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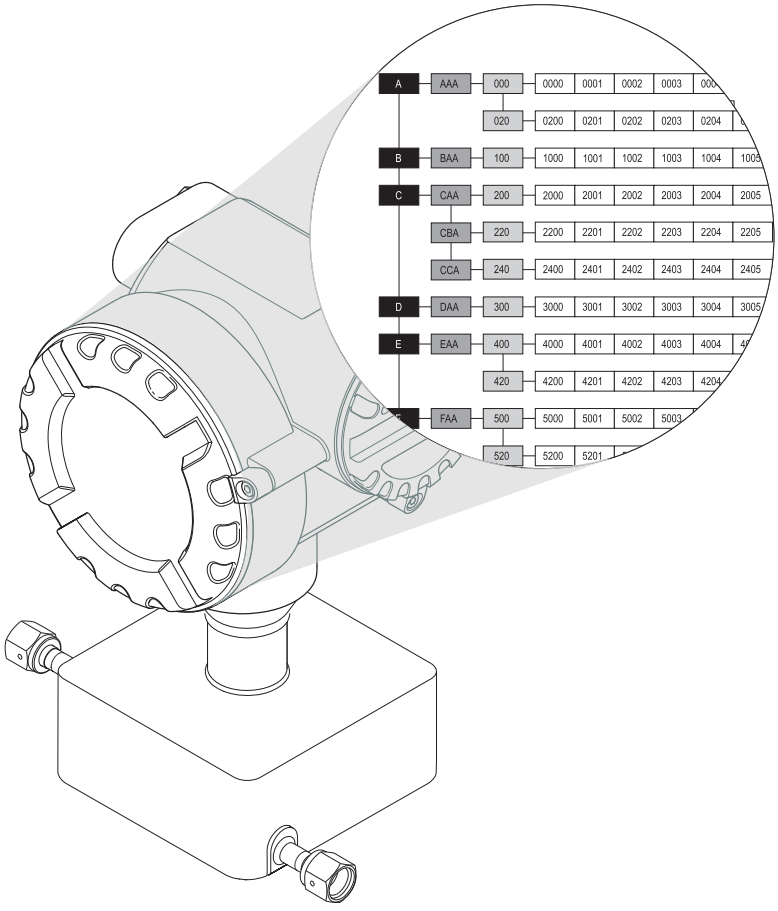
valid as of version
V 1.01.00 (Device software)

Description of Device Functions
Cubemass
Modbus RS485

Coriolis flowmeter



Endress+Hauser
People for Process Automation

Endress+Hauser

People for Process Automation

Table of contents

1 Using this manual

This manual must be used in conjunction with the Operating Instructions of the measuring device. A description of all the functions of the measuring device is provided here.

1.1 Finding a function description

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

1.1.1 Using the table of contents

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.

1.1.2 Using the graphic of the function matrix

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 → 🖹 5. 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.

2 Function matrix

2.1 General layout of the function matrix

The function matrix consists of four levels:
Blocks → Groups → Function groups → Functions

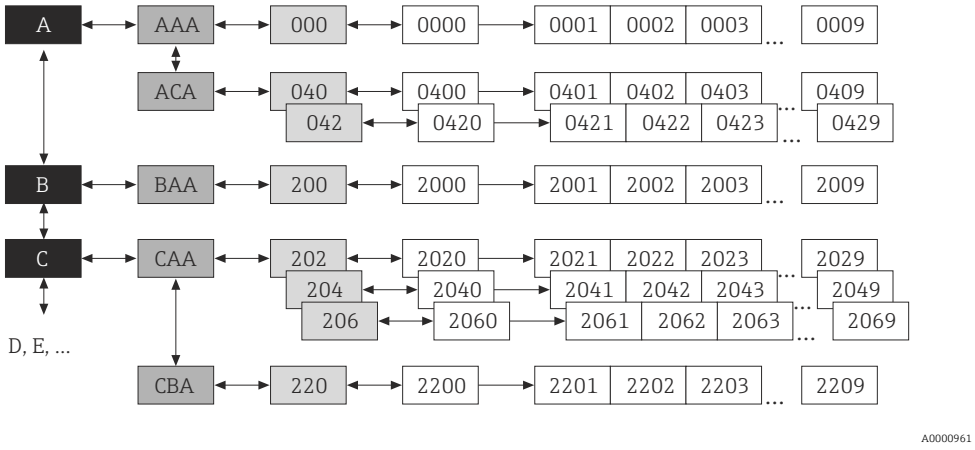


Fig. 1: General layout of the function matrix

2.1.1 Blocks

The blocks are the highest-level grouping of the operation options for the device.
The blocks include, for example: MEASURED VARIABLES, TOTALIZER, OUTPUTS.

2.1.2 Groups

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 "MEASURED VARIABLES" block, for example, include: MEASURING VALUES, SYSTEM UNITS.

2.1.3 Function groups

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. The function groups in the "PROCESS PARAMETER" group, for example, include: CONFIGURATION, ADJUSTMENT.

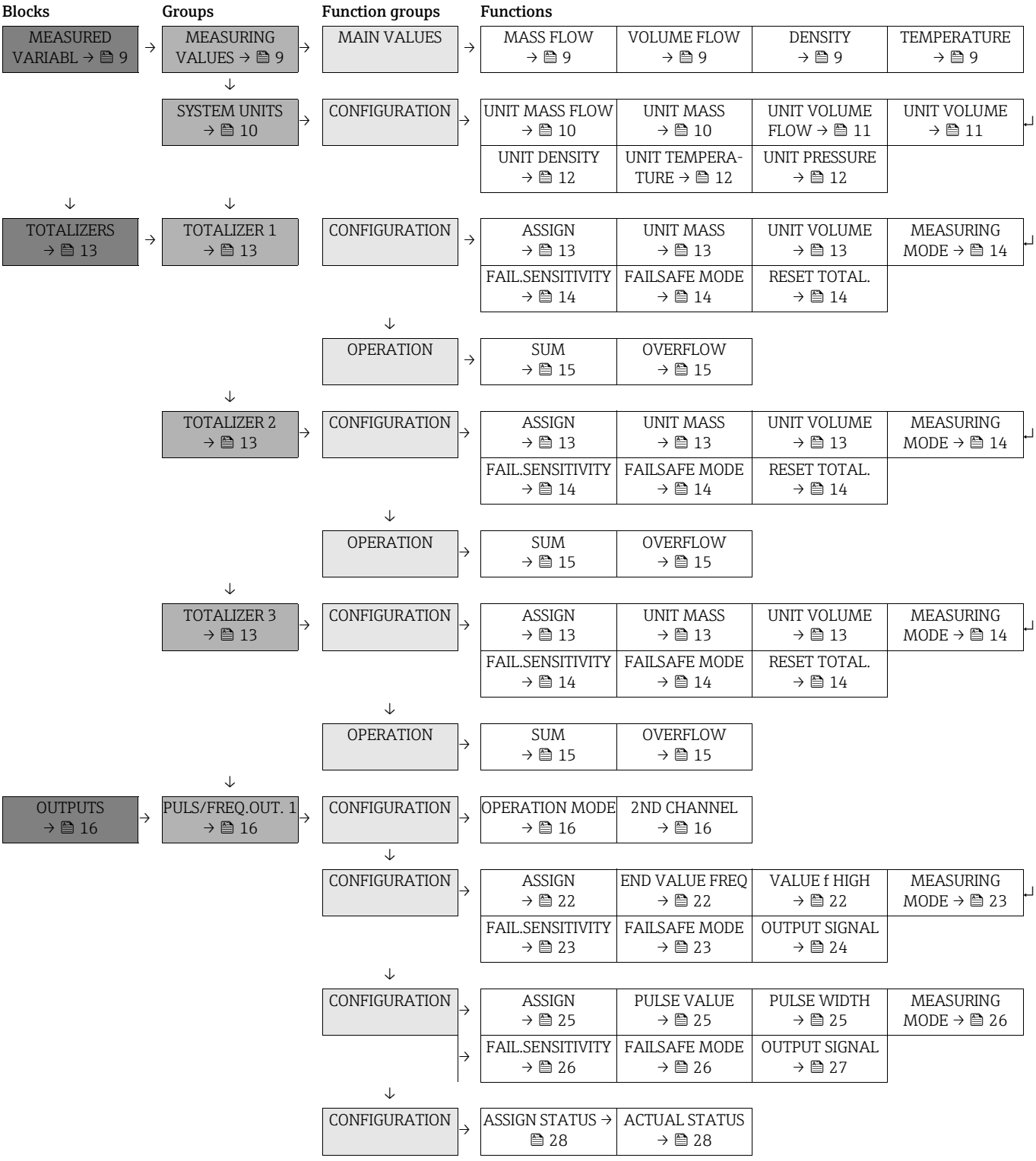
2.1.4 Functions

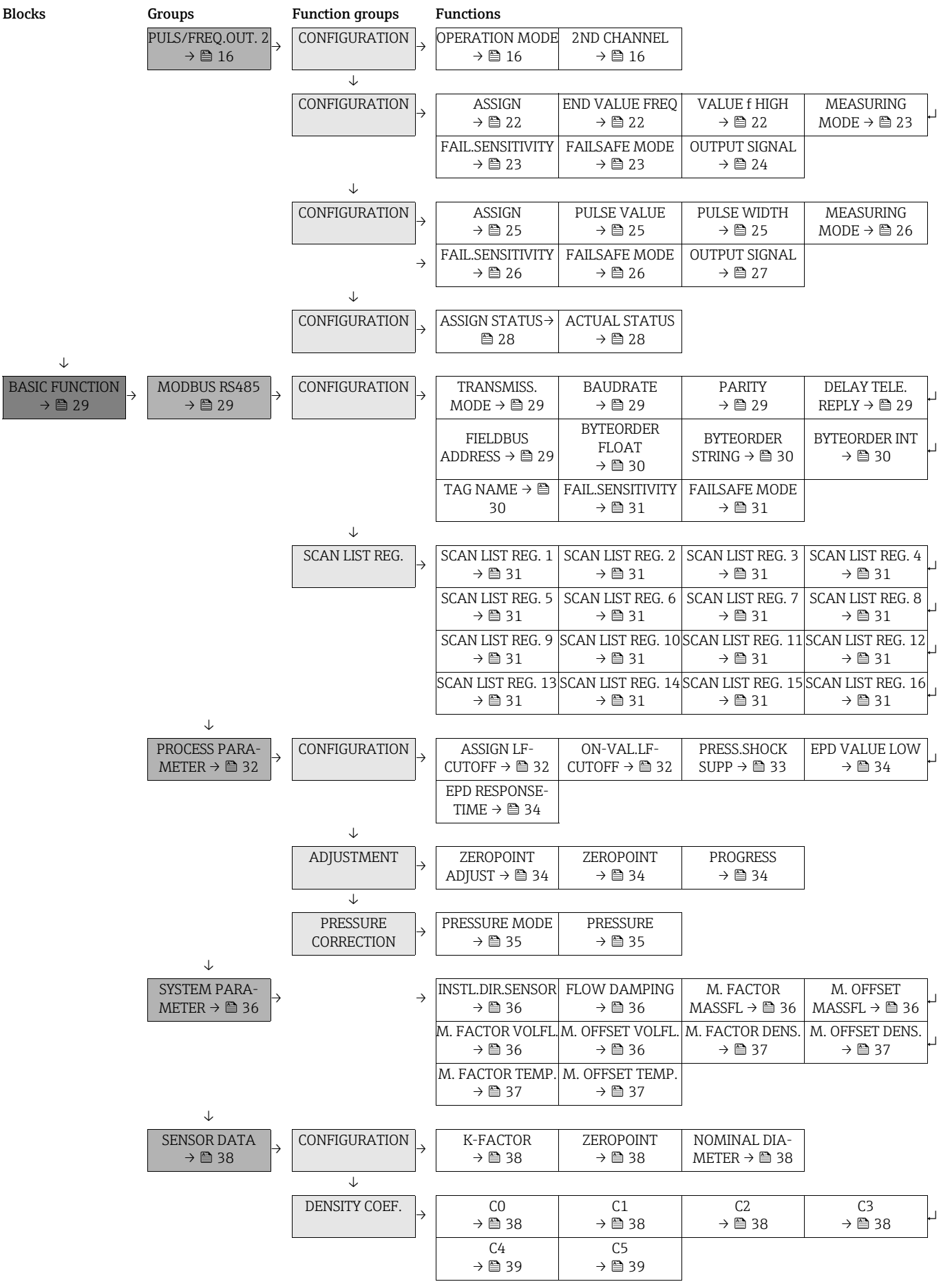
Each function group consists of one or more functions. The functions are used to operate and parameterize the measuring instrument. Numerical values can be entered or parameters selected and saved. Available functions of the function group "PRESSURE CORRECTION" are: PRESSURE MODE, PRESSURE.

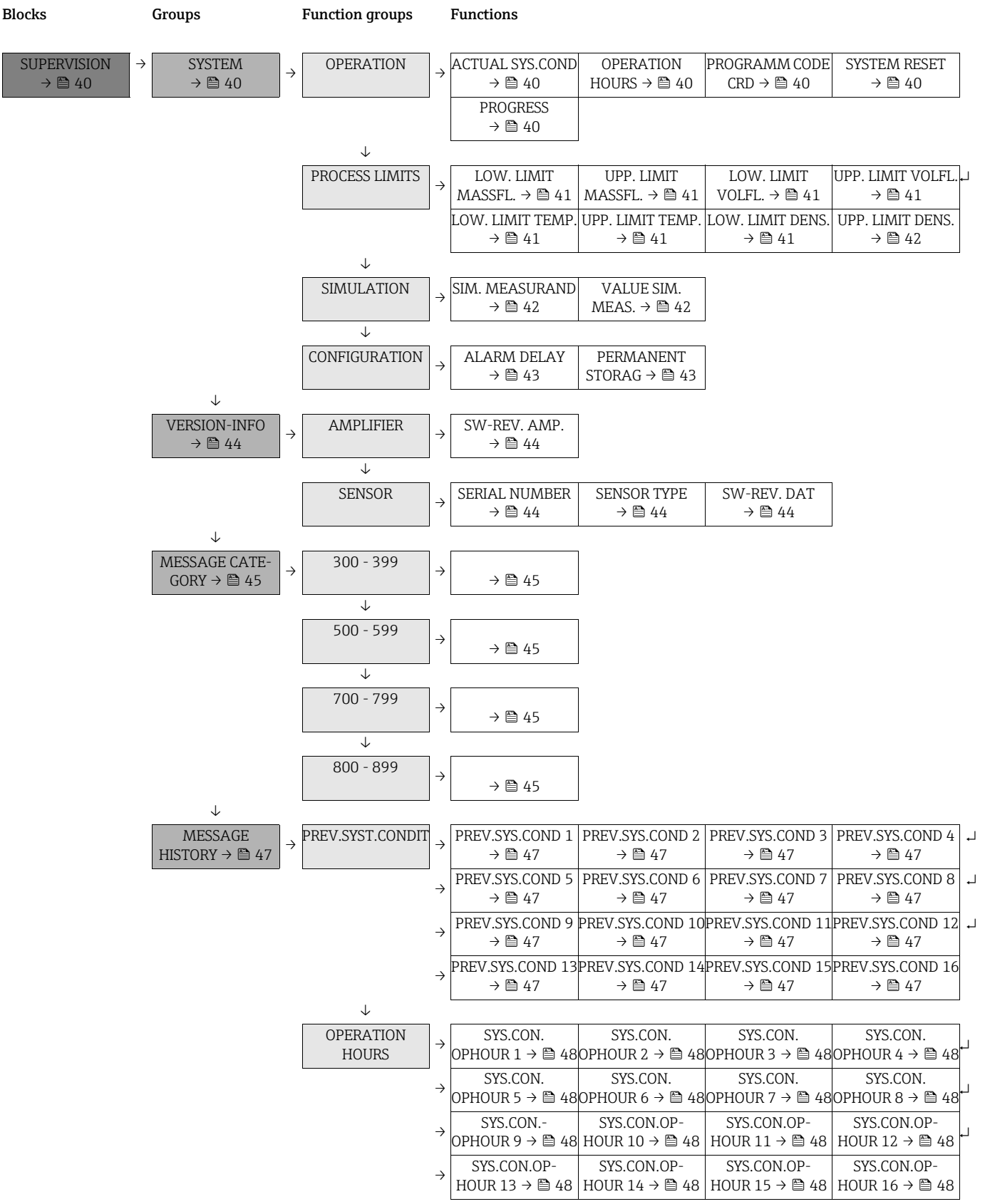
The procedure for changing the pressure, for example, is as follows:

1. Select the block "BASIC FUNCTION"
2. Select the group "PROCESS PARAMETER"
3. Select the function group "PRESSURE CORRECTION"
4. Select the function "PRESSURE"

2.2 Display of function matrix




Blocks
Groups
Function groups
Functions
PULS/FREQ.OUT. 2 → 16
CONFIGURATION
OPERATION MODE → 16
2ND CHANNEL → 16
CONFIGURATION
ASSIGN → 22
END VALUE FREQ → 22
VALUE f HIGH → 22
MEASURING MODE → 23
FAIL.SENSITIVITY → 23
FAILSAFE MODE → 23
OUTPUT SIGNAL → 24
CONFIGURATION
ASSIGN → 25
PULSE VALUE → 25
PULSE WIDTH → 25
MEASURING MODE → 26
FAIL.SENSITIVITY → 26
FAILSAFE MODE → 26
OUTPUT SIGNAL → 27
CONFIGURATION
ASSIGN STATUS → 28
ACTUAL STATUS → 28
BASIC FUNCTION → 29
MODBUS RS485 → 29
CONFIGURATION
TRANSMISS. MODE → 29
BAUDRATE → 29
PARITY → 29
DELAY TELE. REPLY → 29
FIELDBUS ADDRESS → 29
BYTEORDER FLOAT → 30
BYTEORDER STRING → 30
BYTEORDER INT → 30
TAG NAME → 30
FAIL.SENSITIVITY → 31
FAILSAFE MODE → 31
SCAN LIST REG.
SCAN LIST REG. 1 → 31
SCAN LIST REG. 2 → 31
SCAN LIST REG. 3 → 31
SCAN LIST REG. 4 → 31
SCAN LIST REG. 5 → 31
SCAN LIST REG. 6 → 31
SCAN LIST REG. 7 → 31
SCAN LIST REG. 8 → 31
SCAN LIST REG. 9 → 31
SCAN LIST REG. 10 → 31
SCAN LIST REG. 11 → 31
SCAN LIST REG. 12 → 31
SCAN LIST REG. 13 → 31
SCAN LIST REG. 14 → 31
SCAN LIST REG. 15 → 31
SCAN LIST REG. 16 → 31
PROCESS PARA-METER → 32
CONFIGURATION
ASSIGN LF-CUTOFF → 32
ON-VAL.LF-CUTOFF → 32
PRESS.SHOCK SUPP → 33
EPD VALUE LOW → 34
EPD RESPONSE-TIME → 34
ADJUSTMENT
ZEROPOINT ADJUST → 34
ZEROPOINT → 34
PROGRESS → 34
PRESSURE CORRECTION
PRESSURE MODE → 35
PRESSURE → 35
SYSTEM PARA-METER → 36
INSTL.DIR.SENSOR → 36
FLOW DAMPING → 36
M. FACTOR MASSFL → 36
M. OFFSET MASSFL → 36
M. FACTOR VOLFL. → 36
M. OFFSET VOLFL. → 36
M. FACTOR DENS. → 37
M. OFFSET DENS. → 37
M. FACTOR TEMP. → 37
M. OFFSET TEMP. → 37
SENSOR DATA → 38
CONFIGURATION
K-FACTOR → 38
ZEROPOINT → 38
NOMINAL DIA-METER → 38
DENSITY COEF.
C0 → 38
C1 → 38
C2 → 38
C3 → 38
C4 → 39
C5 → 39


Blocks
Groups
Function groups
Functions
SUPERVISION → 🖹 40
SYSTEM → 🖹 40
OPERATION
ACTUAL SYS.COND → 🖹 40
OPERATION HOURS → 🖹 40
PROGRAMM CODE CRD → 🖹 40
SYSTEM RESET → 🖹 40
PROGRESS → 🖹 40
PROCESS LIMITS
LOW. LIMIT MASSFL. → 🖹 41
UPP. LIMIT MASSFL. → 🖹 41
LOW. LIMIT VOLFL. → 🖹 41
UPP. LIMIT VOLFL. → 🖹 41
LOW. LIMIT TEMP. → 🖹 41
UPP. LIMIT TEMP. → 🖹 41
LOW. LIMIT DENS. → 🖹 41
UPP. LIMIT DENS. → 🖹 42
SIMULATION
SIM. MEASURAND → 🖹 42
VALUE SIM. MEAS. → 🖹 42
CONFIGURATION
ALARM DELAY → 🖹 43
PERMANENT STORAG → 🖹 43
VERSION-INFO → 🖹 44
AMPLIFIER
SW-REV. AMP. → 🖹 44
SENSOR
SERIAL NUMBER → 🖹 44
SENSOR TYPE → 🖹 44
SW-REV. DAT → 🖹 44
MESSAGE CATE-GORY → 🖹 45
300 - 399
→ 🖹 45
500 - 599
→ 🖹 45
700 - 799
→ 🖹 45
800 - 899
→ 🖹 45
MESSAGE HISTORY → 🖹 47
PREV.SYST.CONDIT
PREV.SYS.COND 1 → 🖹 47
PREV.SYS.COND 2 → 🖹 47
PREV.SYS.COND 3 → 🖹 47
PREV.SYS.COND 4 → 🖹 47
PREV.SYS.COND 5 → 🖹 47
PREV.SYS.COND 6 → 🖹 47
PREV.SYS.COND 7 → 🖹 47
PREV.SYS.COND 8 → 🖹 47
PREV.SYS.COND 9 → 🖹 47
PREV.SYS.COND 10 → 🖹 47
PREV.SYS.COND 11 → 🖹 47
PREV.SYS.COND 12 → 🖹 47
PREV.SYS.COND 13 → 🖹 47
PREV.SYS.COND 14 → 🖹 47
PREV.SYS.COND 15 → 🖹 47
PREV.SYS.COND 16 → 🖹 47
OPERATION HOURS
SYS.CON. OPHOUR 1 → 🖹 48
SYS.CON. OPHOUR 2 → 🖹 48
SYS.CON. OPHOUR 3 → 🖹 48
SYS.CON. OPHOUR 4 → 🖹 48
SYS.CON. OPHOUR 5 → 🖹 48
SYS.CON. OPHOUR 6 → 🖹 48
SYS.CON. OPHOUR 7 → 🖹 48
SYS.CON. OPHOUR 8 → 🖹 48
SYS.CON.- OPHOUR 9 → 🖹 48
SYS.CON.OP- HOUR 10 → 🖹 48
SYS.CON.OP- HOUR 11 → 🖹 48
SYS.CON.OP- HOUR 12 → 🖹 48
SYS.CON.OP- HOUR 13 → 🖹 48
SYS.CON.OP- HOUR 14 → 🖹 48
SYS.CON.OP- HOUR 15 → 🖹 48
SYS.CON.OP- HOUR 16 → 🖹 48

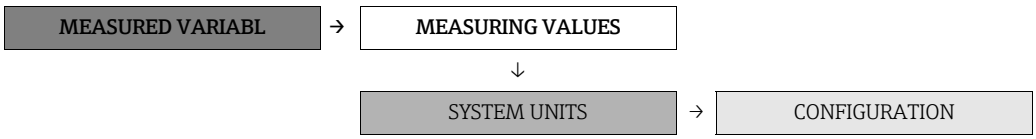
2.3 Block "MEASURED VARIABL"

2.3.1 Group "MEASURING VALUES"

MEASURED VARIABL → MEASURING VALUES → MAIN VALUES

Function description MEASURED VARIABL →MEASURING VALUES →MAIN VALUES	
✎ Note! The engineering units of all the measured variables shown here can be set in the "SYSTEM UNITS" group.	
MASS FLOW Modbus register: 2007 Data type: Float Access: Read	The currently measured mass flow appears on the display.
VOLUME FLOW Modbus register: 2009 Data type: Float Access: Read	The calculated volume flow appears on the display. The volume flow is derived from the measured mass flow and the measured density of the fluid.
DENSITY Modbus register: 2013 Data type: Float Access: Read	The currently measured density or its specific gravity appears on the display.
TEMPERATURE Modbus register: 2017 Data type: Float Access: Read	The currently measured temperature appears on the display.

2.3.2 Group "SYSTEM UNITS"



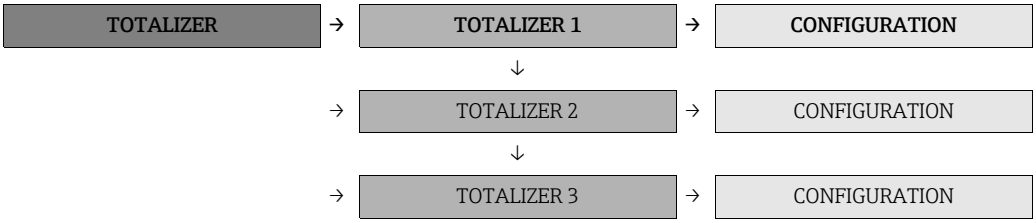
Function description MEASURED VARIABL → SYSTEM UNITS	
UNIT MASS FLOW Modbus register: 2101 Data type: Integer Access: read/ write	For selecting the desired unit for the mass flow (mass/time). **Options:** Metric: 0 to 3 = gram → g/s; g/min; g/h; g/day 4 to 7 = kilogram → kg/s; kg/min; kg/h; kg/day 8 to 11 = ton → t/s; t/min; t/h; t/day US: 12 to 15 = ounce → oz/s; oz/min; oz/h; oz/day 16 to 19 = pound → lb/s; lb/min; lb/h; lb/day 20 to 23 = ton → ton/s; ton/min; ton/h; ton/day **Factory setting:** Country-dependent (kg/min or lb/min)
UNIT MASS Modbus register: 2102 Data type: Integer Access: read/ write	For selecting the desired unit for the mass. **Options:** 0; 1; 2 = metric → g; kg; t 3; 4; 5 = US → oz; lb; ton **Factory setting:** Country-dependent (kg or lb) ✎ 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 VARIABL → SYSTEM UNITS	
UNIT VOLUME FLOW Modbus register: 2103 Data type: Integer Access: read/ write	For selecting the desired unit for the volume flow (volume/time). **Options:** Metric: 0 to 3 = cubic centimeter → cm3/s; cm3/min; cm3/h; cm3/day 4 to 7 = cubic decimeter → dm3/s; dm3/min; dm3/h; dm3/day 8 to 11 = cubic meter → m3/s; m3/min; m3/h; m3/day 12 to 15 = milliliter → ml/s; ml/min; ml/h; ml/day 16 to 19 = liter → l/s; l/min; l/h; l/day 20 to 23 = hectoliter → hl/s; hl/min; hl/h; hl/day 24 to 27 = megaliter → Ml/s; Ml/min; Ml/h; Ml/day US: 28 to 31 = cubic centimeter → cc/s; cc/min; cc/h; cc/day 32 to 35 = acre foot → af/s; af/min; af/h; af/day 36 to 39 = cubic foot → ft3/s; ft3/min; ft3/h; ft3/day 40 to 43 = fluid ounce → oz f/s; oz f/min; oz f/h; oz f/day 44 to 47 = gallon → gal/s; gal/min; gal/h; gal/day 52 to 55 = barrel (normal fluids: 31.5 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 56 to 59 = barrel (beer: 36.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 60 to 63 = Barrel (petrochemicals: 42.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 64 to 67 = Barrel (filling tanks: 55.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Imperial: 68 to 71 = gallon → gal/s; gal/min; gal/h; gal/day 76 to 79 = barrel (beer: 36.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day 80 to 83 = Barrel (petrochemicals: 34.97 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day **Factory setting:** Country-dependent (l/min or US gal/min)
UNIT VOLUME Modbus register: 2104 Data type: Integer Access: read/ write	For selecting the desired unit for the volume. **Options:** Metric: 0 to 6 = cm3; dm3; m3; ml; l; hl; Ml US: 7 to 16 = cc; af; ft3; oz f; gal; bbl (normal fluids); bbl (beer); bbl (petrochemicals); bbl (filling tanks); Imperial: 17; 19; 20 = gal; bbl (beer); bbl (petrochemicals) **Factory setting:** Country-dependent (l or US gal) ✎ 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 VARIABL → SYSTEM UNITS	
UNIT DENSITY Modbus register: 2107 Data type: Integer Access: read/ write	For selecting the desired unit for the density. **Options:** Metric: 0...10 = g/cm3; g/cc; kg/dm3; kg/l; kg/m3; SD 4 °C, SD 15 °C, SD 20 °C; SG 4 °C, SG 15 °C, SG 20 °C US: 11 to 16 = lb/ft3; lb/gal; lb/bbl (normal fluids); lb/bbl (beer); lb/bbl (petrochemicals); lb/bbl (filling tanks) Imperial: 17 to 19 = lb/gal; lb/bbl (beer); lb/bbl (petrochemicals) **Factory setting:** Country-dependent (kg/l or g/cc) ✎ Note! 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 (39, 59, 68 °F).
UNIT TEMPERATURE Modbus register: 2109 Data type: Integer Access: read/ write	For selecting the desired unit for the temperature. **Options:** 0 = °C (Celsius) 1 = K (Kelvin) 2 = °F (Fahrenheit) **Factory setting:** Country-dependent (°C or °F)
UNIT PRESSURE Modbus register: 2130 Data type: Integer Access: read/ write	For selecting the desired unit for the pressure. **Options:** 0 = bara 1 = barg 2 = psia 3 = psig **Factory setting:** Country-dependent (barg or psig)

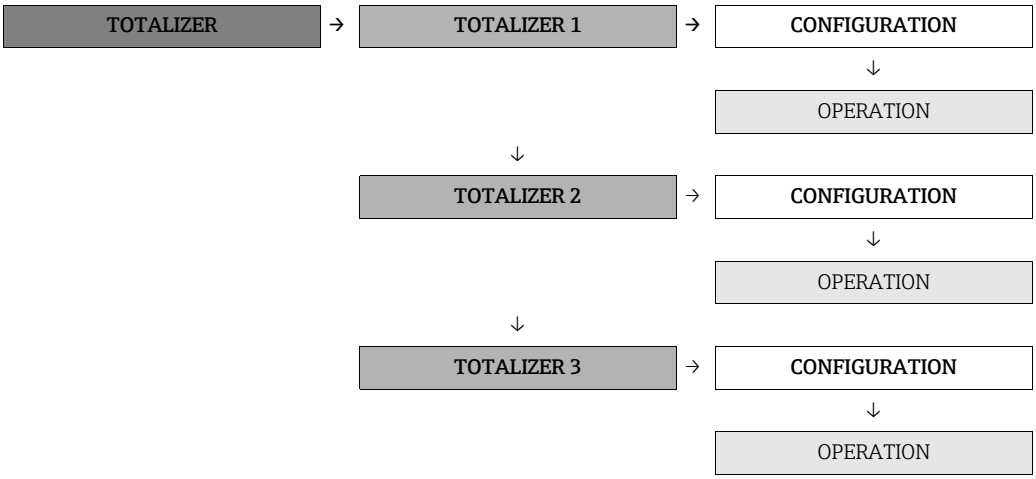
2.4 Block "TOTALIZER"

2.4.1 Group "TOTALIZER (1 to 3)"



Function description TOTALIZER → TOTALIZER 1 to 3 → CONFIGURATION	
✎ Note! The function descriptions below apply to totalizers 1 to 3; the totalizers are independently configurable.	
ASSIGN Modbus register: Totalizer 1 2601 Totalizer 2 2801 Totalizer 3 3001 Data type: Integer Access: read/ write	For assigning a measured variable to the totalizer in question. **Options:** 0 = OFF 1 = MASS FLOW 2 = VOLUME FLOW **Factory setting:** MASS FLOW ✎ Note! If 0 = OFF is selected and the options are changed, the value of the totalizer is reset to 0.
UNIT MASS Modbus register: Totalizer 1 2602 Totalizer 2 2802 Totalizer 3 3002 Data type: Integer Access: read/ write	For selecting the unit for the measured variable assigned in the function ASSIGN. **Options:** Metric: 0 to 2 = g; kg; t US: 3 to 5 = oz; lb; ton **Factory setting:** Country-dependent (kg or lb)
UNIT VOLUME Modbus register: Totalizer 1 2603 Totalizer 2 2803 Totalizer 3 3003 Data type: Integer Access: read/ write	For selecting the unit for the measured variable assigned in the function ASSIGN. **Options:** Metric: 0 to 6 = cm3; dm3; m3; ml; l; hl; Ml US: 7 to 16 = cc; af; ft3; oz f; gal; bbl (normal fluids); bbl (beer); bbl (petrochemicals); bbl (filling tanks) Imperial: 17; 19; 20 = gal; bbl (beer); bbl (petrochemicals) **Factory setting:** Country-dependent (l or gal)

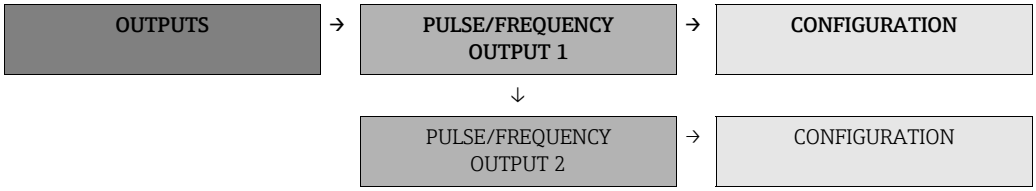
Function description TOTALIZER → TOTALIZER 1 to 3 → CONFIGURATION	
MEASURING MODE Modbus register: Totalizer 1 2605 Totalizer 2 2805 Totalizer 3 3005 Data type: Integer Access: read/ write	For selecting how the totalizer should operate. **Options:** 0 = BIDIRECTIONAL Positive and negative flow components are measured. 1 = FORWARD Only positive flow components are measured. 2 = BACKWARD Only negative flow components are measured. **Factory setting:** 1 = FORWARD
FAILURE SENSITIVITY Modbus register: Totalizer 1 2615 Totalizer 2 2815 Totalizer 3 3015 Data type: Integer Access: read/ write	Defines the status categories to which the totalizer reacts. **Options:** 0 = OFF The totalizer does not react to any status. 1 = WARNING The totalizer reacts to warnings. 2 = ERROR The totalizer reacts to errors. 3 = ERRORS AND WARN. The totalizer reacts to errors and warnings. **Factory setting:** ERROR
FAILSAFE MODE Modbus register: Totalizer 1 2606 Totalizer 2 2806 Totalizer 3 3006 Data type: Integer Access: read/ write	Defines how the totalizer behaves when a status occurs of the category to which the totalizer is configured to react. **Options:** 0 = STOP The totalizer remains at a stop. 1 = HOLD VALUE The totalizer resumes counting with the last value before the status occurred. **Factory setting:** STOP
RESET TOTALIZER Modbus register: Totalizer 1 2608 Totalizer 2 2808 Totalizer 3 3008 Data type: Integer Access: read/ write	Resets the total and the overflow of the totalizer (1…3) to zero. **Options:** 0 = CANCEL 1 = START



Function description TOTALIZER 1...3 →OPERATION	
Note! The following function descriptions apply to totalizers 1 to 3.	
SUM Modbus register: Totalizer 1 2610 Totalizer 2 2810 Totalizer 3 3010 Data type: Float Access: Read	Displays the total for the totalizer's measured variable aggregated since the last reset.
OVERFLOW Modbus register: Totalizer 1 2612 Totalizer 2 2812 Totalizer 3 3012 Data type: Float Access: Read	Displays the totalized measured variable of the totalizer since the last reset above 10^7 in the selected unit.

2.5 Block "OUTPUTS"

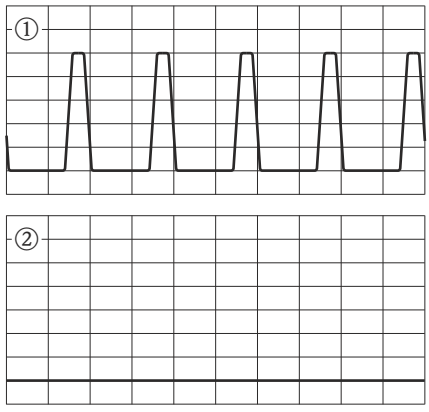
2.5.1 Group "PULSE/FREQUENCY OUTPUTS (1 to 2)"



Function description OUTPUTS →PULSE/FREQUENCY OUTPUTS 1...2 →CONFIGURATION	
OPERATION MODE Modbus register: Pulse/freq. output 1 3201 Pulse/freq. output 2 3401 Data type: Integer Access: read/ write	Configuration of the output as a pulse, frequency 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 3 = OFF **Factory setting:** Pulse/frequency output 1: PULSE Pulse/frequency output 2: STATUS
2ND CHANNEL Modbus register: Pulse/freq. output 1 3255 Pulse/freq. output 2 3455 Data type: Integer Access: read/ write	Selection for output of the assigned measured variable on PULS/FREQ.OUT. 2 **Options:** 0 = OFF = no output 1 = REDUNDANCY 0° = repeated output without time delay 2 = REDUNDANCY 90° = repeated output with time delay of one-half of a pulse width 3 = REDUNDANCY 180° = repeated output with time delay of an entire pulse width 4 = PHASE SHIFT 0° = repeated output without phase shift 5 = PHASE SHIFT 90° = repeated output with 90° phase shift 6 = PHASE SHIFT 180° = repeated output with 180° phase shift **Factory setting:** OFF ✎ Note! ▪ REDUNDANCY 0°, REDUNDANCY 90° and REDUNDANCY 180° can be selected in PULSE mode of operation only. ▪ PHASE SHIFT 0°, PHASE SHIFT 90° and PHASE SHIFT 180° can be selected in PULSE and FREQUENCY modes of operation.

✎ Note!
The options selected in the functions OPERATION MODE and 2ND CHANNEL, and the resulting effects on the two pulse/frequency/status outputs, are illustrated on the following pages using examples.

Function description OUTPUTS →PULSE/FREQUENCY OUTPUTS 1...2 →CONFIGURATION	
Descriptions of pulse/frequency/ status outputs	There are two pulse/frequency/status outputs, which can be operated **independent** or **dependent** of each other. In PULSE and FREQUENCY modes, flow measurement values can be output; in STATUS mode, statuses can be output. For example, the first pulse/frequency/status output can be used as the pulse output for mass flow, and the second pulse/frequency/status output can be used as the status output for the system status. If, for custody transfer reasons or due to the function of the downstream totalizer counter, a measured value must be output redundantly or phase-shifted, a logical pulse/frequency/status output assigns both physical outputs (selection with parameter 2ND CHANNEL). The other pulse/ frequency/status output is then switched off, regardless of its mode of operation. The parameter 2ND CHANNEL is used to select the mode of the measured value output on the second channel. A distinction is made between the redundant pulse output REDUNDANCY in PULSE mode of operation and PHASE SHIFT in PULSE or FREQUENCY mode. Redundant pulse output means that a pulse in the first channel must always be followed by a corresponding pulse in the second channel. On the contrary, the phase shift relates to the period length of the output signal of the logically first channel. The following applies for the examples below: ▪ Wiring of pulse/frequency/status output 1 24 V DC via 1 kW pull-up at terminal 24 (+), terminal 25 (-) at ground, Signal tapped at terminal 24 (+) ▪ Wiring of pulse/frequency/status output 2 24 V DC via 1 kW pull-up at terminal 22 (+), terminal 23 (-) at ground, Signal tapped at terminal 22 (+)
Example 1 (in metric units)	Mass flow = +3600 kg/h

Parameter	IFS ouput ①	IFS output ②
OPERATION MODE	Pulse	Status
2. CHANNEL	Off	-
ASSIGN	Mass flow	Fault
MEASURING MODE	Bidirectional	-
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive positive	-
Output signal: Pulse with 0,25 ms length Pulse rate = (3600 kg/h) / 0,001 kg = 1 kHz Gauge 0 V DC, because no error status active		

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Function description
OUTPUTS →PULSE/FREQUENCY OUTPUTS 1...2 →CONFIGURATION

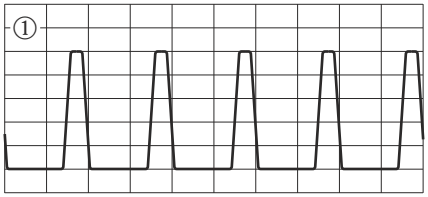
Example 2
(in metric units)

Mass flow = +3600 kg/h

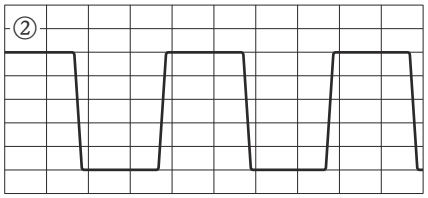
Parameter	IFS output ①	IFS output ②
OPERATION MODE	Pulse	Frequency
2. CHANNEL	Off	Off
ASSIGN	Mass flow	Mass flow
MEASURING MODE	Bidirectional	Bidirectional
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive positive	Passive positive
END VALUE	-	36000 kg/h
END VALUE FREQ.	-	5 kHz

Output signal:

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz



Frequency f =
(3600 kg/h) /
(36000 kg /h) x
5 kHz = 500 Hz



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Example 3
(in metric units)

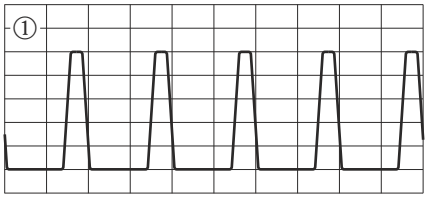
Mass flow = +3600 kg/h

Parameter	IFS output ①	IFS output ②
OPERATION MODE	Pulse	Off*
2ND CHANNEL	Redundancy 90°	-
ASSIGN	Mass flow	-
MEASURING MODE	Bidirectional	-
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive positive	-

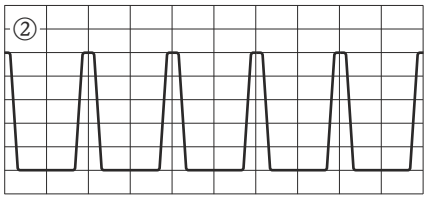
* because 2ND CHANNEL on IFS 1 is set to Redundancy 90°.

Output signal:

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz



Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz, **lagging** half a
pulse width, because
mass flow is **positive**



A0006948-EN

Function description
OUTPUTS →PULSE/FREQUENCY OUTPUTS 1…2 →CONFIGURATION

Example 4
(in metric units)

Mass flow = −3600 kg/h

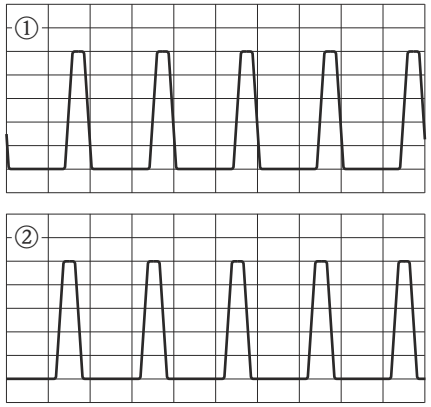
Parameter	IFS output ①	IFS output ②
OPERATION MODE	Pulse	Off *
2ND CHANNEL	Redundancy 90°	-
ASSIGN	Mass flow	-
MEASURING MODE	Bidirectional	-
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive positive	-

* because 2ND CHANNEL on IFS 1 is set to Redundancy 90°.

Output signal:

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz, **advanced** half
a pulse width,
because mass flow is
negative



A0006949-EN

Example 5
(in metric units)

Mass flow = +3600 kg/h

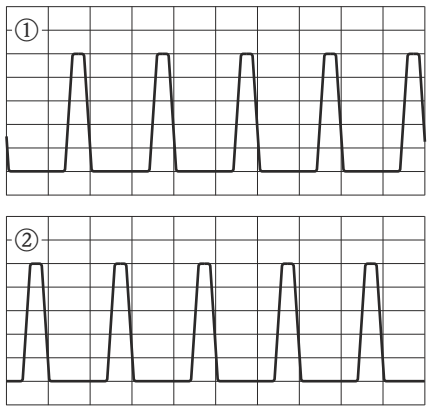
Parameter	IFS output ①	IFS output ②
OPERATION MODE	Pulse	Off *
2ND CHANNEL	Phase shift 180°	-
ASSIGN	Mass flow	-
MEASURING MODE	Bidirectional	-
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive positive	-

* because 2ND CHANNEL on IFS 1 is set to Phase shift 180°.

Output signal:

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz, phase-shift
180°.



A0006950-EN

Function description
OUTPUTS →PULSE/FREQUENCY OUTPUTS 1...2 →CONFIGURATION

Example 6
(in metric units)

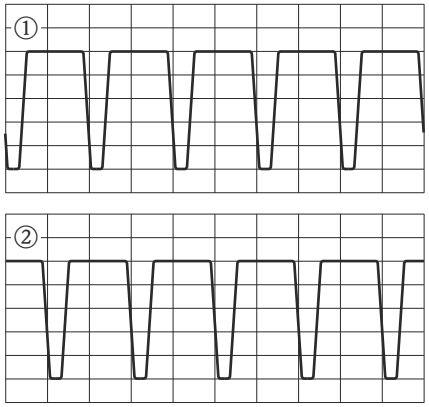
Mass flow = +3600 kg/h

Parameter	IFS output ①	IFS output ②
OPERATION MODE	Pulse	Off *
2ND CHANNEL	Phase shift 180°	-
ASSIGN	Mass flow	-
MASURING MODE	Bidirectional	-
PULSE VALUE	0,001 kg	-
PULSE WIDTH	0,25 ms	-
SIGNAL FORM	Passive negative	-
* because 2ND CHANNEL on IFS 1 is set to Phase shift 180°		

Output signal:

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz

Pulse with
0,25 ms length
Pulse rate =
(3600 kg/h) / 0,001 kg
= 1 kHz, phase-shift
180°.



A0006951-EN

Example 7
(in metric units)

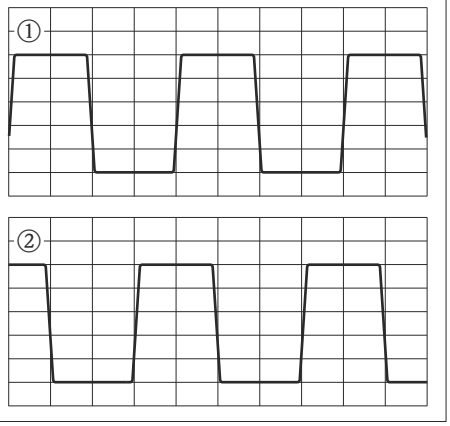
Mass flow = +3600 kg/h

Parameter	IFS output ①	IFS output ②
OPERATION MODE	Off *	Frequency
2ND CHANNEL	-	Phase shift 90°
ASSIGN	-	Mass flow
MEASURING MODE	-	Bidirectional
SIGNAL FORM	-	Passive negative
END VALUE	-	36000 kg/h
END VALUE FREQ.	-	5 kHz
* because 2ND CHANNEL on IFS 2 is set to Phase shift 90°		

Output signal:

Frequency f =
(3600 kg/h)/
(36000 kg/h) x 5 kHz
= 500 Hz, **lagging** 90°,
because mass flow is
positive

Frequency f =
(3600 kg/h)/
(36000 kg/h) x 5 kHz
= 500 Hz



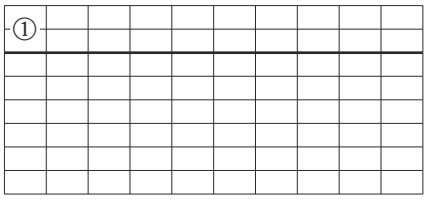
A0006952-EN

Function description OUTPUTS →PULSE/FREQUENCY OUTPUTS 1...2 →CONFIGURATION	
Example 8 (in metric units)	Mass flow = +3600 kg/h*

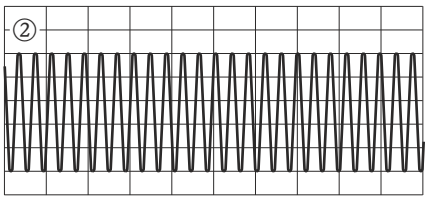
Parameter	IFS output ①	IFS output ②
OPERATION MODE	Status	Frequency
2ND CHANNEL	-	Off
ASSIGN	Fault	Mass flow
MEASURING MODE	-	Bidirectional
SIGNAL FORM	-	Passive positive
END VALUE	-	36000 kg/h
END VALUE FREQ.	-	5 kHz
FAIL SAFE MODE	-	Max. value
FAULT SENSITIVITY	-	Fault
* but error condition #587 is active		

Output signal:

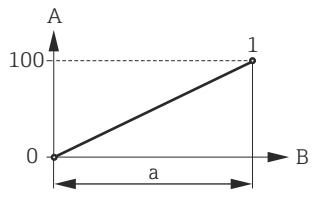
Gauge 24 V DC, because fail safe mode is active



Frequency f = 5 kHz, because highly possible end value frequency

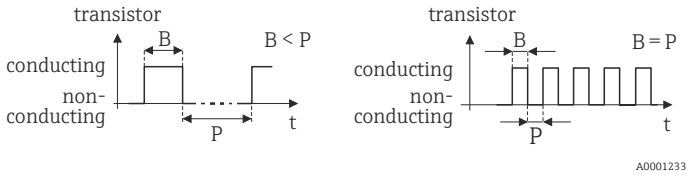


A0006953-EN

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1...2 →CONFIGURATION (frequency)	
ASSIGN Modbus register: Pulse/freq. output 1 3202 Pulse/freq. output 2 3402 Data type: Integer Access: read/ write	Assign a measured variable to the output. ✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. **Options:** 0 = OFF 2 = MASS FLOW 5 = VOLUME FLOW **Factory setting:** MASS FLOW
END VALUE FREQUENCY Modbus register: Pulse/freq. output 1 3205 Pulse/freq. output 2 3405 Data type: Float Access: read/ write	For defining an end value frequency for the frequency output. Assign the corresponding measured value to the measuring range in the function VALUE f HIGH (see below). ✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. **User input:** 5-digit fixed-point number: 100 to 5000 Hz **Factory setting:** 1000 Hz Example: ▪ VALUE f HIGH = 1000 kg/h, end value frequency = 1000 Hz: i.e. a frequency of 1000 Hz is output at a flow of 1000 kg/h. ▪ VALUE f HIGH = 3600 kg/h, end value frequency = 5000 Hz: i.e. a frequency of 5000 Hz is output at a flow of 3600 kg/h. ✎ Note! In the FREQUENCY operating mode, the output signal is symmetrical (on/off ratio = 1:1).
VALUE f HIGH Modbus register: Pulse/freq. output 1 3209 Pulse/freq. output 2 3409 Data type: Float Access: read/ write	In this function, a value is assigned to the END VALUE FREQ. Determine the desired span by defining VALUE f HIGH. ✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. **User input:** Floating-point number **Factory setting:** Depends on nominal diameter  A0007114 *Fig. 2: Behavior of frequency output* a = Span A = Frequency [%] B = Measured variable (amount) 1 = VALUE f HIGH (END VALUE FREQ) ✎ Note! A value greater than VALUE f HIGH cannot be output; otherwise, a message is generated (#355/#356). We recommend providing reserve capacity during parameter configuration.

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1...2 →CONFIGURATION (frequency)	
MEASURING MODE Modbus register: Pulse/freq. output 1 3211 Pulse/freq. output 2 3411 Data type: Integer Access: read/ write	Use this function to define the measuring mode for the frequency output. ✎ Note! Function available only if PULSE or FREQUENCY has been selected in the MODE OF OPERATION function. **Options:** 0 = FORWARD 1 = BIDIRECTIONAL 3 = BACKWARD **Factory setting:** FORWARD **Description of the individual options:** FORWARD Only positive flow rates are output. Negative flow rates are cut off. If the output is again on the second PULS/FREQ.OUT., the time delay or phase shift is lagging. BIDIRECTIONAL Positive and negative flow rates are output. Only the amount of the flow is relevant for generating the pulses or frequency. If the output is again at the second PULS/FREQ.OUT., the time delay or phase shift is lagging if the flow rate is positive and leading if the flow rate is negative. BACKWARD Only negative flow rates are output. Positive flow rates are cut off. If the output is again on the second PULS/FREQ.OUT., the time delay or phase shift is leading.
FAILURE SENSITIVITY Modbus register: Pulse/freq. output 1 3256 Pulse/freq. output 2 3456 Data type: Integer Access: read/ write	Defines the message categories to which the output reacts. **Options:** 0 = OFF = The output does not react to any status. 1 = WARNING = The output reacts to warnings. 2 = ERROR = The output reacts to errors. 3 = ERROR AND WARN. = The output reacts to errors and warnings **Factory setting:** ERROR
FAILSAFE MODE Modbus register: Pulse/freq. output 1 3215 Pulse/freq. output 2 3415 Data type: Integer Access: read/ write	Defines how the PULS/FREQ.OUT. behaves when a message occurs of the category to which the PULS/FREQ.OUT. is configured to react. ✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. **Options:** 0 = FALLBACK VALUE = Output is 0 Hz 2 = HOLD VALUE = Measured value display on the basis of the last measured value preceding occurrence of the status 4 = HIGH VALUE Output of the highest possible pulse rate or frequency. **Factory setting:** FALLBACK VALUE ✎ Note! If OFF is not selected for 2ND CHANNEL, the failsafe mode of channel 2 is as follows: 1st channel / 2nd channel FALLBACK VALUE / HIGH VALUE HOLD VALUE / HOLD VALUE HIGH VALUE / FALLBACK VALUE A0007100-EN

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1…2 →CONFIGURATION (frequency)	
OUTPUT SIGNAL Modbus register: Pulse/freq. output 1 3212 Pulse/freq. output 2 3412 Data type: Integer Access: read/ write	Use this function to select the polarity of the output signal. ✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. **Options:** 0 = PASSIVE/POSITIVE 1 = PASSIVE/NEGATIVE **Factory setting:** PASSIVE/POSITIVE **Description of the individual options:** PASSIVE/POSITIVE The output transistor is **nonconductive** during the first half of the period of the output signal and **conductive** during the second half of the period. PASSIVE/NEGATIVE The output transistor is **conductive** during the first half of the period of the output signal and **nonconductive** during the second half of the period.

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1...2 →CONFIGURATION (impulse)	
ASSIGN Modbus register: Pulse/freq. output 1 3223 Pulse/freq. output 2 3423 Data type: Integer Access: read/ write	Assign a measured variable to the output. ✎ Note! Function is not available unless the PULSE setting was selected in the OPERATION MODE function. **Options:** 0 = OFF 2 = MASS FLOW 5 = VOLUME FLOW **Factory setting:** MASS FLOW
PULSE VALUE Modbus register: Pulse/freq. output 1 3224 Pulse/freq. output 2 3424 Data type: Float Access: read/ write	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. ✎ Note! Function is not available unless the PULSE setting was selected in the OPERATION MODE function. **User input:** Floating-point number **Factory setting:** Depends on nominal diameter
PULSE WIDTH Modbus register: Pulse/freq. output 1 3226 Pulse/freq. output 2 3426 Data type: Float Access: read/ write	Use this function to enter the pulse width of the output pulse. ✎ Note! Function is not available unless the PULSE setting was selected in the OPERATION MODE function. **User input:** 0.1 to 1000 ms **Factory setting:** 1 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).  *Fig. 3: Pulse Width* B = Pulse width entered (the illustration applies to positive pulses) P = Pauses between the individual pulses ✎ Note! When entering the pulse width, select a value that can still be processed by an external totalizer (e.g. mechanical totalizer, PLC, etc.). ☞ Caution! If the pulse rate resulting from the entered pulse value (see above) and the current flow rate is too large to maintain the selected pulse width (the pause interval P is smaller than the entered pulse width B), a message is generated (# 359/360).

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1...2 →CONFIGURATION (impulse)	
MEASURING MODE Modbus register: Pulse/freq. output 1 3228 Pulse/freq. output 2 3428 Data type: Integer Access: read/ write	Use this function to define the measuring mode for the pulse output. ✎ Note! Function available only if PULSE or FREQUENCY has been selected in the OPERATION MODE function. **Options:** 0 = FORWARD 1 = BIDIRECTIONAL 3 = BACKWARD **Factory setting:** FORWARD **Description of the individual options:** BALANCE Positive and negative flow rates are output. Only the amount of the flow is relevant for generating the pulses or frequency. If the output is again at the second PULS/FREQ.OUT., the time delay or phase shift is lagging if the flow rate is positive and leading if the flow rate is negative. FORWARD Only positive flow rates are output. Negative flow rates are cut off. If the output is again on the second PULS/FREQ.OUT., the time delay or phase shift is lagging. BACKWARD Only negative flow rates are output. Positive flow rates are cut off. If the output is again on the second PULS/FREQ.OUT., the time delay or phase shift is leading.
FAILURE SENSITIVITY Modbus register: Pulse/freq. output 1 3254 Pulse/freq. output 2 3454 Data type: Integer Access: read/ write	Defines the message categories to which the output reacts. **Options:** 0 = OFF = The output does not react to any status. 1 = WARNING = The output reacts to warnings. 2 = ERROR = The output reacts to errors. 3 = ERROR AND WARN. = The output reacts to warnings and notes **Factory setting:** ERROR
FAILSAFE MODE Modbus register: Pulse/freq. output 1 3230 Pulse/freq. output 2 3430 Data type: Integer Access: read/ write	Defines how the PULS/FREQ.OUT. behaves when a message occurs of the category to which the PULS/FREQ.OUT. is configured to react. ✎ Note! Function is not available unless the PULSE setting was selected in the OPERATION MODE function. **Options:** 0 = FALLBACK VALUE = Output is 0 Hz 2 = HOLD VALUE = Measured value display on the basis of the last measured value preceding occurrence of the message 4 = HIGH VALUE Output of the highest possible pulse rate or frequency. **Factory setting:** FALLBACK VALUE ✎ Note! If OFF is not selected for 2ND CHANNEL, the failsafe mode of channel 2 is as follows: 1st channel / 2nd channel FALLBACK VALUE / HIGH VALUE HOLD VALUE / HOLD VALUE HIGH VALUE / FALLBACK VALUE A0007100-EN

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1…2 →CONFIGURATION (impulse)	
OUTPUT SIGNAL Modbus register: Pulse/freq. output 1 3229 Pulse/freq. output 2 3429 Data type: Integer Access: read/ write	Use this function to select the polarity of the output signal. ✎ Note! Function is not available unless the PULSE setting was selected in the OPERATION MODE function. **Options:** 0 = PASSIVE/POSITIVE 1 = PASSIVE/NEGATIVE **Factory setting:** PASSIVE/POSITIVE **Description of the individual options:** PASSIVE/POSITIVE The output transistor is **nonconductive** during the first half of the output of a pulse and **conductive** otherwise. PASSIVE/NEGATIVE The output transistor is **conductive** during the first half of the output of a pulse and **nonconductive** otherwise.

Function description OUTPUTS →PULSE/FREQUENCY OUTPUT 1...2 →CONFIGURATION (status)	
ASSIGN STATUS Modbus register: Pulse/freq. output 1 3236 Pulse/freq. output 2 3436 Data type: Integer Access: read/ write	Use this function to assign a switching function to the status output. ✎ Note! Function is not available unless the STATUS setting was selected in the OPERATION MODE function. **Options:** 0 = OFF → nonconductive 1 = ON → conductive 2 = ERROR → nonconductive if error message is present 3 = WARNING →nonconductive if warning message is present 4 = ERROR AND WARN. → nonconductive if error or warning message is present 6 = FLOW DIRECTION → conductive if flow rate is positive and nonconductive if flow rate is negative **Factory setting:** ERRORS
ACTUAL STATUS Modbus register: 3248 Data type: Integer Access: read/ write	Use this function to check the current status of the status output. ✎ Note! Function is not available unless the STATUS setting was selected in the OPERATION MODE function. **Display:** 0 = NON CONDUCTIVE 1 = CONDUCTIVE

2.6 Block "BASIC FUNCTION"

2.6.1 Group "Modbus RS485"

BASIC FUNCTION → MODBUS RS485 → CONFIGURATION

Function description BASIC FUNCTION →MODBUS RS485 ® CONFIGURATION	
TRANSMISSION MODE Modbus register: 4913 Data type: Integer Access: read/ write	For selecting the data transfer mode. **Options:** 0 = RTU 1 = ASCII **Factory setting:** RTU
BAUDRATE Modbus register: 4912 Data type: Integer Access: read/ write	For selecting the baud rate. **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
PARITY Modbus register: 4914 Data type: Integer Access: read/ write	For selecting whether no parity bit or an even or uneven parity bit should be transmitted. **Options:** 0 = EVEN 1 = ODD 2 = NONE/STOP BITS 2 **Factory setting:** EVEN
DELAY TELEGRAM REPLY Modbus register: 4916 Data type: Float Access: read/ write	For entering a minimum 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 RS485 masters. **User input:** 0 to 100 ms **Factory setting:** 10 ms
FIELDBUS ADDRESS Modbus register: 4910 Data type: Integer Access: read/ write	For entering the device address. **User input:** 1 to 247 **Factory setting:** 247

Function description BASIC FUNCTION →MODBUS RS485 ® CONFIGURATION	
BYTEORDER FLOAT Modbus register: 4924 Data type: Integer Access: read/ write	Select the transmission sequence of bytes for the data type Float. **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. ▪ For more information →Operating Instructions, keyword "Byte transmission sequence".
BYTEORDER STRING Modbus register: 4922 Data type: Integer Access: read/ write	Select the transmission sequence of bytes for the data type String. **Options:** 0 = 0 - 1 1 = 1 - 0 **Factory setting:** 1 - 0 ✎ Note! ▪ The transmission sequence must suit the Modbus master. ▪ For more information →Operating Instructions, keyword "Byte transmission sequence".
BYTEORDER INTEGER Modbus register: 4923 Data type: Integer Access: read/ write	Select the transmission sequence of bytes for the data type Integer. **Options:** 0 = 0 - 1 1 = 1 - 0 **Factory setting:** 1 - 0 ✎ Note! ▪ The transmission sequence must suit the Modbus master. ▪ For more information →Operating Instructions, keyword "Byte transmission sequence".
TAG NAME Modbus register: 4901 Data type: String (16) Access: read/ write	For entering a tag name for the measuring device. **User input:** max. 15-character text, permissible: A-Z, 0-9, +, -, punctuation marks **Factory setting:** "_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _" (No text) ✎ Note! For the Modbus, the input must end with the termination (binary null).

Function description BASIC FUNCTION →MODBUS RS485 ® CONFIGURATION	
FAILURE SENSITIVITY Modbus register: 4921 Data type: Integer Access: read/ write	Defines the message categories to which the data transmission reacts. **Options:** 0 = OFF = The data transmission does not react to any messages. 1 = WARNING = The data transmission reacts to warnings. 2 = ERROR = The data transmission reacts to errors. 3 = ERROR AND WARN. = The data transmission reacts to errors and warnings **Factory setting:** ERROR
FAILSAFE MODE Modbus register: 4920 Data type: Integer Access: read/ write	Defines how the measured value output behaves when a message occurs of the category to which it is configured to react. **Options:** 0 = STOP = The data transmission returns "NaN" 1 = HOLD VALUE = The data transmission returns the last value before the message occurred. **Factory setting:** STOP

BASIC FUNCTION → MODBUS RS485 → CONFIGURATION

↓

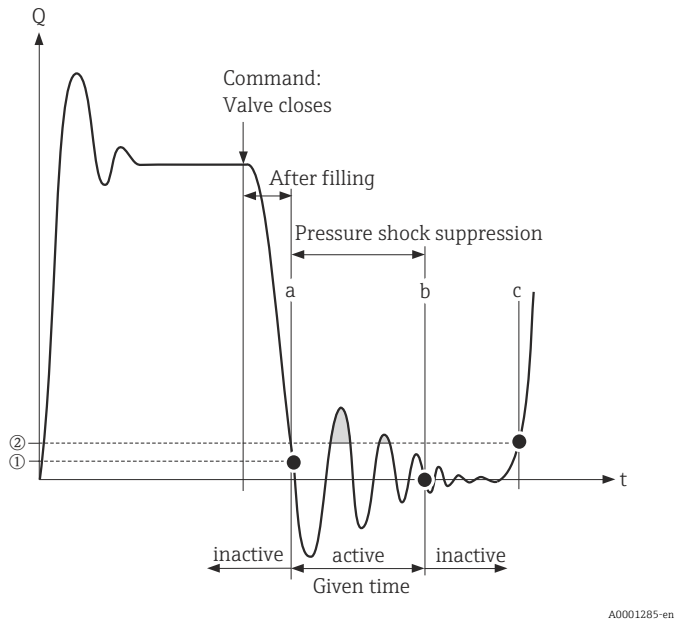
SCAN LIST REGISTER

Function description BASIC FUNCTION → PROCESSPARAMETER → SCAN LIST REGISTER	
SCAN LIST REGISTER 1 TO 16 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 (1-based), 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 to 5081. **User input:** 1 to 65535 **Factory setting:** 1

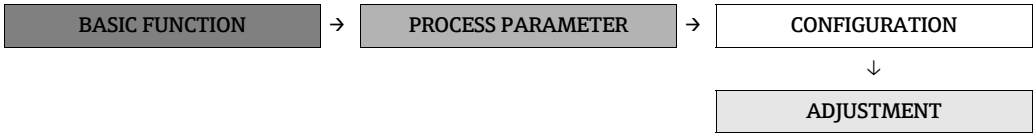
2.6.2 Group "PROCESSPARAMETER"

BASIC FUNCTION → PROCESS PARAMETER → CONFIGURATION

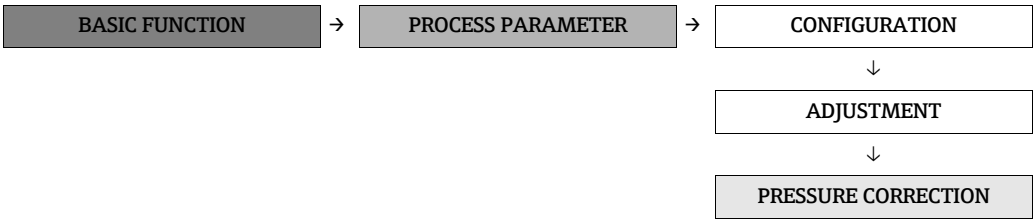
Function description BASIC FUNCTION → PROCESSPARAMETER → CONFIGURATION	
ASSIGN LOW FLOW-CUTOFF Modbus register: 5101 Data type: Integer Access: read/ write	Use this function to assign the measured variable to which the low flow cut off pertains. **Options:** 1 = MASS FLOW 2 = VOLUME FLOW **Factory setting:** MASS FLOW
ON-VALUE LOW FLOW-CUTOFF Modbus register: 5138 Data type: Float Access: read/ write	Use this function to assign a value to the switch-on point for low flow cut off. Low flow cut off is active if the value entered is not equal to 0. **User input:** Floating-point number **Factory setting:** Depends on nominal diameter ✎ Note! The switch-off point for low flow cut off is implicit 150% of the switch-on point for low flow cut off. Therefore the low flow cut off features a hysteresis.

Function description BASIC FUNCTION → PROCESSPARAMETER → CONFIGURATION	
PRESSURE SHOCK SUPPRESSION Modbus register: 5140 Data type: Float Access: read/ write	The closure of a valve can cause brief but severe movements of the fluid which the measuring system registers. 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 function ON-VAL.LF-CUTOFF → 32). 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 a in graphic). When pressure shock suppression is activated, the flow is set to null. **Deactivation of the pressure shock suppression** The pressure shock suppression is deactivated after the time interval, set in this function, has passed (see point b in graphic). The actual flow value is not displayed and output until the specified 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 c in the graphic)  *Fig. 4: Pressure shock suppression* *1 On-value (low flow cut off)* *2 Off-value (low flow cut off)* *a Active when value falls below the on-value of the low flow cut off* *b Deactivated after specified time expires* *c Flow values are again used to calculate the pulses* *Suppressed values* *Q Flow* **User input:** 0.00 to 10.0 s **Factory setting:** 0.00 s

Function description BASIC FUNCTION → PROCESSPARAMETER → CONFIGURATION	
EPD VALUE LOW Modbus register: 5110 Data type: Float Access: read/ write	Use this function to set a lower threshold for the measured density value. If the value falls below this threshold, the measuring tube is considered empty. Message #700 appears. **User input:** Floating-point number **Factory setting:** 0.2 kg/l or 0.2 g/cc
EPD RESPONSETIME Modbus register: 5108 Data type: Float Access: read/ write	Use this function to define a time span for which the activation criterion for an error has to be satisfied without interruption before the function is activated. **User input:** 0 to 100 s **Factory setting:** 1.0 s



Function description BASIC FUNCTION → PROCESSPARAMETER → ADJUSTMENT	
ZEROPOINT ADJUST Modbus register: 5121 Data type: Integer Access: read/ write	This function enables a zero point adjustment to be carried out. The new zero point determined by the measuring system is adopted by the function ZEROPOINT. **Options:** 0 = CANCEL 1 = START 2 = ERROR **Factory setting:** CANCEL ☝ Caution! Before carrying this out, please refer to the detailed description of the procedure for a zero point adjustment →Operating Instructions.
ZEROPOINT Modbus register: 7527 Data type: Float Access: read/ write	This function shows the current zero point correction value for the sensor. **Display:** max. 5-digit number: –99999 to +99999 **Factory setting:** Depends on calibration
PROGRESS Modbus register: 6797 Data type: Integer Access: read/ write	Displays the progress of a zero point adjustment as a percentage of the duration. **Display:** 0 to 100%



Function description BASIC FUNCTION → PROCESSPARAMETER → PRESSURE CORRECTION	
PRESSURE MODE Modbus register: 5184 Data type: Integer Access: read/ write	Use this function to configure an automatic pressure correction. In this way, the effect of a pressure deviation between the calibration and process pressures on the measured error for mass flow is compensated for (→Operating Instructions, chapter "Accuracy"). **Options:** 0 = OFF 1 = ON (a fixed process pressure for pressure correction is specified). **Factory setting:** OFF ✎ Note! Measuring cells in which the pressure has only a negligible effect on the accuracy do not need this correction.
PRESSURE Modbus register: 5185 Data type: Float Access: read/ write	Use this function to enter the value for the process pressure which should be used during pressure correction. ✎ Note! Function is not available unless the ON selection was selected in the PRESSURE MODE function. **User input:** Floating-point number

2.6.3 Group "SYSTEM PARAMETER"

BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION

Function description BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION	
Caution! The settings configured under these functions are used by the verification official to adjust the individual measured values. These settings cannot be modified after the device has been sealed. Changing these values when not in custody transfer mode can potentially cause measured values to be incorrect and is therefore not recommended.	
INSTLALLATION DIRECTION SENSOR Modbus register: 5501 Data type: Integer Access: read/ write	Use this function to reverse the sign of the flow direction, if necessary. **Options:** 0 = FORWARD (flow in direction of arrow) 1 = REVERSE (flow reverse to direction of arrow) **Factory setting:** NORMAL
FLOW DAMPING Modbus register: 5510 Data type: Float Access: read/ write	For setting the damping of the mass flow measured value. It can be used to reduce the spread. The reaction time of the measuring device increases with every increase in the damping. The damping acts on all functions and outputs of the measuring device. **User input:** 0 to 100 s **Factory setting:** 0 s
M. FACTOR MASSFLOW Modbus register: 5519 Data type: Float Access: read/ write	Use this function to enter the factor for adjustment of the mass flow. **User input:** Floating-point number **Factory setting:** 1
M. OFFSET MASSFLOW Modbus register: 5521 Data type: Float Access: read/ write	Use this function to enter the offset for adjustment of the mass flow. **User input:** Floating-point number **Factory setting:** 0
M. FACTOR VOLUMEFLOW Modbus register: 5523 Data type: Float Access: read/ write	Use this function to enter the factor for adjustment of the volume flow. **User input:** Floating-point number **Factory setting:** 1
M. OFFSET VOLUME FLOW Modbus register: 5525 Data type: Float Access: read/ write	Use this function to enter the offset for adjustment of the volume flow. **User input:** Floating-point number **Factory setting:** 0

Function description BASIC FUNCTION → SYSTEM PARAMETER → CONFIGURATION	
M. FACTOR DENSITY Modbus register: 5527 Data type: Float Access: read/ write	Use this function to enter the factor for adjustment of the density. **User input:** Floating-point number **Factory setting:** 1
M. OFFSET DENSITY Modbus register: 5529 Data type: Float Access: read/ write	Use this function to enter the offset for adjustment of the density. **User input:** Floating-point number **Factory setting:** 0
M. FACTOR TEMPERATURE Modbus register: 5531 Data type: Float Access: read/ write	Use this function to enter the factor for adjustment of the temperature. **User input:** Floating-point number **Factory setting:** 1 ✎ Note! The value entered relates to the absolute temperature in Kelvin. Example: - current temperature = 26.85 °C equals 300 Kelvin - if you enter a value of 1.01 the temperature changes thus to 303 Kelvin. This equals 29.85 °C.
M. OFFSET TEMPERATURE Modbus register: 5533 Data type: Float Access: read/ write	Use this function to enter the offset for adjustment of the temperature. **User input:** Floating-point number **Factory setting:** 0 ✎ Note! The value entered shows always the unit Kelvin. Example: - actual temperature = 26.85 °C equals 300 Kelvin - if you enter a value of 1 the temperature changes thus to 301 Kelvin. This equals 27.85 °C.

2.6.4 Group "SENSOR DATA"

BASIC FUNCTION → SENSOR DATA → CONFIGURATION

Function description BASIC FUNCTION → SENSOR DATA → CONFIGURATION	
K-FACTOR Modbus register: 7513 Data type: Float Access: Read	This function shows the calibration factor for the sensor.
ZEROPOINT Modbus register: 7527 Data type: Float Access: read/ write	Shows the zero point for the sensor.
NOMINAL DIAMETER Modbus register: 7525 Data type: Integer Access: Read	This function shows the nominal diameter for the sensor. **Display:** 0 = DN 1 or 1/24" 1 = DN 2 or 1/12" 4 = DN 4 or 1/8" 5 = DN 6 or 1/4"

BASIC FUNCTION → SENSOR DATA → CONFIGURATION

↓

DENSITY COEFICIENT

Function description BASIC FUNCTION → SENSOR DATA → DENSITY COEFICIENT	
C0 Modbus register: 7501 Data type: Float Access: Read	Displays the density coefficient C0.
C1 Modbus register: 7503 Data type: Float Access: Read	Displays the density coefficient C1.
C2 Modbus register: 7505 Data type: Float Access: Read	Displays the density coefficient C2.
C3 Modbus register: 7507 Data type: Float Access: Read	Displays the density coefficient C3.

Function description BASIC FUNCTION → SENSOR DATA → DENSITY COEFICIENT	
C4 Modbus register: 7509 Data type: Float Access: Read	Displays the density coefficient C4.
C5 Modbus register: 7511 Data type: Float Access: Read	Displays the density coefficient C5.

2.7 Block "SUPERVISION"

2.7.1 Group "SYSTEM"

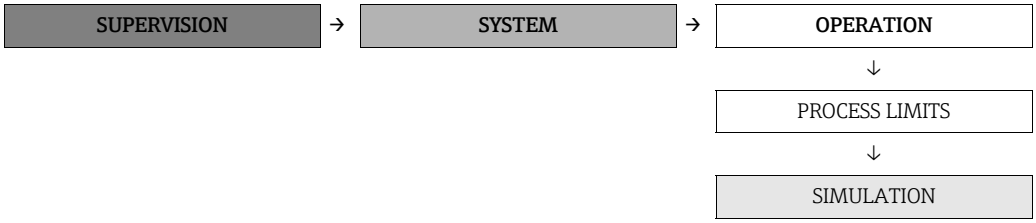
SUPERVISION → SYSTEM → OPERATION

Function description SUPERVISION → SYSTEM → OPERATION	
ACTUAL SYSTEM CONDITION Modbus register: 6801 Data type: Integer Access: Read	Displays the present system condition. **Display:** 0 = "SYSTEM OK" or Displays the message with the highest priority. ✎ Note! The number of the message is output via Modbus RS485 →Operating Instructions.
OPERATION HOURS Modbus register: 6810 Data type: Float Access: Read	The operating hours of the device appear on the display. **Display:** ▪ Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec) ▪ Hours of operation 10 to 10,000 hours → display format = 0000:00 (hr:min) ▪ Hours of operation > 10,000 hours → display format = 000000 (hr)
PROGRAM CODE CRC Modbus register: 8933 Data type: String Access: Read	Display of the CRC checksum of the program code. ✎ Note! The CRC checksum is calculated cyclically to verify its consistency.
SYSTEM RESET Modbus register: 6817 Data type: Integer Access: read/ write	Use this function to perform a reset of the measuring system. **Options:** 0 = CANCEL 1 = RESTART SYSTEM (restart without interrupting power supply) 2 = RESET DELIVERY **Factory setting:** CANCEL ✎ Note! Setting back parameters can require several minutes, followed by a start-up of the device. The power supply must not be switched off while the factory settings are being restored.
PROGRESS Modbus register: 6797 Data type: Integer Access: Read	Displays the progress of restoring the default values. **Display:** 0 to 100%

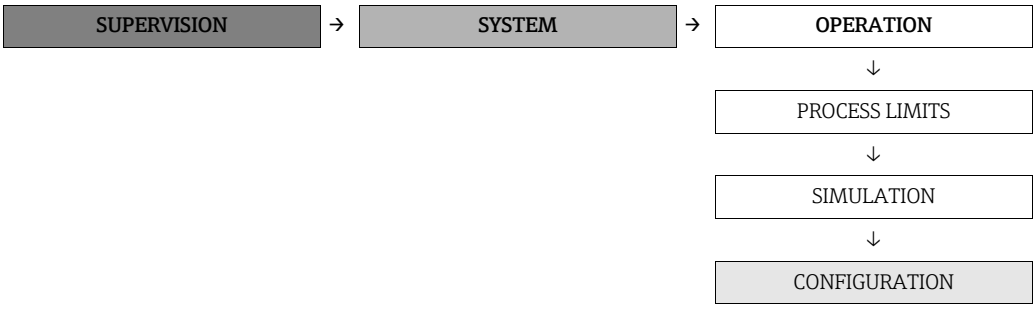
SUPERVISION → SYSTEM → OPERATION
↓
PROCESS LIMITS

Function description SUPERVISION → SYSTEM → PROCESS LIMITS	
LOWER LIMIT MASSFLOW Modbus register: 6781 Data type: Float Access: read/ write	Use this function to enter the lower process limit for the mass flow. If value falls below this limit, message #805 is output. **User input:** Floating-point number **Factory setting:** depends on nominal diameter and country
UPPER LIMIT MASSFLOW Modbus register: 6783 Data type: Float Access: read/ write	Use this function to enter the upper process limit for the mass flow. If value exceeds this limit, message #806 is output. **User input:** Floating-point number **Factory setting:** depends on nominal diameter and country
LOWER LIMIT VOLUMEFLOW Modbus register: 6785 Data type: Float Access: read/ write	Use this function to enter the lower process limit for the volume flow. If value falls below this limit, message #807 is output. **User input:** Floating-point number **Factory setting:** depends on nominal diameter and country
UPPER LIMIT VOLUMEFLOW Modbus register: 6787 Data type: Float Access: read/ write	Use this function to enter the upper process limit for the volume flow. If value exceeds this limit, message #808 is output. **User input:** Floating-point number **Factory setting:** depends on nominal diameter and country
LOWER LIMIT TEMPERATURE Modbus register: 6789 Data type: Float Access: read/ write	Use this function to enter the lower process limit for the temperature. If value falls below this limit, message #801 is output. **User input:** Floating-point number **Factory setting:** −55°C or −67°F
UPPER LIMIT TEMPERATURE Modbus register: 6791 Data type: Float Access: read/ write	Use this function to enter the upper process limit for the temperature. If value exceeds this limit, message #802 is output. **User input:** Floating-point number **Factory setting:** +205°C or +400°F
LOWER LIMIT DENSITIY Modbus register: 6793 Data type: Float Access: read/ write	Use this function to enter the lower process limit for the pressure. If value falls below this limit, message #803 is output. **User input:** Floating-point number **Factory setting:** 0 kg/l or 0 g/cc

Function description SUPERVISION → SYSTEM → PROCESS LIMITS	
UPPER LIMIT DENSITIY Modbus register: 6795 Data type: Float Access: read/ write	Use this function to enter the upper process limit for the density. If value exceeds this limit, message #804 is output. **User input:** Floating-point number **Factory setting:** 4 kg/l or 4 g/cc



Function description SUPERVISION → SYSTEM → SIMULATION	
SIMULATION MEASURAND Modbus register: 6813 Data type: Integer Access: read/ write	Use this function to set the inputs, outputs and totalizers to their corresponding defined flow-response modes in order to check whether they respond correctly. During this time, message #692, "SIM. MEASURAND", appears on the display. **Options:** 0 = OFF 1 = MASS FLOW 2 = VOLUME FLOW 4 = DENSITY 6 = TEMPERATURE **Factory setting:** OFF Caution! ▪ The measuring device cannot be used for measuring while this simulation is in progress. ▪ The setting is not saved in the event of a power failure.
VALUE SIMULATION MEASURAND Modbus register: 6814 Data type: Float Access: read/ write	For entering a user-selectable value (e.g. 30 kg/min) to check the associated functions in the device itself and downstream signal loops. Note! This function is not available unless the function SIM. MEASURAND is active. **User input:** Floating-point number **Factory setting:** 0 Caution! The setting is not saved in the event of a power failure.



Function description SUPERVISION → SYSTEM → CONFIGURATION	
ALARM DELAY Modbus register: 6808 Data type: Float Access: read/ write	Enter a time span for which the criteria for an error have to be satisfied without interruption before a message is generated. **User input:** 0 to 10 s (in one-second increments) **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 delayed, a value of 0 seconds must be entered here.
PERMANENT STORAG Modbus register: 6907 Data type: Integer Access: read/ write	Enter whether permanent storage of all parameters in the DAT has been switched on or off. **Options:** 0 = OFF 1 = ON **Factory setting:** ON **Description of the individual options:** OFF Changes of settings are not stored permanently. After a power failure, the settings are the same as they were before OFF was selected. This function is recommended if a setting is frequently changed via Modbus, as the number of write actions to the DAT allowed is limited to 1,000,000. ON Every change of the settings is stored permanently. After selecting ON, the measuring instrument carries out a restart and then has the same settings as before OFF was selected.

2.7.2 Group "VERSION-INFO"

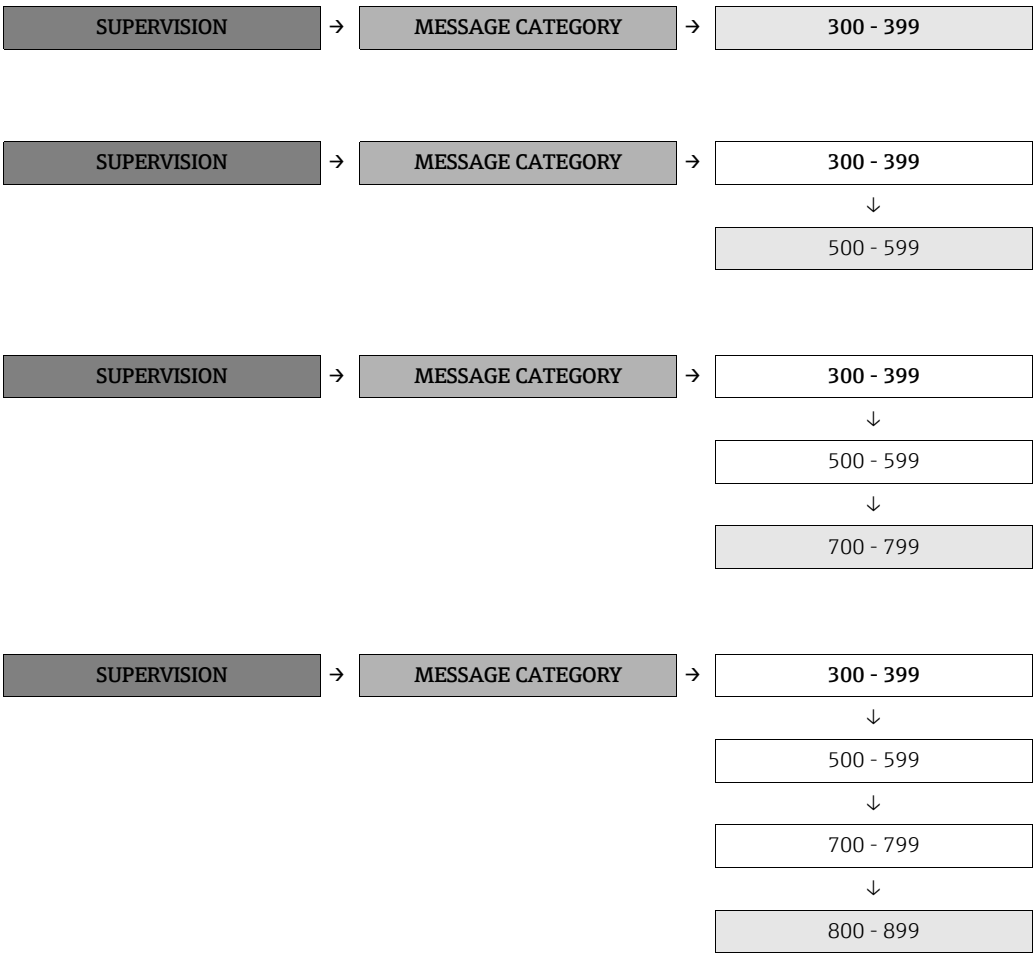
SUPERVISION → VERSION-INFO → AMPLIFIER

Function description SUPERVISION → VERSION-INFO → AMPLIFIER	
SOFTWARE-REVISION AMPLIFIER Modbus register: 7039 Data type: String Access: (16) Read	Use this function to view the software revision number of the amplifier.

SUPERVISION → VERSION-INFO → AMPLIFIER → SENSOR

Function description SUPERVISION → VERSION-INFO → SENSOR	
SERIAL NUMBER Modbus register: 7003 Data type: String Access: (16) Read	The serial number of the device appears on the display.
SENSOR TYPE Modbus register: 7012 Data type: String Access: (16) Read	The sensor type appears on the display.
SOFTWARE-REVISION DAT Modbus register: 7021 Data type: String Access: (16) Read	Use this function to view the software revision number of the software used to program the DAT.

2.7.3 Group "MESSAGE CATEGORY"



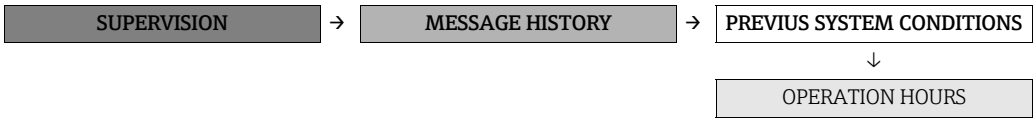
Function description SUPERVISION → MESSAGE CATEGORY → 300 TO 899	
300 to 899 Modbus register: 355 10038 356 10039 358 10041 359 10042 360 10043 361 10044 362 10045 379 10026 380 10027 381 10028 382 10029 383 10030 384 10031 385 10032 386 10033 387 10034 388 10070 389 10071 586 10035 587 10036	Set the category of a message. **Options:** 0 = OFF = No status is activated. 1 = WARNING = The status in the "Warning" category. 2 = ERROR = The status is in the "Error" category. **Factory setting:** 300 to 399 = ERROR 500 to 599 = ERROR 700 to 799 = NOTE 800 = NOTE 801 to 899 = OFF (continued on next page)

Function description SUPERVISION → MESSAGE CATEGORY → 300 TO 899	
700	10050
701	10046
702	10047
703	10048
704	10049
705	10037
706	10051
707	10052
708	10053
709	10054
710	10055
800	10056
801	10057
802	10058
803	10059
804	10060
805	10061
806	10062
807	10063
808	10064
809	10065
810	10066
Data type:	Integer
Access:	read/ write

2.7.4 Group "MESSAGE HISTORY"

SUPERVISION → MESSAGE HISTORY → PREVIUS SYSTEM CONDITIONS

Function description SUPERVISION → MESSAGE HISTORY → PREVIUS SYSTEM CONDITIONS	
PREVIUS SYSTEM CONDITIONS Modbus register: Fault/notice message: 1 6842 2 6843 3 6844 4 6845 5 6846 6 6847 7 6848 8 6849 9 6850 10 6851 11 6852 12 6853 13 6854 14 6855 15 6856 16 6857 Data type: Integer Access: Read	Displays the last 16 messages to occur. ✎ Note! For more information, refer to the keyword "System or process error messages."



Function description SUPERVISION → MESSAGE HISTORY → OPERATION HOURS	
SYSTEM CONDITION OPERATING HOURS Modbus register: 1 8901 2 8903 3 8905 4 8907 5 8909 6 8911 7 8913 8 8915 9 8917 10 8919 11 8921 12 8923 13 8925 14 8927 15 8929 16 8931 Data type: Float Access: Read	This displays the status of the operating hours counter at which a message has occurred. **Display:** ▪ Status of operating hours < 10 hours ® display format = 0:00:00 (hr:min:sec) ▪ Status of operating hours 10 to 10,000 hours ® display format = 0000:00 (hr:min) ▪ Status of operating hours > 10,000 hours ® display format = 000000 (hr)

3 Factory settings

3.1 SI units (not for USA and Canada)

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

Nominal diameter [mm]	Low flow cut off [kg/h]	Full scale value Current output [kg/h]	Pulse value [kg/p]
1	0.08	4	0.001
2	0.4	20	0.010
4	1.8	90	0.010
6	4.0	200	0.100

3.2 US units (only for USA and Canada)

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

Nominal diameter [inch]	Low flow cut off [lb/min]	Full scale value Current output [lb/min]	Pulse value [lb/p]
1/24"	0.003	0.15	0.002
1/12"	0.015	0.75	0.020
1/8"	0.066	3.30	0.020
1/4"	0.15	7.4	0.200

Index

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