

# Special Documentation

## Promag 400

Custody transfer  
Meter for drinking water  
Modbus RS485





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# 1 About this document

## 1.1 Document function

This manual is Special Documentation that describes the use of the device in custody transfer measurement.

### NOTICE

#### When installing:

- ▶ Follow the Operating Instructions for the device.

## 1.2 Using this document

### 1.2.1 Information on the document structure










Additional information regarding:


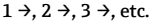

- The arrangement of the parameters, along with a short description, according to the **Operation** menu, **Setup** menu, **Diagnostics** menu: Operating Instructions
- Operating concept: Operating Instructions

## 1.3 Symbols used

### 1.3.1 Symbols for certain types of information

Symbol	Meaning
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
	Series of steps
	Result of a step

### 1.3.2 Symbols in graphics

Symbol	Meaning
	Item numbers
	Series of steps of individual, consecutive images
	Series of steps within an image

Symbol	Meaning
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

## 1.4 Documentation



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

- *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

This manual is Special Documentation. It does not replace the Operating Instructions supplied with the device.

The Special Documentation is an integral part of the following Operating Instructions:

Measuring device	Documentation code
Promag W 400	BA01231D



This Special Documentation is available:

In the Download Area of the Endress+Hauser Internet site: [www.endress.com](http://www.endress.com) → Downloads

## 2 Basic safety instructions

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Are authorized by the plant owner/operator.
- ▶ Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

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

### 3 Product description

The measuring device is optionally tested in accordance with OIML R49 ([www.oiml.org](http://www.oiml.org)) and has an EU type-examination certificate according to Measuring Instruments Directive 2014/32/EU (MID) for service subject to legal metrological control ("custody transfer") for cold water (Annex III).

The device is used with a legally controlled totalizer on the local display and optionally with a legally controlled pulse output.

Measuring devices subject to legal metrological control totalize in both directions, i.e. all the outputs consider flow components in the positive (forward) and negative (reverse) flow direction.

Generally a measuring device subject to legal metrological control is secured against tampering by seals on the transmitter or sensor. Usually, these seals may be broken only by an authorized representative of the responsible authority for legal metrology controls.


After putting the device into circulation or after sealing the device, operation via the local display is only possible to a limited extent.

#### Europe

Since the European Measuring Instruments Directive 2004/22/EC came into effect on November 1 2006 and was replaced by 2014/32/EU on April 20 2016, meters with the relevant marking can be placed on the market across the borders of all EU member states that have ratified the requirements of Annex III (MI-001) of the European Measuring Instruments Directive and incorporated them into national law.

The associated Declaration of Conformity for the measuring device, as per the European Measuring Instruments Directive 2014/32/EC, was made in accordance with Modules B +D:

Module B: Type examination according to OIML R49:2013 Module D: Declaration of type conformity based on quality assurance of the production process.

 With the entry into force of the revised European Measuring Instruments Directive 2014/32/EU on April 20 2016, all certificates issued under Directive 2004/22/EC will remain valid until their regular expiry date. As a result of this transitional system, various certificates and documents pertaining to the same device can make reference to different versions of the European Measuring Instruments Directive. This does not compromise the conformity of the measuring device in any way.

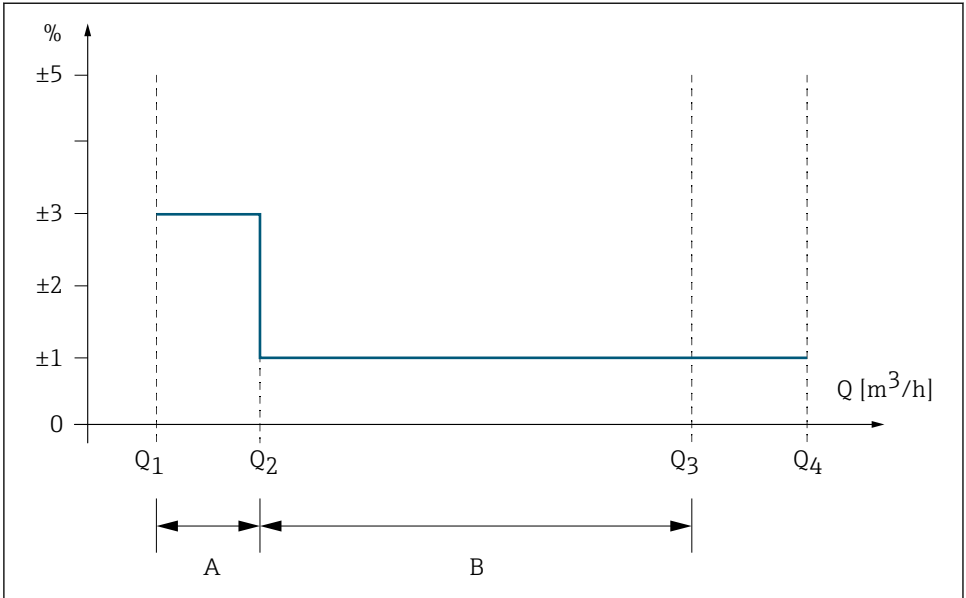
#### Outside Europe

Detailed ordering information for national approvals based on OIML R49 is available from your local Endress+Hauser sales center.

## 4 Product identification

Measuring devices for use subject to legal metrology controls are supplied with the relevant marking.

### 4.1 Accuracy class 1

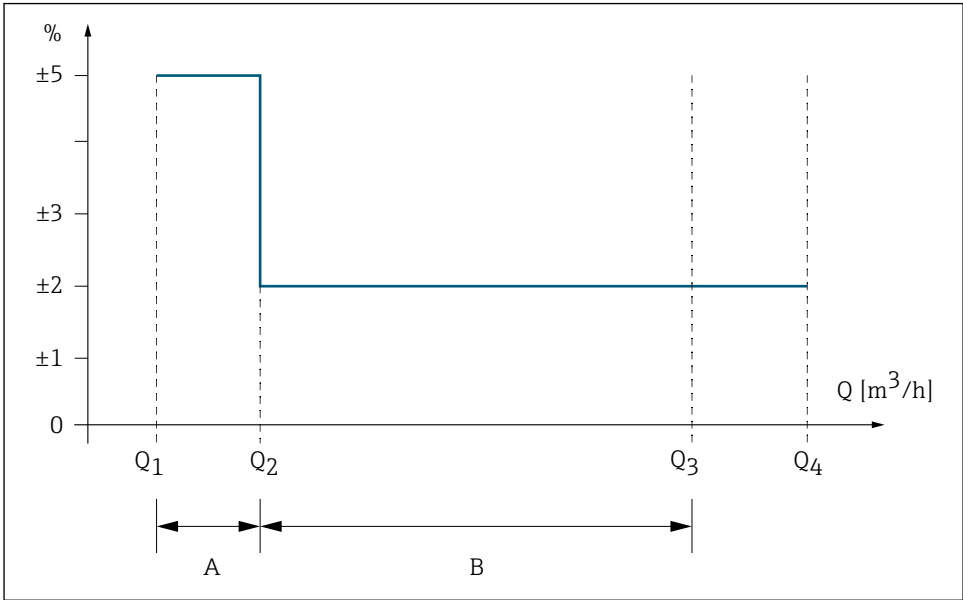


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1 Flow ranges and maximum permissible errors for cold water

- A Lower zone  
Maximum permissible error:  $\pm 3\%$
- B Upper zone  
Maximum permissible error:  $\pm 1\%$

## 4.2 Accuracy class 2



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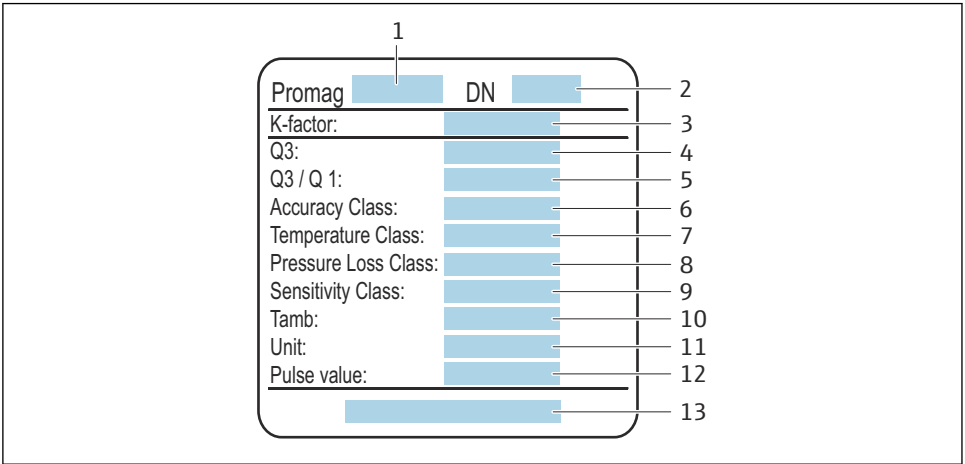
### 2 Flow ranges and maximum permissible errors for cold water

- A Lower zone  
Maximum permissible error:  $\pm 5\%$
- B Upper zone  
Maximum permissible error:  $\pm 2\%$

Cold water Medium temperature range $+0.1$ to $+50\text{ }^\circ\text{C}$ ( $+32.2$ to $+122\text{ }^\circ\text{F}$ )	
Minimum flowrate $Q_1$	The lowest flowrate at which the meter provides indications that satisfy the requirements concerning the maximum permissible errors (MPEs).
Transitional flowrate $Q_2$	The flowrate value occurring between the permanent flowrate $Q_3$ and the minimum flowrate $Q_1$ , at which the flowrate range is divided into two zones (the upper zone and lower zone). Each zone has a characteristic MPE.
Permanent flowrate $Q_3$	The highest flowrate at which the meter operates in a satisfactory manner under normal conditions of use.
Overload flowrate $Q_4$	The highest flowrate at which the meter operates in a satisfactory manner for a short period of time without deteriorating.



### 4.3 Nameplate



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3 Sensor nameplate, subject to mandatory verification

- 1 Name of sensor
- 2 Nominal diameter of sensor
- 3 Calibration factor / zero point
- 4 Flowrate  $Q_3$
- 5 Flowrate  $Q_3 / Q_1$
- 6 Accuracy class
- 7 Temperature class
- 8 Pressure loss class
- 9 Sensitivity class
- 10 Ambient temperature
- 11 Unit
- 12 Pulse value (output option P)
- 13 Number of certificate

## 5 Operation and commissioning

Two versions of the custody-transfer Promag W 400 are available.

Version	Sensor
Standard	Continuous measuring tube
0 x DN inlet/outlet runs	Constricted measuring tube

## 5.1 Operating conditions for "standard" version

The measuring device should be sized in such a way that, under normal operating conditions as per the specifications of OIML R49, it operates in the range from  $Q_1$  to  $Q_4$ .

The measuring device is designed for:

Accuracy class	2
Temperature class	T50
Pressure loss class	$\Delta p$ 10
Environmental class	B / O / M
Electromagnetic class	E2
Orientation	Horizontal, vertical
Inlet run from flange	5 × DN corresponds to sensitivity class U5
Outlet run from flange	2 × DN corresponds to sensitivity class D3
Flow direction	Bidirectional
Test equipment	Measurement transducer, calculator, indicating device
Test equipment	Type P



Please note the following for operation:

- Ensure an uninterrupted power supply.
- Use shielded signal cables.

### 5.1.1 Flow characteristic values

The following flow characteristic values correspond to the specifications of OIML R49.

DN		$Q_1$	$Q_2$	$Q_3$	$Q_4$	$Q_3 / Q_1$	Low flow cutoff with 50 % hysteresis <sup>1)</sup>
[mm]	[in]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]
25	1	0.10	0.16	16.00	20.00	160	0.016
32	1 ¼	0.16	0.25	25.00	31.25	160	0.025
40	1 ½	0.25	0.40	40.00	50.00	160	0.040
50	2	0.39	0.63	63.00	78.75	160	0.063
65	2 ½	0.50	0.80	100.00	125.00	200	0.080
80	3	0.80	1.28	160.00	200.00	200	0.128
100	4	1.25	2.00	250.00	312.50	200	0.200
125	5	1.60	2.56	400.00	500.00	250	0.256

DN		Q1	Q2	Q3	Q4	Q3 / Q1	Low flow cutoff with 50 % hysteresis <sup>1)</sup>
[mm]	[in]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]
150	6	2.52	4.03	630.00	787.50	250	0.403
200	8	4.00	6.40	1000.00	1250.00	250	0.640
250	10	6.40	10.24	1600.00	2000.00	250	1.024
300	12	10.00	16.00	2500.00	3125.00	250	1.600
350	14	10.00	16.00	2500.00	3125.00	250	1.600
375	15	16.00	25.60	4000.00	5000.00	250	2.560
400	16	16.00	25.60	4000.00	5000.00	250	2.560
450	18	16.00	25.60	4000.00	5000.00	250	2.560
500	20	25.20	40.32	6300.00	7875.00	250	4.032
600	24	39.38	63.00	6300.00	7875.00	160	6.300
700	28	50.40	80.64	6300.00	7875.00	125	8.064
750	30	63.00	100.80	6300.00	7875.00	100	10.080
800	32	63.00	100.80	6300.00	7875.00	100	10.080

1) Values cannot be edited when the custody transfer mode is activated.

### 5.1.2 Flow characteristic values of certified pulse output

DN		Pulse value	Pulse width
[mm]	[in]	[dm <sup>3</sup> ]	[ms]
25	1	0.50	45
32	1 ¼	1.00	50
40	1 ½	1.00	35
50	2	2.50	50
65	2 ½	2.50	35
80	3	5.00	45
100	4	5.00	25
125	5	10.00	35
150	6	10.00	20
200	8	25.00	35
250	10	25.00	20

DN		Pulse value	Pulse width
[mm]	[in]	[dm <sup>3</sup> ]	[ms]
300	12	50.00	25
350	14	50.00	25
375	15	100.00	35
400	16	100.00	35
450	18	100.00	35
500	20	150.00	30
600	24	250.00	50
700	28	250.00	50
750	30	250.00	50
800	32	250.00	50



- The configuration of the certified pulse output is defined by the standard.
- The factory setting for the certified pulse output is such that the minimum measured value resolution specified in the standard is maintained for the "flow characteristic values" in the table and the pulse output does not go to overflow at Q4.
- A pulse modulation of 50/50 (high low level) is presumed.
- If the certified pulse output is configured differently, in terms of the approval this can limit the operable flow range (Q3/Q1).

## 5.2 Operating conditions for "0 x DN inlet/outlet runs" version



Only applies for the order code for "Design", option C

The measuring device should be sized in such a way that, under normal operating conditions as per the specifications of OIML R49, it operates in the range from Q<sub>1</sub> to Q<sub>4</sub>.

The measuring device is designed for:

Accuracy class <sup>1)</sup>	1 or 2
Temperature class	T50
Pressure loss class	Δp 40
Environmental class	B / O / M
Electromagnetic class	E2
Orientation	Horizontal, vertical
Inlet run from flange	0 × DN corresponds to sensitivity class U0
Outlet run from flange	0 × DN corresponds to sensitivity class D0
Flow direction	Bidirectional

Test equipment	Measurement transducer, calculator, indicating device
Test equipment	Type P

1) Only accuracy class 2 exists as a legal basis for measuring devices according to European approval MI-001.



Please note the following for operation:

- Ensure an uninterrupted power supply.
- Use shielded signal cables.

### 5.2.1 Flow characteristic values

The following flow characteristic values correspond to the specifications of OIML R49.

#### Accuracy class 1

DN		Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>3</sub> / Q <sub>1</sub>	Low flow cutoff with 50 % hysteresis <sup>1)</sup>
[mm]	[in]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]
50	2	0.13	0.20	40.00	50.00	315	0.02
65	2 ½	0.20	0.32	63.00	78.80	315	0.03
80	3	0.32	0.51	100.00	125.00	315	0.05
100	4	0.51	0.81	160.00	200.00	315	0.08
125	5	0.79	1.27	250.00	312.50	315	0.13
150	6	1.27	2.03	400.00	500.00	315	0.20
200	8	2.00	3.20	630.00	787.50	315	0.32
250	10	3.17	5.08	1000.00	1250.00	315	0.51
300	12	5.08	8.13	1600.00	2000.00	315	0.81

1) Values cannot be edited when the custody transfer mode is activated.

#### Accuracy class 2

DN		Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>3</sub> / Q <sub>1</sub>	Low flow cutoff with 50 % hysteresis <sup>1)</sup>
[mm]	[in]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]
50	2	0.06	0.10	40.00	50.00	630	0.01
65	2 ½	0.10	0.16	63.00	78.80	630	0.02
80	3	0.16	0.25	100.00	125.00	630	0.03

DN		Q1	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>3</sub> / Q <sub>1</sub>	Low flow cutoff with 50 % hysteresis <sup>1)</sup>
[mm]	[in]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]
100	4	0.25	0.41	160.00	200.00	630	0.04
125	5	0.40	0.63	250.00	312.50	630	0.06
150	6	0.63	1.02	400.00	500.00	630	0.10
200	8	1.00	1.60	630.00	787.50	630	0.16
250	10	1.59	2.54	1000.00	1250.00	630	0.25
300	12	2.54	4.06	1600.00	2000.00	630	0.41

1) Values cannot be edited when the custody transfer mode is activated.

### 5.2.2 Flow characteristic values of certified pulse output



The pulse value is the same for both accuracy classes.

DN		Pulse value	Pulse width
[mm]	[in]	[dm <sup>3</sup> ]	[ms]
50	2	0.50	15
65	2 ½	0.50	10
80	3	1.00	15
100	4	1.00	10
125	5	2.50	15
150	6	2.50	10
200	8	5.00	10
250	10	10.00	15
300	12	15.00	10



- The configuration of the certified pulse output is defined by the standard.
- The factory setting for the certified pulse output is such that the minimum measured value resolution specified in the standard is maintained for the "flow characteristic values" in the table and the pulse output does not go to overflow at Q<sub>4</sub>.
- A pulse modulation of 50/50 (high low level) is presumed.
- If the certified pulse output is configured differently, in terms of the approval this can limit the operable flow range (Q<sub>3</sub>/Q<sub>1</sub>).

## 5.3 As-delivered state



### Europe

Measuring devices according to the type-examination certificate as per Measuring Instruments Directive 2014/32/EU, Annex III (MI-001) are supplied in an electronically and mechanically locked state with custody transfer mode enabled. Changes to the measuring device's custody transfer-related configuration may only be made by specially qualified Endress+Hauser service technicians or by authorized representatives of the local authority responsible for legal metrology controls.



### Additional information for as-delivered state in Europe

Measuring devices with the order code for "Output/input": option M and O are delivered with the **CT locking: Defined parameters** option. Measuring devices with the order code for "Output/input": option P (certified pulse output) are delivered with the **CT locking: All parameters** option.

Custody transfer parameters	Default value
Custody transfer counter	1
Timestamp last custody transfer	Activation at the factory
Counter custody transfer changes	0



### Outside Europe

Measuring devices according to the Declaration of Conformity as per OIML R49 are not supplied in an electronically locked state. The customer is expected to place the measuring device on the market with the involvement of the competent national calibration authority and correctly implement the locally applicable requirements as regards the locking and sealing of the measuring device. The authorized representative of the national authority for legal metrology controls is responsible for any information required in this regard.

Custody transfer parameters	Default value
Custody transfer counter	0
Timestamp last custody transfer	0
Counter custody transfer changes	0

## 5.4 Custody transfer



National rules or regulations must be observed when performing custody transfer.



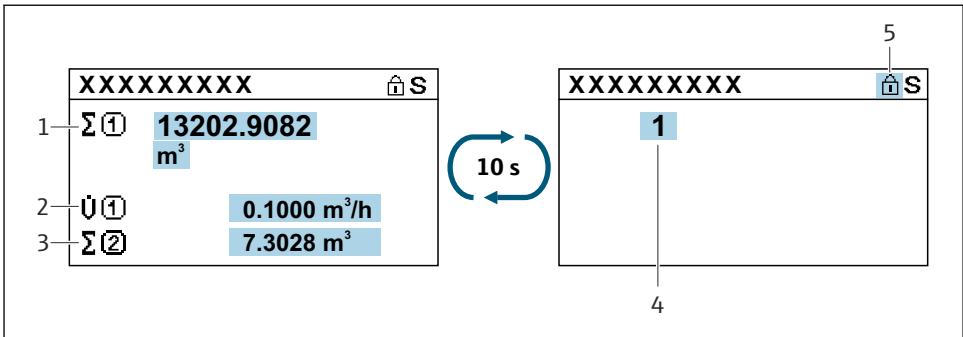
An **authorized user login** is available: EH000 with password 177801. This **authorized user login** is the non-personalized factory login and enables the activation and deactivation of the custody transfer mode. Settings made using this login must be documented and personalized by the system operator. In addition, the responsible calibration authority must be informed of these changes.

### 5.4.1 Outputs relevant for custody transfer

With the order code for "Input/output": option M and O, the local display of totalizer 1 is the output that is relevant for custody transfer. With the order code for "Input/output": option P, either the local display or the certified pulse output can be selected as the output that is relevant for custody transfer.

#### Local display

In Custody transfer mode, the values that are displayed on the local display are set. Any configuration settings made beforehand for the local display are overwritten. The local display shows one value in large format and two additional values. The local display alternates every ten seconds between values 1 to 3 and value 4. A padlock symbol is displayed in the top right-hand corner in the custody transfer mode.



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- 1 Display for value 1
- 2 Display for value 2
- 3 Display for value 3
- 4 Display for custody transfer counter
- 5 Padlock symbol (Custody transfer active)

Value	Description
1	Totalizer with unit m <sup>3</sup> . Displays up to nine integer values (before the decimal). Higher values are displayed in scientific notation.
2	Current volume flow with unit m <sup>3</sup> /h.
3	User configurable.
4	Custody transfer counter.

#### Certified pulse output

In the case of measuring devices with the order code for "Input/output": option P, the PFS 1 and PFS 2 outputs can be used to display the measured values that are relevant for custody transfer on a suitable display. The PFS 1 output transmits pulses proportional to the volume, while the PFS 2 output is used to detect the flow direction.



### 5.4.2 Authorized user login



To change the measuring device to the Custody transfer mode, the non-personalized, **authorized user login** (factory login) can be used. However, the use of a personalized, **authorized user login** with associated **password** is recommended. This is available only to national market surveillance and authorized persons from the relevant centers. This **authorized user login** is comparable to a personalized sealing pliers and is used to uniquely identify the person / authority who has locked or unlocked the measuring device for custody transfer measurement.



To create an **authorized user login** with **password**, please contact your E+H sales center.

To create the **Authorized user login** parameter with **password**, the following data are required.

Required data	Example
Applicant type	<ul style="list-style-type: none"> <li>▪ System operator</li> <li>▪ Market surveillance</li> <li>▪ Approval center</li> <li>▪ Endress+Hauser employee</li> </ul>
First name	John
Surname	Smith
Company	ABC Company
Department	ABC Department
Address	Any Street 1
Country	Anywhere
City/Town	Anytown
ZIP code	123456
Telephone	123456
E-mail address	John.Smith@sample.com

- The **Authorized user login** parameter consists of five characters comprising two letters and three digits.
- For each **Authorized user login** parameter comprising five characters, a **password** is generated.
- When changes are made, the **Authorized user login** parameter is saved in the Custody transfer logbook.

### 5.4.3 Parameter description - deactivating Custody transfer



An **authorized user login** is available: EH000 with password 177801. This **authorized user login** is the non-personalized factory login and enables the activation and deactivation of the custody transfer mode. Settings made using this login must be documented and personalized by the system operator. In addition, the responsible calibration authority must be informed of these changes.

## Navigation

"Setup" menu → Advanced setup → Custody transfer deactivation

► Custody transfer deactivation	
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Hour	→ 19
Minute	→ 19
Clear custody transfer logbook	→ 19
Entry 30 of custody transfer logbook	→ 19
Toggle DIP switch	→ 19

## Parameter overview with brief description

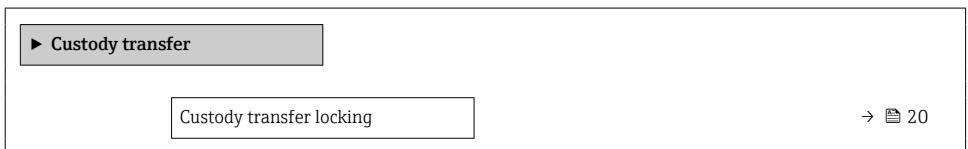
Parameter	Description	User entry / User interface / Selection	Factory setting
Authorized user login	Enter a specified authorized user login.	Authorized user login	EH000
Password	Enter a specified password.	0 to 999 999	177 801

Parameter	Description	User entry / User interface / Selection	Factory setting
Login state	Display login status.	<ul style="list-style-type: none"> <li>■ Logged in</li> <li>■ Logged out</li> </ul>	Logged out
Year	Enter the year.	9 to 99	10
Month	Enter the month.	<ul style="list-style-type: none"> <li>■ January</li> <li>■ February</li> <li>■ March</li> <li>■ April</li> <li>■ May</li> <li>■ June</li> <li>■ July</li> <li>■ August</li> <li>■ September</li> <li>■ October</li> <li>■ November</li> <li>■ December</li> </ul>	January
Day	Enter the day.	1 to 31 d	1 d
AM/PM	Select AM/PM.	<ul style="list-style-type: none"> <li>■ AM</li> <li>■ PM</li> </ul>	AM
Hour	Enter the hour.	0 to 23 h	12 h
Minute	Enter the minutes.	0 to 59 min	0 min
Clear custody transfer logbook	Delete custody transfer logbook selection.	<ul style="list-style-type: none"> <li>■ Cancel</li> <li>■ Clear data</li> </ul>	Cancel
Entry 30 of custody transfer logbook	Display the recorded logbook entries.	0...30	0
Toggle DIP switch	Display the DIP switch status.	<ul style="list-style-type: none"> <li>■ Off</li> <li>■ On</li> </ul>	Off

#### 5.4.4 Determining parameters locked in Custody transfer

##### Navigation


"Custody transfer" submenu → Custody transfer locking





## Parameter overview with brief description


Parameter	Description	Selection	Factory setting
Custody transfer locking	Select the output version of the measuring device. "Defined parameters" for devices with the order code for "Output/input": option M and O; "All parameters" for the order code for "Output/input": option P.	<ul style="list-style-type: none"> <li>▪ Defined parameters</li> <li>▪ All parameters</li> </ul>	Defined parameters


### 5.4.5 Disabling Custody transfer

A list of all the defined and custody transfer parameters is provided in the Appendix →  33.


 If the **authorized user login** and **password** are entered via the display module, perform the following steps in the order indicated. If the **authorized user login** and **password** are entered via the Web server, the device must first be opened and connected to the service interface.

 The procedure does not have a time limit.

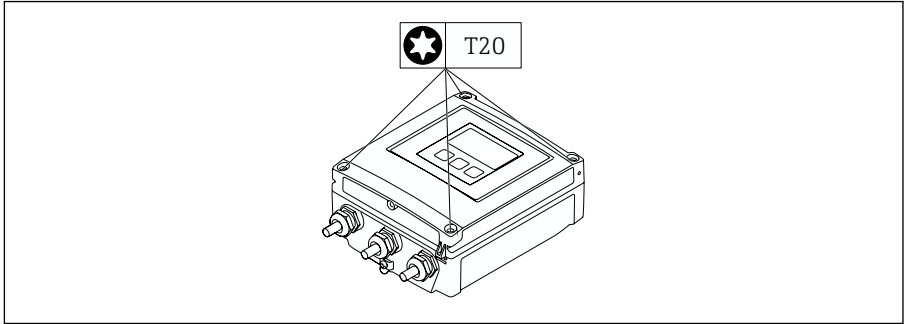
 The measuring device can only be unlocked with the **Authorized user login** parameter and the associated **password** and **DIP switch**. If only the **DIP switch** is set to the **OFF** position, the measuring device does not switch off the Custody transfer. A warning message is generated, which can be cleared only by resetting the **DIP switch** .

 Use a suitable tool - preferably one with a non-metal tip - to switch the DIP switch.

### Opening the measuring device and disabling the custody transfer mode

1. Break the optional sealing.
2. In the menu enter the **Authorized user login** parameter and the **Password** parameter →  22.
3. Enter the time and date information.
4. Disconnect the power supply to the device.

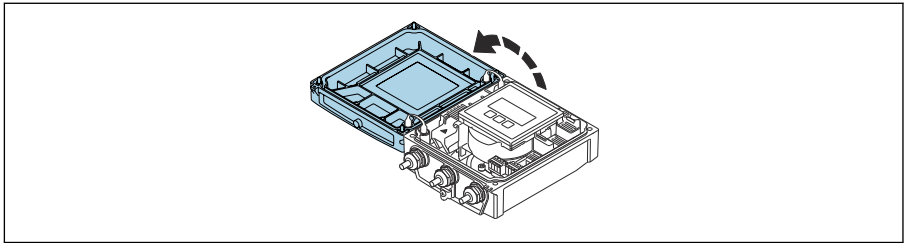
5.



A0021571

Unscrew the cover of the transmitter.

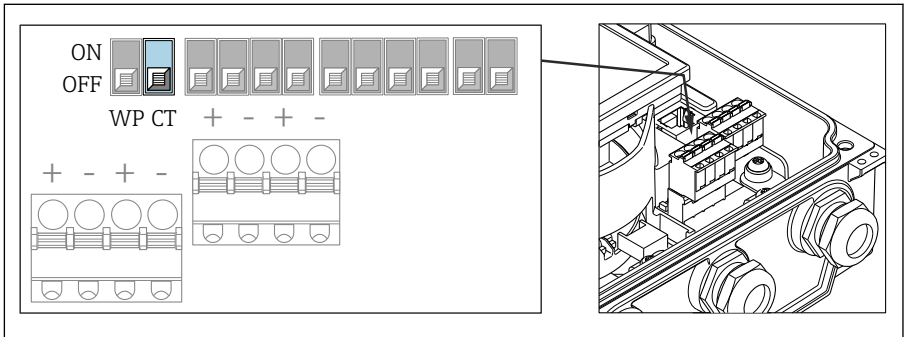
6.



A0021572

Open the connection compartment cover.

7.



A0048281

Set the **CT DIP switch** to the **OFF** position.

8.

Reverse the procedure to close the measuring device.

## 9. Reestablish the power supply.

**i** If the measuring device has been unlocked correctly with the **Authorized user login** parameter, **password** and the **CT DIP switch**, the locking symbol disappears from the display and the value of the internal Custody transfer counter increases. In addition, an entry with a Timestamp (operating hours) is generated in the logbook. An entry is also recorded in the event logbook. When the device is in an unlocked state, all parameters can be edited.





### 5.4.6 Parameter description for Custody transfer activation

**i** An **authorized user login** is available: EH000 with password 177801. This **authorized user login** is the non-personalized factory login and enables the activation and deactivation of the custody transfer mode. Settings made using this login must be documented and personalized by the system operator. In addition, the responsible calibration authority must be informed of these changes.

#### Navigation

"Setup" menu → Advanced setup → Custody transfer activation

► Custody transfer activation	
Authorized user login	→ 23
Password	→ 23
Login state	→ 23
Display test	→ 23
Year	→ 23
Month	→ 23
Day	→ 23
AM/PM	→ 23
Hour	→ 23
Minute	→ 23


Clear custody transfer logbook	→  23
Entry 30 of custody transfer logbook	→  23
Checksum	→  24
Toggle DIP switch	→  24

### Parameter overview with brief description


Parameter	Description	User entry / User interface / Selection	Factory setting
Authorized user login	Enter a specified authorized user login.	Authorized user login	EH000
Password	Enter a specified password.	0 to 999999	177801
Login state	Display login status.	<ul style="list-style-type: none"> <li>■ Logged in</li> <li>■ Logged out</li> </ul>	Logged out
Display test	Start or cancel display test.	<ul style="list-style-type: none"> <li>■ Cancel</li> <li>■ Start</li> </ul>	Cancel
Year	Enter the year.	9 to 99	10
Month	Enter the month.	<ul style="list-style-type: none"> <li>■ January</li> <li>■ February</li> <li>■ March</li> <li>■ April</li> <li>■ May</li> <li>■ June</li> <li>■ July</li> <li>■ August</li> <li>■ September</li> <li>■ October</li> <li>■ November</li> <li>■ December</li> </ul>	January
Day	Enter the day.	1 to 31 d	1 d
AM/PM	Select AM/PM.	<ul style="list-style-type: none"> <li>■ AM</li> <li>■ PM</li> </ul>	AM
Hour	Enter the hour.	0 to 23 h	12 h
Minute	Enter the minutes.	0 to 59 min	0 min
Clear custody transfer logbook	Delete custody transfer logbook selection.	<ul style="list-style-type: none"> <li>■ Cancel</li> <li>■ Clear data</li> </ul>	Cancel
Entry 30 of custody transfer logbook	Display the recorded logbook entries.	0...30	0


Parameter	Description	User entry / User interface / Selection	Factory setting
Checksum	Shows the firmware's checksum.	Positive integer	-
Toggle DIP switch	Display the DIP switch status.	<ul style="list-style-type: none"> <li>■ Off</li> <li>■ On</li> </ul>	Off



### 5.4.7 Setting up Custody transfer mode


 If the **authorized user login** and **password** are entered via the display module, perform the following steps in the order indicated. If the **authorized user login** and **password** are entered via the Web server, the device must first be opened and connected to the service interface.

 The procedure does not have a time limit.



 The measuring device can only be locked with the **Authorized user login** parameter and the associated password and **CT DIP switch**. If only the **CT DIP switch** is set to the **ON** position, the measuring device does not switch to the custody transfer mode. A warning message is generated, which can be cleared only by resetting the **CT DIP switch**.

 Defined parameters and custody transfer parameters cannot be edited in the locked state. A list of all the non-editable parameters is provided in the Section 6 →  33.

 Before you activate the custody transfer mode, select whether all parameters or only defined parameters should be locked. →  33

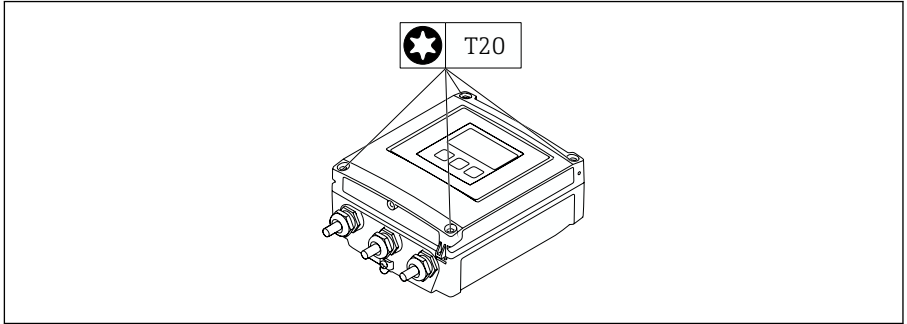
 Use a suitable tool - preferably one with a non-metal tip - to switch the DIP switch.

### Opening the measuring device and setting up the custody transfer mode

1. Select the parameters to be locked with the **Custody transfer locking** parameter →  26.
2. In the menu enter the **Authorized user login** parameter and the **Password** parameter →  22.
3. Enter the time and date information.
4. As an option, the custody transfer logbook can be cleared.
5. Disconnect the power supply to the device.



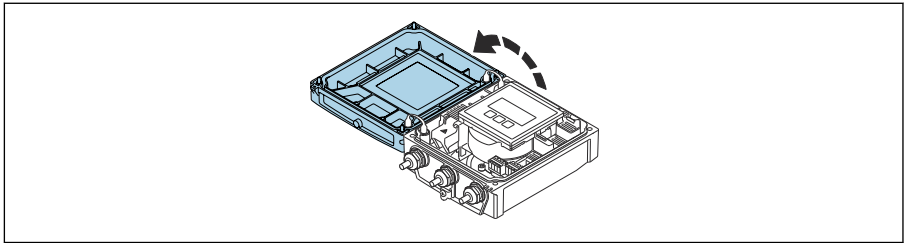
6.



A0021571

Unscrew the cover of the transmitter.

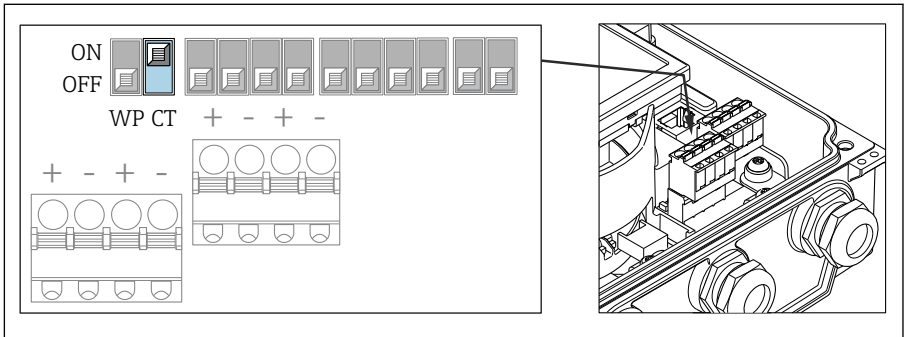
7.



A0021572

Open the connection compartment cover.

8.



A0048554

Set the **CT DIP switch** to the **ON** position.

9.

Follow the reverse sequence to close the measuring device, and seal if desired.

10.

Reestablish the power supply.

11. A padlock symbol (🔒) appears in the header of the display.

**i** If the measuring device has been locked correctly with the **Authorized user login** parameter, **Password** parameter and the **CT DIP switch**, the locking symbol appears on the display and the value of the internal Custody transfer counter increases. In addition, an entry with a Timestamp (operating hours) is generated in the Custody transfer logbook. An entry is also recorded in the event logbook.

## 5.5 Reading parameters relevant for custody transfer

**i** In custody transfer mode, the following parameters can be viewed via the display or the service interface (web server). These can also be read via the MODBUS RS485 tab.

### Navigation

"Operation" menu → Custody transfer

▶ Custody transfer	
Custody transfer mode	→ 📄 26
Firmware version	→ 📄 26
Checksum	→ 📄 26
Custody transfer counter	→ 📄 27
Custody transfer locking	→ 📄 27
Timestamp last custody transfer	→ 📄 27
Display test	→ 📄 27

### Parameter overview with brief description

Parameter	Description	User interface / Selection	Factory setting
Custody transfer mode	Shows if the device is in custody transfer mode.	<ul style="list-style-type: none"> <li>▪ Off</li> <li>▪ On</li> </ul>	Off
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	-
Checksum	Shows the firmware's checksum.	Positive integer	-

Parameter	Description	User interface / Selection	Factory setting
Custody transfer counter	Indicates how often custody transfer mode has been enabled so far.	0 to 65 535	–
Custody transfer locking	Select the output version of the measuring device. "Defined parameters" for devices with the order code for "Output/input": option M and O; "All parameters" for the order code for "Output/input": option P.	<ul style="list-style-type: none"> <li>▪ Defined parameters</li> <li>▪ All parameters</li> </ul>	Defined parameters
Timestamp last custody transfer	Indicates the time when the custody transfer mode was last enabled.	Days (d), hours (h), minutes (m) and seconds (s)	–
Display test	Start or cancel display test.	<ul style="list-style-type: none"> <li>▪ Cancel</li> <li>▪ Start</li> </ul>	Cancel

### 5.5.1 Display test

The character test string is used to test the display. When the display test is selected, the display test sequence starts and the test string is displayed with an inverted background. Once the text display is confirmed, the test string is displayed again with a non-inverted background and the display test is finished.

## 5.6 Custody transfer logbook








The Custody transfer logbook can be viewed on the display via FieldCare or the Web server.

- The last entry is displayed first.
- A maximum of 30 entries can be saved in the Custody transfer logbook. If these are all in use, no further entries will be saved and a warning message will appear.
- If parameters relating to Custody transfer mode are changed while custody transfer mode is disabled, this is recorded in the Custody transfer logbook. In addition, an exact description of the changed parameter is saved in the event logbook.

### Navigation

"Diagnostics" menu → Custody transfer logbook

▶ Custody transfer logbook	
Logbook entry	→ 📄 28
Entry 30 of custody transfer logbook	→ 📄 28

Event number	→  28
Event logbook	→  28
Timestamp	→  28
Authorized user login	→  28
Totalizer value	→  28
Totalizer overflow	→  28
Date/time	→  28

### Parameter overview with brief description

Parameter	Description	User entry / User interface	Factory setting
Logbook entry	Select a logbook entry.	1 to 30	1
Entry 30 of custody transfer logbook	Display the recorded logbook entries.	0...30	0
Event number	Display the event number.	Positive integer	1
Event logbook	Display the event.	–	0
Timestamp	Display the timestamp.	Date of timestamp.	0
Authorized user login	Display the specified authorized user login.	Authorized user login	EH000
Totalizer value	Display the totalizer value.	Signed floating-point number	0
Totalizer overflow	Display the totalizer overflow.	Signed floating-point number	0
Date/time	Display the date/time.	Date/time	0

#### 5.6.1 Deleting the Custody transfer logbook

The Custody transfer logbook can be deleted only if you have previously logged in using an **Authorized user login** parameter and **password**.

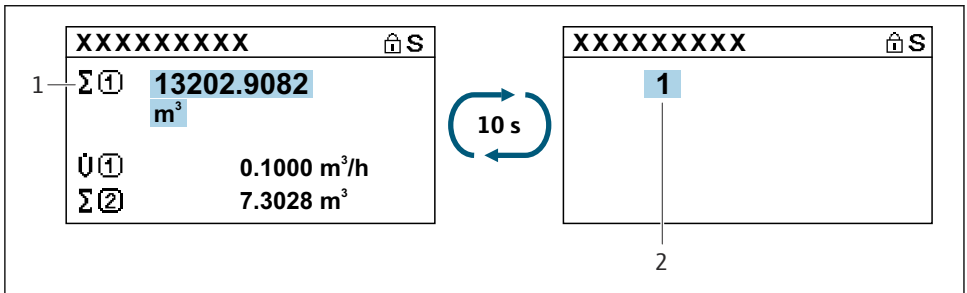
1. In the **Custody transfer activation** wizard or **Custody transfer deactivation** wizard, log in with an **Authorized user login** parameter and **password**.

2. The **Clear custody transfer logbook** parameter is now available in the **Custody transfer activation** wizard and in the **Custody transfer deactivation** wizard .

↳ If the Custody transfer logbook is deleted, this is stored as the first new entry in the custody transfer logbook.

## 5.7 Procedure for market surveillance

The recommended procedure for market surveillance is the comparison between the status of the custody transfer counter shown under display value 4 on the display and the last documented status of the custody transfer counter. The display alternates every ten seconds between the custody transfer counter status and the totalizer.



A0024892

- 1 Display for totalizer.
- 2 Display for custody transfer counter status.

If the custody transfer counter status on the display and the last documented custody transfer counter status are identical, the device has not been tampered with.

However, if the two custody transfer counter statuses are not identical, the following procedure is recommended:

### Retrieve the following parameters in the Custody transfer logbook:


1. **Authorized user login** parameter: Check the last authorized user login where a change was made to parameters relevant for custody transfer.
2. **Event logbook** parameter: Verify changes.
3. **Totalizer value** parameter: Check the value of the totalizer at the time of the change.
4. **Timestamp** parameter: Check the operating time at which the change was made.
5. In the Event logbook, search for the entry with the applicable Timestamp in the Event logbook and verify which changes were carried out.

In this way, market surveillance can verify what was changed by whom at a particular time.

## 5.8 Repeated calibration due to legal metrology controls

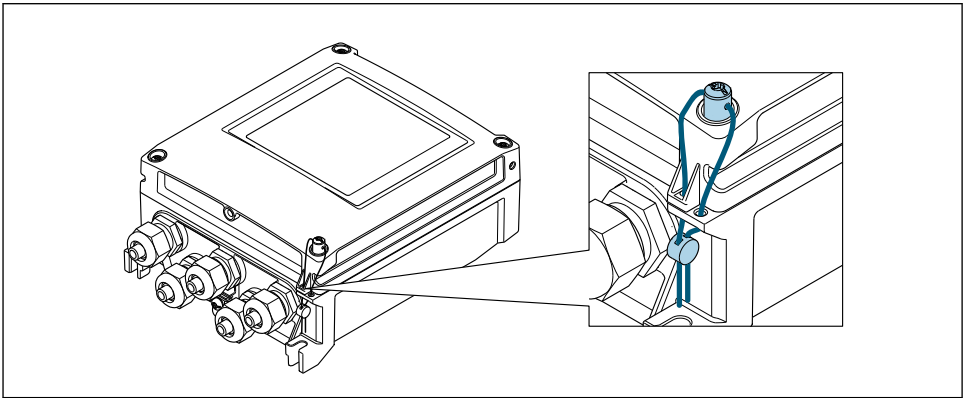
The system operator is obliged to perform a recalibration in accordance with the relevant applicable national regulations.

## 5.9 Sealing

 It is possible to seal the measuring device. The system operator or the competent calibration authority is responsible for applying the optional seal. The seal can be applied to the housing using a seal screw and the relevant bracket.

### 5.9.1 Sealing the transmitter

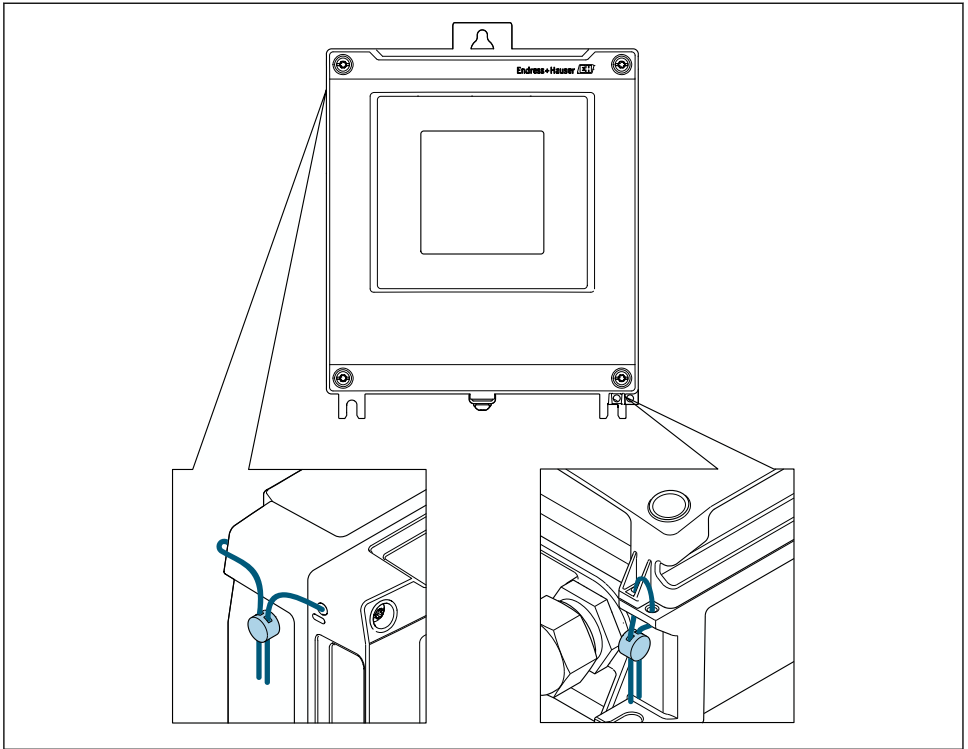
#### Aluminum transmitter



A0025237

1. Pull the wire through the bore in the housing and through the screw head. In doing so, ensure that the wire is taut and there is no leeway for the screw to loosen.
2. Seal the wire ends.

## Polycarbonate transmitter

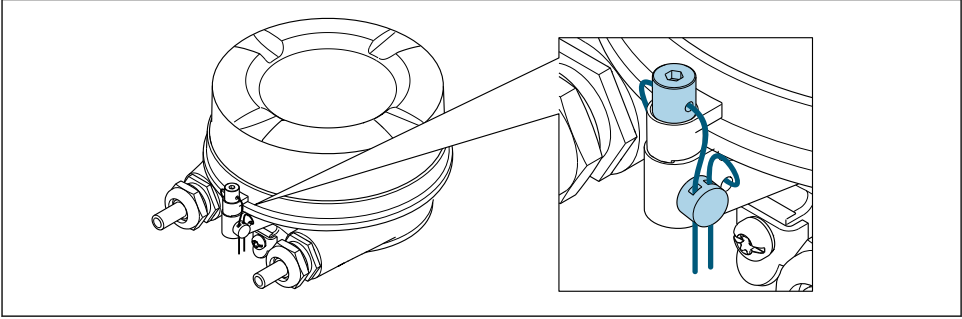


A0041369

1. Remove the display guard before sealing.
2. Pull the wire through the holes in the housing.
3. Seal the wire ends.
4. Fit the display guard back on after sealing.

## 5.9.2 Sealing the connection housing

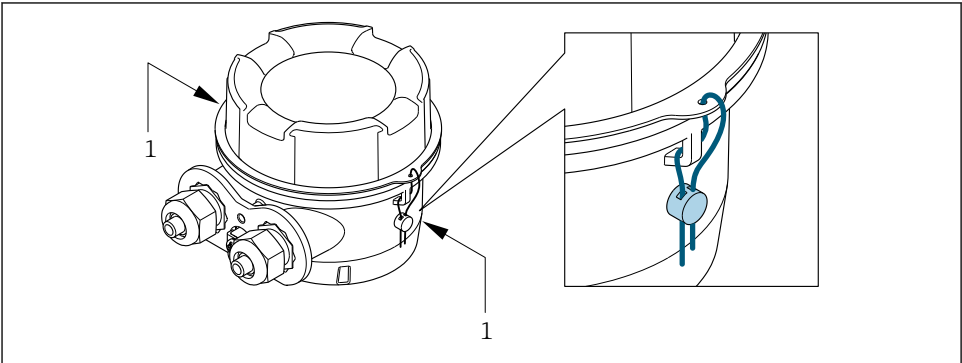
### Connection housing remote version



A0025239

1. Pull the wire through the bore in the housing and through the screw head. In doing so, ensure that the wire is taut and there is no leeway for the screw to loosen.
2. Seal the wire ends.

### Connection housing remote version, IP68



A0025238

1. Feed the wire through the bore hole in the cover and connection housing. In doing so, ensure that the wire is taut.
2. Seal the wire ends.



## 6 Parameters in custody transfer mode

Parameters that are relevant for custody transfer must be write-protected in the custody transfer mode. Three options are available for this purpose:

Write protection	Description
Hardware write protection	Sets every parameter to write-protected.
CT locking: <b>All parameters</b>	Factory setting for devices with the order code for "Output/input": option P "Modbus RS485, 4-20mA".
CT locking: <b>Defined parameters</b>	Factory setting for devices with the order code for "Output/input": option M "Modbus RS485" and option O "Modbus RS485, 4-20mA, 2x pulse/freq."

### 6.1 Configurable parameters

#### Description

- The parameters that are not marked can be edited in **CT locking: All parameters** and **Defined parameters**.
- The parameters that are marked can only be edited in **CT locking: Defined parameters**.
- Generally speaking, all the parameters that are not listed cannot be edited in the custody transfer mode.



A description of the device parameters is provided in the associated Technical Documentation → 5

#### Navigation

"Expert" menu

Expert	
Direct access	
▶ System	→  35
▶ Display	→  35
▶ Administration	→  35
▶ Sensor	→  36
▶ System units	→  36

▶ Process parameters	→ 37
▶ External compensation	→ 37
▶ Calibration	→ 38
▶ Output	→ 38
▶ Current output 1	→ 38
▶ Pulse/frequency/switch output 1 to n	→ 39
▶ Communication	→ 40
▶ Modbus configuration	→ 40
▶ Modbus data map	→ 41
▶ Web server	→ 41
▶ WLAN settings	→ 42
▶ Diagnostics	→ 43
▶ Event logbook	→ 43
▶ Device information	→ 43
▶ Data logging	→ 43
▶ Heartbeat Technology	→ 44
▶ Simulation	→ 45

### 6.1.1 "System" submenu

#### "Display" submenu

##### Navigation

"Expert" menu → System → Display

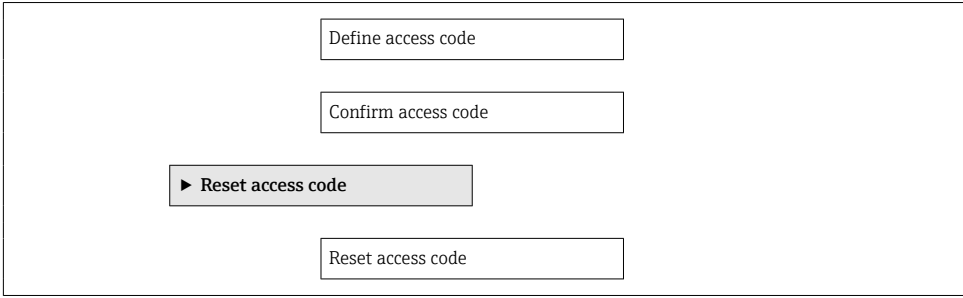
The screenshot shows a menu structure for the 'Display' submenu. At the top, there is a grey button labeled '► Display'. Below it, there are ten white rectangular buttons with black text, arranged vertically. The buttons are: 'Display language', 'Value 3 display', '0% bargraph value 3', '100% bargraph value 3', 'Decimal places 3', 'Header', 'Header text', 'Separator', 'Contrast display', and 'Backlight'.

#### "Administration" submenu

##### Navigation

"Expert" menu → System → Administration

The screenshot shows a menu structure for the 'Administration' submenu. At the top, there is a grey button labeled '► Administration'. Below it, there is one white rectangular button with black text labeled '► Define access code'.



Define access code

Confirm access code

▶ Reset access code

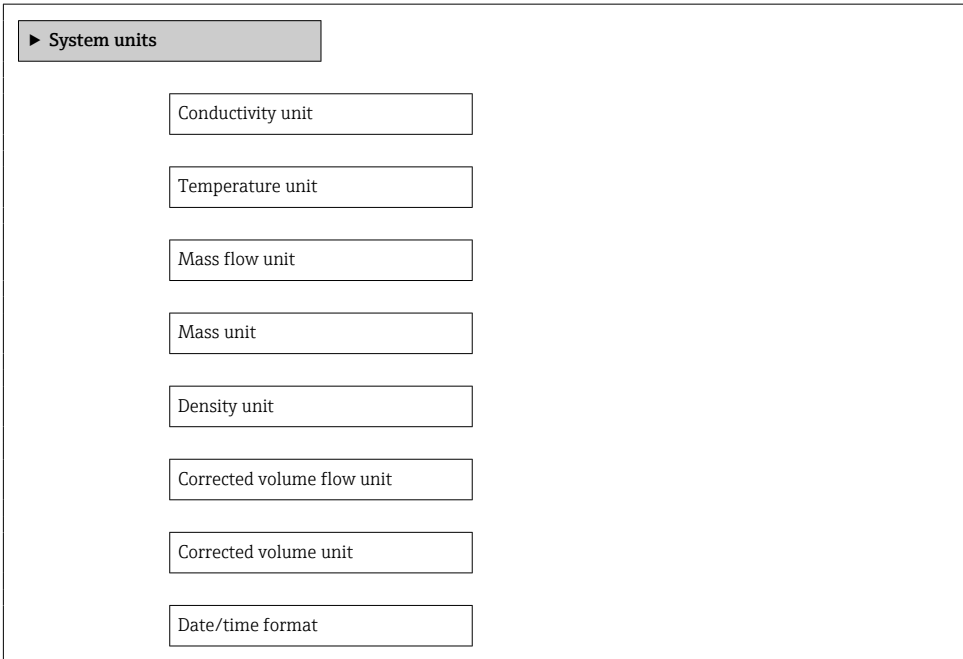
Reset access code

### 6.1.2 "Sensor" submenu

#### "System units" submenu

##### Navigation

"Expert" menu → Sensor → System units



▶ System units

Conductivity unit

Temperature unit

Mass flow unit

Mass unit

Density unit

Corrected volume flow unit

Corrected volume unit

Date/time format

## "Process parameters" submenu

### Navigation

"Expert" menu → Sensor → Process parameters

The screenshot shows a menu structure for 'Process parameters'. At the top is a grey header box with a right-pointing triangle and the text 'Process parameters'. Below this are five white rectangular buttons with black text, arranged vertically: 'Conductivity measurement', 'Conductivity damping', 'Conductivity temperature coefficient', 'Temperature damping', and 'Reference density'. Below these is another grey header box with a right-pointing triangle and the text 'Build-up index'. Underneath this second header are two more white rectangular buttons with black text: 'Build-up index' and 'Build-up index damping'.

## "External compensation" submenu

### Navigation

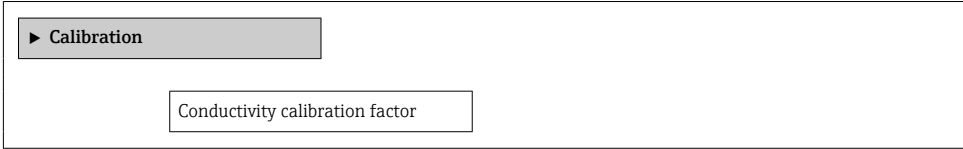
"Expert" menu → Sensor → External compensation

The screenshot shows a menu structure for 'External compensation'. At the top is a grey header box with a right-pointing triangle and the text 'External compensation'. Below this are four white rectangular buttons with black text, arranged vertically: 'Density source', 'Fixed density', 'Temperature source', and 'Reference temperature'.

## "Calibration" submenu

### Navigation

"Expert" menu → Sensor → Calibration

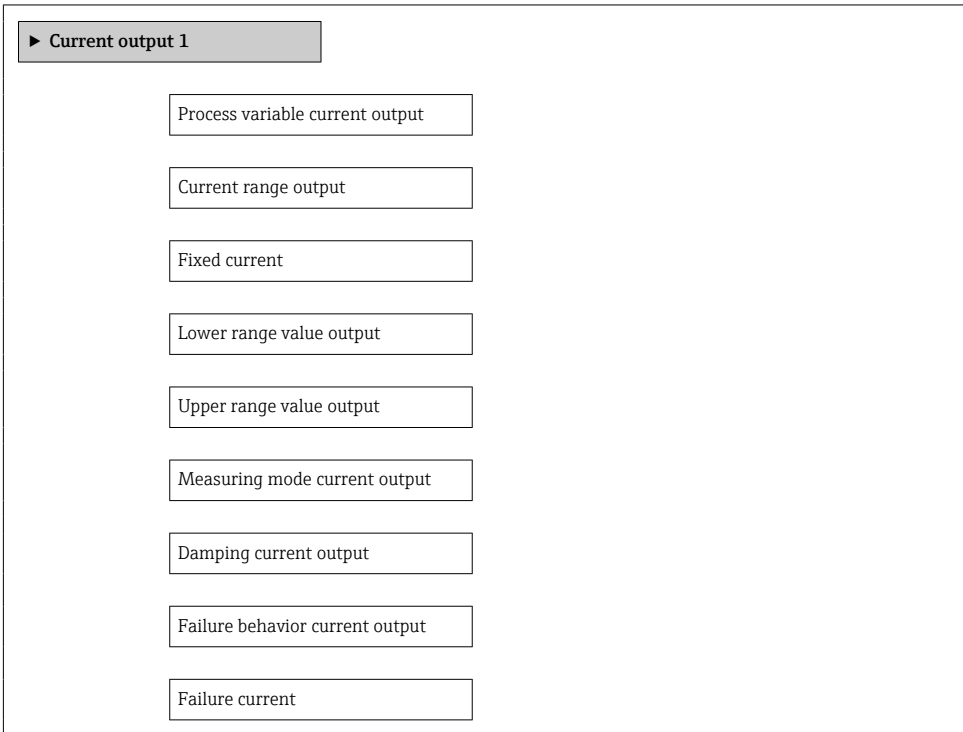


## 6.1.3 "Output" submenu

### "Current output 1" submenu

### Navigation

"Expert" menu → Output → Current output 1














## "Pulse/frequency/switch output 1 to n" submenu

### Navigation

"Expert" menu → Output → Pulse/frequency/switch output 1 to n

▶ Pulse/frequency/switch output 1 to n	
Operating mode	✕
Assign pulse output 1 to n	✕
Pulse scaling	✕
Pulse width	✕
Measuring mode	✕
Failure mode	✕
Assign frequency output	
Minimum frequency value	
Maximum frequency value	
Measuring value at minimum frequency	
Measuring value at maximum frequency	
Measuring mode	
Damping output 1 to n	
Failure mode	
Failure frequency	

Switch output function	
Assign diagnostic behavior	
Assign limit	
Switch-on value	
Switch-off value	
Assign flow direction check	
Assign status	
Switch-on delay	
Switch-off delay	
Failure mode	
Invert output signal	

#### 6.1.4 "Communication" submenu

##### "Modbus configuration" submenu

##### Navigation

"Expert" menu → Communication → Modbus configuration

► Modbus configuration
Bus address
Baudrate
Data transfer mode



Parity
Byte order
Telegram delay
Failure mode
Fieldbus writing access

### "Modbus data map" submenu

#### Navigation

"Expert" menu → Communication → Modbus data map

▶ Modbus data map
Scan list register 0 to 15

### "Web server" submenu

#### Navigation

"Expert" menu → Communication → Web server

▶ Web server
Web server language
DHCP client
IP address
Subnet mask
Default gateway

Web server functionality

Login page

## "WLAN settings" wizard

### Navigation

"Expert" menu → Communication → WLAN settings

#### ▶ WLAN settings

WLAN

WLAN mode

SSID name

Network security

User name

WLAN password

WLAN IP address

WLAN subnet mask

WLAN passphrase

Assign SSID name

SSID name

2.4 GHz WLAN channel

<input type="text" value="Select antenna"/>
<input type="text" value="WLAN IP address"/>

### 6.1.5 "Diagnostics" submenu

#### "Event logbook" submenu

##### Navigation

"Expert" menu → Diagnostics → Event logbook

<input type="button" value="▶ Event logbook"/>
<input type="text" value="Filter options"/>

#### "Device information" submenu

##### Navigation

"Expert" menu → Diagnostics → Device information

<input type="button" value="▶ Device information"/>
<input type="text" value="Serial number"/>
<input type="text" value="Device name"/>

#### "Data logging" submenu

##### Navigation

"Expert" menu → Diagnostics → Data logging

<input type="button" value="▶ Data logging"/>
<input type="text" value="Assign channel 1"/>
<input type="text" value="Assign channel 2"/>
<input type="text" value="Assign channel 3"/>

Assign channel 4
Logging interval
Clear logging data
Data logging
Logging delay
Data logging control

### "Heartbeat Technology" submenu

#### Navigation

"Expert" menu → Diagnostics → Heartbeat Technology

▶ Heartbeat Technology
▶ Heartbeat base settings
Plant operator
Location
Partially filled pipe
▶ Performing verification
Year
Month
Day
Hour

AM/PM
Minute
External device information
Measured values

## "Simulation" submenu

### Navigation




"Expert" menu → Diagnostics → Simulation

▶ Simulation	
Current output 1 simulation	
Current output value	
Frequency output 1 to n simulation	
Frequency output 1 to n value	
Pulse output simulation 1 to n	✖
Pulse value 1 to n	✖
Switch output simulation 1 to n	✖
Switch state 1 to n	✖

## 6.2 Deviating parameter configuration



The configuration of the following parameters deviates from the factory settings and corresponds to the specifications of OIML R49.

Parameter	Factory setting	Parameter configuration for custody transfer
Format display	1 value, large format	1 value, large format + 2 values <sup>1)</sup>
Value 1 display	Volume flow	Totalizer 1 <sup>1)</sup>
Decimal places 1	x.xx	Depends on the nominal diameter of the measuring device <sup>1)</sup>
Value 2 display	None	Volume flow <sup>1)</sup>
Value 4 display	None	Custody transfer counter <sup>1)</sup>
Display interval	5 s	10 s <sup>1)</sup>
Volume flow unit	l/h or gal/min	m <sup>3</sup> /h
Volume unit	m <sup>3</sup> or gal	dm <sup>3</sup>
Totalizer 1 (Assign process variable)	Volume flow	Volume flow
Totalizer 1 (Operating mode)	Net flow total	Net flow total
Unit totalizer 1 to n	l or gal	m <sup>3</sup>
Totalizer 1 (Failure mode)	Stop	Stop
Totalizer 2 (Assign process variable)	Volume flow	Volume flow
Totalizer 2 (Operating mode)	Net flow total	Forward flow
Totalizer 2 to n (Unit totalizer 1)	l or gal	m <sup>3</sup>
Totalizer 2 (Failure mode)	Stop	Stop
Totalizer 3 (Assign process variable)	Volume flow	Volume flow
Totalizer 3 (Operating mode)	Net flow total	Reverse flow
Totalizer 3 to n (Unit totalizer 1)	l or gal	m <sup>3</sup>
Totalizer 3 (Failure mode)	Stop	Stop
Flow damping	4	7
Low flow cut off	Volume flow	Volume flow
On-time low flow cut off	Depends on nominal diameter	See the "Operation and commissioning" section →  9
Empty pipe detection	Off	On
PFS output 1 (operating mode) <sup>2)</sup>	Pulse	Pulse
PFS output 1 (Assign pulse 1) <sup>2)</sup>	Off	Volume flow
PFS output 1 (Value per pulse) <sup>2)</sup>	Depends on nominal diameter	See the "Operation and commissioning" section →  9
PFS output 1 (Pulse width) <sup>2)</sup>	100	See the "Operation and commissioning" section →  9
PFS output 1 (Measuring mode) <sup>2)</sup>	Forward flow	Forward/reverse flow
PFS output 1 to n (Failure mode) <sup>2)</sup>	No pulses	No pulses

Parameter	Factory setting	Parameter configuration for custody transfer
PFS output 2 (Operating mode) <sup>2)</sup>	Pulse	Switch
PFS output 2 (Switch off function) <sup>2)</sup>	Off	Flow direction monitoring
PFS output 2 (Assign flow direction check) <sup>2)</sup>	Volume flow	Volume flow

- 1) These parameters are set automatically when the custody transfer mode is activated and reset when the custody transfer mode is deactivated.
- 2) Only available for the order code for "Output;input", option P.



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