H12	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% Kr	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Krypton Kr option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% N2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Nitrogen N2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the AGA Nx19 option or the ISO 12213- 2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% n-C10H22	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% n-C4H10	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Butane C4H10 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213- 2 option is selected. Or In the Select medium parameter, the Liquid option is selected and in the Select liquid type parameter, the LPG option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% n-C5H12	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% n-C6H14	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	O %
Mol% n-C7H16	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% n-C8H18	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% n-C9H2O	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Natural gas option is selected. In the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% Ne	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Neon Ne option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% NH3	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Ammonia NH3 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% O2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected and in the Gas mixture parameter, the Oxygen O2 option is selected. Or In the Select gas type parameter, the Natural gas option is selected and in the Density calculation parameter, the ISO 12213-2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% SO2	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Sulfur dioxide SO2 option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Mol% Xe	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Xenon Xe option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Mol% other gas	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Gas mixture option is selected. In the Gas mixture parameter, the Others option is selected.	Enter amount of substance for the gas mixture.	0 to 100 %	0 %
Relative humidity	The following conditions are met: In the Select medium parameter, the Gas option is selected. In the Select gas type parameter, the Air option is selected.	Enter humidity content of air in %.	0 to 100 %	0 %

10.5.2 Performing external compensation

The **External compensation** submenu contains parameters which can be used to enter external or fixed values. These values are used for internal calculations.

The **Fixed process pressure** parameter is set to the value **0 bar abs.** (ex works). In this case, the measuring device ignores the pressure read in via PROFIBUS PA. For the measuring device to use the external (read-in) pressure, a value > 0 bar abs. must be entered in the **Fixed process pressure** parameter.

For a detailed description of how to calculate the mass flow and energy flow:

Navigation

"Expert" menu \rightarrow Sensor \rightarrow External compensation

► External compensation	
External value	→ 🖺 100
Atmospheric pressure	→ 🖺 100
Delta heat calculation	→ 🖺 100
Fixed density	→ 🖺 100
Fixed temperature	→ 🖺 100
2nd temperature delta heat	→ 🖺 100
Fixed process pressure	→ 🖺 100

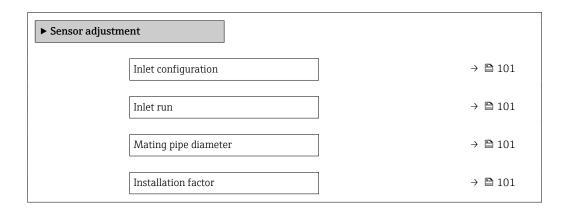
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
External value	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Assign variable from external device to process variable. Selection NOTE! If pressure is the selected option, the pressure is read in externally by means of a pressure transmitter. The pressure must be read in the unit Pascal so that pressure compensation can be read in correctly. Select the Pa option in the Pressure unit parameter. For detailed information on the calculation of the	Off Pressure Gauge pressure Density Temperature 2nd temperature delta heat	Off
Atmospheric pressure	In the External value	measured variables with steam: → 🖺 125 Enter atmospheric pressure	0 to 250 bar	1.01325 bar
	parameter, the Gauge pressure option is selected.	value to be used for pressure correction. Dependency The unit is taken from the Pressure unit parameter		
Delta heat calculation	The Delta heat calculation parameter is visible.	Calculates the transferred heat of a heat exchanger (= delta heat).	OffDevice on cold sideDevice on warm side	Device on warm side
Fixed density	With order code for "Sensor version": Option "Volume" or Option "Volume high temperature"	Enter fixed value for medium density. Dependency The unit is taken from the Density unit parameter.	0.01 to 15 000 kg/m ³	1000 kg/m ³
Fixed temperature	_	Enter a fixed value for process temperature. Dependency The unit is taken from the Temperature unit parameter	−200 to 450 °C	20 °C
2nd temperature delta heat	The 2nd temperature delta heat parameter is visible.	Enter 2nd temperature value to calculate the delta heat. Dependency The unit is taken from the Temperature unit parameter	−200 to 450 °C	20 °C
Fixed process pressure	The following conditions are met: Order code for "Sensor version", Option "Mass flow (integrated temperature measurement)" In the External value parameter (→ ≧ 100) the Pressure option is not selected.	Enter fixed value for process pressure. Dependency The unit is taken from the Pressure unit parameter. For detailed information on the calculation of the measured variables with steam: → ■ 125	0 to 250 bar abs.	0 bar abs.

10.5.3 Carrying out a sensor adjustment

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

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Sensor adjustment



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Inlet configuration	The inlet run correction feature: Is a standard feature and can only be used in Prowirl F 200. Can be used for the following pressure ratings and nominal diameters: DN 15 to 150 (1 to 6") EN (DIN) ASME B16.5, Sch. 40/80	Select inlet configuration.	 Off Single elbow Double elbow Double elbow 3D Reduction 	Off
Inlet run	The inlet run correction feature: Is a standard feature and can only be used in Prowirl F 200. Can be used for the following pressure ratings and nominal diameters: DN 15 to 150 (1 to 6") EN (DIN) ASME B16.5, Sch. 40/80	Define length of the straight inlet run. Dependency The unit is taken from the Length unit parameter	0 to 20 m	0 m
Mating pipe diameter	-	Enter diameter of mating pipe to enable diameter mismatch correction. Detailed information on diameter mismatch correction: → 🖹 102 Dependency The unit is taken from the Length unit parameter.	0 to 1 m (0 to 3 ft) Input value = 0: Diameter mismatch correction is disabled.	Country-specific: • 0 m • 0 ft
Installation factor	-	Enter factor to adjust for installation conditions.	Positive floating- point number	1.0

Diameter mismatch correction



The measuring device is calibrated according to the ordered process connection. This calibration takes account of the edge at the transition from the mating pipe to the process connection. If the mating pipe used deviates from the ordered process connection, a diameter mismatch correction can compensate for the effects. The difference between the internal diameter of the ordered process connection and the internal diameter of the mating pipe used must be taken into consideration.

The measuring device can correct shifts in the calibration factor which are caused, for example, by a diameter mismatch between the device flange (e.g. ASME B16.5/Sch. 80, DN 50 (2")) and the mating pipe (e.g. ASME B16.5/Sch. 40, DN 50 (2")). Only apply diameter mismatch correction within the following limit values (listed below) for which test measurements have also been performed.

Disc (wafer flange):

- DN 15 ($\frac{1}{2}$ "): ±15 % of the internal diameter
- DN 25 (1"): ±12 % of the internal diameter
- DN 40 (1½"): ± 9 % of the internal diameter
- DN \geq 50 (2"): \pm 8 % of the internal diameter

If the standard internal diameter of the ordered process connection differs from the internal diameter of the mating pipe, an additional measuring uncertainty of approx. 2 % o.r. must be expected.

Example

Influence of the diameter mismatch without using the correction function:

- Mating pipe DN 100 (4"), Schedule 80
- Device flange DN 100 (4"), Schedule 40
- This installation position results in a diameter mismatch of 5 mm (0.2 in). If the correction function is not used, an additional measuring uncertainty of approx. 2 % o.r. must be expected.
- If the basic conditions are met and the feature is enabled, the additional measuring uncertainty is 1 % o.r.

10.5.4 Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

Navigation

"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	PulseFrequencySwitch	Pulse

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output

Pulse/frequency/switch output	
Assign pulse output 1	→ 🖺 103
Value per pulse	→ 🖺 103
Pulse width	→ 🖺 103
Failure mode	→ 🖺 104
Invert output signal	→ 🖺 104

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign pulse output	The Pulse option is selected in the Operating mode parameter.	Select process variable for pulse output.	 Off Volume flow Corrected volume flow Mass flow Total mass flow* Energy flow* Heat flow difference* 	Volume 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 (→ 🗎 103): Volume flow Corrected volume flow Mass flow Total mass flow Energy flow Heat flow difference	Enter measured value at which a pulse is output.	Positive 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 (→ ■ 103): ■ Volume flow ■ Corrected volume flow ■ Mass flow ■ Total mass flow ■ Energy flow ■ Heat flow difference	Define time width of the output pulse.	5 to 2 000 ms	100 ms

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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 (→ 🖺 103): • Volume flow • Corrected volume flow • Mass flow • Total mass flow • Energy flow • Heat flow difference	Define output behavior in alarm condition.	Actual valueNo pulses	No pulses
Invert output signal	-	Invert the output signal.	NoYes	No

^{*} Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output

Pulse/frequency/switch output	
Assign frequency output	→ 🖺 105
Minimum frequency value	→ 🖺 105
Maximum frequency value	→ 🖺 105
Measuring value at minimum frequency	→ 🖺 106
Measuring value at maximum frequency	→ 🖺 106
Failure mode	→ 🗎 106
Failure frequency	→ 🖺 107
Invert output signal	→ 🖺 107

104

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign frequency output	The Frequency option is selected in the Operating mode parameter (→ 🖺 102) parameter.	Select process variable for frequency output.	 Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Energy flow Heat flow difference* 	Off
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 (→ 105): Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure* Total mass flow Energy flow Heat flow difference	Enter minimum frequency.	0 to 1000 Hz	0 Hz
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 (→ 105): Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure* Total mass flow Energy flow Heat flow difference*	Enter maximum frequency.	0 to 1000 Hz	1000 Hz

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
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 (→ 105): Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure* Total mass flow Energy flow Heat flow difference *	Enter measured value for minmum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum 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 (→ ○ 105): ○ Volume flow ○ Corrected volume flow ○ Mass flow ○ Flow velocity ○ Temperature ○ Pressure ○ Calculated saturated steam pressure ○ Total mass flow ○ Energy flow ○ Heat flow difference	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	In the Operating mode parameter (→ 🖺 102), the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→ 🖺 105): • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Pressure • Calculated saturated steam pressure* • Total mass flow • Energy flow • Heat flow difference	Define output behavior in alarm condition.	 Actual value Defined value 0 Hz 	0 Hz

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Failure frequency	In the Operating mode parameter (→ ■ 102), the Frequency option is selected, and one of the following options is selected in the Assign frequency output parameter (→ ■ 105): Volume flow Corrected volume flow Mass flow Flow velocity Temperature Pressure Calculated saturated steam pressure* Total mass flow Energy flow Heat flow difference	Enter frequency output value in alarm condition.	0.0 to 1250.0 Hz	0.0 Hz
Invert output signal	-	Invert the output signal.	NoYes	No

^{*} Visibility depends on order options or device settings

Configuring the switch output

Navigation

"Setup" menu \rightarrow Pulse/frequency/switch output

Pulse/frequ	ency/switch output	
	Switch output function	→ 🖺 108
	Assign diagnostic behavior	→ 🗎 108
	Assign limit	→ 🖺 108
	Assign flow direction check	→ 🖺 108
	Assign status	→ 🖺 108
	Switch-on value	→ 🖺 108
	Switch-off value	→ 🖺 108
	Switch-on delay	→ 🖺 108
	Switch-off delay	→ 🖺 109
	Failure mode	→ 🖺 109
	Invert output signal	→ 🖺 109

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Switch output function	The Switch option is selected in the Operating mode parameter.	Select function for switch output.	OffOnDiagnostic behaviorLimitStatus	Off
Assign diagnostic behavior	 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.	AlarmAlarm or warningWarning	Alarm
Assign limit	 The Switch option is selected in the Operating mode parameter parameter. The Limit option is selected in the Switch output function parameter parameter. 	Select process variable for limit function.	 Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Energy flow* Heat flow difference Reynolds number* Totalizer 1 Totalizer 2 Totalizer 3 	Volume flow
Assign flow direction check	 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.	 Off Volume flow Mass flow Corrected volume flow 	Volume flow
Assign status	 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.	Low flow cut offDigital output 2	Low flow cut off
Switch-on value	 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: • 0 m³/h • 0 ft³/h
Switch-off value	 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: • 0 m³/h • 0 ft³/h
Switch-on delay	 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	0.0 s

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Switch-off delay	 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	0.0 s
Failure mode	-	Define output behavior in alarm condition.	Actual statusOpenClosed	Open
Invert output signal	-	Invert the output signal.	■ No ■ Yes	No

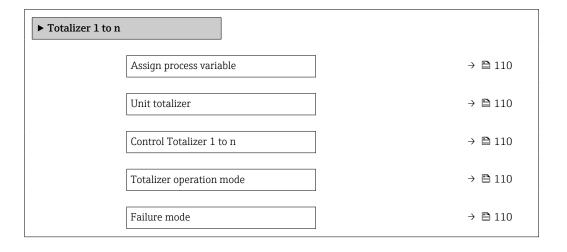
^{*} Visibility depends on order options or device settings

10.5.5 Configuring the totalizer

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

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Totalizer 1 to n



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Assign process variable	-	Select process variable for totalizer.	 Volume flow Mass flow Corrected volume flow Total mass flow * Condensate mass flow * Energy flow * Heat flow difference * 	 Totalizer 1: Volume flow Totalizer 2: Mass flow Totalizer 3: Corrected volume flow
Unit totalizer	One of the following options is selected in the Assign process variable parameter: • Volume flow • Mass flow • Corrected volume flow • Total mass flow* • Condensate mass flow* • Energy flow* • Heat flow difference*	Select the unit for the process variable of the totalizer.	Unit choose list	m³
Control Totalizer 1 to n	In the Assign process variable parameter, one of the following options is selected: Volume flow Mass flow Corrected volume flow Total mass flow* Condensate mass flow* Energy flow Heat flow difference	Control totalizer value.	 Totalize Reset + hold Preset + hold 	Totalize
Totalizer operation mode	In the Assign process variable parameter, one of the following options is selected: Volume flow Mass flow Corrected volume flow Total mass flow* Condensate mass flow* Energy flow* Heat flow difference*	Select totalizer calculation mode.	 Net flow total Forward flow total Reverse flow total Last valid value 	Net flow total
Failure mode	One of the following options is selected in the Assign process variable parameter: • Volume flow • Mass flow • Corrected volume flow • Total mass flow* • Condensate mass flow* • Energy flow* • Heat flow difference	Define the totalizer behavior in the event of a device alarm.	StopActual valueLast valid value	Actual value

^{*} Visibility depends on order options or device settings

10.5.6 Carrying out additional display configurations

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

Navigation

"Setup" menu \rightarrow Advanced setup \rightarrow Display

► Display			
	Format display	→ 🖺 112	
	Value 1 display	→ 🖺 112	
	0% bargraph value 1	→ 🖺 112	
	100% bargraph value 1	→ 🖺 112	
	Decimal places 1	→ 🖺 112	
	Value 2 display	→ 🖺 112	
	Decimal places 2	→ 🗎 112	
	Value 3 display	→ 🖺 112	
	0% bargraph value 3	→ 🖺 112	
	100% bargraph value 3	→ 🖺 112	
	Decimal places 3	→ 🖺 113	
	Value 4 display	→ 🖺 113	
	Decimal places 4	→ 🖺 113	
	Language	→ 🖺 113	
	Display interval	→ 🖺 113	
	Display damping	→ 🗎 113	
	Header	→ 🗎 113	
	Header text	→ 🗎 113	
	Separator	→ 🖺 113	
	Backlight	→ 🗎 113	

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.	 1 value, max. size 1 bargraph + 1 value 2 values 1 value large + 2 values 4 values 	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	■ Volume flow ■ Corrected volume flow ■ Mass flow ■ Flow velocity ■ Temperature ■ Calculated saturated steam pressure ■ Total mass flow ■ Condensate mass flow ■ Energy flow ■ Heat flow difference ■ Reynolds number ■ Density ■ Pressure ■ Specific volume ■ Degrees of superheat ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: • 0 m³/h • 0 ft³/h
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.	XX.XX.XXX.XXXX.XXX	x.xx
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	None
Decimal places 2	A measured value is specified in the Value 2 display parameter.	Select the number of decimal places for the display value.	• x • x.x • x.xx • x.xxx • x.xxx	x.xx
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 (→ 🖺 81)	None
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 m³/h • 0 ft³/h
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	0

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Decimal places 3	A measured value is specified in the Value 3 display parameter.	Select the number of decimal places for the display value.	• X • X.X • X.XX • X.XXX • X.XXXX	x.xx
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 (→ 🖺 81)	None
Decimal places 4	A measured value is specified in the Value 4 display parameter.	Select the number of decimal places for the display value.	• X • X.X • X.XX • X.XXX	x.xx
Language	A local display is provided.	Set display language.	English Deutsch* Français* Español* Italiano* Nederlands* Portuguesa* Polski* pyсский 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	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	Device tagFree text	Device tag
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.	• . (point) • , (comma)	. (point)
Backlight	Order code for "Display; operation", option E "SD03 4- line, illum.; touch control + data backup function"	Switch the local display backlight on and off.	DisableEnable	Enable

^{*} Visibility depends on order options or device settings

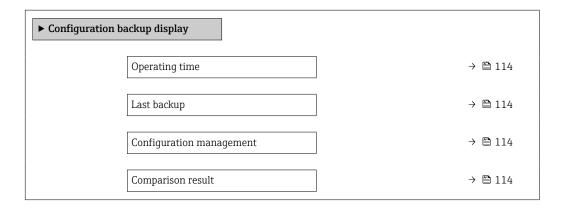
10.5.7 Configuration management

After commissioning, you can save the current device configuration, copy it to another measuring point or restore the previous device configuration.

You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup display** submenu.

Navigation

"Setup" menu → Advanced setup → Configuration backup display



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection	Factory setting
Operating time	-	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	-
Last backup	A local display is provided.	Indicates when the last data backup was saved to the display module.	Days (d), hours (h), minutes (m) and seconds (s)	-
Configuration management	A local display is provided.	Select action for managing the device data in the display module.	 Cancel Execute backup Restore Duplicate Compare Clear backup data 	Cancel
Comparison result	A local display is provided.	Comparison between present device data and display backup.	 Settings identical Settings not identical No backup available Backup settings corrupt Check not done Dataset incompatible 	Check not done

Function scope of the "Configuration management" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the HistoROM backup to the display module of the device. The backup copy includes the transmitter data of the device.
Restore	The last backup copy of the device configuration is restored from the display module to the device's HistoROM backup. The backup copy includes the transmitter data of the device.
Compare	The device configuration saved in the display module is compared with the current device configuration of the HistoROM backup.

Options	Description
Duplicate	The transmitter configuration from another device is duplicated to the device using the display module.
Clear backup data	The backup copy of the device configuration is deleted from the display module of the device.

HistoROM backup

A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

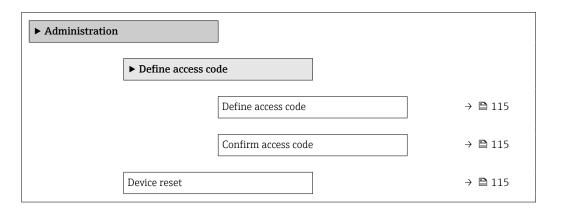
While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

10.5.8 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 \rightarrow Advanced setup \rightarrow Administration



Parameter overview with brief description

Parameter	Description	User entry / Selection	Factory setting
Define access code	Restrict write-access to parameters to protect the configuration of the device against unintentional changes via the local display.	0 to 9 999	0
Confirm access code	Confirm the entered access code.	0 to 9999	0
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	CancelTo factory defaultsTo delivery settingsRestart device	Cancel

10.6 Simulation

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

 $\begin{tabular}{ll} \textbf{Navigation} \\ "Diagnostics" menu \rightarrow Simulation \\ \end{tabular}$

► Simulation		
	Assign simulation process variable	→ 🖺 117
	Value process variable	→ 🖺 117
	Frequency simulation	→ 🖺 117
	Frequency value	→ 🖺 117
	Pulse simulation	→ 🖺 117
	Pulse value	→ 🖺 117
	Switch output simulation	→ 🖺 117
	Switch status	→ 🖺 117
	Simulation device alarm	→ 🖺 118
	Diagnostic event category	→ 🖺 118
	Simulation diagnostic event	→ 🖺 118

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign simulation process variable		Select a process variable for the simulation process that is activated.	Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Condensate mass flow* Energy flow Heat flow difference* Reynolds number	Off
Value process variable	One of the following options is selected in the Assign simulation process variable parameter (→ 🗎 117): Volume flow Corrected volume flow Mass flow Flow velocity Temperature* Pressure Calculated saturated steam pressure* Total mass flow Condensate mass flow Energy flow Heat flow difference Reynolds number*	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Frequency simulation	In the Operating mode parameter, the Frequency option is selected.	Switch the simulation of the frequency output on and off.	• Off • On	Off
Frequency value	In the Frequency simulation parameter, the On option is selected.	Enter the frequency value for the simulation.	0.0 to 1250.0 Hz	0.0 Hz
Pulse simulation	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 (→ 103) defines the pulse width of the pulses output.	OffFixed valueDown-counting value	Off
Pulse value	In the Pulse simulation parameter (→ 🗎 117), the Down-counting value option is selected.	Enter the number of pulses for simulation.	0 to 65 535	0
Switch output simulation	In the Operating mode parameter, the Switch option is selected.	Switch the simulation of the switch output on and off.	• Off • On	Off
Switch status	In the Switch output simulation parameter (→ 117) 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.	■ Open ■ Closed	Open

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Simulation device alarm	-	Switch the device alarm on and off.	OffOn	Off
Diagnostic event category	-	Select a diagnostic event category.	SensorElectronicsConfigurationProcess	Process
Simulation diagnostic event	-	Select a diagnostic event for the simulation process that is activated.	 Off Diagnostic event picklist (depends on the category selected) 	Off

Visibility depends on order options or device settings

10.7 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
- Write protection via write protection switch
- Write protection via keypad lock

10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:

- Via local operation, the parameters for the measuring device configuration are writeprotected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.

Defining the access code via local display

- 1. Navigate to the **Enter access code** parameter.
- 2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
- 3. Enter the access code again in the to confirm the code.
 - ► The 🗈-symbol appears in front of all write-protected parameters.

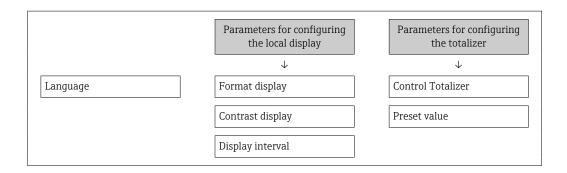
The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code $\rightarrow \triangleq 56$.
 - The user role with which the user is currently logged on via the local display is indicated by the →

 56 Access status display parameter. Navigation path: Operation → Access status display

Parameters which can always be modified via the local display

Certain parameters that do not affect the measurement are excepted from parameter write protection via the local display. Despite the user-specific access code, they can always be modified, even if the other parameters are locked.

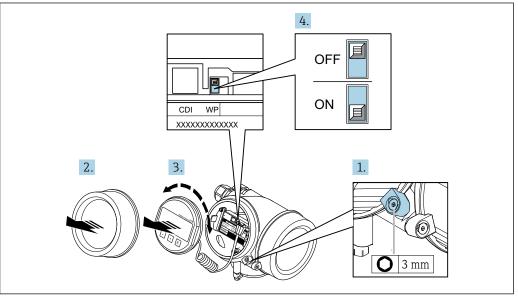


10.7.2 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the "Contrast display" parameter - to be locked.

The parameter values are now read only and cannot be edited any more (exception "Contrast display" parameter):

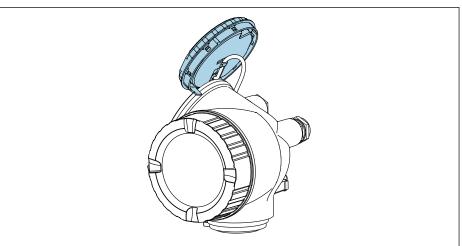
- Via local display
- Via PROFIBUS PA protocol



A00322

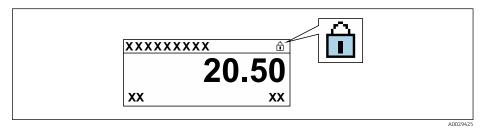
- 1. Loosen the securing clamp.
- 2. Unscrew the electronics compartment cover.

- 3. Pull out the display module with a gentle rotational movement. To make it easier to access the write protection switch, attach the display module to the edge of the electronics compartment.
 - → Display module is attached to the edge of the electronics compartment.



A003223

- 4. Setting the write protection switch (WP) on the main electronics module to the **ON** position enables hardware write protection. Setting the write protection switch (WP) on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.
 - ☐ If the hardware write protection is enabled: The **Hardware locked** option is displayed in the **Locking status** parameter . In addition, on the local display the ☐ symbol appears in front of the parameters in the header of the operational display and in the navigation view.



If the hardware write protection is disabled: No option is displayed in the **Locking status** parameter . On the local display, the a-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view

- 5. Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment in the desired direction until it engages.
- 6. Reverse the removal procedure to reassemble the transmitter.

10.8 Application-specific commissioning

10.8.1 Steam application

Select medium

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.

- 2. In the **Select medium** parameter, select the **Steam** option.
- 3. When pressure measured value is read in ²⁾:
 In the **Steam calculation mode** parameter, select the **Automatic (p-/T-compensated)** option.
- 4. If pressure measured value is not read in:
 In the **Steam calculation mode** parameter, select the **Saturated steam (T-compensated)** option.
- 5. In the **Steam quality value** parameter, enter the steam quality present in the pipe.
 - ► Measuring device uses this value to calculate the mass flow of the steam.

Configuring the analog input (AI)

6. Configuring the analog input (AI).

10.8.2 Liquid application

User-specific liquid, e.g. heat carrier oil

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Liquid** option.
- 3. In the **Select liquid type** parameter, select the **User-specific liquid** option.
- 4. In the **Enthalpy type** parameter, select the **Heat** option.
 - ► Heat option: Non-flammable liquid that serves as a heat carrier.Calorific value option: Flammable liquid whose combustion energy is calculated.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 5. Call up the **Medium properties** submenu.
- 6. In the **Reference density** parameter, enter the reference density of the fluid.
- 7. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
- 8. In the **Linear expansion coefficient** parameter, enter the expansion coefficient of the fluid.
- 9. In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
- 10. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid.

²⁾ Pressure read in via PA

10.8.3 Gas applications

- For accurate mass or corrected volume measurement, it is recommended to use the pressure-/temperature-compensated sensor version. If this sensor version is not available, read in the pressure via the PA. If neither of these two options is possible, the pressure can also be entered as a fixed value in the **Fixed process pressure** parameter.
- Flow computer available only with the order code for "Sensor version", option "mass" (integrated temperature measurement)" or option "mass (integrated pressure/temperature measurement)".

Single gas

Combustion gas, e. g. methane CH₄

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Gas** option.
- 3. In the **Select gas type** parameter, select the **Single gas** option.
- 4. In the **Gas type** parameter, select the **Methane CH4** option.

Configuring fluid properties

Navigation:

Setup → Advanced setup → Medium properties

- 5. Call up the **Medium properties** submenu.
- 6. In the **Reference combustion temperature** parameter, enter the reference combustion temperature of the fluid.
- 7.

Configuring the analog input (AI)

8. Configure the Analog Input (AI) for the "energy flow" process variable..

Configuring optional fluid properties for output of corrected volume flow

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 9. Call up the **Medium properties** submenu.
- 10. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
- 11. In the **Reference temperature** parameter, enter the reference temperature of the fluid.

Gas mixture

Forming gas for steel mills and rolling mills, e. g. N_2/H_2

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Gas** option.

3. In the **Select gas type** parameter, select the **Gas mixture** option.

Configuring gas composition

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties \rightarrow Gas composition

- 4. Call up the **Gas composition** submenu.
- 5. In the **Gas mixture** parameter, select the **Hydrogen H2** option and the **Nitrogen N2** option.
- 6. In the **Mol% H2** parameter, enter the quantity of hydrogen.
- 7. In the **Mol% N2** parameter, enter the quantity of nitrogen.
 - All quantities must add up to 100 %. The density is determined according to NEL 40.

Configuring optional fluid properties for output of corrected volume flow

Navigation:

Setup → Advanced setup → Medium properties

- 8. Call up the **Medium properties** submenu.
- 9. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
- 10. In the **Reference temperature** parameter, enter the reference temperature of the fluid.

Air

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter ($\rightarrow \implies 74$), select the **Gas** option.
- 3. In the **Select gas type** parameter ($\rightarrow \triangle 74$), select the **Air** option.
 - ► The density is determined according to NEL 40.
- 4. Enter the value in the **Relative humidity** parameter ($\rightarrow \triangleq 99$).
 - The relative humidity is entered as a %. The relative humidity is converted internally to absolute humidity and is then factored into the density calculation according to NEL 40.
- 5. In the **Fixed process pressure** parameter ($\rightarrow \implies 75$), enter the value of the process pressure present.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 6. Call up the **Medium properties** submenu.
- 7. In the **Reference pressure** parameter (→ 🖺 87) enter the reference pressure for calculating the reference density.
 - Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.

- 8. In the **Reference temperature** parameter (→ 🖺 87) enter the temperate for calculating the reference density.
- Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries .

Natural gas

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter ($\rightarrow \boxminus 74$), select the **Gas** option.
- 3. In the **Select gas type** parameter ($\rightarrow \triangleq 74$), select the **Natural gas** option.
- 4. In the **Fixed process pressure** parameter ($\rightarrow \implies 75$), enter the value of the process pressure present.
- 5. In the **Enthalpy calculation** parameter ($\rightarrow \stackrel{\triangle}{=} 75$), select one of the following options:
 - → AGA5
 ISO 6976 option (contains GPA 2172)
- **6.** In the **Density calculation** parameter ($\rightarrow \blacksquare 75$), select one of the following options.
 - ► AGA Nx19

ISO 12213- 2 option (contains AGA8-DC92)
ISO 12213- 3 option (contains SGERG-88, AGA8 Gross Method 1)

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 7. Call up the **Medium properties** submenu.
- 8. In the **Calorific value type** parameter, select one of the options.
- 9. n the **Reference gross calorific value** parameter, enter the reference gross calorific value of the natural gas.
- 10. In the **Reference pressure** parameter ($\rightarrow \triangleq 87$) enter the reference pressure for calculating the reference density.
 - Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.
- 11. In the **Reference temperature** parameter ($\rightarrow \implies 87$) enter the temperate for calculating the reference density.
- 12. In the **Relative density** parameter, enter the relative density of the natural gas.
- Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries .

Ideal gas

The unit "corrected volume flow" is often used to measure industrial gas mixtures, in particular natural gas. To do so, the calculated mass flow is divided by a reference density. To calculate the mass flow, knowledge of the exact composition of the gas is essential. In practice, however, this information is often not available (e. g. as it varies over time). In this case, it can be useful to regard the gas as an ideal gas. This means that only the operating temperature and operating pressure variables as well as the reference temperature and reference pressure variables are needed to calculate the corrected volume

flow. The error resulting from this assumption (typically 1 to 5%) is often considerably smaller than the error caused by inaccurate composition data. This method should not be used for condensing gases (e. g. saturated steam).

Select medium

Navigation:

Setup → Medium selection

- 1. Call up the **Medium selection** wizard.
- 2. In the **Select medium** parameter, select the **Gas** option.
- 3. In the **Select gas type** parameter, select the **User-specific gas** option.
- 4. For non-flammable gas:
 In the **Enthalpy type** parameter, select the **Heat** option.

Configuring fluid properties

Navigation:

Setup \rightarrow Advanced setup \rightarrow Medium properties

- 5. Call up the **Medium properties** submenu.
- 6. In the **Reference density** parameter, enter the reference density of the fluid.
- 7. In the **Reference pressure** parameter, enter the reference pressure of the fluid.
- 8. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
- 9. In the **Reference Z-factor** parameter, enter the value **1**.
- 10. If specific heat capacity is to be measured:

 In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
- 11. In the **Z-factor** parameter, enter the value **1**.
- 12. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid under operating conditions.

10.8.4 Calculation of the measured variables

A flow computer can be found in the electronics of the measuring device with order code for "Sensor version", option "mass (integrated temperature measurement)". This computer can calculate the following secondary measured variables directly from the primary measured variables recorded using the pressure value (entered or external) and/or temperature value (measured or entered).

Mass flow and corrected volume flow

Medium	Fluid	Standards	Explanation		
Steam 1)	Water vapor	IAPWS-IF97/ ASME	For integrated temperature measurement For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via PROFIBUS PA		
-	Single gas	NEL40	or fixed process pressure, pressure measured directly at the meter		
	Gas mixture	NEL40	body or if the pressure is read in via PROFIBUS PA		
	Air	NEL40			
Gas	Natural gas	ISO 12213-2	 Contains AGA8-DC92 For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via PROFIBUS PA 		
		AGA NX-19	For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via PROFIBUS PA		

Medium	Fluid	Standards	Explanation
		ISO 12213-3	 Contains SGERG-88, AGA8 Gross Method 1 For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via PROFIBUS PA
	Other gases	Linear equation	 Ideal gases For fixed process pressure, pressure measured directly at the meter body or if the pressure is read in via PROFIBUS PA
	Water	IAPWS-IF97/ ASME	-
Liquids	Liquefied gas	Tables	Propane and butane mixture
	Other liquid	Linear equation	Ideal liquids

Mass flow calculation

Volume flow × operating density

- Operating density for saturated steam, water and other liquids: depends on the temperature
- Operating density for superheated steam and all other gases: depends on the temperature and process pressure

Corrected volume flow calculation

(Volume flow × operating density)/reference density

- Operating density for water and other liquids: depends on the temperature
- Operating density for all other gases: depends on the temperature and process pressure

Energy flow

Medium	Fluid	Standards	Explanation	Heat/energy option
Steam 1)	-	IAPWS- IF97/ASME	For fixed process pressure or if the pressure is read in via PROFIBUS PA	
Gas	Single gas	ISO 6976	 Contains GPA 2172 For fixed process pressure or if the pressure is read in via PROFIBUS PA 	
	Gas mixture	ISO 6976	 Contains GPA 2172 For fixed process pressure or if the pressure is read in via PROFIBUS PA 	Heat Gross calorific value ²⁾ in relation to mass Net calorific value ³⁾ in relation to mass Gross calorific value ²⁾ in relation to corrected
	Air	NEL40	For fixed process pressure or if the pressure is read in via PROFIBUS PA	volume Net calorific value ³⁾ in relation to corrected volume
	Natural gas	ISO 6976	 Contains GPA 2172 For fixed process pressure or if the pressure is read in via PROFIBUS PA 	
		AGA 5	-	
Liquids	Water	IAPWS- IF97/ASME	-	

Medium	Fluid	Standards	Explanation	Heat/energy option
	Liquefied gas	ISO 6976	Contains GPA 2172	
	Other liquid	Linear equation	_	

- Gross calorific value: combustion energy + condensation energy of the flue gas (gross calorific value > net calorific value)
- Net calorific value: only combustion energy

Mass flow and energy flow calculation

NOTICE

The process pressure (p) in the process pipe is required to calculate the process variables and the limit values of the measuring range.

▶ In the case of the PROFIBUS PA device, the process pressure can be transmitted from the Profibus master to the measuring device via the AO Block or entered as a fixed value in the **External compensation** submenu (→ 🗎 99).

Steam is calculated based on the following factors:

- Fully compensated calculation of density using the "pressure" and "temperature" measured variables
- Calculation based on overheated steam until saturation point is reached
 Configuration of diagnostic behavior of the △S871 Near steam saturation limit
 diagnostic messageAssign behavior of diagnostic no. 871 parameter set to Off option
 (factory setting) as standard →
 □ 147

Optional configuration of diagnostic behavior to the **Alarm** option or **Warning** option $\rightarrow \implies 144$ option.

At 2 K above saturation, activation of the $\Delta \textbf{S871}$ Near steam saturation limit diagnostic message.

- The smaller of the following two pressure values is always used to calculate the density:
 - Pressure measured directly at meter body or pressure read in via PROFIBUS PA
 - Saturated steam pressure, which is derived from the saturated steam line (IAPWS-IF97/ASME)
- With fixed process pressure = 0 bar abs. the measuring device only calculates on the saturated steam curve using temperature compensation .
- $brack {
 m T}$ For detailed information on how to perform external compensation, see .

Calculated value

The unit calculates the mass flow, heat flow, energy flow, density and specific enthalpy from the measured volume flow and the measured temperature and/or the pressure based on international standard IAPWS-IF97/ASME.

Formulae for calculation:

- Mass flow: $\dot{m} = \dot{v} \cdot \rho$ (T, p)
- Heat flow: $\dot{Q} = \dot{v} \cdot \rho (T, p) \cdot h_D (T, p)$

 \dot{m} = Mass flow

Q = Heat flow

 \dot{v} = Volume flow (measured)

 h_D = Specific enthalpy

T = Process temperature (measured)

p = Process pressure

 $\rho = Density^{3)}$

Pre-programmed gases

The following gases are pre-programmed in the flow computer:

Hydrogen ¹⁾	Helium 4	Neon	Argon
Krypton	Xenon	Nitrogen	Oxygen
Chlorine	Ammonia	Carbon monoxide 1)	Carbon dioxide
Sulfur dioxide	Hydrogen sulfide 1)	Hydrogen chloride	Methane 1)
Ethane ¹⁾	Propane ¹⁾	Butane 1)	Ethylene (ethene) 1)
Vinyl chloride	Mixtures of up to 8 component		

1) The energy flow is calculated as per ISO 6976 (contains GPA 2172) or AGA5 - in relation to the net calorific value or gross calorific value .

Energy flow calculation

Volume flow × operating density × specific enthalpy

- Operating density for saturated steam and water: depends on the temperature
- Operating density for superheated steam, natural gas ISO 6976 (contains GPA 2172), natural gasAGA5: depends on the temperature and pressure

Heat flow difference

- Between saturated steam upstream from a heat exchanger and condensate downstream from the heat exchanger (second temperature read in via PROFIBUS PA) in accordance with IAPWS-IF97/ASME
- Between warm and cold water (second temperature read in via PROFIBUS PA) in accordance with IAPWS-IF97/ASME

Vapor pressure and steam temperature

The measuring device can perform the following in saturated steam measurements between the feed line and return line of any heating liquid (second temperature read in via PROFIBUS PA and Cp value entered:

- Calculation of saturation pressure of steam from the measured temperature and output in accordance with IAPWS-IF97/ASME
- Calculation of saturation temperature of steam from the preset pressure and output in accordance with IAPWS-IF97/ASME

128

³⁾ From steam data as per IAPWS-IF97 (ASME), for the measured temperature and the specified pressure

11 **Operation**

11.1 Reading the device locking status

Device active write protection: Locking status parameter

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access status displayed in the Access status display parameter applies → 🖺 56. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the main electronics module. This locks write access to the parameters (e.g. via local display or operating tool) .
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.

Adjusting the operating language 11.2



Poetailed information:

- To configure the operating language $\rightarrow \triangleq 71$
- For information on the operating languages supported by the measuring device → 🖺 213

11.3 Configuring the display

Detailed information:

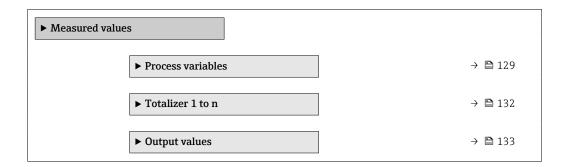
- On the basic settings for the local display $\rightarrow \triangleq 80$
- On the advanced settings for the local display $\rightarrow \implies 111$

11.4 Reading measured values

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

Navigation

"Diagnostics" menu \rightarrow Measured values \rightarrow Process variables



11.4.1 **Process variables**

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

 $\begin{tabular}{ll} \textbf{Navigation} \\ \begin{tabular}{ll} \textbf{"Diagnostics" menu} \rightarrow \textbf{Measured values} \rightarrow \textbf{Process variables} \\ \end{tabular}$

▶ Process variable	es	
	Volume flow	→ 🖺 130
	Corrected volume flow	→ 🖺 130
	Mass flow	→ 🖺 131
	Flow velocity	→ 🖺 131
	Temperature	→ 🖺 131
	Calculated saturated steam pressure	→ 🖺 131
	Energy flow	→ 🖺 131
	Heat flow difference	→ 🖺 131
	Reynolds number	→ 🖺 131
	Density	→ 🖺 131
	Specific volume	→ 🖺 131
	Pressure	→ 🖺 131
	Compressibility factor	→ 🖺 132
	Degrees of superheat	→ 🖺 132

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Volume flow	-	Displays the volume flow currently measured.	Signed floating-point number
		Dependency The unit is taken from the Volume flow unit parameter $(\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	
Corrected volume flow	-	Displays the corrected volume flow currently calculated. Dependency	Signed floating-point number
		The unit is taken from the Corrected volume flow unit parameter $(\rightarrow \boxminus 77)$.	

130

Parameter	Prerequisite	Description	User interface	
Mass flow	-	Displays the mass flow currently calculated. Dependency The unit is taken from the Mass flow unit parameter (→ ↑ 76).	Signed floating-point number	
Flow velocity –		Displays the flow velocity currently calculated. Dependency The unit is taken from the Velocity unit parameter (→ 🖺 78).	Signed floating-point number	
Temperature	-	Displays the temperature currently measured. Dependency The unit is taken from the Temperature unit parameter (→ 🖺 77).	Signed floating-point number	
Calculated saturated steam pressure	The following conditions are met: Order code for "Sensor version", option "Mass (integrated temperature measurement)" The Steam option is selected in the Select medium parameter (→ 74).	Displays the saturated steam pressure currently calculated. Dependency The unit is taken from the Pressure unit parameter (→ 🖺 77).	Signed floating-point number	
Energy flow	With order code for "Sensor version": option "Mass (integrated temperature measurement)"	Displays the energy flow currently calculated. Dependency The unit is taken from the Energy flow unit parameter (→ 🖺 77).	Signed floating-point number	
Heat flow difference	The following conditions are met: Order code for "Sensor version" option "Mass (integrated temperature measurement)" One of the following options is selected in the Select gas type parameter (→ ≅ 74): Single gas Gas mixture Natural gas User-specific gas	Displays the heat flow difference currently calculated. Dependency The unit is taken from the Energy flow unit parameter (→ 🖺 77).	Signed floating-point number	
Reynolds number	With order code for "Sensor version": option "Mass (integrated temperature measurement)"	Displays the Reynolds number currently calculated.	Signed floating-point number	
Density	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Displays the density currently measured. Dependency The unit is taken from the Density unit parameter.	Positive floating-point number	
Specific volume	With order code for "Sensor version": Option "Mass (integrated temperature measurement)"	Displays the current value for the specific volume. Dependency The unit is taken from the Specific volume unit parameter.	Positive floating-point number	
Pressure	One of the following conditions is met: Order code for "Sensor version", Option "Mass (integrated temperature measurement)" or The Pressure option is selected in the External value parameter parameter.	Displays the current process pressure. Dependency The unit is taken from the Pressure unit parameter.	0 to 250 bar	

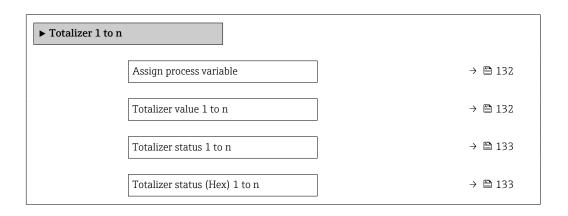
Parameter	Prerequisite	Description	User interface
Compressibility factor	The following conditions are met: Order code for "Sensor version" Option "Mass (integrated temperature measurement)" The Gas option or the Steam option is selected in the Select medium parameter.	Displays the compressibility factor currently calculated.	0 to 2
Degrees of superheat	In the Select medium parameter, the Steam option is selected.	Displays the degree of superheating currently calculated.	0 to 500 K

11.4.2 Totalizer

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

Navigation

"Diagnostics" menu \rightarrow Measured values \rightarrow Totalizer 1 to n



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign process variable	_	Select process variable for totalizer.	 Volume flow Mass flow Corrected volume flow Total mass flow* Condensate mass flow* Energy flow* Heat flow difference* 	 Totalizer 1: Volume flow Totalizer 2: Mass flow Totalizer 3: Corrected volume flow
Totalizer value 1 to n	In the Assign process variable parameter one of the following options is selected: Volume flow Mass flow Corrected volume flow Total mass flow Condensate mass flow Energy flow Heat flow difference	Displays the current totalizer counter value.	Signed floating-point number	0 m³

132

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Totalizer status 1 to n	-	Displays the current totalizer status.	GoodUncertainBad	-
Totalizer status (Hex) 1 to n	In Target mode parameter, the Auto option is selected.	Displays the current status value (hex) of the totalizer.	0 to 0xFF	-

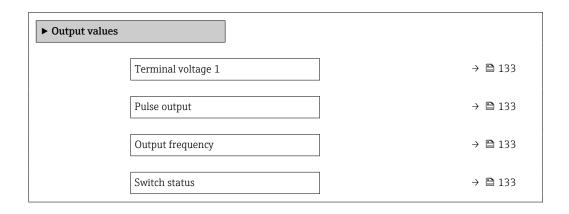
^{*} Visibility depends on order options or device settings

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
Terminal voltage 1	-	Displays the current terminal voltage that is applied at the output.	0.0 to 50.0 V
Pulse output	The Pulse option is selected in the Operating mode parameter parameter.	Displays the pulse frequency currently output.	Positive floating-point number
Output frequency	In the Operating mode parameter, the Frequency option is selected.	Displays the value currently measured for the frequency output.	0 to 1250 Hz
Switch status	The Switch option is selected in the Operating mode parameter.	Displays the current switch output status.	OpenClosed

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:

- Basic settings using the **Setup** menu (→ 🗎 72)

11.6 Performing a totalizer reset

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

Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to its defined start value from the Preset value 1 to n parameter.
Stop totalizing option	Totalizing is stopped.

Navigation

"Operation" menu \rightarrow Totalizer handling



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer 1 to n	In the Assign process variable parameter, one of the following options is selected: Volume flow Mass flow Corrected volume flow Total mass flow* Condensate mass flow* Energy flow* Heat flow difference*	Control totalizer value.	 Totalize Reset + hold Preset + hold 	Totalize
Preset value 1 to n	In the Assign process variable parameter one of the following options is selected: Volume flow Mass flow Corrected volume flow Total mass flow Condensate mass flow Energy flow Heat flow difference	Specify start value for totalizer.	Signed floating-point number	0 m³
Reset all totalizers	-	Reset all totalizers to 0 and start.	CancelReset + totalize	Cancel

Visibility depends on order options or device settings

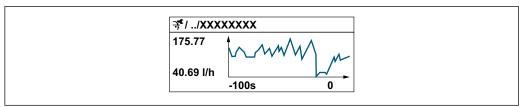
11.7 Showing data logging

The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:
Plant Asset Management Tool FieldCare → 🗎 58.

Function range

- A total of 1000 measured values can be stored
- 4 logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart



A0034352

- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.
- If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

Navigation

"Diagnostics" menu → Data logging

► Data logging	
Assign channel 1	→ 🖺 136
Assign channel 2	→ 🖺 136
Assign channel 3	→ 🖺 136
Assign channel 4	→ 🖺 136
Logging interval	→ 🖺 137
Clear logging data	→ 🖺 137
▶ Display channel 1	
▶ Display channel 2	
▶ Display channel 3	
▶ Display channel 4	
▶ Display channel 4	

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign channel 1	The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter.		Off Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure* Total mass flow* Condensate mass flow* Energy flow* Heat flow difference* Reynolds number* Density* Pressure* Specific volume* Degrees of superheat* Vortex frequency Vortex amplitude Vortex kurtosis Gap capacity Gap capacity Compressibility factor Electronic temperature	Off
Assign channel 2	The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter.	Assign process variable to logging channel.	Picklist, see Assign channel 1 parameter (→ 🖺 136)	Off
Assign channel 3	The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter.	Assign process variable to logging channel.	Picklist, see Assign channel 1 parameter (→ 🖺 136)	Off
Assign channel 4	The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter.	Assign process variable to logging channel.	Picklist, see Assign channel 1 parameter (→ 🖺 136)	Off

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Logging interval	The Extended HistoROM application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	1.0 to 3 600.0 s	10.0 s
Clear logging data	The Extended HistoROM application package is available.	Clear the entire logging data.	CancelClear data	Cancel

^{*} Visibility depends on order options or device settings

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 → 🖺 35.
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 → 🖺 184.
Local display dark and output signals in failure current	Sensor short-circuit, electronics module short-circuit	1. Contact service.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	 Set the display brighter 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 → 🖺 184.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press □ + tor 2 s ("home position"). 2. Press □. 3. Set the desired language in the Display language parameter (→ □ 113).
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	 Check the cable and the connector between the main electronics module and display module. Order spare part → 184.

For output signals

Error	Possible causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 🖺 184.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	Check and correct parameter configuration. Observe limit values specified in the "Technical Data".

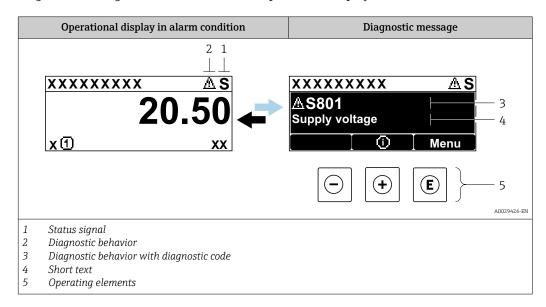
For access

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 $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
No write access to parameters	Current user role has limited access authorization	1. Check user role → 🗎 56. 2. Enter correct customer-specific access code → 🖺 56.
No connection via PROFIBUS PA	PROFIBUS PA cable incorrectly terminated	Check terminating resistor .
No connection via service interface	Incorrect configuration of USB interface on PC or driver not installed correctly.	Observe the documentation for the Commubox. FXA291: Document "Technical Information"
		TI00405C

12.2 Diagnostic information on local display

12.2.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.



If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

- Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
 - Via parameter
 - Via submenus \rightarrow 🗎 177

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).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

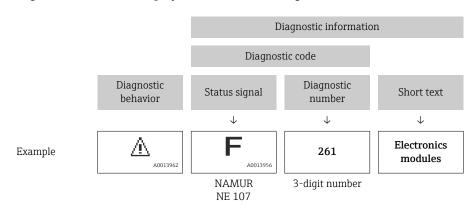
Symbol	Meaning
F	Failure A device error has occurred. The measured value is no longer valid.
С	Function check The device is in service mode (e.g. during a simulation).
S	Out of specification The device is operated: Outside its technical specification limits (e.g. outside the process temperature range)
М	Maintenance required Maintenance is required. The measured value remains valid.

Diagnostic behavior

Symbol	Meaning
8	Alarm Measurement is interrupted. Signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red.
Δ	Warning Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Diagnostic information

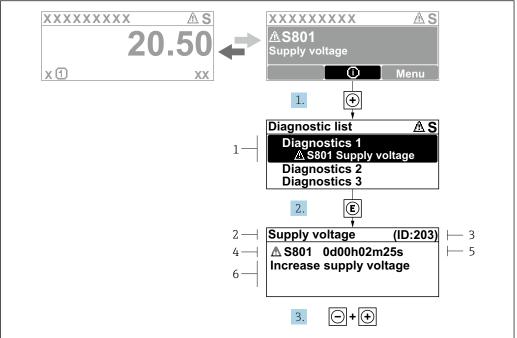
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Key	Meaning
	Plus key
(+)	In a menu, submenu Opens the message about remedy information.
	Enter key
E	In a menu, submenu Opens the operating menu.

12.2.2 Calling up remedial measures



A0029431-EN

- 21 Message about remedial measures
- 1 Diagnostic information
- 2 Short text
- 3 Service ID
- 4 Diagnostic behavior with diagnostic code
- 5 Operation time of occurrence
- 6 Remedial measures
- 1. The user is in the diagnostic message.

Press ± (① symbol).

- The **Diagnostic list** submenu opens.
- 2. Select the desired diagnostic event with \pm or \Box and press \Box .
 - └ The message about the remedial measures opens.
- 3. Press \Box + \pm simultaneously.
 - ► The message about the remedial measures closes.

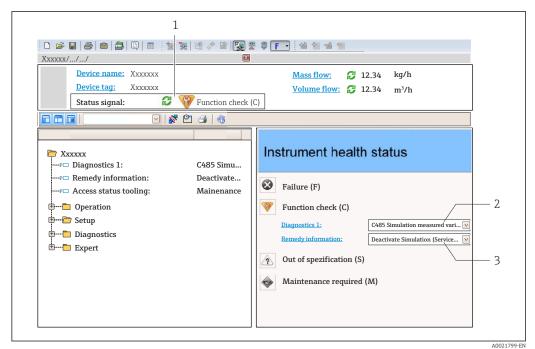
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

- 1. Press E.
 - └ The message for the remedial measures for the selected diagnostic event opens.
- 2. Press \Box + \pm simultaneously.
 - ► The message for the remedial measures closes.

12.3 Diagnostic information in FieldCare or DeviceCare

12.3.1 Diagnostic options

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



- 1 Status area with status signal→ 🖺 140
- Diagnostic information → □ 141
 Remedy information with Service ID
- In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
 - Via parameter
 - Via submenu → 🖺 177

Status signals

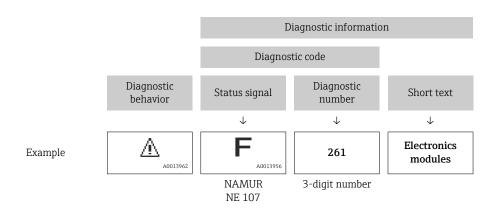
The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
8	Failure A device error has occurred. The measured value is no longer valid.
V	Function check The device is in service mode (e.g. during a simulation).
<u>^</u>	Out of specification The device is operated: Outside its technical specification limits (e.g. outside the process temperature range)
&	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. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



12.3.2 Calling up remedy information

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

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

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

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

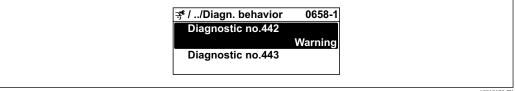
12.4 Adapting the diagnostic information

12.4.1 Adapting the diagnostic behavior

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

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

Expert \rightarrow System \rightarrow Diagnostic handling \rightarrow Diagnostic behavior



A0019179-EN

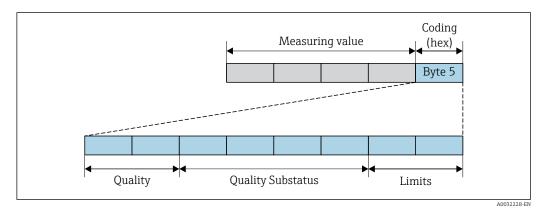
Available diagnostic behaviors

The following diagnostic behaviors can be assigned:

Diagnostic behavior	Description
Alarm	The device stops measurement. The totalizers assume the defined alarm condition. A diagnostic message is generated. For local display with touch control: the background lighting changes to red.
Warning	The device continues to measure. The measured value output via PROFIBUS and the totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is displayed only in the Event logbook submenu (Event list submenu) and not in alternation with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

Displaying the measured value status

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



22 Structure of the coding byte

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

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

When the diagnostic behavior is assigned, this also changes the measured value status and device status for the diagnostic information. The measured value status and device status depend on the choice of diagnostic behavior and on the group in which the diagnostic information is located.

The diagnostic information is grouped as follows:

- Diagnostic information pertaining to the sensor: diagnostic number 000 to 199
- Diagnostic information pertaining to the electronics: diagnostic number 200 to 399
 →

 146
- Diagnostic information pertaining to the configuration: diagnostic number 400 to 599 \rightarrow $\stackrel{ riangle}{=}$ 147
- Diagnostic information pertaining to the process: diagnostic number 800 to 999
 →

 147

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

Diagnostic information pertaining to the sensor: diagnostic number 000 to 199

Diagnostic hohavior	IV.	leasured value sta	Device diagnosis		
Diagnostic behavior (configurable)	Quality	Quality Substatus	Coding (hex)	Category (NE107)	(fixed assignment)
Alarm	BAD	Maintenance alarm	0x24 to 0x27	F (Failure)	Maintenance alarm
Warning	GOOD	Maintenance demanded	0xA8 to 0xAB	M (Maintenance)	Maintenance demanded
Logbook entry only	COOD	ole	0x80 to 0x8E	_	_
Off	GOOD	GOOD ok	OXOU TO OXOE	_	_

Diagnostic information pertaining to the electronics: diagnostic number 200 to 399

Diagnostic number 200 to 301, 303 to 399

Diagnostis habarian	Measured value status (fixed assignment)				Davisa dingposis
Diagnostic behavior (configurable)	Quality	Quality Substatus	Coding (hex)	Category (NE107)	Device diagnosis (fixed assignment)
Alarm	DVD	Maintenance	0x24 to 0x27	F	Maintenance
Warning	BAD	alarm	0.824 (0.0827	(Failure)	alarm
Logbook entry only	GOOD	20	000 +- 005		
Off	GOOD	ok	0x80 to 0x8E	_	_

Diagnostic information 302

Diagnostic behavior	N	leasured value sta	Device diagnosis		
(configurable)	Quality	Quality Substatus	Coding (hex)	Category (NE107)	(fixed assignment)
Alarm	BAD	Function check, local override	0x24 to 0x27	С	Function check
Warning	GOOD	Function check	0xBC to 0xBF	-	-

Diagnostic information 302 (device verification active) is output during internal or external Heartbeat verification.

- Signal status: Function check
- Choice of diagnostic behavior: alarm or warning (factory setting)

When Heartbeat verification starts, data logging is interrupted, the last valid measured value is output and the totalizers are stopped.

Diagnostic information	pertaining to th	he confiauration:	diaanostic nu	mber 400 to 599

Diagnostic behavior	M	leasured value st	Device diagnosis		
(configurable)	Quality	Quality Substatus	Coding (hex)	Category (NE107)	(fixed assignment)
Alarm	BAD	Process related	0x28 to 0x2B	F (Failure)	Invalid process condition
Warning	UNCERTA IN	Process related	0x78 to 0x7B	S (Out of specification)	Invalid process condition
Logbook entry only	GOOD	GOOD ok	0x80 to 0x8E		
Off	GOOD	UK .	OXOO TO OXOE	_	

Diagnostic information pertaining to the process: diagnostic number 800 to 999

Diagnostis hohovion	M	leasured value st	Device dia succia		
Diagnostic behavior (configurable)	Quality	Quality Substatus	Coding (hex)	Category (NE107)	Device diagnosis (fixed assignment)
Alarm	BAD	Process related	0x28 to 0x2B	F (Failure)	Invalid process condition
Warning	UNCERTA IN	Process related	0x78 to 0x7B	S (Out of specification)	Invalid process condition
Logbook entry only Off	GOOD	ok	0x80 to 0x8E	-	-

12.5 Overview of diagnostic information

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

12.5.1 Diagnostic of sensor

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
004	Sensor defective		1. Check plug connections	Calculated saturated
	Measured variable status		2. Change pre-amplifier 3. Change DSC sensor	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic i	information	Remedy instructions	Influenced measured
No.	Short text			variables
022	Temperature sensor defective		1. Check plug connections	Calculated saturated
			2. Change pre-amplifier 3. Change DSC sensor	steam pressure Density
	Quality	Bad		Energy flowHeat flow differenceMass flow
	Quality substatus	Maintenance alarm		
	Coding (hex)	0x24 to 0x27		Total mass flowPressure
	Status signal	F		Reynolds number
	Diagnostic behavior	Alarm		 Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature

	Diagnostic	information	Remedy instructions	Influenced measured
No.	s	hort text		variables
046	Sensor limit exceeded		1. Check plug connections	Calculated saturated
	Measured variable status		Change pre-amplifier Change DSC sensor	steam pressure Density
	Quality	Good		Energy flowFlow velocityHeat flow difference
	Quality substatus	Maintenance demanded		
	Coding (hex)	0xA8 to 0xAB		Low flow cut off optionMass flow
	Status signal	S		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
062	Sensor connection defective		1. Check plug connections	Calculated saturated
	Measured variable status		2. Change pre-amplifier 3. Change DSC sensor	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex) 0x24 to 0x27		Low flow cut off optionMass flow	
	Status signal	nal F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
082	Data storage		1. Change main electronic module	Calculated saturated
	Measured variable status		2. Change sensor	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
083	Memory content		1. Restart device	Calculated saturated
	Measured variable status	3. Change sensor		steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		Heat flow differenceLow flow cut off option
	Coding (hex)	0x24 to 0x27		 Mass flow
	Status signal	F		Total mass flow Switch output status
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
114	Sensor leaky		Change DSC sensor	Calculated saturated steam pressure
	Measured variable status			Density
	Quality	Bad		Energy flow
	Ovelity substatus	Maintananaa alama		Flow velocity
	Quality substatus	Maintenance alarm		Heat flow difference
	Coding (hex)	0x24 to 0x27		 Low flow cut off option Mass flow
	Status signal	F		 Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
122	Temperature sensor defective		1. Check plug connections	Calculated saturated
	Measured variable status [from the factory] 1)	2. Change pre-amplifier3. Change DSC sensor	steam pressure • Energy flow	
	Quality	Good		Heat flow differenceMass flow
	Quality substatus	Maintenance demanded		 Total mass flow
	Coding (hex)	0xA8 to 0xAB		Corrected volume flowSteam quality
	Status signal	M		Temperature
	Diagnostic behavior	Warning		

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

12.5.2 Diagnostic of electronic

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
242	Software incompatible		1. Check software	Calculated saturated
	Measured variable status		Flash or change main electronics module	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
252	Modules incompatible		Check electronic modules Change I/O or main electronic module	 Calculated saturated steam pressure
	Measured variable status		2. Change 1/0 of main electronic module	Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		Heat flow difference
-	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
261	Electronic modules		1. Restart device	Calculated saturated
	Meacured variable status		Check electronic modules Change I/O Modul or main electronics	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
262	Module connection		1. Check module connections	Calculated saturated
	Measured variable status		2. Change electronic modules	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
-	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow Social assets at the second at the secon
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	No. Short text			variables
270			Change main electronic module	Calculated saturated steam pressure
	Measured variable status			Density
	Quality	Bad		Energy flow
	Quality substatus	Maintenance alarm		Flow velocityHeat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
271	Main electronic failure		1. Restart device	Calculated saturated
	Measured variable status		2. Change main electronic module	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		 Low flow cut off option Mass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
272	Main electronic failure		1. Restart device	Calculated saturated
	Measured variable status		2. Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		 Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
273	Main electronic failure		1. Emergency operation via display	Calculated saturated
	Measured variable status		2. Change main electronics	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
-	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	No. Short text			variables
275	I/O module failure		Change I/O module	Calculated saturated
	Measured variable status			steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flowSwitch output status
	Diagnostic behavior	Alarm		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
276	I/O module failure		1. Restart device	Calculated saturated
	Measured variable status		 Low flow cut off of Mass flow Total mass flow 	-
	Quality	Bad		
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
277	Electronics defective		1. Change pre-amplifier	Calculated saturated
	Measured variable status		2. Change main electronic module	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
282	Data storage		1. Restart device	Calculated saturated
	Measured variable status		2. Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Io. Short text			variables
283	Memory content		1. Transfer data or reset device	Calculated saturated
	Measured variable status		2. Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocityHeat flow difference
	Quality substatus	Maintenance alarm		
	Coding (hex)	0x24 to 0x27		 Low flow cut off option Mass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
302	Device verification active		Device verification active, please wait.	 Calculated saturated steam pressure
	Measured variable status			Density
	Quality	Good		Energy flowFlow velocity
	Quality substatus	Function check		Heat flow difference
	Coding (hex)	0xBC to 0xBF		 Low flow cut off option Mass flow
	Status signal	С		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	Short text		variables
311			1. Transfer data or reset device	Calculated saturated
			2. Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
311	Electronic failure		Maintenance required!	Calculated saturated
	Monayand reminble status		Do not perform reset Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	M		Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	No. Short text			variables
350	Pre-amplifier defective	.1 (Change pre-amplifier	 Calculated saturated steam pressure
	Measured variable status [from the factory] 1)			Density
	Quality	Bad		■ Energy flow
	Quality substatus	Maintenance alarm		Flow velocityHeat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		 Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
351	Pre-amplifier defective		Change pre-amplifier	Calculated saturated
	Measured variable status			steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
370	Pre-amplifier defective		1. Check plug connections	Calculated saturated
	Measured variable status		Check cabel connection of remote version	steam pressure Density
	Quality	Bad	3. Change pre-amplifier or main electronic module	Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
371	Temperature sensor defective		1. Check plug connections	Calculated saturated
	Monayand reminble status I from the factory I		Change pre-amplifier Change DSC sensor	steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		Heat flow difference
	Coding (hex)	0x78 to 0x7B		 Low flow cut off option Mass flow
	Status signal	M		 Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

12.5.3 Diagnostic of configuration

	Diagnostic information		Remedy instructions	Influenced measured
No.	Jo. Short text			variables
410			1. Check connection	Calculated saturated
	Measured variable status		2. Retry data transfer	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		 Low flow cut off option Mass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

160

	Diagnostic information		Remedy instructions	Influenced measured variables
No.	Short text			variables
412	12 Processing Download		Download active, please wait	Calculated saturated steam pressure
	Measured variable status Quality Uncertain		Density	
			Energy flow	
	Quality substatus	Initial value		 Flow velocity Heat flow difference Low flow cut off option Mass flow
	Coding (hex)	0x4C to 0x4F		
	Status signal C	С		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
437	Configuration incompatible		1. Restart device	Calculated saturated
	Measured variable status		2. Contact service	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
438	Management variable status		Check data set file Check device configuration Up- and download new configuration	Calculated saturated steam pressureDensity
	Quality Quality substatus Coding (hex) Status signal Diagnostic behavior	Uncertain Maintenance demanded 0x68 to 0x6B M Warning		 Energy flow Flow velocity Heat flow difference Low flow cut off option Mass flow Total mass flow Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic	information	Remedy instructions	Influenced measured
No.	SI	hort text		variables
442	Frequency output		1. Check process	-
	Measured variable status [from the factory] 1)	2. Check frequency output settings		
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	S		
	Diagnostic behavior	Warning		

	Diagnostic information		Remedy instructions	Influenced measured variables
No.	S	hort text		
442	Frequency output		1. Check process	_
	Measured variable status	2. Check frequency output settings		
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	S		
	Diagnostic behavior	Warning		

	Diagnostic	information	Remedy instructions	Influenced measured
No.	S	hort text		variables
443	Pulse output		1. Check process	-
	Measured variable status [from the factory] $^{1)}$	2. Check pulse output settings		
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	S		
	Diagnostic behavior	Warning		

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	hort text		variables
443			1. Check process	-
	Measured variable status		2. Check pulse output settings	
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	S		
	Diagnostic behavior	Warning		

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
453	Flow override		Deactivate flow override	Calculated saturated storm programs
	Measured variable status			steam pressure Density
	Quality	Good		Energy flowFlow velocity
	Quality substatus	Function check		 Heat flow difference
	Coding (hex)	0xBC to 0xBF		Low flow cut off optionMass flow
	Status signal	C		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
482	FB not Auto/Cas		Set Block in AUTO mode	_
	Measured variable status			
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	F		
	Diagnostic behavior	Alarm		

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
484	Simulation failure mode		Deactivate simulation	Calculated saturated
	Measured variable status			steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Function check		 Heat flow difference
	Coding (hex)	0x3C to 0x3F		Low flow cut off optionMass flow
	Status signal	С		Total mass flowSwitch output status
	Diagnostic behavior	Alarm		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
485		Deactivate simulation	Calculated saturated steam pressure	
	Measured variable status			Density
	Quality	Good		Energy flowFlow velocityHeat flow difference
	Quality substatus	Function check		
	Coding (hex)	0xBC to 0xBF		• Low flow cut off option
	Status signal	С		 Mass flow Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

No.	Diagnostic information No. Short text		Remedy instructions	Influenced measured variables
492	Simulation frequency output Measured variable status		Deactivate simulation frequency output	Calculated saturated steam pressureEnergy flow
	Quality Quality substatus Coding (hex) Status signal Diagnostic behavior	Good Ok Ox80 to 0x83 C Warning		 Flow velocity Heat flow difference Low flow cut off option Mass flow Total mass flow Switch output status option Corrected volume flow Steam quality Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	Short text		variables
493	Simulation pulse output		Deactivate simulation pulse output	Calculated saturated
	Measured variable status			steam pressure • Energy flow
	Quality	Good		Flow velocityHeat flow difference
	Quality substatus	Ok		■ Low flow cut off option
	Coding (hex)	0x80 to 0x83		Mass flowTotal mass flow
	Status signal	С		 Switch output status
	Diagnostic behavior	Warning		option Corrected volume flow Steam quality Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
494	94 Switch output simulation		Deactivate simulation switch output	Calculated saturated
	Measured variable status			steam pressure • Energy flow
	Quality	Good		Flow velocityHeat flow difference
	Quality substatus	Function check		 Low flow cut off option
	Coding (hex)	0xBC to 0xBF		Mass flowTotal mass flow
	Status signal	С		Switch output status
	Diagnostic behavior	Warning		option Corrected volume flow Steam quality Temperature Volume flow

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
495	Simulation diagnostic event		Deactivate simulation	-
	Measured variable status			
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	С		
	Diagnostic behavior	Warning		

	Diagnostic i	information	Remedy instructions	Influenced measured
No.	Short text			variables
497	Simulation block output		Deactivate simulation	-
	Measured variable status			
	Quality	Good		
	Quality substatus	Ok		
	Coding (hex)	0x80 to 0x83		
	Status signal	С		
	Diagnostic behavior	Warning		

	Diagnostic information		Remedy instructions	Influenced measured
No.		Short text		variables
538	Flow computer configuration incorrect Measured variable status		Check input value (pressure, temperature)	Calculated saturated steam pressure
	Quality Quality substatus	Good Function check		 Density Energy flow Heat flow difference Low flow cut off option
	Coding (hex) Status signal	0xBC to 0xBF		 Mass flow Total mass flow Switch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
539	Flow computer configuration incorrect		1. Check input value (pressure,	Calculated saturated
	Measured variable status		temperature) 2. Check allowed values of the medium	steam pressure Density
	Quality	Bad	properties	Energy flowFlow velocity
	Quality substatus	Function check		 Heat flow difference
	Coding (hex)	0x3C to 0x3F		Low flow cut off optionMass flow
	Status signal	S		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	S	Short text		variables
540	Flow computer configuration	incorrect	Check entered reference value using the	Calculated saturated
	Measured variable status		document Operating Instructions	 steam pressure Density Energy flow Heat flow difference Low flow cut off option
	Quality	Good		
	Quality substatus	Function check		
	Coding (hex)	0xBC to 0xBF		Mass flowTotal mass flow
	Status signal	S		 Switch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
570	0 Inverted delta heat		Check configuration of mounting location	Heat flow difference
	Measured variable status		(parameter Installation direction)	
	Quality	Bad		
-	Quality substatus	Function check		
	Coding (hex)	0x3C to 0x3F		
	Status signal	F		
	Diagnostic behavior	Alarm		

12.5.4 Diagnostic of process

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
801	Supply voltage too low		Increase supply voltage	 Calculated saturated
	Measured variable status			steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
_	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		Total mass flowSwitch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
828	1		Increase ambient temperature of pre-	Calculated saturated
	Measured variable status [from the factory] 1)		amplifier	steam pressure Density
	Quality	Uncertain		■ Energy flow
	Quality substatus	Process related		Flow velocityHeat flow difference
	Coding (hex)	0x78 to 0x7B		 Low flow cut off option Mass flow
	Status signal	S		Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

168

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
829			Reduce ambient temperature of pre- amplifier	 Calculated saturated steam pressure Density
	Quality Quality substatus Coding (hex) Status signal	Uncertain Process related 0x78 to 0x7B		 Energy flow Flow velocity Heat flow difference Low flow cut off option Mass flow Total mass flow Switch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
832	1 3		Reduce ambient temperature	 Calculated saturated steam pressure
	Measured variable status [from	om the factory] 1)		Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		 Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
833	333 Electronic temperature too low Measured variable status [from the factory] 1)		Increase ambient temperature	Calculated saturated steam pressureDensity
	Quality Quality substatus	Uncertain Process related		Energy flowFlow velocityHeat flow difference
	Coding (hex)	0x78 to 0x7B		 Low flow cut off option Mass flow Total mass flow
	Status signal Diagnostic behavior	Warning		Switch output status optionPressure
				 Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
834	Process temperature too high		Reduce process temperature	Calculated saturated
	Measured variable status [fi	om the factory] 1)		steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		 Low flow cut off option Mass flow
	Status signal	S		 Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnostic	information	Remedy instructions	Influenced measured
No.	Short text			variables
835	Process temperature too low		Increase process temperature	Calculated saturated
	Measured variable status [from the factory] 1)		steam pressure Density	
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal S	S		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	o. Short text			variables
841	Flow velocity too high		Reduce flow velocity	Calculated saturated
	Measured variable status [from the factory] 1)			steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		Total mass flowSwitch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
842	Process limit		Low flow cut off active!	Calculated saturated
	Measured variable status		Check low flow cut off configuration	steam pressure Density
	Quality	Good		Energy flowFlow velocity
	Quality substatus	Ok		 Heat flow difference
	Coding (hex)	0x80 to 0x83		Low flow cut off optionMass flow
	Status signal	S		■ Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
844	Sensor range exceeded Measured variable status [from the factory] 1)		Reduce flow velocity	Calculated saturated steam pressure
	Quality Quality substatus Coding (hex) Status signal Diagnostic behavior	Uncertain Process related 0x78 to 0x7B S Warning		 Density Energy flow Flow velocity Heat flow difference Low flow cut off option Mass flow Total mass flow Switch output status option Pressure Reynolds number Specific volume
				 Corrected volume flow Steam quality Degrees of superheat Volume flow

¹⁾ Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

172

	Diagnostic	information	Remedy instructions	Influenced measured
No.	. Short text			variables
870	Measuring inaccuracy increas	ed	1. Check process	Calculated saturated
	Measured variable status [from the factory] 1)		2. Increase flow volume	steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.		Short text		variables
871	Near steam saturation limit Measured variable status [from the factory] 1)		Check process conditions	Calculated saturated steam pressureDensity
	Quality Quality substatus	Uncertain Process related		Energy flowHeat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flowTotal mass flow
	Status signal Diagnostic behavior	S Warning		 Switch output status option Pressure Reynolds number
				Specific volumeCorrected volume flowSteam qualityDegrees of superheat

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnostic i	information	Remedy instructions	Influenced measured
No.	SI	nort text		variables
872	Wet steam detected		1. Check process	■ Energy flow
	Measured variable status [fro	om the factory] 1)		 Heat flow difference Low flow cut off option Total mass flow Switch output status option Corrected volume flow Steam quality
	Quality	Uncertain		
	Quality substatus	Process related		
	Coding (hex)	0x78 to 0x7B		
	Status signal	S		1 5
	Diagnostic behavior	Warning		

1) Diagnostic behavior can be changed. This causes the overall status of the measured variable to change.

	Diagnos	ic information	Remedy instructions	Influenced measured
No.		Short text		variables
873	Water detected		Check process (water in piping)	Calculated saturated
	Measured variable status [from the factory] 1)			steam pressure Density
	Quality	Uncertain		Energy flowHeat flow difference
	Quality substatus	Process related		■ Low flow cut off option
	Coding (hex)	0x78 to 0x7B		Mass flowTotal mass flow
	Status signal	S		Switch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat

	Diagnostic	information	Remedy instructions	Influenced measured
No.	S	hort text		variables
874	X% spec invalid		1. Check pressure, temperature	Calculated saturated
	Measured variable status		Check flow velocity Check for flow fluctuation	steam pressure Density
	Quality	Uncertain		Energy flowHeat flow difference
	Quality substatus	Process related		 Low flow cut off option
	Coding (hex)	0x78 to 0x7B		Mass flowTotal mass flow
	Status signal	S		Switch output status
	Diagnostic behavior	Warning		option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat

	Diagnostic information		Remedy instructions	Influenced measured
No.	. Short text			variables
882	Input signal		1. Check input configuration	Calculated saturated
	Measured variable status		Check external device or process conditions	steam pressure Density
	Quality	Bad		Energy flowFlow velocity
	Quality substatus	Maintenance alarm		 Heat flow difference
	Coding (hex)	0x24 to 0x27		Low flow cut off optionMass flow
	Status signal	F		■ Total mass flow
	Diagnostic behavior	Alarm		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Temperature Volume flow

Diagnostic information			Remedy instructions	Influenced measured
No.	Short text			variables
945	Sensor range exceeded		Check immediately process conditions (pressure-temperature rating)	Calculated saturated
	Measured variable status [from the factory] 1)			steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

	Diagnostic information		Remedy instructions	Influenced measured
No.	Short text			variables
946	Vibration detected		Check installation	 Calculated saturated
	Measured variable status			steam pressure Density
	Quality	Uncertain		Energy flowFlow velocity
	Quality substatus	Process related		 Heat flow difference
	Coding (hex)	0x78 to 0x7B		Low flow cut off optionMass flow
	Status signal	S		 Total mass flow
	Diagnostic behavior	Warning		 Switch output status option Pressure Reynolds number Specific volume Corrected volume flow Steam quality Degrees of superheat Volume flow

Diagnostic information		Remedy instructions	Influenced measured	
No.	Short text			variables
947	Vibration exceeded Measured variable status [fr	om the factory] ¹⁾	Check installation	Calculated saturated steam pressureDensity
	Quality Quality substatus Coding (hex) Status signal Diagnostic behavior	Uncertain Process related 0x78 to 0x7B S Alarm		 Energy flow Flow velocity Heat flow difference Low flow cut off option Mass flow Total mass flow Switch output status option Pressure Reynolds number Specific volume Corrected yolume flow
				Steam qualityDegrees of superheatVolume flow

No.	Diagnostic information No. Short text		Remedy instructions	Influenced measured variables
972	Degrees of superheat limit exceeded		1. Controll process conditions	Calculated saturated steam pressureDensity
	Measured variable status [from the factory] 1)		2. Install pressure transmitter or enter correct fixed pressure value	
	Quality	Uncertain	_	Energy flowHeat flow difference
	Quality substatus	Process related		■ Low flow cut off option
	Coding (hex)	0x78 to 0x7B		Mass flowTotal mass flow
	Status signal	S		Switch output status
	Diagnostic behavior	Warning		option Reynolds number Corrected volume flow Steam quality

Diagnostic behavior can be changed. This causes the overall status of the measured variable to change. 1)

Operating conditions for displaying the following diagnostics 12.5.5 information

- Operating conditions for displaying the following diagnostics information:
 - 871 Near steam saturation limit diagnostic message: The process temperature is less than 2K from the saturated steam line.
 - Diagnostics information 872: The measured steam quality has dropped below the configured limit value for the steam quality (limit value: Expert \rightarrow System
 - \rightarrow Diagnostic handling \rightarrow Diagnostic limits \rightarrow Steam quality limit).
 - Diagnostics information 873: The process temperature is ≤ 0 °C.
 - Diagnostics information 972: The degree of superheat has exceeded the configured limit value (limit value: Expert \rightarrow System \rightarrow Diagnostic handling \rightarrow Diagnostic limits → Degrees of superheat limit).

Emergency mode in event of temperature compensation

- Change temperature measurement: PT1+PT2 to the PT1 option, PT2 option or the Off option.
 - └ If the **Off** option is selected, the measuring device calculates by using the fixed process pressure.

176

12.6 Pending diagnostic events

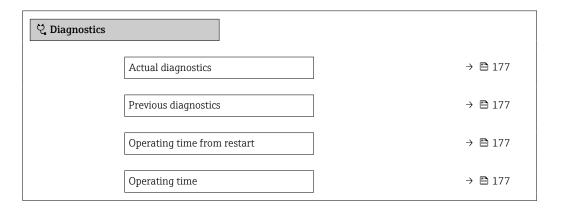
The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

- i
 - To call up the measures to rectify a diagnostic event:
 - Via local display →

 142
 - Via "FieldCare" operating tool → 🖺 144
 - Via "DeviceCare" operating tool → 🗎 144
- Other pending diagnostic events can be displayed in the **Diagnostic list** submenu $\rightarrow \stackrel{\cong}{=} 177$

Navigation

"Diagnostics" menu



Parameter overview with brief description

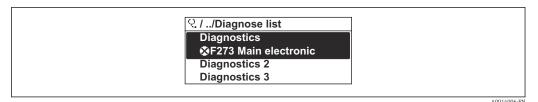
Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.
		If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	
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)

12.7 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

 $Diagnostics \rightarrow Diagnostic list$



■ 23 Taking the example of the local display

To call up the measures to rectify a diagnostic event:

- Via local display \rightarrow 🗎 142
- Via "FieldCare" operating tool → 🗎 144
- Via "DeviceCare" operating tool →

 144

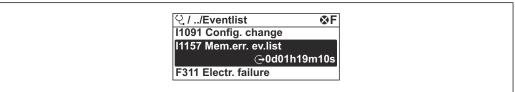
12.8 Event logbook

12.8.1 Reading out the event logbook

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

Navigation path

Diagnostics menu → **Event logbook** submenu → Event list



A0014008-F7

■ 24 Taking the example of the local display

- A maximum of 20 event messages can be displayed in chronological order.
- If the **Extended HistoROM** application package (order option) is enabled in the device, the event list can contain up to 100 entries .

The event history includes entries for:

- Diagnostic events → 🖺 147
- Information events → 🖺 179

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 local display →

 142
 - Via "FieldCare" operating tool → 🖺 144
- For filtering the displayed event messages $\rightarrow \triangleq 178$

12.8.2 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 \rightarrow Event logbook \rightarrow Filter options

Filter categories

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

12.8.3 Overview of information events

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

Info number	Info name
I1000	(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Trend data deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
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
I1227	Sensor emergency mode activated
I1228	Sensor emergency mode failed
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1459	Failed: I/O module verification
I1461	Failed: Sensor verification
I1512	Download started
I1513	Download finished

Info number	Info name
I1514	Upload started
I1515	Upload finished
I1552	Failed: Main electronic verification
I1553	Failed: Pre-amplifier verification

12.9 Resetting the measuring device

Using the **Device reset** parameter ($\rightarrow \boxminus 115$) it is possible to reset the entire device configuration or some of the configuration to a defined state.

12.9.1 Function scope of the "Device reset" parameter

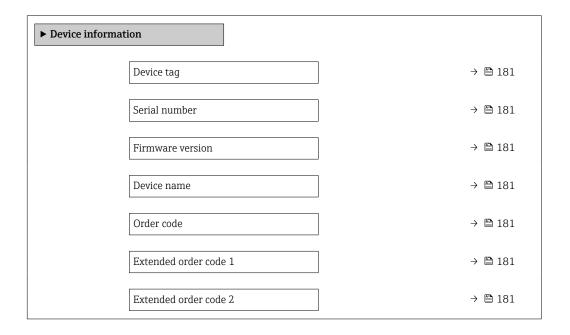
Options	Description	
Cancel	No action is executed and the user exits the parameter.	
To fieldbus defaults	Every parameter is reset to fieldbus default values.	
To factory defaults	Every parameter is reset to its factory setting.	
To delivery settings	Every parameter for which a customer-specific default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

12.10 Device information

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

Navigation

"Diagnostics" menu \rightarrow Device information



Extended order code 3	→ 🖺 181
ENP version	→ 🗎 181

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. @, %, /).	Prowirl 200 PA
Serial number	Shows the serial number of the measuring device.	Max. 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.	Prowirl 200 PA
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	2.02.00
PROFIBUS ident number	Displays the PROFIBUS identification number.	0 to FFFF	0x1564
Status PROFIBUS Master Config	Displays the status of the PROFIBUS Master configuration.	ActiveNot active	Not active

12.11 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
01.2018	01.01.zz	Option 73	 No need to restart device after parameter download Additional process variables: Pressure Degree of overheating Specific volume Process variables interconnectable with local display and data logger (trend) Additional AI channels: Pressure Degree of overheating Specific volume Density Reynolds number Verification progress is displayed (0-100%) New Wet Steam Measurement application package Operation in steam simplified More robust signal processing in event of low flow rates in wet steam 	Operating Instructions	BA01689D/06/EN/01.18

- 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:
 - \blacksquare In the Download Area of the Endress+Hauser web site: www.endress.com \to Downloads
 - Specify the following details:
 - Product root: e.g. 7F2C
 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

NOTICE

The use of unsuitable equipment or cleaning liquids can damage the transducer.

▶ Do not use pigs to clean the pipe.

13.1.3 Replacing seals

Replacing sensor seals

NOTICE

Seals in contact with fluid must always be replaced!

▶ Only Endress+Hauser sensor seals may be used: replacement seals

Replacing housing seals

NOTICE

When using the device in a dusty atmosphere:

- only use the associated Endress+Hauser housing seals.
- 1. Replace defect seals only with original seals from Endress+Hauser.
- 2. The housing seals must be clean and undamaged when inserted into their grooves.
- 3. Dry, clean or replace the seals if necessary.

13.2 Measuring and test equipment

Endress+Hauser offers a variety of measuring and testing equipment, such as Netilion or device tests.

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

List of some of the measuring and testing equipment: $\rightarrow \implies 188$

13.3 Endress+Hauser services

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

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

14 Repair

14.1 General notes

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 conversion of a measuring device, observe the following notes:

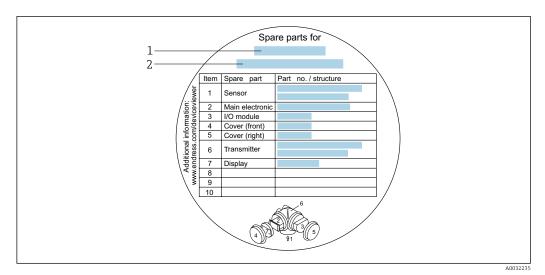
- ▶ Use only original Endress+Hauser spare parts.
- ► Carry out the repair according to the Installation Instructions.
- ▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶ Document all repairs and conversions and enter the details in Netilion Analytics.

14.2 Spare parts

Some interchangeable measuring device components are listed on an overview sign in the connection compartment cover.

The spare part overview sign contains the following information:

- A list of the most important spare parts for the measuring device, including their ordering information.
- The URL to the *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.



■ 25 Example for "Spare part overview sign" in connection compartment cover

- 1 Measuring device name
- 2 Measuring device serial number
- Measuring device serial number:
 - Is located on the device nameplate and the spare part overview sign.
 - Can be read out via the Serial number parameter (→

 181) 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 requirements for safe device return can vary depending on the device type and national legislation.

- 1. Refer to the web page for information: https://www.endress.com/support/return-material
 - ► Select the region.
- 2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

14.5 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

14.5.1 Removing the measuring device

1. Switch off the device.

A WARNING

Danger to persons from process conditions!

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

MARNING

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

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

Observe the following notes during disposal:

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

15 Accessories

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

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Prowirl 200 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: Approvals Output, input Display/operation Housing Software Installation Instructions EA01056D (Order number: 7X2CXX)
Remote display FHX50	FHX50 housing for accommodating a display module . FHX50 housing suitable for: SD02 display module (push buttons) SD03 display module (touch control) Length of connecting cable: up to max. 60 m (196 ft) (cable lengths available for order: 5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft))
	The measuring instrument can be ordered with the FHX50 housing and a display module. The following options must be selected in the separate order codes: Order code for measuring instrument, feature 030: Option L or M "Prepared for FHX50 display" Order code for FHX50 housing, feature 050 (device version): Option A "Prepared for FHX50 display" Order code for FHX50 housing, depends on the desired display module in feature 020 (display, operation): Option C: for an SD02 display module (push buttons) Option E: for an SD03 display module (touch control)
	The FHX50 housing can also be ordered as a retrofit kit. The measuring instrument display module is used in the FHX50 housing. The following options must be selected in the order code for the FHX50 housing: Feature 050 (measuring instrument version): option B "Not prepared for FHX50 display" Feature 020 (display, operation): option A "None, existing displayed used" Special Documentation SD01007F (Order number: FHX50)
Overvoltage protection for 2-wire devices	Ideally, the overvoltage protection module should be ordered directly with the device. See product structure, feature 610 "Accessory mounted", option NA "Overvoltage protection". Separate order necessary only if retrofitting. OVP10: For 1-channel devices (feature 020, option A): OVP20: For 2-channel devices (feature 020, options B, C, E or G) Special Documentation SD01090F
	(Order number OVP10: 71128617) (Order number OVP20: 71128619)

Accessories	Description
Protective cover	The protective cover is used to protect against direct sunlight, precipitation and ice. It can be ordered together with the device via the product structure: Order code for "Accessories enclosed" option PB "Protective cover" Special Documentation SD00333F (Order number: 71162242)
Transmitter holder (pipe mounting)	To secure the remote version to the pipe DN 20 to 80 (3/4 to 3") Order code for "Accessory enclosed", option PM

15.1.2 For the sensor

Accessories	Description
Mounting set	Mounting set for disc (wafer version) comprising: Tie rods Seals Nuts Washers Installation Instructions EA00075D (Order number: DK7D)
Flow conditioner	Is used to shorten the necessary inlet run. (Order number: DK7ST) Dimensions of flow conditioner

15.2 Service-specific accessories

Accessories	Description	
Applicator	Software for selecting and sizing Endress+Hauser measuring instruments: Choice of measuring instruments for industrial requirements Calculation of all the necessary data for identifying the optimum flowmete e.g. nominal diameter, pressure loss, flow velocity and accuracy. Graphic display of the calculation results Determination of the partial order code, administration, documentation ar access to all project-related data and parameters over the entire life cycle of a project.	
	Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator	
Netilion	lloT ecosystem: Unlock knowledge With the Netilion IIoT ecosystem,Endress+Hauser allows you to optimize your plant performance, digitize workflows, share knowledge, and enhance collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, and reliability - ultimately resulting in a more profitable plant. www.netilion.endress.com	
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all intelligent 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. Operating Instructions BA00027S and BA00059S	
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S	

15.3 System components

Accessories	Description	
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the releval 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.	
	 Technical Information TI00133R Operating Instructions BA00247R 	

16 Technical data

16.1 Application

The measuring device is intended for the flow measurement of liquids, gas and steam.

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 sufficiently resistant.

16.2 Function and system design

Measuring principle

Vortex meters work on the principle of the Karman vortex street.

Measuring system

The device consists of a transmitter and a sensor.

Two device versions are available:

- Compact version transmitter and sensor form a mechanical unit.
- Remote version transmitter and sensor are mounted in separate locations.

For information on the structure of the measuring instrument $\rightarrow \implies 12$

16.3 Input

Measured variable

Direct measured variables

Order code for "Sensor version; DSC sensor; measuring tube"			
Option	Description Measured variable		
AA	Volume; 316L; 316L	Volume flow	
BA	Volume high-temperature; 316L; 316L		

Order code for "Sensor version; DSC sensor; measuring tube"		
Option	Description Measured variable	
CA	Mass; 316L; 316L (integrated temperature measurement)	Volume flowTemperature

Calculated measured variables

Order code for "Sensor version; DSC sensor; measuring tube"			
Option	Description	Measured variable	
AA	Volume; 316L; 316L	Under constant process conditions:	
BA	Volume high-temperature; 316L; 316L	 Mass flow ¹⁾ Corrected volume flow 	
		The totalized values for: Volume flow Mass flow Corrected volume flow	

A fixed density must be entered for calculating the mass flow (Setup menu → Advanced setup submenu →
 External compensation submenu → Fixed density parameter).

Order code for "Sensor version; DSC sensor; measuring tube"			
Option	Description	Measured variable	
CA	Mass; 316L; 316L (integrated temperature measurement)	 Corrected volume flow Mass flow Calculated saturated steam pressure Energy flow Heat flow difference Specific volume Degrees of superheat 	

Order code for "Sensor version; DSC sensor; measuring tube"			
Option	Description	Measured variable	
AA	Volume; 316L; 316L	Under constant process conditions:	
AB	Volume; Alloy C22; 316L	Mass flow 1) Corrected volume flow	
AC	Volume; Alloy C22; Alloy C22	The totalized values for:	
BA	Volume high-temperature; 316L; 316L	Volume flow Mass flow	
BB	Volume high-temperature; Alloy C22; 316L	Corrected volume flow	

A fixed density must be entered for calculating the mass flow (Setup menu → Advanced setup submenu → External compensation submenu → Fixed density parameter).

Order code for "Sensor version; DSC sensor; measuring tube"			
Option	Description	Measured variable	
CA	Mass; 316L; 316L (integrated temperature measurement)	Corrected volume flow	
СВ	Mass; Alloy C22; 316L (integrated temperature measurement)	Mass flowCalculated saturated steam pressureEnergy flow	
CC	Mass; Alloy C22; Alloy C22 (integrated temperature measurement)	Heat flow differenceSpecific volumeDegrees of superheat	

Measuring range

The measuring range is dependent on the nominal diameter, the fluid and environmental influences.



The following specified values are the largest possible flow measuring ranges (Q_{min} to Q_{max}) for each nominal diameter. Depending on the fluid properties and environmental influences, the measuring range may be subject to additional restrictions. Additional restrictions apply to both the lower range value and the upper range value.

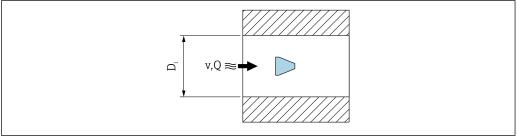
Flow measuring ranges in SI units

DN [mm]	Liquids [m³/h]	Gas/steam [m³/h]
15	0.06 to 4.9	0.3 to 25
25	0.18 to 15	0.9 to 125
40	0.45 to 37	2.3 to 308
50	0.75 to 62	3.8 to 821
80	1.7 to 138	8.5 to 1843
100	2.9 to 239	15 to 3 192
150	6.7 to 545	33 to 7262

Flow measuring ranges	in	US	units
-----------------------	----	----	-------

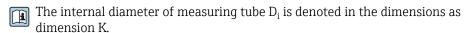
DN	Liquids	Gas/steam
[in]	[ft³/min]	[ft³/min]
1/2	0.035 to 2.9	0.18 to 15
1	0.11 to 8.8	0.54 to 74
1½	0.27 to 22	1.3 to 181
2	0.44 to 36	2.2 to 483
3	1 to 81	5 to 1085
4	1.7 to 140	8.7 to 1879
6	3.9 to 320	20 to 4272

Flow velocity



A003346

- *D_i* Internal diameter of measuring tube (corresponds to dimension K)
- v Velocity in mating pipe
- Q Flow



$$v [m/s] = \frac{4 \cdot Q [m^{3}/h]}{\pi \cdot D_{i} [m]^{2}} \cdot \frac{1}{3600 [s/h]}$$
$$v [ft/s] = \frac{4 \cdot Q [ft^{3}/min]}{\pi \cdot D_{i} [ft]^{2}} \cdot \frac{1}{60 [s/min]}$$

A0034301

Lower range value

Reynolds number

A restriction applies to the lower range value due to the turbulent flow profile, which only occurs with Reynolds numbers greater than 5 000. The Reynolds number is dimensionless and indicates the ratio of the inertia force of a fluid to its viscous force when flowing and is used as a characteristic variable for pipe flows. In the case of pipe flows with Reynolds numbers less than 5 000, periodic vortices are no longer generated and flow rate measurement is no longer possible.

The Reynolds number is calculated as follows:

$$Re = \frac{4 \cdot Q [m^3/s] \cdot \rho [kg/m^3]}{\pi \cdot D_i [m] \cdot \mu [Pa \cdot s]}$$

$$Re = \frac{4 \cdot Q [ft^3/s] \cdot \rho [lbm/ft^3]}{\pi \cdot D_i [ft] \cdot \mu [lbf \cdot s/ft^2]}$$

Δ003429

Re Reynolds number

Q Flow

 D_i Internal diameter of measuring tube (corresponds to dimension K)

μ Dynamic viscosity

ρ Density

The Reynolds number 5 000, together with the density and viscosity of the fluid and the nominal diameter, is used to calculate the corresponding flow rate.

$$Q_{Re-5000} [m^{3}/h] = \frac{5000 \cdot \pi \cdot D_{i} [m] \cdot \mu [Pa \cdot s]}{4 \cdot \rho [kg/m^{3}]} \cdot 3600 [s/h]$$

$$Q_{Re-5000} [ft^{3}/h] = \frac{5000 \cdot \pi \cdot D_{i} [ft] \cdot \mu [lbf \cdot s/ft^{2}]}{4 \cdot \rho [lbm/ft^{3}]} \cdot 60 [s/min]$$

A0034302

 $Q_{Re=5000}$ Flow rate is dependent on the Reynolds number

 D_i Internal diameter of measuring tube (corresponds to dimension K)

μ Dynamic viscosity

ρ Density

Minimum measurable flow velocity based on signal amplitude

The measuring signal must have a certain minimum signal amplitude so that the signals can be evaluated without any errors. Using the nominal diameter, the corresponding flow can also be derived from this amplitude.

The minimum signal amplitude depends on the setting for the sensitivity of the DSC sensor, the steam quality \mathbf{x} and the force of the vibrations present \mathbf{a} .

The value \mathbf{mf} corresponds to the lowest measurable flow velocity without vibration (no wet steam) for a density of 1 kg/m³ (0.0624 lbm/ft³).

The value \mathbf{mf} can be set in the range of 20 to 6 m/s (6 to 1.8 ft/s) (factory setting 12 m/s (3.7 ft/s)) with the **Sensitivity** parameter (value range 1 to 9, factory setting 5).

$$v_{\text{AmpMin}} \text{ [m/s]} = \max \begin{cases} \frac{mf \text{ [m/s]}}{x^2 \cdot \sqrt{\frac{\rho \text{ [kg/m^3]}}{1 \text{ [kg/m^3]}}}} \\ \frac{\sqrt{50 \text{ [m]} \cdot \text{a [m/s^2]}}}{x^2} \end{cases}$$

$$v_{\text{AmpMin}} \text{ [ft/s]} = \max \begin{cases} \frac{mf \text{ [ft/s]}}{x^2 \cdot \sqrt{\frac{\rho \text{ [lbm/ft^3]}}{0.0624 \text{ [lbm/ft^3]}}}} \\ \frac{\sqrt{164 \text{ [ft]} \cdot \text{a [ft/s^2]}}}{x^2} \end{cases}$$

A0034303

 v_{AmpMin} Minimum measurable flow velocity based on signal amplitude

mf Sensitivity
x Steam quality
p Density

Minimum measurable flow rate based on signal amplitude

$$Q_{\text{AmpMin}} [m^3/h] = \frac{v_{\text{AmpMin}} [m/s] \cdot \pi \cdot (D_i [m])^2}{4} \cdot 3600 [s/h]$$

$$Q_{\text{AmpMin}} [ft^3/\text{min}] = \frac{v_{\text{AmpMin}} [ft/s] \cdot \pi \cdot (D_i [ft])^2}{4} \cdot 60 [s/\text{min}]$$

A003430

 Q_{AmpMin} Minimum measurable flow rate based on signal amplitude

 v_{AmpMin} Minimum measurable flow velocity based on signal amplitude

D_i Internal diameter of measuring tube (corresponds to dimension *K*)

ρ Density

Effective lower range value

The effective lower range value Q_{Low} is determined using the largest of the three values Q_{min} , $Q_{Re=5000}$ and Q_{AmpMin} .

$$\begin{split} Q_{\text{Low}} \left[m^3 / h \right] &= max \; \left\{ \begin{array}{c} Q_{\text{min}} \left[m^3 / h \right] \\ Q_{\text{Re-5000}} \left[m^3 / h \right] \\ Q_{\text{AmpMin}} \left[m^3 / h \right] \\ \\ Q_{\text{Low}} \left[ft^3 / min \right] &= max \; \left\{ \begin{array}{c} Q_{\text{min}} \left[ft^3 / min \right] \\ Q_{\text{Re-5000}} \left[ft^3 / min \right] \\ Q_{\text{AmpMin}} \left[ft^3 / min \right] \\ \end{array} \right. \end{split}$$

A0034313

 Q_{Low} Effective lower range value Q_{min} Minimum measurable flow rate

 $Q_{Re=5000}$ Flow rate is dependent on the Reynolds number

 Q_{AmpMin} Minimum measurable flow rate based on signal amplitude



The Applicator is available for calculation purposes.

Upper range value

Maximum measurable flow rate based on signal amplitude

The measuring signal amplitude must be below a certain limit value to ensure that the signals can be evaluated without error. This results in a maximum permitted flow rate Q_{AmpMax} .

$$Q_{\text{AmpMax}} [\text{m}^3/\text{h}] = \frac{\text{URV} [\text{m/s}] \cdot \pi \cdot D_{\text{i}} [\text{m}]^2}{4 \cdot \sqrt{\frac{\rho [\text{kg/m}^3]}{1 [\text{kg/m}^3]}}} \cdot 3600 [\text{s/h}]$$

$$Q_{\text{AmpMax}}\left[ft^3/\text{min}\right] = \frac{\text{URV}\left[ft/s\right] \cdot \pi \cdot D_{_{i}}\left[ft\right]^2}{4 \cdot \sqrt{\frac{\rho\left[lbm/ft^3\right]}{0.0624\left[lbm/ft^3\right]}}} \cdot 60 \left[s/\text{min}\right]$$

A003/31/

 Q_{AmpMax} Maximum measurable flow rate based on signal amplitude

 D_i Internal diameter of measuring tube (corresponds to dimension K)

ρ Density

URV Limit value for determining the maximum flow rate:

■ DN 15 to 40: URV = 350

• DN 50 to 300: URV = 600

■ NPS ½ to 1½: URV = 1148

• NPS 2 to 12: URV = 1969

Restricted upper range value is dependent on Mach number

For gas applications, an additional restriction applies to the upper range value with regard to the Mach number in the measuring instrument, which must be less than 0.3. The Mach number Ma describes the ratio of the flow velocity v to the sound velocity c in the fluid.

$$Ma = \frac{v [m/s]}{c [m/s]}$$

$$Ma = \frac{v [ft/s]}{c [ft/s]}$$

A00343

Ma Mach number

v Flow velocity

c Speed of sound

The corresponding flow rate can be derived using the nominal diameter.

$$Q_{Ma=0.3} [m^3/h] = \frac{0.3 \cdot c [m/s] \cdot \pi \cdot D_i [m]^2}{4} \cdot 3600 [s/h]$$

$$Q_{Ma=0.3} [ft^{3}/min] = \frac{0.3 \cdot c [ft/s] \cdot \pi \cdot D_{_{i}} [ft]^{2}}{4} \cdot 60 [s/min]$$

A003433

 $Q_{Ma=0.3}$ Restricted upper range value is dependent on Mach number

c Speed of sound

 D_i Internal diameter of measuring tube (corresponds to dimension K)

ρ Density

Effective upper range value

The effective upper range value Q_{High} is determined using the smallest of the three values Q_{max} , Q_{AmpMax} and $Q_{Ma=0.3}$.

$$\begin{split} Q_{\text{High}} \left[m^3/h \right] &= min \; \begin{cases} &Q_{\text{max}} \left[m^3/h \right] \\ &Q_{\text{AmpMax}} \left[m^3/h \right] \\ &Q_{\text{Ma} = 0.3} \left[m^3/h \right] \end{cases} \\ Q_{\text{Ma}} \left[ft^3/min \right] &= min \; \begin{cases} &Q_{\text{max}} \left[ft^3/min \right] \\ &Q_{\text{AmpMax}} \left[ft^3/min \right] \\ &Q_{\text{Ma} = 0.3} \left[ft^3/min \right] \end{cases} \end{split}$$

A003433

Q_{Hiqh} Effective upper range value

Q_{max} Maximum measurable flow rate

 Q_{AmpMax} Maximum measurable flow rate based on signal amplitude

 $Q_{Ma=0.3}$ Restricted upper range value is dependent on Mach number

For liquids, the occurrence of cavitation may also restrict the upper range value.

The Applicator is available for calculation purposes.

Operable flow range

The value, which is typically up to 49: 1, may vary depending on the operating conditions (ratio between upper range value and lower range value)

Input signal

External measured values

To increase the measurement accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring instrument:

- Operating pressure to increase measurement accuracy (Endress+Hauser recommends the use of a pressure measuring instrument for absolute pressure, e.g. Cerabar M or Cerabar S)
- Medium temperature to increase measurement accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow



- Various pressure measuring devices can be ordered as accessories from Endress+Hauser.
- If using pressure measuring devices, pay attention to outlet runs when installing external devices → 🖺 23.

If the device does not have temperature compensation, it is recommended that external pressure measurement values be read in so that the following measured variables can be calculated:

- Energy flow
- Mass flow
- Corrected volume flow

Digital communication

The measured values are written from the automation system to the measuring instrument via PROFIBUS PA.

16.4 Output

Output signal

Pulse/frequency/switch output

Function	Can be configured as pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	■ DC 35 V ■ 50 mA
Voltage drop	For ≤ 2 mA: 2 VFor 10 mA: 8 V
Residual current	≤ 0.05 mA
Pulse output	
Pulse width	Configurable: 5 to 2 000 ms
Maximum pulse rate	100 Impulse/s
Pulse value	Configurable
Assignable measured variables	 Mass flow Volume flow Corrected volume flow Total mass flow Energy flow Heat flow difference
Frequency output	
Output frequency	Configurable: 0 to 1000 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1

Assignable measured variables	Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure Total mass flow Energy flow Heat flow difference Pressure
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	 Off On Diagnostic behavior Limit value Volume flow Corrected volume flow Mass flow Flow velocity Temperature Calculated saturated steam pressure Total mass flow Energy flow Heat flow difference Pressure Reynolds number Totalizer 1-3 Status Status of low flow cut off

PROFIBUS PA

PROFIBUS PA	In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
Data transmission	31.25 kbit/s
Current consumption	16 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

Signal on alarm

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

Pulse/frequency/switch output

Pulse output		
Failure mode	No pulses	
Frequency output		
Failure mode	Choose from: Actual value O Hz Definable value between: 0 to 1250 Hz	

198

Switch output	
Failure mode	Choose from: Current status Open Closed

PROFIBUS PA

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
Failure current FDE (Fault Disconnection Electronic)	0 mA

Local display

Plain text display	With information on cause and remedial measures
Backlight	Additionally for device version with SD03 local display: red lighting indicates a device error.



Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication: PROFIBUS PA
- Via service interface Endress+Hauser Common Data Interface (CDI)

Plain text display	With information on cause and remedial measures	

Low flow cut off

The switch points for low flow cut off are preset and can be configured.

Galvanic isolation

All inputs and outputs are galvanically isolated from one another.

Protocol-specific data

Manufacturer ID	0x11	
Ident number	0x1564	
Profile version	3.02	
Device description files (GSD, DTM, DD)	Information and files at: ■ www.endress.com → Download Area ■ https://www.profibus.com	
Supported functions	 Identification & Maintenance Simple device identification via control system and nameplate PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download Condensed Status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur 	

Configuration of the device address	 DIP switches on the I/O electronics module Local display Via operating tools (e.g. FieldCare) 	
System integration	For information on system integration, see $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
	 Cyclic data transmission Block model Description of the modules 	

16.5 Power supply

Terminal assignment	→ 🗎 32
Available device plugs	→ 🖺 32

Supply voltage

Transmitter

An external power supply is required for each output.

The following supply voltage values apply for the outputs available:

Supply voltage for a compact version without a local display 1)

Order code for "Output; input"	Minimum terminal voltage ²⁾	Maximum Terminal voltage
Option G : PROFIBUS PA, pulse/frequency/switch output	≥ DC 9 V	DC 32 V

- 1) In event of external supply voltage of the PROFIBUS DP/PA coupler
- 2) The minimum terminal voltage increases if local operation is used: see the following table

Increase of minimum terminal voltage with local operation

Order code for "Display; operation"	Increase in minimum Terminal voltage
Option C : Local operation SD02	+ DC 1 V
Option E: Local operation SD03 with lighting (backlighting not used)	+ DC 1 V
Option E: Local operation SD03 with lighting (backlighting used)	+ DC 3 V

Power consumption

Transmitter

Order code for "Output; input"	Maximum power consumption
Option G: PROFIBUS PA, pulse/frequency/switch output	 Operation with output 1: 512 mW Operation with output 1 and 2: 2512 mW

Current consumption

20 to 55.56 mA

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 pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

→ 🖺 35

Potential equalization

→ 🖺 41

Terminals

- For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- For device version with integrated overvoltage protection: screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)

Cable entries



The type of cable entry available depends on the specific device version.

Cable gland (not for Ex d)

 $M20 \times 1.5$

Thread for cable entry

- NPT ½"
- G ½"
- M20 × 1.5

Cable specification

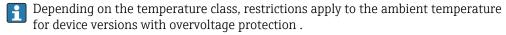
→ 🖺 30

Overvoltage protection

The device can be ordered with integrated overvoltage protection: Order code for "Accessory mounted", option NA "Overvoltage protection"

Input voltage range	Values correspond to supply voltage specifications $\rightarrow $
Resistance per channel	$2 \cdot 0.5 \Omega$ max.
DC sparkover voltage	400 to 700 V
Trip surge voltage	< 800 V
Capacitance at 1 MHz	< 1.5 pF
Nominal discharge current (8/20 μs)	10 kA
Temperature range	−40 to +85 °C (−40 to +185 °F)

1) The voltage is reduced by the amount of the internal resistance $I_{min} \cdot R_i$



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

16.6 Performance characteristics

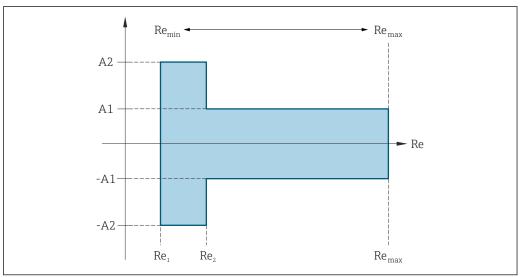
Reference operating conditions

- Error limits following ISO/DIN 11631
- +20 to +30 °C (+68 to +86 °F)
- 2 to 4 bar (29 to 58 psi)
- Calibration system traceable to national standards
- Calibration with the process connection corresponding to the particular standard

Maximum measurement error

Base accuracy

o.r. = of reading



A0034077

Reynolds numbers	Incompressible	Compressible	
Reynolus numbers	Standard	Standard	
Re ₁	5 000		
Re ₂	20 000		

Volume flow

Medium type		Incompressible	Compressible 1)
Reynolds number range Measurement error		Standard	Standard
Re ₁ to Re ₂	A2	< 10 %	< 10 %
Re ₂ to Re _{max}	A1	< 0.75 %	< 1.0 %

1) Accuracy specifications valid up to 75 m/s (246 ft/s)

Temperature

- Saturated steam and liquids at room temperature if T > 100 $^{\circ}$ C (212 $^{\circ}$ F) applies: < 1 $^{\circ}$ C (1.8 $^{\circ}$ F)
- Gas: < 1 % o.r. [K]

Rise time 50 % (stirred under water, following IEC 60751): 8 s

202

Mass flow saturated steam

Process pressure [bar abs.]	Flow velocity [m/s (ft/s)]	Reynolds number range	Measurement error	Standard
> 4.76	20 to 50 (66 to 164)	Re ₂ to Re _{max}	A1	< 1.7 %
> 3.62	10 to 70 (33 to 230)	Re ₂ to Re _{max}	A1	< 2 %

Mass flow of superheated steam/gases 4) 5)

Process pressure [bar abs. (psi abs.)]	Reynolds number range	Measurement error	Standard 1)
< 40 (580)	Re ₂ to Re _{max}	A1	< 1.7 %
< 120 (1740)	Re ₂ to Re _{max}	A1	< 2.6 %

 The use of a Cerabar S is required for the measurement errors listed in the following section. The measurement error used to calculate the error in the measured pressure is 0.15 %.

Water mass flow

Reynolds number range	Measurement error	Standard
$Re = Re_2$	A1	< 0.85 %
Re ₁ to Re ₂	A2	< 10 %

Mass flow (user-specific liquids)

To specify the system accuracy, Endress+Hauser requires information about the type of liquid and its operating temperature or information in table form about the dependency between the liquid density and the temperature.

Example

- Acetone is to be measured at fluid temperatures from +70 to +90 °C (+158 to +194 °F).
- For this purpose, the **Reference temperature** parameter (7703) (here 80 °C (176 °F)), **Reference density** parameter (7700) (here 720.00 kg/m³) and **Linear expansion coefficient** parameter (7621) (here 18.0298 × 10⁻⁴ 1/°C) must be entered in the transmitter.
- The overall system uncertainty, which is less than 0.9 % for the example above, is comprised of the following measurement uncertainties: uncertainty of volume flow measurement, uncertainty of temperature measurement, uncertainty of the density-temperature correlation used (including the resulting uncertainty of density).

Mass flow (other media)

Depends on the selected fluid and the pressure value, which is specified in the parameters. Individual error analysis must be performed.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Pulse/frequency output

o.r. = of reading

⁴⁾ Single gas, gas mixture, air: NEL40; natural gas: ISO 12213-2 contains AGA8-DC92, AGA NX-19, ISO 12213-3 contains SGERG-88 and AGA8 Gross Method 1

⁵⁾ The measuring instrument is calibrated with water and has been verified under pressure on gas calibration rigs.

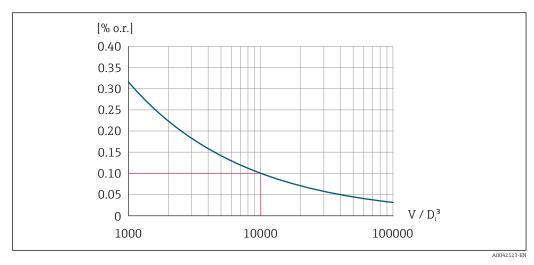
Accuracy	Max. ±100 ppm o.r.
riccuracy	With 2100 ppin on

Repeatability

o.r. = of reading

$$r = \left\{ \frac{-100 \cdot D_i^3}{V} \right\}^{1/2} \text{ % o.r.}$$

A0042121-EN



■ 26 Repeatability = 0.1 % o.r. with a measured volume $[m^3]$ of $V = 10000 \cdot D_i^3$

The repeatability can be improved if the measured volume is increased. Repeatability is not a device characteristic but a statistical variable that is dependent on the boundary conditions indicated.

Response time

If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, in the event of vortex frequencies of 10 Hz and higher a response time of $max(T_v, 100 \text{ ms})$ can be expected.

In the event of measuring frequencies < 10 Hz, the response time is > 100 ms and can be up to 10 s. $T_{\rm v}$ is the average vortex period duration of the flowing fluid.

Influence of ambient temperature

Pulse/frequency output

o.r. = of reading

Temperature coefficient	Max. ±100 ppm o.r.
-------------------------	--------------------

16.7 Installation

Installation requirements

→ 🖺 20

16.8 Environment

Ambient temperature range

Temperature tables



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



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

Storage temperature

All components apart from the display modules:

 $-50 \text{ to } +80 ^{\circ}\text{C} (-58 \text{ to } +176 ^{\circ}\text{F})$

Display modules

 $-40 \text{ to } +80 ^{\circ}\text{C} (-40 \text{ to } +176 ^{\circ}\text{F})$

Remote display FHX50:

 $-40 \text{ to } +80 ^{\circ}\text{C} (-40 \text{ to } +176 ^{\circ}\text{F})$

Relative humidity

The device is suitable for use in outdoor and indoor areas with a relative humidity of 5 to 95%.

Climate class

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

Degree of protection

Transmitter

- Standard: IP66/67, Type 4X enclosure, suitable for pollution degree 4
- When the housing is open: IP20, Type 1 enclosure, suitable for pollution degree 2
- Display module: IP20, Type 1 enclosure, suitable for pollution degree 2

Sensor

IP66/67, Type 4X enclosure, suitable for pollution degree 4

Device plug

IP67, only in screwed situation

Vibration-resistance and shock resistance

Vibration sinusoidal, in accordance with IEC 60068-2-6

Order code for "Housing", option B "GT18 dual compartment, 316L, compact"

- 2 to 8.4 Hz, 3.5 mm peak
- 8.4 to 500 Hz, 1 g peak

Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote"

- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 500 Hz, 2 g peak

Vibration broad-band random, according to IEC 60068-2-64

Order code for "Housing", option B "GT18 dual compartment, 316L, compact"

- 10 to 200 Hz, $0.003 \text{ g}^2/\text{Hz}$
- \bullet 200 to 500 Hz, 0.001 g²/Hz
- Total: 0.93 g rms

Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote")

- 10 to 200 Hz, $0.01 \text{ g}^2/\text{Hz}$
- 200 to 500 Hz, 0.003 q²/Hz
- Total: 1.67 g rms

Half-sine shocks according to IEC 60068-2-27

- Order code for "Housing", option B "GT18 dual compartment, 316L, compact" 6 ms 30 g
- Order code for "Housing", option C "GT20 dual compartment, alu, coated, compact" or option J "GT20 dual compartment, alu, coated, remote" or option K "GT18 dual compartment, 316L, remote")
 6 ms 50 q

Rough handling shocks according to IEC 60068-2-31

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21), NAMUR Recommendation 21 (NE 21) is fulfilled when installed in accordance with NAMUR Recommendation 98 (NE 98)
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4
- Details are provided in the Declaration of Conformity.
- This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

16.9 Process

Medium temperature range

DSC sensor 1)

Order code for "Sensor version; DSC sensor; measuring tube"			
Option Description Medium temperature range		Medium temperature range	
AA	Volume; 316L; 316L	-40 to $+260$ °C (-40 to $+500$ °F), stainless steel	
BA	Volume high-temperature; 316L; 316L	-200 to $+400$ °C (-328 to $+750$ °F), stainless steel	
CA	Mass; 316L; 316L	-200 to $+400$ °C (-328 to $+750$ °F), stainless steel	

1) Capacitance sensor

Seals

Order code for "DSC sensor seal"		
Option	Description Medium temperature range	
A	Graphite	−200 to +400 °C (−328 to +752 °F)
В	Viton	−15 to +175 °C (+5 to +347 °F)
С	Gylon	-200 to +260 °C (-328 to +500 °F)
D	Kalrez	−20 to +275 °C (−4 to +527 °F)

Pressure-temperature ratings

For an overview of the pressure-temperature ratings for the process connections, see the Technical Information

Nominal pressure of sensor

The following overpressure resistance values apply to the sensor shaft in the event of a membrane rupture:

Sensor version; DSC sensor; measuring tube	Overpressure, sensor shaft in [bar a]
Volume	200
Volume high-temperature	200
Mass (integrated temperature measurement)	200

Pressure loss

For a precise calculation, use the Applicator $\rightarrow \implies 188$.

Vibrations

16.10 Mechanical construction

Design, dimensions



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

Weight

Compact version

Weight data:

- Including the transmitter:
 - Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact"
 1.8 kg (4.0 lb):
 - Order code for "Housing", option B "GT18 two-chamber, 316L, compact"4.5 kg (9.9 lb):
- Excluding packaging material

Weight in SI units

DN	Weight [kg]	
[mm]	Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" ¹⁾	Order code for "Housing", option B "GT18 two-chamber, 316L, compact" ¹⁾
15	3.1	5.8
25	3.3	6.0
40	3.9	6.6
50	4.2	6.9
80	5.6	8.3
100	6.6	9.3
150	9.1	11.8

¹⁾ For high-temperature/low-temperature version: values + 0.2 kg

Weight in US units

DN	Weight [lbs]	
[in]	Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" ¹⁾	Order code for "Housing", option B "GT18 two-chamber, 316L, compact" ¹⁾
1/2	6.9	12.9
1	7.4	13.3

DN	3	
[in]	Order code for "Housing", option C "GT20 two-chamber, aluminum, coated, compact" 1)	Order code for "Housing", option B "GT18 two-chamber, 316L, compact" ¹⁾
1½	8.7	14.6
2	9.4	15.3
3	12.4	18.4
4	14.6	20.6
6	20.2	26.1

1) For high-temperature/low-temperature version: values +0.4 lbs

Transmitter remote version

Wall-mount housing

Dependent on the material of wall-mount housing:

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote"2.4 kg (5.2 lb):
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote" 6.0 kg (13.2 lb):

Sensor remote version

Weight data:

- Including sensor connection housing:
 - Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote" 0.8 kg (1.8 lb):
 - Order code for "Housing", option K "GT18 two-chamber, 316L, remote"2.0 kg (4.4 lb):
- Excluding the connecting cable
- Excluding packaging material

Weight in SI units

DN	Weight [kg]	
[mm]	sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" ¹⁾	sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" ¹⁾
15	2.1	3.3
25	2.3	3.5
40	2.9	4.1
50	3.2	4.4
80	4.6	5.8
100	5.6	6.8
150	8.1	9.3

1) For high-temperature/low-temperature version: values + 0.2 kg $\,$

Weight in US units

DN	Weight [lbs]	
[in]	sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" ¹⁾	sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" ¹⁾
1/2	4.5	7.3
1	5.0	7.8

DN	Weight [lbs]	
[in]	sensor connection housing Order code for "Housing", option J "GT20 two-chamber, aluminum, coated, remote" ¹⁾	sensor connection housing Order code for "Housing", option K "GT18 two-chamber, 316L, remote" ¹⁾
1½	6.3	9.1
2	7.0	9.7
3	10.0	12.8
4	12.3	15.0
6	17.3	20.5

1) For high-temperature/low-temperature version: values +0.4 lbs

Accessories

Flow conditioner

Weight in SI units

DN ¹⁾ [mm]	Pressure rating	Weight [kg]
15	PN 10 to 40	0.04
25	PN 10 to 40	0.1
40	PN 10 to 40	0.3
50	PN 10 to 40	0.5
80	PN 10 to 40	1.4
100	PN10 to 40	2.4
150	PN 10/16 PN 25/40	6.3 7.8

1) EN (DIN)

DN ¹⁾ [mm]	Pressure rating	Weight [kg]
15	Class 150 Class 300	0.03 0.04
25	Class 150 Class 300	0.1
40	Class 150 Class 300	0.3
50	Class 150 Class 300	0.5
80	Class 150 Class 300	1.2 1.4
100	Class 150 Class 300	2.7
150	Class 150 Class 300	6.3 7.8

1) ASME

DN ¹⁾ [mm]	Pressure rating	Weight [kg]
15	20K	0.06
25	20K	0.1
40	20K	0.3
50	10K 20K	0.5
80	10K 20K	1.1
100	10K 20K	1.80
150	10K 20K	4.5 5.5

1) JIS

Weight in US units

DN ¹⁾ [in]	Pressure rating	Weight [lbs]
1/2	Class 150 Class 300	0.07 0.09
1	Class 150 Class 300	0.3
1½	Class 150 Class 300	0.7
2	Class 150 Class 300	1.1
3	Class 150 Class 300	2.6 3.1
4	Class 150 Class 300	6.0
6	Class 150 Class 300	14.0 16.0

1) ASME

Materials Transmitter housing

Compact version

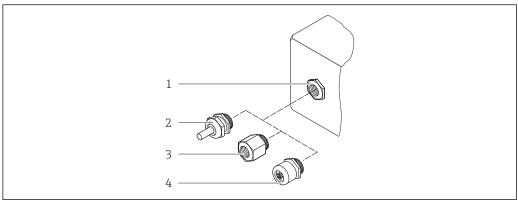
- Order code for "Housing", option B "GT18 two-chamber, 316L, compact": Stainless steel, CF3M
- Order code for "Housing", option C "GT20, two-chamber, aluminum, coated, compact": Aluminum, AlSi10Mg, coated
- Window material: glass

Remote version

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote": For maximum corrosion resistance: Stainless steel, CF3M
- Window material: glass

210

Cable entries/cable glands



A0028352

■ 27 Possible cable entries/cable glands

- 1 Internal thread M20 \times 1.5
- 2 Cable gland $M20 \times 1.5$
- 3 Adapter for cable entry with internal thread G $\frac{1}{2}$ " or NPT $\frac{1}{2}$ "
- 4 Device plug

Order code for "Housing", option B "GT18 dual compartment, 316L, compact" option K "GT18 dual compartment, 316L, remote" $^{\circ}$

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	 Non-hazardous area Ex ia Ex ic Ex nA, Ex ec Ex tb 	Stainless steel ,1.4404
Adapter for cable entry with internal thread G ½"	Non-hazardous area and hazardous area (except for XP)	Stainless steel, 1.4404 (316L)
Adapter for cable entry with internal thread NPT ½"	Non-hazardous area and hazardous area	

Order code for "Housing": option C "GT20 dual compartment, aluminum, coated, compact", option J "GT20 dual compartment, aluminum, coated remote"

Cable entry/cable gland	Type of protection	Material
Cable gland M20 × 1.5	Non-hazardous areaEx iaEx ic	Plastic
	Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	Non-hazardous area and hazardous area (except for XP)	Nickel-plated brass
Thread NPT ½" via adapter	Non-hazardous area and hazardous area	

Connecting cable for remote version

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

The material of the sensor connection housing is dependent on the material selected for the transmitter housing.

- Order code for "Housing" option J "GT20 two-chamber, aluminum, coated, remote":
 Coated aluminum AlSi10Mg
- Order code for "Housing", option K "GT18 two-chamber, 316L, remote": Stainless cast steel, 1.4408 (CF3M)
 Compliant with:
 - NACE MR0175
 - NACE MR0103

Measuring tubes

DN 15 to 150 (½ to 6"), pressure ratingsPN 10/16/25/40, Class 150/300 , and JIS 10K/20K

- Stainless cast steel, CF3M/1.4408
- Complies with:
 - NACE MR0175-2003
 - NACE MR0103-2003

DSC sensor

Order code for "Sensor version; DSC sensor; measuring tube", option AA, BA, CA

Pressure ratings PN 10/16/25/40, Class 150/300, as well as JIS 10K/20K:

Parts in contact with medium (marked as "wet" on the DSC sensor flange):

- Stainless steel 1.4404 and 316 and 316L
- Compliant with:
 - NACE MR0175/ISO 15156-2015
 - NACE MR0103/ISO 17945-2015

Parts not in contact with medium:

Stainless steel 1.4301 (304)

Seals

- Graphite
- Sigraflex foil ZTM (BAM-certified for oxygen applications)
- FPM (VitonTM)
- Kalrez 6375TM
- Gylon 3504TM (BAM-certified for oxygen applications)

Housing support

Stainless steel, 1.4408 (CF3M)

Screws for DSC sensor

- Order code for "Sensor version", option AA "Stainless steel, A4-80 according to ISO 3506-1 (316)"
- Order code for "Sensor version", option BA, CA Stainless steel, A2 as per ISO 3506-1 (304)

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

Flow conditioner

- Stainless steel, multiple certifications, 1.4404 (316, 316L)
- Compliant with:
 - NACE MR0175-2003
 - NACE MR0103-2003

16.11 Operability

Languages

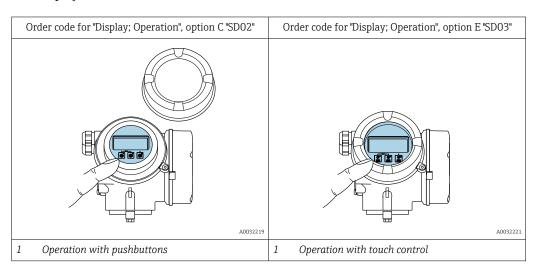
Can be operated in the following languages:

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

Onsite operation

Via display module

Two display modules are available:



Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured

Operating elements

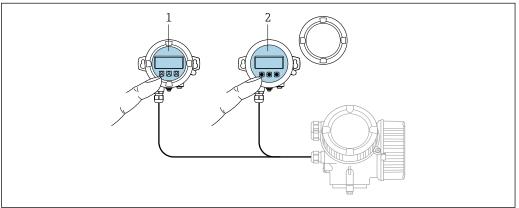
- lacksquare Operation with 3 push buttons with open housing: lacksquare, lacksquare
- External operation via touch control (3 optical keys) without opening the housing: ±, □, ■
- Operating elements also accessible in the various zones of the hazardous area

Additional functionality

- Data backup function
 The device configuration can be saved in the display module.
- Data comparison function
 The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function
 The transmitter configuration can be transmitted to another device using the display module.

Via remote display FHX50

The remote display FHX50 can be ordered as an optional extra \rightarrow \implies 187.



A00322

- 28 FHX50 operating options
- 1 SD02 display and operating module, push buttons: cover must be opened for operation
- 2 SD03 display and operating module, optical buttons: operation possible through cover glass

Display and operating elements

The display and operating elements correspond to those of the display module.

Remote operation

Service interface

→ 🖺 58

16.12 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

- 1. Select the product using the filters and search field.
- 2. Open the product page.
- 3. Select **Downloads**.

CE mark

The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

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

UKCA marking

The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:

Endress+Hauser Ltd.

Floats Road

Manchester M23 9NF United Kingdom www.uk.endress.com

RCM marking

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

Ex-approval

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

Certification PROFIBUS

PROFIBUS interface

The measuring device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e.V./PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications:

- Certified according to PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

Pressure Equipment Directive

- With the marking
 - a) PED/G1/x (x = category) or
 - b) PESR/G1/x (x = category)

on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements"

- a) specified in Annex I of the Pressure Equipment Directive 2014/68/EU or
- b) Schedule 2 of Statutory Instruments 2016 No. 1105.
- Devices not bearing this marking (without PED or PESR) are designed and manufactured according to sound engineering practice. They meet the requirements of
 - a) Art. 4 Para. 3 of the Pressure Equipment Directive 2014/68/EU or
 - b) Part 1, Para. 8 of Statutory Instruments 2016 No. 1105.

The scope of application is indicated

- a) in diagrams 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU or
- b) Schedule 3, Para. 2 of Statutory Instruments 2016 No. 1105.

Experience

The Prowirl 200 measuring system is the successor model of the Prowirl 72 and Prowirl 73.

External standards and guidelines

■ EN 60529

Degrees of protection provided by enclosure (IP code)

■ DIN ISO 13359

Measurement of conductive liquid flow in closed conduits - Flanged-type electromagnetic flow meters - Overall length

■ ISO 12764:2017

 $\label{lem:measurement} Measurement of fluid flow in closed conduits - Flow rate measurement by means of vortex shedding flowmeters inserted in circular cross-section conduits running full \\$

■ EN 61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements

■ EN 61326-1/-2-3

EMC requirements for electrical equipment for measurement, control and laboratory use

■ NAMUR NE 21

Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment

■ NAMUR NE 32

Data retention in the event of a power failure in field and control instruments with microprocessors

■ NAMUR NE 43

Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

■ NAMUR NE 53

Software of field devices and signal-processing devices with digital electronics

NAMUR NE 105

Specifications for integrating fieldbus devices in engineering tools for field devices

■ NAMUR NE 107

Self-monitoring and diagnosis of field devices

■ NAMUR NE 131

Requirements for field devices for standard applications

■ ETSI EN 300 328

Guidelines for 2.4 GHz radio components.

■ EN 301489

Electromagnetic compatibility and radio spectrum matters (ERM).

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 with the device or subsequently from Endress+Hauser. 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.



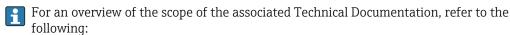
Detailed information on the application packages: Special Documentation \rightarrow $\stackrel{\triangle}{=}$ 218

16.14 Accessories



Overview of accessories available to order → 🖺 187

16.15 Documentation



- Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

216

Standard Documentation

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Prowirl D 200	KA01322D

Brief Operating Instructions for the transmitter

Measuring instrument	Documentation code
Prowirl 200	KA01328D

Technical Information

Measuring device	Documentation code
Prowirl D 200	TI01332D

Description of Device Parameters

Measuring instrument	Documentation code
Prowirl 200	GP01110D

Supplementary devicedependent documentation

Safety instructions

Contents	Documentation code
ATEX/IECEx Ex d	XA01635D
ATEX/IECEx Ex ia	XA01636D
ATEX/IECEx Ex ec, Ex ic	XA01637D
_C CSA _{US} XP	XA01638D
_C CSA _{US} IS	XA01639D
EAC Ex d	XA01684D
EAC Ex ia	XA01782D
EAC Ex ec, Ex ic	XA01685D
INMETRO Ex d	XA01642D
INMETRO Ex ia	XA01640D
INMETRO Ex ec, Ex ic	XA01641D
JPN Ex d	XA01766D
NEPSI Ex d	XA01643D
NEPSI Ex ia	XA01644D
NEPSI Ex ec, Ex ic	XA01645D
UKEX Ex d	XA02630D
UKEX Ex ia	XA02631D
UKEX Ex ec, Ex ic	XA02632D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Heartbeat Technology	SD02031D
Protective cover	SD00333F

Installation Instructions

Contents	Note
Installation instructions for spare part sets and accessories	 Access the overview of all the available spare part sets via <i>Device Viewer</i> → □ 184 Accessories available for order with Installation Instructions → □ 187

Index

A	D
Access authorization to parameters	Date of manufactu
Read access	Declaration of Con
Write access	Define access code
Access code	Degree of protection
Incorrect input	Design
Adapting the diagnostic behavior 144	Measuring devi
Ambient conditions	Device components
Ambient temperature	Device description
Storage temperature	Device locking, star
Vibration resistance and shock resistance 205	Device master file
Ambient temperature	GSD
Influence	Device name
Ambient temperature range	Sensor
Analog Input module	Transmitter
Analog Output module 68	Device repair
Application	Device type ID
Applicator	Device Viewer
Approvals	DeviceCare
	Device descripti
C	Diagnostic behavio
Cable entries	Explanation
Technical data	Symbols
Cable entry	Diagnostic informa
Degree of protection	Design, descrip
CE mark	DeviceCare
Certificates	FieldCare
Certification PROFIBUS	Local display
Checklist	Overview
Post-connection check	Remedial meas
Post-mounting check	Diagnostic list
Cleaning	Diagnostic messag
Exterior cleaning	Diagnostics
Interior cleaning	Symbols
Replacing housing seals	DIP switches
Replacing seals	see Write prote
Replacing sensor seals	Direct access
Climate class	Disabling write pro
Commissioning	Discrete Input mod
Advanced settings	Discrete Output mo
Configuring the measuring device	Display
Connecting the device	see Local displa
Connection	Display area
see Electrical connection	For operational
Connection cable	In the navigation
Connection preparations	Display values
Connection tools	For locking stat
Context menu	Disposal
Calling up	Document
Closing	Function
Explanation	Symbols Document function
Current consumption	Documentation
Cyclic data transmission	Documentation
5, and add transmission	

D
Date of manufacture
Declaration of Conformity
Define access code
Degree of protection 41, 205
Design
Measuring device
Device components
Device description files 62
Device locking, status
Device master file
GSD
Device name
Sensor
Transmitter
Device repair
Device type ID 62
Device Viewer
DeviceCare
Device description file 62
Diagnostic behavior
Explanation
Symbols
Diagnostic information
Design, description 141, 143
DeviceCare
FieldCare
Local display
Overview
Remedial measures
Diagnostic list
Diagnostic message
Diagnostics
Symbols
DIP switches
see Write protection switch
Direct access
Disabling write protection
Discrete Input module 69
Discrete Output module 69
Display
see Local display
Display area
For operational display
In the navigation view 48
Display values
For locking status
Disposal
Document
Function
Symbols
Document function 6
Documentation

E	Identifying the measuring instrument	
Electrical connection	Incoming acceptance	13
Commubox FXA291	Influence	
Degree of protection 41	Ambient temperature	
Measuring instrument	Information about this document	6
Operating tools	Inlet runs	. 21
Via PROFIBUS PA network 57	Input	190
Via service interface (CDI) 58	Input screen	. 50
Electromagnetic compatibility 206	Inspection	
EMPTY_MODULE module 70	Connection	42
Enabling write protection	Installation	. 29
Enabling/disabling the keypad lock	Received goods	13
Endress+Hauser services	Installation	
Maintenance	Installation dimensions	
Repair	Installation requirements	
Error messages	Inlet and outlet runs	21
see Diagnostic messages	Mounting set	
Event list	Orientation	
Event logbook	Thermal insulation	
Ex-approval	Intended use	
Experience	Interior cleaning	
Extended order code		
Sensor	L	
Transmitter	Languages, operation options	213
Exterior cleaning	Line recorder	
Exterior cleaning	Local display	
F	Editing view	49
Field of application	Navigation view	
Residual risks	see Diagnostic message	
FieldCare	see In alarm condition	
	see Operational display	
Device description file	Low flow cut off	190
Function	Low now cut on	1))
	M	
User interface	Main electronics module	12
Filtering the event logbook	Maintenance tasks	
Firmware	Managing the device configuration	
Release date	Manufacturer ID	
Version	Materials	
Firmware history	Maximum measurement error	
Flow direction	Measured values	. 202
Function check	Measured	100
Function range	Measured variables	. 130
SIMATIC PDM 61	Calculated	100
Functions	see Process variables	. 190
see Parameters		100
6	Measuring and test equipment	103
G	Measuring device	70
Galvanic isolation	Configuration	
	Conversion	
H	Design	
Hardware write protection	Disposal	
Help text	Preparing for mounting	
Calling up	Removing	
Closing	Repairs	
Explanation	Switch-on	. 71
HistoROM	Measuring instrument	
,	Installing the sensor	
I	Preparing for electrical connection	
I/O electronics module	Measuring principle	190
	1	

220

Measuring range	Outlet runs
Measuring system	Output signal
Medium temperature range 206	Output variables
Menu	P
Diagnostics	-
Setup	Packaging disposal
Menus	Parameter settings
For measuring device configuration	Administration (Submenu)
For specific settings	Analog inputs (Submenu)
Module	Communication (Submenu)
Analog input	Configuration backup display (Submenu) 113
Analog output	Data logging (Submenu)
Discrete Input	Device information (Submenu) 180
Discrete Output 69	Diagnostics (Menu)
EMPTY_MODULE	Display (Submenu)
Totalizer	Display (Wizard) 80
SETTOT MODETOT TOTAL	External compensation (Submenu) 99
SETTOT TOTAL 67	Gas composition (Submenu) 88
TOTAL 66	Low flow cut off (Wizard) 82
Mounting dimensions	Medium properties (Submenu) 85
see Installation dimensions	Medium selection (Wizard) 74
Mounting location	Output values (Submenu)
Mounting preparations	Process variables (Submenu)
Mounting requirements	Pulse/frequency/switch output (Wizard)
Installation dimensions	
Mounting location 20	Sensor adjustment (Submenu) 101
Mounting set	Setup (Menu)
Mounting tools	Simulation (Submenu)
iviounting tools	System units (Submenu)
N	Totalizer 1 to n (Submenu)
Nameplate	Totalizer handling (Submenu)
Sensor	Parameters
Transmitter	Changing
Navigation path (navigation view)	Entering a value
Navigation view	Performance characteristics
In the submenu	Post-connection check (checklist)
In the wizard	Post-installation check
Netilion	Post-mounting check (checklist)
±	Potential equalization
Sensor	Power consumption
Numeric editor	Power supply failure
0	Pressure Equipment Directive
Onsite display	Pressure loss
1 3	Pressure-temperature ratings 206
Operable flow range	Process conditions
1 3	Medium temperature
Operating keys	Pressure loss
see Operating elements	Product safety
Operating menu	Profile version
Menus, submenus	Protecting parameter settings
Structure	ם
Submenus and user roles	R
Operating philosophy	RCM marking
Operation	Read access
Operation options	Reading measured values
Operational display	Recalibration
Operational safety	Reference operating conditions
Order code	Registered trademarks
Orientation (vertical, horizontal) 20	

Remedial measures	Status area
Calling up	For operational display
Closing	In the navigation view 48
Remote operation	Status signals
Remote version	Storage conditions
Connecting the connecting cable	Storage temperature
Repair	Storage temperature range 205
Notes	Structure
Repair of a device	Operating menu
Repeatability	Submenu
Replacement	Administration
Device components	Advanced setup
Replacing seals	Analog inputs
Requirements for personnel	Communication
Response time	Configuration backup display
Return	Data logging
Actum 1 103	Device information
S	Display
- Safety	Event list
Sensor	External compensation
Installing	Gas composition
Serial number	Medium properties
Setting the operating language	Output values
Settings	Overview
Adapting the measuring device to the process	Process variables
conditions	Sensor adjustment
Administration	Simulation
Advanced display configurations	System units
Analog input	Totalizer 1 to n
Communication interface	Totalizer handling
Device reset	Supply unit
Device tag	Requirements
External compensation	Supply voltage
Gas composition	Symbols
Local display	For communication
Low flow cut off	For correction
Managing the device configuration	For diagnostic behavior
Medium	For locking
Medium properties	For measured variable
Operating language	For measurement channel number
Pulse output	For menus
Pulse/frequency/switch output 102, 104	For parameters
Resetting the totalizer	For status signal
Sensor adjustment	For submenu
Simulation	For wizards
Switch output	In the status area of the local display
System units	In the text and numeric editor
Totalizer	System design
Totalizer reset	Measuring system
SETTOT MODETOT TOTAL module 67	see Measuring device design
SETTOT_TOTAL module	System integration
Showing data logging	System integration
Signal on alarm	Т
SIMATIC PDM	Technical data, overview
Function	Temperature range
Spare part	Storage temperature
Spare parts	Terminal assignment
Standards and guidelines	Terminals
Standards and galacinics	Text editor

222

	24
Tool Transporting	18
Tool tip	
see Help text	
Tools Electrical connection	30
	26
	56
Totalizer	, 0
Assign process variable	32
Configuration	
Operation	
Reset	3
Transmitter	
Connecting the signal cables	
J J	29
Turning the housing	
Transporting the measuring instrument	-8
Troubleshooting	
General	
Turning the display module	19
see Turning the transmitter housing	
	28
Turning the trunsmitter mousing	10
U	
UKCA marking	15
Use of measuring device	
Borderline cases	9
Incorrect use	9
Use of measuring instrument	
see Intended use	
User interface	, –
Current diagnostic event	
Previous diagnostic event	
User roles	ŧЭ
V	
Version data for the device 6	52
Vibration resistance and shock resistance 20)5
W	_
W@M Device Viewer	.3
Weight	
Compact version	.7
SI units	
US units	
Sensor remote version	J
SI units	າຂ
US units	
Transport (notes)	_
Wizard	
Display	30
Low flow cut off	
Medium selection	
Pulse/frequency/switch output 102, 103, 104, 10)7
Workplace safety	LO

Write access
Write protection
Via access code
Via write protection switch
Write protection switch



www.addresses.endress.com