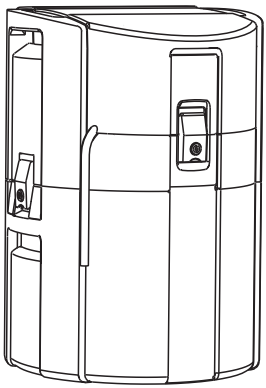
BA00492C/07/EN/15.13
71214525

Valid as of:
Softwareversion 01.04.00

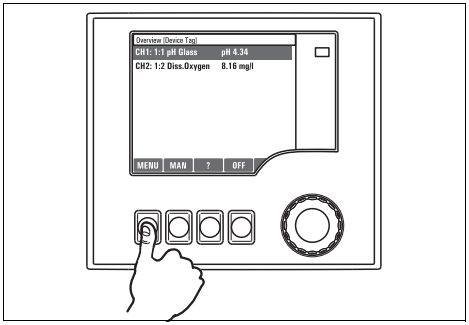
Operating Instructions
Liquiport 2010 CSP44

Automatic sampler for liquid media
Operation & settings



Endress+Hauser
People for Process Automation

Operation concept



a0013353-en

Fig. 1: Pressing the soft key: selecting the menu directly

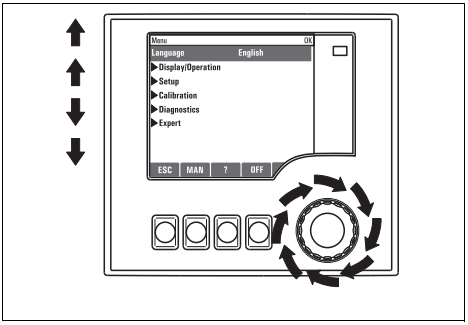


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Fig. 2: Turning the navigator: moving the cursor in the menu

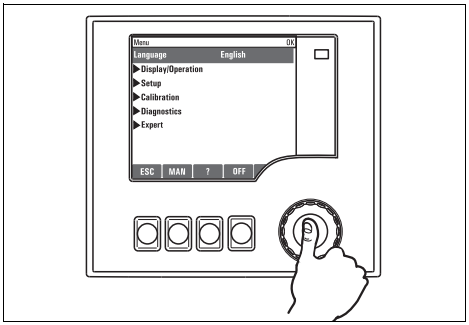

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Fig. 3: Pressing the navigator: launching a function

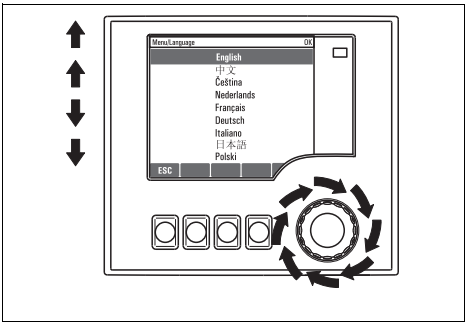

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Fig. 4: Turning the navigator: selecting a value (e.g. from a list)

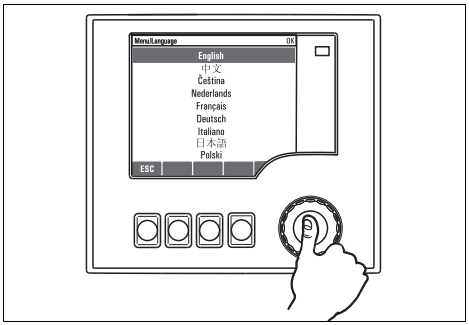

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Fig. 5: Pressing the navigator: accepting the new value

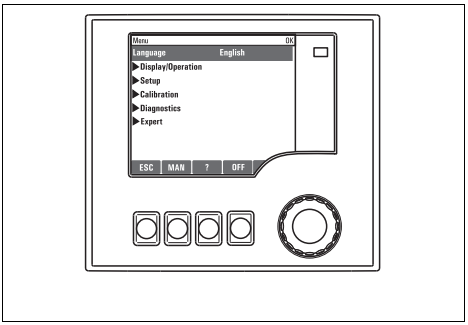

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Fig. 6: Result: new setting is accepted

Table of contents

1 About this manual

This manual gives a detailed account of all the configuration options **in the "Setup" menu**.

A description of the following menus is provided here:
- Inputs
  - Input configuration
  - Split into separate sections based on the different types of sensor that can be connected

    Some submenus are identical for all sensor types.
    These submenus are repeated in each input-specific section to make sure you can find the information you need quickly and easily.
- Outputs
  - Output configuration
  - Split into separate sections based on the different output types
- Sampling programs
  - Creating sampling programs
  - Configuring different types of programs
- Additional functions
  - Settings for the alarm sensor
  - Cleaning program configuration
- Data management
  - Firmware updates
  - Saving and loading configurations

This manual does not include the following:
- Setup/General settings
  --> Operating Instructions BA00465C "Commissioning"
- Display/Operation
  --> Operating Instructions BA00465C "Commissioning"
- Calibration
  --> Operating Instructions BA00493C "Calibration"
- Diagnostics
  --> Operating Instructions BA00470C "Maintenance & diagnostics"
- Expert
  --> Internal Service Manual

2 General settings

Many settings are not visible when a program is running.
If a program is running, stop the program before making any settings!

2.1 Basic settings

Some settings are only visible with optional hardware.

Path: Menu/Setup/General settings

Function	Options	Info
Device tag	Customized text, 32 characters	Select any name for your controller. Use the TAG name for example.
Temperature unit	Options ▪ ℃ ▪ ℉ ▪ K **Factory setting** ℃	
Current output range	Options ▪ 0 to 20 mA ▪ 4 to 20 mA **Factory setting** 4 to 20 mA	In accordance with Namur NE43, the linear range is from 3.8 to 20.5 mA (Current output range="4 to 20 mA") or from 0 to 20.5 mA (Current output range="0 to 20 mA"). If the range is exceeded or undershot, the current value stops at the range limit and a diagnostics message (460 or 461) is output.
Error current	0.0 to 23.0 mA **Factory setting** 21.5 mA	The function meets NAMUR NE43. Set the current value that should be output at the current outputs in the event of an error.
The value for "Error current" should be outside the measuring range. If you decided that your Current output range = "-0 to 20 mA", you should set an error current between 20.1 and 23 mA. If the Current output range = "4 to 20 mA" you could also define a value < 4 mA as the error current. The device allows an error current within the measuring range. In such instances pay attention to possible affects this may have on your process.		
Alarm delay	0 to 9999 s **Factory setting** 0 s	The system only displays the errors that are present longer than the set delay time. This makes it possible to suppress error messages that only occur briefly and are caused by normal process-specific fluctuations.
Device Hold	Options ▪ Disabled ▪ Enabled **Factory setting** Disabled	You can enable an immediate, general hold here. The function has the same effect as the "HOLD" soft key in the measuring screens.

2.2 Date and time

Path: Menu/Setup/General settings/Date/Time

Function	Options	Info
Set date	Depends on the format	Editing mode: DD (day): 01 to 31 MM (month): 01 to 12 YYYY (year): 1970 to 2106
Set time	Depends on the format	Editing mode: hh (hour): 00 to 23 / 0 am to 12 pm mm (minutes): 00 to 59 ss (seconds): 00 to 59
▶ Extended setup		
Date format	Options ▪ DD.MM.YYYY ▪ YYYY-MM-DD ▪ MM-DD-YYYY **Factory setting** DD.MM.YYYY	Decide which date format you want to use.
Time format	Options ▪ HH:MM am (12h) ▪ HH:MM (24h) ▪ HH:MM:SS (24h) **Factory setting** HH:MM:SS (24h)	Decide whether you want to use the 12-hour or 24-hour clock. Seconds can also be displayed with the latter version.
Time zone	Options ▪ None ▪ Choice of 35 time zones **Factory setting** None	If no time zone is selected, then Greenwich Mean Time is used (London).
DST	Options ▪ Off ▪ Europe ▪ USA ▪ Manual **Factory setting** Off	The controller adapts the summertime/normal time changeover automatically if you choose European or American daylight saving time. Manual means that you can specify the start and end of daylight saving time yourself. Here, two additional submenus are displayed in which you specify the changeover date and time.

2.3 Automatic hold (optional)

Path: Menu/Setup/General settings/Automatic hold

Function	Options	Info
▶ Device specific hold		
Setup menu Diagnostics menu	Options ▪ Disabled ▪ Enabled **Factory setting** Disabled	Decide whether a hold should be output at the current output when the particular menu is opened.
Calibration active	**Factory setting** Enabled	
Hold release time	0 to 600 s **Factory setting** 0 s	The hold is maintained for the duration of the delay time when you switch to the measuring mode.

If a device-specific hold is enabled, any cleaning that was previously started is stopped. You can only start a manual cleaning if a hold is active.

2.4 Logbooks

Logbooks record the following events:
- Calibration/adjustment events
- Operator events
- Diagnostic events
- Programming events

Here you define how the logbooks should store the data.
In addition, you are also able to define individual data logbooks. Assign the logbook name and select the measured value to be recorded. You can configure the recording rate (Scan time) individually for every data logbook.
More information on the logbooks is provided in BA00470C "Maintenance & diagnostics", "Diagnostics menu" section.

Path: Menu/Setup/General settings/Logbooks

Function	Options	Info
Logbook ident	Customized text	Part of the file name when exporting a logbook
Event logbook	Options ▪ Off ▪ Ring buffer ▪ Fill up buffer **Factory setting** Ring buffer	All diagnostic messages are recorded **Ring buffer** If the memory is full, the latest entry automatically overwrites the oldest entry. **Fill up buffer** If the memory is 80% full, the device displays a diagnostic message. If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually.
Logbook program	Options ▪ Off ▪ Ring buffer ▪ Fill up buffer **Factory setting** Ring buffer	All program messages are recorded **Ring buffer** If the memory is full, the latest entry automatically overwrites the oldest entry. **Fill up buffer** If the memory is 80% full, the device displays a diagnostic message. If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually.
▶ Overflow warnings *Event logbook="Fill up buffer"*		
Calibration logbook Diagnostic logbook Configuration logbook	Options ▪ Off ▪ On **Factory setting** Off	Decide whether you want to receive a diagnostic message from the controller in the event of memory overrun of the logbook in question.

Path: Menu/Setup/General settings/Logbooks

Function	Options	Info
Overflow warnings *Logbook program="Fill up buffer"*	Options ▪ Off ▪ On **Factory setting** Off	If the fill-up buffer overruns, you can decide whether you want to receive a diagnostic message from the controller or not for each individual logbook.
▶ Data logbooks		
▶ New		You can create a maximum of 8 data logbooks.
Logbook name	Customized text, 20 characters	
Source of data	Options ▪ None ▪ Binary input 1 ▪ Binary input 2 ▪ Analog input 1 ▪ Analog input 2 ▪ Temperature ▪ Sensor 1 (optional) ▪ Sensor 2 (optional) **Factory setting** None	Select the input that should be the data source of the logbook entries.
Measured value	Options ▪ Depends on Source of data **Factory setting** None	You can record different measured values depending on the source of data.
Scan time	00:00:01 ... 01:00:00 **Factory setting** 00:01:00	Minimum interval between two entries Format: HH:MM:SS
Data logbook	Options ▪ Off ▪ Ring buffer ▪ Fill up buffer **Factory setting** Off	**Ring buffer** If the memory is full, the latest entry automatically overwrites the oldest entry. **Fill up buffer** If the memory is 80% full, the device displays a diagnostic message. If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually.
Overflow warning *Data logbook="Fill up buffer"*	Options ▪ Off ▪ On **Factory setting** Off	If the fill-up buffer overruns, you can decide whether you want to receive a diagnostic message from the controller or not for each individual logbook.
▷ Add another logbook	Action	*Only if you want to create another data logbook immediately*. You add a new data logbook at a later data using ▶ New.

Path: Menu/Setup/General settings/Logbooks

Function	Options	Info
▷ Finished	Action	This allows you to exit the menu ▶ New.
▷ Start/stop simultaneously	Action	Appears if you have created more than one data logbook. With one click, you can start or stop recording for all the data logbooks.
▶ "Logbook name"		The name of this submenu is based on the name of the logbook and only appears once you have created a logbook.
This menu appears several times if you have several data logbooks.		
Source of data	Read only	This is for information purposes only. If you want to record another value, delete this logbook and create a new data logbook.
Measured value		
Log time left *Data logbook="Fill up buffer"*	Read only	Displays the days, hours and minutes remaining until the logbook is full.
Log size *Data logbook="Ring buffer"*	Read only	Displays the number of entries remaining until the logbook is full.
Logbook name	Customized text, 20 characters	You can change the name here.
Scan time	00:00:01 ... 01:00:00 **Factory setting** 00:01:00	As above Minimum interval between two entries Format: HH:MM:SS
Data logbook	Options ▪ Off ▪ Ring buffer ▪ Fill up buffer **Factory setting** Off	**Ring buffer** If the memory is full, the latest entry automatically overwrites the oldest entry. **Fill up buffer** If the memory is 80% full, the device displays a diagnostic message. If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually.
▶ Line plotter		Menu to define the graphic display
Axes	Options ▪ Off ▪ On **Factory setting** On	Should the axes (x, y) be displayed (On) or not (Off)?
Orientation	Options ▪ Horizontal ▪ Vertical **Factory setting** Horizontal	You can choose whether the value curves should be displayed from left to right ("Horizontal") or from top to bottom ("Vertical"). If you want to display two data logbooks simultaneously, make sure that both logbooks have the same settings here.

Path: Menu/Setup/General settings/Logbooks

Function	Options	Info
X-Description	Options ▪ Off ▪ On **Factory setting** On	Decide whether a description should be displayed for the axes and whether grids should be shown. In addition, you can also decide whether a pitch should be displayed.
Y-Description		
Grids		
Pitches		
X Pitch/Grid distance	10 ... 50% **Factory setting** 10 %	Specify the pitch.
Y Pitch/Grid distance		
▷ Remove	Action	This action removes the data logbook. Any data that have not been saved are lost.

Example for setting up a new data logbook

1. Menu/Setup/General settings/Logbooks/Data logbooks/New:
   a. Logbook name: Assign a name, e.g. "01".
   b. Source of data: Select a data source, e.g. the sensor connected to binary input 1.
   c. Measured value: Select the measured value that you want to record.
   d. Scan time: Specify the interval between two logbook entries.
   e. Data logbook: Activate the logbook. Specify the type of memory, "Ring buffer" or "Fill up buffer".
2. ../Finished: Execute this action.
   --> Your new logbook now appears in the list of data logbooks.
3. Select the data logbook with the name "01".
4. If you selected "Fill up buffer", you can also decide whether you want to receive a diagnostic message in the event of memory overrun.
5. Depending on the type of memory selected, you receive information about the memory space (for "Ring buffer") or the time remaining until memory overrun (for "Fill up buffer").
6. Define the graphic display mode in the "Line plotter" submenu.

2.5 Configuring the sampling depending on the device version

Path: Menu/Setup/General settings

Function	Options	Info
▶ Sampling		
Number of bottles	Choice of all possible bottle combinations	The bottle configuration you ordered is preset in the device.
Bottle volume	0 to 100000 ml **Factory setting** Depends on the bottle configuration	If continuous operation is selected for a sampling program, there is the danger of overfilling the bottles. Do not forget to empty the bottles!
Distribution reference (only for version with distributor drive)	Options ▪ Pre sampling ▪ Pre bottle change ▪ Pre program start **Factory setting** Pre sampling	The distributor arm goes through a reference point depending on the option selected.
Power failure	Options ▪ Resume program ▪ Stop program **Factory setting** Resume program	Decide how the sampler should react when it is energized after a power failure. **Resume program:** ▪ Time and flow-paced The program calculates the omitted samples and enters them in the logbook as failed. When the program is restarted, it continues where it was interrupted. ▪ Flow-paced No samples are entered in the logbook during the power failure. When the program is restarted, it continues where it was interrupted.
Sample retries	0 ... 3 **Factory setting** 0	If sampling is started and no sample is drawn in, sampling can be repeated up to 3 times.
Sampling delay	0 to 99 s **Factory setting** 0 s	The start of the sampling cycle can be delayed by up to 99 s. The binary output is switched without any delay.
Liquid detection	Options ▪ Automatic ▪ Semi automatic ▪ Off **Factory setting** Automatic	If "Semiautomatic" is selected, the purge times and intake times can be defined separately. **Off:** The definition of the purge times and intake times is completely time-controlled. **Automatic:** The last intake time determined is the new purge time. **Semi automatic:** If the suction heights tend to vary greatly.
Rinse cycles	0 ... 3 **Factory setting** 0	The suction line is rinsed with the sample up to 3 times.

Path: Menu/Setup/General settings

Function	Options	Info
Safety interlock (optional)	Options ▪ Off ▪ On **Factory setting** Off	If the peristaltic pump is opened, the safety interlock stops all the functions.
▶ Diagnostics settings		
▶ Pump tube life		
Control	Options ▪ Off ▪ On **Factory setting** On	Indicates the pump hose has to be exchanged.
Warning	10 to 50 h **Factory setting** 30 h	When the tube has been in operation for this length of time, a diagnostic message is displayed to indicate that the tube should be replaced in time.
Alarm	30 to 200 h **Factory setting** 50 h	
Totalizer	00-00:00 ... 49710-06:28 **Factory setting** 00-00:00	Operating time of the current pump hose in days, hours and minutes
▷ Reset	Action	The tube life counter is reset to 0:00 h.

2.6 Extended setup

2.6.1 Diagnostics settings

The list of diagnostic messages displayed depends on the path selected. There are device-specific messages, and messages that depend on what sensor is connected.

Path: ... /Extended setup/Diagnostics settings/Diag. behavior (optional)

Function	Options	Info
List of diagnostic messages		Select the message to be changed. Only then can you make the settings for this message.
Diag. code	Read only	
Diagnostic message	Options ▪ On ▪ Off **Factory setting** Depends on the message	You can deactivate or reactivate a diagnostic message here. Deactivating means: ▪ No error message in the measuring mode ▪ No error current at the current output
Error current	Options ▪ On ▪ Off **Factory setting** Depends on the message	Decide whether an error current should be output at the current output if the diagnostic message display is activated. If general device errors occur, the error current is output at all the current outputs. In the case of channel-specific errors, the error current is only output at the specific current output.
Status signal	Options ▪ Maintenance (M) ▪ Out of specification (S) ▪ Function check (C) ▪ Failure (F) **Factory setting** Depends on the message	The messages are divided into different error categories in accordance with NAMUR NE 107. --> BA00470C "Maintenance & diagnostics" Decide whether you want to change the status signal assignment for your application.
Diag. output	Options ▪ None ▪ Binary output **Factory setting** None	You can use this function to select a binary output to which the diagnostic message should be assigned. For sensors with the Memosens protocol: You first have to configure a relay output for "Diagnostics" (Menu/Setup/Outputs, assign "Diagnostics" function and set Operating mode to "as assigned") before being able to assign the message to an output. --> BA00492C "Operation & configuration"
Cleaning program (optional)	Options ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	Decide whether the diagnostic message should trigger a cleaning program. You can define the cleaning programs under: Menu/Setup/Additional functions/Cleaning.

Path: ... /Extended setup/Diagnostics settings/Diag. behavior (optional)

Function	Options	Info
Detail information	Read only	Here you can find more information on the diagnostic message and instructions on how to resolve the problem.

2.6.2 Data management

Firmware update

Please contact your local sales office for information on firmware updates available for your controller and its compatibility with earlier versions.
Your **current firmware version** can be found at: Menu/Diagnostics/System information/Software version.

Activation code

You require activation codes for:
- Additional functions,
- Software upgrades

If activation codes are available for your device, these codes are provided on the inner nameplate. The corresponding device functions are activated at the factory. You only require the codes if servicing the device.

1. Enter the activation code: Menu/Setup/General settings/Extended setup/Data management/Activation code.
2. Confirm your entry.

   ↳ Your new hardware or software function is activated and can be configured.

The table below tells you what functions an activation code enables:

Function	Activation code beginning with
Second Memosens input	062...
Two current outputs (BASE-E module only)	081...

3 Inputs

Liquiport 2010 CSP44 is fitted with the number of inputs specified in the order option. All inputs are galvanically isolated from one another.

3.1 Binary inputs

The binary inputs are used to control the sampler using external signals.
With the CSP44, the power supply is made available at the multiple I/O socket (see BA00465C, "Commissioning").

Path: Menu/Setup/Inputs

Function	Options	Info
▶ Binary input S:x		
Mode	Options ▪ Off ▪ On **Factory setting** Off	Switches the function on or off
Input mode	Options ▪ Flow rate ▪ Rainfall ▪ External event **Factory setting** Flow rate	▪ Pulse input for connected flowmeters or rain gages ▪ Control of sampling functions via external signals
If Input mode **Flow rate** is selected:		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Preselect the level change of the signal.
Unit	Options ▪ m^3 ▪ l ▪ cf ▪ gal **Factory setting** m^3	Select the unit.
Meas. value format	**Factory setting** **#.#**	Specify the number of decimal places for the flow.
1 Impulse =	0 to 1000 m^3 **Factory setting** 10 m^3	Definition of the pulse value, limits are calculated depending on the unit

Path: Menu/Setup/Inputs

Function	Options	Info
▶ Unit of totalized flow		
Current totalized flow	- - -	The totalized flow values are displayed.
Reset totalizer	Options ▪ Manual ▪ Automatic ▪ At program start **Factory setting** Manual	**Manual:** Reset the counter manually. **Automatic:** The counter is reset automatically at intervals. **At program start:** The counter is reset at program start.
If counter reset **Manual** is selected:		
▷ Reset totalized flow	Action	The totalized flow currently calculated is set to zero when the counter is reset.
If counter reset **Automatic** is selected:		
Interval	Options ▪ Daily ▪ Weekly ▪ Monthly **Factory setting** Daily	**Daily:** If a daily interval is selected, set the Time in the menu item that follows. **Weekly:** If a weekly interval is selected, set the Day of week and the Time in the menu items that follow. **Monthly:** If a monthly interval is selected, set the Day of month and the Time in the menu items that follow.
Time	00:00:00 to 23:59:59 HH:MM:SS **Factory setting** 12:00:00 HH:MM:SS	
If Input mode **Rainfall** is selected:		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Preselect the level change of the signal.
Unit	Options ▪ mm ▪ inch **Factory setting** mm	Select the unit.
Meas. value format	**Factory setting** #.#	Specify the number of decimal places.
1 Impulse =	0.00 to 5.00 mm **Factory setting** 1.0 mm	Definition of the pulse value, limits are calculated depending on the unit. The correct switch value is provided in the Operating Instructions of your rain gage.

Path: Menu/Setup/Inputs

Function	Options	Info
Intensity	Options ▪ mm/min ▪ mm/h ▪ mm/d **Factory setting** mm/min	Select the intensity per minute, hour or day according to your requirements.
▶ Totalized rainfall		
Totalized rainfall	- - -	The totalized rainfall is displayed.
Reset totalizer	Options ▪ Manual ▪ Automatic ▪ At program start **Factory setting** Manual	**Manual:** Reset the counter manually. **Automatic:** The counter is reset automatically at intervals. **At program start:** The counter is reset at program start.
If counter reset **Manual** is selected:		
▷ Reset totalized rainfall	Action	The totalized rainfall currently calculated is set to zero when the meter is reset manually.
If counter reset **Automatic** is selected:		
Interval	Options ▪ Daily ▪ Weekly ▪ Monthly **Factory setting** Daily	**Daily:** If a daily interval is selected, set the Time in the menu item that follows. **Weekly:** If a weekly interval is selected, set the Day of week and the Time in the menu items that follow. **Monthly:** If a monthly interval is selected, set the Day of month and the Time in the menu items that follow.
Time	00:00:00 to 23:59:59 HH:MM:SS **Factory setting** 12:00:00 HH:MM:SS	
If Input mode **External event** is selected:		

Path: Menu/Setup/Inputs

Function	Options	Info
Operation	Options ▪ No operation ▪ Start sampling ▪ Program start ▪ Program stop ▪ Program duration ▪ Program pause ▪ Partprogram activation ▪ Change bottle ▪ Bottle synchronization ▪ External hold ▪ Start cleaning **Factory setting** No operation	**No operation**: No action is executed. **Start sampling**: A pulse triggers sampling. **Program start**: A pulse starts a program. **Program stop**: A pulse stops the program running. **Program duration**: A program is active as long as the input signal is present. The signal is a level signal, i.e. the action takes effect as long as the level is present. The level that triggers the action is configured in the Signal slope menu item that follows. **Program pause**: The input signal stops the program running. The programs continue running when the signal disappears. The signal is a level signal, i.e. the action takes effect as long as the level is present. The level that triggers the action is configured in the Signal slope menu item that follows. **Partprogram activation**: A pulse triggers a subprogram. **Change bottle**: A pulse triggers a changeover to the next bottle. **Bottle synchronization**: A pulse triggers a changeover to the set bottle position. --> Then select the bottle position (depends on the bottle configuration). **External hold**: The input signal triggers an external hold. The signal is a level signal, i.e. the action takes effect as long as the level is present. The level that triggers the action is configured in the Signal slope menu item that follows. **Start cleaning**: A pulse triggers the cleaning.
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Preselect the level change of the signal. --> If Low-High is selected, the high level brings about the corresponding setting.
▷ Binary input assignment view		

3.2 Current inputs

The current input must be assigned an analog signal for the functions described. Active and passive current inputs are optionally available to connect two-wire or four-wire devices.

For the correct wiring of the current inputs, see:
BA00465C "Commissioning"

Path: Menu/Setup/Inputs

Function	Options	Info
▶ Current input S:x		
Mode	Options ▪ Off ▪ 0..20 mA ▪ 4..20 mA **Factory setting** Off	Enter the output signal of the connected device: 0 to 20 mA or 4 to 20 mA.
Input mode	Options ▪ Flow rate ▪ Parameter ▪ Current **Factory setting** Current	Select the input variable. **Flow rate:** The input can be used as the source for time/flow-paced or flow-paced sampling programs. **Parameter:** The input can be used as the source for limit switches, logbooks and enabling and disabling events for sampling programs. **Current:** The input can be used as the source for limit switches, logbooks and enabling and disabling events for sampling programs. A unit name cannot be specified.
If Input mode **Flow rate** is selected:		
Unit of flow	Options ▪ l/s ▪ m^3/s ▪ m^3/h ▪ m^3/d ▪ cfs ▪ cfm ▪ gpm ▪ gph ▪ mgd **Factory setting** l/s	Select the unit.
Unit of totalized flow	Options ▪ l ▪ m^3 ▪ cf ▪ gal **Factory setting** m^3	Select the unit for the totalized flow.

Path: Menu/Setup/Inputs

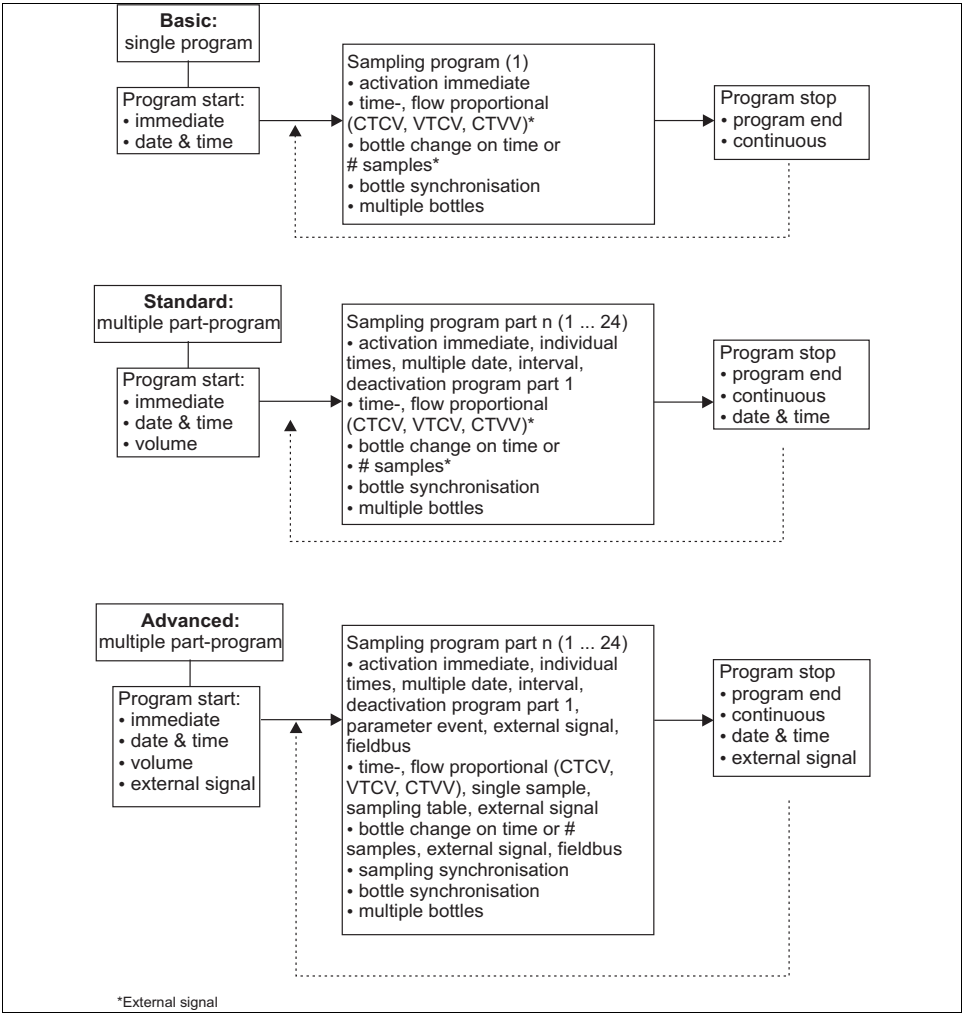
Function	Options	Info
Meas. value format	**Factory setting** #.#	Specify the number of decimal places for the flow.
Minimum flow	0 to 10000 l/s **Factory setting** 0 l/s	The set limit value prevents sampling if the flow falls below this value (only for time/flow-paced sampling).
Lower range value	0 to 10000 l/s **Factory setting** 0 l/s	Enter a value for the start of the measuring range. 0/4 mA is assigned to this value as per your specifications.
Upper range value	0 to 10000 l/s **Factory setting** 100000 l/s	Enter a value for the end of the measuring range. 20 mA is assigned to this value as per your specifications.
Damping	0 to 60 s **Factory setting** 0 s	The damping causes a floating average curve of the measured values over the time specified.
▶ Totalized flow The totalized flow is calculated when the program is started if you use a sampling program with volume, flow-paced sampling or time/flow-paced sampling as the start condition. The samples are taken based on this value. The current totalizer is used for calculating purposes if the totalized flow is used as the measured value for an enabling or disabling event.		
Current totalized flow	- - -	The totalized flow values are displayed.
Reset totalizer	Options ▪ Manual ▪ Automatic ▪ At program start **Factory setting** Manual	**Manual:** Reset the counter manually. **Automatic:** The counter is reset automatically at intervals. **At program start:** The counter is reset at program start.
Flow rate	- - -	The current flow rate is displayed.
If counter reset **Manual** is selected:		
▷ Reset totalized flow	Action	The totalized flow currently calculated is set to zero when the counter is reset.
If counter reset **Automatic** is selected:		
Interval	Options ▪ Daily ▪ Weekly ▪ Monthly **Factory setting** Daily	**Daily:** If a daily interval is selected, set the Time in the menu item that follows. **Weekly:** If a weekly interval is selected, set the Day of week and the Time in the menu items that follow. **Monthly:** If a monthly interval is selected, set the Day of month and the Time in the menu items that follow.

Path: Menu/Setup/Inputs

Function	Options	Info
If Input mode **Parameter** is selected:		
Meas. value format	**Factory setting** #.#	Specify the number of decimal places.
Parameter name	Customized text	Assign a name.
Unit of measure	Customized text	Enter the engineering unit.
Lower range value	-20 ... 10000 **Factory setting** 0	Enter a value for the start of the measuring range. 0/4 mA is assigned to this value as per your specifications.
Upper range value	-20 ... 10000 **Factory setting** 10	Enter a value for the end of the measuring range. 20 mA is assigned to this value as per your specifications.
Damping	0 to 60 s **Factory setting** 0 s	The damping causes a floating average curve of the measured values over the time specified.
If Input mode **Current** is selected:		
Meas. value format	**Factory setting** #.#	Specify the number of decimal places.
Damping	0 to 60 s **Factory setting** 0 s	The damping causes a floating average curve of the measured values over the time specified.

4 Programming

The Liquiport 2010 CSP44 offers users a wide range of options for configuring individual sampling programs. The 3 different program types (Basic, Standard and Advanced) make it easy for you to find the right program for your application.



a0020230-en

4.1 Overview of the possible program types

Basic program type	Standard program type	Advanced program type
Time-paced	Time-paced	Time-paced
Flow-paced	Flow-paced	Flow-paced
		Single sample
		Sampling table
		External signal
Time/flow-paced	Time/flow-paced	Time/flow-paced

The graphic below explains the various ways sampling can be controlled on the basis of a flow curve.

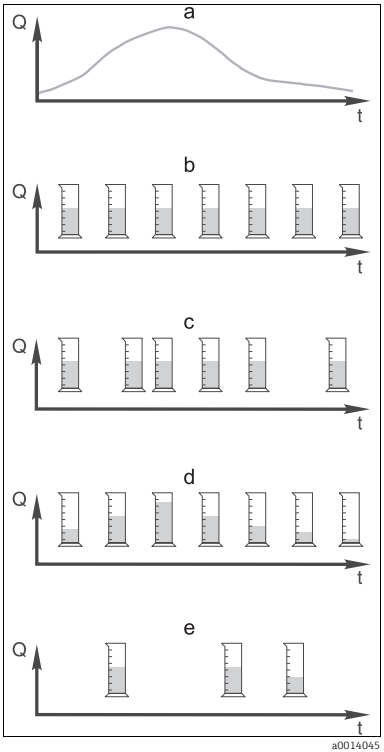


Fig. 7: Sampling control

a. Flow curve
b. **Time-paced sampling**
   A constant sampling volume (e.g. 50 ml) is taken at steady intervals (e.g. every 5 min).
c. **Flow-paced sampling**
   A constant sampling volume is taken at variable intervals (depending on the inflow volume).
d. **Time/flow-paced sampling**
   A variable sampling volume (the sampling volume depends on the inflow) is taken at steady time intervals (e.g. every 10 min).
e. **Event-controlled sampling**
   Sampling is triggered by an event (e.g. pH limit value). Sampling can be time-paced, flow-paced, or time/flow-paced, or single samples can be taken.

The following table explains the various types of sampling using specific examples.

Type of sampling	Example	Info
Time-paced	▪ Sampling interval: 5 min ▪ Sampling volume: 50 ml ▪ Bottle change mode: 2 h With this setting, a 50 ml sample is taken every 5 minutes. 12 samples are thus taken every hour. Each bottle is filled over a period of 2 hours. This results in a total sampling volume of 24 samples per bottles x 50 ml = 1200 ml.	This type of sampling remains constant over time and does not take changes in flow or polluting load into account. It is possible to take a representative sample if the intervals are brief (e.g. 5 min).
Flow-paced	**Controlled via current input** ▪ Signal: 0 to 20 mA = 0 to 600 m^3/h ▪ Sampling volume: 50 ml ▪ Sampling interval: 20 m^3 ▪ Bottle change mode: 2 h If 20 mA = 600 m^3/h, a sample is taken every 2 minutes (smallest sampling interval with maximum flow). The total number of samples amounts to 60 samples per bottle. With a flow of 300 m^3/h, a sample is taken every 4 minutes. **Controlled via binary input** ▪ Signal pulse: 5 m^3 ▪ Sampling volume: 50 ml ▪ Sampling interval: 20 m^3 ▪ Bottle change mode: 2 h The pulses are scaled at the flowmeter. By multiplying the pulses at the sampling interval, the shortest sampling interval at the maximum pulse frequency can be set. Example: Given a maximum flow of 600 m^3/h, the pulse frequency at 5 m^3 is 120 pulses/h or 2 pulses/min. With a sampling interval of 20 m^3, sampling takes place after 4 pulses = 2 minutes.	▪ The current inputs can be configured for the current range of 0 to 20 mA or 4 to 20 mA. ▪ The binary inputs require power (24 V DC) for floating contacts. In the case of flow-paced sampling, the sampling interval is calculated on the basis of the volume flow. The same sampling volume is take at variable intervals. **Advantage:** Good, representative results in the event of minor fluctuations in flow. **Disadvantage:** Longer intervals when the level of water is low mean that malfunctions cannot be detected.

Type of sampling	Example	Info
Time/flow-paced	**Controlled via current input** ▪ Signal: 0 to 20 mA ▪ Sampling interval: 10 min ▪ Sampling volume: variable The maximum sampling volume is defined at the maximum flow rate. Example: The maximum flow rate at 20 mA at the current input is 160 l/s, and the maximum sampling volume is 200 ml. When transferring samples into a 30l mixed sample container, 144 samples are taken per day with a maximum sampling volume of 28.8 l. With a flow rate of 80 l/s, a sampling volume of only 100 ml would be grabbed, and a sampling volume of 50 ml would be grabbed at a flow rate of 40 l/s. The sampling volume is always calculated based on the flow. **Controlled via binary input** ▪ Binary input (pulse per flow unit) ▪ Sampling interval: 10 min ▪ Sampling volume: variable The sampling volume is defined for a flow pulse, e.g.: 1 pulse is 20 ml. For instance, if 5 flow pulses are counted between the sampling intervals, this results in a sampling volume of 5 x 20 = 100 ml, and a volume of 8 x 20 = 160 ml for 8 pulses. If a binary input is used for time/flow-paced sampling, the sampling volume is calculated per sample as a percentage of the specified sampling volume.	Samples are taken at set intervals with a variable sampling volume. The sampling volume is calculated from the **flow rate**. More volume is grabbed when the flow is high than when it is low. Since the flow normally fluctuates and the maximum flow is only rarely a constant variable, the sampling volume transferred to the container will depend on the daily average. **Advantage:** Very good, representative sampling given large fluctuations in the flow and constant time intervals. **Disadvantage:** Too little sampling volume is made available for analysis when the flow is low. **Advantage with current input:** For the sampling interval, either the current flow rate or the average value between the last and current flow rate is used to calculate the exact sampling volume (depending on the presetting). **Disadvantage with binary input:** For the sampling interval, the pulses counted since the last sampling are multiplied by a volume. If this is too high - e.g. 100 ml - the composition of the sample is not representative for analysis.
Event	Event-based sampling is controlled via the current input, binary input and/or sensor input. The subprogram created waits to be activated by an event that can consist of up to 3 individual events. Every possible condition can be created using logical "and" / "or" links. For example, the information from a flowmeter connected to the current input can be linked to a rain gage and a pH sensor signal connected to the binary input. An event is defined as limit value violation (exceeded or undershot), range monitoring within or outside a range, or a rate of change. Users can decide whether additional sampling is started when the event starts and/or ends. For the duration of the event, users can choose from time-paced, flow-paced or time/flow-paced sampling, or can take single samples, use a sampling table or the external control system.	The sampler waits for an event. This event takes place via internal sensor signal processing or via devices connected externally. As bottle assignment is possible when using several bottles, events can be assigned to individual bottles. A maximum of 24 subprograms can be started simultaneously and assigned to individual bottles.

4.1.1 Bottle synchronization

The bottle synchronization setting is possible with all types of program. In addition, bottle synchronization can be switched via an external signal.
Bottle synchronization is only possible with a bottle change after a specific time and not with a bottle change after a number of samples.

Specific bottles can be assigned specific filling times with the bottle synchronization function. For example, bottle 1 is to be filled from midnight to 2 a.m., bottle 2 from 2 a.m. to 4 a.m. etc.. The following options are available for this:

- None: The time of sampling and bottle change are not synchronized.
- 1. bottle change time: Sampling starts with the first bottle. The changeover to the next bottles is synchronized. For example, a time of 2 hours was set for bottle changeover, and 00:00 was set for the synchronization. If the program is started at 5:23 a.m., for example, bottle 1 is initially filled. The system switches for the first time to bottle 2 at midnight (00:00), to bottle 3 at 2 a.m. etc.
- 1. Time of change + bottle number: A specific filling time is assigned to every bottle. For example, midnight to 2 a.m. for bottle 1; 2 a.m. to 4 a.m. for bottle 2; 4 a.m. to 6 a.m. for bottle 3 etc. If the program is started at 10 a.m., for example, the device starts filling bottle 6.
  It is also possible to start synchronization on a specific day of the week.
  For example, a time of 24 hours was set for bottle changeover, Monday 00:00 was the time set for synchronization, and Tuesday 8 a.m. was set for starting the program. The system fills bottle 2 until 00:00 on Wednesday and then switches to bottle 3.
- External signal: The system changes to the next bottle when an external signal is received. The external signal first has to be configured via the binary input. The binary input can then be selected as the source.

4.2 Program type: Basic

With the Basic program type, you can create simple sampling programs quickly based on time, volume and flow. In the case of volume- and flow-controlled sampling, the inputs have to be configured appropriately beforehand. If you want to create a program and use it immediately, you have to check the configuration of the sampler before programming. You can make the settings under "Menu/Setup/General settings/Sampling": e.g. the bottle configuration, and the bottle volume, as well as the correct dosing volume for the device version with a vacuum pump. The dosing volume setting makes it possible to correctly calculate the level in the bottle and is a reliable way of preventing the bottles from being overfilled.

You can go to the Setup program either via the overview under "Select sampling program" or via the path "Menu/Setup/Sampling programs".

Path: Menu/Setup/Sampling programs

Function	Options	Info
Current program:	Read only	The last sampling program to be created or used is displayed.
Status	Read only	Display "Active": The sampling program has been started and the device takes a sample as per the set parameters. Display "Inactive": No sampling program has been started, or a program that was running has been paused. Display "Pause": Sampling program paused.
▶ Setup program		
New		A list of all the programs created is displayed. For this reason, it is often helpful to add a "B" for Basic in the program name.
Program1, which is supplied with the device, is displayed, as is a list of all the programs already created (Basic, Standard or Advanced programs). You can either create a new program or select an existing one. If you select an existing program, you can edit, delete, start or duplicate it. Furthermore, you can also see whether this program is a Basic, Standard or Advanced program. If you are creating a new program, select the Basic, Standard or Advanced program type.		
▶ Basic		
Program name	Customized text	Use a distinct name for your sampling program. The program name can be up to 16 characters long.
Bottle configuration	Choice of all possible bottle combinations **Options:** - 1x - PE direct distribution - 12x - PE direct distribution - 24x - PE direct distribution - 12x+6x PE direct distribution	The ordered bottle configuration is preset or the configuration selected in the setup is displayed.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Bottle volume	0 to 100000 ml **Factory setting** 30000 ml	Set the bottle volume. The preset value depends on the bottle configuration configured. The bottle volume is always 30 l for individual containers. In the case of asymmetric distribution, e.g. 12 x 1 l + 6 x 2 l, you can set the bottle volume on the left and right in the menu items that follow.
Sampling mode	Options ▪ Time paced CTCV ▪ Flow paced VTCV ▪ Time/flow paced CTVV **Factory setting** Time paced CTCV	The following functions depend on the option selected. These versions are illustrated individually in the following section to provide a clearer understanding of the options. **Time paced CTCV:** A constant sampling volume is taken at steady intervals. **Flow paced VTCV:** A constant sampling volume is taken at variable intervals. **Time/flow paced CTVV:** A variable sampling volume is taken at steady intervals.

4.2.1 Settings with a time-paced Basic program

Settings with the Basic program type with 1 bottle
Sampling mode = "Time paced CTCV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling interval	00:01:00 to 99:59:00 HH:MM:SS **Factory setting** 00:10:00 HH:MM:SS	Set the sampling interval.
Sampling volume	10 to 10000 ml **Factory setting** 100 ml	Set the sampling volume. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (days, hours and minutes) after which the system should change to the next bottle.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. Set the synchronization time. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time. Set the synchronization time and the weekday.
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

Settings with the Basic program type with multiple bottles

Sampling mode = "Time paced CTCV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling interval	00:01:00 to 99:59:00 HH:MM:SS **Factory setting** 00:10:00 HH:MM:SS	Set the sampling interval.
Sampling volume	10 to 10000 ml **Factory setting** 100 ml	Set the sampling volume. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples. If the bottle is full beforehand based on the calculated level, the system prevents more samples being added to the bottle. Such samples are logged as failed samples in the program logbook.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (days, hours and minutes) after which the system should change to the next bottle.
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. Set the synchronization time. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time. Set the synchronization time and the weekday.
If Bottle change mode **External signal** is selected:		
Bottle change signal input	Options ▪ No bottle change input configured ▪ Binary input S:x **Factory setting** No bottle change input configured	The bottle change input can be configured under ▶ Inputs .
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles. The bottle level is reset once a program loop has been run through.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

4.2.2 Settings with a flow-paced Basic program

Settings with the Basic program type with 1 bottle
Sampling mode = "Flow paced VTCV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Flowmeter input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the flow input. The binary input or the current input must be configured for this function. Only the inputs configured as a flow input are displayed.
Sampling interval	1.000 to 9999.000 m^3 **Factory setting** 10.000 m^3	Set the sampling interval. The unit and the number of decimal places are displayed as configured under Setup/Inputs.
Sampling volume	10 to 10000 ml **Factory setting** 100 ml	Set the sampling volume. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (days, hours and minutes) after which the system should change to the next bottle.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. Set the synchronization time. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time. Set the synchronization time and the weekday.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

Settings with the Basic program type with multiple bottles

Sampling mode = "Flow paced VTCV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Flowmeter input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the flow input. The binary input or the current input must be configured for this function. Only the inputs configured as a flow input are displayed.
Sampling interval	1.000 to 9999.000 m^3 **Factory setting** 10.000 m^3	Set the sampling interval. The unit and the number of decimal places are displayed as configured under Setup/Inputs.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling volume	10 to 10000 ml **Factory setting** 100 ml	Set the sampling volume. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (in days, hours and minutes) after which the system should change to the next bottle.
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles. **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time.
If Bottle change mode **External signal** is selected:		
Bottle change signal input	Options ▪ No bottle change input configured **Factory setting** No bottle change input configured	The bottle change input can be configured under ▶ Inputs .

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

4.2.3 Settings with a time/flow-paced Basic program

Settings with the Basic program type with 1 bottle
Sampling mode = "Time/flow paced CTVV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling volume input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the sampling volume input. The binary input or the current input must be configured for this function. Only the inputs configured as a sampling volume input are displayed.
Sampling interval	00:01:00 to 99:59:00 HH:MM:SS **Factory setting** 00:10:00 HH:MM:SS	Set the sampling interval.
If Sampling volume input **Binary input** is selected:		
Sampling volume / pulse	10 to 1000 ml **Factory setting** 20 ml	Set what sampling volume should be grabbed per pulse. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
If Sampling volume input **Current input** is selected:		
Sampling volume 20mA	10 to 10000 ml **Factory setting** 100 ml	Set what sampling volume should be grabbed at 20 mA. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Flow calculation	Options ▪ Current ▪ Average flow **Factory setting** Current	**Current:** The current flow is converted to the sampling volume at the time of sampling. **Average flow:** The system calculates the mean between the last and the current sample and sets the sampling volume accordingly.
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (days, hours and minutes) after which the system should change to the next bottle.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. Set the synchronization time. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time. Set the synchronization time and the weekday.
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

Settings with the Basic program type with multiple bottles

Sampling mode = "Time/flow paced CTVV"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling volume input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the sampling volume input. The binary input or the current input must be configured for this function. Only the inputs configured as a sampling volume input are displayed.
Sampling interval	00:01:00 to 99:59:00 HH:MM:SS **Factory setting** 00:10:00 HH:MM:SS	Set the sampling interval.
If Sampling volume input **Binary input** is selected:		
Sampling volume / pulse	10 to 1000 ml **Factory setting** 20 ml	Set what sampling volume should be grabbed per pulse. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
If Sampling volume input **Current input** is selected:		
Sampling volume 20mA	10 to 10000 ml **Factory setting** 100 ml	Set what sampling volume should be grabbed at 20 mA. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
Flow calculation	Options ▪ Current ▪ Average flow **Factory setting** Current	**Current:** The current flow is converted to the sampling volume at the time of sampling. **Average flow:** The system calculates the mean between the last and the current sample and sets the sampling volume accordingly.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed either after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (in days, hours and minutes) after which the system should change to the next bottle.
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
If Bottle change mode **External signal** is selected:		
Bottle change signal input	Options ▪ No bottle change input configured ▪ Binary input S:x **Factory setting** No bottle change input configured	The bottle change input can be configured under ▶ Inputs .
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

4.2.4 Settings with a Basic program and external signal

Settings with the Basic program type with 1 bottle
Sampling mode = "External signal"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling volume	10 to 1000 ml **Factory setting** 100 ml	Enter the sample volume.
Sampling signal input	Options ▪ No sampling input configured **Factory setting** No sampling input configured	Select the input for the sampling signal. The fieldbus must be configured for this function. The sampling input can be configured under ▶ Inputs .
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (days, hours and minutes) after which the system should change to the next bottle.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number **Factory setting** None	None: The time of sampling and bottle change are not synchronized. 1. bottle change time: Sampling starts with the first bottle. Set the synchronization time. 1. Time of change + bottle number: Each bottle is assigned to a specific fill time. Set the synchronization time and the weekday.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

Settings with the Basic program type with multiple bottles

Sampling mode = "External signal"

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling volume	10 to 1000 ml **Factory setting** 100 ml	Enter the sample volume.

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Sampling signal input	Options ▪ No sampling input configured **Factory setting** No sampling input configured	Select the input for the sampling signal. The fieldbus must be configured for this function. The sampling input can be configured under ▶ Inputs .
Bottle change mode	Options ▪ Number of samples ▪ Time ▪ External signal **Factory setting** Number of samples	The bottle can be changed either after a specific number of samples, after a time or by an external signal.
If Bottle change mode **Number of samples** is selected:		
Samples per bottle	1 ... 9999 **Factory setting** 1	Set the number of samples.
If Bottle change mode **Time** is selected:		
Time interval	00-00:02 to 31-00:00 DD-HH:MM **Factory setting** 00-01:00 DD-HH:MM	Set the time (in days, hours and minutes) after which the system should change to the next bottle.
If Bottle change mode **External signal** is selected:		
Bottle change signal input	Options ▪ No bottle change input configured **Factory setting** No bottle change input configured	The bottle change input can be configured under ▶ Inputs .
Multiple bottles	0 ... 23 The configuration options depend on the current number of bottles **Factory setting** 0	Multiple bottles: "Simultaneous" transfer of two samples to separate bottles.
Start condition	Options ▪ Immediate ▪ Date/time **Factory setting** Immediate	The sampling program can be started either immediately or at a specific, configurable time.
If Start condition **Date/time** is selected:		

Path: Menu/Setup/Sampling programs/Setup program/New/Basic

Function	Options	Info
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
Stop condition	Options ▪ Program end ▪ Continuous **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.

4.3 Program types: Standard and Advanced

A Standard program can comprise a maximum of 5 subprograms. An Advanced program can comprise a maximum of 24 subprograms. These subprograms can be run simultaneously or consecutively.
Each event subprogram can consist of up to 3 conditions.
As the device contains dual bottle trays, you can assign a program easily, and easily detect a change in the program.

4.3.1 Settings for the Standard program

Path: Menu/Setup/Sampling programs

Function	Options	Info
▶ Setup program		
New		A list of all the programs created is displayed. For this reason, it is often helpful to add an "S" for Standard in the program name.
▶ Standard		
Program name	Customized text	Use a distinct name for your sampling program. The program name can be up to 16 characters long.
Bottle configuration	Choice of all possible bottle combinations	The ordered bottle configuration is preset or the configuration selected in the setup is displayed.
Bottle volume	0 to 100000 ml **Factory setting** 30000 ml	Set the bottle volume.
Start condition	Options ▪ Immediate ▪ Date/time ▪ Volume **Factory setting** Immediate	The sampling program can be started either immediately, at a specific, configurable time, or when a certain totalized flow is reached.
If Start condition **Date/time** is selected:		
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
If Start condition **Volume** is selected:		

Path: Menu/Setup/Sampling programs

Function	Options	Info
Start volume input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the start volume input. The binary input or the current input must be configured for this function. Only the inputs configured for flow measurement are displayed.
Start flow sum	1.000 to 9999.000 m^3 **Factory setting** 10.000 m^3	Set the start volume.
Stop condition	Options ▪ Program end ▪ Continuous ▪ Date/time **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. All the assigned bottles are filled. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles. **Date/time:** The device stops the set program at a specific time.
If Stop condition **Date/time** is selected:		
Stop date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the stop date for the sampling program. The format depends on the option configured under general settings.
Stop time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is stopped. The format depends on the option configured under general settings.
▶ Setup subprogram		
New		
Programpart		Use a distinct name for your subprogram. The program name can be up to 16 characters long.
Sampling mode	Options ▪ Time paced CTCV ▪ Flow paced VTCV ▪ Time/flow paced CTVV ▪ External signal **Factory setting** Time paced CTCV	**Time paced CTCV:** A constant sampling volume is taken at steady intervals. **Flow paced VTCV:** A constant sampling volume is taken at variable intervals. **Time/flow paced CTVV** A variable sampling volume is taken at steady intervals. **External signal** A pulse at the binary input starts a sampling cycle

Path: Menu/Setup/Sampling programs

Function	Options	Info
The settings that depend on the sampling mode are listed in the "Program type: Basic" section.		
Enable subprogram	Options ▪ Immediate ▪ Individual dates ▪ Repeating date ▪ Interval ▪ Deactivation **Factory setting** Immediate	**Immediate:** The subprogram is enabled immediately. **Individual dates:** Set the start and stop dates for enabling the subprogram. **Repeating date:** Set the start condition, activity time and repetition interval for the subprogram. **Interval:** Set the start condition, activity time and inactivity time for the subprogram. **Deactivation:** Only visible if there is more than one subprogram
If Enable subprogram **Individual dates** is selected:		
▶ Individual dates Set the start and stop times for the subprogram. Enter a new date via "INSERT". Delete a date via "DELETE". You can assign a maximum of 25 start and stop dates.		
If Enable subprogram **Repeating date** is selected:		
Start condition	Options ▪ No delay ▪ Date/Time ▪ Time **Factory setting** No delay	**No delay:** The subprogram is started when the program is enabled. **Date/Time:** Set the start date and start time for enabling the subprogram. **Time:** Set the start time for enabling the subprogram.
Activity time	00:01 to 99:59 HH:MM **Factory setting** 00:01 HH:MM	Specify how long the subprogram should be active in hours and minutes. The time to be selected depends on the setting for the repetition mode.
▶ Multiple date		
Repetition mode	Options ▪ Daily interval ▪ Weekly interval ▪ Days of week **Factory setting** Daily interval	**Daily interval**: Specify whether the subprogram should be repeated every day. **Weekly interval**: Specify whether the subprogram should be repeated every week. **Days of week**: Specify whether the subprogram should be repeated on certain days of the week. --> Select the days of the week in the subsequent menu item.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Repetition interval (only for Daily interval and Weekly interval)	1 ... 999 **Factory setting** 1	Specify for how many days or weeks the subprogram should be active. Example: Repetition mode = daily interval Repetition interval = 2 The subprogram is enabled every second day from the start condition.
If Enable subprogram **Interval** is selected:		
Start condition	Options ▪ No delay ▪ Date/Time ▪ Time **Factory setting** Date/Time	**No delay:** The subprogram is started when the program is enabled. **Date/Time:** Set the start date and start time for enabling the subprogram. **Time:** Set the start time for enabling the subprogram.
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the 1st interval. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time for the 1st interval. The format depends on the option configured under general settings.
Activity time	00-00:01 to 31-00:00 DD-HH:MM **Factory setting** 00-00:01 DD-HH:MM	Specify how long the subprogram should be active in days, hours and minutes. The subprogram always begins with an activation.
Inactivity time	00-00:01 to 31-00:00 DD-HH:MM **Factory setting** 00-00:01 DD-HH:MM	Specify how long the subprogram should be inactive in days, hours and minutes.
Sample at enable	Options ▪ No ▪ Yes **Factory setting** Yes	Specify whether the first sample should be taken directly when the subprogram is enabled. For example, with intervals, a sample is taken at the start of every activation interval.
Sample at disable	Options ▪ No ▪ Yes **Factory setting** No	Specify whether a sample should be taken when the subprogram is disabled. For example, with intervals, a sample is taken at the end of every activation interval.

Path: Menu/Setup/Sampling programs

Function	Options	Info
New bottle at disable	Options ▪ No ▪ Yes **Factory setting** Yes	
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number ▪ External BC sync input **Factory setting** None	Specific bottles can be assigned specific filling times with the bottle synchronization function. For example, bottle 1 is to be filled from midnight to 2 a.m., bottle 2 from 2 a.m. to 4 a.m. etc.. **None** The time of sampling and bottle change are not synchronized. **1. bottle change time** Sampling starts with the first bottle. The changeover to the next bottles is synchronized. **1. Time of change + bottle number** A specific fill time is assigned to each bottle. **External BC sync input** The system changes to the next bottle when an external signal is received. The external signal first has to be configured via the binary input. The binary input can then be selected as the source.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.
Use "SAVE" to save the subprogram setup. Then press "ESC" to return to the main program. A prompt to save the program appears if you have not yet saved the subprogram. You can avoid saving the program by pressing "ESC".		
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.
Bottle assignment (only possible with multiple bottles) This menu item appears when more than one bottle is available, regardless of the number of subprograms.	Options ▪ No bottle assignment ▪ Dynamical bottle assignment ▪ Statical bottle assignment **Factory setting** Dynamical bottle assignment	**No bottle assignment:** Each subprogram fills the same bottle until the bottle is full. All the subprograms then change to the next bottle. Only visible if there is more than one subprogram. **Dynamical bottle assignment:** When the subprogram changes, the system switches to the next empty bottle. **Statical bottle assignment:** A table can be used to assign a subprogram to each bottle.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Via the "Bottle change" menu item, the bottle change can be configured after a certain time or number of samples if bottle distribution with more than one bottle has been selected and either dynamic or static bottle assignment has been selected.		
If Bottle assignment **Statical bottle assignment** is selected:		
▶ Bottle assignment table Select a bottle and assign it a subprogram.		

4.3.2 Settings for the Advanced program

Path: Menu/Setup/Sampling programs

Function	Options	Info
▶ Setup program		
New		A list of all the programs created is displayed. For this reason, it is often helpful to add an "A" for Advanced in the program name.
▶ Advanced		
Program name	Customized text	Use a distinct name for your sampling program. The program name can be up to 16 characters long.
Bottle configuration	Choice of all possible bottle combinations	The ordered bottle configuration is preset or the configuration selected in the setup is displayed.
Bottle volume	10 to 100000 ml **Factory setting** 30000 ml	Set the bottle volume.
Start condition	Options ▪ Immediate ▪ Date/time ▪ Volume ▪ External start ▪ External duration **Factory setting** Immediate	**Immediate** The sampling program is started immediately. **Date/time** The sampling program is started at a specific time that can be configured. **Volume** The sampling program is started when a certain totalized flow is reached. **External start** The sampling program is started by a pulse at the configured binary input. **External duration** The sampling program is active as long as the configured input has the corresponding level.
If Start condition **Date/time** is selected:		

Path: Menu/Setup/Sampling programs

Function	Options	Info
Start date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the start date for the sampling program. The format depends on the option configured under general settings.
Start time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is started. The format depends on the option configured under general settings.
If Start condition **Volume** is selected:		
Start volume input	Options ▪ No flow input configured ▪ Binary input S:x ▪ Current input S:x **Factory setting** No flow input configured	Select the start volume input. The binary input or the current input must be configured for this function. Only the inputs configured for flow measurement are displayed.
Start flow sum	1.000 to 9999.000 m^3 **Factory setting** 10.000 m^3	Set the start volume.
If Start condition **External start** is selected:		
Start signal input	Options ▪ No program start input configured ▪ Binary input S:x **Factory setting** No program start input configured	Select the program start input. The binary input must be configured for this function. Only the inputs configured as a program start input are displayed.
If Start condition **External duration** is selected:		
Start signal input	Options ▪ No program duration input configured ▪ Binary input S:x **Factory setting** No program duration input configured	Select the program duration input. The binary input must be configured for this function. Only the inputs configured as a program duration input are displayed.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Stop condition (not for External start)	Options ▪ Program end ▪ Continuous ▪ Date/time ▪ External signal **Factory setting** Program end	**Program end:** The device stops sampling automatically once it has run through the set program. **Continuous:** The device runs through the set program continuously in an infinite loop. Do not forget to empty the bottles. **Date/time:** The device stops the set program at a specific time. **External signal:** The device stops the set program if a pulse is sent to a binary input configured accordingly.
If Stop condition **Date/time** is selected:		
Stop date	01.01.2000 ... 31.12.2099 **Factory setting** DD.MM.YYYY	Set the stop date for the sampling program. The format depends on the option configured under general settings.
Stop time	00:00:00 ... 23:59:59 **Factory setting** HH:MM:SS (24h)	Set the time when the sampling program is stopped. The format depends on the option configured under general settings.
If Stop condition **External signal** is selected:		
Stop signal input	Options ▪ No program stop input configured ▪ Binary input S:x **Factory setting** No program stop input configured	Select the program stop input. The binary input must be configured for this function. Only the inputs configured as a program stop input are displayed.
▶ Setup subprogram		
New		
Programpart		Use a distinct name for your subprogram. The program name can be up to 16 characters long.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Sampling mode	Options ▪ Time paced CTCV ▪ Flow paced VTCV ▪ Time/flow paced CTVV ▪ Single sample ▪ Sampling table ▪ External signal **Factory setting** Time paced CTCV	**Time paced CTCV:** A constant sampling volume is taken at steady intervals. **Flow paced VTCV:** A constant sampling volume is taken at variable intervals. **Time/flow paced CTVV:** A variable sampling volume is taken at steady intervals. **Single sample:** The device takes a single sample with a specific volume. **Sampling table:** The time and the sampling volume is assigned to a certain bottle in the sampling table. **External signal:** A sample is taken when an external signal is received.
The settings that depend on the sampling mode (time-paced, flow-paced and time/flow-paced sampling) are listed in the "Program type: Basic" section.		
If Sampling mode **Single sample** is selected:		
Sampling volume	10 to 10000 ml **Factory setting** 100 ml	Set the sampling volume. The dosing accuracy and the repeatability of a sample volume < 20 ml can vary, depending on the specific application.
If Sampling mode **Sampling table** is selected:		
▶ Sampling table Assign the time and sampling volume to a certain bottle. Add a new entry via "INSERT". Delete an entry via "DELETE". You can make a maximum of 24 entries.		
Example: - Bottle: 1 - Bottle: 2 ...	- Delta (=waiting time): 01:00:00 - Delta (=waiting time): 00:10:00	- Volume: 100 ml - Volume: 100 ml
1st sampling one hour after program start: 100 ml in bottle 1 2nd sampling 10 minutes later: 100 ml in bottle 2 The sampling table indicates: After the defined "Delta time" (column 2) the volume of column 3 will be dosed into the bottle of column 1.		
If Sampling mode **External signal** is selected:		

Path: Menu/Setup/Sampling programs

Function	Options	Info
Sampling signal input	Options ▪ No sampling input configured ▪ Binary input S:x **Factory setting** No sampling input configured	Select the input for the sampling signal. The binary input must be configured for this function. Only the configured inputs are displayed.
Enable subprogram	Options ▪ Immediate ▪ Individual dates ▪ Repeating date ▪ Interval ▪ Event ▪ External start ▪ Deactivation **Factory setting** Immediate	**Immediate:** The subprogram is enabled immediately. **Individual dates:** Set the start and stop dates for enabling the subprogram. **Repeating date:** Set the start condition, activity time and repetition interval for the subprogram. **Interval:** Set the start condition, activity time and inactivity time for the subprogram. **Event:** The subprogram is enabled by an event. Up to 3 measuring signals are linked to form a start signal using And/Or logic. **External start:** The subprogram is enabled by a pulse at a binary input configured accordingly. **Deactivation:** Subprogram 2 or 2+n is started as soon as subprogram 1 is disabled. (Only possible with multiple subprograms)
The settings (Immediate, Individual dates, Repeating date and Interval) that depend on the activation of the subprogram are listed in the "Program type: Standard" section.		
If Enable subprogram **Event** is selected:		
Start condition	Options ▪ No delay ▪ Date/Time ▪ Time **Factory setting** No delay	**No delay:** The subprogram is started when the program is enabled. **Date/Time:** Set the start date and start time for enabling the subprogram. **Time:** Set the start time for enabling the subprogram.
▶ Activation event		

Path: Menu/Setup/Sampling programs

Function	Options	Info
Number of events	Options ▪ 1 ▪ 2 ▪ 3 **Factory setting** 1	Specify how many measuring inputs (1-3) you want to link to generate an activation signal.
▶ Event Editor 1 If you have more than one event editor, the "Event editor" menu item appears often. Use the "Link" menu item to configure the logical link between the signals.		
Source of data	Options ▪ None ▪ Binary input S:x ▪ Current input S:x ▪ Temperature input (depending on the version and sensor) **Factory setting** None	Select the input via which the activation event is to be output. The inputs are configured in the "Setup/Inputs" menu. The binary inputs are only visible if they have been configured accordingly (rainfall or flow).
Measured value	Options (depends on sensor/data source) ▪ None ▪ Totalized flow **Factory setting** None	
Operating mode	Options ▪ Upper limit ▪ Lower limit ▪ Within range ▪ Out of range ▪ Rate of change **Factory setting** Upper limit	Type of limit value monitoring: ▪ Limit value overshoot or undershoot ▪ Measured value within or outside a range ▪ Rate of change
Limit value	**Range of adjustment and factory setting** Depends on the measured value	*Operating mode="Above limit check" or "Below limit check"* ▪ The event is triggered if the limit value + hysteresis is exceeded for the switch-on duration. ▪ The event is reset again if the limit value - hysteresis is undershot for the duration of the switch-off delay at least.
Range lower value Range upper value	**Range of adjustment and factory setting** Depends on the measured value	*Operating mode="In range check" or "Out of range check"* ▪ The event is triggered if the range lower value + hysteresis is exceeded for the switch-on duration. ▪ The event is reset again if the range upper value - hysteresis is undershot for the duration of the switch-off delay at least.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Hysteresis	**Range of adjustment and factory setting** Depends on the measured value	The hysteresis is the difference between the switch-on point and the switch-off point if values, which cause the limit switch to pick up, become closer or move further apart. It is needed to ensure a stable switching behavior.
Start delay	0 to 9999 s **Factory setting** 0 s	Synonyms: pick-up and drop-out delay
Switch off delay		
Delta value	**Range of adjustment and factory setting** Depends on the measured value	*Operating mode="Change rate"* The event is triggered if the measured value changes by at least the delta value (both positive and negative) within the set delta time. The event is deleted as soon as the rate of change is lower than the set value and the auto confirmation time has elapsed.
Delta time	00:01 ... 23:59 **Factory setting** 01:00	
Auto Confirm	00:01 ... 23:59 **Factory setting** 00:01	
If Enable subprogram **External start** is selected:		
Activation input	Options ▪ No program part start input configured ▪ Binary input S:x **Factory setting** No program part start input configured	Select the input for start of the subprogram. The binary input must be configured for this function. Only the configured inputs are displayed.
Sample at enable (not for single sample and sampling table)	Options ▪ No ▪ Yes **Factory setting** Yes	Specify whether the first sample should be taken directly when the subprogram is enabled.
Sample at disable (not for single sample and sampling table and also not for "Immediate" and event)	Options ▪ No ▪ Yes **Factory setting** No	Specify whether a sample should be taken when the subprogram is disabled.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Deactivation	Options ▪ Bottles full ▪ Enable invalid ▪ Deactivation with event **Factory setting** Enable invalid	Select the disable function of the subprogram: **Bottles full** The subprogram is disabled once all the assigned bottles have been filled. **Enable invalid** Disable via limit value **Deactivation with event** New parameter can be defined
Bottle change mode	Options ▪ No ▪ Yes **Factory setting** Yes	**No:** The bottle is changed following a disable/enable **Yes:** When the cycle is finished, the system continues filling the last bottle.
Synchronize samplings	Options ▪ To subprogram start ▪ To clock **Factory setting** To subprogram start	**To subprogram start** The intervals defined in the sampling mode are enabled when the subprogram is started. **To clock** The intervals defined in the sampling mode are enabled after a specific time. For example, if 30 min is entered this means that the interval is only activated at a time of xx:30. --> You configure this time in the "Offset synchronization" menu item.
Bottle synchronization	Options ▪ None ▪ 1. bottle change time ▪ 1. Time of change + bottle number ▪ External BC sync input **Factory setting** None	Specific bottles can be assigned specific filling times with the bottle synchronization function. For example, bottle 1 is to be filled from midnight to 2 a.m., bottle 2 from 2 a.m. to 4 a.m. etc.. **None** The time of sampling and bottle change are not synchronized. **1. bottle change time** Sampling starts with the first bottle. The changeover to the next bottles is synchronized. **1. Time of change + bottle number** A specific fill time is assigned to each bottle. **External BC sync input** The system changes to the next bottle when an external signal is received. The external signal first has to be configured via the binary input. The binary input can then be selected as the source.
Assignment bin. output	Options ▪ No binary output config. for state reporting ▪ Binary output S:x **Factory setting** No binary output config. for state reporting	Assignment of the binary output to the program cycle.

Path: Menu/Setup/Sampling programs

Function	Options	Info
Use "SAVE" to save the subprogram setup. Then press "ESC" to return to the main program.		
▶ Inputs		Settings for the inputs can be made as described in the "Inputs" section.
Bottle assignment (only possible with multiple bottles) This menu item appears when more than one bottle is available.	Options ▪ No bottle assignment ▪ Dynamical bottle assignment ▪ Statical bottle assignment **Factory setting** No bottle assignment	**No bottle assignment:** Each subprogram fills the same bottle until the bottle is full. All the subprograms then change to the next bottle. **Dynamical bottle assignment:** When the subprogram changes, the system switches to the next bottle. **Statical bottle assignment:** A table can be used to assign a subprogram to each bottle.
Via the "Bottle change" menu item, the bottle change can be configured after a certain time or number of samples if more than 1 subprogram is available and either dynamic or static bottle assignment has been selected.		
If Bottle assignment **Statical bottle assignment** is selected:		
▶ Bottle assignment table Select a bottle and assign it a subprogram.		

4.4 Selecting and executing the program

In the overview, you can see all the programs created under "Select sampling program". Here, you also have the possibility of creating a new program with "New". Using the navigator, you can select the program you want to execute here and then choose from the following items: "Edit", "Delete", "Start", "Duplicate or "Cancel".

Path: Setup program

Function	Info
▶ Edit	The selected program is displayed and can be edited. Press the "SAVE" key to save the changes.
▶ Delete	The selected program is deleted following a confirmation prompt.
▶ Start	The selected program is started immediately. The program can be canceled or paused by pressing the "OFF" key. If there are differences between the setup and the selected program, the "Program configuration contains errors!" message appears, e.g. the bottle configuration in the program does not match the configuration in the setup. The program is not started. In this example, the actual bottle configuration must be checked against the configuration in the setup and the program and changed accordingly. Only the bottle configuration entered in the setup is valid for the program to be executed.
▶ Duplicate	The selected program is duplicated and saved with an ID.
▶ Cancel	Back to the overview.

The "Setup program" display contains the "ESC", "MAN", "?" and "OFF" soft keys.

Path: Setup program

Function	Info
▶ ESC	Back to the overview. Any program currently running is canceled.
▶ MAN	Manual sampling can be configured and started here. Any program currently running is paused. -> See BA00443C "Commissioning", Sampling program/Manual sampling section
▶ ?	A help text is displayed for the item.
▶ OFF	If no program is enabled, the device can be switched off here. If a program is enabled, the following options appear: **Power down sampler:** Following a confirmation prompt, the device is set to the standby mode. Power continues to be supplied to the device and the LED flashes green. **Stop program %0V [1]:** Stops a program currently running following a confirmation prompt. The overview display appears. **Pause program %0V [1]:** Is selected if maintenance work is pending. The program is paused and the pause time is entered in the logbook. The current program is resumed when the "Resume program" button is pressed.

Path: <emphasis/>Program active

Function	Info
▶ ESC	Back to the overview. Any program currently running is canceled.
▶ STAT	For selecting statistics about measured values, sampling and inputs See "Display settings" section in BA00465C.
▶ OFF	If no program is enabled, the device can be switched off here. If a program is enabled, the following options appear: **Power down sampler:** Following a confirmation prompt, the device is set to the standby mode. Power continues to be supplied to the device and the LED flashes green. **Stop program %0V:** [1] Stops a program currently running following a confirmation prompt. The overview display appears. **Pause program %0V:** [1] Is selected if maintenance work is pending. The program is paused and the pause time is entered in the logbook. The current program is resumed when the "Resume program" button is pressed.

1) "%0V" stands for context-dependent text here which is automatically generated by the software and inserted instead of the "%0V". In the simplest scenario, this could be the name of the measuring channel, for example.

5 Outputs

5.1 Binary outputs (optional)

Up to two binary outputs are available as an option.

Possible application
--> For outputting a manipulated variable to connected actuators

The binary output must be assigned in the program or subprogram before it can be activated.

Path: Menu/Setup/Outputs

Function	Options	Info
▶ OutputBinary		
Function	Options ▪ Off ▪ Event ▪ Limit value ▪ Diagnostics message ▪ Cleaning (only for version with sensors with the Memosens protocol) **Factory setting** Off	The following functions depend on the option selected. Function = "Off" switches off the function of the binary output and means no further settings are required.
If Function: **Event** is selected:		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Select the level change of the signal

Path: Menu/Setup/Outputs

Function	Options	Info
Event	Options ▪ Program enabled ▪ End of program ▪ Sampling start ▪ End of sampling ▪ Dosing ▪ Sampling cycle ▪ Bottle change ▪ External stop ▪ No sample ▪ Sub program enabled **Factory setting** Sampling cycle	**Program enabled:** A permanent signal is switched when the sampling program starts. **End of program:** A pulse or permanent signal is switched when the sampling program ends. **Sampling start:** A pulse is switched when a sample is taken. **End of sampling:** A pulse is switched when sampling has ended. **Dosing:** A pulse is switched while the device doses a sample. **Sampling cycle:** The output signal is switched for the duration of the sampling cycle. **Bottle change:** A pulse is switched when a bottle is changed. **External stop:** A pulse is switched when an external stop is performed. **No sample:** The output signal is switched if no sample was taken. **Sub program enabled:** The output signal is switched if this subprogram is active.
If Function: **Limit value** is selected:		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Select the level change of the signal
Source of data	Options ▪ None ▪ Limit switch 1-8 **Factory setting** None	Select the limit switch via which the status of the relay is to be output. The limit switches are configured in the "Setup/Additional functions/LimitSwitch" menu.
If Function: **Diagnostics message** is selected:		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Select the level change of the signal

Path: Menu/Setup/Outputs

Function	Options	Info
Operating mode	Options ▪ as assigned ▪ Namur M ▪ Namur S ▪ Namur C ▪ Namur F **Factory setting** as assigned	**as assigned:** If this option is selected, the diagnostics messages which you have individually assigned to the binary output are output via the binary output. **Namur M - F:** If you decided to use one of the Namur classes, all the messages that are assigned to the individual class are output via the binary output. You can also change the Namur class assignment for every diagnostics message. (Menu/Setup/General settings/Diagnostics/Device behavior or Menu/Setup/Inputs/../Diagnostics settings/Diag. behavior)
▷ Attributed diagnostic messages	Read only List of diagnostic messages	All the messages assigned to the relay output appear on the display. You do not have the option of editing the information here.
If Function: **Cleaning** is selected: (only for version with sensors with the Memosens protocol)		
Signal slope	Options ▪ Low-High ▪ High-Low **Factory setting** Low-High	Select the level change of the signal
Assignment	Options ▪ None ▪ Cleaning 1-4 **Factory setting** None	Use this function to choose the cleaning instance which should be started when the binary output is active.

5.2 Current outputs (optional)

Up to two optional current outputs are available.
Set the current range from 0 to 20 mA or 4 to 20 mA under Menu/Setup/General settings.

Possible applications
- For outputting a measured value to a process control system or an external recorder
- For outputting a manipulated variable to connected actuators

The current output curve is always linear.

Path: Menu/Setup/Outputs/Current output

Function	Options	Info
Current output	Options ▪ On ▪ Off **Factory setting** Off	Use this function to activate and deactivate a variable being output at the current output
Source of data	Options ▪ None ▪ Connected inputs ▪ Temperature sensors **Factory setting** None	The sources of data on offer depend on your device version. All the sensors and controllers connected to inputs are available for selection.
Measured value	Options ▪ None ▪ Depends on theSource of data **Factory setting** None	The measured value you can select depends on the option selected under "Source of data".
The table on the next page lists the measured values available depending on the data source. In the "Additional functions" menu, you can also select and configure the current output for outputting the controlled variable.		
Range lower value Range upper value	Selection range and factory settings depend on: "Measured value"	You can output the entire measuring range of the "Measured value" or just some of it at the current output. For this purpose, specify the start and end of the range in accordance with your requirements.
Hold behavior	Options ▪ Freeze ▪ Fixed value ▪ None **Factory setting** Depends on the channel:output	**Freeze** The device freezes the last current value. **Fixed value** You define a fixed current value that is output at the output. **None** A hold does not affect this current output.
Hold current *Hold behavior="Fixed value"*	0.0 to 23.0 mA **Factory setting** 22.0 mA	Specify which current should be output at this current output in the event of a hold.

Measured valuedepending on theSource of data

Source of data	Measured value
pH Glass pH ISFET	Options ▪ Raw value mV ▪ pH ▪ Temperature
Redox	Options ▪ Temperature ▪ Redox mV ▪ Redox %
Oxygen (amp.) Oxygen (opt.)	Options ▪ Temperature ▪ Partial pressure ▪ Concentration liquid ▪ Saturation ▪ Raw value nA(only Oxygen (amp.)) ▪ Raw value µs(only Oxygen (opt.))
Cond i Cond c	Options ▪ Temperature ▪ Conductivity ▪ Resistance(only Cond c) ▪ Concentration(only Cond i)
Chlorine	Options ▪ Temperature ▪ Current ▪ Concentration
ISE	Options ▪ Temperature ▪ pH ▪ Ammonium ▪ Nitrate ▪ Potassium ▪ Chloride
TU/TS	Options ▪ Temperature ▪ Turbidity g/l ▪ Turbidity FNU
Nitrate	Options ▪ Temperature ▪ NO3 ▪ NO3-N
SAC	Options ▪ Temperature ▪ SAC ▪ Transm. ▪ Absorption ▪ COD ▪ BOD

Measured valuedepending on theSource of data

Source of data	Measured value
Current input 1-3	Options depend on the configuration
Temperature 1-3	
Mathematical functions	All the mathematic functions can also be used as a data source and the calculated value can be used as the measured value.

5.3 Functions of the optional binary outputs

5.3.1 Outputting the status of a limit switch via the optional binary output

Function="LimitSwitch"

Function	Options	Info
Source of data	Options ▪ None ▪ Limit switch 1 ▪ Limit switch 2 ▪ Limit switch 3 ▪ Limit switch 4 ▪ Limit switch 5 ▪ Limit switch 6 ▪ Limit switch 7 ▪ Limit switch 8 **Factory setting** None	Select the limit switch via which the status of the relay is to be output. The limit switches are configured in the "Setup/Additional functions/Limit switches" menu.

5.3.2 Outputting diagnostics messages via the optional binary output

You can output two categories of diagnostics messages via the relay:
1. Diagnostics messages from one of the 4 Namur classes
   (--> BA00470C "Maintenance&diagnostics" for more information on the Namur classes)
2. Diagnostics messages which you have individually assigned to the relay output

A message is individually assigned to the relay output at 2 specific points in the menu:
- Menu/Setup/General settings/Diagnostics/Device behavior
  (device-specific messages)
- Menu/Setup/Inputs/../Diagnostics settings/Diag. behavior
  (sensor-specific messages)

Before being able to assign a special message to the relay output in "Device behavior", you must first configure Outputs/relay x:y or /Alarm relay/Function="Diagnostics".

Function="Diagnostics"

Function	Options	Info
Operating mode	Options ▪ as assigned ▪ Namur M ▪ Namur S ▪ Namur C ▪ Namur F **Factory setting** as assigned	**as assigned** If this option is selected, the diagnostics messages which you have individually assigned to the relay are output via the relay. **Namur M... F** If you decided to use one of the Namur classes, all the messages that are assigned to the individual class are output via the relay. You can also change the Namur class assignment for every diagnostics message. (Menu/Setup/General settings/Diagnostics/Device behavior or Menu/Setup/Inputs/../Diagnostics settings/Diag. behavior)
Attributed diagnostic messages *Operating mode="as assigned"*	Read only List of diagnostic messages	All the messages assigned to the relay output appear on the display. You do not have the option of editing the information here.

6 Additional functions

6.1 Limit switch

There are different ways of configuring a limit switch:
- Assigning a switch-on and switch-off point
- Assigning a switch-on and switch-off delay for a relay
- Setting an alarm threshold and also outputting an error message
- Starting a cleaning function

Path: Menu/Setup/Additional functions/Limit switches/Limit switches 1 to 8

Function	Options	Info
Source of data	Options ▪ None ▪ Connected sensors ▪ Connected inputs ▪ Temperature sensors **Factory setting** None	Specify the input or output which should be the source of data for the limit switch. The sources of data on offer depend on your device version. All the sensors and controllers connected to inputs are available for selection.
Measuring value	Options ▪ None ▪ Depends on theSource of data **Factory setting** None	The measured value you can select depends on the option selected under "Source of data".

Measured valuedepending on theSource of data

Source of data	Measured value
pH Glass pH ISFET	Options ▪ Raw value mV ▪ pH ▪ Temperature
Redox	Options ▪ Temperature ▪ Redox mV ▪ Redox %
Oxygen (amp.) Oxygen (opt.)	Options ▪ Temperature ▪ Partial pressure ▪ Concentration liquid ▪ Saturation ▪ Raw value nA(only Oxygen (amp.)) ▪ Raw value µs(only Oxygen (opt.))

Measured valuedepending on theSource of data

Source of data	Measured value
Cond i	Options ▪ Temperature ▪ Conductivity ▪ Resistance(only Cond c) ▪ Concentration(only Cond i)
Cond c	
Chlorine	Options ▪ Temperature ▪ Current ▪ Concentration
ISE	Options ▪ Temperature ▪ pH ▪ Ammonium ▪ Nitrate ▪ Potassium ▪ Chloride
TU/TS	Options ▪ Temperature ▪ Turbidity g/l ▪ Turbidity FNU
Nitrate	Options ▪ Temperature ▪ NO3 ▪ NO3-N
SAC	Options ▪ Temperature ▪ SAC ▪ Transm. ▪ Absorption ▪ COD ▪ BOD
Current input 1-3	Options depend on the configuration
Temperature 1-3	
Mathematical functions	All the mathematic functions can also be used as a data source and the calculated value can be used as the measured value.

Path: Menu/Setup/Additional functions/Limit switches/Limit switches 1 to 8

Function	Options	Info
Cleaning program	Options ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	Use this function to choose the cleaning instance which should be started when the limit switch is active.
Function	Options ▪ On ▪ Off **Factory setting** Off	Activating/deactivating the limit switch
Operating mode	Options ▪ Above limit check ▪ Below limit check ▪ In range check ▪ Out of range check ▪ Change rate **Factory setting** Above limit check	Type of limit value monitoring: ▪ Limit value overshoot or undershoot→ 8 ▪ Measured value within or outside a range→ 9 ▪ Rate of change→ 11
Limit value	**Settings** Depends on the measured value	*Operating mode="Above limit check" or "Below limit check"*

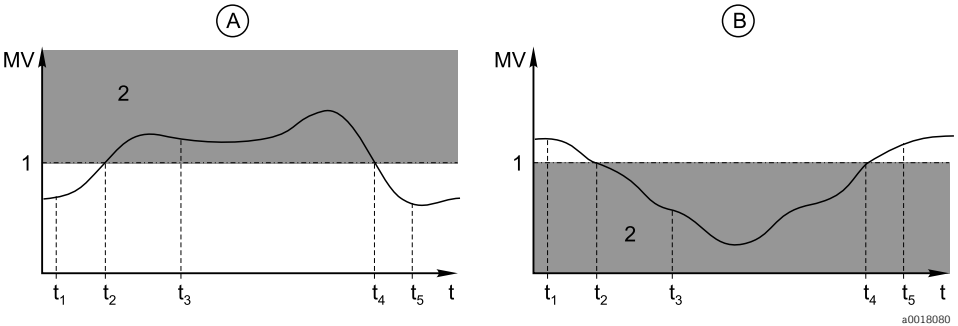


Fig. 8: Limit value exceeded (A) and undershot (B) (without hysteresis and switch-on delay)

1 Limit value
2 Alarm range
t_1,t_3,t_5 No action
t_2,t_4 An event is generated

- If the measured values (MV) are increasing, the relay contact is closed when the on-value is exceeded ("Limit value" + "Hysteresis") and the start delay has elapsed ("Start delay").
- If the measured values are decreasing, the relay contact is reset when the off-value is undershot ("Limit value" - "Hysteresis") and following the release delay ("Switch off delay").

Path: Menu/Setup/Additional functions/Limit switches/Limit switches 1 to 8

Function	Options	Info
Range lower value	**Settings** Depends on the measured value	*Operating mode="In range check" or "Out of range check"*
Range upper value		

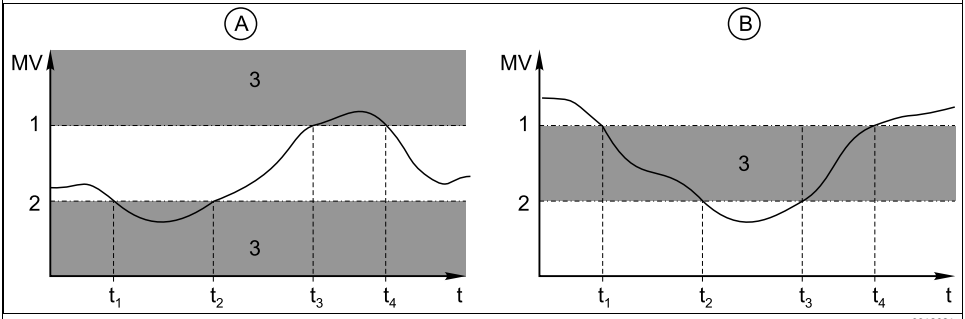
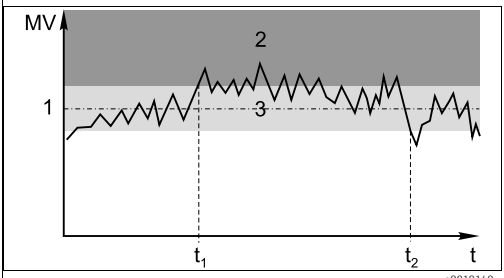


Fig. 9: Monitoring outside (A) and within (B) a range (without hysteresis and switch-on delay)

1 End of range
2 Start of range
3 Alarm range
$t_{1, 2, 3, 4}$ An event is generated

- If the measured values (MV) are increasing, the relay contact is closed when the on-value is exceeded ("Range lower value" + "Hysteresis") and the start delay has elapsed ("Start delay").
- If the measured values are decreasing, the relay contact is reset when the off-value is undershot ("Range upper value" - "Hysteresis") and following the release delay ("Switch off delay").

Hysteresis	**Settings** Depends on the measured value	*Operating mode="In range check", "Out of range check","Above limit check" or "Below limit check"*



The hysteresis is needed to ensure a stable switching behavior.

The device software adds or subtracts the value set here to the upper and lower limit value (Limit value, Range lower value or Range upper value). The result is that the hysteresis range around the limit value is double the value for "Hysteresis".
An event is only generated if the measured value (MV) completely crosses the hysteresis range. → 10

Fig. 10: Hysteresis using the example of limit value overshoot

1 Limit value
2 Alarm range
3 Hysteresis range
t_1, t_2 An event is generated

Path: Menu/Setup/Additional functions/Limit switches/Limit switches 1 to 8

Function	Options	Info
Start delay	0 to 9999 s **Factory setting** 0 s	*Operating mode="In range check", "Out of range check","Above limit check" or "Below limit check"* Synonyms: pick-up and drop-out delay
Switch off delay		
Delta value	**Settings** Depends on the measured value	*Operating mode="Change rate"* The slope of the measured value (MV) is monitored in this mode. An event is generated if, in the specified time frame (Delta time), the measured value increases or drops by more than the specified value (Delta value). If the value continues to increase or drop so sharply afterwards, no other event is generated. Once the slope is back below the limit value, the alarm status is reset after a preset time (Auto Confirm). In the example given, events are triggered when the following conditions occur: $t_2 - t_1$ < "Delta time" **and** ΔMV_1 > "Delta value" $t_4 - t_3$ > "Auto Confirm" **and** ΔMV_2 < "Delta value" $t_6 - t_5$ < "Delta time" **and** ΔMV_3 > ΔMV
Delta time	00:01 ... 23:59 **Factory setting** 01:00	
Auto Confirm	00:01 to 23:59 **Factory setting** 00:01	

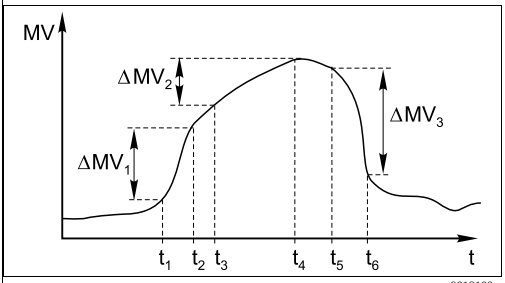


Fig. 11: Rate of change

6.2 Mathematical functions

In addition to "real" process values which are delivered by analog inputs or physical sensors connected to the device, you can also calculate a maximum of 6 "virtual" process values using mathematical functions.

The "virtual" process values can be:
- Output via a current output or a fieldbus
- Used as a controlled variable
- Assigned as a measured variable to a limit contactor
- Used as a measured variable to trigger cleaning
- Displayed in user-defined measuring menus.

6.2.1 Difference

You can subtract the measured values of two sensors and use the result to detect incorrect measurements, for example.
To calculate a difference, you must use two measured values with the same engineering unit.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/Difference

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Y1	The options depend on the sensors connected	Select the sensors and the measured variables that should be used as the minuend (Y1) or subtrahend (Y2).
Measured value		
Y2		
Measured value		
Difference value	Read only	View this value in a user-defined measuring screen or output the value via the current output.

6.2.2 Redundancy

Use this function to monitor two or three sensors with redundant measurements. The arithmetic average of the two closest measured values is calculated and output as the redundancy value.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/Redundancy

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Y1	The options depend on the sensors connected	You can select different types of sensor that output the same measured value. **Example for temperature redundancy:** You have a pH sensor and an oxygen sensor at inputs 1 and 2. Select both as "Y1" and "Y2". For "Measured value" select the temperature.
Measured value		
Y2		
Measured value		
Y3 (optional)		
Measured value		
Deviation control	Options ▪ Off ▪ On **Factory setting** Off	You can monitor the redundancy. Specify an absolute limit value that may not be exceeded.
Deviation limit	Depends on the selected measured value	
Redundancy	Read only	View this value in a user-defined measuring screen or output the value via the current output.

6.2.3 rH value

To calculate the rH value, a pH sensor and an ORP sensor must be connected. It is irrelevant whether you are using a pH glass sensor, an ISFET sensor or the pH electrode of an ISE sensor.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/rH calculation

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
pH source	Connected pH sensor	Set the input for the pH sensor and the input for the ORP sensor. Measured value interrogation is obsolete as you must select pH or ORP mV.
Redox source	Connected ORP sensor	
Calculated rH	Read only	View this value in a user-defined measuring screen or output the value via the current output.

6.2.4 Degassed conductivity

Carbon dioxide from the air can be a contributing factor to the conductivity of a medium. The degassed conductivity is the conductivity of the medium excluding the conductivity caused by carbon dioxide.

In the power station industry, for example, it is advantageous to use the degassed conductivity:
- The percentage of conductivity caused by corrosion products or fouling in the feed water can be determined as early as when the turbines are started. The system excludes the initially high conductivity values resulting from the ingress of air.
- If carbon dioxide is regarded as non-corrosive, the live steam can be directed to the turbine far earlier during startup.
- If the conductivity value increases during normal operation, it is possible to immediately determine an ingress of coolant or air by calculating the degassed conductivity.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/Degassed conductivity

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Cation conductivity	Connected conductivity sensor	"Cation conductivity" is the sensor downstream from the cation exchanger and upstream from the "degassing module", "Degassed conductivity" is the sensor at the outlet of the degassing module. Measured value interrogation is obsolete as you can only choose conductivity.
Degassed conductivity	Connected conductivity sensor	
CO2 concentration	Read only	View this value in a user-defined measuring screen or output the value via the current output.

6.2.5 Dual conductivity

You can subtract two conductivity values and use the result, for example, to monitor the efficiency of an ion exchanger.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/Dual conductivity

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Inlet	The options depend on the sensors connected	Select the sensors that should be used as the minuend (Inlet, e.g. sensor upstream from the ion exchanger) and subtrahend (Outlet, e.g. sensor downstream from the ion exchanger.
Measured value		
Outlet		
Measured value		
Main value format	Options ▪ Auto ▪ # ▪ #.# ▪ #.## ▪ #.### **Factory setting** Auto	
Cond. unit	Options ▪ Auto ▪ µS/cm ▪ mS/cm ▪ S/cm ▪ µS/m ▪ mS/m ▪ S/m **Factory setting** Auto	
Dual conductivity	Read only	View this value in a user-defined measuring screen or output the value via the current output.

6.2.6 Calculated pH value

The pH value can be calculated from the measured values of two conductivity sensors under certain conditions. Areas of application include power stations, steam generators and boiler feedwater.

Path: Menu/Setup/Additional functions/Mathematical functions/MF 1 to 6/Mode/pH calculation from conductivity

Function	Options	Info
Calculation	Options ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Method	Options ▪ NaOH ▪ NH3 ▪ LiOH **Factory setting** NaOH	The calculation is performed on the basis of Guideline VGB-R-450L of the Technical Association of Large Power Plant Operators (Verband der Großkesselbetreiber, (VGB)). **NaOH** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/273\}$ **NH3** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/243\}$ **LiOH** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/228\}$ κ_v ... "Inlet" ... direct conductivity κ_h ... "Outlet" ... acid conductivity
Inlet Outlet	Choice of conductivity sensor	Inlet Sensor upstream from the cation exchanger, "direct conductivity" Outlet Sensor downstream from the cation exchanger, "acid conductivity" The choice of measured value is obsolete since it must always be "Conductivity".
Calculated pH	Read only	View this value in a user-defined measuring screen or output the value via the current output.

7 Communication

7.1 Service interface

You can connect the device to a computer via the service interface and configure it using "FieldCare". Furthermore, configurations can also be saved, transferred and documented.

7.1.1 Connection

- Connect the service port on the controller housing to the Commubox (FXA291).
- Via the USB port, connect the Commubox to the computer.
- Commubox is supplied with a CD which contains USB drivers that must be installed when connecting for the first time.
- FieldCare must be installed on the computer for the application. The software can either be downloaded from www.de.endress.com or ordered on a CD.

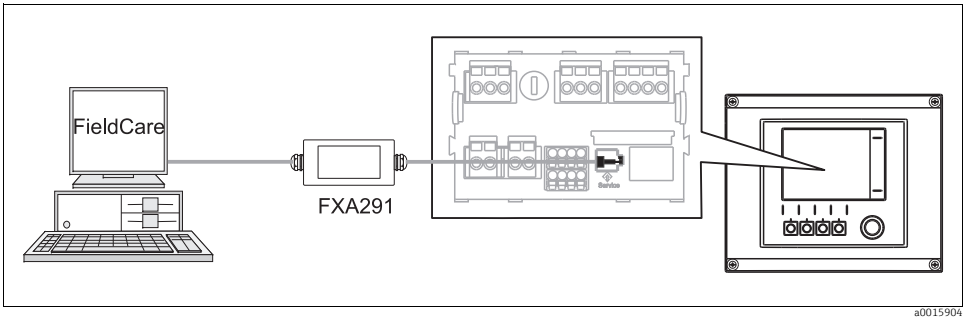


Fig. 12: Connection overview

7.1.2 Creating the data connection

- ▶ Start Fieldcare.
- ▶ Establish the connection to the Commubox.
- ▶ For this purpose, under "Host PC" click "Add device" and select "CDI Communication FXA291".
- ▶ Click "Configuration" to select the serial interface for FXA291 and to set the baud rate (115200).
- ▶ Click "Link connection" to start communicating with the FXA291 (◁▷ are green).
- ▶ Click "Add device" again and select your device type.
- ▶ Click "Link connection" to start communicating with the device (◁▷ are green).
- ▶ Select "Online parameterize" to be able to communicate with the device online.

You can now start online configuration via the DTM.
Online configuration competes with onsite operation, i.e. each of the two options blocks the other one. Either side is able to prevent access from the other side.

7.1.3 Operation

- Clicking a menu name or a function corresponds to pressing the navigator.
- You can make your settings conveniently via the computer keyboard.
- Via Fieldcare, you can save logbooks, make backups of configurations and transfer the configurations to other devices.
- To start exporting the logbook click "Operating devices", "Device functions" and "Further functions". Select ".dat" to save the file in a protected format for processing with the Field Data Manager.
- You can also print out configurations or save them as PDFs.

8 Information on sensors with the Memosens protocol

The following options are only available for versions with at least one digital sensor with Memosens technology.
Sensors with the Memosens protocol have integrated electronics that save calibration data and other information. The sensor data are automatically communicated to the transmitter when the sensor is connected and are used to calculate the measured value.

Data digital sensors save include:
- Manufacturer data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Date of calibration
  - Calibration values
  - Number of calibrations
  - Serial number of the transmitter used to perform the last calibration
- Operating data
  - Date of initial commissioning
  - Hours of operation under extreme operating conditions
  - Sensor monitoring data

The specific data that are recorded and communicated to the transmitter depend on the sensor used. Differences can also occur within a sensor type.
In the case of the CM44x controller, this causes different menu items to be displayed or hidden depending on the sensor connected.
Pay attention to specific information in this manual.

Example:
The amperometric oxygen sensor COS51D cannot be sterilized. For this reason, you will not be able to define limit values for sterilization in the diagnostics settings for this sensor. On the other hand, these menu items are displayed for a sterilizable amperometric sensor, such as COS22D.

9 Inputs: General

9.1 Configuration

An input can be configured in one of two ways:

1. Configuration where a sensor is not connected
   - ▶ Select the appropriate channel.
   - ▶ From the list of sensor types, select the sensor which you want to configure.
   - ▶ Configure the channel as explained in following sections.
   - ▶ Connect the selected sensor type later on.
2. Configuration where a sensor is connected
   - ▶ Configure the channel as explained in following sections.

The following applies when configuring with a sensor:

- Some settings require sensor communication.
  You cannot make these settings if a sensor is not connected.
- It is also possible to save a setup and transfer it to another device (see "Data management" in the "General settings" section). This function might be a better option than performing a configuration when a sensor is not connected.

9.2 Frequently occurring functions

Some submenus are identical for all sensor types.
These submenus are explained below so you can find a description of these menus in one central location. Instead of repeating the description, the sensor-specific section then only contains a reference to this chapter.

9.2.1 Damping

The damping causes a floating average curve of the measured values over the time specified.

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Damping <Sensor type>	0 to 600 s **Factory setting** 0 s	You specify the damping of the main measured value of the connected sensor and that of the integrated temperature sensor.
Damping temp.		

9.2.2 Manual hold

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Manual hold	Options ▪ On ▪ Off **Factory setting** Off	**On** You can use this function to set the channel manually to "Hold". **Off** No hold

9.2.3 Cleaning

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup

Function	Options	Info
Cleaning	Options ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	Select a cleaning program. This program is executed: ▪ At the specified interval The cleaning program must be started for this purpose. ▪ If a diagnostic message is present at the channel **and** a cleaning process has been specified for this message (--> "Inputs/Diagnostics settings/Diag. behavior").

You define the cleaning programs in the "Setup/Additional functions/Cleaning" menu.

9.2.4 Calibration timer and calibration expiration date

You can specify the calibration interval for the sensor here.
Once the time configured elapses, the "Calibration timer" diagnostics message appears on the display.

The timer is reset automatically if you recalibrate the sensor.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup/Calib. settings

Function	Options	Info
Calibration timer	Options ▪ Off ▪ On **Factory setting** Off	Switches the function on or off
Calibration timer value *Calibration timer="On"*	14 to 365 d (chlorine sensor) 1 to 10000 h (all others) **Factory setting** 180 d (chlorine sensor) 1000 h (all others)	Specify the time after which the timer should have timed out. Once this time has elapsed, the "Calib. Timer" diagnostics message, along with the code 102, appears on the display.
Calib. expiration date	Options ▪ Off ▪ On **Factory setting** Off	The function checks whether the calibration of a sensor is still valid. Example: You install a precalibrated sensor. The function checks how much time has elapsed since the sensor was last calibrated. A diagnostics message is displayed if the time since the last calibration is longer than the predefined warning and alarm limit.
▶ Calib. expiration date		
Warning limit	**Factory setting** 11 months	Diagnostics message: 105 "Calib. validity"
Alarm limit	**Factory setting** 12 months	Diagnostics message: 104 "Calib. validity"
Warning and alarm limits mutually affect each other's possible ranges for adjustment. Range of adjustment which must include both limits: 1 to 24 months Generally the following applies: alarm limit > warning limit		

9.2.5 Process check system (PCS)

The process check system (PCS) checks the measuring signal for stagnation. An alarm is triggered if the measuring signal does not change over a certain period (several measured values).

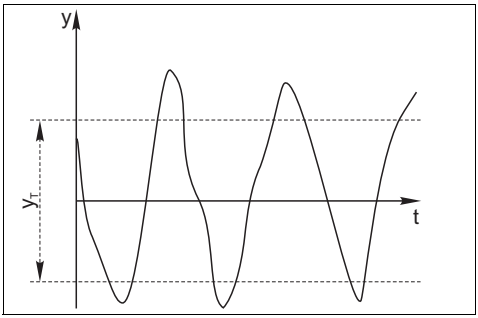


Fig. 13: Normal measuring signal, no alarm

y *Measuring signal*
y_T *Set value for "Tolerance width"*

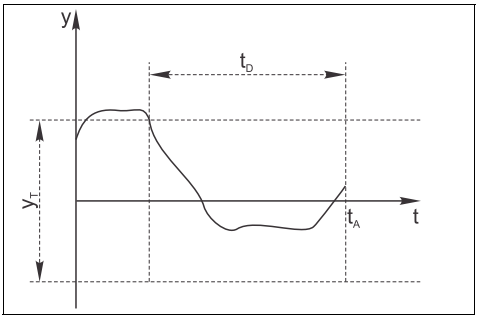


Fig. 14: Stagnating signal, alarm is triggered

t_D *Set value for "Duration"*
t_A *Time when the alarm is triggered*

The main causes of stagnating measured values are:
- Sensor fouled or outside the medium
- Sensor failure
- Process error (e.g. through control system)

Remedial action
- ▶ Clean the sensor.
- ▶ Check the position of the sensor in the medium.
- ▶ Check the measuring chain.
- ▶ Switch off the controller and switch it back on again.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup/Diagnostics settings

Function	Options	Info
▶ Process Check System		Diagnostics code and associated message text: 904 "Process check"
Function	Options ▪ On ▪ Off **Factory setting** Off	
Duration	1 to 240 min **Factory setting** 60 min	The measured value must change during this time. Otherwise the error message is triggered.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup/Diagnostics settings

Function	Options	Info
Tolerance width *Not available for pH/ORP*	The range depends on the sensor **Factory setting** Depends on the sensor	Interval around the measuring signal (raw value) for detecting stagnation. Measured values within the set interval are regarded as stagnating.

9.2.6 Diagnostic behavior

The list of diagnostic messages displayed depends on the path selected. There are device-specific messages, and messages that depend on what sensor is connected.

Path: ... /Extended setup/Diagnostics settings/Diag. behavior (optional)

Function	Options	Info
List of diagnostic messages		Select the message to be changed. Only then can you make the settings for this message.
Diag. code	Read only	
Diagnostic message	Options ▪ On ▪ Off **Factory setting** Depends on the message	You can deactivate or reactivate a diagnostic message here. Deactivating means: ▪ No error message in the measuring mode ▪ No error current at the current output
Error current	Options ▪ On ▪ Off **Factory setting** Depends on the message	Decide whether an error current should be output at the current output if the diagnostic message display is activated. If general device errors occur, the error current is output at all the current outputs. In the case of channel-specific errors, the error current is only output at the specific current output.
Status signal	Options ▪ Maintenance (M) ▪ Out of specification (S) ▪ Function check (C) ▪ Failure (F) **Factory setting** Depends on the message	The messages are divided into different error categories in accordance with NAMUR NE 107. --> BA00470C "Maintenance & diagnostics" Decide whether you want to change the status signal assignment for your application.
Diag. output	Options ▪ None ▪ Binary output **Factory setting** None	You can use this function to select a binary output to which the diagnostic message should be assigned. For sensors with the Memosens protocol: You first have to configure a relay output for "Diagnostics" (Menu/Setup/Outputs, assign "Diagnostics" function and set Operating mode to "as assigned") before being able to assign the message to an output. --> BA00492C "Operation & configuration"

Path: ... /Extended setup/Diagnostics settings/Diag. behavior (optional)

Function	Options	Info
Cleaning program (optional)	Options ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	Decide whether the diagnostic message should trigger a cleaning program. You can define the cleaning programs under: Menu/Setup/Additional functions/Cleaning.
Detail information	Read only	Here you can find more information on the diagnostic message and instructions on how to resolve the problem.

9.2.7 Sterilizations

The system counts the number of operating hours in which the sensor is exposed to a temperature that is typical for a sterilization. This temperature depends on the sensor.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup/Diagnostics settings

Function	Options	Info
▶ Sterilizations	0 ... 99	Specify the limit values for the number of sensor sterilizations.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 30[1)]	Diagnostics code and associated message text: 108 "Sterilization"

1) For oxygen: 25

9.2.8 Tag control

With this function, you specify which sensors are accepted at your device.

"Tag" stands for the name of a measuring point, and is used in many areas of process measuring technology.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup

Function	Options	Info
▶ Tag control		Additional information on the display: tag control currently used
Operating mode	Options ▪ Off ▪ Tag ▪ Group **Factory setting** Off	**Off** No tag control, all sensors are accepted. **Tag** Only sensors with the same tag are accepted. **Group** Only sensors in the same tag group are accepted.
Tag	Customized text **Factory setting** EH_CSF48_	Enter the tag name. The controller checks every sensor to be connected as to whether this sensor belongs to the measuring point, and only accepts the sensors that have the same tag.
Group	Numerical **Factory setting** 0	

9.2.9 Sensor replacement

When the sensor is replaced, the last measured value is retained via the "hold" function. A diagnostics message is not triggered.

9.2.10 Data processing factory setting

Here you can restore the factory settings for the sensor input. For this purpose, simply press the navigator button and select "OK" when the prompt for the device software appears.
Only the factory settings for this particular input are restored. All other settings remain unchanged.

9.2.11 Sensor factory setting

Here you can restore the sensor factory settings. For this purpose, simply press the navigator button and select "OK" when the prompt for the device software appears.
Only the factory settings for the sensor are restored. The settings for the input remain unchanged.

10 Inputs: pH/ORP

10.1 Basic settings

10.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

10.1.2 Main value

Path: Menu/Setup/Inputs/pH or Redox or pH/Redox

Function	Options	Info
Main value	Options ▪ pH (only pH sensor) ▪ mV ▪ % (only ORP sensor) ▪ Redox mV (only combined sensor) ▪ Redox % (only combined sensor) ▪ rH (only combined sensor) **Factory setting** pH (pH sensor and combined sensors) mV (ORP sensor)	Select how the main measured value should be displayed. You can display the main measured value of a pH sensor as a pH value or as a raw value in mV. If using an ORP sensor, here you decide which ORP mode to use: mV or %. The rH value is also available for selection if you have connected a combined sensor. Subsequent configuration options depend on the option selected here.

10.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 85

10.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

10.2 Extended setup

10.2.1 Temperature and medium compensation (only pH)

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup

Function	Options	Info
Temp. compensation	Options ▪ Off ▪ Automatic ▪ Manual **Factory setting** Automatic	Decide how you want to compensate the medium temperature: ▪ Automatically using the temperature sensor of your sensor (ATC) ▪ Manually by entering the medium temperature ▪ Not at all
This setting only refers to compensation during measurement. You enter the compensation for calibration in the calibration settings.		
Medium comp. *only pH sensor*	Options ▪ Off ▪ 2-point ▪ Table **Factory setting** Off	Take a sample from the medium and determine its pH value at different temperatures in the lab. Decide whether you want to compensate using two points or several points in a table.
The dissociation of water changes with increasing temperature. The balance shifts towards the protons; the pH value drops. You can balance out this effect with the "Medium compensation" function.		
Internal buffer *(only pH glass or combined sensor)*	pH 0 to 14 **Factory setting** pH 7.00	Only change the value if you are using a sensor with an internal buffer other than pH 7.

10.2.2 Measured value formats

Path: Menu/Setup/Inputs/pH or Redox or pH/Redox/Extended setup

Function	Options	Info
Main value format *(only pH)*	Options ▪ #.# ▪ #.## **Factory setting** #.#	Specify the number of decimal places for displaying the main measured value.
Temperature format	Options ▪ #.# ▪ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.

10.2.3 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 85

10.2.4 Calibration settings

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta mV	1 to 10 mV **Factory setting** 1 mV	Permitted measured value fluctuation during calibration
Duration	10 to 60 s **Factory setting** 20 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

Buffer recognition (only pH)

Automatic buffer recognition
To ensure a buffer is detected correctly, the measuring signal may deviate by a maximum of 30 mV from the value stored in the buffer table. This is approx. 0.5 pH at a temperature of 25 °C. If both buffers - 9.00 and 9.20 - were used, this would cause the signal intervals to overlap and buffer recognition would not work. For this reason, the device would recognize a buffer with a pH of 9.00 as a pH of 9.20. --> Do not use the buffer with a pH of 9.00 for automatic buffer recognition.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Calib. settings

Function	Options	Info
Temp. compensation	Options ▪ Off ▪ Automatic ▪ Manual **Factory setting** Automatic	Decide how you want to compensate the buffer temperature: ▪ Automatically using the temperature sensor of your sensor (ATC) ▪ Manually by entering the buffer temperature ▪ Not at all
Temperature *Temp. compensation="Manual"*	-50 to 250 °C (-58 to 482 °F) **Factory setting** 25 °C (77 °F)	Specify the buffer temperature.
This setting only refers to compensation during calibration, not in measuring mode. You perform the compensation in the measuring mode further down in the menu.		

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Calib. settings

Function	Options	Info
Buffer recognition	Options ▪ Fixed ▪ Automatic *(only pH glass or combined sensor)* ▪ Manual **Factory setting** Fixed	**Fixed** You choose values from a list. This list depends on the setting for "Buffer manufacturer". **Automatic** *(only pH glass or combined sensor)* The device recognizes the buffer automatically. The recognition depends on the setting for "Buffer manufacturer". **Manual** You enter any two buffer values. These must differ in terms of their pH value.
Buffer manufacturer	Options ▪ Endress+Hauser ▪ Ingold/Mettler ▪ DIN 19266 ▪ DIN 19267 ▪ Merck/Riedel ▪ Hamilton ▪ Special buffer **Factory setting** Endress+Hauser	Temperature tables are stored internally in the unit for the following pH values: ▪ Endress+Hauser 2,00 / 4,00 / 7,00 / *(9,00)* / 9,20 / 10,00 / 12,00 ▪ Ingold/Mettler 2,00 / 4,01 / 7,00 / 9,21 ▪ DIN 19266 1,68 / 4,01 / 6,86 / 9,18 ▪ DIN 19267 1,09 / 4,65 / 6,79 / 9,23 / 12,75 ▪ Merck/Riedel 2,00 / 4,01 / 6,98 / 8,95 / 12,00 ▪ Hamilton 1,09 / 1,68 / 2,00 / 3,06 / 4,01 / 5,00 / 6,00 7,00 / 8,00 / 9,21 / 10,01 / 11,00 / 12,00

You have the possibility of defining two buffers of your own with the "Special buffer" option. For this purpose, two tables are displayed in which you can enter value pH value/temperature value pairs.

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 85

10.2.5 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Sensor check system (only pH glass)

The sensor check system (SCS) monitors the high impedance of the pH glass.
An alarm is issued if a minimum impedance value is undershot or a maximum impedance is exceeded.
- Glass breakage is the main reason for a drop in high impedance values.
- The reasons for increasing impedance values include:
  - Dry sensor
  - Worn pH glass membrane

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Glass impedance (SCS)	0 to 10000 MΩ	Specify your limit values for monitoring the impedance of the pH glass.
Upper limit	Options ▪ On ▪ Off **Factory setting** On	**On** SCS operates with the following settings for the upper warning and alarm limits. **Off** SCS is switched off.
Upper alarm limit	**Factory setting** 2000 MΩ	Diagnostics code and associated message text: 124 "Sensor glass"
Upper warning limit	**Factory setting** 1600 MΩ	Diagnostics code and associated message text: 125 "Sensor glass"
Lower limit	Options ▪ On ▪ Off **Factory setting** On	**On** SCS operates with the following settings for the lower warning and alarm limits. **Off** SCS is switched off.
Lower warning limit	**Factory setting** 1 MΩ	Diagnostics code and associated message text: 123 "Sensor glass"
Lower alarm limit	**Factory setting** 0 MΩ	Diagnostics code and associated message text: 122 "Sensor glass"

The upper and lower limit values for the SCS can be switched on/off independently of each another.

Slope (only pH)

The slope characterizes the sensor condition. The bigger the deviation from the ideal value (59 mV/pH) the poorer the condition of the sensor.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Slope	5.00 to 99.00 mV/pH	Specify your limit values for slope monitoring.
Warning limit	**Factory setting** 55.00 mV/pH	Associated diagnostics code and message text: 509 "Sensor calib."

Zero point (only pH glass) or Operating point (only pH ISFET)

pH glass sensors
The zero point characterizes the condition of the sensor reference. The bigger the deviation from the ideal value (pH 7.00) the poorer the condition. This can be caused by KCl dissolving away or reference contamination.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Zero point *(pH glass or combined sensor)* Operating point *(pH ISFET)*	**pH glass** -2,00 ... 16,00 **pH ISFET** -950 mV to 950 mV	Specify your limit values for zero point or operating point monitoring.
Upper warning limit	**Factory setting** pH 8.00 / 300 mV	Associated diagnostics code and message text: 505 "Sensor calib." (pH glass) 515 "Sensor calib." (pH ISFET)
Lower warning limit	**Factory setting** pH 6.00 / -300 mV	Associated diagnostics code and message text: 507 "Sensor calib." (pH glass) 517 "Sensor calib." (pH ISFET)

Sensor condition check (only pH glass)

Sensor condition check (SCC) monitors the electrode status and the degree of electrode aging. The electrode status is updated after every calibration.

The main reasons for a deteriorating electrode status are:
- Glass membrane blocked or dry
- Diaphragm (reference) blocked

Remedial action
- ▶ Clean or regenerate the sensor.
- ▶ Replace the sensor if this does not have the desired effect.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Sensor Condition Check		The function can only be switched on or off. It uses internal limit values
Function	Options ▪ On ▪ Off **Factory setting** On	Diagnostics code and associated message text: 127 "SCC sufficient" 126 "SCC bad"

Redox-Meas value (only ORP)

You can specify limit values in order to monitor your process. A diagnostics message is displayed if the limits are exceeded or undershot.

Path: Menu/Setup/Inputs/Redox or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Redox-Meas value		Specify your limit values for monitoring the measured value.
Upper warning limit	**Factory setting** 900 mV	Diagnostics code and associated message text: 942 "Process value"
Lower warning limit	**Factory setting** -900 mV	Diagnostics code and associated message text: 943 "Process value"

Process check system

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/pH or Redox or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		Specify your limit values for monitoring the number of operating hours under extreme conditions.
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** On	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
▶ Operation > 80°C		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 193 "Operating time"
▶ Operation > 100°C		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 194 "Operating time"
▶ Operation < -300 mV		*Only pH* or combined sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 180 "Operating time"
▶ Operation > 300 mV		*Only pH* or combined sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 179 "Operating time"

Delta slope(only pH)

The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. The greater the change, the greater the wear experienced by the pH-sensitive glass membrane as a result of chemical corrosion or abrasion.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta slope	0.10 to 10.00 mV/pH	Specify your limit values for monitoring the slope differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 5.00 mV/pH	Diagnostics code and associated message text: 518 "Sensor calib."

Delta zero point (only pH glass) or Delta operating point (only pH ISFET)

The device determines the difference between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. The following applies to pH glass electrodes: The greater the change, the greater the wear experienced by the reference as a result of contaminating ions or KCl dissolving away.

Path: Menu/Setup/Inputs/pH or pH/Redox/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta zero point *(pH glass or combined sensor)* Delta operating point *(pH-ISFET)*	**pH glass** pH 0.00 to 2.00 **pH ISFET** 0 to 950 mV	Specify your limit values for monitoring the zero point or operating point differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** pH 0.50 / 25 mV	Diagnostics code and associated message text: 520 "Sensor calib." (pH glass) 522 "Sensor calib." (pH ISFET)

Sterilizations

--> "Inputs: General/Frequently occurring functions" section → 85

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 85

10.2.6 Tag control

--> "Inputs: General/Frequently occurring functions" section → 85

10.2.7 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 85

10.2.8 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 85

11 Inputs: Conductivity

11.1 Basic settings

11.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

11.1.2 Damping

--> "Inputs: General/Frequently occurring functions" section → 85

11.1.3 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

11.1.4 Operating mode and cell constant

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Operating mode	Options ▪ Conductivity ▪ Resistance *(only Cond c)* ▪ Concentration *(only Cond i)* ▪ TDS *(only Cond c)* **Factory setting** Conductivity	Alternatively to the conductivity, you can also measure the resistivity and the total dissolved solids (TDS) parameter with a **conductive conductivity sensor**. Alternatively to the conductivity, you can determine the concentration of the medium with an **inductive conductivity sensor**. **TDS** TDS stands for all the organic and inorganic substances in the water in ionic, molecular or microgranular (<2 µm) form. Compared with laboratory methods (gravimetric analysis), TDS measurement via the conductivity value delivers a maximum measured error of less than 10%.
Cell constant	Read only (Only available if a sensor is connected)	The cell constant of the connected sensor is displayed (--> sensor certificate)

11.1.5 Installation factor (only inductive sensors)

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Inst. factor	Read only (Only available if a sensor is connected)	Displays the current value. Only changes with a calibration.

In confined installation conditions, the wall affects conductivity measurement in the liquid. The installation factor compensates for this effect. The transmitter corrects the cell constant by multiplying by the installation factor.
The size of the installation factor depends on the diameter and the conductivity of the pipe nozzle, as well as the distance between the sensor and the wall.
If there is a sufficient distance between the wall and the sensor (a > 15 mm (0.59"), from DN 80), the installation factor f does not have to be taken into consideration (f = 1.00).
If distances from the wall are smaller, the installation factor is bigger for electrically insulating pipes (f >1), and smaller for electrically conductive pipes (f < 1).
It can be measured using calibration solutions, or a close approximation determined from the following diagram.

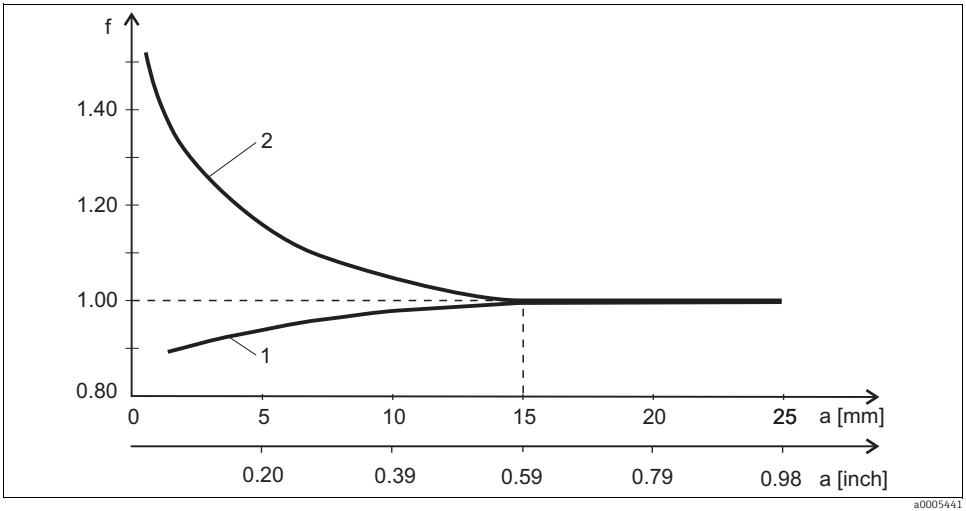


Fig. 15: Relation between the installation factor f and the wall distance

1 Electrically conductive pipe wall
2 Electrically insulating pipe wall

11.1.6 Concentration table (only inductive sensors)

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Conc. Table *(Operating mode=Concentration)*	Options ▪ NaOH 0..15% ▪ HCl 0..20% ▪ HNO3 0..25% ▪ HNO3 24..30% ▪ H2SO4 0..28% ▪ H2SO4 40..80% ▪ H2SO4 93..100% ▪ H3PO4 0..40% ▪ NaCl 0..26% ▪ User table 1 ▪ User table 2 ▪ User table 3 ▪ User table 4 **Factory setting** NaOH 0..15%	Concentration tables saved at the factory: NaOH: 0 to 15%, 0 to 100 °C (32 to 212 °F) HCl: 0 to 20%, 0 to 65 °C (32 to 149 °F) HNO_3: 0 to 25%, 2 to 80 °C (36 to 176 °F) H_2SO_4: 0 to 28%, 0 to 100 °C (32 to 212 °F) H_2SO_4: 40 to 80%, 0 to 100 °C (32 to 212 °F) H_2SO_4: 93 to 100%, 0 to 100 °C (32 to 212 °F) H_3PO_4: 0 to 40%, 2 to 80 °C (36 to 176 °F) NaCl: 0 to 26%, 2 to 80 °C (36 to 176 °F)
Temp. comp. mode *(Operating mode=Concentration)*	Options ▪ with temp. comp ▪ without temp. comp **Factory setting** with temp. comp	Only select "without temp. comp" in very small temperature ranges. In all other cases, select "with temp. comp".
Table name *(Conc. Table=one of the user tables)*	Customized text, 16 characters	Assign a meaningful name to the selected table.
▶ Edit table *(Conc. Table=one of the user tables)*	3-column table	Assign conductivity and concentration value pairs for a specific temperature.
Conc. unit *(Operating mode=Concentration)*	**Read only** %	This is for information purposes only. No options are available.

Example of a concentration table:

Conductivity (uncompensated)	Concentration	Temperature
1.000 mS/cm	0.000 mg/l	0.00 °C
2.000 mS/cm	0.000 mg/l	100.00 °C
100.0 mS/cm	3.000 mg/l	0.00 °C
300.0 mS/cm	3.000 mg/l	100.00 °C

Values must be constantly increasing or decreasing.

11.1.7 Unit and format

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Main value format	Options ■ Auto ■ # ■ #.# ■ #.## ■ #.### **Factory setting** Auto	Specify the number of decimal places.
Cond. unit *(Operating mode=Conductivity)* Unit *(Operating mode=Resistance)*	Options Conductivity/resistance ■ Auto / Auto ■ µS/cm / MΩm ■ mS/cm / MΩcm ■ S/cm / kΩcm ■ µS/m / kΩm ■ mS/m / Ωm ■ S/m / Ωcm **Factory setting** Auto / Auto	The picklist depends on the operating mode. You can either choose from units for conductivity or units for resistivity. Since there are no options for concentration measurement, this function is not displayed for such measurements.

11.1.8 Temperature compensation

Temperature coefficient α= change in the conductivity per degree of temperature change:
$\kappa(T) = \kappa(T_0)(1 + \alpha(T - T_0))$
$\kappa(T)$ ... conductivity at process temperature T
$\kappa(T_0)$ ... conductivity at reference temperature T_0

The temperature coefficient depends both on the chemical composition of the solution and the temperature itself.

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Temp. source	Options ▪ Sensor ▪ Manual **Factory setting** Sensor	Decide how you want to compensate the medium temperature: ▪ Automatically using the temperature sensor of your sensor ▪ Manually by entering the medium temperature
Medium temperature *(Temp. source=Manual)*	-50.0 to 250.0 °C (-58.0 to 482.0 °F) **Factory setting** 25.0 °C (77 °F)	Enter the temperature of your medium.
Compensation *(Operating mode=Conductivity)*	Options ▪ None ▪ Linear ▪ NaCl (IEC 746-3) ▪ Water ISO7888 (20°C) ▪ Water ISO7888 (25°C) ▪ UPW NaCl ▪ UPW HCl ▪ User table 1 ▪ User table 2 ▪ User table 3 ▪ User table 4 **Factory setting** Linear	Various methods are available to compensate for the temperature dependency. Depending on your process, decide which type of compensation you want to use. Alternatively, you can also select "None" and thus measure uncompensated conductivity.

Linear temperature compensation

The change between two temperature points is taken to be constant, i.e. α = const. The value for alpha remains stored in the sensor and is recalculated for each calibration.

Reference temperature and alpha coefficient (only for linear temperature compensation)

The alpha coefficients and alpha reference temperatures of your medium must be known. Typical alpha coefficients at a reference temperature of 25 °C are:

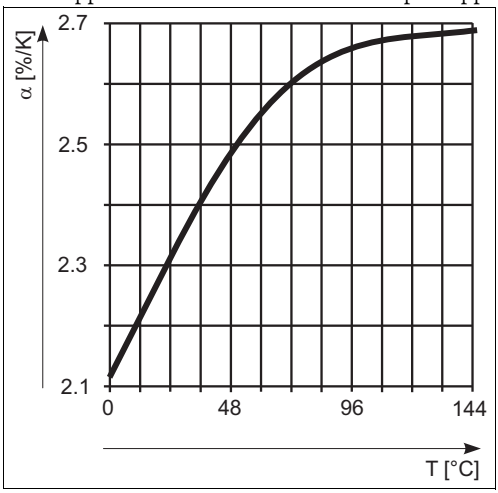
- Salts (e.g. NaCl): approx. 2.1 %/K
- Alkalis (e.g. NaOH): approx. 1.7 %/K
- Acids (e.g. HNO_3): approx. 1.3 %/K

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Ref. temp.	-5.0 to 100.0 °C (23.0 to 212.0 °F) **Factory setting** 25.0 °C (77.0 °F)	Reference temperature for calculating the temperature-compensated conductivity
Factor alpha	0.000 to 20.000 %/K **Factory setting** 2.100 %/K	For entering the conductivity coefficient of your medium

NaCl compensation

In the case of NaCl compensation (as per IEC 60746), a fixed non-linear curve specifying the relationship between the temperature coefficient and temperature is saved in the device. This curve applies to low concentrations of up to approx. 5 % NaCl.



Compensation for natural water

A non-linear in accordance with ISO 7888 is saved in the device for temperature compensation in natural water.

Ultrapure water compensation (for conductive sensors)

Algorithms for pure and ultrapure water are stored in the device. These algorithms take the dissociation of the water and its temperature dependency into account. They are used for conductivity values up to approx. 100 µS/cm.

- UPW NaCl: Optimized for pH-neutral contamination.
- UPW HCl: Optimized for measuring the acid conductivity downstream of a cation exchanger. Also suitable for ammonia (NH_3) and caustic soda (NaOH).

User-defined tables

You can save a function that takes the properties of your specific process into account. To do so, determine the value pairs made up of the temperature T and conductivity κwith:

- $\kappa(T_0)$ for the reference temperature T_0
- $\kappa(T)$ for the temperatures that occur in the process

Use the following formula to calculate the αvalues for the temperatures that are relevant in your process:

$$\alpha = \frac{100\%}{\kappa(T_0)} \cdot \frac{\kappa(T) - \kappa(T_0)}{T - T_0} ; T \neq T_0$$

Values must be constantly increasing or decreasing.

Path: Menu/Setup/Inputs/Conductivity

Function	Options	Info
Temp. comp. mode *(Compensation=one of the user tables)*	Options ▪ Conductivity ▪ Coeff. Alpha **Factory setting** Conductivity	**Conductivity** You specify the temperature, conductivity and uncompensated conductivity. Recommended for large measuring ranges and small measured values. **Coeff. Alpha** As the value pairs, you specify an alpha value and the related temperature.
Table name *(Compensation=one of the user tables)*	Customized text, 16 characters	Assign a meaningful name to the selected table.
▶ Edit table *(Compensation=one of the user tables)*	▪ Temperature ▪ Conductivity ▪ Temperature comp. cond. or ▪ Temperature ▪ Coefficient alpha	Maximum number of rows: 25 The type of table depends on the option under "Temp. comp. mode".

11.2 Extended setup

11.2.1 Temperature format

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup

Function	Options	Info
Temperature format	Options ■ #.# ■ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.

11.2.2 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 85

11.2.3 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Process check system

--> "Inputs: General/Frequently occurring functions" section → 85

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/Conductivity/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
▶ Operation > 80°C		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 193 "Operating time"
▶ Operation > 120°C		*Only conductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 195 "Operating time"
▶ Operation > 125°C		*Only inductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 196 "Operating time"
▶ Operation > 140°C		*Only conductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 197 "Operating time"
▶ Operation > 150°C		*Only inductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 198 "Operating time"
▶ Operation > 80°C < 100nS/cm		*Only conductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 187 "Operating time"
▶ Operation < 5°C		*Only inductive sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 188 "Operating time"

Sterilizations

--> "Inputs: General/Frequently occurring functions" section → 85

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 85

Polarization detection (only conductive sensors)

As a result of flow through the electrolyte/electrode interface, reactions take place here which result in additional voltage. These polarization effects limit the measuring range of conductive sensors. Sensor-specific compensation increases the level of accuracy at the measuring range limits.

The controller recognizes the Memosens sensor and automatically uses suitable compensation. You can view the measuring range limits of the sensor under Diagnostics/Sensor information/Sensor specifications.

Path: Menu/Setup/Inputs/Conductivity/Extended setup/Diagnostics settings/Polarization detetected

Function	Options	Info
Polarization detetected	Options ▪ On ▪ Off **Factory setting** Off	Diagnostics code and associated message text: 168 "Polarization"

11.2.4 Pharmaceutical water

Here you can make settings for monitoring pharmaceutical water in accordance with the United States Pharmacopoeia (USP) or European Pharmacopoeia (EP).
The uncompensated conductivity value and the temperature are measured for the limit functions. The measured values are compared with the tables defined in the standards. If the limit is exceeded, an alarm is triggered. Furthermore, you can also set a preliminary alarm (warning limit) which signals undesired operating states before they occur.

Path: Menu/Setup/Inputs/Conductivity/Extended setup/Diagnostics settings/Pharmacy-water

Function	Options	Info
Function	Options ▪ Off ▪ EP ▪ USP **Factory setting** Off	The alarm values are stored in the device in accordance with USP or EP specifications. You define the warning limit as a % of the alarm value.
Warning limit	10,0 ... 99,9 % **Factory setting** 80,0 %	Diagnostics code and associated message text: 915 "USP / EP warning" If the value exceeds the USP or EP alarm values saved in the software, diagnostics message 914 "USP/ EP alarm" is displayed.

11.2.5 Tag control

--> "Inputs: General/Frequently occurring functions" section → 85

11.2.6 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 85

11.2.7 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 85

11.2.8 Sensor factory setting (only CLS50D)

--> "Inputs: General/Frequently occurring functions" section → 85

12 Inputs: Oxygen

12.1 Basic settings

12.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

12.1.2 Main value

Path: Menu/Setup/Inputs/DO

Function	Options	Info
Main value	Options ▪ Concentration liquid ▪ Concentration gaseous ▪ Saturation ▪ Partial pressure ▪ Raw value nA(only Oxygen (amp.)) ▪ Raw value µs(only Oxygen (opt.)) **Factory setting** Concentration liquid	Decide how you want to display the main value. Other functions, such as the setting for the unit, depends on this setting.

12.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 📄 85

12.1.4 Unit

Path: Menu/Setup/Inputs/DO

Function	Options	Info
Unit *Main value="Concentration liquid" or "Concentration gaseous"*	Options *(Main value="Concentration liquid")* ▪ mg/l ▪ µg/l ▪ ppm ▪ ppb Options *(Main value="Concentration gaseous")* ▪ %Vol ▪ ppmVol *(Main value="Concentration gaseous"* **Factory setting** mg/l %Vol	

12.1.5 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

12.2 Extended setup

12.2.1 Temperature compensation (only amperometric sensors)

Path: Menu/Setup/Inputs/DO/Extended setup

Function	Options	Info
Temp. compensation	Options ▪ Automatic ▪ Manual **Factory setting** Automatic	Decide how you want to compensate the medium temperature: ▪ Automatically using the temperature sensor of your sensor This means that the temperature is always compensated based on the current temperature value. ▪ Manually by entering the medium temperature This means that the measured value is always compensated against the value entered, e.g. for inlet and outlet monitoring in a cooling facility.
Temperature *(Temp. compensation=Manual)*	0.0 to 80.0 °C (32.0 to 176.0 °F) **Factory setting** 20.0 °C (68 °F)	Enter the temperature of your medium, or another temperature which you want to use as a reference temperature.

12.2.2 Measured value formats

Path: Menu/Setup/Inputs/DO or Chlorine/Extended setup[1)]

Function	Options	Info
Main value format	Options ▪ #.# ▪ #.## ▪ #.### ▪ # **Factory setting** #.##	Specify the number of decimal places for displaying the main measured value.
Temperature format	Options ▪ #.# ▪ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.

1) In the case of chlorine, the sequence of the two menu functions is reversed

12.2.3 Medium compensation (in the process)

Path: Menu/Setup/Inputs/DO/Extended setup

Function	Options	Info
Medium pressure	Options ▪ Process pressure ▪ Air pressure ▪ Altitude **Factory setting** Air pressure	
Altitude *Medium pressure="Altitude"*	-300 to 4000 m **Factory setting** 0 m	Enter the altitude **or** the average air pressure (mutually dependent values). If you specify the altitude, the average air pressure is calculated from the barometric altitude formula and vice versa. If you are compensating using the process pressure, enter the pressure in your process here. The pressure is then independent of the altitude.
Air pressureorProcess pressure	*Medium pressure="Air pressure"* 500 to 1200 hPa *Medium pressure="Process pressure"* 500 to 9999 hPa **Factory setting** 1013 hPa	
Salinity	0 to 40 g/kg **Factory setting** 0 g/kg	The influence of salt content on oxygen measurement is compensated with this function. Example: sea water measurement as per Copenhagen Standard (30 g/kg).

12.2.4 Cleaning

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup

Function	Options	Info
Cleaning	Options ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	Select a cleaning program. This program is executed: ▪ At the specified interval The cleaning program must be started for this purpose. ▪ If a diagnostic message is present at the channel **and** a cleaning process has been specified for this message (--> "Inputs/Diagnostics settings/Diag. behavior").

You define the cleaning programs in the "Setup/Additional functions/Cleaning" menu.

12.2.5 Calibration settings

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/Oxygen/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta signal	0,1 ... 2,0 % **Factory setting** 0,2 %	Permitted measured value fluctuation during calibration. Referenced to the raw value in nA in the case of amperometric sensors, and referenced to the partial pressure in the case of optical sensors.
Delta temperature	0.10 to 2.00 K **Factory setting** 0.50 K	Permitted temperature fluctuation during calibration
Duration	5 to 60 s **Factory setting** 20 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

Medium compensation (during calibration)

Path: Menu/Setup/Inputs/DO/Extended setup/Calib. settings

Function	Options	Info
Medium pressure	Options ▪ Process pressure ▪ Air pressure ▪ Altitude **Factory setting** Air pressure	
Altitude *Medium pressure="Altitude"*	-300 to 4000 m **Factory setting** 0 m	Enter the altitude **or** the average air pressure (mutually dependent values). If you specify the altitude, the average air pressure is calculated from the barometric altitude formula and vice versa. If you are compensating using the process pressure, enter the pressure in your process here. The pressure is then independent of the altitude.
Air pressureorProcess pressure	*Medium pressure="Air pressure"* 500 to 1200 hPa *Medium pressure="Process pressure"* 500 to 9999 hPa **Factory setting** 1013 hPa	
Rel. hum. (air variable)	0 ... 100 % **Factory setting** 100 %	

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 📄 85

12.2.6 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Slope

The (relative) slope characterizes the sensor condition. Decreasing values indicate electrolyte exhaustion. You can control when the electrolyte should be replaced by specifying limit values and the diagnostics messages these limit values trigger.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Slope	0,0 … 200,0 %	Specify the limit values for slope monitoring in your sensor.
Upper warning limit	**Factory setting** 140,0 %	Diagnostics code and associated message text: 511 "Sensor calib."
Lower warning limit	**Factory setting** 60,0 %	Diagnostics code and associated message text: 509 "Sensor calib."

Delta slope (only amperometric sensors)

The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. An increasing change indicates the formation of buildup on the sensor diaphragm or electrolyte contamination. Replace the diaphragm and electrolyte as specified in the instructions in the sensor operating manual.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta slope	0,0 … 50,0 %	Specify the limit values for monitoring the slope differential.
Function	Options ▪ On ▪ Off **Factory setting** On	
Warning limit	**Factory setting** 5,0 %	Diagnostics code and associated message text: 518 "Sensor calib."

Zero point (only amperometric sensors)

The zero point corresponds to the sensor signal that is measured in a medium in the absence of oxygen. You can calibrate the zero point in water that is free from oxygen or in high-purity nitrogen. This improves accuracy in the trace range.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Zero point	0.0 to 10.0 nA	Specify the limit values for zero point monitoring in your sensor.
Warning limit	**Factory setting** 3.0 nA	Diagnostics code and associated message text: 513 "Zero Warn"

Delta zero point (only amperometric sensors)

The device determines the difference between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. Increasing differences indicate the formation of buildup on the cathode. Clean or replace the cathode as specified in the instructions in the sensor operating manual.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta zero point	0.0 to 10 nA	Specify your limit values for monitoring the zero point differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 1.0 nA	Diagnostics code and associated message text: 520 "Sensor calib."

Calibrations, cap (only amperometric sensors)

The calibration counters in the sensor make a distinction between sensor calibrations and calibrations with the membrane cap currently used. If this cap is replaced, only the (cap) counter is reset.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Number of cap calibrations		Specify how many calibrations may be performed with a membrane cap before the cap has to be replaced. The number depends heavily on the process and must be determined individually.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	0 … 1000 **Factory setting** 6	Diagnostics code and associated message text: 535 "Sensor check"

Sterilizations, cap (only sterilizable, amperometric sensors)

The sterilization counters in the sensor make a distinction between the sensor and the membrane cap currently used. If this cap is replaced, only the (cap) counter is reset.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Number of cap sterilizations		Specify how many sterilizations may be performed with a membrane cap before the cap has to be replaced. The number depends heavily on the process and must be determined individually.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	0 … 100 **Factory setting** 25	Diagnostics code and associated message text: 109 "Sterilizat. cap"

Sterilizations (only sterilizable sensors)

--> "Inputs: General/Frequently occurring functions" section → 85

Process check system

--> "Inputs: General/Frequently occurring functions" section → 85

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
▶ Operation < 5°C		*Only optical sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 188 "Operating time"
▶ Operation > 5°C		*Only COS51D*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 189 "Operating time"
▶ Operation > 25°C		*Only optical sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 190 "Operating time"
▶ Operation > 30°C		*Only COS51D*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 191 "Operating time"
▶ Operation > 40°C		*Only COS22D, COS61D*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 192 "Operating time"

Path: Menu/Setup/Inputs/DO/Extended setup/Diagnostics settings

Function	Options	Info
▶ Operation > 80°C		*Only COS22D*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 193 "Operating time"
▶ (Operation above first specified nA value)		*Only amperometric sensors, sensor-specific limit* – *COS22D: >15 nA* – *COS51D: >30 nA*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 183 "Operating time" (COS22D) 184 "Operating time" (COS51D)
▶ (Operation above second specified nA value)		*Only amperometric sensors, sensor-specific limit* – *COS22D: >50 nA* – *COS51D: >160 nA*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 185 "Operating time" (COS22D) 186 "Operating time" (COS51D)
▶ Operation < 25 µs		*Only optical sensors (µS = fluorescence decay time, raw value of optical measurement)*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 181 "Operating time"
▶ Operation > 40 µs		*Only optical sensors*
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 182 "Operating time"

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 🗎 85

12.2.7 Tag control

--> "Inputs: General/Frequently occurring functions" section → 🗎 85

12.2.8 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 🗎 85

12.2.9 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 🗎 85

12.2.10Sensor factory setting (only COS61D)

--> "Inputs: General/Frequently occurring functions" section → 🗎 85

13 Inputs: Chlorine

13.1 Basic settings

13.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

13.1.2 Main value

Path: Menu/Setup/Inputs/Chlorine

Function	Options	Info
Main value	Options ▪ Concentration ▪ Sensor current (nA) **Factory setting** Concentration	Decide how you want to display the main value.

13.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 📄 85

13.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 📄 85

13.1.5 Unit

Path: Menu/Setup/Inputs/Chlorine

Function	Options	Info
Unit *Main value="Concentration liquid"*	Options ▪ mg/l ▪ µg/l ▪ ppm ▪ ppb **Factory setting** mg/l	

13.2 Extended setup

13.2.1 Measured value formats

Path: Menu/Setup/Inputs/DO or Chlorine/Extended setup[1)]

Function	Options	Info
Main value format	Options ▪ #.# ▪ #.## ▪ #.### ▪ # **Factory setting** #.##	Specify the number of decimal places for displaying the main measured value.
Temperature format	Options ▪ #.# ▪ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.

1) In the case of chlorine, the sequence of the two menu functions is reversed

13.2.2 Medium compensation (in the process)

Path: Menu/Setup/Inputs/Chlorine/Extended setup

Function	Options	Info
Medium comp. (pH)	Options ▪ Off ▪ On **Factory setting** On	**Off** The concentration measured value is calculated as HClO (=free available chlorine). **On** The pH value is used to calculate a cumulative concentration value from HClO and ClO^- (=total chlorine).
Mode *Medium comp. (pH)="On"*	Options ▪ Fixed value ▪ Measured value **Factory setting** Fixed value	Decide whether you want to specify a fixed pH value for calculating the total chlorine or whether the measured value of a pH sensor attached to another input should be used.
Fixed pH *Mode="Fixed value"*	4.00 to 9.00 pH **Factory setting** 7.20 pH	Useful for media with constant pH values Enter the pH value of your medium which you determined with a reference measurement.
Associated pH-sensor *Mode="Measured value"*	Select the pH sensor **Factory setting** None	Preferred method for media with varying pH values Select the sensor input with the connected pH sensor. The measured value of the sensor is then continuously used to calculate the total chlorine.
Temp. compensation	Options ▪ Off ▪ Automatic ▪ Manual **Factory setting** Automatic	Decide whether and how you want to compensate the medium temperature: ▪ No compensation ▪ Automatically using the temperature sensor of your sensor ▪ Manually by entering the medium temperature
Medium temperature *(Temp. compensation=Manual)*	-5.0 to 50.0 °C (23.0 to 122.0 °F) **Factory setting** 20.0 °C (68 °F)	Enter the temperature of your medium.

13.2.3 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 📄 85

13.2.4 Calibration settings

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta signal	0,1 … 5,0 % **Factory setting** 1 %	Permitted measured value fluctuation during calibration. (referenced to the raw value in nA)
Delta temperature	0.10 to 2.00 K **Factory setting** 0.50 K	Permitted temperature fluctuation during calibration
Duration	5 to 100 s **Factory setting** 20 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

13.2.5 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Slope

The (relative) slope characterizes the sensor condition. Decreasing values indicate electrolyte exhaustion. You can control when the electrolyte should be replaced by specifying limit values and the diagnostics messages these limit values trigger.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Slope	3,0 … 500,0 %	Specify the limit values for slope monitoring in your sensor.
Upper warning limit	**Factory setting** 200,0 %	Diagnostics code and associated message text: 511 "Sensor calib."
Lower warning limit	**Factory setting** 25,0 %	Diagnostics code and associated message text: 509 "Sensor calib."

Delta slope

The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. An increasing change indicates the formation of buildup on the sensor diaphragm or electrolyte contamination. Replace the diaphragm and electrolyte as specified in the instructions in the sensor operating manual.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta slope	1 … 15 %	Specify the limit values for monitoring the slope differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 5 %	Diagnostics code and associated message text: 518 "Sensor calib."

Zero point

The zero point corresponds to the sensor signal that is measured in a medium in the absence of chlorine. You can calibrate the zero point in water that is free from chlorine. This improves accuracy in the trace range.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Zero point	0.0 to 3.2 nA	Specify the limit values for zero point monitoring in your sensor.
Warning limit	**Factory setting** 2.0 nA	Diagnostics code and associated message text: 513 "Zero Warn"

Delta zero point

The device determines the difference between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. Increasing differences indicate the formation of buildup on the cathode. Clean the cathode as specified in the instructions in the sensor operating manual.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta zero point	0.0 to 3.2 nA	Specify your limit values for monitoring the zero point differential.
Function	Options ▪ On ▪ Off **Factory setting** On	
Warning limit	**Factory setting** 1.0 nA	Diagnostics code and associated message text: 520 "Sensor calib."

Number of cap calibrations

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Number of cap calibrations		Specify how many calibrations may be performed with a membrane cap before the cap has to be replaced. The number depends heavily on the process and must be determined individually.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	1 ... 20 **Factory setting** 6	Diagnostics code and associated message text: 535 "Sensor check"

Process check system

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 100000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
▶ Operation > 15°C		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 178 "Operating time"
▶ Operation > 30°C		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 191 "Operating time"
▶ Operation > 20 nA		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 177 "Operating time"
▶ Operation > 100 nA		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 176 "Operating time"

Electrolyte counter

The electrolyte consumption is calculated on the basis of the load volume entered by the sensor diaphragm.

The following applies for the sensor CCS142D:
Half the chloride would be consumed and the entire dihydrogen phosphate would be converted to monohydrogen phosphate in an electrolyte filling (4 ml) at 20 000 000 µAs (=20 As). This would render the electrolyte and the sensor unusable.

In the interests of predictive maintenance, you should replace the electrolyte at 10 000 000 µAs, and preferably at 5 000 000 µAs. 25%-50% of the dihydrogen phosphate is then consumed.
The calculation presumes that the buffer of the electrolyte is only changed by the electrochemical conversion of hypochlorous acid. It does not take the penetration of acids and bases into the sensor into account.
Depending on the application it can be necessary to change the electrolyte before a load of 5 As is reached.

Path: Menu/Setup/Inputs/Chlorine/Extended setup/Diagnostics settings

Function	Options	Info
▶ Electrolyte counter	0 to 2000000 µAs	
Function	Options ▪ On ▪ Off **Factory setting** On	
Warning limit	**Factory setting** 1000000 µAs	Diagnostics code and associated message text: 534 "Sensor calib."

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 85

13.2.6 Tag control

--> "Inputs: General/Frequently occurring functions" section → 85

13.2.7 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 85

13.2.8 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 85

14 Inputs: Turbidity and solids

14.1 Basic settings

14.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

14.1.2 Application

The sensor is precalibrated on leaving the factory. As such, it can be used in a wide range of applications (e.g. clear water measurement) without the need for additional calibration. The factory calibration is based on a three-point calibration of a reference sample.
The factory calibration cannot be deleted and can be retrieved at any time. All other calibrations - performed as customer calibrations - are referenced to this factory calibration.

Calibration data records are saved under an individual name. You can add your own data records during each calibration. These are then available for selection under "Application".

Path: Menu/Setup/Inputs/Turbidity

Function	Options	Info
Application type	Options ▪ Clear water ▪ Solid **Factory setting** Clear water	Preselection for saved calibration data records
Application	Depends on the sensor	Select a saved calibration data record

14.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 85

14.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

14.2 Extended setup

14.2.1 Measured value formats

Path: Menu/Setup/Inputs/Turbidity/Extended setup

Function	Options	Info
Temperature format	Options ▪ #.# ▪ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.
Main value format	Options ▪ #.# ▪ #.## ▪ #.### ▪ # **Factory setting** #.#	Specify the number of decimal places for the main value.
Unit	Options Application="Formacine" ▪ FNU ▪ NTU Options All apart from "Formacine" ▪ g/l ▪ ppm ▪ %TS **Factory setting** FNU g/l	Select the unit for the main measured value.

14.2.2 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 85

14.2.3 Calibration settings

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 85

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/Turbidity/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta turbidity	0,1 … 5,0 % **Factory setting** 2,0 %	Permitted measured value fluctuation during calibration
Delta temperature	0.10 to 2.00 K **Factory setting** 0.50 K	Permitted temperature fluctuation during calibration
Duration	0 to 100 s **Factory setting** 20 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

14.2.4 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/Turbidity/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		Specify your limit values for monitoring the number of operating hours under extreme conditions.
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
The names of the menu functions in brackets depend on the sensor specification. For this reason, they cannot be specified here.		
▶ (Operation below specified temperature limit, e.g. < -5 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 935 "Process temp."
▶ (Operation above specified temperature limit, e.g. > 55 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 934 "Process temp."
▶ (Operation below specified limit value, e.g. < 0 FNU)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 943 "Process value"
▶ (Operation above specified limit value e.g. > 10000 FNU)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 942 "Process value"

Process check system

--> "Inputs: General/Frequently occurring functions" section → 85

Sensor operating hours

The data displayed here are the current hours the device has been in operation under extreme conditions. You cannot make any changes. You can only read the values.
The same data can be found in the Diagnostics menu.

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 85

14.2.5 Tag control

--> "Inputs: General/Frequently occurring functions" section → 85

14.2.6 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 85

14.2.7 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 85

14.2.8 Sensor factory setting

--> "Inputs: General/Frequently occurring functions" section → 85

15 Inputs: SAC

15.1 Basic settings

15.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

15.1.2 Application

Calibration data records are saved under an individual name in the sensor. A new sensor is calibrated at the factory and thus already has appropriate data records. You can add your own data records during each calibration. These are then available for selection under "Application".

Path: Menu/Setup/Inputs/SAC

Function	Options	Info
Basic application	Options ▪ SAC ▪ Transm. ▪ Absorption ▪ COD ▪ TOC ▪ DOC ▪ BOD **Factory setting** SAC	Preselection for saved calibration data records
Application	Options ▪ Factory calib. ▪ 5 other data records **Factory setting** Factory calib.	Select a saved calibration data record

15.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 85

15.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

15.2 Extended setup

15.2.1 Measured value formats

Path: Menu/Setup/Inputs/SAC/Extended setup

Function	Options	Info
Temperature format	Options ■ #.# ■ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.
Main value format	Options ■ #.# ■ #.## ■ #.### ■ # **Factory setting** #.#	Specify the number of decimal places for the main value.
Unit	Options ■ None ■ % ■ mg/l ■ ppm ■ 1/m **Factory setting** Depends on "Basic application"	The unit of the main value depends on the basic application selected. Depending on this setting only certain units are available for selection.

15.2.2 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 85

15.2.3 Calibration settings

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 85

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/SAC/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta SAC	0,1 … 5,0 % **Factory setting** 2,0 %	Permitted measured value fluctuation during calibration
Delta temperature	0.10 to 2.00 K **Factory setting** 0.50 K	Permitted temperature fluctuation during calibration
Duration	0 to 100 s **Factory setting** 10 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

15.2.4 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/SAC/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		Specify your limit values for monitoring the number of operating hours under extreme conditions.
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
The names of the menu functions in brackets depend on the sensor specification. For this reason, they cannot be specified here.		
▶ (Operation below specified temperature limit, e.g. < 5 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 935 "Process temp."
▶ (Operation above specified temperature limit, e.g. > 50 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 934 "Process temp."
▶ (Operation below specified limit value, e.g. < 50 mg/l)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 170 "Process value"
▶ (Operation above specified limit value, e.g. > 200 mg/l)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 169 "Process value"
▶ Filter change		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 157 "Filter change"
Alarm limit	**Factory setting** 15000 h	Diagnostics code and associated message text: 161 "Filter change"

Path: Menu/Setup/Inputs/SAC/Extended setup/Diagnostics settings

Function	Options	Info
▶ Lamp life		
Warning limit	**Factory setting** 35040 h	Diagnostics code and associated message text: 171 "Lamp change"
Alarm limit	**Factory setting** 36500 h	Diagnostics code and associated message text: 71 "Lamp change"

Process check system

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Sensor operating hours

The data displayed here are the current hours the device has been in operation under extreme conditions. You cannot make any changes. You can only read the values.
The same data can be found in the Diagnostics menu.

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 📄 85

15.2.5 Tag control

--> "Inputs: General/Frequently occurring functions" section → 📄 85

15.2.6 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 📄 85

15.2.7 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 📄 85

15.2.8 Sensor factory setting

--> "Inputs: General/Frequently occurring functions" section → 📄 85

16 Inputs: Nitrate

16.1 Basic settings

16.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

16.1.2 Application

Calibration data records are saved under an individual name in the nitrate sensor. A new sensor is calibrated at the factory and always has a corresponding data record. You can add additional data records during each calibration. These are then available for selection under "Application".

Path: Menu/Setup/Inputs/Nitrate

Function	Options	Info
Application	Depends on the sensor	Select a saved calibration data record

16.1.3 Damping

--> "Inputs: General/Frequently occurring functions" section → 85

16.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 85

16.2 Extended setup

16.2.1 Measured value formats

Path: Menu/Setup/Inputs/Nitrate/Extended setup

Function	Options	Info
Temperature format	Options ▪ #.# ▪ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.
Main value format	Options ▪ #.# ▪ #.## ▪ #.### ▪ # **Factory setting** #.#	Specify the number of decimal places.
Unit	Options ▪ mg/l NO3-N ▪ mg/l NO3 ▪ ppm NO3-N ▪ ppm NO3 **Factory setting** mg/l NO3-N	Select the unit for the main measured value.

16.2.2 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 85

16.2.3 Calibration settings

Calibration timer and calibration expiration date

--> "Inputs: General/Frequently occurring functions" section → 85

Stability criteria

You define the permitted measured value fluctuation which must not be exceeded in a certain time frame during calibration.
If the permitted difference is exceeded, calibration is not permitted and is aborted automatically.

Path: Menu/Setup/Inputs/Nitrate/Extended setup/Calib. settings

Function	Options	Info
▶ Stability criteria		
Delta nitrate	0,1 … 5,0 % **Factory setting** 2,0 %	Permitted measured value fluctuation during calibration
Delta temperature	0.10 to 2.00 °C 0.18 to 3.60 °F **Factory setting** 0.50 °C 0.90 °F	Permitted temperature fluctuation during calibration
Duration	0 to 100 s **Factory setting** 10 s	Timeframe within which the permitted range for measured value fluctuation should not be exceeded

16.2.4 Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/Nitrate/Extended setup/Diagnostics settings

Function	Options	Info
▶ Limits operating hours		Specify your limit values for monitoring the number of operating hours under extreme conditions.
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 199 "Operating time"
The names of the menu functions in brackets depend on the sensor specification. For this reason, they cannot be specified here.		
▶ (Operation below specified temperature limit, e.g. < 5 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 935 "Process temp."
▶ (Operation above specified temperature limit, e.g. > 50 °C)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 934 "Process temp."
▶ (Operation below specified limit value, e.g. < 50 mg/l)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 943 "Process value"
▶ (Operation above specified limit value, e.g. > 200 mg/l)		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 942 "Process value"
▶ Filter change		
Warning limit	**Factory setting** 10000 h	Diagnostics code and associated message text: 157 "Filter change"
Alarm limit	**Factory setting** 15000 h	Diagnostics code and associated message text: 161 "Filter change"

Path: Menu/Setup/Inputs/Nitrate/Extended setup/Diagnostics settings

Function	Options	Info
▶ Lamp life		
Warning limit	**Factory setting** 35000 h	Diagnostics code and associated message text: 171 "Lamp change"
Alarm limit	**Factory setting** 36500 h	Diagnostics code and associated message text: 71 "Lamp change"

Process check system

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Sensor operating hours

The data displayed here are the current hours the device has been in operation under extreme conditions. You cannot make any changes. You can only read the values.
The same data can be found in the Diagnostics menu.

Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 📄 85

16.2.5 Tag control

--> "Inputs: General/Frequently occurring functions" section → 📄 85

16.2.6 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 📄 85

16.2.7 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 📄 85

16.2.8 Sensor factory setting

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17 Inputs: ISE

17.1 Basic settings

17.1.1 Sensor identification

Path: Menu/Setup/Inputs/<Sensor type>

Function	Options	Info
Channel	Options ▪ On ▪ Off **Factory setting** On	**On** The channel display is switched on in the measuring mode **Off** The channel is not displayed in the measuring mode, regardless of whether a sensor is connected or not.
Sensor type	Read only (Only available if a sensor is connected)	Connected sensor type
Order code		Order code of the connected sensor

17.1.2 Main value

The main value can be any parameter which is returned by one of the electrodes in the ISE-sensor.

Path: Menu/Setup/Inputs/ISE

Function	Options	Info
Main value	Options ▪ Ammonium ▪ Nitrate ▪ Potassium ▪ Chloride ▪ pH ▪ ORP **Factory setting** pH	Decide which parameter you want to display as the main value for the ISE channel. Here, you can only choose from the electrodes which you configured via the electrode slot menus. At the factory, this is equivalent to the types of electrode that are actually installed in the ISE sensor.

17.1.3 Damping of the temperature value

The damping causes a floating average curve of the measured values over the time specified.

Path: Menu/Setup/Inputs/ISE

Function	Options	Info
Damping temp.	0 to 300 s **Factory setting** 0 s	Specify the damping for the temperature measurement.

17.1.4 Manual hold

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.2 Extended setup

17.2.1 Temperature format

Path: Menu/Setup/Inputs/<Sensor type>/Extended setup

Function	Options	Info
Temperature format	Options ■ #.# ■ #.## **Factory setting** #.#	Select how many decimal places should be used to display the temperature.

17.2.2 Cleaning

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.2.3 Diagnostic behavior

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.2.4 Tag control

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.2.5 Sensor replacement

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.2.6 Data processing factory setting

--> "Inputs: General/Frequently occurring functions" section → 📄 85

17.3 Electrode slot menus

17.3.1 Electrode slot

A CAS40D sensor has 4 electrode slots in total. Consequently, each of these slots has its own menu.

Make settings:

- ▶ Define the parameter for the slot (only slots 2-4).
  The 1st slot is always designated to the pH electrode. There is no way you can select another parameter for this slot.
- ▶ You can complete and assign the other 3 slots as you prefer.
- ▶ Specify the measured variable that should be output. No options can be selected for pH which is why the "Measured variable" function is not available for this parameter.

Options displayed for "Measured variable" with the following parameters:				
pH	**Ammonium**	**Nitrate**	**Potassium**	**Chloride**
-	▪ NH4-N ▪ NH4	▪ NO3-N ▪ NO3	▪ K	▪ Cl

NOTICE

Electrode (hardware) incorrectly assigned to the software menu

Unreliable measured values and malfunctions in the measuring point could result

- ▶ When assigning the slot in the software, make sure it matches the assignment in the sensor.
- ▶ Example: You have connected the ammonium electrode to cable No. 2 in the sensor. In the "Slot 2:1 (ISE)" software menu then configure the ammonium parameter.

17.3.2 Damping

The damping causes a floating average curve of the measured values over the time specified.

Path: Menu/Setup/Inputs/ISE/Electrode slot

Function	Options	Info
Damping	0 to 600 s **Factory setting** 0 s	Specify the damping of the main value of the electrode assigned to the slot.

17.3.3 Extended setup

Main value format

If the measured variable of the electrode slot is not your main value for the ISE input, it will be displayed with all the measured values in the measuring mode.

Path: Menu/Setup/Inputs/ISE/Extended setup

Function	Options	Info
Main value format	Options ▪ # ▪ #.# ▪ #.## **Factory setting** #.##	Specify the number of decimal places for the measured variable of the electrode slot.

Compensation (only ammonium and nitrate)

Depending on the selectivity of the ion-selective electrode vis-à-vis other ions (interference ions), and the concentration of these ions, such ions could also be interpreted as part of the measuring signal and thus cause measuring errors.
When measuring in wastewater, the potassium ion which is chemically similar to the ammonium ion can cause higher measured values.
The measured values for nitrate can be too high due to high concentrations of chloride.
To reduce measuring errors resulting from such cross-interference, the concentration of the potassium or chloride interference ion can be measured and compensated for with a suitable additional electrode.

You can only configure an offset for the pH, chloride and potassium electrode. The settings to compensate for the effect of interference ions are only available for ammonium and nitrate.

Path: Menu/Setup/Inputs/ISE/Electrode slot/Compensation

Function	Options	Info
Compensation	Options ▪ Off ▪ On **Factory setting** Off	If you want to use the compensation function, you must have installed a compensation electrode (potassium or chloride) in another electrode slot and have configured it in the software.
Offset	-14.00 to 14.00 pH -100 to 100 mg/l **Factory setting** 0.00 pH 0.00 mg/l	The offset compensates for a difference between a laboratory measurement and an online measurement which is caused by interference ions. Enter this value manually. If you are using a compensation electrode, keep the offset at zero.

Path: Menu/Setup/Inputs/ISE/Electrode slot/Compensation

Function	Options	Info
Compensation type	Options ▪ Chloride ▪ pH ▪ Potassium ▪ pH and potassium **Factory setting** Chloride Potassium	The options depends on the parameter to be compensated. You compensate for chloride when using a nitrate electrode, while you can compensate for potassium and pH when using the ammonium electrode. The factory setting depends on the electrode used.
Comp. electrode	Select the slot	If you have installed and configured several compensation electrodes of the same type in the CAS40D sensor, you have to define which electrode is used for compensation here. Generally, you have a potassium or chloride electrode and Liquiline recognizes the right slot.
Selectivity coefficient	-10,00 ... 10,00 **Factory setting** -2.00 (chloride) -0.85 (potassium)	The coefficients are empirical values.
Mode	Options ▪ + ▪ - **Factory setting** -	The standard setting (-) corrects a measured value that is too high as a result of the effect of interference ions.

Calibration settings

Stability criteria

Path: Menu/Setup/Inputs/ISE/<Electrode slot>Extended setup/Calib. settings

Function	Options	Info
Stability criteria	Options ▪ Off ▪ Weak ▪ Medium ▪ Hard **Factory setting** Medium	In normal situations leave the stability criterion at "Medium".

Buffer recognition (only pH)

Path: Menu/Setup/Inputs/ISE/<Electrode slot>Extended setup/Calib. settings

Function	Options	Info
Buffer recognition	Options ▪ Fixed ▪ Manual **Factory setting** Fixed	**Fixed** You choose values from a list. This list depends on the setting for "Buffer manufacturer". **Manual** You enter any two buffer values. These must differ in terms of their pH value.
Buffer manufacturer	Options ▪ Endress+Hauser ▪ Ingold/Mettler ▪ DIN 19266 ▪ DIN 19267 ▪ Merck/Riedel ▪ Hamilton ▪ Special buffer **Factory setting** Endress+Hauser	Temperature tables are stored internally in the unit for the following pH values: ▪ Endress+Hauser 2,00 / 4,00 / 7,00 / *(9,00)* / 9,20 / 10,00 / 12,00 ▪ Ingold/Mettler 2,00 / 4,01 / 7,00 / 9,21 ▪ DIN 19266 1,68 / 4,01 / 6,86 / 9,18 ▪ DIN 19267 1,09 / 4,65 / 6,79 / 9,23 / 12,75 ▪ Merck/Riedel 2,00 / 4,01 / 6,98 / 8,95 / 12,00 ▪ Hamilton 1,09 / 1,68 / 2,00 / 3,06 / 4,01 / 5,00 / 6,00 7,00 / 8,00 / 9,21 / 10,01 / 11,00 / 12,00
You have the possibility of defining two buffers of your own with the "Special buffer" option. For this purpose, two tables are displayed in which you can enter value pH value/temperature value pairs.		

Standard addition (all except for pH)

The "Standard addition" calibration method is only available via the "Expert" menu, which can normally only be accessed by the Service Department.

Different types of calibration are available to calibrate an ion-selective electrode.
Initial settings are only required for the standard addition method.

Path: Menu/Setup/Inputs/ISE/<Electrode slot>Extended setup/Calib. settings

Function	Options	Info
▶ Standard addition		
Sampling volume	0.00 to 5000.00 ml **Factory setting** 1000.00 ml	Here, specify the sample volume which you use during the calibration.
Standard volume	0.00 to 100.00 ml **Factory setting** 1.00 ml	Volume of the added standard solution per addition step

Path: Menu/Setup/Inputs/ISE/<Electrode slot>Extended setup/Calib. settings

Function	Options	Info
Standard concentration	0.00 to 10.00 mol/l **Factory setting** 1.00 mol/l	Concentration of the standard solution
No. of steps	1 ... 4 **Factory setting** 3	Number of addition steps (=measuring points of the calibration function)

Calibration timer

You can specify the calibration interval for the sensor here.
Once the time configured elapses, the "Calibration timer" diagnostics message appears on the display.

The timer is reset automatically if you recalibrate the sensor.

Path: Menu/Setup/Inputs/ISE/<Slot>/Extended setup/Calib. settings

Function	Options	Info
Calibration timer	Options ▪ Off ▪ On **Factory setting** Off	Switches the function on or off
Calibration timer *Calibration timer="On"*	1 to 10000 h **Factory setting** 1000 h	Specify the time after which the timer should have timed out. Once this time has elapsed, the "Calib. Timer" diagnostics message, along with the code 102, appears on the display.

Diagnostics settings

This menu branch is used for specifying warning limits, and for defining whether and how diagnostics tools should be used.
The associated diagnostics code is displayed for every setting.

Process check system

--> "Inputs: General/Frequently occurring functions" section → 📄 85

Slope (only pH)

The slope characterizes the sensor condition. The bigger the deviation from the ideal value (100%, corresponds to -59 mV/pH) the poorer the condition of the sensor.

Path: Menu/Setup/Inputs/ISE/Extended setup/Diagnostics settings

Function	Options	Info
▶ Slope	80,00 ... 100,00 %	Specify your limit values for slope monitoring.
Warning limit	**Factory setting** 90,00 %	Associated diagnostics code and message text: 509 "Sensor calib."

Zero point (only pH)

The zero point characterizes the condition of the sensor reference. The bigger the deviation from the ideal value (pH 7.00) the poorer the condition. This can be caused by KCl dissolving away or reference contamination.

Path: Menu/Setup/Inputs/ISE/Extended setup/Diagnostics settings

Function	Options	Info
▶ Zero point *(pH glass)*	-10,00 ... 10,00	Specify your limit values for zero point or operating point monitoring.
Upper warning limit	**Factory setting** 2,50	Associated diagnostics code and message text: 505 "Sensor calib."
Lower warning limit	**Factory setting** -2,50	Associated diagnostics code and message text: 507 "Sensor calib."

Delta slope (only pH)

The device determines the difference in slope between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. The greater the change, the greater the wear experienced by the pH-sensitive glass membrane as a result of chemical corrosion or abrasion.

Path: Menu/Setup/Inputs/ISE/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta slope	0,50 … 10,00 %	Specify your limit values for monitoring the slope differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 2,5 %	Diagnostics code and associated message text: 518 "Sensor calib."

Delta zero point (only pH)

The device determines the difference between the last calibration and the penultimate calibration, and issues a warning or an alarm depending on the setting configured. The difference is an indicator for the condition of the sensor. The following applies to pH glass electrodes: The greater the change, the greater the wear experienced by the reference as a result of contaminating ions or KCl dissolving away.

Path: Menu/Setup/Inputs/ISE/Extended setup/Diagnostics settings

Function	Options	Info
▶ Delta zero point	0,00 … 5,00	Specify your limit values for monitoring the zero point or operating point differential.
Function	Options ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Factory setting** 1,00	Diagnostics code and associated message text: 520 "Sensor calib."

17.4 Limits operating hours

The total operating time of the sensor and its use under extreme conditions is monitored. If the operating time exceeds the defined threshold values, the device issues a corresponding diagnostics message.

Each sensor has a limited life expectancy which heavily depends on the operating conditions. If you specify warning limits for operating times under extreme conditions, you can guarantee the operation of your measuring point without any downtime by performing maintenance tasks in time.

Path: Menu/Setup/Inputs/ISE

Function	Options	Info
▶ Limits operating hours		Specify your limit values for monitoring the number of operating hours under extreme conditions.
The range of adjustment for the operating hours alarm and warning limits is generally 1 to 50000 h.		
Function	Options ▪ On ▪ Off **Factory setting** Off	**On** The operation of the sensor under extreme conditions is monitored, recorded in the sensor and diagnostics messages are displayed on the controller. **Off** No diagnostics messages. However, the time the sensor operates under extreme conditions is recorded in the sensor and can be read in the sensor information in the diagnostics menu.
▶ Operating time		Total operating time of the sensor
Warning limit	**Factory setting** 36000 h	Diagnostics code and associated message text: 199 "Operating time"
▶ Operation > 30°C		
Warning limit	**Factory setting** 36000 h	Diagnostics code and associated message text: 191 "Operating time"
▶ Operation > 40°C		
Warning limit	**Factory setting** 36000 h	Diagnostics code and associated message text: 192 "Operating time"

Index

E

F

G

I

L

M

N

O

P

S

T

U

Z

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