01.09.00

# Operating Instructions **Liquiline System CA80SI**

Colorimetric analyzer for silica





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## 1 About this document

## 1.1 Warnings

Structure of information	Meaning
Causes (/consequences) If necessary, Consequences of non-compliance (if applicable)  ► Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation <b>will</b> result in a fatal or serious injury.
<b>▲</b> WARNING	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation <b>can</b> result in a fatal or serious
Causes (/consequences) If necessary, Consequences of non-compliance (if applicable)  ► Corrective action	injury.
<b>A</b> CAUTION	This symbol alerts you to a dangerous situation.
Causes (/consequences) If necessary, Consequences of non-compliance (if applicable)  ▶ Corrective action	Failure to avoid this situation can result in minor or more serious injuries.
NOTICE	This symbol alerts you to situations which may result in damage to
Cause/situation If necessary, Consequences of non-compliance (if applicable)  ► Action/note	property.

## 1.2 Symbols

Additional information, tips
Permitted or recommended
Not permitted or not recommended
Reference to device documentation
Reference to page
Reference to graphic
Result of a step

## 1.3 Symbols on the device

 $\Lambda$ — $\square$  Reference to device documentation

Caution: Hazardous voltage

Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

## 1.4 Documentation

The following instructions complement these Operating Instructions and are available on the product pages on the Internet:

- Brief Operating Instructions Liquiline System CA80SI, KA01281C
- Operating Instructions Memosens, BA01245C
  - Software description for Memosens inputs
  - Calibration of Memosens sensors
  - Sensor-specific diagnostics and troubleshooting
- Guidelines for communication via fieldbus and web server
  - PROFIBUS, SD01188C
  - Modbus, SD01189C
  - Web server, SD01190C
  - EtherNet/IP, SD01293C

## 2 Basic safety instructions

## 2.1 Requirements for the personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.
- Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

#### 2.2 Intended use

The Liquiline System CA80SI is a wet-chemical analyzer for almost continuous determination of the concentration of silica in ultrapure water and boiler feedwater.

The analyzer is designed for use in the following applications:

- Ultrapure water
- Boiler feedwater
- Steam and condensate analysis
- Reverse osmosis
- Desalination systems

Use of the device for any purpose other than that described poses a threat to the safety of people and of the entire measuring system, and is therefore not permitted. The manufacturer is not liable for damage caused by improper or non-designated use.

## 2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:

- Installation quidelines
- Local standards and regulations
- Regulations for explosion protection

#### Electromagnetic compatibility

- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

## 2.4 Operational safety

#### Before commissioning the entire measuring point:

- 1. Verify that all connections are correct.
- 2. Ensure that electrical cables and hose connections are undamaged.
- 3. Do not operate damaged products, and protect them against unintentional operation.
- 4. Label damaged products as defective.

#### **During operation:**

► If faults cannot be rectified: products must be taken out of service and protected against unintentional operation.

#### **A** CAUTION

#### Activities while the analyzer is in operation

Risk of injury and infection from medium!

- ▶ Before you release any hoses, make sure that no actions, such as the pumping of sample, are currently running or are due to start shortly.
- ► Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.
- ▶ Wipe up any spilt reagent with a disposable tissue and rinse with clear water. Then dry the cleaned areas with a cloth.

#### **A** CAUTION

#### Risk of injury from door stop mechanism

► Always open the door fully to ensure the door stop engages properly.

### 2.5 Product safety

## 2.5.1 State-of-the-art technology

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed.

Devices connected to the analyzer must comply with the applicable safety standards.

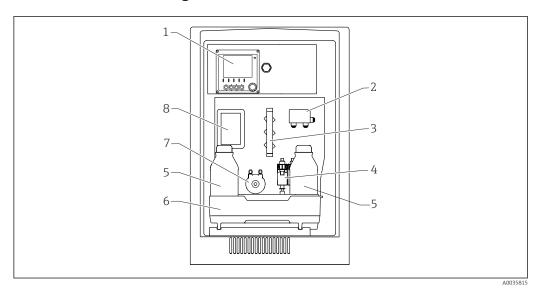
#### 2.5.2 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

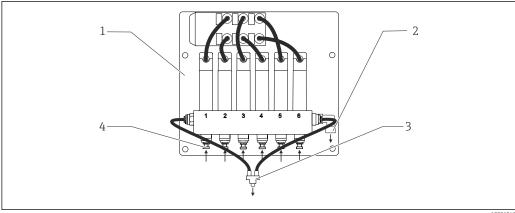
#### **Product description** 3

#### 3.1 Product design



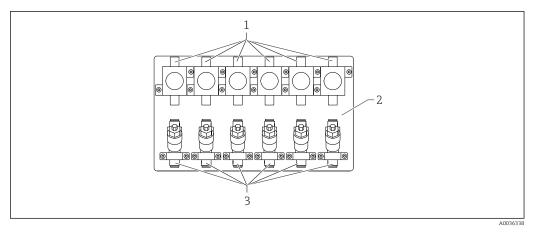
**■** 1 Example of a Liquiline System CA80SI 1-/2-channel version

- 1 Controller
- Sample channel switching (2-channel version)
- 3 Manifold
- Dispensers
- 4 5 Reagent bottle
- Bottle tray
- Peristaltic pump for dosing the standard
- Cover (in front of overflow cuvette and photometer)



**₽** 2  ${\it Example of a Liquiline System CA80SI: sample channel switching, 6-channel version}$ 

- Panel 1
- Overflow 2
- Sample infeed to analyzer
- Sample inlets

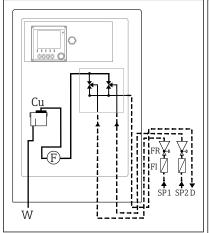


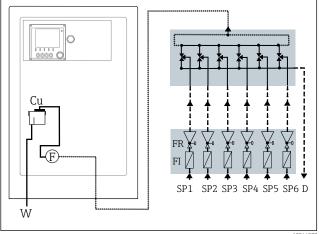
- **■** 3 Example of a Liquiline System CA80SI 4-/6-channel version: Panel with pressure relief valves and filter
- 1 Pressure relief valve
- 2 Panel
- 3 Filter

#### Measuring system 3.2

A complete measuring system comprises:

- Analyzer Liquiline System CA80SI with the configuration ordered
- reagents and standard solution (to be ordered separately)
- Filter and pressure relief valve (enclosed separately with angle brackets in 1-/2-channel version, mounted on panel in 4-/6-channel version)
- Panel for sample channel switching: 4 /6 sample inlets (4-/6-channel version)



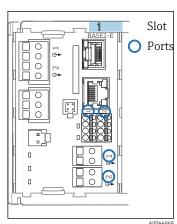


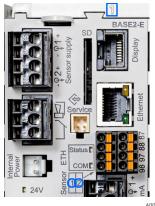
- € 4 1-/2-channel version: Measuring system with upstream pressure relief valves and filters
- 4-/6-channel version: Measuring system with upstream pressure relief valves and filters on panel and external sample channel switching on panel
- Overflow cuvette Си D Sample outlet
- Pressure relief valve FR
- F
- SPx Sample inlets, x = 1 to n
- Flow sensor
- W Outlet

FΙ Filter

## 3.3 Equipment architecture

#### 3.3.1 Slot and port assignment







■ 8 Slots and ports on the display

Analyzer measured value (parameter-specific)

■ 6 Slot and port assignment

■ 7 Slot and port assignment

• Inputs are assigned to measuring channels in the ascending order of the slots and ports. In the example above:

"CH1: 1:1 pH glass" means:

Channel 1 (CH1) is slot 1 (basic module): Port 1 (input 1), pH glass sensor

- Outputs and relays are named according to their function, e.g. "current output", and are displayed in ascending order with the slot and port numbers
- Display shows SP1: analyzer measuring channel 1 with sampling point SP1 (measured value display is parameter-specific; is not illustrated in the example)

#### 3.3.2 Terminal diagram

The unique terminal name is derived from:

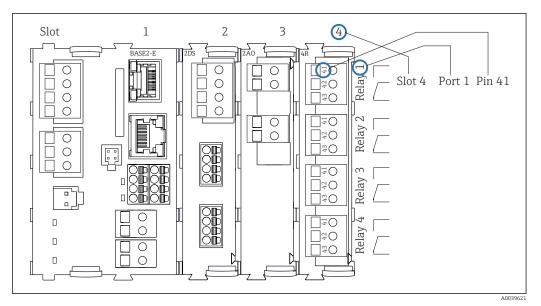
Slot no. : Port no. : Terminal

#### Example, NO contact of a relay

Device with 4 inputs for digital sensors, 4 current outputs and 4 relays

- Base module BASE2-E (contains 2 sensor inputs, 2 current outputs)
- 2DS module (2 sensor inputs)
- 2AO module (2 current outputs)
- 4R module (4 relays)

Product description



 $\blacksquare$  9 Creating a terminal diagram using the example of the NO contact (terminal 41) of a relay

## 4 Incoming acceptance and product identification

## 4.1 Incoming acceptance

- 1. Verify that the packaging is undamaged.
  - Notify the supplier of any damage to the packaging.

    Keep the damaged packaging until the issue has been resolved.
- 2. Verify that the contents are undamaged.
  - Notify the supplier of any damage to the delivery contents. Keep the damaged goods until the issue has been resolved.
- 3. Check that the delivery is complete and nothing is missing.
  - ► Compare the shipping documents with your order.
- 4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
  - The original packaging offers the best protection.

    Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.

#### **NOTICE**

#### Incorrect transportation can damage the analyzer

▶ Always use a lifting truck or a fork-lift to transport the analyzer.

#### 4.2 Product identification

#### 4.2.1 Nameplate

Nameplates can be found:

- On the inside of the door on the bottom right, or on the front in the bottom right-hand corner
- On the packaging (adhesive label, portrait format)

The nameplate provides you with the following information on your device:

- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Firmware version
- Ambient and process conditions
- Input and output values
- Measuring range
- Activation codes
- Safety information and warnings
- Certificate information
- Approvals as per order version
- ► Compare the information on the nameplate with the order.

#### 4.2.2 Product identification

#### Product page

www.endress.com/ca80si

#### Interpreting the order code

The order code and serial number of your product can be found in the following locations:

- On the nameplate
- In the delivery papers

#### Obtaining information on the product

- 1. Go to www.endress.com.
- 2. Page search (magnifying glass symbol): Enter valid serial number.
- 3. Search (magnifying glass).
  - The product structure is displayed in a popup window.
- 4. Click the product overview.
  - A new window opens. Here you fill information pertaining to your device, including the product documentation.

#### 4.2.3 Manufacturer address

Endress+Hauser Conducta GmbH+Co. KG Dieselstraße 24 D-70839 Gerlingen

## 4.3 Scope of delivery

#### Scope of delivery

- 1 analyzer in the version ordered with optional hardware
- 1 x Brief Operating Instructions (hard copy)
- Accessories enclosed:
  - Wall holder unit
  - Magnetic stir bar (for installation in cuvette)
  - 10 ml dispenser with hose (for draining cuvette and sample channel)
  - SD card (optional)
  - Supply hose
  - Sample outlet hose (for sample overflow)
  - Outlet hose (for overflow at cuvette)
  - 2 m Norprene hose ID 1.6 mm (for large reagent set)
  - Cable gland M32 PA (for large reagent set)
  - Counter nut M32 PA (for large reagent set)
  - O-ring ID 29.00 W 3.00 (for large reagent set)
  - Drain plug M32x1.5 with hole 4.9 (for large reagent set)

	1-channel	2-channel	4-channel	6-channel
Filters and pressure relief valves	1 filter, 1 pressure relief valve with angle bracket	2 filters, 2 pressure relief valves with angle brackets	Panel with 4 pre- installed filters and 4 pre-installed pressure relief valves	Panel with 6 pre- installed filters and 6 pre-installed pressure relief valves
Sample channel switching	in analyzer	in analyzer	pre-installed on panel	pre-installed on panel

#### ► If you have any gueries:

Please contact your supplier or local sales center.

Liquiline System CA80SI Mounting

## 5 Mounting

#### **A** CAUTION

Incorrect transportation can cause injury and damage the device

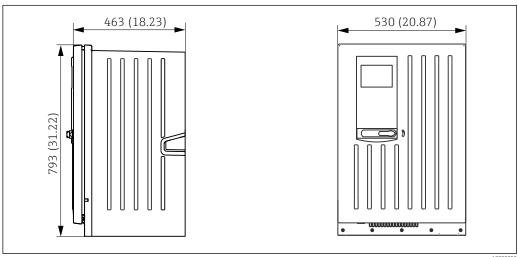
- Always use a lifting truck or a fork-lift to transport the analyzer. Two people are needed for the installation.
- ▶ Lift the device by the recessed grips.

## 5.1 Mounting requirements

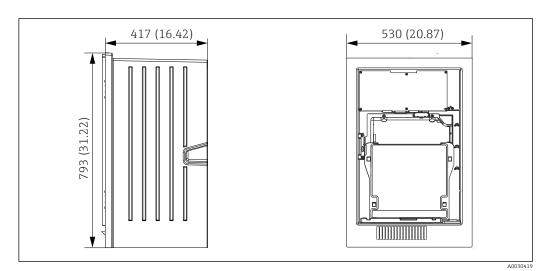
The device can be installed in the following ways:

- Mounted on a wall
- Mounted on a base

#### 5.1.1 Dimensions



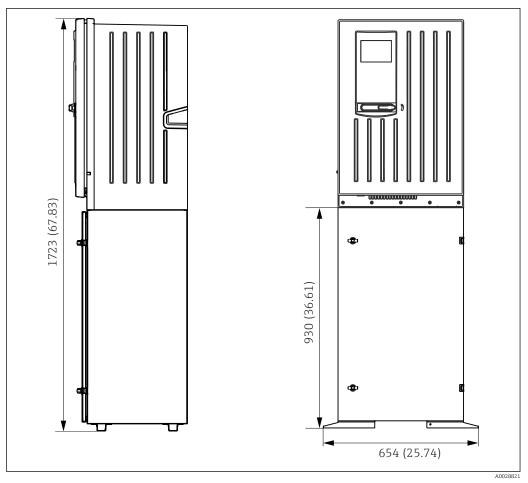
10 Liquiline System CA80 closed version, dimensions in mm (in)



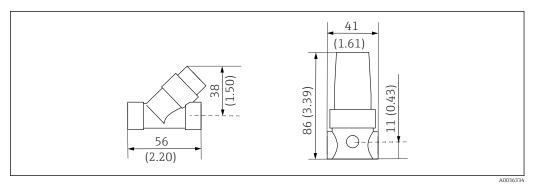
■ 11 Liquiline System CA80 open version, dimensions in mm (in)

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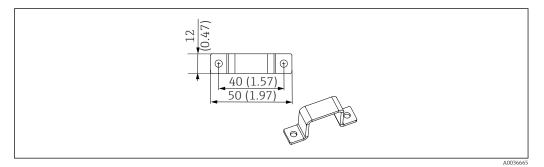
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 $\blacksquare$  12 Liquiline System CA80 with base, dimensions in mm (in)



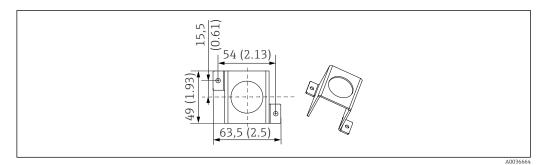
■ 13 CA80SI 1-/2-channel version: Filter (left), pressure-reducing valve (right), dimensions in mm (in)



Dimensions of angle bracket for filter

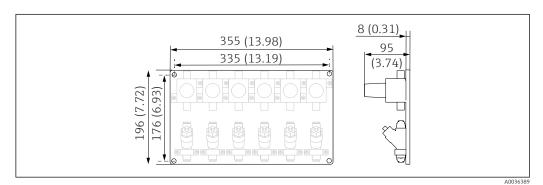
-- Fasteners (2 x M5)

Liquiline System CA80SI Mounting

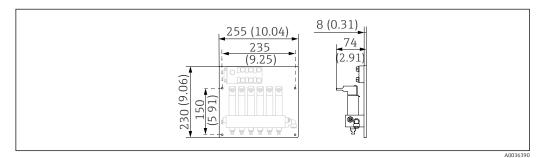


15 Dimensions of angle bracket for pressure relief valve

--- *Fasteners* (2 x M5)



16 CA80SI 4-/6-channel version: Panel with pressure-reducing valves and filters, dimensions in mm (in)



■ 17 CA80SI 4-/6-channel version: Panel with sample channel switching, dimensions in mm (in)

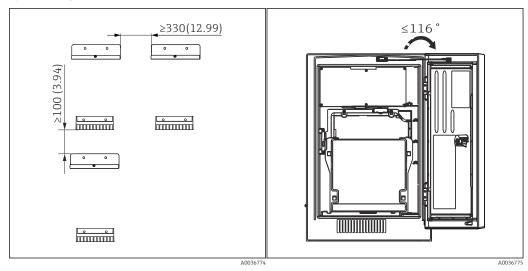
#### 5.1.2 Mounting location

Note the following when erecting the device:

- ► If mounting on a wall, make sure that the wall has sufficient load-bearing capacity and is fully perpendicular.
- ▶ If mounting on a base, erect the device on a level surface.
- Protect the device against additional heating (e.g. from a heating system).
- ▶ Protect the device against mechanical vibrations.
- ► Protect the device against corrosive gases, e.g. hydrogen sulfide (H<sub>2</sub>S) and chlorine gases.
- ► Make sure to pay attention to the maximum height difference and the maximum distance from the sampling point.
- ► Ensure that sample outlet hose "D" and outlet hose "W" can drain freely , without any siphoning effects.
- ▶ Make sure air can circulate freely at the front of the housing.
- ▶ Open analyzers (i.e. analyzers that are supplied without a door) may only be erected in closed areas or in a protective cabinet or similar facility.

#### 5.1.3 Spacing requirements when mounting

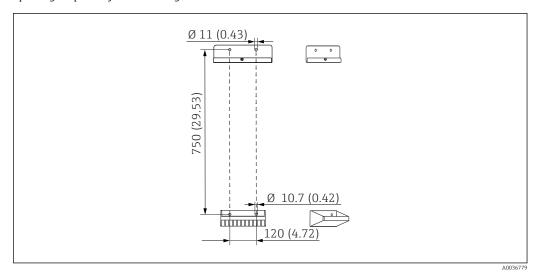
Spacing required for installing analyzer



Minimum spacing required for mounting. Engineering unit mm (in).

■ 19 Maximum opening angle

Spacing required for installing wall-mount version



■ 20 Holder unit dimensions. Engineering unit mm (in)

## 5.2 Mounting the analyzer

#### 5.2.1 Mounting the analyzer on a wall

#### **A** CAUTION

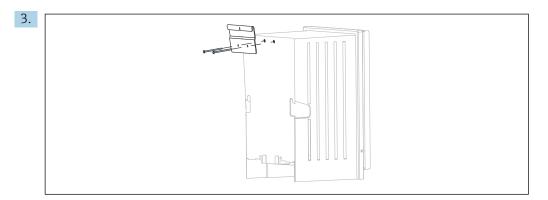
Incorrect installation can cause injury and damage the device

▶ If mounting on a wall, check that the analyzer is fully hooked into the wall holder unit at the top and bottom, and secure the analyzer to the upper wall holder unit using the securing screw.

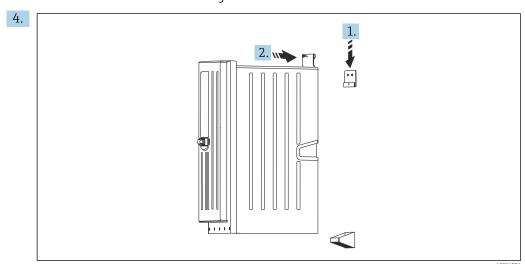
The mounting materials required to secure the device to the wall are not supplied.

- 1. Provide the mounting materials to secure the device to the wall (screws, wall plugs) onsite.
- 2. Mount the wall holder unit (2 parts) on the wall.

Liquiline System CA80SI Mounting



Secure the mount on the housing.



Hook the analyzer into the wall holder unit (1).

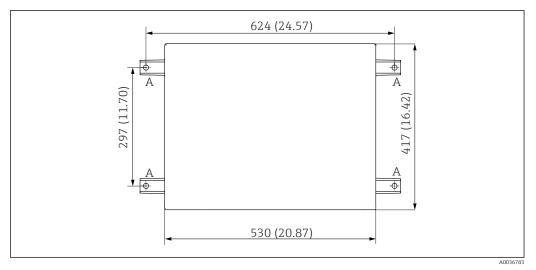
5. Fix the mount and wall holder unit in place with the screw supplied (2).

## 5.2.2 Installing version with analyzer stand

#### **A** CAUTION

Incorrect installation can cause injury and damage the device

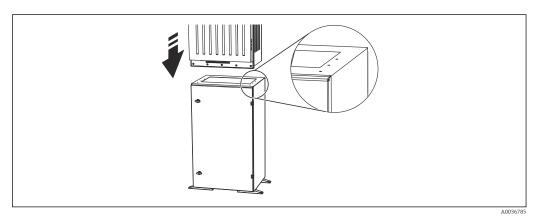
► If using the version with analyzer stand, make sure that the analyzer stand is secured to the floor.



■ 21 Foundation plan

A Fasteners (4 x M10)

--- Dimensions of Liquiline System CA80

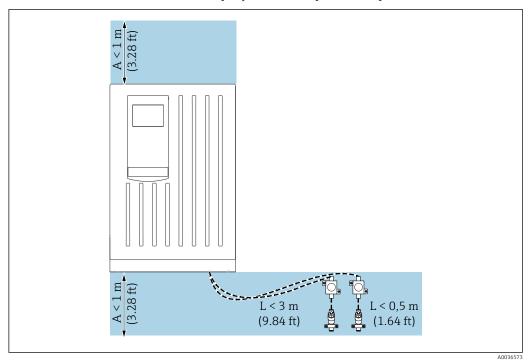


- 1. Screw the base to the ground.
- 2. With 2 people, lift the analyzer and fit it on the base. Use the recessed grips.
- 3. Secure the base to the analyzer using the 6 screws supplied.

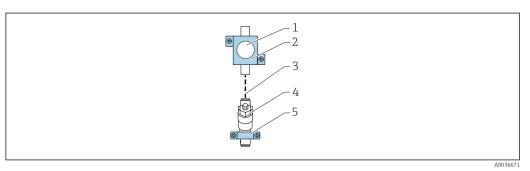
Liquiline System CA80SI Mounting

#### 5.2.3 1-/2-channel version: Installing pressure relief valve and filter

1-/2-channel device: Installation area for pressure relief valve and filter

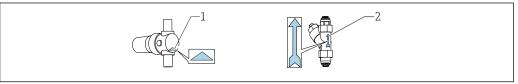


23 Permitted installation area, engineering unit m (ft)



eals 24 Installing angle brackets for pressure relief valve and filter

- 1 Pressure relief valve
- 2 Angle bracket for pressure relief valve
- 3 Hose piece (polyurethane hose, length should be < 0.5 m (1.64 ft))
- 4 Filter
- 5 Angle bracket for filter



A0045935

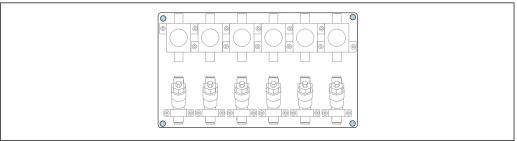
- Correct flow direction of the pressure relief valve (indicated by triangle on pressure relief valve)
- 2 Correct flow direction of filter (indicated by arrow on filter)
- 1. Cut hose piece (polyurethane hose) to the required length (< 0.5 m (1.64 ft)).
- 2. Mount pressure relief valve in angle bracket: Unscrew coupling nut, guide pressure relief valve through round opening, screw coupling nut back on.
- 3. Attach the hose piece to the push-in connector of the pressure relief valve.

- 4. Mount the pressure relief valve on a level surface, e.g. on a panel. Note the direction of flow.
- 5. Mount the filter with the angle bracket on a level surface, e.g. on a panel. Note the direction of flow. Connect the hose piece from the pressure relief valve to the push-in connector of the filter.

## 5.2.4 4-/6-channel version: Installing panel with pressure relief valves and filters

Mounting materials are not supplied.

▶ Provide the mounting materials onsite.



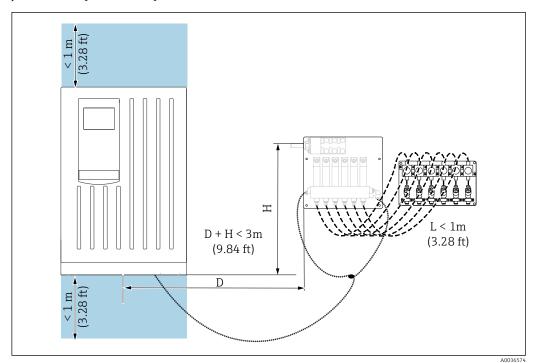
A003634

■ 25 Panel with pressure relief valves and filters

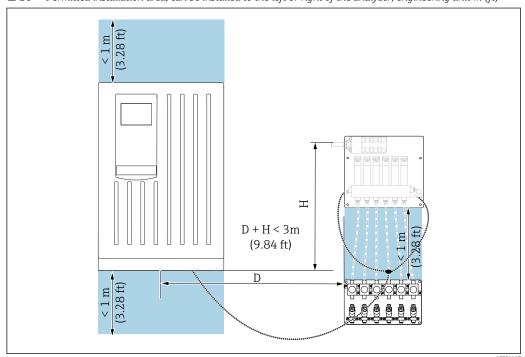
22

Liquiline System CA80SI Mounting

4-/6-channel device: Installation area for sample channel switching and panel with pressure relief valves and filters



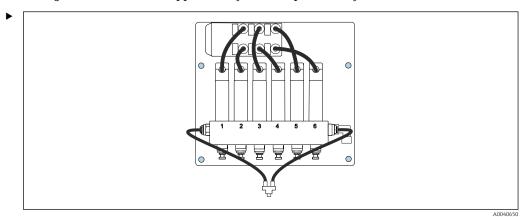
 $\blacksquare$  26 Permitted installation area, can be installed to the left or right of the analyzer, engineering unit m (ft)



■ 27 Permitted installation area, engineering unit m (ft)

## 5.2.5 4-/6-channel version: Installing panel with sample channel switching

Mounting materials are not supplied; they must be provided by the customer onsite.



Mount the panel via the mounting boreholes (blue).

Panel dimensions  $\rightarrow \triangleq 17$ 

## 5.3 Post-mounting check

After mounting, check all the connections to ensure they are secure.

### 6 Electrical connection

#### **▲** WARNING

#### Device is live!

Incorrect connection may result in injury or death!

- ▶ The electrical connection may be performed only by an electrical technician.
- ► The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ **Prior** to commencing connection work, ensure that no voltage is present on any cable.
- ▶ Before establishing the electrical connection, verify that the pre-installed power cable meets the local national electrical safety specifications.

## 6.1 Connecting requirements

Power supply cable	Power supply cable with safety plug Cable length 4.3 m (14.1 ft) Order version CA80xx-CA (CSA C/US General Purpose): Power supply cable as per North American standard
Mains voltage	The maximum mains voltage fluctuation may not be more than $\pm 10\%$ of the values indicated on the nameplate.
Analog, signal and transmission lines	e.g. LiYY 10 x 0.34 mm <sup>2</sup>

## 6.2 Connecting the analyzer

#### NOTICE

#### The device does not have a power switch

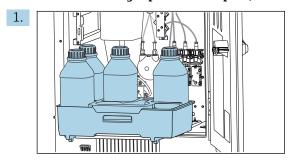
- ► You must install the device near (distance < 3 m (10 ft)) an easily accessible and fused plug socket so that it can be disconnected from the power supply.
- ► Comply with the instructions for protective grounding when installing the analyzer.

#### 6.2.1 Routing the cable in the connection compartment

The analyzer is supplied with a pre-installed power cable.

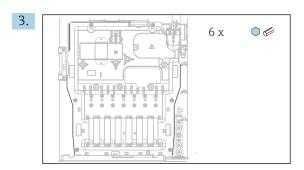
- For cabinet versions, the cable length is approx. 4.3 m (14.1 ft) from the base of the housing.
- For analyzer stands, the cable length is approx. 3.5 m (11.5 ft) from the foundation.

#### Connection of analog inputs and outputs, Memosens sensors or digital fieldbuses

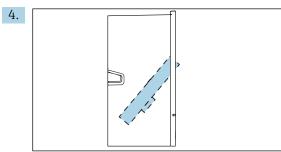


Remove the bottle tray: Lift up the recessed grip slightly and pull it towards the front.

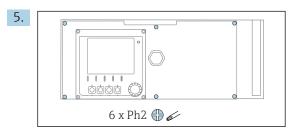
2. Remove all liquid-bearing sample lines.



Release the 6 screws on the carrier board using a Torx screwdriver (T25).



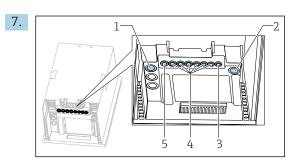
Fold out the carrier board towards the front and remove.



Release the 6 screws on the electronics compartment cover using a Phillips-head screwdriver and fold out the cover towards the front.

#### 6. Only for order versions with G or NPT glands:

Replace the pre-installed M-thread cable glands with the G or NPT cable glands that are enclosed. This does not affect the M32 hose glands.



- 1 Sample outlet hose "D" and either sample inlet hose SP1 and SP2 (1-/2-channel version) or SPx (4-/6-channel version)
- 2 Outlet hose "W"
- 3 4-/6-channel version: Cable connection for panel
- 4 Connections for sensors, signal lines
- 5 Power cable (factory-connected)

Guide the cables through the cable glands on the bottom of the device.

#### For all versions

8. Route the cables on the rear panel of the device so that they are properly protected. Use cable clips.

26

9. Guide the cable to the electronics compartment.

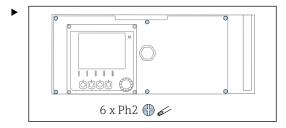
#### After connecting:

- 1. Secure the electronics compartment cover with the 6 screws.
- 2. Fold up the carrier board and use the 6 screws to secure it after connecting.
- 3. Tighten the cable glands on the bottom of the device to secure the cables.
- 4. Place the bottle tray back into the housing.

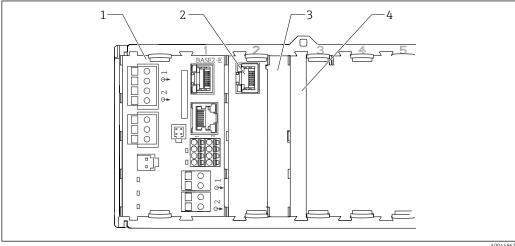
#### 6.3 Connecting the sensors and additional modules

#### 6.3.1 Overview of connection compartment in the controller housing

The controller has a separate connection compartment.



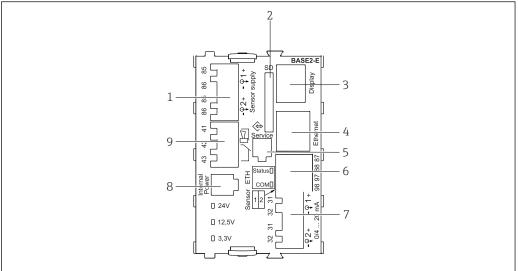
Release the 6 screws on the electronics compartment cover using a Phillips-head screwdriver and fold out the cover towards the front.



Connection compartment in the controller housing

- Base module Base2-E
- Analyzer interface
- Dummy cover
- Module cover

#### Base module E



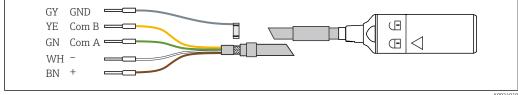
Δ00422

#### ■ 29 BASE2-E

- 1 Power supply for digital fixed cable sensors with Memosens protocol
- 2 SD card slot
- 3 Slot for display cable 1)
- 4 Ethernet interface
- 5 Service interface
- 6 Connections for 2 Memosens sensors
- 7 Current outputs
- 8 Socket for internal power supply cable 1)
- 9 Alarm relay connection

#### 6.3.2 Connecting the sensors

Only use terminated original cables where possible.



A0024019

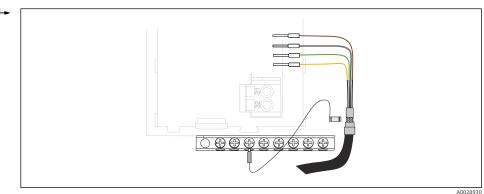
■ 30 Example of a Memosens CYK10 data cable

#### Connecting the ferrules of the sensor cable to the base module E

- 1. To access the electronics compartment, proceed as described in the "Routing the cables" section .
- 2. Guide the sensor connecting cable from below through the cable gland on the inner rear panel of the device and feed it up into the electronics compartment.
- 3. Establish the connection as per  $\rightarrow \blacksquare 30$ ,  $\blacksquare 28$ .

<sup>1)</sup> Internal device connection. Do not disconnect the plug!

4. Ground the outer shield of the cable via the metal gland on the grounding rail below the base module E.



■ 31 Terminal strip

#### 6.3.3 Connecting additional inputs, outputs or relays

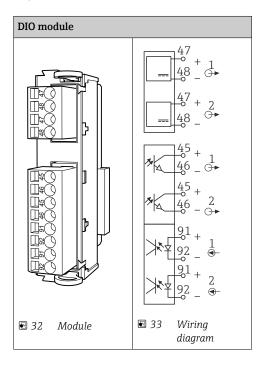
#### **A** WARNING

#### Module not covered

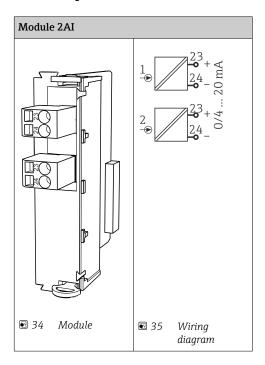
No shock protection. Danger of electric shock!

- ► Change or extend the hardware for the **non-hazardous area**: always fill the slots from left to right. Do not leave any gaps.
- ▶ If all of the slots are not occupied in the case of devices for the **non-hazardous area**: always insert a dummy cover or end cover in the slot to the right of the last module → 28, 27. This ensures that the unit is shock-protected.
- ► Always ensure shock protection is guaranteed particularly in the case of relay modules (2R, 4R, AOR).
- ▶ Hardware for the **hazardous area** may not be modified. Only the Manufacturer's Service Team may convert a certified device to another certified device version. This includes all modules of the transmitter with an integrated 2DS Ex-i module, as well as changes that concern non-intrinsically safe modules.
- ► If additional shields are required, connect them with PE centrally in the control cabinet via terminal blocks supplied by the customer.

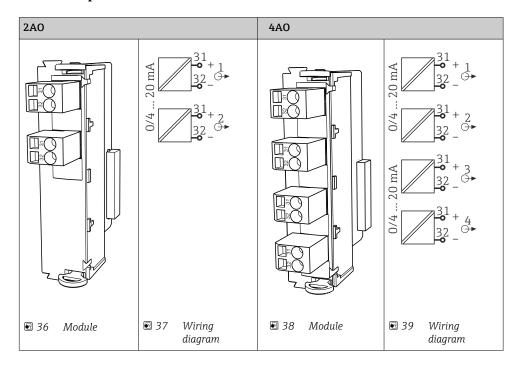
#### Digital inputs and outputs



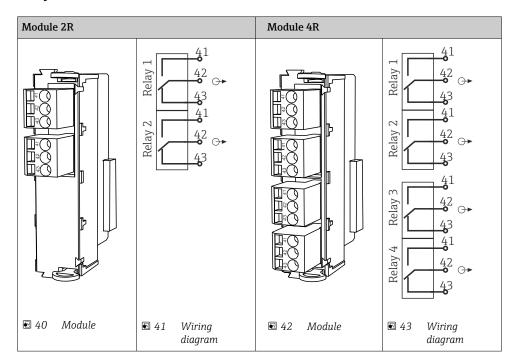
#### **Current inputs**



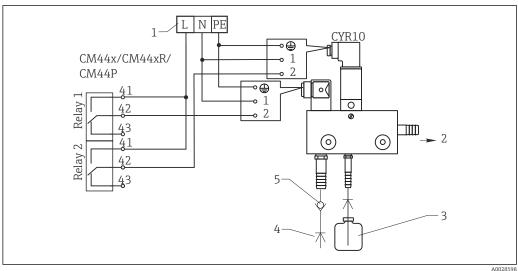
#### **Current outputs**



#### Relays



Example: Connecting the Chemoclean CYR10 injector cleaning unit

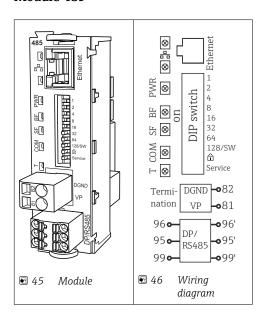


**₽** 44 Connecting the CYR10 injector cleaning unit

- 1 External power supply
- 2 Cleaner to spray head
- 3 Container with cleaner
- 4 Motive water 2 to 12 bar (30 to 180 psi)
- Backflow valve (to be provided by the customer)

## 6.3.4 Connecting digital communication

#### Module 485



Terminal	PROFIBUS DP	Modbus RS485
95	A	В
96	В	A
99	Not connected	С
82	DGND	DGND
81	VP	VP

#### LEDs on front of module

LED	Identifier	Color	Description
RJ45	LNK/ACT	GN	RJ45 is disabled. Ethernet communication is via the BASE2 module
RJ45	10/100	YE	
PWR	Power	GN	Supply voltage is applied and module is initialized
BF	Bus failure	RD	Bus failure
SF	System failure	RD	Device error
COM	Communication	YE	Modbus message sent or received
Т	Bus termination	YE	<ul><li>Off = No termination</li><li>On = Termination is used</li></ul>

## DIP switches on front of module

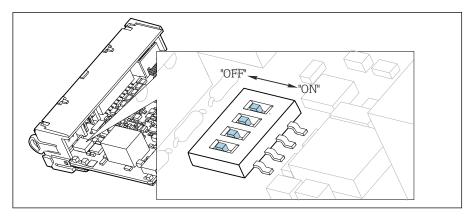
DIP	Factory setting	Assignment
1-128	ON	Bus address (→ "Commissioning/communication")
۵	OFF	Write protection: "ON" = configuration not possible via the bus, only via local operation
Service	OFF	The switch has no function

## 6.4 Hardware settings

#### 6.4.1 Bus termination (module 485 only)

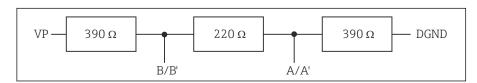
There are 2 ways to terminate the bus:

1. Internal termination (via DIP switch on module board)



■ 47 DIP switch for internal termination

- ▶ Using a suitable tool such as a tweezer, move all four DIP switches to the "ON" position.
  - **└** The internal termination is used.



■ 48 Structure of internal termination

#### 2. External termination

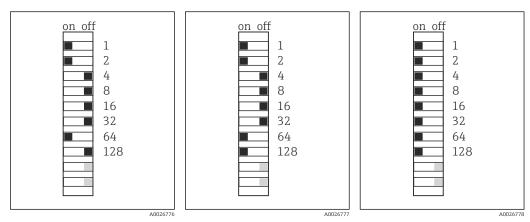
Leave the DIP switches on the module board in the "OFF" position (factory setting).

- ► Connect the external termination to terminals 81 and 82 on the front of module 485 for 5-V power supply.
  - ► The external termination is used.

#### 6.4.2 Bus address

#### Setting the bus address

- 1. Open the housing.
- 2. Set the desired bus address via the DIP switches of module 485.
- For PROFIBUS DP, valid bus addresses are anything between 1 and 126, and anything between 1 and 247 for Modbus. If you configure an invalid address, software addressing is automatically enabled via the local configuration or via the fieldbus.



🛮 49 Valid PROFIBUS address 67 📵 50 Valid Modbus address 195 📵 51 Invalid address 255 1)

## 6.5 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

► Exercise care when carrying out the work.

Individual types of protection permitted for this product (impermeability (IP), electrical safety, EMC interference immunity, Ex protection) can no longer be guaranteed if, for example:

- Covers are left off
- Different power units to the ones supplied are used
- Cable glands are not sufficiently tightened (must be tightened with 2 Nm (1.5 lbf ft) for the permitted level of IP protection)
- Unsuitable cable diameters are used for the cable glands
- Modules are not fully secured
- The display is not fully secured (risk of moisture entering due to inadequate sealing)
- Loose or insufficiently tightened cables/cable ends
- Conductive cable strands are left in the device

#### 6.6 Post-connection check

#### **A** WARNING

#### **Connection errors**

The safety of people and of the measuring point is at risk! The manufacturer does not accept any responsibility for errors that result from failure to comply with the instructions in this manual.

▶ Put the device into operation only if you can answer **yes** to **all** the following questions.

Device condition and specifications

► Are the device and all the cables free from damage on the outside?

#### Electrical connection

- ► Are the mounted cables strain relieved?
- ▶ Are the cables routed without loops and cross-overs?
- ► Are the signal cables correctly connected as per the wiring diagram?
- ► Are all plug-in terminals securely engaged?
- ▶ Are all the connection wires securely positioned in the cable terminals?

<sup>1)</sup> Order configuration, software addressing is active, software address configured at the factory: PROFIBUS 126, Modbus 247

## **7** System integration

## 7.1 Overview of device description files

#### 7.1.1 Device identification

→ 🖺 159, protocol-specific data

#### 7.1.2 Source for device description and device master files

#### Downloading device drivers

- 1. Go to the website: www.endress.com/downloads.
  - ► A dropdown list is displayed.
- 2. Select: device driver.
- 3. Narrow your search by specifying the driver type, product root and communication protocol.
- 4. Search.
- 5. Click the suitable entry from the list of hits.
  - You receive the download links including an extended description.

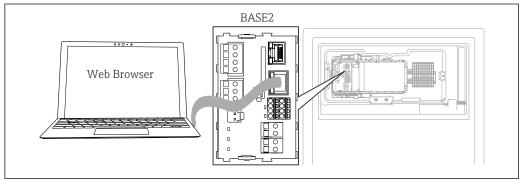
## 7.2 Integrating the measuring device into the system

#### 7.2.1 Web server

Yersions without fieldbus: An activation code is required for the web server.

#### Connection

► Connect the communication cable of the computer to the Ethernet port of the BASE2 module.



■ 52 Web server/Ethernet connection

#### Establishing the data connection

All versions with the exception of PROFINET:

To ensure that your device has a valid IP address, you must disable the **DHCP** parameter in the Ethernet settings. (**Menu/Setup/General settings/Extended setup/Ethernet/Settings**)

You can assign the IP address manually in the same menu (for point-to-point connections).

Endress+Hauser 35

A004487

*All versions including PROFINET:* 

You will find the IP address and subnet mask of the device under: **DIAG/System information/Ethernet**.

- 1. Start your PC.
- 2. First, configure a manual IP address in the network connection settings of the operating system.

#### **Example: Microsoft Windows 10**

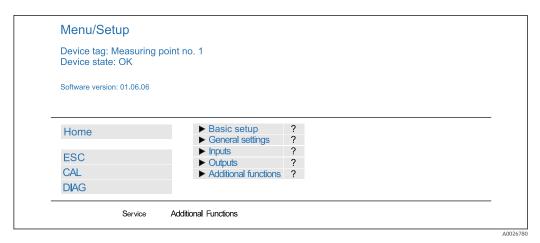
- 3. Open Network and Sharing Center.
  - Apart from your standard network, you should see an additional Ethernet connection (e.g. as an "unidentified network").
- 4. Select the link to this Ethernet connection.
- 5. In the pop-up window select the "Properties" button.
- 6. Double-click "Internet Protocol Version 4 (TCP/IPv4)".
- 7. Select "Use the following IP Address".
- 8. Enter the desired IP address. This address must be in the same subnet as the IP address of the device, e.g.:
  - ► IP address for Liquiline: 192.168.1.212 (as configured previously) IP address for PC: 192.168.1.213.
- 9. Start the Internet browser.
- **10.** If you use a proxy server to connect to the Internet: Disable the proxy (browser settings under "Connections/LAN settings").
- 11. Enter the IP address of your device in the address bar (192.168.1.212 in the example).
  - The system takes a few moments to establish the connection and then the CM44 web server starts. You might be asked for a password. The factory setting is "admin" for the user name and "admin" for the password.
- 12. Enter the following address(es) to download logbooks:
  - → 192.168.1.212/logbooks\_csv.fhtml (for logbooks in CSV format) 192.168.1.212/logbooks\_fdm.fhtml (for logbooks in FDM format)
- Downloads in FDM format can be securely transmitted, saved and visualized with Endress+Hauser's "Field Data Manager Software".

(→ www.endress.com/ms20)

#### Operation

The menu structure of the web server corresponds to the onsite operation.

36



■ 53 Example of web server (menu/language=English)

• Clicking a menu name or a function corresponds to pressing the navigator.

- You can make your settings conveniently via the computer keyboard.
- Instead of using an Internet browser, you can also use FieldCare for configuration via Ethernet. The Ethernet DTM required for this is an integral part of the "Endress +Hauser Interface Device DTM Library".

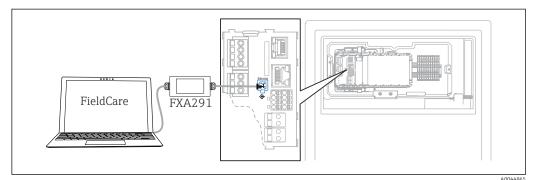
Download: https://portal.endress.com/webdownload/FieldCareDownloadGUI/

### 7.2.2 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.

#### Connection

- 1. Connect the service connector to the interface on the Liquiline base module and connect it to the Commubox.
- 2. Connect the Commubox via the USB connection to the computer on which FieldCare is installed.



**■** 54 Connection overview

#### Establishing the data connection

- 1. Start FieldCare.
- 2. Establish a connection to the Commubox. To do so, select the "CDI Communication FXA291" ComDTM.
- 3. Then select the "Liquiline CM44x" DTM and start configuration.

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. On both sides it is possible to take away access from the other side.

#### Operation

- In the DTM the menu structure corresponds to the onsite operation. The functions of the Liquiline soft keys are found in the main window on the left.
- Clicking a menu name or a function corresponds to pressing the navigator.
- You can make your settings conveniently via the computer keyboard.
- You can use FieldCare to save logbooks, make backups of configurations and transfer configurations to other devices.
- You can also print out configurations or save them as PDFs.

#### 7.2.3 Fieldbus systems

#### PROFIBUS DP

With the fieldbus module 485 and the appropriate device version, you can communicate via PROFIBUS DP.

Connect the PROFIBUS data cable to the terminals of the fieldbus module as described → 🖺 32.



For detailed information on "PROFIBUS communication", see the product pages on the Internet ( $\rightarrow$  SD01188C).

#### Modbus

With the fieldbus module 485 and the appropriate device version, you can communicate via Modbus RS485.

You use the BASE2 module for Modbus TCP.

The RTU and ASCII protocols are available when connecting via Modbus RS485. You can switch to ASCII on the device.

▶ Connect the Modbus data cable to the terminals of the fieldbus module (RS 485) or to the RI45 socket of the BASE2 module (TCP) as described.



For detailed information on "Modbus communication", see the product pages on the Internet ( $\rightarrow$  SD01189C).

### EtherNet/IP

With the BASE2 module and the appropriate device version, you can communicate via EtherNet/IP.

► Connect the EtherNet/IP data cable to the RJ45 socket of the BASE2 module.



For detailed information on "Ethernet/IP communication", see the product pages on the Internet ( $\rightarrow$  SD01293C).

# PROFINET

With the BASE2 module and the appropriate device version, you can communicate via PROFINET.

► Connect the PROFINET data cable to the RJ45 socket of the BASE2 module.

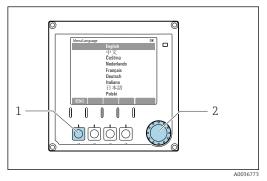


For detailed information on "PROFINET communication", see the product pages on the internet ( $\rightarrow$  SD02490C).

Liquiline System CA80SI Operation options

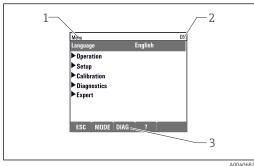
# 8 Operation options

# 8.1 Structure and function of the operating menu



■ 55 Display (example)

- 1 Soft key (press function)
- 2 Navigator (jog/shuttle and press/hold function)



■ 56 Display (example)

- 1 Menu path and/or device designation
- 2 Status indicator
- 3 Assignment of soft keys, ESC: Go back, MODE: Fast access to frequently used functions, DIAG: Link to Diagnostics menu ?: Help, if available

# 8.2 Access to the operating menu via the local display

# 8.2.1 Locking or unlocking operating keys

#### Locking operating keys

- 1. Press the navigator for longer than 2 s.
  - A context menu for locking the operating keys is displayed.
    You have the choice of locking the keys with or without password protection.
    "With password" means that you can only unlock the keys again by entering the correct password. Set this password here: Menu/Setup/General settings/Extended setup/Data management/Change key lock password.
- 2. Select whether to lock keys with or without a password.
  - ► The keys are locked. No more entries can be made. In the soft key bar, you will see the fisymbol.
- The password is 0000 when the device is delivered from the factory. **Make sure to note down any changes to the password,** as otherwise you will not be able to unlock the keypad yourself.

### Unlocking operating keys

- 1. Press the navigator for longer than 2 s.
  - A context menu for unlocking the operating keys is displayed.
- 2. Key unlock .
  - The keys are unlocked immediately if you did not choose to lock with a password. Otherwise you are asked to enter your password.
- 3. Only if keypad is password-protected: enter the right password.
  - The keys are unlocked. It is possible to access the entire onsite operation again. The  $\hat{\Pi}$  symbol is no longer visible on the display.

# 8.2.2 Configuration options

#### Display only

- You can only read the values but cannot change them.
- Typical read-only values are: analyzer data, sensor data and system information
- Example: Menu/Setup/Analyzer/../Measuring parameter

#### **Picklists**

- You receive a list of options. In a few cases, these also appear in the form of multiple choice boxes.
- Usually you just select one option; in rare instances you select one or more options.

#### Numerical values

- You are changing a variable.
- The maximum and minimum values for this variable are shown on the display.
- Configure a value within these limits.

#### Actions

- You trigger an action with the appropriate function.
- You know that the item in question is an action if it is preceded by the following symbol:
- Examples of typical actions include:
  - Deleting log entries
  - Saving or loading configurations
  - Triggering cleaning programs
- Example: Menu/Operation/Manual operation

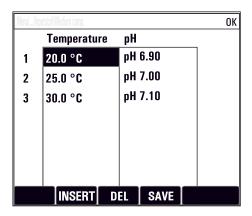
# User-defined text

- You are assigning an individual designation.
- Enter a text. You can use the characters in the editor for this purpose (upper-case and lower-case letters, numbers and special characters).
- Using the soft keys, you can:
  - Cancel your entries without saving the data (🗷)
  - Delete the character in front of the cursor (※)
  - Move the cursor back one position (←)
  - Finish your entries and save (



#### **Tables**

- Tables are needed to map mathematical functions.
- You edit a table by navigating through rows and columns with the navigator and changing the values of the cells.
- You only edit the numerical values. The controller automatically takes care of the engineering units.
- You can add rows to the table (INSERT soft key) or delete them (DEL soft key).
- Afterwards, you save the table (**SAVE** soft key).
- ullet You can also cancel your entries any time using the  $oldsymbol{\mathcal{X}}$  soft key.
- Example: Menu/Setup/Inputs/pH/Medium comp.



# 9 Commissioning

# Before the supply voltage is applied

On account of the device design, high switch-on currents occur when the device is commissioned at low temperatures. The power value indicated on the nameplate refers to the power consumption after one minute of operation when the device is commissioned at  $5 \, ^{\circ} \text{C}$  (41  $^{\circ} \text{F}$ ).

### Activities while the analyzer is in operation

Risk of injury and infection from medium!

- ▶ Before you release any hoses, make sure that no actions, such as the pumping of sample, are currently running or are due to start shortly.
- ► Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.
- ▶ Wipe up any spilt reagent with a disposable tissue and rinse with clear water. Then dry the cleaned areas with a cloth.

### 9.1 Preliminaries

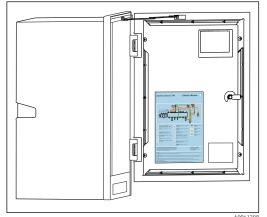
# 9.1.1 Commissioning steps

When commissioning the device for the first time, the device must be rinsed with process medium for a number of hours (recommended: 16 hours) so that a reliable zero point calibration can be performed.

#### To commission, proceed as follows:

- 1. Mount the analyzer on a wall or on a base.
- 2. 1-/2-channel version: Mount pressure relief valve and filter with angle brackets.
- 3. 4-/6-channel version: Mount panel with pressure relief valves and filters.
- 4. 4-/6-channel version: Install the panel with sample channel switching.
- 5. Route the cable for sensor inputs and outputs.
- 6. Connect sample outlet hose "D".
- 7. Connect sample inlet hose "SPx". .
- 8. Connect outlet hose "W" (outflow from cuvette).
- 9. Place the magnetic stir bar in the measuring chamber of the cuvette.
- 10. Connect the power supply.
  - ► The measuring device switches on.
- 11. Perform basic configuration of measuring device.
- 12. Configure the sample flow.
- 13. Connect reagents and standard.
- 14. Start the measurement.
- 15. Attach cover in front of cuvette assembly.

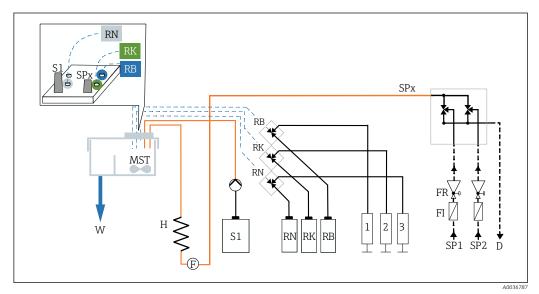
# 9.1.2 Hose connection diagram



The diagrams below reflect the status at the time of issue of this documentation. The hose connection diagram that applies for your device version is provided on the inside of the door of the analyzer.

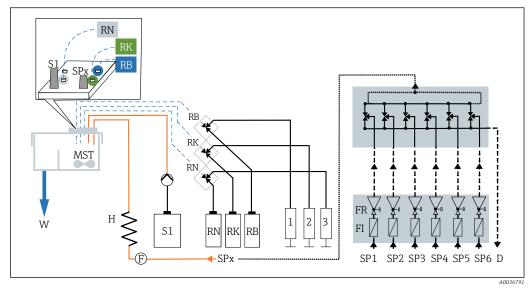
► Only connect the hoses as specified in this diagram.

■ 57 Hose connection diagram



 $\blacksquare$  58 Hose connection diagram for 1-/2-channel version

D	Sample outlet	RBN	Reagents RB, RK, RN
F	Flow sensor	S1	Standard 1
FR	Pressure relief valve	SP16	Sample inlets
FI	Filter	W	Outlet
Н	Heater	1, 2, 3	Dispensers
MST	Magnetic stirrer		



■ 59 Hose connection diagram for 4-/6-channel version

D Sample outlet Reagents RB, RK, RN F Flow sensor S1 Standard 1 FR Pressure relief valve SP1..6 Sample inlets FΙ Filter W Outlet Н Dispensers Heater 1, 2, 3 MST Magnetic stirrer

# 9.1.3 Connecting the sample outlet hose "D"

The liquid from sample outlet hose "D" contains only sample mixture. It can be disposed of accordingly.

Ensure that it can drain freely: Route sample outlet hose "D" without counterpressure.

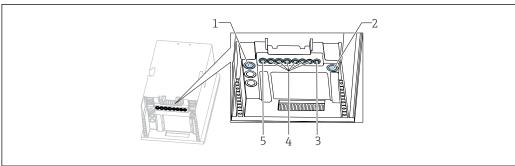
### 1-/2-channel version

- 1. Guide sample outlet hose "D" out of the housing via a hose gland.
- 2. Attach sample outlet hose "D" to the outlet of the sample channel switching and secure using a PG coupling with the appropriate clamping unit.

#### 4-/6-channel version

► Attach sample outlet hose "D" to the outlet of the panel with the sample channel switching.

# 9.1.4 Connecting the sample inlet hose "SPx"



40026026

- 1 Sample outlet hose "D" and either sample inlet hose SP1 and SP2 (1-/2-channel version) or SPx (4-/6-channel version)
- 2 Outlet hose "W"
- 3 4-/6-channel version: Cable connection for panel
- 4 Connections for sensors, signal lines
- 5 Power cable

#### 1-channel version

- 1. Ensure a constant and sufficient supply of sample at the installation location.
- 2. Remove the drain plug from sample channel 1. Do not remove the drain plug in sample channel 2.
- 3. Connect sample inlet hose SP1 to sample channel 1 and guide it out of the housing via a hose gland.
- 4. Secure sample inlet hose SP1 with a PG gland with the appropriate clamping unit.
- 5. Connect sample inlet hose SP1 to the pressure relief valve. Keep the length of hose between the sample inlet hose SP1 and the pressure relief valve as short as possible: max. 3 m (9.84 ft).
- 6. Connect the pressure relief valve to the filter. Keep the length of hose as short as possible, max. 0.5 m (1.64 ft).

### 2-channel version

- 1. Ensure a constant and sufficient supply of sample at the installation location.
- 2. If a sample channel is not used:

  Do not remove the red drain plug in the valve.
- 3. Remove the drain plug from the sample channels.
- 4. Connect sample inlet hoses SP1 and SP2 to the sample channels and guide them out of the housing via a hose gland.
- 5. Secure sample inlet hoses SP1 and SP2 with a PG gland with the appropriate clamping unit.
- 6. Connect sample inlet hoses SP1 and SP2 to the pressure relief valves. Keep the length of hose between the sample inlet hose and the pressure relief valve as short as possible: max. 3 m (9.84 ft).
- 7. Connect the pressure relief valve to the filter. Keep the length of hose as short as possible, max. 0.5 m (1.64 ft).

#### 4-/6-channel version

- 1. Ensure a constant and sufficient supply of sample at the installation location.
- If a sample channel is not used:Do not remove the red drain plug in the valve.
- 3. Remove the drain plug from the sample channels.

- 4. Using the SPx sample inlet hoses, connect the channels of the panel with the sample channel switching to the pressure relief valves of the panel. Keep the length of hose between the pressure relief valves and the panel with the sample channel switching as short as possible: max. 1 m (3.28 ft).
- 5. Connect sample inlet hose SPx of the sample channel switching to the push-in connector upstream from the flowmeter. In the process, guide the sample inlet hose into the housing via a hose gland.
- 6. Plug in the connector of the panel with the sample channel switching.

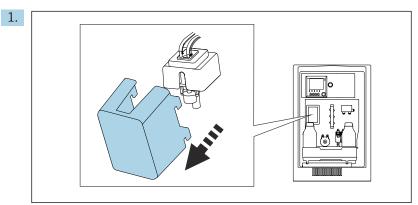
# 9.1.5 Connecting the outlet hose "W"

# 1-channel, 2-channel and 4-/6-channel version

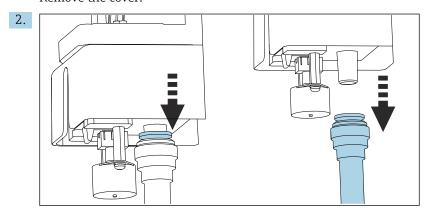
- The liquid from outlet hose "W" of the cuvette contains reaction mixture. Observe the local regulations regarding waste disposal.
- ► Secure outlet hose "W" to the appropriate connector nozzle in a PG gland. Avoid counterpressure.

# 9.1.6 Placing the magnetic stir bar in the measuring chamber of the cuvette

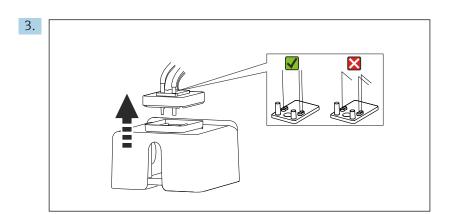
Before operating the analyzer, you must insert the magnetic stir bar supplied into the cuvette.



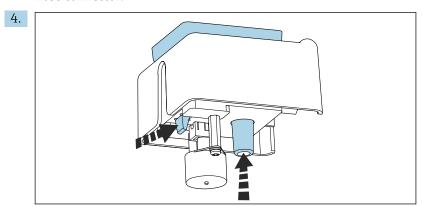
Remove the cover.

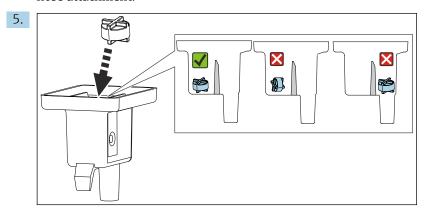


Remove outlet hose "W".

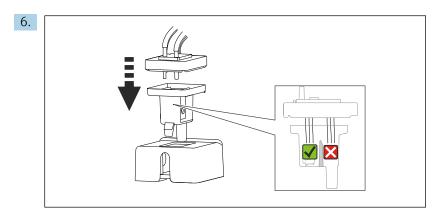


Lift the rubber cover off the cuvette. There must be no kinks in the capillaries at the capillary holder or at the valves, and the capillaries must not be removed from the hose connector.

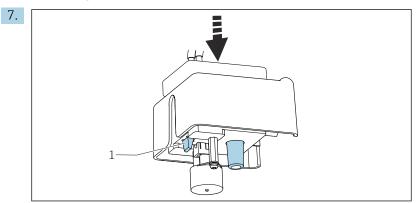




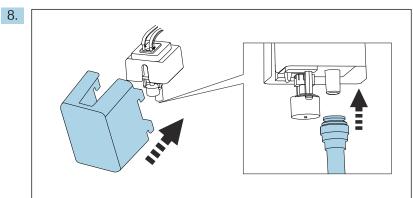
Place the magnetic stir bar in the measuring chamber, making sure that it is flat and in the measuring chamber.



Put the rubber cover back on, making sure that all the capillaries are located in the measuring chamber.



Push the cuvette with the magnetic stir bar and cover into the holder. Ensure that the tab (1) snaps into place.



Connect the outlet hose "W" again and secure the cover again.

# 9.2 Function check

# **A** WARNING

# $Incorrect\ connection,\ incorrect\ supply\ voltage$

Safety risks for staff and device malfunctions!

- ► Check that all connections have been established correctly in accordance with the wiring diagram.
- ► Ensure that the supply voltage matches the voltage indicated on the nameplate.

### **▲** WARNING

#### **Connection errors**

The safety of people and of the measuring point is under threat. The manufacturer does not accept any responsibility for errors that result from failure to comply with the instructions in this manual.

▶ Put the device into operation only if you can answer **yes** to **all** the following questions.

Device condition and specifications

▶ Are the hoses free from damage on the outside?

Visual inspection of the liquid-bearing lines

- ► Have the bottles with reagents, and standard been inserted and connected?
- ▶ Is the magnetic stir bar lying flat in the measuring chamber?

# 9.3 Switching on the measuring device

- 1. Connect the power supply.
- 2. Wait for the initialization to finish.

# 9.4 Setting the operating language

### Configuring the language

- 1. Press the soft key: **MENU**.
- 2. Set your language in the top menu item.
  - The device can now be operated in your chosen language.

# 9.5 Configuring the measuring device

# 9.5.1 Basic setup analyzer

#### Making basic settings

- 1. Switch to the menu **Setup/Basic setup analyzer**.
  - Make the following settings.
- Device tag

Give your device any name of your choice (max. 32 characters).

Set date

Correct the set date if necessary.

Set time

Correct the set time if necessary.

- 2. Insert the bottles and activate the bottles used in the menu: **Bottle insertion/Bottle selection**.
- 3. Check the concentration of the calibration standard used: **Calibration/Settings/Nominal concentration**.
- 4. Optionally, also change the measuring interval: **Measurement/Measuring interval**.
  - ► All the other settings can be left in the default factory settings for the time being.
- 5. Return to the measuring mode: press and hold the soft key for **ESC** for at least one second.
  - Your analyzer now works with your general settings. Optionally connected sensors use the factory settings of the specific sensor type and the individual calibration settings that were last saved.

If you want to already configure additional input and output parameters in the **Basic setup** analyzer:

► Configure the current outputs, relays, limit switches and device diagnostics with the following submenus.

# 9.5.2 Configuring the sample flow

- 1. Open any shut-off valves that may be present in the sample supply lines. From this step onwards, there must be sample present at the sample channel switching filter. The recommended range is: 1.5 to 3 bar (21.8 to 43.5 psi).
- 2. Configure the sample flow at the pressure relief valve and check via the **System test** menu: (**Menu/Diagnostics/System test/Analyzer/Sample channel**). Recommendation: 70 ml/min.
- 3. Select the relevant sample channel via **Test channel** and press **Confirm** to activate.
- 4. Recommendation: Do not configure the next sample channel until the sample flow has been stable for several minutes.
- 5. Once the sample flow is configured for all channels, select and activate the **None** sample channel to close all valves. If the channel is deactivated, sample continues to flow through each channel and is diverted via sample outlet hose "D".

# 9.5.3 Connecting the reagents and standard

- 1. Insert reagents and standard with bottle tray.
- 2. Connect reagent hoses to the relevant valves.
- 3. Connect the standard to the inlet in the hose pump.
- 4. Menu/Operation /Maintenance/Bottle change mode/Bottle insertion/Bottle selection must be selected.
- 5. Select all of the bottles you have inserted and confirm with **OK** .
- 6. The device is now ready to measure. At the start of the initial measurement, the reagent dispensers are fully opened and emptied. This is to guarantee the measuring performance from the start, and occurs after commissioning, after replacing the reagent bottles or after certain diagnostic cases.

# Using the large reagent set (optional)

If the large reagent set is used, the calibration standard (5 l) must be installed outside the analyzer. The hose of the standard solution must be replaced with the long hose supplied.

- 1. Remove the hose for the standard from the peristaltic pump and replace it with the long hose.
- 2. Shorten the long hose if necessary; its length must not exceed 1.5 m (4.92 ft).
- 3. Cut the hose on the bottle side at an angle so that it does not attach itself to the bottle.
- 4. Mount the M32 coupling, including the drain plug from the CA80SI standard accessories, in the base of the analyzer.
- 5. Guide the hose through the new M32 coupling towards the outside and through the grommet in the bottle cover as far as the base of the standard bottle (5 l).
- 6. When level monitoring is activated, set the correct volume for the standard S1 (Analyzer/Extended setup/Diagnostics settings/Bottles/Monitoring = On/Bottle filling levels/Start flow sum/Standard S1 → 5000 ml).

Liquiline System CA80SI Commissioning

# 9.6 Starting the measurement

Pay attention to the following, particularly if measuring very low concentrations of silica:

- The measurement results can display an initial drift. This can be caused by the possible contamination of the components carrying sample.
- For this reason it is advisable to rinse the sample-bearing pipes for several hours with continuous measurements prior to performing a calibration.
- The stability of the calibration factors can be checked by repeating the calibration manually.
- 1. Select start condition Immediate under Menu/Setup/Analyzer/Measurement/
  Start condition/Immediate. The analyzer starts immediately with the measurement cycle once the system changes to automatic mode.
- 2. If necessary, adjust the measuring interval under **Menu/Setup/Analyzer/ Measurement/Measuring interval**.
- 3. If necessary, adjust the calibration interval under **Menu/Setup/Analyzer/ Calibration/Calibration interval**.
- 4. If necessary, adjust the sequence of sample channels under **Menu/Setup/Analyzer/ Measurement/Measuring interval/Sequence of measurements**.
- 5. Start automatic mode: Press the **MODE** and select **Start automatic mode** must be selected.
  - ► The display shows **Current mode- Automatic**.
- ▶ Re-attach the cover in front of the cuvette assembly.

# 10 Operation

# 10.1 Display

# 10.1.1 Soft keys in the measuring mode

On the bottom row of the display you can find four soft keys in the measuring screens:

- With **MENU** and **DIAG** take you directly to the specific software menu.
- With **HOLD** you can activate an immediate, general hold for sensors. This also sets all the linked outputs, controllers and cleaning cycles to HOLD. Any sensor cleaning programs that are currently running are interrupted. However, you can also start manual sensor cleaning when a hold is active.
- With **MODE** takes you to a picklist of frequently used software functions.

# 10.1.2 Measuring mode

There are different display modes: (press the navigator button to change the mode)

- (1) Overview of all the inputs and outputs
- (2) Analyzer measured value or main measured value of an input or output or the status of a relay
- (3) Smaller visualization of the analyzer measured value or main and secondary measured value in the case of a sensor input
- (4) Analyzer measured value and pending actions or all measured values in the case of a sensor input
- (5) Only for analyzer measured value: Graphic display

There are also submenus:

(6) User-definable measuring menus (only available if already defined) Choice of previously configured screens

#### Change of channel to modes (2) - (5)

- ► Turn the navigator.
  - ► The display changes from channel to channel.

### 10.1.3 Device status

Icons on the display alert you to special device states.

Icon	Location	Description
F	Header bar	Diagnostic message "Failure"
М	Header bar	Diagnostic message "Maintenance request"
С	Header bar	Diagnostic message "Check"
S	Header bar	Diagnostic message "Out of specification"
←→	Header bar	Fieldbus or TCP/IP communication active
<b>X</b>	Header bar	Hold active (for sensors)
₹	At measured value	Hold for the actuator (current output, limit switch etc.) is active
<u></u>	At measured value 1)	An offset has been added to the measured value
⊗	At measured value	Measured value in "Bad" or "Alarm" state
ATC	At measured value	Automatic temperature compensation active (for sensors)
MTC	At measured value	Manual temperature compensation active (for sensors)
SIM	Header bar	Simulation mode active or Memocheck SIM connected

Icon	Location	Description
SIM	At measured value	The measured value is influenced by a simulated value
SIM	At measured value	The displayed measured value is simulated (for sensors)
	Header bar	Controller is active

1) Only pH or ORP measurement



If two or more diagnostic messages occur simultaneously, only the icon for the message with the highest priority is shown on the display (for the order of priority according to NAMUR,  $\rightarrow \, \cong \, 118$ ).

# 10.1.4 Assignment views

Assignment views, e.g. **Channel assignment view**, appear as the last function in many sections of the menu. You can use this function to see which actuators or functions are connected to an input or output. The assignments appear in hierarchical order.

# 10.2 General settings

# 10.2.1 Basic settings

	Options	Tf	
T		Info	
	Selection  Control  Selection  Control  Selection  Sele		
	Selection  020 mA  420 mA  Factory setting  420 mA	In accordance with Namur NE43, the linear range is from 3.8 to 20.5 mA (420 mA) or from 0 to 20.5 mA (020 mA). If the range is exceeded or undershot, the current value stops at the range limit and a diagnostic message (460 or 461) is output.	
Failure current	0.0 to 23.0 mA	The function meets NAMUR NE43.	
	Factory setting 22.5 mA	► Set the current value that should be output at the current outputs in the event of an error.	
The value for <b>Failure current</b> should be outside the measuring range. If you decided that your <b>Current</b> output range = 020 mA you should set an error current between 20.1 and 23 mA. If the <b>Current</b> output range = 420 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 any effects this may have on your process.			
Alarm delay	0 to 9999 s	The software displays only the errors that are	
	<b>Factory setting</b> 0 s	present longer than the set delay time. This makes it possible to suppress messages that only occur briefly and are caused by normal process-specific fluctuations.	
	Selection Disabled Enabled	You can enable an immediate, general hold (for sensors) here. The function acts in the same way as the <b>HOLD</b> soft key in the screens.	
	<b>Factory setting</b> Disabled		

# 10.2.2 Date and time

Menu/Setup/General settings/Date/Time			
Function	Options	Info	
Set date	Depends on the format	Editing mode: Day (two-digit): 01 to 31 Month (two-digit): 01 to 12 Year (four-digit): 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	Selection DD.MM.YYYY YYYY-MM-DD MM-DD-YYYY	➤ Select a date format.	
	Factory setting DD.MM.YYYY		
Time format	Selection     hh:mm am (12h)     hh:mm (24h)     hh:mm:ss (24h)	► Choose between 12-hour display or 24-hour display. Seconds can also be displayed with the latter version.	
	Factory setting hh:mm:ss (24h)		
Time zone	Selection None Choice of 35 time zones Factory setting None	None = Greenwich Mean Time (London).	
DST	Selection    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.	

# 10.2.3 Hold settings

Menu/Setup/General settings/Hold settings			
Function	Options	Info	
Settings automatic Hold			
Hold release time	0 to 600 s  Factory setting 0 s	The hold status is maintained for the duration of the delay time when you switch to the measuring mode.	
Setup menu Diagnostics menu	Selection  Disabled	► Decide whether the device outputs should switch to the defined hold state when the	
Diagnostics menu	<ul><li>Enabled</li><li>Factory setting</li><li>Disabled</li></ul>	particular menu is opened.	
Calibration active	Factory setting Enabled		

# 10.2.4 Logbooks

Logbooks record the following events:

- Calibration/adjustment events
- Operator events
- Diagnostic events
- Analyzer events
- Measured values

You define how the logbooks should store the data.

In addition, you can also define individual data logbooks for sensors.

- 1. Assign the logbook name.
- 2. Select the measured value to be recorded.
- 3. Set the scan time (**Scan time**).
  - ► You can set the scan time individually for every data logbook.
- Further information on the logbooks: .

Data logbooks only apply for sensors (optional). There are special data logbooks for the analyzer. These logbooks are automatically enabled and assigned to the measuring channel.

SP1: Data logbook SP1 is assigned to measuring channel 1 of the analyzer.

Menu/Setup/General settings/Logbooks			
Function	Options	Info	
Logbook ident	Customized text, 16 characters	Part of the file name when exporting a logbook	
Event logbook	Selection    Off    Ring buffer    Fill up buffer Factory setting Ring buffer	All diagnostic messages are recorded  Ring buffer  If the memory is full, the most recent entry automatically overwrites the oldest entry.  Fill up buffer  If the memory is full, there is an overflow,i. e. you cannot store any new values. The controller displays a corresponding diagnostic message.  The memory then has to be cleared manually.	
Analyzer event logbook	Selection Ring buffer Fill up buffer Factory setting Ring buffer	All diagnostic messages are recorded  Ring buffer  If the memory is full, the most recent 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.	

Function	Options	Info
Overflow warnings		
Analyzer calibration logbook = Fill up buffer		
Calibration logbook	Selection	► Decide whether you want to receive a
Diagnostic logbook	• Off • On	diagnostic message if the fill buffer of the relevant logbook overflows.
Configuration logbook	<b>Factory setting</b> Off	
Analyzer data logbooks		For analyzer measured data The entry is made automatically on completion of the measurement. A setting does not need to be made. The logbook is activated automatically. SP1 is assigned to data logbook SP1.
▶ Data logbook SP1		Assignment to measuring channel
Source of data	Read only	The assigned measuring channel is displayed
Measuring parameter	Read only	Plain-text information on the parameter that is being recorded
Unit	Read only	Information about the unit in which the data are available
Logbook name	Customized text, 16 characters	
▶ Line plotter		Menu to define the graphic display
Axes	Selection    Off    On Factory setting On	Should the axes (x, y) be displayed ( <b>On</b> ) or not ( <b>Off</b> )?
Orientation	Selection  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.
X-Description	Selection	► Decide whether a description should be
Y-Description	• Off • On	displayed for the axes and whether gridlines should be shown. In addition, you can also
Grids	Factory setting	decide whether pitches should be displayed.
Pitches	On	
X Pitch/Grid distance	10 to 50%  Factory setting 10 %	► Determine the pitch.
Y Pitch/Grid distance		

Menu/Setup/General settings/Logbooks			
unction	Options	Info	
Data logbooks		For connected Memosens sensors (optional)	
▶ New		You can create a maximum of 8 data logbooks.	
Logbook name	Customized text, 20 characters		
Source of data	Selection     Sensor inputs     Controller     Current inputs     Temperature     Fieldbus signals     Mathematical functions  Factory setting None	<ul> <li>Select a data source for the logbook entrie</li> <li>You can choose from the following:</li> <li>Connected sensors</li> <li>Available controllers</li> <li>Current inputs</li> <li>Fieldbus signals</li> <li>Binary input signals</li> <li>Mathematical functions</li> </ul>	
Measured value	Selection Depends on Source of data Factory setting None	You can record different measured values depending on the data source.	
Scan time	0:00:01 to 1:00:00 <b>Factory setting</b> 0:01:00	Minimum time interval between two entries Format: H:MM:SS	
Data logbook	Selection Ring buffer Fill up buffer	Ring buffer If the memory is full, the most recent entry automatically overwrites the oldest entry.	
	<b>Factory setting</b> Ring buffer	Fill up buffer If the memory is full, there is an overflow,i.e. new values can be saved. The controller displa a corresponding diagnostic message. The memory then has to be cleared manually.	
Overflow warnings  Data logbook =  Fill up buffer	Selection     Off     On  Factory setting Off	► Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows.	
⊳ Add another logbook	Action	Only if you want to create another data logboo immediately. You add a new data logbook at a later date using <b>New</b> .	
▶ Finished	Action	This allows you to exit the <b>New</b> menu.	
▷ Start/stop simultaneously	Action	Appears if you have created more than one da logbook. With one mouse click, you can start c stop recording all the data logbooks.	
▶ Logbook name		The name of this submenu is based on the nar of the logbook and only appears once you have created a logbook.	

Function	Options	Info
Source of data  Measured value	Read only	This is for information purposes only. If you want to record another value, delete this logboo and create a new data logbook.
Log time left  Data logbook =	Read only	Displays the days, hours and minutes remaining until the logbook is full.
Fill up buffer		
Log size <b>Data logbook =</b> Fill up 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 again.
Scan time	0:00:01 to 1:00:00	As above
	Factory setting 0:01:00	Minimum time interval between two entries Format: H:MM:SS
Data logbook	Selection Ring buffer Fill up buffer	<b>Ring buffer</b> If the memory is full, the most recent entry automatically overwrites the oldest entry.
	<b>Factory setting</b> Ring buffer	Fill up buffer If the memory is full, there is an overflow, i. e. r new values can be saved. The controller display a corresponding diagnostic message. The memory then has to be cleared manually.
Overflow warnings  Data logbook =  Fill up buffer	Selection    Off    On Factory setting	Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows.
▶ Line plotter	Off	Menu to define the graphic display
Axes	Selection • Off • On	Should the axes (x, y) be displayed ( <b>On</b> ) or not ( <b>Off</b> )?
	<b>Factory setting</b> On	
Orientation	Selection     Horizontal     Vertical Factory setting Horizontal	You can choose whether the value curves should be displayed from left to right ( <b>Horizontal</b> ) or from top to bottom ( <b>Vertical</b> ). If you want to display two data logbooks simultaneously, mak sure that both logbooks have the same settings here.
X-Description	Selection	► Decide whether a description should be
Y-Description	Off On	displayed for the axes and whether gridline should be shown. In addition, you can also
Grids	Factory setting	decide whether pitches should be displayed
Pitches	On	
X Pitch/Grid distance	10 to 50%	► Determine the pitch.
Y Pitch/Grid distance	Factory setting	
▶ Remove	Action	This action removes the data logbook. Any data that have not been saved are lost.

Example: New data logbook (Setup/General settings/Logbooks/Data logbooks/New)

1. Make the settings:

- Logbook name
  - Assign a name. Example: "01".
- Source of data
  - Select a data source. Example: Signal of binary input 1.
- Measured value
  - Select the measured value to be recorded. Example: pH value.
- Scan time
  - Specify the time interval between two logbook entries.
- Data logbook
  - Activate the logbook: specify the data storage method.
- 2. ../**Finished**: Perform the action.
  - ► The device shows the new logbook in the list of data logbooks.
- 3. Select data logbook "01".
  - ► Additional display: **Log time left**.
- 4. Only in the case of **Fill up buffer**:
  - Decide to set **Overflow warning: On** or **Off**.
  - **On**: The device displays a diagnostic message in the event of memory overflow.
- 5. **Line plotter** submenu: Specify the type of graphic representation.

# 10.2.5 Extended setup

### 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.

Menu/Setup/(General settings or Inputs <sensor channel="">)/Extended setup/Diagnostics settings/Diag. behavior</sensor>			
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	Selection 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 failure current at the current output	
Failure current	Selection On Off Factory setting Depends on the message	Decide whether an failure current should be output at the current output if the diagnostic message display is activated.  In the event of general device errors, the failure current is output at all the current outputs. In the event of channel-specific errors, the failure current is only output at the assigned current output.	
Status signal	Selection  Maintenance (M)  Out of specification (S)  Function check (C)  Failure (F)	The messages are divided into different error categories in accordance with NAMUR NE 107.  ▶ Decide whether you want to change a status signal assignment for your application.	
	<b>Factory setting</b> Depends on the message		

Menu/Setup/(General settings or Inputs <sensor channel="">)/Extended setup/Diagnostics settings/Diag. behavior</sensor>			
Function	Options	Info	
Diag. output  Alarm relays are available,	Selection  None Alarm relay Binary output Relay 1 to n (depends on the device version)  Factory setting None depending on the device verse	Before being able to assign the message to an output you must first configure a relay output to Diagnostics. (Menu/Setup/Outputs: assign Diagnostics function and set Operating mode to as assigned.)	
Cleaning program (for sensors)	Selection None Cleaning 1 Cleaning 2 Cleaning 3 Cleaning 4 Factory setting None	<ul> <li>Decide whether the diagnostic message should trigger a cleaning program.</li> <li>You can define the cleaning programs under: Menu/Setup/Additional functions/Cleaning.</li> </ul>	
Detail information	Read only	Here you can find more information on the diagnostic message and instructions on how to resolve the problem.	

# PROFIBUS DP

Menu/Setup/General settings/Extended setup/PROFIBUS		
Function	Options	Info
Enable	Selection    Off    On Factory setting On	You can switch off communication at this point. The software can then only be accessed via local operation.
Termination	Read only	If the device is the last in the bus, you can terminate via the hardware.
Bus address	1 to 125	If you have addressed the bus via hardware (DIP switches on the module, ), you can only read the address here.  If an invalid address is set via the hardware, you have to assign a valid address for your device either here or via the bus.
Ident number	Selection     Automatic     PA-Profile 3.02 (9760)     Manufacturer specific     Factory setting     Automatic	

# Modbus

Menu/Setup/General settings/Extended setup/Modbus		
Function	Options	Info
Enable	Selection     Off     On Factory setting On	You can switch off communication at this point. The software can then only be accessed via local operation.
Termination	Read only	If the device is the last in the bus, you can terminate via the hardware.
Settings		
Transmission mode	Selection TCP RTU ASCII Factory setting (Modbus-RS485 only) RTU	The transmission mode is displayed depending on the version ordered.  In the case of RS485 transmission, you can choose between <b>RTU</b> and <b>ASCII</b> . There are no choices for Modbus-TCP.
Byte order	Selection ■ 1-0-3-2 ■ 0-1-2-3 ■ 2-3-0-1 ■ 3-2-1-0 Factory setting 1-0-3-2	
Watchdog	0 to 999 s  Factory setting 5 s	If no data transmission takes place for longer than the time set, this is an indicator that communication has been interrupted. After this time, input values received via the Modbus are considered to be invalid.

# Web server

Menu/Setup/General settings/Extended setup/Webserver		
Function	Options	Info
Webserver	Selection Off On Factory setting On	You can switch off communication at this point. The software can then only be accessed via local operation.
Webserver TCP port 80	Read only	The Transmission Control Protocol (TCP) is an arrangement (protocol) as to how data should be exchanged between computers. A port is a part of an address which assigns data segments to a network protocol.
Webserver login	Selection Off On Factory setting On	You can switch user administration on and off at this point. This makes it possible to create multiple users with password access.

Menu/Setup/General settings/Extended setup/Webserver		
Function	Options	Info
User administration		
List of users already created	View/edit	You can change user names or passwords or delete users. A user is already created at the factory: "admin" with password "admin".
New user:		
Name	Free text	Create new user
Enter new user password	Free text	1. INSERT .
Confirm new user	Free text	2. Assign any name to the new user.
password		3. Select a password for the user.
Change user password	Free text	4. Confirm password.
		You can now change the password at any time.

# EtherNet/IP



If PROFINET is used, the settings in this menu are read only settings. The network settings are made via the PROFINET-DCP protocol.



Menu/Setup/General settings/Extended setup/Ethernet		
Function	Options	Info
Enable	Selection     Off     On Factory setting On	You can switch off communication at this point. The software can then only be accessed via local operation.
Settings		
Link settings	Selection  Auto negotiation  10MBps half duplex  10MBps full duplex  100MBps half duplex  100MBps full duplex  factory setting  Auto negotiation	Transmission methods of the communication channels  Full duplex: Data can be transmitted and received simultaneously.  Half-duplex: Data can be transmitted and received on an alternating basis only, i.e. not simultaneously.
DHCP	Selection Off On Factory setting On	The Dynamic Host Configuration Protocol (DHCP) makes it possible to assign the network configuration to clients via a server. With DHCP, it is possible to automatically integrate the device into an existing network without the need for manual configuration. Normally only the automatic assignment of the IP address must be configured at the client. During startup, the IP address, the netmask and the gateway are retrieved from a DHCP server.  Do you want to assign the IP address of the device manually? If so, you have to set DHCP = Off.
IP-Address	XXX.XXX.XXX	An IP address is an address in computer networks which are based on the Internet protocol (IP). You can only set the IP address if <b>DHCP</b> is switched off.

Menu/Setup/General settings/Extended setup/Ethernet		
Function	Options	Info
Netmask	XXX.XXX.XXX	On the basis of the IP address of a device, the netmask specifies which IP addresses this device searches for in its own network and which addresses it could access in other networks via a router. It therefore divides the IP address into a network part (network prefix) and a device part. The network part must be identical for all devices in the individual network, and the device part must be different for every device within the network.
Gateway	x.x.x.x	A gateway (protocol converter) enables communication between networks that are based on completely different protocols.
Service switch	Read only	
MAC-Address	Read only	The MAC address (Media Access Control address) is the hardware address of every individual network adapter which is used to uniquely identify the device in a computer network.
EtherNetIP Port 44818	Read only	A port is a part of an address which assigns data segments to a network protocol.

#### Accepting settings

Have you changed settings manually, such as the IP address?

- ► Before you leave the **Ethernet** menu: select **SAVE** to apply your settings.
  - In the **DIAG/System information** menu you can check whether the new settings are used.

#### 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.

**Current firmware version** of the analyzer, actuator control module: **Menu/Diagnostics/ System information**.

▶ Back up your current setup and your logbooks to an SD card.

To install a firmware update, you must have the update available on an SD card.

- 1. Insert the SD card into the controller card reader.
- 2. Go to Menu/Setup/General settings/Extended setup/Data management/Firmware update.
  - ► The update files on the SD card are displayed.
- 3. Select the desired update and select yes when asked the following:

The current firmware will be overwritten.

After this the device will reboot.

Do you want to proceed?

└ The firmware is loaded and the device is then started with the new firmware.

### Saving the setup

Saving a setup offers the following advantages, among others:

- Copying settings for other devices
- Quick and easy switching between various setups, e. g. for different user groups or for recurring sensor type changes
- Restoring a tried-and-tested setup, e. g. if you have changed a lot of settings and no longer know what the original settings were
- 1. Insert the SD card into the controller card reader.
- 2. Go to Menu/Setup/General settings/Extended setup/Data management/Save setup.
- 3. **Name**: Assign a file name.
- 4. Then select **Save** .
  - If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.
- 5. Use **OK** to confirm or cancel and assign a new file name.
  - Your setup is stored on the SD card and you can upload it quickly to the device at a later date.

# Loading the setup

When you load a setup, the current configuration is overwritten.

Note that cleaning and controller programs may be active. Do you want to continue anyway?

- 1. Insert the SD card into the controller card reader. A setup must have been saved to the SD card.
- 2. Go to Menu/Setup/General settings/Extended setup/Data management/Load setup.
  - A list of all the setups on the SD card is displayed.

    An error message is displayed if there is no valid setup on the card.
- 3. Select the desired setup.
  - ► A warning is displayed:

The current parameters will be overwritten and the device will reboot. Warning: Please note that cleaning and controller programs can be active. Do you want to proceed?

- 4. Use **OK** to confirm or cancel.
  - ► If you select **OK** to confirm, the device restarts with the desired setup.

#### Exporting the setup

Exporting a setup offers the following advantages, among others:

- Export in XML format with a stylesheet for formatted display in an XML-compatible application, such as . Microsoft Internet Explorer
- Importing the data (drag and drop the XML file into a browser window)
- 1. Insert the SD card into the controller card reader.
- 2. Go to Menu/Setup/General settings/Extended setup/Data management/Export setup.
- 3. **Name**: Assign a file name.
- 4. Then select **Export** .
  - If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.

- 5. Use **OK** to confirm or cancel and assign a new file name.
  - ► Your setup is saved on the SD card in the "Device" folder.

You cannot upload the exported setup to the device again. You must use the **Save setup**. This is the only way you can save a setup to an SD card and reload it later on or upload it to other devices.

#### Activation code

Activation codes are required for:

- Additional functions, e. q. Fieldbus communication
- Firmware upgrades
- If the original device has activation codes, these can be found on the nameplate. The corresponding device functions are activated at the factory. Codes are only required if servicing the device.
- 1. Enter the activation code: Menu/Setup/General settings/Extended setup/Data management/Activation code.
- 2. Confirm your entry.
  - ► The new hardware or software function is activated and can be configured.

Functions that are enabled by an activation code:

Function	Activation code beginning with
2 current outputs (BASE2-E module only)	081
Web server 1) 2)	351
PROFIBUS DP	0B3
Modbus TCP <sup>2)</sup>	0B8
Modbus RS485	0B5
EtherNet/IP 2)	0B9
PROFINET	0B7
Cooling <sup>3)</sup>	0F1
Feedforward control	220
Chemoclean Plus	25
Collecting vessel 3)	20
Measuring channels <sup>3)</sup>	28
Formula <sup>4)</sup>	321

- 1) Via Ethernet socket of the BASE2 module, for versions without an Ethernet fieldbus
- 2)3) Availability depends on measuring parameter
- 4) Mathematical function

# Changing the password

You can lock the operating keys with a password (access the context menu by pressing the navigator for longer). The keys can then only be enabled by entering the right password.

You can set the password to lock the keys here: **Menu/Setup/General settings/Extended setup/Data management/Change key lock password**.

- 1. Enter the current password (factory setting 0000).
  - ► Enter new password
- 2. Enter a new password.
  - Confirm new password

- 3. Enter the new password again.
  - ☐ The password has been changed successfully.

Press the navigator for longer to return to the measuring mode.

# 10.3 Analyzer

Menu/Setup/Analyzer		
Function	Options	Info
Mode	Read only	Manual, automatic or fieldbus
Device tag	Customized text, 32 characters	➤ Select any name for your analyzer. Use the TAG name for example.
	Factory setting Analyzer_serial number	
Measuring parameter	Read only	
Measuring range	Read only	

# 10.3.1 Extended setup

# Measured value

Menu/Setup/Analyzer/Extended setup/Measuring value		
Function	Options	Info
Main value	Selection SiO2 SiO2-Si H2SiO3 Factory setting SiO2	
Unit	Selection  mg/l  μg/l  ppb  Factory setting μg/l	
Main value format	Selection # ### #### Auto Factory setting Auto	
Status for failed measurement	Selection  Keep last value  Status bad  Factory setting  Keep last value	Keep last value Standard practice is to keep the measured value of the last successful measurement until the next successful measurement. To detect an error during measurement, the NAMUR status signal, the time stamp of the measurement and the measured value status must be evaluated.  Status bad If a measurement cannot be performed due to an error, the measured value status is set to Bad and the measured value to 0. The time stamp is updated accordingly.

Menu/Setup/Analyzer/Extended setup		
Function	Options	Info
Device range	Selection	The options available depend on the device version ordered.  • Select the desired measuring range from the list.

# Signals

Menu/Setup/Analyzer/Extended setup		
Function	Options	Info
▶ Signal for process access		
SP1	Selection Always accessible Binary input x:y Factory setting Always accessible	Always accessible: The input signal level at the binary inputs does not affect actions that require sample (measurement, calibration, cleaning).  Binary input x:y: When the signal is active at the selected input, the analyzer starts actions where sample is required. Otherwise the analyzer defers or skips the action.  In the case of multi-channel devices, SP2 to SP6 is also displayed, depending on the number of channels.

# Diagnostic settings

Limit values for dispensers

Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Limits dispensers		
Function	Options	Info
Control	Selection    Off    On Factory setting On	
▶ Warning limits		Diag. code 733
Remaining operating time	Selection 1 to 90 (d) Factory setting 28 d	A warning limit can be configured for every dispenser:  Dispenser 1 Dispenser 2 Dispenser 3
▶ Alarm limits		Diag. code 732
Remaining operating time	Selection 1 to 60 d Factory setting 7 d	An alarm limit can be configured for every dispenser:  Dispenser 1 Dispenser 2 Dispenser 3

# **Bottles**

You can monitor the levels of all the bottles.

- 1. Switch on monitoring.
- 2. Enter the starting volume for every bottle.
- 3. Specify alarm and warning limits for the residual volumes.
- 4. Specify alarm and warning limits for the remaining time until the bottle refills are consumed.

Function	Options	Info
Control	Selection Off On Factory setting Off	On After the monitoring function is switched on, you can find 2 additional menu items in: Menu/Operation/Maintenance/Change bottle Remaining operating time Bottle filling levels
▶ Bottle filling levels		
► Start volume		
Reagent RB	100 to 2500 ml  Factory setting 1000 ml	
Reagent RK	100 to 2500 ml	
reagene fax	Factory setting	
Reagent RN	100 to 2500 ml	
	Factory setting 1000 ml	
Standard S1	100 to 5000 ml  Factory setting 2500 ml	
► Warning limits	Diag. code 726	Warning limits are intended as an early warning for maintenance tasks that will need to be performed soon.  1. Procure spare parts in time.  2. Schedule maintenance tasks.
Reagent RB	1 to 40 %	
	Factory setting 10 %	
Reagent RK	1 to 40 %	
	Factory setting 10 %	
Reagent RN	1 to 40 %	
	Factory setting 10 %	
Standard S1	1 to 20 %	
	<b>Factory setting</b> 5 %	
► Alarm limits	Diag. code 727	Alarm limits are intended to immediately trigge maintenance tasks.  • Replace the materials concerned as quickly as possible.
Reagent RB	1 to 40 %	
-	Factory setting 5 %	
Reagent RK	1 to 40 %	
	Factory setting 5 %	

unction	Options	Info	
Reagent RN	1 to 40 %		
·	Factory setting 5 %		
Standard S1	1 to 20 %		
	Factory setting 2 %		
Remaining operating ti	me		
<b>▶</b> Warning limits		Diag. code 726	
Reagent RB	1 to 14 d		
	Factory setting 14 d		
Reagent RK	1 to 14 d		
	Factory setting 14 d		
Reagent RN	1 to 14 d		
	Factory setting 14 d		
Standard S1	1 to 14 d		
	Factory setting 14 d		
▶ Alarm limits		Diag. code 727	
Reagent RB	1 to 7 d		
	Factory setting 2 d		
Reagent RK	1 to 7 d		
	Factory setting 2 d		
Reagent RN	1 to 7 d		
	Factory setting 2 d		
Standard S1	1 to 7 d		
	Factory setting 2 d		

# Absorption curve recording

Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Absorption curve recording		
Function	Options	Info
In automatic mode	Selection    Off    On Factory setting Off	Off: Recording is only possible in the manual mode On: Recording also takes place in the automatic mode
Curve	Selection 1 to 7 Factory setting 3	Select the absorption curve to be recorded. Only one curve can be selected at any one time. The data are saved in a logbook.

# Behavior after power failure and other settings

Menu/Setup/Analyzer/Extended setup		
Function	Options	Info
After power failure	Selection  Last mode  Manual mode  Factory setting Last mode	Setting specifying how the analyzer should behave after a power failure, or when the power is back on.  Last mode: The analyzer remains in the mode that was last set. Example: The automatic mode was set. The analyzer continues after initialization and after any samples have been discarded.  Manual mode: The analyzer switches to the manual mode and waits for user action.
Timeout no sample	Selection 0:00 to 30:00 mm:ss Factory setting 1:00 (MM:SS)	Maximum time the device waits for sufficient sample flow

# 10.3.2 Measurement

Menu/Setup/Analyzer/Measurement		
Function	Options	Info
Start condition	Selection Immediate Date/time Factory setting Immediate	Immediate: The analyzer immediately starts with the measurement cycle once the system changes to the automatic mode.  Date/time: The analyzer starts with the measurement cycle at the set date/time.
Date	01.01.1970 to 07.02.2106	Functions only available for:
Time	00:00:00 to 23:59:59	Start condition = Date/time
Measuring interval	0:10 to 24:00 (hh:mm)  Factory setting 0:20	Function only available for: Start condition = Immediate or Date/time For configuring the time interval of the measurement
▶ Sequence of measurements	Selection	Defines the sequence of channels in automatic mode.  Is displayed only in the case of a two-, four- or six-channel device.  SP1: Indicate the number of consecutive measurements for channel SP1  SP2: Indicate the number of consecutive measurements for channel SP2  SP3: Indicate the number of consecutive measurements for channel SP3  SP4: Indicate the number of consecutive measurements for channel SP4  SP5: Indicate the number of consecutive measurements for channel SP5  SP6: Indicate the number of consecutive measurements for channel SP5  SP6: Indicate the number of consecutive measurements for channel SP6  Pause: If the Pause channel is selected, the analyzer does not perform the measurement.  You can add, delete or save rows in the table using the INSERT, DEL and SAVE soft keys.
Signal delay	0 to 600 s Factory setting 0 s	<b>Measurement active</b> : You can delay the process of outputting the signal during an active measurement by the defined time. Measuring is paused for the duration of the signal delay time.

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#### Measuring a manual sample

Use at least a sampling volume of 1000 ml (33.81 fl.oz) for the measurement of a manual sample.

#### NOTICE

# Contamination of the sample

▶ Do not use a glass vessel for the manual sample.

#### Replacing a standard solution with the manual sample

- 1. Press the soft key **MODE** and select **Manual mode** .
  - The display shows **Current mode- Manual**.

    Wait until all operations have stopped. Ongoing operations can be canceled under **Menu/Operation/Manual operation**.
- 2. Remove the hose for the standard solution from the peristaltic pump. When removing, lift the end of the hose and allow the hose the drain ( $\rightarrow \triangleq 43$ ).
- 3. Connect a separate, clean hose of the appropriate length (e.g. Connect Norprene, ID 1.6 mm (0.06 in) to the peristaltic pump.
- 4. Place the hose in the vessel with the manual sample.

### Starting manual sample measurement

- Menu/Operation/Manual operation/Select Start manual sample measurement.
  - ► Manual sample measurement is started.

#### Using the standard solution again after completing manual sample measurements

- 1. Remove the hose for the manual sample from the peristaltic pump.
- 2. Connect the standard solution to the peristaltic pump again.

#### 10.3.3 Calibration

Menu/Setup/Analyzer/Calibration			
Function	Options	Info	
Start condition	Selection Immediate Date/time Disabled	The calibration can start either immediately or at the set time.	
	Factory setting Immediate		
If the start condition selected is <b>Immediate</b>			
Date	01.01.1970 to 07.02.2106	Functions only available for:	
Time	00:00:00 to 23:59:59	Start condition = Date/time	
Calibration interval	0-01 to 90-00 ( <b>DD-hh</b> ) <b>Factory setting</b> 03-00 <b>DD-hh</b>	For configuring the time interval of the calibration/adjustment.	
Next calibration Mode = Automatic	Read only		
Zero point	Read only		
Calibration factor	Read only	Relationship of the measured concentration to the pre-specified concentration of the calibration standard.	

Menu/Setup/Analyzer/Calibration		
Function	Options	Info
▶ Settings		
Nominal concentration	Factory setting	For configuring the concentration of the calibration standard solution.  Depends on the settings under Menu/Setup/ Analyzer/Extended setup/Measuring value/ Main value
Automatic cleaning	Selection Off On Factory setting	For specifying whether cleaning will take place before every calibration/adjustment (only in the automatic mode).

# 10.4 Current inputs

The input can be used as the data source for limit switches and logbooks, for example. Furthermore, external values can be made available as set points for controllers.

Menu/Setup/Inputs/Current input x:y 1)		
Function	Options	Info
Mode	Selection     Off     0 - 20mA     4 - 20mA	► Select the same current range as in the data source (connected device).
	Factory setting 4 - 20mA	
Input variable	Selection Parameter Current	► Select the input variable.
	Factory setting Current	
Meas. value format	Selection ####################################	► Specify the number of decimal places.
	Factory setting #.#	
Parameter name	Customized text, 16 characters	► Assign a useful name, e.g. the parameter
Input variable = Parameter		name that the data source also uses.
Unit of measure	Customized text, 16	You cannot choose the unit from a list. If you
Input variable = Parameter	characters	want to use a unit, you must enter it here as customized text.

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Menu/Setup/Inputs/Current input x:y 1)		
Function	Options	Info
Lower range value Input variable = Parameter	-20.0 Upper range value <unit measure="" of=""> Factory setting 0.0 <engineering unit=""></engineering></unit>	► Enter the measuring range. The lower and upper range values are assigned to the 0 or 4 mA value and the 20 mA value respectively. The system uses the engineering unit which you entered
Upper range value Input variable = Parameter	Lower range value to 10000.0 <engineering unit=""> Factory setting 10.0 <engineering unit=""></engineering></engineering>	beforehand.
Damping	0 to 60 s Factory setting 0 s	The damping causes a floating average curve of the measured values over the time specified.

1) x:y = slot no. : input number

## 10.5 Binary inputs and outputs

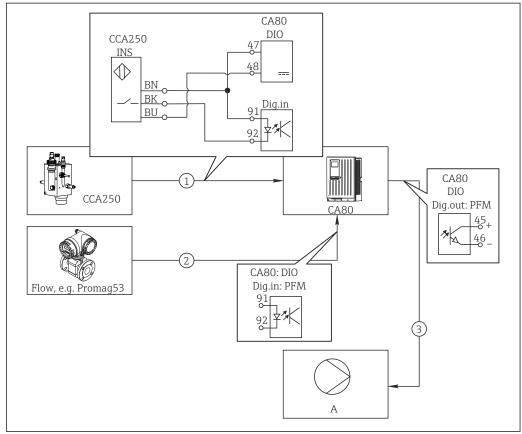
Hardware options, such as the "DIO" module with 2 digital inputs and 2 digital outputs or fieldbus module "485" enable the following:

- Via a digital input signal

  - switching between different calibration datasets in the case of optical sensors
  - external hold (for sensors)
  - a cleaning interval to be triggered (for sensors)
  - measurements to be started, interruption of measuring intervals
  - PID controller switch-on/switch-off, e.g. via the proximity switch of the CCA250
  - the use of the input as an "analog input" for pulse-frequency modulation (PFM)
- Via a digital output signal
  - diagnostic states, point level switches, "Active measurement" system state, "Sample required" information or similar states transmitted statically (similar to a relay)
  - the dynamic transmission (comparable to a non-wearing "analog output") of PFM signals, e.g. to control dosing pumps

### 10.5.1 Application examples

### Chlorine regulation with feedforward control



A002923

■ 60 Example of chlorine control with feedforward control

- 1 Connection of the inductive proximity switch INS of CCA250 to the digital input of the DIO module
- 2 Connection of the signal from a flowmeter to the digital input of the DIO module
- 3 Activation of a (pulse) dosing pump via the digital output of the DIO module
- A Dosing pump

Utilize the advantage of the effectively wear-free control with binary outputs versus a control system with relay. With pulse frequency modulation (PFM), it is possible to achieve virtually continuous dosing using a dosing pump with higher input frequency.

- 1. Connect the INS proximity switch of the CCA250 assembly to a digital input of the DIO module (e.g. slot 6, port 1).
- 2. In the software, configure a controller and as the source select the binary input (e.g.Binary input 1) to which the proximity switch is connected. (Menu/Additional functions/Controllers/Controller 1/Controller enable = Binary input 1)
- 3. **Signal type**: For the selected input, select the factory setting (**Static signal**).
- 4. Connect the measured value of a flowmeter to the second input of the DIO module (e.g. slot 6, port 2).
- 5. Signal type: for this input, select PFM . (Menu/Inputs/Binary input 6:2/Signal type = PFM)
- 6. **Input variable**: select the corresponding measured value (**Flow rate**).
  - You can now use the input you have just configured as the disturbance variable for your controller 1).

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<sup>1)</sup> An activation code, Order No. 71211288, is necessary for the "feedforward control" function.

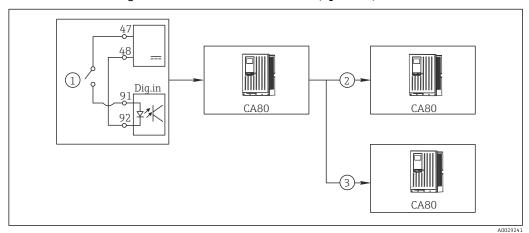
7. **Disturbance variable**: in the controller menu, select the binary input to which you have connected the flow measured value. (Menu/Additional functions/Controllers/Controller 1/Disturbance variable/Source of data = Binary input 6:2 and Measured value = PFM value)

8. You can activate a dosing pump through PFM via a digital output of the DIO module. Connect the pump to an output of the DIO module (e.g. slot 6, port 1) and select the following settings in the menu: Menu/Outputs/Binary output 6:1/Signal type = PFM and Source of data = Controller 1.

Take the direction of action of your dosing into account. Select the correct parameter (**Actuator type** = **Unipolar+** or **Unipolar-**).

You must make additional settings in the controller menu to fully customize the control to suit your process conditions.

### CA80 as the cleaning master for connected sensors (optional)



■ 61 Example of a central cleaning control

- 1 External cleaning trigger at the binary input
- 2 Transferring the external hold over binary output to other measuring devices without connected cleaning functions
- 3 Transferring the cleaning trigger over a binary output to other self-cleaning measuring points
- 1. An external trigger actuates a cleaning operation at the master.

  A cleaning unit is connected via a relay or a binary output, for example.
- 2. The cleaning trigger is transferred to another device via a binary output. This does not have its own connected cleaning unit, but its sensors are installed in the medium affected by cleaning the master and are set to hold by the trigger.
- 3. The trigger is transferred via an additional binary output to another device, whose connected sensors have their own cleaning units. The signal can be used to simultaneously activate a self-cleaning with the master.

### Interrupting the operation via an external signal

You can temporarily interrupt the automatic operation of the analyzer via an external signal at the "DIO" module. This can be useful if no sample is available in your process at certain times, e.g. during a cleaning phase.

The following information is processed at the binary inputs or output at the binary outputs:

■ Binary inputs:

**Signal for process access**: The analyzer can only perform activities that require sample (measurement, calibration, cleaning) when the signal is active. The time and the sequence of activities correspond to the settings in the setup. All activities that require sample are delayed as long as the signal is inactive.

- Binary outputs:
  - **Measurement active** signal: Indicates that a measurement is currently running. The signal is not active in the event of a calibration or cleaning.
  - **Sample required** signal: The signal is active for a configurable time before every activity that requires sample. This makes it possible to activate an external pump or a dilution module, for example.
- 1. Select Menu/Setup/Inputs/Binary input x:y.
- 2. Configure the binary inputs as follows:

Menu/Setup/Inputs/Binary input x:y 1)		
Function	Options	Info
Binary input	Selection On	
Signal type	Selection Static signal	
Signal level	Selection High Low	Specifies the active signal level: <b>Low</b> Input signals between 0 and 5 V DC
		<b>High</b> Input signals between 11 and 30 V DC

- 1) x:y = slot no. : input number
- 3. Link the binary inputs with the analyzer: select **Menu/Setup/Analyzer/Extended setup/Signal for process access**.
- 4. Select measuring channel **SP1**.
- 5. Assign a binary input to the selected measuring channel: select **Binary input** x:y.

### Controlling the measurement start time via an external signal

You can temporarily interrupt the automatic operation of the analyzer via an external signal at the "DIO" module. You can also use this signal to specifically start individual measurements. In this way, you can specify the time of the measurements using your external control system.

For this, connect the **Signal for process access** to a binary input of the "DIO" module and set the starting time of the measurements to **Continuous**. A measurement starts immediately as soon as the signal at the binary input is active. The only exception is if a calibration or cleaning is due on the basis of the set time intervals: in this case, these activities are performed first of all and then the measurement follows immediately afterwards. If necessary, connect the **Measurement active** to a binary output to identify when the measurement actually begins. If you do not require any more measurements once the first measurement is finished, you have to already disable the **Signal for process access** during the active measurement.

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The following information is processed at the binary inputs or output at the binary outputs:

■ Binary inputs:

**Signal for process access**: The analyzer can only perform activities that require sample (measurement, calibration, cleaning) when the signal is active. The time and the sequence of activities correspond to the settings in the setup. All activities that require sample are delayed as long as the signal is inactive.

- Binary outputs:
  - **Measurement active** signal: Indicates that a measurement is currently running. The signal is not active in the event of a calibration or cleaning.
  - **Sample required** signal: The signal is active for a configurable time before every activity that requires sample. This makes it possible to activate an external pump or a dilution module, for example.
- 1. For the measurement, under **Menu/Setup/Analyzer/Measurement** select **Continuous** as the start condition (analyzer measures continuously, without interruption, between the measurements).
- 2. Select Menu/Setup/Inputs/Binary input x:y.
- 3. Configure the binary inputs as follows:

Menu/Setup/Inputs/Binary input x:y 1)		
Function	Options	Info
Binary input	Selection On	
Signal type	<b>Selection</b> Static signal	
Signal level	Selection High Low	Specifies the active signal level:  Low Input signals between 0 and 5 V DC  High Input signals between 11 and 30 V DC

- 1) x:y = slot no. : input number
- 4. Link the binary inputs with the analyzer: select **Menu/Setup/Analyzer/Extended setup/Signal for process access**.
- 5. Select measuring channel **SP1**.
- 6. Assign a binary input to the selected measuring channel: select **Binary input** x:y.
- 7. Select Menu/Setup/Outputs/Binary output x:y.
- 8. Configure the binary outputs as follows:

Menu/Setup/Outputs/Binary output x:y 1)		
Function	Options	Info
Binary output	Selection On	
Signal type	Selection Static signal	
Function	Selection Analyzer	
Assignments Function = Analyzer	Selection Measurement active SP1	Here select which binary outputs output the system status for a measurement currently running.

1) x:y = slot no. : input number

- 9. Press **OK** to confirm.
  - ► The binary inputs and binary outputs are configured.
- 10. Switch to the automatic mode: Press the **MODE** soft key and select **Continue** automatic mode or **Start automatic mode**.
  - ► The display shows **Current mode- Automatic**.

### Activating an external pump before every measurement

If you convey the sample to the analyzer using an external pump or an external sample preparation system, you can use the **Signal for sample request** to switch on the external devices for a limited time only when the analyzer requires sample. The signal becomes active before every measurement, calibration and cleaning. You can configure how long the signal should be active for. The start of the actual analyzer activity is delayed by this time

- 1. You must select Menu/Setup/Analyzer/Extended setup/Signal for sample request.
- 2. Under **Lead time**, set how long an action that requires sample (measurement, calibration or cleaning) is delayed.
- 3. Under **Duration SP%C**, set how long the signal should remain active. The duration can be longer than the lead time. The maximum possible value equals the lead time plus the duration of the measurement.
- 4. Configure the binary outputs as follows:

Menu/Setup/Outputs/Binary output x:y 1)		
Function	Options	Info
Binary output	Selection On	
Signal type	Selection Static signal	
Function	Selection Analyzer	
Assignments Function = Analyzer	Selection Sample required SP1	Here select which binary outputs output the system status for a measurement currently running.

- 1) x:y = slot no. : input number
- 5. The output signal level **High** indicates that sample is required.

# 10.5.2 Binary input configuration

Menu/Setup/Inputs/Binary input x:y 1)		
Function	Options	Info
Binary input	Selection    Off    On Factory setting On	Switches the input on/off
Signal type	Selection     Static signal     PFM Factory setting Static signal	► Select the signal type.  Static signal  Use this setting to read out the position of, for example, an on/off switch, an inductive proximity switch or a PLC binary output.  Signal application: for measuring range switching, acceptance of an external hold, as a cleaning trigger or for controller activation  PFM  The PFM setting produces a pulse-frequency-modulated signal that is subsequently available on the device as a quasi-continuous process value.  Example: Measuring signal of a flowmeter
Signal type = Static signa	վ	
Signal level	Selection Low High Factory setting High	Specifies which input signal levels should activate, for example, measuring range switching or a cleaning.  Low Input signals between 0 and 5 V DC  High
		Input signals between 11 and 30 V DC
Signal type = PFM		
Max. frequency	100.00 to 1000.00 Hz  Factory setting 1000.00 Hz	Maximum frequency of the PFM input signal Is to equal the maximum possible upper limit of the measuring range.  If the value selected is too small, higher frequencies will not be detected. If the value is too large, on the other hand, the resolution for small frequencies will be relatively inexact.
Meas. value format	Selection  # # #.#  #.##  #.##  Factory setting #.##	► Specify the number of decimal places.

Menu/Setup/Inputs/Binary input x:y 1)		
Function	Options	Info
Input variable	Selection     Frequency     Parameter     Flow rate Factory setting Frequency	Frequency Display in Hz in the measuring menu Parameter You subsequently determine the parameter name and unit. These are then displayed in the measuring menu. Flow rate For connecting a flowmeter
Parameter name Input variable = Parameter	Customized text, 16 characters	► Define a name for the parameter, e.g. "Pressure".
Unit of measure Input variable = Parameter	Customized text, 16 characters	► Specify the unit for your parameter, e.g. "hPa".
Lower range value Input variable = Parameter or Flow rate	-2000.00 to 0.00  Factory setting 0.00	The start of measuring range corresponds to a frequency of 0 Hz. Your previously defined unit is additionally displayed.
Upper range value Input variable = Parameter or Flow rate	0.00 to 10000.00  Factory setting 0.00	The end of measuring range corresponds to the maximum frequency defined above. Your previously defined unit is additionally displayed.
Damping	0 to 60 s  Factory setting 0 s	The damping causes a floating average curve of the measured values over the time specified.

<sup>1)</sup> x:y = slot no. : input number

# 10.5.3 Configuration of binary outputs

Menu/Setup/Outputs/Binary output x:y 1)		
Function	Options	Info
Binary output	Selection     Off     On Factory setting On	Switches the output on/off
Signal type	Selection  Static signal FPFM Factory setting Static signal	► Select the signal type.  Static signal  Comparable to a relay: output of a diagnostic status, a limit switch or the status of an active measurement
		PFM You can output a measured value, e.g. the chlorine value or the manipulated variable of a controller. It acts as a "wear-free" switching contact that can be used to activate a dosing pump, for example.

Function	Options	Info
Signal type = Static signal		
Function	Selection None Limit switches Diagnostics message Cleaning Analyzer Factory setting None	Source for the outputted switching state The following functions depend on the option selected. Function = None switches off the function. There are no other settings.
Assignments Function = Cleaning	Multiple selection ■ Cleaning 1 - Water ■ Cleaning 4 - Cleaner	Here you can decide which binary outputs should be used for activating the valves and pumps. Here you specifically assign a control signal to the binary output for the cleaner/water dosing of a cleaning program. You can define cleaning programs under: Menu/Setup/Additional functions/Cleaning.
Data sources Function = Limit switches	Multiple selection Limit switch 1 8	<ul> <li>Select the limit switches that should be output via the binary output.</li> <li>Configuration of the limit switches: Menu/Setup/Additional functions/Limit switches.</li> </ul>
Operating mode  Function = Diagnostics message	Selection  as assigned  Namur M  Namur S  Namur C  Namur F  Factory setting as assigned	as assigned With this selection, the diagnosis messages are transmitted over the binary output that you individually allocated to it.  Namur M F  When you choose one of the Namur classes, all messages allocated to that respective class are output.  You can change the Namur class assignment for every diagnostic message.
Assignments Function = Analyzer	Selection    None    Sample required SP1    Measurement active SP1 Factory setting None	If this option is selected, the binary output outputs information as to whether a measurement is active on the selected measuring channel or an action is started that requires sample (measurement, calibration or cleaning).
Signal type = PFM		
Max. frequency	1.00 to 1000.00 Hz  Factory setting 1000.00 Hz	Maximum frequency of the PFM output signal Is to equal the maximum possible upper limit of the measuring range.
Meas. value format	Selection # # #.# # #.# # #.## Factory setting # .##	► Specify the number of decimal places.

Menu/Setup/Outputs/Binary output x:y 1)		
Function	Options	Info
Source of data	Selection  None Sensor inputs Binary inputs Controller Fieldbus signals Mathematical functions Factory setting None	Source whose value should be read out as a frequency via the binary output.
Measuring value  Source of data ≠ Controller	Selection Depends on: Source of data	► Choose the measured value which should be output as the frequency via the binary output.
Actuator type  Source of data = Controller	Selection None Bipolar Unipolar+ Unipolar- Factory setting None	<ul> <li>▶ Determines which controller component should trigger the connected actuator, e.g. the dosing pump.</li> <li>Bipolar "Split range"</li> <li>Unipolar+ Part of the manipulated variable that the controller uses to increase the process value</li> <li>Unipolar- For connected actuators that decrease the controlled variable</li> </ul>
Hold behavior	Selection     Freeze     Fixed value     None Factory setting None	Freeze The device freezes the last value. Fixed value You define a fixed current value that is transmitted at the output.  None A hold does not affect this output.
Hold value	0 to 100 %	
Hold behavior = Fixed value	Factory setting 0 %	
Error behavior	Selection Freeze Fixed value Factory setting Fixed value	Freeze The device freezes the last value. Fixed value You define a fixed current value that is transmitted at the output.
Error value Error behavior = Fixed value	0 to 100 %  Factory setting 0 %	

<sup>1)</sup> x:y = slot no. : input number

# 10.6 Signal outputs

### **10.6.1** Current outputs

Liquiline System CA80 has two analog current outputs by default.

You can configure additional current outputs with extension modules.

### Setting the current output range

► Menu/Setup/General settings: 0..20 mA or 4..20 mA.

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Menu/Setup/Outputs/Current output x:y 1)		
Function	Options	Info
Current output	Selection Off On Factory setting Off	Use this function to activate or deactivate a variable being output at the current output
Source of data	Selection None Connected inputs Controller Factory setting None	The sources of data on offer depend on your device version. The main value of the analyzer and all the sensors and controllers connected to inputs are available for selection.
Measured value	Selection None Depends on the Source of data Factory setting None	The measured value you can select depends on the option selected under <b>Source of data</b> .

The list of dependent measured values is provided in the **Measured value** table, subject to the **Source of**  $data \rightarrow riangleq 83$ .

 $Apart\ from\ measured\ values\ from\ connected\ sensors,\ you\ can\ also\ select\ a\ controller\ as\ the\ data\ source.$ The best way to do so is by using the Additional functions menu. Here, you can select and configure the current output for outputting the controlled variable.

Range lower value Range upper value	Range of adjustment and factory settings depend on the <b>Measured value</b>	You can output the entire measuring range or just some of it at the current output. To do so, specify the upper and lower range values in accordance with your requirements.
Hold behavior (for sensors)	Selection     Freeze last value     Fixed value     Ignore Factory setting Depends on the channel:output	Freeze last value The device freezes the last current value. Fixed value You define a fixed current value that is output at the output. Ignore A hold does not affect this current output.
Hold current (for sensors) 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 hold state.

<sup>1)</sup> x:y = slot:output number

### Measured value depending on the Source of data

Source of data	Measured value
	Selection Main value
pH Glass pH ISFET	Selection  Raw value mV  pH Temperature
ORP	Selection  Temperature ORP mV ORP %

Source of data	Measured value
Oxygen (amp.) Oxygen (opt.)	Selection  Temperature Partial pressure Concentration liquid Saturation Raw value nA (only Oxygen (amp.)) Raw value µs (only Oxygen (opt.))
Cond i Cond c	Selection  Temperature  Conductivity  Resistance (only Cond c)  Concentration (only Cond i and Cond c 4-pol)
Disinfection	Selection  Temperature Sensor current Concentration
ISE	Selection  Temperature  pH  Ammonium  Nitrate  Potassium  Chloride
TU/TS TU	Selection  Temperature Turbidity g/l (only TU/TS) Turbidity FNU (only TU/TS) Turbidity Formazine (only TU) Turbidity solid (only TU)
Nitrate	Selection  Temperature  NO3 NO3-N
Ultrasonic interface	Selection Interface
SAC	Selection  Temperature SAC Transm. Absorption COD BOD
Controller 1 Current input 1 3  Controller 2 Temperature 1 3	Selection  Bipolar (only for current outputs)  Unipolar+ Unipolar-
Mathematical functions	All the mathematical functions can also be used as a data source and the calculated value can be used as the measured value.

### Outputting the controller manipulated variable via the current output

**Unipolar+** Assign to the output to which an actuator that can increase the measured value is connected. **Unipolar-** Assign to the output to which an actuator that can decrease the measured value is connected.

To output the manipulated variable of a two-sided controller, positive manipulated variables and negative manipulated variables generally have to be output to different actuators, as most actuators are able to influence the process in one direction only (not in both). For this purpose, the instrument splits the bipolar manipulated variable y into two unipolar manipulated variables, y+ and y-.

Only the two unipolar manipulated variable parts are available for selection for outputting to modulated relays. If outputting the values via a current output, you also have the possibility of outputting the bipolar manipulated variable y to one current output only (split range).

### 10.6.2 Alarm relay and optional relays

The basic version of the device always has one alarm relay. Additional relays are also available depending on the version of the device.

### The following functions can be output via a relay:

- Limit switch status
- Controller manipulated variable for controlling an actuator
- Diagnostic messages
- Status of a cleaning function in order to control a pump or a valve
  - You can assign a relay to multiple inputs in order to clean several sensors with just one cleaning unit, for example.

Menu/Setup/Outputs/Alarm relay or relay at channel no.		
Function	Options	Info
Function	Selection  Off  Limit switch  Controller  Diagnostics  Cleaning (sensor)  Formula (sensor)  Analyzer  Factory setting  Alarm relays: Diagnostics  Other relays: Off	The following functions depend on the option selected.  These versions are illustrated individually in the following sections to provide a clearer understanding of the options.  Function = Off  Switches off the relay function and means no further settings are required.

### Outputting the status of a limit switch

Function = Limit switch		
Function	Options	Info
Source of data	Selection Limit switch 1 8	Select the limit switch via which the status of the relay is to be output.
	Factory setting None	The limit switches are configured in the menu: Setup/Additional functions/Limit switches.
		Use the <b>ALL</b> and <b>NONE</b> soft keys to select or deselect all the limit switches in one go.
Hold behavior	Selection     Freeze last value     Fixed value     Ignore	
	Factory setting Ignore	

### Outputting the manipulated variable of a controller

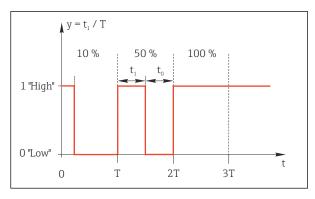
To output a controller manipulated variable via a relay, the relay is modulated. The relay is energized (pulse,  $t_1$ ) and is then de-energized (interval,  $t_0$ ).

Function = Controller		
Function	Options	Info
Source of data	Selection None Controller 1 Controller 2 Factory setting None	➤ Select the controller that should act as the data source.
Operating mode	Selection PWM PFM Factory setting PWM	PWM=pulse width modulation PFM=pulse frequency modulation

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### 1. **PWM** (pulse width modulation):

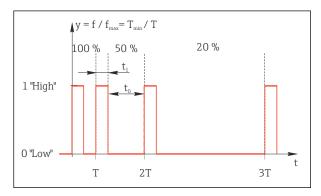
The duty cycle is varied within a period  $\mathbf{T}$  ( $T=t_1+t_0$ ). The cycle duration remains constant.



■ 62 Typical application: solenoid valve

### 2. **PFM** (pulse frequency modulation):

Here, pulses of a constant length  $(t_1)$  are output and the interval between the pulses varies  $(t_0)$ . At a maximum frequency,  $t_1 = t_0$ .



■ 63 Typical application: dosing pump

Function = Controller		
Function	Options	Info
Actuator type	Selection None Unipolar(-) Unipolar(+) Factory setting None	Here you specify what part of the controller should power the relay. <b>Unipolar(+)</b> is the part of the manipulated variable which the controller uses to increase the process value (e.g. for heating purposes). Alternatively, select <b>Unipolar(-)</b> if you are connecting an actuator to the relay that reduces the controlled variable (e.g. for cooling purposes).
Cycle duration  Operating mode = PWM	Shortest turn-on time to 999.0 s Factory setting	► Specify the cycle duration within which the duty cycle should be varied (only PWM).
The settings for Cycle de Cycle duration ≥ Shorte		time influence one another. The following applies:
Shortest turn-on time  Operating mode = PWM	0.3 s to Cycle duration Factory setting 0.3 s	Pulses that are shorter than this limit value are not output in order to conserve the actuator.

Function = Controller		
Function	Options	Info
Maximum frequency Operating mode = PFM	1 to 180 min <sup>-1</sup> <b>Factory setting</b> 60 min <sup>-1</sup>	Maximum number of pulses per minute The controller calculates the pulse duration based on this setting.
Hold behavior	Selection     Freeze last value     Fixed value     Ignore	
	<b>Factory setting</b> Ignore	

### Outputting diagnostic messages via the relay

If a relay is defined as a diagnostic relay (**Function** = **Diagnostics**), it works in the **"fail-safe mode"**.

This means that the relay is always energized ("normally closed", n.c.) in the basic state if an error is not present. In this way it can also indicate a drop in voltage, for example. The alarm relay always works in the failsafe mode.

You can output two categories of diagnostic messages via the relay:

- Diagnostic messages from one of the 4 Namur classes
- Diagnostic 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/Extended setup/Diagnostics settings/Diag. behavior (device-specific messages)
- Menu/Setup/Inputs/<Sensor>/Extended setup/Diagnostics settings/Diag. behavior (sensor-specific messages)
- Before being able to assign the relay output to a special message in **Diag. behavior** you must first configure **Outputs**/Relay x:y or /**Alarm relay/Function = Diagnostics**.

Function = Diagnostics		
Function	Options	Info
Operating mode	Selection  as assigned  Namur M  Namur S  Namur C  Namur F  Factory setting  Relay: as assigned  Alarm relays: Namur F	as assigned If this option is selected, the diagnostic messages which you have individually assigned to the relay are output via the relay.  Namur M Namur 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 diagnostic message.  (Menu/Setup/General settings/Extended setup/Diagnostics settings/Diag. behavior or Menu/Setup/Inputs/ <sensor>/Extended setup/Diagnostics settings/Diag. behavior)</sensor>
Attributed diagnostic messages  Operating mode = as assigned	Read only	All the messages assigned to the relay output appear on the display. You do not have the option of editing the information here.

### Outputting the status of a cleaning function

Function = Cleaning(for sensors)		
Function	Options	Info
Assignments	Selection None Depends on the type of cleaning Factory setting None	Here you can specify how a cleaning function should be displayed for the relay.  You have the following options depending on the cleaning program that is selected (Menu/Setup/Additional functions/Cleaning:  Cleaning type = Standard clean Cleaning 1 - Water, Cleaning 2 - Water, Cleaning 3 - Water, Cleaning 4 - Water  Cleaning type = Chemoclean Cleaning 1 - Water, Cleaning 1 - Cleaner, Cleaning 2 - Water, Cleaning 2 - Cleaner, Cleaning 3 - Water, Cleaning 3 - Cleaner, Cleaning 4 - Water, Cleaning 4 - Cleaner  Cleaning type = Chemoclean Plus  4x Cleaning 1 - %0V, 4x Cleaning 2 - %0V 1)
Hold behavior	Selection Freeze last value Fixed value Ignore Factory setting Ignore	Freeze last value The device freezes the last measured value. Fixed value You define a fixed measured value that is output at the output. Ignore A hold has no effect.

<sup>1) %0</sup>V is variable text which you can assign in Menu/Setup/Additional functions/Cleaning/Chemoclean Plus/Output label 1 ... 4.

# Outputting the "Measurement active" system status and the information "Sample required"

Function = Analyzer		
Function	Options	Info
Signal type = Static signal		
Assignments Function = Analyzer	Selection None Sample required SP1 Measurement active SP1 Factory setting None	If this option is selected, information is output as to whether a measurement is active on the selected measuring channel or an action is started that requires sample (measurement, calibration or cleaning).

### 10.6.3 PROFIBUS DP and PROFINET

### Device variables (device → PROFIBUS/PROFINET)

Here you can specify which process values should be mapped to the PROFIBUS function blocks and are thereby available for transmission via PROFIBUS communication.

You can define a maximum of 16 device variables (AI Blocks).

- 1. Define the data source.
  - You can choose from sensor inputs, current inputs and mathematical functions.
- 2. Choose the measured value to be transmitted.
- 3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**)  $\Rightarrow \triangleq 83$

Please note that if you select **Hold behavior= Freeze**, the system not only flags the status but also actually "freezes" the measured value.

In addition, you can define 8 binary variables (DI Blocks):

- 1. Define the data source.
- 2. Select the limit switch or relay whose status is to be transmitted.

### PROFIBUS/PROFINET variables (PROFIBUS/PROFINET → device)

A maximum of 4 analog (AO) and 8 digital (DO) PROFIBUS variables are available as measured values in the controller, limit switch or current output menus.

Example: Using an AO or DO value as the set point for the controller

### Menu/Setup/Additional functions/Controller 1

- 1. In the specified menu, define PROFIBUS as the data source.
- 2. Select the desired analog output (AO) or digital output (DO) as the measured value.
- Further information on "PROFIBUS" can be found in the Guideline for Communication via PROFIBUS, SD01188C
- Further information on "PROFINET" can be found in the Guideline for Communication via PROFINET, SD02490C

#### 10.6.4 Modbus RS485 and Modbus TCP

Specify which process values should be output via Modbus RS485 Communication or via Modbus TCP.

In the case of Modbus RS485, you can switch between the RTU and the ASCII protocol.

You can define a maximum of 16 device variables.

- 1. Define the data source.
  - ► You can choose from the analyzer as well as sensor inputs and controllers.
- 2. Select the measured value to be output.
- Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**)  $\Rightarrow \triangleq 83$

Please note that if you select **Hold behavior** = **Freeze**, the system not only flags the status but also actually "freezes" the measured value.

Further information on "Modbus" can be found in the Guideline for Communication via Modbus, SD01189C

### 10.6.5 EtherNet/IP

Specify which process values should be output via EtherNet/IP communication.

You can define a maximum of 16 analog device variables (AI).

- 1. Define the data source.
  - You can choose from the analyzer as well as sensor inputs and controllers.
- 2. Select the measured value to be output.
- 3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**)  $\rightarrow \stackrel{\triangle}{=} 83$
- 4. In the case of controllers, also specify the type of manipulated variable.

Please note that if you select **Hold behavior** = **Freeze**, the system not only flags the status but also actually "freezes" the measured value.

**In addition** you can define 8 digital device variables (DI):

- ► Define the data source.
  - └ You can choose from relays, binary inputs and limit switches.

For further information on "EtherNet/IP", see the Guideline for Communication via EtherNet/IP, SD01293C

### 10.7 Additional functions

### 10.7.1 Limit switch

There are different ways to configure 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 (for sensors)

Menu/Setup/Additional functions/Limit switches/Limit switch 1 8		
Function	Options	Info
Source of data	Selection None Sensor inputs Binary inputs Controller Fieldbus signals Mathematical functions MRS set 1 2 Factory setting None	➤ Specify the input or output which is to be the data source for the limit switch.  The sources of data on offer depend on your device version.  You can choose from connected sensors, binary inputs, fieldbus signals, mathematical functions, controllers and sets for measuring range switching.
Measuring value	Selection Depends on: Source of data	► Select the measured value, see the following table.

### Measured value depending on the Source of data

Source of data	Measured value
	Selection Main value
pH Glass	Selection
pH ISFET	<ul> <li>Raw value mV</li> <li>pH</li> <li>Temperature</li> </ul>
ORP	Selection  Temperature ORP mV ORP %
Oxygen (amp.)	Selection
Oxygen (opt.)	<ul> <li>Temperature</li> <li>Partial pressure</li> <li>Concentration liquid</li> <li>Saturation</li> <li>Raw value nA         <ul> <li>(only Oxygen (amp.))</li> </ul> </li> <li>Raw value µs         (only Oxygen (opt.))</li> </ul>

Source of data	Measured value
Cond i	Selection
Cond c	<ul> <li>Temperature</li> <li>Conductivity</li> <li>Resistance         (only Cond c)</li> <li>Concentration         (only Cond i and Cond c 4-pol)</li> </ul>
Disinfection	Selection  Temperature Sensor current Concentration
ISE	Selection  Temperature  pH Ammonium Nitrate Potassium Chloride
TU/TS	Selection
TU	<ul> <li>Temperature</li> <li>Turbidity g/l         (only TU/TS)</li> <li>Turbidity FNU         (only TU/TS)</li> <li>Turbidity Formazine         (only TU)</li> <li>Turbidity solid         (only TU)</li> </ul>
Nitrate	Selection  Temperature NO3 NO3-N
Ultrasonic interface	Selection Interface
SAC	Selection  Temperature SAC Transm. Absorption COD BOD
Controller 1 Current input 1 3	Selection  Bipolar  (only for current outputs)
Controller 2 Temperature 1 3	(only for current outputs)  Unipolar+  Unipolar-
Mathematical functions	All the mathematical functions can also be used as a data source and the calculated value can be used as the measured value.

You can monitor the manipulated variable by assigning the controller manipulated variable to a limit switch (e. g. configure a dosing time alarm).

Menu/Setup/Additional functions/Limit switches/Limit switch 1 8		
Function	Options	Info
Cleaning program	Selection  None Cleaning 1 4  Factory setting None	Use this function to choose which cleaning instance should start when the limit switch is active.
Function	Selection     Off     On Factory setting Off	Activating/deactivating the limit switch
Operating mode	Selection     Above limit check     Below limit check     In range check     Out of range check     Change rate	Type of limit value monitoring:  ■ Limit value overshoot or undershoot → 📵 64  ■ Measured value within or outside a range → 📵 65  ■ Rate of change → 📵 67
	<b>Factory setting</b> Above limit check	
Limit value	Settings depend on the measured value	Operating mode = Above limit check <i>or</i> Below limit check
A		B
1 2	MV 1	2

■ 64 Exceeding (A) and undershooting (B) a limit value (without hysteresis and switch-on delay)

t<sub>2</sub>

 $t_3$ 

 $t_4$   $t_5$ 

A0028523

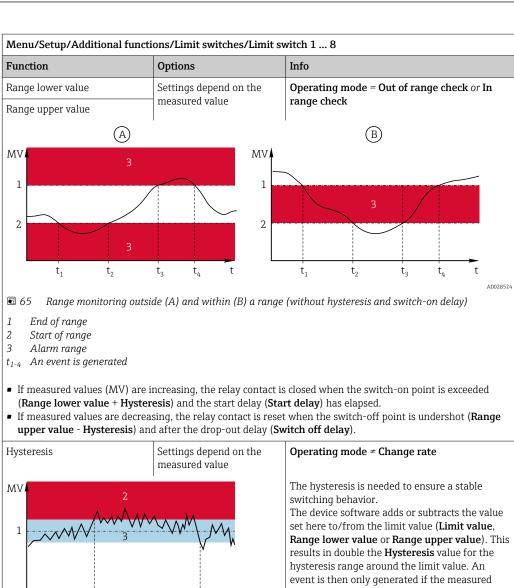
 $t_4$   $t_5$  t

- 1 Limit value
- 2 Alarm range
- $t_{1,3,5}$  No action
- $t_{2,4}$  An event is generated

 $t_2$ 

 $t_3$ 

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



■ 66 Hysteresis taking the example of limit value overshoot

- 1 Limit value
- 2 Alarm range

Start delay

rate

Switch off delay

- 3 Hysteresis range
- $t_{1,2}$  An event is generated

Operating mode ≠ Change

Operating mode ≠ Change

The hysteresis is needed to ensure a stable switching behavior.
The device software adds or subtracts the value set here to/from the limit value (Limit value, Range lower value or Range upper value). This results in double the Hysteresis value for the hysteresis range around the limit value. An event is then only generated if the measured value (MV) completely passes through the hysteresis range.

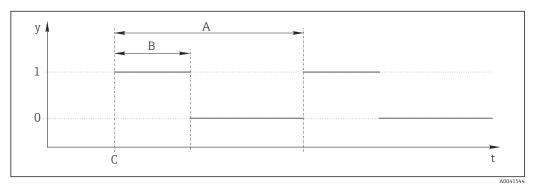
O to 9999 s

Factory setting
O s

Menu/Setup/Additional functions/Limit switches/Limit switch 1 8		
Function	Options	Info
Delta value	Settings depend on the measured value	Operating mode = Change rate The slope of the measured value (MV) is
Delta time	00:00:01 23:59:00 <b>Factory setting</b> 01:00:00	monitored in this mode.  If, in the specified time frame ( <b>Delta time</b> ), the measured value increases or decreases by more than the specified value ( <b>Delta value</b> ), an event
Auto confirm	00:01 to 23:59  Factory setting 00:01	is generated. No further event is generated if the value continues to experience such a steep increase or decrease. If the slope is back below the limit value, the alarm status is reset after a preset time (Auto confirm).
$\Delta MV_1$ $\Delta MV_1$ $t_1$ $t_2$ $t_3$ $t_4$	ΔMV <sub>3</sub> t <sub>5</sub> t <sub>6</sub> t	Events are triggered by the following conditions in the example given: $t_2 - t_1 < \textbf{Delta time} \text{ and } \Delta MV1 > \textbf{Delta value} \\ t_4 - t_3 > \textbf{Auto confirm} \text{ and } \Delta MV2 < \textbf{Delta value} \\ t_6 - t_5 < \textbf{Delta time} \text{ and } \Delta MV3 > \textbf{Delta value} \\ \end{cases}$
■ 67 Rate of change	AUU28520	

### 10.7.2 Time switch

A time switch provides a time-controlled, binary process value. This can be used as a source by the "Formula" mathematical function.



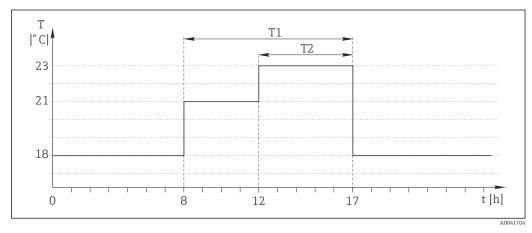
■ 68 Signal pattern of a time switch

- t Timeline
- y Signal level (1 = on, 0 = off)
- A Period
- B Signal duration
- C Start time (Start date, Start time)

Menu/Setup/Additional functions/Time switches/ Time switch 1 8		
Function	Options	Info
Function	Selection On Off	Switches the function on or off
	<b>Factory setting</b> Off	
Start date	01.01.2000 to 31.12.2099	► Enter start date
	Format DD.MM.YYYY	
Start time	00:00:00 to 23:59:59	► Enter start time
	Format hh.mm.ss	
Signal duration	00:00:03 to 2400:00:00 <b>Format</b> hh.mm.ss	Duration of the high signal level at the start of a cycle
Period	00:00:03 to 2400:00:00	Duration of a cycle
	Format hh.mm.ss	
Signal	Display only	Current process value of the time switch
Next signal date	Display only	Date of the next signal
Next signal time	Display only	Time of the next signal

### Example 1: Time-based set point for a temperature controller

The temperature should increase to  $21\,^{\circ}\text{C}$  from 08:00 every day, and then to  $23\,^{\circ}\text{C}$  for 5 hours from 12:00. The temperature should be controlled to fall back down to  $18\,^{\circ}\text{C}$  from 17.00. Two time switches are defined for this purpose which are used in a **MF1: Formula** mathematical function. Using the mathematical function, an analog temperature set point is thus available for a controller.



■ 69 Time-based temperature control

1. Program **Time switch 1** (T1):

- **Start date** = 01.01.2020
- **Start time** = 08:00:00
- **Signal duration** = 09:00:00
- **Period** = 24:00:00

2. Define **Time switch 2** (T2):

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- **Start date** = 01.01.2020
- **Start time** = 12:00:00
- **Signal duration** = 05:00:00
- **Period** = 24:00:00
- 3. Create **Formula** mathematical function.

#### Menu/Setup/Additional functions/Mathematical functions

- MF1: Formula
- Tracking = On
- Source A = Time switch 1
- Source B = Time switch 2
- Formula = 18.0 + 3\*NUM(A) + 2\*NUM(B)

Explanation: NUM converts the logical value to a numerical value and thus enables multiplication.

- 3\*NUM(A) results in the value 3.0 from 08:00 to 17:00 and 0.0 outside of this time period.
- 2\*NUM(B) results in the value 2.0 from 12:00 to 17:00 and 0.0 outside of this time period.

The formula thus yields one of these analog values depending on the time: 18.0, 21.0 or 23.0. This analog value can be used as a set point for a temperature controller.

### Example 2: Time-based condition

A pump should switch on (via a relay) for 10 minutes every 2 hours. This only applies if the pH value is lower than 4.0.

- 1. Program **Time switch 1**:
- **Start date** = 01.01.2020
- **Start time** = 00:00:00
- **Signal duration** = 00:10:00
- **Period** = 02:00:00
- 2. Create **Formula** mathematical function.

### Menu/Setup/Additional functions/Mathematical functions

- MF1: Formula
- Tracking = On
- Source A = Time switch 1
- **Source B** = pH value of a Memosens pH input
- **Formula** = A AND(B<4.0)
- 3. Use the formula as the data source of a relay.

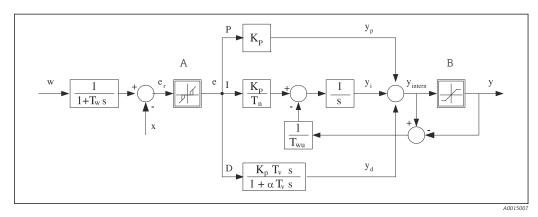
#### Menu/Setup/Outputs/Relay[x:y]

- **■** Function = Formula
- Operating mode = Static signal
- Source of data = MF1: Formula

The formula yields a logical value (TRUE or FALSE) and is thus suitable to trigger a relay directly in the static operating mode. **Time switch 1** provides a TRUE value for 10 minutes every 2 hours but only if the pH value has dropped to below 4 at the same time.

### 10.7.3 Controller

#### Controller structure in Laplace representation



**■** 70 Block diagram of the controller structure

Ι Α Neutral zone Integral value В Output limiting D Derivative value Gain (P-value)  $K_p$ *Damping time constant with*  $\alpha$  = 0 to 1  $\alpha T_{vr}$  $T_n$ Integral action time (I-value) Control deviation  $T_{\nu}$ Derivative action time (D-value) Set point w

 $T_{w}$  Time constant for set point damping x Controlled variable  $T_{wu}$  Time constant for anti-windup feedback y Manipulated variable

P Proportional value

The controller structure of the device comprises set point damping at the input to prevent erratic changes in the manipulated variable if the set point changes. The difference between the set point w and the controlled variable (measured value) X results in the control deviation which is filtered by a neutral zone.

The neutral zone is used to suppress control deviations (e) that are too small. The control deviation thus filtered is now fed to the actual PID controller which divides into 3 parts based on the P (proportional), I (integral) and D (derivative) values (top-down). The integral section (middle) also comprises an anti-windup mechanism for limiting the integrator. A low-pass filter is added to the D-section to damp hard D-terms in the manipulated variable. The sum of the 3 sections results in the internal controller manipulated variable which is limited according to the settings (for PID-2s to -100% to +100%).

The graphic does not illustrate a downstream filter for limiting the rate of change of the manipulated variable (can be configured in the menu in **Max y change rate**).

In the menu do not configure the gain  $K_p$ . Instead configure the reciprocal value, the proportional band  $X_p$  ( $K_p=1/X_p$ ).

### Configuration

Make the following decisions to configure a controller:

- (1) What type of process can your process be assigned to?  $\rightarrow$  **Process type**
- (2) Should it be possible to influence the measured variable (controlled variable) in one direction or in both directions? One-sided or two-sided controller, → **Controller type**
- (3) What should be the controlled variable (sensor, measured value)? → Controlled variable
- (4) Do you have a disturbance variable that should be active at the controller output? → Disturbance variable

- (5) Specify the parameters for the controller:
  - Set point, → **Setpoint**
  - Neutral zone,  $\rightarrow$  Xn
  - Proportional band,  $\rightarrow$  **Xp**
  - Integral action time (I-value),  $\rightarrow$  **Tn**
  - Derivative action time (D-value), → **Tv**
- (6) What should the controller do in the event of a hold (measured error, sensor replacement, cleaning etc.)?
  - Pause or continue with dosing? →**Hold behavior/Manipulated Variable**
  - At the end of a hold, continue or restart the control loop (affects I-value)? →Hold behavior/State
- (7) How should the actuator be triggered?
  - **Unipolar+**: assign this setting to the output for an actuator which can increase the measured value.
  - **Unipolar**-: assign this setting to the output for an actuator which can decrease the measured value.
  - **Bipolar**: select this setting if you want to output the manipulated variable via one current output only (split range).
- (8) Configure the outputs and switch on the controller.

Menu/Setup/Additional functions/Controller 1 2		
Function	Options	Info
Control	Selection Off Automatic Manual mode Factory setting Off	<ul> <li>First configure the controller and leave the switch at the factory setting (Off).</li> <li>Once you have made all the settings, you can assign the controller to an output and switch it on.</li> </ul>
► Manual mode		
у	-100 to 100 %  Factory setting 0 %	► Specify the manipulated variable that should be output in manual mode.
y actual output	Read only	Manipulated variable actually output.
Setpoint		Current set point
Х		Current measured value
Disturbance variable		Current measured value of disturbance variable
Norm. disturb. value		
Name	Free text	► Give the controller a name so you can identify it later on.
Controller enable	Selection  None Binary inputs Limit switches Fieldbus variables Factory setting None	In connection with the DIO module, you can select a binary input signal, e. g.from an inductive proximity switch, as a source for enabling the controller.
Setup Level	Selection  Standard Advanced  Factory setting Standard	Changes the number of parameters that can be configured. → <b>Parameters</b> → 🗎 103 <b>Standard</b> : If you choose this, the other controller parameters are active nevertheless. The factory settings are used. These suffice in most cases.

Menu/Setup/Additional functions/Controller 1 2		
Function	Options	Info
Process type	Selection Inline Batch	► Decide what type of process best describes your particular process.
	Factory setting Inline	

#### **Batch process**

The medium is in a closed system.

The task of the control system is to dose in such a way that the measured value (controlled variable) changes from its start value to its target value. No more dosing is needed once the set point has been reached and the system is stable. If the target value is overshot, a two-sided control system can compensate for this. In the case of 2-sided batch control systems, a neutral zone is used/configured to suppress oscillations around the set point.

#### In-line process

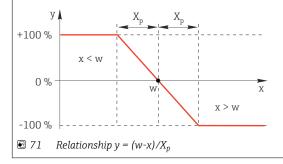
In an in-line process, the control system works with the medium flowing by in the process. Here, the controller has the task of using the manipulated variable to set a mixture ratio between the medium and dosing agent such that the resulting measured variable corresponds to the set point. The properties and volume of the medium flow can change at any time and the controller has to react to these changes on a continuous basis. If the flow rate and medium remain constant, the manipulated variable can also assume a fixed value once the process has settled. Since the control process is never "finished" here, this type of control is also referred to as continuous control.

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A mixture of both process types can often be found in practice: the semi-batch process. Depending on the ratio between the flow and the container volume, this arrangement behaves either like a batch process or an in-line process.

Controller type	Selection	Depending on which actuator you have
	■ PID 1-sided	connected, you influence the process in only one
	■ PID 2-sided	direction (e.g. heating) or in both directions
	Factory setting	(e.g. heating and cooling).
	PID 2-sided	

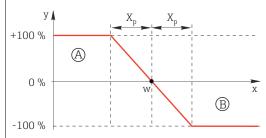
A 2-sided controller can output a manipulated variable in the range from -100 % to +100 %, i. e. the manipulated variable is bipolar. The manipulated variable is positive if the controller should increase the process value. In the case of a pure P-controller, this means that the value of the controlled variable x is smaller than the set point w. On the other hand, the manipulated variable is negative if the process value should be decreased. The value for x is greater than the set point w.



Menu/Setup/Additional functions/Controller 1 2		
Function	Options	Info
Effective direction  Controller type = PID 1-sided	Selection Direct Reverse Factory setting Reverse	In what direction should the controller influence the measured value?  ■ The measured value should increase as a result of dosing (e. g. heating)  → Reverse  ■ The measured value should decrease as a result of dosing (e. g. cooling)  → Direct

A 1-sided controller has a unipolar manipulated variable, i. e. it can only influence the process in one direction. **Reverse**: If the controller should increase the process value, set this as the direction of action. The controller becomes active when the process value is too small (range A).

**Direct**: With this direction of action, the controller acts as a "downwards controller". It becomes active when the process value (e. g. the temperature) is too high (range B).



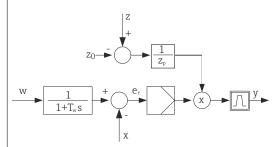
 $\blacksquare$  72 Red: overlap between the curves of the two 1-sided controllers.

► Controlled variable		
Source of data	Selection None Sensor inputs Current inputs Fieldbus signals Binary inputs Mathematical functions	► Specify the input or output which should be the source of data for the controlled variable.
	Factory setting None	
Measured value	Selection Depends on Source of data	► Specify the measured value that should be your controlled variable.
	Factory setting None	You can use different measured values depending on the data source.
▶ Setpoint		Target value of the controlled variable This menu is not displayed if you selected a fieldbus as the source (Source of data = fieldbus).
Setpoint	Range of adjustment and factory setting depending on the <b>Source of data</b>	Specify the target value for the controlled variable.
Tw	0.0 to 999.9 s	Time constant for the set point damping filter
Setup Level = Advanced	Factory setting 2.0 s	
▶ Disturbance variable		optional, activation code necessary

### Menu/Setup/Additional functions/Controller 1 ... 2

Function Options Info

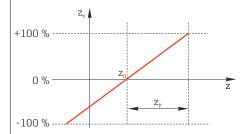
In the case of "flowing medium" (in-line) controls, the flow rate may not be constant. In some circumstances, strong fluctuations are possible. In the case of a settled control system in which the flow rate is suddenly halved, it is desirable that the dosed quantity from the controller is also directly halved. In order to achieve this type of "flow-rate-proportional" dosing, this task is not left to the I-component of the controller, but rather one enters the (to be measured) flow rate as disturbance variable z multiplicative at the controller output.



Strictly speaking, feedforward control involves an open-loop control system, since its effect is not measured directly. That means that the feed flow is directed exclusively forward. Hence the designation "feedforward control".

For the additive feedforward control that is alternatively available in the device, the (standardized) disturbance variable is added to the controller manipulated variable. This enables you to set up a type of variable base load dosing.

The standardization of the disturbance variable is required both for multiplicative and for additive feedforward control and is done using parameters  $Z_0$  (zero point) and  $Z_p$  (proportional band):  $z_n = (z - z_0)/z_p$ 



#### Example

Flowmeter with measuring range 0 to 200  $m^3/h$ 

The controller would currently dose 100% without feedforward control.

The feedforward control should be configured such that at  $z = 200 \text{m}^3/\text{h}$ , the controller still doses at 100% ( $z_n = 1$ ).

If the flow rate drops, the dosing rate should be reduced, and at a flow rate of less than  $4 \text{ m}^3/\text{h}$ , dosing should stop entirely  $(z_n = 0)$ .

 $\rightarrow$  Select the zero point  $z_0 = 4 \text{ m}^3/\text{h}$  and the proportional band  $Z_p = 196 \text{ m}^3/\text{h}$ .

Function	Selection    Off    Multiply    Add	Selecting multiplicative or additive feedforward control
	<b>Factory setting</b> Off	
Source of data	Selection None Sensor inputs Current inputs Fieldbus signals Binary inputs Mathematical functions Factory setting None	► Specify the input which should be the source of data for the disturbance variable.

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Menu/Setup/Additional functions/Controller 1 2		
Function	Options	Info
Measured value	Selection Depends on Source of data	► Specify the measured value that should be your disturbance variable.
	Factory setting None	You can use different measured values depending on the data source.
Zp	Range of adjustment depending on the selection of the measured value	Proportional band>
ZO		Zero point
▶ Parameters		

The Liquiline PID controller has been implemented in the serial structural form, i. e. it has the following parameters:

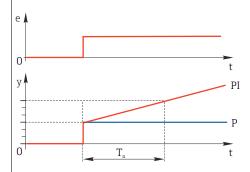
- Integral action time T<sub>n</sub>
   Derivative action time T<sub>v</sub>
- Proportional band X<sub>p</sub>

**Setup Level** = **Advanced**: With this setup level, you can also configure the following:

- Time constant T<sub>wu</sub>
- $\bullet \ \ Time\ constant\ \alpha$
- ullet Width of the neutral zone  $X_n$
- Width of the hysteresis range of the neutral zone X<sub>hyst</sub>
- Clock time of the controller

Tn	0.0 to 9999.0 s	The integral action time specifies the effect of
	LU.U.S	the I-value If $Tn > 0$ the following applies: $Clock < Twu < 0.5(Tn + Tv)$

The integral action time is the time needed in a step-function response to achieve a change in the manipulated variable - as a result of the I effect - which has the same magnitude as the P-value.

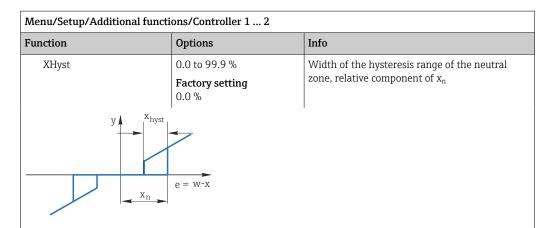


e = control deviation, e=w-x (set point controlled variable)

Menu/Setup/Additional functions/Controller 1 2				
Function	Options	Info		
Twu	0.1 to 999.9 s  Factory setting 20.0 s	Time constant for anti-windup feedback The lower the value the greater the integrator inhibition. Exercise extreme caution when making changes. $ \textbf{Clock} < \textbf{Twu} < 0.5(\textbf{Tn} + \textbf{Tv}) $		
Tv	0.1 to 999.9 s  Factory setting 0.0 s	The derivative action time specifies the effect of the D-value		
The derivative action time is the time by which the ramp response of a PD controller reaches a specific value of the manipulated variable at an earlier stage than it would solely as a result of its P-value.				

e	
0	t
у	PD
	P
0	t
alpha	0.0 to 1.0
	Factory cotting

alpha	0.0 to 1.0  Factory setting 0.3	Affects the additional damping filter of the D-controller. The time constant is calculated from $\alpha \cdot T_v.$
Process balance  Controller type = PID 2- sided	Selection Symmetric Asymmetric Factory setting	Symmetric There is only one control gain and this applies for both sides of the process. Asymmetric
	Symmetric	You can set the control gain individually for both sides of the process.
Xp Process balance = Symmetric	Range of adjustment and factory setting depending on the <b>Source of data</b>	Proportional band, reciprocal value of the proportional gain $K_p$ As soon as controlled variable x deviates more than $x_p$ from the set point w, manipulated variable y reaches 100%.
Xp Low Process balance = Asymmetric	Range of adjustment and factory setting depending on the <b>Source of data</b>	$x_p$ for y < 0 (manipulated variable < 0)
Xp High Process balance = Asymmetric		$x_p$ for $y > 0$ (manipulated variable $> 0$ )
Xn	Range of adjustment and factory setting depending on the <b>Source of data</b>	Tolerance range about the set point that prevents minor oscillations about the set point if using two-sided control loops.
XN Low Process balance = Asymmetric	Range of adjustment and factory setting depending on the <b>Source of data</b>	$x_n$ for $x \le w$ (controlled variable $\le$ set point)
XN High  Process balance = Asymmetric	_	$x_n$ for $x \ge w$ (controlled variable $\ge$ set point)



The graphic illustrates the manipulated variable (with a pure P-controller) over the control deviation e (set point minus controlled variable). Very low control deviations are set to zero. Control deviations  $> x_n$  are processed "in the normal way". Via  $x_{hyst}$  it is possible to configure a hysteresis to suppress oscillations at the edges.

Clock	0.333 to 100.000 s  Factory setting 1.000 s	Expert setting Only change the clock time of the controller if you know exactly what you are doing. Clock < Twu < 0.5(Tn + Tv)
Max y change rate	0.00 to 1.00 Factory setting 0.40	Limits the change of the output variable A value of 0.5 permits a maximum manipulated variable change of 50 % within one second.
► Exception behavior		Hold=measured value is no longer reliable
Manipulated Variable	Selection  Freeze Fixed value	How should the controller react to a measured value that is no longer reliable?
	Factory setting Freeze	Freeze The manipulated variable is frozen at the current value
		<b>Fixed value</b> Manipulated variable is set to 0 (no dosing)
State	Selection     Freeze     Reset Factory setting Freeze	Internal controller status  Freeze No change  Reset After a hold, the control system starts from scratch, and settling time takes place again.
Hold as exception	Selection All None Factory setting All	➤ Select: Should the hold trigger the previously selected exception behaviour, or should it be ignored?
Outputs		Goes to the menu <b>Outputs</b>
► Controller assignment view		Shows an overview of the inputs and outputs used

### 10.7.4 Cleaning programs for sensors

### **A** CAUTION

Programs not switched off during maintenance activities.

Risk of injury due to medium or cleaning agent!

- ▶ Quit any programs that are active.
- Switch to the Service Mode before you remove sensors from the assembly.
- ▶ If you need to test the cleaning function while cleaning is in progress, wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

### Types of cleaning

The user can choose from the following cleaning types:

- Standard clean
- Chemoclean
- Chemoclean Plus
- **State of cleaning**: Indicates whether the cleaning program is active or not. This is for information purposes only.

### Selecting the cleaning type

- 1. **Menu/Setup/Additional functions/Cleaning**: Select a cleaning program.
  - You can configure 4 different types of cleaning which you can assign individually to the inputs.
- 2. **Cleaning type**: For each cleaning program decide which type of cleaning should be performed.

### Standard cleaning

Standard cleaning involves cleaning a sensor with compressed air, for instance, as performed with the ion-selective sensor CAS40D (connection of cleaning unit for CAS40D)

Menu/Setup/Additional functions/Cleaning/Cleaning 1 4/Standard clean			
Function	Options	Info	
Cleaning time	5 to 600 s Factory setting 10 s	Cleaning duration The cleaning duration and interval depend on the process and sensor.  Determine the variables empirically or based on experience.	

▶ Define the cleaning cycle  $\rightarrow$   $\blacksquare$  108.

### Chemoclean

Menu/Setup/Additional functions/Cleaning/Cleaning 1 4/Chemoclean			
Function	Options	Info	
Cleaning time	0 to 900 s Factory setting 5 s	Cleaning duration	
Prerinse time  Postrinse time	0 to 900 s  Factory setting 0 s	The cleaning duration, pre-rinse and post-rinse times and the interval depend on the process and sensor. Determine the variables empirically or based on experience.	

### Chemoclean Plus

Menu/Setup/Additional functions/Cleaning/Cleaning 1 4/Chemoclean Plus/ChemoCleanPlus setup				
Function	Options	Info		
Cleaning steps setup	Table to create a time program	You define a maximum of 30 program steps which should be performed one after the other. For each step enter the duration [s] and the state (0 = "off", 1 = "on") of each relay or output. You can specify the number and name of the outputs further down in the menu.  See below for an example of programming.		
Failsafe step setup	Table view	► In the table specify the states that the relays or outputs should assume in the event of an error.		
Limit contacts	0 to 2	<ul> <li>Select the number of digital input signals (e. g. from limit position switches of the retractable assembly).</li> </ul>		
Limit contact 1 2	Selection Binary inputs Fieldbus signals	► Define the signal source for each limit position switch.		
Outputs	0 to 4	► Select the number of outputs that actuators, such as valves or pumps, should activate.		
Output label 1 4	Free text	You can assign a meaningful name to each output, e. g. "assembly", "cleaner 1", "cleaner 2", etc.		

Programming example: regular cleaning with water and 2 cleaning agents

Limit switch	Duration [s]	Assembly CPA87x	Water	Cleaner 1	Cleaner 2
ES1 1	5	1	1	0	0
ES2 1	5	1	1	0	0
0	30	1	1	0	0
0	5	1	1	1	0
0	60	1	0	0	0
0	30	1	1	0	0
0	5	1	1	0	1
0	60	1	0	0	0
0	30	1	1	0	0
ES1 0	5	0	1	0	0
ES2 0	5	0	1	0	0
0	5	0	0	0	0

The pneumatic retractable assembly, e.g. CPA87x, is activated by compressed air via a two-way valve. As a result, the assembly assumes either the "Measure" position (sensor in medium) or the "Service" position (sensor in rinse chamber). Media such as water or cleaning agents are supplied via valves or pumps. Here there are two states: 0 = 0 or "closed") and 0 = 0 or "open").

The hardware required for "Chemoclean Plus", such as control valves, pumps, compressed air supply, media supply etc., must be provided by the customer.

### Defining the cleaning cycle

Menu/Setup/Additional functions/Cleaning/Cleaning 1 4				
Function	Options	Info		
Cleaning cycle	Selection    Off    Interval    Weekly program Factory setting Weekly program	► Choose from a cleaning routine that is restarted at set intervals and a user-definable weekly program.		
Cleaning interval Cleaning cycle = Interval	0-00:01 to 07-00:00 (D-hh:mm) Factory setting 1-00:00	The interval value can be between 1 minute and 7 days. Example: You have set the value "1-00:00". Each day, the cleaning cycle starts at the same time you started the first cleaning cycle.		
Daily event times  Cleaning cycle = Weekly program	00:00 to 23:59 (HH:MM)	1. Define up to 6 times (Event time 1 6).  You can then choose from these for each day of the week.		
Weekdays Cleaning cycle = Weekly program	Selection Monday Sunday	2. Choose individually for each day of the week which of the 6 times should be used for a cleaning routine on this particular day.		
		This allows you to create weekly programs that are perfectly adapted to suit your process.		

### Other settings and manual cleaning

Menu/Setup/Additional functions/Cleaning/Cleaning 1 4				
Function	Options	Info		
Start signal	Selection None Fieldbus signals Signals of digital or analog inputs  Factory setting None	In addition to cyclic cleaning, you can also use an input signal to start event-controlled cleaning.  ▶ Choose the trigger for such a cleaning process here.  Interval and weekly programs are executed as normal, i. e. conflicts can occur. Priority is given to the cleaning program that was the first to be started.		
Hold	Selection Off On Factory setting On	▶ Decide whether there should be a hold during the cleaning process. This hold affects the inputs to which this cleaning process is assigned.		
▷ Start single	Action	Start an individual cleaning process with the selected parameters. If cyclical cleaning is enabled, there are times in which it is not possible to manually start the process.		
Stop or Stop failsafe	Action	End the cleaning process (cyclically or manually)		
▶ Outputs		Goes to the menu <b>Outputs</b>		
► Cleaning program assignment view		Shows an overview of the cleaning processes		

### 10.7.5 Mathematical functions

In addition to "real" process values, which are provided by connected physical sensors or analog inputs, mathematical functions can be used to calculate a maximum of 8 "virtual" process values.

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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 switch
- Used as a measured variable to trigger cleaning
- Displayed in user-defined measuring menus

### 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.

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Difference			
Function Options		Info	
Calculation	Selection Off On Factory setting Off	On/off switch for the function	
Y1	The options depend on the	Select the sensors and measured variables that	
Measured value	sensors connected	should function as the minuend (Y1) or subtrahend (Y2).	
Y2			
Measured value			
Difference value	Read only	View this value in a user-defined measuring screen or output the value via the current output.	
▶ Mathematical function assignment view		Overview of the configured functions	

### 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.

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Redundancy			
Function	Options	Info	
Calculation	Selection Off On	On/off switch for the function	
	<b>Factory setting</b> Off		
Y1	The options depend on the	You can select a maximum of 3 different types of	
Measured value	sensors connected	sensor that output the same measured value.	
Y2		Example for temperature redundancy You have a pH sensor and an oxygen sensor at	
Measured value		inputs 1 and 2. Select the pH sensor as <b>Y1</b> and the oxygen sensor as <b>Y2</b> . <b>Measured value</b> : Select	
Y3 (optional)		<b>Temperature</b> in each case.	
Measured value			

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Redundancy			
Function	Options	Info	
Deviation control	Selection     Off     On Factory setting Off	You can monitor the redundancy. Specify an absolute limit value that must 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.	
▶ Mathematical function assignment view		Overview of the configured functions	

#### 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.

Instead of the mathematical functions, you can also connect a combined pH/ORP sensor.

Set the main measured value simply to rH.

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = rH calculation			
Function	Options	Info	
Calculation	Selection Off On	On/off switch for the function	
	<b>Factory setting</b> Off		
pH source	Connected pH sensor	Set the input for the pH sensor and the input for	
ORP source	Connected ORP sensor	the ORP sensor. Measured value interrogation is obsolete as you must select pH or ORP mV.	
Calculated rH	Read only	View this value in a user-defined measuring screen or output the value via the current output.	
► Mathematical function assignment view		Overview of the configured functions	

### 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.

Advantages of using degassed conductivity taking the example of a power station:

- The conductivity caused by corrosion products or contamination in the feed water is determined as soon as 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.

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Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Degassed conductivity			
Function Options		Info	
Calculation	Selection    Off    On Factory setting Off	On/off switch for the function	
Cation conductivity	Connected conductivity sensor	Cation conductivity represents the sensor downstream from the cation exchanger and	
Degassed conductivity	Connected conductivity sensor	upstream from the "degassing module",  Degassed conductivity represents the sensor at the outlet of the degassing module.  Measured value interrogation is obsolete as you can only choose conductivity.	
CO2 concentration	Read only	View this value in a user-defined measuring screen or output the value via the current output.	
► Mathematical function assignment view		Overview of the configured functions	

# **Dual conductivity**

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

Function	Options	Info
Calculation	Selection     Off     On Factory setting	On/off switch for the function
	Off	
Inlet	The options depend on the sensors connected	Select the sensors that should function as the minuend ( <b>Inlet</b> , e.g. sensor upstream from the
Measured value	Sensors connected	ion exchanger) or subtrahend ( <b>Outlet</b> , e.g.
Outlet		sensor downstream from the ion exchanger).
Measured value		
Main value format	Selection  Auto  # ### ###  Factory setting Auto	Specify the number of decimal places.
Cond. unit	Selection  Auto  µS/cm  mS/cm  S/cm  µS/m  µS/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.
► Mathematical function assignment view		Overview of the configured functions

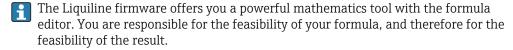
### Calculated pH value

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.

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = pH calculation from conductivity			
Function	Options	Info	
Calculation	Selection     Off     On Factory setting Off	On/off switch for the function	
Method	Selection NaOH NH3 LiOH	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)).	
	Factory setting NaOH	NaOH pH = 11 + log $\{(\kappa_v - 1/3 \kappa_h)/273\}$	
		<b>NH3</b> pH = 11 + log { $(\kappa_v - 1/3 \kappa_h)/243$ }	
		LiOH pH = 11 + log { $(K_v - 1/3 K_h)/228$ }	
		$\kappa_v$ Inlet direct conductivity $\kappa_h$ Outlet acid conductivity	
Inlet	The options depend on the	Inlet	
Measured value	sensors connected	Sensor upstream from the cation exchanger, "direct conductivity"	
Outlet		Outlet	
Measured value		Sensor downstream from the cation exchanger, "acid conductivity"	
		Selection of the measured value is obsolete as it must always be <b>Conductivity</b> .	
Calculated pH	Read only	View this value in a user-defined measuring screen or output the value via the current output.	
► Mathematical function assignment view		Overview of the configured functions	

# Formula (optional, with activation code)

With the formula editor, it is possible to calculate a new value from a maximum of 3 measured values. A wide range of mathematical and logical (Boolean) operations are available for this purpose.



Symbol	Operation	Type of operands	Type of result	Example
+	Addition	Numerical	Numerical	A+2
-	Subtraction	Numerical	Numerical	100-B
*	Multiplication	Numerical	Numerical	A*C
/	Division	Numerical	Numerical	B/100
^	Power	Numerical	Numerical	A^5
2	Square	Numerical	Numerical	A <sup>2</sup>
3	Cube	Numerical	Numerical	B <sup>3</sup>

Symbol	Operation	Type of operands	Type of result	Example
SIN	Sine	Numerical	Numerical	SIN(A)
COS	Cosine	Numerical	Numerical	COS(B)
EXP	Exponential function e <sup>x</sup>	Numerical	Numerical	EXP(A)
LN	Natural logarithm	Numerical	Numerical	LN(B)
LOG	Decadic logarithm	Numerical	Numerical	LOG(A)
MAX	Maximum of two values	Numerical	Numerical	MAX(A,B)
MIN	Minimum of two values	Numerical	Numerical	MIN(20,B)
MOD	Division with remainder	Numerical	Numerical	MOD (10.3)
ABS	Absolute value	Numerical	Numerical	ABS(C)
NUM	Boolean → numerical conversion	Boolean	Numerical	NUM(A)
=	Equals	Boolean	Boolean	A=B
<>	Not equal to	Boolean	Boolean	A<>B
>	Greater than	Numerical	Boolean	B>5.6
<	Less than	Numerical	Boolean	A <c< td=""></c<>
OR	Disjunction	Boolean	Boolean	B OR C
AND	Conjunction	Boolean	Boolean	A AND B
XOR	Exclusive disjunction	Boolean	Boolean	B XOR C
NOT	Negation	Boolean	Boolean	NOT A

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Formula			
Function	Options	Info	
Calculation	Selection Off Off Factory setting Off	On/off switch for the function	
Source A C	Selection Select source Factory setting None	You can use all the sensor inputs, binary and analog inputs, mathematical functions, limit switches, time switches, fieldbus signals, controllers and datasets for measuring range switching as the source for measured values.	
Measured value	Selection Depends on the source	Choose a maximum of three sources (A, B and C) for measured values.	
A C	The current measured value is displayed	<ol> <li>For each source, choose the measured value to be calculated.</li> <li>All available signals - depending on the selected source - are possible measured values.</li> <li>Enter the formula.</li> <li>Switch on the calculation.</li> <li>The current measured values A, B and C as well as the result of the calculation using the formula are displayed.</li> </ol>	

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Formula			
Function	Options	Info	
Formula	User-defined text	Table → 🗎 112  Make sure the exact notation is used (upper case). Blank spaces before and after mathematical characters are irrelevant. Note the operator precedence, i.e. multiplication and division take precedence over addition and subtraction. Use parentheses if necessary.	
Result unit	User-defined text	You may enter a unit for the calculated value if desired.	
Result format	Selection  ###################################	Select the number of decimal places.	
Result numeric	Read only	Current, calculated value	
▶ Mathematical function assignment view		Overview of the configured functions	

#### Example: 2-point chlorine regulator with volume flow monitoring

A relay output activates a dosing pump. The pump should switch on when the following 3 conditions are met:

- (1) There is flow
- (2) The volume flow is above a defined value
- (3) The concentration of chlorine drops below a defined value
- 1. Connect a binary input signal from an "INS" point level switch of the CCA250 assembly to the DIO module.
- 2. Connect an analog input signal of a volume flow meter to the AI module.
- 3. Connect the chlorine sensor.
- 4. Configure the **Formula** mathematical function: **Source A** = binary input DIO, **Source B** = current input AI, **Source C** = input **Disinfection**.
  - **→** Formula

#### A AND (B > 3) AND (C < 0.9)

(where 3 is the lower limit value of the volume flow and 0.9 is the lower limit value of the chlorine concentration)

5. Configure the relay output with the **Formula** mathematical function and connect the dosing pump to the corresponding relay.

The pump is switched on if all 3 conditions are met. If one of the conditions is no longer met, the pump is switched off again.

**1** Instead of outputting the result of the formula directly to a relay, you can also connect a limit switch in between in order to attenuate the output signal via a switch-on and switch-off delay.

## Example: Load-based control

The load - i.e. the product of the concentration and volume flow - is needed for the dosage of precipitants, for instance.

1. Connect an analog input signal of a volume flow meter to the AI module.

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2. Configure the **Formula** mathematical function: **Source A** = input signal phosphate and **Source B** = input signal volume flow.

► Formula:

### A\*B\*x

(where x is an application-specific proportionality factor)

- 3. Select this formula as the source e.g. of the current output or of a modulated binary output.
- 4. Connect the valve or pump.

### 10.7.6 Diagnostic modules

Here you can configure a maximum of 8 individual diagnostic messages.

A diagnostic module has the following properties:

- The feed source can be configured like a binary output (relay, digital output).
- You can choose whether the diagnostic message should be output at a high level or low level.
- You decide which error category (Namur class) should be assigned to the message.
- You can define a customized text to be output as the diagnostic message text.

In addition you can switch off the factory diagnostic code for limit switches. This allows you to:

- Use the limit switch on a purely functional basis (without a message)
- Configure application-specific message texts
- Control diagnostic modules directly by a digital signal or via a limit switch output (enables the use of switch-on/switch-off delay, for example).

Menu/Setup/Additional functions/Diagnostic modules			
Function	Options	Info	
▶ Diagnostic module 1 (961) 8 (968)			
Source of data	Selection None Fieldbus signals Binary inputs Limit switches	Specify the input which should be the source of data for the diagnostic message.	
	<b>Factory setting</b> None		
Measured value	Selection depend on Source of data	Specify the measured value that should trigger the diagnostic message.	
	Factory setting None	You can use different measured values depending on the data source.	
Active low	Selection Off On	On: The output value is equal to the inverse output value.	
	<b>Factory setting</b> On		
Short text	Free text	Give the diagnostic message a name.	
▶ Diagnostic module assignment view		Shows an overview of the diagnostic modules used.	

# 11 Diagnostics and troubleshooting

# 11.1 General troubleshooting

The analyzer continuously monitors its functions itself.

If a diagnostic message occurs, the display alternates between the diagnostic message and the measured value in the measuring mode.

The color of the display background changes to red if a diagnostic message for error category "F" occurs.

# 11.1.1 Troubleshooting

A diagnostic message appears on the display or via the fieldbus, measured values are not plausible, or you identify a fault.

- 1. See the Diagnostics menu for details on the diagnostic message.
  - ► Follow the instructions to rectify the problem.
- 2. If this does not help, search for the diagnostic message under "Overview of diagnostic information" in these Operating Instructions. Use the message number as a search criterion. Ignore the letters indicating the Namur error category.
  - Follow the troubleshooting instructions provided in the last column of the error tables.
- 3. If the measured values are implausible, the local display is faulty or you encounter other problems, search for the faults under "Process errors without messages" ( $\rightarrow$  Operating Instructions Memosens, BA01245C) or "Device-specific errors" ( $\rightarrow$   $\cong$  120).
  - ► Follow the recommended measures.
- 4. Contact the Service Department if you cannot rectify the error yourself. citing only the error number.

### 11.1.2 Process errors without messages

Operating Instructions "Memosens", BA01245C

### 11.1.3 Device-specific errors

Problem	Possible cause	Tests and/or remedial measures			
Dark display	No supply voltage	► Check if supply voltage applied.			
	Base module defective	► Replace base module			
Values appear on display but:	Module not wired correctly	► Check modules and wiring.			
<ul><li>Display does not change and/or</li><li>Device cannot be operated</li></ul>	Impermissible operating system condition	► Switch off device and switch it on again.			
Implausible measured values	Inputs defective	First perform tests and take measures as outlined in "Process-specific errors" section.			
		Measuring input test:			
		► Connect the Memocheck Sim CYP03D to the input and use it to check the function of the input.			
	Calibration/adjustment failed	▶ Repeat calibration			

Problem	Possible cause	Tests and/or remedial measures			
	No reagents/sample	1. Check levels			
		2. Check the hoses of the reagents			
		3. Check sample			
		4. Check all connectors and tighten if necessary.			
	Cuvette dirty	1. Perform calibration with standard			
		2. Clean using manual cleaning routine, then repeat calibration with standard			
	Incorrect reagent	► Check the configured measuring parameter and the reagents used			
	Incorrect concentration of the standard solution	Check the concentration setting for the standard solution			
	Reagents have passed their shelf life				
	Incorrect hose system	► Check the hose system using the hose routing diagram (see "Commissioning" section).			
Measurement//calibration does	Action still active				
not start	Appropriate bottles not used	► Check status			
	No sample available				
	Device is in the fieldbus mode; no manual actions are possible				
	Dispenser run times have elapsed				
Calibration has failed	Stability criterion was not met	Check the configuration and perform manual calibration again			
		2. Check the hoses of the reagents			
Current output, incorrect	Incorrect adjustment	► Check with integrated current simulation,			
current value	Load too large	connect mA meter directly to current output.			
	Shunt/short to ground in current loop				
No current output signal	Base module defective	► Check with integrated current simulation, connect mA meter directly to current output.			

# 11.2 Diagnostic information on local display

Up-to-date diagnostic events are displayed along with their status category, diagnostic code and short text. Clicking on the navigator lets you retrieve more information and tips on remedial measures.

# 11.3 Diagnostic information via web browser

The same information as for the local display is available via the web server.

# 11.4 Diagnostic information via fieldbus

Diagnostic events, status signals and more information are transmitted according to the definitions and technical capability of the respective fieldbus systems.

# 11.5 Adapting the diagnostic information

### 11.5.1 Classification of diagnostic messages

In the **DIAG/Diagnostics list** menu you can find more detailed information on the current diagnostic messages displayed.

In accordance with Namur specification NE 107, the diagnostic messages are characterized by:

- Message number
- Error category (letter in front of the message number)
  - **F** = (Failure) a malfunction has been detected

    The measured value of the affected channel is no longer reliable. The cause of the malfunction is to be found in the measuring point. Any control system connected should be set to manual mode.
  - C = (Function check), (no error)
     Maintenance work is being performed on the device. Wait until the work has been completed.
  - **S** = (Out of specification), the measuring point is being operated outside its specification

    Operation is still possible. However, you run the risk of increased wear, shorter
    - operation is still possible. However, you run the risk of increased wear, shorter operating life or lower measurement accuracy. The cause of the problem is to be found outside the measuring point.
  - **M** = (Maintenance required), action should be taken as soon as possible

    The device still measures correctly. Immediate measures are not necessary. However,
    proper maintenance efforts would prevent a possible malfunction in the future.
- Message text
- If you contact the Service Department, please cite the message number only. Since you can individually change the assignment of an error to an error category, the Service Department cannot use this information.

# 11.5.2 Adapting the diagnostic behavior

All the diagnostic messages are assigned to specific error categories at the factory. Since other settings might be preferred depending on the application, error categories and the effect errors have on the measuring point can be configured individually. Furthermore, every diagnostic message can be disabled.

### Example

Diagnostic message 531 **Logbook full**appears on the display. You want to change this message so that an error is not shown on the display for example.

- 1. For analyzer-specific diagnostic messages, select Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Diag. behavior and for sensor-related messages, select Menu/Setup/Inputs/<Sensor>/Extended setup/Diagnostics settings/Diag. behavior.
- 2. Select the diagnostics message and press the navigator button.
- 3. Decide: (a) Should the message be deactivated? (**Diagnostics message = Off**)
  - (b) Do you want to change the error category?(**Status signal**)
  - (c) Should an error current be output? (**Failure current = On**)
  - (d) Do you want to trigger a cleaning program? (Cleaning program)
- 4. Example: You deactivate the message.
  - The message is no longer displayed. In the **DIAG** menu, the message appears as **Past message**.

### Possible 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.

Function	Options	Info
List of diagnostic messages	- Types	<ul> <li>Select the message to be changed.</li> <li>Only then can you make the settings for this message.</li> </ul>
Diag. code	Read only	
Diagnostic message	Selection     Off     On Factory setting Depends on the Diag. code	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
Failure current	Selection     Off     On Factory setting Depends on the Diag. code	Decide whether an error current should be output at the current output if the diagnostic message display is activated.  In the event of general device errors, the error current is switched to all the current outputs. In the event of channel-specific errors, the error current is only switched to the current output in question.
Status signal	Selection  Maintenance (M)  Out of specification (S)  Function check (C)  Failure (F)  Factory setting  Depends on the  Diag. code	The messages are divided into different error categories in accordance with NAMUR NE 107. Decide whether you want to change a status signal assignment for your application.
Diag. output	Selection None Binary outputs Alarm relay Relay1 to n (depends on the device version) Factory setting None	You can use this function to select an output to which the diagnostic message should be assigned.  An alarm relay is always available, regardless of the device version. Other relays are optional.  For sensors with the Memosens protocol:  Before you can assign the message to an output: Configure one of the output types mentioned as follows:  Menu/Setup/Outputs/(Alarm relay or Binary output or relay)/Function = Diagnostics and Operating mode = as assigned.
Cleaning program	Selection None Cleaning 1 4 Factory setting None	Decide whether the diagnostic message should trigger a cleaning program.  You can define 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.

# 11.6 Overview of diagnostic information

# 11.6.1 Device-specific, general diagnostic messages

No.	Message	Factory	settings		Tests or remedial action		
		S 1)	D 2)	F <sup>3)</sup>			
202	Selftest active	F	On	Off	Wait for self-test to be finished		
216	Hold active	С	On	Off	Output values and status of the channel are on hold		
241	Firmware failure	F	On	On	Internal device error		
242	Firmware incomp.	F	On	On	1. Update the software.		
243	Firmware failure	F	On	On	2. Contact the Service Department.		
					3. Replace the backplane (Service).		
261	Electronics module	F	On	On	Electronics module defective		
					1. Replace the module.		
					2. Contact the Service Department.		
262	Module connection	F	On	On	Electronics module not communicating		
					1. Check the module , replace it if necessary.		
					2. Contact the Service Department.		
263	Incomp. detected	F	On	On	Wrong kind of electronics module		
					1. Replace the module.		
					2. Contact the Service Department.		
284	Firmware update	M	On	Off	Update completed successfully		
285	Update error	F	On	On	Firmware update failed		
					1. Repeat.		
					2. SD card error $\rightarrow$ use another card.		
					3. Incorrect firmware → repeat with suitable firmware.		
					4. Contact the Service Department.		
302	Battery low	М	On	Off	Buffer battery of real time clock is low The date and time are lost if the power is interrupted.		
					► Contact the Service Department (battery replacement).		
304	Module data	F	On	On	At least 1 module has incorrect configuration data		
					1. Check the system information.		
					2. Contact the Service Department.		
305	Power consumption	F	On	On	Total power consumption too high		
					1. Check installation.		
					2. Remove sensors/modules.		
306	Software error	F	On	On	Internal firmware error		
					► Contact the Service Department.		
335	Fan defective	F	On	On	Fan defective		
					1. Replace the fan.		
					2. Contact the Service Department.		

No.	Message	Factory settings			Tests or remedial action			
	<b>3</b> -	S <sup>1)</sup>	$D^{2}$	F <sup>3)</sup>				
337	Pump hose warning	M	On	Off	End of pump hose service life will be reached shortly Display under Menu/Diagnostics/Operating time information/Pump tube life  1. Schedule replacement.  2. After replacing, reset the operating time under Menu/Diagnostics/Operating time information.			
360	Cooling/Heating	С	On	Off	Temperature range in the housing exceeded  1. Check installation conditions and the ambient temperature  2. Replace the actuator module.  3. Contact the Service Department.			
361	Cooling/Heating	F	On	On	Cooling/heating module defective  Defined temperature range not reached. This could affect the functionality of the reagents.  1. Check whether the insulation cap is seated correctly over the reagents.  2. Replace cooling/heating module.  3. Contact the Service Department.			
362	Photometer temp.	F	On	Off	Temperature of the photometer too high  Contact the Service Department.			
363	Photometer temp.	F	On	Off	Temperature of the photometer too low  Contact the Service Department.			
364	Timeout dosing	F	On	On	The Liquid Manager/dosing dispenser has timed out.  Possible reasons:  Photoelectric barrier defective Blocking  Contact the Service Department.			
365	Photometer comm.	F	On	On	Photometer not communicating Possible reasons: Incorrect photometer connection  1. Check photometer connection.  2. Contact the Service Department.			
367	Module connect.	F	On	On	No communication to sample preparation  ► Check the connecting cable to the sample preparation system.			
370	Internal voltage	F	On	On	Internal voltage outside the valid range  1. Check supply voltage.  2. Check inputs and outputs for short-circuiting.			
373	Electronictemp. high	M	On	Off	High electronics temperature  Check ambient temperature and energy consumption.			
374	Sensor check	F	On	Off	No measurement signal from sensor  1. Check sensor connection.  2. Check the sensor, replace it if necessary.			

No.	Message	Factory	settings		Tests or remedial action		
		S 1)	D 2)	F 3)			
380	Temperature sensor	F	On	On	Temperature sensor defective in reactor, cuvette or sample pre-heating system		
					► Contact the Service Department and quote the number displayed.		
381	Valve malfunction	F	On	On	Indicated valve is defective		
					► Contact the Service Department and quote the number displayed.		
385	Heating temp. low	S	On	Off	Sample pre-heating target temperature not reached		
					1. Check fuse.		
					2. Check cable and connector.		
386	Heating temp. high	S	On	Off	Temperature of sample pre-heating too high		
					1. Monitor the temperature of the sample.		
					2. Disconnect the power supply if the sample temperature does not drop.		
401	Factory reset	F	On	On	Factory reset is performed		
405	Service IP active	С	Off	Off	Service switch is switched on The device can be addressed at 192.168.1.212.		
					<ul> <li>Switch off the service switch to change to the saved IP settings.</li> </ul>		
412	Writing backup	F	On	Off	▶ Wait for the write process to be finished		
413	Reading backup	F	On	Off	▶ Wait.		
436	SD card (80%)	M	On	Off	SD card 80% full		
					1. Replace SD card with empty card.		
					2. Clear SD card.		
					3. Set logbook properties to ring buffer (Setup/General settings/Logbooks).		
437	<b>SD card</b> (100%)	M	On	Off	SD card 100% full. No longer possible to write to the card.		
					1. Replace SD card with empty card.		
					2. Clear SD card.		
					3. Set logbook properties to ring buffer (Setup/General settings/Logbooks).		
438	SD card removed	M	On	Off	SD card not plugged in		
					1. Check SD card.		
					2. Replace SD card.		
					3. Disable logging.		
455	Mathemat. function	F	On	On	Mathematical function: fault condition		
					Check mathematical function.		
		_	_		2. Check assigned input variables.		
460	Output below limit	S	On	Off	Reasons  Sensor in air		
461	Output above limit	S	On	Off	<ul><li>Air pockets in assembly</li><li>Sensor fouled</li></ul>		
					Incorrect flow to sensor		
					1. Check sensor installation.		
					2. Clean sensor.		
					3. Change assignment of current outputs.		
502	No text catalog	F	On	On	► Contact the Service Department.		

No.	Message	Factory settings			Tests or remedial action		
140.	Wiessage	S <sup>1)</sup>	D <sup>2)</sup>	F <sup>3)</sup>	rests of remedial action		
503	Language change	M	On	Off	Language change failed  Contact the Service Department.		
529	Diag. setup active	С	Off	Off	➤ Wait for maintenance to be finished.		
530	Logbook at 80%	M	On	Off	Save the loqbook to the SD card and then		
531	Logbook full	M	On	Off	delete the logbook in the device.		
					<ol> <li>Set memory to circular buffer.</li> <li>Deactivate logbook.</li> </ol>		
532	License error	M	On	Off	Contact the Service Department.		
540	Parameter save fail	M	On	Off	Storage of configuration has failed		
					► Repeat.		
541	Parameter load ok	M	On	Off	Configuration successfully loaded		
542	Parameter load fail	M	On	Off	Loading of configuration has failed		
					► Repeat.		
543	Parameter load abort	M	On	Off	Configuration loading aborted		
544	Parameter reset ok	M	On	Off	Factory default successful		
545	Parameter reset fail	M	On	Off	Setting of device configuration to factory setting has failed		
565	Configuration	M	On	Off	Invalid configuration of sample preparation system		
					In Setup/Sample preparation, check the number of channels used, their operating mode and type of installation.		
					2. Check the permitted combinations of sample preparation and analyzers, see the Operating Instructions for the sample preparation system.		
714	Filter mats change	M	On	Off	Filter mat change necessary The limit value for operating hours has been exceeded		
					➤ Replace the filter mats and reset the operating hours counter in the Diagnostics menu.		
715	Calibration expired	M	On	Off	The validity of the last calibration has expired. The date of the last calibration is too far in the past. Measurement can still take place.		
					Possible reasons: Manual intervention has prevented automatic calibration		
					Calibrate analyzer manually.		
					2. Check device configuration.		
716	Calibration expired	S	On	Off	Calibration has failed or is not reliable		
					Possible reasons: Stability criteria are not met		
					Check the configuration and perform a manual calibration again.		
					2. Contact the Service Department.		
717	Photometer defective	F	On	On	Photometer defective		
					Possible reasons:		
					<ul><li>No lamp voltage</li><li>No lamp power</li></ul>		
					► Contact the Service Department.		

Residual State   Part   Part	No.	Message	Factory settings			Tests or remedial action		
Measurement can still take place.   Possible reasons   The level of one or more liquids is low   One or more liquids almost past their shelf life.   Top up/replace the liquids in question and reset the counter in Diagnostics/Operating time information.		,	_		F <sup>3)</sup>			
The level of one or more liquids also low one or more liquids almost past their shelf life. Top up/replace the liquids in question and reset the counter in Diagnostics/Operating time information.    Table   Table	726	Liquids warning	M	On	Off			
Liquids alarm						The level of one or more liquids is low		
Measurement can still take place.   Possible reasons   The level of one or more liquids is low   One or more liquids past their shelf life.   Top up/replace the liquids in question and reset the counter in Diagnostics/Operating time information.						reset the counter in <b>Diagnostics/Operating</b>		
The level of one or more liquids is low One or more liquids past their shelf life. Top up/replace the liquids in question and reset the counter in Diagnostics/Operating time information.  For Son One of more liquids past their shelf life. Top up/replace the liquids in question and reset the counter in Diagnostics/Operating time information.  Leakage detected For One Off Controller variable is not OK Controller input warning Status of set point is not OK Controller input warning Controller setpoint Son Off Controller input warning Status of set point is not OK Controller input warning Controller setpoint Son Off Controller input warning Status of disturbance variable is not OK Controller input warning Controller input warning Status of disturbance variable is not OK Controller input warning Status of disturbance variable is not OK Controller input warning Status of disturbance variable is not OK Controller input warning Status of disturbance variable is not OK	727	Liquids alarm	F	On	Off	<u> </u>		
731       Leakage detected       F       On       Off analyzer       Leak detected in the sample preparation system or analyzer         732       Leakage detected       F       On       Off analyzer       1. Check hoses and connections.         2. Check solenoid valves.       3. Check leak sensor.       4. Check the free outlet on the analyzer.         5. Replace defective parts and, if necessary, reset the operating hours counters in the Diagnostics menu.         732       Wear parts alarm       F       On       On or or more wear parts has exceeded its service life.         733       Wear parts warning       M       On       Off or or more wear parts in question and reset the counter in Diagnostics/Operating time information.         730       Wear parts warning       M       On       Off       One or more wear parts has almost reached the end of its service life.         930       No sample       F       On       Off       Limit switch activated         930       No sample       F       On       On       Sample flow interrupted during intake         930       Controlled variable       F       On       On       Sample flow interrupted during intake         930       Controlled variable       F       On       On       Controller input warning         931       Controller setpoint <t< td=""><td></td><td></td><td></td><td></td><td></td><td>The level of one or more liquids is low</td></t<>						The level of one or more liquids is low		
analyzer  1. Check hoses and connections. 2. Check solenoid valves. 3. Check leak sensor. 4. Check the free outlet on the analyzer. 5. Replace defective parts and, if necessary, reset the operating hours counters in the Diagnostics menu.  732 Wear parts alarm F On On One or more wear parts has exceeded its service life.  Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.  733 Wear parts warning M On Off One or more wear parts has almost reached the end of its service life.  Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.  910 Limit switch S On Off Limit switch activated  930 No sample F On On Sample flow interrupted during intake Suction line blocked or leaking No inflow of sample 1. Check the suction line and suction strainer. 2. Check inflow of sample.  937 Controlled variable S On Off Controller input warning Status of the controller variable is not OK Check application.  939 Control. disturbance S On Off Controller input warning Status of set point is not OK Check application.						reset the counter in <b>Diagnostics/Operating</b>		
Check solenoid valves.   Check solenoid valves.   Check the free outlet on the analyzer.	731	Leakage detected	F	On	Off			
3. Check leak sensor.   4. Check the free outlet on the analyzer.   5. Replace defective parts and, if necessary, reset the operating hours counters in the Diagnostics menu.   732   Wear parts alarm   F   On   One or more wear parts has exceeded its service life.   Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts has almost reached the end of its service life.   Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts in question and reset the counter in Diagnostics/Operating time information.   One of the counter in Diagnostics/Operating t						1. Check hoses and connections.		
4. Check the free outlet on the analyzer.						2. Check solenoid valves.		
Semple   S						3. Check leak sensor.		
732       Wear parts alarm       F       On       On       One or more wear parts has exceeded its service life.         733       Wear parts warning       M       On       Off       One or more wear parts has exceeded its service life.         733       Wear parts warning       M       On       Off       One or more wear parts has almost reached the end of its service life.         930       No sample       S       On       Off       Limit switch activated         930       No sample       F       On       On       Sample flow interrupted during intake         930       Sample flow interrupted during intake       Suction line blocked or leaking       No inflow of sample         1       Check the suction line and suction strainer.       Check the suction line and suction strainer.         2       Check inflow of sample.         937       Controlled variable       S       On       Off       Controller input warning Status of the controller variable is not OK         938       Controller setpoint       S       On       Off       Controller input warning Status of set point is not OK         939       Control. disturbance       S       On       Off       Controller input warning Status of disturbance variable is not OK						4. Check the free outlet on the analyzer.		
Ilife.   Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.   One or more wear parts has almost reached the end of its service life.   Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.   Page 10						reset the operating hours counters in the		
the counter in Diagnostics/Operating time information.  Wear parts warning  M  On  Off  One or more wear parts has almost reached the end of its service life.  ▶ Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.  Limit switch  S  On  Off  Limit switch activated  No sample  F  On  On  Sample flow interrupted during intake  ■ Suction line blocked or leaking  ■ No inflow of sample  1. Check the suction line and suction strainer.  2. Check inflow of sample.  On  Off  Controller input warning Status of the controller variable is not OK  ▶ Check application.  Off  Controller input warning Status of set point is not OK  ➤ Check application.  Off  Controller input warning Status of set point is not OK  ➤ Check application.	732	Wear parts alarm	F	On	On	•		
end of its service life.  Replace the wear parts in question and reset the counter in Diagnostics/Operating time information.  910 Limit switch  S  On  Off  Limit switch activated  930 No sample  F  On  On  Sample flow interrupted during intake  Suction line blocked or leaking  No inflow of sample  1. Check the suction line and suction strainer.  2. Check inflow of sample.  937 Controlled variable  S  On  Off  Controller input warning Status of the controller variable is not OK  Check application.  938 Control. disturbance  S  On  Off  Controller input warning Status of set point is not OK  Check application.  939 Control. disturbance  S  On  Off  Controller input warning Status of set point is not OK  Check application.						the counter in <b>Diagnostics/Operating time</b>		
the counter in Diagnostics/Operating time information.  910 Limit switch S On Off Limit switch activated  930 No sample  F On On Sample flow interrupted during intake Suction line blocked or leaking No inflow of sample  1. Check the suction line and suction strainer. 2. Check inflow of sample.  937 Controlled variable  S On Off Controller input warning Status of the controller variable is not OK Check application.  938 Controller setpoint  S On Off Controller input warning Status of set point is not OK Check application.  939 Control. disturbance  S On Off Controller input warning Status of set point is not OK Check application.	733	Wear parts warning	M	On	Off	•		
930 No sample F On On Sample flow interrupted during intake  ■ Suction line blocked or leaking  ■ No inflow of sample  1. Check the suction line and suction strainer.  2. Check inflow of sample.  937 Controlled variable S On Off Controller input warning Status of the controller variable is not OK  ► Check application.  938 Controller setpoint S On Off Controller input warning Status of set point is not OK  ► Check application.  939 Control. disturbance S On Off Controller input warning Status of set point is not OK  ► Check application.						the counter in <b>Diagnostics/Operating time</b>		
Suction line blocked or leaking No inflow of sample  1. Check the suction line and suction strainer. 2. Check inflow of sample.  937 Controlled variable S On Off Controller input warning Status of the controller variable is not OK ► Check application.  938 Controller setpoint S On Off Controller input warning Status of set point is not OK ► Check application.  939 Control. disturbance S On Off Controller input warning Status of set point is not OK ► Check application.	910	Limit switch	S	On	Off	Limit switch activated		
937 Controlled variable S On Off Controller input warning Status of the controller variable is not OK ► Check application.  938 Controller setpoint S On Off Controller input warning Status of set point is not OK ► Check application.  939 Control. disturbance S On Off Controller input warning Status of set point is not OK ► Check application.	930	No sample	F	On	On	<ul><li>Suction line blocked or leaking</li><li>No inflow of sample</li></ul>		
Status of the controller variable is not OK  Check application.  Controller setpoint  S  On  Off  Controller input warning Status of set point is not OK  Check application.  Check application.  Controller input warning Status of disturbance variable is not OK						2. Check inflow of sample.		
938 Controller setpoint S On Off Controller input warning Status of set point is not OK  ► Check application.  939 Control. disturbance S On Off Controller input warning Status of disturbance variable is not OK	937	Controlled variable	S	On	Off			
Status of set point is not OK  ► Check application.  939 Control. disturbance S On Off Controller input warning Status of disturbance variable is not OK						► Check application.		
939 Control. disturbance S On Off Controller input warning Status of disturbance variable is not OK	938	Controller setpoint	S	On	Off			
Status of disturbance variable is not OK						► Check application.		
► Check application.	939	Control. disturbance	S	On	Off	1 1		
						► Check application.		

No.	Message	Factory	settings		Tests or remedial action
		S 1)	D 2)	F 3)	
940	Process value	S	On	Off	Measured value out of specification Uncertain measured value.
					1. Change the measuring range.
					2. Calibrate the system.
941	Process value	F	On	On	Measured value out of specification Invalid measured value.  1. Change the measuring range.
					Calibrate the system.
951 - 958	Hold active CH1	С	On	Off	Output values and status of the channels are on hold.
					▶ Wait until the hold is deactivated again.
961 - 968	Diagnostic module 1 (961)	S	Off	Off	Diagnostic module is enabled
	Diagnostic module 8 (968)				
969	Modbus Watchdog	S	Off	Off	The device did not receive a Modbus telegram from the master within the specified time. The status of Modbus process values received is set to invalid
970	Curr. input overload	S	On	On	Current input overloaded The current input is switched off from 23 mA due to overload and reactivated automatically when a normal load is present.
971	Current Input low	S	On	On	Current input too low At 4 to 20 mA, the input current is less than the lower failure current.
					► Check the input for short-circuiting.
972	Curr. input > 20 mA	S	On	On	Current output range exceeded
973	Current Input < 4 mA	S	On	On	Current output range undershot
974	Diagnostics confirm.	С	Off	Off	User has acknowledged the message displayed in the measuring menu.
975	Device restart	С	Off	Off	Device reset
976	PFM/PWM value high	S	On	Off	Pulse frequency modulation: output signal exceeded/undershot. Measured value outside the
977	PFM/PWM value low	S	On	Off	specified range.  Sensor in air  Air pockets in assembly  Incorrect flow to sensor  Sensor fouled  Clean the sensor  Check plausibility.  Adjust the PFM configuration.
978	ChemoClean Failsafe	S	On	On	No feedback signal detected within the configured period.  1. Check application.  2. Check wiring.  3. Extend the duration.
990	Deviation limit	F	On	On	Redundancy: limit value of percentage deviation exceeded
991	CO2 conc. range	F	On	On	$\ensuremath{\text{CO}_2}$ concentration (degassed conductivity) outside the measuring range

No.	Message	Factory settings			Tests or remedial action
		S 1)	D 2)	F <sup>3)</sup>	
992	pH calculation range	F	On	On	pH calculation outside the measuring range
993	rH calculation range	F	On	On	rH calculation outside the measuring range
994	Difference conduct.	F	On	On	Dual conductivity outside the measuring range

- 1) Status signal
- 2) Diagnostic message
- 3) Failure current

### 11.6.2 Sensor-specific diagnostic messages

Operating Instructions "Memosens", BA01245C

# 11.7 Pending diagnostic messages

The Diagnostics menu contains all the information on the device status. Furthermore, various service functions are available.

The following messages are directly displayed every time you enter the menu:

- Most important message
   Diagnostic message recorded with the highest criticality level
- Past message
   Diagnostic message whose cause is no longer present.

All the other functions in the Diagnostics menu are described in the following chapters.

# 11.8 Diagnostics list

All the current diagnostic messages are listed here.

A time stamp is available for each message. Furthermore, the user also sees the configuration and description of the message as saved in **Menu/Setup/General settings/Extended setup/Diagnostics settings/Diag. behavior** .

# 11.9 Logbooks

### 11.9.1 Available logbooks

Types of logbooks

- Logbooks physically available (all apart from the overall logbook)
- Database view of all logbooks (=overall logbook)

Logbook	Visible in	Max. entries	Can be disabled 1	Logbook can be deleted	Entries can be deleted	Can be exported
Overall logbook	All events	20000	Yes	No	Yes	No
Calibration logbook	Calibration events	75	(Yes)	No	Yes	Yes
Operation logbook	Configuration events	250	(Yes)	No	Yes	Yes
Diagnostics logbook	Diagnostic events	250	(Yes)	No	Yes	Yes
Analyzer event logbook	Analyzer events	19500 <sup>2)</sup>	No	No	Yes	Yes
Analyzer calibration logbook	Analyzer calibration logbook	250	(Yes)	No	Yes	Yes

Logbook	Visible in	Max. entries	Can be disabled 1	Logbook can be deleted	Entries can be deleted	Can be exported
Analyzer data logbook	Analyzer data logbooks	20000 2)	No	No	Yes	Yes
Analyzer absorbance data logbook	Absorption data logbook	5000	No	No	Yes	Yes
Analyzer raw values logbook	Raw data logbook	5000	No	No	Yes	Yes
Version logbook	All events	50	No	No	No	Yes
Hardware version logbook	All events	125	No	No	No	Yes
Data logbook for sensors (optional)	Data logbooks	150 000	Yes	Yes	Yes	Yes
Debugging logbook	Debug events (only accessible by entering the special service activation code)	1000	Yes	No	Yes	Yes

- 1) 2) Data in brackets means this depends on the overall logbook Suffices for 1 year of operation with a usual measuring interval  $\,$

#### 11.9.2 Menu Logbooks

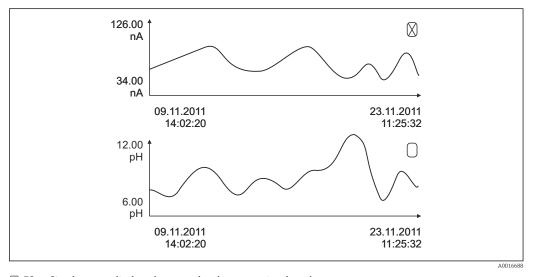
DIAG/Logbooks		
Function	Options	Info
▶ All events		Chronological list of all the logbook entries, with information on the type of event
<b>▶</b> Show	Events are displayed	Select a particular event to display more detailed information.
► Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
► Calibration events		Chronological list of the calibration events
<b>▶</b> Show	Events are displayed	Select a particular event to display more detailed information.
► Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
Delete all entries	Action	You can delete all the calibration logbook entries here.
► Configuration events		Chronological list of the configuration events
<b>▶</b> Show	Events are displayed	Select a particular event to display more detailed information.
▶ Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
Delete all entries	Action	You can use this to delete all the operation logbook entries.

DIAG/Logbooks		
Function	Options	Info
▶ Diagnostic events		Chronological list of the diagnostics events
▶ Show	Events are displayed	Select a particular event to display more detailed information.
▶ Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
Delete all entries	Action	You can use this to delete all the diagnostics logbook entries.
▶ Analyzer events		Entries for analyzer events, such as measurement, cleaning and calibration.
▶ Show	Events are displayed	Select a particular event to display more detailed information.
▶ Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
> Delete all entries	Action	You can use this to delete all analyzer event entries.

You can also view your data logbook entries graphically on the display (Show plot).

You can also adapt the display to suit your individual requirements:

- Press the navigator button in the graphic display: you are given additional options such as the zoom function and x/y movement of the graph.
- Define the cursor: if you select this option, you can move along the graph with the navigator and view the logbook entry (data stamp/measured value) in text form for every point in the graph.
- Simultaneous display of two logbooks: **Select 2nd plot** and **Show plot** 
  - A small cross marks the currently selected graph for which the zoom can be changed or a cursor used, for example.
  - In the context menu (press the navigator button), you can select the other graph. You can then apply the zoom function, a movement or a cursor to this graph.
  - Using the context menu, you can also select both graphs simultaneously. This enables you to use the zoom function on both graphs simultaneously, for example.



 $\blacksquare$  73 Simultaneous display of two graphs, the top one is selected

ınction	Options	Info
Analyzer data logbooks	Options	Data logbooks for the data of the wet-chemical
	1	analyzers
▶ Data logbook SP1		
Source of data	Read only	Displays the measuring channel
Measuring parameter	Read only	Displays the measurement parameter recorded
Unit	Read only	Displays the unit
► Show	Events are displayed	Select a particular event to display more detailed information.
► Go to date	User entry ■ Go to date ■ Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scrol through all the information. The complete list is always visible, however.
► Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu <b>General settings/ Logbooks</b> .
▷ Delete all entries	Action	You can use this to delete all data logbook entries.
►Absorption data logbook		
Curve	Read only	Displays the absorption curve
▶ Show	Events are displayed	Select a particular event to display more detaile information.
▶ Go to date	User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scrol through all the information. The complete list is always visible, however.
►Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu <b>General settings/ Logbooks</b> .
Delete all entries	Action	You can delete all the absorption data logbook entries here.
▶ Raw data logbook		
▶ Show	Events are displayed	Select a particular event to display more detaile information.
►Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu <b>General settings/ Logbooks</b> .
▶ Set plotting window range		Here you can specify the start and end times of the logbook entries to be displayed graphically.
Plotter begin	Selection First entry Date/Time Factory setting First entry	<ul> <li>First entry: Defines the first entry saved in the logbook as the start time.</li> <li>Date/Time: Defines the set date/time as the start time.</li> </ul>
Plotter end	Selection  Last entry Date/Time Factory setting Last entry	<ul> <li>First entry: Defines the last entry saved in the logbook as the end time.</li> <li>Date/Time: Defines the set date/time as the end time.</li> </ul>
► Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu <b>General settings/ Logbooks</b> .
▷ Delete all entries	Action	You can delete all the absorption data logbook entries here.

Options	Info
	Chronological list of the data logbook entries for sensors
	This submenu is available for each data logbook that you have set up and activated.
Read only	Input or mathematical function is displayed
Read only	Measured value being recorded is displayed
Read only	Display of days, hours and minutes until logbook is full.  Pay attention to the information on selecting the memory type in the menu General settings/Logbooks.
Events are displayed	Select a particular event to display more detailed information.
User entry Go to date Time	Use this function to go directly to a specific time in the list. In this way, you avoid having to scroll through all the information. The complete list is always visible, however.
Graphic display of the logbook entries	The display is according to your settings in the menu <b>General settings/Logbooks</b> .
Select another data logbook	You can view a second logbook at the same time as the current one.
Action	You can use this to delete all data logbook entries.
Selection CSV FDM	<ul> <li>Save the logbook in the preferred file format.</li> <li>You can then open the saved CSV file on the PC in MS Excel, for example, and make further edits here. <sup>1)</sup>. You can import the FDM files into FieldCare and archive them so that they are tamper-proof.</li> </ul>
Action, commences as soon as the option is selected	Use this function to save the logbook to an SD card.  ► Save the logbook in the preferred file format. You can then open the saved CSV file on the PC in MS-Excel, for example, and edit it. You can import the FDM files into Fieldcare and archive them so they are tamper-proof.
	Read only Read only Read only  Events are displayed  User entry Go to date Time  Graphic display of the logbook entries  Select another data logbook  Action  Selection CSV FDM  Action, commences as soon as the

CSV files use international number formats and separators. Therefore they must be imported into MS
 Excel as external data with the correct format settings. If you double-click the file to open it, the data are
 only displayed correctly if MS Excel is installed with the US country setting.

# 11.10 System information

DIAG/System information			
Function	Options	Info	
Device tag	Read only	Individual device tag → <b>General</b> settings	
Order code	Read only	You can order identical hardware with this code. This code changes on account of changes to the hardware and you can enter the new code you received from the manufacturer here 1).	
To establish the version of your device address: www.endress.com/order-ider		search screen at the following	
Orig. order code ext.	Read only	Complete order code for the original device, resulting from the product structure.	
Current order code ext.	Read only	Current code, taking into account changes to the hardware. You must enter this code yourself.	
Serial number	Read only	The serial number allows you to access device data and documentation on the Internet: www.endress.com/device-viewer	
Software version	Read only	Current version	
Measuring parameter	Read only	Set measuring parameter	
MPL version	Read only	Current version	
▶ Actuator control module	Read only Firmware version Hardware version		
▶ Photometer	Read only Firmware version Hardware version		
► Modbus  Only with the Modbus option	Read only     Enable     Bus address     Termination     Modbus TCP Port 502	Modbus-specific information	
▶ PROFIBUS  Only with the PROFIBUS option	Read only Termination Bus address Ident number Baudrate DPV0 state DPV0 fault DPV0 master addr DPV0 WDT [ms]	Module status and other PROFIBUS-specific information	
► Ethernet  Only with the Ethernet, EtherNet/IP,  Modbus TCP, Modbus RS485 or PROFIBUS  DP or PROFINET option	Read only  Enable  Webserver  Link settings  DHCP  IP-Address  Netmask  Gateway  Service switch  MAC-Address  EtherNetIP Port 44818  Modbus TCP Port 502  Webserver TCP port 80	Ethernet-specific information Display depends on the fieldbus protocol used.	

DIAG/System information			
Function	Options	Info	
▶ SD card	Read only Total Free memory		
▶ System modules			
Backplane	Read only	This information is provided for	
Base	<ul><li>Description</li><li>Serial number</li></ul>	every electronics module available. Specify the serial numbers and order codes when servicing, for example.	
Display module	<ul><li>Order code</li><li>Hardware version</li></ul>		
Extension module 1 8	Software version		
▶ Sensors	Read only     Description     Serial number     Order code     Hardware version     Software version	This information is provided for every sensor available. Specify the serial numbers and order codes when servicing, for example.	
► Save system information			
⊳ Save to SD card	File name assigned automatically (includes a time stamp)	The information is saved on the SD card in a "sysinfo" subfolder. The csv file can be read and edited in MS Excel, for example. This file can be used when servicing the device.	

1) Provided you give the manufacturer all the information about changes to the hardware.

### 11.11 Sensor information

► Select the channel you want from the list of channels.

Information in the following categories is displayed:

## Extreme values

Extreme conditions to which the sensor was previously exposed, e. g. min./max. temperatures  $^{2)}\,$ 

# Operating time

Operating time of the sensor under defined extreme conditions

### Calibration information

Calibration data of the last calibration

# Sensor specifications

Measuring range limits for main measured value and temperature

#### General information

Information on sensor identification

The specific data that are displayed depends on what sensor is connected.

# 11.12 Simulation

You can simulate values at inputs and outputs for testing purposes:

- Current values at current outputs
- Measured values at inputs
- Relay contact opening or closing
- Only current values are simulated. Via the simulation function, it is not possible to calculate the totalized value for the flow or rainfall.

Not available for all sensor types.

▶ Before simulation: Enable the inputs and outputs in the Setup menu.

DIAG/Simulation		
Function	Options	Info
► Current output x:y		Simulation of an output current This menu appears once for each current output
Simulation	Selection     Off     On Factory setting	If you simulate the value at the current output, this is indicated on the display by a simulation icon in front of the current value.
	Off	
Current	2.4 to 23.0 mA	► Set the desired simulation value.
	Factory setting 4 mA	
► Alarm relay ► Relay x:y		Simulation of a relay state This menu appears once for each relay.
Simulation	Selection ■ Off ■ On	If you simulate the relay state, this is indicated on the display by a simulation icon in front of the relay display.
	<b>Factory setting</b> Off	
State	Selection	► Set the desired simulation value.
	<ul><li>Low</li><li>High</li></ul>	The relay switches in accordance with your setting when you switch on the simulation. On
	Factory setting Low	the measured value display, you see <b>On</b> (= <b>Low</b> ) or <b>Off</b> (= <b>High</b> ) for the simulated relay state.
Meas. inputs		Simulation of a measured value (only for sensors)
Channel : parameter		This menu appears once for each measuring input.
Simulation	Selection Off On	If you simulate the measured value, this is indicated on the display by a simulation icon in front of the measured value.
	Factory setting Off	
Main value	Depends on the sensor	► Set the desired simulation value.
Sim. temperature	Selection Off On	If you simulate the temperature measured value this is indicated on the display by a simulation icon in front of the temperature.
	<b>Factory setting</b> Off	
Temperature	-50.0 to +250.0 °C (-58.0 to 482.0 °F)	► Set the desired simulation value.
	Factory setting 20.0 °C (68.0 °F)	
Binary input x:y Binary output x:y		Simulation of a binary input or output signal The number of submenus available corresponds to the number of binary inputs or outputs.
Simulation	Selection Off On	
	<b>Factory setting</b> Off	
State	Selection Low High	

# 11.13 Device test

# 11.13.1 Analyzer

DIAG/System testAnalyzer/Photometer		
Function Options Info		
Cleaning factor	Read only	
Raw value	Read only	

Function	Options	Info
Cuvette heating		Cuvette heating test
Temperature		Displays the current cuvette heating temperature
Current		Displays the current heating current in ampere
Power		Displays the heating power in % (current controller actuating value)
State		Displays the cuvette heating status
Selection Heating Heating up Off		
▷ Off for 10 minutes		Cuvette heating is switched off for 10 minutes. Cuvette heating is switched on by default. It can be switched off temporarily for testing.
⊳ On		Cuvette heating is switched on.
▶ Magnetic stirrer		
⊳ Start for 1 minute		The magnetic stirrer is switched on for 1 minute
Stop		
Sample pre-heating		
Temperature		Displays the current sample pre-heating temperature
Power		Displays the heating power in % (current controller actuating value)
State		Displays the current sample pre-heating status
<b>○ Off for 10 minutes</b>		Sample pre-heating is switched off for 10 minutes.
⊳ On		Sample pre-heating is switched on.
▶ Valves		
Valve selection		
Selection None Reagent RB Reagent RK Reagent RN		
> Open		Opens the selected valve.
Close		Closes the selected valve.
Pump		
		The pump is switched on for 1 minute.

DIAG/System testAnalyzer			
Function	Options	Info	
<b>⊳</b> Stop			
▶ Sample channel		·	
Current channel		Displays the active measuring channel	
Flow rate		Displays the current flow of the active measuring channel	
Test channel		Select the measuring channel to be tested After making the selection, press <b>Confirm</b>	
Confirm			
<b>▶</b> Dispensers			
Dispenser selection			
Selection  None  1 2 3			
> Empty dispenser		Dispenser is emptied	
⊳ Draw up dispenser		Dispenser draws in reagent from the reagent bottles	

# 11.13.2 Power supply

DIAG/System test/Power supply		
Function	Options	Info
Digital supply 1: 1.2V	Read only	Detailed list of power supply to instrument.
Digital supply 2: 3.3V		The actual values can vary without a malfunction having occurred.
Analog supply: 12.5V		manunction having occurred.
Sensor supply: 24V		
Temperature		

# 11.14 Resetting

DIAG/Reset		
Function	Options	Info
Device restart	Selection OK ESC	Restart and keep all the settings
> Factory default	Selection OK ESC	Restart with factory settings Settings that have not been saved are lost.

# 11.15 Operating time information

List of functional and operating time counters

- Operating time filter mats
   Displays the period of usage in days
- Operating time photometer
- Remaining operating time Dispensers

Displays the remaining period of usage in days; i.e. the individual dispensers can still be used for this many days.

# 11.16 Firmware history

Date	Version	Changes to firmware	Documentation
03/2021	01.09.00	Extension Support for new base module PROFINET	BA01650C/07//03.21 BA01245C/07//08.20
		<ul> <li>Improvements</li> <li>Air bubble detection, measurement is repeated if the threshold value is overshot</li> <li>Zero point calibration improved</li> <li>Minimum time for compressed air cleaning reduced to 1 s</li> </ul>	
03/2019	1.06.08	Extension  Implementation of the manual mode  Improvements  Deactivation of heating when device is put out of service  Adaptation of standard measurement and calibration intervals	BA01650C/07//02.19 BA01245C/07//07.19
06/2018	01.06.06	Original software	BA01650C/07//01.18 BA01245C/07//06.18

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# 12 Maintenance

Effects on process and process control

► Take all the necessary precautions in time to ensure the operational safety and reliability of the entire measuring point.

### **A** WARNING

### Process pressure and temperature, contamination, electrical voltage

Risk of serious or fatal injury

- ► If a sensor has to be removed during maintenance work, avoid hazards posed by pressure, temperature and contamination.
- ▶ Make sure the device is de-energized before you open it.
- ▶ Power can be supplied to switching contacts from separate circuits. De-energize these circuits before working on the terminals.

### **A** CAUTION

#### Maintenance activities in automatic mode

Risk of injury from chemicals or contaminated media

- ▶ Before releasing the hoses, ensure that no action is running or about to start.
- ▶ Set the device to the manual mode.
- ► Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

### **NOTICE**

### Electrostatic discharge (ESD)

Risk of damaging the electronic components

- ► Take personal protective measures to avoid ESD, such as discharging beforehand at PE or permanent grounding with a wrist strap.
- ► For your own safety, use only genuine spare parts. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

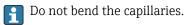
### NOTICE

#### Failure to observe the maintenance intervals

Possibility of material damage

▶ Observe the recommended maintenance intervals.

### 12.1 Maintenance schedule



Do not subject the capillaries to any tensile load.

Interval	Maintenance work	
After every reagent replacement, during commissioning, maintenance and repair	<ul> <li>Carry out zero point calibration.</li> <li>Visually inspect the cuvette for cracks and discoloration.</li> <li>Replace the cuvette if it is damaged.</li> </ul>	
2 months	<ul> <li>Check levels of reagents and standard.</li> <li>Replace reagents CY80SI RB, RK and RN (typically: with a measuring interval of 20 min, depending on the temperature and measuring range).</li> <li>Replace standard CY80SI (typically: with a calibration interval of 96 h).</li> </ul>	
6 months	<ul> <li>Replace dispensers and hose connectors at dispensers.</li> <li>Visually inspect the cuvette for cracks and discoloration. Replace the cuvette if it is damaged.</li> </ul>	

Interval	Maintenance work
12 months	<ul> <li>▶ Replace the cuvette.</li> <li>▶ Clean the magnetic stir bar.</li> <li>▶ Check hose of hose pump for wear, and replace if necessary.</li> <li>▶ Replace hoses.</li> <li>▶ Replace filter mats.</li> </ul>
If required	<ul> <li>Clean the housing.</li> <li>Clean the cuvette.</li> <li>Replace the cuvette.</li> <li>Clean the magnetic stir bar.</li> <li>Rinse the reagent and standard channels.</li> <li>Replace the hose connector.</li> <li>Clean the filter (backwash).</li> </ul>

### 12.2 Maintenance tasks

### 12.2.1 Software menu Maintenance

### Menu/Operation/Maintenance

- Bottle replacement
  - If level monitoring is activated: specify when bottles are replaced.
- Dispenser replacement
  - Operating time counter, can be reset here. Replace dispensers:  $\rightarrow \triangleq 145$
- Filter mats replacement
  - Operating time counter, can be reset here. Replace filter mats:  $\rightarrow \implies 144$
- Decommissioning
  - → 🖺 145

# 12.2.2 Setting the manual mode

Initial situation: The device is still in the automatic mode and you want to perform maintenance work.

- 1. Press the **MODE** soft key.
  - ► The current mode is displayed: **Automatic**
- 2. Select an action: Manual mode
  - ► The device changes to the manual mode.
- 3. Wait until all operations have stopped.
- 4. Alternatively:

Stop actions currently running under: **Menu/Operation/Manual operation**.

## 12.2.3 Cleaning

# **A** CAUTION

#### Risk of injury from reagents escaping

▶ Before replacing, always rinse the reagent and standard channels first.

# Cleaning the housing

▶ Clean the front of the housing using commercially available cleaning agents only.

The front of the housing is resistant to the following in accordance with DIN 42 115:

- Ethanol (for a short time)
- Diluted acids (max. 2% HCl)
- Diluted bases (max. 3% NaOH)
- Soap-based household cleaning agents

### NOTICE

### Cleaning agents not permitted

Damage to the housing surface or housing seal

- ▶ Never use concentrated mineral acids or alkaline solutions for cleaning.
- ► Never use organic cleaners such as acetone, benzyl alcohol, methanol, methylene chloride, xylene or concentrated glycerol cleaner.
- ▶ Never use high-pressure steam for cleaning.

#### Rinsing the reagent and standard channels

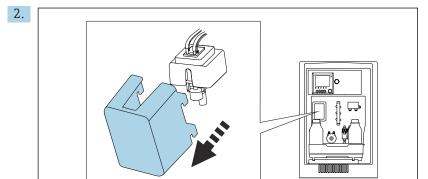
- 1. Place the ends of the hoses (RB, RK, RN, S) into an empty plastic beaker.
- 2. Purge the hoses with air. Select: **Menu/Operation /Maintenance/ Decommissioning/Empty hoses** .
  - The hoses are automatically purged with air and emptied. This process takes several minutes.
- 3. Rinse the hoses with water: Immerse all hoses (RB, RK, RN, S) in a beaker with approx. 500 ml (16.9 fl.oz) of distilled water.
- 4. Start rinsing: Menu/Operation /Maintenance/Decommissioning/Rinse with water must be selected.
  - The hoses are automatically rinsed and emptied. This process takes approx. 8 minutes.
- 5. Once the action is finished, remove the hoses from the beaker and dry them with a clean paper towel.
- 6. Place the ends of the hoses into an empty plastic beaker.
- 7. Purge the hoses again with air. Select: **Menu/Operation /Maintenance/ Decommissioning/Empty hoses** .
  - The hoses are automatically purged with air and emptied. This process takes several minutes.

### Cleaning the cuvette and magnetic stir bar

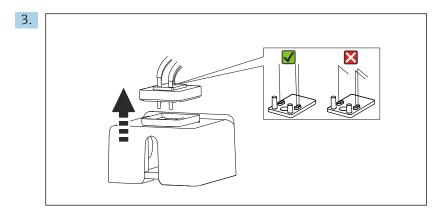
Only clean the cuvette and magnetic stir bar when this is necessary. This is not part of routine maintenance work.

### Emptying the cuvette and removing it from the holder

1. If you have not already done so, set the manual mode.

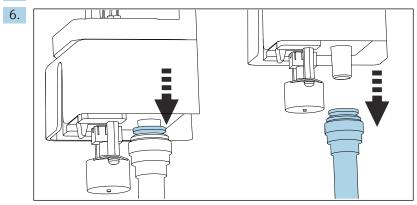


Remove the cover in front of the cuvette assembly.

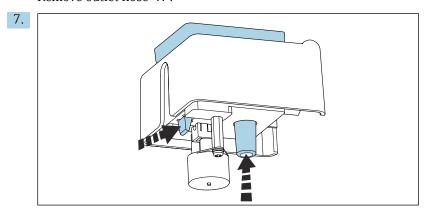


Lift the rubber cover off the cuvette. There must be no kinks in the capillaries at the capillary holder or at the valves, and the capillaries must not be removed from the hose connector.

- 4. Insert the maintenance dispenser together with the hose piece provided through the hole in the capillary holder of the cuvette.
- 5. Empty the cuvette completely.

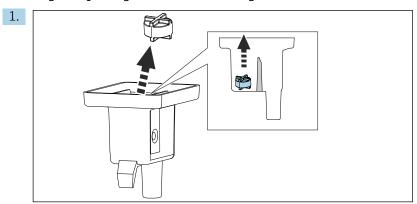


Remove outlet hose "W".



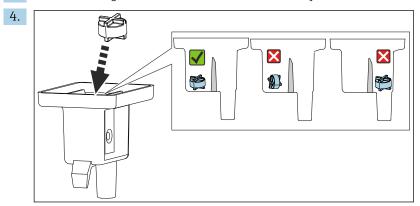
Push the cuvette out from below by pressing simultaneously against the tab and the hose attachment.

## Cleaning or replacing the cuvette and magnetic stir bar



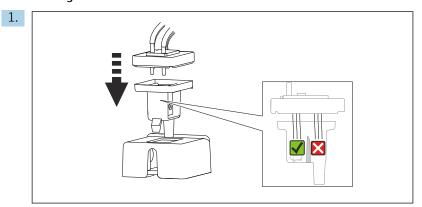
Remove the magnetic stir bar from the measuring chamber.

- 2. Check the cuvette for dirt and clean if necessary or replace with a new cuvette.
- 3. Check the magnetic stir bar and clean if necessary.

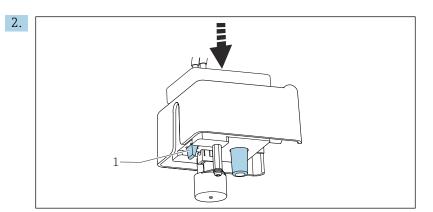


Place the magnetic stir bar back into the measuring chamber, making sure that it is flat and in the measuring chamber.

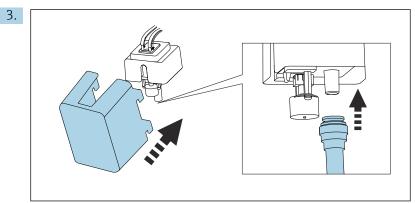
## Reinstalling the cuvette



Place the rubber cover back on the cuvette, and ensure that all capillaries are in the measuring chamber.



Push the cuvette with the magnetic stir bar and cover into the holder. Ensure that the tab (1) snaps into place.



Connect the outlet hose "W" again and secure the cover again.

## 12.2.4 Replacing reagents

### Removing bottles

- 1. Stop the sample supply.
- 2. If you have not already done so, set the manual mode.
- 3. Remove the bottles you wish to replace by removing the hoses at the valves. Use a paper towel to catch any reagents that may escape.
- 4. Select Menu/Operation / Maintenance/Bottle change mode/Bottle removal/Bottle selection.
- 5. Select the bottles that you want to remove and press **OK** to confirm.
- 6. Select **Confirm bottles removed**.

### Replacing bottles

- 1. Replace the removed bottles with fresh reagent.
  - Reagents must be prepared according to the instructions for mixing a reagent.
- 2. Reconnect the hoses to the valves.
- 3. Select Menu/Operation / Maintenance/Bottle change mode/Bottle insertion/Bottle selection.
- 4. Select all the bottles that you have replaced and press **OK** to confirm.
- 5. Select **Confirm bottles inserted**.

- 6. Following the replacement, a zero point calibration must be performed and the calibration factor must be redetermined: Menu/Operation/Manual operation/Determine zero point and /Determine calibration factor.
- Go back to the MODE/Continue automatic mode or MODE/Start automatic mode to start the normal measurement.

# 12.2.5 Carrying out zero point calibration

#### Replacing standard calibration solution with zero standard

- 1. If you have not already done so, set the manual mode.
- 2. Replace the standard with zero standard. Use either an additional hose in order to reconnect the standard calibration solution, or allow the hose to drain and dry the hose well.
- 3. Select Menu/Operation / Maintenance/Bottle change mode/Bottle insertion/Bottle selection.
- 4. Select **Standard S1** and press **OK** to confirm.
- 5. Select **Confirm bottles inserted**.

#### Determining the zero point

- 1. Call up: Menu/Operation/Manual operation/Determine zero point.
- 2. Carry out zero point calibration.
- 3. Following successful calibration, the following message appears: "Do you want to accept the calibration data for adjustment?". Press **OK** to confirm.

### Re-deploying the standard calibration solution

- ▶ Replace the zero standard with the standard.
- Recommendation: Afterwards, perform a manual calibration with the standard solution (**Determine calibration factor**).

Alternatively, the zero point and calibration factor can be determined in one step (**Determine zero point and calibr. factor**).

### 12.2.6 Replacing the hoses

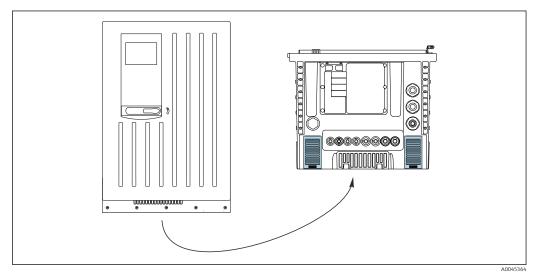
- 1. Rinse the reagent and standard channels.  $\rightarrow \triangleq 139$
- 2. Remove the bottles and the bottle tray.
- 3. Replace the hoses with hoses of the same diameter and length. Attach hose labels to the new hoses.
- 4. Place the bottle tray back into the housing.
- 5. Connect the bottles to the appropriate covers and hoses.
- 6. Select Menu/Operation / Maintenance/Bottle change mode/Bottle insertion/Bottle selection.
- 7. Select all the bottles and press **OK** to confirm.
- 8. Select **Confirm bottles inserted**.
- 9. Press the **MODE** soft key and select **Continue automatic mode** or **Start automatic mode**.

### Replacing the pump hose

- The replacement of the pump hose is not part of routine maintenance activities. Only replace the pump hose when this is necessary.
- 1. Open the analyzer.
- 2. Stop the sample supply.
- 3. Rinse the reagent and standard channels. → 🗎 139
  - There should not be any more liquid left in the hoses.
- 4. Remove the bottles and the bottle tray.
- 5. Press the soft key **MODE** and select **Manual mode** .
  - The display shows Current mode- Manual.
     Wait until all operations have stopped. Ongoing operations can be stopped under Menu/Operation/Manual operation.
- 6. Open the bayonet lock of the peristaltic pump.
- 7. Replace the hose and, if necessary, replace the pump head.
- 8. Close the bayonet lock of the peristaltic pump.
- 9. Make sure all the hoses and connectors are seated correctly.
- 10. Place the bottle tray back into the housing.

## 12.2.7 Replacing filter mats

You require the following parts: Filter mats (part of the CAV maintenance kit)



■ 74 Fan screen on the bottom

- 1. Open both fan screens and remove them.
  - └ The filter mats are located under the screens.
- 2. Remove the used filter mats and replace them with new ones from the maintenance kit.
- 3. Fit the fan screens back on.
- 4. Reset the operating hours counter for the mats: **Menu/Operation/Operating time filter mats/Reset**.

### 12.2.8 Replacing dispensers

You require the following parts:

- From the CAV800 maintenance kit: 10 ml dispensers with adapter
- 1 pair of gloves that are resistant to the reagents used

#### Preparing to replace dispensers

- 1. Rinse the reagent and standard channels.  $\rightarrow \blacksquare 139$
- 2. Remove the bottles including the reagent hoses and the bottle tray.

#### Removing the dispensers

- 1. Open the dispenser holder by pressing both snap-fit hooks together and removing it.
- 2. Remove the adapter and the dispenser from the dispenser drive. To do so, hold the dispenser by the black block at the lower end and pull the block from the metal pin.

### Inserting new

- 1. Make sure that the dispenser is connected correctly.
- 2. Slide the dispenser holder over the snap-fit hooks. Ensure that the holder snaps into place.
- 3. Place the bottle tray back into the housing.
- 4. Connect the reagent hoses to the corresponding reagent valves.
- 5. Select Menu/Operation/Dispenser replacement/Dispenser selection.
- 6. Select the dispensers that you have replaced and press **OK** to confirm.
- 7. Select **Reset operating time counter**.
- 8. Select Menu/Operation / Maintenance/Bottle change mode/Bottle insertion/Bottle selection.
- 9. Select all the bottles and press **OK** to confirm.
- 10. Select **Confirm bottles inserted**.
- 11. The system must be calibrated after a replacement routine. Select **Menu/Operation/ Manual operation/Determine calibration factor**.
- 12. After the calibration go back to MODE/Continue automatic mode or MODE/Start automatic mode.

# 12.3 Taking out of service

### **A** CAUTION

#### Activities while the analyzer is in operation

Risk of injury and infection from medium!

- ▶ Before you release any hoses, make sure that no actions, such as the pumping of sample, are currently running or are due to start shortly.
- ▶ Wear protective clothing, goggles and gloves or take other suitable measures to protect vourself.
- ▶ Wipe up any spilt reagent with a disposable tissue and rinse with clear water. Then dry the cleaned areas with a cloth.

#### NOTICE

# Do not operate the analyzer for longer than 2 days without taking it out of service properly!

Can result in damage to the device.

► Take the analyzer out of service as described.

### To take out of service, proceed as follows:

- 1. Set the manual mode
- 2. Rinse the reagent and standard channels
- 3. Empty the sample channels
- 4. Empty the cuvette

### 12.3.1 Setting the manual mode

Initial situation: The device is still in the automatic mode and you now want to take the device out of service.

- 1. Press the **MODE** soft key.
  - ► The current mode is displayed: **Automatic**
- 2. Select an action: Manual mode
  - ➤ The device changes to the manual mode.
- 3. Wait until all operations have stopped.
- 4. Alternatively:

Stop actions currently running under: **Menu/Operation/Manual operation**.

- 5. Shut off the inflow of sample at the place of installation.
- 6. Remove the supply hoses from the push-in connectors on the filters. Smaller amounts of sample may drip from the filters. Pay attention to liquid-sensitive devices in the vicinity.
- 7. Unscrew the lids from the reagent bottles and standard.
- 8. Seal the reagent bottles and standard with the lids supplied.
- 9. Dry the ends of the hoses with a clean paper towel.
- 10. Remove the bottle tray: Lift up the recessed grip slightly and pull it towards the front.

### 12.3.2 Rinsing the reagent and standard channels

- 1. Place the ends of the hoses (RB, RK, RN, S) into an empty plastic beaker.
- 2. Purge the hoses with air. Select: **Menu/Operation /Maintenance/ Decommissioning/Empty hoses** .
  - The hoses are automatically purged with air and emptied. This process takes several minutes.
- 3. Rinse the hoses with water: Immerse all hoses (RB, RK, RN, S) in a beaker with approx. 500 ml (16.9 fl.oz) of distilled water.
- 4. Start rinsing: Menu/Operation / Maintenance/Decommissioning/Rinse with water must be selected.
  - The hoses are automatically rinsed and emptied. This process takes approx. 8 minutes.
- 5. Once the action is finished, remove the hoses from the beaker and dry them with a clean paper towel.
- 6. Place the ends of the hoses into an empty plastic beaker.
- 7. Purge the hoses again with air. Select: **Menu/Operation /Maintenance/ Decommissioning/Empty hoses** .
  - The hoses are automatically purged with air and emptied. This process takes several minutes.

### 12.3.3 Emptying the sample hose

#### 1-/2-channel device

- 1. Disconnect sample inlet hose SPx from the sample channel switching: Remove the connector nozzle of hose SPx from the outlet of the sample channel switching in the analyzer.
- 2. Fill the maintenance dispenser with air.
- 3. Slide the C-Flex hose of the maintenance dispenser onto the connector nozzle of hose SPx.
- 4. Drive air through the sample channel.
  - ► Any liquid remaining in the sample channel is driven into the cuvette.
- 5. Repeat steps 2 to 4 until the sample channel is empty.
- 6. Slide the connector nozzle of hose SPx back into the outlet at the sample channel switching in the analyzer.

#### 4-/6-channel device

- 1. Disconnect sample inlet hose SPx from the sample inlet in the analyzer: remove hose SPx from the T-section downstream from sample channel switching.
- 2. Fill the maintenance dispenser with air.
- 3. Slide the C-Flex hose of the maintenance dispenser onto the end of hose SPx.
- 4. Drive air through the sample channel.
  - ► Any liquid remaining in the sample channel is driven into the cuvette.
- 5. Repeat steps 2 to 4 until the sample channel is empty.

### 12.3.4 Emptying the cuvette

- 1. Remove the cover in front of the cuvette.
- 2. Insert the maintenance dispenser together with the hose piece provided through the hole in the capillary holder of the cuvette.
- 3. Empty the cuvette completely.
- 4. Remove the magnetic stir bar and store it separately.

# 13 Repair

### 13.1 General information

The repair and conversion concept provides for the following:

- The product has a modular design
- Spare parts are grouped into kits which include the associated kit instructions
- Only use original spare parts from the manufacturer
- Repairs are carried out by the manufacturer's Service Department or by trained users
- Certified devices can only be converted to other certified device versions by the manufacturer's Service Department or at the factory
- Observe applicable standards, national regulations, Ex documentation (XA) and certificates
- 1. Carry out the repair according to the kit instructions.
- 2. Document the repair and conversion and enter, or have entered, in the Life Cycle Management tool (W@M).

## 13.2 Spare parts

Device spare parts that are currently available for delivery can be found on the website:

www.endress.com/device-viewer

▶ Quote the serial number of the device when ordering spare parts.

#### **13.3** Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure the swift, safe and professional return of the device:

► Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

# 13.4 Disposal



If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

#### Dispose of batteries correctly

▶ Always dispose of batteries in accordance with local regulations on battery disposal.

Liquiline System CA80SI Repair

### Disposing of chemicals

► CAUTION

Risk of injury if used reagents and reagent waste are disposed of incorrectly!

- ▶ When disposing, follow the instructions of the safety data sheets for the chemicals used.
- ▶ Observe the local regulations regarding waste disposal.

### 14 Accessories

The following are the most important accessories available at the time this documentation was issued.

► For accessories not listed here, please contact your Service or Sales Center.

# 14.1 Device-specific accessories

#### 14.1.1 Installation accessories

Kit CA8x wall holder unit for reagents

- Collecting tray wall mounting
- Kit installation instructions
- Order No. 71422095

#### 14.1.2 Consumables

You can find the order codes on the website: https://www.endress.com/device-viewer.

- 1. Indicate the serial number of the device.
- 2. Search.
  - ▶ Device information is displayed.
- 3. Select the "Spare parts" tab.
- 4. Click the product root.
  - ► The complete product structure is displayed.

The following consumables are available: Reagent and standard solutions

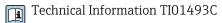
CY80SI

#### 14.1.3 **Sensors**

#### pH glass electrodes

### Memosens CPS11E

- pH sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps11e



#### Memosens CPS41E

- pH sensor for process technology
- With ceramic junction and KCl liquid electrolyte
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps41e

Technical Information TI01495C

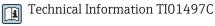
### Memosens CPS71E

- pH sensor for chemical process applications
- With ion trap for poison-resistant reference
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e

Technical Information TI01496C

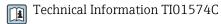
#### Memosens CPS91E

- pH sensor for heavily polluted media
- With open aperture
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e



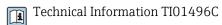
#### Memosens CPS31E

- pH sensor for standard applications in drinking water and swimming pool water
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps31e



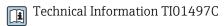
#### Memosens CPS71E

- pH sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e



#### Memosens CPS91E

- pH sensor for heavily polluted media
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e

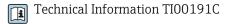


#### Ceramax CPS341D

- pH electrode with pH-sensitive enamel
- Meets highest demands of measuring accuracy, pressure, temperature, sterility and durability
- Product Configurator on the product page: www.endress.com/cps341d
- Technical Information TI00468C

#### **Orbipac CPF81D**

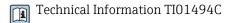
- Compact pH sensor for installation or immersion operation
- In industrial water and wastewater
- Product Configurator on the product page: www.endress.com/cpf81d



#### **ORP** electrodes

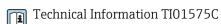
#### Memosens CPS12E

- ORP sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps12e



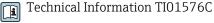
#### **Memosens CPS42E**

- ORP sensor for process technology
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps42e



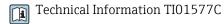
#### Memosens CPS72E

- ORP sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps72e



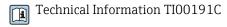
#### Memosens CPS92E

- ORP sensor for use in heavily polluted media
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps92e



#### Orbipac CPF82D

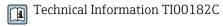
- Compact ORP sensor for installation or immersion operation in process water and wastewater
- Product Configurator on the product page: www.endress.com/cpf82d



### Conductivity sensors with inductive measurement of conductivity

#### **Indumax CLS50D**

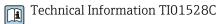
- High-durability inductive conductivity sensor
- For standard and hazardous area applications
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cls50d



### Conductivity sensors with conductive measurement of conductivity

#### Memosens CLS21E

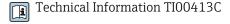
- Digital conductivity sensor for media with medium or high conductivity
- Conductive measurement
- With Memosens 2.0
- Product Configurator on the product page: www.endress.com/cls21e



### Oxygen sensors

### Oxymax COS51D

- Amperometric sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos51d



### Oxymax COS61D

- Optical oxygen sensor for drinking water and industrial water measurement
- Measuring principle: quenching
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos61d

Technical Information TI00387C

#### Memosens COS81D

- Sterilizable, optical sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos81d



Technical Information TI01201C

#### Chlorine dioxide and chlorine sensors

#### Memosens CCS50D

- Membrane-covered amperometric sensor for chlorine dioxide
- With Memosens technology
- Product Configurator on the product page: www.endress.com/ccs50d



Technical Information TI01353C

#### Memosens CCS51D

- Sensor for measuring free chlorine
- Product configurator on the product page: www.endress.com/ccs51d



Technical Information TI01423C

#### Ion-selective sensors

#### ISEmax CAS40D

- Ion selective sensors
- Product Configurator on the product page: www.endress.com/cas40d



Technical Information TI00491C

#### **Turbidity sensors**

#### **Turbimax CUS51D**

- For nephelometric measurements of turbidity and solids in wastewater
- 4-beam scattered light method
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus51d



Technical Information TI00461C

### **Turbimax CUS52D**

- Hygienic Memosens sensor for turbidity measurement in drinking water, process water and in utilities
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus52d



Technical Information TI01136C

#### SAC and nitrate sensors

### Viomax CAS51D

- SAC and nitrate measurement in drinking water and wastewater
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cas51d



Technical Information TI00459C

#### Interface measurement

#### **Turbimax CUS71D**

- Immersion sensor for interface measurement
- Ultrasonic interface sensor
- Product Configurator on the product page: www.endress.com/cus71d



Technical Information TI00490C

#### Cable junction with Velcro strip 14.1.4

- 4 pieces, for sensor cable
- Order No. 71092051

#### Communication-specific accessories 14.2

#### Additional functionality 14.2.1

▶ Always quote the serial number of your device when ordering activation codes.

	Communication; software
51516983	Commubox FXA291 (hardware)
71127100	SD card with Liquiline Firmware, 1 GB, Industrial Flash Drive
71135636	Activation code for Modbus RS485
71219871	Activation code for EtherNet/IP
71135635	Activation code for Profibus DP for module 485
71449914	Upgrade code for EtherNet/IP+web server for BASE2
71449915	Upgrade code for Modbus TCP+web server for BASE2
71449918	Upgrade code for web server for BASE2
71449901	Upgrade code for PROFINET+web server for BASE2
71249548	Kit CA80: activation code for 1st digital sensor input
71249555	Kit CA80: activation code for 2nd digital sensor input

	Retrofit kits
71136999	Kit CSF48/CA80: retrofit service interface (CDI flange connector, counter nut)
71111053	Kit module AOR: 2 x relay, 2 x analog output 0/4 to 20 mA
71125375	Kit module 2R: 2 x relay
71125376	Kit module 4R: 4 x relay
71135632	Kit module 2AO: 2 x analog output 0/4 to 20 mA
71135633	Kit module 4AO: 4 x analog output 0/4 to 20 mA
71135631	Kit module 2DS: 2 x digital sensor, Memosens
71135634	Kit module 485: PROFIBUS DP or Modbus RS485. This requires an additional activation code which can be ordered separately.
71135638	Kit module DIO: 2 x digital input; 2 x digital output; auxiliary power supply for digital output
71135639	Kit module 2AI: 2 x analog input 0/4 to 20 mA
71140888	Upgrade kit module 485 + Profibus DP
71140889	Upgrade kit module 485 + Modbus RS485
71141366	Kit, extension backplane module

#### 14.2.2 Software

#### Memobase Plus CYZ71D

- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations stored in database
- Product Configurator on the product page: www.endress.com/cyz71d



Technical Information TI00502C

### Field Data Manager Software MS20/21

- PC software for central data management
- Visualization of series of measurements and logbook events
- SQL database for secure data storage

## 14.3 System components

### 14.3.1 Measuring cable

### Memosens data cable CYK10

- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk10



Technical Information TI00118C

#### Memosens data cable CYK11

- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: www.endress.com/cyk11



Technical Information TI00118C

#### Measuring cable CYK81

- Unterminated cable for extending sensor cables (e.g. Memosens, CUS31/CUS41)
- 2 x 2 cores, twisted with shielding and PVC sheath (2 x 2 x 0.5 mm² + shielding)
- Sold by meter, Order No.: 51502543

#### 14.3.2 SD card

- Industrial Flash Drive, 1 GB
- Order number: 71110815

#### Technical data 15

#### 15.1 **Input**

Measured variables	SIO <sub>2</sub> [mg/l, μg	l, ppm, ppb]	
 Measuring range	CA80SI-**AH	: 0 to 5	00 μg/l (ppb)
	CA80SI-**AJ*	50 to	5 000 μg/l (ppb)
Types of input	<ul> <li>1, 2, 4 or 6 measuring channels (analyzer main parameter)</li> <li>1 to 4 digital sensor inputs for sensors with Memosens protocol (optional)</li> <li>Analog current inputs (optional)</li> <li>Binary inputs (optional)</li> </ul>		
Input signal	Depending on 2 x 0/4 to 20	version nA (optional), passive, poten	itially isolated
Current input, passive	<b>Span</b> > 0 to 20 mA		
	<b>Signal charac</b> Linear	eristic	
	<b>Internal resis</b> Non-linear	ance	
	<b>Test voltage</b> 500 V		
Cable specification (for optional sensors with Memosens technology)		a cable CYK10 or sensor fixe lector (optional)	d cable, each with cable end sleeves or M12
	Cable length Max. 100 m (	30 ft)	
	15.2 O	tput	
Output signal	Depending on version:  2 x 0/4 to 20 mA, active, potentially isolated (standard version)		

- 4 x 0/4 to 20 mA, active, potentially isolated (version with 2 additional analog outputs)
   6 x 0/4 to 20 mA, active, potentially isolated (version with 4 additional analog outputs)
- Binary outputs

PROFIBUS DP/RS485	
Signal encoding	EIA/TIA-485, PROFIBUS DP-compliant acc. to IEC 61158
Data transmission rate	9.6 kBd, 19.2 kBd, 45.45kBd, 93.75 kBd, 187.5 kBd, 500 kBd, 1.5 MBd, 6 MBd, 12 MBd
Galvanic isolation	Yes
Connectors	Spring terminal (max. 1.5 mm), bridged internally (T-function), optional M12
Bus termination	Internal slide switch with LED display

Modbus RS485	
Signal encoding	EIA/TIA-485
Data transmission rate	2,400, 4,800, 9,600, 19,200, 38,400, 57,600 and 115,200 baud
Galvanic isolation	Yes
Bus termination	Internal slide switch with LED display

Web server and Modbus TCP		
Signal encoding	IEEE 802.3 (Ethernet)	
Data transmission rate	10 / 100 MBd	
Galvanic isolation	Yes	
Connection	RJ45, M12 optional	
IP address	DHCP or configuration using menu	

EtherNet/IP		
Signal encoding IEEE 802.3 (Ethernet)		
Data transmission rate	10 / 100 MBd	
Galvanic isolation	Yes	
Connection	RJ45, M12 optional (D-encoded)	
IP address	DHCP (default) or configuration via menu	

PROFINET	
Signal encoding	IEEE 802.3 (Ethernet)
Data transmission rate	100 MBd
Galvanic isolation	Yes
Connection	RJ45
Name of station	Via DCP protocol using the configuration tool (e.g. Siemens PRONETA)
IP address	Via DCP protocol using the configuration tool (e.g. Siemens PRONETA)

Signal on	a.	larm
-----------	----	------

Adjustable, as per NAMUR Recommendation NE 43

- In measuring range 0 to 20 mA: Failure current from 0 to 23 mA
- In measuring range 4 to 20 mA:
   Failure current from 2.4 to 23 mA
- Factory setting for failure current for both measuring ranges: 21.5 mA

Load

Max. 500 Ω

Transmission behavior

Linear

# 15.3 Current outputs, active

Span

0 to 23 mA

Signal characteristic

Linear

Electrical specification

Output voltage

Max. 24 V

Test voltage

500 V

Cable specification

Cable type

Recommended: shielded cable

Cable specification

Max. 2.5 mm<sup>2</sup> (14 AWG)

# 15.4 Relay outputs

### Electrical specification

### Relay types

- 1 single-pin changeover contact (alarm relay)
- 2 or 4 single-pin changeover contacts (optional with extension modules)

### Maximum load

Alarm relay: 0.5 AAll other relays: 2.0 A

### Relay switching capacity

Base module (Alarm relay)

Switching voltage	Load (max.)	Switching cycles (min.)
230  V AC, cosΦ = 0.8 to 1	0.1 A	700,000
	0.5 A	450,000
115 V AC, $cosΦ = 0.8$ to 1	0.1 A	1,000,000
	0.5 A	650,000
24 V DC, L/R = 0 to 1 ms	0.1 A	500,000
	0.5 A	350,000

### Extension module

Switching voltage	Load (max.)	Switching cycles (min.)
230 V AC, cosΦ = 0.8 to 1	0.1 A	700,000
	0.5 A	450,000
	2 A	120,000
115 V AC, $\cos \Phi = 0.8 \text{ to } 1$	0.1 A	1,000,000
	0.5 A	650,000
	2 A	170,000
24 V DC, L/R = 0 to 1 ms	0.1 A	500,000
	0.5 A	350,000
	2 A	150,000

### Minimum load (typical)

- Min. 100 mA at 5 V DC
- Min. 1 mA at 24 V DC
- Min. 5 mA at 24 V AC
- Min. 1 mA at 230 V AC

# 15.5 Protocol-specific data

PROFIBUS DP	Manufacturer ID	11 <sub>h</sub>
	Device type	155E <sub>h</sub>
	Profile version	3.02
	Device database files (GSD files)	www.endress.com/profibus Device Integration Manager DIM
	Output variables	16 AI blocks, 8 DI blocks
	Input variables	4 AO blocks, 8 DO blocks
	Supported features	<ul> <li>1 MSCYO connection (cyclical communication, master class 1 to slave)</li> <li>1 MSAC1 connection (acyclical communication, master class 1 to slave)</li> <li>2 MSAC2 connections (acyclical communication, master class 2 to slave)</li> <li>Device lock: The device can be locked using the hardware or software.</li> <li>Addressing using DIL switches or software</li> <li>GSD, PDM DD, DTM</li> </ul>

Modbus RS485	Protocol	RTU/ASCII
	Function codes	03, 04, 06, 08, 16, 23
	Broadcast support for function codes	06, 16, 23
	Output data	16 measured values (value, unit, status), 8 digital values (value, status)
	Input data	4 setpoints (value, unit, status), 8 digital values (value, status), diagnostic information

Address can be configured using switch or software

Supported features

### Modbus TCP

TCP port	502
TCP connections	3
Protocol	TCP
Function codes	03, 04, 06, 08, 16, 23
Broadcast support for function codes	06, 16, 23
Output data	16 measured values (value, unit, status), 8 digital values (value, status)
Input data	4 setpoints (value, unit, status), 8 digital values (value, status), diagnostic information
Supported features	Address can be configured using DHCP or software

### EtherNet/IP

Log	EtherNet/IP	
ODVA certification	Yes	
Device profile	Generic device (p	roduct type: 0x2B)
Manufacturer ID	0x049E <sub>h</sub>	
Device type ID	0x109F	
Polarity	Auto-MIDI-X	
Connections	CIP	12
	I/O	6
	Explicit message	6
	Multicast	3 consumers
Minimum RPI	100 ms (default)	
Maximum RPI	10000 ms	
System integration	EtherNet/IP	EDS
	Rockwell	Add-on-Profile Level 3, Faceplate for Factory Talk SE
IO data	Input $(T \rightarrow O)$	Device status and diagnostic message with highest priority
		Measured values:  16 AI (analog input) + Status + Unit  8 DI (discrete input) + Status
	Output (O → T)	Actuating values:  4 A0 (analog output) + status + unit  8 D0 (discrete output) + Status

### PROFINET

Protocol	"Application layer protocol for decentral device periphery and distributed automation", PNIO Version 2.34
Communication type	100 MBit/s
Conformance Class	Conformance Class B
Netload Class	Netload Class II
Baud rate	Automatic 100 Mbps with full-duplex detection
Cycle times	From 32 ms
Device profile	Application interface identifier 0xF600 Generic device
PROFINET interface	1 port, Realtime Class 1 (RT_CLASS_1)
Manufacturer ID	0x11 <sub>h</sub>
Device type ID	0x859F <sub>h</sub>
Device description files (GSD)	Information and files under:  ■ www.endress.com  On the product page for the device: Documents/Software →  Device drivers  ■ www.profibus.com  On the website under Products/Product Finder
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported connections	<ul> <li>1 x AR (IO Controller AR)</li> <li>1 x AR (IO-Supervisor Device AR connection allowed)</li> <li>1 x Input CR (Communication Relation)</li> <li>1 x Output CR (Communication Relation)</li> <li>1 x Alarm CR (Communication Relation)</li> </ul>
Configuration options for measuring device	<ul> <li>Web browser</li> <li>Manufacturer-specific software (FieldCare, DeviceCare)</li> <li>Device master file (GSD), can be read out via the integrated web server of the measuring device</li> </ul>
Configuration of the device name	DCP protocol
Supported functions	<ul> <li>Identification &amp; maintenance         Simple device identification via:         <ul> <li>Process control system</li> <li>Nameplate</li> </ul> </li> <li>Measured value status         <ul> <li>The process variables are communicated with a measured value status</li> </ul> </li> <li>Blinking feature (FLASH_ONCE) via the local display for simple device identification and assignment</li> <li>Device operation via operating tools (e.g. FieldCare, DeviceCare)</li> </ul>
System integration	For information on system integration, see the Operating Instructions  Cyclic data transmission Overview and description of the modules Status coding Startup configuration Factory setting

#### Web server

The Web server enables full access to the device configuration, measured values, diagnostic messages, logbooks and service data via standard WiFi/WLAN/LAN/GSM or 3G routers with a user-defined IP address.

TCP port	80
Supported features	<ul> <li>Remote-controlled device configuration(1 session)</li> <li>Save/restore device configuration (via SD card)</li> <li>Logbook export (file formats: CSV, FDM)</li> <li>Access to Web server via DTM or Internet Explorer</li> <li>Login</li> <li>Web server can be switched off</li> </ul>

# 15.6 Power supply

### Supply voltage

- 100 to 120 V AC / 200 to 240 V AC
- 50 or 60 Hz

#### Fieldbus connection

Supply voltage: not applicable

### Power consumption

For a sample flow rate of 80 ml/min (2.7 fl oz/min), a continuous measuring interval (10 minutes), a sample temperature of 25  $^{\circ}$ C (77  $^{\circ}$ F), an ambient temperature of 25  $^{\circ}$ C (77  $^{\circ}$ F) and a device with a supply voltage of 230 V:

- Typically 60 VA
- Max. 1250 VA

#### Cable entries

- 4 x bores for M16, G3/8, NPT3/8", Memosens connection  $^{3)}$
- 4 x bores for M20, G1/2, NPT1/2"

### Cable specification

Cable gland	Permitted cable diameter
M16x1.5 mm	4 to 8 mm (0.16 to 0.32")
M12x1.5 mm (for order version M12 socket for Memosens sensors)	2 to 5 mm (0.08 to 0.20")
M20x1.5 mm	6 to 12 mm (0.24 to 0.48")
NPT <sup>3</sup> / <sub>8</sub> "	4 to 8 mm (0.16 to 0.32")
$G^3/_8$	4 to 8 mm (0.16 to 0.32")
NPT½"	6 to 12 mm (0.24 to 0.48")
G½	7 to 12 mm (0.28 to 0.48")

i

Cable glands mounted at the factory are tightened with 2 Nm.

# Sensor connection (optional)

Sensors with Memosens protocol

Sensor types	Sensor cable	Sensors
Digital sensors <b>without</b> additional internal power supply	With plug-in connection and inductive signal transmission	<ul> <li>pH sensors</li> <li>ORP sensors</li> <li>Combined sensors</li> <li>Oxygen sensors (amperometric and optical)</li> <li>Conductivity sensors with conductive measurement of conductivity</li> <li>Chlorine sensors (disinfection)</li> </ul>
	Fixed cable	Conductivity sensors with inductive measurement of conductivity
Digital sensors with additional internal power supply	Fixed cable	<ul> <li>Turbidity sensors</li> <li>Sensors for interface measurement</li> <li>Sensors for measuring the spectral absorption coefficient (SAC)</li> <li>Nitrate sensors</li> <li>Optical oxygen sensors</li> <li>Ion-sensitive sensors</li> </ul>

# 15.7 Performance characteristics

Maximum measured error <sup>4)</sup>	CA80SI-**AH*:	Concentrations <200 μg/l: ±1.0 μg/l (ppb) or 2 % of reading (typically) Concentrations ≥200 μg/l: 5 % of reading (typically)		
error	CA80SI-**AJ*:	5 % of reading (typically)		
Maximum measured error for sensor inputs	→ Documentation of the connected sensor			
Maximum measured error	Typical measure	d errors:		
for current inputs and outputs	< 20 μA (with cu	rrent values < 4 mA)		
outputs	< 50 μA (with cu	$<$ 50 $\mu$ A (with current values 4 to 20 mA)		
	at 25 °C (77° F) in each case			
	Additional measured error depending on the temperature: $<1.5\;\mu\text{A/K}$			
LOD (limit of detection)	0.5 μg/l			
Repeatability <sup>4)</sup>	CA80SI-**AH*:	$\pm$ 0.5 µg/l (ppb) or $\pm$ 1 % of measured value		
	CA80SI-**AJ*:	± 1 % of reading		
Repeatability of sensor inputs	→ Documentation of the connected sensor			
Measuring interval	<ul> <li>Continuous (approx. 10 min), adjustable ≥ 10 min</li> <li>Factory setting: 20 min</li> </ul>			

<sup>4)</sup> According to ISO 15839 with standard solutions. Measured errors include all the uncertainties of the analyzer. They do not include the uncertainties from the standard solutions used as a reference.

Sample requirement	> 140 ml (4.73 fl oz)/measurement, depending on flow	
Reagent requirement	<ul> <li>200 µl per reagent and measurement <sup>5)</sup> for measuring intervals ≥ 15 minutes</li> <li>Given a measuring interval of 20 min, one set of reagents (1000 ml) lasts for approx. 65 days</li> <li>Given a measuring interval of 12 min, one set of reagents (2500 ml) lasts for approx. 100 days</li> </ul>	
Standard requirement	<ul> <li>Approx. 140 ml (4.73 fl.oz) / calibration</li> <li>With a 2.5 l (84.5 fl.oz) standard bottle and calibration interval of 96 h approx. 65 days</li> <li>With a 5 l (169 fl.oz) standard bottle and calibration interval of 96 h approx. 130 days</li> </ul>	
Calibration interval	1 to 99 days, depending on application and ambient conditions	
Maintenance interval	Every 3 to 6 months, depending on the application	
Maintenance effort	Weekly: visual inspection	
	15.8 Environment	
Ambient temperature range	+5 to +40 °C (41 to 104 °F)	
Storage temperature	−20 to 60 °C (−4 to 140 °F)	
Relative humidity	10 to 95 %, non-condensing	
Degree of protection	IP55 (cabinet, analyzer stand), TYPE 3R (cabinet, analyzer stand)	
Electromagnetic compatibility <sup>6)</sup>	Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry	
Electrical safety	According to EN/IEC 61010-1:2010, Class I equipment Low voltage: overvoltage category II For installations up to 2000 m (6500 ft) above MSL	
Pollution degree	Pollution level 2	
	15.9 Process	
Sample temperature	5 to 45 °C (41 to 113 °F)	

<sup>5)</sup> We recommend the large reagent set  $3 \times 2.5 + 1 \times 5$  for measuring intervals < 15 minutes. We recommend the small reagent set  $3 \times 1 + 1 \times 2.5$  l

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<sup>6)</sup> Sufficient mains quality is required to operate the product as designated.

Process pressure	1 to 5 bar (14.5 to 72.5 psi)
	Recommended:1.5 to 3 bar (21.8 to 43.5 psi)
Sample flow rate	60 to 250 ml/min (2.0 to 8.5 fl.oz/min)
	Recommended:70 ml/min (2.4 fl.oz/min)
Consistency of the sample	Particle-free

# 15.10 Mechanical construction

Dimensions	→ 🖺 15		
 Weight	Order version	Weight	
	Cabinet version	40 kg (88.2 lbs)	
	Open installation	32 kg (70.6 lbs)	
	Analyzer stand	73 kg (161 lbs)	

Materials	Parts not in contact with medium	Parts not in contact with medium	
	Cabinet version, exterior cover	Plastic ASA+PC	
	Open installation, exterior cover		
	Cabinet version, interior lining	Plastic PP	
	Open installation, interior lining	- Plastic PP	
	Window	Shatterproof glass, coated	
	Reagent container	Plastic PP	
	Insulation	Plastic EPP (extruded PP)	
	Base, analyzer stand	Powder-coated sheet steel	

Parts in contact with medium			
Pressure relief valve	<ul><li>EPDM</li><li>POM</li><li>Stainless steel 1.4401</li></ul>		
Flow sensor	■ FKM ■ PP ■ PVDF		
Filter	<ul><li>Stainless steel 1.4408</li><li>PTFE</li></ul>		
Capillary holder	PC, black		
Cuvette	PMMA		
Sample channel switching	<ul><li>Manifold: PVC</li><li>Valves: EPDM, PPS</li></ul>		
Sample pre-heating (heating coil)	Stainless steel 1.4301		

Hoses	<ul> <li>C-Flex</li> <li>Norprene</li> <li>PEEK</li> <li>Polyurethane</li> <li>PTFE</li> <li>PVC</li> </ul>
Plug-in connector (John-Guest plug-in connector)	POM

Process connection

Sample inlet: Sample outlet:

Plug-in connector for rigid hoses with OD 6 mm Plug-in connector for rigid hoses with OD 8 mm

Cuvette outlet:

Hose barb for flexible hoses with ID 13 mm

Hose entries

4 x bores for M32 for sample inflow and outflow

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