

Description of Device Parameters

Proline Promag 300

Electromagnetic flowmeter
Modbus TCP

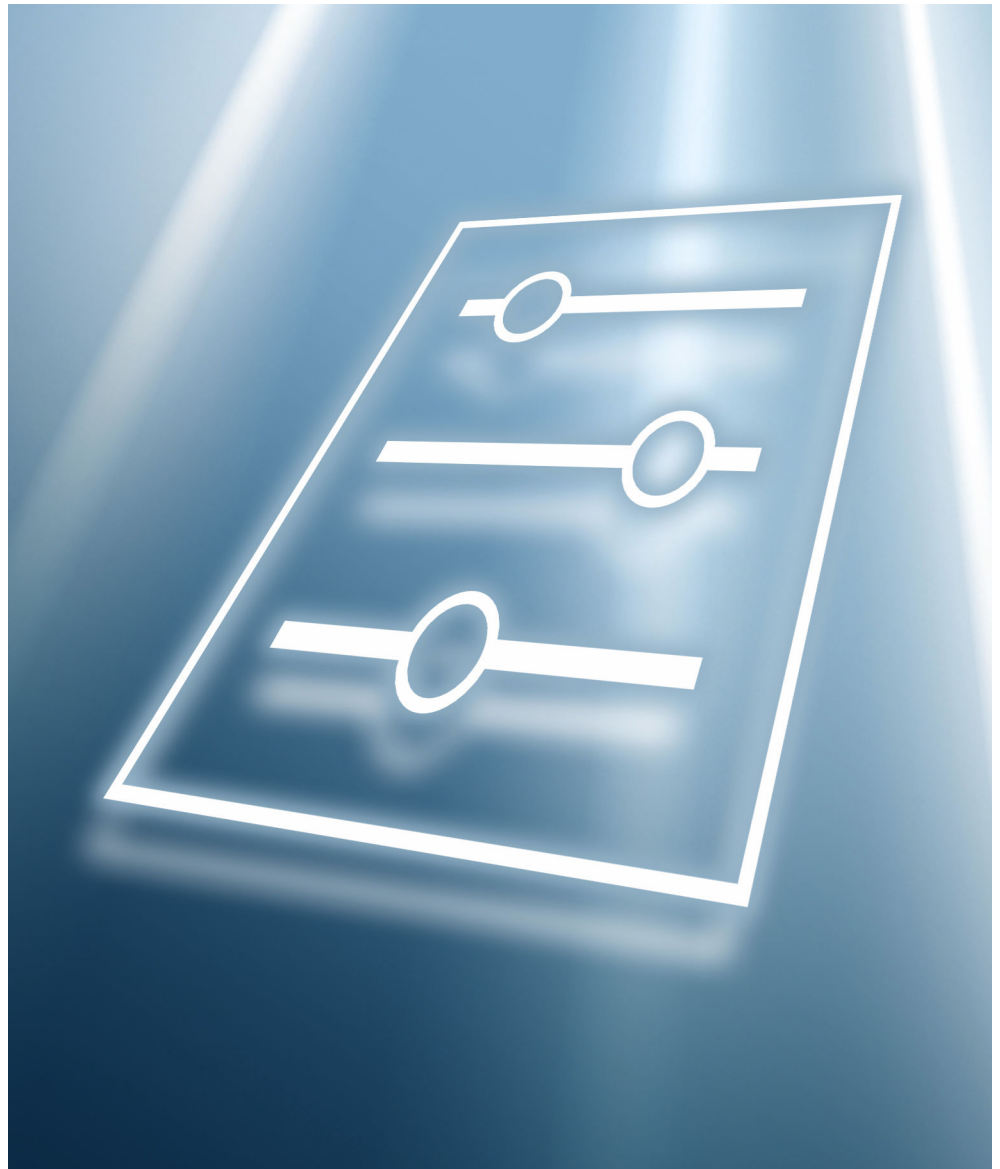


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1 About this document

1.1 Document function

The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

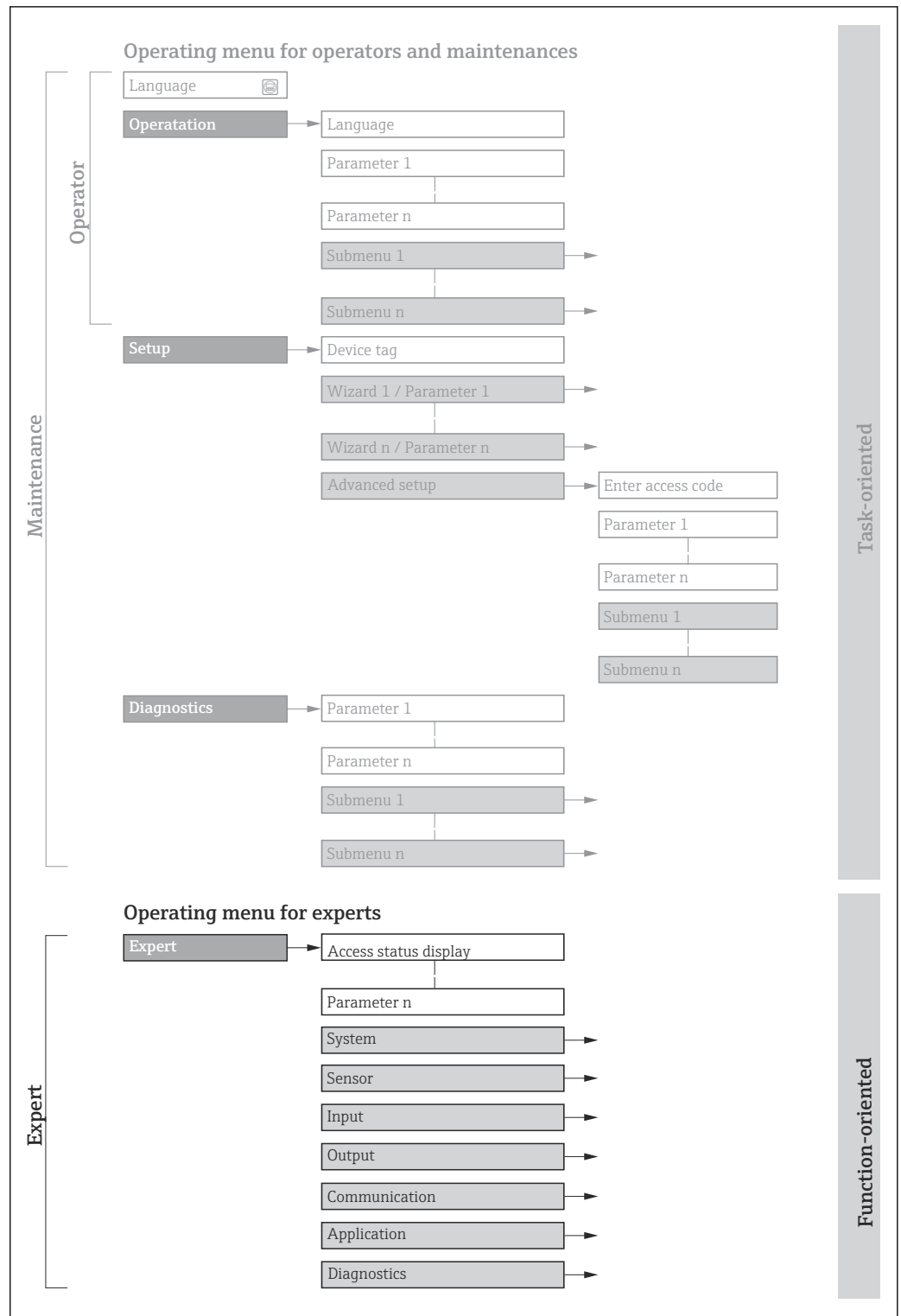
1.2 Target group

The document is aimed at experts who work with the device over the entire life cycle and perform specific configurations.

1.3 Using this document

1.3.1 Information on the document structure

The document lists the submenus and their parameters according to the structure from the **Expert** menu (→  8), which is displayed when the **"Maintenance" user role** is enabled.



1 Sample graphic for the schematic layout of the operating menu



Additional information regarding:

- The arrangement of the parameters according to the menu structure of the **Operation** menu, **Setup** menu, **Diagnostics** menu with a brief description: Operating Instructions → 7
- Operating concept of the operating menus: Operating Instructions → 7

1.3.2 Structure of a parameter description

The individual parts of a parameter description are described in the following section:

Complete parameter name		Write-protected parameter = 
Navigation	 Navigation path to the parameter via the local display (direct access code) or web browser  Navigation path to the parameter via the operating tool The names of the menus, submenus and parameters are abbreviated to the form in which they appear on the display and in the operating tool.	
Prerequisite	The parameter is only available under these specific conditions	
Description	Description of the parameter function	
Selection	List of the individual options for the parameter ■ Option 1 ■ Option 2	
User entry	Parameter entry range	
Display	Display value/data of the parameter	
Factory setting	Default setting ex works	
Additional information	Additional explanations (e.g. in examples): ■ For individual options ■ For display value/data ■ For the input range ■ For the factory setting ■ For the parameter function	

1.4 Symbols

1.4.1 Symbols for certain types of information

Symbol	Meaning
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
 A0028662	Operation via local display
 A0028663	Operation via operating tool
 A0028665	Write-protected parameter

1.4.2 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

1.5 Documentation

1.5.1 Standard documentation

Operating instructions

Measuring instrument	Documentation code
Promag H 300	BA02391D
Promag P 300	BA02392D
Promag W 300	BA02393D

1.5.2 Supplementary device-dependent documentation

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Web server	
Remote display and operating module DKX001	SD01763D

Contents	Documentation code
Modbus TCP system integration	SD03383D

2 Overview of the Expert operating menu

The following table provides an overview of the menu structure of the expert operating menu and its parameters. The page reference indicates where the associated description of the submenu or parameter can be found.

► Expert	
Direct access (0106)	→ 13
Locking status (0004)	→ 14
User role (0005)	→ 15
Enter access code (0003)	→ 15
► System	→ 16
► Display	→ 16
► Configuration backup	→ 29
► Diagnostic handling	→ 32
► Administration	→ 41
► Sensor	→ 46
► Measured values	→ 47
► System units	→ 57
► Process parameters	→ 64
► External compensation	→ 81
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► I/O configuration	→ 107
I/O module 1 to n terminal numbers (3902-1 to n)	→ 108
I/O module 1 to n information (3906-1 to n)	→ 108

I/O module 1 to n type (3901-1 to n)	→ 108
Apply I/O configuration (3907)	→ 109
I/O alteration code (2762)	→ 109
► Input	→ 109
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► Pulse/frequency/switch output 1 to n	→ 54
► Relay output 1 to n	→ 143
► Double pulse output	→ 149
► Communication	→ 154
► Modbus configuration	→ 154
► Modbus information	→ 157
► Modbus data map	→ 158
► Web server	→ 170
► WLAN settings	→ 159
► Application	→ 173
Reset all totalizers (2806)	→ 173
► Totalizer 1 to n	→ 50
► Custody transfer	→ 173
► Diagnostics	→ 175
Actual diagnostics (0691)	→ 176
Previous diagnostics (0690)	→ 177

Operating time from restart (0653)	→  177
Operating time (0652)	→  177
▶ Diagnostic list	→  178
▶ Event logbook	→  180
▶ Custody transfer logbook	→  181
▶ Device information	→  181
▶ Main electronic module + I/O module 1	→  185
▶ Sensor electronic module (ISEM)	→  186
▶ I/O module 2	→  187
▶ I/O module 3	→  188
▶ Display module	→  190
▶ Data logging	→  191
▶ Min/max values	→  199
▶ Heartbeat Technology	→  203
▶ Simulation	→  214

3 Description of device parameters

In the following section, the parameters are listed according to the menu structure of the local display. Specific parameters for the operating tools are included at the appropriate points in the menu structure.

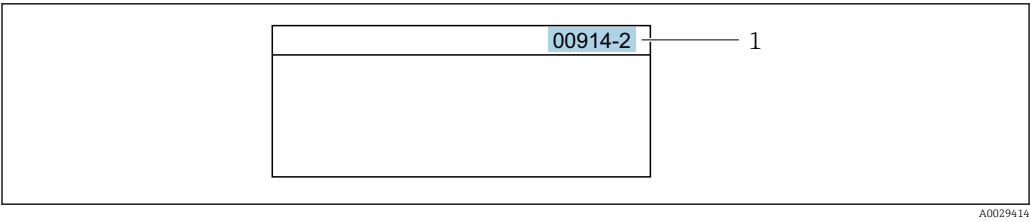
 Expert		
Direct access (0106)	→ 	13
Locking status (0004)	→ 	14
User role (0005)	→ 	15
Enter access code (0003)	→ 	15
▶ System	→ 	16
▶ Display	→ 	16
▶ Configuration backup	→ 	29
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▶ I/O configuration	→ 	107
I/O module 1 to n terminal numbers (3902-1 to n)	→ 	108
I/O module 1 to n information (3906-1 to n)	→ 	108

I/O module 1 to n type (3901-1 to n)	→ 108
Apply I/O configuration (3907)	→ 109
I/O alteration code (2762)	→ 109
► Input	→ 109
► Current input 1 to n	→ 110
► Status input 1 to n	→ 113
► Output	→ 115
► Current output 1 to n	→ 115
► Pulse/frequency/switch output 1 to n	→ 54
► Relay output 1 to n	→ 143
► Double pulse output	→ 149
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▶ I/O module 4	→ 189
▶ Display module	→ 190
▶ Data logging	→ 191
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▶ Heartbeat Technology	→ 203
▶ Simulation	→ 214

Direct access

Navigation	 Expert → Direct access (0106)
Description	Use this function to enter the access code to enable direct access to the desired parameter via the local display. A parameter number is assigned to each parameter for this purpose.
User entry	0 to 65 535
Additional information	User entry 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

Locking status

Navigation Expert → Locking status (0004)

Description Displays the active write protection.

- User interface
- Hardware locked
 - CT active - defined parameters
 - CT active - all parameters
 - Temporarily locked

Additional information *User interface*

If two or more types of write protection are active, the write protection with the highest priority is shown on the local display. In the operating tool all active types of write protection are displayed.

Detailed information on access authorization is provided in the "User roles and associated access authorization" and "Operating concept" sections of the Operations Instructions for the device → 7

Selection

Options	Description
None	The access authorization displayed in the Access status parameter (→ 15) applies . Only appears on local display.
Hardware locked (priority 1)	The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool) .
CT active - all parameters	Only available for Promag H. The DIP switch for custody transfer mode is activated on the PCB board. Locks the parameters that are relevant for custody transfer and also parameters that are predefined by Endress+Hauser and are not relevant for custody transfer (e.g. on local display or operating tool). For detailed information on custody transfer mode, see the Special Documentation for the device

Options	Description
CT active - defined parameters	 Only available for Promag H. The DIP switch for the custody transfer mode is activated on the PCB board. Only locks the parameters that are relevant for custody transfer (e.g. on the local display or operating tool).  For detailed information on custody transfer mode, see the Special Documentation for the device
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 again.

User role

Navigation	 Expert → User role (0005)
Description	Displays the access authorization to the parameters via the local display, Web browser or operating tool.
User interface	■ Maintenance ■ Service
Factory setting	Maintenance
Additional information	<i>Description</i>  Access authorization can be modified via the Enter access code parameter (→  15).  If additional write protection is active, this restricts the current access authorization even further. <i>User interface</i>  Detailed information on access authorization is provided in the "User roles and associated access authorization" and "Operating concept" sections of the Operations Instructions for the device →  7

Enter access code

Navigation	 Expert → Ent. access code (0003)
Description	Use this function to enter the user-specific release code to remove parameter write protection.
User entry	Max. 16-digit character string comprising numbers, letters and special characters

3.1 "System" submenu

Navigation  Expert → System

► System		
► Display		→  16
► Configuration backup		→  29
► Diagnostic handling		→  32
► Administration		→  41

3.1.1 "Display" submenu

Navigation  Expert → System → Display

► Display		
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Format display (0098)		→  18
Value 1 display (0107)		→  20
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100% bargraph value 1 (0125)		→  21
Decimal places 1 (0095)		→  21
Value 2 display (0108)		→  22
Decimal places 2 (0117)		→  22
Value 3 display (0110)		→  23
0% bargraph value 3 (0124)		→  23
100% bargraph value 3 (0126)		→  24
Decimal places 3 (0118)		→  24
Value 4 display (0109)		→  25
Decimal places 4 (0119)		→  25

Display interval (0096)	→  26
Display damping (0094)	→  26
Header (0097)	→  27
Header text (0112)	→  27
Separator (0101)	→  28
Contrast display (0105)	→  28
Backlight (0111)	→  29

Display language

Navigation	 Expert → System → Display → Display language (0104)
Prerequisite	A local display is provided.
Description	Use this function to select the configured language on the local display.
Selection	■ English ■ Deutsch ■ Français ■ Español ■ Italiano ■ Nederlands ■ Portuguesa ■ Polski ■ русский язык (Russian) ■ Svenska ■ Türkçe ■ 中文 (Chinese) ■ 日本語 (Japanese) ■ 한국어 (Korean) ■ العربية (Arabic) * ■ Bahasa Indonesia ■ ภาษาไทย (Thai) * ■ tiếng Việt (Vietnamese) ■ čeština (Czech)
Factory setting	English

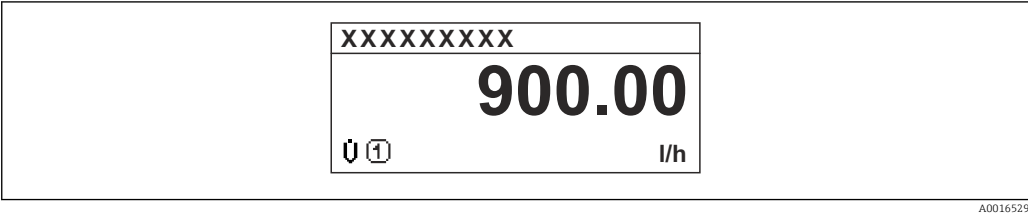
* Visibility depends on order options or device settings

Format display

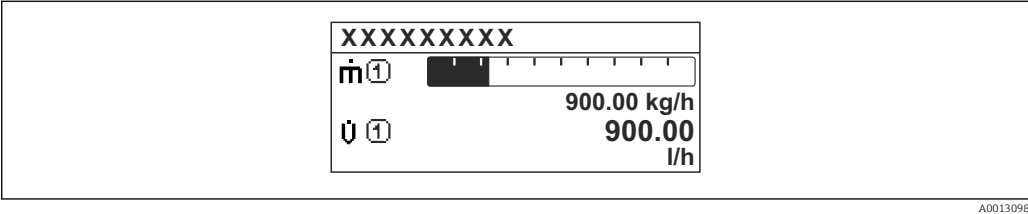
Navigation	 Expert → System → Display → Format display (0098)
Prerequisite	A local display is provided.
Description	Use this function to select how the measured value is shown on the local display.
Selection	■ 1 value, max. size ■ 1 bargraph + 1 value ■ 2 values ■ 1 value large + 2 values ■ 4 values
Factory setting	1 value, max. size
Additional information	<i>Description</i> The display format (size, bar graph) and number of simultaneously displayed measured values (1 to 8) can be configured. This setting only applies to normal operation.  ■ The Value 1 display parameter (→  20)...Value 8 display parameter are used to specify which measured values are shown on the local display and in what order. ■ If more measured values are specified than the display mode selected permits, then the values alternate on the device display. The display time until the next change is configured using the Display interval parameter (→  26).

Possible measured values shown on the local display:

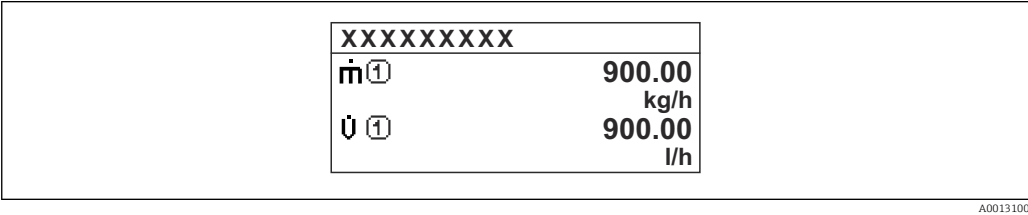
"1 value, max. size" option



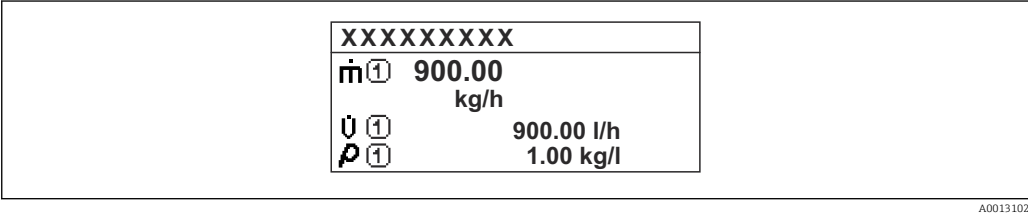
"1 bargraph + 1 value" option



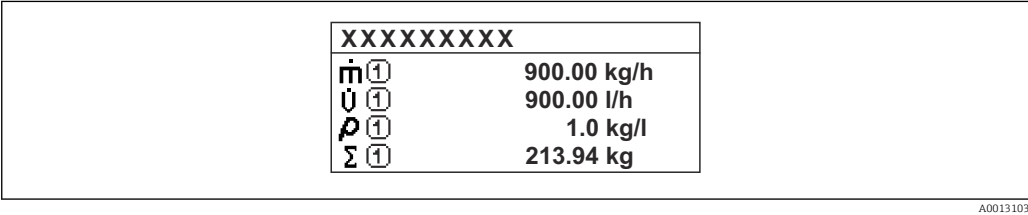
"2 values" option



"1 value large + 2 values" option



"4 values" option



Value 1 display 	
Navigation	 Expert → System → Display → Value 1 display (0107)
Prerequisite	A local display is provided.
Description	Use this function to select a measured value that is shown on the local display.
Selection	■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity[*] ■ Corrected conductivity[*] ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Current output 1[*] ■ Current output 2[*] ■ Current output 3[*] ■ Current output 4[*] ■ Temperature[*] ■ Electronics temperature ■ HBSI[*] ■ Noise[*] ■ Coil current shot time[*] ■ Reference electrode potential against PE[*] ■ Build-up index[*] ■ Test point 1 ■ Test point 2 ■ Test point 3
Factory setting	Volume flow
Additional information	<i>Description</i> If several measured values are displayed one below the other, the measured value selected here will be the first value to be displayed. The value is only displayed during normal operation.  The Format display parameter (→  18) is used to specify how many measured values are displayed simultaneously and how. <i>Dependency</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).

0% bargraph value 1 	
Navigation	 Expert → System → Display → 0% bargraph 1 (0123)
Prerequisite	A local display is provided.

* Visibility depends on order options or device settings

Description	Use this function to enter the 0% bar graph value to be shown on the display for the measured value 1.
User entry	Signed floating-point number
Factory setting	Country-specific: ■ 0 l/h ■ 0 gal/min (us)
Additional information	<i>Description</i>  The Format display parameter (→  18) is used to specify that the measured value is to be displayed as a bar graph. <i>User entry</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).

100% bargraph value 1

Navigation	  Expert → System → Display → 100% bargraph 1 (0125)
Prerequisite	A local display is provided.
Description	Use this function to enter the 100% bar graph value to be shown on the display for the measured value 1.
User entry	Signed floating-point number
Factory setting	Depends on country and nominal diameter →  224
Additional information	<i>Description</i>  The Format display parameter (→  18) is used to specify that the measured value is to be displayed as a bar graph. <i>User entry</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).

Decimal places 1

Navigation	  Expert → System → Display → Decimal places 1 (0095)
Prerequisite	A measured value is specified in the Value 1 display parameter (→  20).
Description	Use this function to select the number of decimal places for measured value 1.

Selection	■ X ■ X.X ■ X.XX ■ X.XXX ■ X.XXXX
Factory setting	X.XX
Additional information	<i>Description</i>  This setting does not affect the accuracy of the device for measuring or calculating the value.

Value 2 display

Navigation	 Expert → System → Display → Value 2 display (0108)
Prerequisite	A local display is provided.
Description	Use this function to select a measured value that is shown on the local display.
Selection	For the picklist, see Value 1 display parameter (→  20)
Factory setting	None
Additional information	<i>Description</i> If several measured values are displayed one below the other, the measured value selected here will be the second value to be displayed. The value is only displayed during normal operation.  The Format display parameter (→  18) is used to specify how many measured values are displayed simultaneously and how. <i>Dependency</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).

Decimal places 2

Navigation	 Expert → System → Display → Decimal places 2 (0117)
Prerequisite	A measured value is specified in the Value 2 display parameter (→  22).
Description	Use this function to select the number of decimal places for measured value 2.
Selection	■ X ■ X.X ■ X.XX ■ X.XXX ■ X.XXXX

Factory setting x.xx

Additional information *Description*



This setting does not affect the accuracy of the device for measuring or calculating the value.

Value 3 display

Navigation Expert → System → Display → Value 3 display (0110)

Prerequisite A local display is provided.

Description Use this function to select a measured value that is shown on the local display.

Selection For the picklist, see **Value 1 display** parameter (→ 20)

Factory setting None

Additional information *Description*

If several measured values are displayed one below the other, the measured value selected here will be the third value to be displayed. The value is only displayed during normal operation.



The **Format display** parameter (→ 18) is used to specify how many measured values are displayed simultaneously and how.

Options



The unit of the displayed measured value is taken from the **System units** submenu (→ 57).

0% bargraph value 3

Navigation Expert → System → Display → 0% bargraph 3 (0124)

Prerequisite A selection was made in the **Value 3 display** parameter (→ 23).

Description Use this function to enter the 0% bar graph value to be shown on the display for the measured value 3.

User entry Signed floating-point number

Factory setting Country-specific:
 ■ 0 l/h
 ■ 0 gal/min (us)

Additional information	<i>Description</i>  The Format display parameter (→  18) is used to specify that the measured value is to be displayed as a bar graph. <i>User entry</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).
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100% bargraph value 3	
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Navigation	  Expert → System → Display → 100% bargraph 3 (0126)
Prerequisite	A selection was made in the Value 3 display parameter (→  23).
Description	Use this function to enter the 100% bar graph value to be shown on the display for the measured value 3.
User entry	Signed floating-point number
Factory setting	0
Additional information	<i>Description</i>  The Format display parameter (→  18) is used to specify that the measured value is to be displayed as a bar graph. <i>User entry</i>  The unit of the displayed measured value is taken from the System units submenu (→  57).

Decimal places 3	
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Navigation	  Expert → System → Display → Decimal places 3 (0118)
Prerequisite	A measured value is specified in the Value 3 display parameter (→  23).
Description	Use this function to select the number of decimal places for measured value 3.
Selection	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx
Factory setting	x.xx
Additional information	<i>Description</i>  This setting does not affect the accuracy of the device for measuring or calculating the value.

Value 4 display



Navigation	Expert → System → Display → Value 4 display (0109)
Prerequisite	A local display is provided.
Description	Use this function to select a measured value that is shown on the local display.
Selection	For the picklist, see Value 1 display parameter (→ 20)
Factory setting	None
Additional information	<i>Description</i> If several measured values are displayed one below the other, the measured value selected here will be the fourth value to be displayed. The value is only displayed during normal operation. The Format display parameter (→ 18) is used to specify how many measured values are displayed simultaneously and how. <i>Options</i> The unit of the displayed measured value is taken from the System units submenu (→ 57).

Decimal places 4



Navigation	Expert → System → Display → Decimal places 4 (0119)
Prerequisite	A measured value is specified in the Value 4 display parameter (→ 25).
Description	Use this function to select the number of decimal places for measured value 4.
Selection	■ x ■ x.x ■ x.xx ■ x.xxx ■ x.xxxx
Factory setting	x.xx
Additional information	<i>Description</i> This setting does not affect the accuracy of the device for measuring or calculating the value.

Display interval

Navigation	 Expert → System → Display → Display interval (0096)
Prerequisite	A local display is provided.
Description	Use this function to enter the length of time the measured values are displayed if the values alternate on the display.
User entry	1 to 10 s
Factory setting	5 s
Additional information	<i>Description</i> This type of alternating display only occurs automatically if the number of measured values defined exceeds the number of values the selected display format can display simultaneously.  The Value 1 display parameter (→  20)...Value 8 display parameter are used to specify which measured values are shown on the local display. - The display format for the measured values displayed is defined in the Format display parameter (→  18).

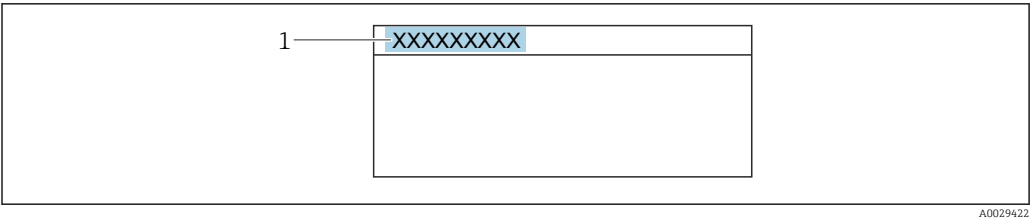
Display damping

Navigation	 Expert → System → Display → Display damping (0094)
Prerequisite	A local display is provided.
Description	Use this function to enter a time constant for the reaction time of the local display to fluctuations in the measured value caused by process conditions.
User entry	0.0 to 999.9 s
Factory setting	0.0 s
Additional information	<i>User entry</i> Use this function to enter a time constant (PT1 element ¹⁾) for display damping: - At a low time constant, the display reacts quickly to fluctuating measured variables. - If a high time constant is entered, the display reacts more slowly.  The damping is not active if the value 0 (factory setting) is entered.

1) proportional transmission behavior with first order delay

Header	
Navigation	Expert → System → Display → Header (0097)
Prerequisite	A local display is provided.
Description	Use this function to select the contents of the header of the local display.
Selection	■ Device tag ■ Free text
Factory setting	Device tag
Additional information	<i>Description</i> The header text only appears during normal operation.
	A0029422
	<i>Selection</i> Free text Is defined in the Header text parameter (→ 27).

Header text	
Navigation	Expert → System → Display → Header text (0112)
Prerequisite	The Free text option is selected in the Header parameter (→ 27).
Description	Use this function to enter a customer-specific text for the header of the local display.
User entry	Max. 12 characters, such as letters, numbers or special characters (e.g. @, %, /)
Factory setting	-----
Additional information	<i>Description</i> The header text only appears during normal operation.



1 Position of the header text on the display

A0029422

User entry

The number of characters displayed depends on the characters used.

Separator



Navigation	 Expert → System → Display → Separator (0101)
Prerequisite	A local display is provided.
Description	Use this function to select the decimal separator.
Selection	▪ . (point) ▪ , (comma)
Factory setting	. (point)

Contrast display

Navigation	 Expert → System → Display → Contrast display (0105)
Prerequisite	A local display is provided.
Description	Use this function to enter a value to adapt the display contrast to the ambient conditions (e.g. the lighting or viewing angle).
User entry	20 to 80 %
Factory setting	Depends on the display

Backlight

Navigation	  Expert → System → Display → Backlight (0111)
Prerequisite	One of the following conditions is met: ▪ Order code for "Display; operation", option F "4-line, illum.; touch control" ▪ Order code for "Display; operation", option G "4-line, illum.; touch control +WLAN" ▪ Order code for "Display; operation", option O "Remote display 4-line illuminated; 10m/30ft cable; touch control"
Description	Switch the local display backlight on and off.
Selection	▪ Disable ▪ Enable
Factory setting	Enable

3.1.2 "Configuration backup" submenu

Navigation   Expert → System → Config. backup

► Configuration backup		
Operating time (0652)	→	 29
Last backup (2757)	→	 30
Configuration management (2758)	→	 30
Backup state (2759)	→	 31
Comparison result (2760)	→	 31

Operating time

Navigation	  Expert → System → Config. backup → Operating time (0652)
Description	Displays the length of time the device has been in operation.
User interface	Days (d), hours (h), minutes (m) and seconds (s)
Additional information	<i>Indication</i> Maximum number of days: 9 999 (corresponds to approx. 27 years and 5 months)

Last backup

Navigation	 Expert → System → Config. backup → Last backup (2757)
Description	Displays the time since a backup copy of the data was last saved to the device memory.
User interface	Days (d), hours (h), minutes (m) and seconds (s)

Configuration management



Navigation	 Expert → System → Config. backup → Config. managem. (2758)
Description	Use this function to select an action to save the data to the device memory.
Selection	■ Cancel ■ Execute backup ■ Restore * ■ Compare * ■ Clear backup data
Factory setting	Cancel
Additional information	<i>Selection</i>

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 memory of the device. The backup copy includes the transmitter data of the device. The following message appears on the local display: Backup active, please wait!
Restore	The last backup copy of the device configuration is restored from the display module from the device memory to the device's HistoROM backup. The backup copy includes the transmitter data of the device. The following message appears on the local display: Restore active! Do not interrupt power supply!
Compare	The device configuration saved in the device memory is compared with the current device configuration of the HistoROM backup. The following message appears on the local display: Comparing files The result can be viewed in Comparison result parameter.
Clear backup data	The backup copy of the device configuration is deleted from the memory of the device. The following message appears on the local display: Deleting file

HistoROM

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

* Visibility depends on order options or device settings

Backup state

Navigation  Expert → System → Config. backup → Backup state (2759)

Description Displays the status of the data backup process.

User interface

- None
- Backup in progress
- Restoring in progress
- Delete in progress
- Compare in progress
- Restoring failed
- Backup failed

Factory setting None

Comparison result

Navigation  Expert → System → Config. backup → Compar. result (2760)

Description Displays the last result of the comparison of the data records in the device memory and in the HistoROM.

User interface

- Settings identical
- Settings not identical
- No backup available
- Backup settings corrupt
- Check not done
- Dataset incompatible

Factory setting Check not done

Additional information *Description*

 The comparison is started via the **Compare** option in the **Configuration management** parameter (→  30).

Options

Options	Description
Settings identical	The current device configuration of the HistoROM is the same as its backup copy in the device memory. If the transmitter configuration of another device has been transmitted to the device via HistoROM in Configuration management parameter, the current device configuration of the HistoROM is only partially identical to the backup copy in the device memory: The settings for the transmitter are not identical.
Settings not identical	The current device configuration of the HistoROM differs from the backup copy in the device memory.
No backup available	There is no backup copy of the device configuration of the HistoROM in the device memory.
Backup settings corrupt	The current device configuration of the HistoROM is corrupt or not compatible with the backup copy in the device memory.

Options	Description
Check not done	The device configuration of the HistoROM has not yet been compared to the backup copy in the device memory.
Dataset incompatible	The backup copy in the device memory is not compatible with the device.

HistoROM

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

3.1.3 "Diagnostic handling" submenu

Navigation  Expert → System → Diagn. handling

► Diagnostic handling

Alarm delay (0651) →  32

► Diagnostic behavior →  33

Alarm delay

Navigation  Expert → System → Diagn. handling → Alarm delay (0651)

Description Use this function to enter the time interval until the device generates a diagnostic message.

 The diagnostic message is reset without a time delay.

User entry 0 to 60 s

Factory setting 0 s

Additional information *Effect*
This setting affects the following diagnostic messages:

- 170 coil resistance
- 832 Electronics temperature too high
- 833 Electronics temperature too low
- 834 Process temperature too high
- 835 Process temperature too low

"Diagnostic behavior" submenu

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 (→  33).



For a list of all the diagnostic events, see the Operating Instructions for the device
→  7

Navigation



Expert → System → Diagn. handling → Diagn. behavior

► Diagnostic behavior	
Assign behavior of diagnostic no. 043 (0650)	→  34
Assign behavior of diagnostic no. 143 (0635)	→  34
Assign behavior of diagnostic no. 302 (0739)	→  35
Assign behavior of diagnostic no. 376 (0645)	→  35
Assign behavior of diagnostic no. 377 (0777)	→  35
Assign behavior of diagnostic no. 441 (0657)	→  36
Assign behavior of diagnostic no. 442 (0658)	→  36
Assign behavior of diagnostic no. 443 (0659)	→  36
Assign behavior of diagnostic no. 444 (0740)	→  37
Assign behavior of diagnostic no. 531 (0741)	→  37
Assign behavior of diagnostic no. 832 (0681)	→  37
Assign behavior of diagnostic no. 833 (0682)	→  38
Assign behavior of diagnostic no. 834 (0700)	→  38
Assign behavior of diagnostic no. 835 (0702)	→  39

Assign behavior of diagnostic no. 842 (0638)	→ 39
Assign behavior of diagnostic no. 961 (0736)	→ 39
Assign behavior of diagnostic no. 962 (0745)	→ 40
Assign behavior of diagnostic no. 937 (0743)	→ 40
Assign behavior of diagnostic no. 938 (0642)	→ 40

Assign behavior of diagnostic no. 043 (Sensor short circuit)

Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 043 (0650)
Description	Use this function to change the diagnostic behavior of the 043 Sensor short circuit diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 143 (HBSI limit exceeded)

Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 143 (0635)
Description	Change behavior of diagnostic event with diagnostic number 143 'HBSI limit exceeded'.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 302 (Device verification active)

Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 302 (0739)
Description	Use this function to change the diagnostic behavior of the 302 Device verification active diagnostic message.
Selection	■ Off ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 376 (Sensor electronics (ISEM) faulty)

Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 376 (0645)
Description	Use this function to change the diagnostic behavior of the 376 Sensor electronics (ISEM) faulty diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 377 (Sensor electronics (ISEM) faulty)

Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 377 (0777)
Description	Use this function to change the diagnostic behavior of the 377 Sensor electronics (ISEM) faulty diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 441 (Current output 1 to n)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 441 (0657)
Description	Use this function to change the diagnostic behavior of the 441 Current output 1 to n diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 442 (Frequency output 1 to n)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 442 (0658)
Prerequisite	The measuring device has a pulse/frequency/switch output.
Description	Use this function to change the diagnostic behavior of the 442 Frequency output 1 to n diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 443 (Pulse output 1 to n)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 443 (0659)
Prerequisite	The measuring device has a pulse/frequency/switch output.
Description	Use this function to change the diagnostic behavior of the 443 Pulse output 1 to n diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only

Factory setting

Warning

Additional information

For a detailed description of the options available:

Assign behavior of diagnostic no. 444 (Current input 1 to n)**Navigation**

Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 444 (0740)

Prerequisite

The device has one current input.

DescriptionUse this function to change the diagnostic behavior of the **444 Current input 1 to n** diagnostic message.**Selection**

- Off
- Alarm
- Warning
- Logbook entry only

Factory setting

Warning

Additional information

For a detailed description of the options available:

Assign behavior of diagnostic no. 531 (Empty pipe detection)**Navigation**

Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 531 (0741)

DescriptionUse this function to change the diagnostic behavior of the **531 Empty pipe detection** diagnostic message.**Selection**

- Off
- Alarm
- Warning
- Logbook entry only

Factory setting

Warning

Additional information

For a detailed description of the options available:

Assign behavior of diagnostic no. 832 (Electronics temperature too high)**Navigation**

Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 832 (0681)

DescriptionUse this function to change the diagnostic behavior of the **832 Electronics temperature too high** diagnostic message.

Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Logbook entry only
Additional information	 For a detailed description of the options available:

Assign behavior of diagnostic no. 833 (Electronics temperature too low)

Navigation	 Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 833 (0682)
Description	Use this function to change the diagnostic behavior of the 833 Electronics temperature too low diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Logbook entry only
Additional information	 For a detailed description of the options available:

Assign behavior of diagnostic no. 834 (Process temperature too high)

Navigation	 Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 834 (0700)
Description	Use this function to change the diagnostic behavior of the 834 Process temperature too high diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	 For a detailed description of the options available:

Assign behavior of diagnostic no. 835 (Process temperature too low)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 835 (0702)
Description	Use this function to change the diagnostic behavior of the 835 Process temperature too low diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 842 (Process limit)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 842 (0638)
Description	Use this function to change the diagnostic behavior of the 842 Process limit diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Off
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 961 (Electrode potential out of specification)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 961 (0736)
Description	Use this function to change the diagnostic behavior of the 861 Process fluid diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Alarm
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 962 (Pipe empty)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 962 (0745)
Description	Use this function to change the diagnostic behavior of the 862 Pipe empty diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 937 (EMC interference)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 937 (0743)
Description	Use this function to change the diagnostic behavior of the 937 EMC interference diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Warning
Additional information	For a detailed description of the options available:

Assign behavior of diagnostic no. 938 (EMC interference)



Navigation	Expert → System → Diagn. handling → Diagn. behavior → Diagnostic no. 938 (0642)
Description	Use this function to change the diagnostic behavior of the 938 EMC interference diagnostic message.
Selection	■ Off ■ Alarm ■ Warning ■ Logbook entry only
Factory setting	Alarm

Additional information

 For a detailed description of the options available:

3.1.4 "Administration" submenu

Navigation  Expert → System → Administration

► Administration		
► Define access code	→ 	41
► Reset access code	→ 	42
Device reset	→ 	43
Transmitter identifier	→ 	44
Activate SW option	→ 	44
Software option overview	→ 	45

"Define access code" wizard

 The **Define access code** wizard (→  41) is only available when operating via the local display or Web browser.

If operating via the operating tool, the **Define access code** parameter can be found directly in the **Administration** submenu. There is no **Confirm access code** parameter if the device is operated via the operating tool.

Navigation  Expert → System → Administration → Def. access code

► Define access code		
Define access code	→ 	41
Confirm access code	→ 	42

Define access code

Navigation

 Expert → System → Administration → Def. access code → Def. access code

Description

Use this function to enter a user-specific release code to restrict write-access to the parameters. This protects the device configuration against any inadvertent modifications via the local display, Web browser, FieldCare or DeviceCare (via CDI-RJ45 service interface).

User entry

Max. 16-digit character string comprising numbers, letters and special characters

Additional information

Description

The write protection affects all parameters in the document marked with the  symbol.

On the local display, the  symbol in front of a parameter indicates that the parameter is write-protected.

The parameters that cannot be write-accessed are grayed out in the Web browser.

 Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the **Enter access code** parameter (→  15).

 If you lose the access code, please contact your Endress+Hauser sales organization.

User entry

A message is displayed if the access code is not in the input range.

Factory setting

If the factory setting is not changed or **0** is defined as the access code, the parameters are not write-protected and the device configuration data can be modified. The user is logged on in the **"Maintenance"** role.

Confirm access code

Navigation

  Expert → System → Administration → Def. access code → Confirm code

Description

Enter the defined release code a second time to confirm the release code.

User entry

Max. 16-digit character string comprising numbers, letters and special characters

"Reset access code" submenu

Navigation

  Expert → System → Administration → Reset acc. code

▶ Reset access code

Operating time (0652)

→  42

Reset access code (0024)

→  43

Operating time

Navigation

  Expert → System → Administration → Reset acc. code → Operating time (0652)

Description

Displays the length of time the device has been in operation.

User interface Days (d), hours (h), minutes (m) and seconds (s)

Additional information *Indication*

Maximum number of days: 9 999 (corresponds to approx. 27 years and 5 months)

Reset access code

Navigation  Expert → System → Administration → Reset acc. code → Reset acc. code (0024)

Description Use this function to enter a reset code to reset the user-specific access codes to the factory setting .

User entry Character string comprising numbers, letters and special characters

Factory setting 0x00

Additional information *Description*

 For a reset code, contact your Endress+Hauser service organization.

User entry

The reset code can only be entered via:

- Web browser
- DeviceCare, FieldCare (via CDI RJ45 interface)
- Fieldbus

Additional parameters in the "Administration" submenu

Device reset



Navigation  Expert → System → Administration → Device reset (0000)

Description Reset the device configuration - either entirely or in part - to a defined state.

Selection

- Cancel
- To delivery settings
- Restart device
- Restore S-DAT backup *

Factory setting Cancel

* Visibility depends on order options or device settings

Additional information *Selection*

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to the customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter with data stored in volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.

Transmitter identifier**Navigation**  Expert → System → Administration → Transm. identif. (2765)**Description** Select transmitter identifier.

User interface

- Unknown
- 500
- 300

Factory setting 300**Activate SW option****Navigation**  Expert → System → Administration → Activate SW opt. (0029)**Description** Use this function to enter an activation code to enable an additional, ordered software option.**User entry** Max. 10-digit string of numbers.**Factory setting** Depends on the software option ordered**Additional information** *Description*

If a measuring device was ordered with an additional software option, the activation code is programmed in the device at the factory.

 To activate a software option subsequently, please contact your Endress+Hauser sales organization.

Entering the activation code

 The activation code is linked to the serial number of the measuring device and varies according to the device and software option.

If an incorrect or invalid code is entered, this results in the loss of software options that have already been activated.

- Before you enter a new activation code, make a note of the current activation code .
- Enter the new activation code provided by Endress+Hauser when the new software option was ordered.

- ▶ Once the activation code has been entered, check if the new software option is displayed in the **Software option overview** parameter (→  45).
- ↳ The new software option is active if it is displayed.
- ↳ If the new software option is not displayed or all software options have been deleted, the code entered was either incorrect or invalid.
- ▶ If the code entered is incorrect or invalid, enter the old activation code .
- ▶ Have your Endress+Hauser sales organization check the new activation code remembering to specify the serial number or ask for the code again.

Example for a software option

Order code for "Application package", option **EA** "Extended HistoROM"



The software options currently enabled are displayed in the **Software option overview** parameter (→  45).

Web browser



Once a software option has been activated, the page must be loaded again in the Web browser.

Software option overview

Navigation

  Expert → System → Administration → SW option overv. (0015)

Description

Displays all the software options that are enabled in the device.

User interface

- Extended HistoROM *
- Electrode cleaning circuit *
- Custody transfer
- Build-up index
- Heartbeat Monitoring *
- Heartbeat Verification *

or

Additional information

Description

Displays all the options that are available if ordered by the customer.

"Extended HistoROM" option

Order code for "Application package", option EA "Extended HistoROM"

"Electrode cleaning circuit" option

Order code for "Application package", option **EC** "ECC electrode cleaning"

"Heartbeat Verification" option and "Heartbeat Monitoring" option

Order code for "Application package", option EB "Heartbeat Verification + Monitoring"

* Visibility depends on order options or device settings

Define Software Lock code		
Navigation	Expert → System → Administration → SoftwareLockCode (14409)	
Description	Specify an access code that is required to obtain write access to the 'Software lock' parameter.	
User entry	Character string comprising numbers, letters and special characters (16)	
Factory setting	0000	
Additional information	The locking code can contain lower-case letters, upper-case letters, numbers and special characters.	

Software Lock login		
Navigation	Expert → System → Administration → SoftwLockLogin (14410)	
Description	Enter Software Lock code to obtain write access to the 'Software lock' parameter.	
User entry	Character string comprising numbers, letters and special characters (16)	

Software lock		
Navigation	Expert → System → Administration → Software lock (14411)	
Description	Activate or deactivate the software lock (Software Lock access rights required).	
Selection	■ Off ■ On	
Factory setting	Off	

3.2 "Sensor" submenu

Navigation Expert → Sensor

▶ Sensor

▶ Measured values

→ 47

▶ System units

→ 57

► Process parameters	→ 64
► External compensation	→ 81
► Sensor adjustment	→ 83
► Calibration	→ 89
► Build-up index adjustment	→ 90

3.2.1 "Measured values" submenu

Navigation   Expert → Sensor → Measured val.

► Measured values	
► Process variables	→ 47
► Totalizer	→ 50
► Input values	→ 52
► Output values	→ 53

"Process variables" submenu

Navigation   Expert → Sensor → Measured val. → Process variab.

► Process variables	
Volume flow (1838)	→ 48
Mass flow (1847)	→ 48
Corrected volume flow (1851)	→ 48
Flow velocity (1854)	→ 48
Conductivity (1850)	→ 49
Corrected conductivity (1853)	→ 49
Temperature (1852)	→ 49
Density (1857)	→ 50

Volume flow

Navigation  Expert → Sensor → Measured val. → Process variab. → Volume flow (1838)

Description Displays the volume flow that is currently measured.

User interface Signed floating-point number

Additional information

Mass flow

Navigation  Expert → Sensor → Measured val. → Process variab. → Mass flow (1847)

Description Displays the mass flow that is currently calculated.

User interface Signed floating-point number

Additional information *Dependency*
 The unit is taken from the **Mass flow unit** parameter (→  61)

Corrected volume flow

Navigation  Expert → Sensor → Measured val. → Process variab. → CorrecVolumeFlow (1851)

Description Displays the corrected volume flow that is currently measured.

User interface Signed floating-point number

Additional information *Dependency*
 The unit is taken from the **Corrected volume flow unit** parameter (→  62)

Flow velocity

Navigation  Expert → Sensor → Measured val. → Process variab. → Flow velocity (1854)

Description Displays the flow velocity that is currently calculated.

User interface Signed floating-point number

Conductivity

Navigation	 Expert → Sensor → Measured val. → Process variab. → Conductivity (1850)
Description	Displays the conductivity that is currently measured.
User interface	Signed floating-point number
Additional information	<i>Dependency</i>  The unit is taken from the Conductivity unit parameter (→  59)

Corrected conductivity

Navigation	 Expert → Sensor → Measured val. → Process variab. → CorrConductivity (1853)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" - or ■ The temperature is read into the flowmeter from an external device.
Description	Displays the conductivity that is currently corrected.
User interface	Positive floating-point number
Additional information	<i>Dependency</i>  The unit is taken from the Conductivity unit parameter (→  59)

Temperature

Navigation	 Expert → Sensor → Measured val. → Process variab. → Temperature (1852)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" - or ■ The temperature is read into the flowmeter from an external device.
Description	Displays the temperature that is currently calculated.
User interface	Positive floating-point number
Additional information	<i>Dependency</i>  The unit is taken from the Temperature unit parameter (→  60)

Density

Navigation	 Expert → Sensor → Measured val. → Process variab. → Density (1857)
Description	Displays the current fixed density or density read in from an external device.
User interface	Signed floating-point number
Additional information	Dependency  The unit is taken from the Density unit parameter (→  62)

"Totalizer" submenu

Navigation

 Expert → Sensor → Measured val. → Totalizer → Tot. 1 to n overflow

► Totalizer

Totalizer value 1 to n

Totalizer overflow 1 to n

→  50

→  51

Totalizer value 1 to n

Navigation	 Expert → Sensor → Measured val. → Totalizer → Totalizer val. 1 to n (0911–1 to n)
Prerequisite	A process variable is selected in the Assign process variable parameter of the Totalizer 1 to n submenu.
Description	Displays the current totalizer reading.
User interface	Signed floating-point number

Additional information	<i>Description</i> As it is only possible to display a maximum of 7 digits in the operating tool, the current counter value is the sum of the totalizer value and the overflow value from the Totalizer overflow 1 to n parameter if the display range is exceeded.  In the event of an error, the totalizer adopts the mode defined in the Failure mode parameter. <i>Display</i> The value of the process variable aggregated since measuring began can be positive or negative. This depends on the settings in the Totalizer operation mode parameter.  <i>Example</i> Calculation of the current totalizer reading when the value exceeds the 7-digit display range of the operating tool: ■ Value in the Totalizer value 1 parameter: 1 968 457 m³ ■ Value in the Totalizer overflow 1 parameter: $1 \cdot 10^7$ (1 overflow) = 10 000 000 m³ ■ Current totalizer value: 11 968 457 m³
Totalizer overflow 1 to n	
Navigation	 Expert → Sensor → Measured val. → Totalizer → Tot. overflow 1 to n (0910-1 to n)
Prerequisite	A process variable is selected in the Assign process variable parameter of the Totalizer 1 to n submenu.
Description	Displays the current totalizer overflow.
User interface	Integer with sign
Additional information	<i>Description</i> If the current totalizer reading exceeds 7 digits, which is the maximum value range that can be displayed by the operating tool, the value above this range is output as an overflow. The current totalizer value is therefore the sum of the overflow value and the totalizer value from the Totalizer value 1 to n parameter. <i>Display</i>  <i>Example</i> Calculation of the current totalizer reading when the value exceeds the 7-digit display range of the operating tool: ■ Value in the Totalizer value 1 parameter: 1 968 457 m³ ■ Value in the Totalizer overflow 1 parameter: $2 \cdot 10^7$ (2 overflows) = 20 000 000 [m³] ■ Current totalizer value: 21 968 457 m³

"Input values" submenu

Navigation  Expert → Sensor → Measured val. → Input values

► Input values

► Current input 1 to n

→  52

► Value status input 1 to n

→  53

"Current input 1 to n" submenu

Navigation  Expert → Sensor → Measured val. → Input values → Current input 1 to n

► Current input 1 to n

Measured values 1 to n (1603-1 to n)

→  52

Measured current 1 to n (1604-1 to n)

→  52

Measured values 1 to n

Navigation	 Expert → Sensor → Measured val. → Input values → Current input 1 to n → Measured val. 1 to n (1603-1 to n)
Description	Displays the current input value.
User interface	Signed floating-point number

Measured current 1 to n

Navigation	 Expert → Sensor → Measured val. → Input values → Current input 1 to n → Measur. curr. 1 to n (1604-1 to n)
Description	Displays the current value of the current input.
User interface	0 to 22.5 mA

"Value status input 1 to n" submenu

Navigation   Expert → Sensor → Measured val. → Input values → Val.stat.inp. 1 to n

► Value status input 1 to n

Value status input (1353-1 to n) →  53

Value status input

Navigation	  Expert → Sensor → Measured val. → Input values → Val.stat.inp. 1 to n → Val.stat.inp. (1353-1 to n)
Description	Displays the current input signal level.
User interface	■ High ■ Low

"Output values" submenu

Navigation   Expert → Sensor → Measured val. → Output values

► Output values

► Value current output 1 to n →  53

► Pulse/frequency/switch output 1 to n →  54

► Relay output 1 to n →  56

► Double pulse output →  149

"Value current output 1 to n" submenu

Navigation   Expert → Sensor → Measured val. → Output values → Val. curr.outp 1 to n

► Value current output 1 to n

Output current 1 to n (0361-1 to n) →  54

Measured current 1 to n (0366-1 to n) →  54

Output current 1 to n

Navigation	  Expert → Sensor → Measured val. → Output values → Val. curr.outp 1 to n → Output curr. 1 to n (0361–1 to n)
Description	Displays the current value currently calculated for the current output.
User interface	0 to 22.5 mA

Measured current 1 to n

Navigation	  Expert → Sensor → Measured val. → Output values → Val. curr.outp 1 to n → Measur. curr. 1 to n (0366–1 to n)
Description	Displays the actual measured value of the output current.
User interface	0 to 30 mA

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

Navigation	  Expert → Sensor → Measured val. → Output values → PFS output 1 to n
------------	---

Pulse/frequency/switch output 1 to n

Output frequency 1 to n (0471–1 to n)

→  54

Pulse output 1 to n (0456–1 to n)

→  55

Switch state 1 to n (0461–1 to n)

→  55

Output frequency 1 to n

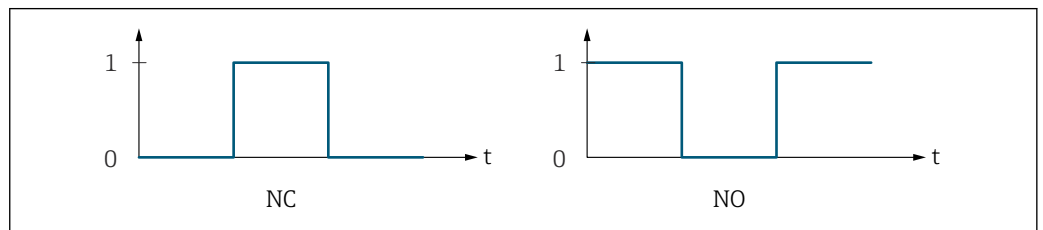
Navigation	  Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Output freq. 1 to n (0471–1 to n)
Prerequisite	In the Operating mode parameter (→  122), the Frequency option is selected.
Description	Displays the actual value of the output frequency which is currently measured.
User interface	0.0 to 12 500.0 Hz

Pulse output 1 to n

Navigation	  Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Pulse output 1 to n (0456–1 to n)
Prerequisite	The Pulse option is selected in the Operating mode parameter (→  122) parameter.
Description	Displays the pulse frequency currently output.
User interface	Positive floating-point number

Additional information*Description*

- The pulse output is an open collector output.
- This is configured at the factory in such a way that the transistor is conductive for the duration of the pulse (NO contact) and is safety-oriented.



A0028726

0 Non-conductive
 1 Conductive
 NC NC contact (normally closed)
 NO NO contact (normally open)

The output behavior can be reversed via the **Invert output signal** parameter (→  142) i.e. the transistor does not conduct for the duration of the pulse.

In addition, the behavior of the output in the event of a device alarm (**Failure mode** parameter (→  128)) can be configured.

Switch state 1 to n

Navigation	  Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Switch state 1 to n (0461–1 to n)
Prerequisite	The Switch option is selected in the Operating mode parameter (→  122).
Description	Displays the current switch status of the status output.
User interface	■ Open ■ Closed

Additional information	<i>User interface</i> ■ Open The switch output is not conductive. ■ Closed The switch output is conductive.
-------------------------------	---

"Relay output 1 to n" submenu

<i>Navigation</i>	  Expert → Sensor → Measured val. → Output values → Relay output 1 to n
-------------------	---

► Relay output 1 to n

Switch state (0801-1 to n)

→  56

Switch cycles (0815-1 to n)

→  56

Max. switch cycles number (0817-1 to n)

→  57

Switch state	
Navigation	  Expert → Sensor → Measured val. → Output values → Relay output 1 to n → Switch state (0801-1 to n)
Description	Displays the current status of the relay output.
User interface	■ Open ■ Closed
Additional information	<i>User interface</i> ■ Open The relay output is not conductive. ■ Closed The relay output is conductive.

Switch cycles	
Navigation	  Expert → Sensor → Measured val. → Output values → Relay output 1 to n → Switch cycles (0815-1 to n)
Description	Displays all the switch cycles performed.
User interface	Positive integer

Max. switch cycles number

Navigation	  Expert → Sensor → Measured val. → Output values → Relay output 1 to n → Max. cycles no. (0817–1 to n)
Description	Displays the maximum number of guaranteed switch cycles.
User interface	Positive integer

3.2.2 "System units" submenu

Navigation   Expert → Sensor → System units

► System units		
Volume flow unit (0553)	→	 57
Volume unit (0563)	→	 59
Conductivity unit (0582)	→	 59
Temperature unit (0557)	→	 60
Mass flow unit (0554)	→	 61
Mass unit (0574)	→	 61
Density unit (0555)	→	 62
Corrected volume flow unit (0558)	→	 62
Corrected volume unit (0575)	→	 63
Date/time format (2812)	→	 64

Volume flow unit



Navigation	  Expert → Sensor → System units → Volume flow unit (0553)
Description	Use this function to select the unit for the volume flow.

Selection*SI units*

- cm³/s
- cm³/min
- cm³/h
- cm³/d
- dm³/s
- dm³/min
- dm³/h
- dm³/d
- m³/s
- m³/min
- m³/h
- m³/d
- ml/s
- ml/min
- ml/h
- ml/d
- l/s
- l/min
- l/h
- l/d
- hl/s
- hl/min
- hl/h
- hl/d
- Ml/s
- Ml/min
- Ml/h
- Ml/d

US units

- af/s
- af/min
- af/h
- af/d
- ft³/s
- ft³/min
- ft³/h
- ft³/d
- kft³/s
- kft³/min
- kft³/h
- kft³/d
- MMft³/s
- MMft³/min
- MMft³/h
- Mft³/d
- fl oz/s (us)
- fl oz/min (us)
- fl oz/h (us)
- fl oz/d (us)
- gal/s (us)
- gal/min (us)
- gal/h (us)
- gal/d (us)
- Mgal/s (us)
- Mgal/min (us)
- Mgal/h (us)
- Mgal/d (us)
- bbl/s (us;liq.)
- bbl/min (us;liq.)
- bbl/h (us;liq.)
- bbl/d (us;liq.)
- bbl/s (us;beer)
- bbl/min (us;beer)
- bbl/h (us;beer)
- bbl/d (us;beer)
- bbl/s (us;oil)
- bbl/min (us;oil)
- bbl/h (us;oil)
- bbl/d (us;oil)
- bbl/s (us;tank)
- bbl/min (us;tank)
- bbl/h (us;tank)
- bbl/d (us;tank)
- kgal/s (us)
- kgal/min (us)
- kgal/h (us)
- kgal/d (us)

Imperial units

- gal/s (imp)
- gal/min (imp)
- gal/h (imp)
- gal/d (imp)
- Mgal/s (imp)
- Mgal/min (imp)
- Mgal/h (imp)
- Mgal/d (imp)
- bbl/s (imp;beer)
- bbl/min (imp;beer)
- bbl/h (imp;beer)
- bbl/d (imp;beer)
- bbl/s (imp;oil)
- bbl/min (imp;oil)
- bbl/h (imp;oil)
- bbl/d (imp;oil)

Factory setting

Country-specific:

- l/h
- gal/min (us)

Additional information*Effect*

The selected unit applies to:

Volume flow parameter (→  48)

Options

For an explanation of the abbreviated units: →  232

Volume unit**Navigation**

Expert → Sensor → System units → Volume unit (0563)

Description

Use this function to select the unit for the volume.

Selection*SI units*

- cm³
- dm³
- m³
- ml
- l
- hl
- Ml Mega

US units

- af
- ft³
- Mft³
- Mft³
- fl oz (us)
- gal (us)
- kgal (us)
- Mgal (us)
- bbl (us;oil)
- bbl (us;liq.)
- bbl (us;beer)
- bbl (us;tank)

Imperial units

- gal (imp)
- Mgal (imp)
- bbl (imp;beer)
- bbl (imp;oil)

Factory setting

Country-specific:

- m³
- gal (us)

Additional information*Options*

For an explanation of the abbreviated units: →  232

Conductivity unit**Navigation**

Expert → Sensor → System units → Conductiv. unit (0582)

Prerequisite

The **On** option is selected in the **Conductivity measurement** parameter (→  68).

Description

Use this function to select the unit for the conductivity.

Selection	<i>SI units</i> ■ nS/cm ■ µS/cm ■ µS/m ■ µS/mm ■ mS/m ■ mS/cm ■ S/cm ■ S/m ■ kS/m ■ MS/m
Factory setting	µS/cm
Additional information	<i>Effect</i> The selected unit applies to: ■ Conductivity parameter (→ ⓘ 49) ■ Corrected conductivity parameter (→ ⓘ 49) <i>Selection</i>  For an explanation of the abbreviated units: → ⓘ 232

Temperature unit

Navigation	  Expert → Sensor → System units → Temperature unit (0557)	
Description	Use this function to select the unit for the temperature.	
Selection	<i>SI units</i> ■ °C ■ K	<i>US units</i> ■ °F ■ °R
Factory setting	Country-specific: ■ °C ■ °F	
Additional information	<i>Effect</i> The selected unit applies to: ■ Temperature parameter (→ ⓘ 49) ■ Maximum value parameter (→ ⓘ 200) ■ Minimum value parameter (→ ⓘ 200) ■ External temperature parameter (→ ⓘ 83) ■ Maximum value parameter ■ Minimum value parameter <i>Options</i>  For an explanation of the abbreviated units: → ⓘ 232	

**Mass flow unit**

Navigation  Expert → Sensor → System units → Mass flow unit (0554)

Description Use this function to select the unit for the mass flow.

Selection	<i>SI units</i>	<i>US units</i>
	■ g/s ■ g/min ■ g/h ■ g/d ■ kg/s ■ kg/min ■ kg/h ■ kg/d ■ t/s ■ t/min ■ t/h ■ t/d	■ oz/s ■ oz/min ■ oz/h ■ oz/d ■ lb/s ■ lb/min ■ lb/h ■ lb/d ■ STon/s ■ STon/min ■ STon/h ■ STon/d

Factory setting Country-specific:
 ■ kg/h
 ■ lb/min

Additional information *Effect*
 The selected unit applies to:
Mass flow parameter (→  48)

Options

 For an explanation of the abbreviated units: →  232

**Mass unit**

Navigation  Expert → Sensor → System units → Mass unit (0574)

Description Use this function to select the unit for the mass.

Selection	<i>SI units</i>	<i>US units</i>
	■ g ■ kg ■ t	■ oz ■ lb ■ STon

Factory setting Country-specific:
 ■ kg
 ■ lb

Additional information *Options*
 For an explanation of the abbreviated units: →  232

Density unit



Navigation

 Expert → Sensor → System units → Density unit (0555)

Description

Use this function to select the unit for the density.

Selection

SI units

- g/cm³
- g/m³
- kg/l
- kg/dm³
- kg/m³
- SD4°C
- SD15°C
- SD20°C
- SG4°C
- SG15°C
- SG20°C

US units

- lb/ft³
- lb/gal (us)
- lb/bbl (us;liq.)
- lb/bbl (us;beer)
- lb/bbl (us;oil)
- lb/bbl (us;tank)

Imperial units

- lb/gal (imp)
- lb/bbl (imp;beer)
- lb/bbl (imp;oil)

Factory setting

Country-specific:

- kg/l
- lb/ft³

Additional information

Effect

The selected unit applies to:

- **External density** parameter (→  82)
- **Fixed density** parameter (→  81)

Options

- SD = specific density
The specific density is the ratio of the medium density to the water density at a water temperature of +4 °C (+39 °F), +15 °C (+59 °F), +20 °C (+68 °F).
- SG = specific gravity
The specific gravity is the ratio of the medium density to the water density at a water temperature of +4 °C (+39 °F), +15 °C (+59 °F), +20 °C (+68 °F).



For an explanation of the abbreviated units: →  232

Corrected volume flow unit



Navigation

 Expert → Sensor → System units → Cor.volflow unit (0558)

Description

Use this function to select the unit for the corrected volume flow.

Selection	<i>SI units</i>	<i>US units</i>	<i>Imperial units</i>
	■ Nl/s ■ Nl/min ■ Nl/h ■ Nl/d ■ Nhl/s ■ Nhl/min ■ Nhl/h ■ Nhl/d ■ Nm^3/s ■ Nm^3/min ■ Nm^3/h ■ Nm^3/d ■ Sl/s ■ Sl/min ■ Sl/h ■ Sl/d ■ Sm^3/s ■ Sm^3/min ■ Sm^3/h ■ Sm^3/d	■ Sft^3/s ■ Sft^3/min ■ Sft^3/h ■ Sft^3/d ■ MSft^3/s ■ MSft^3/min ■ MSft^3/h ■ MSft^3/D ■ MMSft^3/s ■ $\text{MMSft}^3/\text{min}$ ■ MMSft^3/h ■ MMSft^3/d ■ Sgal/s (us) ■ Sgal/min (us) ■ Sgal/h (us) ■ Sgal/d (us) ■ Sbbl/s (us;liq.) ■ $\text{Sbbl/min (us;liq.)}$ ■ Sbbl/h (us;liq.) ■ Sbbl/d (us;liq.) ■ Sbbl/s (us;oil) ■ Sbbl/min (us;oil) ■ Sbbl/h (us;oil) ■ Sbbl/d (us;oil)	■ Sgal/s (imp) ■ Sgal/min (imp) ■ Sgal/h (imp) ■ Sgal/d (imp)
Factory setting	Country-specific: ■ Nl/h ■ Sft^3/h		
Additional information	<i>Effect</i>		
	The selected unit applies to: Corrected volume flow parameter (→  48)		
	<i>Options</i>		
	 For an explanation of the abbreviated units: →  232		

Corrected volume unit



Navigation   Expert → Sensor → System units → Corr. vol. unit (0575)

Description Use this function to select the unit for the corrected volume.

Selection	<i>SI units</i>	<i>US units</i>	<i>Imperial units</i>
	■ Nl ■ Nhl ■ Nm^3 ■ Sl ■ Sm^3	■ Sft^3 ■ MSft^3 ■ MMSft^3 ■ Sgal (us) ■ Sbbl (us;liq.) ■ Sbbl (us;oil)	■ Sgal (imp)

Factory setting	Country-specific: ■ Nm³ ■ Sft³
Additional information	<i>Options</i>  For an explanation of the abbreviated units: →  232

Date/time format

Navigation	  Expert → Sensor → System units → Date/time format (2812)
Description	Use this function to select the desired time format for calibration history.
Selection	■ dd.mm.yy hh:mm ■ dd.mm.yy hh:mm am/pm ■ mm/dd/yy hh:mm ■ mm/dd/yy hh:mm am/pm
Factory setting	dd.mm.yy hh:mm
Additional information	<i>Selection</i>  For an explanation of the abbreviated units: →  232

3.2.3 "Process parameters" submenu

Navigation   Expert → Sensor → Process param.

► Process parameters		
Filter options (6710)		→  65
Flow damping (6661)		→  67
Flow override (1839)		→  67
Conductivity measurement (6514)		→  68
Conductivity damping (1803)		→  68
Conductivity temperature coefficient (1891)		→  69
Temperature damping (1886)		→  69

Corrected volume flow reference density (1885)	→ 69
▶ Low flow cut off	→ 70
▶ Empty pipe detection	→ 72
▶ Electrode cleaning cycle	→ 75
▶ Build-up index	→ 77
▶ HBSI	→ 79

Filter options

Navigation	Expert → Sensor → Process param. → Filter options (6710)
Description	Use this function to select a filter option.
Selection	■ Adaptive ■ Adaptive CIP on ■ Dynamic ■ Dynamic CIP on ■ Binomial ■ Binomial CIP on
Factory setting	Binomial
Additional information	<i>Description</i> The user can choose from a range of filter combinations which can optimize the measurement result depending on the application. Each change in the filter setting affects

the output signal of the measuring device. The response time of the output signal increases as the filter depth increases.

Selection

- **Adaptive**
 - Strong flow damping with a short output signal response time.
 - Some time is needed before a stable output signal can be generated.
 - Not suitable for pulsating flow as the average flow can be different here.
- **Dynamic**
 - Average flow damping with a delayed output signal response time.
 - The average flow is displayed correctly over a measuring interval determined over a long period.
- **Binomial**
 - Weak flow damping with a short output signal response time.
 - The average flow is displayed correctly over a measuring interval determined over a long period.
- **CIP**
 - This filter makes the **Adaptive**, **Dynamic** and **Binomial** filter options additionally available.
 - If the CIP filter has detected a change in the medium (abrupt increase in the noise level, e.g. quickly changing medium conductivity values during CIP cleaning), flow damping is greatly increased and the raw value (before flow damping) is limited by the mean value (delimiter). This eliminates extremely high measured errors (up to several 100 m/s).
 - If the CIP filter is enabled, the response time of the entire measuring system increases and the output signal is delayed accordingly.

Examples

Possible applications for the filters

Application	Adaptive	Adaptive CIP	Dynamic	Dynamic CIP	Binomial	Binomial CIP
Pulsating flow (flow is negative intermittently)	---	---	++	--	++	--
Flow changes frequently (flow is dynamic)	-	--	++	-	++	-
Clear signal, fast control loop (< 1 s)	--	--	+ ¹⁾		++	-
Poor signal, slow control loop (response time of a few seconds)	++	-	--	---	---	---
Permanently bad signal	++	--	-	---	-	---
Short and severe signal distortion after a while		++		++		++
Replacement of a Promag 50/53: system damping Promag 100 = 0.5 * system damping Promag 50/53					+++	+++
Replacement of a Promag 10: system damping Promag 100 = system damping Promag 10 + 2			+++			
For a stable flow signal (no other requirements)	+++					

1) Value of flow damping < 6

Flow damping



Navigation	Expert → Sensor → Process param. → Flow damping (6661)
Description	Use this function to enter a value for flow damping. Reduction of the variability of the flow measured value (in relation to interference). For this purpose, the depth of the flow filter is adjusted: when the filter setting increases, the reaction time of the device also increases.
User entry	0 to 15
Factory setting	4
Additional information	<i>Input range 0 to 15</i> ■ Value = 0: no damping ■ Value = 1: minor damping ■ Value = 15: strong damping ■ The damping depends on the measuring period and the filter type selected. ■ An increase or decrease in the damping depends on the application. <i>Effect</i> The damping affects the following variables of the device: ■ Outputs ■ Low flow cut off → 70 ■ Totalizers

Flow override



Navigation	Expert → Sensor → Process param. → Flow override (1839)
Description	Use this function to select whether to interrupt the evaluation of measured values. This is useful for the cleaning processes of a pipeline, for example.
Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Description</i> Flow override is active ■ The 453 Flow override diagnostic message is output. ■ Output values ■ Temperature: continues to be output ■ Totalizer 1...3: stop being totalized The Flow override option can also be activated in the Status input submenu: Assign status input parameter (→ 113).

Conductivity measurement



Navigation	 Expert → Sensor → Process param. → Conduct. measur. (6514)
Prerequisite	The On option is selected in the Conductivity measurement parameter (→  68)
Description	Use this function to enable and disable conductivity measurement.
Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Description</i>  For conductivity measurement to work, the medium must have a minimum conductivity of 5 µS/cm.

Conductivity damping



Navigation	 Expert → Sensor → Process param. → Conduct. damping (1803)
Prerequisite	The On option is selected in the Conductivity measurement parameter (→  68).
Description	Use this function to enter a time constant for conductivity damping (PT1 element).
User entry	0 to 999.9 s
Factory setting	0 s
Additional information	<i>Description</i>  The damping is performed by a PT1 element ²⁾. <i>User entry</i> ■ Value = 0: no damping ■ Value > 0: damping is increased  Damping is switched off if 0 is entered (factory setting).

2) Proportional behavior with first-order lag

Conductivity temperature coefficient



Navigation	 Expert → Sensor → Process param. → Cond. temp.coeff (1891)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" or ■ The temperature is read into the flowmeter from an external device.
Description	Use this function to enter the temperature coefficient for the conductivity.
User entry	Signed floating-point number
Factory setting	2.1 %/K

Temperature damping



Navigation	 Expert → Sensor → Process param. → Temp. damping (1886)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" or ■ The temperature is read into the flowmeter from an external device.
Description	Use this function to enter the time constant for temperature damping.
User entry	0 to 999.9 s
Factory setting	0 s

Corrected volume flow reference density



Navigation	 Expert → Sensor → Process param. → CVolFlowRefDens (1885)
Description	Use this function to enter a fixed value for the reference density.
User entry	Positive floating-point number
Factory setting	Country-specific: ■ 1 kg/l ■ 1 lb/ft³
Additional information	<i>Dependency</i>  The unit is taken from the Density unit parameter (→  62)

"Low flow cut off" submenu

Navigation  Expert → Sensor → Process param. → Low flow cut off

► Low flow cut off

Assign process variable (1837)

→  70

On value low flow cutoff (1805)

→  70

Off value low flow cutoff (1804)

→  71

Pressure shock suppression (1806)

→  71

Assign process variable

Navigation	 Expert → Sensor → Process param. → Low flow cut off → Assign variable (1837)
Description	Use this function to select the process variable for low flow cutoff detection.
Selection	■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow
Factory setting	Volume flow

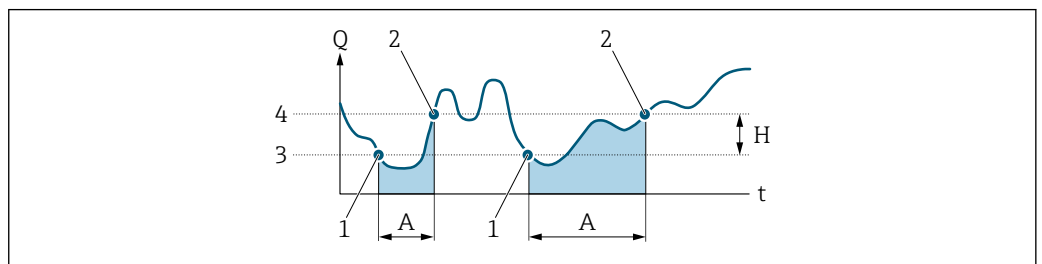
On value low flow cutoff

Navigation	 Expert → Sensor → Process param. → Low flow cut off → On value (1805)
Prerequisite	A process variable is selected in the Assign process variable parameter (→  70).
Description	Use this function to enter a switch-on value for low flow cut off. Low flow cut off is activated if the value entered is not equal to 0 →  71.
User entry	Positive floating-point number
Factory setting	Depends on country and nominal diameter →  226
Additional information	Dependency  The unit depends on the process variable selected in the Assign process variable parameter (→  70).

Off value low flow cutoff



Navigation	Expert → Sensor → Process param. → Low flow cut off → Off value (1804)
Prerequisite	A process variable is selected in the Assign process variable parameter (→ 70).
Description	Use this function to enter a switch-off value for low flow cut off. The switch-off value is entered as a positive hysteresis from the switch-on value → 70.
User entry	0 to 100.0 %
Factory setting	50 %
Additional information	<i>Example</i>



A0012887

- Q* Flow
t Time
H Hysteresis
A Low flow cut off active
1 Low flow cut off is activated
2 Low flow cut off is deactivated
3 On value entered
4 Off value entered

Pressure shock suppression



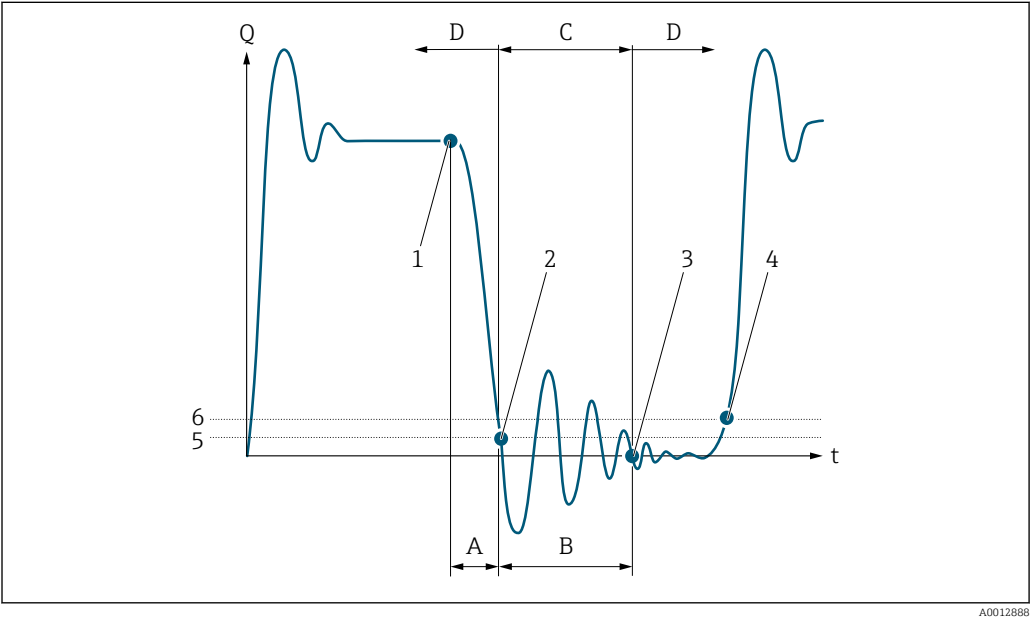
Navigation	Expert → Sensor → Process param. → Low flow cut off → Pres. shock sup. (1806)
Prerequisite	A process variable is selected in the Assign process variable parameter (→ 70).
Description	Use this function to enter the time interval for signal suppression (= active pressure shock suppression).
User entry	0 to 100 s
Factory setting	0 s
Additional information	<i>Description</i> Pressure shock suppression is enabled ■ Prerequisite: Flow rate < on-value of low flow cut off ■ Output values ■ Flow displayed: 0 ■ Totalizer: the totalizers are pegged at the last correct value

Pressure shock suppression is disabled

- Prerequisite: the time interval set in this function has elapsed.
- If the flow also exceeds the off value for low flow cut off, the device starts processing and displaying the current flow value again.

Example

When closing a valve, momentarily strong fluid movements may occur in the pipeline, which are registered by the measuring system. These totalized flow values lead to a false totalizer status, particularly during batching processes.



- Q Flow
t Time
A After run
B Pressure shock
C Pressure shock suppression active according to the time entered
D Pressure shock suppression inactive
1 Valve closes
2 Flow falls below the on-value of the low flow cut off: pressure shock suppression is activated
3 The time entered has elapsed: pressure shock suppression is deactivated
4 The current flow value is processed and displayed again
5 On value for low flow cut off
6 Off value for low flow cut off

"Empty pipe detection" submenu

Navigation  Expert → Sensor → Process param. → Empty pipe det.

► Empty pipe detection

Empty pipe detection (1860)

→  73

Switch point empty pipe detection (6562)

→  73

Response time empty pipe detection (1859)	→ 73
New adjustment (6560)	→ 74
Progress (6571)	→ 74
Measured value EPD (6559)	→ 74

Empty pipe detection

Navigation	 Expert → Sensor → Process param. → Empty pipe det. → Empty pipe det. (1860)
Description	Use this function to switch empty pipe detection on and off.
Selection	■ Off ■ On
Factory setting	Off

Switch point empty pipe detection

Navigation	 Expert → Sensor → Process param. → Empty pipe det. → Switch point EPD (6562)
Prerequisite	The On option is selected in the Empty pipe detection parameter (→ 73).
Description	Use this function to enter the percentage threshold value of the resistance in relation to the adjustment values.
User entry	0 to 100 %
Factory setting	50 %

Response time empty pipe detection

Navigation	 Expert → Sensor → Process param. → Empty pipe det. → Response time (1859)
Prerequisite	A process variable is selected in the Assign process variable parameter (→ 73).
Description	Use this function to enter the minimum time (hold time) the signal must be present before diagnostic message S962 "Empty pipe" is triggered in the event of a partially filled or empty measuring pipe.
User entry	0 to 100 s

Factory setting 1 s

New adjustment

Navigation   Expert → Sensor → Process param. → Empty pipe det. → New adjustment (6560)

Prerequisite The **On** option is selected in the **Empty pipe detection** parameter (→  73).

Description For selecting whether to perform an empty pipe or full pipe adjustment.

Selection

- Cancel
- Empty pipe adjust
- Full pipe adjust

Factory setting Cancel

Progress

Navigation   Expert → Sensor → Process param. → Empty pipe det. → Progress (6571)

Prerequisite The **On** option is selected in the **Empty pipe detection** parameter (→  73).

Description Use this function to view the progress.

User interface

- Ok
- Busy
- Not ok

Measured value EPD

Navigation   Expert → Sensor → Process param. → Empty pipe det. → Meas. value EPD (6559)

Prerequisite In the **Empty pipe detection** parameter (→  73), the **On** option is selected.

Description Displays the current measured value.

User interface Positive floating-point number

"Electrode cleaning circuit" submenu

Navigation   Expert → Sensor → Process param. → ECC

► Electrode cleaning cycle		
Electrode cleaning cycle (6528)	→	 75
ECC duration (6555)	→	 75
ECC recovery time (6556)	→	 76
ECC interval (6557)	→	 76
ECC polarity (6631)	→	 76

Electrode cleaning cycle



Navigation	  Expert → Sensor → Process param. → Elec. clean cycl → Elec. clean cycl (6528)
Prerequisite	For the following order code: "Application package", option EC "ECC electrode cleaning"
Description	Use this function to enable and disable cyclic electrode cleaning.
Selection	■ Off ■ On
Factory setting	On
Additional information	Conductive deposits on the electrodes and on the walls of the measuring tube (e.g. magnetite) can falsify measurement values. The Electrode Cleaning Circuitry (ECC) was developed to prevent such conductive deposits developing in the vicinity of the electrodes. ECC functions as described above for all available electrode materials except tantalum. If tantalum is used as the electrode material, the ECC protects the electrode surface only against oxidation.

ECC duration



Navigation	  Expert → Sensor → Process param. → Elec. clean cycl → ECC duration (6555)
Prerequisite	For the following order code: "Application package", option EC "ECC electrode cleaning"
Description	Use this function to enter the duration of electrode cleaning in seconds.
User entry	0.01 to 30 s

Factory setting 2 s

ECC recovery time



Navigation Expert → Sensor → Process param. → Elec. clean cycl → ECC recov. time (6556)

Prerequisite For the following order code:
"Application package", option **EC** "ECC electrode cleaning"

Description Use this function to enter the recovery time after electrode cleaning to prevent signal output interference. The current output values are frozen in the meanwhile.

User entry 1 to 600 s

Factory setting 60 s

ECC interval



Navigation Expert → Sensor → Process param. → Elec. clean cycl → ECC interval (6557)

Prerequisite For the following order code:
"Application package", option **EC** "ECC electrode cleaning"

Description Use this function to enter the pause duration until the next electrode cleaning.

User entry 0.5 to 168 h

Factory setting 0.5 h

ECC polarity

Navigation Expert → Sensor → Process param. → Elec. clean cycl → ECC polarity (6631)

Prerequisite For the following order code:
"Application package", option **EC** "ECC electrode cleaning"

Description Displays the polarity of the electrode cleaning circuit.

User interface

- Positive
- Negative

Factory setting Depends on the electrode material:

- Tantalum: **Negative** option
- Platinum, Alloy C22, stainless steel: **Positive** option

"Coating detection" submenu

-  Build-up detection is only available:
- In conjunction with the Promag W sensor
 - In the compact device version (transmitter and sensor form a mechanical unit)
 - For detailed information on build-up detection: see the Special Documentation for the **Heartbeat Verification + Monitoring** application package

Navigation  Expert → Sensor → Process param. → Build-up detect.

► Build-up index

Build-up index operating mode

→  77

Build-up index damping

→  77

Build-up index

→  78

Build-up limit

→  78

Build-up limit hysteresis

→  79

Build-up index operating mode

Navigation	 Expert → Sensor → Process param. → Build-up index → BuildUpIndexMode (6734)
Description	Select mode of operation for build-up index.
Selection	■ Off ■ Slow ■ Standard ■ Fast
Factory setting	Off

Build-up index damping

Navigation	 Expert → Sensor → Process param. → Build-up index → BuildUpIndexDamp (6840)
Description	Enter damping value for build-up index. Damping value: ■ 0 = minimum damping ■ 15 = maximum damping The damping value should only be increased if the measured value is unstable.
User entry	0 to 15

Factory setting 0

Build-up index

Navigation  Expert → Sensor → Process param. → Build-up index → Build-up index (12111)

Description Shows current build-up index value.

User interface 0.0 to 100.0 %

Factory setting 0.0 %

Additional information The formation of build-up is output as a percentage in the Build-up index value (→  78) parameter. The higher the percentage, the thicker the build-up.

Build-up index value (→  78) = 0%

- No build-up present
- Measuring tube as-delivered state (initial value)
- Measuring tube was cleaned thoroughly after formation of build-up

Build-up index value (→  78) = 100%

- Value for the maximum measurable build-up thickness
- The thickness of the build-up at 100% varies depending on the process
- A value of 100% should not be equated with a blocked measuring tube

The percentage indicated in the Build-up index value (→  78) parameter does not provide direct information about the absolute thickness or the composition of the build-up. Therefore, to make optimum use of the build-up detection function, it is necessary to first compare the formation of build-up in the process, as known from experience, with the associated Build-up index value (→  78). The aim is to determine the Build-up index value (→  78) at the time the cleaning is usually performed.

On the basis of the Build-up index value (→  78) during cleaning, it is possible to make a valid assessment of the condition inside the measuring tube and to plan the cleaning using the build-up limit and build-up detection hysteresis parameters.

In addition, conclusions about possible effects on neighboring processes can be drawn from the Build-up index value (→  78).

Build-up limit

Navigation  Expert → Sensor → Process param. → Build-up index → Build-up limit (6466)

Description Enter limit value for the build-up index.

User entry 0 to 100 %

Factory setting 50 %

Build-up limit hysteresis

Navigation	  Expert → Sensor → Process param. → Build-up index → BuildUpLimitHyst (6467)
Description	Enter hysteresis for build-up limit value. If the value for build-up detection hysteresis is higher than the Build-up limit (→  78), the "Build-up detected" diagnostic information is not reset until the measuring tube has been cleaned and a restart has been performed.
User entry	0 to 100 %
Factory setting	20 %

"HBSI" submenu

Navigation   Expert → Sensor → Process param. → HBSI

► HBSI

HBSI limit (6472)

HBSI hysteresis (6473)

HBSI (12116)

→  79

→  79

→  80

HBSI limit



Navigation	  Expert → Sensor → Process param. → HBSI → HBSI limit (6472)
Description	Enter HBSI limit value.
User entry	0 to 100 %
Factory setting	4 %

HBSI hysteresis



Navigation	  Expert → Sensor → Process param. → HBSI → HBSI hysteresis (6473)
Description	Enter hysteresis for HBSI limit value.
User entry	0 to 100 %

Factory setting

1 %

HBSI

Navigation

  Expert → Sensor → Process param. → HBSI → HBSI (12116)

Description

Displays the relative change of the entire sensor, with all its electrical, mechanical and electromechanical components incorporated in the sensor housing (including the measuring tube, electrodynamic pick-ups, excitation system, cables etc.), in % of the reference value.

User interface

–100.0 to 100.0 %

3.2.4 "Calculated values" submenu

Navigation

  Expert → Sensor → Calculated value

► Calculated values

► Reference values

→  80

"Reference values" submenu

Navigation

  Expert → Sensor → Calculated value → Reference values

► Reference values

Fixed density (1862)

→  80

Fixed density

Navigation

  Expert → Sensor → Calculated value → Reference values → Fixed density (1862)

Description

Use this function to enter a fixed value for the density. The density is used to calculate the mass flow.

User entry

Positive floating-point number

Factory setting

1 000 kg/l

Additional information

User entry

 The unit is taken from the **Density unit** parameter (→  62).

3.2.5 "External compensation" submenu

Navigation   Expert → Sensor → External comp.

► External compensation

Density source (6615)

→  81

Fixed density (6623)

→  81

External density (6630)

→  82

Temperature source (6712)

→  82

External temperature (6673)

→  83

Density source	
Navigation	  Expert → Sensor → External comp. → Density source (6615)
Description	Use this function to select the density source.
Selection	■ Fixed density ■ Current input 1 * ■ Current input 2 * ■ Current input 3 * ■ External density ■ Calculated value
Factory setting	Fixed density

Fixed density	
Navigation	  Expert → Sensor → External comp. → Fixed density (6623)
Prerequisite	The Fixed density option is selected in the Density source parameter (→  81).

* Visibility depends on order options or device settings

Description	Use this function to enter a fixed value for the density.
User entry	Positive floating-point number
Factory setting	Depends on country: ■ 1 000 kg/m³ ■ 62 lb/ft³
Additional information	<i>Dependency</i>  The unit is taken from the Density unit parameter (→  62)

External density

Navigation	  Expert → Sensor → External comp. → External density (6630)
Prerequisite	The External density option is selected in the Density source parameter (→  81).
Description	Shows the density read from the external device.
User entry	Positive floating-point number
Factory setting	0 kg/l
Additional information	<i>Dependency</i>  The unit is taken from the Density unit parameter (→  62)

Temperature source



Navigation	  Expert → Sensor → External comp. → Temp. source (6712)
Description	Use this function to select the temperature source.
Selection	■ Off ■ Internal temperature sensor * ■ External value ■ Current input 1 * ■ Current input 2 * ■ Current input 3 *
Factory setting	Off

* Visibility depends on order options or device settings

External temperature

Navigation	 Expert → Sensor → External comp. → External temp. (6673)
Prerequisite	The External value option is selected in the Temperature source parameter (→  82).
Description	Shows the external process temperature read in from the external device.
User entry	Floating point number with sign
Factory setting	-273.15 °C
Additional information	<i>Dependency</i>  The unit is taken from the Temperature unit parameter (→  60)

3.2.6 "Sensor adjustment" submenu

Navigation  Expert → Sensor → Sensor adjustm.

▶ Sensor adjustment

Installation direction (1809)

→  83

▶ Process variable adjustment

→  84

Installation direction



Navigation	 Expert → Sensor → Sensor adjustm. → Install. direct. (1809)
Description	Use this function to change the sign of the medium flow direction.
Selection	■ Forward flow ■ Reverse flow
Factory setting	Forward flow
Additional information	<i>Description</i>  Before changing the sign: ascertain the actual direction of fluid flow with reference to the direction indicated by the arrow on the sensor nameplate.

"Process variable adjustment" submenu

Navigation  Expert → Sensor → Sensor adjustm. → Variable adjust

► Process variable adjustment		
Volume flow offset (1831)	→	 84
Volume flow factor (1832)	→	 85
Mass flow offset (1841)	→	 85
Mass flow factor (1846)	→	 85
Conductivity offset (1848)	→	 86
Conductivity factor (1849)	→	 86
Corrected volume flow offset (1866)	→	 86
Corrected volume flow factor (1867)	→	 87
Temperature offset (1868)	→	 87
Temperature factor (1869)	→	 87
Corrected conductivity offset (1870)	→	 88
Corrected conductivity factor (1871)	→	 88
Flow velocity offset (1879)	→	 88
Flow velocity factor (1880)	→	 89

Volume flow offset

Navigation  Expert → Sensor → Sensor adjustm. → Variable adjust → Vol. flow offset (1831)

Description Use this function to enter the zero point shift for the volume flow trim. The volume flow unit on which the shift is based is m³/s.

User entry Signed floating-point number

Factory setting 0 m³/s

Additional information *Description*
 Corrected value = (factor × value) + offset

Volume flow factor



Navigation	Expert → Sensor → Sensor adjustm. → Variable adjust → Vol. flow factor (1832)
Description	Enter quantity factor for the volume flow value.
User entry	Positive floating-point number
Factory setting	1
Additional information	<i>Description</i> Corrected value = (factor × value) + offset

Mass flow offset



Navigation	Expert → Sensor → Sensor adjustm. → Variable adjust → Mass flow offset (1841)
Description	Use this function to enter the zero point shift for the mass flow trim. The mass flow unit on which the shift is based is kg/s.
User entry	Signed floating-point number
Factory setting	0 kg/s
Additional information	<i>Description</i> Corrected value = (factor × value) + offset

Mass flow factor



Navigation	Expert → Sensor → Sensor adjustm. → Variable adjust → Mass flow factor (1846)
Description	Use this function to enter a quantity factor (without time) for the mass flow. This multiplication factor is applied over the mass flow range.
User entry	Positive floating-point number
Factory setting	1
Additional information	<i>Description</i> Corrected value = (factor × value) + offset

Conductivity offset		
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Conduct. offset (1848)	
Prerequisite	The On option is selected in the Conductivity measurement parameter (→  68).	
Description	Use this function to enter the zero point shift for the conductivity trim. The conductivity unit on which the shift is based is S/m.	
User entry	Signed floating-point number	
Factory setting	0 S/m	
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset	
Conductivity factor		
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Conduct. factor (1849)	
Prerequisite	The On option is selected in the Conductivity measurement parameter (→  68).	
Description	Use this function to enter a quantity factor for the conductivity. This multiplication factor is applied over the conductivity range.	
User entry	Positive floating-point number	
Factory setting	1	
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset	
Corrected volume flow offset		
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Corr. vol offset (1866)	
Description	Use this function to enter the zero point shift for the corrected volume flow trim. The corrected volume flow unit on which the shift is based is 1 Nm ³ /s.	
User entry	Signed floating-point number	
Factory setting	0 Nm ³ /s	
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset	

Corrected volume flow factor 	
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Corr. vol factor (1867)
Description	Use this function to enter a quantity factor (without time) for the corrected volume flow. This multiplication factor is applied over the corrected volume flow range.
User entry	Positive floating-point number
Factory setting	1
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset
Temperature offset 	
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Temp. offset (1868)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" or ■ The temperature is read into the flowmeter from an external device.
Description	Use this function to enter the zero point shift for the temperature trim. The temperature unit on which the shift is based is 1 K.
User entry	Signed floating-point number
Factory setting	0 K
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset
Temperature factor 	
Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Temp. factor (1869)
Prerequisite	One of the following conditions is met: ■ Order code for "Sensor option", option CI "Medium temperature measurement" or ■ The temperature is read into the flowmeter from an external device.
Description	Use this function to enter a quantity factor (without time) for the temperature. This multiplication factor is applied over the temperature range.
User entry	Positive floating-point number

Factory setting 1

Additional information *Description*

 Corrected value = (factor × value) + offset

Corrected conductivity offset

Navigation   Expert → Sensor → Sensor adjustm. → Variable adjust → Corr.cond.offset (1870)

Prerequisite The **On** option is selected in the **Conductivity measurement** parameter (→  68).

Description Use this function to enter the zero point shift to trim the corrected conductivity. The conductivity unit on which the shift is based is µS/cm.

User entry Signed floating-point number

Factory setting 0 S/m

Additional information *Description*

 Corrected value = (factor × value) + offset

Corrected conductivity factor

Navigation   Expert → Sensor → Sensor adjustm. → Variable adjust → Corr.cond.factor (1871)

Prerequisite The **On** option is selected in the **Conductivity measurement** parameter (→  68).

Description Use this function to enter a quantity factor for the corrected conductivity. In each case, this factor refers to the conductivity in µS/cm.

User entry Positive floating-point number

Factory setting 1

Additional information *Description*

 Corrected value = (factor × value) + offset

Flow velocity offset

Navigation   Expert → Sensor → Sensor adjustm. → Variable adjust → Flow vel. offset (1879)

Description Use this function to enter the zero point shift for the flow velocity trim. The flow velocity unit on which the shift is based is m/s.

User entry	Signed floating-point number
Factory setting	0 m/s
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset

Flow velocity factor

Navigation	  Expert → Sensor → Sensor adjustm. → Variable adjust → Flow vel. factor (1880)
Description	Use this function to enter a quantity factor (without time) for the flow velocity. This multiplication factor is applied over the flow velocity range.
User entry	Positive floating-point number
Factory setting	1
Additional information	<i>Description</i>  Corrected value = (factor × value) + offset

3.2.7 "Calibration" submenu

Navigation   Expert → Sensor → Calibration

► Calibration

Nominal diameter (2807)

→  89

Calibration factor (6522)

→  90

Nominal diameter

Navigation	  Expert → Sensor → Calibration → Nominal diameter (2807)
Description	Displays the nominal diameter of the sensor.
User interface	DNxx / x"
Factory setting	Depends on the size of the sensor

Additional information

Description

 The value is also specified on the sensor nameplate.

Calibration factor

Navigation

 Expert → Sensor → Calibration → Cal. factor (6522)

Description

Displays the current calibration factor for the sensor.

User interface

Positive floating-point number

Factory setting

Depends on nominal diameter and calibration.

3.2.8 "Build-up index adjustment" wizard

Complete this wizard to adjust the reference values of the build-up index for each electrode (E1 and E2) and activate the build-up index for build-up measurement.

Navigation

 Expert → Sensor → BuildUpIndAdjust

► Build-up index adjustment

Prerequisites

→  90

Progress (2808)

→  91

Build-up index reference value E 1 (6475)

→  91

Signal to noise ratio (6469)

→  91

Build-up index reference value E 2 (6474)

→  91

Signal to noise ratio (6469)

→  91

Build-up index operating mode (6734)

→  92

Prerequisites

Navigation

 Expert → Sensor → BuildUpIndAdjust → Prerequisites

Description

The following conditions must be met before performing a build-up index adjustment.

User interface	■ The sensor is free of build-up ■ The measuring tube is completely filled
-----------------------	---

Progress

Navigation	 Expert → Sensor → BuildUpIndAdjust → Progress (2808)
Description	The progress of the process is indicated.
User interface	0 to 100 %

Build-up index reference value E 1

Navigation	 Expert → Sensor → BuildUpIndAdjust → BuildUpIndRefE 1 (6475)
Description	Shows the reference value 'Build-up free sensor' measured for electrode E1.
User interface	0 to 1

Signal to noise ratio

Navigation	 Expert → Sensor → BuildUpIndAdjust → SNR (6469)
Description	Shows the signal to noise ratio during the measurement. A value between 1.0 - 2.0 is sufficient to excellent.
User interface	Signed floating-point number

Build-up index reference value E 2

Navigation	 Expert → Sensor → BuildUpIndAdjust → BuildUpIndRefE 2 (6474)
Description	Shows the reference value 'Build-up free sensor' measured for electrode E2.
User interface	0 to 1

Build-up index operating mode

Navigation	  Expert → Sensor → BuildUpIndAdjust → BuildUpIndexMode (6734)
Description	Select mode of operation for build-up index.
Selection	■ Off ■ Slow ■ Standard ■ Fast

3.2.9 "Testpoints" submenu

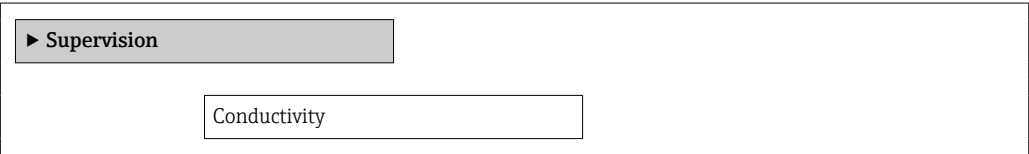
 The **Testpoints** submenu (→  92) is used to test the measuring device or the application.

Navigation   Expert → Sensor → Testpoints



"Supervision" submenu

Navigation   Expert → Sensor → Testpoints → Supervision



Status bits

Navigation	  Expert → Sensor → Testpoints → Status bits (6773)
Description	Displays the current status.
User interface	Positive integer
Factory setting	0

Flow velocity

Navigation	  Expert → Sensor → Testpoints → Flow velocity (6510)
Description	The flow velocity is displayed.
User interface	Signed floating-point number

Flow velocity

Navigation	  Expert → Sensor → Testpoints → Flow velocity (6510)
Description	The flow velocity is displayed.
User interface	Signed floating-point number

Filtered volume flow

Navigation	  Expert → Sensor → Testpoints → Filter.vol.flow (6622)
Description	Displays the filtered volume flow.
User interface	Signed floating-point number
Factory setting	0 l/h

Conductivity

Navigation	  Expert → Sensor → Testpoints → Conductivity (6558)
Description	Shows the conductivity currently measured.
User interface	Positive floating-point number
Factory setting	0 µS/cm

Conductivity

Navigation	  Expert → Sensor → Testpoints → Conductivity (6558)
Description	Shows the conductivity currently measured.

User interface Positive floating-point number

Factory setting 0 µS/cm

Electronics temperature

Navigation   Expert → Sensor → Testpoints → Electronics temp (6501)

Description Shows the current temperature of the electronic module.

User interface Signed floating-point number

Factory setting 0 °C

Difference potential E1 and E2

Navigation   Expert → Sensor → Testpoints → DiffPotE1E2 (6568)

Description Shows the difference between the potentials of electrode 1 and electrode 2.

User interface Signed floating-point number

Factory setting 0 V

Potential electrode 1

Navigation   Expert → Sensor → Testpoints → Potential E 1 (6569)

Description Use this function to display the current potential of measuring electrode 1, measured between measuring electrode 1 and reference electrode.

User interface Signed floating-point number

Additional information *Description*

The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.

A value of ±1 V is regarded as good once the difference between the values for measuring electrode 1 and 2 is <0.2 V (**Current difference potential** parameter (→  94)).

Potential electrode 2

Navigation	 Expert → Sensor → Testpoints → Potential E 2 (6676)
Description	Use this function to display the current potential of measuring electrode 2, measured between measuring electrode 2 and reference electrode.
User interface	Signed floating-point number
Additional information	<i>Description</i> The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. A value of ± 1 V is regarded as good once the difference between the values for measuring electrode 1 and 2 is < 0.2 V (Current difference potential parameter (→  94)).

Reference electrode potential against PE

Navigation	 Expert → Sensor → Testpoints → Ref Electr. Pot. (6511)
Description	Shows the potential of the reference electrode with respect to PE.
User interface	Signed floating-point number
Additional information	If using the "Measurement isolated from ground" option (order code for "Sensor options"), the value must not be greater than ± 16 V. The potential is measured between PE and the reference electrode.  No voltage can build up when the switch is closed.

Impedance electrode EPD

Navigation	 Expert → Sensor → Testpoints → Impedan. el. EPD (6815)
Description	Shows the impedance of the EPD electrode last measured with respect to PE.
User interface	Positive floating-point number
Additional information	The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. The resistance between EPD and the reference electrode is measured; the value is highly dependent on the medium used and is measured only in the case of specific actions.

Impedance electrode E1

Navigation	 Expert → Sensor → Testpoints → Impedance el. E1 (6816)
Description	Shows the impedance of electrode 1 last measured with respect to PE.
User interface	Positive floating-point number
Additional information	The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. The resistance between electrode 1 and the reference electrode is measured; the value is highly dependent on the medium used and is measured only in the case of specific actions.

Impedance electrode E2

Navigation	 Expert → Sensor → Testpoints → Impedance el. E2 (6817)
Description	Shows the impedance of electrode 2 last measured with respect to PE.
User interface	Positive floating-point number
Additional information	The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. The resistance between electrode 2 and the reference electrode is measured; the value is highly dependent on the medium used and is measured only in the case of specific actions.

Current gain mode

Navigation	 Expert → Sensor → Testpoints → Curr. gain mode (6584)
Description	The current operating mode of the amplifier is displayed in relation to the gain factor.
User interface	■ Low ■ High
Factory setting	Low
Additional information	At low differential voltages, the input amplifier automatically switches to the higher amplification level: High option

Current gain mode

Navigation	 Expert → Sensor → Testpoints → Curr. gain mode (6584)
Description	The current operating mode of the amplifier is displayed in relation to the gain factor.

User interface	■ Low ■ High
Factory setting	Low
Additional information	At low differential voltages, the input amplifier automatically switches to the higher amplification level: High option

Current rise time

Navigation	  Expert → Sensor → Testpoints → Curr. rise time (6591)
Description	The current rise time of the coil current is displayed.
User interface	Positive floating-point number
Additional information	<i>Description</i> The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. The rise time of the coil current when the polarity of the magnetic field is reversed. This rise time is variable in the measuring device as two different coil currents can be regulated by the amplifier. Therefore it would not make sense to use the rise time to assess the state of the measuring device. The Current hold voltage parameter should be used for this. The value is highly dependent on the nominal diameter and temperature.

Current integration time

Navigation	  Expert → Sensor → Testpoints → Curr. int. time (6572)
Description	Shows the current integration time.
User interface	Positive floating-point number
Additional information	The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. Back-measured integration time. If this value deviates from the set integration time, the current effect of network synchronization can be seen here. Maximum deviation from set integration time: approx. ±10%

Split time coil current

Navigation	  Expert → Sensor → Testpoints → Split time coil (6814)
Description	Length of time until coil current stabilizes.

User interface Positive floating-point number

Additional information The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
From this point on, the coil current is stable.

Coil peak current

Navigation   Expert → Sensor → Testpoints → Coil peak curr. (6771)

Description Shows coil peak current at the switch-off time of the overvoltage.

User interface Positive floating-point number

Additional information The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
Maximum current at the end of the rise time, represents the eddy currents.
The value is highly dependent on the sensor used.

Current overvoltage

Navigation   Expert → Sensor → Testpoints → Curr. overvolt. (6818)

Description Shows the currently remeasured overvoltage.

User interface Signed floating-point number

Additional information The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.

Coil impedance

Navigation   Expert → Sensor → Testpoints → Coil impedance (6687)

Description Shows the currently measured coil impedance.

User interface Signed floating-point number

Additional information The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
The resistance of the exciter coil is measured; the value is highly dependent on the sensor used and the temperature.

Coil inductance

Navigation	  Expert → Sensor → Testpoints → Coil inductance (6838)
Description	Shows the currently measured coil inductance.
User interface	Signed floating-point number
Additional information	The value is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics. The value is highly dependent on the sensor used.

Power line current synchronisation

Navigation	  Expert → Sensor → Testpoints → Pwr. curr. sync. (6678)
Description	Use this function to indicate if the measuring technology was able to sync up with the mains frequency.
User interface	■ Synchronous ■ Asynchronous
Factory setting	Asynchronous
Additional information	<i>Description</i> Integration always begins at the same mains voltage phase. The measuring period is adjusted for this purpose. The integration time remains constant.  Only meaningful when the device is supplied with alternating current (AC). ■ Device is supplied with alternating current (AC): ■ Device behavior is correct: Synchronous option is displayed ■ Device behavior is incorrect: Asynchronous option is displayed ■ Device is supplied with direct current (DC): - The Asynchronous option is always displayed.

Floating measurement switch

Navigation	  Expert → Sensor → Testpoints → FloatMeasSwitch (6813)
Description	Shows the status of the switch for floating measurement.
User interface	■ Open ■ Closed
Factory setting	Closed
Additional information	 If using the "Measurement isolated from ground" option (order code for "Sensor options"), the ground connection switch must always be open.

Response time 95 %

Navigation	  Expert → Sensor → Process param. → Resp. time 95% (6819)   Expert → Sensor → Testpoints → Resp. time 95% (6819)
Description	Use this function to display how quickly 95% (of 100%) of the change was reached in the event of a change in the measured value.
User interface	Positive floating-point number
Factory setting	0 s
Additional information	The response time refers only to the system damping. The effect of the damping on the output is not taken into account.

HBSI field A

Navigation	  Expert → Sensor → Testpoints → HBSI field A (6471)
Description	Shows the HBSI value when Field A is active.
User interface	-100 to 100 %
Factory setting	0 %

HBSI field B

Navigation	  Expert → Sensor → Testpoints → HBSI field B (6470)
Description	Shows the HBSI value when Field B is active.
User interface	Signed floating-point number
Factory setting	0 %

"Testpoints" submenu

Navigation  Expert → Sensor → Testpoints → Testpoints

► Testpoints

Assign test point 1



Navigation	 Expert → Sensor → Testpoints → Assign test pt 1 (6775)
Description	The parameter may only be changed following consultation with Endress+Hauser Flow RD (Research & Development).
User entry	0 to 65 535
Factory setting	0
Additional information	Default setting 0 = no test point assigned.

Test point 1

Navigation	 Expert → Sensor → Testpoints → Test point 1 (6783)
Description	The parameter may only be changed following consultation with Endress+Hauser Flow RD (Research & Development).
User interface	Signed floating-point number
Factory setting	0

Assign test point 2



Navigation	 Expert → Sensor → Testpoints → Assign test pt 2 (6776)
Description	The parameter may only be changed following consultation with Endress+Hauser Flow RD (Research & Development).
User entry	0 to 65 535
Factory setting	0
Additional information	Default setting 0 = no test point assigned.

Test point 2

Navigation	 Expert → Sensor → Testpoints → Test point 2 (6784)
Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
User interface	Signed floating-point number

Factory setting0

Assign test point 3

Navigation	  Expert → Sensor → Testpoints → Assign test pt 3 (6777)
Description	The parameter may only be changed following consultation with Endress+Hauser Flow RD (Research & Development).
User entry	0 to 65 535
Factory setting	0
Additional information	Default setting 0 = no test point assigned.

Test point 3

Navigation	  Expert → Sensor → Testpoints → Test point 3 (6785)
Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
User interface	Signed floating-point number
Factory setting	0

"Build-up index" submenu

Navigation Expert → Sensor → Testpoints → Build-up index



Build-up parameter Z (E1)

Navigation	  Expert → Sensor → Testpoints → Build-up param Z (E1) (6726)
Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
User interface	Signed floating-point number

Factory setting	0 Ohm
------------------------	-------

Build-up parameter Z (E2)

Navigation	  Expert → Sensor → Testpoints → Build-up param Z (E2) (6453)
-------------------	---

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	Signed floating-point number
-----------------------	------------------------------

Factory setting	0 Ohm
------------------------	-------

Build-up parameter P (E1)

Navigation	  Expert → Sensor → Testpoints → Build-up param P (E1) (6723)
-------------------	---

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	Signed floating-point number
-----------------------	------------------------------

Factory setting	0
------------------------	---

Build-up parameter P (E2)

Navigation	  Expert → Sensor → Testpoints → Build-up param P (E2) (6454)
-------------------	---

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	Signed floating-point number
-----------------------	------------------------------

Factory setting	0
------------------------	---

Build-up type E1

Navigation	  Expert → Sensor → Testpoints → Build-up type E1 (6739)
-------------------	--

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	0 to 255
-----------------------	----------

Factory setting	0
------------------------	---

Build-up type E2

Navigation	  Expert → Sensor → Testpoints → Build-up type E2 (6455)
-------------------	--

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	0 to 255
-----------------------	----------

Factory setting	0
------------------------	---

Build-up error code E1

Navigation	  Expert → Sensor → Testpoints → Build-up error E1 (6744)
-------------------	---

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	0 to 255
-----------------------	----------

Factory setting	0
------------------------	---

Build-up error code E2

Navigation	  Expert → Sensor → Testpoints → Build-up error E2 (6456)
-------------------	---

Description	The parameter is used by Endress+Hauser Flow RD (Research & Development) for error diagnostics.
--------------------	---

User interface	0 to 255
-----------------------	----------

Factory setting	0
------------------------	---

Fluid in pipe E1

Navigation	  Expert → Sensor → Testpoints → Fluid in pipe E1 (6809)
-------------------	--

Description	Parameter value is used by R&D for troubleshooting.
--------------------	---

User interface	■ No ■ Yes ■ Not done
-----------------------	---

Factory setting	Not done
------------------------	----------

Fluid in pipe E2

Navigation	  Expert → Sensor → Testpoints → Fluid in pipe E2 (6457)
-------------------	--

Description	Parameter value is used by R&D for troubleshooting.
--------------------	---

User interface	■ No ■ Yes ■ Not done
-----------------------	---

Factory setting	Not done
------------------------	----------

Build-up index E1

Navigation	  Expert → Sensor → Testpoints → BuildUpIndex E1 (6808)
-------------------	---

Description	Use this function to display the current buildup value on measuring electrode E1.
--------------------	---

User interface	Positive floating-point number
-----------------------	--------------------------------

Factory setting	0.0 %
------------------------	-------

Additional information	 The user sees only the mean buildup value of measuring electrode E1 and E2.
-------------------------------	---

Build-up index E2

Navigation	  Expert → Sensor → Testpoints → BuildUpIndex E2 (6458)
-------------------	---

Description	Use this function to display the current buildup value on measuring electrode E2.
--------------------	---

User interface	Positive floating-point number
-----------------------	--------------------------------

Factory setting	0.0 %
------------------------	-------

Additional information	 The user sees only the mean buildup value of measuring electrode E1 and E2.
-------------------------------	---

3.2.10 "Properties" submenu

Navigation  Expert → Sensor → Properties

► Properties

EPD electrode existing

→ 106

Nominal diameter

Navigation  Expert → Sensor → Properties → Nominal diameter (6599)

Description The nominal diameter is displayed.

User interface Positive floating-point number

Tube inner diameter

Navigation  Expert → Sensor → Properties → Tube inner diam. (6502)

Description The internal pipe diameter is displayed.

User interface Positive floating-point number

Temperature sensor type

Navigation  Expert → Sensor → Properties → Temp.sensor type (6706)

Description Displays the temperature sensor type used.

User interface No

EPD electrode existing

Navigation  Expert → Sensor → Properties → EPD electrode (6561)

Description Shows whether the empty pipe detection electrode exists.

User interface

- No
- Yes

Factory setting Yes

Build-up index measurement method

Navigation	  Expert → Sensor → Properties → BuildUpMeasMeth. (6839)
Description	Shows the build-up measurement method applied to the sensor.
User interface	0 to 255
Factory setting	0

Conductivity measurement existing

Navigation	  Expert → Sensor → Properties → Conduc. existing (6513)
Description	Use this function to view whether conductivity measurement is possible (software option).
User interface	■ No ■ Yes
Factory setting	Yes

3.3 "I/O configuration" submenu

Navigation   Expert → I/O config.

	
I/O module 1 to n terminal numbers (3902-1 to n)	→  108
I/O module 1 to n information (3906-1 to n)	→  108
I/O module 1 to n type (3901-1 to n)	→  108
Apply I/O configuration (3907)	→  109
I/O alteration code (2762)	→  109

I/O module 1 to n terminal numbers

Navigation	 Expert → I/O config. → I/O 1 to n terminals (3902–1 to n)
Description	Displays the terminal numbers used by the I/O module.
User interface	■ Not used ■ 26-27 (I/O 1) ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)

I/O module 1 to n information

Navigation	 Expert → I/O config. → I/O 1 to n info (3906–1 to n)
Description	Displays information about the plugged in I/O module.
User interface	■ Not plugged ■ Invalid ■ Not configurable ■ Configurable ■ MODBUS
Additional information	<i>"Not plugged" option</i> The I/O module is not plugged in. <i>"Invalid" option</i> The I/O module is not plugged correctly. <i>"Not configurable" option</i> The I/O module is not configurable. <i>"Configurable" option</i> The I/O module is configurable. <i>"MODBUS" option</i> The I/O module is configured for Modbus.

I/O module 1 to n type



Navigation	 Expert → I/O config. → I/O 1 to n type (3901–1 to n)
Prerequisite	For the following order code: "Output; input 2", option D "Configurable I/O initial setting off"
Description	Use this function to select the I/O module type for the configuration of the I/O module.

Selection	■ Off ■ Current output * ■ Current input * ■ Status input * ■ Pulse/frequency/switch output * ■ Double pulse output * ■ Relay output *
------------------	--

Factory setting	Off
------------------------	-----

Apply I/O configuration

Navigation	  Expert → I/O config. → Apply I/O config (3907)
Description	Use this function to activate the newly configured I/O module type.
Selection	■ No ■ Yes
Factory setting	No

I/O alteration code

Navigation	  Expert → I/O config. → I/O alterat.code (2762)
Description	Use this function to enter the ordered activation code to activate the I/O configuration change.
User entry	Positive integer
Factory setting	0
Additional information	<i>Description</i> The I/O configuration is changed in the I/O module type parameter (→  108).

3.4 "Input" submenu

Navigation   Expert → Input

► Input

* Visibility depends on order options or device settings

► Current input 1 to n	→ 110
► Status input 1 to n	→ 113

3.4.1 "Current input 1 to n" submenu

Navigation Expert → Input → Current input 1 to n

► Current input 1 to n	
Terminal number (1611-1 to n)	→ 110
Signal mode (1610-1 to n)	→ 110
Current span (1605-1 to n)	→ 111
0/4 mA value (1606-1 to n)	→ 111
20 mA value (1607-1 to n)	→ 112
Failure mode (1601-1 to n)	→ 112
Failure value (1602-1 to n)	→ 112

Terminal number

Navigation	Expert → Input → Current input 1 to n → Terminal no. (1611-1 to n)
Description	Displays the terminal numbers used by the current input module.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	"Not used" option The current input module does not use any terminal numbers.

Signal mode

Navigation	Expert → Input → Current input 1 to n → Signal mode (1610-1 to n)
Prerequisite	The measuring device is not approved for use in the hazardous area with type of protection Ex-i.

Description Use this function to select the signal mode for the current input.

Selection

- Passive
- Active *

Factory setting Active

Current span



Navigation Expert → Input → Current input 1 to n → Current span (1605–1 to n)

Description Use this function to select the current range for the process value output and the upper and lower level for signal on alarm.

Selection

- 4...20 mA (4... 20.5 mA)
- 4...20 mA NE (3.8...20.5 mA)
- 4...20 mA US (3.9...20.8 mA)
- 0...20 mA (0... 20.5 mA)

Factory setting Country-specific:

- 4...20 mA NE (3.8...20.5 mA)
- 4...20 mA US (3.9...20.8 mA)

Additional information *Examples*

Sample values for the current range: **Current span** parameter (→ 117)

0/4 mA value



Navigation Expert → Input → Current input 1 to n → 0/4 mA value (1606–1 to n)

Description Use this function to enter a value for the 4 mA current.

User entry Signed floating-point number

Factory setting 0

Additional information *Current input behavior*

The current input behaves differently depending on the settings configured in the following parameters:

- Current span (→ 111)
- Failure mode (→ 112)

Configuration examples

Pay attention to the configuration examples for **4 mA value** parameter (→ 118).

* Visibility depends on order options or device settings

20 mA value 	
Navigation	  Expert → Input → Current input 1 to n → 20 mA value (1607–1 to n)
Description	Use this function to enter a value for the 20 mA current.
User entry	Signed floating-point number
Factory setting	Depends on country and nominal diameter
Additional information	<i>Configuration examples</i>  Pay attention to the configuration examples for 4 mA value parameter (→  118).
Failure mode 	
Navigation	  Expert → Input → Current input 1 to n → Failure mode (1601–1 to n)
Description	Use this function to select the input behavior when measuring a current outside the configured Current span parameter (→  111).
Selection	■ Alarm ■ Last valid value ■ Defined value
Factory setting	Alarm
Additional information	<i>Options</i> ■ Alarm An error message is set. ■ Last valid value The last valid measured value is used. ■ Defined value A user-defined measured value is used (Failure value parameter (→  112)).
Failure value 	
Navigation	  Expert → Input → Current input 1 to n → Failure value (1602–1 to n)
Prerequisite	In the Failure mode parameter (→  112), the Defined value option is selected.
Description	Use this function to enter the value that the device uses if it does not receive an input signal from the external device, or if the input signal is invalid.
User entry	Signed floating-point number
Factory setting	0

3.4.2 "Status input 1 to n" submenu

Navigation  Expert → Input → Status input 1 to n

► Status input 1 to n		
Terminal number (1358-1 to n)	→ 	113
Assign status input (1352-1 to n)	→ 	113
Value status input (1353-1 to n)	→ 	114
Active level (1351-1 to n)	→ 	114
Response time status input (1354-1 to n)	→ 	114

Terminal number

Navigation	 Expert → Input → Status input 1 to n → Terminal no. (1358-1 to n)
Description	Displays the terminal numbers used by the status input module.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	"Not used" option The status input module does not use any terminal numbers.

Assign status input



Navigation	 Expert → Input → Status input 1 to n → Assign stat.inp. (1352-1 to n)
Description	Use this function to select the function for the status input.
Selection	■ Off ■ Reset totalizer 1 ■ Reset totalizer 2 ■ Reset totalizer 3 ■ Reset all totalizers ■ Flow override
Factory setting	Off

Additional information*Options*

- Off
The status input is switched off.
- Reset totalizer 1...3
The individual totalizers are reset.
- Reset all totalizers
All totalizers are reset.
- Flow override
The Flow override (→  67) is activated.
-  Note on the Flow override (→  67):
 - The Flow override (→  67) is enabled as long as the level is at the status input (continuous signal).
 - All other assignments react to a change in level (pulse) at the status input.

Value status input**Navigation**
  Expert → Input → Status input 1 to n → Val.stat.inp. (1353-1 to n)
Description

Displays the current input signal level.

User interface

- High
- Low

Active level**Navigation**
  Expert → Input → Status input 1 to n → Active level (1351-1 to n)
Description

Use this function to determine the input signal level at which the assigned function is activated.

Selection

- High
- Low

Factory setting

High

Response time status input**Navigation**
  Expert → Input → Status input 1 to n → Response time (1354-1 to n)
Description

Use this function to enter the minimum time period for which the input signal level must be present before the selected function is activated.

User entry

5 to 200 ms

Factory setting

50 ms

3.5 "Output" submenu

Navigation  Expert → Output

► Output

► Current output 1 to n

→  115

► Pulse/frequency/switch output 1 to n

→  121

► Relay output 1 to n

→  143

► Double pulse output

→  149

3.5.1 "Current output 1" submenu

Navigation  Expert → Output → Curr.output 1 to n → Curr.output 1

► Current output 1

Terminal number

→  116

Signal mode

→  116

Process variable current output

→  117

Current range output

→  117

Fixed current

→  118

Lower range value output

→  118

Upper range value output

→  118

Measuring mode current output

→  118

Damping current output

→  119

"Current output 1 to n" wizard | "Current output 1" submenu

Navigation  Setup → Curr.output 1 to n → Terminal no.

Navigation  Expert → Output → Curr.output 1 to n → Curr.output 1 → Terminal no.

► Current output 1

Terminal number	→ ⓘ 116
Signal mode	→ ⓘ 116
Process variable current output	→ ⓘ 117
Current range output	→ ⓘ 117
Fixed current	→ ⓘ 118
Lower range value output	→ ⓘ 118
Upper range value output	→ ⓘ 118
Measuring mode current output	→ ⓘ 118
Damping current output	→ ⓘ 119

Terminal number

Navigation	ⓘ ⓘ Setup → Curr.output 1 to n → Terminal no. (0379–1 to n)
Description	Shows the terminal numbers used by the current output module.
User interface	■ Not used ■ 26-27 (I/O 1) ■ 24-25 (I/O 2) ■ 22-23 (I/O 3) ■ 20-21 (I/O 4)
Factory setting	Not used

Signal mode ⓘ

Navigation	ⓘ Setup → Curr.output 1 to n → Signal mode (0377–1 to n)
Description	Select the signal mode for the current output.
Selection	■ Active * ■ Passive *
Factory setting	Passive

* Visibility depends on order options or device settings

Process variable current output 	
Navigation	 Setup → Curr.output 1 to n → Proc.var. outp (0359–1 to n)
Description	Select process variable for current output.
Selection	■ Off * ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity * ■ Corrected conductivity * ■ Temperature * ■ Electronics temperature ■ Noise * ■ Coil current shot time * ■ Reference electrode potential against PE * ■ HBSI * ■ Build-up index ** ■ Test point 1 ■ Test point 2 ■ Test point 3
Factory setting	Volume flow

Current range output 	
Navigation	 Setup → Curr.output 1 to n → Curr.range out (0353–1 to n)
Description	Select current range for process value output and upper/lower level for alarm signal.
Selection	■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4... 20.5 mA) ■ 0...20 mA (0... 20.5 mA) ■ Fixed value
Factory setting	4...20 mA NE (3.8...20.5 mA)

* Visibility depends on order options or device settings

** The build-up index is only available in conjunction with Heartbeat Technology. If Heartbeat Technology was ordered together with the measuring device, the option will already be enabled, and no further action is required. If Heartbeat Technology was ordered at a later date, you must first activate the option under 'Activate SW option' by entering the activation key you received. To purchase Heartbeat Technology, contact your local sales and service center. In addition to Heartbeat Technology, conductivity measurement must be enabled on the device. To do this, go to the 'Conductivity measurement' parameter on the 'Process parameters' menu and select the 'On' option.

Fixed current

Navigation  Setup → Curr.output 1 to n → Fixed current (0365–1 to n)

Description Defines the fixed output current.

User entry 3.59 to 22.5 mA

Factory setting 22.5 mA

Lower range value output

Navigation  Setup → Curr.output 1 to n → Low.range outp (0367–1 to n)

Description Enter lower range value for the measured value range.

User entry Signed floating-point number

Factory setting 0 l/h

Upper range value output

Navigation  Setup → Curr.output 1 to n → Upp.range outp (0372–1 to n)

Description Enter upper range value for the measured value range.

User entry Signed floating-point number

Factory setting 0.025 l/h

Measuring mode current output

Navigation   Expert → Output → Curr.output 1 to n → Meas.mode outp (0351–1 to n)

Description Select measuring mode for output.

Selection

- Forward flow
- Forward/Reverse flow *
- Reverse flow compensation

Factory setting Forward flow

* Visibility depends on order options or device settings

Damping current output

Navigation	Setup → Curr.output 1 to n → Damp.curr.outp (0363–1 to n)
Description	Set reaction time for output signal to fluctuations in the measured value.
User entry	0.0 to 999.9 s
Factory setting	1.0 s

"Current output 1" submenu

Navigation Expert → Output → Curr.output 1 to n → Curr.output 1

► Current output 1

Failure behavior current output

→ 119

Failure current

→ 120

Output current

→ 121

Measured current

→ 121

Failure behavior current output

Navigation	Expert → Output → Curr.output 1 to n → Fail.behav.out (0364–1 to n) Setup → Curr.output 1 to n → Fail.behav.out (0364–1 to n) Setup → Curr.output 1 to n → Fail.behav.out (0364–1 to n)
Prerequisite	A process variable is selected in the Assign current output parameter (→ 117) and one of the following options is selected in the Current span parameter (→ 117): ■ 4...20 mA NE (3.8...20.5 mA) ■ 4...20 mA US (3.9...20.8 mA) ■ 4...20 mA (4... 20.5 mA) ■ 0...20 mA (0... 20.5 mA)
Description	Use this function to select the value of the current output in the event of a device alarm.
Selection	■ Min. ■ Max. ■ Last valid value ■ Actual value ■ Fixed value

Factory setting	Max.
Additional information	<i>Description</i>  This setting does not affect the failsafe mode of other outputs and totalizers. This is specified in separate parameters. <i>"Min." option</i> The current output adopts the value of the lower level for signal on alarm.  The signal on alarm level is defined via the Current span parameter (→  117). <i>"Max." option</i> The current output adopts the value of the upper level for signal on alarm.  The signal on alarm level is defined via the Current span parameter (→  117). <i>"Last valid value" option</i> The current output adopts the last measured value that was valid before the device alarm occurred. <i>"Actual value" option</i> The current output adopts the measured value on the basis of the current flow measurement; the device alarm is ignored. <i>"Defined value" option</i> The current output adopts a defined measured value.  The measured value is defined via the Failure current parameter (→  120).

Failure current


Navigation	  Expert → Output → Curr.output 1 to n → Fail. current (0352-1 to n)  Setup → Curr.output 1 to n → Fail. current (0352-1 to n)  Expert → Curr.output 1 to n → Fail. current (0352-1 to n)
Prerequisite	The Defined value option is selected in the Failure mode parameter (→  119).
Description	Use this function to enter a fixed value that the current output adopts in the event of a device alarm.
User entry	0 to 22.5 mA
Factory setting	22.5 mA

Output current 1 to n

Navigation	Diagnostics → Measured val. → Output values → Curr.output 1 to n → Output curr. 1 to n (0361-1 to n) Expert → Output → Curr.output 1 to n → Output curr. 1 to n (0361-1 to n) Expert → Sensor → Measured val. → Output values → Val. curr.outp 1 to n → Output curr. 1 to n (0361-1 to n)
Description	Displays the current value currently calculated for the current output.
User interface	0 to 22.5 mA

Measured current 1 to n

Navigation	Diagnostics → Measured val. → Output values → Curr.output 1 to n → Measur. curr. 1 to n (0366-1 to n) Expert → Output → Curr.output 1 to n → Measur. curr. 1 to n (0366-1 to n) Expert → Sensor → Measured val. → Output values → Val. curr.outp 1 to n → Measur. curr. 1 to n (0366-1 to n)
Description	Displays the actual measured value of the output current.
User interface	0 to 30 mA

3.5.2 "Pulse/frequency/switch output" submenu

Navigation

[Expert](#) → [Output](#) → [PFS output 1 to n](#) → [PFS output](#)

► Pulse/frequency/switch output
1 to n

"Pulse/frequency/switch output" submenu

Navigation

[Expert](#) → [Output](#) → [PFS output 1 to n](#) → [PFS output](#)

► Pulse/frequency/switch output
1 to n

Terminal number

Signal mode

Operating mode

→ 122

→ 122

→ 122

Terminal number	
Navigation	  Expert → Output → PFS output 1 to n → Terminal no. (0492–1 to n)  Setup → PFS output 1 to n → Terminal no. (0492–1 to n)   Setup → PFS output 1 to n → Terminal no. (0492–1 to n)
Description	Displays the terminal numbers used by the pulse/frequency/switch output module.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	<i>"Not used" option</i> The pulse/frequency/switch output module does not use any terminal numbers.
Signal mode	
Navigation	  Expert → Output → PFS output 1 to n → Signal mode (0490–1 to n)  Setup → PFS output 1 to n → Signal mode (0490–1 to n)  Setup → PFS output 1 to n → Signal mode (0490–1 to n)
Description	Use this function to select the signal mode for the pulse/frequency/switch output.
Selection	■ Passive ■ Active * ■ Passive NE
Factory setting	Passive
Operating mode	
Navigation	  Expert → Output → PFS output 1 to n → Operating mode (0469–1 to n)  Setup → PFS output 1 to n → Operating mode (0469–1 to n)  Setup → PFS output 1 to n → Operating mode (0469–1 to n)
Description	Use this function to select the operating mode of the output as a pulse, frequency or switch output.
Selection	■ Pulse ■ Frequency ■ Switch
Factory setting	Pulse

* Visibility depends on order options or device settings

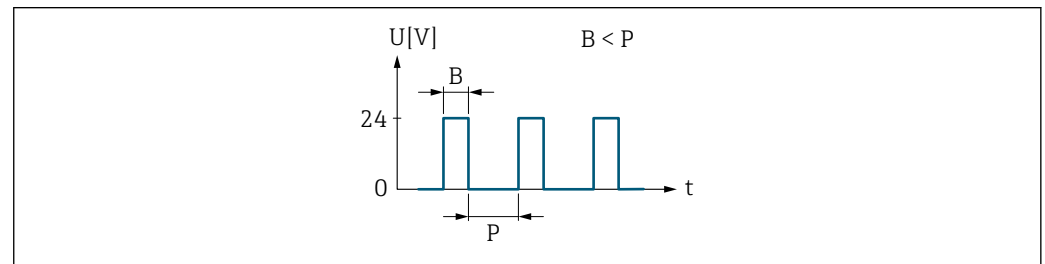
Additional information*"Pulse" option*

Quantity-dependent pulse with configurable pulse width

- Whenever a specific mass, volume or corrected volume is reached (pulse value), a pulse is output, the duration of which was set previously (pulse width).
- The pulses are never shorter than the set duration.

Example

- Flow rate approx. 100 g/s
- Pulse value 0.1 g
- Pulse width 0.05 ms
- Pulse rate 1 000 Impuls/s



A0026883

2 Quantity-proportional pulse (pulse value) with pulse width to be configured

B Pulse width entered

P Pauses between the individual pulses

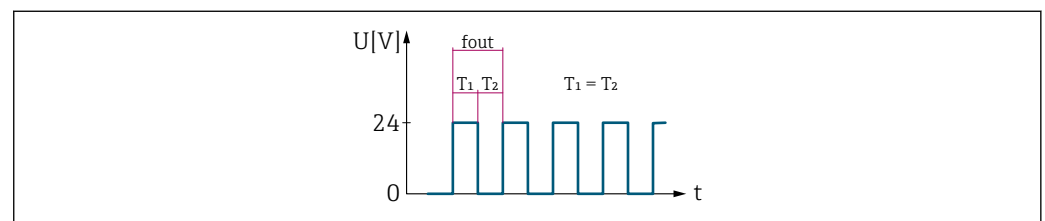
"Frequency" option

Flow-proportional frequency output with 1:1 on/off ratio

An output frequency is output that is proportional to the value of a process variable, such as mass flow, volume flow, corrected volume flow, flow velocity, conductivity, corrected conductivity, temperature or electronic temperature.

Example

- Flow rate approx. 100 g/s
- Max. frequency 10 kHz
- Flow rate at max. frequency 1 000 g/s
- Output frequency approx. 1 000 Hz



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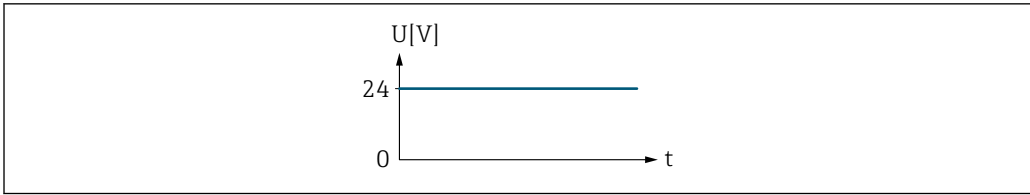
3 Flow-proportional frequency output

"Switch" option

Contact for displaying a condition (e.g. alarm or warning if a limit value is reached)

Example

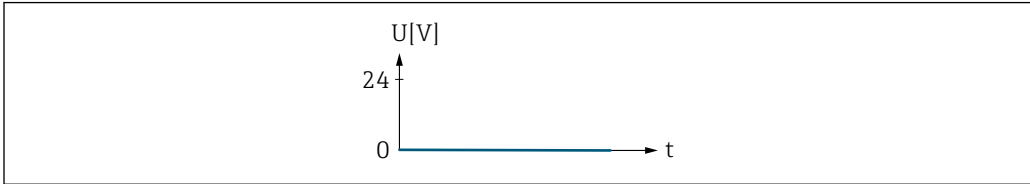
Alarm response without alarm



A0026884

4 No alarm, high level

Example
Alarm response in case of alarm



A0026885

5 Alarm, low level

"Settings" submenu

Navigation   Expert → Output → PFS output 1 to n → Settings

► Settings

Assign pulse output

→  125

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Minimum frequency value

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→  131

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Output damping	→  132
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Switch output function	→  135
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Switch-on value	→  138
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Assign status	→  140
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Failure mode	→  141
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Assign pulse output 1 to n



- Navigation**
-   Expert → Output → PFS output 1 to n → Assign pulse 1 to n (0460-1 to n)
 -  Setup → PFS output 1 to n → Assign pulse 1 to n (0460-1 to n)
 -  Setup → PFS output 1 to n → Assign pulse 1 to n (0460-1 to n)

Prerequisite The **Pulse** option is selected in **Operating mode** parameter (→  122).

Description Use this function to select the process variable for the pulse output.

Selection	■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow
------------------	--

Factory setting	Off
------------------------	-----

Pulse scaling



Navigation	Expert → Output → PFS output 1 to n → Pulse scaling (0455-1 to n) Setup → PFS output 1 to n → Pulse scaling (0455-1 to n) Setup → PFS output 1 to n → Pulse scaling (0455-1 to n)
Prerequisite	The Pulse option is selected in the Operating mode parameter (→ 122) and a process variable is selected in the Assign pulse output parameter (→ 125).
Description	Use this function to enter the value for the measured value that a pulse is equivalent to.
User entry	Positive floating point number
Factory setting	Depends on country and nominal diameter → 225
Additional information	<i>User entry</i> Weighting of the pulse output with a quantity. The lower the pulse value, the ■ better the resolution. ■ the higher the frequency of the pulse response.

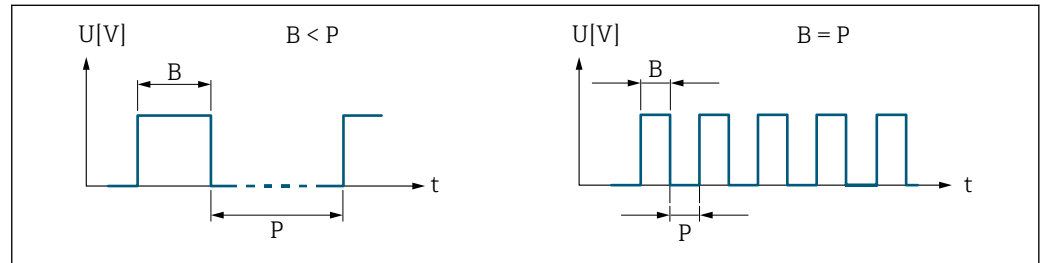
Pulse width



Navigation	Expert → Output → PFS output 1 to n → Pulse width (0452-1 to n) Setup → PFS output 1 to n → Pulse width (0452-1 to n) Setup → PFS output 1 to n → Pulse width (0452-1 to n)
Prerequisite	The Pulse option is selected in the Operating mode parameter (→ 122) and a process variable is selected in the Assign pulse output parameter (→ 125).
Description	Use this function to enter the duration of the output pulse.
User entry	0.05 to 2 000 ms
Factory setting	100 ms

Additional information*Description*

- Define how long a pulse is (duration).
- The maximum pulse rate is defined by $f_{\max} = 1 / (2 \times \text{pulse width})$.
- The interval between two pulses lasts at least as long as the set pulse width.
- The maximum flow is defined by $Q_{\max} = f_{\max} \times \text{pulse value}$.
- If the flow exceeds these limit values, the measuring device displays the **443 Pulse output 1 to n** diagnostic message.



A0026882

B Pulse width entered
P Pauses between the individual pulses

Example

- Pulse value: 0.1 g
- Pulse width: 0.1 ms
- $f_{\max}: 1 / (2 \times 0.1 \text{ ms}) = 5 \text{ kHz}$
- $Q_{\max}: 5 \text{ kHz} \times 0.1 \text{ g} = 0.5 \text{ kg/s}$

Measuring mode**Navigation**

Expert → Output → PFS output 1 to n → Measuring mode (0457-1 to n)

Prerequisite

The **Pulse** option is selected in the **Operating mode** parameter (→ 122) and one of the following options is selected in the **Assign pulse output** parameter (→ 125):

- Mass flow
- Volume flow
- Corrected volume flow

Description

Use this function to select the measuring mode for the pulse output.

Selection

- Forward flow
- Forward/Reverse flow
- Reverse flow
- Reverse flow compensation

Factory setting

Forward flow

Additional information*Options*

- Forward flow
Positive flow is output, negative flow is not output.
- Forward/Reverse flow
Positive and negative flow are output (absolute value), but a distinction is not made between positive and negative flow.
- Reverse flow
Negative flow is output, positive flow is not output.
- Reverse flow compensation
The flow components outside the measuring range are buffered, balanced and output after a maximum delay of 60 s.

 For a detailed description of the options available, see the **Measuring mode** parameter (→  118)

Examples

 For a detailed description of the configuration examples, see the **Measuring mode** parameter (→  118)

Failure mode**Navigation**

-   Expert → Output → PFS output 1 to n → Failure mode (0480–1 to n)
-  Setup → PFS output 1 to n → Failure mode (0480–1 to n)
-  Setup → PFS output 1 to n → Failure mode (0480–1 to n)

Prerequisite

The **Pulse** option is selected in the **Operating mode** parameter (→  122) and a process variable is selected in the **Assign pulse output** parameter (→  125).

Description

Use this function to select the failure mode of the pulse output in the event of a device alarm.

Selection

- Actual value
- No pulses

Factory setting

No pulses

Additional information*Description*

The dictates of safety render it advisable to ensure that the pulse output shows a predefined behavior in the event of a device alarm.

Options

- Actual value
In the event of a device alarm, the pulse output continues on the basis of the current flow measurement. The fault is ignored.
- No pulses
In the event of a device alarm, the pulse output is "switched off".

NOTICE! A device alarm indicates a serious fault with the measuring device. The measurement quality may possibly be influenced and may no longer be guaranteed. The **Actual value** option is only recommended if it is ensured that all possible alarm conditions do not influence the measurement quality.

Pulse output 1 to n

Navigation

- 📖📖 Diagnostics → Measured val. → Output values → PFS output 1 to n → Pulse output 1 to n (0456-1 to n)
- 📖📖 Expert → Output → PFS output 1 to n → Pulse output 1 to n (0456-1 to n)
- 📖📖 Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Pulse output 1 to n (0456-1 to n)

Prerequisite

The **Pulse** option is selected in the **Operating mode** parameter (→ 📖 122) parameter.

Description

Displays the pulse frequency currently output.

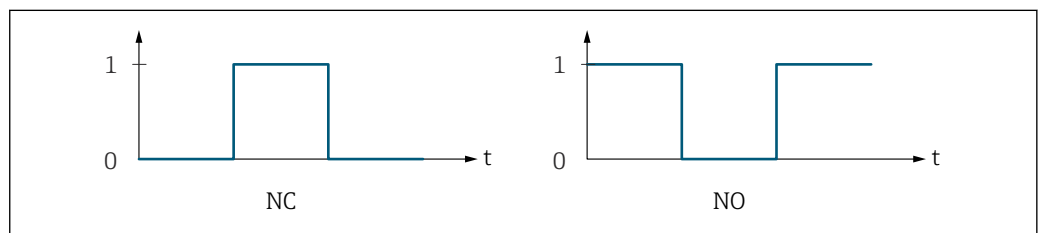
User interface

Positive floating-point number

Additional information

Description

- The pulse output is an open collector output.
- This is configured at the factory in such a way that the transistor is conductive for the duration of the pulse (NO contact) and is safety-oriented.



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0 Non-conductive
 1 Conductive
 NC NC contact (normally closed)
 NO NO contact (normally open)

The output behavior can be reversed via the **Invert output signal** parameter (→ 📖 142) i.e. the transistor does not conduct for the duration of the pulse.

In addition, the behavior of the output in the event of a device alarm (**Failure mode** parameter (→ 📖 128)) can be configured.

Assign frequency output



Navigation

- 📖📖 Expert → Output → PFS output 1 to n → Assign freq. (0478-1 to n)
- 📖 Setup → PFS output 1 to n → Assign freq. (0478-1 to n)
- 📖 Setup → PFS output 1 to n → Assign freq. (0478-1 to n)

Prerequisite

The **Frequency** option is selected in **Operating mode** parameter (→ 📖 122).

Description

Use this function to select the process variable for the frequency output.

Selection

- Off
- Volume flow
- Mass flow
- Corrected volume flow

- Flow velocity
- Conductivity^{*}
- Corrected conductivity^{*}
- Temperature^{*}
- Electronics temperature
- Noise^{*}
- Coil current shot time^{*}
- Reference electrode potential against PE^{*}
- HBSI^{*}
- Build-up index^{*}
- Test point 1
- Test point 2
- Test point 3

Factory setting Off

Minimum frequency value

Navigation

-   Expert → Output → PFS output 1 to n → Min. freq. value (0453–1 to n)
-  Setup → PFS output 1 to n → Min. freq. value (0453–1 to n)
-  Setup → PFS output 1 to n → Min. freq. value (0453–1 to n)

Prerequisite

The **Frequency** option is selected in the **Operating mode** parameter (→  122) and a process variable is selected in the **Assign frequency output** parameter (→  129).

Description

Use this function to enter the minimum frequency.

User entry

0.0 to 10 000.0 Hz

Factory setting

0.0 Hz

Maximum frequency value

Navigation

-   Expert → Output → PFS output 1 to n → Max. freq. value (0454–1 to n)
-  Setup → PFS output 1 to n → Max. freq. value (0454–1 to n)
-  Setup → PFS output 1 to n → Max. freq. value (0454–1 to n)

Prerequisite

The **Frequency** option is selected in the **Operating mode** parameter (→  122) and a process variable is selected in the **Assign frequency output** parameter (→  129).

Description

Use this function to enter the end value frequency.

User entry

0.0 to 10 000.0 Hz

Factory setting

10 000.0 Hz

* Visibility depends on order options or device settings

Measuring value at minimum frequency


Navigation	Expert → Output → PFS output 1 to n → Val. at min.freq (0476-1 to n) Setup → PFS output 1 to n → Val. at min.freq (0476-1 to n) Setup → PFS output 1 to n → Val. at min.freq (0476-1 to n)
Prerequisite	The Frequency option is selected in the Operating mode parameter (→ 122) and a process variable is selected in the Assign frequency output parameter (→ 129).
Description	Use this function to enter the measured value for the start value frequency.
User entry	Signed floating-point number
Factory setting	Depends on country and nominal diameter
Additional information	<i>Dependency</i> The entry depends on the process variable selected in the Assign frequency output parameter (→ 129).

Measuring value at maximum frequency


Navigation	Expert → Output → PFS output 1 to n → Val. at max.freq (0475-1 to n) Setup → PFS output 1 to n → Val. at max.freq (0475-1 to n) Setup → PFS output 1 to n → Val. at max.freq (0475-1 to n)
Prerequisite	The Frequency option is selected in the Operating mode parameter (→ 122) and a process variable is selected in the Assign frequency output parameter (→ 129).
Description	Use this function to enter the measured value for the end value frequency.
User entry	Signed floating-point number
Factory setting	Depends on country and nominal diameter
Additional information	<i>Description</i> Use this function to enter the maximum measured value at the maximum frequency. The selected process variable is output as a proportional frequency. <i>Dependency</i> The entry depends on the process variable selected in the Assign frequency output parameter (→ 129).

Measuring mode 	
Navigation	  Expert → Output → PFS output 1 to n → Measuring mode (0479-1 to n)
Prerequisite	One of the following options is selected in the Assign current output parameter (→  117): ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity[*] ■ Corrected conductivity[*] ■ Temperature[*] ■ Electronics temperature
Description	Use this function to select the measuring mode for the frequency output.
Selection	■ Forward flow ■ Forward/Reverse flow ■ Reverse flow compensation
Factory setting	Forward flow
Additional information	<i>Options</i>  For a detailed description of the options available, see the Measuring mode parameter (→  118) <i>Examples</i>  For a detailed description of the configuration examples, see the Measuring mode parameter (→  118)
Damping output 1 to n 	

Navigation	  Expert → Output → PFS output 1 to n → Damping out. 1 to n (0477-1 to n)  Setup → PFS output 1 to n → Damping out. 1 to n (0477-1 to n)  Setup → PFS output 1 to n → Damping out. 1 to n (0477-1 to n)
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Prerequisite	One of the following options is selected in the Assign current output parameter (→  117): ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity[*] ■ Corrected conductivity[*] ■ Temperature[*] ■ Electronics temperature
---------------------	---

* Visibility depends on order options or device settings

Description	Use this function to enter a time constant for the reaction time of the output signal to fluctuations in the measured value.
User entry	0 to 999.9 s
Factory setting	0.0 s
Additional information	<i>User entry</i> Use this function to enter a time constant (PT1 element ³⁾) for frequency output damping: ■ If a low time constant is entered, the current output reacts particularly quickly to fluctuating measured variables. ■ On the other hand, the current output reacts more slowly if a high time constant is entered.  Damping is switched off if 0 is entered (factory setting). The frequency output is subject to separate damping that is independent of all preceding time constants.

Response time

Navigation	  Expert → Output → PFS output 1 to n → Response time (0491–1 to n)
Prerequisite	One of the following options is selected in the Assign current output parameter (→  117): ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity * ■ Corrected conductivity * ■ Temperature * ■ Electronics temperature
Description	Displays the response time. This specifies how quickly the pulse/frequency/switch output reaches 63 % of 100 % of the measured value change when the measured value changes.
User interface	Positive floating-point number
Additional information	<i>Description</i>  The response time is made up of the time specified for the following dampings: ■ Damping of pulse/frequency/switch output and ■ Depending on the measured variable assigned to the output. Flow damping

3) proportional transmission behavior with first order delay

* Visibility depends on order options or device settings

Failure mode 	
Navigation	  Expert → Output → PFS output 1 to n → Failure mode (0451–1 to n)  Setup → PFS output 1 to n → Failure mode (0451–1 to n)  Setup → PFS output 1 to n → Failure mode (0451–1 to n)
Prerequisite	The Frequency option is selected in the Operating mode parameter (→  122) and a process variable is selected in the Assign frequency output parameter (→  129).
Description	Use this function to select the failure mode of the frequency output in the event of a device alarm.
Selection	■ Actual value ■ Defined value ■ 0 Hz
Factory setting	0 Hz
Additional information	<i>Options</i> ■ Actual value In the event of a device alarm, the frequency output continues on the basis of the current flow measurement. The device alarm is ignored. ■ Defined value In the event of a device alarm, the frequency output continues on the basis of a predefined value. The Failure frequency (→  134) replaces the current measured value, making it possible to bypass the device alarm. The actual measurement is switched off for the duration of the device alarm. ■ 0 Hz In the event of a device alarm, the frequency output is "switched off". NOTICE! A device alarm indicates a serious fault with the measuring device. The measurement quality may possibly be influenced and may no longer be guaranteed. The Actual value option is only recommended if it is ensured that all possible alarm conditions do not influence the measurement quality.

Failure frequency 	
Navigation	  Expert → Output → PFS output 1 to n → Failure freq. (0474–1 to n)  Setup → PFS output 1 to n → Failure freq. (0474–1 to n)  Setup → PFS output 1 to n → Failure freq. (0474–1 to n)
Prerequisite	In the Operating mode parameter (→  122), the Frequency option is selected, in the Assign frequency output parameter (→  129) a process variable is selected, and in the Failure mode parameter (→  134), the Defined value option is selected.
Description	Enter frequency output value in alarm condition.
User entry	0.0 to 12 500.0 Hz
Factory setting	0.0 Hz

Output frequency 1 to n	
Navigation	  Diagnostics → Measured val. → Output values → PFS output 1 to n → Output freq. 1 to n (0471–1 to n)   Expert → Output → PFS output 1 to n → Output freq. 1 to n (0471–1 to n)   Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Output freq. 1 to n (0471–1 to n)
Prerequisite	In the Operating mode parameter (→  122), the Frequency option is selected.
Description	Displays the actual value of the output frequency which is currently measured.
User interface	0.0 to 12 500.0 Hz
Switch output function 	
Navigation	  Expert → Output → PFS output 1 to n → Switch out funct (0481–1 to n)  Setup → PFS output 1 to n → Switch out funct (0481–1 to n)  Setup → PFS output 1 to n → Switch out funct (0481–1 to n)
Prerequisite	The Switch option is selected in the Operating mode parameter (→  122).
Description	Use this function to select a function for the switch output.
Selection	■ Off ■ On ■ Diagnostic behavior ■ Limit ■ Flow direction check ■ Status
Factory setting	Off
Additional information	<i>Options</i> ■ Off The switch output is permanently switched off (open, non-conductive). ■ On The switch output is permanently switched on (closed, conductive). ■ Diagnostic behavior Indicates if the diagnostic event is present or not. Is used to output diagnostic information and to react to it appropriately at the system level. ■ Limit Indicates if a specified limit value has been reached for the process variable. Is used to output diagnostic information relating to the process and to react to it appropriately at the system level. ■ Flow direction check Indicates the flow direction (forward or reverse flow). ■ Status Displays the device status depending on whether empty pipe detection or low flow cut off is selected.

Assign diagnostic behavior 	
Navigation	  Expert → Output → PFS output 1 to n → Assign diag. beh (0482-1 to n)  Setup → PFS output 1 to n → Assign diag. beh (0482-1 to n)  Setup → PFS output 1 to n → Assign diag. beh (0482-1 to n)
Prerequisite	■ In the Operating mode parameter (→  122), the Switch option is selected. ■ In the Switch output function parameter (→  135), the Diagnostic behavior option is selected.
Description	Use this function to select the diagnostic event category that is displayed for the switch output.
Selection	■ Alarm ■ Alarm or warning ■ Warning
Factory setting	Alarm
Additional information	<i>Description</i>  If no diagnostic event is pending, the switch output is closed and conductive.
	<i>Selection</i> ■ Alarm The switch output signals only diagnostic events in the alarm category. ■ Alarm or warning The switch output signals diagnostic events in the alarm and warning category. ■ Warning The switch output signals only diagnostic events in the warning category.
Assign limit 	

Navigation	  Expert → Output → PFS output 1 to n → Assign limit (0483-1 to n)  Setup → PFS output 1 to n → Assign limit (0483-1 to n)  Setup → PFS output 1 to n → Assign limit (0483-1 to n)
Prerequisite	■ The Switch option is selected in Operating mode parameter (→  122). ■ The Limit option is selected in Switch output function parameter (→  135).
Description	Use this function to select a process variable for the limit function.
Selection	■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity*

* Visibility depends on order options or device settings

- Corrected conductivity *
- Totalizer 1
- Totalizer 2
- Totalizer 3
- Temperature *
- Electronics temperature

Factory setting

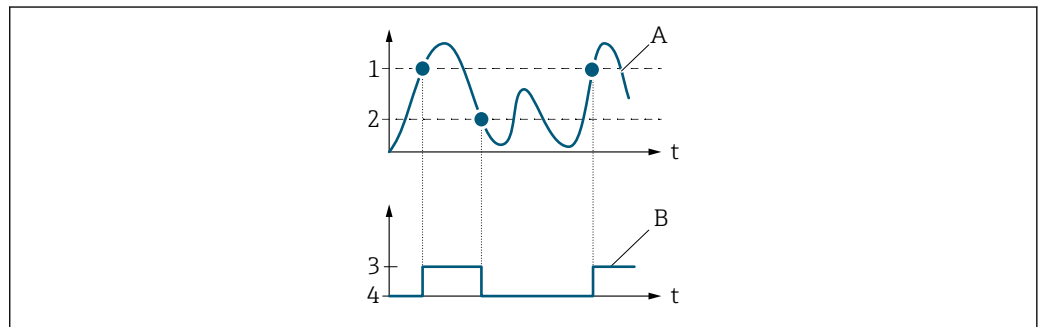
Volume flow

Additional information

Description

Behavior of status output when Switch-on value > Switch-off value:

- Process variable > Switch-on value: transistor is conductive
- Process variable < Switch-off value: transistor is non-conductive

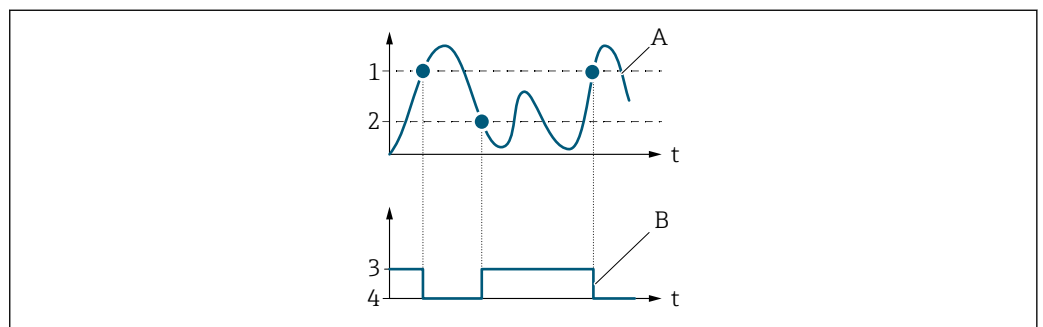


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- 1 Switch-on value
- 2 Switch-off value
- 3 Conductive
- 4 Non-conductive
- A Process variable
- B Status output

Behavior of status output when Switch-on value < Switch-off value:

- Process variable < Switch-on value: transistor is conductive
- Process variable > Switch-off value: transistor is non-conductive



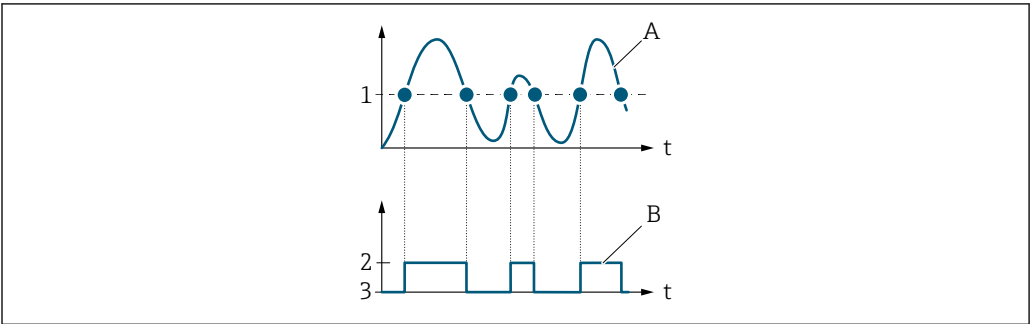
A0026892

- 1 Switch-off value
- 2 Switch-on value
- 3 Conductive
- 4 Non-conductive
- A Process variable
- B Status output

* Visibility depends on order options or device settings

Behavior of status output when Switch-on value = Switch-off value:

- Process variable > Switch-on value: transistor is conductive
- Process variable < Switch-off value: transistor is non-conductive



A0026893

- 1 Switch-on value = Switch-off value
- 2 Conductive
- 3 Non-conductive
- A Process variable
- B Status output

Switch-on value



Navigation

- Expert → Output → PFS output 1 to n → Switch-on value (0466-1 to n)
- Setup → PFS output 1 to n → Switch-on value (0466-1 to n)
- Setup → PFS output 1 to n → Switch-on value (0466-1 to n)

Prerequisite

- The **Switch** option is selected in the **Operating mode** parameter (→ 122).
- The **Limit** option is selected in the **Switch output function** parameter (→ 135).

Description

Use this function to enter the measured value for the switch-on point.

User entry

Signed floating-point number

Factory setting

- Depends on country:
- 0 l/h
 - 0 gal/min (us)

Additional information

Description

Use this function to enter the limit value for the switch-on value (process variable > switch-on value = closed, conductive).

 When using a hysteresis: Switch-on value > Switch-off value.

Dependency

 The unit depends on the process variable selected in the **Assign limit** parameter (→ 136).

Switch-off value	
Navigation	Expert → Output → PFS output 1 to n → Switch-off value (0464-1 to n) Setup → PFS output 1 to n → Switch-off value (0464-1 to n) Setup → PFS output 1 to n → Switch-off value (0464-1 to n)
Prerequisite	■ The Switch option is selected in the Operating mode parameter (→ 122). ■ The Limit option is selected in the Switch output function parameter (→ 135).
Description	Use this function to enter the measured value for the switch-off point.
User entry	Signed floating-point number
Factory setting	Depends on country: ■ 0 l/h ■ 0 gal/min (us)
Additional information	<i>Description</i> Use this function to enter the limit value for the switch-off value (process variable < switch-off value = open, non-conductive). When using a hysteresis: Switch-on value > Switch-off value. <i>Dependency</i> The unit depends on the process variable selected in the Assign limit parameter (→ 136).
Assign flow direction check	
Navigation	Expert → Output → PFS output 1 to n → Assign dir.check (0484-1 to n) Setup → PFS output 1 to n → Assign dir.check (0484-1 to n) Setup → PFS output 1 to n → Assign dir.check (0484-1 to n)
Prerequisite	■ The Switch option is selected in the Operating mode parameter (→ 122). ■ The Flow direction check option is selected in the Switch output function parameter (→ 135).
Description	Use this function to select a process variable for monitoring the flow direction.
Selection	
Factory setting	Volume flow

Assign status

Navigation	  Expert → Output → PFS output 1 to n → Assign status (0485–1 to n)  Setup → PFS output 1 to n → Assign status (0485–1 to n)  Setup → PFS output 1 to n → Assign status (0485–1 to n)
Prerequisite	■ The Switch option is selected in Operating mode parameter (→  122). ■ The Status option is selected in Switch output function parameter (→  135).
Description	Select the device function whose status you want to display.
Selection	■ Empty pipe detection ■ Low flow cut off ■ Build-up index * ■ HBSI limit exceeded *
Factory setting	Empty pipe detection
Additional information	<i>Options</i> When the switch-on point for the selected device function is reached, the output is switched on (closed, conductive). Otherwise, the output is non-conductive.

Switch-on delay

Navigation	  Expert → Output → PFS output 1 to n → Switch-on delay (0467–1 to n)  Setup → PFS output 1 to n → Switch-on delay (0467–1 to n)  Setup → PFS output 1 to n → Switch-on delay (0467–1 to n)
Prerequisite	■ The Switch option is selected in the Operating mode parameter (→  122). ■ The Limit option is selected in the Switch output function parameter (→  135).
Description	Use this function to enter a delay time for switching on the switch output.
User entry	0.0 to 100.0 s
Factory setting	0.0 s

* Visibility depends on order options or device settings

Switch-off delay 	
Navigation	  Expert → Output → PFS output 1 to n → Switch-off delay (0465-1 to n)  Setup → PFS output 1 to n → Switch-off delay (0465-1 to n)  Setup → PFS output 1 to n → Switch-off delay (0465-1 to n)
Prerequisite	■ The Switch option is selected in the Operating mode parameter (→  122). ■ The Limit option is selected in the Switch output function parameter (→  135).
Description	Use this function to enter a delay time for switching off the switch output.
User entry	0.0 to 100.0 s
Factory setting	0.0 s
Failure mode 	
Navigation	  Expert → Output → PFS output 1 to n → Failure mode (0486-1 to n)  Setup → PFS output 1 to n → Failure mode (0486-1 to n)  Setup → PFS output 1 to n → Failure mode (0486-1 to n)
Description	Use this function to select a failsafe mode for the switch output in the event of a device alarm.
Selection	■ Actual status ■ Open ■ Closed
Factory setting	Open
Additional information	<i>Options</i> ■ Actual status In the event of a device alarm, faults are ignored and the current behavior of the input value is output by the switch output. The Actual status option behaves in the same way as the current input value. ■ Open In the event of a device alarm, the switch output's transistor is set to non-conductive. ■ Closed In the event of a device alarm, the switch output's transistor is set to conductive.

Switch state 1 to n

Navigation

Diagnostics → Measured val. → Output values → PFS output 1 to n → Switch state 1 to n (0461-1 to n)
 Expert → Output → PFS output 1 to n → Switch state 1 to n (0461-1 to n)
 Expert → Sensor → Measured val. → Output values → PFS output 1 to n → Switch state 1 to n (0461-1 to n)

Prerequisite

The **Switch** option is selected in the **Operating mode** parameter (→ 122).

Description

Displays the current switch status of the status output.

User interface

■ Open

■ Closed

Additional information

User interface

■ Open

The switch output is not conductive.

■ Closed

The switch output is conductive.

"Additional settings" submenu

Navigation

Expert → Output → PFS output 1 to n → Add. settings

► Additional settings

Invert output signal

→ 142

Invert output signal

Navigation

Expert → Output → PFS output 1 to n → Invert outp.sig. (0470-1 to n)
 Setup → PFS output 1 to n → Invert outp.sig. (0470-1 to n)
 Setup → PFS output 1 to n → Invert outp.sig. (0470-1 to n)

Description

Use this function to select whether to invert the output signal.

Selection

■ No

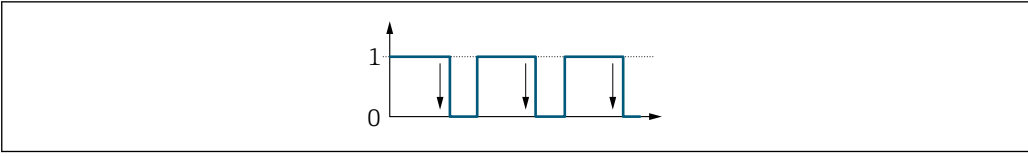
■ Yes

Factory setting

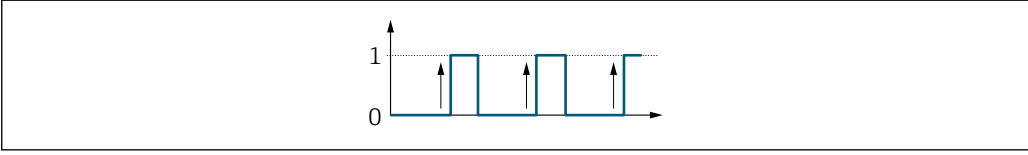
No

Additional information

Selection
No option (passive - negative)



Yes option (passive - positive)



3.5.3 "Relay output 1 to n" submenu

Navigation   Expert → Output → Relay output 1 to n

► Relay output 1 to n		
Terminal number	→ 	144
Relay output function	→ 	144
Assign flow direction check	→ 	145
Assign limit	→ 	145
Assign diagnostic behavior	→ 	145
Assign status	→ 	146
Switch-off value	→ 	146
Switch-off delay	→ 	147
Switch-on value	→ 	147
Switch-on delay	→ 	148
Failure mode	→ 	148
Switch state	→ 	148
Powerless relay status	→ 	149

Terminal number	
Navigation	 Expert → Output → Relay output 1 to n → Terminal no. (0812–1 to n)
Description	Displays the terminal numbers used by the relay output module.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	<i>"Not used" option</i> The relay output module does not use any terminal numbers.
Relay output function 	
Navigation	 Expert → Output → Relay output 1 to n → Relay outp.func. (0804–1 to n)
Description	Use this function to select an output function for the relay output.
Selection	■ Closed ■ Open ■ Diagnostic behavior ■ Limit ■ Flow direction check ■ Digital Output
Factory setting	Closed
Additional information	<i>Selection</i> ■ Closed The relay output is permanently switched on (closed, conductive). ■ Open The relay output is permanently switched off (open, non-conductive). ■ Diagnostic behavior Indicates if the diagnostic event is present or not. Is used to output diagnostic information and to react to it appropriately at the system level. ■ Limit Indicates if a specified limit value has been reached for the process variable. Is used to output diagnostic information relating to the process and to react to it appropriately at the system level. ■ Flow direction check Indicates the flow direction (forward or reverse flow). ■ Digital Output Indicates the device status depending on whether empty pipe detection or low flow cut off is selected.

Assign flow direction check 	
Navigation	  Expert → Output → Relay output 1 to n → Assign dir.check (0808–1 to n)
Prerequisite	The Flow direction check option is selected in the Relay output function parameter (→  144).
Description	Use this function to select a process variable for monitoring the flow direction.
Selection	
Factory setting	Volume flow
Assign limit 	
Navigation	  Expert → Output → Relay output 1 to n → Assign limit (0807–1 to n)
Prerequisite	The Limit option is selected in Relay output function parameter (→  144).
Description	Use this function to select a process variable for the limit value function.
Selection	■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity ■ Conductivity[*] ■ Corrected conductivity[*] ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3 ■ Temperature[*] ■ Electronics temperature
Factory setting	Volume flow
Assign diagnostic behavior 	
Navigation	  Expert → Output → Relay output 1 to n → Assign diag. beh (0806–1 to n)
Prerequisite	In the Relay output function parameter (→  144), the Diagnostic behavior option is selected.
Description	Use this function to select the category of the diagnostic events that are displayed for the relay output.

* Visibility depends on order options or device settings

Selection	■ Alarm ■ Alarm or warning ■ Warning
Factory setting	Alarm
Additional information	<i>Description</i>  If no diagnostic event is pending, the relay output is closed and conductive. <i>Selection</i> ■ Alarm The relay output signals only diagnostic events in the alarm category. ■ Alarm or warning The relay output signals diagnostic events in the alarm and warning category. ■ Warning The relay output signals only diagnostic events in the warning category.

Assign status

Navigation	 Expert → Output → Relay output 1 to n → Assign status (0805–1 to n)
Prerequisite	In the Relay output function parameter (→  144), the Digital Output option is selected.
Description	Use this function to select the device status for the relay output.
Selection	■ Partially filled pipe detection ■ Low flow cut off ■ HBSI limit exceeded *
Factory setting	Partially filled pipe detection

Switch-off value

Navigation	 Expert → Output → Relay output 1 to n → Switch-off value (0809–1 to n)
Prerequisite	The Limit option is selected in the Relay output function parameter (→  144).
Description	Use this function to enter the measured value for the switch-off point.
User entry	Signed floating-point number
Factory setting	Depends on country: ■ 0 l/h ■ 0 gal(us)/min

* Visibility depends on order options or device settings

Additional information	<i>Description</i> Use this function to enter the limit value for the switch-off value (process variable < switch-off value = open, non-conductive).  When using a hysteresis: Switch-on value > Switch-off value. <i>Dependency</i>  The unit is dependent on the process variable selected in the Assign limit parameter (→  145).
-------------------------------	---

Switch-off delay 	
Navigation	  Expert → Output → Relay output 1 to n → Switch-off delay (0813–1 to n)
Prerequisite	In the Relay output function parameter (→  144), the Limit option is selected.
Description	Use this function to enter a delay time for switching off the switch output.
User entry	0.0 to 100.0 s
Factory setting	0.0 s

Switch-on value 	
Navigation	  Expert → Output → Relay output 1 to n → Switch-on value (0810–1 to n)
Prerequisite	The Limit option is selected in the Relay output function parameter (→  144).
Description	Use this function to enter the measured value for the switch-on point.
User entry	Signed floating-point number
Factory setting	Depends on country: ■ 0 l/h ■ 0 gal(us)/min
Additional information	<i>Description</i> Use this function to enter the limit value for the switch-on value (process variable > switch-on value = closed, conductive).  When using a hysteresis: Switch-on value > Switch-off value. <i>Dependency</i>  The unit is dependent on the process variable selected in the Assign limit parameter (→  145).

Switch-on delay		
Navigation	  Expert → Output → Relay output 1 to n → Switch-on delay (0814–1 to n)	
Prerequisite	In the Relay output function parameter (→  144), the Limit option is selected.	
Description	Use this function to enter a delay time for switching on the switch output.	
User entry	0.0 to 100.0 s	
Factory setting	0.0 s	
Failure mode		
Navigation	  Expert → Output → Relay output 1 to n → Failure mode (0811–1 to n)	
Description	Use this function to select the failure mode of the relay output in the event of a device alarm.	
Selection	■ Actual status ■ Open ■ Closed	
Factory setting	Open	
Additional information	<i>Selection</i> ■ Actual status In the event of a device alarm, faults are ignored and the current behavior of the input value is output by the relay output. The Actual status option behaves in the same way as the current input value. ■ Open In the event of a device alarm, the relay output's transistor is set to non-conductive. ■ Closed In the event of a device alarm, the relay output's transistor is set to conductive.	
Switch state		
Navigation	  Expert → Output → Relay output 1 to n → Switch state (0801–1 to n)	
Description	Displays the current status of the relay output.	
User interface	■ Open ■ Closed	

Additional information	<i>User interface</i> ■ Open The relay output is not conductive. ■ Closed The relay output is conductive.
-------------------------------	---

Powerless relay status

Navigation	  Expert → Output → Relay output 1 to n → Powerless relay (0816–1 to n)
Description	Use this function to select the quiescent state for the relay output.
Selection	■ Open ■ Closed
Factory setting	Open
Additional information	<i>Selection</i> ■ Open The relay output is not conductive. ■ Closed The relay output is conductive.

3.5.4 "Double pulse output" submenu

Navigation   Expert → Output → Double pulse out

► Double pulse output		
Master terminal number (0981)	→	 150
Slave terminal number (0990)	→	 150
Signal mode (0991)	→	 150
Assign pulse output 1 (0982–1)	→	 151
Value per pulse (0983)	→	 151
Pulse width (0986)	→	 151
Phase shift (0992)	→	 152
Measuring mode (0984)	→	 152

Failure mode (0985)	→ 153
Pulse output (0987)	→ 153
Invert output signal (0993)	→ 153

Master terminal number

Navigation	  Expert → Output → Double pulse out → Master term. no. (0981)
Description	Displays the master terminal number for the double pulse output.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	<i>"Not used" option</i> The double pulse output does not use any terminal numbers.

Slave terminal number

Navigation	  Expert → Output → Double pulse out → Slave term. no. (0990)
Description	Displays the slave terminal number for the double pulse output.
User interface	■ Not used ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)
Additional information	<i>"Not used" option</i> The double pulse output does not use any terminal numbers.

Signal mode



Navigation	  Expert → Output → Double pulse out → Signal mode (0991)
Description	Use this function to select the signal mode for the double pulse output.
Selection	■ Passive ■ Active * ■ Passive NE

* Visibility depends on order options or device settings

Factory setting Passive

Assign pulse output 1

Navigation   Expert → Output → Double pulse out → Assign pulse 1 (0982–1)

Description Use this function to select a process variable for the double pulse output.

Selection

- Off
- Volume flow
- Mass flow
- Corrected volume flow

Factory setting Off

Value per pulse

Navigation   Expert → Output → Double pulse out → Value per pulse (0983)

Description Use this function to enter the value for the measured value that a pulse is equivalent to.

User entry Signed floating-point number

Factory setting Depends on country and nominal diameter →  225

Additional information *User entry*
Weighting of the pulse output with a quantity.
The lower the pulse value, the

- better the resolution.
- the higher the frequency of the pulse response.

Pulse width

Navigation   Expert → Output → Double pulse out → Pulse width (0986)

Description Use this function to enter the duration of the output pulse.

User entry 0.5 to 2 000 ms

Factory setting 0.5 ms

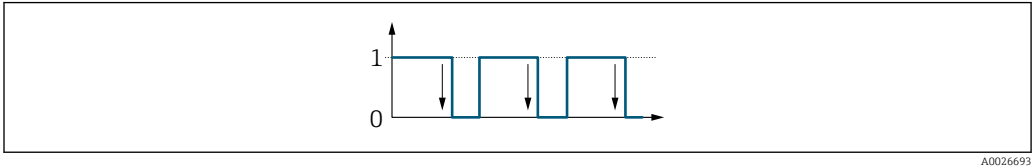
Additional information  For a detailed description and example: **Pulse width** parameter (→  126)

Phase shift 	
Navigation	  Expert → Output → Double pulse out → Phase shift (0992)
Description	Use this function to select the degree of phase shift.
Selection	■ 90° ■ 180°
Factory setting	90°
Additional information	<i>Selection</i> ■ 90° Phase shift by a quarter period. ■ 180° Phase shift by a half period, which is equivalent to a phase reversal.
Measuring mode 	
Navigation	  Expert → Output → Double pulse out → Measuring mode (0984)
Description	Use this function to select the measuring mode for the double pulse output.
Selection	■ Forward flow ■ Forward/Reverse flow ■ Reverse flow ■ Reverse flow compensation
Factory setting	Forward flow
Additional information	<i>Selection</i> ■ Forward flow Positive flow is output, negative flow is not output. ■ Forward/Reverse flow Positive and negative flow are output (absolute value), but a distinction is not made between positive and negative flow. ■ Reverse flow Negative flow is output, positive flow is not output. ■ Reverse flow compensation The flow components outside the span are buffered, balanced and output after a maximum delay of 60 s.  For a detailed description of the options available, see the Measuring mode parameter (→  118) <i>Examples</i>  For a detailed description of the configuration examples, see the Measuring mode parameter (→  118)

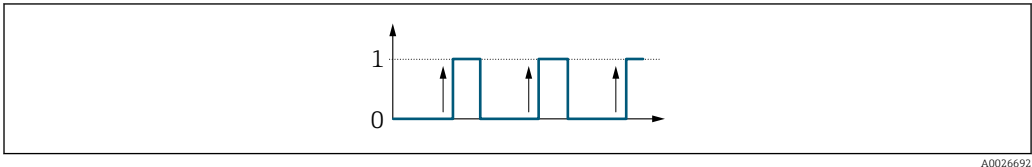
Failure mode 	
Navigation	  Expert → Output → Double pulse out → Failure mode (0985)
Description	Use this function to select the failure mode of the double pulse output in the event of a device alarm.
Selection	■ Actual value ■ No pulses
Factory setting	No pulses
Additional information	<i>Description</i> The dictates of safety render it advisable to ensure that the double pulse output shows a predefined behavior in the event of a device alarm. <i>Options</i> ■ Actual value In the event of a device alarm, the double pulse output continues on the basis of the current flow measurement. The fault is ignored. ■ No pulses In the case of the double pulse output, if a device alarm occurs one pulse output is stopped and the other pulse output runs at the maximum pulse frequency. NOTICE! A device alarm indicates a serious fault with the measuring device. The measurement quality may possibly be influenced and may no longer be guaranteed. The Actual value option is only recommended if it is ensured that all possible alarm conditions do not influence the measurement quality.
Pulse output 	
Navigation	  Expert → Output → Double pulse out → Pulse output (0987)
Description	Displays the pulse frequency of the double pulse output which is currently output.
User interface	Positive floating-point number
Additional information	 For a detailed description and example: Pulse output parameter (→  55)
Invert output signal 	
Navigation	  Expert → Output → Double pulse out → Invert outp.sig. (0993)
Description	Use this function to select whether to invert the output signal.
Selection	■ No ■ Yes

Factory setting No

Additional information *Selection*
No option (passive - negative)



Yes option (passive - positive)



3.6 "Communication" submenu

Navigation  Expert → Communication

► Communication		
► Modbus configuration	→	 154
► Modbus information	→	 157
► Modbus data map	→	 158
► Web server	→	 170
► WLAN settings	→	 159

3.6.1 "Modbus configuration" submenu

Navigation  Expert → Communication → Modbus config.

► Modbus configuration		
Byte order (7113)	→	 155
Failure mode (7116)	→	 156
Fieldbus writing access (7156)	→	 156

**Byte order****Navigation**
 Expert → Communication → Modbus config. → Byte order (7113)
Description

Use this function to select the sequence in which the bytes are transmitted. The transmission sequence must be coordinated with the Modbus master.

Selection

- 0-1-2-3
- 3-2-1-0
- 1-0-3-2
- 2-3-0-1

Factory setting

1-0-3-2

Additional information*Description*

The byte sequence is not standardized by the Modbus protocol. However, if the host system and the measuring device do not use the same byte sequence, correct data exchange is not possible.

Changing the byte sequence in the host system often requires a extensive knowledge and significant programming efforts. Endress+Hauser introduced the **Byte order** parameter (→  155) for this reason.

This makes it possible to use the standard settings of the host system and change the byte sequence on the measuring device by trial and error. If correct data exchange cannot be achieved by changing the byte sequence, the settings for the byte sequence of the host system must be adapted accordingly.

Byte transmission sequence

Byte addressing, i.e. the transmission sequence of the bytes, is not specified in the Modbus specification. For this reason, it is important to coordinate or match the addressing method between the master and slave during commissioning. This can be configured in the measuring device using the **Byte order** parameter (→  155).

The bytes are transmitted depending on the selection in the **Byte order** parameter (→  155):

FLOAT				
	Sequence			
Options	1.	2.	3.	4.
1 - 0 - 3 - 2 *	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)
0 - 1 - 2 - 3	Byte 0 (MMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)
2 - 3 - 0 - 1	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 0 (MMMMMMMM)	Byte 1 (MMMMMMMM)
3 - 2 - 1 - 0	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
* = factory setting, S = sign, E = exponent, M = mantissa				

INTEGER		
	Sequence	
Options	1.	2.

1 - 0 - 3 - 2 * 3 - 2 - 1 - 0	Byte 1 (MSB)	Byte 0 (LSB)
0 - 1 - 2 - 3 2 - 3 - 0 - 1	Byte 0 (LSB)	Byte 1 (MSB)
* = factory setting, MSB = most significant byte, LSB = least significant byte		

STRING					
Presentation taking the example of a device parameter with a data length of 18 bytes.					
	Sequence				
Options	1.	2.	...	17.	18.
1 - 0 - 3 - 2 * 3 - 2 - 1 - 0	Byte 17 (MSB)	Byte 16	...	Byte 1	Byte 0 (LSB)
0 - 1 - 2 - 3 2 - 3 - 0 - 1	Byte 16	Byte 17 (MSB)	...	Byte 0 (LSB)	Byte 1
* = factory setting, MSB = most significant byte, LSB = least significant byte					

Failure mode

Navigation	  Expert → Communication → Modbus config. → Failure mode (7116)
Description	Use this function to select the measured value output in the event of a diagnostic message via Modbus communication.
Selection	■ NaN value ■ Last valid value
Factory setting	NaN value
Additional information	<i>Options</i> ■ NaN value The device outputs the NaN value ⁴⁾. ■ Last valid value The device outputs the last valid measured value before the fault occurred.  This effect of this parameter depends on the option selected in the Assign diagnostic behavior parameter.

Fieldbus writing access

Navigation	  Expert → Communication → Modbus config. → Fieldb.writ.acc. (7156)
Description	Use this function to restrict access to the measuring device via fieldbus (Modbus protocol).
Selection	■ Read + write ■ Read only

4) Not a Number

Factory setting	Read + write
Additional information	<i>Description</i> If read and/or write protection is enabled, the parameter can only be controlled and reset via local operation. Access is no longer possible via operating tools.  This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed. <i>Selection</i> ■ Read + write The parameters are read and write parameters. ■ Read only The parameters are read only parameters.

3.6.2 "Modbus information" submenu

Navigation

 Expert → Communication → Modbus info

► Modbus information

Device ID (7153)

→  157

Device revision (7154)

→  157

Device ID

Navigation	  Expert → Communication → Modbus info → Device ID (7153)
Description	Displays the device ID for identifying the measuring device.
User interface	4-digit hexadecimal number

Device revision

Navigation	  Expert → Communication → Modbus info → Device revision (7154)
Description	Displays the device revision.
User interface	4-digit hexadecimal number

3.6.3 "Modbus data map" submenu

Navigation  Expert → Communication → Modbus data map

► Modbus data map

Scan list register 0 to 15 (7114)

→  158

Scan list register 0 to 15



Navigation  Expert → Communication → Modbus data map → Scan list reg.0 to 15 (7114)

Description Use this function to enter the scan list register. By entering the register address (1-based), up to 16 device parameters can be grouped by assigning them to the scan list registers 0 to 15. The data of the device parameters assigned here are read out via the register addresses 5051 to 5081.

User entry 1 to 65 535

Factory setting

Additional information To read out the current values of the device parameters defined in the scan list register, the Modbus client accesses the data area of the Modbus data map.

Client access to data area	Via register addresses 5051-5081
----------------------------	----------------------------------

Data area					
Device parameter value	Modbus register	I/O data	Delivery status of registers 5001-5016	Data type*	Access**
Value of scan list register 0	5051	Volume flow	2009	Integer/Real	Read/write
Value of scan list register 1	5053	Mass flow	2007	Integer/Real	Read/write
Value of scan list register 2	5055	Corrected volume flow	2011	Integer/Real	Read/write
Value of scan list register 3	5057	Flow velocity	2019	Integer/Real	Read/write
Value of scan list register 4	5059	Temperature	2015	Integer/Real	Read/write
Value of scan list register 5	5061	Totalizer 1	2610	Integer/Real	Read/write
Value of scan list register 6	5063	Totalizer 2	2810	Integer/Real	Read/write
Value of scan list register 7	5065	Totalizer 3	3010	Integer/Real	Read/write
* Data type depends on the device parameters entered in the scan list. ** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.					

Data area					
Device parameter value	Modbus register	I/O data	Delivery status of registers 5001-5016	Data type*	Access**
Value of scan list register 8	5067	Actual diagnostics (no.)	6859	Integer/Real	Read/write
Value of scan list register 9	5069	Tot1 Control	2608	Integer/Real	Read/write
Value of scan list register 10	5071	Tot2 Control	2808	Integer/Real	Read/write
Value of scan list register 11	5073	Tot3 Control	3008	Integer/Real	Read/write
Value of scan list register 12	5075	-	-	Integer/Real	Read/write
Value of scan list register 13	5077	-	-	Integer/Real	Read/write
Value of scan list register 14	5079	-	-	Integer/Real	Read/write
Value of scan list register 15	5081	-	-	Integer/Real	Read/write
* Data type depends on the device parameters entered in the scan list. ** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.					

3.6.4 "WLAN settings" wizard

Navigation  Expert → Communication → WLAN settings

► WLAN settings

WLAN (2702)

→  160

WLAN mode (2717)

→  160

SSID name (2714)

→  161

Network security (2705)

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User name (2715)

→  162

WLAN password (2716)

→  162

WLAN IP address (2711)

→  162

WLAN MAC address (2703)

→  163

WLAN subnet mask (2709)	→ 163
WLAN MAC address (2703)	→ 163
WLAN passphrase (2706)	→ 163
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Assign SSID name (2708)	→ 164
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Received signal strength (2721)	→ 165
WLAN IP address (2711)	→ 162
Gateway IP address (2719)	→ 165
IP address domain name server (2720)	→ 166

WLAN

Navigation	Expert → Communication → WLAN settings → WLAN (2702)
Description	Use this function to enable and disable the WLAN connection.
Selection	Disable Enable
Factory setting	Enable

WLAN mode

Navigation	Expert → Communication → WLAN settings → WLAN mode (2717)
Description	Use this function to select the WLAN mode.
Selection	WLAN access point WLAN Client

Factory setting WLAN access point

SSID name 

Navigation  Expert → Communication → WLAN settings → SSID name (2714)

Prerequisite The client is activated.

Description Use this function to enter the user-defined SSID name (max. 32 characters) of the WLAN network.

User entry –

Factory setting –

Network security 

Navigation  Expert → Communication → WLAN settings → Network security (2705)

Description Use this function to select the type of security for the WLAN interface.

Selection

- Unsecured
- WPA2-PSK
- EAP-PEAP with MSCHAPv2 *
- EAP-PEAP MSCHAPv2 no server authentic. *
- EAP-TLS *

Factory setting WPA2-PSK

Additional information *Selection*

- Unsecured
Access the WLAN connection without identification.
- WPA2-PSK
Access the WLAN connection with a network key.
- EAP-PEAP with MSCHAPv2
Access the WLAN connection with a password-based authentication protocol.
- EAP-PEAP MSCHAPv2 no server authentic.
Access the WLAN connection with a password-based protocol without server authentication.
- EAP-TLS
Access the WLAN connection with a certificate-based, two-way authentication of the client and network.

* Visibility depends on order options or device settings

Security identification

Navigation	  Expert → Communication → WLAN settings → Sec. identific. (2718)
Description	Use this function to select the security settings (download via the menu: Data Management > Security > Download WLAN).
User interface	■ Trusted issuer certificate ■ Device certificate ■ Device private key

User name

Navigation	  Expert → Communication → WLAN settings → User name (2715)
Description	Use this function to enter the username of the WLAN network.
User entry	–
Factory setting	–

WLAN password

Navigation	  Expert → Communication → WLAN settings → WLAN password (2716)
Description	Use this function to enter the WLAN password for the WLAN network.
User entry	–
Factory setting	–

WLAN IP address

Navigation	  Expert → Communication → WLAN settings → WLAN IP address (2711)
Description	Use this function to enter the IP address of the measuring device's WLAN connection.
User entry	4 octet: 0 to 255 (in the particular octet)
Factory setting	192.168.1.212

WLAN MAC address

Navigation	  Expert → Communication → WLAN settings → WLAN MAC address (2703)
Description	Displays the MAC ⁵⁾ address of the measuring device.
User interface	Unique 12-digit character string comprising letters and numbers
Factory setting	Each measuring device is given an individual address.
Additional information	<i>Example</i> For the display format 00:07:05:10:01:5F

WLAN subnet mask



Navigation	  Expert → Communication → WLAN settings → WLAN subnet mask (2709)
Description	Use this function to enter the subnet mask.
User entry	4 octet: 0 to 255 (in the particular octet)
Factory setting	255.255.255.0

WLAN passphrase



Navigation	  Expert → Communication → WLAN settings → WLAN passphrase (2706)
Prerequisite	The WPA2-PSK option is selected in the Security type parameter (→  161).
Description	Use this function to enter the network key.
User entry	8 to 32-digit character string comprising numbers, letters and special characters (without spaces)
Factory setting	Serial number of the measuring device (e.g. L100A802000)

5) Media Access Control

Assign SSID name

Navigation  Expert → Communication → WLAN settings → Assign SSID name (2708)

Description Use this function to select which name is used for the SSID ⁶⁾.

Selection

- Device tag
- User-defined

Factory setting User-defined

Additional information *Selection*

- Device tag
The device tag name is used as the SSID.
- User-defined
A user-defined name is used as the SSID.

SSID name

Navigation  Expert → Communication → WLAN settings → SSID name (2707)

Prerequisite

- The **User-defined** option is selected in the **Assign SSID name** parameter (→  164).
- The **WLAN access point** option is selected in the **WLAN mode** parameter (→  160).

Description Use this function to enter a user-defined SSID name.

User entry Max. 32-digit character string comprising numbers, letters and special characters

Factory setting EH_device designation_last 7 digits of the serial number (e.g. EH_Promag_300_A802000)

2.4 GHz WLAN channel

Navigation  Expert → Communication → WLAN settings → WLAN channel (2704)

Description Use this function to enter the 2.4 GHz WLAN channel.

User entry 1 to 11

Factory setting 6

Additional information *Description*

-  It is only necessary to enter a 2.4 GHz WLAN channel if multiple WLAN devices are in use.
- If just one measuring device is in use, it is recommended to keep the factory setting.

6) Service Set Identifier



Select antenna

Navigation	Expert → Communication → WLAN settings → Select antenna (2713)
Description	Use this function to select whether the external or internal antenna is used for reception.
Selection	■ External antenna ■ Internal antenna
Factory setting	Internal antenna

Connection state

Navigation	Expert → Communication → WLAN settings → Connection state (2722)
Description	The connection status is displayed.
User interface	■ Connected ■ Not connected
Factory setting	Not connected

Received signal strength

Navigation	Expert → Communication → WLAN settings → Rec.sig.strength (2721)
Description	Displays the signal strength received.
User interface	■ Low ■ Medium ■ High
Factory setting	High

Gateway IP address

Navigation	Expert → Communication → WLAN settings → Gateway IP addr. (2719)
Description	Use this function to enter the IP address of the gateway.
User interface	Character string comprising numbers, letters and special characters
Factory setting	192.168.1.212

IP address domain name server

Navigation	 Expert → Communication → WLAN settings → IP address DNS (2720)
Description	Use this function to enter the IP address of the domain name server.
User interface	Character string comprising numbers, letters and special characters
Factory setting	192.168.1.212

3.6.5 "APL port" submenu

Navigation

 Setup → Communication → APL port

▶ APL port

IP address

→  166

Subnet mask

→  166

Default gateway

→  167

MAC address

→  167

DHCP client

→  167

IP address

Navigation	 Setup → Communication → APL port → IP address (7263)
Description	Enter the IP address of the measuring device.
User entry	Character string comprising numbers, letters and special characters (15)
Factory setting	0.0.0.0

Subnet mask

Navigation	 Setup → Communication → APL port → Subnet mask (7265)
Description	Enter subnet mask of the measuring device.

User entry Character string comprising numbers, letters and special characters (15)

Factory setting 255.255.255.0

Default gateway



Navigation Setup → Communication → APL port → Default gateway (7264)

Description Enter IP address for the default gateway of the measuring device.

User entry Character string comprising numbers, letters and special characters (15)

Factory setting 0.0.0.0

MAC address

Navigation Setup → Communication → APL port → MAC Address (7262)

Description Shows the MAC address of the measuring device.

User interface Character string comprising numbers, letters and special characters

Factory setting

DHCP client



Navigation Setup → Communication → APL port → DHCP client

Description Switch the DHCP client functionality on and of.

Selection

- Off
- On

Factory setting On

3.6.6 "Service interface" submenu

Navigation  Setup → Communication → ServiceInterface

► Service interface		
IP address	→ 	168
Subnet mask	→ 	168
Default gateway	→ 	169
MAC address	→ 	169
DHCP client	→ 	169
Duplex speed negotiation	→ 	169
Interface speed	→ 	170
Duplex status	→ 	170

IP address

Navigation	 Expert → Communication → Web server → IP address (7209)
Description	Display or enter the IP address of the web server integrated in the measuring instrument.
User entry	4 octet: 0 to 255 (in the particular octet)
Factory setting	192.168.1.212

Subnet mask

Navigation	 Expert → Communication → Web server → Subnet mask (7211)
Description	Display or enter the subnet mask.
User entry	4 octet: 0 to 255 (in the particular octet)
Factory setting	255.255.255.0

Default gateway



Navigation	  Expert → Communication → Web server → Default gateway (7210)
Description	Display or enter the Default gateway (→  169).
User entry	4 octet: 0 to 255 (in the particular octet)
Factory setting	0.0.0.0

MAC address

Navigation	  Expert → Communication → Web server → MAC Address (7214)
Description	Displays the MAC ⁷⁾ address of the measuring instrument.
User interface	Unique 12-digit character string comprising letters and numbers
Factory setting	Each measuring instrument is given an individual address.
Additional information	<i>Example</i> For the display format 00:07:05:10:01:5F

DHCP client



Navigation	  Expert → Communication → Web server → DHCP client (7212)
Description	Switch the DHCP client functionality on and of.
Selection	■ Off ■ On
Factory setting	Off

Duplex speed negotiation



Navigation	  Setup → Communication → ServiceInterface → DuplexSpeedNegot
Description	Select the duplex mode and transmission speed for the connected devices.

7) Media Access Control

Selection	■ Auto ■ 10 Mbit/s full duplex ■ 10 Mbit/s half duplex ■ 100 Mbit/s full duplex ■ 100 Mbit/s half duplex
-----------	--

Factory setting	Auto
-----------------	------

Interface speed

Navigation	 Setup → Communication → ServiceInterface → Interface speed
User interface	Positive integer
Factory setting	100 Mbit/s

Duplex status

Navigation	 Setup → Communication → ServiceInterface → Duplex status
User interface	■ Full duplex ■ Half duplex ■ Unknown
Factory setting	Unknown

3.6.7 "Web server" submenu

Navigation  Expert → Communication → Web server

	
Web server language	→  171
IP address	→  171
Subnet mask	→  171
Default gateway	→  172
Web server functionality	→  172
Login page	→  172

Web server language

Navigation  Expert → Communication → Web server → Webserv.language (7221)

Description Use this function to select the language configured for the web server.

Selection

- English
- Deutsch
- Français
- Español
- Italiano
- Nederlands
- Portuguesa
- Polski
- русский язык (Russian)
- Svenska
- Türkçe
- 中文 (Chinese)
- 日本語 (Japanese)
- 한국어 (Korean)
- العربية (Arabic) *
- Bahasa Indonesia
- ภาษาไทย (Thai) *
- tiếng Việt (Vietnamese)
- čeština (Czech)

Factory setting English

IP address

Navigation  Expert → Communication → Web server → IP address (7209)

Description Display or enter the IP address of the web server integrated in the measuring instrument.

User entry 4 octet: 0 to 255 (in the particular octet)

Factory setting 192.168.1.212

Subnet mask

Navigation  Expert → Communication → Web server → Subnet mask (7211)

Description Display or enter the subnet mask.

User entry 4 octet: 0 to 255 (in the particular octet)

Factory setting 255.255.255.0

* Visibility depends on order options or device settings

Default gateway

- Navigation

Expert → Communication → Web server → Default gateway (7210)
- Description

Display or enter the Default gateway (→ 169).
- User entry

4 octet: 0 to 255 (in the particular octet)
- Factory setting

0.0.0.0

Web server functionality

- Navigation

Expert → Communication → Web server → Webserver funct. (7222)
- Description

Use this function to switch the Web server on and off.
- Selection

Off

HTML Off

On
- Factory setting

On
- Additional information

Description

Once disabled, the Web server functionality can only be enabled again via the local display, the FieldCare operating tool or the DeviceCare operating tool.

Selection

Option	Description
Off	The Web server is completely disabled. Port 80 is locked.
HTML Off	The HTML version of the Web server is not available.
On	The complete Web server functionality is available. JavaScript is used. The password is transferred in an encrypted state. Any change to the password is also transferred in an encrypted state.

Login page

- Navigation

Expert → Communication → Web server → Login page (7273)
- Description

Use this function to select the format of the login page.
- Selection

Without header

With header

Factory setting With header

3.7 "Application" submenu

Navigation   Expert → Application

▶ Application

Reset all totalizers (2806)

→  173

▶ Totalizer 1 to n

→  50

▶ Custody transfer

→  173

Reset all totalizers

Navigation   Expert → Application → Reset all tot. (2806)

Description Use this function to reset all totalizers to the value **0** and restart the totaling process. This deletes all the previously aggregated flow values.

Selection

- Cancel
- Reset + totalize

Factory setting Cancel

Additional information Selection

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

3.7.1 "Custody transfer" submenu

 For detailed information on the parameter descriptions for custody transfer measurement, see the Special Documentation for the device

Navigation   Expert → Application → Custody transfer

▶ Custody transfer

Custody transfer mode	→ ⓘ 174
Checksum	→ ⓘ 174
Custody transfer locking	→ ⓘ 174
Custody transfer counter	→ ⓘ 175
Timestamp last custody transfer	→ ⓘ 175

Custody transfer mode

Navigation	🔍📄 Expert → Application → Custody transfer → Cust.trans. mode (14405)
Description	Shows if the device is in custody transfer mode.
User interface	■ Off ■ On
Factory setting	Off

Checksum

Navigation	🔍📄 Expert → Application → Custody transfer → Checksum (14407)
Description	Shows the firmware's checksum.
User interface	Positive integer
Factory setting	–

Custody transfer locking



Navigation	🔍📄 Expert → Application → Custody transfer → Cust.transf.lock (14406)
Description	Indicate whether all parameters or only parameters relevant to custody transfer should be write-protected.
Selection	■ Defined parameters ■ All parameters
Factory setting	Defined parameters

Custody transfer counter

Navigation	 Expert → Application → Custody transfer → Cust.trans.count (14402)
Description	Displays the number of times custody transfer mode has been enabled so far.
User interface	0 to 65 535
Additional information	<i>Custody transfer</i>  For information about the as-delivered state of the measuring instruments for custody transfer, see the Special Documentation for the device

Timestamp last custody transfer

Navigation	 Expert → Application → Custody transfer → Time cust.trans. (14403)
Description	Displays the time when the custody transfer mode was last enabled.
User interface	Days (d), hours (h), minutes (m) and seconds (s)
Additional information	<i>Example</i> For the display format: 24d12h13m00s

3.8 "Diagnostics" submenu

Navigation  Expert → Diagnostics

► Diagnostics	
Actual diagnostics (0691)	→  176
Previous diagnostics (0690)	→  177
Operating time from restart (0653)	→  177
Operating time (0652)	→  177
► Diagnostic list	→  178
► Event logbook	→  180
► Custody transfer logbook	→  181
► Device information	→  181

► Main electronic module + I/O module 1	→ ⓘ 185
► Sensor electronic module (ISEM)	→ ⓘ 186
► I/O module 2	→ ⓘ 187
► I/O module 3	→ ⓘ 188
► I/O module 4	→ ⓘ 189
► Display module	→ ⓘ 190
► Data logging	→ ⓘ 191
► Min/max values	→ ⓘ 199
► Heartbeat Technology	→ ⓘ 203
► Simulation	→ ⓘ 214

Actual diagnostics

Navigation	ⓘ ⓘ Expert → Diagnostics → Actual diagnos. (0691)
Prerequisite	A diagnostic event has occurred.
Description	Displays the current diagnostic message. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.
User interface	Symbol for diagnostic behavior, diagnostic code and short message.
Additional information	Display ⓘ Additional pending diagnostic messages can be viewed in the Diagnostic list submenu (→ ⓘ 178). ⓘ Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the ⓘ key. Example For the display format: ⊗F271 Main electronics failure

Previous diagnostics

Navigation	  Expert → Diagnostics → Prev.diagnostics (0690)
Prerequisite	Two diagnostic events have already occurred.
Description	Displays the diagnostic message that occurred before the current message.
User interface	Symbol for diagnostic behavior, diagnostic code and short message.
Additional information	<i>Display</i>  Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the  key. <i>Example</i> For the display format:  F271 Main electronics failure

Operating time from restart

Navigation	  Expert → Diagnostics → Time fr. restart (0653)
Description	Use this function to display the time the device has been in operation since the last device restart.
User interface	Days (d), hours (h), minutes (m) and seconds (s)

Operating time

Navigation	  Expert → Diagnostics → Operating time (0652)
Description	Displays the length of time the device has been in operation.
User interface	Days (d), hours (h), minutes (m) and seconds (s)
Additional information	<i>Indication</i> Maximum number of days: 9 999 (corresponds to approx. 27 years and 5 months)

3.8.1 "Diagnostic list" submenu

Navigation  Expert → Diagnostics → Diagnostic list

► Diagnostic list		
Diagnostics 1 (0692)	→ 	178
Diagnostics 2 (0693)	→ 	178
Diagnostics 3 (0694)	→ 	179
Diagnostics 4 (0695)	→ 	179
Diagnostics 5 (0696)	→ 	180

Diagnostics 1

Navigation	 Expert → Diagnostics → Diagnostic list → Diagnostics 1 (0692)
Description	Displays the current diagnostics message with the highest priority.
User interface	Symbol for diagnostic behavior, diagnostic code and short message.
Additional information	Display  Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the  key. Examples For the display format: ■  F271 Main electronics failure ■  F276 I/O module failure

Diagnostics 2

Navigation	 Expert → Diagnostics → Diagnostic list → Diagnostics 2 (0693)
Description	Displays the current diagnostics message with the second-highest priority.
User interface	Symbol for diagnostic behavior, diagnostic code and short message.

Additional information*Display*

Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the key.

Examples

For the display format:

- F271 Main electronics failure
- F276 I/O module failure

Diagnostics 3

Navigation

Expert → Diagnostics → Diagnostic list → Diagnostics 3 (0694)

Description

Displays the current diagnostics message with the third-highest priority.

User interface

Symbol for diagnostic behavior, diagnostic code and short message.

Additional information*Display*

Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the key.

Examples

For the display format:

- F271 Main electronics failure
- F276 I/O module failure

Diagnostics 4

Navigation

Expert → Diagnostics → Diagnostic list → Diagnostics 4 (0695)

Description

Displays the current diagnostics message with the fourth-highest priority.

User interface

Symbol for diagnostic behavior, diagnostic code and short message.

Additional information*Display*

Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the key.

Examples

For the display format:

- F271 Main electronics failure
- F276 I/O module failure

Diagnostics 5

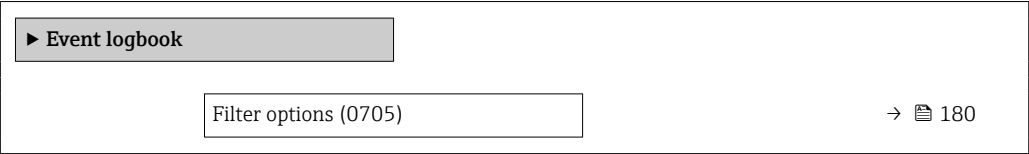
Navigation	Expert → Diagnostics → Diagnostic list → Diagnostics 5 (0696)
Description	Displays the current diagnostics message with the fifth-highest priority.
User interface	Symbol for diagnostic behavior, diagnostic code and short message.
Additional information	Display Via the local display: the time stamp and corrective measures referring to the cause of the diagnostic message can be accessed via the key. Examples For the display format: ■ F271 Main electronics failure ■ F276 I/O module failure

3.8.2 "Event logbook" submenu

Viewing event messages

Event messages are displayed in chronological order. The event history includes both diagnostic events and information events. The symbol in front of the timestamp indicates whether the event has started or ended.

Navigation Expert → Diagnostics → Event logbook



Filter options

Navigation	Expert → Diagnostics → Event logbook → Filter options (0705)
Description	Use this function to select the category whose event messages are displayed in the event list of the local display.
Selection	■ All ■ Failure (F) ■ Function check (C) ■ Out of specification (S) ■ Maintenance required (M) ■ Information (I)
Factory setting	All

Additional information

Description

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

3.8.3 "Custody transfer logbook" submenu

-  For detailed information on the parameter descriptions for custody transfer measurement, see the Special Documentation for the device

Navigation  Expert → Diagnostics → Cust.transf.log.

► Custody transfer logbook

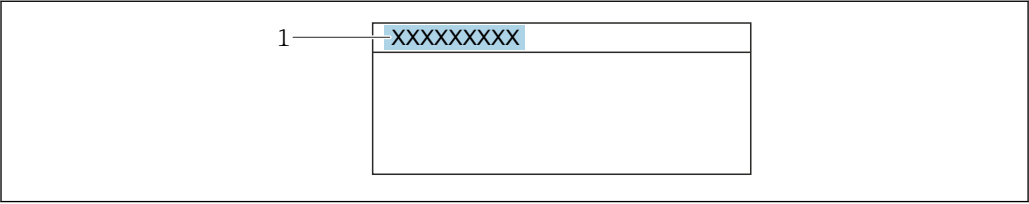
3.8.4 "Device information" submenu

Navigation  Expert → Diagnostics → Device info

► Device information

Device tag (0011)	→  182
Serial number (0009)	→  182
Firmware version (0010)	→  182
Device name (0020)	→  183
Order code (0008)	→  183
Extended order code 1 (0023)	→  183
Extended order code 2 (0021)	→  184
Extended order code 3 (0022)	→  184
ENP version (0012)	→  184

Device tag

Navigation	  Expert → Diagnostics → Device info → Device tag (0011)
Description	Displays a unique name for the measuring point so it can be identified quickly within the plant. It is displayed in the header.
User interface	Character string comprising numbers, letters and special characters
Factory setting	Promag
Additional information	<i>User interface</i>  1 — Position of the header text on the display The number of characters displayed depends on the characters used.

Serial number

Navigation	  Expert → Diagnostics → Device info → Serial number (0009)
Description	Displays the serial number of the measuring device.  The number can be found on the nameplate of the sensor and transmitter.
User interface	Max. 11-digit character string comprising letters and numbers.
Additional information	<i>Description</i>  Uses of the serial number ▪ To identify the measuring device quickly, e.g. when contacting Endress+Hauser. ▪ To obtain specific information on the measuring device using the Device Viewer: www.endress.com/deviceviewer

Firmware version

Navigation	  Expert → Diagnostics → Device info → Firmware version (0010)
Description	Displays the device firmware version installed.
User interface	Character string in the format xx.yy.zz

Additional information*Display*

The Firmware version is also located:

- On the title page of the Operating instructions
- On the transmitter nameplate

Device name**Navigation**

Expert → Diagnostics → Device info → Device name (0020)

Description

Displays the name of the transmitter. It can also be found on the nameplate of the transmitter.

User interface

Promag 300/500

Order code**Navigation**

Expert → Diagnostics → Device info → Order code (0008)

Description

Displays the device order code

User interface

Character string composed of letters, numbers and certain punctuation marks (e.g. /).

Additional information*Description*

The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.

The order code is generated from the extended order code through a process of reversible transformation. The extended order code indicates the attributes for all the device features in the product structure. The device features are not directly readable from the order code.

**Uses of the order code**

- To order an identical spare device.
- To identify the device quickly and easily, e.g. when contacting Endress+Hauser.

Extended order code 1**Navigation**

Expert → Diagnostics → Device info → Ext. order cd. 1 (0023)

Description

Displays the first part of the extended order code

On account of length restrictions, the extended order code is split into a maximum of 3 parameters.

User interface

Character string

Additional information	<i>Description</i> The extended order code indicates the version of all the features of the product structure for the measuring device and thus uniquely identifies the measuring device.  The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.
-------------------------------	--

Extended order code 2



Navigation	  Expert → Diagnostics → Device info → Ext. order cd. 2 (0021)
Description	Displays the second part of the extended order code.
User interface	Character string
Additional information	For additional information, see Extended order code 1 parameter (→  183)

Extended order code 3



Navigation	  Expert → Diagnostics → Device info → Ext. order cd. 3 (0022)
Description	Displays the third part of the extended order code.
User interface	Character string
Additional information	For additional information, see Extended order code 1 parameter (→  183)

ENP version

Navigation	  Expert → Diagnostics → Device info → ENP version (0012)
Description	Displays the version of the electronic nameplate.
User interface	Character string
Factory setting	2.02.00
Additional information	<i>Description</i> This electronic nameplate stores a data record for device identification that includes more data than the nameplates attached to the outside of the device.

3.8.5 "Main electronic module + I/O module 1" submenu

Navigation  Expert → Diagnostics 1 → Main elec.+I/O1

► Main electronic module + I/O module 1

Firmware version (0072)

→  185

Build no. software (0079)

→  185

Bootloader revision (0073)

→  185

Firmware version

Navigation  Expert → Diagnostics → Main elec.+I/O1 → Firmware version (0072)

Description Use this function to display the software revision of the module.

User interface Positive integer

Build no. software

Navigation  Expert → Diagnostics → Main elec.+I/O1 → Build no. softw. (0079)

Description Use this function to display the software build number of the module.

User interface Positive integer

Bootloader revision

Navigation  Expert → Diagnostics → Main elec.+I/O1 → Bootloader rev. (0073)

Description Use this function to display the bootloader revision of the software.

User interface Positive integer

3.8.6 "Sensor electronic module (ISEM)" submenu

Navigation  Expert → Diagnostics → Sens. electronic

► Sensor electronic module (ISEM)

Firmware version (0072)

→  186

Build no. software (0079)

→  186

Bootloader revision (0073)

→  186

Firmware version

Navigation	 Expert → Diagnostics → Sens. electronic → Firmware version (0072)
Description	Use this function to display the software revision of the module.
User interface	Positive integer

Build no. software

Navigation	 Expert → Diagnostics → Sens. electronic → Build no. softw. (0079)
Description	Use this function to display the software build number of the module.
User interface	Positive integer

Bootloader revision

Navigation	 Expert → Diagnostics → Sens. electronic → Bootloader rev. (0073)
Description	Use this function to display the bootloader revision of the software.
User interface	Positive integer

3.8.7 "I/O module 2" submenu

Navigation  Expert → Diagnostics → I/O module 2

► I/O module 2		
I/O module 2 terminal numbers (3902-2)	→ 	187
Firmware version (0072)	→ 	187
Build no. software (0079)	→ 	187
Bootloader revision (0073)	→ 	188

I/O module 2 terminal numbers

Navigation	 Expert → Diagnostics → I/O module 2 → I/O 2 terminals (3902-2)
Description	Displays the terminal numbers used by the I/O module.
User interface	■ Not used ■ 26-27 (I/O 1) ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)

Firmware version

Navigation	 Expert → Diagnostics → I/O module 2 → Firmware version (0072)
Description	Use this function to display the software revision of the module.
User interface	Positive integer

Build no. software

Navigation	 Expert → Diagnostics → I/O module 2 → Build no. softw. (0079)
Description	Use this function to display the software build number of the module.
User interface	Positive integer

Bootloader revision

Navigation	 Expert → Diagnostics → I/O module 2 → Bootloader rev. (0073)
Description	Use this function to display the bootloader revision of the software.
User interface	Positive integer

3.8.8 "I/O module 3" submenu

Navigation

 Expert → Diagnostics → I/O module 3

► I/O module 3

I/O module 3 terminal numbers
(3902–3)

Firmware version (0072)

Build no. software (0079)

Bootloader revision (0073)

→  188

→  188

→  189

→  189

I/O module 3 terminal numbers

Navigation	 Expert → Diagnostics → I/O module 3 → I/O 3 terminals (3902–3)
Description	Displays the terminal numbers used by the I/O module.
User interface	■ Not used ■ 26-27 (I/O 1) ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)

Firmware version

Navigation	 Expert → Diagnostics → I/O module 3 → Firmware version (0072)
Description	Use this function to display the software revision of the module.
User interface	Positive integer

Build no. software

Navigation	 Expert → Diagnostics → I/O module 3 → Build no. softw. (0079)
Description	Use this function to display the software build number of the module.
User interface	Positive integer

Bootloader revision

Navigation	 Expert → Diagnostics → I/O module 3 → Bootloader rev. (0073)
Description	Use this function to display the bootloader revision of the software.
User interface	Positive integer

3.8.9 "I/O module 4" submenu

Navigation  Expert → Diagnostics → I/O module 4

► I/O module 4		
I/O module 4 terminal numbers (3902-4)	→ 	189
Firmware version (0072)	→ 	190
Build no. software (0079)	→ 	190
Bootloader revision (0073)	→ 	190

I/O module 4 terminal numbers

Navigation	 Expert → Diagnostics → I/O module 4 → I/O 4 terminals (3902-4)
Description	Displays the terminal numbers used by the I/O module.
User interface	■ Not used ■ 26-27 (I/O 1) ■ 24-25 (I/O 2) ■ 22-23 (I/O 3)

Firmware version

Navigation	  Expert → Diagnostics → I/O module 4 → Firmware version (0072)
Description	Use this function to display the software revision of the module.
User interface	Positive integer

Build no. software

Navigation	  Expert → Diagnostics → I/O module 4 → Build no. softw. (0079)
Description	Use this function to display the software build number of the module.
User interface	Positive integer

Bootloader revision

Navigation	  Expert → Diagnostics → I/O module 4 → Bootloader rev. (0073)
Description	Use this function to display the bootloader revision of the software.
User interface	Positive integer

3.8.10 "Display module" submenu

Navigation   Expert → Diagnostics → Display module

► Display module

Firmware version (0072)

→  191

Build no. software (0079)

→  191

Bootloader revision (0073)

→  191

Firmware version	
Navigation	  Expert → Diagnostics → Display module → Firmware version (0072)
Description	Use this function to display the software revision of the module.
User interface	Positive integer
Build no. software	
Navigation	  Expert → Diagnostics → Display module → Build no. softw. (0079)
Description	Use this function to display the software build number of the module.
User interface	Positive integer
Bootloader revision	
Navigation	  Expert → Diagnostics → Display module → Bootloader rev. (0073)
Description	Use this function to display the bootloader revision of the software.
User interface	Positive integer

3.8.11 "Data logging" submenu

Navigation   Expert → Diagnostics → Data logging

► Data logging

Assign channel 1 (0851)

Assign channel 2 (0852)

Assign channel 3 (0853)

Assign channel 4 (0854)

Logging interval (0856)

Clear logging data (0855)

→  192

→  193

→  193

→  194

→  194

→  195

Data logging (0860)	→  195
Logging delay (0859)	→  195
Data logging control (0857)	→  196
Data logging status (0858)	→  196
Entire logging duration (0861)	→  197
► Display channel 1	→  197
► Display channel 2	→  198
► Display channel 3	→  198
► Display channel 4	→  199

Assign channel 1



Navigation

  Expert → Diagnostics → Data logging → Assign chan. 1 (0851)

Prerequisite

The **Extended HistoROM** application package is available.

 The software options currently enabled are displayed in the **Software option overview** parameter (→  45).

Description

Use this function to assign a process variable to the data logging channel.

Selection

- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity^{*}
- Corrected conductivity^{*}
- Temperature^{*}
- Electronics temperature
- Current output 1^{*}
- Current output 2^{*}
- Current output 3^{*}
- Current output 4^{*}
- Noise^{*}
- Coil current shot time^{*}
- Reference electrode potential against PE^{*}
- HBSI^{*}
- Build-up index^{*}

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

- Test point 1
- Test point 2
- Test point 3

Factory setting Off

Additional information *Description*

A total of 1000 measured values can be logged. This means:

- 1000 data points if 1 logging channel is used
- 500 data points if 2 logging channels are used
- 333 data points if 3 logging channels are used
- 250 data points if 4 logging channels are used

Once the maximum number of data points is reached, the oldest data points in the data log are cyclically overwritten in such a way that the last 1000, 500, 333 or 250 measured values are always in the log (ring memory principle).



The log contents are cleared if the option selected is changed.

Assign channel 2



Navigation Expert → Diagnostics → Data logging → Assign chan. 2 (0852)

Prerequisite The **Extended HistoROM** application package is available.



The software options currently enabled are displayed in the **Software option overview** parameter (→ 45).

Description Use this function to assign a process variable to the logging channel.

Selection For the picklist, see **Assign channel 1** parameter (→ 192)

Factory setting Off

Assign channel 3



Navigation Expert → Diagnostics → Data logging → Assign chan. 3 (0853)

Prerequisite The **Extended HistoROM** application package is available.



The software options currently enabled are displayed in the **Software option overview** parameter (→ 45).

Description Use this function to assign a process variable to the logging channel.

Selection For the picklist, see **Assign channel 1** parameter (→ 192)

Factory setting Off

Assign channel 4 	
Navigation	 Expert → Diagnostics → Data logging → Assign chan. 4 (0854)
Prerequisite	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter (→  45).
Description	Use this function to assign a process variable to the logging channel.
Selection	For the picklist, see Assign channel 1 parameter (→  192)
Factory setting	Off
Logging interval 	

Navigation	 Expert → Diagnostics → Data logging → Logging interval (0856)
Prerequisite	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter (→  45).
Description	Use this function to enter the logging interval $T_{\log}$ for data logging.
User entry	0.1 to 3 600.0 s
Factory setting	1.0 s
Additional information	<i>Description</i> This defines the interval between the individual data points in the data log, and thus the maximum loggable process time $T_{\log}$: ■ If 1 logging channel is used: $T_{\log} = 1000 \times t_{\log}$ ■ If 2 logging channels are used: $T_{\log} = 500 \times t_{\log}$ ■ If 3 logging channels are used: $T_{\log} = 333 \times t_{\log}$ ■ If 4 logging channels are used: $T_{\log} = 250 \times t_{\log}$ Once this time elapses, the oldest data points in the data log are cyclically overwritten such that a time of $T_{\log}$ always remains in the memory (ring memory principle).  The log contents are cleared if the length of the logging interval is changed. <i>Example</i> If 1 logging channel is used: ■ $T_{\log} = 1000 \times 1 \text{ s} = 1\,000 \text{ s} \approx 15 \text{ min}$ ■ $T_{\log} = 1000 \times 10 \text{ s} = 10\,000 \text{ s} \approx 3 \text{ h}$ ■ $T_{\log} = 1000 \times 80 \text{ s} = 80\,000 \text{ s} \approx 1 \text{ d}$ ■ $T_{\log} = 1000 \times 3\,600 \text{ s} = 3\,600\,000 \text{ s} \approx 41 \text{ d}$

Clear logging data 	
Navigation	  Expert → Diagnostics → Data logging → Clear logging (0855)
Prerequisite	The Extended HistoROM application package is available.  The software options currently enabled are displayed in the Software option overview parameter (→  45).
Description	Use this function to clear the entire logging data.
Selection	■ Cancel ■ Clear data
Factory setting	Cancel
Additional information	<i>Selection</i> ■ Cancel The data is not cleared. All the data is retained. ■ Clear data The logging data is cleared. The logging process starts from the beginning.
Data logging 	
Navigation	  Expert → Diagnostics → Data logging → Data logging (0860)
Description	Use this function to select the data logging method.
Selection	■ Overwriting ■ Not overwriting
Factory setting	Overwriting
Additional information	<i>Selection</i> ■ Overwriting The device memory applies the FIFO principle. ■ Not overwriting Data logging is canceled if the measured value memory is full (single shot).
Logging delay 	
Navigation	  Expert → Diagnostics → Data logging → Logging delay (0859)
Prerequisite	In the Data logging parameter (→  195), the Not overwriting option is selected.
Description	Use this function to enter the time delay for measured value logging.
User entry	0 to 999 h

Factory setting 0 h

Additional information *Description*

Once data logging has been started with the **Data logging control** parameter (→  196), the device does not save any data for the duration of the delay time entered.

Data logging control

Navigation   Expert → Diagnostics → Data logging → Data log.control (0857)

Prerequisite In the **Data logging** parameter (→  195), the **Not overwriting** option is selected.

Description Use this function to start and stop measured value logging.

Selection

- None
- Delete + start
- Stop

Factory setting None

Additional information *Selection*

- None
Initial measured value logging status.
- Delete + start
All the measured values recorded for all the channels are deleted and measured value logging starts again.
- Stop
Measured value logging is stopped.

Data logging status

Navigation   Expert → Diagnostics → Data logging → Data log. status (0858)

Prerequisite In the **Data logging** parameter (→  195), the **Not overwriting** option is selected.

Description Displays the measured value logging status.

User interface

- Done
- Delay active
- Active
- Stopped

Factory setting Done

Additional information	Selection
	■ Done Measured value logging has been performed and completed successfully.
	■ Delay active Measured value logging has been started but the logging interval has not yet elapsed.
	■ Active The logging interval has elapsed and measured value logging is active.
	■ Stopped Measured value logging is stopped.

Entire logging duration

Navigation	Expert → Diagnostics → Data logging → Logging duration (0861)
Prerequisite	In the Data logging parameter (→ 195), the Not overwriting option is selected.
Description	Displays the total logging duration.
User interface	Positive floating-point number
Factory setting	0 s

"Display channel 1" submenu

Navigation Expert → Diagnostics → Data logging → Displ.channel 1

► Display channel 1

Display channel 1 → 197

Display channel 1

Navigation	Expert → Diagnostics → Data logging → Displ.channel 1
Prerequisite	The Extended HistoROM application package is available. The software options currently enabled are displayed in the Software option overview parameter (→ 45). One of the following options is selected in the Assign channel 1 parameter (→ 192): ■ Conductivity* ■ Corrected conductivity* ■ Temperature*

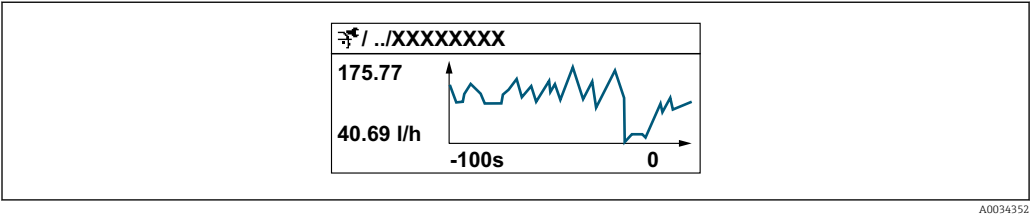
* Visibility depends on order options or device settings

Description

Displays the measured value trend for the logging channel in the form of a chart.

Additional information

Description



6 Chart of a measured value trend

- 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.

"Display channel 2" submenu

Navigation Expert → Diagnostics → Data logging → Displ.channel 2

► Display channel 2

Display channel 2 → 198

Display channel 2

Navigation Expert → Diagnostics → Data logging → Displ.channel 2

Prerequisite A process variable is specified in the **Assign channel 2** parameter.

Description See the **Display channel 1** parameter → 197

"Display channel 3" submenu

Navigation Expert → Diagnostics → Data logging → Displ.channel 3

► Display channel 3

Display channel 3 → 199

Display channel 3

Navigation	 Expert → Diagnostics → Data logging → Displ.channel 3
Prerequisite	A process variable is specified in the Assign channel 3 parameter.
Description	See the Display channel 1 parameter →  197

"Display channel 4" submenu

Navigation  Expert → Diagnostics → Data logging → Displ.channel 4

► Display channel 4

Display channel 4 →  199

Display channel 4

Navigation	 Expert → Diagnostics → Data logging → Displ.channel 4
Prerequisite	A process variable is specified in the Assign channel 4 parameter.
Description	See the Display channel 1 parameter →  197

3.8.12 "Min/max values" submenu

Navigation   Expert → Diagnostics → Min/max val.

► Min/max values

► Electronics temperature →  200

► Main electronics temperature →  201

► Sensor electronics temperature (ISEM) →  202

Reset min/max values

Navigation	  Expert → Diagnostics → Min/max val. → Reset min/max (6541)
Description	Use this function to select measured variables whose minimum, maximum and average measured values are to be reset.
Selection	■ Cancel ■ Terminal voltage ■ IO module temperature
Factory setting	Cancel

"Main electronics temperature" submenu

Navigation   Expert → Diagnostics → Min/max val. → Main elect.temp.

► Electronics temperature

Minimum value (6547)

→  200

Maximum value (6545)

→  200

Minimum value

Navigation	  Expert → Diagnostics → Min/max val. → Electronics temp → Minimum value (6547)
Description	Displays the lowest previously measured temperature value of the main electronics module.
User interface	Signed floating-point number
Additional information	<i>Dependency</i>  The unit is taken from the Temperature unit parameter (→  60)

Maximum value

Navigation	  Expert → Diagnostics → Min/max val. → Electronics temp → Maximum value (6545)
Description	Displays the highest previously measured temperature value of the main electronics module.

User interface Signed floating-point number

Additional information *Dependency*
 The unit is taken from the **Temperature unit** parameter (→  60)

"Main electronics temperature" submenu

Navigation   Expert → Diagnostics → Min/max val. → Main elect.temp.

► Main electronics temperature

Minimum electronics temperature
(0688)

→  201

Maximum electronics temperature
(0665)

→  201

Minimum electronics temperature

Navigation   Expert → Diagnostics → Min/max val. → Main elect.temp. → Min.electr.temp. (0688)

Description Shows the lowest previously measured temperature for the main electronic module in the transmitter.

User interface Signed floating-point number

Additional information *Dependency*
 The unit is taken from the **Temperature unit** parameter (→  60)

Maximum electronics temperature

Navigation   Expert → Diagnostics → Min/max val. → Main elect.temp. → Max.electr.temp. (0665)

Description Shows the highest previously measured temperature for the main electronic module in the transmitter.

User interface Signed floating-point number

Additional information

Dependency

 The unit is taken from the **Temperature unit** parameter (→  60)

"Sensor electronics temperature (ISEM)" submenu

Navigation  Expert → Diagnostics → Min/max val. → Sensor elec.temp

▶ Sensor electronics temperature (ISEM)

Minimum value (6547)

→  202

Maximum value (6545)

→  202

Minimum value

Navigation

 Expert → Diagnostics → Min/max val. → Sensor elec.temp → Minimum value (6547)

Description

Displays the lowest previously measured temperature value of the main electronics module.

User interface

Signed floating-point number

Additional information

Dependency

 The unit is taken from the **Temperature unit** parameter (→  60)

Maximum value

Navigation

 Expert → Diagnostics → Min/max val. → Sensor elec.temp → Maximum value (6545)

Description

Displays the highest previously measured temperature value of the main electronics module.

User interface

Signed floating-point number

Additional information

Dependency

 The unit is taken from the **Temperature unit** parameter (→  60)

3.8.13 "Heartbeat Technology" submenu

 For detailed information on the parameter descriptions for the **Heartbeat Verification+Monitoring**: Special Documentation for the device

Navigation   Expert → Diagnostics → Heartbeat Techn.

▶ Heartbeat Technology		
▶ Heartbeat base settings	→ 	203
▶ Performing verification	→ 	204
▶ Verification results	→ 	208
▶ Monitoring results	→ 	212

"Heartbeat base settings" submenu

Navigation   Expert → Diagnostics → Heartbeat Techn. → Base settings

▶ Heartbeat base settings		
Plant operator (2754)	→ 	203
Location (2755)	→ 	203
Partially filled pipe (6465)	→ 	204

Plant operator

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Base settings → Plant operator (2754)
Description	Use this function to enter the plant operator.
User entry	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)

Location

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Base settings → Location (2755)
Description	Use this function to enter the location.
User entry	Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)

Partially filled pipe

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Base settings → Part.filled pipe (6465)
Description	Indicate, if the measuring tube is partially filled during the verification process in order to avoid evaluating the EPD electrode cable.
Selection	No Yes
Factory setting	No

"Performing verification" wizard

Navigation  Expert → Diagnostics → Heartbeat Techn. → Perform.verific.

► Performing verification

Year (2846)

Month (2845)

Day (2842)

Hour (2843)

AM/PM (2813)

Minute (2844)

Start verification (12127)

Progress (2808)

Status (12153)

Verification result (12149)

→  204

→  205

→  205

→  206

→  206

→  206

→  207

→  207

→  207

→  208

Year

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Year (2846)
Prerequisite	 Can be edited if Heartbeat Verification is not active.

Description	Use this function to enter the year of recalibration.
User entry	9 to 99
Factory setting	10

Month



Navigation	Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Month (2845)
Prerequisite	Can be edited if Heartbeat Verification is not active.
Description	Use this function to select the month of recalibration.
Selection	■ January ■ February ■ March ■ April ■ May ■ June ■ July ■ August ■ September ■ October ■ November ■ December
Factory setting	January

Day



Navigation	Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Day (2842)
Prerequisite	Can be edited if Heartbeat Verification is not active.
Description	Use this function to enter the day of the month of recalibration.
User entry	1 to 31 d
Factory setting	1 d

Hour



Navigation  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Hour (2843)

Prerequisite  Can be edited if Heartbeat Verification is not active.

Description Use this function to enter the hour of recalibration.

User entry 0 to 23 h

Factory setting 12 h

AM/PM



Navigation  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → AM/PM (2813)

Prerequisite  Can be edited if Heartbeat Verification is not active.

The **dd.mm.yy hh:mm am/pm** option or the **mm/dd/yy hh:mm am/pm** option is selected in the **Date/time format** parameter (2812) (→  64).

Description Use this function to select the time entry in the morning (**AM** option) or afternoon (**PM** option) in the case of 12-hour notation.

Selection

- AM
- PM

Factory setting AM

Minute



Navigation  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Minute (2844)

Prerequisite  Can be edited if Heartbeat Verification is not active.

Description Use this function to enter the minutes of recalibration.

User entry 0 to 59 min

Factory setting 0 min

Start verification 	
Navigation	  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Start verificat. (12127)
Description	Start the verification. To carry out a complete verification, select the selection parameters individually. Once the external measured values have been recorded, verification is started using the Start option.
Selection	■ Cancel ■ Output 1 low value * ■ Output 1 high value * ■ Output 2 low value * ■ Output 2 high value * ■ Output 3 low value * ■ Output 3 high value * ■ Frequency output 1 * ■ Pulse output 1 * ■ Frequency output 2 * ■ Pulse output 2 * ■ Double pulse output * ■ Start
Factory setting	Cancel
Progress	
Navigation	  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Progress (2808)
Description	The progress of the process is indicated.
User interface	0 to 100 %
Status	
Navigation	  Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Status (12153)
Description	Displays the current status of the verification.
User interface	■ Done ■ Busy ■ Failed ■ Not done

* Visibility depends on order options or device settings

Verification result

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Perform.verific. → Verific. result (12149)
Description	Displays the overall result of the verification.  Detailed description of the classification of the results:
User interface	■ Not supported ■ Passed ■ Not done ■ Failed
Factory setting	Not done

"Verification results" submenu

Navigation  Expert → Diagnostics → Heartbeat Techn. → Verific. results

► Verification results		
Date/time (manually entered) (12142)	→	 208
Verification ID (12141)	→	 209
Operating time (12126)	→	 209
Verification result (12149)	→	 209
Sensor (12152)	→	 210
Sensor electronic module (ISEM) (12151)	→	 210
I/O module (12145)	→	 211
System status (12109)	→	 211

Date/time (manually entered)

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Verific. results → Date/time (12142)
Prerequisite	The verification has been performed.

Description	Date and time.
User interface	dd.mmmm.yyyy; hh:mm
Factory setting	1 January 2010; 12:00

Verification ID

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Verific. results → Verification ID (12141)
Prerequisite	The verification has been performed.
Description	Displays consecutive numbering of the verification results in the measuring device.
User interface	0 to 65 535
Factory setting	0

Operating time

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Verific. results → Operating time (12126)
Prerequisite	The verification has been performed.
Description	Indicates how long the device has been in operation up to the verification.
User interface	Days (d), hours (h), minutes (m), seconds (s)
Factory setting	–

Verification result

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Verific. results → Verific. result (12149)
Description	Displays the overall result of the verification.  Detailed description of the classification of the results:
User interface	■ Not supported ■ Passed ■ Not done ■ Failed
Factory setting	Not done

Sensor

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Verific. results → Sensor (12152)
Prerequisite	The Failed option was shown in the Overall result parameter (→  208).
Description	Displays the result for the sensor.  Detailed description of the classification of the results:
User interface	■ Not supported ■ Passed ■ Not done ■ Failed
Factory setting	Not done

HBSI

Navigation	 Expert → Diagnostics → Heartbeat → Verific. results → HBSI (12167)
Prerequisite	The Failed option is shown in the Overall result parameter (→  208).
Description	Displays the relative change in the sensor with all the sensor components.  Detailed description of the classification of the results:
User interface	■ Failed ■ Passed ■ Not done
Factory setting	Not done

Sensor electronic module (ISEM)

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Verific. results → Sens. electronic (12151)
Prerequisite	The Failed option was shown in the Overall result parameter (→  208).
Description	Displays the result for the sensor electronics module (ISEM).  Detailed description of the classification of the results:
User interface	■ Not supported ■ Passed ■ Not done ■ Failed

Factory setting Not done

I/O module

Navigation   Expert → Diagnostics → Heartbeat Techn. → Verific. results → I/O module (12145)

Prerequisite The **Failed** option was shown in the **Overall result** parameter (→  208).

Description Displays the result for I/O module monitoring of the I/O module.

- For current output: Accuracy of the current
- For pulse output: Accuracy of pulses
- For frequency output: Accuracy of frequency
- Current input: Accuracy of the current
- Double pulse output: Accuracy of the pulses
- Relay output: Number of switching cycles

 **Heartbeat Verification** does not check the digital inputs and outputs and does not issue a result for this.

 Detailed description of the classification of the results:

User interface

- Not supported
- Passed
- Not done
- Not plugged
- Failed

Factory setting Not done

System status

Navigation   Expert → Diagnostics → Heartbeat Techn. → Verific. results → System status (12109)

Prerequisite The **Failed** option was shown in the **Overall result** parameter (→  208).

Description Displays the system condition. Tests the measuring device for active errors.

 Detailed description of the classification of the results:

User interface

- Not supported
- Passed
- Not done
- Failed

Factory setting Not done

"Monitoring results" submenu

Navigation   Expert → Diagnostics → Heartbeat Techn. → Monitor. results

► Monitoring results		
Noise (12158)	→	 212
Coil current shot time (12150)	→	 212
Reference electrode potential against PE (12155)	→	 212
Build-up index (12111)	→	 213
HBSI (12116)	→	 213

Noise

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Monitor. results → Noise (12158)
Description	Indicates the degree to which the differential signal from both measuring electrodes is dispersed.
User interface	0 to $3.0 \cdot 10^{+38} \mu V$

Coil current shot time

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Monitor. results → CoilCurrShotTime (12150)
Description	Indicates the rise time of the coil current for the buildup of the magnetic field.
User interface	2 to 500 ms

Reference electrode potential against PE

Navigation	  Expert → Diagnostics → Heartbeat Techn. → Monitor. results → Ref Electr. Pot. (12155)
Description	Displays the voltage of the reference electrode in relation to the potential of the measuring tube.
User interface	-30 to +30 V

Build-up index

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Monitor. results → Build-up index (12111)
Description	Shows current build-up index value.
User interface	0.0 to 100.0 %
Factory setting	0.0 %
Additional information	The formation of build-up is output as a percentage in the Build-up index value (→  78) parameter. The higher the percentage, the thicker the build-up. Build-up index value (→  78) = 0% ■ No build-up present ■ Measuring tube as-delivered state (initial value) ■ Measuring tube was cleaned thoroughly after formation of build-up Build-up index value (→  78) = 100% ■ Value for the maximum measurable build-up thickness ■ The thickness of the build-up at 100% varies depending on the process ■ A value of 100% should not be equated with a blocked measuring tube The percentage indicated in the Build-up index value (→  78) parameter does not provide direct information about the absolute thickness or the composition of the build-up. Therefore, to make optimum use of the build-up detection function, it is necessary to first compare the formation of build-up in the process, as known from experience, with the associated Build-up index value (→  78). The aim is to determine the Build-up index value (→  78) at the time the cleaning is usually performed. On the basis of the Build-up index value (→  78) during cleaning, it is possible to make a valid assessment of the condition inside the measuring tube and to plan the cleaning using the build-up limit and build-up detection hysteresis parameters. In addition, conclusions about possible effects on neighboring processes can be drawn from the Build-up index value (→  78).

HBSI

Navigation	 Expert → Diagnostics → Heartbeat Techn. → Monitor. results → HBSI (12116)
Description	Displays the relative change of the entire sensor, with all its electrical, mechanical and electromechanical components incorporated in the sensor housing (including the measuring tube, electrodynamic pick-ups, excitation system, cables etc.), in % of the reference value.
User interface	-100.0 to 100.0 %

3.8.14 "Simulation" submenu

Navigation  Expert → Diagnostics → Simulation

► Simulation

"Process value simulation" submenu

Navigation  Expert → Diagnostics → Simulation → Proc. val. sim.

► Process value simulation

Process variable simulation

→  214

Process value

→  215

Assign simulation process variable

Navigation	 Diagnostics → Simulation → Assign proc.var. (1810)  Expert → Diagnostics → Simulation → Assign proc.var. (1810)
Description	Use this function to select a process variable for the simulation process that is activated. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ Volume flow ■ Mass flow ■ Corrected volume flow ■ Flow velocity[*] ■ Conductivity[*] ■ Corrected conductivity[*] ■ Temperature[*]
Factory setting	Off
Additional information	Description  The simulation value of the process variable selected is defined in the Process variable value parameter (→  215).

* Visibility depends on order options or device settings

Process variable value		
Navigation	Diagnostics → Simulation → Proc. var. value (1811) Expert → Diagnostics → Simulation → Proc. var. value (1811)	
Prerequisite	A process variable is selected in the Assign simulation process variable parameter (→ 214).	
Description	Use this function to enter a simulation value for the selected process variable. Subsequent measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.	
User entry	Depends on the process variable selected	
Factory setting	0	
Additional information	<i>User entry</i> The unit of the displayed measured value is taken from the System units submenu (→ 57).	

"Input simulation" submenu

Navigation Expert → Diagnostics → Simulation → Input simulation

► Input simulation		
Current input 1 to n simulation		→ 215
Value current input 1 to n		→ 216
Status input simulation		→ 216
Input signal level		→ 217

Current input 1 to n simulation		
Navigation	Diagnostics → Simulation → Curr.inp 1 to n sim. (1608–1 to n) Expert → Diagnostics → Simulation → Curr.inp 1 to n sim. (1608–1 to n)	
Description	Option for switching simulation of the current input on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress. The desired simulation value is defined in the Value current input 1 to n parameter.	

Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Selection</i> ■ Off Current simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Current simulation is active.

Value current input 1 to n



Navigation	Diagnostics → Simulation → Value curr.inp 1 to n (1609–1 to n) Expert → Diagnostics → Simulation → Value curr.inp 1 to n (1609–1 to n)
Prerequisite	In the Current input 1 to n simulation parameter, the On option is selected.
Description	Use this function to enter the current value for the simulation. In this way, users can verify the correct configuration of the current input and the correct function of upstream feed-in units.
User entry	0 to 22.5 mA

Status input simulation 1 to n



Navigation	Diagnostics → Simulation → Status inp.sim 1 to n (1355–1 to n) Expert → Diagnostics → Simulation → Status inp.sim 1 to n (1355–1 to n)
Description	Use this function to switch simulation of the status input on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ On
Factory setting	Off

Additional information	Description
	 The desired simulation value is defined in the Input signal level parameter (→  217).
	Selection ■ Off Simulation for the status input is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Simulation for the status input is active.

Input signal level 1 to n 	
Navigation	  Diagnostics → Simulation → Signal level 1 to n (1356–1 to n)   Expert → Diagnostics → Simulation → Signal level 1 to n (1356–1 to n)
Prerequisite	In the Status input simulation parameter (→  216), the On option is selected.
Description	Use this function to select the signal level for the simulation of the status input. In this way, users can verify the correct configuration of the status input and the correct function of upstream feed-in units.
Selection	■ High ■ Low

"Output simulation" submenu

Navigation   [Expert → Diagnostics → Simulation → Output sim.](#)

 Output simulation	
Current output 1 to n simulation	→  218
Current output 1 to n value	→  218
Frequency output 1 to n simulation	→  219
Frequency output 1 to n value	→  219
Pulse output simulation 1 to n	→  220
Pulse value 1 to n	→  220
Switch output simulation 1 to n	→  221

Switch state 1 to n	→ 221
Relay output 1 to n simulation	→ 222
Switch state 1 to n	→ 222
Pulse output simulation	→ 223
Pulse value	→ 223

Current output 1 to n simulation

Navigation	Diagnostics → Simulation → Curr.outp 1 to n sim. (0354–1 to n) Expert → Diagnostics → Simulation → Curr.outp 1 to n sim. (0354–1 to n)
Description	Use this function to switch simulation of the current output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ On
Factory setting	Off
Additional information	Description The desired simulation value is defined in the Value current output 1 to n parameter. Selection ■ Off Current simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Current simulation is active.

Current output value

Navigation	Diagnostics → Simulation → Curr.outp val. (0355) Expert → Diagnostics → Simulation → Curr.outp val. (0355) Expert → Diagnostics → Simulation → Value curr.out 1 to n (0355–1 to n)
Prerequisite	In the Current output 1 to n simulation parameter, the On option is selected.
Description	Use this function to enter a current value for the simulation. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.

User entry	3.59 to 22.5 mA
Additional information	<i>Dependency</i> The input range is dependent on the option selected in the Current span parameter (→  117).

Frequency output 1 to n simulation



Navigation	  Diagnostics → Simulation → Freq.outp 1 to n sim. (0472-1 to n)   Expert → Diagnostics → Simulation → Freq.outp 1 to n sim. (0472-1 to n)
Prerequisite	In the Operating mode parameter (→  122), the Frequency option is selected.
Description	Use this function to switch simulation of the frequency output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Description</i>  The desired simulation value is defined in the Frequency value 1 to n parameter. <i>Selection</i> ■ Off Frequency simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Frequency simulation is active.

Frequency output 1 to n value



Navigation	  Diagnostics → Simulation → Freq.outp 1 to n val. (0473-1 to n)   Expert → Diagnostics → Simulation → Freq.outp 1 to n val. (0473-1 to n)
Prerequisite	In the Frequency simulation 1 to n parameter, the On option is selected.
Description	Use this function to enter a frequency value for the simulation. In this way, users can verify the correct adjustment of the frequency output and the correct function of downstream switching units.
User entry	0.0 to 12 500.0 Hz

Pulse output simulation 1 to n 	
Navigation	  Diagnostics → Simulation → Puls.outp.sim. 1 to n (0458-1 to n)   Expert → Diagnostics → Simulation → Puls.outp.sim. 1 to n (0458-1 to n)
Prerequisite	In the Operating mode parameter (→  122), the Pulse option is selected.
Description	Use this function to switch simulation of the pulse output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ Fixed value ■ Down-counting value
Factory setting	Off
Additional information	<i>Description</i>  The desired simulation value is defined in the Pulse value 1 to n parameter. <i>Selection</i> ■ Off Pulse simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ Fixed value Pulses are continuously output with the pulse width specified in the Pulse width parameter (→  126). ■ Down-counting value The pulses specified in the Pulse value parameter (→  220) are output.
Pulse value 1 to n 	
Navigation	  Diagnostics → Simulation → Pulse value 1 to n (0459-1 to n)   Expert → Diagnostics → Simulation → Pulse value 1 to n (0459-1 to n)
Prerequisite	In the Pulse output simulation 1 to n parameter, the Down-counting value option is selected.
Description	Use this function to enter a pulse value for the simulation. In this way, users can verify the correct adjustment of the pulse output and the correct function of downstream switching units.
User entry	0 to 65 535

Switch output simulation 1 to n


Navigation	Diagnostics → Simulation → Switch sim. 1 to n (0462-1 to n) Expert → Diagnostics → Simulation → Switch sim. 1 to n (0462-1 to n)
Prerequisite	In the Operating mode parameter (→ 122), the Switch option is selected.
Description	Use this function to switch simulation of the switch output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Description</i> The desired simulation value is defined in the Switch state 1 to n parameter.
	<i>Selection</i> ■ Off Switch simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Switch simulation is active.

Switch state 1 to n


Navigation	Diagnostics → Simulation → Switch state 1 to n (0463-1 to n) Expert → Diagnostics → Simulation → Switch state 1 to n (0463-1 to n)
Description	Use this function to select a switch value for the simulation. In this way, users can verify the correct adjustment of the switch output and the correct function of downstream switching units.
Selection	■ Open ■ Closed
Additional information	<i>Selection</i> ■ Open Switch simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ Closed Switch simulation is active.

Relay output 1 to n simulation 	
Navigation	  Diagnostics → Simulation → Relay out. 1 to n sim (0802-1 to n)   Expert → Diagnostics → Simulation → Relay out. 1 to n sim (0802-1 to n)
Description	Use this function to switch simulation of the relay output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ On
Factory setting	Off
Additional information	<i>Description</i>  The desired simulation value is defined in the Switch state 1 to n parameter. <i>Selection</i> ■ Off Relay simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ On Relay simulation is active.
Switch state 1 to n 	
Navigation	  Diagnostics → Simulation → Switch state 1 to n (0803-1 to n)   Expert → Diagnostics → Simulation → Switch state 1 to n (0803-1 to n)
Prerequisite	The On option is selected in the Switch output simulation 1 to n parameter parameter.
Description	Use this function to select a relay value for the simulation. In this way, users can verify the correct adjustment of the relay output and the correct function of downstream switching units.
Selection	■ Open ■ Closed
Additional information	<i>Selection</i> ■ Open Relay simulation is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ Closed Relay simulation is active.

Pulse output simulation	
Navigation	Diagnostics → Simulation → Puls.outp.sim. (0988) Expert → Diagnostics → Simulation → Puls.outp.sim. (0988)
Description	Use this function to switch simulation of the double pulse output on and off. The display alternates between the measured value and a diagnostic message of the "Function check" category (C) while simulation is in progress.
Selection	■ Off ■ Fixed value ■ Down-counting value
Factory setting	Off
Additional information	<i>Description</i> The desired simulation value is defined in the Pulse value parameter (→ 223). <i>Selection</i> ■ Off Simulation of the double pulse output is switched off. The device is in normal measuring mode or another process variable is being simulated. ■ Fixed value Pulses are continuously output with the pulse width specified in the Pulse width parameter (→ 151). ■ Down-counting value The pulses specified in the Pulse value parameter (→ 223) are output.
Pulse value	
Navigation	Diagnostics → Simulation → Pulse value (0989) Expert → Diagnostics → Simulation → Pulse value (0989)
Prerequisite	In the Pulse output simulation parameter (→ 223), the Down-counting value option is selected.
Description	Use this function to enter a pulse value for simulation of the double pulse output. In this way, users can verify the correct adjustment of the double pulse output and the correct function of downstream switching units.
User entry	0 to 65 535

4 Country-specific factory settings

4.1 SI units

 Not valid for USA and Canada.

4.1.1 System units

Process variable	Unit
Volume flow	l/h
Volume	m ³
Conductivity	µS/cm
Temperature	°C
Mass flow	kg/h
Mass	kg
Density	kg/l
Corrected volume flow	NI/h
Corrected volume	Nm ³

4.1.2 Full scale values

 The factory settings apply to the following parameters:

- 20 mA value (full scale value of the current output)
- 100% bar graph value 1

Nominal diameter [mm]	(v ~ 2.5 m/s) [dm ³ /min]
2	0.5
4	2
8	8
15	25
25	75
32	125
40	200
50	300
65	500
80	750
100	1200
125	1850

Nominal diameter [mm]	(v ~ 2.5 m/s) [m ³ /h]
150	150
200	300
250	500
300	750

Nominal diameter [mm]	(v ~ 2.5 m/s) [m³/h]
350	1000
400	1200
450	1500
500	2000
600	2500
700	3500
750	4000
800	4500
900	6000
1000	7000
1200	10000
1400	14000
1600	18000
1800	23000
2000	28500
2200	34000
2400	40000
2600	48000
2800	55500
3000	63500

4.1.3 Output current span

Output	Current range
Current output 1...n	4 to 20 mA NAMUR

4.1.4 Pulse value

Nominal diameter [mm]	(~ 2 pulse/s at v ~ 2.5 m/s) [dm³]
2	0.005
4	0.025
8	0.1
15	0.2
25	0.5
32	1
40	1.5
50	2.5
65	5
80	5
100	10
125	15

Nominal diameter [mm]	(~ 2 pulse/s at v ~ 2.5 m/s) [m³]
150	0.03
200	0.05
250	0.05
300	0.1
350	0.1
400	0.15
450	0.25
500	0.25
600	0.3
700	0.5
750	0.5
800	0.75
900	0.75
1000	1
1200	1.5
1400	2
1600	2.5
1800	3
2000	3.5
2200	4.5
2400	5.5
2600	7
2800	8
3000	9

4.1.5 Switch-on point low flow cut off



The switch-on point depends on the type of medium and the nominal diameter.

Nominal diameter [mm]	(v ~ 0.04 m/s) [dm³/min]
2	0.01
4	0.05
8	0.1
15	0.5
25	1
32	2
40	3
50	5
65	8
80	12
100	20
125	30

Nominal diameter [mm]	($v \sim 0.04 \text{ m/s}$) [m³/h]
150	2.5
200	5
250	7.5
300	10
350	15
400	20
450	25
500	30
600	40
700	50
750	60
800	75
900	100
1000	125
1200	150
1400	225
1600	300
1800	350
2000	450
2200	540
2400	650
2600	775
2800	875
3000	1025

4.2 US units



Only valid for USA and Canada.

4.2.1 System units

Process variable	Unit
Volume flow	gal/min (us)
Volume	gal (us)
Temperature	°F
Mass flow	lb/min
Mass	lb
Density	lb/ft³
Corrected volume flow	Sft³/h
Corrected volume	Sft³

4.2.2 Full scale values



The factory settings apply to the following parameters:

- 20 mA value (full scale value of the current output)
- 100% bar graph value 1

Nominal diameter [in]	(v ~ 2.5 m/s) [gal/min]
1/12	0.1
1/8	0.5
3/8	2
1/2	6
1	18
1 1/2	50
2	75
3	200
4	300
5	450
6	600
8	1200
10	1500
12	2400
14	3600
15	4800
16	4800
18	6000
20	7500
24	10500
28	13500
30	16500
32	19500
36	24000
40	30000
42	33000
48	42000

Nominal diameter [in]	(v ~ 2.5 m/s) [Mgal/d]
54	75
60	95
66	120
72	140
78	175
84	190
90	220
96	265

Nominal diameter [in]	(v ~ 2.5 m/s) [Mgal/d]
102	300
108	340
114	375
120	415

4.2.3 Output current span

Output	Current range
Current output 1...n	4 to 20 mA US

4.2.4 Pulse value

Nominal diameter [in]	(~ 2 pulse/s at v ~ 2.5 m/s) [gal]
1/12	0.001
1/8	0.005
3/8	0.02
1/2	0.1
1	0.2
1 1/2	0.5
2	0.5
3	2
4	2
5	5
6	5
8	10
10	15
12	25
14	30
15	50
16	50
18	50
20	75
24	100
28	125
30	150
32	200
36	225
40	250
42	250
48	400

Nominal diameter [in]	(~ 2 pulse/s at v ~ 2.5 m/s) [Mgal]
54	0.0005
60	0.0005
66	0.0008
72	0.0008
78	0.001
84	0.0011
90	0.0013
96	0.0015
102	0.0017
108	0.0020
114	0.0022
120	0.0024

4.2.5 Switch-on point low flow cut off



The switch-on point depends on the type of medium and the nominal diameter.

Nominal diameter [in]	(v ~ 0.04 m/s) [gal/min]
1/12	0.002
1/8	0.008
3/8	0.025
1/2	0.15
1	0.25
1 1/2	0.75
2	1.25
3	2.5
4	4
5	7
6	12
8	15
10	30
12	45
14	60
15	60
16	60
18	90
20	120
24	180
28	210
30	270
32	300
36	360

Nominal diameter [in]	(v ~ 0.04 m/s) [gal/min]
40	480
42	600
48	600

Nominal diameter [in]	(v ~ 0.04 m/s) [Mgal/d]
54	1.3
60	1.3
66	2.2
72	2.6
78	3.0
84	3.2
90	3.6
96	4.0
102	5.0
108	5.0
114	6.0
120	7.0

5 Explanation of abbreviated units

5.1 SI units

Process variable	Units	Explanation
Density	g/cm ³ , g/m ³	Gram/volume unit
	kg/dm ³ , kg/l, kg/m ³	Kilogram/volume unit
	SD4°C, SD15°C, SD20°C	Specific density: The specific density is the ratio of the density of the fluid to the density of water at a water temperature of 4 °C (39 °F), 15 °C (59 °F), 20 °C (68 °F).
	SG4°C, SG15°C, SG20°C	Specific gravity: The specific gravity is the ratio of the density of the fluid to the density of water at a water temperature of 4 °C (39 °F), 15 °C (59 °F), 20 °C (68 °F).
Conductivity	µS/mm	Microsiemens/length unit
	nS/cm, µS/cm, mS/cm, S/cm	Nano-, Micro-, Milli-, Siemens/length unit
	µS/m, mS/m, S/m, kS/m, MS/m	Micro-, Milli-, Siemens, Kilo-, Megasiemens/length unit
Mass	g, kg, t	Gram, kilogram, metric ton
Mass flow	g/s, g/min, g/h, g/d	Gram/time unit
	kg/s, kg/min, kg/h, kg/d	Kilogram/time unit
	t/s, t/min, t/h, t/d	Metric ton/time unit
Temperature	°C, K	Celsius, Kelvin
Volume	cm ³ , dm ³ , m ³	Cubic centimeter, cubic decimeter, cubic meter
	ml, l, hl, Ml Mega	Milliliter, liter, hectoliter, megaliter
Time	s, m, h, d, y	Second, minute, hour, day, year

5.2 US units

Process variable	Units	Explanation
Density	lb/ft ³ , lb/gal (us)	Pound/cubic foot, pound/gallon
	lb/bbl (us;liq.), lb/bbl (us;beer), lb/bbl (us;oil), lb/bbl (us;tank)	Pound/volume unit
Mass	oz, lb, STon	Ounce, pound, standard ton
Mass flow	oz/s, oz/min, oz/h, oz/d	Ounce/time unit
	lb/s, lb/min, lb/h, lb/d	Pound/time unit
	STon/s, STon/min, STon/h, STon/d	Standard ton/time unit
Corrected volume	Sft ³ , Sgal (us), Sbbl (us;liq.)	Standard cubic foot, standard gallon, standard barrel
Corrected volume flow	Sft ³ /s, Sft ³ /min, Sft ³ /h, Sft ³ /d	Standard cubic foot/time unit
	Sgal/s (us), Sgal/min (us), Sgal/h (us), Sgal/d (us)	Standard gallon/time unit
	Sbbl/s (us;liq.), Sbbl/min (us;liq.), Sbbl/h (us;liq.), Sbbl/d (us;liq.)	Barrel/time unit (normal liquids)
Temperature	°F, °R	Fahrenheit, Rankine
Volume	af	Acre foot
	ft ³	Cubic foot

Process variable	Units	Explanation
	fl oz (us), gal (us), kgal (us), Mgal (us)	Fluid ounce, gallon, kilogallon, million gallon
	bbl (us;liq.), bbl (us;beer), bbl (us;oil), bbl (us;tank)	Barrel (normal liquids), barrel (beer), barrel (petrochemicals), barrel (filling tanks)
Volume flow	af/s, af/min, af/h, af/d	Acre foot/time unit
	ft ³ /s, ft ³ /min, ft ³ /h, ft ³ /d	Cubic foot/time unit
	fl oz/s (us), fl oz/min (us), fl oz/h (us), fl oz/d (us)	Fluid ounce/time unit
	gal/s (us), gal/min (us), gal/h (us), gal/d (us)	Gallon/time unit
	kgal/s (us), kgal/min (us), kgal/h (us), kgal/d (us)	Kilogallon/time unit
	Mgal/s (us), Mgal/min (us), Mgal/h (us), Mgal/d (us)	Million gallon/time unit
	bbl/s (us;liq.), bbl/min (us;liq.), bbl/h (us;liq.), bbl/d (us;liq.)	Barrel/time unit (normal liquids) Normal liquids: 31.5 gal/bbl
	bbl/s (us;beer), bbl/min (us;beer), bbl/h (us;beer), bbl/d (us;beer)	Barrel /time unit (beer) Beer: 31.0 gal/bbl
	bbl/s (us;oil), bbl/min (us;oil), bbl/h (us;oil), bbl/d (us;oil)	Barrel/time unit (petrochemicals) Petrochemicals: 42.0 gal/bbl
	bbl/s (us;tank), bbl/min (us;tank), bbl/h (us;tank), bbl/d (us;tank)	Barrel/time unit (filling tank) Filling tanks: 55.0 gal/bbl
Time	s, m, h, d, y	Second, minute, hour, day, year
	am, pm	Ante meridiem (before midday), post meridiem (after midday)

5.3 Imperial units

Process variable	Units	Explanation
Density	lb/gal (imp), lb/bbl (imp;beer), lb/bbl (imp;oil)	Pound/volume unit
Corrected volume	Sgal (imp)	Standard gallon
Corrected volume flow	Sgal/s (imp), Sgal/min (imp), Sgal/h (imp), Sgal/d (imp)	Standard gallon/time unit
Volume	gal (imp), Mgal (imp)	Gallon, mega gallon
	bbl (imp;beer), bbl (imp;oil)	Barrel (beer), barrel (petrochemicals)
Volume flow	gal/s (imp), gal/min (imp), gal/h (imp), gal/d (imp)	Gallon/time unit
	Mgal/s (imp), Mgal/min (imp), Mgal/h (imp), Mgal/d (imp)	Mega gallon/time unit
	bbl/s (imp;beer), bbl/min (imp;beer), bbl/h (imp;beer), bbl/d (imp;beer)	Barrel /time unit (beer) Beer: 36.0 gal/bbl
	bbl/s (imp;oil), bbl/min (imp;oil), bbl/h (imp;oil), bbl/d (imp;oil)	Barrel/time unit (petrochemicals) Petrochemicals: 34.97 gal/bbl
Time	s, m, h, d, y	Second, minute, hour, day, year
	am, pm	Ante meridiem (before midday), post meridiem (after midday)

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