BA01585C/07/EN/04.21
71532804
2021-01-31

Valid as of version
01.09.00

Operating Instructions
Liquiline System CA80AL

Colorimetric analyzer for aluminum

Endress+Hauser
People for Process Automation

Table of contents

1 About this document 5
1.1 Warnings 5
1.2 Symbols 5
1.3 Symbols on the device 5
1.4 Documentation 6

2 Basic safety instructions 7
2.1 Requirements for personnel 7
2.2 Designated use 7
2.3 Workplace safety 7
2.4 Operational safety 7
2.5 Product safety 8

3 Product description 9
3.1 Product design 9
3.2 Measuring system 9
3.3 Equipment architecture 12

4 Incoming acceptance and product identification 14
4.1 Incoming acceptance 14
4.2 Product identification 14
4.3 Scope of delivery 15
4.4 Certificates and approvals 15

5 Installation 16
5.1 Installation conditions 16
5.2 Mounting the analyzer 18
5.3 Post-installation check 24

6 Electrical connection 25
6.1 Connection conditions 25
6.2 Connecting the analyzer 25
6.3 Connecting sample preparation 30
6.4 Connecting the sensors and additional modules 32
6.5 Hardware settings 38
6.6 Ensuring the degree of protection 39
6.7 Post-connection check 40

7 System integration 41
7.1 Overview of device description files 41
7.2 Integrating the measuring device into the system 41

8 Operation options 45
8.1 Structure and function of the operating menu 45
8.2 Access to the operating menu via the local display 45

9 Commissioning 48
9.1 Preparatory steps 48
9.2 Function check 50
9.3 Switching on the measuring device 51
9.4 Setting the operating language 51
9.5 Configuring the measuring device 51

10 Operation 53
10.1 Display 53
10.2 General settings 54
10.3 Analyzer 67
10.4 Sample preparation 74
10.5 Current inputs 78
10.6 Binary inputs and outputs 79
10.7 Signal outputs 88
10.8 Additional functions 97

11 Diagnostics and troubleshooting . . 122
11.1 General troubleshooting 122
11.2 Diagnostic information on local display 123
11.3 Diagnostic information via web browser 123
11.4 Diagnostic information via fieldbus 123
11.5 Adapting the diagnostic information 124
11.6 Overview of diagnostic information 126
11.7 Pending diagnostic messages 132
11.8 Diagnostic list 133
11.9 Logbooks 133
11.10 System information 138
11.11 Sensor information 140
11.12 Simulation 140
11.13 Device test 142
11.14 Resetting 144
11.15 Operating time information 144
11.16 Firmware history 144

12 Maintenance 146
12.1 Maintenance schedule 146
12.2 Maintenance tasks 147
12.3 Taking out of service 154

13 Repair 156
13.1 General information 156
13.2 Spare parts 156
13.3 Return 156
13.4 Disposal 156

14 Accessories 158
14.1 Device-specific accessories 158
14.2 Communication-specific accessories 163
14.3 System components 164

15 Technical data 166
15.1 Input 166
15.2 Output 166
15.3 Current outputs, active 168
15.4 Relay outputs 168
15.5 Protocol-specific data 169
15.6 Power supply 172
15.7 Performance characteristics 173
15.8 Environment 174
15.9 Process 175
15.10 Mechanical construction 175

Index 177

1 About this document

1.1 Warnings

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

- Reference to device documentation
- Caution: Hazardous voltage
- Warning: Risk of injury from rotating cogwheels
- 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 SystemCA80AL, KA01236C
- 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
- Special documentation on reagents:
  CY80AL, SD01846C

2 Basic safety instructions

2.1 Requirements for 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 Designated use

The Liquiline System CA80AL is a wet-chemical analyzer for the almost continuous determination of the concentration of aluminum in liquid media.

The analyzer is designed for use in the following applications:
- Control of the precipitation of phosphates in wastewater treatment plants
- Monitoring of precipitants in drinking water and wastewater treatment plants

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 guidelines
- 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:

1. If faults cannot be rectified:
   products must be taken out of service and protected against unintentional operation.
2. Keep the door closed when not carrying out service and maintenance work.

⚠ 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.

⚠ 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.

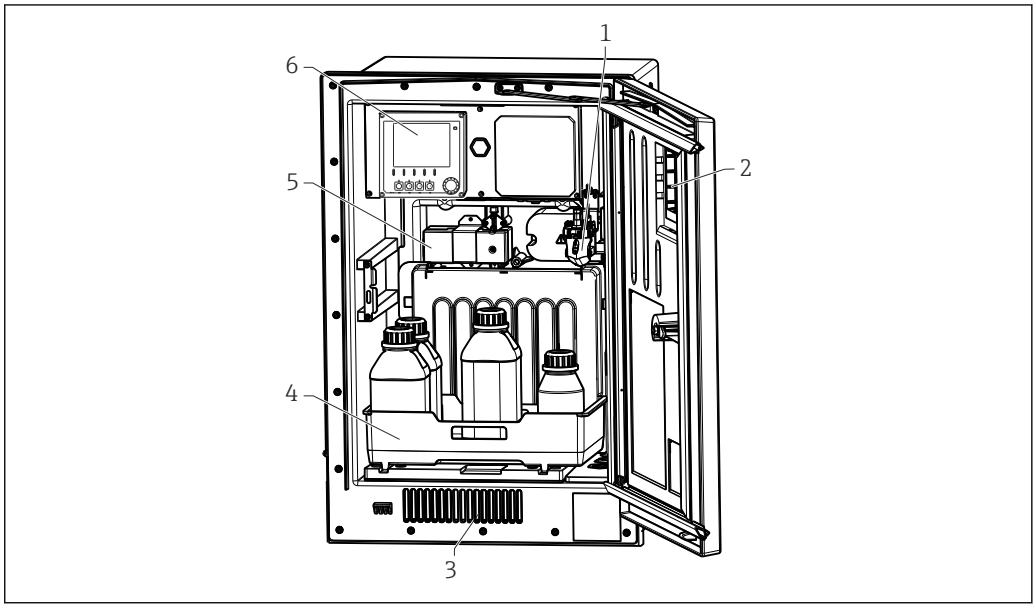
2.5.2 IT security

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.

3 Product description

3.1 Product design



1 *Example of a Liquiline System CA80*

1 *Sample collecting vessel (optional)*
2 *Window*
3 *Air vent for cooling*
4 *Bottle tray for cleaner and standard*
5 *Photometer*
6 *Controller*

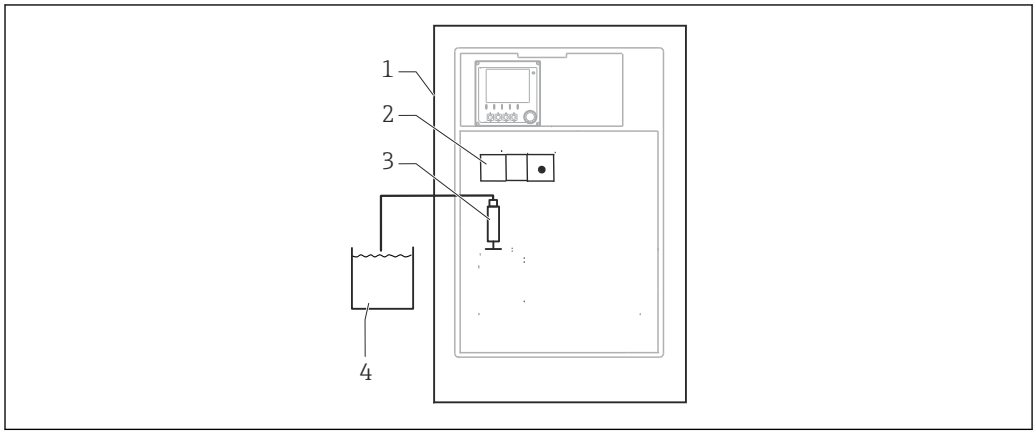
3.2 Measuring system

A complete measuring system comprises:
- Analyzer Liquiline System CA80AL with the configuration ordered
- reagents and standard solution (to be ordered separately)
- Sample conditioning Liquiline System CAT8x0 (optional)

Microfiltration (Liquiline System CAT810)
- Function: pressure pipe sampling and filtration
- Sieve filter, 50 µm
- Control via CA80
  Optional: time control via integrated timer
- Backflushing, with compressed air or water
- Panel version or integration into analyzer stand
- Application: drinking water, industrial wastewater

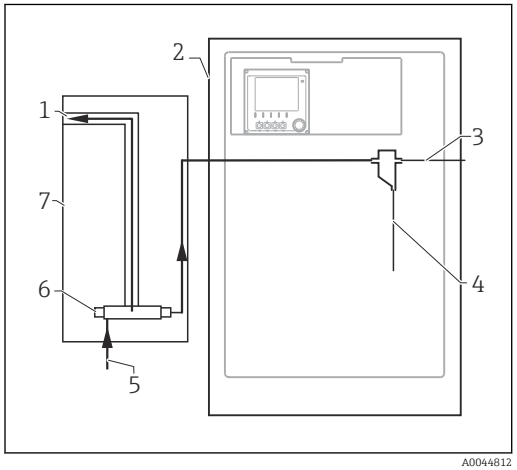
Membrane filtration (Liquiline System CAT820), ceramic filter version
- Function: sampling and filtration
- Ceramic membrane filter candle; pore size 0.1 µm or 0.4 µm
- Communication via Memosens protocol, control via CA80
- Backflushing with compressed air (version with Memosens technology)
- Easy installation with Flexdip CYH112 (TI00430C)
- Application: aeration, drinking water, industrial wastewater, surface water

Membrane filtration (Liquiline System CAT860)
- Function: sampling and filtration
- Ceramic membrane filter candle; pore size 0.1 µm or 0.4 µm
- Communication via Memosens protocol, control via CA80
- Automatic backflush function with cleaning solution and compressed air
- Easy installation via Flexdip CYH112 (TI00430C)
- Application: wastewater treatment plant inlet



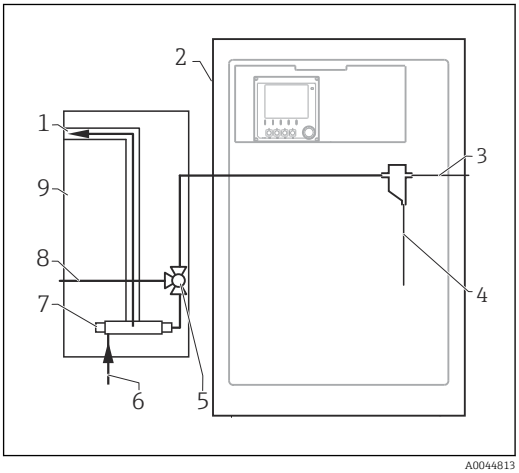
2 Measuring system with Liquiline System, self-priming

1 Liquiline System CA80AL
2 Photometer
3 Dosing dispenser
4 Particle-free sample



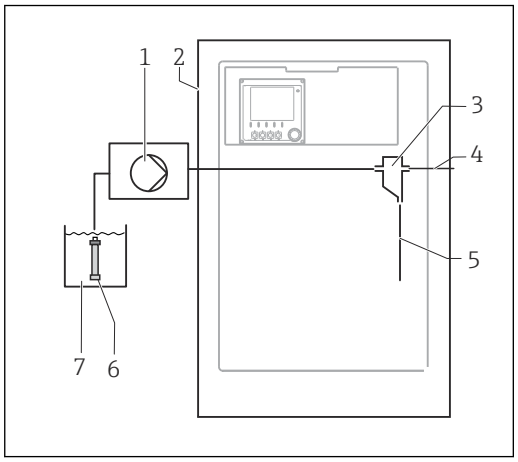
3 Measuring system with Liquiline System CAT810

1 Overflow
2 Liquiline System CA80
3 Sample collecting vessel overflow
4 Sample
5 Pressurized sample
6 Filter unit
7 Liquiline System CAT810



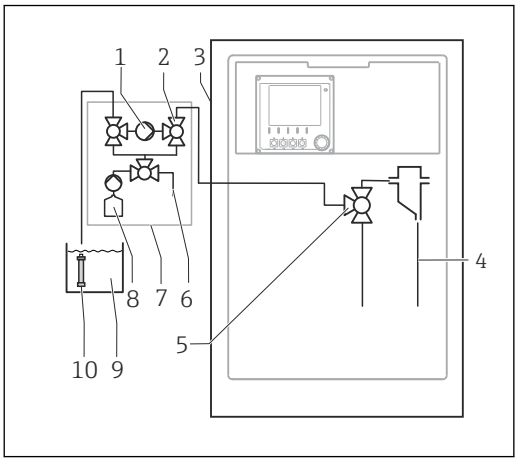
4 Measuring system with Liquiline System CAT810 and cleaning valve

1 Overflow
2 Liquiline System CA80
3 Sample collecting vessel overflow
4 Sample
5 Cleaning valve
6 Pressurized sample
7 Filter unit
8 Purge connection (compressed air or water)
9 Liquiline System CAT810



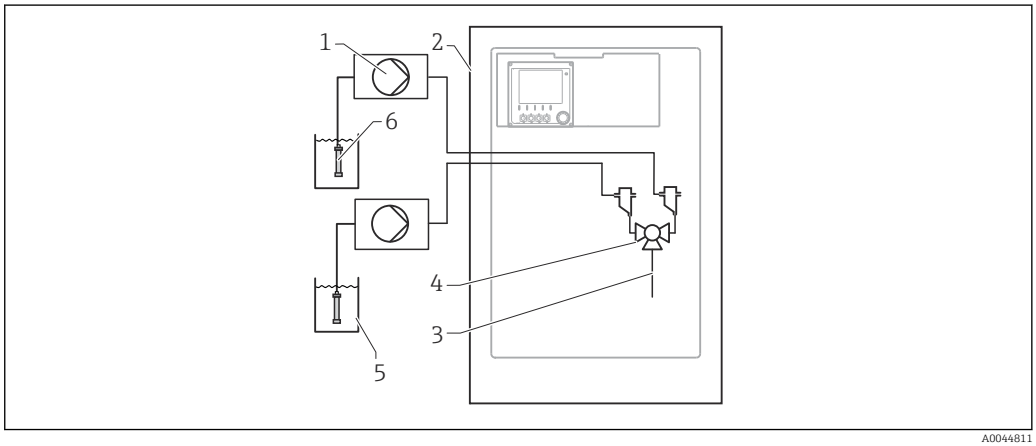
5 *Measuring system with Liquiline System CAT820*

1 *Pump*
2 *Liquiline System CA80*
3 *Sample collecting vessel*
4 *Sample collecting vessel overflow*
5 *Sample*
6 *Filter (ceramic)*
7 *Medium*



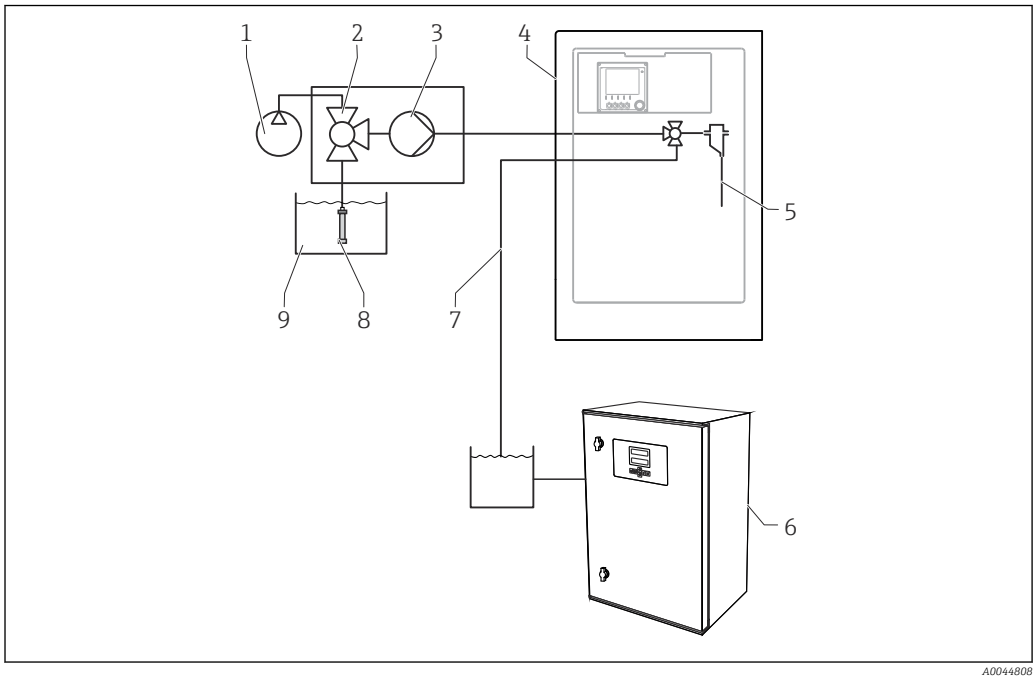
6 *Measuring system with Liquiline System CAT860*

1 *Pump*
2 *Valve*
3 *Liquiline System CA80*
4 *Sample*
5 *Valve*
6 *Compressed air*
7 *Liquiline System CAT860*
8 *Cleaning solution*
9 *Medium*
10 *Filter (ceramic)*



7 *Measuring system with 2x Liquiline System CAT820*

1 *Pump*
2 *Liquiline System CA80*
3 *Sample*
4 *Valve*
5 *Medium*
6 *Filter (ceramic)*



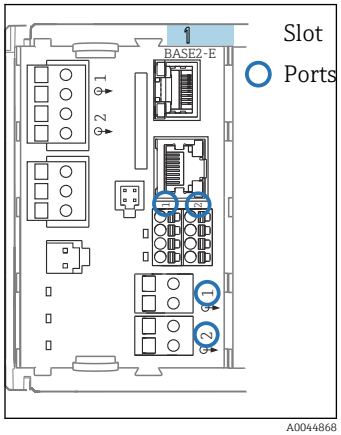
A0044808

8 *Measuring system with Liquiline System CA80, Liquiline System CAT820 and second analyzer*

1	*Backflushing with compressed air (optional)*	6	*Second analyzer*
2	*Valve (optional)*	7	*Sample to second analyzer*
3	*Pump*	8	*Filter (ceramic)*
4	*Liquiline System CA80*	9	*Medium*
5	*Sample*		

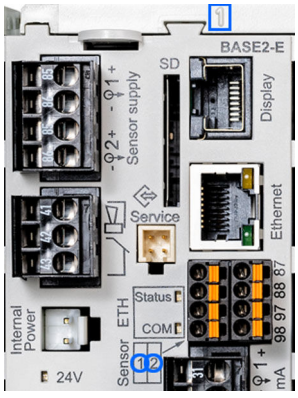
3.3 Equipment architecture

3.3.1 Slot and port assignment



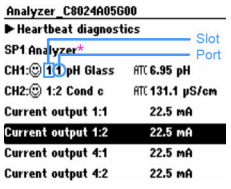
A0044868

9 *Slot and port assignment*



A0044869

10 *Slot and port assignment*



A0040671

11 *Slots and ports on the display*

* *Analyzer measured value (parameter-specific)*

- 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

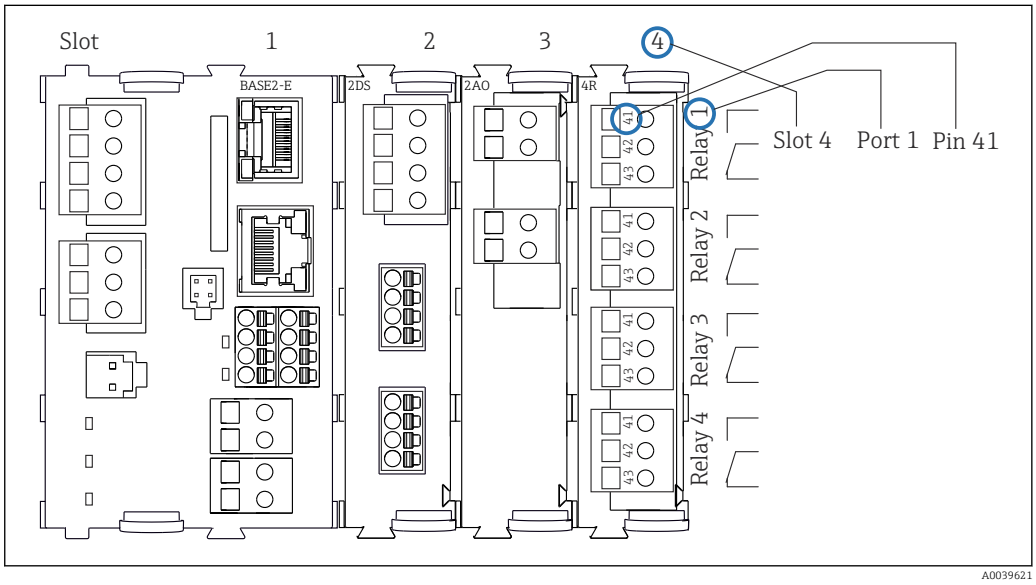
The unique terminal name is derived from:

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)



12 *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/ca80al

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. Call up the site search (magnifying glass).
3. Enter a valid serial number.
4. Search.
   ↳ The product structure is displayed in a popup window.
5. Click on the product image in the popup window.
   ↳ A new window (**Device Viewer**) opens. All of the information relating to your device is displayed in this window as well as the product documentation.

4.2.3 Manufacturer address

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

4.3 Scope of delivery

The scope of delivery comprises:
- 1 analyzer in the version ordered with optional hardware
- 1 x Brief Operating Instructions (hard copy)
- 1 x Maintenance Manual
- Optional accessories

▶ If you have any queries:
Please contact your supplier or local sales center.

4.4 Certificates and approvals

4.4.1 CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

4.4.2 Other standards and guidelines

cCSAus

The product meets the requirements as per "CLASS 2252 06 - Process Control Equipment" and "CLASS 2252 86 - Process Control Equipment". It is tested to Canada and USA standards: CAN/CSA-C22.2 No. 61010-1-12 UL Std. No. 61010-1 (3rd Edition).

EAC

The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

5 Installation

⚠ CAUTION

Incorrect transportation can cause injury and damage the device

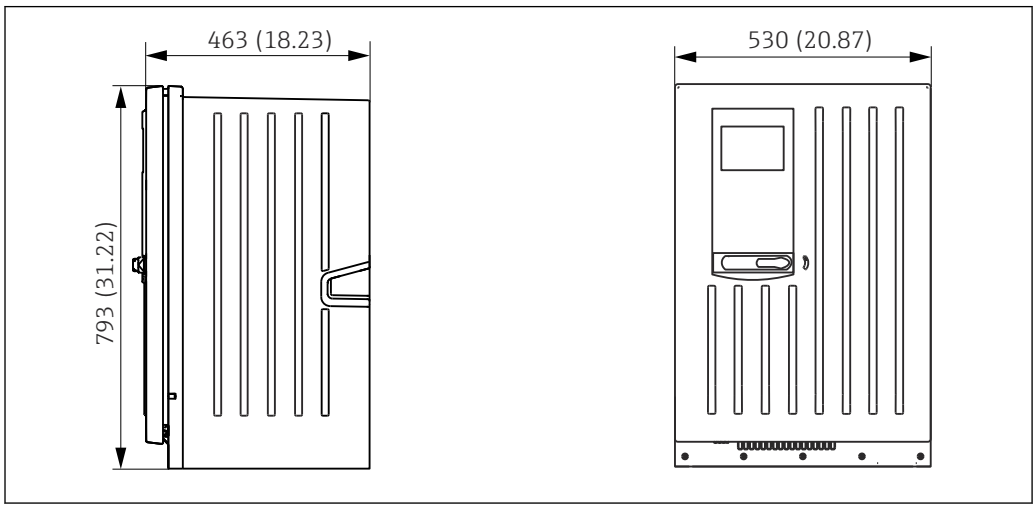
- ▶ Always use a lifting truck or a fork-lift to transport the analyzer. Two people are needed for the installation.
- ▶ Lift the device by the recessed grips.

5.1 Installation conditions

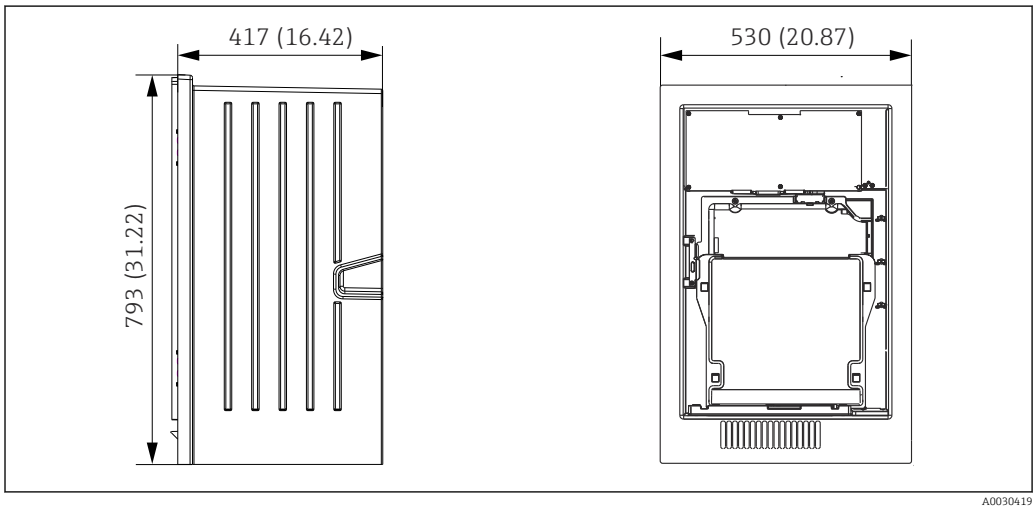
The device can be installed in the following ways:

- Mounted on a wall
- Mounted on a base
- Post mounting / on a post (accessory)

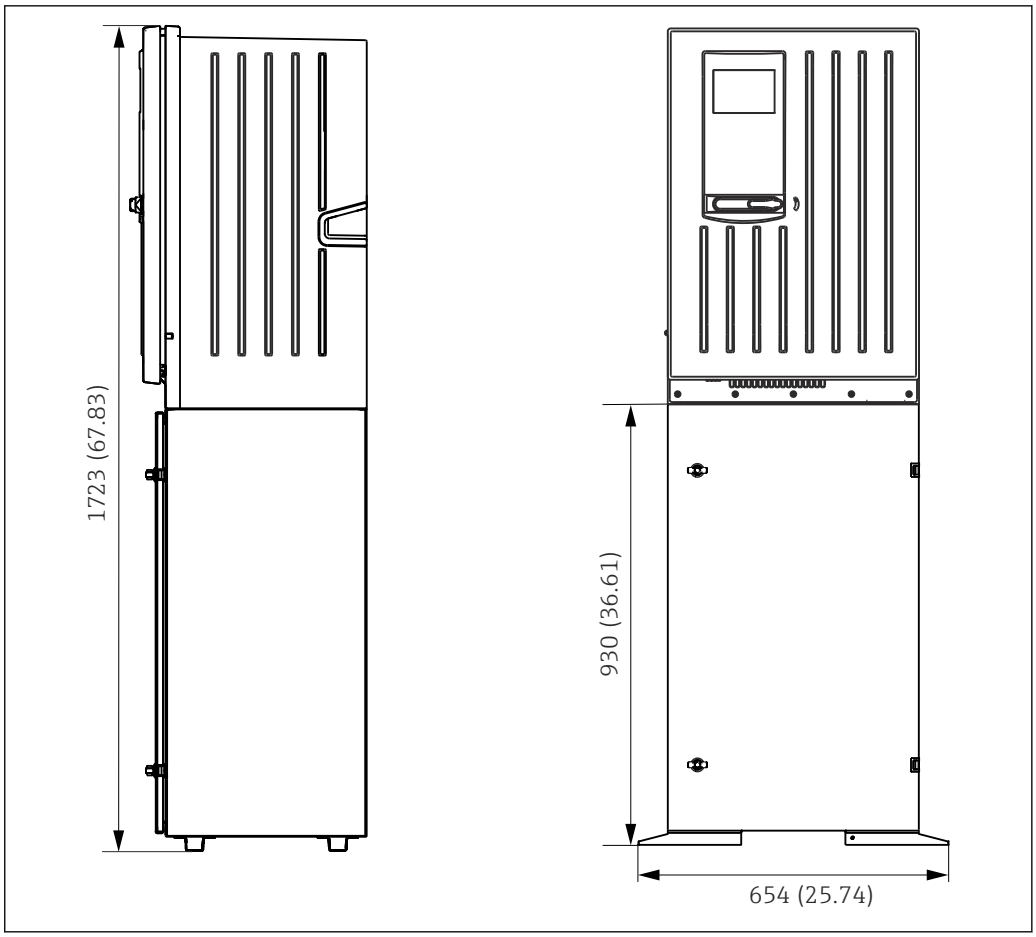
5.1.1 Dimensions



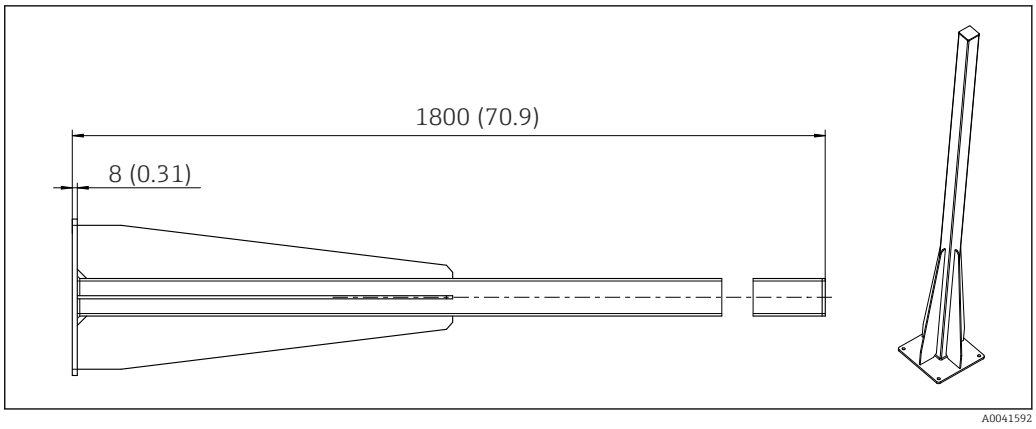
13 *Liquiline System CA80 closed version, dimensions in mm (in)*



14 *Liquiline System CA80 open version, dimensions in mm (in)*



15 *Liquiline System CA80 with base, dimensions in mm (in)*



16 *Post (accessory) for "Outdoor" version, dimensions in mm (inch)*

5.1.2 Mounting location

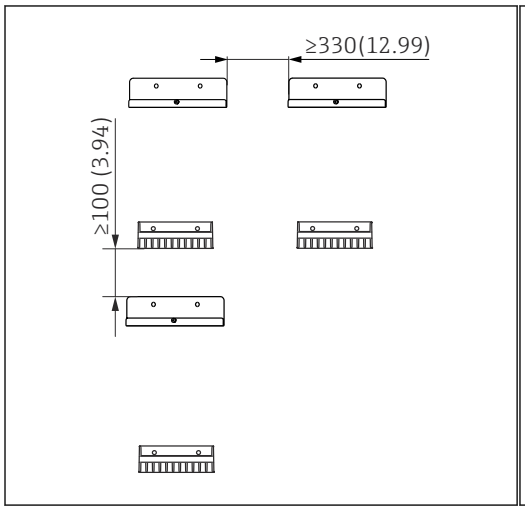
Note the following when erecting the device:

- 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_2S) .
- Make sure to pay attention to the maximum height difference and the maximum distance from the sampling point.

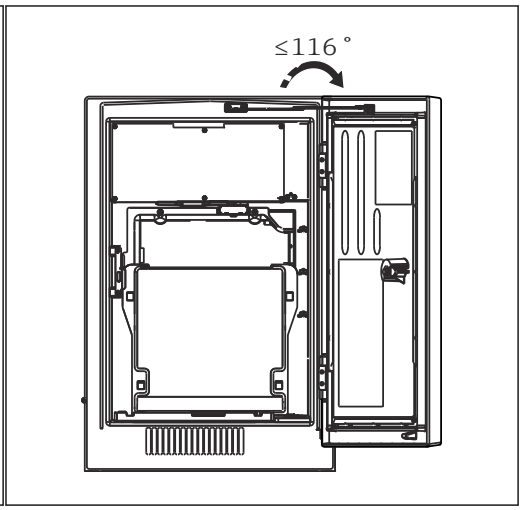
- Ensure that the unit can drain freely, without any siphoning effects.
- Make sure air can circulate freely at the front of the housing.
- Open analyzers (i.e. analyzers that are supplied without a door) may only be erected in closed areas or in a protective cabinet or similar facility.

5.1.3 Spacing requirements when mounting

Spacing required for installing analyzer

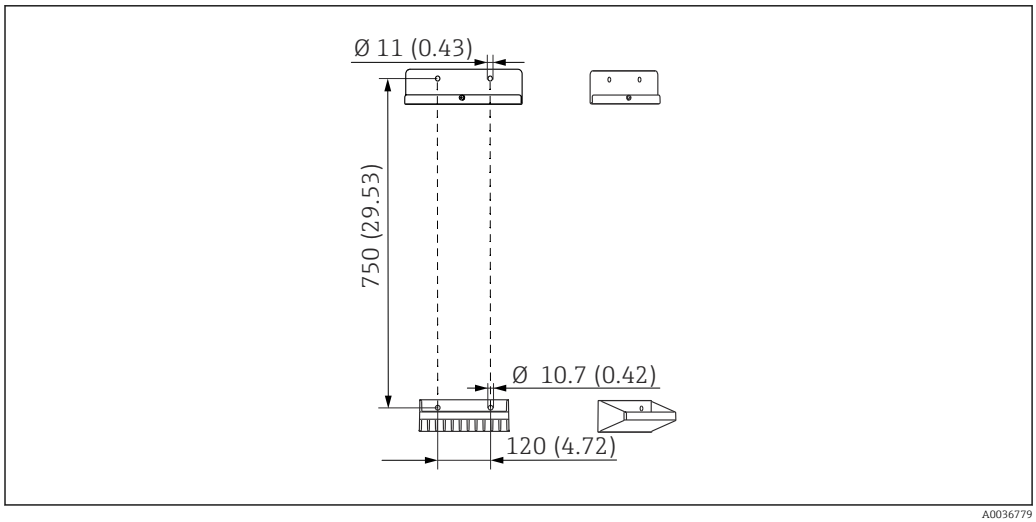


17 *Minimum spacing required for mounting. Engineering unit mm (in).*



18 *Maximum opening angle*

Spacing required for installing wall-mount version



19 *Holder unit dimensions. Engineering unit mm (in)*

5.2 Mounting the analyzer

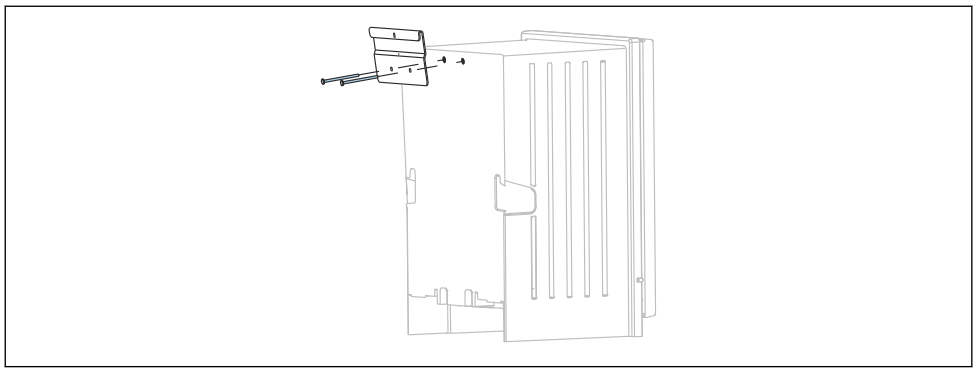
5.2.1 Mounting the analyzer on a wall

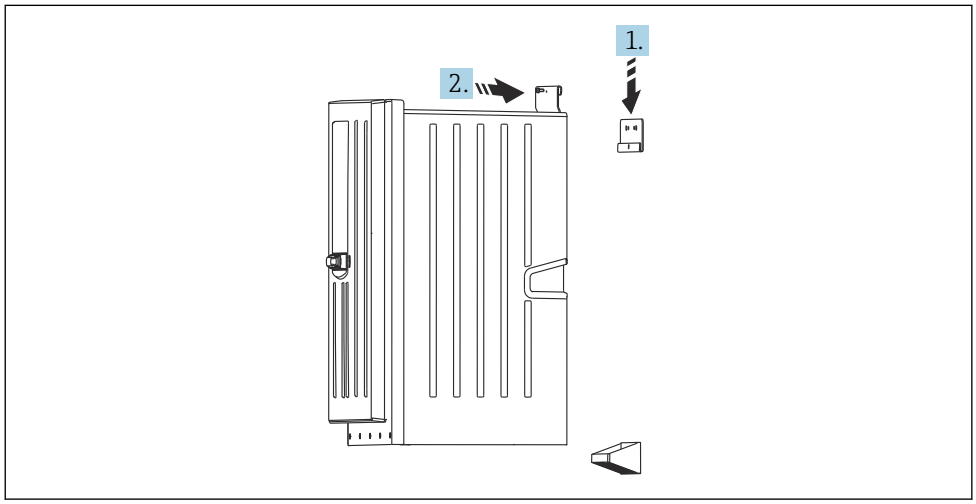
⚠ CAUTION

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.
3. 

   Secure the mount on the housing.
4. 

A0036781

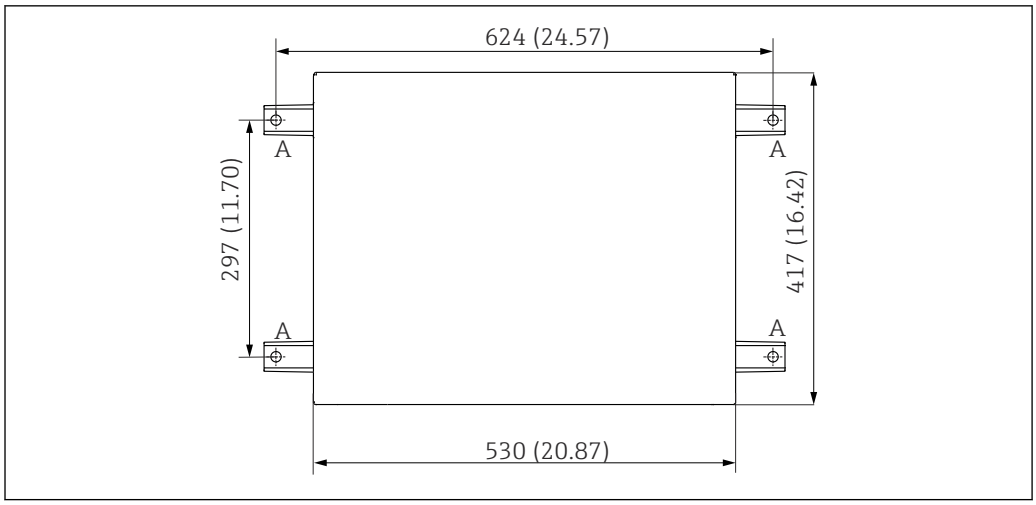
   Hook the analyzer into the wall holder unit (1).
5. Fix the mount and wall holder unit in place with the screw supplied (2).

5.2.2 Installing version with analyzer stand

⚠ CAUTION

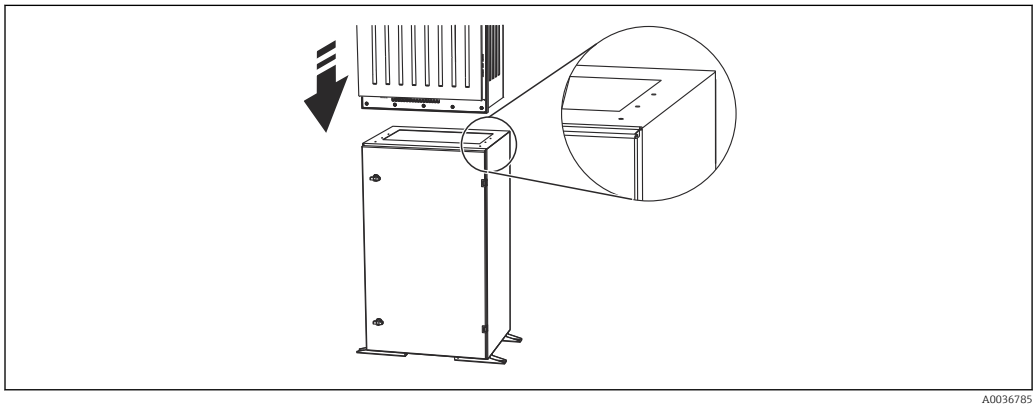
Incorrect installation can cause injury and damage the device

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



20 *Foundation plan*

A Fasteners (4 x M10)
--- Dimensions of Liquiline System CA80

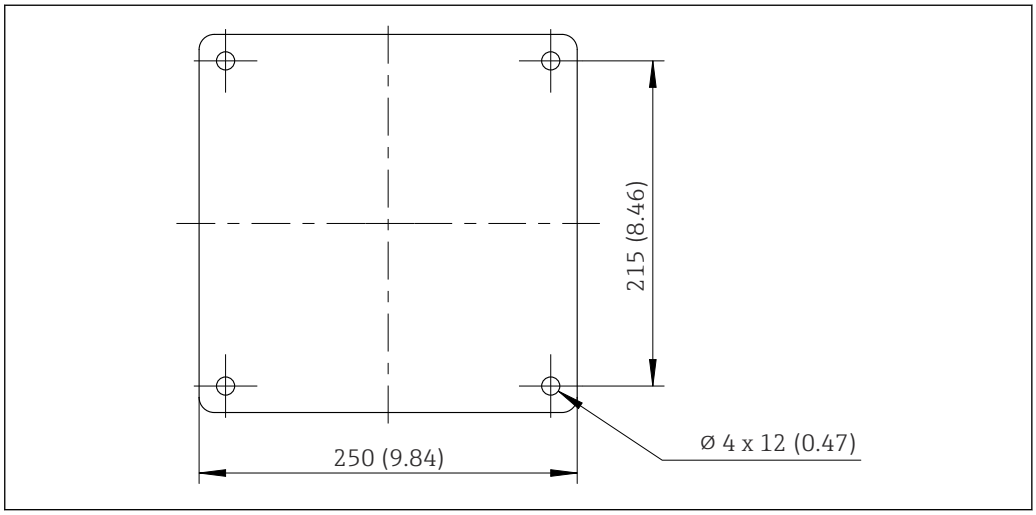


21 *Securing the base*

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.

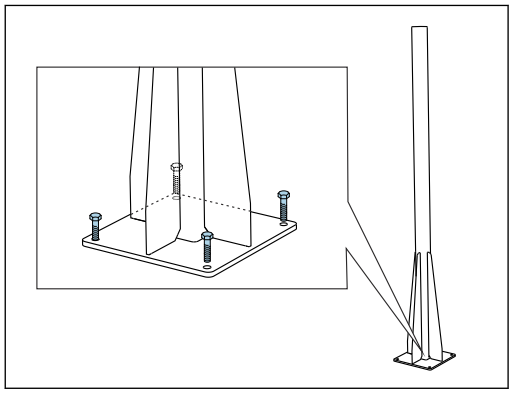
5.2.3 "Outdoor" version: mounting on a post

Erecting the post



22 *Foundation plan, dimensions in mm (in)*

When installing outdoors, consideration must be given to providing correct protection against lightning.

1. Prepare the foundation at the place of installation.
2. 

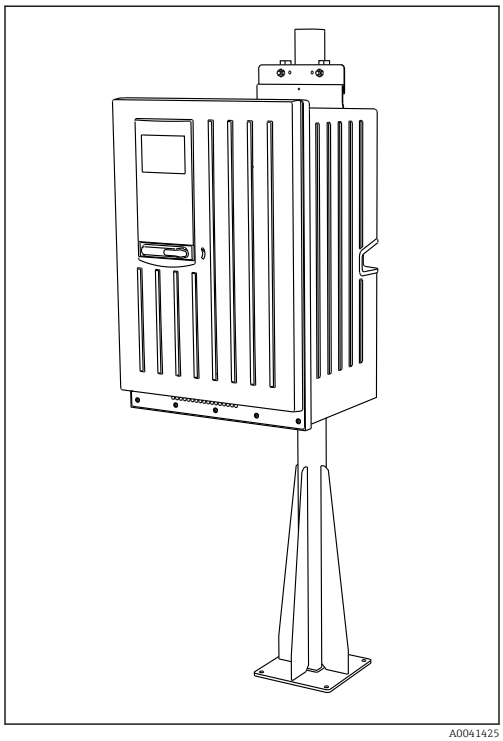
   Erect the post and mount it securely on the foundation using 4 fixing screws (*to be provided by the customer* [1]).

Tool required for post mounting

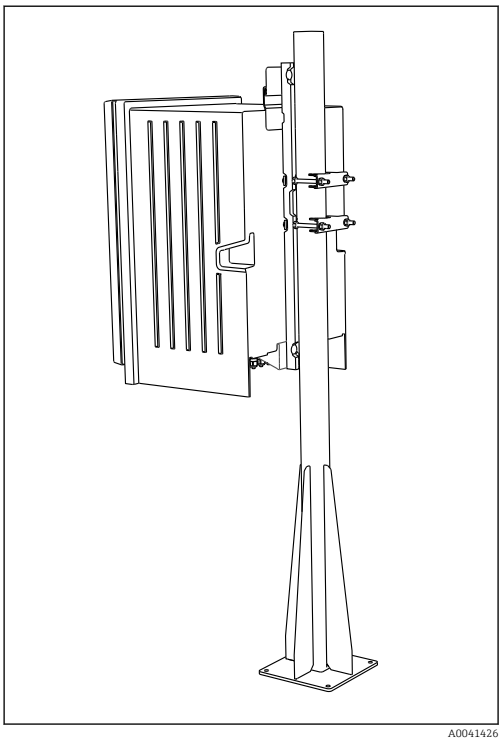
The following tools, which must be provided by the customer at the point of installation, are required to mount the analyzer on the post:
- Open-end wrench, 17mm AF (for post retainer)
- Torx screwdriver TX45 (for analyzer wall holder unit, Torx M8x20 screws)
- Torx screwdriver TX25 (for securing the wall holder unit on the post holder, Torx M5x12 screw)

1) We recommend: hexagonal-headed bolt with a shaft, DIN 931: M10x100 with A2 quality + washer + suitable plug

Mounting analyzer on the post

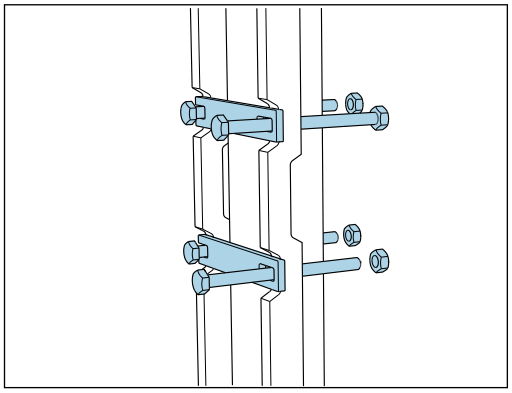


23 *Analyzer mounted on post (from front)*



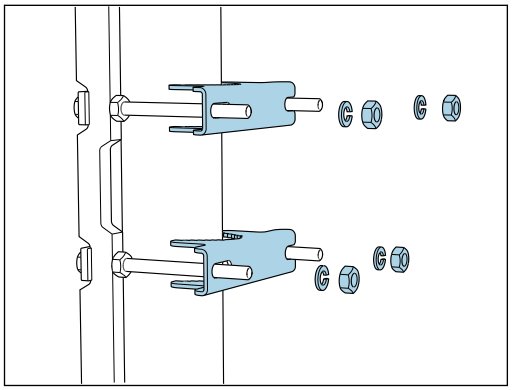
24 *Analyzer mounted on post (from behind)*

1.



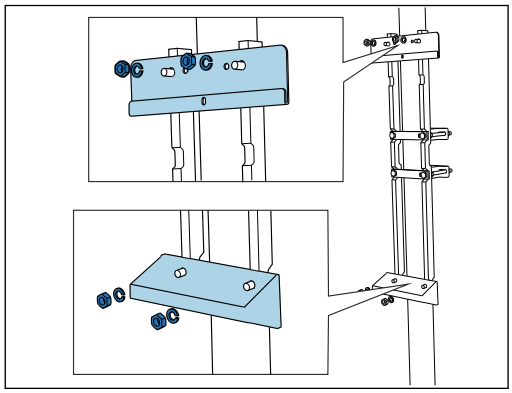
Fit the clamp of the post retainer on the retaining rods and post using the nuts.

2.



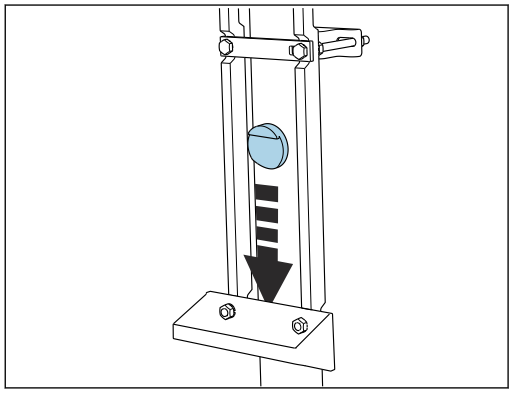
Fit the counterparts and fasten the post retainer using spring washers and nuts.

3.



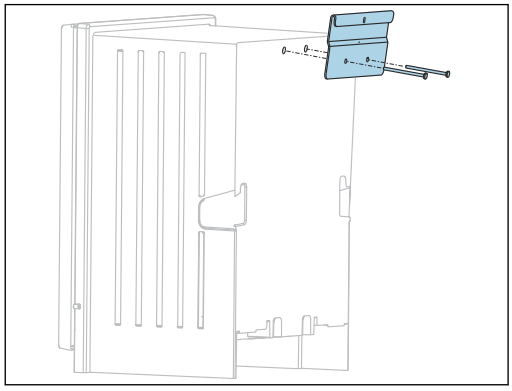
Mount the wall holder unit (included in the delivery with the analyzer) on the post retainer.

4.



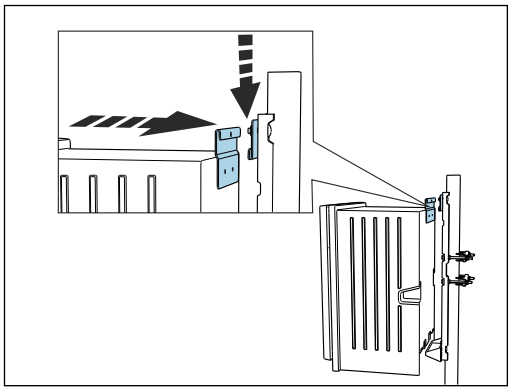
Insert the spacer.

5.



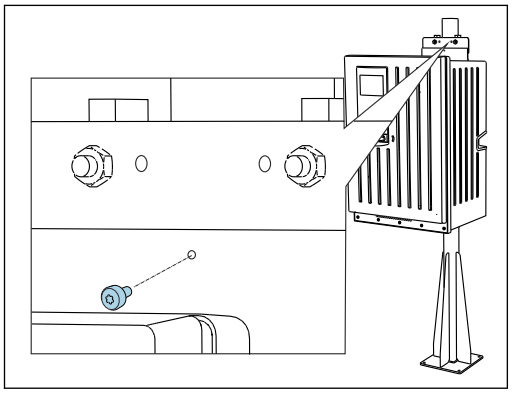
Screw the suspension bracket of the wall holder unit (included in the delivery with the analyzer) onto the analyzer.

6.



Hook in the analyzer.

7.



Fix the upper wall holder unit in place with the screw provided.

5.3 Post-installation 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 Connection conditions

6.1.1 Cable types

Power supply cable A power supply cable is not supplied for the "Outdoor" version!	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 ±10% of the values indicated on the nameplate.
Analog, signal and transmission lines	e.g. LiYY 10 x 0.34 mm^2

6.1.2 "Outdoor" version

NOTICE

Harmonic waves at the feed-in point of the device supply voltage

Higher radiation values

- Avoid harmonic waves at the feed-in point of the device or limit them by connecting a mains filter upstream, for example.

6.2 Connecting the analyzer

NOTICE

The device does not have a power switch

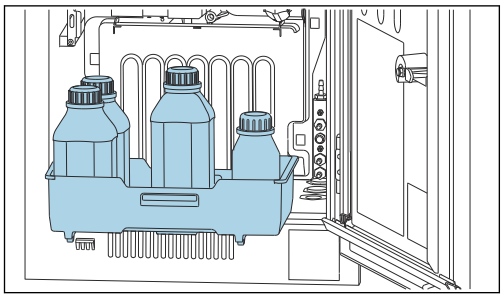
- You must install the device near (distance < 3 m (10 ft)) an easily accessible and fused plug socket so that it can be disconnected from the power supply.
- Comply with the instructions for protective grounding when installing the analyzer.

6.2.1 Routing the cable in the connection compartment

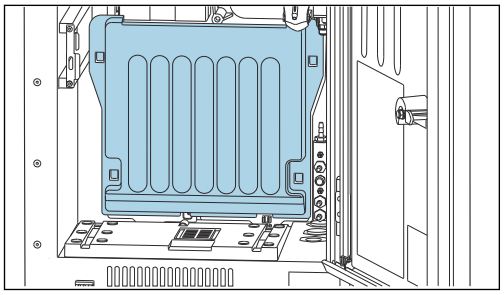
The analyzer is supplied with a pre-installed power cable. (Not in the case of the "Outdoor" version)

- 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

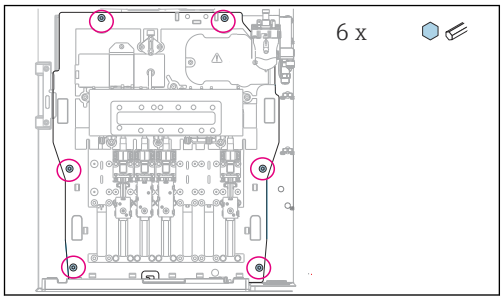
1. 

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

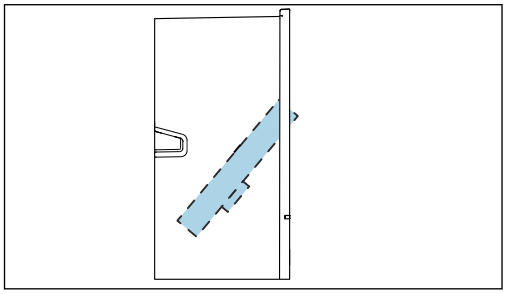
2. 

Remove the cover that is hooked into place.

3. Remove all liquid-bearing suction lines from the Liquid Manager.

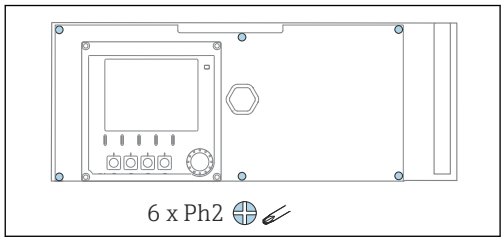
4. 

Release the 6 screws of the carrier board using an Allen key.

5. 

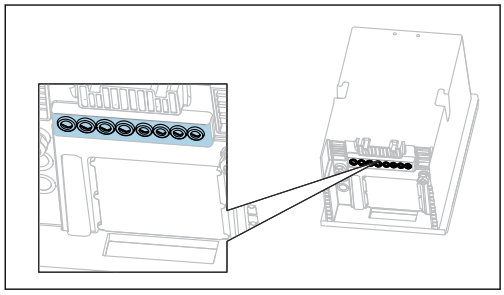
Fold out the carrier board towards the front .

6. For convenience of handling, hook the carrier board onto the locking plate.

7. 

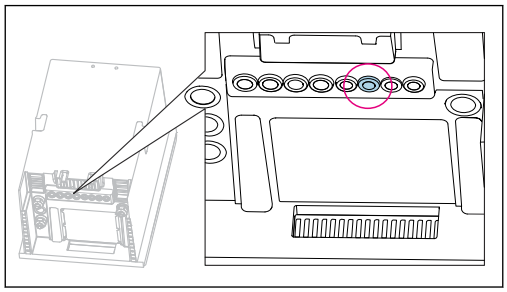
Release the 6 screws on the electronics compartment cover using a Phillips-head screwdriver and fold out the cover towards the front.

8. **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.

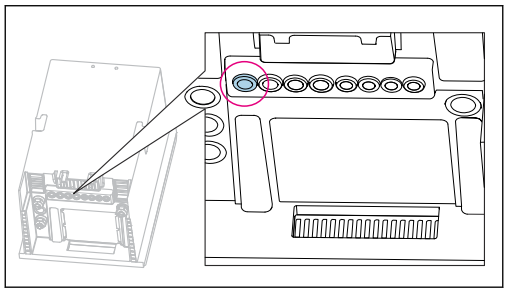
9. 

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

Only for the "Outdoor" version

10. 

Guide the cable of the heated waste hose through the cable gland indicated.

11. 

Guide the power supply cable, which is provided by the customer at the installation location, through the cable gland indicated.

For all versions

12. Route the cables on the rear panel of the device so that they are properly protected. Use cable clips.
13. Guide the cable to the electronics compartment.

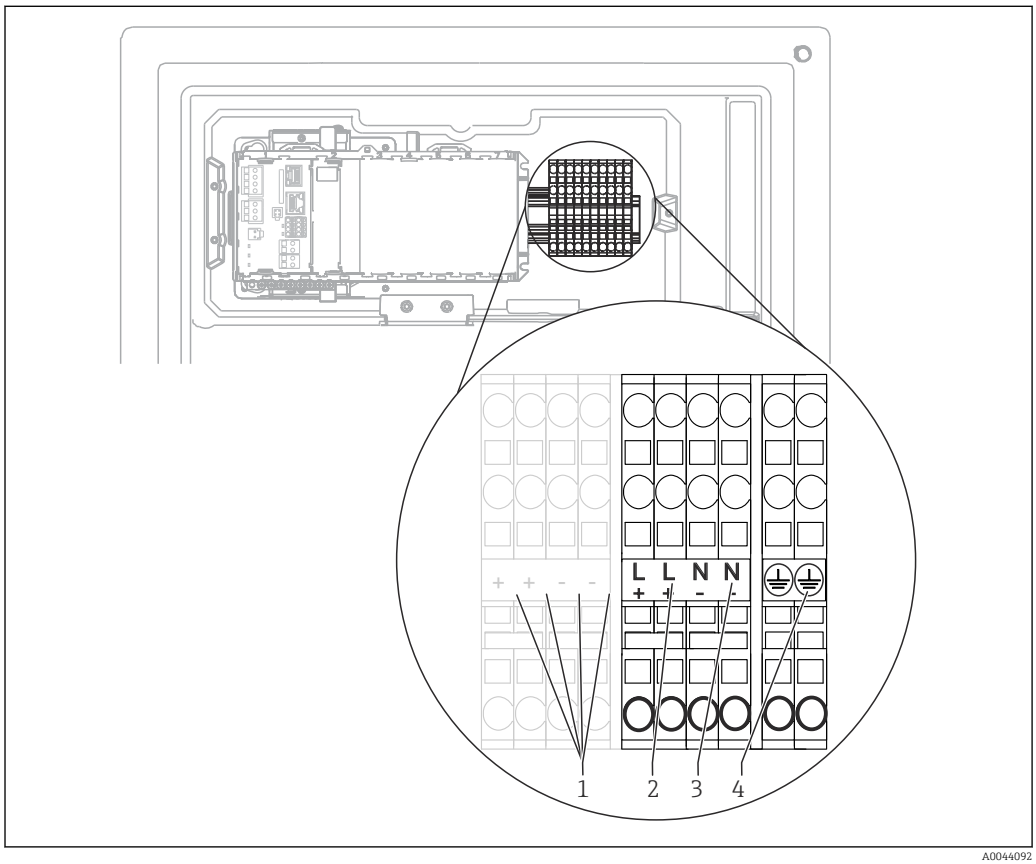
After connecting:

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.

6.2.2 24 V version: connecting the power supply

- In the case of devices with a 24 V power supply, the connection cross-section must be at least 2.5 mm^2 and may not exceed 4 mm^2.
- With 24V power supply, a current of up to 10A can flow. For this reason pay attention to the voltage drop on the supply line.
- The voltage at the device terminals must be within the specified range → 172.

1. To access the electronics compartment, proceed as described in the "Routing the cables" section (→ 25).
2. Guide the 24V 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. Connect the power supply.



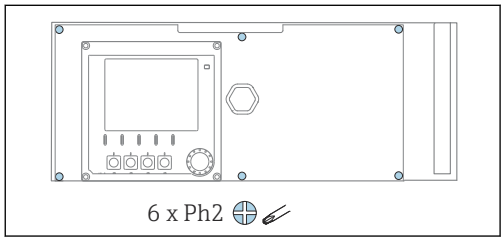
25 Terminal assignment

1 Internal 24 V voltage
2 Power supply +24 V
3 Power supply -24 V
4 Assignment: functional ground

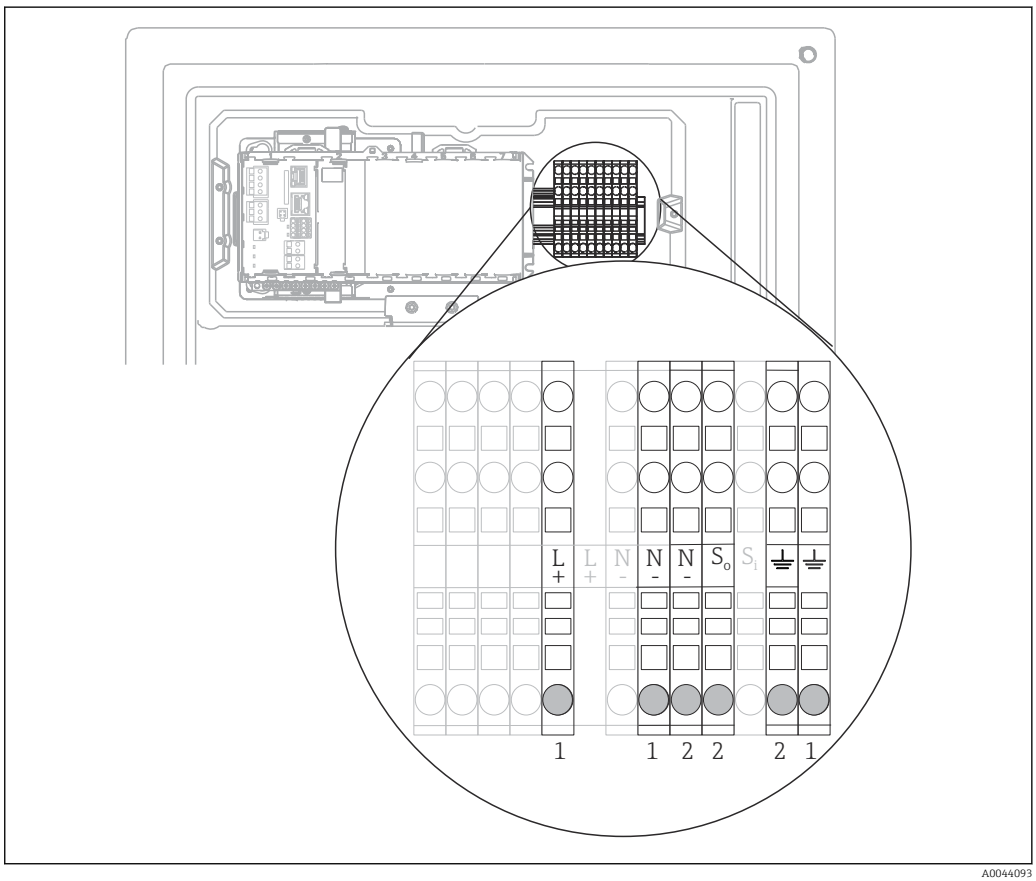
The labeling on the terminal block is selected in such a way that it applies both for 24 V versions (+ and -) and for the other device versions (L and N).

6.2.3 "Outdoor" version: connecting the power supply and hose heater

The power supply cable is not included with the delivery and must be provided by the customer.

1. Guide the power supply cable and the cable of the hose heater from below through the cable gland on the inner rear panel of the device and feed them up into the electronics compartment (→ 27).
2. 

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



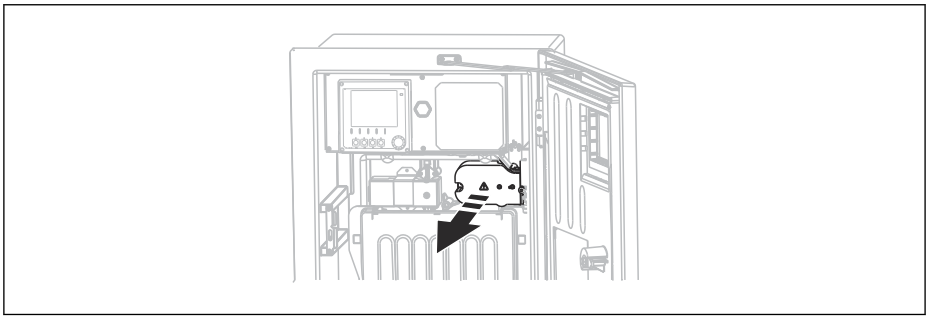
26 *Terminal assignment for the "Outdoor" version*

1 *Terminals for power supply*
2 *Terminals for hose heater*

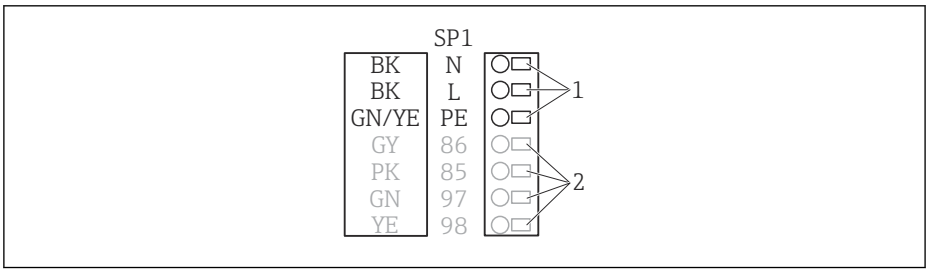
6.3 Connecting sample preparation

6.3.1 Connecting the optional cleaning valve of Liquiline System CAT810

1. Disconnect the mains plug.
2. To fold out the carrier board towards the front, proceed as described in the "Routing the cables" section .
3. Guide the cable through the cable gland.
4. **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.
5. Comply with the instructions for protective grounding when installing the analyzer.
6. Remove the protective cover in the upper right-hand corner.



7. Connect the cleaning valve to the following plug-in terminals:



27 *Connection scheme for Liquiline System CAT810*

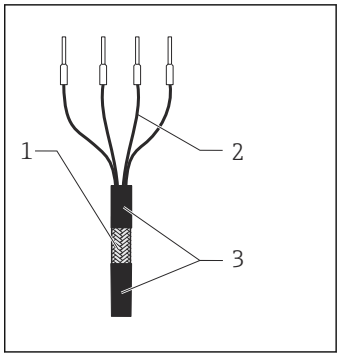
1 Liquiline System CAT810, 100 to 120 V/200 to 240 V AC
2 Are not used

8. Secure the protective cover after connecting. Make sure that no cables or hoses are jammed.
9. Use the 6 screws to secure the carrier board after connecting.

6.3.2 Connecting the optional hose heater and communication between the CAT820/CAT860 and the analyzer

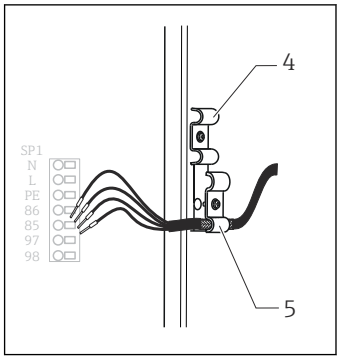
Only use terminated original cables where possible. The sensor cable, fieldbus cable and Ethernet cable must be shielded cables.

Cable sample (does not necessarily correspond to the original cable supplied)



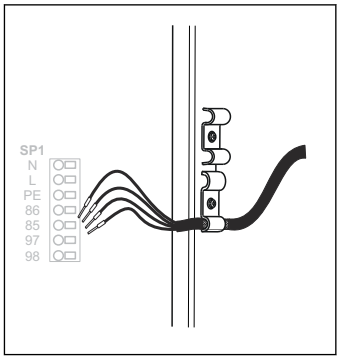
28 Terminated cable

1 Outer shield (exposed)
2 Cable cores with ferrules
3 Cable sheath (insulation)



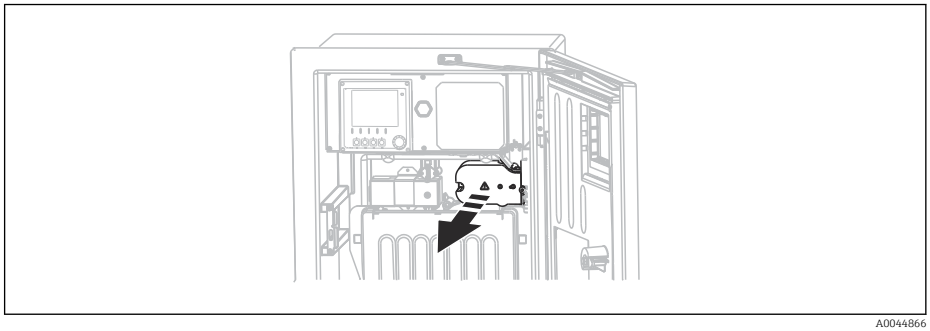
29 Inserting the cable

4 Cable clamp for hose heating
5 Shielding clamp for Memosens supply and power supply



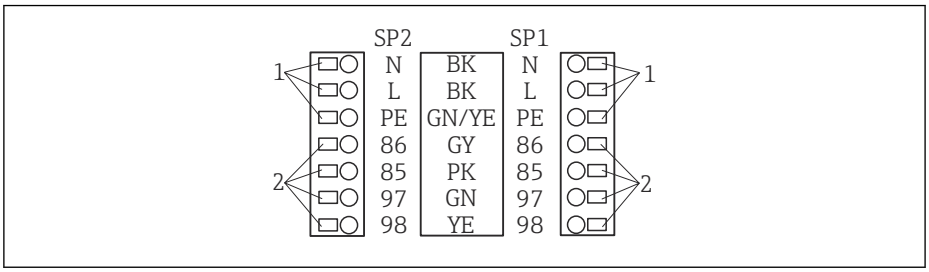
30 Tightening the screw (2 Nm)

1. Disconnect the mains plug.
2. To fold out the carrier board towards the front, proceed as described in the "Routing the cables" section .
3. Release a suitable hose gland on the right-hand underside of the analyzer and remove the dummy plug from the gland.
4. Guide the spiral hose through the hose gland.
5. **Order versions with G and NPT cable glands:** replace the pre-mounted M-thread cable glands with the G or NPT glands enclosed. This does not affect the M32 hose glands.
6. Comply with the instructions for protective grounding when installing the analyzer.
7. Remove the protective cover in the upper right-hand corner.



8. Route the cable in the housing in such a way that the **exposed** cable shield fits into one of the cable clamps and the cable cores can be easily routed as far as the plug-in terminals.
9. Open the cable clamp and clamp the cable in place. Then tighten the screw of the cable clamp.

10. Connect the cable or cables (depending on the version) to the following plug-in terminals:



31 Connection scheme for Liquiline System CAT820 / 860

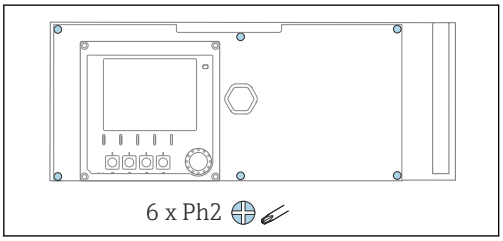
1 Hose heater 100 to 120 V/200 to 240 V AC (optional)
2 Connections for Memosens and communication with analyzer (optional)
SP1 Sample inlet
SP2 2nd sample inlet (optional)

11. Secure the protective cover after connecting. Make sure that no cables or hoses are jammed.
12. Use the 6 screws to secure the carrier board after connecting.

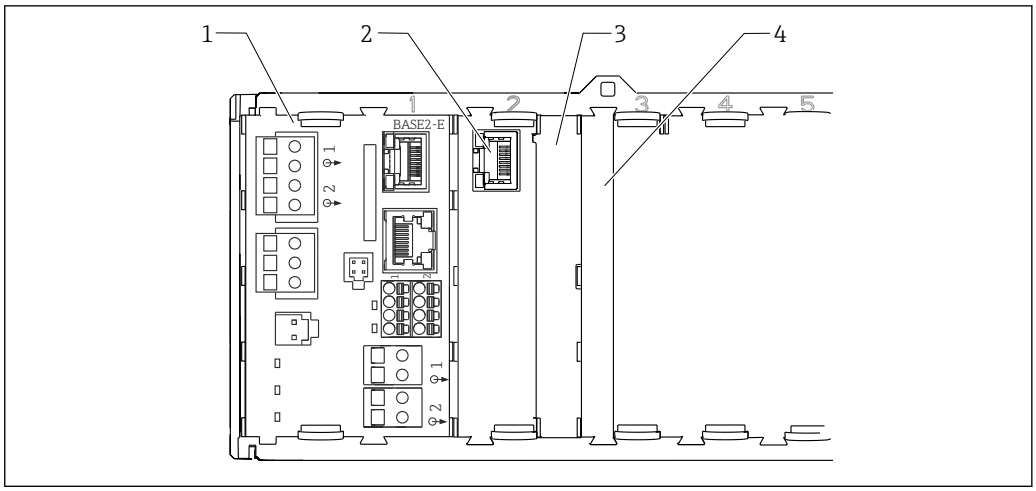
6.4 Connecting the sensors and additional modules

6.4.1 Overview of connection compartment in the controller housing

The controller has a separate connection compartment.



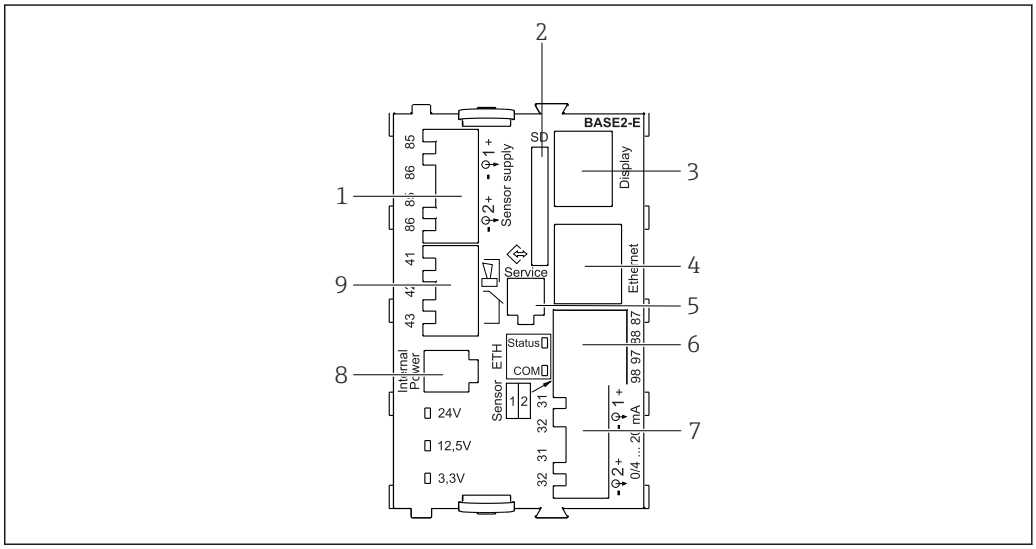
Release the 6 screws on the electronics compartment cover using a Phillips-head screwdriver and fold out the cover towards the front.



32 *Connection compartment in the controller housing*

1 *Base module Base2-E*
2 *Analyzer interface*
3 *Dummy cover*
4 *Module cover*

Base module E



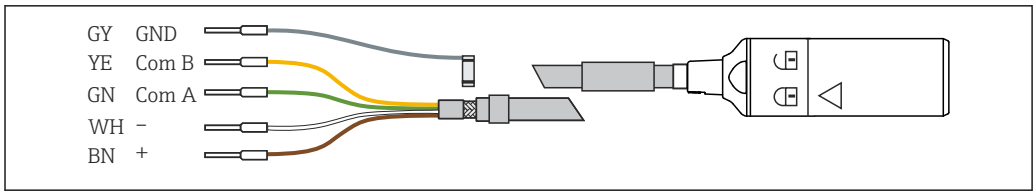
33 *BASE2-E*

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*

1) Internal device connection. Do not disconnect the plug!

6.4.2 Connecting the sensors

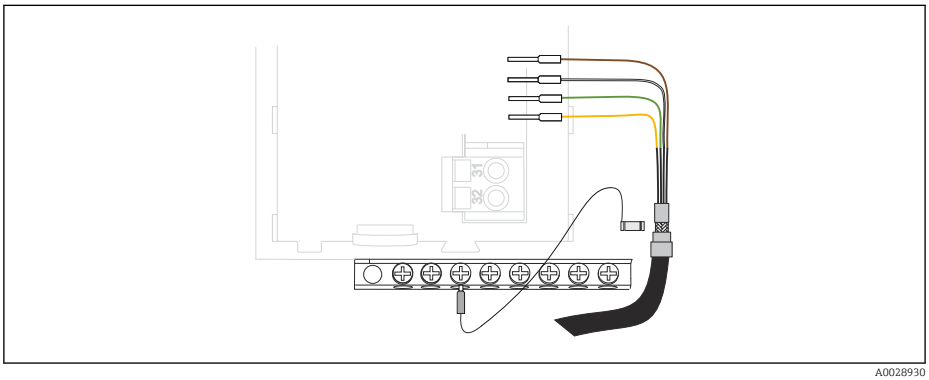
Only use terminated original cables where possible.



34 *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 → 34, 34.
4. Ground the outer shield of the cable via the metal gland on the grounding rail below the base module E.



35 *Terminal strip*

6.4.3 Connecting additional inputs, outputs or relays

WARNING

Module not covered

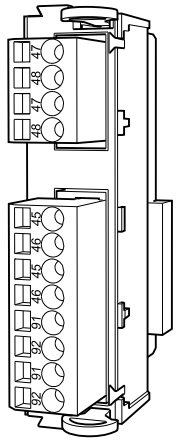
No shock protection. Danger of electric shock!

- 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→ 32, 33. 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.

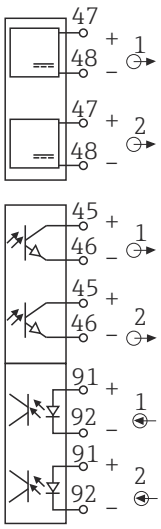
- If additional shields are required, connect them with PE centrally in the control cabinet via terminal blocks supplied by the customer.

Digital inputs and outputs

DIO module



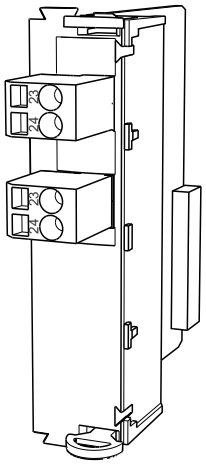
36 Module



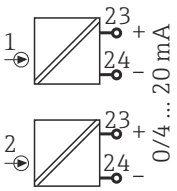
37 Wiring diagram

Current inputs

Module 2AI

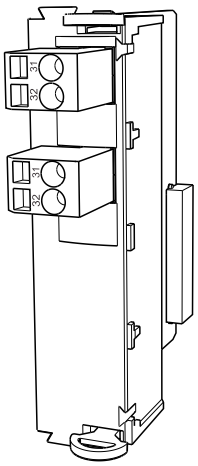
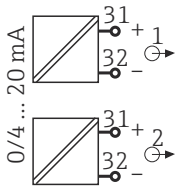
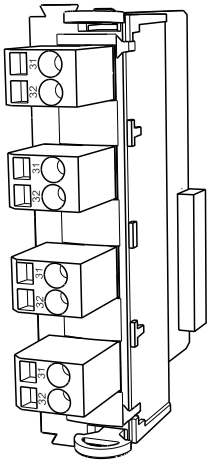
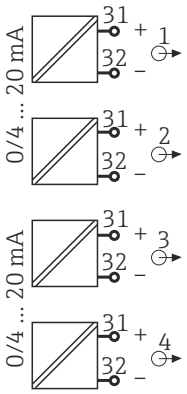


38 Module

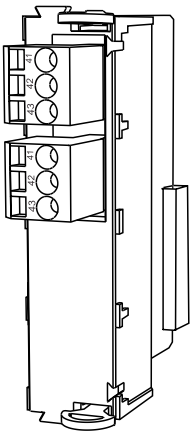
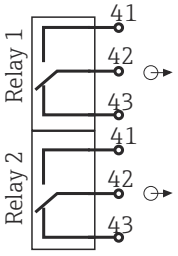
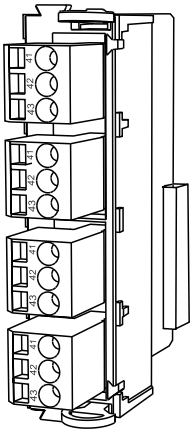
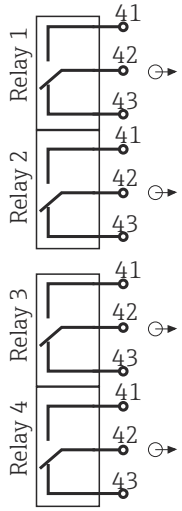


39 Wiring diagram

Current outputs

2AO		4AO	
			
40 *Module*	41 *Wiring diagram*	42 *Module*	43 *Wiring diagram*

Relays

Module 2R		Module 4R	
			
44 *Module*	45 *Wiring diagram*	46 *Module*	47 *Wiring diagram*

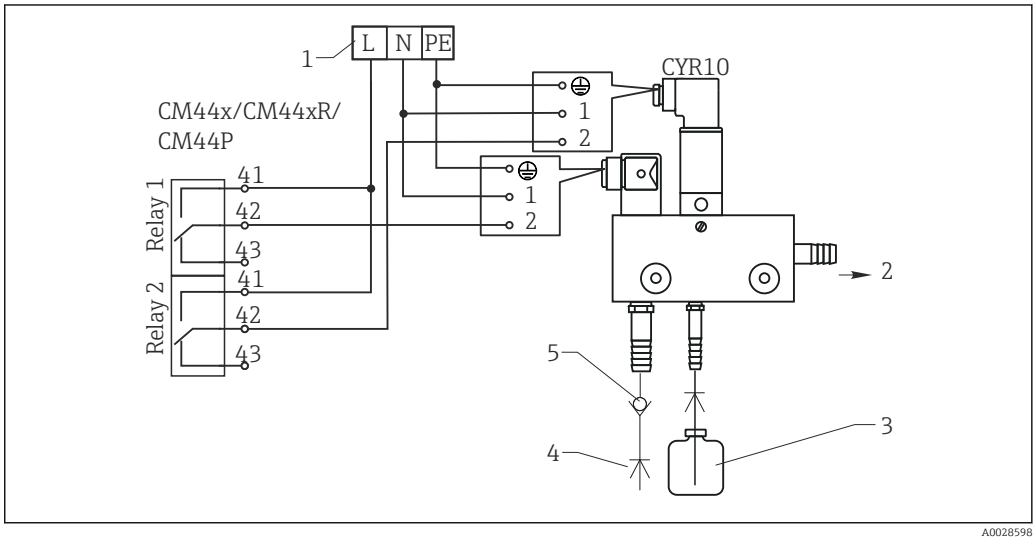
Example: Connecting the cleaning unit 71072583 for CAS40D

NOTICE

Power consumption too high for the Liquiline alarm relay!
Can cause irreparable damage to the base module

- Connect the cleaning unit only to terminals of an additional module (AOR, 2R or 4R), **not** to the alarm relay of the base module.

Example: Connecting the Chemoclean CYR10 injector cleaning unit

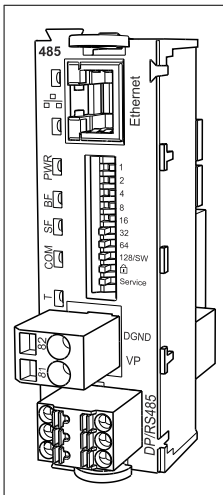


48 *Connecting the CYR10 injector cleaning unit*

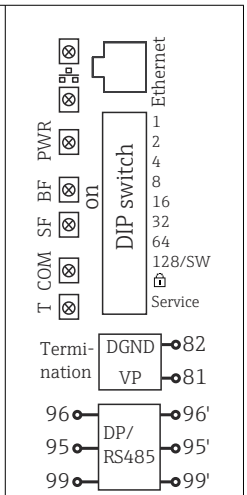
1 *External power supply*
2 *Cleaner to spray head*
3 *Container with cleaner*
4 *Motive water 2 to 12 bar (30 to 180 psi)*
5 *Backflow valve (to be provided by the customer)*

6.4.4 Connecting digital communication

Module 485



49 *Module*



50 *Wiring diagram*

Terminal	PROFIBUS DP	Modbus RS485
95	A	B
96	B	A
99	Not connected	C
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
T	Bus termination	YE	▪ Off = No termination ▪ On = Termination is used

DIP switches on front of module

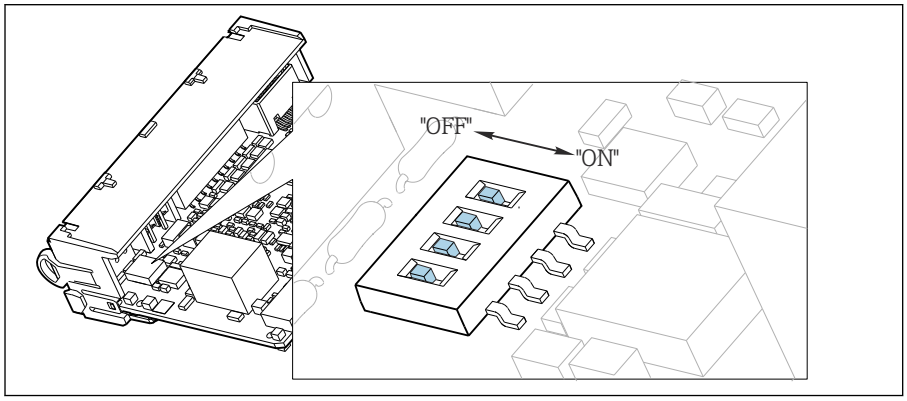
DIP	Factory setting	Assignment
1-128	ON	Bus address (→ "Commissioning/communication")
🔓	OFF	Write protection: "ON" = configuration not possible via the bus, only via local operation
Service	OFF	The switch has no function

6.5 Hardware settings

6.5.1 Bus termination (module 485 only)

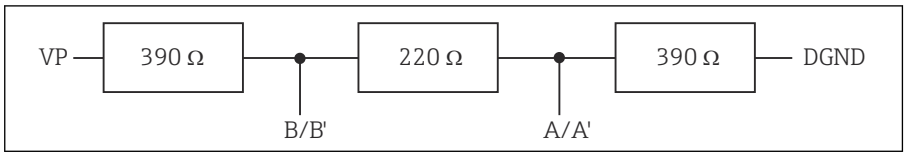
There are 2 ways to terminate the bus:

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



51 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.



52 *Structure of internal termination*

2. External termination

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

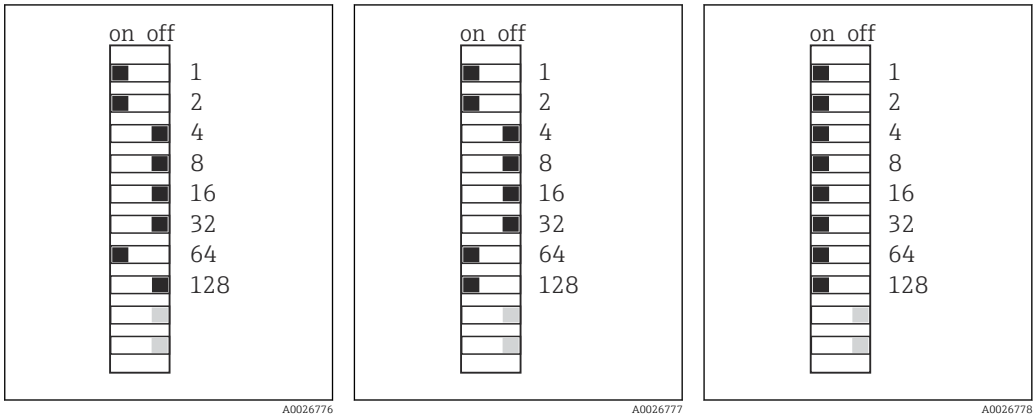
- ▶ Connect the external termination to terminals 81 and 82 on the front of module 485 for 5-V power supply.
  - ↳ The external termination is used.

6.5.2 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.



53 *Valid PROFIBUS address 67* 54 *Valid Modbus address 195* 55 *Invalid address 255* [1]

[1] Order configuration, software addressing is active, software address configured at the factory: PROFIBUS 126, Modbus 247

6.6 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

6.7 Post-connection check

⚠ 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?

7 System integration

7.1 Overview of device description files

7.1.1 Device identification

→ 169, 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.

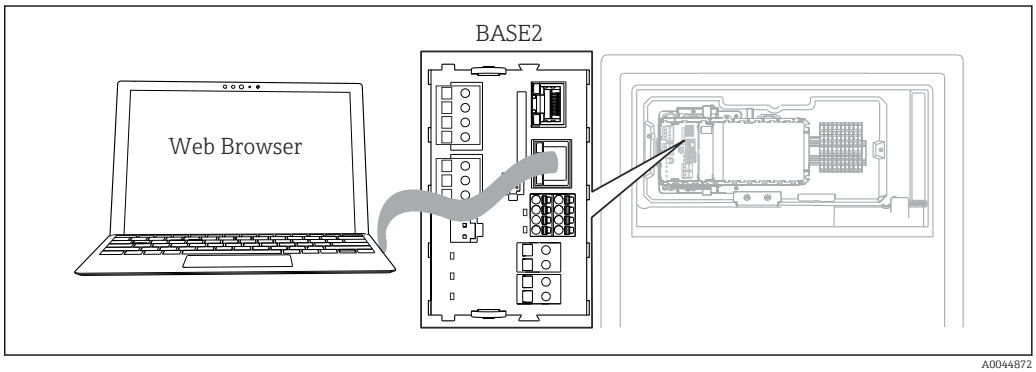
7.2 Integrating the measuring device into the system

7.2.1 Web server

Versions without a fieldbus: you require an activation code for the web server.

Connection

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



56 *Web server/Ethernet connection*

Establishing the data connection

All versions with the exception of PROFINET:
You must switch off the **DHCP** parameter in the Ethernet settings for your device to have a valid IP address. (**Menu/Setup/General settings/Extended setup/Ethernet/Settings**)
You can assign the IP address manually in the same menu (for point-to-point connections).

All versions including PROFINET:
The IP address and subnet mask of the device can be found 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

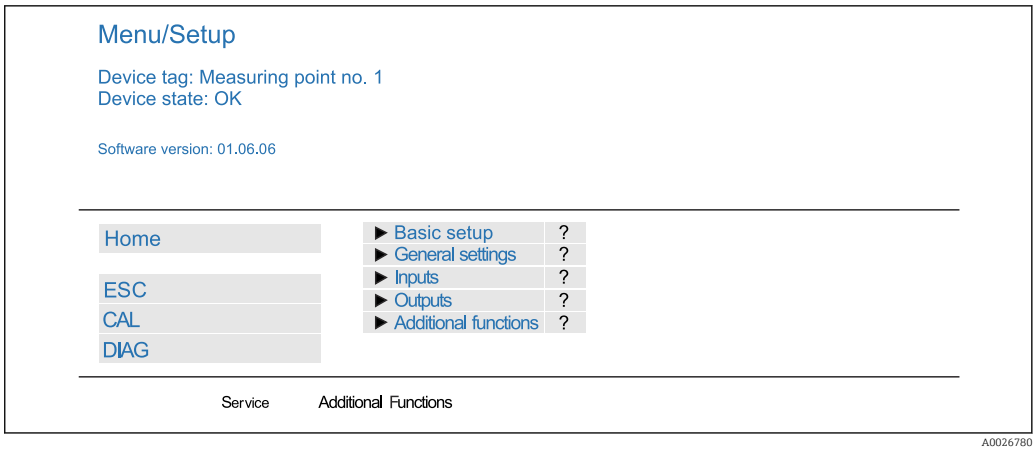
3. Open Network and Sharing Center.
   ↳ Apart from your standard network, you should see an additional Ethernet connection (e.g. as "Unidentified network").
4. Select the link to this Ethernet connection.
5. In the pop-up window select the "Properties" button.
6. Double-click "Internet Protocol Version 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.



57 *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".

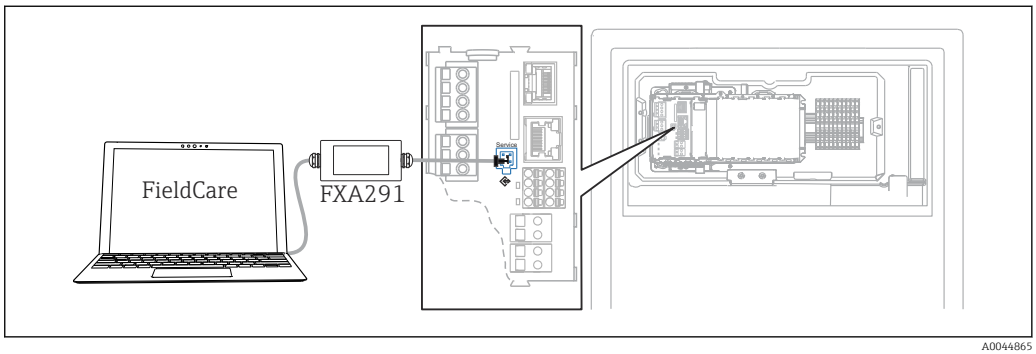
Download: https://portal.endress.com/webdownload/FieldCareDownloadGUI/

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.



58 *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 → 37.

For detailed information on "PROFIBUS communication", see the product pages on the Internet (→ 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 RJ45 socket of the BASE2 module (TCP) as described.

For detailed information on "Modbus communication", see the product pages on the Internet (→ 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 (→ SD01293C).

PROFINET

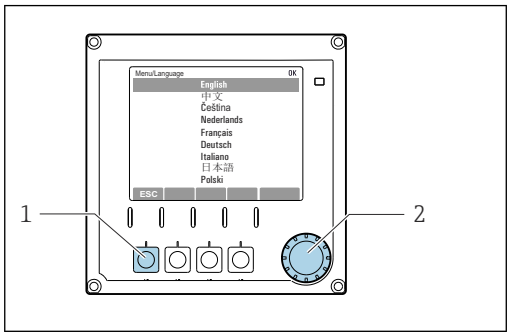
With the BASE2 module and the appropriate device version, you can communicate via PROFINET.

▶ 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 (→ SD02490C).

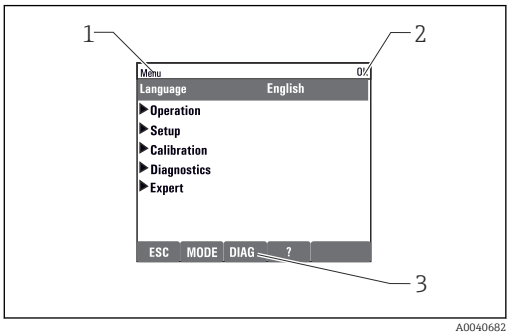
8 Operation options

8.1 Structure and function of the operating menu



59 *Display (example)*

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



60 *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 symbol.

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 symbol is no longer visible on the display.

8.2.2 Configuration options

Display only

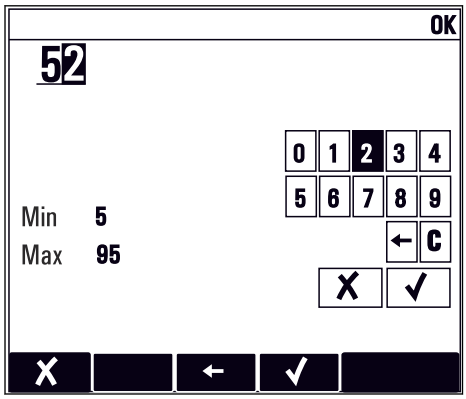
- You can only read the values but cannot change them.
- Typical read-only values are: analyzer data, sensor data and system information
- Example: **Menu/Setup/Analyzer/../Measuring parameter**

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.
- Example: **Menu/Setup/General settings/Temperature unit**

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.
- Example: **Menu/Operation/Display/Contrast**

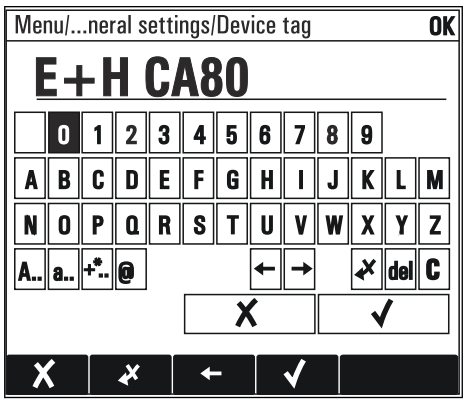


Actions

- 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**

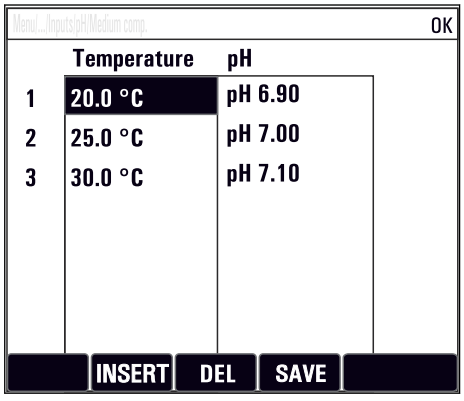
User-defined text

- 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).
- You can also cancel your entries any time using the ✗ 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 °C (41 °F).

- **"Outdoor" version only:** To avoid overloading the power cable or triggering the mains fuse, only commission the device at temperatures ≥5 °C (41 °F).

Automatic cleaning function for the suction hose

Risk of injury from contact with very acidic cleaning solution

- Do not shorten the system intake hose.

Activities while the analyzer is in operation

Risk of injury and infection from medium!

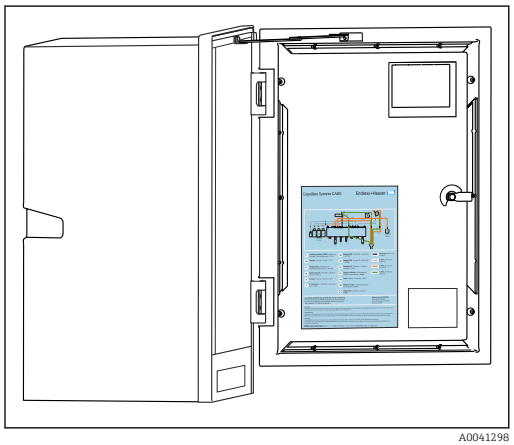
- Before you release any hoses, make sure that no actions, such as the pumping of sample, are currently running or are due to start shortly.
- Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.
- Wipe up any spilt reagent with a disposable tissue and rinse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

9.1 Preparatory steps

9.1.1 Commissioning steps

1. Connect the liquid-bearing hoses of the sample supply system.→ 📄 50
2. Check that the hoses of the sample preparation system are mounted correctly in the hose glands. It should not be possible to remove the hoses without the application of force.
3. Visually inspect all the hose connections to ensure everything is correct. Use the hose connection diagram→ 📄 48.
4. If present, connect the communication cable and hose heater of the sample preparation system to the analyzer.
5. Insert the bottles and make the most important menu settings.→ 📄 51

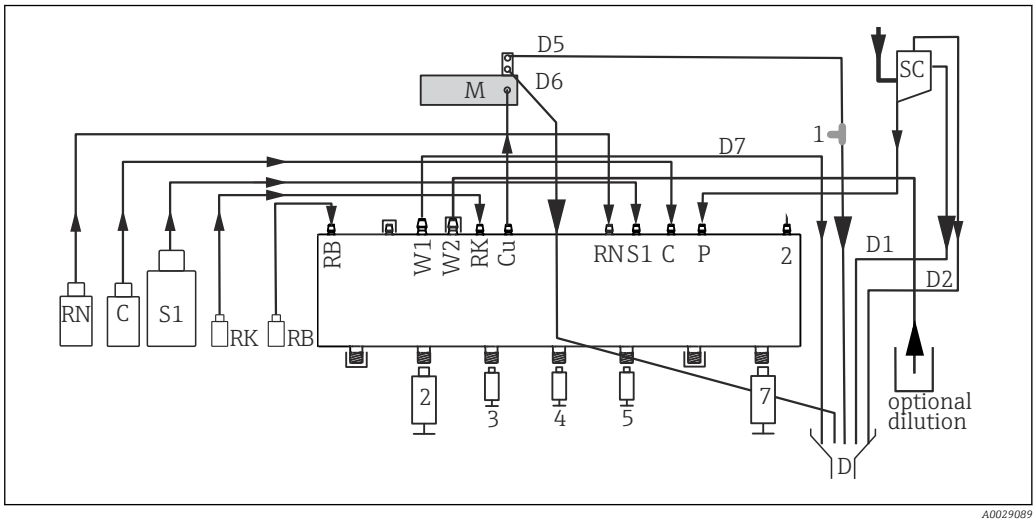
9.1.2 Hose connection diagram



61 *Hose connection diagram*

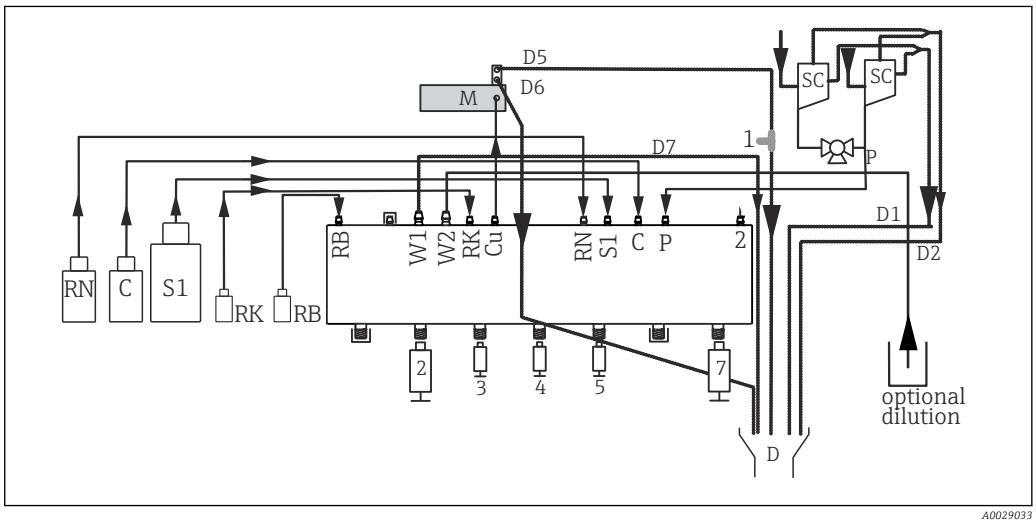
The diagrams below reflect the status at the time of issue of this documentation. The hose connection diagram that applies for your device version is provided on the inside of the door of the analyzer.

- Only connect the hoses as specified in this diagram.



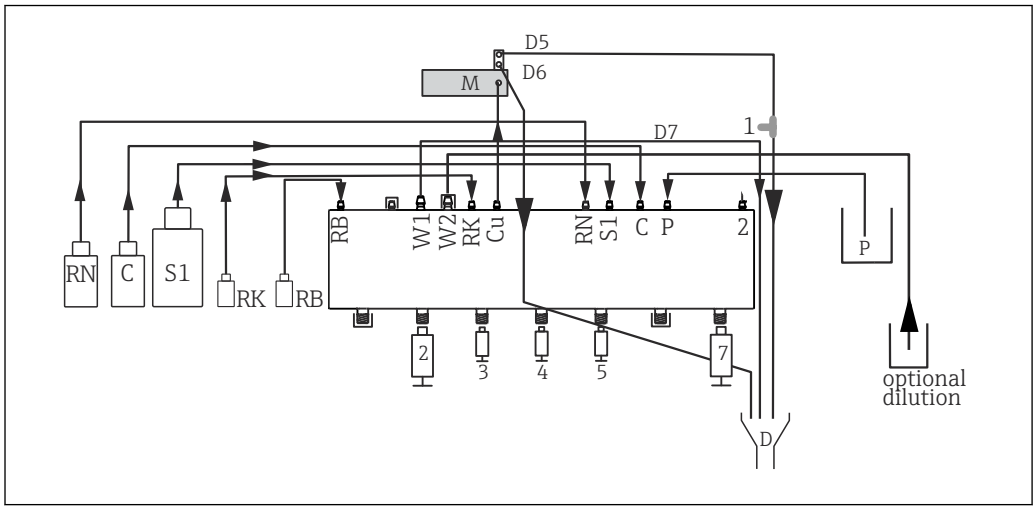
62 *Liquiline System CA80AL, single-channel device*

RN	*Reagent RN*	*M*	*Photometer/measuring cell*
C	*Cleaner*	*Cu*	*Cuvette*
S1	*Standard 1*	*P*	*Sample*
RK	*Reagent RK*	*2, 3, 4, 5, 7*	*Dispensers*
RB	*Reagent RB*	*D*	*Outlet*
W1	*Outlet*	*SC*	*Sample collecting vessel*
1	*T-piece*		



63 *Liquiline System CA80AL, two-channel device*

RN	*Reagent RN*	*M*	*Photometer/measuring cell*
C	*Cleaner*	*Cu*	*Cuvette*
S1	*Standard 1*	*P*	*Sample*
RK	*Reagent RK*	*2, 3, 4, 5, 7*	*Dispensers*
RB	*Reagent RB*	*D*	*Outlet*
W1	*Outlet*	*SC*	*Sample collecting vessel*
1	*T-piece*		



64 *Liquiline System CA80AL, self-priming*

RN	*Reagent RN*	*M*	*Photometer/measuring cell*
C	*Cleaner*	*Cu*	*Cuvette*
S1	*Standard 1*	*P*	*Sample*
RK	*Reagent RK*	*2, 3, 4, 5, 7*	*Dispensers*
RB	*Reagent RB*	*D*	*Outlet*
W1	*Outlet*	*1*	*T-piece*

9.1.3 Connecting the sample inlet hose

1. Ensure a constant and sufficient supply of sample at the installation location.
2. Connect the liquid-bearing hoses of the sample supply system.
3. Self-priming system: connect the intake hose supplied (1.5 m (4.92 ft)) to the Liquid Manager ("sample", → hose connection diagram) and guide it through the hose gland of the analyzer to the outside.
4. If present, connect the communication cable and hose heater of the sample preparation system to the analyzer.
5. Ensure that only sample that has a low solids content is supplied, as otherwise there is a risk of blockage.

9.2 Function check

⚠ 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
- Check the hose connections using the hose connection diagram.
- Is the suction line connected to the sample collector (if present)?
- Are the dispensers inserted correctly?
- Can the dispensers move up and down freely?
- Are all the hose connections leak-tight?
- If sample preparation is provided: has the connection been made? Are the protective hoses in the hose glands strain-relieved?
- If sample preparation is not connected: is the sample hose in the hose gland strain-relieved?
- Have the bottles with reagents, and standard been inserted and connected?

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.

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"
M	Header bar	Diagnostic message "Maintenance request"
C	Header bar	Diagnostic message "Check"
S	Header bar	Diagnostic message "Out of specification"
⇆	Header bar	Fieldbus or TCP/IP communication active
⧗	Header bar	Hold active (for sensors)
⧗	At measured value	Hold for the actuator (current output, limit switch etc.) is active
⤒	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, → 🖹 124).

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

Menu/Setup/General settings		
Function	**Options**	**Info**
Temperature unit	**Selection** ▪ °C ▪ °F ▪ K **Factory setting** °C	
Current output range	**Selection** ▪ 0..20 mA ▪ 4..20 mA **Factory setting** 4..20 mA	In accordance with Namur NE43, the linear range is from 3.8 to 20.5 mA (**4..20 mA**) or from 0 to 20.5 mA (**0..20 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 **Factory setting** 22.5 mA	The function meets NAMUR NE43. ▶ Set the current value that should be output at the current outputs in the event of an error.
The value for **Failure current** should be outside the measuring range. If you decided that your **Current output range** = **0..20 mA** you should set an error current between 20.1 and 23 mA. If the **Current output range** = **4..20 mA** you could also define a value < 4 mA as the error current. The device allows an error current within the measuring range. In such instances pay attention to any effects this may have on your process.		
Alarm delay	0 to 9999 s **Factory setting** 0 s	The software displays only the errors that are 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.
Device hold	**Selection** ▪ Disabled ▪ Enabled **Factory setting** Disabled	You can enable an immediate, general hold (for sensors) here. The function acts in the same way as the **HOLD** soft key in the screens.

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 **Factory setting** DD.MM.YYYY	▶ Select a date format.
Time format	**Selection** ▪ hh:mm am (12h) ▪ hh:mm (24h) ▪ hh:mm:ss (24h) **Factory setting** hh:mm:ss (24h)	▶ Choose between 12-hour display or 24-hour display. Seconds can also be displayed with the latter version.
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.

Menu/Setup/General settings/Hold settings		
Function	**Options**	**Info**
Setup menu	**Selection** ▪ Disabled ▪ Enabled **Factory setting** Disabled	▶ Decide whether the device outputs should switch to the defined hold state when the particular menu is opened.
Diagnostics menu		
Calibration active	**Factory setting** Enabled	
External hold	**Selection** ▪ Disabled ▪ Enabled **Factory setting** Disabled	

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.

Menu/Setup/General settings/Logbooks		
Function	**Options**	**Info**
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.
▶ Overflow warnings **Analyzer calibration logbook = Fill up buffer**		
Calibration logbook Diagnostic logbook Configuration logbook	**Selection** ▪ Off ▪ On **Factory setting** Off	▶ Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows.
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 (**On**) or not (**Off**)?
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 Y-Description Grids Pitches	**Selection** ▪ Off ▪ On **Factory setting** On	▶ Decide whether a description should be displayed for the axes and whether gridlines should be shown. In addition, you can also decide whether pitches should be displayed.
X Pitch/Grid distance Y Pitch/Grid distance	10 to 50% **Factory setting** 10 %	▶ Determine the pitch.

Menu/Setup/General settings/Logbooks		
Function	**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	▸ Select a data source for the logbook entries. You can choose from the following: ▪ Connected sensors ▪ Available controllers ▪ Current inputs ▪ Fieldbus signals ▪ Binary input signals ▪ Mathematical functions
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 **Factory setting** 0:01:00	Minimum time interval between two entries Format: H:MM:SS
Data logbook	**Selection** ▪ Ring buffer ▪ Fill up buffer **Factory setting** Ring buffer	**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. no new values can be saved. The controller displays 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 logbook immediately. You add a new data logbook at a later date using **New**.
▷ Finished	Action	This allows you to exit the **New** menu.
▷ Start/stop simultaneously	Action	Appears if you have created more than one data logbook. With one mouse click, you can start or stop recording all the data logbooks.
▶ Logbook name		The name of this submenu is based on the name of the logbook and only appears once you have created a logbook.
This menu appears several times if you have several data logbooks.		

Menu/Setup/General settings/Logbooks		
Function	**Options**	**Info**
Source of data	Read only	This is for information purposes only. If you want to record another value, delete this logbook and create a new data logbook.
Measured value		
Log time left **Data logbook** = **Fill up buffer**	Read only	Displays the days, hours and minutes remaining until the logbook is full.
Log size **Data logbook** = **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 **Factory setting** 0:01:00	As above Minimum time interval between two entries Format: H:MM:SS
Data logbook	**Selection** ▪ Ring buffer ▪ Fill up buffer **Factory setting** Ring buffer	**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. no new values can be saved. The controller displays 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.
▶ Line plotter		Menu to define the graphic display
Axes	**Selection** ▪ Off ▪ On **Factory setting** On	Should the axes (x, y) be displayed (**On**) or not (**Off**)?
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** ▪ Off ▪ On **Factory setting** On	▶ Decide whether a description should be displayed for the axes and whether gridlines should be shown. In addition, you can also decide whether pitches should be displayed.
Y-Description		
Grids		
Pitches		
X Pitch/Grid distance	10 to 50% **Factory setting** 10 %	▶ Determine the pitch.
Y Pitch/Grid distance		
▷ 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		
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) **Factory setting** Depends on the message	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.

Menu/Setup/(General settings or Inputs<sensor channel>)/Extended setup/Diagnostics settings/Diag. behavior		
Function	**Options**	**Info**
Diag. output	**Selection** ▪ None ▪ Alarm relay ▪ Binary output ▪ Relay 1 to n (depends on the device version) **Factory setting** None	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**.)
Alarm relays are available, depending on the device version.		
Cleaning program (for sensors)	**Selection** ▪ None ▪ Cleaning 1 ▪ Cleaning 2 ▪ Cleaning 3 ▪ Cleaning 4 **Factory setting** None	▶ Decide whether the diagnostic message should trigger a cleaning program. You can define the cleaning programs under: **Menu**/**Setup**/**Additional functions**/**Cleaning**.
Detail information	Read only	Here you can find more information on the diagnostic message and instructions on how to resolve the problem.

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 **RTU** and **ASCII** . 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** 1. **INSERT** . 2. Assign any name to the new user. 3. Select a password for the user. 4. Confirm password. ↳ You can now change the password at any time.
Enter new user password	Free text	
Confirm new user password	Free text	
Change user password	Free text	

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.

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

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.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 **DHCP** is switched off.

Menu/Setup/General settings/Extended setup/Ethernet		
Function	**Options**	**Info**
Netmask	xxx.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, photometer and sample preparation 1 : **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

You require activation codes for:
- Additional functions, e.g. fieldbus communication
- Firmware upgrades

If your original device has activation codes, these can be found on the nameplate. The corresponding device functions are activated at the factory. You only require the codes if servicing the device.

1. Enter the activation code: **Menu/Setup/General settings/Extended setup/Data management/Activation code**.
2. Confirm your entry.
   ↳ 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
Two current outputs (BASE2-E module only)	081...
Web server [1]	351...
PROFIBUS DP	0B3...
Modbus TCP	0B8...
Modbus RS485	0B5...
EtherNet/IP	0B9...
PROFINET	0B7...
Cooling [2]	0F1...
Feedforward control	220...
Chemoclean Plus	25...
Collecting vessel [2]	20...
Measuring channels [2]	28...
Formula [3]	321...

1) Via Ethernet socket of the Base2 module, for versions without an Ethernet fieldbus
2) Availability depends on measuring parameter
3) 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 **Factory setting** Analyzer_serial number	▶ Select any name for your analyzer. Use the TAG name for example.
Measuring parameter	Read only	
Range switch	**Selection** ▪ Automatic ▪ Manual **Factory setting** Manual	**Automatic** ▪ No options available for measuring range or dilution ▪ The device uses all the available ranges ▪ Dilution is not displayed **Manual** ▪ Measuring range can be selected from a list ▪ Internal dilution is displayed in the list for every range ▪ Dilution factor is displayed again separately
Measuring range	**Range switch** = **Automatic** No other options **Range switch** = **Manual** The options available depend on the device version ordered.	

10.3.1 Extended setup

Measured value

Menu/Setup/Analyzer/Extended setup/Measuring value		
Function	**Options**	**Info**
Main value	**Selection** Al **Factory setting** Al	
Unit	**Selection** ▪ mg/l ▪ µg/l ▪ ppm ▪ ppb **Factory setting** µg/l	
Main value format	**Selection** ▪ # ▪ Auto **Factory setting** #	
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 sample request		
Lead time SPX [1]	**Selection** 0.00 to 30.00 (**mm:ss**) **Factory setting** 0.00 (**mm:ss**)	In the automatic mode, each measurement only starts once the lead time has elapsed. The request sample signal is active from the start of the lead time until the end of the specified signal duration time.
Duration SPX [1]	**Selection** 0:00 to 60:00 (**mm:ss**) **Factory setting** 3:00 (**mm:ss**)	You can set the duration for which the signal is active.
▶ 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 two-channel devices **SP2** is also displayed.

1) X is context-dependent, is automatically generated by the software and stands for the name of the sample preparation, e.g. "1" or "2".

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 2 ▪ Dispenser 3 ▪ Dispenser 4 ▪ Dispenser 5 ▪ Dispenser 7
▶ **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 2 ▪ Dispenser 3 ▪ Dispenser 4 ▪ Dispenser 5 ▪ Dispenser 7

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.

Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles		
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**		
Cleaner C	100 to 1000 ml **Factory setting** 500 ml	
Reagent RB	100 to 1000 ml **Factory setting** 250 ml	
Reagent RK	100 to 1000 ml **Factory setting** 250 ml	
Reagent RN	100 to 5000 ml **Factory setting** 500 ml	
Standard S1	100 to 1000 ml **Factory setting** 1000 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.
Cleaner C	1 to 20 % **Factory setting** 2 %	
Reagent RB	1 to 40 % **Factory setting** 10 %	
Reagent RK	1 to 40 % **Factory setting** 10 %	
Reagent RN	1 to 40 % **Factory setting** 10 %	

Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles		
Function	**Options**	**Info**
Standard S1	1 to 20 % **Factory setting** 2 %	
▶ **Alarm limits**	Diag. code 727	Alarm limits are intended to immediately trigger maintenance tasks. ▶ Replace the materials concerned as quickly as possible.
Cleaner C	1 to 20 % **Factory setting** 2 %	
Reagent RB	1 to 40 % **Factory setting** 10 %	
Reagent RK	1 to 40 % **Factory setting** 5 %	
Reagent RN	1 to 40 % **Factory setting** 5 %	
Standard S1	1 to 20 % **Factory setting** 2 %	
▶ **Remaining operating time**		
▶ **Warning limits**		Diag. code 726
Cleaner C	1 to 14 d **Factory setting** 14 d	
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	

Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles		
Function	**Options**	**Info**
▶ **Alarm limits**		Diag. code 727
Cleaner C	1 to 7 d **Factory setting** 2 d	
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

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.

10.3.2 Measurement

Menu/Setup/Analyzer/Measurement		
Function	**Options**	**Info**
Start condition	**Selection** ▪ Immediate ▪ Date/time ▪ Continuous **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. **Continuous**: The analyzer measures continuously, without interruption, between the measurements.
Date	01.01.1970 to 07.02.2106	*Functions only available for:* **Start condition** = **Date/time**
Time	00:00:00 to 23:59:59	
Measuring interval	**Factory setting** 0:10	*Function only available for:* **Start condition** = **Immediate** *or* **Date/time** For configuring the time interval of the measurement
▶ Sequence of measurements	**Selection** ▪ SP1 ▪ SP2 ▪ Pause	Defines the sequence of channels in automatic mode. Is displayed only in the case of a two-channel device. ▪ **SP1**: Indicate the number of consecutive measurements for channel **SP1** ▪ **SP2**: Indicate the number of consecutive measurements for channel **SP2** ▪ **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.
Channel change delay	15 to 600 **Factory setting** 30	Additional delay time which the analyzer waits to elapse after every change of sample.
Signal delay	0 to 600 s **Factory setting** 0 s	**Measurement active**: 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.

10.3.3 Calibration

Menu/Setup/Analyzer/Calibration		
Function	**Options**	**Info**
Start condition	**Selection** ▪ Immediate ▪ Date/time **Factory setting** Immediate	The calibration can start either immediately or at the set time.
If the start condition selected is **Immediate**		
Date	01.01.1970 to 07.02.2106	*Functions only available for:* **Start condition** = **Date/time**
Time	00:00:00 to 23:59:59	
Calibration interval	0-01 to 90-00 (**DD-hh**) **Factory setting** 02-00 **DD-hh**	For configuring the time interval of the calibration/adjustment.
Next calibration **Mode** = **Automatic**	Read only	

Menu/Setup/Analyzer/Calibration		
Function	**Options**	**Info**
Zero point	Read only	
Calibration factor	Read only	Relationship of the measured concentration to the pre-specified concentration of the calibration standard.
▶ Settings		
Nominal concentration	1.00 to 1000.00 (µg/l) **Factory setting** 500.00 µg/l	For configuring the concentration of the calibration standard solution. Depends on the settings under **Menu/Setup/Analyzer/Extended setup/Measuring value/Main value**

10.3.4 Cleaning

Menu/Setup/Analyzer/Cleaning		
Function	**Options**	**Info**
Start condition	**Selection** ▪ Immediate ▪ Date/time ▪ Disabled **Factory setting** Disabled	**Immediate**: Cleaning of the starts immediately. **Date/time**: Cleaning of the starts at the selected date/time. **Disabled**: Additional cleaning is not enabled.
Date	01.01.1970 to 07.02.2106	*Functions only available for:* **Start condition** = **Date/time**
Time	00:00:00 to 23:59:59	
Cleaning interval	0-01 to 90-00 (**DD-hh**) **Factory setting** 02-00 **DD-hh**	For configuring the time interval for (additional) cleaning.
Next cleaning **Mode** = **Automatic**	Read only	

10.4 Sample preparation

The menu displayed depends on the connected sample preparation system. The menu item does not appear if a Liquiline System CA80 analyzer without a collecting vessel is connected. The Liquiline System CAT860 can only be operated with a Liquiline System CA80 single-channel device.

1. Select the installation method.

- Others
  (factory setting)
  e.g. Liquiline System CAT820 oder CAT860
- Pressurized pipe sampling
  Sample preparation that is installed in a pressure pipe, e.g. Liquiline System CAT810.
- Inlet pipe sampling

2. Select sample preparation.

Menu/Setup/Sample preparation/Installation type = Others/Sample preparation 1 … 2		
Function	**Options**	**Info**
Operating mode	**Selection** ▪ Independent ▪ Controlled **Factory setting** Controlled	▪ Controlled Sample preparation that is controlled by the analyzer, e.g. Liquiline System CAT820 / CAT860 ▪ Independent No sample preparation that is controlled by the analyzer. The supply of sample must be guaranteed by the customer. Operating mode = Independent 1. **Power supply**: Switch on if power is to be supplied via the analyzer. 2. **Timeout no sample**: Specify the time for the timeout (3:00 to 30:00 min:ss). Operating mode = Controlled ▶ Make other settings as described below.
Tag	Customized text, 32 characters	
Timeout no sample	3:00 to 30:00 min:ss	
Only for CAT860 Cleaning start condition	**Selection** ▪ Immediate ▪ Date/time ▪ Disabled	**Immediate:** Cleaning starts immediately. **Date/time:** Cleaning starts at the selected date/time. **Disabled:** Cleaning is not active.
Only for CAT860 and **Cleaning start condition** = **Immediate** *or* **Date/time** Cleaning interval	**Selection** ▪ 0-01 to 90-00 (DD-HH) ▪ **Factory setting** 1-00	Compressed air or water cleaning for longer filter maintenance intervals. Cleaning with liquid cleaner.
Only for CAT860 and **Cleaning start condition** = **Date/time** Date	**Selection** ▪ 01.01.1970 to 07.02.2106 DD.MM.YYYY ▪ **Factory setting** 01.01.1970	
Only for CAT860 and **Cleaning start condition** = **Date/time** Time	**Selection** ▪ 00:00:00 to 23:59:59 HH:MM:SS ▪ **Factory setting** 00:00:00	
Only for CAT860 Residence time	**Selection** ▪ 0:30 to 20:00 (MM:SS) ▪ **Factory setting** 1:00	Reaction time of cleaner during the cleaning
CAT820 and CAT860 ▶ **Sampling pump interval**		
Pump time	**Selection** 10 to 20 s **Factory setting** 10 s	Ratio between the pumping duration and the pumping interval of the peristaltic pump. This affects the volume of the pumped sample.

Menu/Setup/Sample preparation/Installation type = Others/Sample preparation 1 ... 2		
Function	**Options**	**Info**
Pump pause	**Selection** 20 to 50 s **Factory setting** 30 s	
CAT820 and CAT860 ▶ **Pressurized air cleaning**		
CAT820 only Compressed air	**Selection** ▪ Available ▪ Not available **Factory setting** Depends on the device version	Settings for sample preparation with or without compressed air cleaning. In the event of retrofitting, the compressed air can be activated here.
Cleaning mode	**Selection** ▪ On ▪ Off **Factory setting** On	Activates or deactivates automatic compressed air cleaning of the pump-to-filter hose and of the filter.
Cleaning interval	**Selection** 0:30 to 4:00 HH:MM **Factory setting** 2:00	Cleaning interval of the automatic compressed air cleaning system
Cleaning duration	**Selection** 10 to 60 s **Factory setting** 30 s	Cleaning duration of the automatic compressed air cleaning system
CAT820 and CAT860 ▶ **Heatings**		
Cabinet	**Selection** ▪ Available ▪ Not available **Factory setting** Depends on device version	You can enable the heating here with a heated sample preparation.
Hose filter	**Selection** ▪ Available ▪ Not available **Factory setting** Depends on the device version	With heated sample preparation
Hose analyzer	**Selection** ▪ Available ▪ Not available **Factory setting** Depends on the device version	With heated sample preparation
▶ **Diagnostics settings**		
▶ **Limit change filter**		
Function	**Selection** ▪ On ▪ Off **Factory setting** Off	
Warning limit	**Selection** 01-00 to 99-00 (DD-HH) **Factory setting** 60-00	Diag. code 729

Menu/Setup/Sample preparation/Installation type = Others/Sample preparation 1 … 2		
Function	**Options**	**Info**
▶ **Limit change hose**		
Function	**Selection** ▪ On ▪ Off **Factory setting** On	
Warning limit	**Selection** 01-00 to 99-00 (DD-HH) **Factory setting** 60-00	Diag. code 337
▷ **Reset settings**		Resets all settings specific to sample preparation. All other settings are retained.

Menu/Setup/Sample preparation/Installation type = Pressurized pipe sampling/Sample preparation 1 … 2		
Function	**Options**	**Info**
Cleaning valve	**Selection** ▪ Available ▪ Not available **Factory setting** Not available	If available, the valve can be activated here.
Cleaning valve = **Available** Filter backflush	**Selection** ▪ On ▪ Off **Factory setting** On	
Cleaning valve = **Available** *and* **Filter backflush** = **On** Cleaning interval	**Selection** 00:10 to 02:00 HH:MM **Factory setting** 00:30	Compressed air or water cleaning (optional) for extended filter maintenance intervals
Cleaning valve = **Available** Cleaning duration	**Selection** 10 to 30 s **Factory setting** 10 s	Cleaning duration of the automatic water or compressed air cleaning system
Cleaning valve = **Available** Cleaning discard time	**Selection** 0 to 1800 s **Factory setting** 180 s	Discard time once cleaning is complete. If water is used as the flushing medium, this must be replaced by a fresh sample before starting the next measurement.
Timeout no sample	3:00 to 30:00 min:ss	
▷ **Reset settings**		Resets all settings specific to sample preparation. All other settings are retained.

Menu/Setup/Sample preparation/Installation type = Inlet pipe sampling/Sample preparation 1 … 2		
Function	**Options**	**Info**
Filter backflush	**Selection** ▪ On ▪ Off **Factory setting** On	
Cleaning duration	**Selection** 10 to 60 s **Factory setting** 00:30	Cleaning duration of the automatic water or compressed air cleaning system
Cleaning discard time	**Selection** 0 to 1800 s **Factory setting** 180 s	Discard time once cleaning is complete. If water is used as the flushing medium, this must be replaced by a fresh sample before starting the next measurement.
Lead time	0:00 to 30:00 min:ss **Factory setting** 25:00 min	
Duration	0:00 to 60:00 min:ss **Factory setting** 25:00 min	
Timeout no sample	3:00 to 30:00 min:ss	
▷ **Reset settings**		Resets all settings specific to sample preparation. All other settings are retained.

10.5 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 **Factory setting** 4 - 20mA	▶ Select the same current range as in the data source (connected device).
Input variable	**Selection** ▪ Parameter ▪ Current **Factory setting** Current	▶ Select the input variable.
Meas. value format	**Selection** ▪ # ▪ #.# ▪ #.## ▪ #.### **Factory setting** #.#	▶ Specify the number of decimal places.
Parameter name **Input variable** = **Parameter**	Customized text, 16 characters	▶ Assign a useful name, e.g. the parameter name that the data source also uses.
Unit of measure **Input variable** = **Parameter**	Customized text, 16 characters	You cannot choose the unit from a list. If you want to use a unit, you must enter it here as customized text.

Menu/Setup/Inputs/Current input x:y [1]		
Function	**Options**	**Info**
Lower range value **Input variable** = **Parameter**	-20.0 ... **Upper range value** <unit of measure> **Factory setting** 0.0 <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 beforehand.
Upper range value **Input variable** = **Parameter**	**Lower range value** to 10000.0 <engineering unit> **Factory setting** 10.0 <engineering unit>	
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

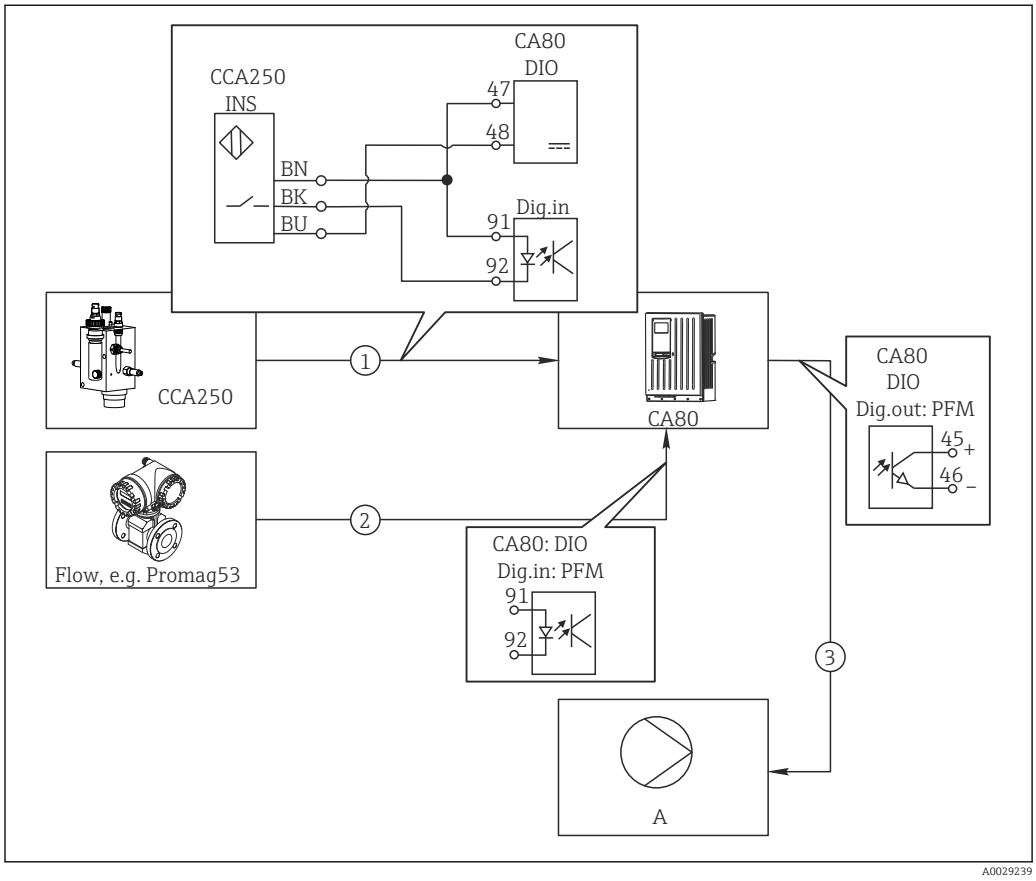
10.6 Binary inputs and outputs

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
  - measuring range switching for conductivity (upgrade code required, → 66)
  - 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

10.6.1 Application examples

Chlorine regulation with feedforward control



65 *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 [2)].

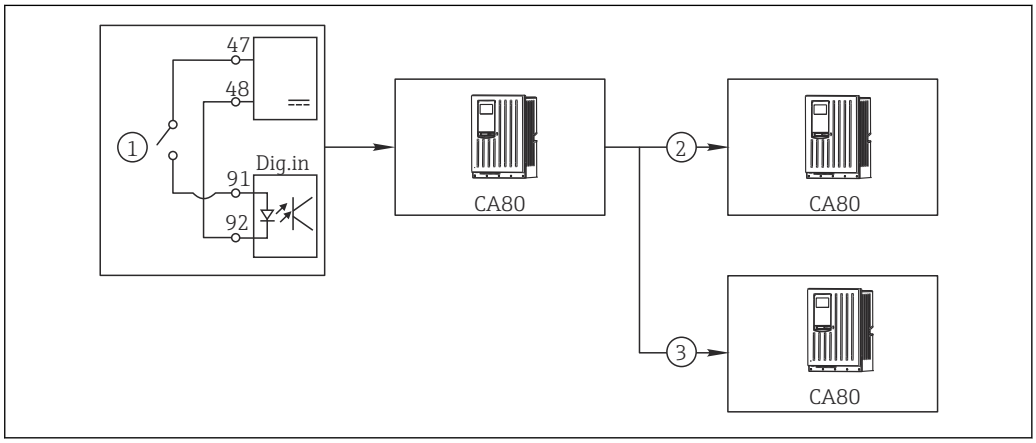
2) An activation code, Order No. 71211288, is necessary for the "feedforward control" function.

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)



66 *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: **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

3. Link the binary inputs with the analyzer: select **Menu/Setup/Analyzer/Extended setup/Signal for process access**.
4. Select measuring channel **SP1** or in the case of two-channel devices select measuring channel **SP1** or **SP2**.
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.

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	**Selection** 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** or in the case of two-channel devices select measuring channel **SP1** or **SP2**.
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. In the case of two-channel devices, **Measurement active SP2** is also displayed

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. In the case of two-channel devices, **Sample required SP2** is also displayed

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

5. ↳ The output signal level **High** indicates that sample is required.

10.6.2 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 signal**		
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.

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

10.6.3 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 ▪ PFM **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.

Menu/Setup/Outputs/Binary output x:y [1]		
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	▶ Select the limit switches that should be output via the binary output. Configuration of the limit switches: **Menu**/**Setup**/**Additional functions**/**Limit switches**.
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). In the case of two-channel devices, **Sample required SP2** and **Measurement active SP2** is also displayed
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	▶ Determines which controller component should trigger the connected actuator, e.g. the dosing pump. **Bipolar** "Split range" **Unipolar+** Part of the manipulated variable that the controller uses to increase the process value **Unipolar-** For connected actuators that decrease the controlled variable
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 **Hold behavior** = **Fixed value**	0 to 100 % **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 %	

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

10.7 Signal outputs

10.7.1 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**.

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 **Source of data**.
The list of dependent measured values is provided in the **Measured value** *table, subject to the* **Source of data**→ 🖹 89. 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 **Measured value**	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.

1) x:y = slot:output number

Measured value *depending on the* Source of data

Source of data	Measured value
Aluminum	**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).

10.7.2 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

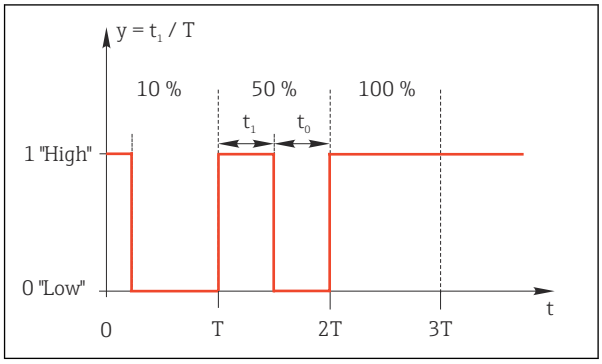
Function = Limit switch		
Function	**Options**	**Info**
Source of data	**Selection** Limit switch 1 ... 8 **Factory setting** None	Select the limit switch via which the status of the relay is to be output. The limit switches are configured in the menu: **Setup/Additional functions/Limit switches**. Use the **ALL** and **NONE** 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).

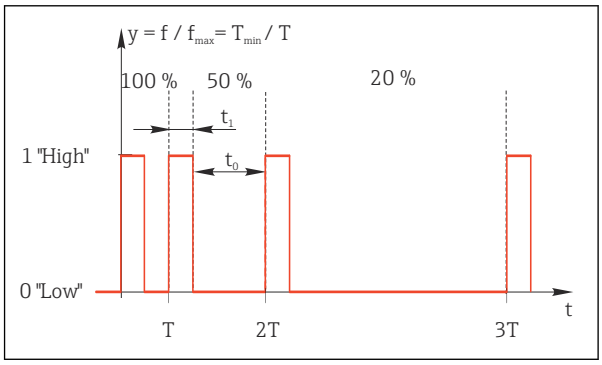
Function = Controller		
Function	**Options**	**Info**
Source of data	**Selection** ▪ None ▪ Controller 1 ▪ Controller 2 **Factory setting** None	▶ Select the controller that should act as the data source.
Operating mode	**Selection** ▪ PWM ▪ PFM **Factory setting** PWM	PWM=pulse width modulation PFM=pulse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

1. **PWM** (pulse width modulation):
   The duty cycle is varied within a period **T** ($T=t_1+t_0$). The cycle duration remains constant.



67 *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, $t_1 = t_0$.



68 *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. **Unipolar(+)** is the part of the manipulated variable which the controller uses to increase the process value (e.g. for heating purposes). Alternatively, select **Unipolar(-)** 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** 10.0 s	▶ Specify the cycle duration within which the duty cycle should be varied (only PWM).
The settings for **Cycle duration** and **Shortest turn-on time** influence one another. The following applies: **Cycle duration** ≥ **Shortest turn-on time**.		
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^{-1} **Factory setting** 60 min^{-1}	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 **Factory setting** 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**)
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.

1) %0V 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). In the case of two-channel devices, **Sample required SP2** and **Measurement active SP2** are also displayed

10.7.3 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**) → 89

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

10.7.4 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.
3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**) → 89

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

10.7.5 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**) → 89
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

10.8 Additional functions

10.8.1 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.

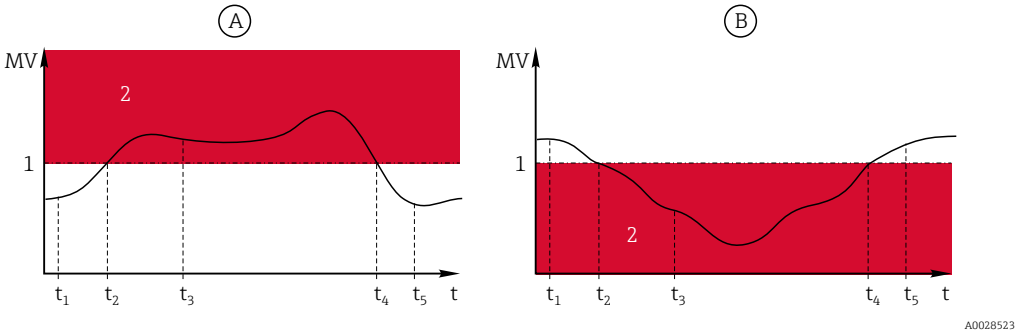
Measured value *depending on the* **Source of data**

Source of data	**Measured value**
Aluminum	**Selection** Main value
pH Glass pH ISFET	**Selection** ▪ Raw value mV ▪ pH ▪ Temperature
ORP	**Selection** ▪ Temperature ▪ ORP mV ▪ ORP %
Oxygen (amp.) Oxygen (opt.)	**Selection** ▪ Temperature ▪ Partial pressure ▪ Concentration liquid ▪ Saturation ▪ Raw value nA *(only* **Oxygen (amp.)***)* ▪ Raw value µs *(only* **Oxygen (opt.)***)*

Source of data	Measured value
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.

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 **Factory setting** Above limit check	Type of limit value monitoring: ▪ Limit value overshoot or undershoot→ 69 ▪ Measured value within or outside a range → 70 ▪ Rate of change → 72
Limit value	Settings depend on the measured value	**Operating mode** = **Above limit check** *or* **Below limit check**

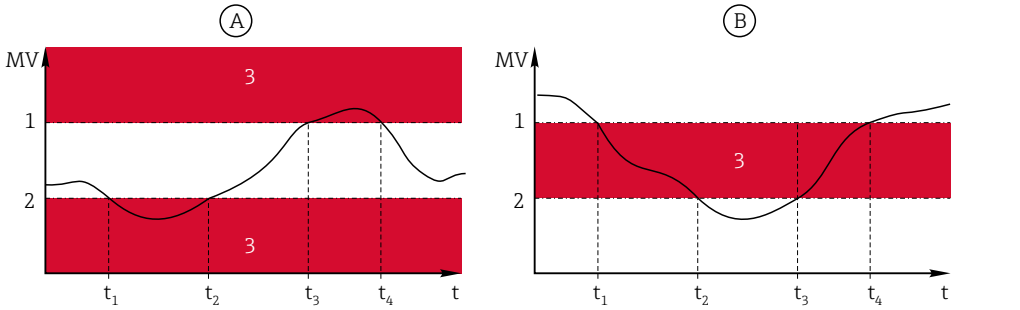


69 *Exceeding (A) and undershooting (B) a limit value (without hysteresis and switch-on delay)*

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

- 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**).

Menu/Setup/Additional functions/Limit switches/Limit switch 1 ... 8		
Function	**Options**	**Info**
Range lower value Range upper value	Settings depend on the measured value	**Operating mode** = **Out of range check** *or* **In range check**

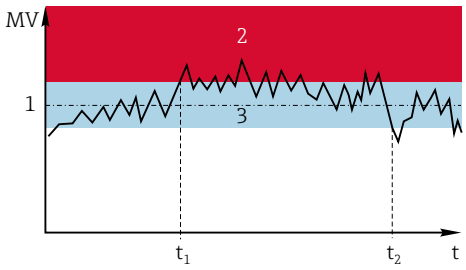


70 Range monitoring outside (A) and within (B) a range (without hysteresis and switch-on delay)

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

- If measured values (MV) are increasing, the relay contact is closed when the switch-on point is exceeded (**Range lower 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 (**Range upper value** - **Hysteresis**) and after the drop-out delay (**Switch off delay**).

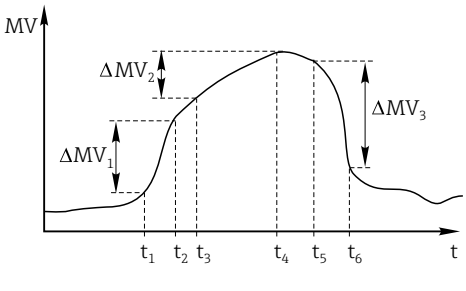
Hysteresis	Settings depend on the measured value	**Operating mode** ≠ **Change rate** The hysteresis is needed to ensure a stable switching behavior. The device software adds or subtracts the value set here to/from the limit value (**Limit value**, **Range lower value** or **Range upper value**). This 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.



71 Hysteresis taking the example of limit value overshoot

1 Limit value
2 Alarm range
3 Hysteresis range
$t_{1,2}$ An event is generated

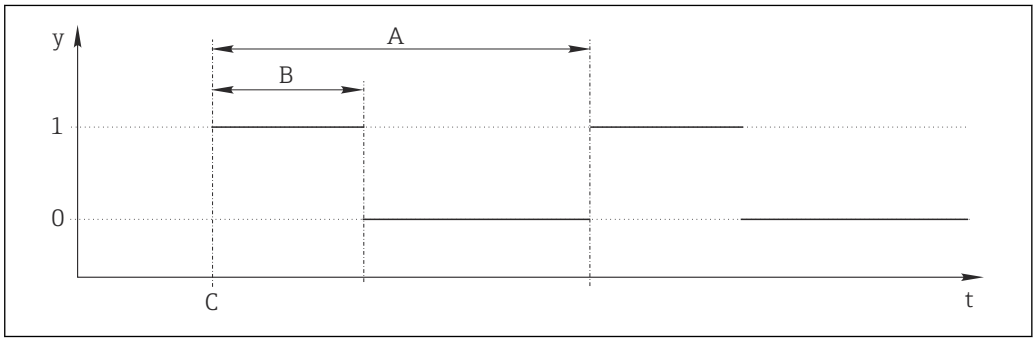
Start delay **Operating mode** ≠ **Change rate**	0 to 9999 s **Factory setting** 0 s	Synonyms: pick-up and drop-out delay
Switch off delay **Operating mode** ≠ **Change rate**		

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 monitored in this mode. If, in the specified time frame (**Delta time**), the measured value increases or decreases by more than the specified value (**Delta value**), an event 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**). Events are triggered by the following conditions in the example given: $t_2 - t_1 <$ **Delta time** and ΔMV1 > **Delta value** $t_4 - t_3 >$ **Auto Confirm** and ΔMV2 < **Delta value** $t_6 - t_5 <$ **Delta time** and ΔMV3 > **Delta value**
Delta time	00:00:01 ... 23:59:00 **Factory setting** 01:00:00	
Auto Confirm	00:01 to 23:59 **Factory setting** 00:01	
		

72 Rate of change

10.8.2 Time switch

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



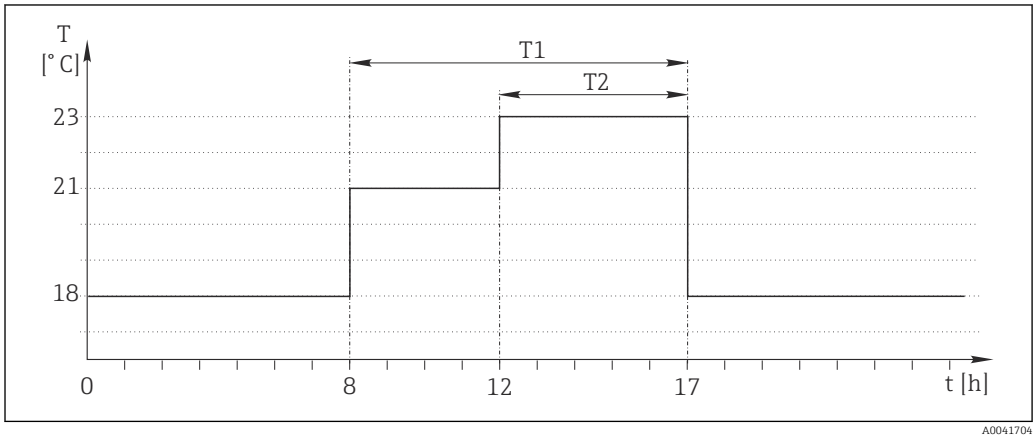
73 Signal pattern of a time switch

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 **Factory setting** Off	Switches the function on or off
Start date	01.01.2000 to 31.12.2099 **Format** DD.MM.YYYY	▶ Enter start date
Start time	00:00:00 to 23:59:59 **Format** hh.mm.ss	▶ Enter start time
Signal duration	00:00:03 to 2400:00:00 **Format** hh.mm.ss	Duration of the high signal level at the start of a cycle
Period	00:00:03 to 2400:00:00 **Format** hh.mm.ss	Duration of a cycle
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 °C from 08:00 every day, and then to 23 °C for 5 hours from 12:00. The temperature should be controlled to fall back down to 18 °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.



74 *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):

- **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)

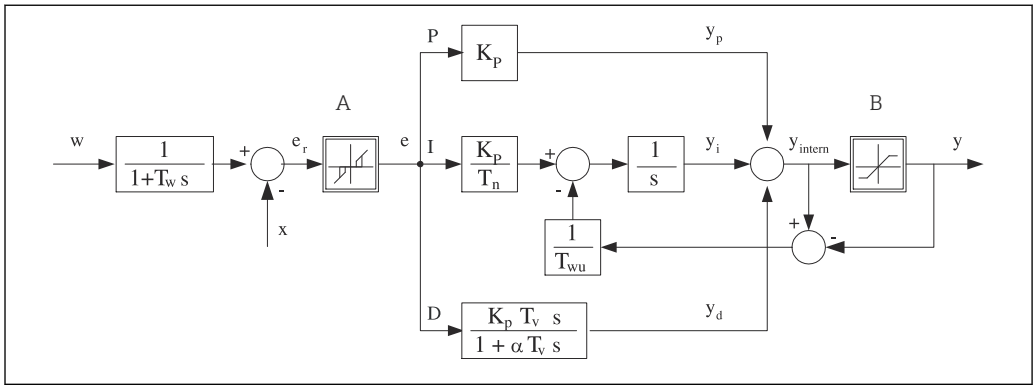
3. Use the formula as the data source of a relay.

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.

10.8.3 Controller

Controller structure in Laplace representation



75 *Block diagram of the controller structure*

A	*Neutral zone*	*I*	*Integral value*
B	*Output limiting*	*D*	*Derivative value*
K_p	*Gain (P-value)*	αT_V	*Damping time constant with α = 0 to 1*
T_n	*Integral action time (I-value)*	*e*	*Control deviation*
T_v	*Derivative action time (D-value)*	*w*	*Set point*
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? → **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, → **Xn**
  - Proportional band, → **Xp**
  - Integral action time (I-value), → **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	▶ First configure the controller and leave the switch at the factory setting (**Off**). Once you have made all the settings, you can assign the controller to an output and switch it on.
▶ Manual mode		
y	-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
x		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. → **Parameters** → 🖹 109 **Standard**: 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 **Factory setting** Inline	▶ Decide what type of process best describes your particular process.

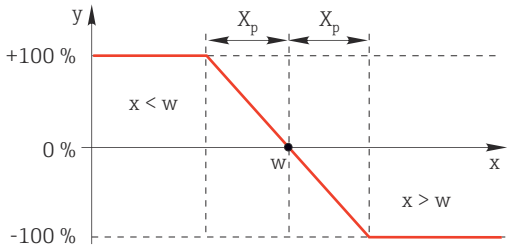
Batch process
The medium is in a closed system.
The task of the control system is to dose in such a way that the measured value (controlled variable) changes from its start value to its target value. No more dosing is needed once the set point has been reached and the system is stable. If the target 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.

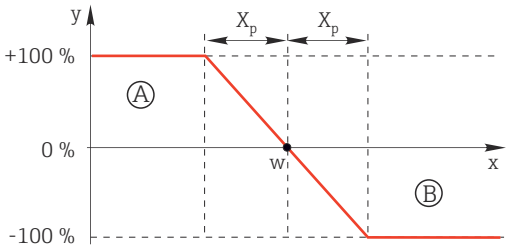
A mixture of both process types can often be found in practice: the semi-batch process. Depending on the ratio between the flow and the container volume, this arrangement behaves either like a batch process or an in-line process.

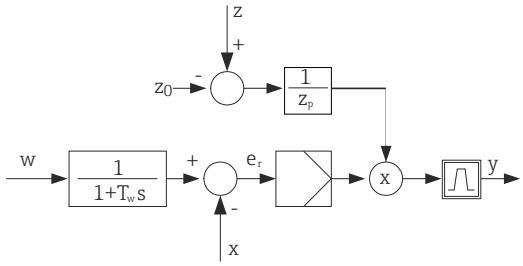
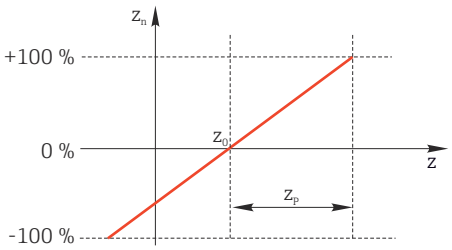
Controller type	**Selection** ▪ PID 1-sided ▪ PID 2-sided **Factory setting** PID 2-sided	Depending on which actuator you have connected, you influence the process in only one direction (e.g . heating) or in both directions (e. g. heating and cooling).

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.



76 *Relationship y = (w-x)/X_p*

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).  77 *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 **Factory setting** None	▶ Specify the input or output which should be the source of data for the controlled variable.
Measured value	**Selection** Depends on **Source of data** **Factory setting** None	▶ Specify the measured value that should be your controlled variable. 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 **Source of data**	▶ Specify the target value for the controlled variable.
Tw **Setup Level** = **Advanced**	0.0 to 999.9 s **Factory setting** 2.0 s	Time constant for the set point damping filter
▶ 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 = 200m^3/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 m^3/h, dosing should stop entirely (z_n = 0). → Select the zero point z_0 = 4 m^3/h and the proportional band Z_p= 196 m^3/h.		
Function	**Selection** ▪ Off ▪ Multiply ▪ Add **Factory setting** Off	Selecting multiplicative or additive feedforward control
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.

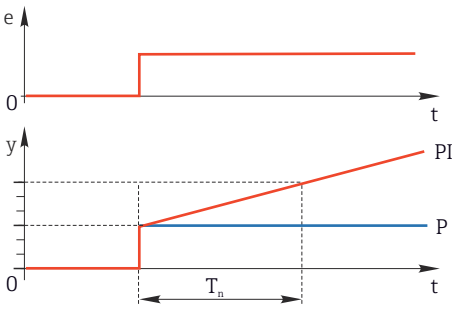
Menu/Setup/Additional functions/Controller 1 ... 2		
Function	**Options**	**Info**
Measured value	**Selection** Depends on **Source of data** **Factory setting** None	▶ Specify the measured value that should be your disturbance variable. You can use different measured values depending on the data source.
Zp	Range of adjustment depending on the selection of the measured value	Proportional band -->
Z0		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_n
- Derivative action time T_v
- Proportional band X_p

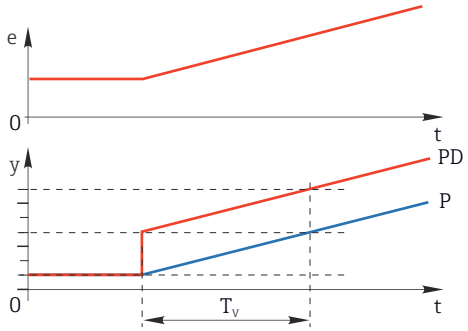
Setup Level = **Advanced**: With this setup level, you can also configure the following:
- Time constant T_{wu}
- Time constant α
- Width of the neutral zone X_n
- Width of the hysteresis range of the neutral zone X_{hyst}
- Clock time of the controller

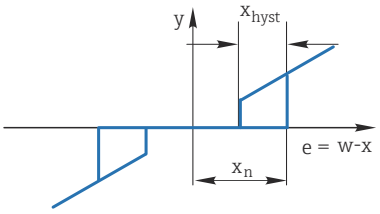
Tn	0.0 to 9999.0 s **Factory setting** 0.0 s	The integral action time specifies the effect of the I-value If **Tn** > 0 the following applies: **Clock** < **Twu** < 0.5(**Tn** + **Tv**)

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. **Clock** < **Twu** < 0.5(**Tn** + **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.  		
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	**Symmetric** There is only one control gain and this applies for both sides of the process. **Asymmetric** 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 **Source of data**	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 **Source of data**	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 **Source of data**	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 **Source of data**	x_n for x < w (controlled variable < set point)
XN High **Process balance** = **Asymmetric**		x_n for x > w (controlled variable > set point)

Menu/Setup/Additional functions/Controller 1 ... 2		
Function	**Options**	**Info**
XHyst	0.0 to 99.9 % **Factory setting** 0.0 %	Width of the hysteresis range of the neutral zone, relative component of x_n
 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 **Factory setting** Freeze	How should the controller react to a measured value that is no longer reliable? **Freeze** The manipulated variable is frozen at the current value **Fixed value** 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 **Outputs**
▶ Controller assignment view		Shows an overview of the inputs and outputs used

10.8.4 Cleaning programs for sensors

⚠ CAUTION

Cleaning not switched off during calibration or maintenance activities

Risk of injury due to medium or cleaning agent!

- ▶ If a cleaning system is connected, switch it off before removing a sensor from the medium.
- ▶ 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 → 37CAS40D)

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→ 114.

Chemoclean

An example is the use of the CYR10 injector unit to clean pH glass sensors. (CYR10 connection → 37)

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	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.
Postrinse time		

Chemoclean Plus

An example is the use of the CYR10 injector unit to clean pH glass sensors. (CYR10 connection → 🖹 37)

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	▶ Select the number of digital input signals (e. g. from limit position switches of the retractable assembly).
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 (= "off" or "closed") and 1 (= "on" 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 **Outputs**
▶ Cleaning program assignment view		Shows an overview of the cleaning processes

10.8.5 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.

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 sensors connected	Select the sensors and measured variables that should function as the minuend (**Y1**) or subtrahend (**Y2**).
Measured value		
Y2		
Measured value		
Difference value	Read only	View this value in a user-defined measuring screen or output the value via the current output.
▶ 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 **Factory setting** Off	On/off switch for the function
Y1	The options depend on the sensors connected	You can select a maximum of 3 different types of sensor that output the same measured value. **Example for temperature redundancy** You have a pH sensor and an oxygen sensor at inputs 1 and 2. Select the pH sensor as **Y1** and the oxygen sensor as **Y2**. **Measured value**: Select **Temperature** in each case.
Measured value		
Y2		
Measured value		
Y3 (optional)		
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 **Factory setting** Off	On/off switch for the function
pH source	Connected pH sensor	Set the input for the pH sensor and the input for the ORP sensor. Measured value interrogation is obsolete as you must select pH or ORP mV.
ORP source	Connected ORP sensor	
Calculated rH	Read only	View this value in a user-defined measuring screen or output the value via the current output.
▶ 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.

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 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.
Degassed conductivity	Connected conductivity sensor	
CO2 concentration	Read only	View this value in a user-defined measuring screen or output the value via the current output.
▶ 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.

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Dual conductivity		
Function	**Options**	**Info**
Calculation	**Selection** ▪ Off ▪ On **Factory setting** Off	On/off switch for the function
Inlet	The options depend on the sensors connected	Select the sensors that should function as the minuend (**Inlet**, e.g. sensor upstream from the ion exchanger) or subtrahend (**Outlet**, e.g. sensor downstream from the ion exchanger).
Measured value		
Outlet		
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 ▪ mS/m ▪ S/m **Factory setting** Auto	
Dual conductivity	Read only	View this value in a user-defined measuring screen or output the value via the current output.
▶ 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 **Factory setting** NaOH	The calculation is performed on the basis of Guideline VGB-R-450L of the Technical Association of Large Power Plant Operators (Verband der Großkesselbetreiber, (VGB)). **NaOH** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/273\}$ **NH3** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/243\}$ **LiOH** $pH = 11 + \log \{(\kappa_v - 1/3\ \kappa_h)/228\}$ κ_v ... **Inlet** ... direct conductivity κ_h ... **Outlet** ... acid conductivity
Inlet Measured value Outlet Measured value	The options depend on the sensors connected	**Inlet** Sensor upstream from the cation exchanger, "direct conductivity" **Outlet** Sensor downstream from the cation exchanger, "acid conductivity" Selection of the measured value is obsolete as it must always be **Conductivity**.
Calculated pH	Read only	View this value in a user-defined measuring screen or output the value via the current output.
▶ 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.

The Liquiline firmware offers you a powerful mathematics tool with the formula editor. You are responsible for the feasibility of your formula, and therefore for the feasibility of the result.

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^2
³	Cube	Numerical	Numerical	B^3

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^x	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
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 ▪ On **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. 1. Choose a maximum of three sources (A, B and C) for measured values. 2. For each source, choose the measured value to be calculated. ↳ All available signals - depending on the selected source - are possible measured values. 3. Enter the formula. 4. Switch on the calculation. ↳ The current measured values A, B and C as well as the result of the calculation using the formula are displayed.
Measured value	**Selection** Depends on the source	
A … C	The current measured value is displayed	

Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Formula		
Function	**Options**	**Info**
Formula	User-defined text	Table → 🖹 118 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** ▪ # ▪ #.# ▪ #.## ▪ #.### ▪ #.#### **Factory setting** #.##	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.

ℹ 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 the input signal of a phosphate analyzer to the AI module.
2. Connect an analog input signal of a volume flow meter to the AI module.

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

10.8.6 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 **Factory setting** None	Specify the input which should be the source of data for the diagnostic message.
Measured value	**Selection** depend on **Source of data** **Factory setting** None	Specify the measured value that should trigger the diagnostic message. You can use different measured values depending on the data source.
Active low	**Selection** ▪ Off ▪ On **Factory setting** On	**On**: The output value is equal to the inverse output value.
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" (→ Operating Instructions Memosens, BA01245C) or "Device-specific errors" (→ 126).
   ↳ 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: ▪ Display does not change and/or ▪ Device cannot be operated	Module not wired correctly	▶ Check modules and wiring.
	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 (only if self-priming) 4. Check all connectors and tighten if necessary.
	Cuvette dirty	1. Perform calibration with zero standard 2. Clean using manual cleaning routine, then repeat calibration with zero 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 not start	Action still active	
	Appropriate bottles not used	▶ Check status
	No sample available	Level detection (only for devices with sample collecting vessel)
	Device is in the fieldbus mode; no manual actions are possible	
	Dispenser run times have elapsed	
Calibration has failed	Stability criterion was not met	1. Check the configuration and perform manual calibration again 2. Check the hoses of the reagents
Current output, incorrect current value	Incorrect adjustment	▶ Check with integrated current simulation, connect mA meter directly to current output.
	Load too large	
	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 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.

Menu/Setup/Run the ../Extended setup/Diagnostics settings/Diag. behavior		
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** ▪ 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 [3]	
202	Selftest active	F	On	Off	Wait for self-test to be finished
216	Hold active	C	On	Off	Output values and status of the channel are on hold
241	Firmware failure	F	On	On	Internal device error 1. Update the software. 2. Contact the Service Department. 3. Replace the backplane (Service).
242	Firmware incomp.	F	On	On	
243	Firmware failure	F	On	On	
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 → use another card. 3. Incorrect firmware → repeat with suitable firmware. 4. Contact the Service Department.
302	Battery low	M	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
		S [1]	D [2]	F [3]	
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	C	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 defective	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	C	Off	Off	Service switch is switched on The device can be addressed at 192.168.1.212. ► Switch off the service switch to change to the saved IP settings.
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	**SD card** (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 1. Check mathematical function. 2. Check assigned input variables.
460	Output below limit	S	On	Off	Reasons ▪ Sensor in air ▪ Air pockets in assembly ▪ Sensor fouled ▪ Incorrect flow to sensor 1. Check sensor installation. 2. Clean sensor. 3. Change assignment of current outputs.
461	Output above limit	S	On	Off	
502	No text catalog	F	On	On	► Contact the Service Department.

No.	Message	Factory settings			Tests or remedial action
		S [1]	D [2]	F [3]	
503	Language change	M	On	Off	Language change failed ▶ Contact the Service Department.
529	Diag. setup active	C	Off	Off	▶ Wait for maintenance to be finished.
530	Logbook at 80%	M	On	Off	1. Save the logbook to the SD card and then delete the logbook in the device. 2. Set memory to circular buffer. 3. Deactivate logbook.
531	Logbook full	M	On	Off	
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 1. 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 1. 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 1. Check the configuration and perform a manual calibration again. 2. Contact the Service Department.
717	Photometer defective	F	On	On	Photometer defective Possible reasons: ▪ No lamp voltage ▪ No lamp power ▶ Contact the Service Department.

No.	Message	Factory settings			Tests or remedial action
		S [1]	D [2]	F [3]	
718	Cuvette covering	M	On	Off	Photometer check High degree of contamination - reliable measurement will not be possible soon 1. Clean analyzer manually. 2. Contact the Service Department.
719	Cuvette covering	F	On	Off	Photometer check buildup, high degree of contamination - measurement no longer possible 1. Start cleaning. 2. Contact the Service Department.
726	Liquids warning	M	On	Off	Consumable liquids, warning 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**.
727	Liquids alarm	F	On	Off	Consumable liquids, alarm 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**.
729	Filter candle change	M	On	Off	▪ Filter cartridge needs replacement ▪ The limit value for operating hours has been exceeded ▶ Replace the filter cartridge for the sample preparation system and reset the operating hours counter in the Diagnostics menu.
730	Cleaning solution	M	On	Off	▪ Level warning for cleaner of sample preparation system ▪ Depending on the duration of cleaning, the cleaning interval and external events, the remaining quantity is sufficient for a few hours or days 1. Top up cleaner for the sample preparation system. 2. Check the level switch for the cleaning solution.
731	Leakage detected	F	On	Off	Leak detected in the sample preparation system or 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**.

No.	Message	Factory settings			Tests or remedial action
		S [1]	D [2]	F [3]	
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.
931	Sampling time	M	On	Off	Standard pumping time exceeded ▪ Filter cartridge clogged ▪ Sample line partially blocked 1. Clean the filter cartridge. 2. Clean the sample line. 3. Replace the filter or sample line.
936	Temp. range exceeded	S	On	Off	Outside temperature for sample preparation system out of specification 1. Check application. 2. Check temperature sensor. 3. Check the configuration of the temperature sensor, sample preparation system and the heating.
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 disturbance variable is not OK ▶ Check application.
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. 2. Calibrate the system.
951 - 958	Hold active CH1 ..	C	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) ... Diagnostic module 8 (968)	S	Off	Off	Diagnostic module is enabled

No.	Message	Factory settings			Tests or remedial action
		S [1]	D [2]	F [3]	
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.	C	Off	Off	User has acknowledged the message displayed in the measuring menu.
975	Device restart	C	Off	Off	Device reset
976	PFM/PWM value high	S	On	Off	Pulse frequency modulation: output signal exceeded/undershot. Measured value outside the specified range. ▪ Sensor in air ▪ Air pockets in assembly ▪ Incorrect flow to sensor ▪ Sensor fouled 1. Clean the sensor 2. Check plausibility. 3. Adjust the PFM configuration.
977	PFM/PWM value low	S	On	Off	
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	CO_2 concentration (degassed conductivity) outside the measuring range
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 Diagnostic 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 [2)]	No	No	Yes	Yes
Analyzer calibration logbook	Analyzer calibration logbook	250	(Yes)	No	Yes	Yes
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

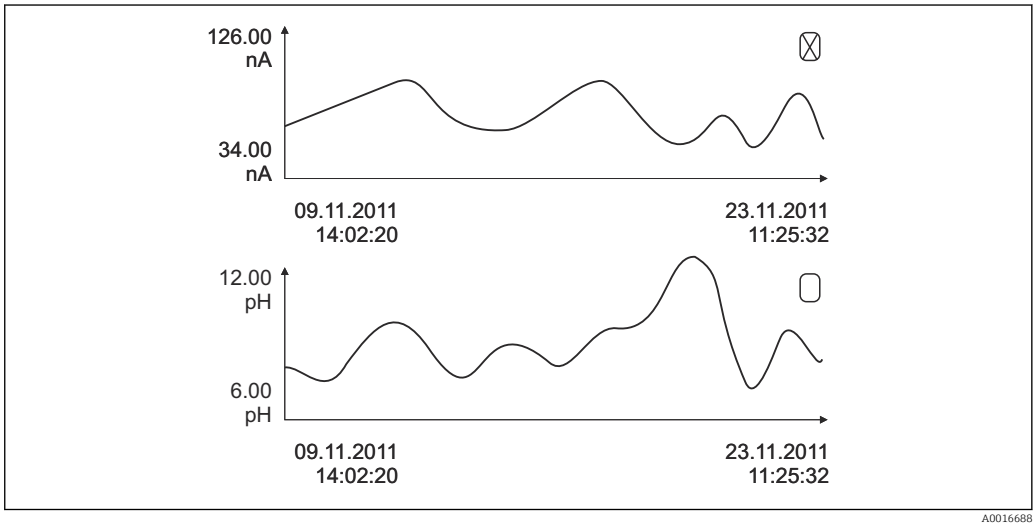
1) Data in brackets means this depends on the overall logbook
2) Suffices for 1 year of operation with a usual measuring interval

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
▶ 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
▶ 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
▶ 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.
▶ 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.



78 *Simultaneous display of two graphs, the top one is selected*

DIAG/Logbooks		
Function	**Options**	**Info**
▶ Analyzer data logbooks		Data logbooks for the data of the wet-chemical analyzers
▶ Data logbook SP1		In the case of two-channel devices, data logbook SP2 is also displayed
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 scroll 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 **General settings**/ **Logbooks**.
Select 2nd plot	Select another data logbook	You can view a second logbook at the same time as the current one.
▷ 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 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.
▶Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu **General settings**/ **Logbooks**.
▷ 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 detailed information.
▶Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu **General settings**/ **Logbooks**.

DIAG/Logbooks		
Function	**Options**	**Info**
▶ 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	▪ **First entry**: Defines the first entry saved in the logbook as the start time. ▪ **Date/Time**: Defines the set date/time as the start time.
Plotter end	**Selection** ▪ Last entry ▪ Date/Time **Factory setting** Last entry	▪ **First entry**: Defines the last entry saved in the logbook as the end time. ▪ **Date/Time**: Defines the set date/time as the end time.
▶ Show plot	Graphic display of the logbook entries	The entries are displayed according to your settings in the menu **General settings**/ **Logbooks**.
▷ Delete all entries	Action	You can delete all the absorption data logbook entries here.
▶ Data logbooks		Chronological list of the data logbook entries for sensors
Data logbook 1 … 8 <Logbook name>		This submenu is available for each data logbook that you have set up and activated.
Source of data	Read only	Input or mathematical function is displayed
Measured value	Read only	Measured value being recorded is displayed
Log time left	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**.
▶ 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.
▶ Show plot	Graphic display of the logbook entries	The display is according to your settings in the menu **General settings/Logbooks**.
Select 2nd plot	Select another data logbook	You can view a second logbook at the same time as the current one.
▷ Delete all entries	Action	You can use this to delete all data logbook entries.
▶ Save logbooks		
File format	**Selection** ▪ CSV ▪ FDM	▶ 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 make further edits here. [1]. You can import the FDM files into FieldCare and archive them so that they are tamper-proof.

DIAG/Logbooks		
Function	**Options**	**Info**
▷ All data logbooks ▷ Data logbook SP1 ▷ Absorption data logbook ▷ Raw data logbook ▷ Data logbook 1 … 8 ▷ All event logbooks ▷ Calibration logbook ▷ Diagnostic logbook ▷ Analyzer data logbook ▷Analyzer event logbook ▷Analyzer calibration logbook ▷ Configuration logbook ▷ HW version logbook ▷ Version logbook	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.
The file name is made up of the **Logbook ident** (**Menu**/**Setup**/**General settings**/**Logbooks**), an abbreviation for the particular logbook and a time stamp.		

1) 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 → **General 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, enter the order code into the search screen at the following address: www.endress.com/order-ident		
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	

DIAG/System information		
Function	**Options**	**Info**
▶ Sample preparation 1 … 2	Read only ▪ SP type ▪ Order code ▪ Serial number ▪ Hardware version ▪ Software version ▪ Orig. order code ext.	Depends on the type and number of sample preparations
▶ General information	Read only ▪ Current status ▪ SP type ▪ Order code ▪ Serial number ▪ Hardware version ▪ Software version ▪ Orig. order code ext.	This information is provided for every electronics module available. Specify the serial numbers and order codes when servicing, for example.
▶ 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.
▶ SD card	Read only ▪ Total ▪ Free memory	
▶ System modules		
Backplane	Read only ▪ Description ▪ Serial number ▪ Order code ▪ Hardware version ▪ Software version	This information is provided for every electronics module available. Specify the serial numbers and order codes when servicing, for example.
Base		
Display module		
Extension module 1 … 8		
▶ 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.

DIAG/System information		
Function	**Options**	**Info**
▶ 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 [3)]
- **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.

▶ 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** Off	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.
Current	2.4 to 23.0 mA **Factory setting** 4 mA	▶ Set the desired simulation value.

3) Not available for all sensor types.

DIAG/Simulation		
Function	**Options**	**Info**
▶ Alarm relay ▶ Relay x:y		Simulation of a relay state This menu appears once for each relay.
Simulation	**Selection** ▪ Off ▪ On **Factory setting** Off	If you simulate the relay state, this is indicated on the display by a simulation icon in front of the relay display.
State	**Selection** ▪ Low ▪ High **Factory setting** Low	▶ Set the desired simulation value. The relay switches in accordance with your setting when you switch on the simulation. On the measured value display, you see **On** (= **Low**) or **Off** (= **High**) for the simulated relay state.
▶ Meas. inputs		Simulation of a measured value (only for sensors) This menu appears once for each measuring input.
Channel : parameter		
Simulation	**Selection** ▪ Off ▪ On **Factory setting** Off	If you simulate the measured value, this is indicated on the display by a simulation icon in front of the measured value.
Main value	Depends on the sensor	▶ Set the desired simulation value.
Sim. temperature	**Selection** ▪ Off ▪ On **Factory setting** Off	If you simulate the temperature measured value, this is indicated on the display by a simulation icon in front of the temperature.
Temperature	-50.0 to +250.0 °C (-58.0 to 482.0 °F) **Factory setting** 20.0 °C (68.0 °F)	▶ Set the desired simulation value.
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 **Factory setting** Off	
State	**Selection** ▪ Low ▪ High	

11.13 Device test

11.13.1 Analyzer

DIAG/System testAnalyzer/Sample collector [1]		
Function	**Options**	**Info**
▷ Empty sample collector		The sample collecting vessel can be automatically emptied in this menu.
▷ Start		
▷ Stop		

1) Is only displayed if a collecting vessel is provided.

DIAG/System testAnalyzer/Sample preparation 1 (CAT820/CAT860) [1]		
Function	**Options**	**Info**
▶ Cabinet heating		Tests the housing heating
Cabinet temperature	Read only	Displays the current housing temperature
Mode	Read only	
▷ On for 10 minutes		The heating is switched on for 10 minutes.
▷ Off		The heating is switched off.
▷ Automatic		The heating is automatically switched on and off according to the housing temperature.
▶ Hose heating filter		Tests the hose heating (filter to pump)
Ambient temperature	Read only	Displays the current outside temperature
Mode	Read only	
▷ On for 10 minutes		The heating is switched on for 10 minutes.
▷ Off		The heating is switched off.
▷ Automatic		The heating is automatically switched on and off according to the outside temperature.
▶ Hose heating analyzer		Tests the hose heating (pump to analyzer)
Ambient temperature	Read only	Displays the current outside temperature
Mode	Read only	
▷ On for 10 minutes		The heating is switched on for 10 minutes.
▷ Off		The heating is switched off.
▷ Automatic		The heating is automatically switched on and off according to the outside temperature.
▷ Start sampling		The sample pump is switched on in interval mode in line with the settings under Menu/ Setup/Sample preparation
▷ Start sampling, continuous mode		The sample pump is switched on in permanent mode.
▷ Stop sampling		The sample pump is switched off.

1) Depends on the connected sample preparation

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

DIAG/System testAnalyzer/Sample collector valve [1]		
Function	**Options**	**Info**
▷ Towards sample collector		If CAT860 sample preparation is connected, this menu item is also displayed. The valve for sample supply is opened towards the collecting vessel.
▷ Towards outlet		If CAT860 sample preparation is connected, this menu item is also displayed. The valve for sample supply is opened towards the outlet.
Towards sample collector 1		This menu item is also displayed for two-channel devices. The valve for sample supply is opened towards collecting vessel 1.
Towards sample collector 2		This menu item is also displayed for two-channel devices. The valve for sample supply is opened towards collecting vessel 2.
Towards analyzer 1		This menu item is additionally displayed in the case of 2 cascaded analyzers. The valve for sample supply is opened towards analyzer 1.
Towards analyzer 2		This menu item is additionally displayed in the case of 2 cascaded analyzers. The valve for sample supply is opened towards analyzer 2.

1) Test the valve for sample supply. This menu item is additionally displayed in the case of two-channel devices, 2 cascaded analyzers or if CAT860 sample preparation is connected.

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. The actual values can vary without a malfunction having occurred.
Digital supply 2: 3.3V		
Analog supply: 12.5V		
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.
- Operating time cooling module
  The counter can also be reset here.
- Operating time sample preparation 1 … 2
  - Device
  - Filter
  - Pump hose
  - Operation < -20 °C
    Only if sample heating is activated
  - Operation > 50 °C
    Only if sample heating is activated

11.16 Firmware history

Date	Version	Changes to firmware	Documentation
03/2021	01.09.00	Extension ▪ Support for new base module ▪ PROFINET Improvements ▪ Air bubble detection, measurement is repeated if the threshold value is overshot ▪ Minimum time for compressed air cleaning reduced to 1 s	BA01585C/07/../04.21 BA01245C/07/../08.20
01/2020	01.07.00	Extension Dilution function	BA01585C/07/../03.20 BA01245C/07/../07.19

06/2017	01.06.04	Extension
		▪ New mathematical function **Formula**
		▪ Improvements
		  ▪ Chemical cleaning (CAT860)
		  ▪ Enhanced help text
			BA01585C/07/../02.17
			BA01245C/07/../05.17

10/2016	01.06.03	Original software	BA01585C/07/../01.16 BA01245C/07/../04.16

This product uses Lua, which is distributed under the following license:

Copyright © 1994–2013 Lua.org, PUC-Rio.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

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.

⚠ 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.

⚠ 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

Interval	Maintenance work
After every reagent replacement, during commissioning, maintenance and repair	Carry out zero point calibration
6 weeks	*Version without cooling module:* ▪ Replace reagent CY80AL (typically; depending on the temperature and measuring range) ▪ Replace standard CY80AL (typically; with a calibration interval of 48 h)
3 months	(Depending on the application; as required) clean the (optional) sample collecting vessel
5 months	Replace cleaner CY800 (typically; with a cleaning interval of 48 h)
6 months	▪ Clean filter mats ▪ Replace dispensers
12 months	▪ (If necessary) replace hoses: Norprene, black ▪ Replace filter mats ▪ Replace the O-ring in the cover of the sample collecting vessel

Interval	Maintenance work
2 to 3 years	(If necessary) replace hoses: ▪ C-Flex, white ID 3.2 mm ▪ C-Flex, white ID 6.4 mm
2 or 4 years	Measuring interval < 1 hour: Replace Liquid Manager every 2 years Measuring interval ≥ 1 hour: Replace Liquid Manager every 4 years
If required	▪ Clean the housing ▪ Check the fan of the cooling module for dirt and vacuum clean if necessary ▪ Clean CAT8x0 sample preparation (automatic cleaning) ▪ Rinse the system

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: → 152
- Liquid manager replacement
  Operating time counter, can be reset here. Replace Liquid Manager: → 153
- Filter mats replacement
  Operating time counter, can be reset here. Replace filter mats: → 151
- Sample preparation 1 … 2
  Operating time counter, can be reset here. Operating hours of:
  - Filter
  - Pump hose
  - Replace filter and hose: → see the Operating Instructions for the sample preparation system
- Decommissioning
  → 154

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

⚠ CAUTION

Risk of injury from reagents escaping

▶ Before replacing, always rinse the system 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.

Cleaning CAT8x0 sample preparation (automatic cleaning)

The Liquiline System CAT8x0 for sample preparation facilitates regular backflushing of the filter and the sample hoses.

▶ Select a suitable cleaning interval under **Menu/Setup/Sample preparation/Sample preparation 1**.

Rinsing the system

Measurement, cleaning or calibration is not possible while the bottles are removed.

Rinsing the collecting vessel with sample and draining it

1. Stop the sample supply.
2. If you have not already done so,
   set the manual mode.
3. Select **Menu/Operation /Maintenance/Decommissioning/Sample collector/ Empty sample collector/Start**.
   ↳ The system is automatically rinsed with sample and emptied. This process takes approx. 4 minutes.

Rinsing the analyzer with water

1. Open all the reagent bottles and carefully remove the hoses. Open all the bottles if you wish to replace dispensers or hoses.
2. Dry the ends of the hoses with a clean paper towel.
3. Place the ends of the hoses into an empty beaker.
4. Trigger the action: **Menu/Operation/Maintenance/Decommissioning/Rinse with water**.
5. Immerse all the hoses into a beaker with approx. 200 ml of distilled water in order to rinse the system with water.
6. Trigger the action again: **Menu/Operation/Maintenance/Decommissioning/Rinse with water**.
7. Remove the hoses from the beaker and dry them with a clean paper towel.

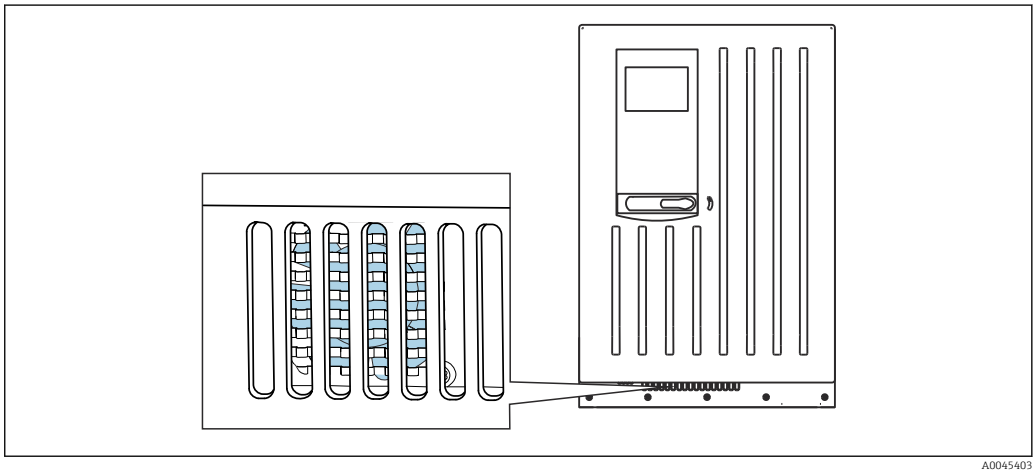
Cleaning the (optional) sample collecting vessel

Cleaning the collecting vessel

Trigger the rinsing and draining of the collecting vessel before rinsing the analyzer → 148.

1. Remove all the hoses from the sample collecting vessel and the cable of the level monitoring system and take the sample collecting vessel out of the holder unit.
2. Open the sample collecting vessel by turning the cover in the clockwise direction.
3. Clean the sample collecting vessel with a small brush and plenty of water.
4. Return the collecting vessel to the holder unit and connect up all the hoses again correctly.
5. Start the sample preparation system.
6. Press the soft key **MODE** and select **Continue automatic mode** to start normal measurement.

Cleaning the fan of the cooling module



79 *Fan of the cooling module (behind the ventilation grille)*

1. Check the fan regularly for dirt.
2. In environments with a heavy particle load:
   vacuum clean regularly from outside.

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 that you wish to replace by removing the hoses on the Liquid Manager. 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 Liquid Manager.
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. If bottle level monitoring is activated (**Menu/Setup/Analyzer/Extended setup/ Diagnostics settings/Bottles**), you must reset this under **Menu/Operation/ Maintenance/ Bottle change mode/Bottle insertion/Reset filling levels**.
7. 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**.
8. 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. Remove the bottles containing standard S1 by removing the hose from the bottle. Use a paper towel to catch any reagents that may escape. This prevents any contamination of the zero standard.
3. Replace the standard with zero standard.
4. Connect the zero standard to the Liquid Manager, connection S1.
5. Select **Menu/Operation /Maintenance/Bottle change mode/Bottle insertion/ Bottle selection**.
6. Select **Standard S1** and press **OK** to confirm.
7. 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

1. Replace the zero standard with the 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.
2. Connect the standard calibration solution to the Liquid Manager.
3. Select **Menu/Operation /Maintenance/Bottle change mode/Bottle insertion/ Bottle selection**.
4. Select **Standard S1** and select **OK** to confirm.

5. Select **Confirm bottles inserted**.

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**).

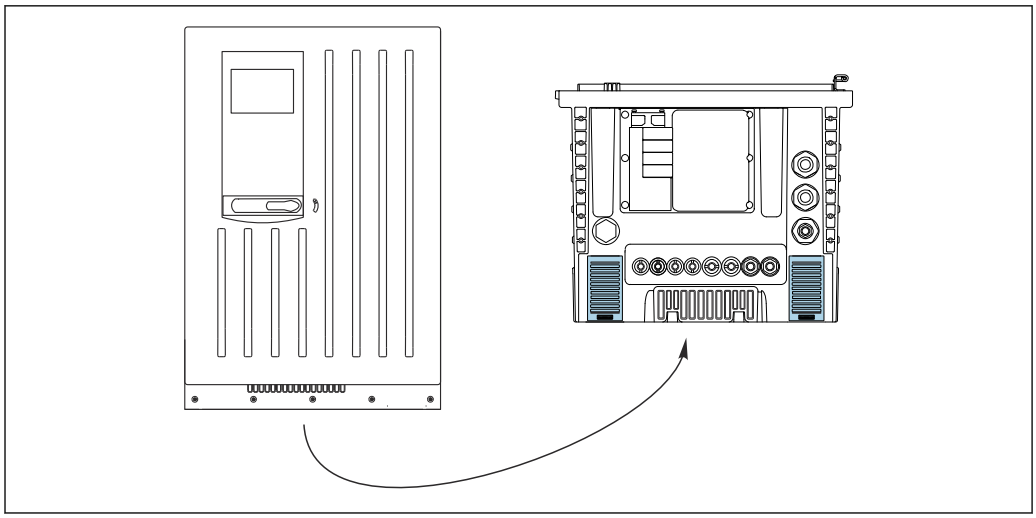
12.2.6 Replacing the hoses

You require the following parts:
- From the CAV800 maintenance kit:
  - NORPRENE hose, ID 1.6 mm
  - C-Flex hose, ID 3.2 mm
  - C-Flex hose, ID 6.4 mm
  - Hose connector
- 1 pair of gloves that are resistant to the reagents used

1. Rinse the system. → 148
   ↳ There should not be any more sample left in the sample collecting vessel.
2. Remove the bottles and the bottle tray.
3. Remove the cover of the carrier board.
4. Replace the hoses with hoses of the same diameter and length. Attach hose labels to the new hoses.
5. Route drain hose D6 **behind** dispenser 7.
6. Secure the cover and place the bottle tray back into the housing.
7. Connect the bottles to the appropriate covers and hoses.
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. Press the **MODE** soft key and select **Continue automatic mode** or **Start automatic mode**.

12.2.7 Replacing filter mats

You require the following parts:
Filter mats (part of the CAV800 maintenance kit)



80 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:
  - NORPRENE hose, ID 1.6 mm
  - 10 ml dispensers with adapter
  - 2.5 ml dispensers with adapter
- 1 pair of gloves that are resistant to the reagents used

Preparing to replace dispensers

1. Rinse the system.→ 🖹 148
2. Remove the bottles including the reagent hoses and the bottle tray.
3. Remove the cover of the carrier board.

Removing dispensers

1. Select **Menu/Operation/Dispenser replacement/Dispenser selection**.
2. Select the dispensers that you want to replace.
3. Select **Draw up dispenser**.
4. Open the dispenser holder by pressing both snap-fit hooks together and removing it.
5. Turn the dispenser counterclockwise to remove it from the Liquid Manager.
6. 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 dispensers

1. Screw a new dispenser onto the Liquid Manager. 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. Make sure that the drain hose D6 is routed behind dispenser 7.
3. Secure the cover and place the bottle tray back into the housing.
4. Connect the reagent hoses to the corresponding connections on the Liquid Manager.
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**.

12.2.9 Replacing the Liquid Manager

You require the following parts:
CAV800-N1xx+PU for CA80AL

Preparations to replace the Liquid Manager

1. Rinse the system (see the "Rinsing the system" section).
2. Remove the bottles and the bottle tray.
3. Remove the cover of the carrier board.

Removing the dispensers

1. **Menu/Operation/Dispenser replacement/Dispenser selection** Select .
2. Select all the dispensers.
3. **Draw up dispenser** Select .
4. Disconnect the power to the analyzer.
5. Open the dispenser holder by pressing both snap-fit hooks together and removing it.
6. Turn the dispenser clockwise to remove it from the Liquid Manager.
7. 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.

Replacing the Liquid Manager

1. Release and remove the 4 Allen screws (4 mm) on the Liquid Manager.
2. Disconnect the two plug-in connectors of the Liquid Manager from the main PCB.
3. Release the four torx screws on the stepping motor of the old Liquid Manager. Remove the stepping motor of the old Liquid Manager.
4. Mount the stepping motor on the new Liquid Manager.
5. Install the new Liquid Manager in the reverse order.

Reinserting the dispensers

1. Screw a new dispenser onto the Liquid Manager. 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. Make sure that the drain hose D6 is routed behind dispenser 7.

Reinserting the bottles and starting the analyzer again

1. Secure the cover and place the bottle tray back into the housing.
2. Connect the bottles to the appropriate covers and hoses.
3. Switch the analyzer back on.
4. **Menu/Operation** Select /**Maintenance/Bottle change mode/Bottle insertion/ Bottle selection** select .
5. Select all the bottles and press **OK** to confirm.
6. **Confirm bottles inserted** Select .

Triggering a calibration

1. The system must be calibrated after a replacement routine. **Menu/Operation/ Manual operation/Determine calibration factor** select .
2. After the calibration go back to **MODE/Continue automatic mode** or **MODE/Start automatic mode**appears.

12.3 Taking out of service

⚠ 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.

NOTICE

Do not operate the analyzer for longer than 5 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. Empty the sample collecting vessel
3. Rinse the system

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**.

12.3.2 Emptying the sample collecting vessel

1. **Menu/Operation /Maintenance/Decommissioning/Sample collector/Empty sample collector/Start** must be selected.
   ↳ The system is automatically rinsed with sample and emptied. This process takes approx. 4 minutes.
2. In the case of a two-channel device, repeat the procedure for the second sample collecting vessel.

12.3.3 Rinsing the system

1. Open all the reagent bottles and carefully remove the hoses. Open all the bottles if you wish to replace dispensers or hoses.
2. Dry the ends of the hoses with a clean paper towel.
3. Place the ends of the hoses into an empty beaker.
4. Once the action is completed, select **Menu/Operation/Maintenance/Decommissioning/Rinse analyzer** must be selected.
5. Immerse all the hoses (RK, RN, S1, P) in a beaker containing approx. 200 ml (6.76 fl.oz) of distilled water in order to rinse the system with water.
6. Select **Menu/Operation /Maintenance/Decommissioning/Sample collector/Empty sample collector/Start** must be selected.
   ↳ The system is automatically rinsed with sample and emptied. This process takes approx. 4 minutes.
7. Remove the hoses from the beaker and dry them with a clean paper towel.
8. Select **Menu/Operation/Maintenance/Decommissioning/Rinse analyzer** once again to rinse the hoses with air.
9. The analyzer can now be disconnected from the mains supply.

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 Endress+Hauser for disposal under the applicable conditions.

Dispose of batteries correctly

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

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 Sample preparation

Liquiline System CAT810
- Pressure pipe sampling and microfiltration
- Order according to product structure
  (--> Online Configurator, www.endress.com/cat810)
- Technical Information TI01138C/07/EN

Liquiline System CAT820
- Sampling and membrane filtration
- Order according to product structure
  (--> Online Configurator, www.endress.com/cat820)
- Technical Information TI01131C/07/EN

Liquiline System CAT860
- Pressure pipe sampling and membrane filtration
- Order according to product structure
  (--> Online Configurator, www.endress.com/cat860)
- Technical Information TI01137C/07/EN

The Liquiline System CAT860 can only be operated with a Liquiline System CA80 single-channel device.

14.1.2 Installation accessories

Kit, post with bracket CA80, outd.
- Post 60 x 60 x 1800 mm, stainless steel 1.4571
- Post mount clamp CA80xx
- Kit installation instructions
- Order No. 71458285

14.1.3 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
  CY80AL
- Cleaner CY800 (for hoses in the device)
- Cleaner CY820 (for hoses of sample preparation system and of sample collecting vessel)
- CAC880, inlet and outlet hoses for CA80

14.1.4 Maintenance kit CAV800

Order according to product structure (https://www.endress.com/device-viewer)

Standard
- Dispensers, 6 x 2.5 ml and 4 x 10 ml, including adapter
- Hoses
- Silicone grease, medium-viscosity, tube 2 g
- Plug
- Sealing caps
- Filter mats

Optional
- Inlet and outlet hoses
- Liquid Manager 3 reagents without motor
- Collecting vessel, beaker (2 pcs.)

14.1.5 Upgrade kits CAZ800

Kit for upgrade with sample collecting vessel
- Sample collecting vessel with level monitoring, pre-fitted on mounting bracket
- Hoses, connection adapters
- Activation code
- Order No. CAZ800-N1A1

Kit for upgrade to two-channel device
- Valve for switching sample flow
- Two sample collecting vessels with level monitoring, pre-fitted on mounting bracket
- Hoses, connection adapters
- Activation code
- Order No. CAZ800-N1A2

Kit for upgrade for second, downstream analyzer [4)]
- Valve for switching sample flow
- Hoses, connection adapters
- Activation code
- Order No. CAZ800-N1M1

Kit for dilution function
Order No. CAZ800-AAN5

Kit for upgrading the dilution function
- Hose with identification marking
- Modified cable gland
- Activation code
- Order No. CAZ800-N1N5

14.1.6 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

Technical Information TI01493C

4) Not for analyzers operated with CAT860 and not for two-channel versions.

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

Technical Information TI01497C

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

Technical Information TI01574C

Memosens CPS71E
- pH sensor for chemical process applications
- 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
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e

Technical Information TI01497C

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

Technical Information TI00191C

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

Technical Information TI01494C

Memosens CPS42E
- ORP sensor for process technology
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps42e

Technical Information TI01575C

Memosens CPS72E
- ORP sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps72e

Technical Information TI01576C

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

Technical Information TI01577C

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

Technical Information TI00191C

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

Technical Information TI00182C

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

Technical Information TI01528C

Oxygen sensors

Oxymax COS51D
- Amperometric sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos51d

Technical Information TI00413C

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

14.1.7 Cable junction with Velcro strip

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

14.2 Communication-specific accessories

14.2.1 Additional functionality

▶ 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 cables

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 mm^2 + shielding)
- Sold by meter, Order No.: 51502543

14.3.2 SD card

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

15 Technical data

15.1 Input

Measured variables	Al [µg/l, ppb]
Measuring range	15 to 1000 µg/l (ppb) Al
Types of input	▪ 1 or 2 measuring channels (analyzer main parameter) ▪ 1 to 4 digital sensor inputs for sensors with Memosens protocol (optional) ▪ Analog current inputs (optional) ▪ Binary inputs (optional)
Input signal	Depending on version 2 x 0/4 to 20 mA (optional), passive, potentially isolated
Current input, passive	**Span** > 0 to 20 mA **Signal characteristic** Linear **Internal resistance** Non-linear **Test voltage** 500 V
Cable specification (for optional sensors with Memosens technology)	**Cable type** Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector (optional) **Cable length** Max. 100 m (330 ft)

15.2 Output

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 alarm

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^2 (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 A
- All 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, cosΦ = 0.8 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_h
Device type	$155E_h$
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	▪ 1 MSCY0 connection (cyclical communication, master class 1 to slave) ▪ 1 MSAC1 connection (acyclical communication, master class 1 to slave) ▪ 2 MSAC2 connections (acyclical communication, master class 2 to slave) ▪ Device lock: The device can be locked using the hardware or software. ▪ Addressing using DIL switches or software ▪ GSD, PDM DD, DTM

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
Supported features	Address can be configured using switch or software

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 (product type: 0x2B)	
Manufacturer ID	$0x049E_h$	
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 → 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 AO (analog output) + status + unit ▪ 8 DO (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	$0x11_h$
Device type ID	$0x859F_h$
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	▪ 1 x AR (IO Controller AR) ▪ 1 x AR (IO-Supervisor Device AR connection allowed) ▪ 1 x Input CR (Communication Relation) ▪ 1 x Output CR (Communication Relation) ▪ 1 x Alarm CR (Communication Relation)
Configuration options for measuring device	▪ Web browser ▪ Manufacturer-specific software (FieldCare, DeviceCare) ▪ Device master file (GSD), can be read out via the integrated web server of the measuring device
Configuration of the device name	DCP protocol
Supported functions	▪ Identification & maintenance Simple device identification via: ▪ Process control system ▪ Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature (FLASH_ONCE) via the local display for simple device identification and assignment ▪ Device operation via operating tools (e.g. FieldCare, DeviceCare)
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	▪ Remote-controlled device configuration(1 session) ▪ Save/restore device configuration (via SD card) ▪ Logbook export (file formats: CSV, FDM) ▪ Access to Web server via DTM or Internet Explorer ▪ Login ▪ Web server can be switched off

15.6 Power supply

Supply voltage

- 100 to 120 V AC / 200 to 240 V AC
  or 24 V DC (not available for "Outdoor" version)
- 50 or 60 Hz

Fieldbus connection

Supply voltage: not applicable

Power consumption

All versions except "Outdoor" version

130 VA + 660 VA per hose heater, max. 1450 VA

24-V version: max. 105 W

"Outdoor" version

680 VA + 660 VA per hose heater, max. 2000 VA (version with cooling system) [5]

Fuse

5 x 20 mm 10 A/250 V fine-wire fuse for hose trace heating system

Cable entries

- 4 x bores for M16, G3/8, NPT3/8", Memosens connection [6]
- 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$^{3}/_{8}$"	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")

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

5) The power value indicated on the nameplate refers to the power consumption when commissioning at 5 °C (41 °F) after an operating time of one minute.
6) In the case of the "Outdoor" version, 2 bores are occupied; for this reason only 2 Memosens sensors are possible

Sensor connection (optional)

Sensors with Memosens protocol

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

15.7 Performance characteristics

Maximum measured error [7)]

2 % of end of measuring range

With dilution and dilution factor 5:
additionally 2.0 % of end of measuring range

Maximum measured error for sensor inputs

→ Documentation of the connected sensor

Maximum measured error for current inputs and outputs

Typical measured errors:

< 20 µA (with current values < 4 mA)

< 50 µA (with current values 4 to 20 mA)

at 25 °C (77° F) in each case

Additional measured error depending on the temperature:
< 1.5 µA/K

Repeatability [7)]

▪ ±10 µg/l (ppb) (to 300 µg/l (ppb))
▪ ±20 µg/l (ppb) (300 to 1000 µg/l (ppb))

With dilution and dilution factor 5:
Additionally 1.5 % of end of measuring range

Repeatability of sensor inputs

→ Documentation of the connected sensor

Measuring interval

Continuous (10.5 min), adjustable 10 min to 24 h

7) 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	Without dilution module 20.5 ml (0.69 fl oz)/measurement With dilution module ▪ Sample: 18 to 22 ml (0.61 to 0.74 fl oz)/measurement (depends on dilution factor) ▪ Dilution water: 17 to 21 ml (0.57 to 0.71)/measurement (depends on dilution factor)

Reagent requirement	RB, RK:	60 µl (0.002 fl.oz) per measurement	0.173 l (5.85 fl.oz) per month given a measuring interval of 15 minutes
	RN:	100 µl (0.003 fl.oz) per measurement	0.288 l (9.74 fl.oz) per month given a measuring interval of 15 minutes

Standard requirement	Given a calibration interval of 48 h approx. 800 ml (27.05 fl.oz) per month
Calibration interval	1 h to 90 days, depending on the application and ambient conditions
Maintenance interval	Every 6 months, depending on the application
Maintenance effort	▪ Weekly: visual inspection ▪ Half-yearly: 2 hours

15.8 Environment

Ambient temperature range	**All housing versions except "Outdoor" version** +5 to +40 °C (41 to 104 °F) **"Outdoor" version** -20 to +40 °C (-4 to 104 °F)
Storage temperature	–20 to 60 °C (–4 to 140 °F)
Humidity	10 to 95 %, non-condensing
Degree of protection	IP55 (cabinet, analyzer stand), TYPE 3R (cabinet, analyzer stand)
Electromagnetic compatibility [8)]	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

8) Sufficient mains quality is required to operate the product as designated.

Pollution degree	Pollution level 2

15.9 Process

Sample temperature	4 to 40 °C (39 to 104 °F)
Consistency of the sample	Low solids content (turbidity < 50 NTU), aqueous, homogenized
pH value of the sample	< 6, measurement according to DIN ISO 10566:1999
Sample supply	Unpressurized

15.10 Mechanical construction

Dimensions → 16

Weight

Order version	Weight
Cabinet version	39.5 kg (87.1 lbs)
Open installation	31.5 kg (69.45 lbs)
Analyzer stand	72.5 kg (159.8 lbs)

Materials

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	
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	
Dispensers	Plastic PP and elastomer TPE
Liquid Manager	Plastic PP and elastomer FKM
Hoses	C-Flex, NORPRENE
Optical window	Glass
Molded seal	Elastomer EPDM
Drain pipe	Plastic PP

Sample collecting vessel (optional) ▪ Beaker ▪ Cover ▪ Level detector pins ▪ Seal	 ▪ Plastic PMMA ▪ Plastic PP ▪ Stainless steel 1.4404 (V4A) ▪ EPDM
Valve (optional)	PVDF

Process connection	Sample inlet:	
	With sample collecting vessel	Plug-in connector for rigid hoses with OD 4 mm
	Without sample collecting vessel	Hose barb for flexible hoses with ID 1.6 mm
	Dilution water:	Hose barb for flexible hoses with ID 3.2 mm
	Outlet:	Hose barb for flexible hoses with ID 13 mm

Hose entries	4 x bores for M32 for sample inflow and outflow

Hose specification (self-priming analyzer)	▪ Clearance: max. 1.0 m (3.3 ft) ▪ Height: max. 0.5 m (1.6 ft) ▪ Hose ID: 1.6 mm ($^{1}/_{16}$ in)

Index

A

Accessories
- Sample preparation . . . 158

Accessory
- For installation . . . 158
- Maintenance kit . . . 159
- Reagent set . . . 158
- Sensors . . . 159
- Standard solution . . . 158

Activation code . . . 66
Adapting the diagnostic behavior . . . 124
Additional functions
- Cleaning programs . . . 111
- Controller . . . 104
- Limit switch . . . 97
- Mathematical functions . . . 114
- Time switch . . . 101

Address . . . 15
Alarm relay . . . 91
Ambient temperature . . . 174
Analyzer
- Additional functions . . . 97
- Binary inputs and outputs . . . 79
- Configuration . . . 51
- Configuration menu . . . 67
- Connecting . . . 25
- Current inputs . . . 78
- Current outputs . . . 88
- EtherNet/IP . . . 96
- Integrating into the system . . . 41
- Modbus . . . 96
- Mounting . . . 18
- Relay . . . 91
- Signal outputs . . . 88
- Switching on . . . 51

Assignment views . . . 54

B

Base mounting . . . 19
Basic settings . . . 54
Basic setup . . . 51
Bus address . . . 39
Bus termination . . . 38

C

Cable entries . . . 172
Cable specification . . . 166, 172
Calculated pH value . . . 118
Changing the password . . . 66
Check
- Connection . . . 40
- Installation . . . 24
- Installation and function . . . 50

Chemoclean . . . 37, 112
Chemoclean Plus . . . 113
Chlorine regulation with feedforward control . . . 80
Cleaning cycle . . . 114
Cleaning function . . . 95
Cleaning programs
- Chemoclean . . . 112
- Chemoclean Plus . . . 113
- Manual cleaning . . . 114
- Standard cleaning . . . 112

Cleaning unit . . . 37
Commissioning
- Basic setup . . . 51
- Steps . . . 48
- Switching on . . . 51

Configuration
- Binary inputs . . . 85
- Binary outputs . . . 86

Configure
- Actions . . . 46
- Numerical values . . . 46
- Picklists . . . 46
- Tables . . . 47
- User-defined text . . . 47

Connection
- Analyzer . . . 25
- Cable entries . . . 172
- Check . . . 40
- Fieldbus . . . 37
- Hose entries . . . 176
- Optional module . . . 34
- Sensors . . . 33
- Supply voltage . . . 172
- Web server . . . 41, 43

Controller . . . 92, 104
Controller structure . . . 104
Current inputs . . . 78, 166
Current outputs . . . 88, 168

D

Data management . . . 64
Date . . . 55
Declaration of Conformity . . . 15
Degassed conductivity . . . 116
Degree of protection . . . 174
Description of the product . . . 9
Design of the product . . . 9
Designated use . . . 7
Device drivers . . . 41
Device status . . . 53
Device variables . . . 95
Device-specific diagnostic messages . . . 126
Device-specific errors . . . 122
Diagnostic messages
- Adapting . . . 124
- Classification . . . 124
- Device-specific . . . 126
- Fieldbus . . . 123
- Local display . . . 123

Outputting via the relay 94
Sensor-specific 132
Web browser 123
Diagnostic modules 121
Diagnostics list 133
Dimensions 16, 175
Display 53
Disposal 156
Documentation 6
DTM 41
Dual conductivity 117

E
Electrical safety 174
Electromagnetic compatibility 174
Ensuring the degree of protection 39
Equipment architecture 12
EtherNet/IP 44, 63, 96, 170
Event logbook 133
Exporting the setup 65
Extended setup 60

F
Fieldbus
Connecting 37
Termination 38
Firmware history 144
Firmware update 64
Formula 118
Function check 50
Fuse 172

H
Hardware settings 38
Hold settings 55
Hook and loop Velcro fasteners 163
Hose connection diagram 48
Hose entries 176
Hose specification 176
Humidity 174

I
Incoming acceptance 14
Input signal 166
Inputs
Binary 79
Current inputs 78
Installation
Check 24
Conditions 16
Installation check 50

L
Laplace representation 104
Limit switch 92, 97
Loading the setup 65
Locking/unlocking operating keys 45
Logbooks 56, 134

M
Maintenance 146
Maintenance tasks 147
Manipulated variable 92
Manual mode 147, 154
Materials 175
Mathematical functions 114
Calculated pH value 118
Degassed conductivity 116
Difference 115
Dual conductivity 117
Formula 118
Redundancy 115
rH value 116
Measured variables 166
Measuring device
Configuration 51
Connecting 25
Integrating into the system 41
Mounting 18
Switching on 51
Measuring mode 53
Measuring range 166
Measuring system 9
Menu
Additional functions 97
Analyzer 54, 67
Binary inputs and outputs 79
Current inputs 78
Current outputs 88
EtherNet/IP 96
Maintenance 147
Modbus 96
Relay 91
Signal outputs 88
Modbus 44, 62, 96
Modbus RS485 169
Modbus TCP 170
Mounting 18
Location 17

N
Nameplate 14

O
Operating language 51
Operating menu 45
Operating time information 144
Operation
Access to the operating menu via the local display 45
Additional functions 97
Analyzer 67
Binary inputs and outputs 79
Configure 46
Current inputs 78
Current outputs 88
Display 53
EtherNet/IP 96
General settings 54

Integrating the measuring device into the system . 41
Modbus 96
Relay 91
Signal outputs 88
Operational safety 7
Output
Output signal 166
Relay outputs 168
Outputs
Binary 79
Current outputs 88
EtherNet/IP 96
Modbus 96
PROFIBUS DP 95
PROFINET 95
Relay 91
Signal outputs 88

P
Pollution degree 175
Port assignment 12
Power consumption 172
Power supply 172
24 V version 28
Cable entries 172
Cable specification 172
Connecting digital communication 37
Connecting optional modules 34
Connecting the analyzer 25
Fuse 172
Hose entries 176
Power consumption 172
Sensor connection 33
Supply voltage 172
Process errors without messages 122
Product description 9
Product design 9
Product identification 14
Product safety 8
PROFIBUS DP 44, 61, 169
Device variables 95
PROFIBUS variables 96
PROFINET 44, 171
Device variables 95
PROFINET variables 96
Protocol-specific data 169

R
Reagent set 158
Relay 91
Repair 156
Requirements for personnel 7
Reset 144
Return 156
rH value 116
Routing the cable in the connection compartment . . . 25

S
Safety
Operational 7
Product 8
Workplace safety 7
Safety instructions 7
Sample preparation 158
Connecting 30
Saving the setup 65
Scope of delivery 15
SD card 165
Security
IT 8
Sensor information 140
Sensor-specific diagnostic messages 132
Service interface 43
Settings
Additional functions 97
Analyzer 67
Binary inputs and outputs 79
Current inputs 78
Current outputs 88
Diagnostics 60
EtherNet/IP 63, 96
Extended 60
General 54
Hardware 38
Modbus 62, 96
Operating language 51
PROFIBUS DP 61
Relay 91
Signal outputs 88
Web server 62
Signal outputs 88
Simulation 140
Slot assignment 12
Soft keys in the measuring mode 53
Spare parts 156
Standard cleaning 112
Standard solution 158
State-of-the-art technology 8
Storage temperature 174
Supply voltage 172
Switching on 51
Symbols 5
System information 138
System integration
Fieldbus 44
Service interface 43
Web server 41
System test 142

T
Technical data
Environment 174
Input 166
Mechanical construction 175
Output 166
Process 175

Protocol-specific data 169
Relay outputs 168
Technical personnel 7
Terminal diagram 13
Time 55
Time switch 101
Troubleshooting 122
Diagnostic information 123
General troubleshooting 122
Types of cleaning 112
Types of input 166

U

Upgrade kit 159
Use 7

W

Wall mounting 18
Warnings 5
Web server 62, 172
Weight 175
Workplace safety 7

www.addresses.endress.com

Endress+Hauser

People for Process Automation