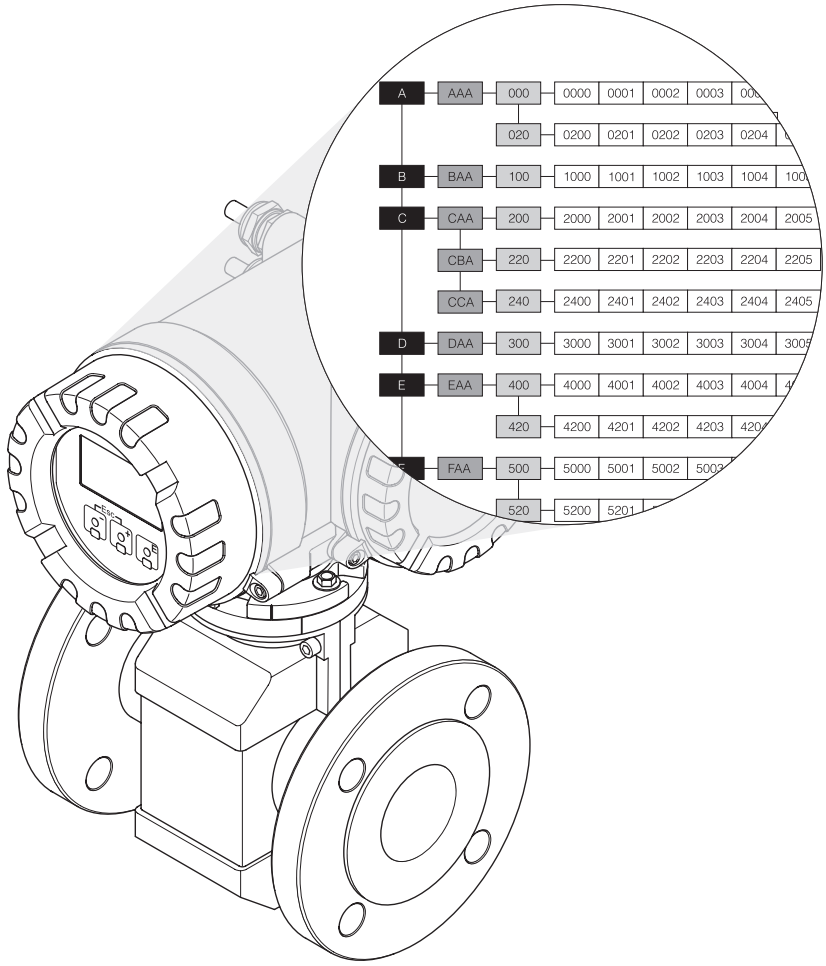
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Description of Device Functions

Proline Promag 53
MODBUS RS485

Electromagnetic Flow Measuring System



BA118D/06/en/10.05
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Valid as of version
V 3.01.XX (Device software)

Endress+Hauser
People for Process Automation

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1 Notes on using this Manual

There are various ways of locating the description of a function of your choice in the manual:

1.1 Using the table of contents to locate a function description

The designations of all the cells in the function matrix are listed in the table of contents. You can use these unambiguous designations (such as USER INTERFACE, INPUTS, OUTPUTS, etc.) to choose whichever functions are applicable to a particular set of conditions. The page references show you exactly where to find the detailed descriptions of the functions in question.
The table of contents is on page 3.

1.2 Using the graphic of the function matrix to locate a function description

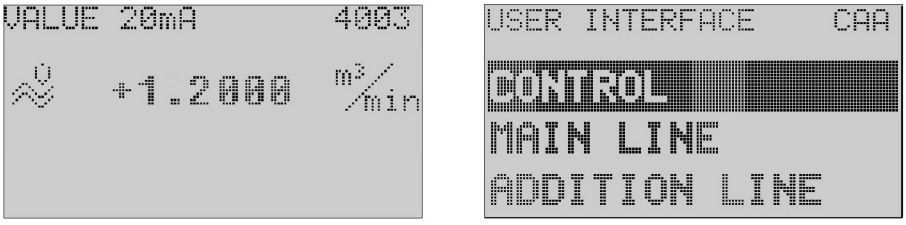
This step-by-step, top-down approach starts with the blocks, the highest level, and factory down through the matrix to the description of the function you need:

1. All blocks available, and their related groups, are illustrated on page 11. Select the block (or the group within the block) which you need for your application and use the page reference to locate the information corresponding to the next level.
2. The page in question contains a graphic showing of the block with all its subordinate groups, function groups and functions. Select the function which you need for your application and use the page reference to locate the detailed function description.

1.3 Using the index of the function matrix to locate a function description

Each “cell” in the function matrix (blocks, groups, function groups, functions) has a unique identifier in the form of a code consisting of one or three letters or a three- or four-digit number. The code identifying a selected “cell” appears at the top right on the local display.

Example:



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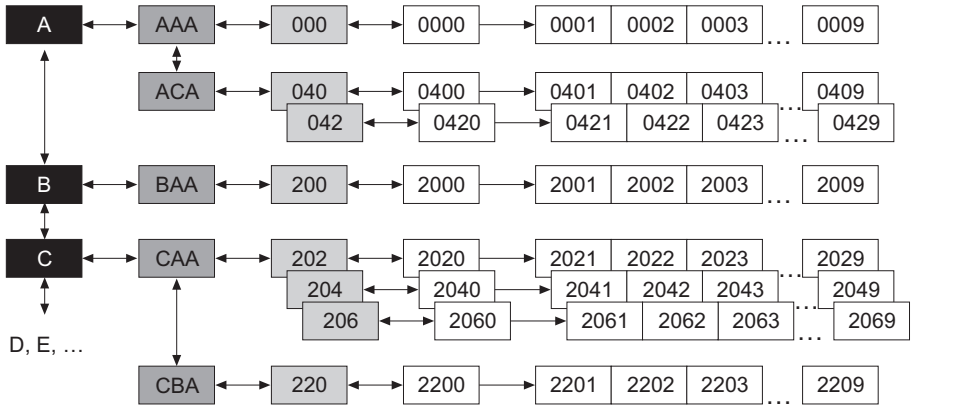
The function matrix index lists the codes for all the available “cells” in alphabetic and consecutive order, complete with the page references for the corresponding functions.
The index to the function matrix is on page 153.

2 Function Matrix

2.1 General layout of the function matrix

The function matrix consists of four levels:

Blocks -> Groups -> Function groups -> Functions



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2.1.1 Blocks (A, B, C, etc.)

The blocks are the highest-level grouping of the operation options for the device.
The blocks include, for example: MEASURED VARIABLES, QUICK SETUP, USER INTERFACE, TOTALIZER, etc.

2.1.2 Groups (AAA, AEA, CAA, etc.)

A block consists of one or more groups. Each group represents a more detailed selection of the operation options in the higher-order block. The groups in the “USER INTERFACE” block, for example, include: CONTROL, MAIN LINE, ADDITIONAL LINE, etc.

2.1.3 Function groups (000, 020, 060, etc.)

A group consists of one or more function groups. Each function group represents a more detailed selection of the operation options in the higher-order group. Function groups available of “CONTROL” group are for example: BASIC CONFIGURATION, UNLOCKING/LOCKING, OPERATION, etc.

2.1.4 Functions (0000, 0001, 0002, etc.)

Each function group consists of one or more functions. The functions are used to operate and parameterize the device. Numerical values can be entered or parameters selected and saved.
The functions in the “BASIC CONFIGURATION” function group include LANGUAGE, DISPLAY DAMPING, CONTRAST LCD, etc. The procedure for changing the language of the user interface, for example, is as follows:

1. Select the block “USER INTERFACE”.
2. Select the group “CONTROL”.
3. Select the function group “BASIC CONFIGURATION”.
4. Select the function “LANGUAGE” (here you can set the language required).

2.1.5 Codes identifying cells

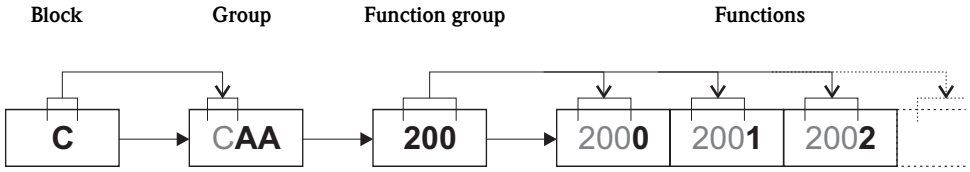
Each cell (block, group, function group and function) in the function matrix has an individual, unique code.

Blocks:
The code is a letter (A, B, C, etc.)

Groups:
The code consists of three letters (AAA, ABA, BAA, etc.).
The first letter matches the block code (i.e. each group in block A has a code starting with an A _ _; the codes of the groups in block B start with a B _ _, etc.). The other two letters are for identifying the group within the respective block.

Function groups:
The code consists of three digits (000, 001, 100, etc.).

Functions:
The code consists of four digits (0000, 0001, 0201, etc.).
The first three digits are the same as the code for the function group.
The last digit in the code is a counter for the functions in the function group, incrementing from 0 to 9 (e.g. function 0005 is the sixth function in group 000).



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2.2 Illustration of the function descriptions

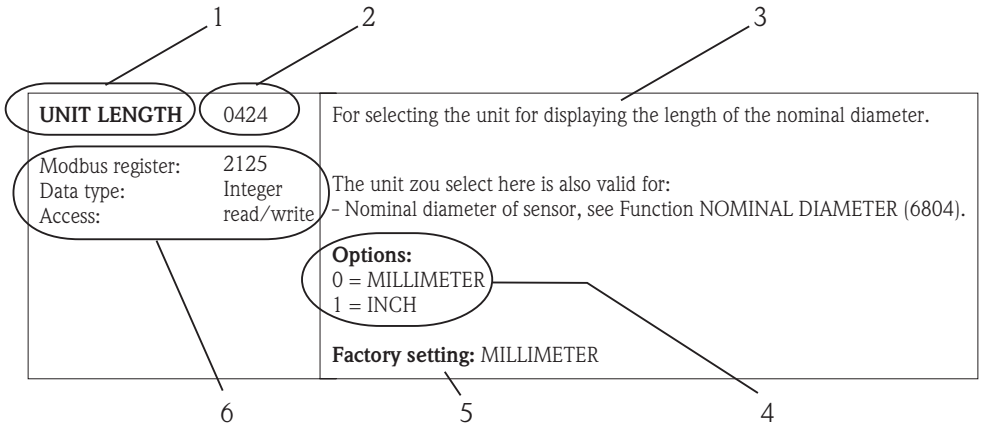

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Fig. 1: Example for the description of a function

1 Name of the function
*2 Number of the function (appears on the local display; is **not** identical to the MODBUS register address)*
3 Description of the function
4 Selection or entry options or display
5 Factory setting (the measuring device is delivered with this setting/selected option)
6 Information on communication via MODBUS RS485
– MODBUS register (information in decimal numerical format)
– Data type: float (length = 4 bytes), integer (length = 2 bytes), string (length = depends on function)
– Possible ways of accessing the function:
read = read access via function code 03, 04 or 23
write = write access via 06, 16 or 23

Note!
If a nonvolatile device parameter is modified via the MODBUS function codes 06, 16 or 23, this change is saved in the EEPROM of the measuring device. The number of writes to the EEPROM is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and measuring device failure. For this reason, avoid constantly writing nonvolatile device parameters via the MODBUS!

2.3 Display lines on the local display

The local display is split into various display lines.

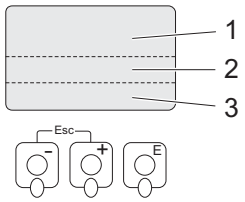

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Fig. 2: Local display

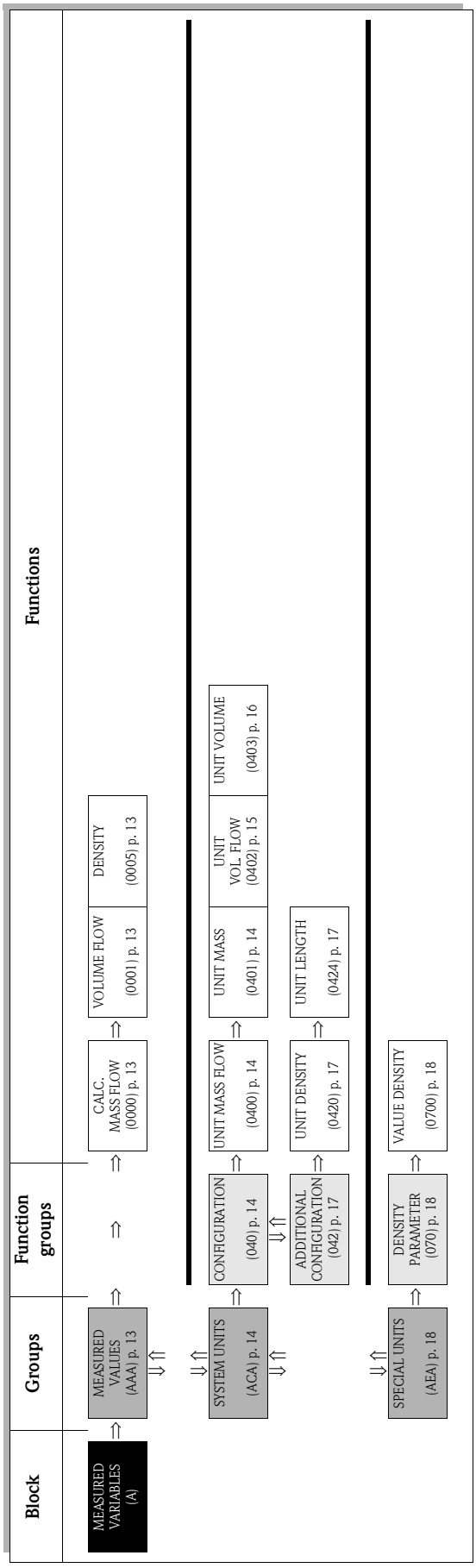
1 Main line
2 Additional line
3 Information line

The values are assigned to the individual lines in the USER INTERFACE block, see page 28.

2.4 Function matrix Promag 53

BLOCKS		GROUPS		FUNCTION GROUPS
MEASURED VARIABLES (see P. 12)	**A**	MEASURED VALUES	AAA	see P. 13
		SYSTEM UNITS	ACA	see P. 14
		SPECIAL UNITS	AEA	see P. 18
QUICK-SETUP (see P. 19)	**B**	Commissioning and application setups		see P. 19
USER INTERFACE (see P. 28)	**C**	CONTROL	CAA	see P. 29
		MAIN LINE	CCA	see P. 33
		ADDITIONAL LINE	CEA	see P. 37
		INFORMATION LINE	CGA	see P. 43
TOTALIZER (see P. 48)	**D**	TOTALIZER 1	DAA	see P. 49
		TOTALIZER 2	DAB	see P. 49
		TOTALIZER 3	DAC	see P. 49
		HANDLING TOTALIZER	DJA	see P. 52
OUTPUTS (see P. 53)	**E**	CURRENT OUTPUT 1	EAA	see P. 54
		PULSE/FREQ. OUTPUT 1	ECA	see P. 65
		RELAY OUTPUT 1	EGA	see P. 89
		RELAY OUTPUT 2	EGB	see P. 89
INPUTS (see P. 99)	**F**	STATUS INPUT	FAA	see P. 100
BASIC FUNCTION (see P. 103)	**G**	MODBUS RS485	GDA	see P. 104
		PROCESSPARAMETER	GIA	see P. 107
		SYSTEM PARAMETER	GLA	see P. 115
		SENSOR DATA	GNA	see P. 117
SPECIAL FUNCTION (see P. 121)	**H**	BATCHING FUNCTION	HCA	see P. 122
SUPERVISION (see P. 140)	**J**	SYSTEM	JAA	see P. 141
		VERSION INFO	JCA	see P. 144

3 Block MEASURED VARIABLES



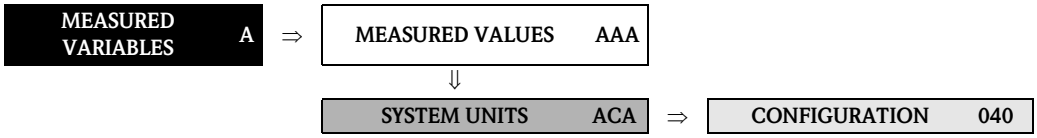
3.1 Group MEASURED VALUES

MEASURED VARIABLES A ⇒ **MEASURED VALUES AAA**

Function description MEASURED VARIABLES → MEASURED VALUES		
✎ Note! ■ The engineering units of all the measured variables shown here can be set in the "SYSTEM UNITS" group. ■ If the fluid in the pipe flows backwards, a negative sign prefixes the flow reading on the display.		
CALCULATED MASS FLOW	**0000**	The calculated mass flow appears on the display. The mass flow is derived from the measured volume flow and the fixed density of the fluid.
MODBUS register: Data type: Access:	2007 Float Read	**User interface:** 5-digit floating-point number, including unit and sign (e.g. 462.87 kg/h; –731.63 lb/min; etc.)
VOLUME FLOW	**0001**	The volume flow currently measured appears on the display.
MODBUS register: Data type: Access:	2009 Float Read	**User interface:** 5-digit floating-point number, including unit and sign (e.g. 5.5445 dm^3/min; 1.4359 m^3/h; –731.63 gal/d; etc.)
DENSITY	**0005**	Display of the fixed density.
MODBUS register: Data type: Access:	2013 Float Read	**User interface:** 5-digit floating-point number, including unit (corresponding to 0.10000...6.0000 kg/dm^3) e.g. 1.2345 kg/dm^3; 993.5 kg/m^3; 1.0015 SG_20 °C; etc.

3.2 Group SYSTEM UNITS

3.2.1 Function group CONFIGURATION

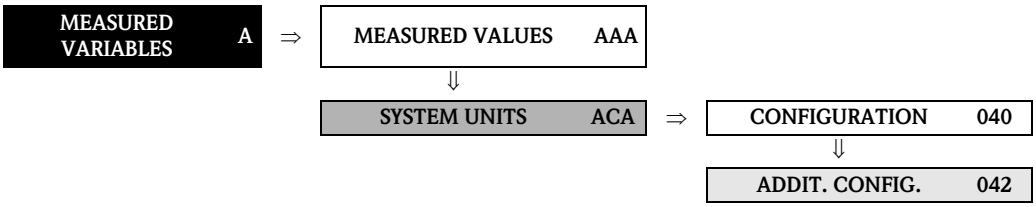


Function description MEASURED VARIABLES → SYSTEM UNITS → CONFIGURATION	
You can select the units for measured variables in this function group.	
UNIT MASS FLOW **0400** MODBUS register: 2101 Data type: Integer Access: read/write	Use this function to select the unit for displaying the calculated mass flow (mass/time). The mass flow is derived from the preset (compensated) specific fluid density and the measured volume flow. The unit you select here is also valid for: ■ Current output ■ Pulse/Frequency output ■ Relay switch points (limit value for mass flow, flow direction) ■ Low flow cut off **Options:** Metric: 0...3 = gram → g/s; g/min; g/h; g/day 4...7 = kilogram → kg/s; kg/min; kg/h; kg/day 8...11 = ton → t/s; t/min; t/h; t/day US: 12...15 = ounce → oz/s; oz/min; oz/h; oz/day 16...19 = pound → lb/s; lb/min; lb/h; lb/day 20...23 = ton → ton/s; ton/min; ton/h; ton/day **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
UNIT MASS **0401** MODBUS register: 2102 Data type: Integer Access: read/write	Use this function to select the unit for displaying the calculated mass. The mass is derived from the preset (compensated) specific fluid density and the measured volume. The unit you select here is also valid for: ■ Pulse value (e.g. kg/p) **Options:** Metric: 0 = g 1 = kg 2 = t US: 3 = oz 4 = lb 5 = ton **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). ✎ Note! The unit of the totalizers is independent of your choice here. The unit for each totalizer is selected separately for the totalizer in question.

Function description MEASURED VARIABLES → SYSTEM UNITS → CONFIGURATION		
UNIT VOLUME FLOW	**0402**	Use this function to select the unit for displaying the volume flow (volume/time). The unit you select here is also valid for: ■ Current output ■ Pulse/Frequency output ■ Relay switch points (limit value for volume flow, flow direction) ■ Low flow cut off **Options:** Metric: 0...3 = cubic centimeter → cm^3/s; cm^3/min; cm^3/h; cm^3/day 4...7 = cubic decimeter → dm^3/s; dm^3/min; dm^3/h; dm^3/day 8...11 = cubic meter → m^3/s; m^3/min; m^3/h; m^3/day 12...15 = milliliter → ml/s; ml/min; ml/h; ml/day 16...19 = liter → l/s; l/min; l/h; l/day 20...23 = hectoliter → hl/s; hl/min; hl/h; hl/day 24...27 = megaliter → Ml/s; Ml/min; Ml/h; Ml/day US: 28...31 = cubic centimeter → cc/s; cc/min; cc/h; cc/day 32...35 = acre foot → af/s; af/min; af/h; af/day 36...39 = cubic foot → ft^3/s; ft^3/min; ft^3/h; ft^3/day 40...43 = fluid ounce → oz f/s; oz f/min; oz f/h; oz f/day 44...47 = gallon → gal/s; gal/min; gal/h; gal/day 88...91 = kilo gallon → Kgal/s; Kgal/min; Kgal/h; Kgal/day 48...51 = million gallon → Mgal/s; Mgal/min; Mgal/h; Mgal/day 52...55 = barrel (normal fluids: 31.5 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 56...59 = barrel (beer: 31.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 60...63 = barrel (petrochemicals: 42.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 64...67 = barrel (filling tanks: 55.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Imperial: 68...71 = gallon → gal/s; gal/min; gal/h; gal/day 72...75 = mega gallon → Mgal/s; Mgal/min; Mgal/h; Mgal/day 76...79 = barrel (beer: 36.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 80...83 = barrel (petrochemicals: 34.97 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
MODBUS register: Data type: Access:	2103 Integer read/write	

Function description MEASURED VARIABLES → SYSTEM UNITS → CONFIGURATION		
UNIT VOLUME	**0403**	Use this function to select the unit for displaying the volume. The unit you select here is also valid for: ■ Pulse weighting (e.g. m^3/p) **Options:** 0...6 = metric → cm^3; dm^3; m^3; ml; l; hl; Ml Mega 7...16 = US → cc; af; ft^3; oz f; gal; Mgal; bbl (normal fluids); bbl (beer); bbl (petrochemicals) → bbl (filling tanks) 22 = Kgal 17...20 = Imperial → gal; Mgal; bbl (beer); bbl (petrochemicals) **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). ✎ Note! ■ The unit of the totalizers is independent of your choice here. The unit for each totalizer is selected separately for the totalizer in question.
MODBUS register: Data type: Access:	2104 Integer read/write	

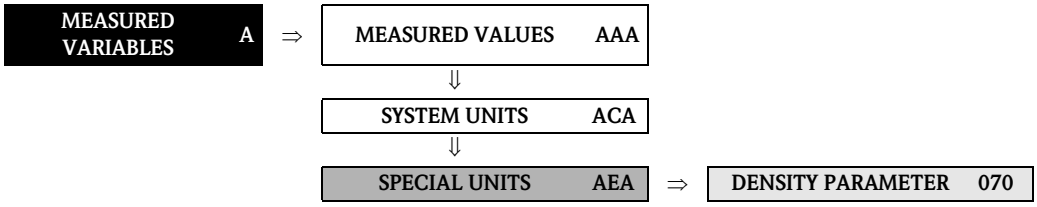
3.2.2 Function group ADDITIONAL CONFIGURATION



Function description MEASURED VARIABLES → SYSTEM UNITS → ADDITIONAL CONFIGURATION	
UNIT DENSITY **0420** MODBUS register: 2107 Data type: Integer Access: read/write	Use this function to select the unit for displaying the fluid density. The unit you select here is also valid for: ■ Fluid density entry **Options:** 0...10 = metric → g/cm^3; g/cc; kg/dm^3; kg/l; kg/m^3; SD 4 °C; SD 15 °C; SD 20 °C; SG 4 °C; SG 15 °C; SG 20 °C 11...16 = US → lb/ft^3; lb/gal; lb/bbl (normal fluids); lb/bbl (beer); lb/bbl (petrochemicals); lb/bbl (filling tanks) 17...19 = Imperial → lb/gal; lb/bbl (beer); lb/bbl (petrochemicals) **Factory setting:** kg/l (SI units: not for USA and Canada) g/cc (US units: only for USA and Canada) SD = Specific Density, SG = Specific Gravity The specific density is the ratio of fluid density to water density (at water temperature = 4, 15, 20 °C).
UNIT LENGTH **0424** MODBUS register: 2125 Data type: Integer Access: read/write	Use this function to select the unit for displaying the length of the nominal diameter. The unit you select here is also valid for: Nominal diameter of sensor (function NOMINAL DIAMETER (6804) on page 118) **Options:** 0 = MILLIMETER 1 = INCH **Factory setting:** MILLIMETER (SI units: not for USA and Canada) INCH (US units: only for USA and Canada)

3.3 SPECIAL UNITS group

3.3.1 Function group DENSITY PARAMETER



Function description MEASURED VARIABLES → SPECIAL UNITS → DENSITY PARAMETER	
VALUE DENSITY **0700** MODBUS register: 2201 Data type: Float Access: read/write	Use this function to enter a density value preferably at process temperature (or at reference temperature). This density value is used to convert the volume flow to a mass flow. **User input:** 5-digit floating-point number **Factory setting:** 1 [unit] ✎ Note! The appropriate unit is taken from the function UNIT DENSITY (0420) (see page 17).

4 Block QUICK-SETUP

Block	Group / Function groups	Functions				
QUICK-SETUP (B)	⇒	QS-COMMISSION. (1002) p. 19	⇒ QUICK SETUP PULSATING (1003) p. 19	QUICK SETUP BATCHING (1005) p. 19	QUICK SETUP COMMUNICATION (1006) p. 19	T-DAT SAVE/LOAD (1009) p. 20

Function description
QUICK-SETUP

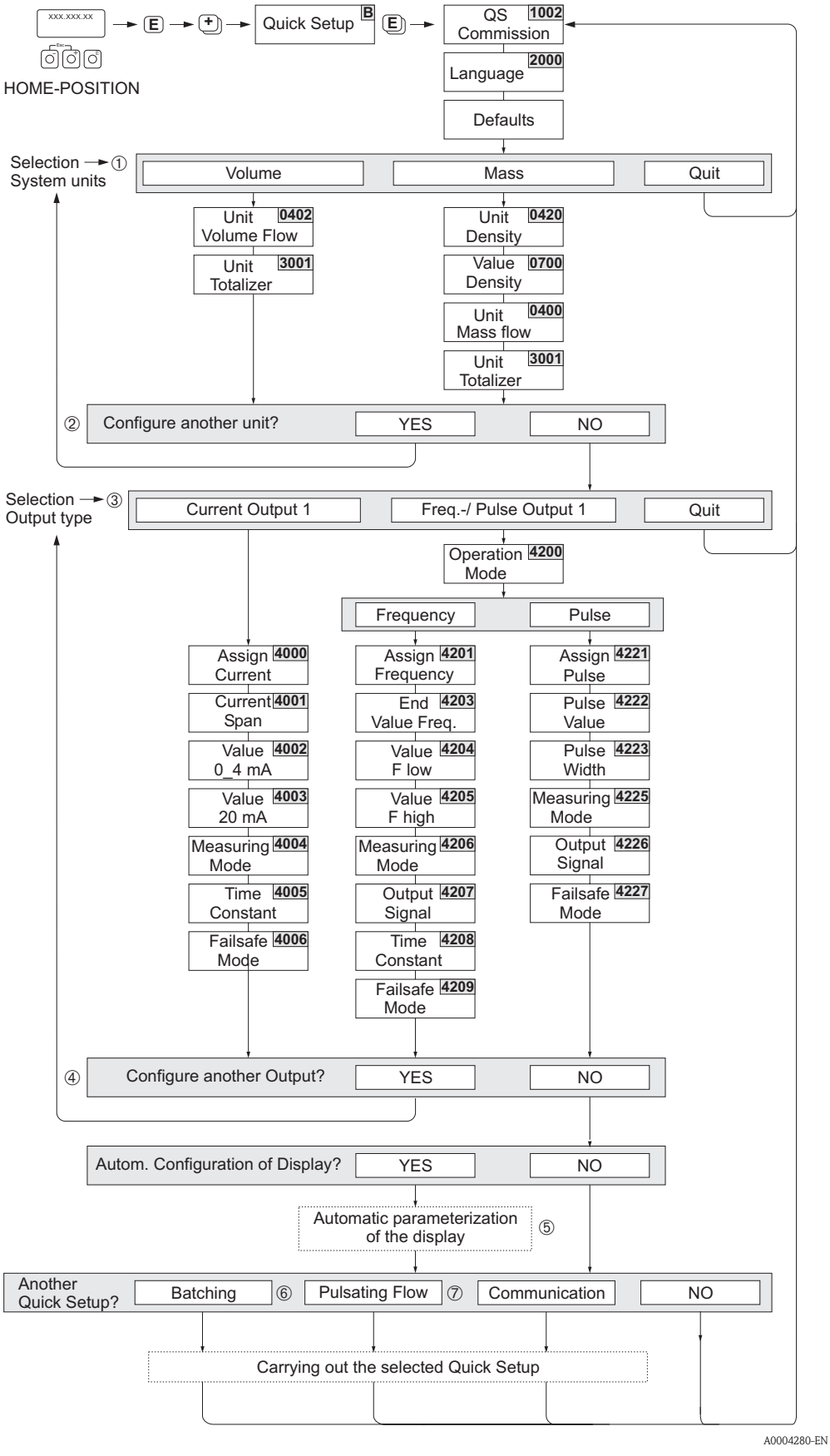
✎ Note!
- The Quick Setups are only available by means of the local display.
- The flowcharts of the various Quick Setups are provided on the pages to follow.
- For more information on the Setup menus, please refer to the Operating Instructions BA117D.

QUICK SETUP COMMISSIONING 1002	For starting the Setup menu. **Options:** NO YES **Factory setting:** NO
QUICK SETUP PULSATING FLOW 1003	✎ Note! Function only available for measuring devices with a current or pulse/frequency output. For starting the Setup menu. **Options:** NO YES **Factory setting:** NO
QUICK SETUP BATCHING 1005	✎ Note! Function is only available with the optional software package BATCHING. For starting the Setup menu. **Options:** NO YES **Factory setting:** NO
QUICK SETUP COMMUNICATION 1006	For starting the Setup menu. **Options:** NO YES **Factory setting:** NO

Function description QUICK-SETUP	
T-DAT SAVE/LOAD **1009** MODBUS register: 2401 Data type: Integer Access: read/write	Use this function to save the parameter settings / configuration of the **transmitter** in a transmitter DAT (T-DAT), or to load the parameter settings from the T-DAT into the EEPROM (**manual** security function). Application examples: ■ After commissioning, the current measuring point parameters can be saved to the T-DAT as a backup. ■ If the transmitter is replaced for some reason, the data from the T-DAT can be loaded into the new transmitter (EEPROM). **Options:** 0 = CANCEL 1 = SAVE (from EEPROM to T-DAT) 2 = LOAD (from the T-DAT into EEPROM) **Factory setting:** CANCEL ✎ Note! ■ If the target device has an older software version, the message “TRANSM. SW-DAT” is displayed during startup. Then only the “SAVE” function is available. ■ LOAD This function is only possible if the target device has the same software version as, or a more recent software version than, the source device. ■ SAVE This function is always available.

4.1 Quick Setup "Commissioning"

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the configuration program, e.g. ToF Tool – Fieldtool Package.



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- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.

- The “Commissioning” Quick Setup must be carried out before one of the Quick Setups explained below is run.

① Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass and volume is derived from the corresponding flow unit.

② The “YES” option remains visible until all the units have been configured. “NO” is the only option displayed when no further units are available.

③ The prompt only appears if a current output and/or a pulse/frequency output is available. Only the outputs not yet configured in the current Setup are offered for selection in each cycle.

④ The “YES” option remains visible until all the outputs have been parameterized. “NO” is the only option displayed when no further outputs are available.

⑤ The “automatic parameterization of the display” option contains the following basic settings/factory settings:

YES: Main line = Volume flow
Additional line = Totalizer 1
Information line = Operating/System conditions

NO: The existing (selected) settings remain.

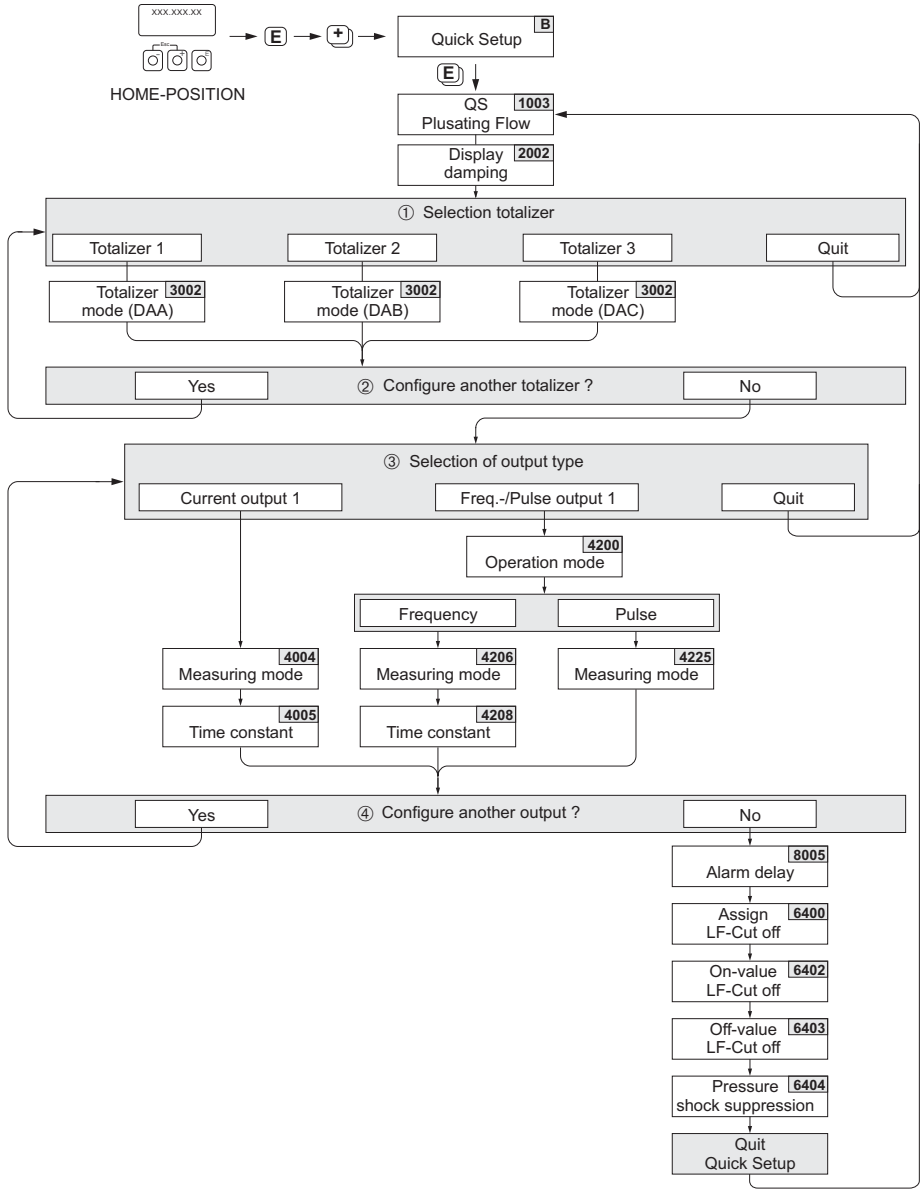
⑥ The BATCHING QUICK SETUP is only available when the optional software package BATCHING is installed.

⑦ The QUICK SETUP PULSATING FLOW is only available if the device has a current output or a pulse/frequency output.

4.2 Quick Setup “Pulsating flow”

Note!
The “Pulsating flow” Quick Setup is only available if the device has a current output or a pulse/frequency output.
Certain types of pump such as reciprocating, peristaltic and cam-type pumps, for example, create a flow characterized by severe periodic fluctuations . Negative flows can occur with pumps of these types on account of the closing volume of the valves or valve leaks.

Note!
Before carrying out the Quick Setup “Pulsating Flow” the Quick Setup “Commissioning” (s. page 24) has to be executed.



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① Only totalizers not yet configured in the current Setup are offered for selection in each cycle.
② The “YES” option remains visible until all the totalizers have been parameterized. “NO” is the only option displayed when no further totalizers are available.
③ Only the output not yet configured in the current Setup is offered for selection in the second cycle.
④ The “YES” option remains visible until both outputs have been parameterized. “NO” is the only option displayed when no further outputs are available.

Note!
- If you press the key combination during parameter interrogation, the display returns to the cell QUICK SETUP PULSATING FLOW (1003).
- You can call up the Setup menu either directly from the "COMMISSIONING" Quick Setup menu or manually by means of the function QUICK SETUP PULSATING FLOW (1003).

Settings for the pulsating flow Setup menu:

Fct. code	Function name	Suggested settings	Description
Call up through the function matrix:			
B	QUICK-SETUP	QUICK SETUP PULSATING FLOW	see P. 19
1003	QUICK SETUP PULSATING FLOW	YES	see P. 19
Basic configuration:			
2002	DISPLAY DAMPING	3 s	see P. 30
3002	TOTALIZER MODE (DAA)	BALANCE (Totalizer 1)	see P. 50
3002	TOTALIZER MODE (DAB)	BALANCE (Totalizer 2)	see P. 50
3002	TOTALIZER MODE (DAC)	BALANCE (Totalizer 3)	see P. 50
Select the signal type: CURRENT OUTPUT 1			
4004	MEASURING MODE	PULSATING FLOW	see P. 59
4005	TIME CONSTANT	3 s	see P. 61
Select the signal type: FREQ./PULSE OUTPUT 1 / operating mode: FREQUENCY			
4206	MEASURING MODE	PULSATING FLOW	see P. 69
4208	TIME CONSTANT	0 s	see P. 74
Select the signal type: FREQ./PULSE OUTPUT 1 / operating mode: PULSE			
4225	MEASURING MODE	PULSATING FLOW	see P. 77
Other settings:			
8005	ALARM DELAY	0 s	see P. 141
6400	ASSIGN LOW FLOW CUT OFF	VOLUME FLOW	see P. 107
6402	ON-VALUE LOW FLOW CUT OFF	see table below	see P. 107
6403	OFF-VALUE LOW FLOW CUT OFF	50%	see P. 107
6404	PRESSURE SHOCK SUPPRESSION	0 s	see P. 108

Recommended settings for the function ON-VALUE LOW FLOW CUT OFF (6402):

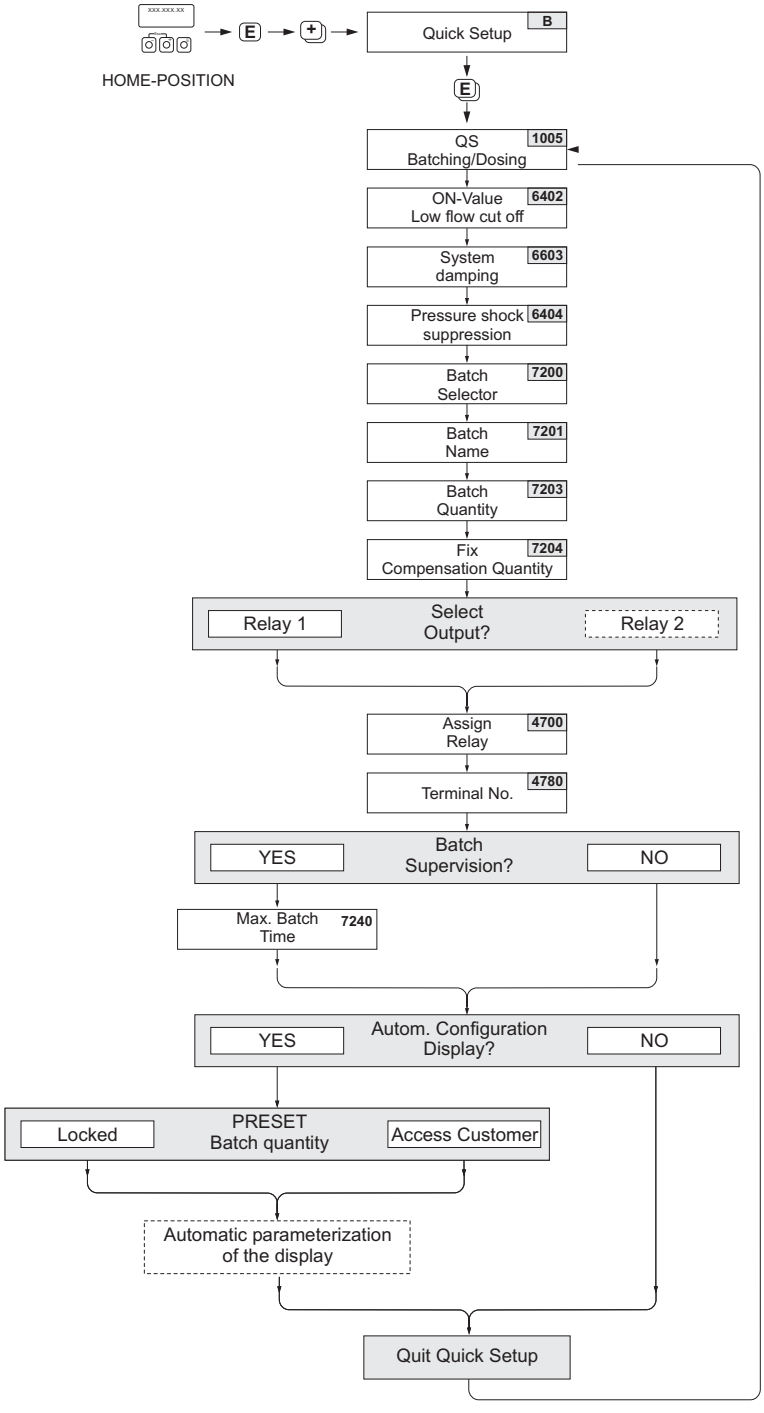
DN [mm]	dm^3/min		US-gal/min
2	0.002	or	0.001
4	0.007	or	0.002
8	0.03	or	0.008
15	0.1	or	0.03
25	0.3	or	0.08
32	0.5	or	0.15
40	0.7	or	0.2
50	1.1	or	0.3
65	2.0	or	0.5
80	3.0	or	0.8
100	4.7	or	1.3

The recommended values correspond to the max. full scale value per DN divided by 1000
(see see Promag 53 MODBUS RS485 Operating Instructions, BA117D/06/en, Chapter "Installation" → nominal diameters and flow rates).

4.3 Quick Setup “Batching”

Note!
This function is only available when the additional “batching” software is installed in the measuring device (order option). You can order this software from Endress+Hauser as an accessory at a later date (see Operating Instructions).

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterized and configured for batching operation. These basic settings allow simple (one step) batching processes.
Additional settings, e.g. for multi-stage batching processes, have to be made via the function matrix itself.



A0004433-EN

Caution!
The “Batching” Quick Setup sets certain device parameters for discontinuous measurement operation.
If the measuring device is used for continuous flow measurement at a later time, we recommend at you rerun the “Commissioning” and/or “Pulsating Flow” Quick Setup.

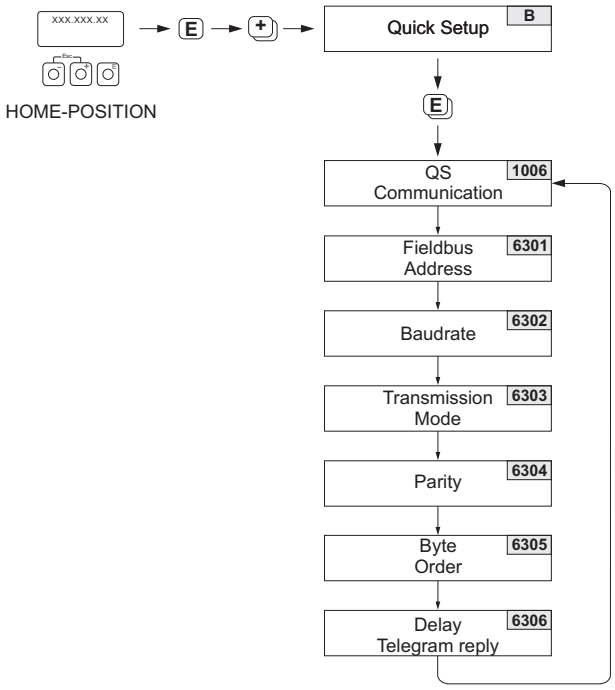
Note!
- Before carrying out the Quick Setup “Batching” the Quick Setup “Commissioning” (s. page 21) has to be executed.
- Detailed information about the batching functions can be found on Page 121 ff.
- You can also directly control filling process using the local display. During Quick Setup, an appropriate dialog appears concerning the automatic display configuration. Acknowledge this by clicking “YES”.
  This assigns special batching functions (START, PRESET, MATRIX) to the bottom line of the display. These can be directly executed onsite using the three operating keys (⊞ / ⊟ / E). Therefore, the measuring device can be fully deployed in the field as a “batch controller”.
- You can also directly control the filling process using the fieldbus.

Settings for the Batching Setup menu:

Fct. code	Function name	Suggested settings	Description
Call up through the function matrix:			
B	QUICK-SETUP	QUICK SETUP BATCHING	see P. 19
1005	QUICK SETUP BATCHING	YES	see P. 19
Settings (functions with a gray background are set automatically):			
6400	ASSIGN LOW FLOW CUT OFF	Volume	see P. 107
6402	ON-VALUE LOW FLOW CUT OFF	Table value	see P. 107
6403	OFF-VALUE LOW FLOW CUT OFF	50%	see P. 107
6603	SYSTEM DAMPING	9 Note! The SYSTEM DAMPING has to be optimized for highly accurate and short filling processes: to do this, put the setting to “0”.	see P. 115
6404	PRESSURE SHOCK SUPPRESSION	0 seconds	see P. 108
7200	BATCH SELECTOR	BATCH #1	see P. 122
7202	BATCH NAME	BATCH #1	see P. 123
7201	ASSIGN BATCH VARIABLE	Volume	see P. 123
7203	BATCH QUANTITY	0	see P. 124
7204	FIX COMPENSATION QUANTITY	0	see P. 124
7208	BATCH STAGES	1	see P. 125
7209	INPUT FORMAT	Value input	see P. 125
4700	ASSIGN RELAY	BATCH VALVE 1	see P. 89
4780	TERMINAL NUMBER	Output (display only)	see P. 95
7220	OPEN VALVE 1	0% or 0 [unit]	see P. 126
7240	MAXIMUM BATCH TIME	0 seconds	see P. 132
7241	MINIMUM BATCH QUANTITY	0 seconds	see P. 133
7242	MAXIMUM BATCH QUANTITY	0 seconds	see P. 134
2200	ASSIGN (Main line)	BATCH NAME	see P. 33
2220	ASSIGN (Multiplex main line)	Off	see P. 35
2400	ASSIGN (Additional line)	BATCH DOWNWARDS	see P. 37
2420	ASSIGN (Multiplex additional line)	Off	see P. 40
2600	ASSIGN (Information line)	BATCHING KEYS	see P. 43
2620	ASSIGN (Multiplex information line)	Off	see P. 46

4.4 Quick Setup "Communication"

To establish serial data transfer, various arrangements between the MODBUS master and MODBUS slave are required which have to be taken into consideration when configuring various functions. These functions can be configured quickly and easily by means of the "Communication" Quick Setup. The following table explains the parameter configuration options in more detail.

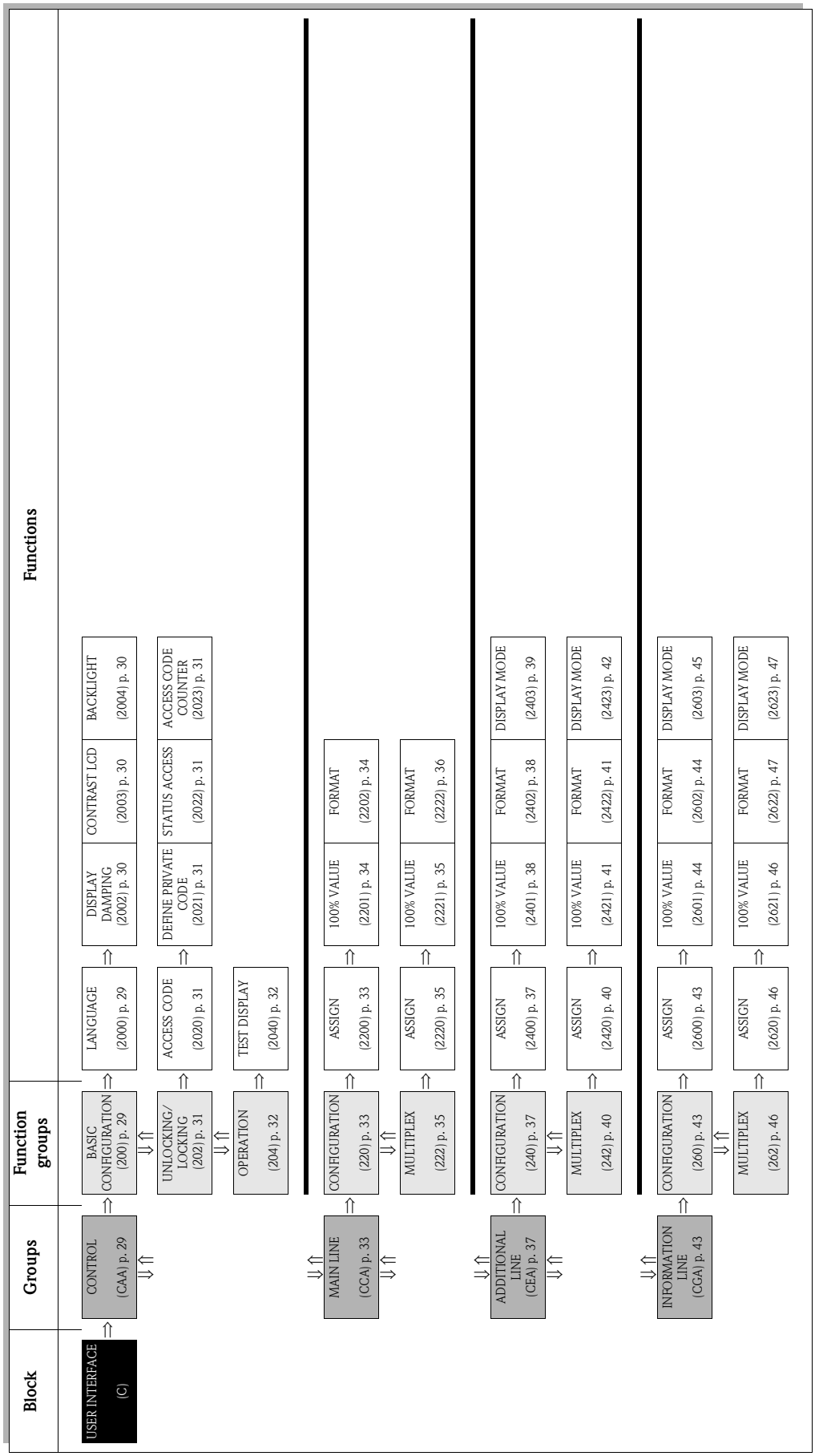


A0004430-EN

Settings for the Communication Setup menu:

Fct. code	Function name	Suggested settings	Description
Call up through the function matrix:			
B	QUICK SETUP	QUICK SETUP COMMUNICATION	see P. 19
1006	QUICK SETUP COMMUNICATION	YES	see P. 19
Basic configuration:		**Factory setting:**	
6301	FIELDBUS ADDRESS	247	see P. 104
6302	BAUDRATE	19200 BAUD	see P. 104
6303	TRANSMISSION MODE	RTU	see P. 104
6304	PARITY	EVEN	see P. 105
6305	BYTE ORDER	1 - 0 - 3- 2	see P. 105
6306	DELAY TELEGRAM REPLY	10 ms	see P. 105

5 Block USER INTERFACE



5.1 Group CONTROL

5.1.1 Function group BASIC CONFIGURATION

USER INTERFACE C ⇒ CONTROL CAA ⇒ BASIC CONFIGURATION 200

Function description USER INTERFACE → CONTROL → BASIC CONFIGURATION		
LANGUAGE	**2000**	Use this function to select the language for all texts, parameters and messages shown on the local display. ✎ Note! The displayed options depend on the available language group shown in the LANGUAGE GROUP (8226) function. **OPTIONS:** Language group WEST EU / USA: 0 = ENGLISH 1 = DEUTSCH 2 = FRANCAIS 3 = ESPANOL 4 = ITALIANO 5 = NEDERLANDS 12 = PORTUGUESE Language group EAST EU / SCAND: 0 = ENGLISH 7 = NORSK 8 = SVENSKA 9 = SUOMI 13 = POLISH 14 = RUSSIAN 15 = CZECH Language group ASIA: 0 = ENGLISH 10 = BAHASA INDONESIA 11 = JAPANESE (syllabary) Language group CHINA: 0 = ENGLISH 16 = CHINESE **Factory setting:** Country-dependent (s. page 151) ✎ Note! ■ If you press the ⊞/⊟ keys at startup, the language defaults to "ENGLISH". ■ You can change the language group via the configuration software ToF Tool - Fieldtool Package. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.
MODBUS register: Data type: Access:	2502 Integer read/write	

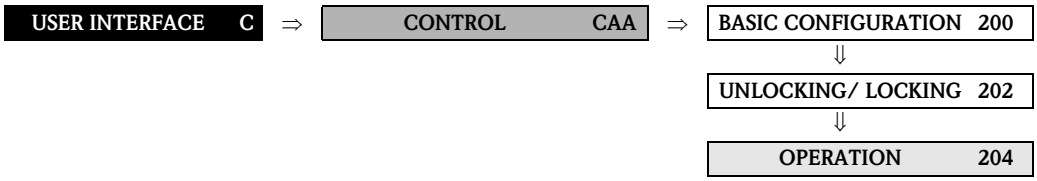
Function description USER INTERFACE → CONTROL → BASIC CONFIGURATION	
DISPLAY DAMPING **2002** MODBUS register: 2503 Data type: Float Access: read/write	Use this function to enter a time constant defining how the display reacts to severely fluctuating flow variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). **User input:** 0...100 seconds **Factory setting:** 3 s ✎ Note! Setting the time constant to zero seconds switches off damping.
CONTRAST LCD **2003** MODBUS register: 2505 Data type: Float Access: read/write	Use this function to optimize display contrast to suit local operating conditions. **User input:** 10...100% **Factory setting:** 50%
BACKLIGHT **2004** MODBUS register: 2566 Data type: Float Access: read/write	Use this function to optimize the backlight to suit local operating conditions. **User input:** 0...100% ✎ Note! Entering the value “0” means that the backlight is “switched off”. The display then no longer emits any light, i.e. the display texts can no longer be read in the dark. **Factory setting:** 50%

5.1.2 Function group UNLOCKING/ LOCKING

USER INTERFACE C ⇒ CONTROL CAA ⇒ BASIC CONFIGURATION 200
⇓
UNLOCKING/ LOCKING 202

Function description USER INTERFACE → CONTROL → UNLOCKING/ LOCKING	
ACCESS CODE **2020** MODBUS register: 2508 Data type: Float Access: read/write	✎ Note! This function is only relevant for local operation and has no effect on access via MODBUS RS485 communication. All data of the measuring system are protected against inadvertent change. Programming is disabled and the settings cannot be changed until a code is entered in this function. If you press the ⊞ / ⊟ keys in any function, the measuring system automatically goes to this function and the prompt to enter the code appears on the display (when programming is disabled). You can enable programming by entering your personal code (**factory setting = 53**, see function). **User input:** max. 4-digit number: 0...9999 ✎ Note! ■ Programming is disabled if you do not press a key within 60 seconds following automatic return to the HOME position. ■ You can also disable programming in this function by entering any number (other than the defined private code). ■ The Endress+Hauser service organization can be of assistance if you mislay your personal code.
DEFINE PRIVATE CODE **2021** MODBUS register: 2510 Data type: Float Access: read/write	Use this function to specify a personal code for enabling programming in the function ACCESS CODE. **User input:** 0...9999 (max. 4-digit number) **Factory setting:** 53 ✎ Note! ■ Programming is always enabled with the code “0”. ■ Programming has to be enabled before this code can be changed. When programming is disabled this function is not available, thus preventing others from accessing your personal code.
STATUS ACCESS **2022** MODBUS register: 2512 Data type: Integer Access: Read	Use this function to check the access status for the function matrix. **User interface:** 0 = LOCKED (parameterization disabled) 1 = ACCESS CUSTOMER (parameterization possible)
ACCESS CODE COUNTER **2023** MODBUS register: 2568 Data type: Integer Access: Read	Displays how often the customer code, service code or the digit “0” (code-free) has been entered to gain access to the function matrix. **User interface:** max. 7-digit number: 0...9999999 **Factory setting:** 0

5.1.3 Function group OPERATION

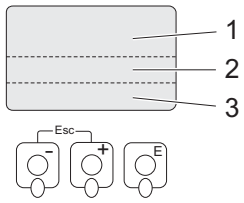


Function description USER INTERFACE → CONTROL → OPERATION		
TEST DISPLAY	**2040**	Use this function to test the operability of the local display and its pixels.
MODBUS register: Data type: Access:	2513 Integer read/write	**Options:** 0 = OFF 1 = ON **Factory setting:** OFF Test sequence: 1. Start the test by selecting ON. 2. All pixels of the main line, additional line and information line are darkened for minimum 0.75 seconds. 3. Main line, additional line and information line show an “8” in each field for minimum 0.75 seconds. 4. Main line, additional line and information line show a “0” in each field for minimum 0.75 seconds. 5. Main line, additional line and information line show nothing (blank display) for minimum 0.75 seconds. When the test completes the local display returns to its initial state and the setting changes to OFF.

5.2 Group MAIN LINE

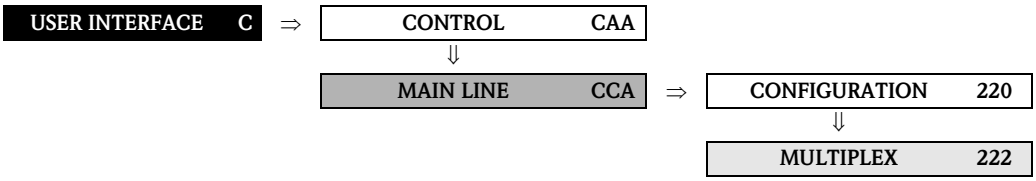
5.2.1 Function group CONFIGURATION

USER INTERFACE C ⇒ CONTROL CAA
⇓
MAIN LINE CCA ⇒ CONFIGURATION 220

Function description USER INTERFACE ➞ MAIN LINE ➞ CONFIGURATION	
 A0001253 1 = main line, 2 = additional line, 3 = information line	
ASSIGN **2200** MODBUS register: 2514 Data type: Integer Access: read/write	In this function, a value to be displayed is assigned to the main line (top line in the local display). This value is displayed during normal operation. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW 3 = VOLUME FLOW IN % 4 = MASS FLOW IN % 8 = ACTUAL CURRENT 1 10 = ACTUAL FREQUENCY 1 12 = TOTALIZER 1 13 = TOTALIZER 2 14 = TOTALIZER 3 **Advanced options with optional software package BATCHING:** 42 = BATCH NAME (“BATCH # 1” or “BEER 330”, etc.) 43 = BATCH QUANTITY (overall quantity to be batched) 44 = BATCH COUNTER (batching processes carried out) 45 = BATCH SUM (effective total batching quantity) ✎ Note! The options given in the BATCHING software package always refer to the batching selected (“BATCH # 1”, “BATCH # 2”, etc.) in the function BATCH SELECTOR (page 122). Example: If BATCH # 1 was selected in the BATCH SELECTOR function (7200), then only the values from BATCH # 1 (batch name, batch quantity, etc.) can be displayed. **Factory setting:** VOLUME FLOW

Function description USER INTERFACE → MAIN LINE → CONFIGURATION	
100% VALUE **2201** MODBUS register: 2519 Data type: Float Access: read/write	✎ Note! This function is only available if VOLUME FLOW IN % or MASS FLOW IN % was selected in the function ASSIGN (2200). Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
FORMAT **2202** MODBUS register: 2516 Data type: Integer Access: read/write	Use this function to define the maximum number of places after the decimal point displayed for the reading in the main line. **Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.

5.2.2 Function group MULTIPLEX



Function description USER INTERFACE → MAIN LINE → MULTIPLEX	
ASSIGN **2220** MODBUS register: 2522 Data type: Integer Access: read/write	Use this function to define the second reading to be displayed in the main line alternately (every 10 seconds) with the value defined in the ASSIGN function (2200). **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW 3 = VOLUME FLOW IN % 4 = MASS FLOW IN % 8 = ACTUAL CURRENT 1 10 = ACTUAL FREQUENCY 1 12 = TOTALIZER 1 13 = TOTALIZER 2 14 = TOTALIZER 3 **Advanced options with optional software package BATCHING:** 42 = BATCH NAME (“BATCH # 1” or “BEER 330”, etc.) 43 = BATCH QUANTITY (overall quantity to be batched) 44 = BATCH COUNTER (batching processes carried out) 45 = BATCH SUM (effective total batching quantity) ✎ Note! The options given in the BATCHING software package always refer to the batching selected (“BATCH # 1”, “BATCH # 2”, etc.) in the function BATCH SELECTOR (page 122). Example: If BATCH # 1 was selected in the BATCH SELECTOR function (7200), then only the values from BATCH # 1 (batch name, batch quantity, etc.) can be displayed. **Factory setting:** OFF
100% VALUE **2221** MODBUS register: 2524 Data type: Float Access: read/write	✎ Note! This function is only available if VOLUME FLOW IN % or MASS FLOW IN % was selected in the function ASSIGN (2220). Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).

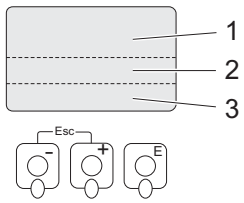
Function description USER INTERFACE → MAIN LINE → MULTIPLEX		
FORMAT	***2222***	Use this function to define the maximum number of places after the decimal point for the second value displayed in the main line.
MODBUS register: Data type: Access:	2523 Integer read/write	**Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.

5.3 Group ADDITIONAL LINE

5.3.1 Function group CONFIGURATION

USER INTERFACE C ⇒ CONTROL CAA
⇓
MAIN LINE CCA
⇓
ADDITIONAL LINE CEA ⇒ CONFIGURATION 240

Function description
USER INTERFACE ➞ ADDITIONAL LINE ➞ CONFIGURATION



A0001253

1 = main line, 2 = additional line, 3 = information line

ASSIGN **2400**

MODBUS register: 2527
Data type: Integer
Access: read/write

In this function, a value to be displayed is assigned to the additional line (middle line in the local display). This value is displayed during normal operation.

Options:
0 = OFF
1 = VOLUME FLOW
2 = MASS FLOW
3 = VOLUME FLOW IN %
4 = MASS FLOW IN %
5 = VOLUME FLOW BARGRAPH IN %
6 = MASS FLOW BARGRAPH IN %
7 = FLOW VELOCITY
8 = ACTUAL CURRENT 1
10 = ACTUAL FREQUENCY 1
12 = TOTALIZER 1
13 = TOTALIZER 2
14 = TOTALIZER 3
15 = TAG NAME

Advanced options with optional software package BATCHING:
42 = BATCH NAME (“BATCH # 1” or “BEER 330”, etc.)
43 = BATCH QUANTITY (overall quantity to be batched)
44 = BATCH COUNTER (batching processes carried out)
45 = BATCH SUM (effective total batching quantity)
46 = BATCH UPWARDS (batching progress upwards)
47 = BATCH DOWNWARDS (batching progress downwards)

✎ Note!
The options given in the BATCHING software package always refer to the batching selected (“BATCH # 1”, “BATCH # 2”, etc.) in the function BATCH SELECTOR (page 122). Example: If BATCH # 1 was selected in the BATCH SELECTOR function (7200), then only the values from BATCH # 1 (batch name, batch quantity, etc.) can be displayed.

Factory setting:
TOTALIZER 1

Function description USER INTERFACE → ADDITIONAL LINE → CONFIGURATION	
100% VALUE **2401** MODBUS register: 2529 Data type: Float Access: read/write	✎ Note! This function is not available unless one of the following was selected in the function ASSIGN (2400): ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
FORMAT **2402** MODBUS register: 2528 Data type: Integer Access: read/write	✎ Note! This function is not available unless a number was selected in the function ASSIGN (2400). Use this function to define the maximum number of places after the decimal point displayed for the reading in the additional line. **Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.

Function description

USER INTERFACE → ADDITIONAL LINE → CONFIGURATION

DISPLAY MODE **2403**

MODBUS register: 2531
Data type: Integer
Access: read/write

✎ Note!
This function is only available if VOLUME FLOW BARGRAPH IN % or MASS FLOW BARGRAPH IN % was selected in the function ASSIGN (2400).

Use this function to define the format of the bar graph.

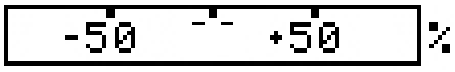
Options:
0 = STANDARD
1 = SYMMETRY

Factory setting:
STANDARD

Illustration of bar graph
Bar graph for STANDARD option
Simple bar graph with 25 / 50 / 75% gradations and integrated sign.

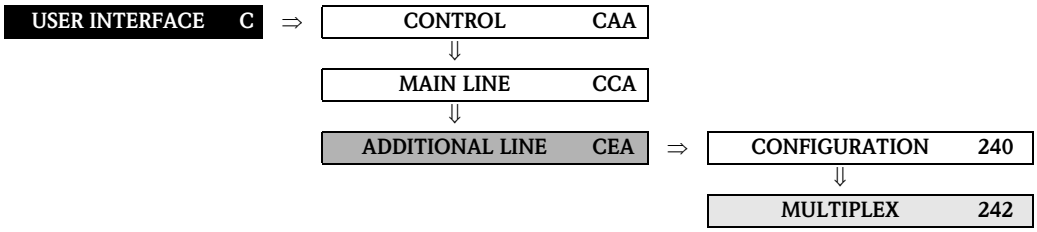
A0001258

Bar graph for SYMMETRY option
Symmetrical bar graph for positive and negative directions of flow, with -50 / 0 / +50% gradations and integrated sign.



A0001259

5.3.2 Function group MULTIPLEX



Function description
USER INTERFACE → ADDITIONAL LINE → MULTIPLEX

ASSIGN **2420**

MODBUS register: 2532
Data type: Integer
Access: read/write

Use this function to define the second reading to be displayed in the additional line alternately (every 10 seconds) with the value defined in the function ASSIGN (2400).

Options:
0 = OFF
1 = VOLUME FLOW
2 = MASS FLOW
3 = VOLUME FLOW IN %
4 = MASS FLOW IN %
5 = VOLUME FLOW BARGRAPH IN %
6 = MASS FLOW BARGRAPH IN %
7 = FLOW VELOCITY
8 = ACTUAL CURRENT 1
10 = ACTUAL FREQUENCY 1
12 = TOTALIZER 1
13 = TOTALIZER 2
14 = TOTALIZER 3
15 = TAG NAME

Advanced options with optional software package BATCHING:
42 = BATCH NAME (“BATCH # 1” or “BEER 330”, etc.)
43 = BATCH QUANTITY (overall quantity to be batched)
44 = BATCH COUNTER (batching processes carried out)
45 = BATCH SUM (effective total batching quantity)
46 = BATCH UPWARDS (batching progress upwards)
47 = BATCH DOWNWARDS (batching progress downwards)

✎ Note!
The options given in the BATCHING software package always refer to the batching selected (“BATCH # 1”, “BATCH # 2”, etc.) in the function BATCH SELECTOR (page 122). Example: If BATCH # 1 was selected in the BATCH SELECTOR function (7200), then only the values from BATCH # 1 (batch name, batch quantity, etc.) can be displayed.

Factory setting:
OFF

✎ Note!
Multiplex mode is suspended as soon as a fault / notice message is generated. The message in question appears on the display.
Once the fault is eliminated, the measuring device resumes operation in Multiplex mode and the error message is no longer displayed on the local display.

Function description USER INTERFACE → ADDITIONAL LINE → MULTIPLEX	
100% VALUE **2421** MODBUS register: 2534 Data type: Float Access: read/write	✎ Note! This function is not available unless one of the following was selected in the function ASSIGN (2420): ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
FORMAT **2422** MODBUS register: 2533 Data type: Integer Access: read/write	✎ Note! This function is not available unless a number was selected in the function ASSIGN (2420). Use this function to define the maximum number of places after the decimal point for the second value displayed in the additional line. **Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.

Function description

USER INTERFACE → ADDITIONAL LINE → MULTIPLEX

DISPLAY MODE **2423**

MODBUS register: 2536
Data type: Integer
Access: read/write

✎ Note!
This function is only available if VOLUME FLOW BARGRAPH IN % or MASS FLOW BARGRAPH IN % was selected in the function ASSIGN (2420).

Use this function to define the format of the bar graph.

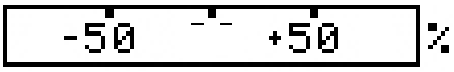
Options:
0 = STANDARD
1 = SYMMETRY

Factory setting:
STANDARD

Illustration of bar graph
Bar graph for STANDARD option
Simple bar graph with 25 / 50 / 75% gradations and integrated sign.

A0001258

Bar graph for SYMMETRY option
Symmetrical bar graph for positive and negative directions of flow, with -50 / 0 / +50% gradations and integrated sign.



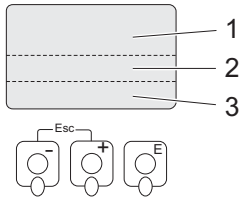
A0001259

5.4 Group INFORMATION LINE

5.4.1 Function group CONFIGURATION

USER INTERFACE C ⇒ CONTROL CAA
⇓
MAIN LINE CCA
⇓
ADDITIONAL LINE CEA
⇓
INFORMATION LINE CGA ⇒ CONFIGURATION 260

Function description
USER INTERFACE ➞ INFORMATION LINE ➞ CONFIGURATION



A0001253

1 = main line, 2 = additional line, 3 = information line

ASSIGN **2600**

MODBUS register: 2537
Data type: Integer
Access: read/write

In this function, a value to be displayed is assigned to the information line (bottom line in the local display). This value is displayed during normal operation.

Options:
0 = OFF
3 = VOLUME FLOW IN %
4 = MASS FLOW IN %
5 = VOLUME FLOW BARGRAPH IN %
6 = MASS FLOW BARGRAPH IN %
7 = FLOW VELOCITY
8 = ACTUAL CURRENT 1
10 = ACTUAL FREQUENCY 1
12 = TOTALIZER 1
13 = TOTALIZER 2
14 = TOTALIZER 3
15 = TAG NAME
16 = OPERATING/SYSTEM CONDITIONS
17 = DISPLAY FLOW DIRECTION

Advanced options with optional software package BATCHING:
50 = BATCHING KEYS (softkeys on the local display)

✎ Note!
- If you select the BATCHING OPERATING KEYS, the multiplex display functionality (function ASSIGN (2620), etc.) is not available in the information line.
- For information on the functional concept of the batching menu, see chapter “Operation” in the see Promag 53 MODBUS RS485 Operating Instructions, BA117D/06/en.

Factory setting:
OPERATING/SYSTEM CONDITIONS

Function description USER INTERFACE → INFORMATION LINE → CONFIGURATION	
100% VALUE **2601** MODBUS register: 2539 Data type: Float Access: read/write	✎ Note! This function is not available unless one of the following was selected in the function ASSIGN (2600): ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).
FORMAT **2602** MODBUS register: 2538 Data type: Integer Access: read/write	✎ Note! This function is not available unless a number was selected in the function ASSIGN (2600). Use this function to define the maximum number of places after the decimal point displayed for the reading in the information line. **Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.

Function description

USER INTERFACE → INFORMATION LINE → CONFIGURATION

DISPLAY MODE **2603**

MODBUS register: 2541
Data type: Integer
Access: read/write

✎ Note!
This function is only available if VOLUME FLOW BARGRAPH IN % or MASS FLOW BARGRAPH IN % was selected in the function ASSIGN (2600).

Use this function to define the format of the bar graph.

Options:
0 = STANDARD
1 = SYMMETRY

Factory setting:
STANDARD

Illustration of bar graph
Bar graph for STANDARD option
Simple bar graph with 25 / 50 / 75% gradations and integrated sign.

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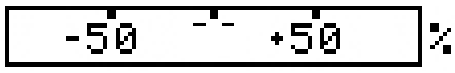
Bar graph for SYMMETRY option
Symmetrical bar graph for positive and negative directions of flow, with -50 / 0 / +50% gradations and integrated sign.



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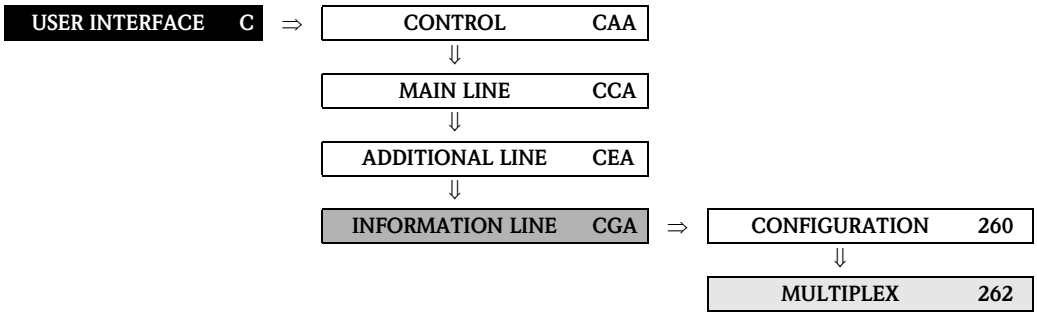
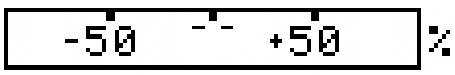
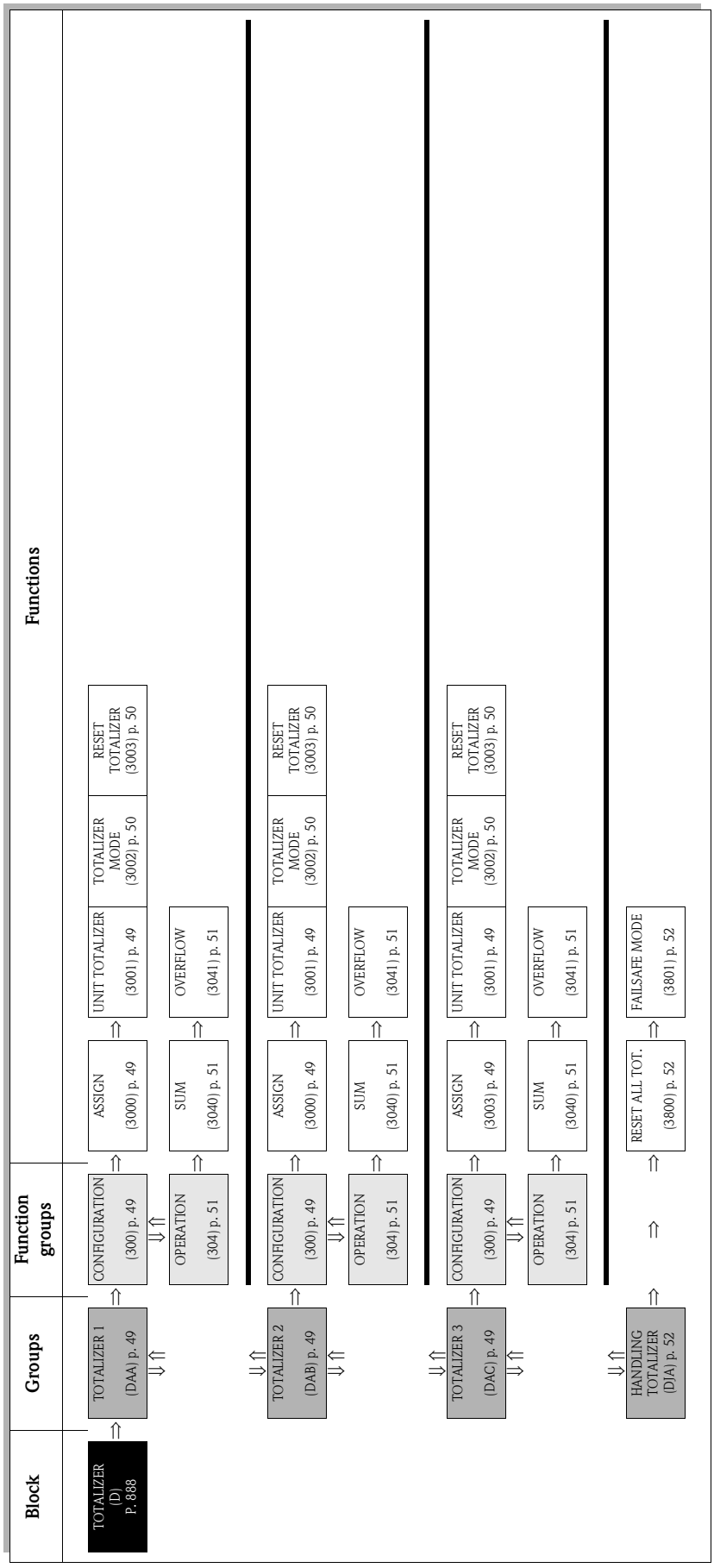
5.4.2 Function group MULTIPLEX



Function description USER INTERFACE → INFORMATION LINE → MULTIPLEX	
✎ Note! If you select the BATCHING KEYS in the function ASSIGN (2600), the multiplex display functionality is not available in the information line.	
ASSIGN **2620** MODBUS register: 2542 Data type: Integer Access: read/write	Use this function to define the second reading to be displayed in the information line alternately (every 10 seconds) with the value defined in the function ASSIGN (2600). **Options:** 0 = OFF 3 = VOLUME FLOW IN % 4 = MASS FLOW IN % 5 = VOLUME FLOW BARGRAPH IN % 6 = MASS FLOW BARGRAPH IN % 7 = FLOW VELOCITY 8 = ACTUAL CURRENT 1 10 = ACTUAL FREQUENCY 1 12 = TOTALIZER 1 13 = TOTALIZER 2 14 = TOTALIZER 3 15 = TAG NAME 16 = OPERATING/SYSTEM CONDITIONS 18 = DISPLAY FLOW DIRECTION **Factory setting:** OFF ✎ Note! Multiplex mode is suspended as soon as a fault / notice message is generated. The message in question appears on the display. Once the fault is eliminated, the measuring device resumes operation in Multiplex mode and the error message is no longer displayed on the local display.
100% VALUE **2621** MODBUS register: 2544 Data type: Float Access: read/write	✎ Note! This function is not available unless one of the following was selected in the function ASSIGN (2620): ■ VOLUME FLOW IN % ■ MASS FLOW IN % ■ VOLUME FLOW BARGRAPH IN % ■ MASS FLOW BARGRAPH IN % Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).

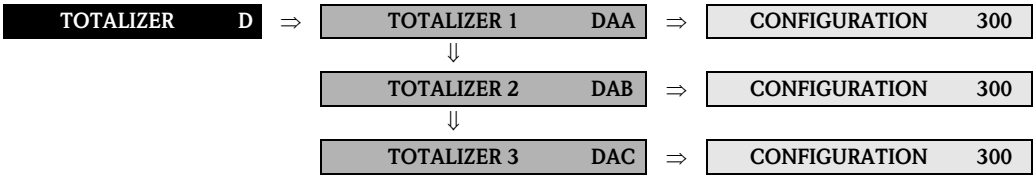
Function description USER INTERFACE → INFORMATION LINE → MULTIPLEX	
FORMAT **2622** MODBUS register: 2543 Data type: Integer Access: read/write	✎ Note! This function is not available unless a number was selected in the function ASSIGN (2600). Use this function to define the maximum number of places after the decimal point for the second value displayed in the information line. **Options:** 0 = XXXXX. 1 = XXXX.X 2 = XXX.XX 3 = XX.XXX 4 = X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. ■ The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In such instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.
DISPLAY MODE **2623** MODBUS register: 2546 Data type: Integer Access: read/write	✎ Note! This function is only available if VOLUME FLOW BARGRAPH IN % or MASS FLOW BARGRAPH IN % was selected in the function ASSIGN (2620). Use this function to define the format of the bar graph. **Options:** 0 = STANDARD 1 = SYMMETRY **Factory setting:** STANDARD **Illustration of bar graph** Bar graph for STANDARD option Simple bar graph with 25 / 50 / 75% gradations and integrated sign.  A0001258 Bar graph for SYMMETRY option Symmetrical bar graph for positive and negative directions of flow, with -50 / 0 / +50% gradations and integrated sign.  A0001259

6 Block TOTALIZER



6.1 Group TOTALIZER (1...3)

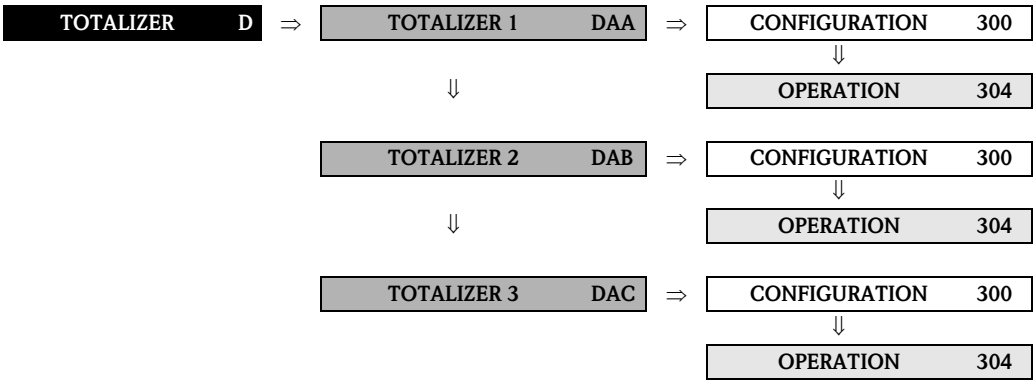
6.1.1 Function group CONFIGURATION



Function description TOTALIZER ➞ TOTALIZER (1...3) ➞ CONFIGURATION	
The function descriptions below apply to totalizers 1...3; the totalizers are independently configurable.	
ASSIGN **3000** MODBUS register: Totalizer 1 2601 Totalizer 2 2801 Totalizer 3 3001 Data type: Integer Access: read/write	Use this function to assign a measured variable to the totalizer in question. **Options:** 0 = OFF 1 = MASS FLOW 2 = VOLUME FLOW **Factory setting:** VOLUME FLOW ✎ Note! ■ The totalizer is reset to "0" as soon as the selection is changed. ■ If you select OFF in the function group CONFIGURATION of the totalizer in question, only the ASSIGN (3000) function remains visible.
UNIT TOTALIZER **3001** MODBUS register: ■ Totalizer 1 – Mass flow 2602 – Volume flow 2603 ■ Totalizer 2 – Mass flow 2802 – Volume flow 2803 ■ Totalizer 3 – Mass flow 3002 – Volume flow 3003 Data type: Integer Access: read/write	Use this function to define the unit for the totalizer's measured variable, as selected beforehand. **Options: (for MASS FLOW assignment):** 0...2 = metric → g; kg; t 3...5 = US → oz; lb; ton **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). **Options (for VOLUME FLOW assignment):** 0...6 = metric → cm^3; dm^3; m^3; ml; l; hl; Ml Mega 7...16 = US → cc; af; ft^3; oz f; gal; Kgal; Mgal; bbl (normal fluids); bbl (beer); bbl (petrochemicals); bbl (filling tanks) 17...20 = Imperial → gal; Mgal; bbl (beer); bbl (petrochemicals) **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.).

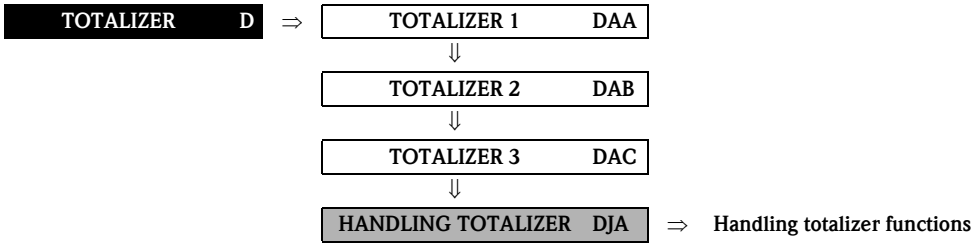
Function description TOTALIZER → TOTALIZER (1...3) → CONFIGURATION	
TOTALIZER MODE **3002** MODBUS register: Totalizer 1 2605 Totalizer 2 2805 Totalizer 3 3005 Data type: Integer Access: read/write	Use this function to define how the flow components are to be totaled. **Options:** 0 = BALANCE Positive and negative flow components. The positive and negative flow components are balanced. In other words, net flow in the flow direction is registered. 1 = FORWARD Positive flow components only 2 = REVERSE Negative flow components only **Factory setting:** Totalizer 1 = BALANCE Totalizer 2 = FORWARD Totalizer 3 = REVERSE
RESET TOTALIZER **3003** MODBUS register: Totalizer 1 2608 Totalizer 2 2808 Totalizer 3 3008 Data type: Integer Access: read/write	Use this function to reset the sum and the overflow of the totalizer to zero. **Options:** 0 = NO 1 = YES **Factory setting:** NO ✎ Note! If the device is equipped with a status input, with the appropriate configuration a reset for each individual totalizer can also be triggered by a pulse (see function ASSIGN STATUS INPUT on page 100).

6.1.2 Function group OPERATION



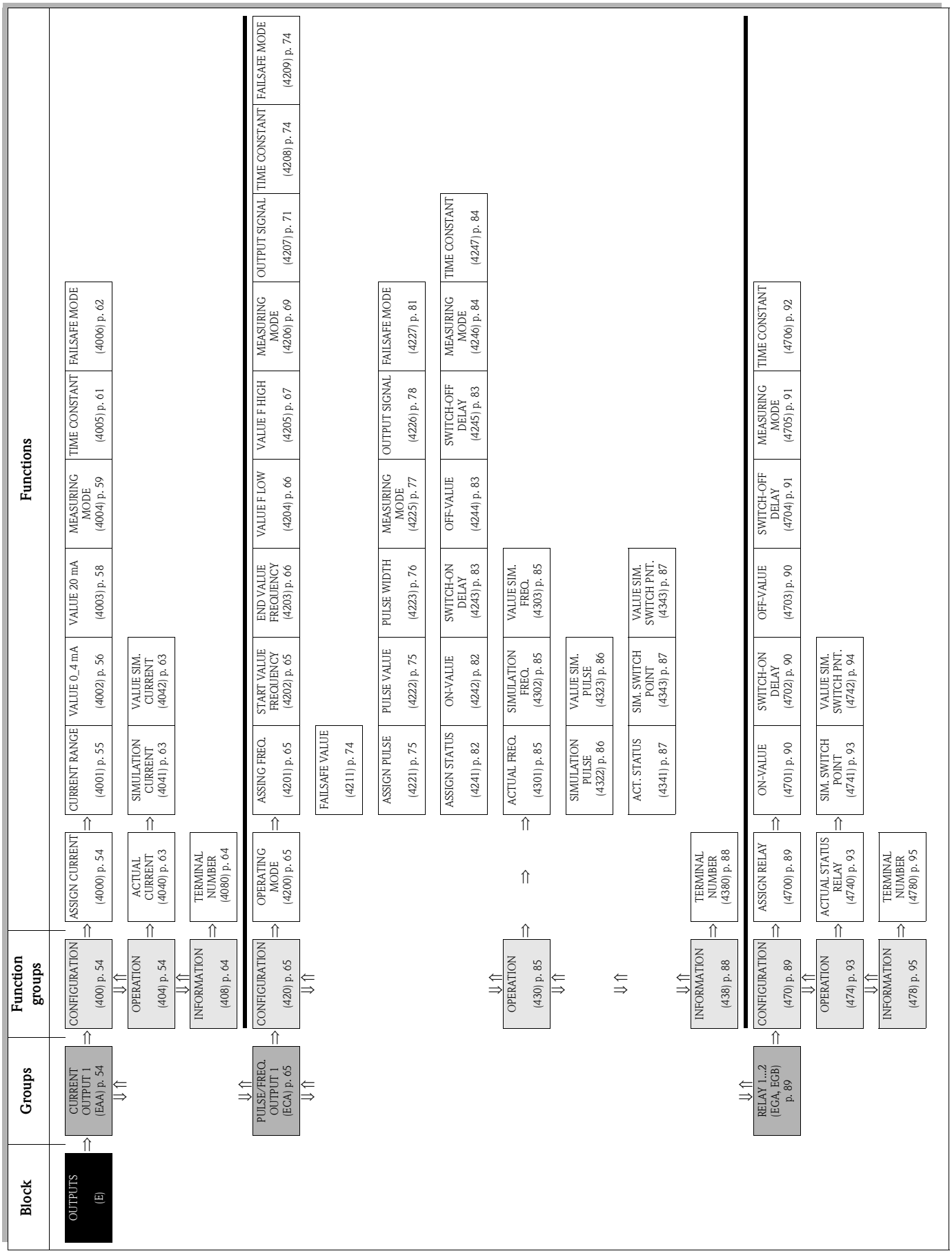
Function description TOTALIZER → TOTALIZER (1...3) → OPERATION	
The function descriptions below apply to totalizers 1...3; the totalizers are independently configurable.	
SUM **3040** MODBUS register: Totalizer 1 2610 Totalizer 2 2810 Totalizer 3 3010 Data type: Float Access: Read	Use this function to view the total for the totalizer's measured variable aggregated since measuring commenced. The value can be positive or negative, depending on the setting selected in the function "TOTALIZER MODE" (3002), and the direction of flow. **User interface:** max. 7-digit floating-point number, including sign and unit (e.g. 15467.04 m^3; –4925.631 kg) ✎ Note! ■ The effect of the setting in the "TOTALIZER MODE" function (see page 50) is as follows: – If the setting is "BALANCE", the totalizer balances flow in the positive and negative directions. – If the setting is "FORWARD", the totalizer registers only flow in the positive direction. – If the setting is "REVERSE", the totalizer registers only flow in the negative direction. ■ The totalizer's response to faults is defined in the "FAILSAFE MODE" function (3801), (see page 52).
OVERFLOW **3041** MODBUS register: Totalizer 1 2612 Totalizer 2 2812 Totalizer 3 3012 Data type: Float Access: Read	Use this function to view the overflow for the totalizer aggregated since measuring commenced. Total flow quantity is represented by a floating-point number consisting of max. 7 digits. You can use this function to view higher numerical values (>9,999,999) as overflows. The effective quantity is thus the total of OVERFLOW plus the value returned by the SUM function. Example: Reading for 2 overflows: 2 E7 dm^3 (= 20,000,000 dm^3) The value displayed in the function SUM = 196,845.7 dm^3 Effective total quantity = 20,196,845.7 dm^3 **User interface:** integer with exponent, including sign and unit, e.g. 2 E7 dm^3

6.2 Group HANDLING TOTALIZER



Function description TOTALIZER → HANDLING TOTALIZER → Handling totalizer functions		
RESET ALL TOTALIZERS MODBUS register: Data type: Access:	**3800** 2609 Integer read/write	Use this function to reset the totals (including all overflows) of the totalizers (1...3) to zero (= RESET). **Options:** 0 = NO 1 = YES **Factory setting:** NO ✎ Note! If the device is equipped with a status input and if it is appropriately configured, a reset for the totalizer (1...3) can also be triggered by a pulse (see function ASSIGN STATUS INPUT on page 100).
FAILSAFE MODE MODBUS register: Data type: Access:	**3801** 2607 Integer read/write	Use this function to define the common response of all totalizers (1...3) in case of error. **Options:** 0 = STOP The totalizer is paused until the fault is rectified. 1 = ACTUAL VALUE The totalizer continues to count is based on the current flow measured value. The fault is ignored. 2 = HOLD VALUE The totalizer continues to count the flow that is based on the last valid flow value (before the fault occurred). **Factory setting:** STOP

7 Block OUTPUTS



7.1 Group CURRENT OUTPUT 1

7.1.1 Function group CONFIGURATION

OUTPUTS E ⇒ **CURRENT OUTPUT 1 EAA** ⇒ **CONFIGURATION 400**

Function description OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION	
ASSIGN CURRENT OUTPUT **4000** MODBUS register: 5801 Data type: Integer Access: read/write	Use this function to assign a measured variable to the current output. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** VOLUME FLOW ✎ Note! If you select OFF, the only function shown in the function group CONFIGURATION (400) is this function, in other words, ASSIGN CURRENT OUTPUT (4000).

Function description

OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION

CURRENT RANGE **4001**

MODBUS register: 5802
Data type: Integer
Access: read/write

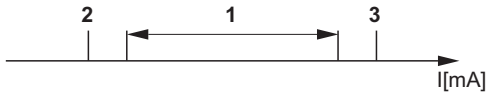
Use this function to define the current range. The selection specifies the operational range and the lower and upper signal on alarm. For the current output 1 the option HART can be defined additionally.

Options
0 = 0–20 mA (25 mA)
1 = 4–20 mA (25 mA)
3 = 0–20 mA
4 = 4–20 mA
6 = 4–20 mA NAMUR
8 = 4–20 mA US

Factory setting:
4–20 mA NAMUR

✎ Note!
When switching the hardware from an active (factory setting) to a passive output signal, select a current range of 4–20 mA (please refer to the Operating Instructions BA117D/06/en).

Current range, operational range and signal on alarm level



a	1	2	3
0-20 mA (25 mA)	0 - 24 mA	0	25
4-20 mA (25 mA)	4 - 24 mA	2	25
0-20 mA	0 - 20.5 mA	0	22
4-20 mA	4 - 20.5 mA	2	22
4-20 mA NAMUR	3.8 - 20.5 mA	3.5	22.6
4-20 mA US	3.9 - 20.8 mA	3.75	22.6

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a Current range
1 Operational range (measuring information)
2 Lower signal on alarm level
3 Upper signal on alarm level

✎ Note!
- If the measured value exceeds the measuring range (as defined in the functions VALUE 0_4 mA (4002) and VALUE 20 mA (4003) a notice message is generated (#351–354, current range).
- In case of a fault the behavior of the current output is according to the selected option in the function FAILSAFE MODE (4006).

Function description

OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION

VALUE 0_4 mA **4002**

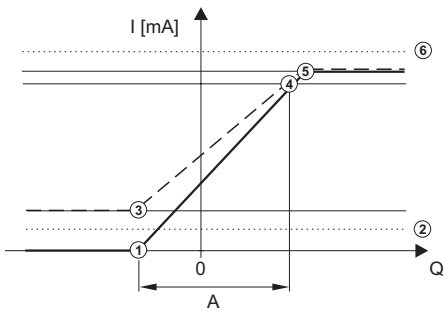
MODBUS register: 5803
Data type: Float
Access: read/write

Use this function to assign the 0/4 mA current a value.
The value can be higher or lower than the value assigned to 20 mA (function VALUE 20 mA (4003)). Positive and negative values are permissible, depending on the measured variable in question (e.g. volume flow).

Example:
4 mA assigned value = –250 l/h
20 mA assigned value = +750 l/h
Calculated current value = 8 mA (at zero flow)

Note that values with different signs cannot be entered for 0/4 mA and 20 mA (function 4003) if SYMMETRY is the setting selected for the MEASURING MODE function (4004). In this case, the message "INPUT RANGE EXCEEDED" appears on the display.

Example for STANDARD measuring mode:



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① = *Initial value (0...20 mA)*
② = *Lower signal on alarm level: depends on the setting in the function CURRENT RANGE*
③ = *Initial value (4...20 mA): depends on the setting in the function CURRENT RANGE*
④ = *Full scale value (0/4...20 mA): depends on the setting in the function CURRENT RANGE*
⑤ = *Maximum current value: depends on the setting in the function CURRENT RANGE*
⑥ = *Failsafe mode (upper signal on alarm level): depends on the setting in the functions CURRENT RANGE (s. page 55) and FAILSAFE MODE, (s. page 62)*

A = Measuring range (the minimum measuring range has to exceed the value that correlates with a flow velocity of 0.3 m/s)

User input:
5-digit floating-point number, with sign

Factory setting:
0 [unit]

✎ Note!
- The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400), (see page 15 or page 14).

Caution!
The current output responds differently, depending on the parameters set in the various functions. Some examples of parameter settings and their effect on the current output are given in the following section.

(continued on next page)

Function description

OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION

VALUE 0_4 mA **4002**
(continued)

Parameter setting example A:
1. VALUE 0_4 mA (4002) = not equal to zero flow (e.g. –5 m^3/h)
   VALUE 20 mA (4003) = not equal to zero flow (e.g. 10 m^3/h) or
2. VALUE 0_4 mA (4002) = not equal to zero flow (e.g. 100 m^3/h)
   VALUE 20 mA (4003) = not equal to zero flow (e.g. –40 m^3/h)

and
MEASURING MODE (4004) = STANDARD

When you enter the values for 0/4 mA and 20 mA, the working range of the measuring device is defined. If the effective flow drops below or exceeds this working range (see ①), a fault/notice message is generated (#351-354, current range) and the current output responds in accordance with the parameter settings in the function FAILSAFE MODE (4006).

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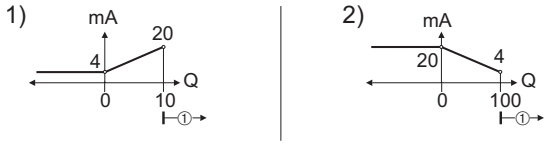
Parameter setting example B:
1. VALUE 0_4 mA (4002) = equal to zero flow (e.g. 0 m^3/h)
   VALUE 20 mA (4003) = not equal to zero flow (e.g. 10 m^3/h) or
2. VALUE 0_4 mA (4002) = not equal to zero flow (e.g. 100 m^3/h)
   VALUE 20 mA (4003) = equal to zero flow (e.g. 0 m^3/h)

and
MEASURING MODE (4004) = STANDARD

When you enter the values for 0/4 mA and 20 mA, the working range of the measuring device is defined. In doing so, one of the two values is parameterized as zero flow (e.g. 0 m^3/h).
If the effective flow drops below or exceeds the value parameterized as the zero flow, no fault/notice message is generated and the current output retains its value.
If the effective flow drops below or exceeds the other value, a fault/notice message is generated (#351-354, current range) and the current output responds in accordance with the parameter settings in the function FAILSAFE MODE (4006).



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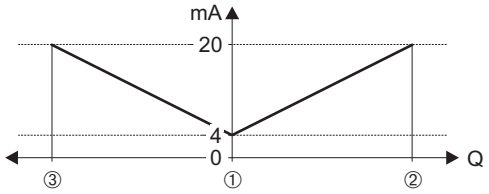
Deliberately only one flow direction is output with this setting and flow values in the other flow direction are suppressed.

Parameter setting example C:
MEASURING MODE (4004) = SYMMETRY
The current output signal is independent of the direction of flow (absolute amount of the measured variable). The 0_4 mA value ① and the 20 mA value ② must have the same sign (+ or -). The "20 mA value" ③ (e.g. backflow) corresponds to the mirrored 20 mA value ② (e.g. flow).



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ASSIGN RELAY (4700) = FLOW DIRECTION
With this setting e.g. the flow direction output via a switching contact can be made.

Parameter setting example D:
MEASURING MODE (4004) = PULSATING FLOW → page 59 ff.

Function description OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION		
VALUE 20 mA	**4003**	Use this function to assign the 20 mA current a value. The value can be higher or lower than the value assigned to 0/4 mA (function VALUE 0_4 mA (4002), see page 56). Positive and negative values are permissible, depending on the measured variable in question (e.g. volume flow). Example: 4 mA assigned value = –250 l/h 20 mA assigned value = +750 l/h Calculated current value = 8 mA (at zero flow) Note that values with different signs cannot be entered for 0/4 mA (function 4002) and 20 mA, if SYMMETRY is the setting selected in the function MEASURING MODE (4004). In this case, the message “INPUT RANGE EXCEEDED” appears. Example for STANDARD measuring mode → page 56 **User input:** 5-digit floating-point number, with sign **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). ✎ Note! ▪ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400). Caution! It is very important to read and comply with the information in the function VALUE 0_4 mA (under “Caution”; Examples of parameter settings) on page 56.
MODBUS register: Data type: Access:	5805 Float read/write	

Function description

OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION

MEASURING MODE **4004**

MODBUS register: 5807
Data type: Integer
Access: read/write

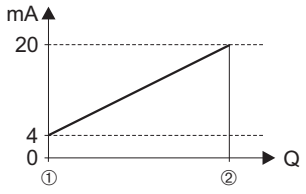
Use this function to define the measuring mode for the current output.

Options:
0 = STANDARD
1 = SYMMETRY
2 = PULSATING FLOW

Factory setting:
STANDARD

Description of the individual options:

- STANDARD The current output signal is proportional to the measured variable. The flow components outside the scaled measuring range (defined by the 0_4 mA VALUE ① and the 20 mA VALUE ②) are taken into account as follows for signal output.
  - If one of the values is defined as equal to the zero flow (e.g. VALUE 0_4 mA = 0 m^3/h), no message is given if this value is exceeded or not achieved and the current output retains its value (4 mA in the example).
    If the other value is exceeded or not achieved, the message "CURRENT OUTPUT AT FULL SCALE VALUE" appears and the current output responds in accordance with the parameter setting in the function FAILSAFE MODE (4006).
  - If both values defined are not equal to the zero flow (for example VALUE 0_4 mA= –5 m^3/h; VALUE 20 mA = 10m^3/h), the message "CURRENT OUTPUT AT FULL SCALE VALUE" appears if the measuring range is exceeded or not achieved and the current output responds in accordance with the parameter setting in the function FAILSAFE MODE (4006).



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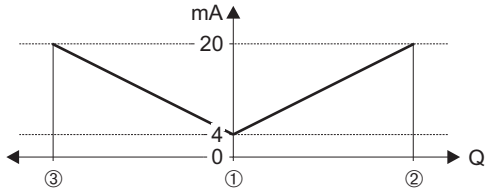
- SYMMETRY
  The current output signal is independent of the direction of flow (absolute amount of the measured variable). The 0_4 mA value ① and the 20 mA value ② must have the same sign (+ or –). The "20 mA value" ③ (e.g. backflow) corresponds to the mirrored 20 mA value ② (e.g. flow).



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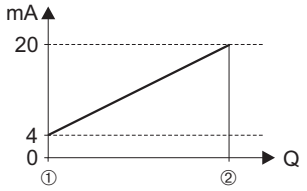
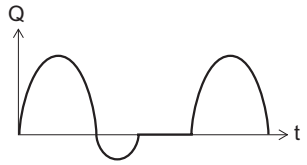
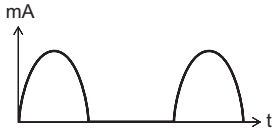
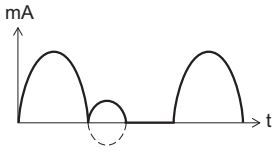
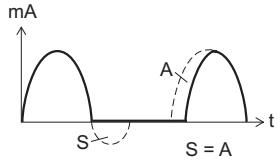
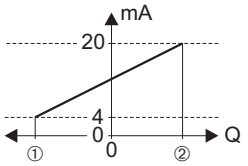
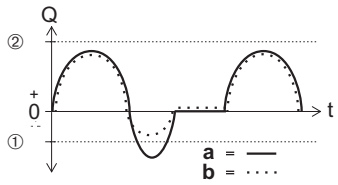
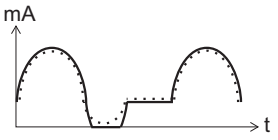
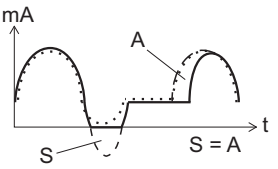
✎ Note!

- The direction of flow can be output via the configurable relay or status outputs.
- SYMMETRY cannot be selected unless the values in the VALUE 0_4 mA (4002) and VALUE 20 mA (4003) functions have the same sign or one of the values is zero. If the values have different signs, SYMMETRY cannot be selected and an "ASSIGNMENT NOT POSSIBLE" message is displayed.

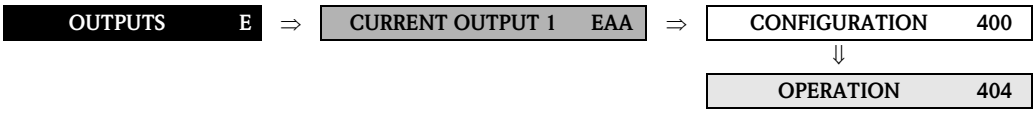
(continued on next page)

Function description OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION	
MEASURING MODE **4004** (continued)	■ PULSATING FLOW If flow is characterized by severe fluctuations as is the case, for example, with reciprocating pumps, flow components outside the measuring range are buffered, balanced and output after a maximum delay of 60 seconds. If the buffered data cannot be processed within approx. 60 seconds, a fault/notice message appears. Under certain plant conditions, flow values can aggregate in the buffer, for example in the case of prolonged and unwanted fluid backflow. However, this buffer is reset in all relevant programming adjustments which affect the current output.
Detailed explanations and information	**How the current output responds under the following postulated conditions:** 1. Defined measuring range (①–②): ① and ② have the **same** sign  A0001248 and the following flow behavior:  A0001265 ■ STANDARD The current output signal is proportional to the measured variable. The flow components outside the scaled measuring range are not taken into account for signal output.  A0001267 ■ SYMMETRY The current output signal is independent of the direction of flow.  A0001268 ■ PULSATING FLOW Flow components outside the measuring range are buffered, balanced and output after a maximum delay of 60 seconds.  A0001269 (continued on next page)

Function description OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION	
Detailed explanations and information (continued)	2. Defined measuring range (①–②): ① and ② do **not** have the **same** sign.  A0001272 Flow a (—) outside, b (- -) within the measuring range.  A0001273 ■ STANDARD a (—): The flow components outside the scaled measuring range cannot be taken into account for signal output. A fault message is generated (# 351...354, current range) and the current output responds in accordance with the parameter settings in the function FAILSAFE MODE (4006). b (- -): The current output signal is proportional to the measured variable assigned.  A0001274 ■ SYMMETRY This option is not available under these circumstances, because the 0_4 mA value and the 20 mA value have different signs. ■ PULSATING FLOW Flow components outside the measuring range are buffered, balanced and output after a maximum delay of 60 seconds.  A0001275
TIME CONSTANT **4005** MODBUS register: 5808 Data type: Float Access: read/write	Use this function to enter a time constant defining how the current output signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). **User input:** fixed-point number 0.01...100.00 s **Factory setting:** 3.00 s

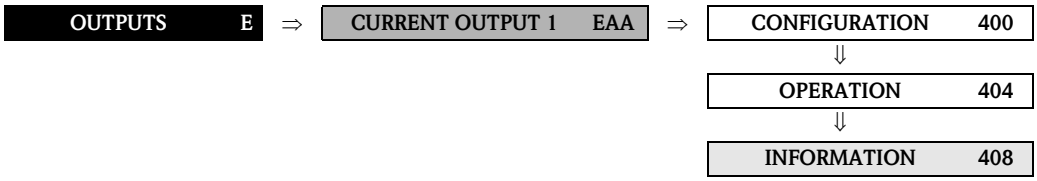
Function description OUTPUTS → CURRENT OUTPUT 1 → CONFIGURATION		
FAILSAFE MODE	**4006**	For safety reasons it is advisable to ensure that the current output assumes a predefined state in the event of a fault. The setting you select here affects only the current output. It has no effect on other outputs and the display (e.g. totalizers). **Options:** 0 = MIN. CURRENT The current output adopts the value of the lower signal on alarm level (as defined in the function CURRENT RANGE (4001, page 55). 1 = MAX. CURRENT The current output adopts the value of the upper signal on alarm level (as defined in the function CURRENT RANGE (4001, page 55). 2 = HOLD VALUE (**not recommended**) Measured value output is based on the last measured value saved before the error occurred . 3 = ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored. **Factory setting:** MIN. CURRENT
MODBUS register: Data type: Access:	5810 Integer read/write	

7.1.2 Function group OPERATION



Function description OUTPUTS → CURRENT OUTPUT 1 → OPERATION	
ACTUAL CURRENT **4040** MODBUS register: 5811 Data type: Float Access: Read	Use this function to view the computed actual value of the output current. **User interface:** 0.00...25.00 mA
SIMULATION CURRENT **4041** MODBUS register: 5813 Data type: Integer Access: read/write	Use this function to activate simulation of the current output. **Options:** 0 = OFF 1 = ON **Factory setting:** OFF ✎ Note! ■ The "SIMULATION CURRENT OUTPUT" message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
VALUE SIMULATION CURRENT **4042** MODBUS register: 5814 Data type: Float Access: read/write	✎ Note! The function is not visible unless the SIMULATION CURRENT function (4041) is active (= ON). Use this function to define a freely selectable value (e.g. 12 mA) to be output at the current output. This value is used to test downstream devices and the measuring device itself. **User input:** 0.00...25.00 mA **Factory setting:** 0.00 mA ☝ Caution! The setting is not saved if the power supply fails.

7.1.3 Function group INFORMATION

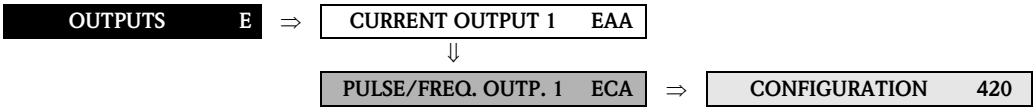


Function description
OUTPUTS → CURRENT OUTPUT 1 → INFORMATION

TERMINAL NUMBER	**4080**	Use this function to display the numbers of the terminals (in the connection compartment) which are used by the current output.
MODBUS register:	5816	**User interface:**
Data type:	Integer	3 = 20(+) / 21 (–)
Access:	Read	

7.2 Group PULSE/FREQUENCY OUTPUT 1

7.2.1 Function group CONFIGURATION



Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)	
OPERATING MODE **4200** MODBUS register: 3201 Data type: Integer Access: read/write	Use this function to configure the output as a pulse output, frequency output or status output. The functions available in this function group vary, depending on which option you select here. **Options:** 0 = PULSE 1 = FREQUENCY 2 = STATUS **Factory setting:** PULSE
ASSIGN FREQUENCY **4201** MODBUS register: 3202 Data type: Integer Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to assign a measured variable to the frequency output. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** VOLUME FLOW ✎ Note! If you select OFF, the only function shown in the CONFIGURATION function group is this function, in other words ASSIGN FREQUENCY (4201).
START VALUE FREQUENCY **4202** MODBUS register: 3203 Data type: Float Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to define an initial frequency for the frequency output. You define the associated measured value of the measuring range in the VALUE F LOW function (4204) described on page 66. **User input:** 5-digit fixed-point number: 0...10000 Hz **Factory setting:** 0 Hz Example: ■ VALUE F LOW = 0 l/h, initial frequency = 0 Hz: i.e. a frequency of 0 Hz is output at a flow of 0 l/h. ■ VALUE F LOW = 1 l/h, initial frequency = 10 Hz: i.e. a frequency of 10 Hz is output at a flow of 1 l/h.

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)	
END VALUE FREQUENCY **4203** MODBUS register: 3205 Data type: Float Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to define a full scale frequency for the frequency output. You define the associated measured value of the measuring range in the VALUE F HIGH function (4205) described on page 67. **User input:** 5-digit fixed-point number 2...10000 Hz **Factory setting:** 10000 Hz Example: ■ VALUE F HIGH = 1000 l/h, full scale value frequency = 1000 Hz: i.e. a frequency of 1000 Hz is output at a flow of 1000 l/h. ■ VALUE F HIGH = 3600 l/h, full scale value frequency = 1000 Hz: i.e. a frequency of 1000 Hz is output at a flow of 3600 l/h. ✎ Note! In the FREQUENCY operating mode the output signal is symmetrical (on/off ratio = 1:1). At low frequencies the pulse duration is limited to a maximum of 2 seconds, i.e. the on/off ratio is no longer symmetrical.
VALUE F LOW **4204** MODBUS register: 3207 Data type: Float Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to assign a variable to the start value frequency (4202). The value can be higher or lower than the value assigned to the VALUE F HIGH. Positive and negative values are permissible, depending on the measured variable in question (e.g. volume flow). You define a measuring range by defining the VALUE F LOW and VALUE F HIGH values. **User input:** 5-digit floating-point number **Factory setting:** 0 [unit] ✎ Note! ■ For graphic illustration of VALUE F LOW see function VALUE F HIGH. ■ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400), (see page 15 or page 14).

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

VALUE F HIGH **4205**

MODBUS register:	3209
Data type:	Float
Access:	read/write

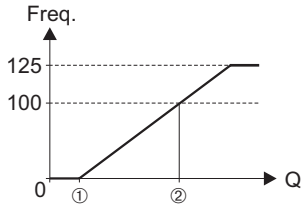
✎ Note!
This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200).

Use this function to assign a variable to the end value frequency (4203).
The value can be higher or lower than the value assigned to the VALUE F LOW. Positive and negative values are permissible, depending on the measured variable in question (e.g. volume flow). You define a measuring range by defining the VALUE F LOW and VALUE F HIGH values.

User input:
5-digit floating-point number

Factory setting:
Depends on nominal diameter and country (s. page 150 ff.).

✎ Note!
Note that values with different signs cannot be entered for VALUE F LOW and VALUE F HIGH, if SYMMETRY is the setting selected for the MEASURING MODE function (4206). In this case, the message “INPUT RANGE EXCEEDED” appears on the display.



A0001279

① = *Value F Low*
② = *Value F High*

(continued on next page)

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

VALUE F HIGH **4205**
(continued)

Parameter setting example 1:
1. VALUE F LOW (4204) = not equal to zero flow (e.g. –5 m^3/h)
   VALUE F HIGH (4205) = not equal to zero flow (e.g. 10 m^3/h) or
2. VALUE F LOW (4204) = not equal to zero flow (e.g. 100 m^3/h)
   VALUE F HIGH (4205) = not equal to zero flow (e.g. –40 m^3/h)

and
MEASURING MODE (4004) = STANDARD

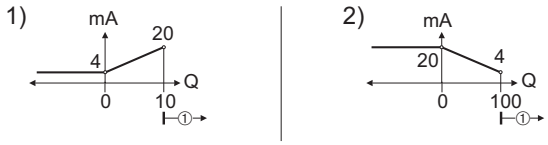
When you enter the values for VALUE F LOW and VALUE F HIGH the working range of the measuring device is defined. If the effective flow drops below or exceeds this working range (see ①), a fault or notice message is generated (#355-358, frequency area) and the frequency output responds in accordance with the parameter settings in the function FAILSAFE MODE (4209).

A0001262

Parameter setting example 2:
1. VALUE F LOW (4204) = not equal to zero flow s (e.g. 0 m^3/h)
   VALUE F HIGH (4205) = not equal to zero flow (e.g. 10 m^3/h) or
2. VALUE F LOW (4204) = not equal to zero flow (e.g. 100 m^3/h)
   VALUE F HIGH (4205) = not equal to zero flow s (e.g. 0 m^3/h)

and
MEASURING MODE (4004) = STANDARD

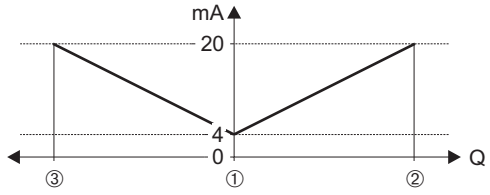
When you enter the values for VALUE F LOW and VALUE F HIGH the working range of the measuring device is defined. In doing so, one of the two values is parameterized as zero flow (e.g. 0 m^3/h).
If the effective flow drops below or exceeds the value parameterized as the zero flow, no fault/notice message is generated and the frequency output retains its value.
If the effective flow drops below or exceeds the other value, a fault/notice message is generated (#355-358, frequency area) and the frequency output responds in accordance with the parameters set in the function FAILSAFE MODE (4209).



A0001264

Deliberately only one flow direction is output with this setting and flow values in the other flow direction are suppressed.

Parameter setting example 3:
MEASURING MODE (4206) = SYMMETRY
The frequency output signal is independent of the direction of flow (absolute amount of the measured variable). The VALUE F LOW ① and VALUE F HIGH ② must have the same sign (+ or -). The "VALUE F HIGH" ③ (e.g. backflow) corresponds to the mirrored VALUE F HIGH ② (e.g. flow).



A0001249

ASSIGN RELAY (4700) = FLOW DIRECTION
With this setting e.g. the flow direction output via a switching contact can be made.

Parameter setting example 4:
MEASURING MODE (4004) = PULSATING FLOW → page 59 ff.

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

MEASURING MODE **4206**

MODBUS register: 3211
Data type: Integer
Access: read/write

✎ Note!
This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200).

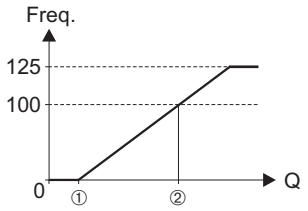
Use this function to define the measuring mode for the frequency output.

Options:
0 = STANDARD
1 = SYMMETRY
2 = PULSATING FLOW

Factory setting:
STANDARD

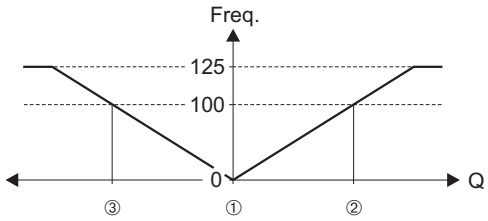
Description of the individual options:

- STANDARD
  The frequency output signal is proportional to the measured variable. The flow components outside the scaled measuring range (defined by the VALUE F LOW. ① and VALUE F HIGH. ②) are not taken into account for signal output.
  – If one of the values is defined as equal to the zero flow (e.g. VALUE F LOW = 0 m^3/h), no message is given if this value is exceeded or not achieved and the frequency output retains its value (0 Hz in the example). If the other value is exceeded or not achieved, the message "FREQUENCY OUTPUT AT FULL SCALE VALUE" appears and the frequency output responds in accordance with the parameter setting in the function FAILSAFE MODE (4209).
  – If both values defined are not equal to the zero flow (for example VALUE F LOW = –5 m^3/h; VALUE F HIGH = 10 m^3/h) the message "FREQUENCY OUTPUT AT FULL SCALE VALUE" appears if the measuring range is exceeded or not achieved and the frequency output responds in accordance with the parameter settings in the function FAILSAFE MODE (4209).



A0001279

- SYMMETRY
  The frequency output signal is independent of the direction of flow (absolute amount of the measured variable). The VALUE F LOW ① and VALUE F HIGH ② must have the same sign (+ or –). The VALUE F HIGH ③ (e.g. backflow) corresponds to the mirrored VALUE F HIGH ② (e.g. forward flow).



A0001280

✎ Note!
- The direction of flow can be output via the configurable relay or status outputs.
- SYMMETRY cannot be selected unless the values in the VALUE F LOW (4204) and VALUE F HIGH (4205) functions have the same sign or one of the values is zero. If the values have different signs, SYMMETRY cannot be selected and an "ASSIGNMENT NOT POSSIBLE" message is displayed.

(continued on next page)

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)		
MEASURING MODE (continued)	**4206**	▪ PULSATING FLOW If flow is characterized by severe fluctuations as is the case, for example, with reciprocating pumps, flow components outside the measuring range are buffered, balanced and output after a maximum delay of 60 seconds. If the buffered data cannot be processed within approx. 60 seconds, a fault/notice message appears. Under certain plant conditions, flow values can aggregate in the buffer, for example in the case of prolonged and unwanted fluid backflow. However, this buffer is reset in all relevant programming adjustments which affect the frequency output.

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

OUTPUT SIGNAL **4207**

MODBUS register: 3212
Data type: Integer
Access: read/write

✎ Note!
Function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200).

For selecting the output configuration of the frequency output.

Options:
0 = PASSIVE - POSITIVE
1 = PASSIVE - NEGATIVE
2 = ACTIVE - POSITIVE
3 = ACTIVE - NEGATIVE

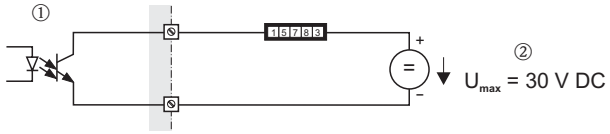
Factory setting:
PASSIVE - POSITIVE

Explanation
- PASSIVE = power is supplied to the frequency output by means of an external power supply.
- ACTIVE = power is supplied to the frequency output by means of the device-internal power supply.

Configuring the output signal level (POSITIVE or NEGATIVE) determines the quiescent behavior (at zero flow) of the frequency output.
The internal transistor is activated as follows:
- If POSITIVE is selected, the internal transistor is activated with a **positive** signal level.
- If NEGATIVE is selected, the internal transistor is activated with a **negative** signal level (0 V).

✎ Note!
With the passive output configuration, the output signal levels of the frequency output depend on the external circuit (see examples).

Example for passive output circuit (PASSIVE)
If PASSIVE is selected, the frequency output is configured as an open collector.

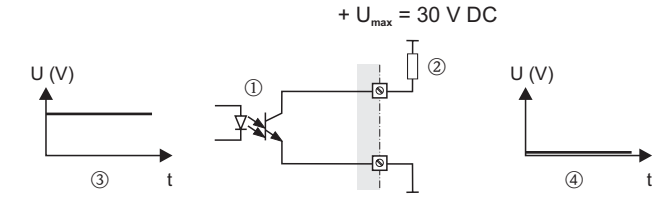


A0001225

① = *Open Collector*
② = *External power supply*

✎ Note!
For continuous currents up to 25 mA (I_{max} = 250 mA / 20 ms).

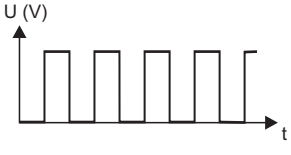
Example for output configuration PASSIVE-POSITIVE:
Output configuration with an external pull-up resistance.
In the quiescent state (at zero flow), the output signal level at the terminals is 0 V.



A0004687

① = *Open Collector*
② = *Pull-Up-Resistance*
③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level.



A0001975

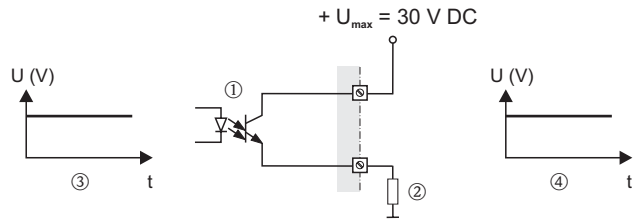
(continued on next page)

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

OUTPUT SIGNAL **4207**
(continued)

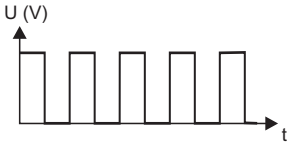
Example for output configuration PASSIVE-POSITIVE:
Output configuration with an external pull-down resistance.
In the quiescent state (at zero flow), a positive voltage level is measured via the pull-down resistance.



A0004689

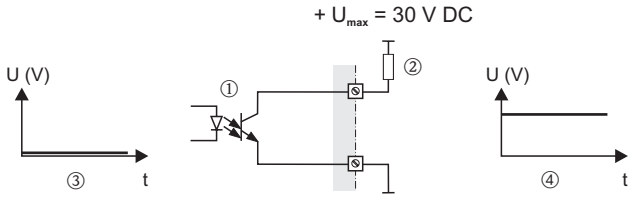
① = *Open Collector*
② = *Pull-Down-Resistance*
③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.



A0001981

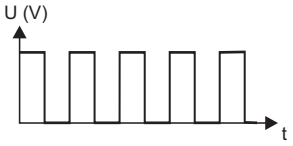
Example for output configuration PASSIVE-NEGATIVE:
Output configuration with an external pull-up resistance.
In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.



A0004690

① = *Open Collector*
② = *Pull-Up-Resistance*
③ = *Transistor activation in "NEGATIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.



A0001981

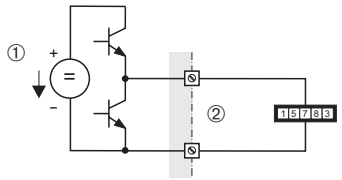
(continued on next page)

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)

OUTPUT SIGNAL **4207**
(continued)

Example for active output circuit (ACTIVE):
With an active circuit, the internal power supply is 24 V.
The frequency output is short-circuit proof.



A0004691

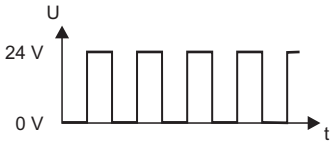
① = *24 V DC internal power supply*
② = *Short-circuit proof output*

The signal levels are to be seen as analogous to the passive circuit.

The following applies for the output configuration **ACTIVE-POSITIVE**:
In the quiescent state (at zero flow), the output signal level at the terminals is 0 V.

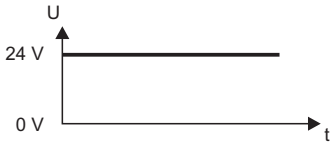
A0004694

In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level.



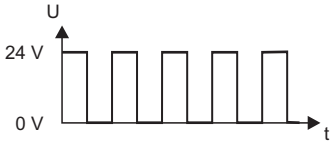
A0004692

The following applies for the output configuration **ACTIVE-NEGATIVE**:
In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.



A0004693

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.



A0004710

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (GENERAL / FREQUENCY)	
TIME CONSTANT **4208** MODBUS register: 3213 Data type: Float Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to enter a time constant defining how the frequency output signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). **User input:** fixed-point number 0.00...100.00 s **Factory setting:** 1.00 s
FAILSAFE MODE **4209** MODBUS register: 3215 Data type: Integer Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). For safety reasons it is advisable to ensure that the frequency output assumes a predefined state in the event of a fault. The setting you select here affects only the frequency output. It has no effect on other outputs and the display (e.g. totalizers). **Options:** 0 = FALLBACK VALUE Output is 0 Hz. 1 = FAILSAFE VALUE Output is the frequency specified in the FAILSAFE VALUE function (4211). 2 = HOLD VALUE Measured value output is based on the last measured value saved before the error occurred . 3 = ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored. **Factory setting:** FALLBACK VALUE
FAILSAFE VALUE **4211** MODBUS register: 3216 Data type: Float Access: read/write	✎ Note! This function is not available unless FREQUENCY was selected in the OPERATING MODE function (4200) and FAILSAFE VALUE was selected in the FAILSAFE MODE function (4209). Use this function to define the frequency that the measuring device outputs in the event of an error. **User input:** max. 5-digit number: 0...12500 Hz **Factory setting:** 12500 Hz

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)	
ASSIGN PULSE **4221** MODBUS register: 3223 Data type: Integer Access: read/write	✎ Note! This function is not available unless the PULSE setting was selected in the OPERATING MODE function (4200). Use this function to assign a measured variable to the pulse output. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** VOLUME FLOW ✎ Note! If you select OFF, the only function shown in the CONFIGURATION function group is this function, in other words ASSIGN PULSE (4221).
PULSE VALUE **4222** MODBUS register: 3224 Data type: Float Access: read/write	✎ Note! This function is not available unless the PULSE setting was selected in the OPERATING MODE function (4200). Use this function to define the flow at which a pulse is triggered. These pulses can be totaled by an external totalizer, and the total flow quantity since measuring started can be registered in this way. **User input:** 5-digit floating-point number [unit] **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). ✎ Note! The appropriate unit is taken from the function UNIT VOLUME (0403) or UNIT MASS (0401) (see page 16 or page 14).

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)

PULSE WIDTH **4223**

MODBUS register: 3226
Data type: Float
Access: read/write

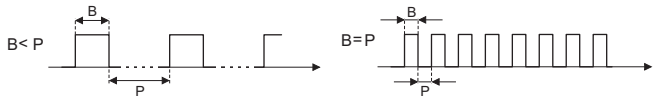
✎ Note!
This function is not available unless the PULSE setting was selected in the OPERATING MODE function (4200).

Use this function to enter the pulse width of the output pulse.

User input:
0.05...2000 ms

Factory setting:
100 ms

Pulse output is **always** with the pulse width (B) entered in this function. The pauses (P) between the individual pulses are automatically configured. However, they must at least correspond to the pulse width (B = P).



A0001233

B = Pulse width entered (the illustration applies to positive pulses)
P= Intervals between the individual pulses

✎ Note!
When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC, etc.).

Caution!
If the pulse number or frequency resulting from the pulse value entered, (see function PULSE VALUE (4222) on page 75) and from the current flow is too large to maintain the pulse width selected (the interval P is smaller than the pulse width B entered), a system error message (# 359...362, pulse memory) is generated after buffering/balancing has occurred.

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)	
MEASURING MODE **4225** MODBUS register: 3228 Data type: Integer Access: read/write	✎ Note! This function is not available unless the PULSE setting was selected in the OPERATING MODE function (4200). Use this function to define the measuring mode for the pulse output. **Options:** 0 = STANDARD Only positive flow components are totaled. Negative components are not taken into account. 1 = SYMMETRY Positive and negative flow components are taken into account. ✎ Note! The direction of flow can be output via the relay output. 2 = PULSATING FLOW If flow is characterized by severe fluctuations as is the case, for example, with reciprocating pumps, the positive and negative flow components are totaled, with the signs taken into account (e.g. –10 l and +25 l = 15 l). Flow components outside the maximum pulse number per second (value/width) are buffered, balanced and output after a maximum delay of 60 seconds. If the buffered data cannot be processed within approx. 60 seconds, a fault/notice message appears. Under certain plant conditions, flow values can aggregate in the buffer, for example in the case of prolonged and unwanted fluid backflow. However, this buffer is reset in all relevant programming adjustments which affect the pulse output. 3 = STANDARD REVERSE Only negative flow components are totaled. Positive components are not taken into account. **Factory setting:** STANDARD

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)

OUTPUT SIGNAL **4226**

MODBUS register: 3229
Data type: Integer
Access: read/write

✎ Note!
Function is not available unless the PULSE setting was selected in the OPERATING MODE (4200) function.

For selecting the output configuration of the pulse output.

Options:
0 = PASSIVE - POSITIVE
1 = PASSIVE - NEGATIVE
2 = ACTIVE - POSITIVE
3 = ACTIVE - NEGATIVE

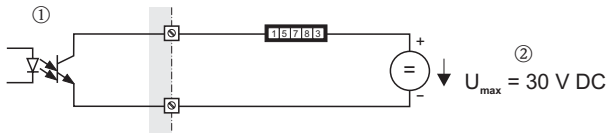
Factory setting: PASSIVE - POSITIVE

Explanation
- PASSIVE = power is supplied to the pulse output by means of an external power supply.
- ACTIVE = power is supplied to the pulse output by means of the device-internal power supply.

Configuring the output signal level (POSITIVE or NEGATIVE) determines the quiescent behavior (at zero flow) of the pulse output.
The internal transistor is activated as follows:
- If POSITIVE is selected, the internal transistor is activated with a **positive** signal level.
- If NEGATIVE is selected, the internal transistor is activated with a **negative** signal level (0 V).

✎ Note!
With the passive output configuration, the output signal levels of the pulse output depend on the external circuit (see examples).

Example for passive output circuit (PASSIVE)
If PASSIVE is selected, the pulse output is configured as an open collector.

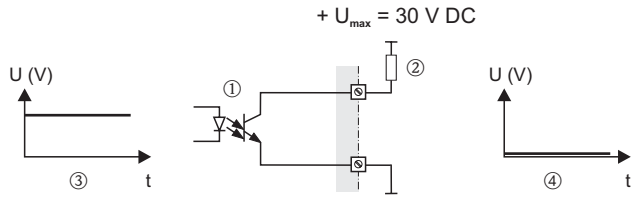


A0001225

① = *Open Collector*
② = *External power supply*

✎ Note!
For continuous currents up to 25 mA (I_{max} = 250 mA / 20 ms).

Example for output configuration PASSIVE-POSITIVE:
Output configuration with an external pull-up resistance.
In the quiescent state (at zero flow), the output signal level at the terminals is 0 V.



A0004687

① = *Open Collector*
② = *Pull-Up-Resistance*
③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level.

A0001975

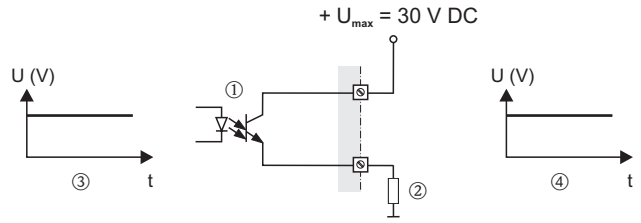
(continued on next page)

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)

OUTPUT SIGNAL 4226
(continued)

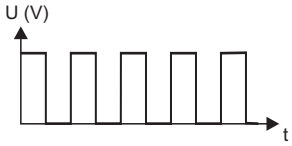
Example for output configuration PASSIVE-POSITIVE:
Output configuration with an external pull-down resistance.
In the quiescent state (at zero flow), a positive voltage level is measured via the pull-down resistance.



A0004689

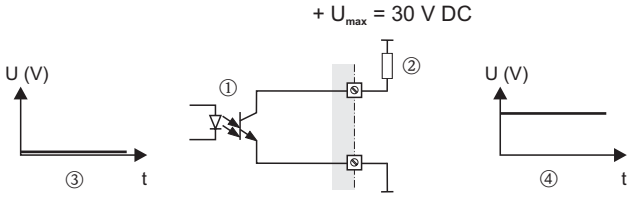
① = *Open Collector*
② = *Pull-Down-Resistance*
③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.



A0001981

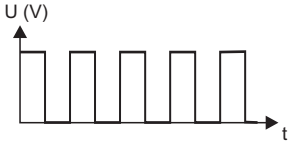
Example for output configuration PASSIVE-NEGATIVE:
Output configuration with an external pull-up resistance.
In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.



A0004690

① = *Open Collector*
② = *Pull-Up-Resistance*
③ = *Transistor activation in "NEGATIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.



A0001981

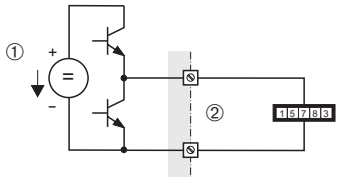
(continued on next page)

Function description

OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)

OUTPUT SIGNAL **4226**
(continued)

Example for active output circuit (ACTIVE):
With an active circuit, the internal power supply is 24 V.
The pulse output is short-circuit proof.



A0004691

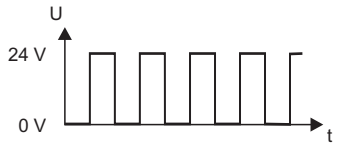
① = *24 V DC internal power supply*
② = *Short-circuit proof output*

The signal levels are to be seen as analogous to the passive circuit.

The following applies for the output configuration **ACTIVE-POSITIVE**:
In the quiescent state (at zero flow), the output signal level at the terminals is 0 V.

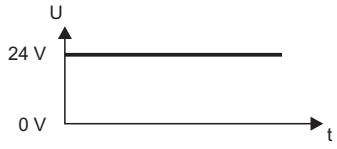
A0004694

In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level.



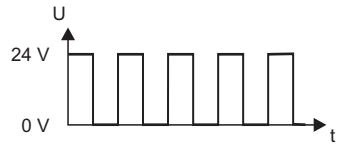
A0004692

The following applies for the output configuration **ACTIVE-NEGATIVE**:
In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.



A0004693

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.

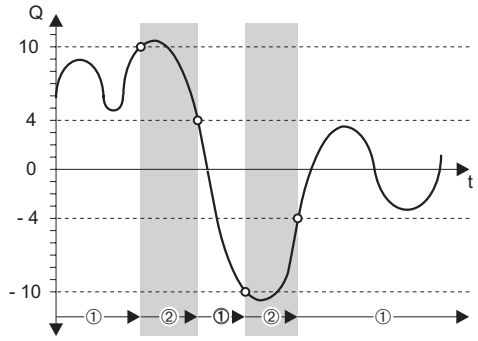


A0004710

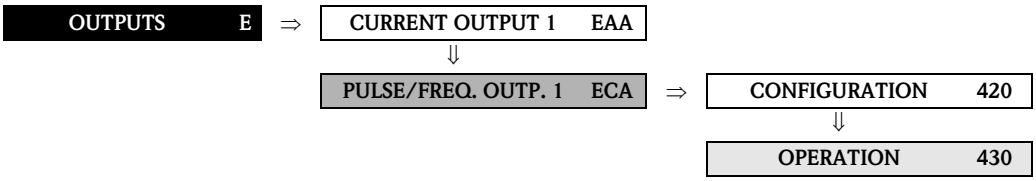
Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (PULSE)	
FAILSAFE MODE **4227** MODBUS register: 3230 Data type: Integer Access: read/write	✎ Note! This function is not available unless the PULSE setting was selected in the OPERATING MODE function (4200). For safety reasons it is advisable to ensure that the pulse output assumes a predefined state in the event of a fault. The setting you select here affects only the pulse output. It has no effect on other outputs and the display (e.g. totalizers). **Options:** 0 = FALLBACK VALUE Output is 0 pulse. 3 = ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored. **Factory setting:** FALL BACK VALUE

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (STATUS)	
ASSIGN STATUS **4241** MODBUS register: 3236 Data type: Integer Access: read/write	✎ Note! This function is not available unless the STATUS setting was selected in the OPERATING MODE function (4200). Use this function to assign a switching function to the status output. **Options:** 0 = OFF 1 = ON (operation) 2 = FAULT MESSAGE 3 = NOTICE MESSAGE 4 = FAULT MESSAGE or NOTICE MESSAGE 5 = EPD or OED (Empty Pipe Detection/ Open Electrode Detection, only if active) 6 = FLOW DIRECTION 7 = MASS FLOW LIMIT VALUE 8 = VOLUME FLOW LIMIT VALUE 9 = TOTALIZER 1 LIMIT VALUE 10 = TOTALIZER 2 LIMIT VALUE 11 = TOTALIZER 3 LIMIT VALUE **Factory setting:** FAULT MESSAGE ✎ Note! ■ The behavior of the status output is a normally closed behavior, in other words the output is closed (transistor conductive) when normal, error-free measuring is in progress. – The following apply as “normal, error-free” measurements: Flow direction = forward; limit values = not exceeded; no empty or partially filled measuring tube (EPD/OED); no fault or notice message present. – For switching behavior such as relay output, s. page 96 ■ If you select OFF, the only function shown in the CONFIGURATION function group is this function, in other words ASSIGN STATUS (4241).
ON-VALUE **4242** MODBUS register: 3237 Data type: Float Access: read/write	✎ Note! This function is not available unless STATUS was selected in the OPERATING MODE function (4200) and LIMIT VALUE or FLOW DIRECTION was selected in the ASSIGN STATUS function (4241). Use this function to assign a value to the switch-on point (activation of the status output). The value can be equal to, higher than or lower than the switch-off point. Positive or negative values are permissible, depending on the measured variable in question (e.g. volume flow, totalizer reading). **User input:** 5-digit floating-point number [unit] **Factory setting:** 0 [unit] ✎ Note! ■ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400). ■ Only the switch-on point is available for flow direction output (no switch-off point). If you enter a value not equal to the zero flow (e.g. 5), the difference between the zero flow and the value entered corresponds to half the switchover hysteresis.

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (STATUS)	
SWITCH-ON DELAY 4243 MODBUS register: 3239 Data type: Float Access: read/write	✎ Note! This function is not available unless STATUS was selected in the OPERATING MODE function (4200) and LIMIT VALUE or FLOW DIRECTION was selected in the ASSIGN STATUS function (4241). Use this function to specify a delay (0...100 seconds) for switching on the status output (i.e. signal changes from 0 to 1). The delay starts when the limit value is reached. The status output does switch when the delay has timed out and the switch-on condition has been valid over the delay time. **User input:** fixed-point number: 0.0...100.0 s **Factory setting:** 0.0 s
OFF-VALUE 4244 MODBUS register: 3241 Data type: Float Access: read/write	✎ Note! This function is not available unless STATUS was selected in the OPERATING MODE function (4200) and LIMIT VALUE was selected in the ASSIGN STATUS function (4241). Use this function to assign a value to the switch-off point (deactivation of the status output). The value can be equal to, higher than or lower than the switch-on point. Positive and negative values are permissible, depending on the measured variable in question (e.g. volume flow, totalizer reading). **User input:** 5-digit floating-point number [unit] **Factory setting:** 0 [unit] ✎ Note! ■ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400). ■ If SYMMETRY is selected in the function MEASURING MODE (4246) and values with different signs are entered for the switch-on and switch-off points, the notice message “INPUT RANGE EXCEEDED” appears.
SWITCH-OFF DELAY 4245 MODBUS register: 3243 Data type: Float Access: read/write Volatile	✎ Note! This function is not available unless the STATUS setting was selected in the OPERATING MODE function (4200). Use this function to define a delay (0...100 seconds) for switching off the status output (i.e. signal changes from 1 to 0). The delay starts when the limit value is reached. The status output does switch when the delay has timed out and the switch condition has been valid over the delay time. **User input:** fixed-point number 0.0...100.0 s **Factory setting:** 0.0 s

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → CONFIGURATION (STATUS)	
MEASURING MODE **4246** MODBUS register: 3245 Data type: Integer Access: read/write	✎ Note! This function is not available unless STATUS was selected in the function OPERATING MODE (4200) and the status output was assigned a limit value. Use this function to define the measuring mode for the status output. **Options:** 0 = STANDARD The status output signal switches at the defined switch points. 1 = SYMMETRY The status output signal switches at the defined switch points, irrespective of the sign. If you define a switch point with a positive sign, the status output signal switches as soon as the value is reached in the negative direction (negative sign), (see illustration). **Factory setting:** STANDARD Example for the SYMMETRY measuring mode: Switch-on point Q = 4, switch-off point: Q = 10 ① = Status output switched on (conductive) ② = Status output switched off (nonconductive)  A0001247 ✎ Note! ■ SYMMETRY cannot be selected unless the values in the ON-VALUE (4242) and OFF-VALUE (4244) functions have the same sign or one of the values is zero. ■ If the values have different signs, SYMMETRY cannot be selected and an "ASSIGNMENT NOT POSSIBLE" message is displayed.
TIME CONSTANT **4247** MODBUS register: 3246 Data type: Float Access: read/write	✎ Note! This function is not available unless the STATUS setting was selected in the OPERATING MODE function (4200). Use this function to enter a time constant defining how the measuring signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). Damping acts on the measuring signal before the switch status changes, and consequently before switch-on or switch-off delay is activated. The purpose of damping, therefore, is to prevent the status output changing state continuously in response to fluctuations in flow. **User input:** fixed-point number 0.00...100.00 s **Factory setting:** 0.00 s

7.2.2 Function group OPERATION

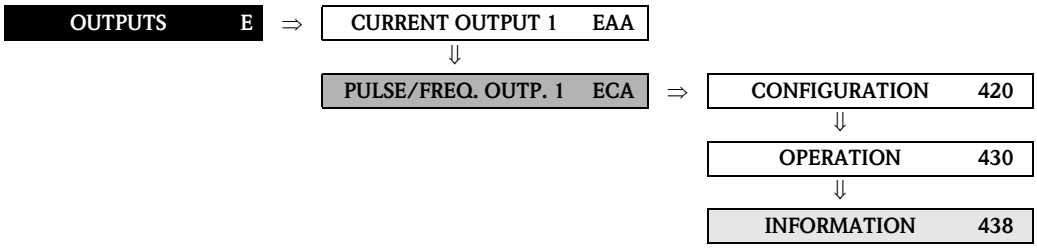


Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → OPERATION (FREQUENCY)	
ACTUAL FREQUENCY **4301** MODBUS register: 3218 Data type: Float Access: Read	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to view the computed actual value of the output frequency. **User interface:** 0...12500 Hz
SIMULATION FREQUENCY **4302** MODBUS register: 3220 Data type: Integer Access: read/write	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATING MODE function (4200). Use this function to activate simulation of the frequency output. **Options:** 0 = OFF 1 = ON **Factory setting:** OFF ✎ Note! ■ The "SIMULATION FREQUENCY OUTPUT" message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
VALUE SIMULATION FREQUENCY **4303** MODBUS register: 3221 Data type: Float Access: read/write	✎ Note! This function is not available unless FREQUENCY was selected in the OPERATING MODE function (4200) and the SIMULATION FREQUENCY function (4302) is active (= ON). Use this function to define a selectable frequency value (e.g. 500 Hz) to be output at the frequency output. This value is used to test downstream devices and the measuring device itself. **User input:** 0...12500 Hz **Factory setting:** 0 Hz ☝ Caution! The setting is not saved if the power supply fails.

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → OPERATION (PULSE)	
SIMULATION PULSE **4322** MODBUS register: 3233 Data type: Integer Access: read/write	✎ Note! This function is not available unless the PULSE option was selected in the OPERATING MODE function. Use this function to activate simulation of the pulse output. **Options:** 0 = OFF 1 = COUNTDOWN The pulses specified in the VALUE SIMULATION PULSE function are output. 2 = CONTINUOUSLY Pulses are continuously output with the pulse width specified in the PULSE WIDTH function. Simulation is started once the CONTINUOUSLY option is confirmed with the E key. ✎ Note! Simulation is started by confirming the CONTINUOUSLY option with the E key. The simulation can be switched off again via the SIMULATION PULSE function. **Factory setting:** OFF ✎ Note! ▪ The notice message #631 “SIM. PULSE” indicates that simulation is active. ▪ The on/off ratio is 1:1 for both types of simulation. ▪ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
VALUE SIMULATION PULSE **4323** MODBUS register: 3234 Data type: Float Access: read/write	✎ Note! This function is not available unless the COUNTDOWN option was selected in the SIMULATION PULSE function. Use this function to specify the number of pulses (e.g. 50) which are output during the simulation. This value is used to test downstream devices and the measuring device itself. The pulses are output with the pulse width specified in the PULSE WIDTH function. The on/off ratio is 1:1. Simulation is started once the specified value is confirmed with the E key. The display remains at 0 if the specified pulses have been output. **User input:** 0...10000 **Factory setting:** 0 ✎ Note! Simulation is started by confirming the simulation value with the E key. The simulation can be switched off again via the SIMULATION PULSE function. ☝ Caution! The setting is not saved if the power supply fails.

Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → OPERATION (STATUS)	
ACTUAL STATUS **4341** MODBUS register: 3248 Data type: Integer Access: Read	✎ Note! This function is not available unless the STATUS setting was selected in the OPERATING MODE function (4200). Use this function to check the current status of the status output. **User interface:** 0 = NOT CONDUCTIVE 1 = CONDUCTIVE
SIMULATION SWITCH POINT **4343** MODBUS register: 3249 Data type: Integer Access: read/write	✎ Note! This function is not available unless the STATUS setting was selected in the OPERATING MODE function (4200). Use this function to activate simulation of the status output. **Options:** 0 = OFF 1 = ON **Factory setting:** OFF ✎ Note! ■ The "SIMULATION STATUS OUTPUT" message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
VALUE SIMULATION SWITCH POINT **4343** MODBUS register: 3250 Data type: Float Access: read/write	✎ Note! This function is not available unless STATUS was selected in the OPERATING MODE function (4200) and the SIMULATION SWITCH POINT function (4343) is active (= ON). Use this function to define the switching response of the status output during the simulation. This value is used to test downstream devices and the measuring device itself. **Options:** 0 = NOT CONDUCTIVE 1 = CONDUCTIVE **Factory setting:** NOT CONDUCTIVE ☝ Caution! The setting is not saved if the power supply fails.

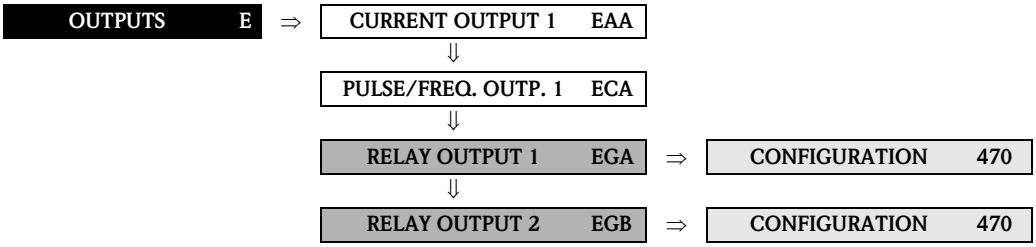
7.2.3 Function group INFORMATION



Function description OUTPUTS → PULSE/FREQUENCY OUTPUT 1 → INFORMATION		
TERMINAL NUMBER	**4380**	Use this function to display the numbers of the terminals (in the connection compartment) which are used by the pulse/frequency output.
MODBUS register: Data type: Access:	3251 Integer Read	**User interface:** 2 = 22(+) / 23 (–)

7.3 Group RELAY OUTPUT (1...2)

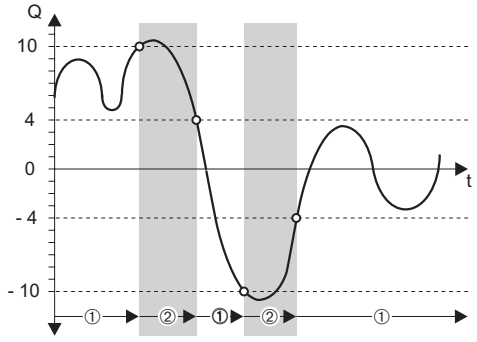
7.3.1 Function group CONFIGURATION



Function description
OUTPUTS → RELAY OUTPUT (1...2) → CONFIGURATION

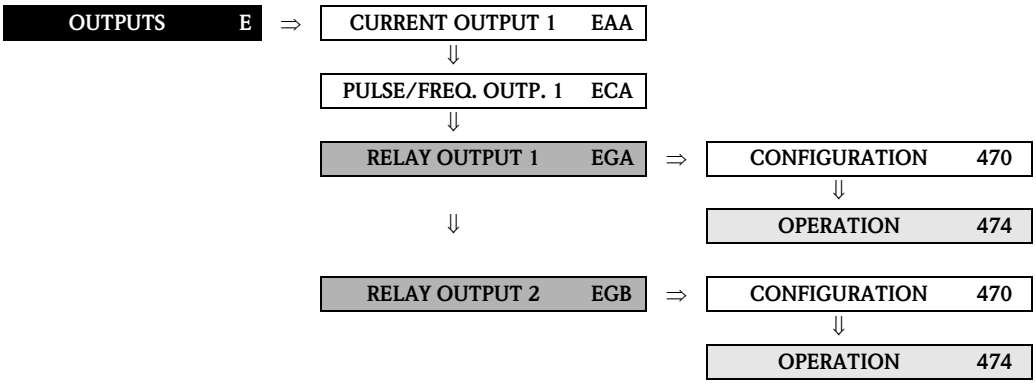
ASSIGN RELAY **4700**	Use this function to assign a switching function to the relay output.
MODBUS register: Relay output 1 3801 Relay output 2 4001 Data type: Integer Access: read/write	**Options:** 0 = OFF 1 = ON (operation) 2 = FAULT MESSAGE 3 = NOTICE MESSAGE 4 = FAULT MESSAGE or NOTICE MESSAGE 5 = EPD or OED (Empty Pipe Detection/ Open Electrode Detection, only if active) 6 = FLOW DIRECTION 7 = MASS FLOW LIMIT VALUE 8 = VOLUME FLOW LIMIT VALUE 9 = TOTALIZER 1 LIMIT VALUE 10 = TOTALIZER 2 LIMIT VALUE 11 = TOTALIZER 3 LIMIT VALUE **Advanced options with optional software package BATCHING:** 22 = BATCH VALVE 1 (e.g. to control valve 1) 23 = BATCH VALVE 2 (e.g. to control valve 2) 25 = BATCH RUNNING 26 = > BATCH TIME 27 = >< BATCH QUANTITIES (< min. / > max. batching quantity) 28 = PROGRESS NOTE (batching end approaching) ✎ Note! ■ The batching valves defined in the function BATCH STAGES (7208) are the only available selection (max. 2). ■ The only options available are the monitoring functions (7240...7243) which have a value not equal to zero. **Factory setting:** FAULT MESSAGE ✎ Note! ■ It is very important to read and comply with the information on the switching characteristics of the relay output, (see page 96). ■ It is advisable to configure at least one relay output as a fault output and define the outputs' response to error. ■ Relay output 1 is configured as a normally open (NO or make) contact and relay output 2 as a normally closed (NC or break) contact by default. It can be reconfigured by means of a jumper on the relay module (see Promag 53 MODBUS RS485 Operating Instructions, BA117D/06/en). ■ If you select OFF, the only function shown in the CONFIGURATION function group is this function (4700).

Function description OUTPUTS → RELAY OUTPUT (1...2) → CONFIGURATION	
ON-VALUE **4701** MODBUS register: Relay output 1 3802 Relay output 2 4002 Data type: Float Access: read/write	✎ Note! This function is not available unless LIMIT VALUE or FLOW DIRECTION was selected in the function ASSIGN RELAY (4700). Use this function to assign a value to the switch-on point (relay output pulls up). The value can be equal to, higher than or lower than the switch-off point. Positive or negative values are permissible, depending on the measured variable in question (e.g. volume flow, totalizer reading). **User input:** 5-digit floating-point number [unit] **Factory setting:** 0 [unit] ✎ Note! ■ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400). ■ Only the switch-on point is available for flow direction output (no switch-off point). If you enter a value not equal to the zero flow (e.g. 5), the difference between the zero flow and the value entered corresponds to half the switchover hysteresis.
SWITCH-ON DELAY **4702** MODBUS register: Relay output 1 3804 Relay output 2 4004 Data type: Float Access: read/write	✎ Note! This function is not available unless LIMIT VALUE or FLOW DIRECTION was selected in the function ASSIGN RELAY (4700). Use this function to define a delay (0 ... 100 seconds) for pull-up (i.e. signal changes from 0 to 1) of the relay output. The delay starts when the limit value is reached. The relay output does switch when the delay has timed out and the switch condition has been valid throughout the delay time. **User input:** fixed-point number 0.0...100.0 s **Factory setting:** 0.0 s
OFF-VALUE **4703** MODBUS register: Relay output 1 3806 Relay output 2 4006 Data type: Float Access: read/write	✎ Note! This function is not available unless LIMIT was selected in the ASSIGN RELAY function (4700). Use this function to assign a value to the switch-off point (relay drops out). The value can be equal to, higher than or lower than the switch-on point. Positive or negative values are permissible, depending on the measured variable in question (e.g. volume flow, totalizer reading). **User input:** 5-digit floating-point number [unit] **Factory setting:** 0 [unit] ✎ Note! ■ The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400). ■ If SYMMETRY is selected in the function MEASURING MODE (4705) and values with different signs are entered for the switch-on and switch-off points, the notice message “INPUT RANGE EXCEEDED” appears.

Function description OUTPUTS → RELAY OUTPUT (1...2) → CONFIGURATION	
SWITCH-OFF DELAY **4704** MODBUS register: Relay output 1 3808 Relay output 2 4008 Data type: Float Access: read/write	✎ Note! This function is not available unless LIMIT was selected in the ASSIGN RELAY function (4700). Use this function to define a delay (0 ... 100 seconds) for dropout (i.e. signal changes from 1 to 0) of the relay output. The delay starts when the limit value is reached. The relay output does switch when the delay has timed out and the switch condition has been valid throughout the delay time. **User input:** fixed-point number 0.0...100.0 s **Factory setting:** 0.0 s
MEASURING MODE **4705** MODBUS register: Relay output 1 3810 Relay output 2 4010 Data type: Integer Access: read/write	✎ Note! This function is not visible unless a limit value was assigned to the relay output. Use this function to define the measuring mode for the relay output. **Options:** 0 = STANDARD The relay output signal switches at the defined switch points. 1 = SYMMETRY The relay output signal switches at the defined switching points, irrespective of the sign. If you define a switch point with a positive sign, the relay output switches as soon as the value is reached in the negative direction (negative sign), (see illustration). **Factory setting:** STANDARD Example for the SYMMETRY measuring mode: Switch-on point Q = 4 Switch-off point Q = 10 ① = Relay energized ② = Relay de-energized  A0001247 ✎ Note! ■ SYMMETRY cannot be selected unless the values in the ON-VALUE (4701) and OFF-VALUE (4703) functions have the same sign or one of the values is zero. ■ If the values have different signs, SYMMETRY cannot be selected and an “ASSIGNMENT NOT POSSIBLE” message is displayed.

Function description OUTPUTS → RELAY OUTPUT (1...2) → CONFIGURATION		
TIME CONSTANT	**4706**	Use this function to enter a time constant defining how the measuring signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). Damping acts on the measuring signal before the switch status changes, and consequently before switch-on or switch-off delay is activated. The purpose of damping, therefore, is to prevent the relay output changing state continuously in response to fluctuations in flow. **User input:** fixed-point number 0.00...100.00 s **Factory setting:** 0.00 s
MODBUS register:		
Relay output 1	3811	
Relay output 2	4011	
Data type:	Float	
Access:	read/write	

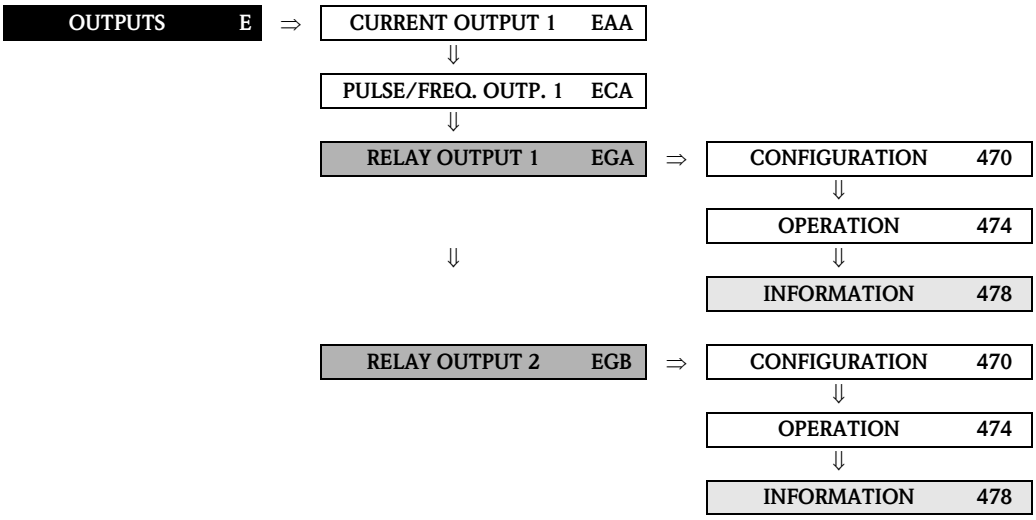
7.3.2 Function group OPERATION



Function description OUTPUTS → RELAY OUTPUT (1...2) → OPERATION		
ACTUAL STATUS RELAY	**4740**	Use this function to check the current status of the relay output. A jumper on the contact side defines the relay output as a normally open (NO or make) or normally closed (NC or break) contact (see see Promag 53 MODBUS RS485 Operating Instructions, BA117D/06/en). **User interface:** 0 = BREAK CONTACT OPEN 1 = BREAK CONTACT CLOSED 2 = MAKE CONTACT OPEN 3 = MAKE CONTACT CLOSED
MODBUS register: Relay output 1 Relay output 2 Data type: Access:	 3813 4013 Integer Read	
SIMULATION SWITCH POINT	**4741**	Use this function to activate simulation of the relay output. **Options:** 0 = OFF 1 = ON **Factory setting:** OFF ✎ Note! ■ The “SIMULATION RELAY” message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
MODBUS register: Relay output 1 Relay output 2 Data type: Access:	 3814 4014 Integer read/write	

Function description OUTPUTS → RELAY OUTPUT (1...2) → OPERATION	
VALUE SIMULATION SWITCH POINT **4742** MODBUS register: Relay output 1 3815 Relay output 2 4015 Data type: Integer Access: read/write	✎ Note! The function is not visible unless the SIMULATION SWITCH POINT function (4741) is active (= ON). Use this function to define the status of the relay output during the simulation. This value is used to test downstream devices and the measuring device itself. Depending on the relay configuration (as make or break contact) the following selections are available. **Options** Relay output configured as normally open (make) contact: 0 = BREAK CONTACT OPEN 1 = BREAK CONTACT CLOSED Relay output configured as normally closed (break) contact: 2 = MAKE CONTACT OPEN 3 = MAKE CONTACT CLOSED ☝ Caution! The setting is not saved if the power supply fails.

7.3.3 Function group INFORMATION



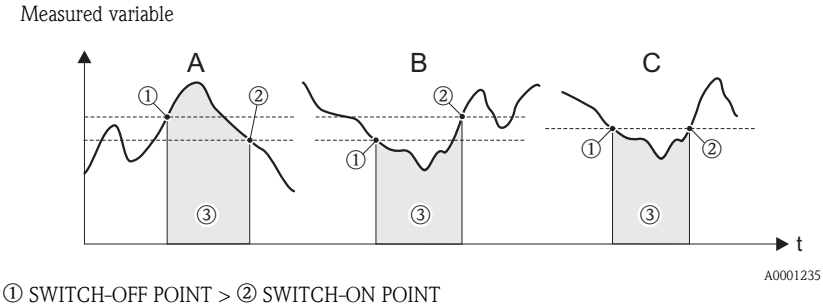
Function description
OUTPUTS → RELAY OUTPUT (1...2) → INFORMATION

TERMINAL NUMBER	**4780**	Use this function to display the numbers of the terminals (in the connection compartment) which are used by the relay output.
MODBUS register:		**User interface:**
Relay output 1	3816	2 = 22 (+) / 23 (–) → RELAY OUTPUT 1
Relay output 2	4016	3 = 20 (+) / 21 (–) → RELAY OUTPUT 2
Data type:	Integer	
Access:	Read	

7.3.4 Information on the response of the relay output

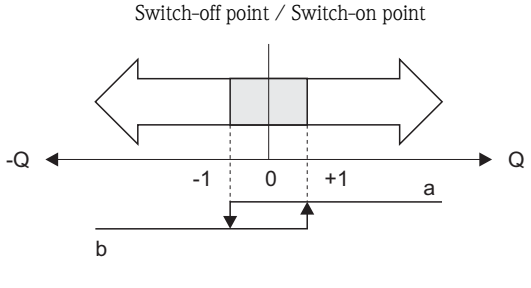
General
If you have configured the relay output signal for "LIMIT VALUE" or "FLOW DIRECTION", you can define the requisite switch points in the ON-VALUE and OFF-VALUE functions. When the measured variable in question reaches one of these predefined values, the relay output switches as shown in the illustrations below.

Relay output configured for "limit value"
The relay output signal switches as soon as the measured variable undershoots or overshoots a defined switch point.
Application: Monitoring flow or process-related boundary conditions.



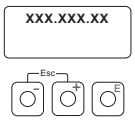
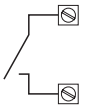
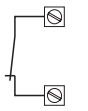
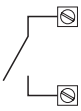
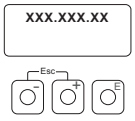
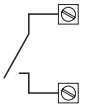
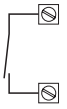
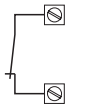
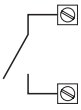
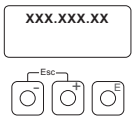
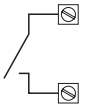
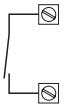
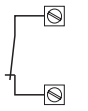
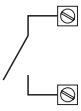
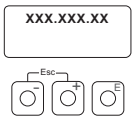
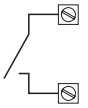
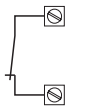
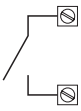
A = Maximum safety → ① SWITCH-OFF POINT > ② SWITCH-ON POINT
B = Minimum safety → ① SWITCH-OFF POINT < ② SWITCH-ON POINT
C = Minimum safety → ① SWITCH-OFF POINT = ② SWITCH-ON POINT (this configuration is to avoid)
③ = Relay de-energized

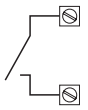
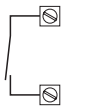
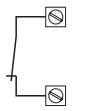
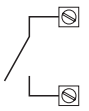
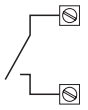
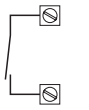
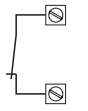
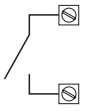
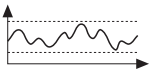
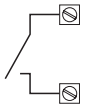
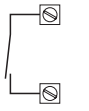
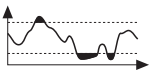
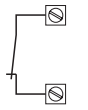
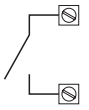
Relay output configured for "flow direction"
The value you entered in the function ON-VALUE defines the switch point for the positive and negative directions of flow.
If, for example, the switch point you define is = 1 m^3/h, the relay drops out at –1 m^3/h and pulls up at +1 m^3/h. Set the switch point to 0 if your process calls for direct switchover (no switching hysteresis). If low flow cut off is used, it is advisable to set hysteresis to a value higher than or equal to the low flow cut off rate.



a = Relay energized
b = Relay de-energized

7.3.5 Switching response of the relay output

Function	State		Relay coil	Contact*	
				NC	NO
ON (operation)	System in measuring mode	 A0001052	energized	 A0001239	 A0001237
	System not in measuring mode (power supply failed)	 A0001291	de-energized	 A0001240	 A0001238
Fault message	System OK	 A0001052	energized	 A0001239	 A0001237
	(System or process error) Fault → Response to error, outputs /inputs and totalizers	 A0001291	de-energized	 A0001240	 A0001238
Notice message	System OK	 A0001052	energized	 A0001239	 A0001237
	(System or process error) Fault → Continuation of measuring	 A0001291	de-energized	 A0001240	 A0001238
Fault message or Notice message	System OK	 A0001052	energized	 A0001239	 A0001237
	(System or process error) Fault → Response to error or Note → Continuation of measuring	 A0001291	de-energized	 A0001240	 A0001238

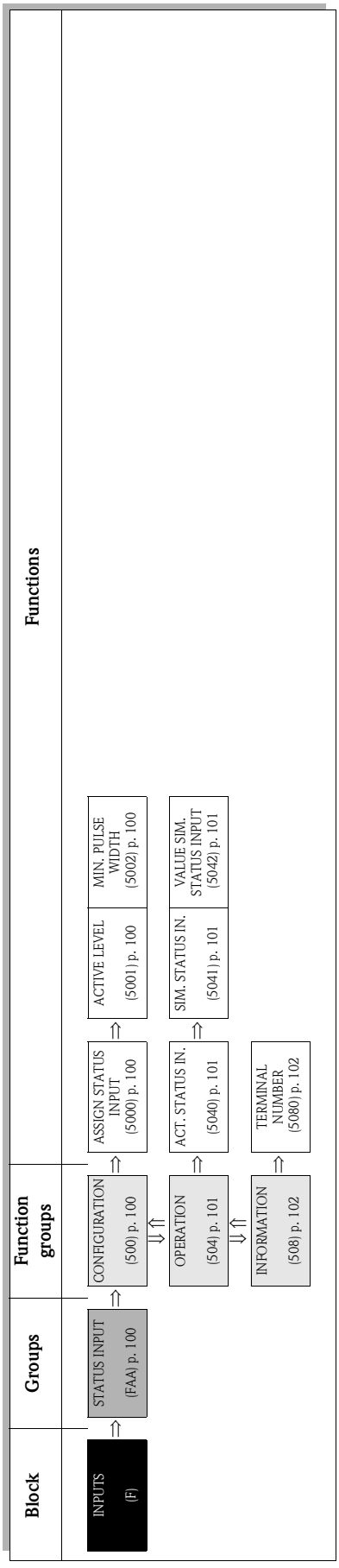
Function	State	Relay coil	Contact*	
			NC	NO
Empty pipe detection (EPD) / Open electrode detection (OED)	Measuring tube full  A0001292	energized	 A0001239	 A0001237
	Measuring tube partially filled /empty measuring tube  A0001293	de-energized	 A0001240	 A0001238
Flow direction	forward  A0001241	energized	 A0001239	 A0001237
	reverse  A0001242	de-energized	 A0001240	 A0001238
Limit value – Volume flow – Totalizer	Limit value **not** overshot or undershot  A0001243	energized	 A0001239	 A0001237
	Limit value overshot or undershot  A0001244	de-energized	 A0001240	 A0001238

* Terminal numbers in accordance with the TERMINAL NUMBER function (4780) on page 95.

✎ Note!
If the measuring device has two relays, the factory setting is:
- Relay 1 → normally open contact (NO)
- Relay 2 → normally closed contact (NC)

☝ Caution!
When using the optional software package BATCHING, it is advisable for the contacts (either normally open or normally closed contacts) to have the same switching response for all relay outputs used.

8 Block INPUTS



8.1 Group STATUS INPUT

8.1.1 Function group CONFIGURATION

INPUTS F ⇒ STATUS INPUT FAA ⇒ CONFIGURATION 500

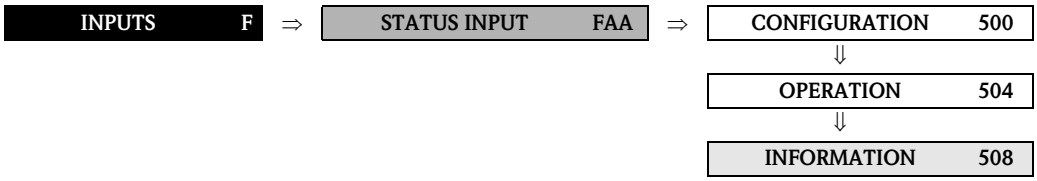
Function description INPUTS → STATUS INPUT → CONFIGURATION		
ASSIGN STATUS INPUT MODBUS register: Data type: Access:	**5000** 4301 Integer read/write	Use this function to assign a switching function to the status input. **Options:** 0 = OFF 1 = RESET TOTALIZER 1 2 = RESET TOTALIZER 2 3 = RESET TOTALIZER 3 4 = RESET ALL TOTALIZERS 5 = POSITIVE ZERO RETURN **Advanced options with optional software package BATCHING:** 9 = RUN BATCHING (start/stop) 10 = HOLD BATCHING (stop/continue) 11 = RESET BATCH SUM (resetting total quantity / total quantity totalizers) **Factory setting:** OFF Caution! Positive zero return is active as long as the level is available at the status input (continuous signal). All other assignments react to a change in level (pulse) at the status input.
ACTIVE LEVEL MODBUS register: Data type: Access:	**5001** 4302 Integer read/write	Use this function to define whether the assigned switch function is released or sustained when the signal level is present (HIGH) or not present (LOW). **Options:** 0 = LOW 1 = HIGH **Factory setting:** HIGH
MINIMUM PULSE WIDTH MODBUS register: Data type: Access:	**5002** 4303 Float read/write	Use this function to define a minimum pulse width which the input pulse must achieve in order to trigger the selected switching function (see function ASSIGN STATUS INPUT (5000). **User input:** 20...100 ms **Factory setting:** 50 ms

8.1.2 Function group OPERATION

INPUTS F ⇒ STATUS INPUT FAA ⇒ CONFIGURATION 500
⇓
OPERATION 504

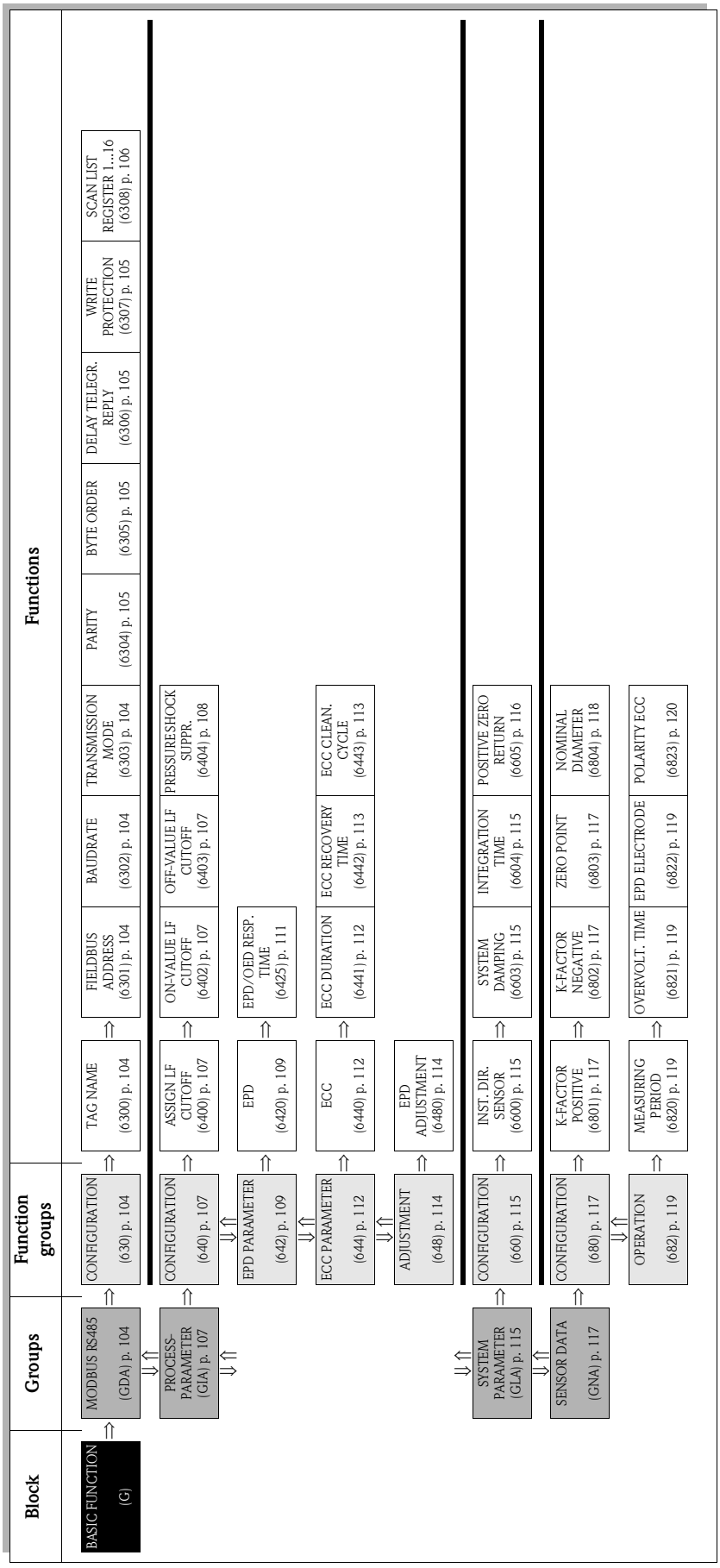
Function description INPUTS → STATUS INPUT → OPERATION		
ACTUAL STATUS INPUT	**5040**	Use this function to view the current level of the status input. **User interface:** 0 = LOW 1 = HIGH
MODBUS register: Data type: Access:	4305 Integer Read	
SIMULATION STATUS INPUT	**5041**	Use this function to simulate the status input, i.e. to trigger the function (see function ASSIGN STATUS INPUT on page 100) assigned to the status input. **Options:** 0 = OFF 1 = ON **Factory setting:** OFF ✎ Note! ■ The "SIMULATION STATUS INPUT" message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☝ Caution! The setting is not saved if the power supply fails.
MODBUS register: Data type: Access:	4306 Integer read/write	
VALUE SIMULATION STATUS INPUT	**5042**	✎ Note! The function is not visible unless the SIMULATION STATUS INPUT function (5041) is active (= ON). Use this function to define the level to be assumed at the status output during the simulation. This value is used to test downstream devices and the measuring device itself. **Options:** 0 = LOW 1 = HIGH **Factory setting:** LOW ☝ Caution! The setting is not saved if the power supply fails.
MODBUS register: Data type: Access:	4307 Integer read/write	

8.1.3 Function group INFORMATION



Function description INPUTS → STATUS INPUT → INFORMATION		
TERMINAL NUMBER	**5080**	Use this function to display the numbers of the terminals (in the connection compartment) which are used by the status input.
MODBUS register: Data type: Access	4308 Integer Read	**User interface:** 1 = 24 (+) / 25 (–)

9 Block BASIC FUNCTION



9.1 Group MODBUS RS485

9.1.1 Function group CONFIGURATION

BASIC FUNCTION G ⇒ **MODBUS RS485 GDA** ⇒ **CONFIGURATION 630**

Function description BASIC FUNCTION → MODBUS RS485 → CONFIGURATION		
TAG NAME	**6300**	For entering a tag name for the measuring device. You can edit and read this tag name via the local display or the MODBUS protocol. **User input:** max. 16-character text, permissible: A-Z, 0-9, +, -, punctuation marks **Factory setting:** "_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _" (No text)
MODBUS register: Data type: Access:	4901 String (16) read/write	
FIELDBUS ADDRESS	**6301**	For entering the device address. **User input:** 1...247 **Factory setting:** 247
MODBUS register: Data type: Access:	4910 Integer read/write	
BAUDRATE	**6302**	For selecting the baudrate. **Options:** 0 = 1200 BAUD 1 = 2400 BAUD 2 = 4800 BAUD 3 = 9600 BAUD 4 = 19200 BAUD 5 = 38400 BAUD 6 = 57600 BAUD 7 = 115200 BAUD **Factory setting:** 19200 BAUD
MODBUS register: Data type: Access:	4912 Integer read/write	
TRANSMISSION MODE	**6303**	For selecting the data transfer mode. **Options:** 0 = RTU 1 = ASCII **Factory setting:** RTU ✎ Note! ■ RTU = transmission of data in binary form. Error protection via CRC16. ■ RTU = transmission of data in the form of readable ASCII characters. Error protection via LRC.
MODBUS register: Data type: Access:	4913 Integer read/write	

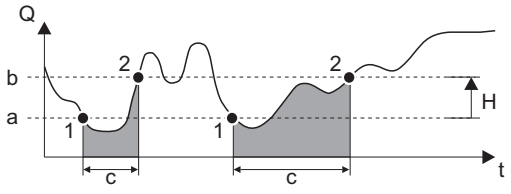
Function description BASIC FUNCTION → MODBUS RS485 → CONFIGURATION		
PARITY MODBUS register: Data type: Access:	**6304** 4914 Integer read/write	For selecting whether no parity bit or an even or uneven parity bit should be transmitted. ✎ Note! The options available depend on the TRANSMISSION MODE function: **Options:** (for DATA TRANSFER MODE = RTU) 0 = EVEN 1 = ODD 2 = NONE **Options:** (for DATA TRANSFER MODE = ASCII) 0 = EVEN 1 = ODD **Factory setting:** EVEN
BYTE ORDER MODBUS register: Data type: Access:	**6305** 4915 Integer read/write	Select the byte transmission sequence for the Integer, Float and String data types. **Options:** 0 = 0-1-2-3 1 = 3-2-1-0 2 = 2-3-0-1 3 = 1-0-3-2 **Factory setting:** 1-0-3-2 ✎ Note! ■ The transmission sequence must suit the MODBUS master. ■ More information can be found in Operating Instructions BA117D under the keyword “Byte transmission sequence”.
DELAY TELEGR. REPLY MODBUS register: Data type: Access:	**6306** 4916 Float read/write	For entering a delay time after which the measuring device replies to the request telegram of the MODBUS master. This allows communication to be adapted to slow MODBUS masters. **User input:** 0...100 ms **Factory setting:** 10 ms
WRITE PROTECTION MODBUS register: Data type: Access:	**6307** 4918 Integer Read	Indicates whether write access to the measuring device is possible via local operation or MODBUS. **User interface:** 0 = OFF (write access via MODBUS possible) 1 = ON (write access via MODBUS blocked) **Factory setting:** OFF ✎ Note! Hardware write protection is activated and deactivated by means of a jumper on the I/O module (see Operating Instructions BA117D).

Function description BASIC FUNCTION → MODBUS RS485 → CONFIGURATION	
SCAN LIST REGISTER 1...16 **6308** MODBUS register: SCAN LIST REG. 1 5001 SCAN LIST REG. 2 5002 SCAN LIST REG. 3 5003 SCAN LIST REG. 4 5004 SCAN LIST REG. 5 5005 SCAN LIST REG. 6 5006 SCAN LIST REG. 7 5007 SCAN LIST REG. 8 5008 SCAN LIST REG. 9 5009 SCAN LIST REG. 10 5010 SCAN LIST REG. 11 5011 SCAN LIST REG. 12 5012 SCAN LIST REG. 13 5013 SCAN LIST REG. 14 5014 SCAN LIST REG. 15 5015 SCAN LIST REG. 16 5016 Data type: Integer Access: read/write	By entering the register address, up to 16 device parameters can be grouped in the auto-scan buffer where they are assigned to the scan list registers 1 to 16. The data of the device parameters assigned here are read out via the register addresses 5051...5081. **User input:** 0...9999 **Factory setting:** 0 ✎ Note! More detailed information and examples of using the auto-scan buffer are provided in Operating Instructions BA117D.

9.2 Group PROCESSPARAMETER

9.2.1 Function group CONFIGURATION

BASIC FUNCTION G ⇒ MODBUS RS485 GDA
⇓
PROCESSPARAMETER GIA ⇒ CONFIGURATION 640

Function description BASIC FUNCTION → PROCESSPARAMETER → CONFIGURATION		
ASSIGN LOW FLOW CUT OFF	**6400**	Use this function to assign the switch point for the low flow cut off. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** VOLUME FLOW
MODBUS register: Data type: Access:	5101 Integer read/write	
ON-VALUE LOW FLOW CUT OFF	**6402**	Use this function to enter the switch-on point for low flow cut off. Low flow cut off is active if the value entered is not equal to 0. The sign of the flow value is highlighted on the display to indicate that low flow cut off is active. **User input:** 5-digit floating-point number [unit] **Factory setting:** Depends on nominal diameter and country (s. page 150 ff.). ✎ Note! The appropriate unit is taken from the function UNIT VOLUME FLOW (0402) or UNIT MASS FLOW (0400), (see page 15 or page 14).
MODBUS register: Data type: Access:	5138 Float read/write	
OFF-VALUE LOW FLOW CUT OFF	**6403**	Use this function to enter the switch-off (b) point for low flow cut off. Enter the switch-off point as a positive hysteresis (H) from the switch-on point (a). **User input:** Integer 0...100% **Factory setting:** 50% Example:  A0001245 Q = Flow [volume/time] t = Time a = ON-VALUE LOW FLOW CUT OFF (6402) = 200 dm^3/h b = OFF-VALUE LOW FLOW CUT OFF (6403) = 10% c = Low flow cut off active 1 = Low flow cut off is switched on at 200 dm^3/h 2 = Low flow cut off is switched off at 220 dm^3/h
MODBUS register: Data type: Access:	5104 Float read/write	

Function description

BASIC FUNCTION → PROCESSPARAMETER → CONFIGURATION

PRESSURE SHOCK SUPPRESSION **6404**

MODBUS register: 5104
Data type: Float
Access: read/write

The closure of a valve can cause brief but severe movements of the fluid in the piping system, movements which the measuring system registers. The pulses totaled in this way result in a totalizer reading error, particularly in the case of batching processes. For this reason, the measuring device is equipped with pressure shock suppression (= short-term signal suppression) which can eliminate system-related “disruptions”.

✎ Note!
Note that pressure shock suppression cannot be used unless the low flow cut off is active (see ON-VALUE LOW FLOW CUT OFF function on page 107).

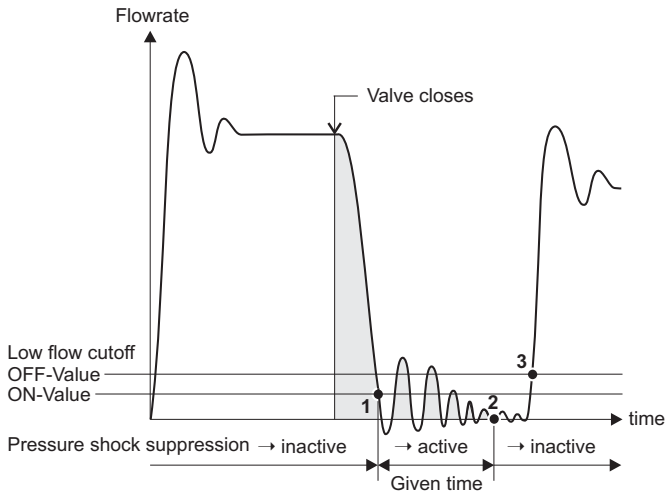
Use this function to define the time span for active pressure shock suppression.

Activation of the pressure shock suppression
Pressure shock suppression is activated after the flow falls below the switch-on point of the low flow cut off (see point **1** in graphic).

While pressure shock suppression is active, the following conditions apply:
- Current outputs → outputs the current corresponding to zero flow.
- Pulse-/Freq.-output → outputs the frequency corresponding to zero flow.
- Flow reading on display → 0
- Totalizer reading → the totalizers are pegged at the last correct value.

Deactivation of the pressure shock suppression
The pressure shock suppression is deactivated after the time interval, set in this function, has passed (see point **2** in graphic).

✎ Note!
The current flow value is displayed and output, when the time interval for the pressure shock suppression has passed and the flow exceeds the switch-off point of the low flow cut off (see point **3** in graphic).

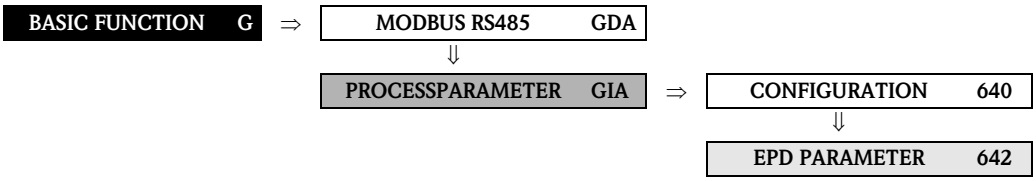


A0001285-EN

User input:
max. 4-digit number, incl. unit: 0.00...100.0 s

Factory setting:
0.00 s

9.2.2 Function group EPD PARAMETER



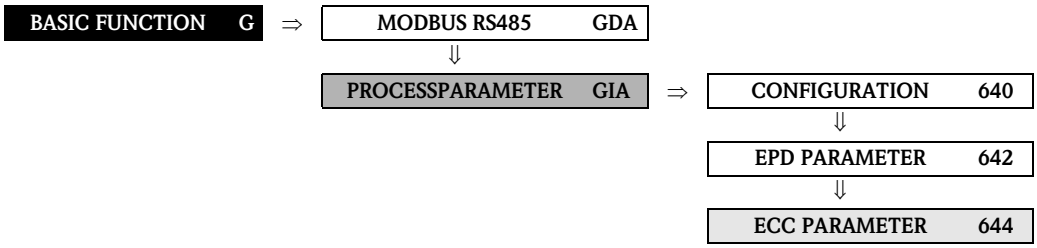
Function description
BASIC FUNCTION → PROCESSPARAMETER → EPD PARAMETER

EPD	**6420**	Flow cannot be measured correctly unless the measuring tube is full. This status can be monitored at all times with the Empty Pipe Detection function. Use this function to activate Empty Pipe Detection (EPD) or Open Electrode Detection (OED). ■ EPD = Empty Pipe Detection (with the help of an EPD electrode) ■ OED = Open Electrode Detection (empty pipe detection with the help of the measuring electrodes, if the sensor is not equipped with an EPD electrode or the orientation is not suitable for using EPD). **Options:** 0 = OFF 1 = ON SPECIAL 2 = OED 3 = ON STANDARD OFF (neither EPD nor OED are active) ON SPECIAL: Switching on the Empty Pipe Detection (EPD) for devices in remote version (transmitter and sensor are installed separately). OED: Switching on the Open Electrode Detection (OED). ON STANDARD: Switching on the Empty Pipe Detection (EPD) for: – Devices in compact version (transmitter and sensor form a single mechanical unit). – Applications where a facing and coating of the fluid on the measuring tube line and measuring electrode accrues. **Factory setting:** OFF ✎ Note! ■ The options ON STANDARD and ON SPECIAL are not available unless the sensor is equipped with an EPD electrode. ■ The default setting for the EPD/OED functions when the device is delivered is OFF. The functions must be activated as required. ■ The devices are calibrated at the factory with water (approx. 500 µS/cm). If the conductivity of certain fluids deviates from this reference, empty pipe/full pipe adjustment must be performed again on site (see function EPD ADJUSTMENT on page 114). ■ The adjustment coefficients must be valid before you can switch on the EPD or OED. If these coefficients are not available, the function EPD ADJUSTMENT is displayed (s. page 114). ■ If there are problems with the adjustment, the following error messages appear on the screen: – ADJUSTMENT FULL = EMPTY: The adjustment values for empty pipe and full pipe are identical. In such instances, empty pipe adjustment/full pipe adjustment **must** be carried out **again**. – ADJUSTMENT NOT OK: Adjustment is not possible as the fluid conductivity values are outside the permitted range. (continued on next page)
MODBUS register:	5106	
Data type:	Integer	
Access:	read/write	

Function description BASIC FUNCTION → PROCESSPARAMETER → EPD PARAMETER		
EPD (continued)	**6420**	**Notes on empty pipe detection (EPD and OED)** ■ Flow cannot be measured correctly unless the measuring tube is full. This status can be monitored at all times by means of the EPD/OED. ■ An empty or partially filled pipe is a process error. A default factory setting defines that a notice message is issued and that this process error has no effect on the outputs. ■ The EPD/OED process error can be output via the configurable relay or status outputs. ■ A plausibility check of the adjustment values will only be executed by activating the empty pipe detection. If an empty or full pipe adjustment is performed during the empty pipe detection is active, the empty pipe detection has to be de- and again activated, after finishing the adjustment, to start the plausibility check. **Response to partially filled pipes** If the EPD/OED is switched on and responds to a partially filled or empty pipe, the notice message "EMPTY PIPE" appears on the display. If the pipe is partially empty and the EPD/OED is **not** switched on, the response can vary in identically configured systems: ■ Flow reading fluctuates ■ Zero flow ■ Excessively high flow values **Notes on open electrode detection (OED)** Open Electrode Detection (OED) functions like the Empty Pipe Detection (EPD). In contrast to the EPD where the measuring device must be equipped with a separate (optional) electrode, the OED detects partial filling by means of the two measuring electrodes which are present as standard (fluid no longer covers the measuring electrodes). Open electrode detection can also be used if: ■ the sensor is not installed in the optimal position for using EPD (optimal = installed horizontally). ■ the sensor is not equipped with an additional (optional) EPD electrode. ✎ Note! ■ Cable connection length: When mounting a remote version, please observe the maximum permissible cable length of 15 meters in order to keep the OED function. ■ OED empty pipe adjustment: To achieve the best results for the open electrode detection, it is important to have the electrodes surface as dry as possible (no liquid film) while the empty-pipe adjustment is being made. Even during normal operation, the OED function is only secured if there is no longer any liquid film present on the electrodes when the measuring pipe is empty.

Function description BASIC FUNCTION → PROCESSPARAMETER → EPD PARAMETER	
EPD RESPONSE TIME **6425** MODBUS register: 5108 Data type: Float Access: read/write	✎ Note! This function is not available unless ON STANDARD, ON SPECIAL or OED was selected in the EPD function (6420). Use this function to enter the time span for which the criteria for an “empty” pipe have to be satisfied without interruption before a notice message or fault message is generated. The setting defined here is used by the active empty pipe detection (EPD) or open electrode detection (OED). **User input:** fixed-point number: 1.0...100 s **Factory setting:** 1.0 s ✎ Note! OED detection time: The recognition of open electrodes is, in contrast to the empty pipe detection (EPD), very slow reacting (delay at least 25 seconds) and is only activated after an additional delay from the programmed response time! We recommend in most applications to use the empty pipe detection (EPD) which is an optimal solution for detecting partly filled measuring tubes.

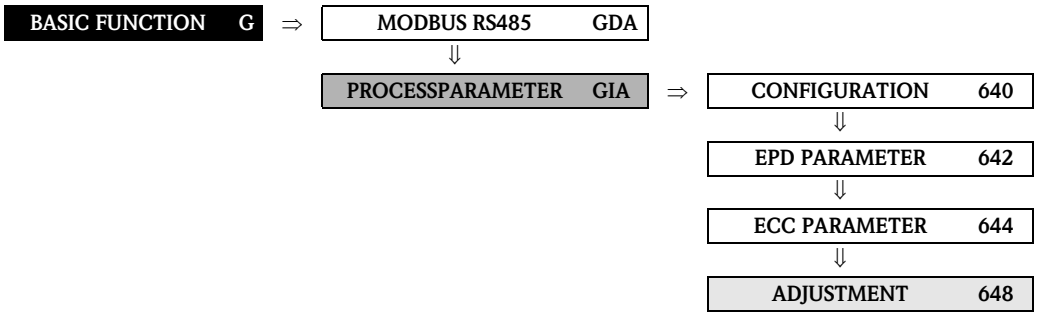
9.2.3 Function group ECC PARAMETER



Function description BASIC FUNCTION → PROCESSPARAMETER → ECC PARAMETER	
ECC **6440** MODBUS register: 5114 Data type: Integer Access: read/write	✎ Note! This function is not available unless the measuring device is equipped with an (optional) electrode cleaning function. Use this function to activate cyclical electrode cleaning (ECC). **Options:** 0 = OFF 1 = ON (only with the optional electrode cleaning function ECC) **Factory setting:** ON (only if the optional electrode cleaning function ECC is available) **Notes on electrode cleaning (ECC)** 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 accreting 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. ☝ Caution! If the ECC is switched off for a prolonged period in applications with conductive deposits, a layer forms inside the measuring tube and this can falsify measurement values. If the layer is allowed to accrete beyond a certain level, it might no longer be possible to remove it by switching on the ECC. If this happens the measuring tube must be cleaned and the layer removed.
ECC DURATION **6441** MODBUS register: 5115 Data type: Float Access: read/write	✎ Note! This function is not available unless the measuring device is equipped with the optional electrode cleaning function (ECC). Use this function to specify the electrode cleaning duration. **User input:** fixed-point number: 0.01...30.0 s **Factory setting:** 2.0 s

Function description BASIC FUNCTION → PROCESSPARAMETER → ECC PARAMETER	
ECC RECOVERY TIME **6442** MODBUS register: 5117 Data type: Float Access: read/write	✎ Note! This function is not available unless the measuring device is equipped with the optional electrode cleaning function (ECC). Use this function to specify the recovery time for which the last flow value measured prior to cleaning is retained. A recovery time is necessary as the signal outputs can fluctuate after electrode cleaning on account of electrochemical interference voltages. **User input:** max. 3-digit number: 1...600 s **Factory setting:** 5 s ☝ Caution! The last value measured prior to cleaning is output for the duration of the recovery time (max. 600 s). This in turn means that the measuring system does not register changes in flow, e.g. stoppage, during this time span.
ECC CLEANING CYCLE **6443** MODBUS register: 5119 Data type: Float Access: read/write	✎ Note! This function is not available unless the measuring device is equipped with the optional electrode cleaning function (ECC). Use this function to specify the cleaning cycle for electrode cleaning. **User input:** Integer: 30...10080 min **Factory setting:** 40 min

9.2.4 Function group ADJUSTMENT



Function description
BASIC FUNCTION → PROCESSPARAMETER → ADJUSTMENT

EPD ADJUSTMENT 6480

MODBUS register: 5107
Data type: Integer
Access: read/write

Use this function to activate the EPD/OED adjustment for an empty or full measuring tube.

✎ Note!
A detailed description and other helpful hints for the empty-pipe/full-pipe adjustment procedure can be found on Seite 109.

Options:
0 = OFF
1 = FULL-PIPE ADJUSTMENT
2 = EMPTY-PIPE ADJUSTMENT
3 = OED FULL ADJUSTMENT
4 = OED EMPTY ADJUSTMENT

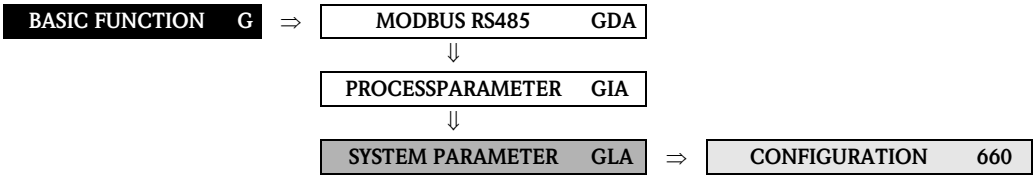
Factory setting:
OFF

Procedure for EPD or OED empty-pipe / full-pipe adjustment
1. Empty the piping. In case of an EPD adjustment, the wall of the measuring tube should be wetted with fluid for the adjustment procedure but this is not the case with an OED adjustment!
2. Start empty-pipe adjustment: Select “EMPTY PIPE ADJUST” or “OED EMPTY ADJUST” and press E to confirm.
3. After empty-pipe adjustment, fill the piping with fluid.
4. Start full-pipe adjustment: Select “FULL PIPE ADJUST” or “OED FULL ADJUST” and press E to confirm.
5. Having completed the adjustment, select the setting “OFF” and exit the function by pressing E .
6. Now select the EPD function (s. page 109). Switch on Empty Pipe Detection by selecting the following settings:
   – EPD → Select ON STANDARD or ON SPECIAL and press E to confirm.
   – OED → Select OED and confirm with E .

☝ Caution!
The adjustment coefficients must be valid before you can activate the EPD/OED function. If adjustment is incorrect the following messages might appear on the display:
– FULL = EMPTY
  The adjustment values for empty pipe and full pipe are identical. In cases of this nature you must repeat empty-pipe or full-pipe adjustment again!
– ADJUSTMENT NOT OK
  Adjustment is not possible because the fluid’s conductivity is out of range.

9.3 Group SYSTEM PARAMETER

9.3.1 Function group CONFIGURATION

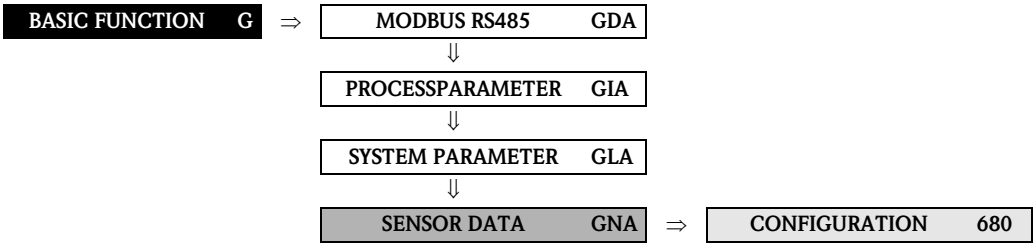


Function description BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION		
INSTALLATION DIRECTION SENSOR MODBUS register: Data type: Access:	**6600** 5501 Integer read/write	Use this function to reverse the sign of the flow direction, if necessary. **Options:** 0 = NORMAL (flow as indicated by the arrow) 1 = INVERSE (flow opposite to direction indicated by the arrow) **Factory setting:** NORMAL ✎ Note! Ascertain the actual direction of fluid flow with reference to the direction indicated by the arrow on the sensor (nameplate).
SYSTEM DAMPING MODBUS register: Data type: Access:	**6603** 5504 Float read/write	Use this function to set the filter depth of the digital filter. This reduces the sensitivity of the measuring signal to interference peaks (e.g. high solids content, gas bubbles in the fluid, etc.). The system reaction time decreases with an increasing filter setting. **User input:** 0...15 **Factory setting:** 9 ✎ Note! ■ The system damping acts on all functions and outputs of the measuring device. ■ The SYSTEM DAMPING has to be optimized for highly accurate and short filling processes. To do this, put the setting to “0”.
INTEGRATION TIME MODBUS register: Data type: Access:	**6604** 5506 Float read/write	Use this function to set the integration time. Under normal circumstances it is not necessary to change the factory settings. **User input:** 3.3...65 ms **Factory setting:** 20 ms at 50 Hz → power supply frequency (e.g. Europe) 16.7 ms at 60 Hz → power supply frequency (e.g. USA) Caution! The integration time must not be selected with a greater value than the measuring period (6820). ✎ Note! The integration time defines the duration of internal totaling of the induced voltage in the fluid (measured by the measuring electrode), i.e. the time in which the measuring device records the true flow (afterwards the magnetic field for the next integration is created from the opposite pole).

Function description BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION		
POSITIVE ZERO RETURN	**6605**	Use this function to interrupt evaluation of measured variables. This is necessary when a piping system is being cleaned, for example. This setting acts on all function and outputs of the measuring device.
MODBUS register: Data type: Access:	5503 Integer read/write	**Options:** 0 = OFF 1 = ON → Signal output is set to the "ZERO FLOW" value. **Factory setting:** OFF ✎ Note! Positive zero return may **not** be activated for batching processes with the optional software package BATCHING.

9.4 Group SENSOR DATA

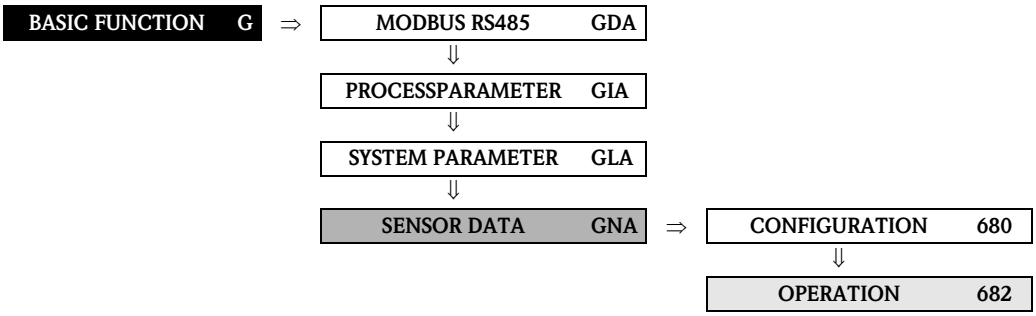
9.4.1 Function group CONFIGURATION



Function description BASIC FUNCTION → SENSOR DATA → CONFIGURATION	
All sensor data (calibration factors, zero (point) and nominal diameter) are set at the factory and saved on the S-DAT sensor memory chip. ☞ Caution! Under normal circumstances you should not change the following parameter settings, because changes affect numerous functions of the entire measuring facility in general and the accuracy of the measuring system in particular. For this reason, the functions described below cannot be changed even when you enter your personal code. Contact the Endress+Hauser service organization if you have any questions about these functions. ✎ Note! The individual values of the functions are also provided on the sensor nameplate.	
K-FACTOR POSITIVE **6801** MODBUS register: 3101 Data type: Float Access: Read	Use this function to display the current calibration factor (positive flow direction) for the sensor. The calibration factor is determined and set at the factory. **User interface:** 5-digit fixed-point number: 0.5000...2.0000 **Factory setting:** Depends on nominal diameter and calibration
K-FACTOR NEGATIVE **6802** MODBUS register: 3103 Data type: Float Access: Read	Use this function to display the current calibration factor (negative flow direction) for the sensor. The calibration factor is determined and set at the factory. **User interface:** 5-digit fixed-point number: 0.5000...2.0000 **Factory setting:** Depends on nominal diameter and calibration
ZERO POINT **6803** MODBUS register: 3105 Data type: Float Access: Read	This function shows the current zero-point correction value for the sensor. Zero-point correction is determined and set at the factory. **User interface:** max. 4-digit number: –1000...+1000 **Factory setting:** Depends on nominal diameter and calibration

Function description BASIC FUNCTION → SENSOR DATA → CONFIGURATION		
NOMINAL DIAMETER	**6804**	This function shows the nominal diameter for the sensor. The nominal diameter depends on the size of the sensor and is set at the factory.
MODBUS register: mm inch Data type: Access:	3107 3108 Integer Read	**User interface:** 1 = DN 2 or 1/12" 2 = DN 3 or 1/8" 3 = DN 3.5 or 9/64" 4 = DN 4 or 5/32" 5 = DN 6 or 1/4" 6 = DN 8 or 5/16" 7 = DN 10 or 3/8" 8 = DN 15 or 1/2" 9 = DN 20 or 3/4" 10 = DN 25 or 1" 11 = DN 32 or 1 1/4" 12 = DN 40 or 1 1/2" 13 = DN 50 or 2" 14 = DN 65 or 2 1/2" 15 = DN 80 or 3" 16 = DN 100 or 4" 17 = DN 125 or 5" 18 = DN 150 or 6" 19 = DN 200 or 8" 20 = DN 250 or 10" 21 = DN 300 or 12" 22 = DN 350 or 14" 23 = DN 400 or 16" 24 = DN 450 or 18" 25 = DN 500 or 20" 26 = DN 600 or 24" 27 = DN 700 or 28" 29 = DN 800 or 32" 30 = DN 900 or 36" 31 = DN 1000 or 40" 32 = DN 1050 or 42" 34 = DN 1200 or 48" 37 = DN 1500 or 60" 41 = DN 1800 or 72" 42 = DN 2000 or 78" **Factory setting:** Depends on the size of the sensor

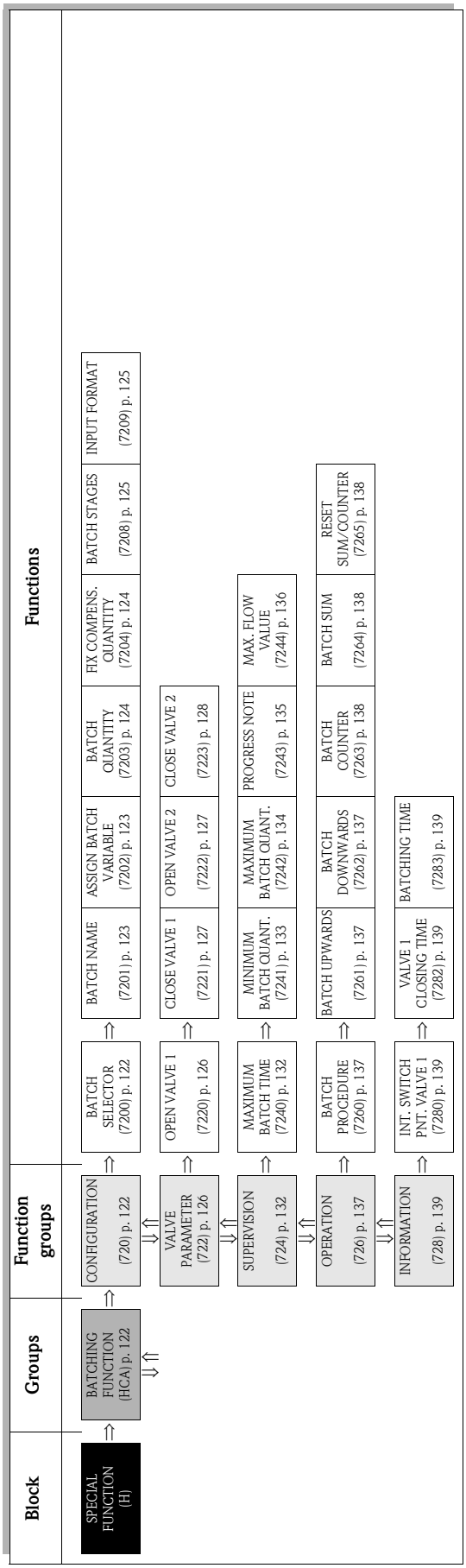
9.4.2 Function group OPERATION



Function description BASIC FUNCTION → SENSOR DATA → OPERATION	
All sensor data (measuring period, overvoltage time etc.) are set at the factory and saved on the S-DAT sensor memory chip.	
MEASURING PERIOD 6820 MODBUS register: 3111 Data type: Float Access: read/write	Use this function to set the time for a full measuring period. The duration of the measuring period is calculated from the rise time of the magnetic field, the brief recovery time, the integration time (which can be set) and the empty pipe detection time. **User input:** 0.0...1000 ms **Factory setting:** Depends on nominal diameter ✎ Note! The system checks the time entered and sets the measuring period which is actually used internally to a plausible value. If you enter 0 ms, the system automatically computes the shortest time.
☝ Caution! Under normal circumstances you should not change the following parameter settings, because changes affect numerous functions of the entire measuring facility in general and the accuracy of the measuring system in particular. For this reason, the functions described below cannot be changed even when you enter your personal code. Contact the Endress+Hauser service organization if you have any questions about these functions.	
OVERVOLTAGE TIME 6821 MODBUS register: 3115 Data type: Float Access: Read	Use this function to specify the time in which overvoltage is applied to the coil circuit in order to build up the magnetic field as fast as possible. The overvoltage time is adjusted automatically while measuring is in progress. The overvoltage time depends on the sensor type and the nominal diameter and is set at the factory. **User interface:** 4-digit floating-point number 0.0...100.0 ms **Factory setting:** Depends on nominal diameter
EPD ELECTRODE 6822 MODBUS register: 3113 Data type: Integer Access: Read	Use this function to check whether the sensor is equipped with an EPD electrode. **User interface:** 0 = NO 1 = YES **Factory setting:** YES → Electrode fitted as standard

Function description BASIC FUNCTION → SENSOR DATA → OPERATION	
POLARITY ECC **6823** MODBUS register: 3114 Data type: Integer Access: Read	✎ Note! This function is not available unless the measuring device is equipped with the optional electrode cleaning function (ECC). Use this function to display the actual current polarity for optional electrode cleaning (ECC). Electrode cleaning uses either a positive or negative current, depending on the electrode material. The measuring device automatically selects the correct polarity on the basis of the electrode-material data stored in the S-DAT. **User interface:** 0 = POSITIVE → for electrodes made of: 1.4435, Hastelloy C, platinum 1 = NEGATIVE → for electrodes made of: tantalum ☝ Caution! If the incorrect current is applied to the electrodes, the electrode material is destroyed.

10 Block SPECIAL FUNCTION



10.1 Group BATCHING FUNCTION

10.1.1 Function group CONFIGURATION

SPECIAL FUNCTION H ⇒ BATCHING FUNCTION HCA ⇒ CONFIGURATION 720

Function description SPECIAL FUNCTION → BATCHING FUNCTION → CONFIGURATION	
BATCH SELECTOR **7200** MODBUS register: 6301 Data type: Integer Access: read/write	Use this function to select a batching specification. There are six different batching specifications available by means of which different batchings can be defined. **Options:** 0 = BATCH # 1 (or the name which was defined for batching specification 1 in the function BATCH NAME (7201). 1 = BATCH # 2 (or the name which was defined for batching specification 2 in the function BATCH NAME (7201). 2 = BATCH # 3 (or the name which was defined for batching specification 3 in the function BATCH NAME (7201). 3 = BATCH # 4 (or the name which was defined for batching specification 4 in the function BATCH NAME (7201). 4 = BATCH # 5 (or the name which was defined for batching specification 5 in the function BATCH NAME (7201). 5 = BATCH # 6 (or the name which was defined for batching specification 6 in the function BATCH NAME (7201). **Factory setting:** BATCH #1 ✎ Note! ■ By selecting a batching specification and its related settings (explained below), up to 6 different batchings can be preconfigured and selected as necessary. ■ All the following functions in this function group, as well as the functions in the function groups VALVE PARAMETER (722) and SUPERVISION (724) are assigned to the batching specification selected here. ■ All the settings in the following functions of this function group are valid only for the batching specification selected in the function BATCH SELECTOR (7200). In other words, the entry or option is assigned to the batching specification currently selected (e.g. in the factory setting BATCH # 1).

Function description SPECIAL FUNCTION → BATCHING FUNCTION → CONFIGURATION		
BATCH NAME MODBUS register: Data type: Access:	**7201** See Note String (8) read/write	Use this function to assign a specific name to the batching specification. **User input:** max. 8-character text, permissible: A–Z, 0–9 **Factory setting:** Name of batching specification (depends on selection in the function BATCH SELECTOR (7200), e.g. “BATCH # 1”). ✎ Note! Once an entry has been made (e.g. “BEER 33”), the batch name (BEER 33) appears in the home position when selecting the quantity and the name of the batching specification (e.g. “BATCH # 1”) no longer appears. ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6302 ■ BATCH # 2 = MODBUS register 6306 ■ BATCH # 3 = MODBUS register 6310 ■ BATCH # 4 = MODBUS register 6314 ■ BATCH # 5 = MODBUS register 6318 ■ BATCH # 6 = MODBUS register 6322
ASSIGN BATCH VARIABLE MODBUS register: Data type: Access:	**7202** See Note Integer read/write	Use this function to assign a batching variable to the batching specification. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** OFF ✎ Note! ■ The possible assignments of the display functions are automatically extended. Once a batching variable has been selected (MASS or VOLUME), you can locally define the application-specific function of the minus key (start-stop-continue) and the plus key (stop-batching name/quantity) in the information line by means of the “batching menu” assignment. In this way, a direct batching control station is made available locally at the measuring device by means of the user interface and the controls. ■ Select OFF if the BATCHING functionality is no longer to be used. All settings related to the function (e.g. switching contact assigned to the relay output) must be assigned to another functionality. ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6326 ■ BATCH # 2 = MODBUS register 6327 ■ BATCH # 3 = MODBUS register 6328 ■ BATCH # 4 = MODBUS register 6329 ■ BATCH # 5 = MODBUS register 6330 ■ BATCH # 6 = MODBUS register 6331

Function description SPECIAL FUNCTION → BATCHING FUNCTION → CONFIGURATION		
BATCH QUANTITY MODBUS register: Data type: Access:	**7203** See Note Float read/write	Use this function to define the quantity to be batched BATCH SELECTOR. **User input:** 5-digit floating-point number: 0...max. value (depends on nominal diameter) [unit] **Factory setting:** 0 [unit] ✎ Note! ■ The appropriate unit is taken from the function group SYSTEM UNITS (ACA), (see page 14). ■ When the batching quantity entered here is achieved, valve 1 closes (see function CLOSE VALVE 1 (7221) on page 127). ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6332 ■ BATCH # 2 = MODBUS register 6334 ■ BATCH # 3 = MODBUS register 6336 ■ BATCH # 4 = MODBUS register 6338 ■ BATCH # 5 = MODBUS register 6340 ■ BATCH # 6 = MODBUS register 6342
FIX COMPENSATION QUANTITY MODBUS register: Data type: Access:	**7204** See Note Float read/write	Use this function to specify a positive or negative compensation quantity. The compensation quantity balances out a **constant**, system-related incorrect quantity. This can be caused, for example, by a pump over-running or by the closing time of a valve. The compensation quantity is determined by the system operator. A negative compensation quantity must be specified for overbatching and a positive compensation quantity for underbatching. **User input:** Floating-point number with sign (depends on nominal diameter) **Factory setting:** 0 [unit] ✎ Note! ■ If the entry range is not sufficient for the compensation quantity, the batching quantity may have to be adjusted. ■ The appropriate unit is taken from the function group SYSTEM UNITS (ACA), (see page 14). ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6344 ■ BATCH # 2 = MODBUS register 6346 ■ BATCH # 3 = MODBUS register 6348 ■ BATCH # 4 = MODBUS register 6350 ■ BATCH # 5 = MODBUS register 6352 ■ BATCH # 6 = MODBUS register 6354

Function description SPECIAL FUNCTION → BATCHING FUNCTION → CONFIGURATION		
BATCH STAGES	**7208**	Use this function to define the number of batching stages. Batching can be carried out in several stages, e.g. 2-stage batching with fast and precise batching. **Options:** 0 = 1-stage (1 valve or 1-stage batching) 1 = 2-stage (2 valves or 2-stage batching) **Factory setting:** 1-stage (1 valve or 1-stage batching) ✎ Note! ■ The batching stage selection (number of valves) is directly dependent on the configuration of the outputs. For 2-stage batching two relay outputs must be available in the measuring device. ■ The functions available in the function group VALVE PARAMETER (page 126) are dependent on the number of batching stages (number of valves) selected in this function. ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6380 ■ BATCH # 2 = MODBUS register 6381 ■ BATCH # 3 = MODBUS register 6382 ■ BATCH # 4 = MODBUS register 6383 ■ BATCH # 5 = MODBUS register 6384 ■ BATCH # 6 = MODBUS register 6385
MODBUS register: Data type: Access:	See Note Integer read/write	
INPUT FORMAT	**7209**	Use this function to define the entry format of the quantities for the switch points of the valves. **Options:** 0 = VALUE-INPUT (e.g. 10 [unit]) 1 = %-INPUT (e.g. 80 [%]) **Factory setting:** VALUE–INPUT ✎ Note! The entry format selected in this function is also used in the function groups VALVE PARAMETER (page 126) and SUPERVISION (page 132). ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 6386 ■ BATCH # 2 = MODBUS register 6387 ■ BATCH # 3 = MODBUS register 6388 ■ BATCH # 4 = MODBUS register 6389 ■ BATCH # 5 = MODBUS register 6390 ■ BATCH # 6 = MODBUS register 6391
MODBUS register: Data type: Access: Storage class:	See Note Integer read/write Volatile	

10.1.2 Function group VALVE PARAMETER

SPECIAL FUNCTION H ⇒ BATCHING FUNCTION HCA ⇒ CONFIGURATION 720
⇓
VALVE PARAMETER 722

Function description
SPECIAL FUNCTION → BATCHING FUNCTION → VALVE PARAMETER

The parameters for the switching contacts of up to 2 valves can be set in the following functions.
The number of switching contacts (valves) available, and thus their settings in this group, is defined in the function BATCH STAGES (7208).

✎ Note!
The following functions are only available if at least one batch stage has been selected in the function BATCH SELECTOR (7200).

OPEN VALVE 1 **7220**

MODBUS register: See Note
Data type: Float
Access: read/write

Use this function to specify the quantity value at which contact 1 opens. This is used as a switch point for valve 1 to output via an assigned output. The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209).

User input:
0...max. value or 0...100% (related to the batching quantity)

Factory setting:
0 [unit] or 0 [%]

✎ Note!
- Dynamic tracking for %-data:
  If the value is entered as a %, this %-value always refers to the batching quantity (e.g. 70% of a batching quantity of 10 liters = 7 liters).
  If the BATCH QUANTITY (7203) is adjusted (reduced/increased), the effective quantity switch point is automatically and dynamically adjusted (e.g. taking 70% and changing the batching quantity from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters).
- Dynamic tracking for value-data:
  If you enter value-input, this value is “absolute” for batching quantities that do not change (e.g. always 7 liters for a batching quantity of 10 liters). If the batching quantity (7203) is adjusted (reduced/increased), the quantity switch point is automatically and dynamically adjusted/tracked (e.g. with a new batching quantity changing from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters). In other words, the existing value data is tracked as a percentage of the altered batching quantity.

✎ Note for MODBUS!
The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200):
- BATCH # 1 = MODBUS register 8001
- BATCH # 2 = MODBUS register 8003
- BATCH # 3 = MODBUS register 8005
- BATCH # 4 = MODBUS register 8007
- BATCH # 5 = MODBUS register 8009
- BATCH # 6 = MODBUS register 8011

Function description SPECIAL FUNCTION → BATCHING FUNCTION → VALVE PARAMETER	
CLOSE VALVE 1 **7221** MODBUS register: 8013 Data type: Float Access: Read	Use this function to display the quantity value at which contact 1 (valve 1) closes. The quantity value is displayed either as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **User interface:** Value or 100% (corresponds to the batching quantity) **Factory setting:** 0 [unit] or 0 [%] ✎ Note! The switching contact for valve 1 is the "main contact", i.e. the closing function of valve 1 is firmly assigned to the batching quantity entered (see function BATCH QUANTITY (7203) on page 124). In this way, function CLOSE VALVE 1 is also the basis for calculating the after run quantity.
OPEN VALVE 2 **7222** MODBUS register: See Note Data type: Float Access: read/write	Use this function to specify the quantity value at which contact 2 opens. This is used as a switch point for valve 2 to output via an assigned output. The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **User input:** 0...max. value or 0...100% (related to the batching quantity) **Factory setting:** 0 [unit] or 0 [%] ✎ Note! ■ Dynamic tracking for %-data: If the value is entered as a %, this %-value always refers to the batching quantity (e.g. 70% of a batching quantity of 10 liters = 7 liters). If the BATCH QUANTITY (7203) is adjusted (reduced/increased), the effective quantity switch point is automatically and dynamically adjusted (e.g. taking 70% and changing the batching quantity from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters). ■ Dynamic tracking for value-data: If you enter value-input, this value is "absolute" for batching quantities that do not change (e.g. always 7 liters for a batching quantity of 10 liters). If the batching quantity (7203) is adjusted (reduced/increased), the quantity switch point is automatically and dynamically adjusted/tracked (e.g. with a new batching quantity changing from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters). In other words, the existing value data is tracked as a percentage of the altered batching quantity. ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8015 ■ BATCH # 2 = MODBUS register 8017 ■ BATCH # 3 = MODBUS register 8019 ■ BATCH # 4 = MODBUS register 8021 ■ BATCH # 5 = MODBUS register 8023 ■ BATCH # 6 = MODBUS register 8025

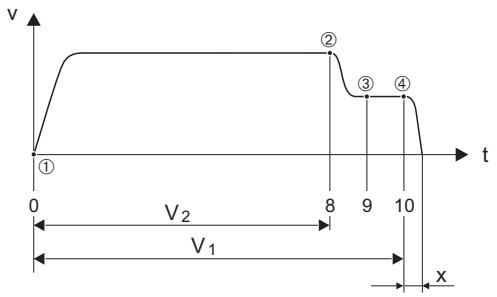
Function description SPECIAL FUNCTION → BATCHING FUNCTION → VALVE PARAMETER		
CLOSE VALVE 2	***7223***	Use this function to specify the quantity value at which contact 2 closes. This is used as a switch point for valve 2 to output via an assigned output. The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **User input:** 0...max. value or 0...100% (related to the batching quantity) **Factory setting:** 0 [unit] or 0 [%] ✎ Note! ■ Dynamic tracking for %-data: If the value is entered as a %, this %-value always refers to the batching quantity (e.g. 70% of a batching quantity of 10 liters = 7 liters). If the BATCH QUANTITY (7203) is adjusted (reduced/increased), the effective quantity switch point is automatically and dynamically adjusted (e.g. taking 70% and changing the batching quantity from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters). ■ Dynamic tracking for value-data: ■ If you enter value-input, this value is “absolute” for batching quantities that do not change (e.g. always 7 liters for a batching quantity of 10 liters). If the batching quantity (7203) is adjusted (reduced/increased), the quantity switch point is automatically and dynamically adjusted/tracked (e.g. with a new batching quantity changing from 10 to 20 liters, the quantity switch point is adjusted from 7 liters to 14 liters). In other words, the existing value data is tracked as a percentage of the altered batching quantity. ✎ Note for MODBUS! The MODBUS register depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8027 ■ BATCH # 2 = MODBUS register 8029 ■ BATCH # 3 = MODBUS register 8031 ■ BATCH # 4 = MODBUS register 8033 ■ BATCH # 5 = MODBUS register 8035 ■ BATCH # 6 = MODBUS register 8037
MODBUS register: Data type: Access:	See Note Float read/write	

10.1.3 Examples of setting parameters for batching processes

The two examples in the next section clearly show the effect of different entries and options in the function groups.

Example 1
The first example explains the parameter setting of various functions for carrying out batching and illustrates how functions are affected when the batching quantity is changed.

The following batching is to take place:
- 2-stage batching with a batching quantity of 10 liters in total.
- Coarse batching quantity of 8 liters. Valve 2 opens at the start of the batching and closes when 8 liters is achieved.
- Fine batching of 2 liters. Valve 1 opens at the start of the batching and closes (automatically) when the batching quantity (10 liters) is achieved.
- Once 9 liters have been batched a batching progress message should be generated.
- Value-input should be entered.



A0004670

v = Flow velocity [m/s]
t = Time
V_1 = Valve 1 open
V_2 = Valve 2 open
① = Start batching/coarse batching, valves 1 (7220) and 2 (7222) open
② = Valve 2 (7223) closes, coarse batching quantity achieved
③ = Batching progress message (7243)
④ = Valve 1 closes (7221), end of batching
x = After run quantity

The following parameter settings must be made:
- Select the unit for batching:
  Function UNIT VOLUME (0403) page 16 = l (liter)
- Select the measured variable for batching:
  Function ASSIGN BATCH VARIABLE (7202) page 123 = VOLUME FLOW
- Enter the batching quantity:
  Function BATCH QUANTITY (7203) page 124 = 10 [liters]
- Select the entry format:
  Function BATCH STAGES (7208) page 125 = 2-stage
- Select the entry format:
  Function INPUT FORMAT (7209) page 125 = VALUE-INPUT
- Quantity data for when the first valve should open:
  Function OPEN VALVE 1 (7220) page 126 = 0 [liters]
  (valve 1 closes automatically when the batching quantity is achieved = 10 [liters], display in function CLOSE VALVE 1 (7221) page 127)
- Quantity data for when the second valve should open:
  Function OPEN VALVE 2 (7224) page 127 = 0 [liters]

– Quantity data for when the second valve should close:
  Function CLOSE VALVE 2 (7223) page 128 = 8 [liters]
– Quantity data for when the message should be generated:
  Function PROGRESS NOTE (7243) page 135 = 9 [liters]

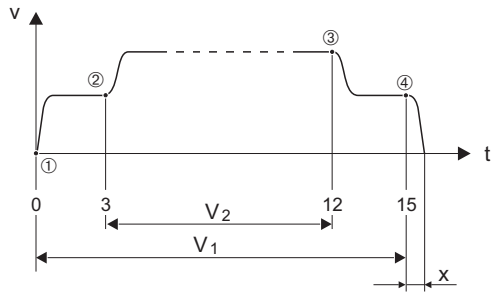
Example 1 a
Batching specifications identical to those in example 1, however the new batching quantity is 20 liters and the message should be generated once 18 liters are batched.

The following parameters must be set **manually** :
– Enter the new batching quantity:
  Function BATCH QUANTITY (7203) page 124 = 20 [liters]
– New quantity data for when the message should be generated:
  Function PROGRESS NOTE (7243) page 135 = 18 [liters]

The following functions are **automatically** adjusted to suit the new batching quantity:
– Function OPEN VALVE 1 = 0 [liters]
– Function OPEN VALVE 2 = 0 [liters]
– Function CLOSE VALVE 2 = 16 [liters]

Example 2
The second example explains the parameter settings of the various functions for batching with the entry format in % for the switch points of the valves.

The following batching is to take place:
- 2-stage batching with a batching quantity of 15 liters in total.
- Coarse batching quantity from 3 to 12 liters. Valve 2 opens when 20% (3 liters) of the batching quantity is achieved and closes once 80% (12 liters) is achieved.
- Valve 1 opens at the start of the batching and closes (automatically) when the batching quantity (15 liters) is achieved.
- %-data should be entered.



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v = Flow velocity [m/s]
t = Time
V_1 = Valve 1 open
V_2 = Valve 2 open
① = Start batching, valve 1 (7220) opens
② = Valve 2 (7222) opens, coarse batching quantity starts
③ = Valve 2 (7223) closes, coarse batching quantity achieved
④ = Valve 1 (7221) closes, end of batching
x = After run quantity

The following parameter settings must be made:
- Select the unit for batching:
  Function UNIT VOLUME (0403) page 16 = l (liter)
- Select the measured variable for batching:
  Function ASSIGN BATCH VARIABLE (7202) page 123 = VOLUME FLOW
- Enter the batching quantity:
  Function BATCH QUANTITY (7203) page 124 = 15 [liters]
- Select the entry format:
  Function BATCH STAGES (7208) page 125 = 2-stage
- Select the entry format:
  Function INPUT FORMAT (7209) page 125 = %-INPUT
- Percentage data for when the first valve should open:
  Function OPEN VALVE 1 (7220) page 126 = 0 [%]
  (valve 1 closes automatically when the batching quantity is achieved = 15 [liters],
  display in function CLOSE VALVE 1 (7221) page 127)
- Percentage data for when the second valve should open:
  Function OPEN VALVE 2 (7224) page 127 = 20 [%], corresponds to 3 liters
- Percentage data for when the second valve should close:
  Function CLOSE VALVE 2 (7223) page 128 = 80 [%], corresponds to 12 liters

Example 2 a
Batching specifications identical to those in example 1, however the new batching quantity is 45 liters.

The following parameters must be set **manually**:
Enter the new batching quantity:
Function BATCH QUANTITY (7203) page 124 = 45 [liters]

The following functions are **automatically** adjusted to suit the new batching quantity:
- Function OPEN VALVE 1 = 0 [%]
- Function OPEN VALVE 2 = 20 [%] corresponds to 9 liters
- Function CLOSE VALVE 2 = 80 [%] corresponds to 36 liters

10.1.4 Function group SUPERVISION

SPECIAL FUNCTION H ⇒ BATCHING FUNCTION HCA ⇒ CONFIGURATION 720
⇓
VALVE PARAMETER 722
⇓
SUPERVISION 724

Function description
SPECIAL FUNCTION → BATCHING FUNCTION → SUPERVISION

MAXIMUM BATCH TIME **7240**

MODBUS register: See Note
Data type: Float
Access: read/write

Use this function to specify a maximum batching time.
All valves close once the specified batching time elapses (see functions CLOSE VALVE 1...2, see page 127 ff.).
This function can be used for safety reasons, for example, to ensure all batching valves close in the event of a system fault.

User input:
0...30000 s

Factory setting:
0 s (= deactivated)

Caution!
- When the batching quantity is adjusted (reduced/increased), (see function BATCH QUANTITY (7203) on page 124), there is no automatic adjustment, i.e. this value must be determined again and reentered, (see also fault message # 471 in the Troubleshooting section of the Promag 53 MODBUS RS485 Operating Instructions BA117D/06/en).
- Batching (START) is not possible when the fault message is active!

Note!
- The function is not active if you enter 0 s (factory setting). This means that the batching valves are not closed by means of this function.
- A fault message is assigned to the function. This fault message can be acknowledged prematurely:
  – By modifying a batching function.
  – By selecting RESET in the "BATCH PROCEDURE" parameter
- This function can be output via the switch output.

Note for MODBUS!
Depends on the option selected in the function BATCH SELECTOR (7200):
- BATCH # 1 = MODBUS register 8063
- BATCH # 2 = MODBUS register 8065
- BATCH # 3 = MODBUS register 8067
- BATCH # 4 = MODBUS register 8069
- BATCH # 5 = MODBUS register 8071
- BATCH # 6 = MODBUS register 8073

Function description SPECIAL FUNCTION → BATCHING FUNCTION → SUPERVISION	
MINIMUM BATCH QUANTITY **7241** MODBUS register: See Note Data type: Float Access: read/write	Use this function to specify a minimum batching quantity. A message is generated if the minimum batching quantity was not achieved by the time batching ends (e.g. if after run mode is active). The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **Application:** Message stating that underbatching is present (e.g. the contents of the containers does not correspond to the quantity declared). **User input:** 0...max. value or 0...100% (related to the batching quantity) **Factory setting:** 0 [Unit] (= deactivated) Caution! ■ When the batching quantity is adjusted (reduced/increased), (see function BATCH QUANTITY (7203) on page 124), there is no automatic adjustment, i.e. this value must be determined again and reentered, (see also fault message # 472 in the Troubleshooting section of the Promag 53 MODBUS RS485 Operating Instructions BA117D/06/en). ■ Batching (START) is not possible when the fault message is active! ■ The function is not active if you enter 0 (factory setting). ■ A fault message is assigned to the function. This fault message can be acknowledged prematurely: – By modifying a batching function. – By selecting RESET in the “BATCH PROCEDURE” parameter ■ This function can be output via the switch output. Note for MODBUS! Depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8075 ■ BATCH # 2 = MODBUS register 8077 ■ BATCH # 3 = MODBUS register 8079 ■ BATCH # 4 = MODBUS register 8081 ■ BATCH # 5 = MODBUS register 8083 ■ BATCH # 6 = MODBUS register 8085

Function description SPECIAL FUNCTION → BATCHING FUNCTION → SUPERVISION		
MAXIMUM BATCH QUANTITY	**7242**	Use this function to specify a maximum batching quantity. If the maximum batching quantity is exceeded during batching, all valves are closed, batching is stopped and a message is generated. The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **Application:** To avoid overbatching and thus prevent critical situations caused by fluid overflow arising in the plant, (e.g. plant standstill caused by safety level switches being triggered, contamination, product loss, etc.). **User input:** 0...2 x max. value or 0...200% (related to the batching quantity) **Factory setting:** 0 [Unit] (= deactivated) Caution! ■ When the batching quantity is adjusted (reduced/increased), (see function BATCH QUANTITY (7203) on page 124), there is no automatic adjustment, i.e. this value must be determined again and reentered, (see also fault message # 472 in the Troubleshooting section of the Promag 53 MODBUS RS485 Operating Instructions BA117D/06/en). ■ Batching (START) is not possible when the fault message is active! Note! ■ The function is not active if you enter 0 (factory setting). ■ A fault message is assigned to the function. This fault message can be acknowledged prematurely: – By modifying a batching function. – By selecting RESET in the “BATCH PROCEDURE” parameter ■ This function can be output via the switch output. Note for MODBUS! Depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8087 ■ BATCH # 2 = MODBUS register 8089 ■ BATCH # 3 = MODBUS register 8091 ■ BATCH # 4 = MODBUS register 8093 ■ BATCH # 5 = MODBUS register 8095 ■ BATCH # 6 = MODBUS register 8097
MODBUS register: Data type: Access:	See Note Float read/write	

Function description SPECIAL FUNCTION → BATCHING FUNCTION → SUPERVISION		
PROGRESS NOTE	**7243**	Use this function to define a batching quantity at which a message should be generated. When the specified batching quantity is achieved, the message is generated and signaled via the output. The quantity value is entered as a % or as an absolute value, depending on the option in the function INPUT FORMAT (7209). **Application:** For longer batching processes when preparing or taking measures related to production (e.g. preparing to replace container, etc.). **User input:** 0...max. value or 0...100% (related to the batching quantity) **Factory setting:** 0 [Unit] (= deactivated) Caution! When the batching quantity is adjusted (reduced/increased), (see function BATCH QUANTITY (7203) on page 124), there is no automatic adjustment, i.e. this value must be determined again and reentered, (see also notice message # 473 in the Troubleshooting section of the Promag 53 MODBUS RS485 Operating Instructions BA117D/06/en). Note! ■ The function is not active if you enter 0 (factory setting). ■ This function can be output via the switch output. ■ The batching progress message remains active until batching ends. Note for MODBUS! Depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8099 ■ BATCH # 2 = MODBUS register 8101 ■ BATCH # 3 = MODBUS register 8103 ■ BATCH # 4 = MODBUS register 8105 ■ BATCH # 5 = MODBUS register 8107 ■ BATCH # 6 = MODBUS register 8109
MODBUS register: Data type: Access:	See Note Float read/write	

Function description SPECIAL FUNCTION → BATCHING FUNCTION → SUPERVISION		
MAX. FLOW VALUE MODBUS register: Data type: Access:	**7244** See Note Float read/write	A maximum flow value can be specified in this function. The batching process is aborted and all the valves are closed if the specified flow value is overshot. **Application:** This function can be used for safety reasons, for example, to ensure all batching valves close in the event of a system fault. **User input:** 5-digit floating-point number **Factory setting:** 0 [Unit] (= deactivated) ✎ Note! ■ The appropriate unit is taken depending on the process variable selected in the ASSIGN BATCH VARIABLE 7202 parameter and the unit configured in the SYSTEM UNITS group. ■ The function is not active if you enter 0 (factory setting). ■ If the batching process is aborted because the specified flow value was overshot, the BATCH COUNTER (7263) parameter is not incremented. ■ The error message #474 > MAX. FLOW is output if the maximum flow is overshot. This fault message can be acknowledged prematurely: – By modifying a batching function. – By selecting RESET in the “BATCH PROCEDURE” parameter ✎ Note for MODBUS! Depends on the option selected in the function BATCH SELECTOR (7200): ■ BATCH # 1 = MODBUS register 8121 ■ BATCH # 2 = MODBUS register 8119 ■ BATCH # 3 = MODBUS register 8117 ■ BATCH # 4 = MODBUS register 8115 ■ BATCH # 5 = MODBUS register 8113 ■ BATCH # 6 = MODBUS register 8111

10.1.5 Function group OPERATION

SPECIAL FUNCTION H ⇒ BATCHING FUNCTION HCA ⇒ CONFIGURATION 720
⇓
VALVE PARAMETER 722
⇓
SUPERVISION 724
⇓
OPERATION 726

Function description SPECIAL FUNCTION → BATCHING FUNCTION → OPERATION		
BATCH PROCEDURE	**7260**	Use this function to control a batching process. The batching can be started manually or a batching already running can be interrupted or stopped at any time.
MODBUS register: Data type: Access:	6392 Integer read/write	**Options:** 0 = STOP (Stop batching) 1 = START (Start batching) 2 = HOLD (Interrupt batching) 3 = GO ON (Continue batching) 4 = RESET (Reset error message # 471, # 472, # 473, # 474) **Factory setting:** STOP ✎ Note! ■ This function can also be controlled via the status input, (see function ASSIGN STATUS INPUT (5000) on page 100). ■ If the information line has been assigned to BATCHING MENU (see page 43), the application-specific functions of the minus key (START-STOP) and the plus key (HOLD / GO ON / PRESET) are defined locally. In this way, a direct batching control station is available locally at the measuring device by means of the user interface (not access-protected). ■ In the event of a fault: – during the batching process, the batching is canceled (STOP) and the local display alternates between displaying the batching menu and the fault message. ■ If the positive zero return is activated (see page 116): – during the batching process, the batching is canceled (STOP). – during a pause in the batching (option HOLD), the batching cannot be restarted, (see also notice messages # 571 and # 572 in the Troubleshooting section of the Promag 53 MODBUS RS485 Operating Instructions BA117D/06/en).
BATCH UPWARDS	**7261**	In this function the batching progress can be read upwards, i.e. **starting from 0** the quantity displayed increases until the batching process is complete or the amount specified in the BATCH QUANTITY (7203) function is reached.
MODBUS register: Data type: Access:	6393 Float Read	**User interface:** Floating-point number incl. unit
BATCH DOWNWARDS	**7262**	In this function the batching progress can be read downwards, i.e. **starting from the batching quantity (BATCH QUANTITY (7203))** the quantity displayed decreases until the batching process is complete.
MODBUS register: Data type: Access:	6395 Float Read	**User interface:** Floating-point number incl. unit

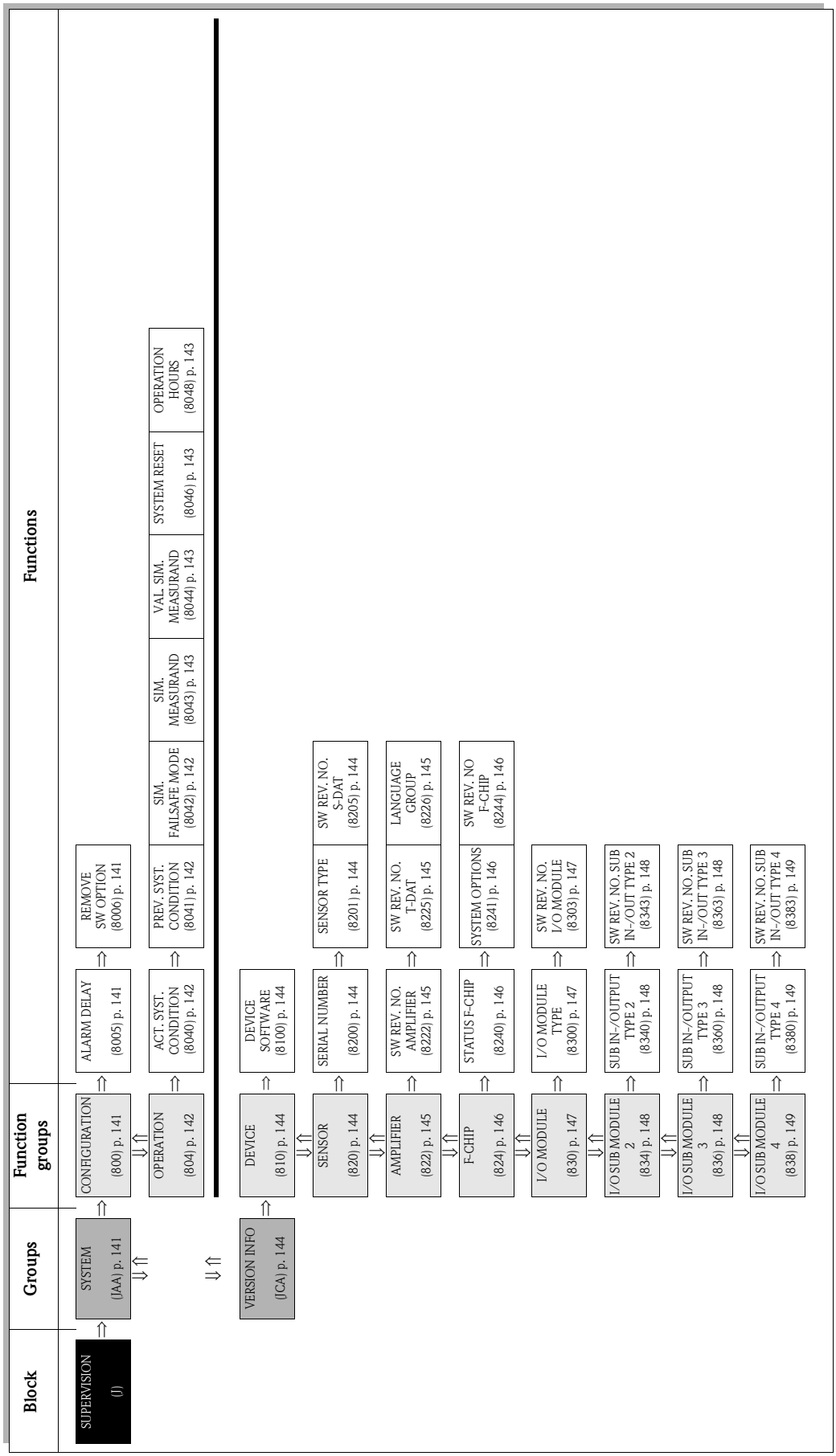
Function description SPECIAL FUNCTION → BATCHING FUNCTION → OPERATION		
BATCH COUNTER MODBUS register: Data type: Access:	**7263** 6397 Float Read	Use this function to display the number of batchings carried out. **User interface:** max. 7-digit floating-point number **Factory setting:** 0 ✎ Note! ■ The batching quantity totalizer can be reset to 0 via the function RESET SUM/COUNTER (7265). ■ This function is reset to 0 (zero) if a different batching specification is selected in the function BATCH SELECTOR (7200).
BATCH SUM MODBUS register: Data type: Access:	**7264** 6399 Float Read	Use this function to display the effective overall total of all the batchings carried out. **User interface:** max. 7-digit floating-point number [unit] **Factory setting:** 0 [unit] ✎ Note! ■ E.g. in 2-stage batching the effective overall total is calculated from the coarse batching quantity and fine batching quantity. ■ The total batching quantity can be reset to 0 via the function RESET SUM/COUNTER (7265). ■ This function is reset to 0 (zero) if a different batching specification is selected in the function BATCH SELECTOR (7200).
RESET SUM/COUNTER MODBUS register: Data type: Access:	**7265** 6401 Integer read/write	Use this function to reset the batch counter and the batch sum to zero. **User input:** 0 = NO 1 = YES **Factory setting:** NO ✎ Note! The batch counter and the batch sum can also be reset via the batching menu (information line on the local display) .

10.1.6 Function group INFORMATION

SPECIAL FUNCTION H ⇒ BATCHING FUNCTION HCA ⇒ CONFIGURATION 720
⇓
VALVE PARAMETER 722
⇓
SUPERVISION 724
⇓
OPERATION 726
⇓
INFORMATION 728

Function description SPECIAL FUNCTION → BATCHING FUNCTION → INFORMATION	
INTERNAL SWITCH POINT VALVE 1 **7280** MODBUS register: 6402 Data type: Float Access: Read	Use this function to display the **internal** switch point of valve 1 (see function CLOSE VALVE 1 on page 127). The value displayed takes the fixed correction quantity into account. **User interface:** max. 7-digit floating-point number [unit] ✎ Note! The appropriate unit is taken from the function group SYSTEM UNITS (ACA) (see page 14).
VALVE 1 CLOSING TIME **7282** MODBUS register: 6406 Data type: Float Access: Read	Use this function to display the valve closing time calculated **internally**. **User interface:** max. 7-digit floating-point number [ms] ✎ Note! ■ The valve closing time is the period between the switch point of valve 1 and the first undershooting of the low flow cut off. ■ The data can only be taken as a general trend as the accuracy of the time value is directly dependent on the measuring period.
BATCHING TIME **7283** MODBUS register: 6408 Data type: Float Access: Read	Displays the batching time for the current or completed batch process. Starting at 0 seconds, the time displayed increases until the batch process is completed. **Application:** The batching time refers to the batch quantity determined in the function BATCH SUM for the current or last batch process. **User interface:** max. 7-digit floating-point number [s] ✎ Note! ■ Behavior when controlling the batching process by means of the BATCH PROCEDURE function: – STOP → BATCHING TIME is not reset and remains at the current value. – START → BATCHING TIME is reset and starts at 0. – HOLD → BATCHING TIME is not reset and remains at the current value. – GO ON → BATCHING TIME is not reset and continues updating based on the last time value. ■ The BATCHING TIME is also updated during the batching process

11 Block SUPERVISION



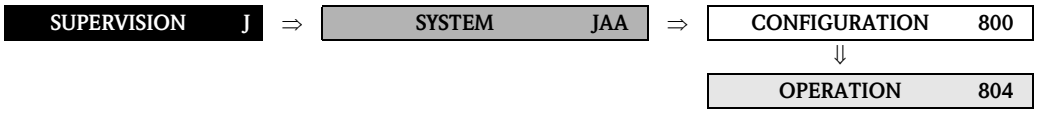
11.1 Group SYSTEM

11.1.1 Function group CONFIGURATION

SUPERVISION J ⇒ SYSTEM JAA ⇒ CONFIGURATION 800

Function description SUPERVISION → SYSTEM → CONFIGURATION	
ALARM DELAY **8005** MODBUS register: 6808 Data type: Float Access: read/write	Use this function to define a time span in which the criteria for a fault have to be satisfied without interruption before a fault or notice message is generated. Depending on the setting and the type of fault, this suppression acts on: ■ User interface ■ Current output ■ Pulse/Frequency output ■ Relay output ■ MODBUS RS485 **User input:** 0...100 s (in steps of one second) **Factory setting:** 0 s ☞ Caution! If this function is activated, fault and notice messages are delayed by the time corresponding to the setting before being transmitted to the higher-order controller (process controller, etc.). It is therefore imperative to check in advance in order to make sure whether a delay of this nature could affect the safety requirements of the process. If fault and notice messages may not be suppressed, a value of 0 seconds must be entered here.
REMOVE SW OPTION **8006** MODBUS register: 6875 Data type: Integer Access: read/write	✎ Note! This function is only available if: ■ The F-CHIP software options were saved beforehand ■ The F-CHIP is **not** located on the I/O board of the measuring device Deletes all F-CHIP software options, such as batching, etc. The measuring device is restarted after the software options have been deleted. **Options:** 0 = NO 1 = YES **Factory setting:** NO ☞ Caution! If process variables which are only available via the F-CHIP software options are assigned to the local display or the outputs, these have to be reconfigured.

11.1.2 Function group OPERATION

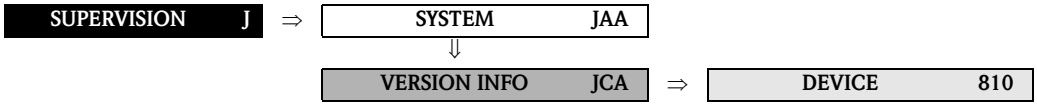


Function description SUPERVISION → SYSTEM → OPERATION	
ACTUAL SYSTEM CONDITION **8040** MODBUS register: 6859 Data type: Integer Access: Read MODBUS register: 6821 Data type: String (18) Access: Read	Use this function to check the present system condition. **User interface:** 1 = "SYSTEM OK" or the fault / notice message with the highest priority. ✎ Note! More information can be found in Operating Instructions BA117D under the keyword "System or process error messages."
PREVIOUS SYSTEM CONDITIONS **8041** MODBUS register: See Note Data type: Integer Access: Read	Use this function to view the sixteen most recent fault and notice messages since measuring last started. **User interface:** The 16 most recent fault or notice messages. ✎ Note for MODBUS! The various less recent system conditions are available via the following MODBUS registers: ■ Fault/notice message 1 = MODBUS register 6860 ■ Fault/notice message 2 = MODBUS register 6861 ■ Fault/notice message 3 = MODBUS register 6862 ■ Fault/notice message 4 = MODBUS register 6863 ■ Fault/notice message 5 = MODBUS register 6864 ■ Fault/notice message 6 = MODBUS register 6865 ■ Fault/notice message 7 = MODBUS register 6866 ■ Fault/notice message 8 = MODBUS register 6867 ■ Fault/notice message 9 = MODBUS register 6868 ■ Fault/notice message 10 = MODBUS register 6869 ■ Fault/notice message 11 = MODBUS register 6870 ■ Fault/notice message 12 = MODBUS register 6871 ■ Fault/notice message 13 = MODBUS register 6872 ■ Fault/notice message 14 = MODBUS register 6873 ■ Fault/notice message 15 = MODBUS register 6874 ■ Fault/notice message 16 = MODBUS register 6875 ✎ Note! More information can be found in Operating Instructions BA117D under the keyword "System or process error messages."
SIMULATION FAILSAFE MODE **8042** MODBUS register: 6812 Data type: Integer Access: read/write	Use this function to set all inputs, outputs and totalizers to their defined failsafe modes, in order to check whether they respond correctly. During this time, the message "SIMULATION FAILSAFE MODE" appears on the display. **Options:** 0 = ON 1 = OFF **Factory setting:** OFF

Function description SUPERVISION → SYSTEM → OPERATION	
SIMULATION MEASURAND **8043** MODBUS register: 6813 Data type: Integer Access: read/write	Use this function to set all inputs, outputs and totalizers to their defined flow-response modes, in order to check whether they respond correctly. During this time, the message "SIMULATION MEASURAND" appears on the display. **Options:** 0 = OFF 1 = VOLUME FLOW 2 = MASS FLOW **Factory setting:** OFF Caution! ■ The measuring device cannot be used for measuring while this simulation is in progress. ■ The setting is not saved if the power supply fails.
VALUE SIMULATION MEASURAND **8044** MODBUS register: 6814 Data type: Float Access: read/write	Note! The function is not visible unless the SIMULATION MEASURAND function (8043) is active. Use this function to specify a selectable value (e.g. 12 m^3/s). This is used to test the associated functions in the device itself and downstream signal loops. **User input:** 5-digit floating-point number [unit] **Factory setting:** 0 [unit] Caution! ■ The setting is not saved if the power supply fails. ■ The appropriate unit is taken from the function group SYSTEM UNITS (ACA) (see page 14).
SYSTEM RESET **8046** MODBUS register: 6817 Data type: Integer Access: read/write	Use this function to perform a reset of the measuring system. **Options:** 0 = NO 1 = RESTART SYSTEM (restart without interrupting power supply) **Factory setting:** NO
OPERATION HOURS **8048** MODBUS register: 6810 Data type: Float Access: Read	The hours of operation of the device appear on the display. **User interface:** depends on the number of hours of operation elapsed ■ Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec) ■ Hours of operation 10...10,000 hours → display format = 0000:00 (hr:min) ■ Hours of operation > 10,000 hours → display format = 000000 (hr)

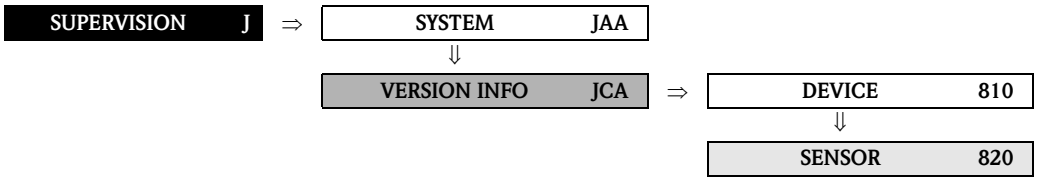
11.2 Group VERSION INFO

11.2.1 Function group DEVICE



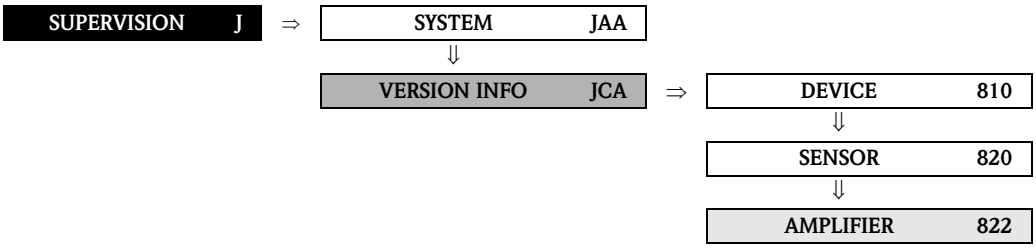
Function description SUPERVISION → VERSION INFO → DEVICE		
DEVICE SOFTWARE	**8100**	Displays the current device software version.
MODBUS register: Data type: Access:	7277 String (16) Read	

11.2.2 Function group SENSOR



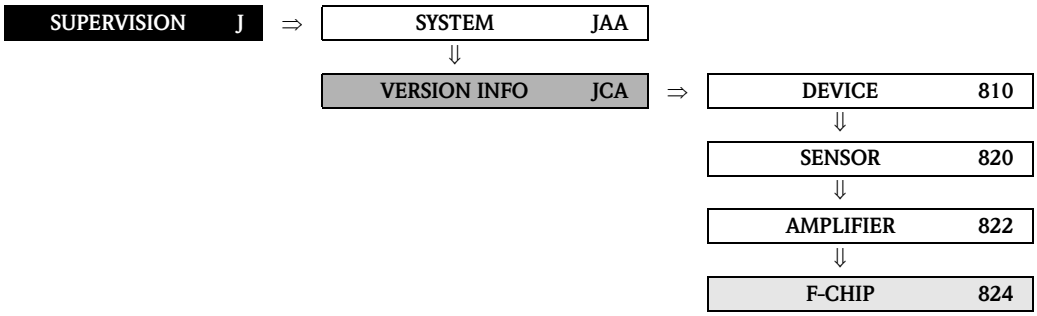
Function description SUPERVISION → VERSION INFO → SENSOR		
SERIAL NUMBER	**8200**	Use this function to view the serial number of the sensor.
MODBUS register: Data type: Access:	7003 String (16) Read	
SENSOR TYPE	**8201**	Use this function to view the sensor type.
MODBUS register: Data type: Access:	7012 String (16) Read	
SW REV. NO. S-DAT	**8205**	Use this function to view the software revision number of the software used to create the content of the S-DAT.
MODBUS register: Data type: Access:	7021 String (16) Read	

11.2.3 Function group AMPLIFIER



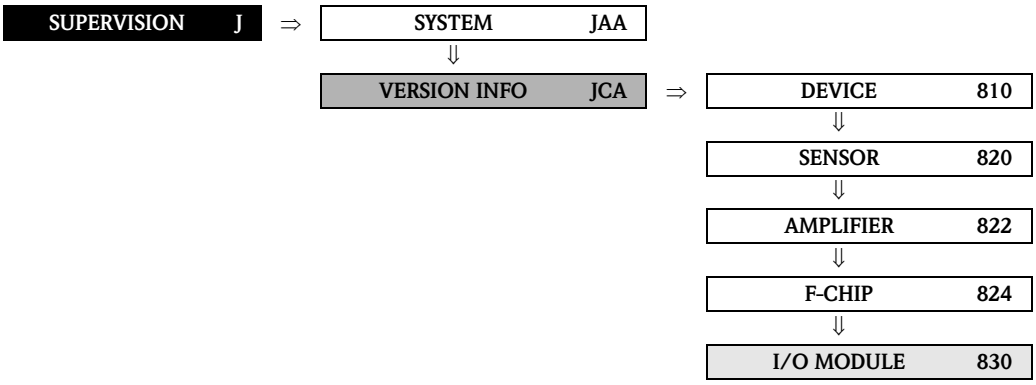
Function description SUPERVISION → VERSION INFO → AMPLIFIER		
SW REV. NO. AMPLIFIER	**8222**	Use this function to view the software revision number of the amplifier.
MODBUS register: Data type: Access:	7039 String (16) Read	
SW REV. NO. T-DAT	**8225**	Use this function to view the software revision number of the software used to create the content of the T-DAT.
MODBUS register: Data type: Access:	7048 String (16) Read	
LANGUAGE GROUP	**8226**	Displays the installed language group. **User interface:** 0 = TYPE UNKNOWN 1 = WEST EU / USA 2 = EAST EU / SCAND. 3 = ASIA 4 = CHINA ✎ Note! ■ The language options of the available language group are displayed in the LANGUAGE (2000) function. ■ You can change the language group via the configuration software ToF Tool – Fieldtool Package. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.
MODBUS register: Data type: Access:	7262 Integer Read	

11.2.4 Function group F-CHIP



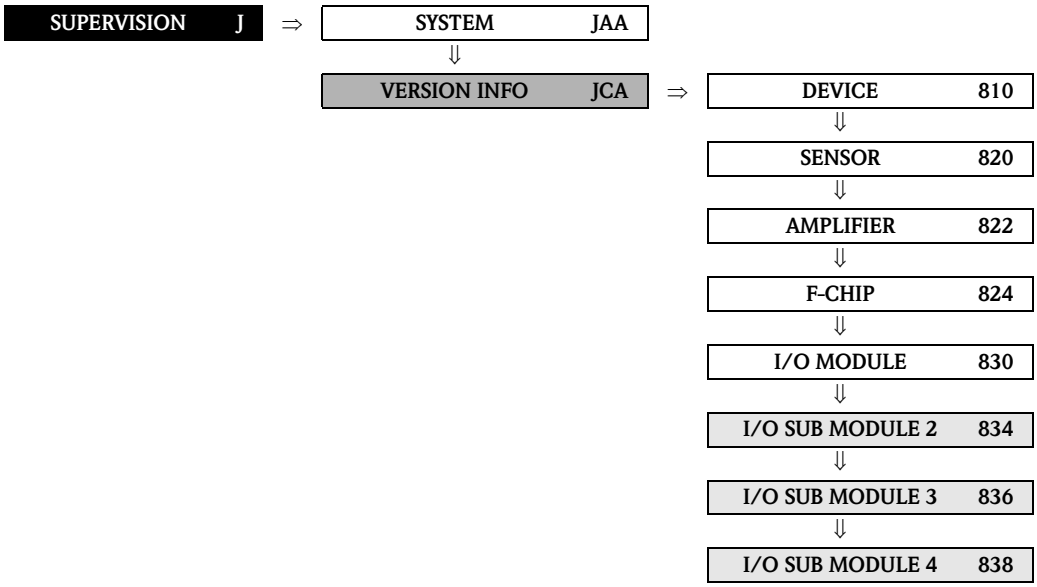
Function description SUPERVISION → VERSION INFO → F-CHIP	
STATUS F-CHIP **8240** MODBUS register: 7057 Data type: Integer Access: Read	Use this function to check whether an F-CHIP is installed and which software options are available. **User interface:** 0 = NO F-CHIP HW 1 = F-CHIP OK 2 = DEMONSTRATION 3 = SERVICE&ANALYSIS 4 = P-TYPE F-CHIP 5 = TYPE UNKNOWN 6 = SER. NUM. WRONG 7 = FAILURE 8 = CRITICAL FAIL. 9 = DEVICE ID
SYSTEM OPTIONS **8241** MODBUS register: 7058 Data type: Integer Access: Read	✎ Note! This function is not available unless the measuring device is equipped an F-CHIP. The software options available in the measuring device appear on the display. **User interface:** 0 = NO ENTRY 1 = ECC 3 = BATCH FUNCTION
SW REV. NO F-CHIP **8244** MODBUS register: 7059 Data type: String (16) Access: Read	✎ Note! This function is not available unless the measuring device is equipped an F-CHIP. Use this function to view the software revision number of the F-CHIP.

11.2.5 Function group I/O MODULE



Function description SUPERVISION → VERSION INFO → I/O MODULE		
I/O MODULE TYPE	**8300**	Use this function to view the configuration of the I/O module complete with terminal numbers. **User interface:** 12 = MODBUS RS485
MODBUS register: Data type: Access:	7285 Integer Read	
SW REV. NO. I/O MODULE	**8303**	Use this function to view the software revision number of the I/O module.
MODBUS register: Data type: Access:	7078 String (16) Read	

11.2.6 Function groups INPUT/OUTPUT 2...4



Function description SUPERVISION → VERSION INFO → IN-/OUTPUT 2...4		
SUB I/O TYPE 2 MODBUS register: Data type: Access:	**8340** 7106 Integer Read	Displays the configuration of the I/O submodule. **User interface:** 7 = STATUS INPUT
SW REV. NO. SUB IN-/OUTPUT TYPE 2 MODBUS register: Data type: Access:	**8343** 7190 String (16) Read	Use this function to view the software revision number of the corresponding submodule.
SUB I/O TYPE 3 MODBUS register: Data type: Access:	**8360** 7107 Integer Read	Displays the configuration of the I/O submodule. **User interface:** 0 = TYPE UNKNOWN 5 = PULS/FREQ. OUT. 6 = STATUS/REL. OUT.
SW REV. NO. SUB IN-/OUTPUT TYPE 3 MODBUS register: Data type: Access:	**8363** 7199 String (16) Read	Use this function to view the software revision number of the corresponding submodule.

Function description SUPERVISION → VERSION INFO → IN-/OUTPUT 2...4	
SUB I/O TYPE 4 **8380** MODBUS register: 7108 Data type: Integer Access: Read	Displays the configuration of the I/O submodule. **User interface:** 0 = TYPE UNKNOWN 4 = CURRENT OUTPUT 6 = STATUS/REL. OUT.
SW REV. NO. SUB IN-/OUTPUT TYPE 4 **8383** MODBUS register: 7199 Data type: String (16) Access: Read	Use this function to view the software revision number of the corresponding submodule.

12 Factory settings

12.1 SI units (not for USA and Canada)

Low flow cut off, full scale value, pulse value, totalizer

Nominal diameter		Low flow cut off (approx. v = 0.04 m/s)			Full scale value (approx. v = 2.5 m/s)			Pulse value (approx. 2 pulse/s at 2.5 m/s)			Totalizer	
[mm]	[inch]		Volume	Mass		Volume	Mass		Vol.	Mass	Vol.	Mass
2	1/12"	0.01	dm³/min	kg/min	0.5	dm³/min	kg/min	0.005	dm³	kg	dm³	kg
4	5/32"	0.05	dm³/min	kg/min	2	dm³/min	kg/min	0.025	dm³	kg	dm³	kg
8	5/16"	0.1	dm³/min	kg/min	8	dm³/min	kg/min	0.10	dm³	kg	dm³	kg
15	1/2"	0.5	dm³/min	kg/min	25	dm³/min	kg/min	0.20	dm³	kg	dm³	kg
25	1"	1	dm³/min	kg/min	75	dm³/min	kg/min	0.50	dm³	kg	dm³	kg
32	1 1/4"	2	dm³/min	kg/min	125	dm³/min	kg/min	1.00	dm³	kg	dm³	kg
40	1 1/2"	3	dm³/min	kg/min	200	dm³/min	kg/min	1.50	dm³	kg	dm³	kg
50	2"	5	dm³/min	kg/min	300	dm³/min	kg/min	2.50	dm³	kg	dm³	kg
65	2 1/2"	8	dm³/min	kg/min	500	dm³/min	kg/min	5.00	dm³	kg	dm³	kg
80	3"	12	dm³/min	kg/min	750	dm³/min	kg/min	5.00	dm³	kg	dm³	kg
100	4"	20	dm³/min	kg/min	1200	dm³/min	kg/min	10.00	dm³	kg	dm³	kg
125	5"	30	dm³/min	kg/min	1850	dm³/min	kg/min	15.00	dm³	kg	dm³	kg
150	6"	2.5	m³/h	t/h	150	m³/h	t/h	0.025	m³	t	m³	t
200	8"	5.0	m³/h	t/h	300	m³/h	t/h	0.05	m³	t	m³	t
250	10"	7.5	m³/h	t/h	500	m³/h	t/h	0.05	m³	t	m³	t
300	12"	10	m³/h	t/h	750	m³/h	t/h	0.10	m³	t	m³	t
350	14"	15	m³/h	t/h	1000	m³/h	t/h	0.10	m³	t	m³	t
400	16"	20	m³/h	t/h	1200	m³/h	t/h	0.15	m³	t	m³	t
450	18"	25	m³/h	t/h	1500	m³/h	t/h	0.25	m³	t	m³	t
500	20"	30	m³/h	t/h	2000	m³/h	t/h	0.25	m³	t	m³	t
600	24"	40	m³/h	t/h	2500	m³/h	t/h	0.30	m³	t	m³	t
700	28"	50	m³/h	t/h	3500	m³/h	t/h	0.50	m³	t	m³	t
–	30"	60	m³/h	t/h	4000	m³/h	t/h	0.50	m³	t	m³	t
800	32"	75	m³/h	t/h	4500	m³/h	t/h	0.75	m³	t	m³	t
900	36"	100	m³/h	t/h	6000	m³/h	t/h	0.75	m³	t	m³	t
1000	40"	125	m³/h	t/h	7000	m³/h	t/h	1.00	m³	t	m³	t
–	42"	125	m³/h	t/h	8000	m³/h	t/h	1.00	m³	t	m³	t
1200	48"	150	m³/h	t/h	10000	m³/h	t/h	1.50	m³	t	m³	t
–	54"	200	m³/h	t/h	13000	m³/h	t/h	1.50	m³	t	m³	t
1400	–	225	m³/h	t/h	14000	m³/h	t/h	2.00	m³	t	m³	t
–	60"	250	m³/h	t/h	16000	m³/h	t/h	2.00	m³	t	m³	t
1600	–	300	m³/h	t/h	18000	m³/h	t/h	2.50	m³	t	m³	t
–	66"	325	m³/h	t/h	20500	m³/h	t/h	2.50	m³	t	m³	t
1800	72"	350	m³/h	t/h	23000	m³/h	t/h	3.00	m³	t	m³	t
–	78"	450	m³/h	t/h	28500	m³/h	t/h	3.50	m³	t	m³	t
2000	–	450	m³/h	t/h	28500	m³/h	t/h	3.50	m³	t	m³	t

Language

Country	Language
Australia	English
Belgium	English
China	Chinese
Denmark	English
Germany	Deutsch
England	English
Finland	Suomi
France	Francais
Netherlands	Nederlands
Hong Kong	English
India	English
Indonesia	Bahasa Indonesia
Instruments International	English
Italy	Italiano
Japan	Japanese
Malaysia	English
Norway	Norsk
Poland	Polish
Portugal	Portuguese
Austria	Deutsch
Russia	Russian
Sweden	Svenska
Switzerland	Deutsch
Singapore	English
Spain	Espanol
South Africa	English
Thailand	English
Czech Republic	Czech
Hungary	English

Density, length, temperature

	Unit
Density	kg/l
Length	mm
Temperature	° C

12.2 US units (only for USA and Canada)

Low flow cut off, full scale value, pulse value, totalizer

Nominal diameter		Low flow cut off (approx. v = 0.04 m/s)			Full scale value (approx. v = 2.5 m/s)			Pulse value (approx. 2 pulse/s at 2.5 m/s)			Totalizer	
[inch]	[mm]		Volume	Mass		Volume	Mass		Vol.	Mass	Vol.	Mass
1/12"	2	0.002	gal/min	lb/min	0.1	gal/min	lb/min	0.001	gal	lb	gal	lb
5/32"	4	0.008	gal/min	lb/min	0.5	gal/min	lb/min	0.005	gal	lb	gal	lb
5/16"	8	0.025	gal/min	lb/min	2	gal/min	lb/min	0.02	gal	lb	gal	lb
1/2"	15	0.10	gal/min	lb/min	6	gal/min	lb/min	0.05	gal	lb	gal	lb
1"	25	0.25	gal/min	lb/min	18	gal/min	lb/min	0.20	gal	lb	gal	lb
1 1/4"	32	0.50	gal/min	lb/min	30	gal/min	lb/min	0.20	gal	lb	gal	lb
1 1/2"	40	0.75	gal/min	lb/min	50	gal/min	lb/min	0.50	gal	lb	gal	lb
2"	50	1.25	gal/min	lb/min	75	gal/min	lb/min	0.50	gal	lb	gal	lb
2 1/2"	65	2.0	gal/min	lb/min	130	gal/min	lb/min	1	gal	lb	gal	lb
3"	80	2.5	gal/min	lb/min	200	gal/min	lb/min	2	gal	lb	gal	lb
4"	100	4.0	gal/min	lb/min	300	gal/min	lb/min	2	gal	lb	gal	lb
5"	125	7.0	gal/min	lb/min	450	gal/min	lb/min	5	gal	lb	gal	lb
6"	150	12	gal/min	lb/min	600	gal/min	lb/min	5	gal	lb	gal	lb
8"	200	15	gal/min	lb/min	1200	gal/min	lb/min	10	gal	lb	gal	lb
10"	250	30	gal/min	lb/min	1500	gal/min	lb/min	15	gal	lb	gal	lb
12"	300	45	gal/min	lb/min	2400	gal/min	lb/min	25	gal	lb	gal	lb
14"	350	60	gal/min	lb/min	3600	gal/min	lb/min	30	gal	lb	gal	lb
16"	400	60	gal/min	lb/min	4800	gal/min	lb/min	50	gal	lb	gal	lb
18"	450	90	gal/min	lb/min	6000	gal/min	lb/min	50	gal	lb	gal	lb
20"	500	120	gal/min	lb/min	7500	gal/min	lb/min	75	gal	lb	gal	lb
24"	600	180	gal/min	lb/min	10500	gal/min	lb/min	100	gal	lb	gal	lb
28"	700	210	gal/min	lb/min	13500	gal/min	lb/min	125	gal	lb	gal	lb
30"	–	270	gal/min	lb/min	16500	gal/min	lb/min	150	gal	lb	gal	lb
32"	800	300	gal/min	lb/min	19500	gal/min	lb/min	200	gal	lb	gal	lb
36"	900	360	gal/min	lb/min	24000	gal/min	lb/min	225	gal	lb	gal	lb
40"	1000	480	gal/min	lb/min	30000	gal/min	lb/min	250	gal	lb	gal	lb
42"	–	600	gal/min	lb/min	33000	gal/min	lb/min	250	gal	lb	gal	lb
48"	1200	600	gal/min	lb/min	42000	gal/min	lb/min	400	gal	lb	gal	lb
54"	–	1.3	Mgal/d	ton/h	75	Mgal/d	ton/h	0.0005	Mgal	ton	Mgal	ton
–	1400	1.3	Mgal/d	ton/h	85	Mgal/d	ton/h	0.0005	Mgal	ton	Mgal	ton
60"	–	1.3	Mgal/d	ton/h	95	Mgal/d	ton/h	0.0005	Mgal	ton	Mgal	ton
–	1600	1.7	Mgal/d	ton/h	110	Mgal/d	ton/h	0.0008	Mgal	ton	Mgal	ton
66"	–	2.2	Mgal/d	ton/h	120	Mgal/d	ton/h	0.0008	Mgal	ton	Mgal	ton
72"	1800	2.6	Mgal/d	ton/h	140	Mgal/d	ton/h	0.0008	Mgal	ton	Mgal	ton
78"	–	3.0	Mgal/d	ton/h	175	Mgal/d	ton/h	0.001	Mgal	ton	Mgal	ton
–	2000	3.0	Mgal/d	ton/h	175	Mgal/d	ton/h	0.001	Mgal	ton	Mgal	ton

Language, density, length, temperature

	Unit
Language	English
Density	g/cc
Length	inch
Temperature	°F

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Blocks

Groups

Function groups

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V

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Z

Numbers

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