# Operating Instructions
# Liquiline System CA80AM
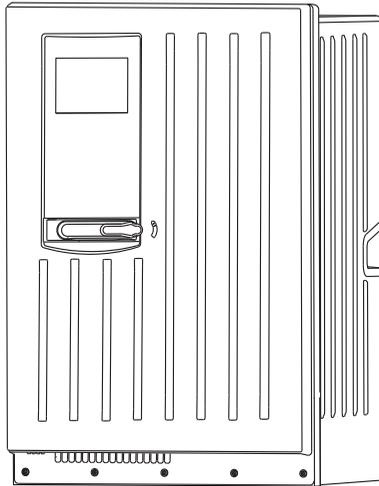


Endress+Hauser

People for Process Automation

# Table of contents

# 1    Document information

## 1.1    Warnings

The structure, signal words and safety colors of the signs comply with the specifications of ANSI Z535.6 ("Product safety information in product manuals, instructions and other collateral materials").

| Safety message structure | Meaning |
|---|---|
| **⚠ DANGER**<br>**Cause (/consequences)**<br>Consequences if safety message is not heeded<br>▶  Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid the situation **will** result in a fatal or serious injury. |
| **⚠ WARNING**<br>**Cause (/consequences)**<br>Consequences if safety message is not heeded<br>▶  Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid the situation **can** result in a fatal or serious injury. |
| **⚠ CAUTION**<br>**Cause (/consequences)**<br>Consequences if safety message is not heeded<br>▶  Corrective action | This symbol alerts you to a dangerous situation.<br>Failure to avoid this situation can result in minor or medium injury. |
| **NOTICE**<br>**Cause/situation**<br>Consequences if safety message is not heeded<br>▶  Action/note | This symbol alerts you to situations that can result in damage to property and equipment. |

## 1.2    Symbols used

| | |
|---|---|
| 🛈 | Additional information, tips |
| ✔ | Permitted or recommended |
| ✖ | Forbidden or not recommended |

## 1.3    Documentation

As a supplement to these Operating Instructions the following manuals are available on the CD-ROM:
- Brief Operating Instructions Liquiline System CA80AM, KA01158C
- 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
  - Modbus, SD01189C
  - Web server, SD01190C

The CD also contains:
- Technical Information Liquiline System CA80AM
- Simulation software (for CM44x, CM44xR, CSF48 and CSP44)
- Documentation for other devices in the Liquiline family:
  - Liquiline CM44x (field device)
  - Liquiline CM44xR (DIN rail device)
  - Liquiline System CAT8x0 (sample preparation)
  - Liquistation CSFxx (sampler)

# 2 Basic safety instructions

## 2.1 Requirements for personnel

▸ Installation, commissioning, operation and maintenance of the measuring system must only be carried out by specially trained technical personnel.
▸ Trained personnel must be authorized for the specified activities by the system operator.
▸ Electrical connection must only be carried out by a certified electrician.
▸ Technical personnel must have read and understood these Operating Instructions and must adhere to them.
▸ Measuring point faults may only be rectified by authorized and specially trained personnel.

ℹ Repairs not described in the enclosed Operating Instructions may only be carried out directly at the manufacturer's or by the service organization.

## 2.2 Designated use

Liquiline System CA80AM is a wet-chemical analyzer for the almost continuous determination of the concentration of ammonium in liquid media.

The analyzer is designed for use in the following applications:
• Monitoring and optimization of the cleaning capacity of wastewater treatment plants
• Monitoring of activated sludge basins
• Monitoring of wastewater treatment plant outlet
• Control of industrial water treatment

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted.
The manufacturer is not liable for damage caused by improper or non-designated use.

## 2.3 Occupational safety

As the user, you are responsible for complying with the following safety conditions:
• Installation instructions
• Local prevailing standards and regulations.

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

## 2.4    Operational safety

▶ Before commissioning the entire measuring point, check all the connections. Ensure that electrical cables and hose connections are not damaged.
▶ Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
▶ If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.

**⚠ CAUTION**

**Analyzer in operation during maintenance activities**
Risk of injury due to medium, reagents or cleaning agent
▶ Before hoses are released make sure that no action, such as the pumping of sample, is currently running or is due to start soon.
▶ Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

## 2.5    Product safety

### 2.5.1    State of the art

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.
Relevant regulations and European standards have been observed.
Equipment connected to the analyzer shall be in compliance with the relevant 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.
Support in the performance of this task can be requested from Endress+Hauser.

# 3      Device description

## 3.1     Device design



1   Collecting vessel (optional)
2   Window
3   Air vent for cooling
4   Bottle tray for reagents, cleaner and standard
5   Reagent insulation box (optional)
6   Photometer
7   Controller

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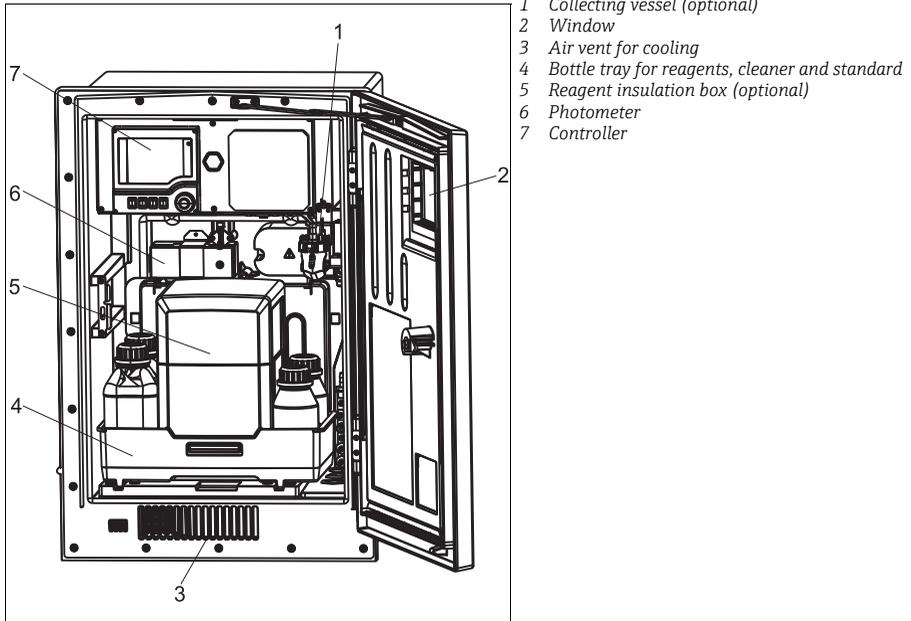
Fig. 1:  Example of Liquiline System CA80AM with cooling
         module

# 3.2    Measuring system

A complete measuring system consists of:
• Liquiline System CA80AM analyzer in the configuration ordered
• Reagents, cleaners and standard solutions (to be ordered separately)
• Liquiline System CAT8x0 sample preparation (optional)



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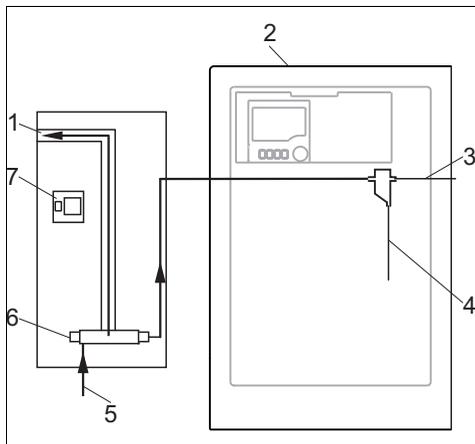
*Fig. 2:  Measuring system with Liquiline System CAT810*

*1    Overflow*
*2    Liquiline System CA80*
*3    Collecting vessel overflow*
*4    Sample*
*5    Pressurized sample*
*6    Filter unit*
*7    Time control, optional*



*a0023080*
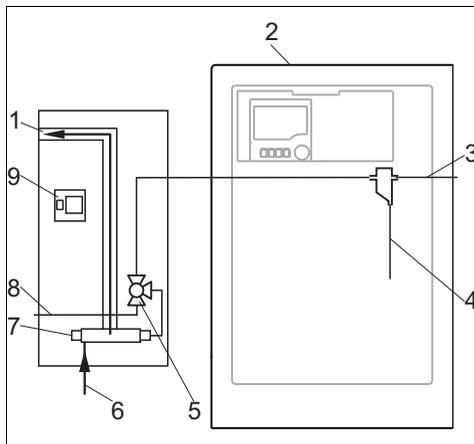
*Fig. 3:  Measuring system with Liquiline System CAT810
         and cleaning valve*

*1    Overflow*
*2    Liquiline System CA80*
*3    Collecting vessel overflow*
*4    Sample*
*5    Cleaning valve*
*6    Pressurized sample*
*7    Filter unit*
*8    Rinse connection (compressed air or water)*
*9    Time control, optional*
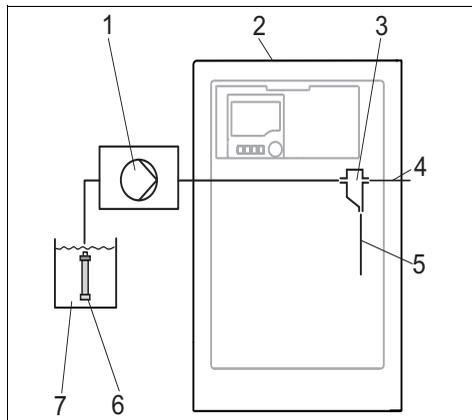
Fig. 4:  Measuring system with Liquiline System CAT820
1    Pump
2    Liquiline System CA80
3    Collecting vessel
4    Outlet
5    Sample
6    Filter (ceramic)
7    Medium
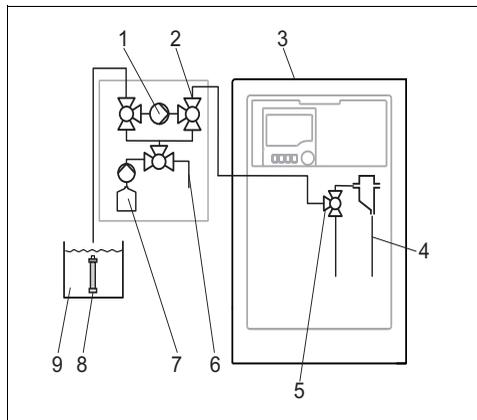
Fig. 5:  Measuring system with Liquiline System CAT860
1    Pump
2    Valve
3    Liquiline System CA80
4    Sample
5    Valve
6    Compressed air
7    Cleaning solution
8    Filter (ceramic)
9    Medium
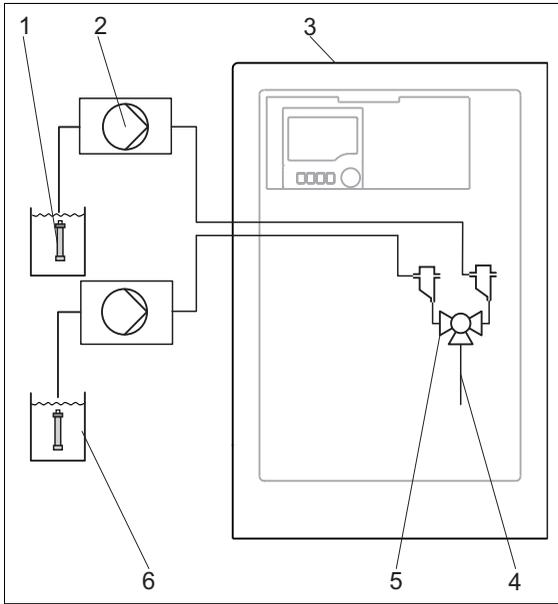
*Fig. 6: Measuring system with two Liquiline System CAT820 units*

1       *Filter (ceramic)*
2       *Pump*
3       *Liquiline System CA80*
4       *Sample*
5       *Valve*
6       *Medium*
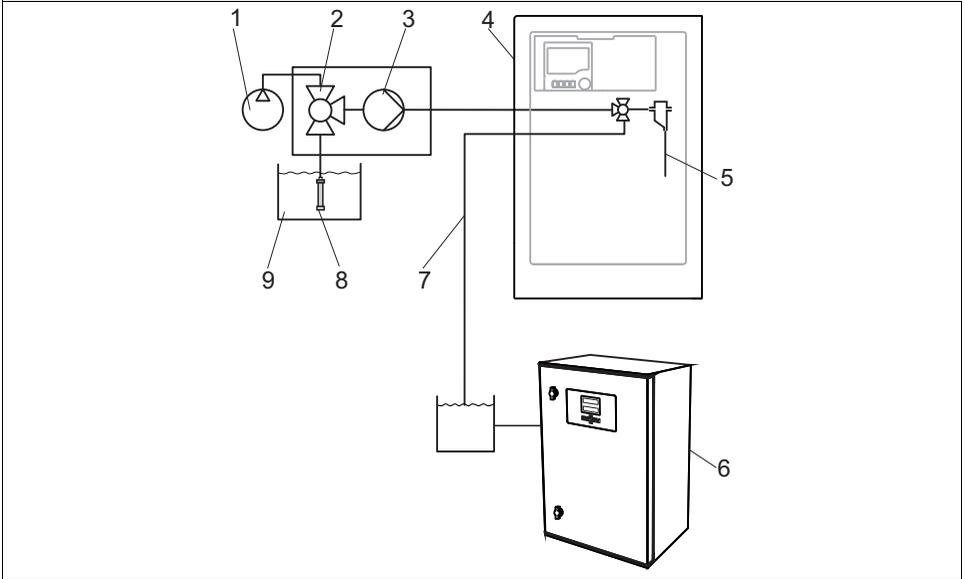
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*Fig. 7: Measuring system with Liquiline System CA80, Liquiline System CAT820 and a second analyzer*

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

# 3.3    Device architecture

## 3.3.1    Slot and port assignment
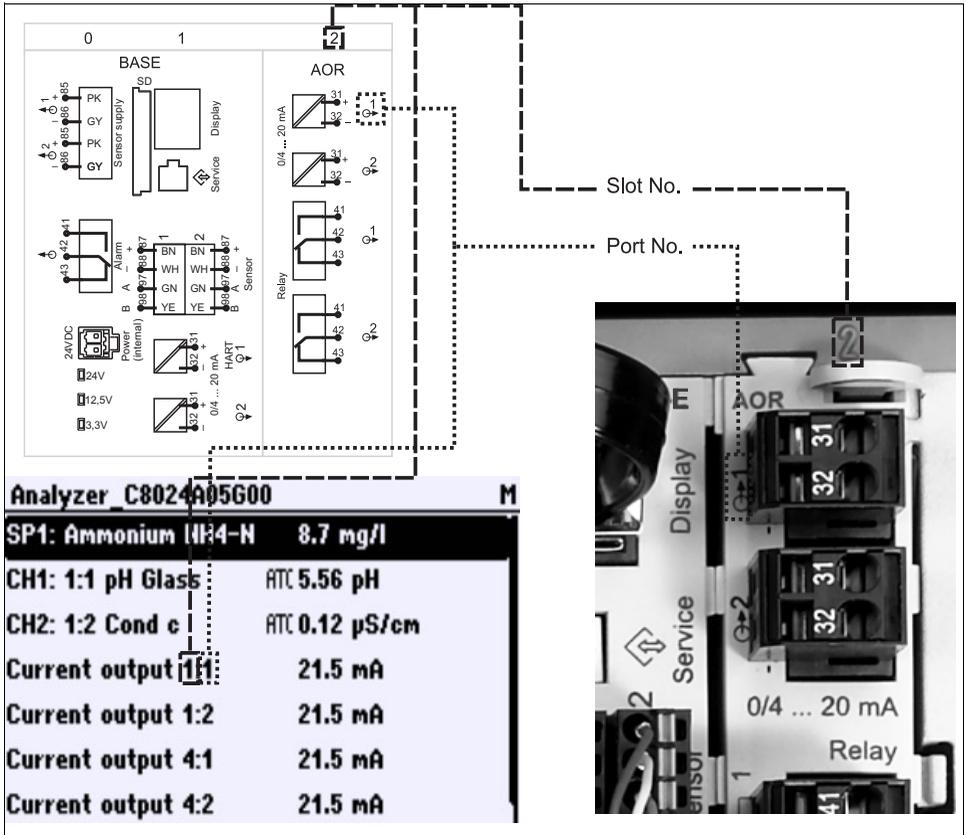


*Fig. 8:  Slot and port assignment of hardware and on-screen display*

The electronic configuration follows a modular concept:
- Several slots are available for electronics modules.
- These slots are numbered consecutively in the housing. Slots 0 and 1 are always reserved for the basic module.
  Slot 2 is the analyzer interface module if no other modules are available.
- In addition, there are also control module inputs and outputs. These slots are labeled "S".
- Each electronics module has one or more inputs and outputs or relays. Here they are all collectively known as "ports".

- Ports are consecutively numbered per electronics module and are recognized automatically by the software.
- The outputs and relays are named after their function, e.g. "Current output", and are displayed in ascending order with the slot and port numbers
  Example, → 🖼 8:
  – "Current output 2:1" shown on the display means:
    Slot 2 (e.g. AOR module) : port 1 (current output 1 of the AOR module)
- Inputs are assigned to measuring channels in ascending order "Slot:Port number"
  Example:
  – "SP1: Ammonium" shown on the display means:
    Sampling point SP1 is assigned to analyzer measuring channel 1.
  – "CH1: 1:1 pH glass" shown on the display for sensors means:
    Channel 1 (CH1) is slot 1 (basic module) : port 1 (input 1) and a pH glass sensor is connected to the port

### 3.3.2    Terminal diagram

ℹ️ The unique terminal name (for sensors) is derived from the following:
Slot No. : Port No. : Terminal

**Example, NO contact of a relay:**
Device with 4 inputs for digital sensors, 4 current outputs and 4 relays
- Basic module BASE-E (contains 2 sensor inputs, 2 current outputs)
- Module 2DS (2 sensor inputs)
- Module 2AO (2 current outputs)
- Module 4R (4 relays)
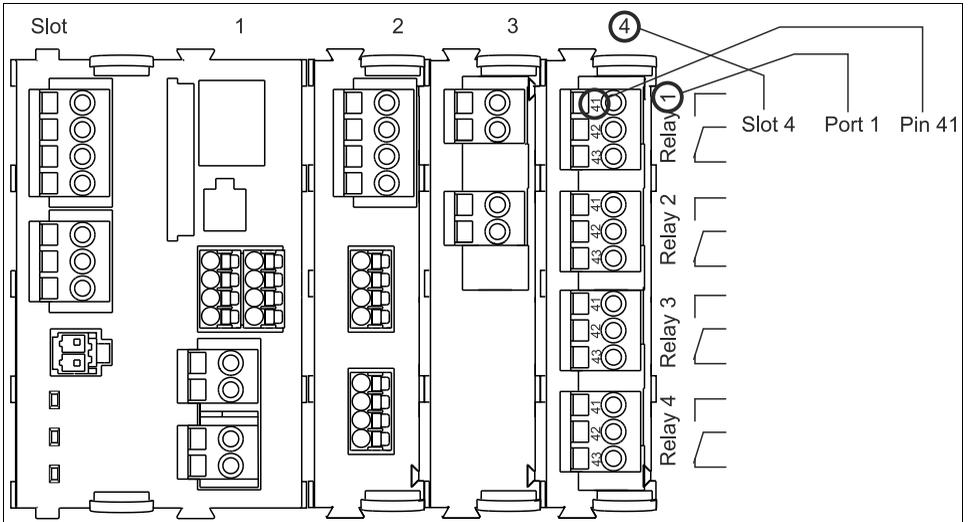


*Fig. 9:  Creating a terminal diagram taking the example of the NO contact (terminal 41) of a relay*

# 4    Incoming acceptance and product identification

## 4.1    Incoming acceptance

1. Make sure the packaging is undamaged.
   - ↳ Inform the supplier about any damage to the packaging.

   Keep the damaged packaging until the matter has been settled.

2. Make sure the contents are undamaged.
   - ↳ Inform the supplier about damage to the contents.

   Keep the damaged products until the matter has been settled.

3. Check that the delivery is complete and nothing is missing.
   - ↳ Compare the scope of delivery against the delivery papers and your order.

4. Pack the product in such a way as to protect it reliably against impact and moisture for storage and transportation.
   - ↳ The original packaging offers the best protection.

   Keep to the approved ambient conditions (see "Technical data").

If you have any questions, 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 ID
- Order code
- Extended order code
- Serial number
- Firmware version
- Input and output variables
- Measuring range
- Environment
- Activation codes
- Safety notices and warnings

🛈   Compare the data on the nameplate with your order.

### 4.2.2     Identifying the product

The order code and serial number of your device can be found in the following locations:
- On the nameplate
- In the delivery papers

## 4.3     Scope of delivery

- 1 analyzer in the version ordered and optional hardware
- 1 CD with Operating Instructions
- 1 Brief Operating Instructions (hard copy)
- 1 Maintenance Manual
- Optional accessories

If you have any questions, contact your supplier or your local sales center.

## 4.4     Certificates and approvals

**Declaration of Conformity**
The product meets the requirements of the harmonized European standards.
As such, it complies with the legal specifications of the EC directives.
The manufacturer confirms successful testing of the product by affixing to it the $C\epsilon$ mark.

# 5    Installation

**⚠ CAUTION**

**Incorrect transportation or installation 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.
▶   In the case of the version with the analyzer stand, make sure that the housing is fixed to the
    floor.
▶   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.

# 5.1    Installation conditions

## 5.1.1    Dimensions
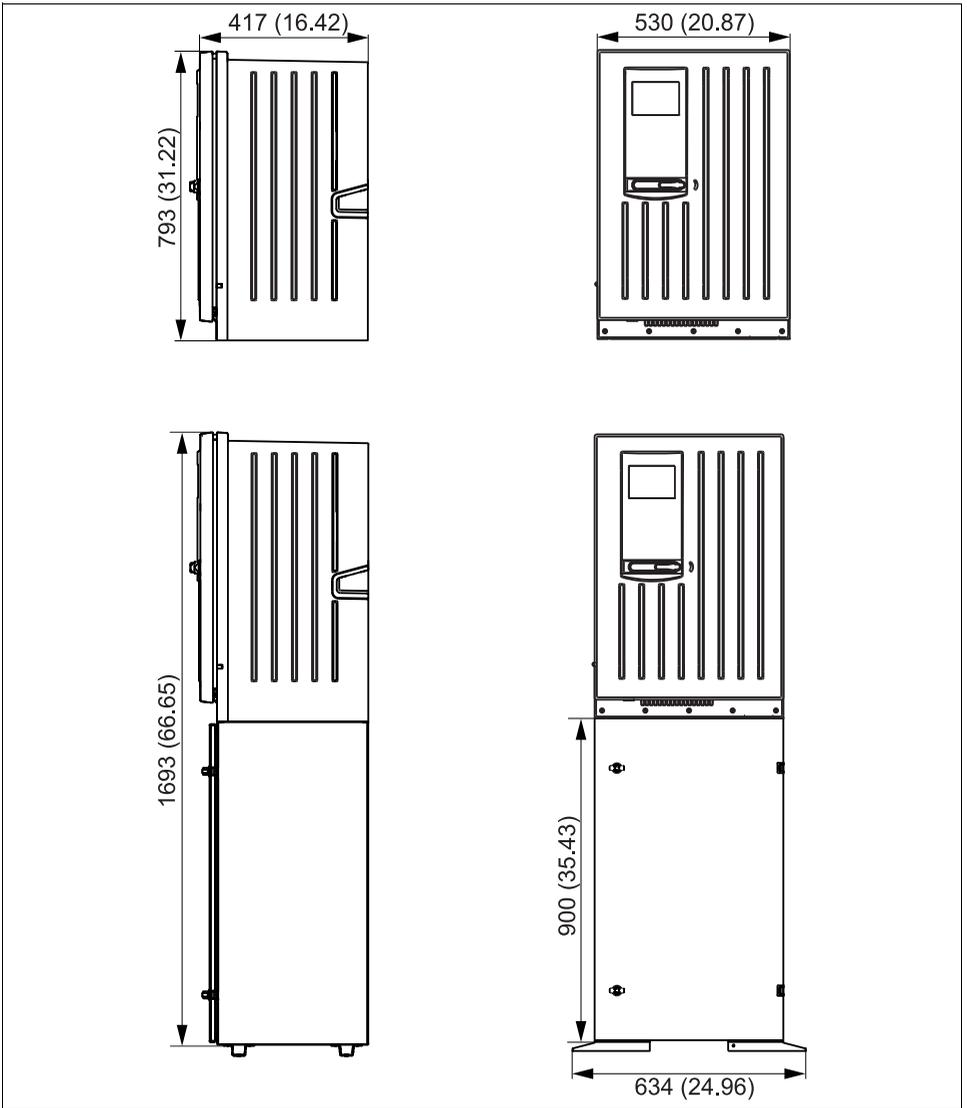


*Fig. 10: Liquiline System CA80 without/with base, dimensions in mm (inch)*

## 5.1.2    Holder unit

ℹ️    Mounting materials for securing the device to the wall (screws, wall plugs) are not included in the delivery and must be provided by the client.



Fig. 12: Securing the holder unit on the housing

a0021967



750 (29.53)

120 (4.72)

a0021955

Fig. 11: Holder unit dimensions. Engineering unit mm (in).

### 5.1.3    Spacing required for mounting



Fig. 13: Minimum spacing required for mounting.
Engineering unit mm (in).
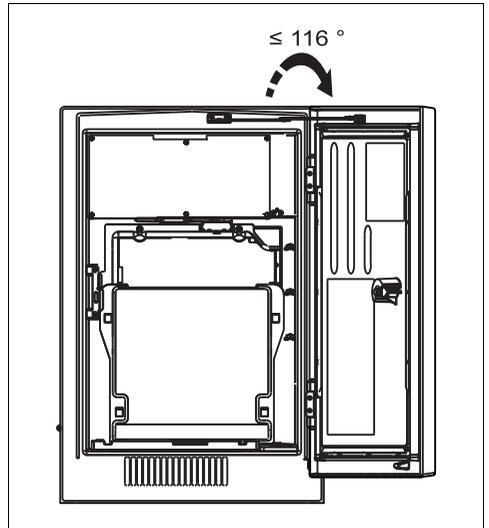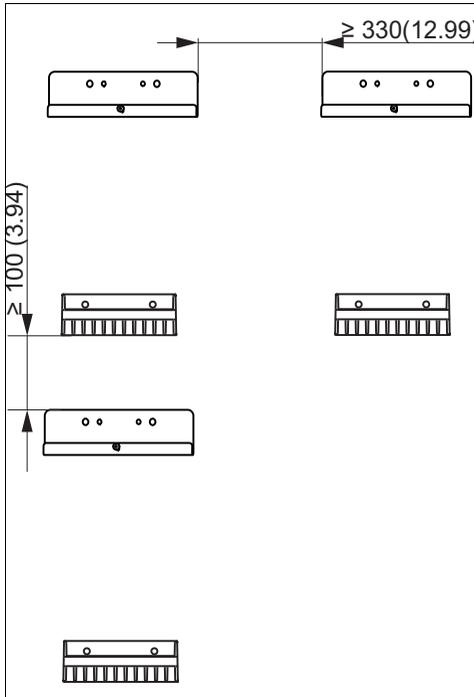


Fig. 14: Maximum opening angle

### 5.1.4    Hooking the analyzer into the wall holder unit
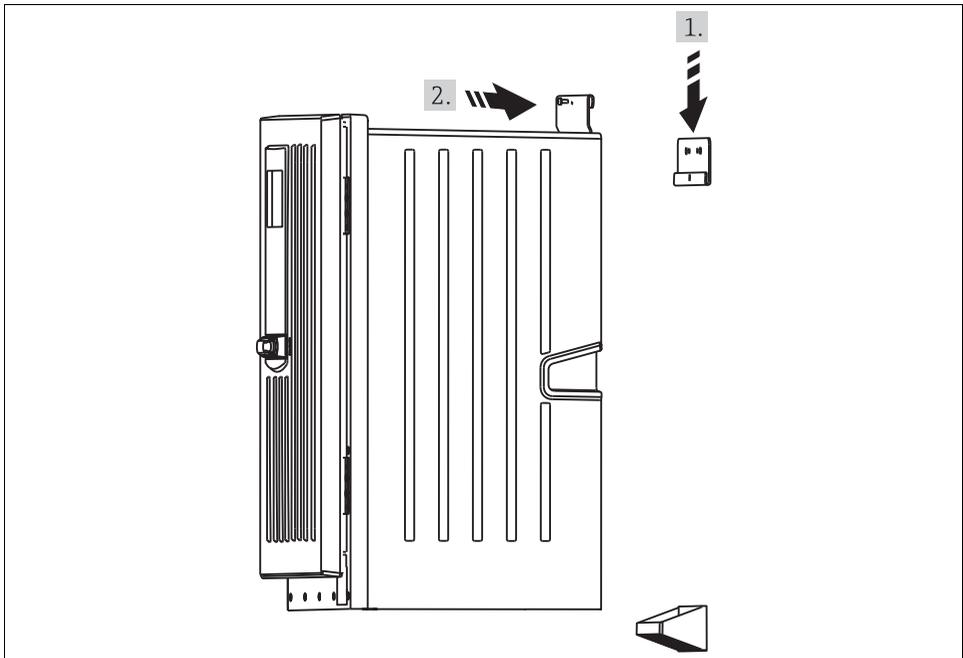


*Fig. 15: Hooking into the wall holder unit*

1. Hook the analyzer into the wall holder unit.

2. Secure the two top parts of the wall holder unit with the screw supplied.

### 5.1.5    Base mounting
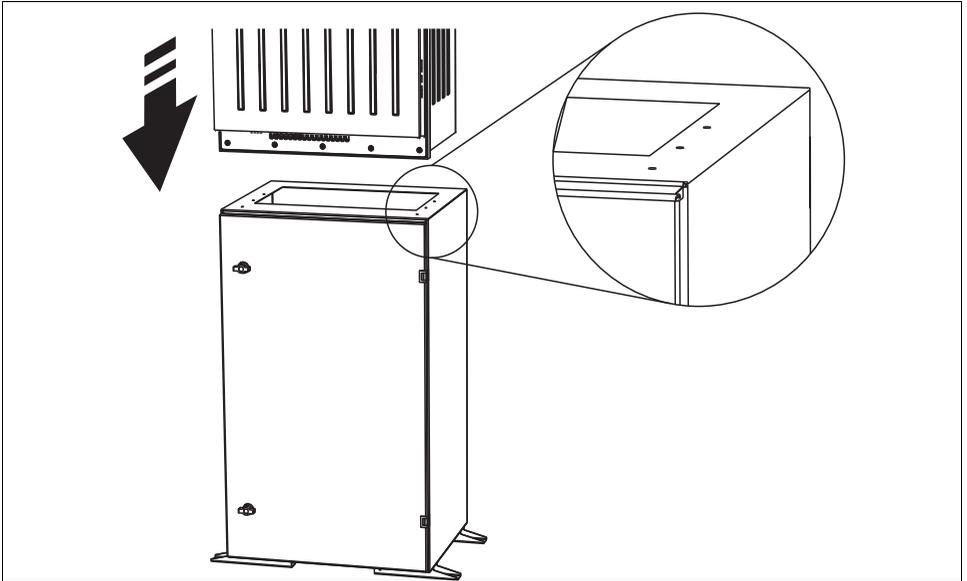


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*Fig. 16: Securing the base*

1.  Have two people lift the analyzer and place it on the base. Use the recessed grips.

2.  Screw the base to the analyzer using 6 screws.

ℹ️    Screw the base to the ground, see the "Mechanical connection" section.

### 5.1.6    Mounting location

Note the following when mounting the sampler:
- Make sure that the wall has sufficient load-bearing capacity.
- Mount the sampler on a level surface (with additional base).
- Protect the sampler from additional heating (e.g. from heaters).
- Protect the sampler from mechanical vibrations.
- Make sure that the fluid can drain freely without any siphoning effects.
- Make sure air can circulate freely on the front of the housing.

## 5.1.7    Mechanical connection

### Hose connection diagram
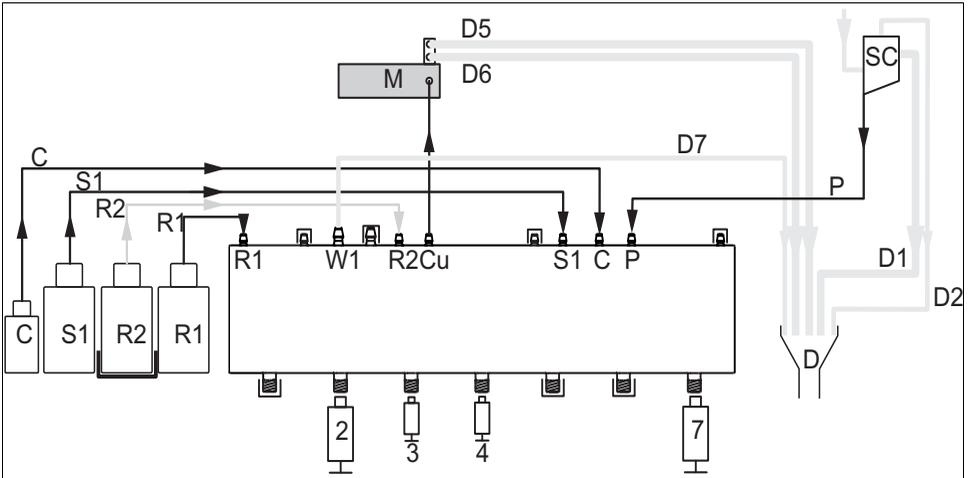


*Fig. 17: Single-channel device*
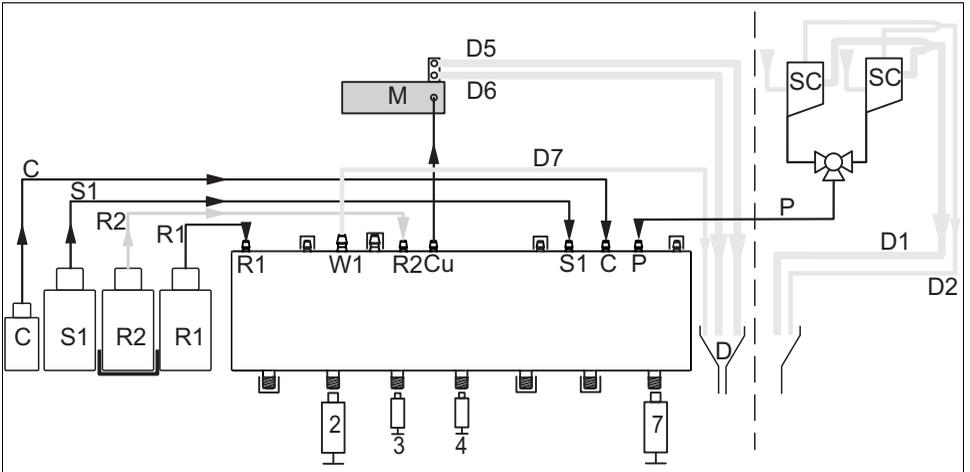


*Fig. 18: Two-channel device and self-priming*

| C | Cleaner | P | Drain |
|---|---|---|---|
| S1 | Standard 1 | SC | Syringe |
| R1 | Reagent 1 | D | Drain |
| R2 | Reagent 2 | 2 - 7 | Syringe |
| W1 | Drain | M | Photometer/measuring cell |
| Cu | Cell | | |

**Foundation plan for version with base**
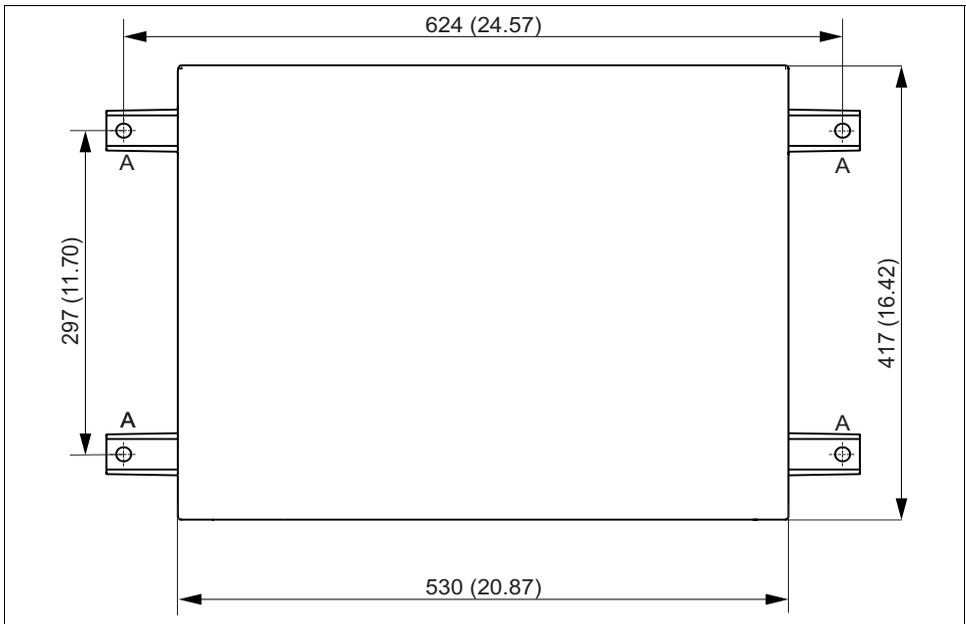


a0021043

*Fig. 19: Foundation plan*

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

## 5.2      Post-installation check

- After mounting, check all the connections to ensure they are secure and leak-tight.
- Make sure that the hoses of the sample preparation system can only be removed from the hose glands by force.
- Visually inspect all the hose connections to ensure everything is correct.

# 6    Electrical connection

**⚠ WARNING**

**Device is energized**

Incorrect wiring can result in injury or fatality

▶  The electrical connection must only be carried out by a certified electrician.
▶  Technical personnel must have read and understood the instructions in this manual and must adhere to them.
▶  **Prior to** beginning any wiring work, make sure voltage is not applied to any of the cables.

## 6.1    Connection conditions

### 6.1.1    Remote operation via Modbus RS485
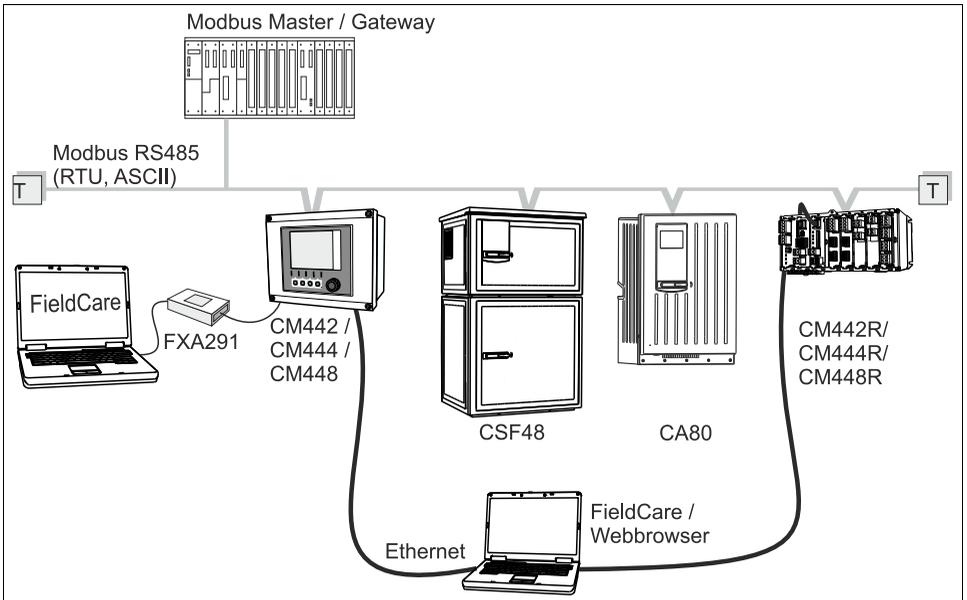


*Fig. 20: Modbus RS485*

*T          Terminating resistor*

### 6.1.2    Remote operation via ethernet/Web server/Modbus TCP
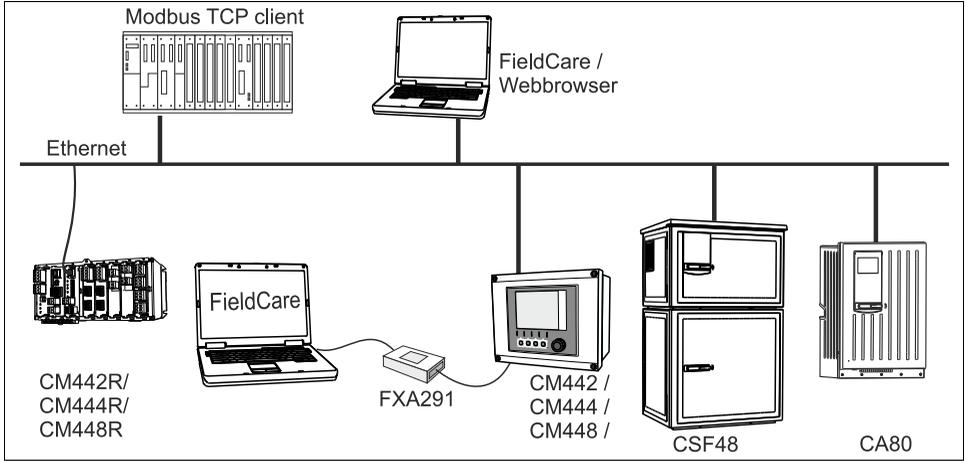


*Fig. 21: Modbus TCP and / or ethernet*

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## 6.2    Connecting the analyzer

> **NOTICE**
>
> **The device does not have a mains switch.**
> ▶ You must install the device near (distance < 3 m (10 ft)) an easily accessible and fused plug
>   socket.

> ℹ️ Depending on the order code, the mounted cable glands with an M-thread should be
>   replaced by the G' or NPT glands enclosed.
>   This does not affect the M32 hose glands.

### 6.2.1    Routing the cables

- Route the cables on the rear panel of the device so that they are properly protected.
- Cable glands are available for the cable entries .
- For cabinet versions, the cable length is approx. 1.0 m (3.3 ft) from the base of the housing.
  For analyzer stand versions, the cable length is approx. 1.8 m (5.9 ft) from the foundation.

### 6.2.2    Cable types

- Analog, signaling and transmission cables: e.g. LiYY 10 x 0.34 mm$^2$

ℹ️  The terminal connection is located under an additional protective cover in the upper section
of the device.
The terminal cross-section must be at least 2.5 mm$^2$ for devices with 24V power supply.
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 (see "Supply voltage" section).

### 6.2.3    Connecting the liquid-bearing suction lines

ℹ️  First connect the liquid-bearing suction lines and visually inspect the hoses before
establishing the connection to the power supply. There is the possibility that both the
analyzer and sample preparation start directly and pump sample into the device.

#### Self-priming

Connect the intake hose supplied (1.5m) to the liquid manager ("Process") (see hose connection
diagram) and guide this hose through the cable gland on the side of the analyzer to the outside.

ℹ️  Make sure that only samples with a low solids content are supplied as there is otherwise a
risk of blocking the system. The customer must guarantee a constant and sufficient volume
of sample.

### 6.2.4    Connecting 24V devices

- Remove the bottle tray by lifting up the recessed grip slightly and then pulling it towards the
front.
- Remove the cover that is hooked into place.
- Using an Allen key, release the six screws on the carrier board and fold it out towards the
front. For convenience of handling, hook the carrier board onto the locking plate.
- Using a Phillips head screwdriver, release the six screws on the electronics compartment cover
and fold out the cover towards the front.
- Guide the power connection cable from below through the cable gland on the inner device rear
panel and feed it upwards into the electronics compartment.
- Establish the connection as per → 🖼 22.

## 6.2.5    Power supply terminal assignment

The power supply is connected via plug-in terminals. Connect the ground to one of the ground connections.
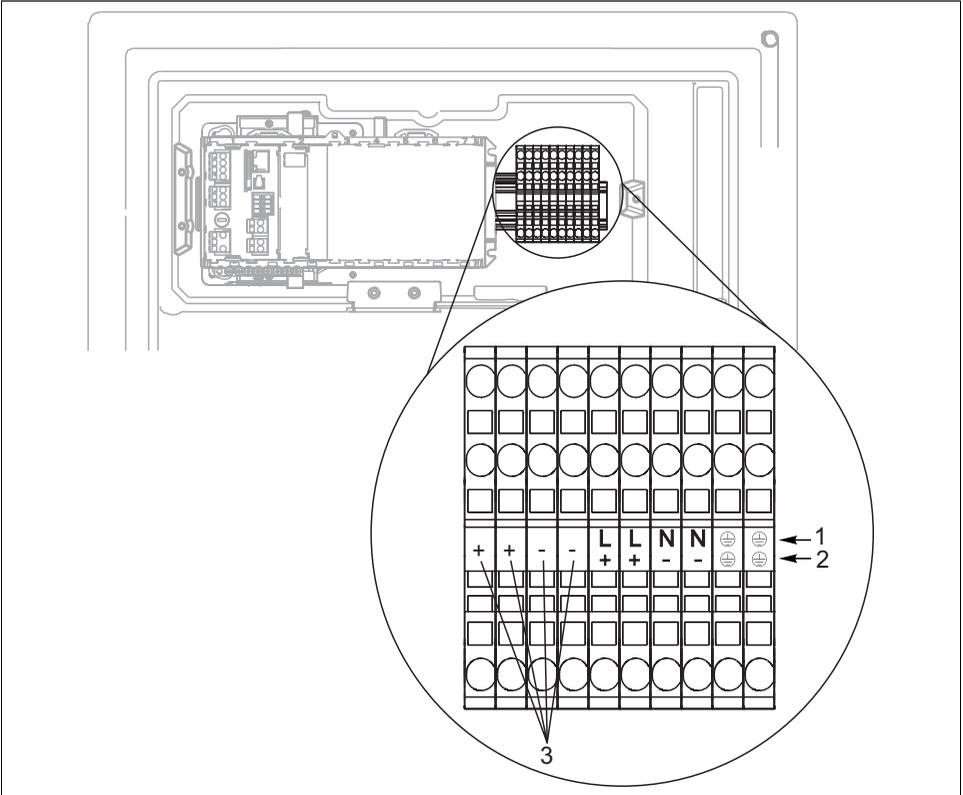


*Fig. 22: Terminal assignment*

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*1        Assignment: 100 to 120 V/200 to 240 V AC ±10 %*
*2        Assignment: 24 V DC +15/-9 %*
*3        Internal 24 V voltage*

### 6.2.6    Cable terminals

**Plug-in terminals for Memosens and RS485 connections**
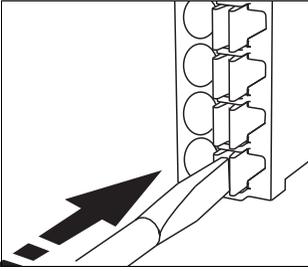

*a0012691*

*Fig. 23: Press the screwdriver against the clip (opens the terminal)*
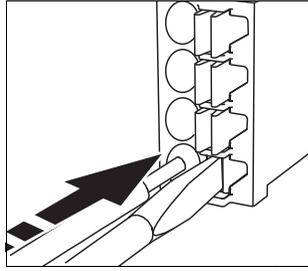

*a0012692*

*Fig. 24: Insert the cable until the limit stop*
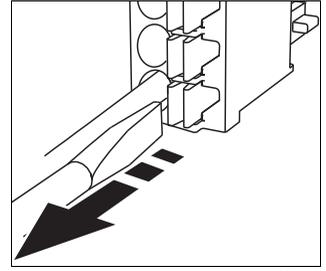

*a0012693*

*Fig. 25: Remove the screwdriver (closes the terminal)*

After connection, make sure that every cable end is securely in place. Terminated cable ends, in particular, tend to come loose easily if they have not been correctly inserted as far as possible.

**All other plug-in terminals**
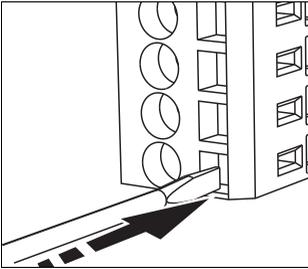

*a0012694*

*Fig. 26: Insert the screwdriver (opens the terminal)*
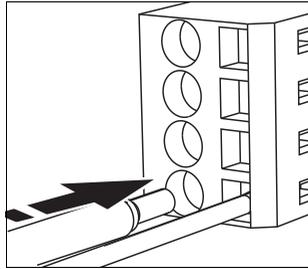

*a0012695*

*Fig. 27: Insert the cable until the limit stop*
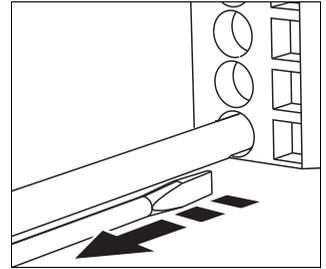

*a0012696*

*Fig. 28: Remove the screwdriver (closes the terminal)*

## 6.3 Connecting sample preparation

### 6.3.1 Connecting the optional valve of Liquiline System CAT810

1. Disconnect the mains plug.

2. Remove the bottle tray by lifting up the recessed grip slightly and then pulling it towards the front.

3. Guide the cable through the hose gland.

4. Remove the electronics cover.

5. Connect the valve to the following plug-in terminals:



a0023101
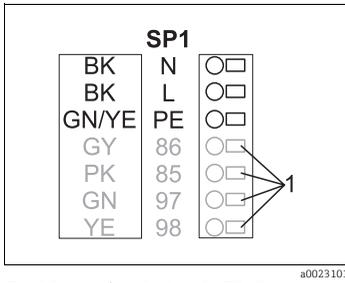
*Fig. 29: Liquiline System CAT810 connection*

*1        Are not used*

ℹ️  Secure the protective cover after connecting. Make sure that no cables or hoses are jammed.

### 6.3.2 Liquiline System CAT820 / CAT860 connection

ℹ️ Only use terminated genuine cables. The cables must be shielded.

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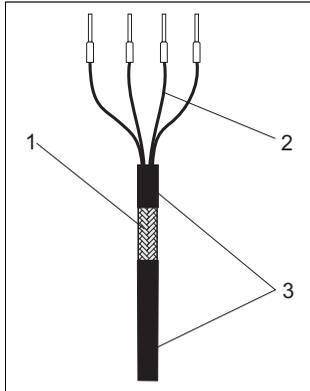


*Fig. 30: Terminated cable*

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

*a0013210*
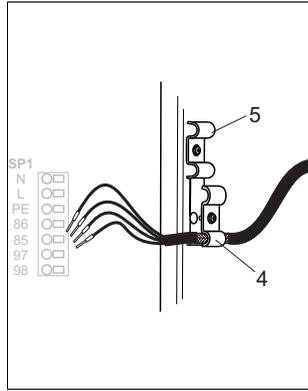
*Fig. 31: Inserting the cable*

*4    Grounding clamp for Memosens supply and power supply*
*5    Cable clamp for hose heating*
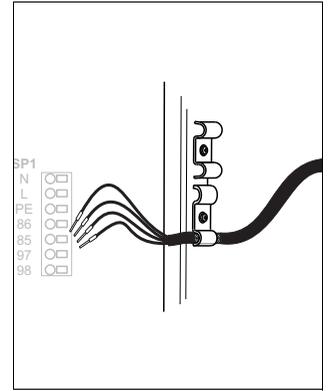
*a0023132*

*Fig. 32: Tightening the screw (2 Nm)[1]*

*The cable shield is grounded by the grounding clip*

*a0023133*

1) Observe the information in the "Guaranteeing the degree of protection" section ()

1. Disconnect the mains plug.

2. Remove the bottle tray by lifting up the recessed grip slightly and then pulling it towards the front.

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. Remove the protective cover in the upper right-hand corner.

6. 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.

7. Screw on the cable clamp and clamp the cable in place. Then tighten the screw of the cable clamp.

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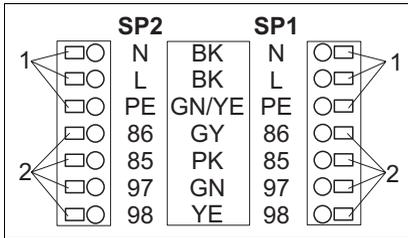


*Fig. 33: Liquiline System CAT820 / 860 connection*

*1        Hose heating (optional)*
*2        Memosens supply and power supply*

ℹ️  Secure the protective cover after connecting. Make sure that no cables or hoses are jammed.

## 6.4    Connection compartment in the controller housing

The controller housing has a separate connection compartment. Release the 6 housing screws to open the connection compartment:
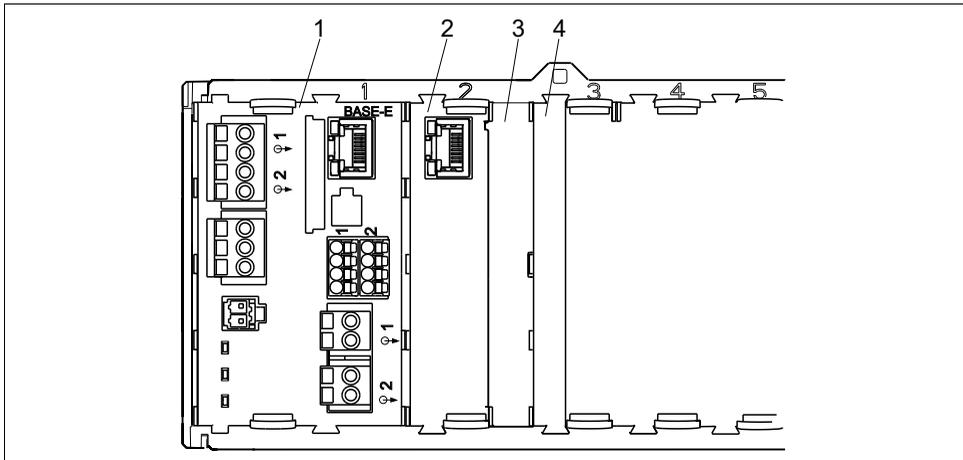


*Fig. 34: Basic module E*

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

### 6.4.1 E basic module
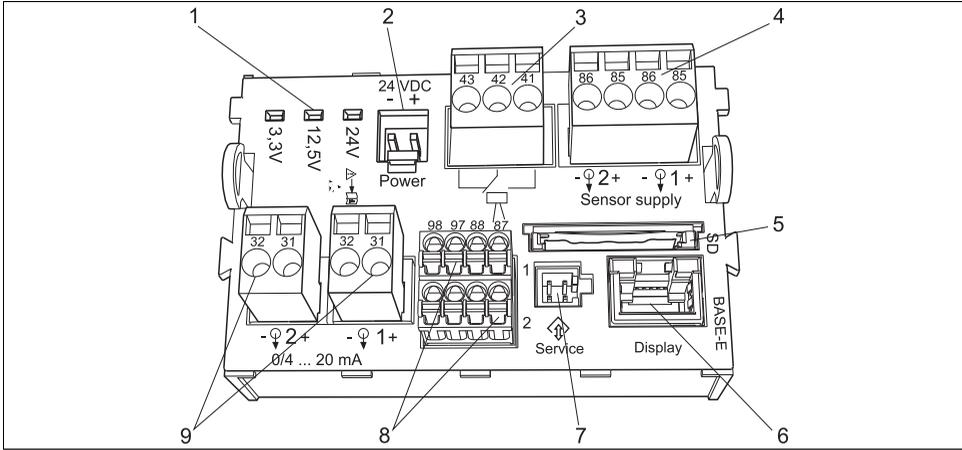


*Fig. 35: E basic module*

| | |
|---|---|
| *1 Indicator LEDs* | *5 SD card slot* |
| *2 Voltage connection[1]* | *6 Slot for the display cable [1]* |
| *3 Alarm relay connection* | *7 Service interface [1]* |
| *4 Power supply for digital fixed cable sensors with Memosens protocol* | *8 Connections for 2 Memosens sensors (optional)* |
| | *9 Current outputs* |

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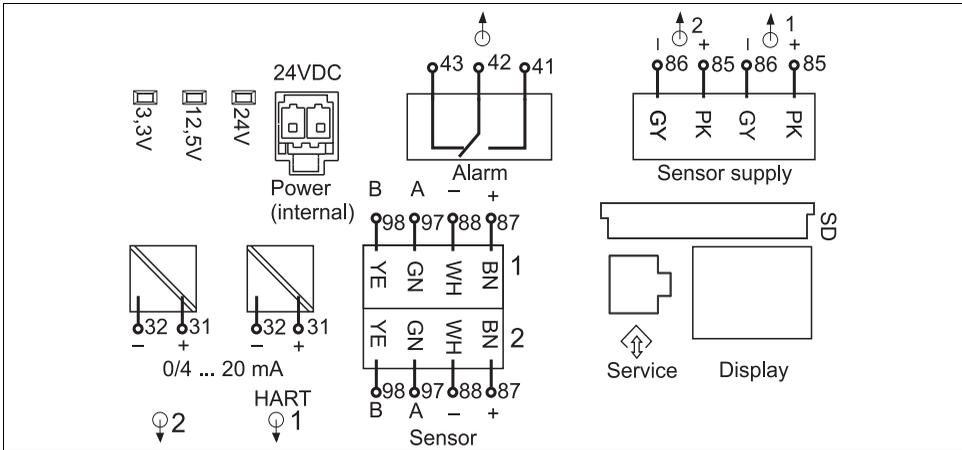


*Fig. 36: E basic module wiring diagram*

# 6.5    Connecting the sensors

ℹ️ Only use terminated genuine cables.



a0003350
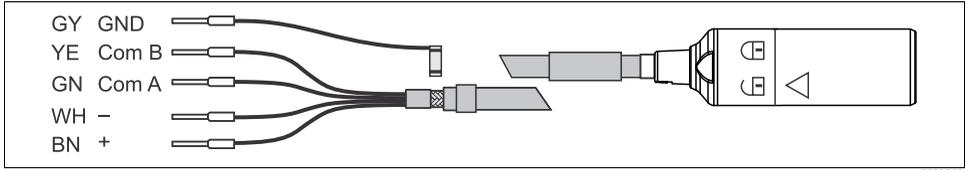
*Fig. 37: Example of Memosens data cable CYK10*

**Connecting the ferrules of the sensor cable to the E basic module**
The outer shield of the cable is grounded by means of the metal gland under the E basic module.



a0023172
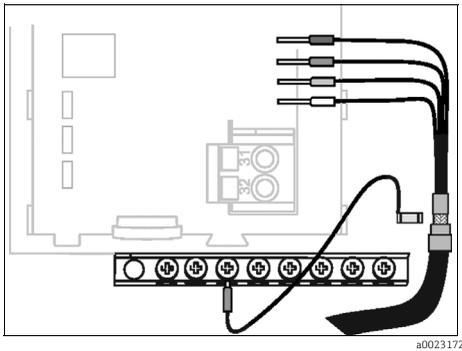
*Fig. 38: Terminal strip*

# 6.6    Optional sensor inputs, current outputs and relays

**⚠ WARNING**

**Module not covered**

No shock protection. Danger of electric shock!

▶   Always ensure shock protection is guaranteed particularly in the case of relay modules (2R, 4R, AOR).

## 6.6.1    Optional modules

**Digital inputs and outputs**

| DIO module |
|---|



Fig. 39: Module front    Fig. 40: Wiring diagram

## Current outputs

| Module 2AO | | Module 4AO | |
|---|---|---|---|
|  |  |  |  |
| *Fig. 41: Module front* a0016179 | *Fig. 42: Wiring diagram* a0015759 | *Fig. 43: Module front* a0016178 | *Fig. 44: Wiring diagram* a0015760 |

## Relays

| Module 2R | | Module 4R | |
|---|---|---|---|
|  |  |  |  |
| *Fig. 45: Module front* a0016181 | *Fig. 46: Wiring diagram* a0015758 | *Fig. 47: Module front* a0016182 | *Fig. 48: Wiring diagram* a0015757 |

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　Endress+Hauser
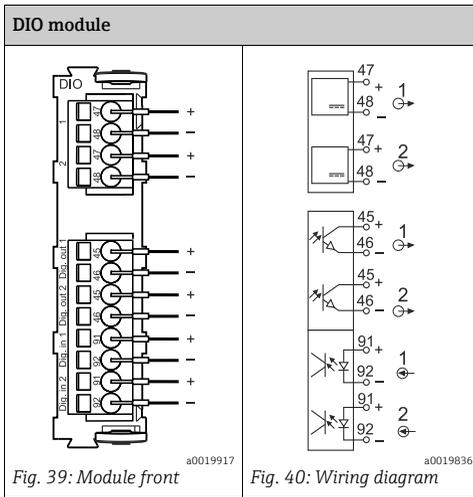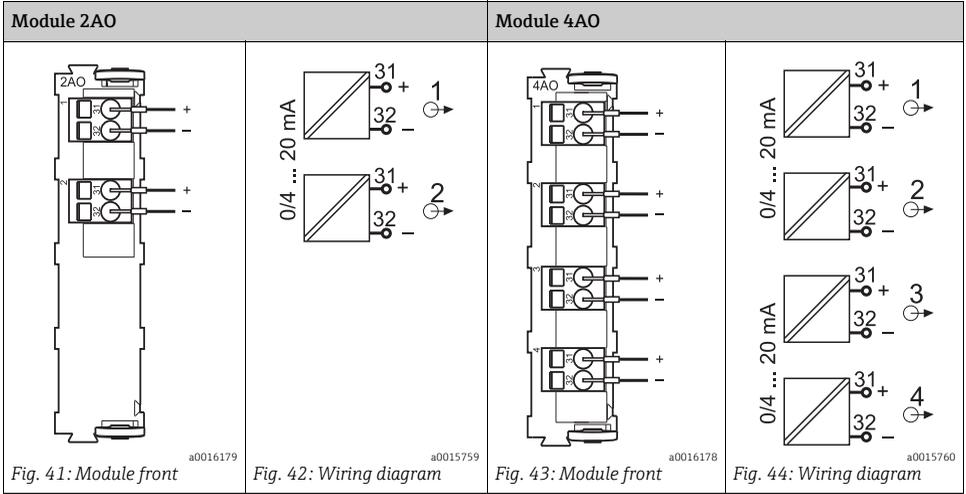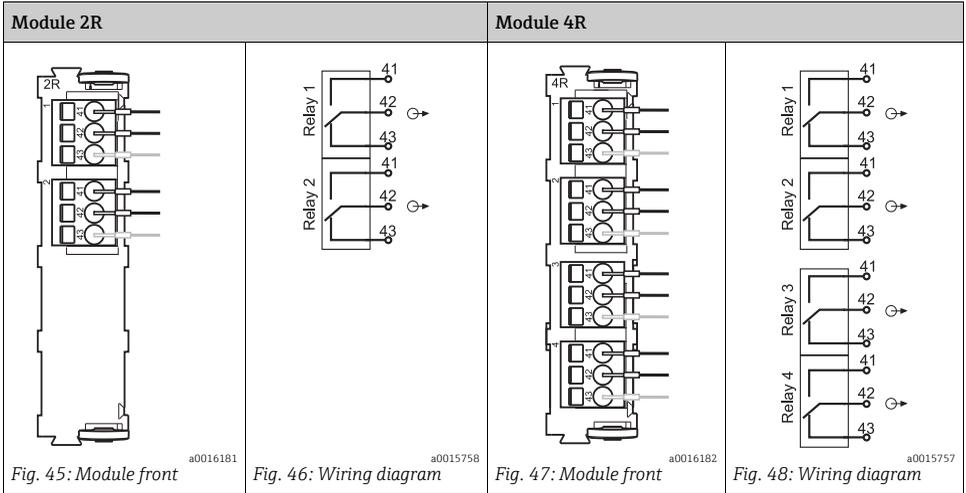
*Example: Connecting the compressed air cleaning unit 71072583 for CAS40D*
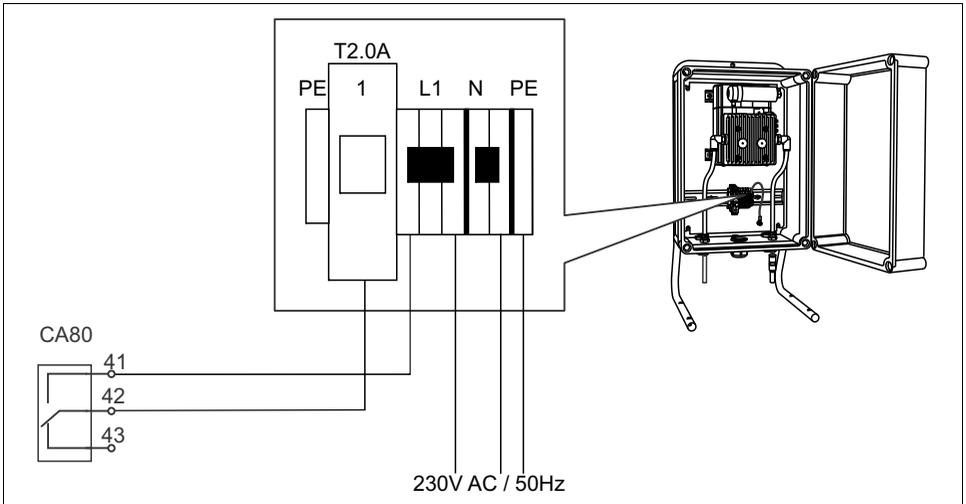


*Fig. 49: Connecting the cleaning unit for CAS40D*

*Example: Connecting the injector cleaning unit Chemoclean CYR10*
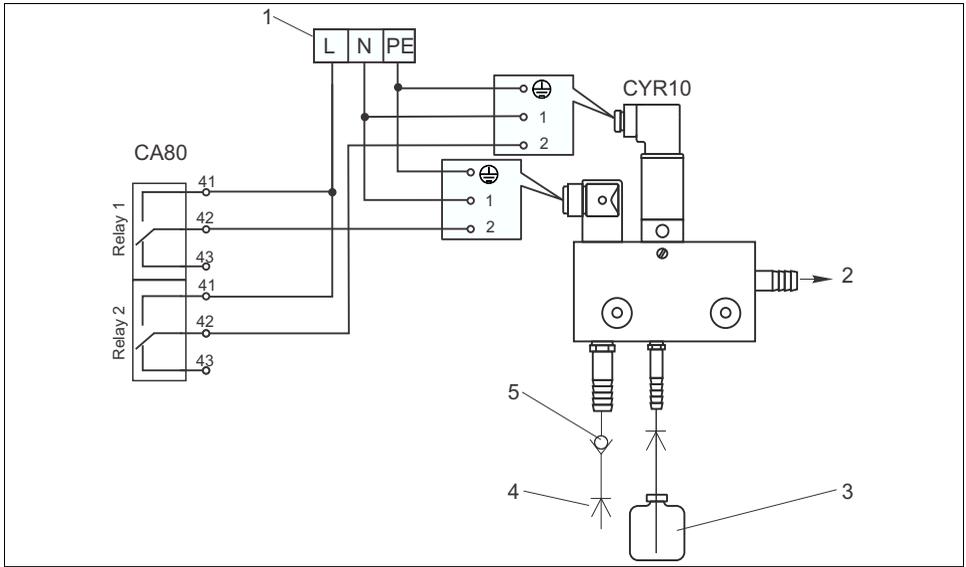


a0021354

*Fig. 50: Connecting the injector cleaning unit CYR10*

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)

# 6.7     Connecting communication

## 6.7.1     Module 485
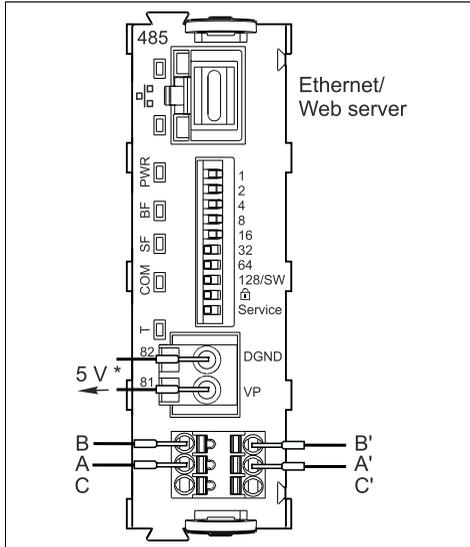


*Fig. 51: Bus connections on module 485*
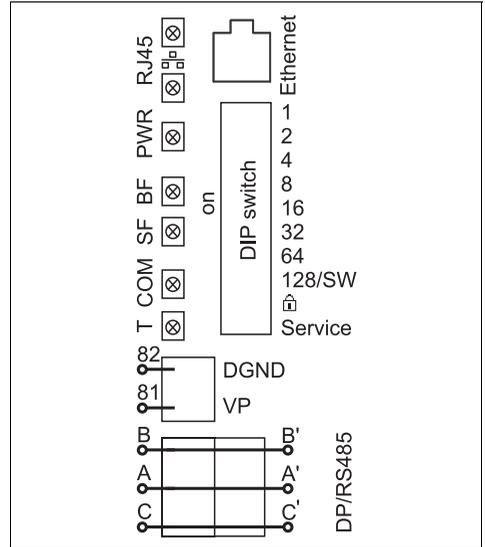


*Fig. 52: Wiring diagram for module 485*

\*      *Optional to supply power to an external terminating resistor for bus termination*

**LEDs on front of module**

| LED | Name | Color | Description |
|------|------|-------|-------------|
| RJ45 | LNK/ACT | GN | • Off = Connection is not active<br>• On = Connection is active<br>• Flashing = Data transmission |
| RJ45 | 10/100 | YE | • Off = Transmission rate 10 MBit/s<br>• On = Transmission rate 100 MBit/s |
| PWR | Power | GN | Supply voltage is applied and module is initialized |
| BF | Bus failure | RD | Bus failure |
| SF | System failure | RD | System failure |
| COM | Communication | YE | Sending or receiving Modbus message |
| T | Bus termination | YE | • Off = No termination<br>• On = Termination is used |

# 6.8    Hardware settings

## 6.8.1    Bus termination

There are two ways to terminate the bus:
1.    **Internal terminating resistor** (via DIP switch on the module board)
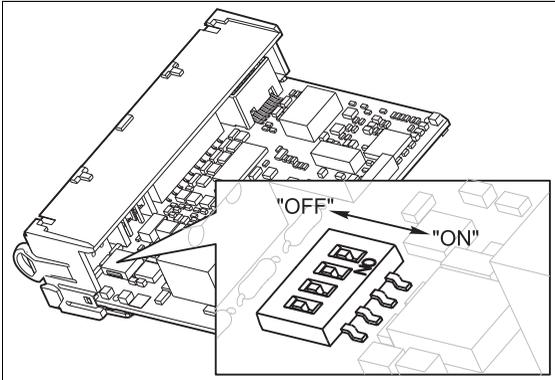


*Fig. 53: DIP switches for internal terminating resistor*

▶    Using a suitable tool, such as a tweezers, set all 4 DIP switches to the "ON" position.

↳    The internal terminating resistor is used.
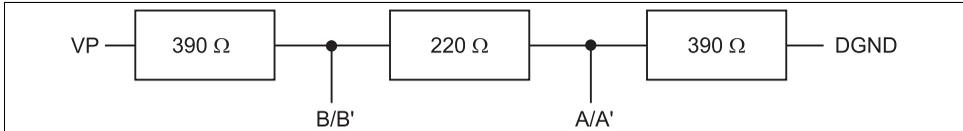


*Fig. 54: Structure of the internal terminating resistor*

a0016306

2.    **External terminating resistor**

Here, leave the DIP switches on the module board in the "OFF" position (factory setting).

▶    Connect the resistor to terminals 81 and 82 on the front of module 485 for 5-V power supply.

↳    The external terminating resistor is used.

### 6.8.2    Bus address

**Setting the bus address**

▶ Set the desired bus address via the DIP switches of module 485.

ℹ️ 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.
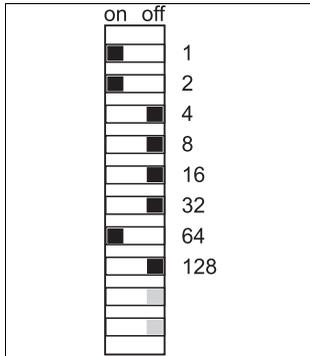


*Fig. 55: Valid PROFIBUS address 67*     *Fig. 56: Valid Modbus address 195*     *Fig. 57: Invalid address 255 [1]*
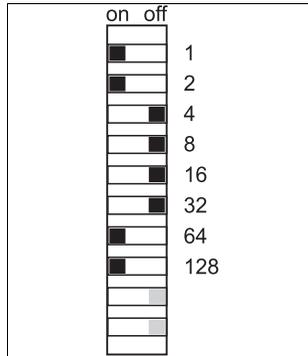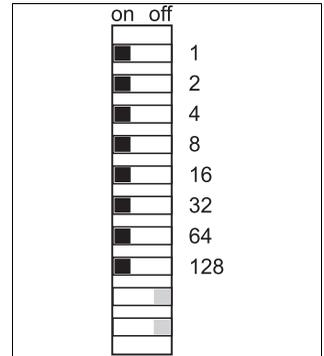
1)    Order configuration, software addressing is enabled, software address configured at the factory: PROFIBUS 126, Modbus 247

## 6.9    Guaranteeing the degree of protection

Only the mechanical and electrical connections that are described in this manual, and  are necessary for the required, designated application, may be established on the device supplied.

▶ Please play close attention when performing the work as degrees of protection individually confirmed for this product (ingress protection (IP), electrical safety, EMC interference immunity, explosion protection) can no longer be guaranteed in the case of the following, for example:
  – Leaving off covers
  – Loose or insufficiently tightened cables/cable ends

## 6.10    Post-connection check

**⚠ WARNING**

**Wiring errors**

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

▶  Only put the analyzer into operation if you can answer **yes** to **all** of the following questions.

**Device state and specifications**
1.    Are the analyzer and cables free from damage on the outside?
2.    Are the hoses free from damage on the outside?

**Electrical connection**
3.    Are the mounted cables strain relieved?

**Visual inspection of the liquid-bearing lines**
4.    Is the suction line connected to the sample collector (if present)?
5.    Are the syringes inserted correctly?
6.    Can the syringes move up and down freely?
7.    Are all the hose connections leak-tight?
8.    If sample preparation is provided: has the connection been made? Are the protective hoses in the hose glands strain relieved?
9.    If sample preparation is not connected: is the hose in the hose gland strain relieved?
10.   Have the bottles with reagents, cleaner and standard been inserted and connected?
11.   Inspect the hose connections. Use the hose connection diagram as a guide.

# 7      System integration

## 7.1      Web server

### 7.1.1    Connection

▶ Connect the PC communication cable to the RJ45 port of module 485.
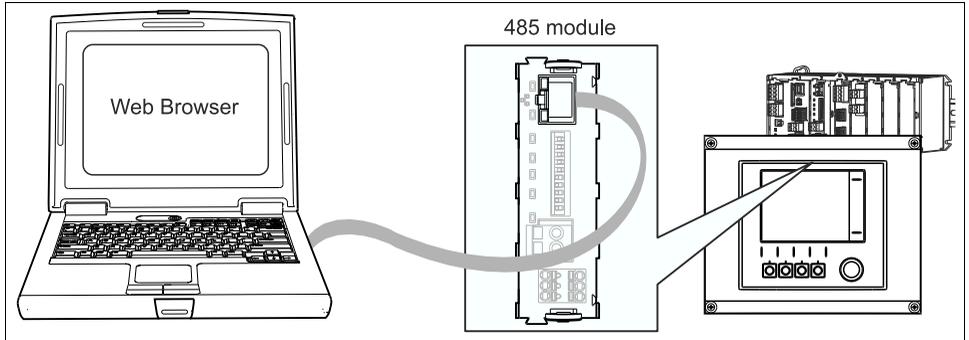


*Fig. 58: Ethernet connection*

### 7.1.2    Creating the data connection

1. Start your PC.

2. First, set a manual IP address in the network connection settings of the operating system.

   ↳ This address must be in the same subnetwork as the IP address of the device.

   **Example:**

   • IP address for Liquiline System: 192.168.1.212 (Diagnostics/System information/Ethernet/IP-Address)

   • IP address for the PC: 192.168.1.**213**

3. Start the Internet browser.

If you use a proxy server to connect to the Internet:

4. Disable the proxy (browser settings under "Connections/LAN settings").

5. Enter the IP address of your device in the address line.

   ↳ The system takes a few moments to establish the connection and then the CM44 web server starts.

▶ 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)

ℹ Downloads in FDM format can be securely transmitted, saved and visualized with
Endress+Hauser's "Field Data Manager Software".
(--> www.products.endress.com/ms20)

### 7.1.3    Operation

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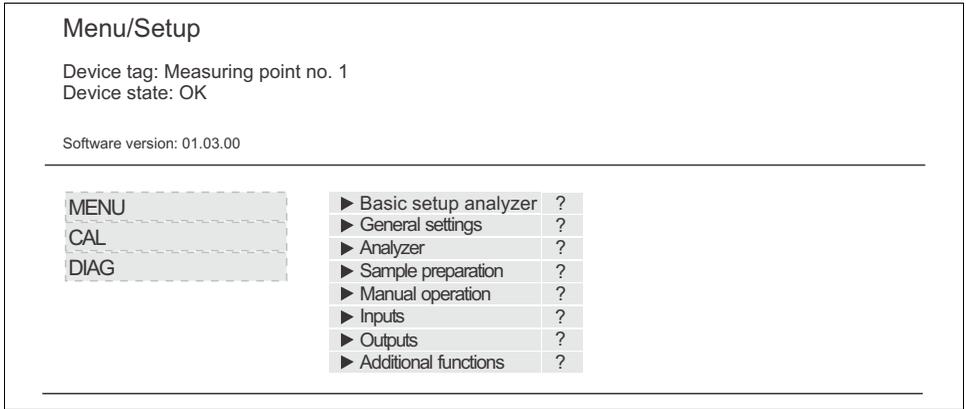


*Fig. 59: Example of web server (menu/language=English)*

- Clicking a menu name or a function corresponds to pressing the navigator.
- You can make your settings conveniently via the computer keyboard.

ℹ Instead of using an Internet browser, you can also use FieldCare for configuration via
ethernet. The ethernet DTM required for this purpose can be downloaded from the product
page.

## 7.2    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.

### 7.2.1    Connection

▶ Connect the service interface on the controller housing to the Commubox (FXA291).
▶ Via the USB port, connect the Commubox to the computer.
▶ A CD is supplied with the Commubox and contains USB drivers that must be installed when
  the device is connected for the first time.
▶ FieldCare must be installed on the computer. The software is either available on a CD or can
  be downloaded from www.de.endress.com.
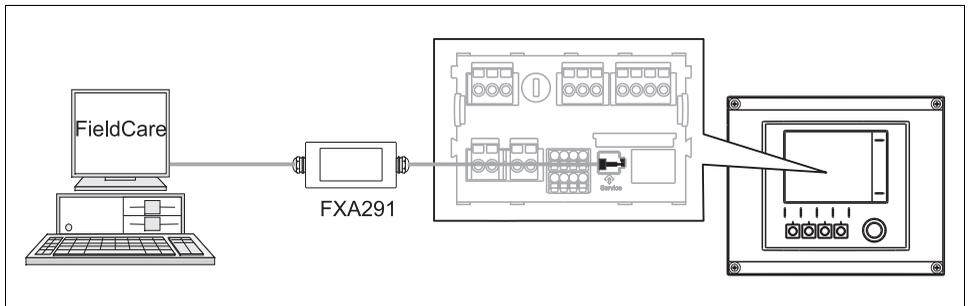


*Fig. 60: Connection overview*

### 7.2.2    Creating the data connection

1. Start Fieldcare.

2. Establish a connection to the Commubox.

3. To this end, for "Host PC" click "Add device" and select "CDI Communication FXA291".

4. Click "Configuration" to select the serial port for the FXA291 and to set the baud rate (115200).

5. Click "Link connection" to start communication with the FXA291 ($\triangleleft\triangleright$ are lit green).

6. Click "Add device" again and select your device type.

7. Click "Link connection" to start communication with the device ($\triangleleft\triangleright$ are lit green).

8. To be able to communicate with the device online, select "Online parameterize".

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.

### 7.2.3    Operation

- In the DTM the menu structure corresponds to the onsite operation. The functions of the Liquiline System soft keys are found in the main window on the left. This is where you also navigate through the software.
- Clicking a menu name or a function corresponds to pressing the navigator.
- You can make your settings conveniently via the computer keyboard.
- Via Fieldcare, you can save logbooks, make backups of configurations and transfer the configurations to other devices.
- Click "Operating devices", "Device functions" and "Further functions" to start the logbook export. Select ".dat" in order to save the file in a protected format to process it with the Field Data Manager.
- You can also print out configurations or save them as PDFs.

## 7.3    Fieldbuses

### 7.3.1    Modbus

With the fieldbus module 485 and the appropriate device version, you can communicate via Modbus RS485 or Modbus TCP.
The RTU and ASCII protocols are available when connecting via Modbus RS485. You can switch to ASCII on the device.

# 8 Operation options

## 8.1 Overview

### 8.1.1 Display and operating elements
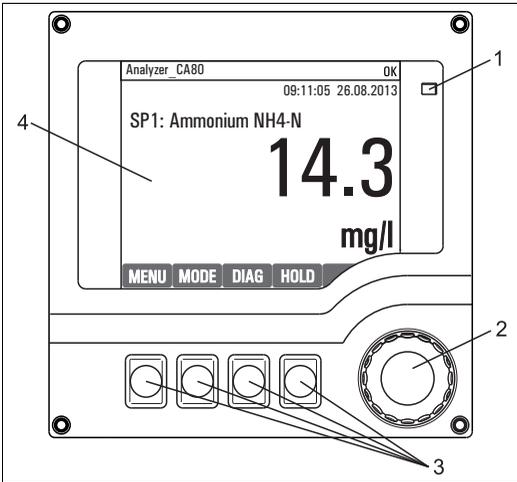


*Fig. 61: ÜOverview of operation*

*LED*
*1    Navigator (jog/shuttle and press/hold*
*     function)*
*2    Soft keys (function depends on the menu)*
*3    Display (red background in the event of an*
*4    error)*
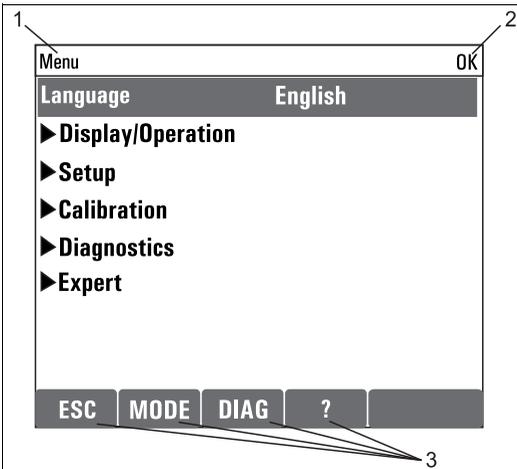
### 8.1.2 Display



*Fig. 62: Display (example)*

*1    Menu path and/or device designation*
*2    Status display*
*3    Assignment of the soft keys, e.g.*
*     ESC: escape or abortion of a sampling process*
*     MODE: quick access to frequently required*
*     functions*
*     DIAG: link to Diagnostics menu*
*     ?: help, if available*

# 8.2    Access to the operating menu via the local display

## 8.2.1    Operation concept
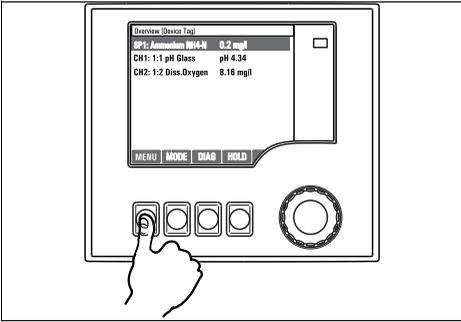


*Fig. 63: Pressing the soft key: selecting the menu directly*
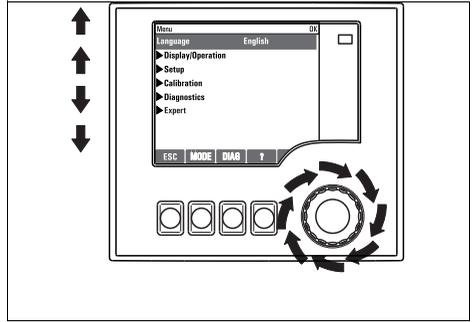


*Fig. 64: Turning the navigator: moving the cursor in the menu*
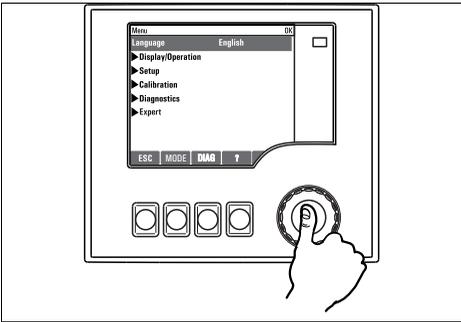


*Fig. 65: Pressing the navigator: launching a function*
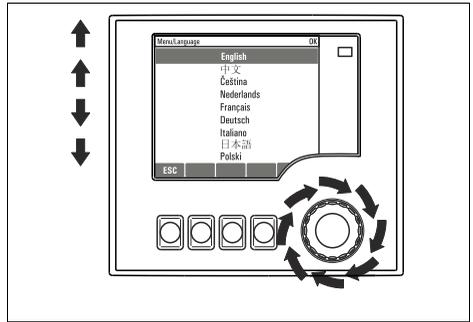


*Fig. 66: Turning the navigator: selecting a value (e.g. from a list)*
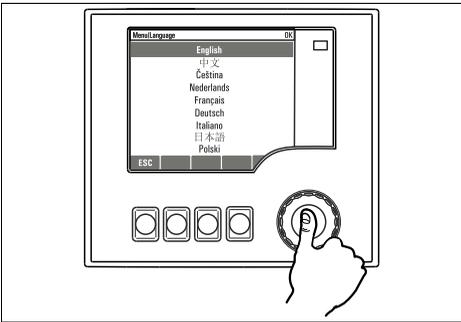


*Fig. 67: Pressing the navigator: accepting the new value*
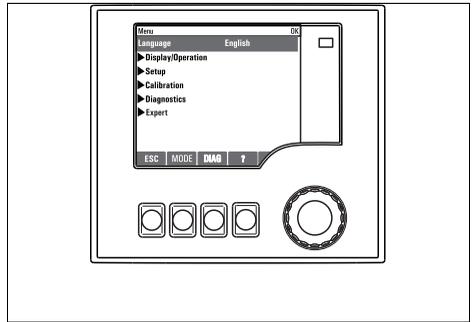


*Fig. 68: Result: new setting is accepted*

### 8.2.2    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. You can set this password here: Menu/Setup/General settings/Extended setup/Data management/Change lock password.

2. Choose whether you want to lock without or without a password.

   ↳ The keys are locked. No more entries can be made. In the soft key bar you can see the symbol 🔒.

   ℹ️    The password is 0000 when the device is delivered from the factory. **Make sure to note down any new 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. Select "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 displayed on the screen.

## 8.3    Access to the operating menu via the Web browser

1. Start your PC.

2. First, set a manual IP address in the network connection settings of the operating system.

   ↳ This address must be in the same subnetwork as the IP address of the device.

   **Example:**

   • IP address for Liquiline System: 192.168.1.212 (Diagnostics/System information/Ethernet/IP-Address)

   • IP address for the PC: 192.168.1.**213**

3. Start the Internet browser.

If you use a proxy server to connect to the Internet:

4. Disable the proxy (browser settings under "Connections/LAN settings").

5. Enter the IP address of your device in the address line.

   ↳ The system takes a few moments to establish the connection and then the CM44 web server starts.

▶ 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)

ℹ Downloads in FDM format can be securely transmitted, saved and visualized with Endress+Hauser's "Field Data Manager Software".
(--> www.products.endress.com/ms20)

## 8.4 Configuration options

### 8.4.1 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

### 8.4.2 Picklists

- You receive a list of options.
- You select one of the options.
- Example: Menu/Setup/General settings/Temperature unit

### 8.4.3 Numerical values

- You are changing a variable.
- The maximum and minimum values for this variable are shown on the display.
- Set a value within this range.
- Example: Menu/Display/Operation/Contrast

```
┌────────────────────────────────────────┐
│ Menu/Display/Operation/Contrast    OK   │
│  5̲2                                      │
│                                         │
│                    ┌─┐┌─┐┌─┐┌─┐┌─┐      │
│                    │0││1││2││3││4│      │
│                    └─┘└─┘└─┘└─┘└─┘      │
│                    ┌─┐┌─┐┌─┐┌─┐┌─┐      │
│  Min    5          │5││6││7││8││9│      │
│                    └─┘└─┘└─┘└─┘└─┘      │
│  Max   95                    ┌─┐┌─┐     │
│                              │←││C│     │
│                              └─┘└─┘     │
│                         ┌─┐┌─┐          │
│                         │✗││✓│          │
│                         └─┘└─┘          │
│                                         │
│  ✗            ←         ✓               │
└────────────────────────────────────────┘
```

### 8.4.4 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: ▷
- Example: Menu/Setup/Analyzer/Manual operation

### 8.4.5 Customized 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 (✔).

### 8.4.6 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 (soft key "INSERT") or delete them (soft key "DEL").
- Afterwards, you save the table (soft key "SAVE").
- You can also cancel your entries any time via the soft key ✗.
- Example: Menu/Setup/Inputs/pH/Medium comp.

| Menu/.../Inputs/pH/Medium comp. | | OK |
|---|---|---|
| | **Temperature** | **pH** |
| 1 | **20.0 °C** | **pH 6.90** |
| 2 | **25.0 °C** | **pH 7.00** |
| 3 | **30.0 °C** | **pH 7.10** |

✗   INSERT   DEL   SAVE

# 9    Commissioning

## 9.1    Function check

**⚠ WARNING**

**Incorrect connection, incorrect supply voltage**

Safety risks for staff and incorrect operation of the device

▶ Check that all connections have been established correctly in accordance with the wiring diagram.

▶ Make sure that the supply voltage matches the voltage indicated on the nameplate.

Before putting the device into operation:

1. Connect the liquid-bearing hoses of the sample supply system.

2. If present, connect the communication cable and hose heater of the sample preparation system to the analyzer.

## 9.2    Switching on the measuring device

▶ Switch on the supply voltage.

 ↳ Wait for the initialization to complete.

## 9.3    Setting the operating language

▶ Press the soft key for "MENU". Select your language in the top menu item.

# 9.4     Configuring the measuring device

## 9.4.1    Display settings

**Path: Menu/Display/Operation**

| Function | Options | Info |
|---|---|---|
| Contrast | 5 ... 95 %<br>**Factory setting**<br>50 % | Adjust the screen settings to suit your working environment.<br>**Backlight="Automatic"**<br>The backlighting is switched off automatically after a short time if a button is not pressed. It switches back on again as soon as you press the navigator button.<br>**Backlight="On"**<br>The backlighting does not switch off automatically. |
| Backlight | Options<br>• On<br>• Off<br>• Automatic<br>**Factory setting**<br>Automatic | |
| Screensaver | Options<br>• Off<br>• Automatic<br>**Factory setting**<br>Off | The screensaver switches off the display if more than 5 minutes have elapsed since the last action executed in the software. The device continues to work as normal even when the display is switched off.<br>Press the Navigator button to reactivate the display. |
| Screen rotation | Options<br>• Manual<br>• Automatic<br>**Factory setting**<br>Manual | If "Automatic" is selected, the single-channel measured value display switches from one channel to the next every second. |
| ▶ User definable screens | | |
| ▶ Meas. screen 1<br>...<br>▶ Meas. screen 6 | | You can create 6 measuring screens of your own and give them a name.<br>As the functions are the same for all 6 measuring screens, only one measuring screen is described below. |
| Meas. screen | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | Once you have defined your own measuring screen, you can switch it on here. You can find the new screen under "User definable screens" in the "All measured values" measuring mode. |
| Label | Customized text,<br>20 characters | Name of the measuring screen<br>Appears in the status bar of the display. |
| Number of lines | 1 ... 8<br>**Factory setting**<br>1 | Specify the number of measured values displayed. |
| ▶ Line 1<br>...<br>▶ Line 8 | | As the following functions are the same for all the lines, they are only described once. |

**Path: Menu/Display/Operation**

| Function | Options | Info |
|---|---|---|
| Signal type | Options<br>• Source of data<br>• Output<br><br>**Factory setting**<br>Source of data | Select a source of data or an output as the signal type. |
| Source of data<br><br>*Signal type = "Source of data"* | Options<br>• None<br>• Sensor inputs<br>• Controller<br>• Fieldbus signals<br><br>**Factory setting**<br>None | Select a binary-, current- or temperature input as the data source. |
| Output<br><br>*Signal type = "Output"* | Options<br>• None<br>• Binary outputs<br>• Current outputs<br>• Relays<br><br>**Factory setting**<br>None | Select an output. You can choose from binary outputs, current outputs and relays. |
| Measured value | Options<br>• Depends on the source of data or output<br><br>**Factory setting**<br>None | You can display different measured values depending on the source of data or output. |
| Actuator type<br><br>*A controller is the data source* | Options<br>• None<br>• Bipolar<br>• Unipolar-<br>• Unipolar+<br><br>**Factory setting**<br>None | More detailed information on controllers and actuating variables can be found in the "Operation & settings" manual. |
| Label | Customized text,<br>20 characters | User-defined name for the parameter to be displayed |
| ▷ Set label to "%0V"[1] | Action | If you perform this action you accept the parameter name that is automatically suggested.<br>Your own parameter name ("Label") is lost! |

1) "%0V" here stands for text that depends on the context. This text is generated automatically by the software and inserted in place of %0V. In the simplest situations, the generated text could be the name of the measuring channel, for example.

## 9.4.2    Basic setup analyzer

**Path: Menu/Setup/Basic setup analyzer**

| Function | Options | Info |
|---|---|---|
| Device tag | Customized text, 32 characters<br><br>**Factory setting**<br>Analyzer_serial number | Select any name for your analyzer. Use the TAG name for example. |
| Set date | Depends on the format | Editing mode:<br>DD (day): 01 to 31<br>MM (month): 01 to 12<br>YYYY (year): 1970 to 2106 |
| Set time | Depends on the format | Editing mode:<br>hh (hour): 00 to 23 / 0 am to 12 pm<br>mm (minutes): 00 to 59<br>ss (seconds): 00 to 59 |
| ▶ Extended setup | | See the "Extended setup" section |
| ▶ Bottle insertion | | Procedure for inserting the bottles |
|   Bottle selection | Options<br>• None<br>• Cleaner<br>• Standard 1<br>• Reagent 1<br>• Reagent 2 | It is possible to select multiple bottles.<br>Make sure that the hoses are connected to the bottles before you select "Bottle insertion". |
| ▷Confirm bottles inserted | | Connect the hoses to the bottles. The hoses of the selected bottles are filled. |
| ▶ Measurement | | See the "Measurement" section |
| ▶ Calibration | | See the "Calibration" section |
| ▶ Cleaning | | See the "Cleaning" section |

For quick commissioning, you can ignore the additional settings for outputs, relays etc. You can make these settings later in the specific menus (see table below).

▶  Return to the measuring mode  by pressing and holding the soft key for "ESC" for at least one second.

  ↳ Your analyzer now works with your general settings.

If you want to configure your most important input and output parameters already in the "Basic setup analyzer", proceed as follows:

▶  Configure the current outputs, relays, limit contactors  and device diagnostics with the submenus which follow.

The table helps you locate the description in the specific section of the manual.

| Menu in Basic setup analyzer | Section | Software path in main menu |
|---|---|---|
| Extended setup | Extended setup | Setup/Analyzer/Extended setup |
| Measurement | Measurement | Setup/Analyzer/Measurement |
| Calibration | Calibration | Setup/Analyzer/Calibration |
| Cleaning | Cleaning | Setup/Analyzer/Cleaning |
| Sample preparation 1 | Sample preparation 1 | Setup/Analyzer/Sample preparation 1 |
| Current output x:y | Outputs | Setup/Outputs/Current output x:y |
| Alarm relay | Outputs | Setup/Outputs/Alarm relay |
| Limit switches | Additional functions | Setup/Additional functions/Limit switches |
| Diagnostics settings | General settings | Setup/General settings/Extended setup/Diagnostics settings |

## 9.5    Display

### 9.5.1    Soft keys in the measurement mode

On the bottom row of the display you can find four soft keys in the measuring screens:
- "MENU" and "DIAG" take you directly to the particular software menu.
- With "HOLD" you can activate an immediate, general hold for sensors. This interrupts any sensor cleaning programs that are currently running. However, you can also start manual sensor cleaning when a hold is active.
- "MODE" takes you to a picklist of frequently used software functions.

### 9.5.2    Measured values

There are various display modes:
(Press the navigator button to change the mode)
1.  Channel overview
    The names of all the channels, e.g. SP1 and SP2, the parameters and the associated main values are shown on the display.
2.  Main value of the selected channel
    The name of the channel, the parameters and the current main value are shown on the display.
3.  Main value and time of next measured value
    The name of the channel, the parameters and the current main value are shown on the display.
4.  Main value and status of the analyzer
    The name of the channel, the parameters and the main value are shown on the display. Furthermore, the screen also displays which action, or which step within an action, is being performed.
    In addition, the duration of the executed action is displayed.
5.  Graphic display (load curve) of the measured value
    Displays the channel and the current main measured value
6.  User-defined measuring screens
    You configure what values you want to display. You can choose from all the measured values of physical and "virtual" sensors (calculated using mathematical functions) and output parameters.

### 9.5.3    Device status

Icons on the display alert you to special device conditions.

| Icon | Location | Description |
|------|----------|-------------|
| **F** | Title bar | Diagnostics message "Failure" |
| **M** | Title bar | Diagnostics message "Maintenance request" |
| **C** | Title bar | Diagnostics message "Check" |
| **S** | Title bar | Diagnostics message "Out of specification" |
| ⇆ | Title bar | Fieldbus or TCP/IP communication active |
| ⩨ | Title bar | Hold active (for sensors) |
| ⩨ | At measured value | Hold for the actuator (current output, limit contactor 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" condition |
| ATC | At measured value | Automatic temperature compensation active (for sensors) |
| MTC | At measured value | Manual temperature compensation active (for sensors) |
| SIM | Title bar | Simulation mode active or Memocheck SIM connected |
| 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) |

1)      Only pH or ORP measurement

ℹ️  If two or more diagnostics 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, see the "Changing diagnostic information" section).

### 9.5.4    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 analyzer
channel  or a sensor channel.
The assignments appear in hierarchical order.

## 9.6    Operation

The analyzer can be operated in three different modes. These modes can be accessed any time via the "MODE" soft key. The user can switch the modes as he wishes. Restrictions only apply due to current operating states.
The mode can be changed at any time, even if an action is running. However, the action must be completed before the mode change can take effect.

### 9.6.1    Manual

The device is in the manual mode when it is delivered or following a device reset.

The analyzer waits for manual input (Menu/Setup/Manual operation). In this mode, it is not possible to access the device from the outside, e.g. via a fieldbus. This can be relevant for safety during maintenance tasks, such as changing the bottles or syringes.

> If accessing via the web server, it is possible to access the analyzer in the manual mode. Some actions, such as sample calibration, are only possible in the manual mode.

### 9.6.2    Automatic

The individual actions (sampling, measuring, cleaning, calibration and maintenance) are performed in the automatic mode. Measuring sequences, calibrations and cleaning intervals can be configured (see the "Analyzer" section). Only adjustments are performed in the automatic mode.

When the automatic mode is activated, two options are available:
- **Continue automatic mode**
  This is only possible if the automatic mode has been active beforehand.
  The time and date stamp are retained.
- **Start automatic mode**
  The time and date stamp are reset.

### 9.6.3    Fieldbus

Remote access can be carried out via fieldbus (Modbus) in order to perform a manual calibration for example.
In addition, an automatic mode can be stopped, the configuration and measuring interval can be changed and then the automatic mode can be restarted.

# 10    Operation

## 10.1    General settings

### 10.1.1    Basic settings

**Path: Menu/Setup/General settings**

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

## 10.1.2  Date and time

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

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

### 10.1.3  Logbooks

Logbooks record the following events:
- Calibration/adjustment events
- Operation events
- Diagnostic events

Here you define how the logbooks should store the data.
In addition, you can also define individual data logbooks for sensors. Assign the logbook name and select the measured value to be recorded. You can configure the recording rate (Scan time) individually for every data logbook.

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.

Path: Menu/Setup/General settings/Logbooks

| Function | Options | Info |
|---|---|---|
| Logbook ident | Customized text | Part of the file name when exporting a logbook |
| Event logbook | Options<br>• Off<br>• Ring buffer<br>• Fill up buffer<br><br>**Factory setting**<br>Ring buffer | All diagnostic messages are recorded<br><br>**Ring buffer**<br>If the memory is full, the latest entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>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. |
| Analyzer event logbook | Options<br>• Off<br>• Ring buffer<br>• Fill up buffer<br><br>**Factory setting**<br>Ring buffer | All program messages are recorded<br><br>**Ring buffer**<br>If the memory is full, the latest entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>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<br>*Event logbook="Fill up buffer"* | | |
|    Calibration logbook<br><br>   Diagnostic logbook<br><br>   Configuration logbook | Options<br>• Off<br>• On<br><br>**Factory setting**<br>Off | Decide whether you want to receive a diagnostic message from the controller in the event of memory overrun of the logbook in question. |

**Path: Menu/Setup/General settings/Logbooks**

| Function | Options | Info |
|---|---|---|
| Overflow warnings<br>*Analyzer event logbook="Fill up buffer"* | Options<br>• Off<br>• On<br><br>**Factory setting**<br>Off | If the fill-up buffer overruns, you can decide whether you want to receive a diagnostic message from the controller or not for each individual logbook. |
| ▶ Analyzer data logbooks | | For analyzer measured data<br>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 the 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 |
| Main value | Read only | Information on the main value and the unit. |
| Unit | Read only | |
| Logbook name | Customized text,<br>16 characters | |
| ▶ Line plotter | | Menu to define the graphic display |
| Axes | Options<br>• Off<br>• On<br><br>**Factory setting**<br>On | Should the axes (x, y) be displayed (On) or not (Off)? |
| Orientation | Options<br>• Horizontal<br>• Vertical<br><br>**Factory setting**<br>Horizontal | You can choose whether the value curves should be displayed from left to right ("Horizontal") or from top to bottom ("Vertical").<br>If you want to display two data logbooks simultaneously, make sure that both logbooks have the same settings here. |
| X-Description<br>Y-Description<br>Grids<br>Pitches | Options<br>• Off<br>• On<br><br>**Factory setting**<br>On | Decide whether a description should be displayed for the axes and whether grids should be shown. In addition, you can also decide whether a pitch should be displayed. |
| X Pitch/Grid distance<br>Y Pitch/Grid distance | 10 ... 50%<br><br>**Factory setting**<br>10 % | Specify the pitch. |

**Path: 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 | Options<br>• Controller<br>• Fieldbus signals<br>• Mathematical functions<br>**Factory setting**<br>None | Select a data source for the logbook entries. You can choose from connected sensors, available controllers, current inputs, field bus signals and mathematical functions. |
|   Measured value | Options<br>• Depends on Source of data<br>**Factory setting**<br>None | You can record different measured values depending on the source of data. |
|   Scan time | 00:00:01 ... 01:00:00<br>**Factory setting**<br>00:01:00 | Minimum interval between two entries<br>Format: HH:MM:SS |
|   Data logbook | Options<br>• Off<br>• Ring buffer<br>• Fill up buffer<br>**Factory setting**<br>Off | **Ring buffer**<br>If the memory is full, the latest entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually. |
|   Overflow warning<br>*Data logbook="Fill up buffer"* | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | If the fill-up buffer overruns, you can decide whether you want to receive a diagnostic message from the controller or not for each individual logbook. |
|   ▷ Add another logbook | Action | *Only if you want to create another data logbook immediately.*<br>You add a new data logbook at a later data using ▶ New. |
|    ▷ Finished | Action | This allows you to exit the menu ▶ New. |
| ▷ Start/stop simultaneously | Action | Appears if you have created more than one data logbook. With one click, you can start or stop recording for all the data logbooks. |
| ▶ "Logbook name" | | The name of this submenu is based on the name of the logbook and only appears once you have created a logbook. |
| ℹ This menu appears several times if you have several data logbooks. | | |

**Path: Menu/Setup/General settings/Logbooks**

| Function | Options | Info |
|---|---|---|
| Source of data<br><br>Measured value | Read only | This is for information purposes only. If you want to record another value, delete this logbook and create a new data logbook. |
| Log time left<br>*Data logbook="Fill up buffer"* | Read only | Displays the days, hours and minutes remaining until the logbook is full. |
| Log size<br>*Data logbook="Ring buffer"* | Read only | Displays the number of entries remaining until the logbook is full. |
| Logbook name | Customized text,<br>20 characters | You can change the name here again. |
| Scan time | 00:00:01 ... 01:00:00<br>**Factory setting**<br>00:01:00 | As above<br>Minimum interval between two entries<br>Format: HH:MM:SS<br>Must be configured individually for each data logbook |
| Data logbook | Options<br>• Off<br>• Ring buffer<br>• Fill up buffer<br>**Factory setting**<br>Off | **Ring buffer**<br>If the memory is full, the latest entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>If the memory is full, there is an overflow, i.e. no new values can be saved. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually. |
| ▶ Line plotter | | Menu to define the graphic display |
| Axes | Options<br>• Off<br>• On<br>**Factory setting**<br>On | Should the axes (x, y) be displayed (On) or not (Off)? |
| Orientation | Options<br>• Horizontal<br>• Vertical<br>**Factory setting**<br>Horizontal | You can choose whether the value curves should be displayed from left to right ("Horizontal") or from top to bottom ("Vertical").<br>If you want to display two data logbooks simultaneously, make sure that both logbooks have the same settings here. |
| X-Description<br><br>Y-Description<br><br>Grids<br><br>Pitches | Options<br>• Off<br>• On<br>**Factory setting**<br>On | Decide whether a description should be displayed for the axes and whether grids should be shown. In addition, you can also decide whether a pitch should be displayed. |
| X Pitch/Grid distance<br><br>Y Pitch/Grid distance | 10 ... 50%<br>**Factory setting**<br>10 % | Specify the pitch. |
| ▷ Remove | Action | This action removes the data logbook. Any data that have not been saved are lost. |

**Example for setting up a new data logbook (for sensors, for instance)**
1.  Menu/Setup/General settings/Logbooks/Data logbooks/New:
    a.  Logbook name: Assign a name, e.g. "01".
    b.  Source of data: Select a data source, e.g. the sensor connected to channel 1 (CH1).
    c.  Measured value: Select the measured value that you want to record.
    d.  Scan time: Specify the interval between two logbook entries.
    e.  Data logbook: Activate the logbook. Specify the type of memory, "Ring buffer" or "Fill up buffer".

2.  ../Finished: Execute this action.
    --> Your new logbook now appears in the list of data logbooks.
3.  Select the data logbook with the name "01".
4.  If you selected "Fill up buffer", you can also decide whether you want to receive a diagnostic message in the event of memory overrun.
5.  Depending on the type of memory selected, you receive information about the memory space (for "Ring buffer") or the time remaining until memory overrun (for "Fill up buffer").
6.  Define the graphic display mode in the "Line plotter" submenu.

### 10.1.4  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.

**Path:    ... /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 | Options<br>• On<br>• Off<br><br>**Factory setting**<br>Depends on the message | You can deactivate or reactivate a diagnostic message here.<br><br>Deactivating means:<br>• No error message in the measuring mode<br>• No error current at the current output |
| Error current | Options<br>• On<br>• Off<br><br>**Factory setting**<br>Depends on the message | Decide whether an error current should be output at the current output if the diagnostic message display is activated. |
| Status signal | Options<br>• Maintenance (M)<br>• Out of specification (S)<br>• Function check (C)<br>• Failure (F)<br><br>**Factory setting**<br>Depends on the message | The messages are divided into different error categories in accordance with NAMUR NE 107.<br><br>Decide whether you want to change a status signal assignment for your application. |

**Path:    ... /Extended setup/Diagnostics settings/Diag. behavior**

| Function | Options | Info |
|---|---|---|
| Diag. output | Options<br>• None<br>**Factory setting**<br>None | Before you can assign the message to an output, you must first configure a relay output to "Diagnostics" (Menu/Setup/Outputs, assign the "Diagnostics" function and set the Operating mode to "as assigned"). |
| Cleaning program (for sensors) | Options<br>• None<br>• Cleaning 1<br>• Cleaning 2<br>• Cleaning 3<br>• Cleaning 4<br>**Factory setting**<br>None | Decide whether the diagnostic message should trigger a cleaning program.<br>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. |

## Modbus

**Path: Menu/Setup/General settings/Extended setup/Modbus**

| Function | Options | Info |
|---|---|---|
| Enable | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | You can switch off Modbus 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 | Options<br>• TCP<br>• RTU<br>• ASCII | The transmission mode is displayed depending on the version ordered. In the case of RS485 transmission, you can choose between "RTU" and "ASCII". |
| Watchdog | 0 to 999 s<br>**Factory setting**<br>5 s | If no data transmission takes place for longer than the time set, this is an indicator that communication has been interrupted.<br>After this time, input values received via the Modbus are considered to be invalid. |

## Ethernet

ℹ️  EtherNet Industrial Protocol is an open fieldbus standard of the Open DeviceNet Vendor
Association (ODVA). --> www.odva.org

Path: Menu/Setup/General settings/Extended setup/Ethernet

| Function | Options | Info |
|---|---|---|
| Enable | Options<br>• Off<br>• On<br>**Factory setting**<br>On | You can switch ethernet communication on and off at this point. |
| Settings | | |
| Link settings | Options<br>• Auto negotiation<br>• 10MBps Half duplex<br>• 10MBps Full duplex<br>• 100MBps Half duplex<br>• 100MBps Full duplex<br>**Factory setting**<br>Auto negotiation | Transmission methods of the communication channels<br>• Full duplex:<br>  Data can be transmitted simultaneously in both directions.<br>• Half-duplex:<br>  Data can only be transmitted alternately in both directions, i.e. not at the same time.<br>Source: Wikipedia |
| DHCP | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | 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, the client need only be configured for automatic retrieval of the IP addresses. During startup, the IP address, the netmask and the gateway are retrieved from a DHCP server. |
| IP-Address | xxx.xxx.xxx.xxx<br>**Factory setting**<br>192.168.1.212 | An IP address is an address in computer networks which are based on the Internet protocol (IP). |
| Netmask | xxx.xxx.xxx.xxx<br>**Factory setting**<br>255.255.255.0 | 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<br>**Factory setting**<br>0.0.0.0 | A gateway (protocol converter) enables communication between networks that are based on completely different protocols. |
| 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. |

**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.
The **current firmware version** of the analyzer, FXAB1 control module, photometer and sample preparation 1 can be found at: Menu/Diagnostics/System information/Software version.

> First save your current setup on an SD card since a firmware update overwrites your settings with the factory settings. After updating the firmware, you can restore your setup by uploading it from the 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 the following question is displayed: 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.

*Updating the measurement parameter lists*

> The measurement parameter lists contain analyzer-specific parameters and constitute a part of the software.

Please contact your local sales office for information on updates that are available for the measurement parameter lists for your analyzer and their compatibility with earlier versions and with firmware versions.
The **current version** of the measurement parameter list of the analyzer can be found at: Menu/Diagnostics/System information/MPL version.

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

1. Insert the SD card into the analyzer card reader.

2. Go to: Menu/Setup/General settings/Extended setup/Data management/Meas. param. list update.

   ↳ The update files on the SD card are displayed.

3. Select the desired update and select yes when the following question is displayed: The current parameter configuration will be overwritten. After this the device will reboot.  Do you want to proceed?

   ↳ The measurement parameter list is loaded and the device is then started.

*Saving the setup*

Saving the setup gives you the following advantages:
- Quick and easy to restore a setup following a firmware update
- Copying settings for other devices
- Quick and easy switching between various setups, e.g. for different user groups or for recurring sensor type change
- 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. Assign a file name (Name).

4. Then select "Save".

5. If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.

6. Select "OK" to confirm, or cancel the action and give the file a new 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*

**You can load a setup you have saved quickly and easily**

When you load a setup, the current configuration is overwritten. Note that cleaning and controller programs could be active. Do you want to continue anyway?

    1. Insert the SD card into the controller card reader.

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.

3. Select the desired setup.

    ↳ The device then displays the following message: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. Select "OK" to confirm or cancel the action.

    ↳ The desired setup is restored after restarting the device.

*Exporting the setup*

Exporting the setup gives you the following advantages
• 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. Assign a file name (Name).

4. Then select "Export".

5. If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.

6. Select "OK" to confirm, or cancel the action and give the file a new name.

   ↳ Your setup is saved on the SD card in a folder named "Device".

   [i] You cannot upload the exported setup to the device again. You must use the "Save setup" function for this purpose. 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
• Software upgrades

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

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

2. Confirm your entry.

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

## 10.2    Analyzer

**Path: Menu/Setup/Analyzer**

| Function | Options | Info |
|---|---|---|
| Mode | Read only | Manual or automatic |
| Device tag | Customized text, 32 characters<br><br>**Factory setting**<br>Analyzer_serial number | Select any name for your analyzer. Use the TAG name for example. |
| Meas. param | Read only | |
| Measuring range | Read only | |

### 10.2.1    Extended setup

**Path: Menu/Setup/Analyzer/Extended setup**

| Function | Options | Info |
|---|---|---|
| ▶ Measuring value | | |
| Main value | Options<br>■  NH4-N<br>■  NH4<br>■  NH3<br><br>**Factory setting**<br>NH4-N | The main value also affects other display screens. However it is only a factor. |
| Unit | Options<br>■  mg/l<br>■  ppm<br><br>**Factory setting**<br>mg/l | |
| Main value format | Options<br>■  #<br>■  #.#<br>■  #.##<br><br>**Factory setting**<br>#.# | |
| ▶ Diagnostics settings | | |
| ▶ Limits dispensers | | |
| Control | Options<br>■  Off<br>■  On<br><br>**Factory setting**<br>On | |

**Path: Menu/Setup/Analyzer/Extended setup**

| Function | Options | Info |
|---|---|---|
| ▶ Warning limit | | |
| Remaining operating hours | Read only | |
| Dispenser 1 ... 7 | 1 to 90 (d)<br>**Factory setting**<br>28 d | |
| Diag. code733 | Read only | |
| ▶ Alarm limit | | |
| Remaining operating hours | Read only | |
| Diag. code732 | Read only | |
| ▶ Bottles | | |
| Control | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | |
| ▶ Bottle filling levels | | |
| ▶ Start volume | | |
| Cleaner | 100 to 1000 ml<br>**Factory setting**<br>500 ml | |
| Standard 1 | 100 to 1000 ml<br>**Factory setting**<br>1000 ml | |
| Reagent 1 | 100 to 1000 ml<br>**Factory setting**<br>1000 ml | |
| Reagent 2 | 100 to 1000 ml<br>**Factory setting**<br>1000 ml | |
| ▶ Warning limits | | |
| Cleaner | 1 to 20 %<br>**Factory setting**<br>5 % | |
| Standard 1 | 1 to 20 %<br>**Factory setting**<br>5 % | |

**Path: Menu/Setup/Analyzer/Extended setup**

| Function | Options | Info |
|---|---|---|
| Reagent 1 | 1 … 40 %<br>**Factory setting**<br>10 % | |
| Reagent 2 | 1 … 40 %<br>**Factory setting**<br>10 % | |
| Diag. code726 | Read only | |
| ▶ Alarm limits | | |
| Cleaner | 1 to 20 %<br>**Factory setting**<br>2 % | |
| Standard 1 | 1 to 20 %<br>**Factory setting**<br>2 % | |
| Reagent 1 | 1 … 40 %<br>**Factory setting**<br>5 % | |
| Reagent 2 | 1 … 40 %<br>**Factory setting**<br>5 % | |
| Diag. code727 | Read only | |
| ▶ Absorption curve recording | | |
| In automatic mode | Options<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | Off: Recording is only possible in the manual mode<br>On: Recording also takes place in the automatic mode |
| Curve | 1 to 7<br>**Factory setting**<br>1 | Select the absorption curve to be recorded.<br>Only one curve can be selected at any one time. The data are saved in a logbook. |
| After power failure | Options<br>▪ Last mode<br>▪ Manual mode<br>**Factory setting**<br>Last mode | Setting specifying how the analyzer should behave after a power failure, and when the power is back on.<br>**Last mode**:<br>The analyzer remains in the mode that was last set. Example: The automatic mode was set. The analyzer returns to operation once initialization has been performed, any sample has been discarded and the system has been cleaned with sample.<br>**Manual mode**:<br>The analyzer switches to the manual mode and waits for user action. |

## 10.2.2   Measurement

**Path: Menu/Setup/Analyzer/Measurement**

| Function | Options | Info |
|---|---|---|
| Start condition | Options<br>• Immediate<br>• Date/time<br>• Continuous<br><br>**Factory setting**<br>Immediate | **Immediate:**<br>The analyzer immediately starts with the measurement cycle once the system changes to the automatic mode<br>**Date/time:**<br>The analyzer starts on the set date/time.<br>**Continuous:**<br>The analyzer measures continuously, without interruption, between the measurements. |
| If Start condition **Immediate** is selected: | | |
| Measuring interval | 00:15 to 24:00 (HH:MM)<br><br>**Factory setting**<br>00:15 | For configuring the time interval of the measurement |
| If Start condition **Date/time** is selected: | | |
| Date | 01.01.1970 ... 07.02.2106<br><br>**Factory setting**<br>DD.MM.YYYY | |
| Time | 00:00:00 ... 23:59:59<br><br>**Factory setting**<br>HH:MM:SS (24 h) | |
| Measuring interval | 00:15 to 24:00 (HH:MM)<br><br>**Factory setting**<br>00:15 | For configuring the time interval of the measurement |
| | | |
| ▶ Sequence of measurements | | Is only displayed for a two-channel device.<br>For further information, see the "Sample preparation" section. |
| SP1 | 0 to 99<br><br>**Factory setting**<br>1 | Number of consecutive measurements |
| SP2 | 0 to 99<br><br>**Factory setting**<br>1 | Number of consecutive measurements |
| Next measurem. %0V[1]<br>*Mode = "Automatic"* | Read only | Time of the next measurement |

1) "%0V" here stands for text that depends on the context. This text is generated automatically by the software and inserted in place of %0V. In the simplest situations, the generated text could contain the time or the name of the measuring channel, for example.

### 10.2.3  Calibration

**Path: Menu/Setup/Analyzer/Calibration**

| Function | Options | Info |
|---|---|---|
| Start condition | Options<br>• Immediate<br>• Date/time<br><br>**Factory setting**<br>Immediate | The calibration can start either immediately or on the set date/time. |
| If Start condition **Date/time** is selected: | | |
| Date | 01.01.1970 ... 07.02.2106<br><br>**Factory setting**<br>DD.MM.YYYY | |
| Time | 00:00:00 ... 23:59:59<br><br>**Factory setting**<br>HH:MM:SS (24 h) | |
| | | |
| Calibration interval | 00-01 to 90-00 (DD-HH)<br><br>**Factory setting**<br>02-00 | For configuring the time interval of the calibration/adjustment. |
| Next calibration<br>*Mode = "Automatic"* | Read only | |
| Calibration factor | Read only | Relationship of the measured concentration to the pre-specified concentration of the calibration standard. |
| ▶ Settings | | |
|     Concentration | 1.0 to 100.0 (mg/l)<br><br>**Factory setting**<br>10.00 (with reference to $NH_4$-N) | For configuring the concentration of the calibration standard solution.<br>Depends on the settings under Menu/Setup/Analyzer/Extended setup/Measuring value/Main value |
|     Automatic cleaning | Options<br>• Off<br>• On<br><br>**Factory setting**<br>On | For specifying whether cleaning will take place before every calibration/adjustment (only in the automatic mode). |

## 10.2.4   Cleaning

Additional cleaning can be adapted to the application conditions in this menu.

**Path: Menu/Setup/Analyzer/Cleaning**

| Function | Options | Info |
|---|---|---|
| Start condition | Options<br>• Immediate<br>• Date/time<br>• Disabled<br>**Factory setting**<br>Disabled | **Immediate:**<br>Cleaning of the valve manifold and cell starts immediately.<br>**Date/time:**<br>Cleaning of the valve manifold and cell starts on the selected date/time.<br>**Disabled:**<br>Additional cleaning is not active. |
| If Start condition **Date/time** is selected: | | |
| Date | 01.01.1970 ... 07.02.2106<br>**Factory setting**<br>DD.MM.YYYY | |
| Time | 00:00:00 ... 23:59:59<br>**Factory setting**<br>HH:MM:SS (24 h) | |
| | | |
| Cleaning interval | 00-01 to 90-00 (DD-HH)<br>**Factory setting**<br>02-00 | For configuring the time interval for (additional) cleaning. |
| Next cleaning<br>*Mode = "Automatic"* | Read only | |

## 10.3    Sample preparation

ℹ️    The menu displayed depends on the connected sample preparation system. The menu item does not appear if a Liquiline System CA80AM analyzer is connected without a collecting vessel.
The Liquiline System CAT860 can only be operated with a Liquiline System CA80 single-channel device.

**Path: Menu/Setup/Sample preparation**

| Function | Options | Info |
|---|---|---|
| Used channels | Options<br>• SP1<br>• SP2<br>• SP1 + SP2<br><br>**Factory setting**<br>SP1 | Is only displayed for a two-channel device.<br>For further information, see the "Measurement" section. |
| InstallationType | Options<br>• Others<br>• Pressurized pipe sampling<br><br>**Factory setting**<br>Others | **Others**:<br>e.g. Liquiline System CAT820 / CAT860<br>**Pressurized pipe sampling**:<br>Sample preparation that is installed in a pressure pipe,<br>e.g. Liquiline System CAT810. |
| If InstallationType **Others** is selected: | | |
| ▶ Sample preparation 1 | | In the case of a two-channel device, Sample preparation 2 is also displayed. |
| Operating mode | Options<br>• Controlled<br>• Independent<br><br>**Factory setting**<br>Controlled | **Controlled:**<br>Sample preparation that is controlled by analyzer CA80,<br>e.g. Liquiline System CAT820 / CAT860<br>**Independent:**<br>No sample preparation that is controlled by the Liquiline System CA80 analyzer, e.g. Stamoclean CAT430.<br>The supply of sample must be guaranteed by the customer. |
| If Operating mode **Controlled** is selected: | | |
| Tag | Customized text,<br>32 characters | |
| Cleaning start condition<br>*(CAT860)* | Options<br>• Immediate<br>• Date/time<br>• Disabled | **Immediate:**<br>Cleaning starts immediately.<br>**Date/time:**<br>Cleaning starts at the selected date/time.<br>**Disabled:**<br>Cleaning is not active. |
| When Start condition **Immediate** or **Date/time** is selected: | | |
| Cleaning interval<br>*(CAT860)* | 00-01 to 90-00 (DD-HH)<br><br>**Factory setting**<br>01-00 | Compressed air or water cleaning for longer filter maintenance intervals<br>Cleaning with liquid cleaner |

**Path: Menu/Setup/Sample preparation**

| Function | Options | Info |
|---|---|---|
| If Start condition **Date/time** is selected: | | |
| Date<br>*(CAT860)* | 01.01.1970 to 07.02.2106<br>DD.MM.YYYY<br>**Factory setting**<br>01.01.1970 | |
| Time<br>*(CAT860)* | 00:00:00 to 23:59:59<br>HH:MM:SS<br>**Factory setting**<br>00:00:00 | |
| | | |
| Residence time<br>*(CAT860)* | 00:30 to 20:00 (MM:SS)<br>**Factory setting**<br>01:00 | Reaction time of cleaner during the cleaning |
| ▶ Sampling pump interval *(CAT820, CAT860)* | | |
| Pump time | 10 to 30 s<br>**Factory setting**<br>10 s | Ratio between the pumping duration and the pumping interval of the peristaltic pump. This affects the volume of the pumped sample. |
| Pump pause | 10 to 50 s<br>**Factory setting**<br>30 | |
| ▶ Pressurized air cleaning *(CAT820, CAT860)* | | |
| Compressed air<br>*(CAT820)* | Options<br>• Available<br>• Not available<br>**Factory setting**<br>Depends on the device version | Settings for sample preparation with or without compressed air cleaning.<br>In the event of retrofitting, the compressed air can be activated here. |
| Cleaning mode | Options<br>• On<br>• Off<br>**Factory setting**<br>On | Activates or deactivates automatic compressed air cleaning of the pump-to-filter hose and of the filter. |
| Cleaning interval | 00:30 to 04:00 HH:MM<br>**Factory setting**<br>02:00 | Cleaning interval of the automatic compressed air cleaning system |
| Cleaning duration | 10 to 60 s<br>**Factory setting**<br>30 s | Cleaning duration of the automatic compressed air cleaning system |

**Path: Menu/Setup/Sample preparation**

| Function | Options | Info |
|---|---|---|
| ▶ Heatings *(CAT820, CAT860)* | | |
| Cabinet | Options<br>• Available<br>• Not available<br>**Factory setting**<br>Depends on the device version | In the event of retrofitting, the heating can be activated here. |
| Hose filter | Options<br>• Available<br>• Not available<br>**Factory setting**<br>Depends on the device version | In the event of retrofitting, the heating can be activated here. |
| Hose analyzer | Options<br>• Available<br>• Not available<br>**Factory setting**<br>Depends on the device version | In the event of retrofitting, the heating can be activated here. |
| ▶ Diagnostics settings | | |
| ▶ Limit change filter *(CAT820, CAT860)* | | |
| Function | Options<br>• Off<br>• On<br>**Factory setting**<br>Off | |
| Diag. code729 | Read only | |
| Warning limit | 01-00 to 99-00 (DD-HH)<br>**Factory setting**<br>60-00 | |
| ▶ Limit change hose *(CAT820, CAT860)* | | |
| Function | Options<br>• Off<br>• On<br>**Factory setting**<br>On | |
| Diag. code337 | Read only | |
| Warning limit | 01-00 to 99-00 (DD-HH)<br>**Factory setting**<br>60-00 | |
| ▷ Reset settings | | Resets all settings specific to sample preparation All other settings are retained. |

**Path: Menu/Setup/Sample preparation**

| Function | Options | Info |
|---|---|---|
| If InstallationType **Pressurized pipe sampling** is selected (with Liquiline System CAT810 for instance): | | |
| ▶ Sample preparation 1 | | In the case of a two-channel device, Sample preparation 2 is also displayed. |
|    Cleaning valve | Options<br>• Not available<br>• Available<br><br>**Factory setting**<br>Not available | In the event of retrofitting, the valve can be activated here. |
| If Cleaning valve **Available** is selected: | | |
|    Filter backflush | Options<br>• On<br>• Off<br><br>**Factory setting**<br>On | |
| If Filter backflush **On** is selected: | | |
|    Cleaning interval | 00:10 to 02:00 HH:MM<br><br>**Factory setting**<br>00:30 | Compressed air or water cleaning (optional) for longer filter maintenance intervals. |
| | | |
|    Cleaning duration | 10 to 30 s<br><br>**Factory setting**<br>10 s | Cleaning duration of the automatic water or compressed air cleaning system |
|    Cleaning discard time | 0 to 60 s<br><br>**Factory setting**<br>30 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. |
| ▷ Reset settings | | Resets all settings specific to sample preparation All other settings are retained. |

## 10.4    Manual operation

In this menu singular actions, such as measurement or cleaning, can be performed in the manual mode. It is also possible to cancel actions here.

🔲 The menu displayed for sample preparation depends on the connected sample preparation system.

**Path: Menu/Setup/Manual operation**

| Function | Options | Info |
|---|---|---|
| Current action | Read only | Describes the actions of the analyzer, such as measurement, calibration, cleaning and pumping. |
| Current step | Read only | The step within the action is displayed |
| Current action for | Read only | Is only displayed if an action is currently running. Display in MM:SS |
| ▷ Start measurement | | Starts a measurement immediately. Is only displayed if no measurement is currently running. |
| ▷ Stop measurement | | Stops the measurement; any sample or reaction solution is discarded and the system is rinsed with the sample. Afterwards the analyzer is set to a defined state. Is only displayed if a measurement is currently running. |
| ▷ Start calibration (zero-point) | | Starts zero point calibration immediately with the set stability criteria. The values of the calibration can be accepted for an adjustment. |
| ▷ Start calibration (1 point) | | Starts a calibration immediately with the configured stability criteria and the specified concentration value for the standard solution. The values of the calibration can be accepted for an adjustment. |
| ▷ Stop calibration | | Stops the calibration currently underway; any sample or reaction solution is discarded and the system is rinsed with the standard solution. The analyzer is set to a defined state. |
| ▷ Start calibration (data input) | | |
|    Current cal. factor | Read only | |
|    New cal. factor | 0.10 … 100.00  **Factory setting** 1.00 | Relationship of the measured concentration to the pre-specified concentration of the calibration standard. This can be changed. |
|   ▷ Accept calibration data | | Accepts the calibration data for the adjustment |
| ▶ Clean. Settings | | |
|    Residence time | 00:01 to 05:00 (MM:SS)  **Factory setting** 00:30 | For setting the residence time of the cleaner for the cell. This residence time is independent of automatic cleaning. |
| ▷ Start cleaning | | Starts a cleaning immediately. Is only displayed if no cleaning is running. |

**Path: Menu/Setup/Manual operation**

| Function | Options | Info |
|---|---|---|
| ▷ Stop cleaning | | Stops the cleaning<br>Is only displayed if a cleaning is currently running. |
| ▶ Sample preparation 1 *(CAT820, CAT860)* | | In the case of two-channel devices, Sample preparation 2 is also displayed. |
| ▶ Cleaning of filter | | |
| ▷ Start flushing with air | | |
| ▷ Stop flushing with air | | |
| ▷ Start flushing with cleaner *(CAT860)* | | |
| ▷ Stop flushing with cleaner *(CAT860)* | | Any remaining cleaner is rinsed out, for example, when you exit the menu. The system is set to a defined state. |
| ▶ Cleaning towards analyzer | | |
| ▷ Start flushing with air | | |
| ▷ Stop flushing with air | | |
| ▷ Start flushing with cleaner *(CAT860)* | | |
| ▷ Stop flushing with cleaner *(CAT860)* | | Any remaining cleaner is rinsed out, for example, when you exit the menu. The system is set to a defined state. |
| ▷ Start sampling | | Sample pumping in interval mode |
| ▷ Start sampling, continuous mode | | |

## 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.

**Path: Menu/Setup/Inputs/Current input %0V x:y[1)]**

| Function | Options | Info |
|---|---|---|
| Mode | Options<br>■ Off<br>■ 0 to 20 mA<br>■ 4 to 20 mA<br><br>**Factory setting**<br>4 to 20 mA | Select the same current range as in the data source (connected device). |
| Input mode | Options<br>■ Parameter<br>■ Current<br><br>**Factory setting**<br>Current | Select the input variable. |
| Meas. value format | Options<br>■ #<br>■ #.#<br>■ #.##<br>■ #.###<br><br>**Factory setting**<br>#.# | Specify the number of decimal places. |
| Parameter name<br>*Input mode "Parameter"* | Customized text | Assign a useful name, such as the parameter name, which the data source uses. |
| Unit of measure<br>*Input mode "Parameter"* | Customized text | You cannot choose the unit from a list. If you want to use a unit, you must enter it manually here. |
| Lower range value<br>*Input mode "Parameter"* | -20.0 to Upper range value <engineering unit><br><br>**Factory setting**<br>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.<br>The system uses the engineering unit which you entered beforehand. |
| Upper range value<br>*Input mode "Parameter"* | Upper range value to 10000.0 <engineering unit><br><br>**Factory setting**<br>10.0 <engineering unit> | |
| Damping | 0 to 60 s<br><br>**Factory setting**<br>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, e.g. "DIO" module with 2 digital inputs and 2 digital outputs or fieldbus module "485" enables the following:
- via a digital input signal
  - measuring range switching for conductivity (upgrade code required, see accessories)
  - switching between different calibration data records in the case of optical sensors
  - an external hold (for sensors)
  - a cleaning interval to be triggered (for sensors)
  - a PID controller to be switched on and off, e.g. via  proximity switch
  - the use of the input as an "analog input" for pulse-frequency modulation (PFM)
- via a digital output signal
  - the static transmission (similar to a relay) of diagnostic states, point level switch states etc.
  - 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 control with feedforward control



*Fig. 69: Example of chlorine control with feedforward control*

| 1 | Connection of the inductive proximity switch INS of the CCA250 assembly at the digital input of the DIO module for enabling the controller |
|---|---|
| 2 | Connection of the signal from a flowmeter to the digital input of the DIO module using the pulse-frequency modulation (=PFM, setting in the Liquiline firmware) for feedforward control |
| 3 | Activation of a (pulse) dosing pump via a digital output of the DIO module using the PFM |
| A | Dosing pump |

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

1. Connect the proximity switch INS from assembly CCA250 to a digital input of the DIO module. Configure a controller in the software, selecting the binary input for the function "Controller Enable" which the proximity switch is connected to. Leave the "Signal type" in the inputs menu at the factory setting "Static signal" as the selected input.

2. Connect the flowmeter value to the second input of the DIO module. Set the "Signal type" for this input to "PFM" in the inputs menu and select the corresponding measured value.

   ↳ You can now use this input in the controller menu as the disturbance variable for your controller [1]. To do so, in the submenu "Disturbance variable" select the binary input to which you connected the flow measured value as the "Source of data."

3. You can activate a dosing pump through PFM via a digital output of the DIO module. In the outputs menu, set the "Signal type" of the corresponding binary output to "PFM" and use the previously configured controller as the "Source of data." Observe your dosing's direction of action, so that you correctly install the "Actuator type."

   ℹ️ You must make additional settings in the controller menu to fully adapt the controller to your process conditions.

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

**CA80 as cleaning master for connected sensors (optional)**
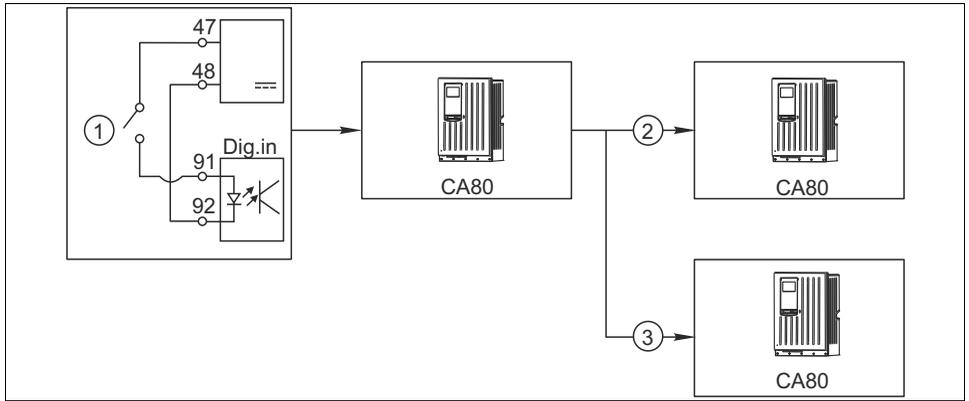


*Fig. 70: Example of a central cleaning control*

*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*

CA80 as "cleaning master"
1.  An external trigger triggers a cleaning  of the sensor at the master. A cleaning unit is connected over 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.

## 10.6.2    Binary input configuration

**Path: Menu/Setup/Inputs/Binary input x:y[1]**

| Function | Options | Info |
|---|---|---|
| Binary input | Options<br>• Off<br>• On<br><br>**Factory setting**<br>On | Switching the input on/off |
| Signal type | Options<br>• Static signal<br>• PFM<br><br>**Factory setting**<br>Static signal | Select the signal type.<br>**Static signal**<br>Use this setting to read out the position of, for example, an on/off switch, an inductive proximity switch or a PLC binary output.<br>Signal application: for measuring range switching, acceptance of an external hold, as a cleaning trigger or for controller activation<br><br>**PFM**<br>The PFM setting produces a pulse-frequency-modulated signal that is subsequently available on the device as a quasi-continuous process value.<br>Example: Measuring signal of a flowmeter |
| | *Signal type = "Static signal"* | |
| Signal level | Options<br>• High<br>• Low<br><br>**Factory setting**<br>High | Determine which input signal levels should activate, for example, measuring range switching or a cleaning.<br>**High**<br>Input signals between 11 and 30 V DC<br>**Low**<br>Input signals between 0 and 5 V DC |
| | *Signal type = "PFM"* | |
| Max. frequency | 100.00 to 1000.00 Hz<br><br>**Factory setting**<br>1000.00 Hz | Maximum frequency of the PFM input signal<br>Is to equal the maximum possible upper limit of the measuring range.<br>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 | Options<br>• #<br>• #.#<br>• #.##<br>• #.###<br><br>**Factory setting**<br>#.## | Specify the number of decimal places. |

**Path: Menu/Setup/Inputs/Binary input x:y[1)]**

| Function | Options | Info |
|---|---|---|
| Input mode | Options<br>• Frequency<br>• Parameter<br><br>**Factory setting**<br>Frequency | **Frequency**<br>Display in Hz in the measuring menu<br><br>**Parameter**<br>You subsequently determine the parameter name and unit. These are then displayed in the measuring menu. |
| Parameter name<br>*Input mode = "Parameter"* | Customized text | Define a name for the parameter, e.g. "flow rate." |
| Unit of measure<br>*Input mode = "Parameter"* | Customized text | Determine the unit in which your parameter should be displayed, e.g." l/min." |
| Lower range value<br>*Input mode = "Parameter"* | -2000.00 ... 0.00<br><br>**Factory setting**<br>0.00 | Your previously defined unit is additionally displayed. The start of measuring range corresponds to a frequency of 0 Hz. |
| Upper range value<br>*Input mode = "Parameter"* | 0.00 ... 10000.00<br><br>**Factory setting**<br>0.00 | The end of measuring range corresponds to the maximum frequency defined above. The displayed unit is the one predefined by you. |
| Damping | 0 to 600 s<br><br>**Factory setting**<br>0 s | The damping generates a floating average curve of the measured value over the specified time. |

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

## 10.6.3   Configuration of binary outputs

**Path: Menu/Setup/Outputs/Binary output x:y[1)]**

| Function | Options | Info |
|---|---|---|
| Binary output | Options<br>• Off<br>• On<br><br>**Factory setting**<br>On | Switching the output on/off |
| Signal type | Options<br>• Static signal<br>• PFM<br><br>**Factory setting**<br>Static signal | Select the signal type.<br><br>**Static signal**<br>Comparable to a relay: output of a diagnostic status or a limit contactor<br><br>**PFM**<br>You can output a measured value, e.g. the chlorine value or the manipulated variable of a controller.<br>It functions as a "wear-free" switching contact that can be used to activate a dosing pump, for example. |

**Path: Menu/Setup/Outputs/Binary output x:y[1]**

| Function | Options | Info |
|---|---|---|
| *Signal type = "PFM"* | | |
| Max. frequency | 1.00 to 1000.00 Hz<br><br>**Factory setting**<br>1000.00 Hz | Maximum frequency of the PFM output signal<br>Is to equal the maximum possible upper limit of the measuring range. |
| Meas. value format | Options<br>▪ #<br>▪ #.#<br>▪ #.##<br>▪ #.###<br><br>**Factory setting**<br>#.## | Specify the number of decimal places. |
| Source of data | Options<br>▪ None<br>▪ Sensor inputs<br>▪ Binary inputs<br>▪ Controller<br>▪ Fieldbus signals<br>▪ Mathematical functions<br><br>**Factory setting**<br>None | Source, whose value should be read out as a frequency over the binary output. |
| Measuring value<br>*Source of data = an input* | Selection dependent on "Source of data" | "Inputs" = everything except controllers |
| Actuator type<br>*Source of data = a controller* | Options<br>▪ None<br>▪ Bipolar<br>▪ Unipolar+<br>▪ Unipolar-<br><br>**Factory setting**<br>None | Determines which controller component the connected actuator, e.g. the dosing pump, should trigger.<br><br>**Unipolar+**<br>Part of the manipulated variable that the controller uses to increase the process value<br><br>**Unipolar-**<br>For connected actuators that decrease the controlled variable<br><br>**Bipolar**<br>"Split range" |
| Hold behavior | Options<br>▪ Freeze<br>▪ Fixed value<br>▪ None<br><br>**Factory setting**<br>Freeze | **Freeze**<br>The device freezes the last value.<br><br>**Fixed value**<br>You define a fixed current value that is transmitted at the output.<br><br>**None**<br>A hold does not affect this output. |
| Hold value<br>*Hold behavior = "Fixed value"* | 0 ... 100 %<br><br>**Factory setting**<br>0 % | |

**Path: Menu/Setup/Outputs/Binary output x:y[1)]**

| Function | Options | Info |
|---|---|---|
| Error behavior | Options<br>• Freeze<br>• Fixed value<br>**Factory setting**<br>Fixed value | **Freeze**<br>The device freezes the last value.<br><br>**Fixed value**<br>You define a fixed current value that is transmitted at the output. |
| Error value<br>*Error behavior = "Fixed value"* | 0 ... 100 %<br>**Factory setting**<br>0 % | |
| *Signal type = "Static signal"* | | |
| Function | Options<br>• None<br>• Limit switches<br>• Diagnostics message<br>• Cleaning<br>**Factory setting**<br>None | Source for the outputted switching state<br><br>The following functions depend on the option selected. Function = "None" switches the function off without requiring any settings. |
| Assignments<br>*Function = "Cleaning"* | Multiple selection<br>• Cleaning 1 - Water<br>...<br>• Cleaning 4 - Cleaner | Here you can decide which binary outputs should be used for activating the valves and pumps. Here you concretely assign a control signal to the binary output for the cleaner/water dosing of a cleaning program.<br><br>You can define the cleaning programs under: Menu/Setup/Additional functions/Cleaning. |
| Data sources<br>*Function = "Limit switches"* | Multiple selection<br>• Limit switch 1<br>...<br>• Limit switch 8 | Select the limit contactor to be transmitted over the binary output.<br>The limit switches are configured in the "Setup/Additional functions/Limit switches" menu. |
| Operating mode<br>*Function = "Diagnostics message"* | Options<br>• as assigned<br>• Namur M<br>• Namur S<br>• Namur C<br>• Namur F<br>**Factory setting**<br>as assigned | **as assigned**<br>With this selection, the diagnosis messages are transmitted over the binary output that you individually allocated to it.<br><br>**Namur M... F**<br>When you choose one of the Namur classes, all messages allocated to that respective class are output. You can also change the Namur class assignment for every diagnostics message.<br>(Menu/Setup/General settings/Diagnostics/Device behavior or Menu/Setup/Inputs/../Diagnostics settings/Diag. behavior) |

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

## 10.7  Outputs

### 10.7.1  Current outputs

Liquiline System CA80 has two analog current outputs as standard.
Set the current range from 0 to 20 mA or 4 to 20 mA under Menu/Setup/General settings.

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

ⓘ   The current output curve is always linear.

**Path: Menu/Setup/Outputs/Current output x:y (slot:output number)**

| Function | Options | Info |
|---|---|---|
| Current output | Options<br>• On<br>• Off<br><br>**Factory setting**<br>Off | Use this function to activate and deactivate a variable being output at the current output |
| Source of data | Options<br>• None<br>• Connected inputs<br>• Controller<br><br>**Factory setting**<br>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 | Options<br>• None<br>• Depends on theSource of data<br><br>**Factory setting**<br>None | The measured value you can select depends on the option selected under "Source of data". |
| ⓘ   The table on the next page lists the measured values available depending on the data source.<br>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 also select and configure the current output for outputting the controlled variable. | | |
| Range lower value<br><br>Range upper value | Selection range and factory settings depend on:<br>"Measured value" | You can output the entire measuring range of the "Measured value" or just some of it at the current output. For this purpose, specify the start and end of the range in accordance with your requirements. |

**Path: Menu/Setup/Outputs/Current output x:y (slot:output number)**

| Function | Options | Info |
|---|---|---|
| Hold behavior (for sensors) | Options<br>• Freeze<br>• Fixed value<br>• None<br><br>**Factory setting**<br>Depends on the channel:output | **Freeze**<br>The device freezes the last current value.<br><br>**Fixed value**<br>You define a fixed current value that is output at the output.<br><br>**None**<br>A hold does not affect this current output. |
| Hold current (for sensors)<br><br>*Hold behavior="Fixed value"* | 0.0 to 23.0 mA<br><br>**Factory setting**<br>22.0 mA | Specify which current should be output at this current output in the event of a hold. |

**Measured valuedepending on theSource of data**

| Source of data | Measured value |
|---|---|
| Ammonium (NH4-N) | Options<br>• Main value |
| | |
| pH Glass<br><br>pH ISFET | Options<br>• Raw value mV<br>• pH<br>• Temperature |
| ORP | Options<br>• Temperature<br>• ORP mV<br>• ORP % |
| Oxygen (amp.)<br><br>Oxygen (opt. WW) | Options<br>• Temperature<br>• Partial pressure<br>• Concentration liquid<br>• Saturation<br>• Raw value nA(only Oxygen (amp.))<br>• Raw value µs(only Oxygen (opt. WW)) |
| Cond i<br><br>Cond c | Options<br>• Temperature<br>• Conductivity<br>• Resistance(only Cond c)<br>• Concentration(only Cond i) |
| Chlorine | Options<br>• Temperature<br>• Current<br>• Concentration |

Measured valuedepending on theSource of data

| Source of data | Measured value |
|---|---|
| ISE | Options<br>• Temperature<br>• pH<br>• Ammonium<br>• Nitrate<br>• Potassium<br>• Chloride |
| TU/TS | Options<br>• Temperature<br>• Turbidity g/l<br>• Turbidity FNU |
| Nitrate | Options<br>• Temperature<br>• NO3<br>• NO3-N |
| Ultrasonic interface (interface measurement) | Options<br>• Interface<br>• Turbidity |
| SAC | Options<br>• Temperature<br>• SAC<br>• Transm.<br>• Absorption<br>• COD<br>• BOD |
| Controller 1<br><br>Controller 2 | Options<br>• Bipolar(only current outputs)<br>• Unipolar+<br>• 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**
Assign "Unipolar+" to the output to which an actuator that can increase the measured value is connected. Assign "Unipolar-" 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.

### ÜThe following functions can be output via a relay

- Limit switch status
- Controller manipulated variable for controlling an actuator
- Diagnostics 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.

**Path: Menu/Setup/Outputs/Alarm relay or relay at channel no.**

| Function | Options | Info |
|---|---|---|
| Function | Options<br>• Off<br>• LimitSwitch<br>• Diagnostics<br>• Cleaning (Sensor)<br><br>**Factory setting**<br>Off | The following functions depend on the option selected. These versions are illustrated individually in the following section to provide a clearer understanding of the options.<br><br>Function="Off" switches off the relay function and means no further settings are required. |

### Outputting the status of a limit switch

**Function="LimitSwitch"**

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

## 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 | Options<br>• None<br>• Controller 1<br>• Controller 2<br><br>**Factory setting**<br>None | Select the controller that should act as the data source. |
| Operating mode | Options<br>• PWM<br>• PFM<br><br>**Factory setting**<br>PWM | PWM=pulse width modulation<br>PFM=pulse frequency modulation |

## Types of 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.
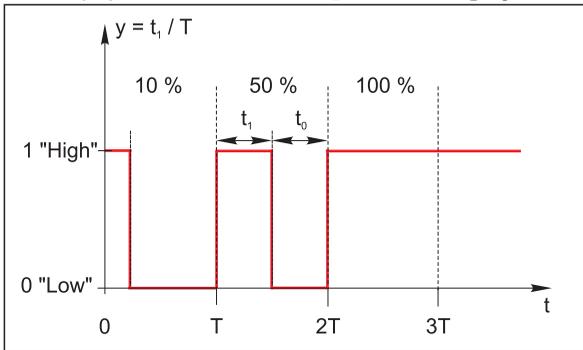
   

   Typical application: solenoid valve

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, $t_1 = t_0$.
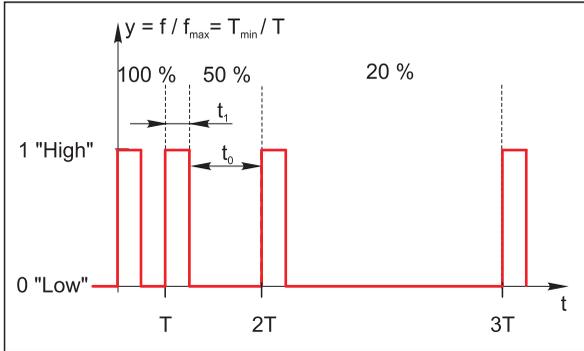


Typical application: dosing pump

**Function="Controller"**

| Function | Options | Info |
|---|---|---|
| Actuator type | Options<br>• None<br>• Unipolar-<br>• Unipolar+<br>**Factory setting**<br>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). On the other hand, select "Unipolar-" if you want to connect an actuator to the relay that causes the controlled variable to drop (e.g. for cooling purposes). |
| Cycle duration<br>*Operating mode="PWM"* | (Shortest turn-on time) to 999.0 s<br>**Factory setting**<br>10.0 s | Specify the cycle duration within which the duty cycle should be varied (only PWM). |
| ℹ The settings for Cycle duration and Shortest turn-on time mutually affect one another. The following applies: Cycle duration ≥ Shortest turn-on time. | | |
| Shortest turn-on time<br>*Operating mode="PWM"* | 0.3 s to (Cycle duration)<br>**Factory setting**<br>0.3 s | Pulses that are shorter than this limit value are not output in order to conserve the actuator. |
| Maximum frequency<br>*Operating mode="PFM"* | 1 to 180 min$^{-1}$<br>**Factory setting**<br>60 min$^{-1}$ | Maximum number of pulses per minute<br>The controller calculates the pulse duration based on this setting. |

**Outputting diagnostics messages via the relay**

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

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

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

**Function="Diagnostics"**

| Function | Options | Info |
|---|---|---|
| Operating mode | Options<br>• as assigned<br>• Namur M<br>• Namur S<br>• Namur C<br>• Namur F<br><br>**Factory setting**<br>as assigned | **as assigned**<br>If this option is selected, the diagnostics messages which you have individually assigned to the relay are output via the relay.<br><br>**Namur M... F**<br>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.<br>You can also change the Namur class assignment for every diagnostics message.<br>(Menu/Setup/General settings/Diagnostics/Device behavior or Menu/Setup/Inputs/../Diagnostics settings/Diag. behavior) |
| Attributed diagnostic messages<br><br>*Operating mode="as assigned"* | Read only<br>List of diagnostic messages | All the messages assigned to the relay output appear on the display.<br>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 |
|----------|---------|------|
| Assignment | Options<br>• None<br>• Cleaning 1 - Water<br>• Cleaning 1 - Cleaner<br>• Cleaning 2 - Water<br>• Cleaning 2 - Cleaner<br>• Cleaning 3 - Water<br>• Cleaning 3 - Cleaner<br>• Cleaning 4 - Water<br>• Cleaning 4 - Cleaner<br><br>**Factory setting**<br>None | Here you can specify how a cleaning function should be displayed for the alarm relay.<br><br>You can define the cleaning programs under:<br>Menu/Setup/Additional functions/Cleaning. |

### 10.7.3   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:
▶  Define the data source. You can choose from the analyzer as well as sensor inputs and controllers.
▶  From the source, select the measured value that should be output.
▶  Define how the device should behave in the event of a "Hold"  (for sensors).
▶  The configuration options for "Source of data", "Measured value" and "Hold behavior" are identical to those described in the "Outputs/Current outputs" section. Please refer to this section for more information.
▶  Please note that if you select Hold behavior="Freeze", the system not only flags the status but also actually "freezes" the measured value.

# 10.8   Additional functions

### 10.8.1   Limit switches

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

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

| Function | Options | Info |
|---|---|---|
| Source of data | Options<br>• None<br>• Connected sensors<br>• Controllers available<br>• Analyzer<br><br>**Factory setting**<br>None | Specify the input or output which should be the source of data for the limit switch. |
| Measuring value | Options<br>• None<br>• Depends on theSource of data<br><br>**Factory setting**<br>None | The measured value you can select depends on the option selected under "Source of data". |

**Measured valuedepending on theSource of data**

| Source of data | Measured value |
|---|---|
| Ammonium (NH4-N) | Options<br>• Main value |
| | |
| pH Glass<br><br>pH ISFET | Options<br>• Raw value mV<br>• pH<br>• Temperature |
| ORP | Options<br>• Temperature<br>• ORP mV<br>• ORP % |

Measured value depending on the Source of data

| Source of data | Measured value |
|---|---|
| Oxygen (amp.)<br><br>Oxygen (opt. WW) | Options<br>• Temperature<br>• Partial pressure<br>• Concentration liquid<br>• Saturation<br>• Raw value nA(only Oxygen (amp.))<br>• Raw value μs(only Oxygen (opt. WW)) |
| Cond i<br><br>Cond c | Options<br>• Temperature<br>• Conductivity<br>• Resistance(only Cond c)<br>• Concentration(only Cond i) |
| Chlorine | Options<br>• Temperature<br>• Current<br>• Concentration |
| ISE | Options<br>• Temperature<br>• pH<br>• Ammonium<br>• Nitrate<br>• Potassium<br>• Chloride |
| TU/TS | Options<br>• Temperature<br>• Turbidity g/l<br>• Turbidity FNU |
| Nitrate | Options<br>• Temperature<br>• NO3<br>• NO3-N |
| Ultrasonic interface (interface measurement) | Options<br>• Interface<br>• Turbidity |
| SAC | Options<br>• Temperature<br>• SAC<br>• Transm.<br>• Absorption<br>• COD<br>• BOD |
| Controller 1<br><br>Controller 2 | Options<br>• Bipolar(only current outputs)<br>• Unipolar+<br>• 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. |

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

| Function | Options | Info |
|---|---|---|
| Cleaning program | Options<br>• None<br>• Cleaning 1<br>• Cleaning 2<br>• Cleaning 3<br>• Cleaning 4<br><br>**Factory setting**<br>None | Use this function to choose the cleaning instance which should be started when the limit switch is active. |
| Function | Options<br>• On<br>• Off<br><br>**Factory setting**<br>Off | Activating/deactivating the limit switch |
| Operating mode | Options<br>• Above limit check<br>• Below limit check<br>• In range check<br>• Out of range check<br>• Change rate<br><br>**Factory setting**<br>Above limit check | Type of limit value monitoring:<br>• Limit value overshoot or undershoot→ 🖾 71<br>• Measured value within or outside a range → 🖾 72<br>• aRate of change→ 🖾 74 |
| Limit value | **Settings**<br>Depends on the measured value | *Operating mode="Above limit check" or "Below limit check"* |
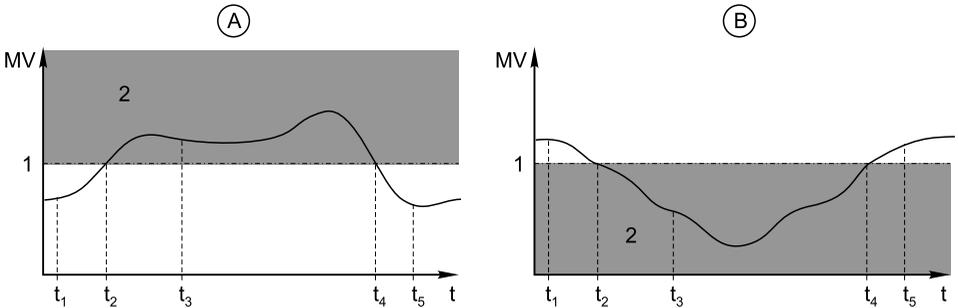


*Fig. 71: ÜExceeding (A) and undershooting (B) a limit value (without hysteresis and switch-on delay)*

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

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

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

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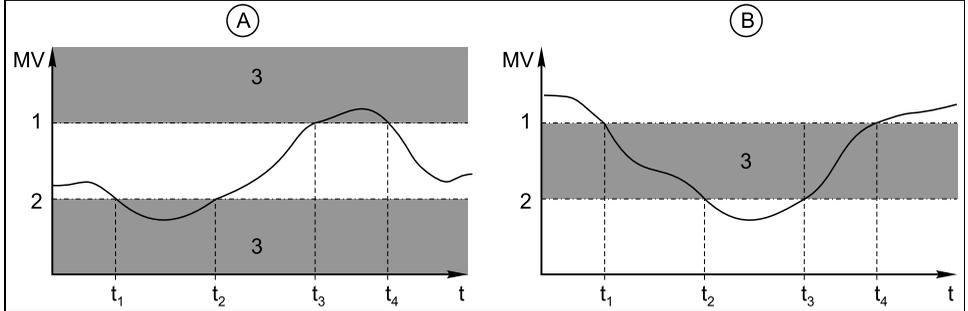


Fig. 72: ÜMonitoring outside (A) and within (B) a range (without hysteresis and switch-on delay)

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

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

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



The hysteresis is needed to ensure a stable switching behavior.

The device software adds or subtracts the value set here to/from the limit value (Limit value, Range lower value or Range upper value). This results in the double "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. → 🖻 73
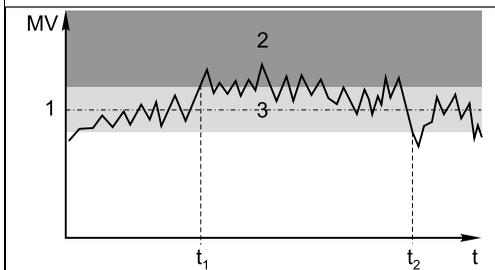
Fig. 73: Hysteresis taking the example of limit value overshoot

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

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

| Function | Options | Info |
|---|---|---|
| Start delay | 0 to 9999 s | *Operating mode="In range check", "Out of range check","Above limit check" or "Below limit check"* |
| Switch off delay | **Factory setting** 0 s | Synonyms: pick-up and drop-out delay |
| Delta value | **Settings** Depends on the measured value | *Operating mode="Change rate"* The slope of the measured value (MV) is monitored in this mode. |
| Delta time | 00:01 ... 23:59 **Factory setting** 01:00 | An event is generated if, in the given timeframe (Delta time), the measured value increases or decreases by more than the specified value (Delta value). No further event is generated if the value continues to experience such a steep increase or decrease. |
| Auto Confirm | 00:01 ... 23:59 **Factory setting** 00:01 | 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** $\Delta MV_1 >$ "Delta value"
$t_4 - t_3 >$ "Auto Confirm" **and** $\Delta MV_2 <$ "Delta value"
$t_6 - t_5 <$ "Delta time" **and** $\Delta MV_3 > \Delta MV$



*Fig. 74: aRate of change*

### 10.8.2 Controller

**Controller structure in Laplace representation**
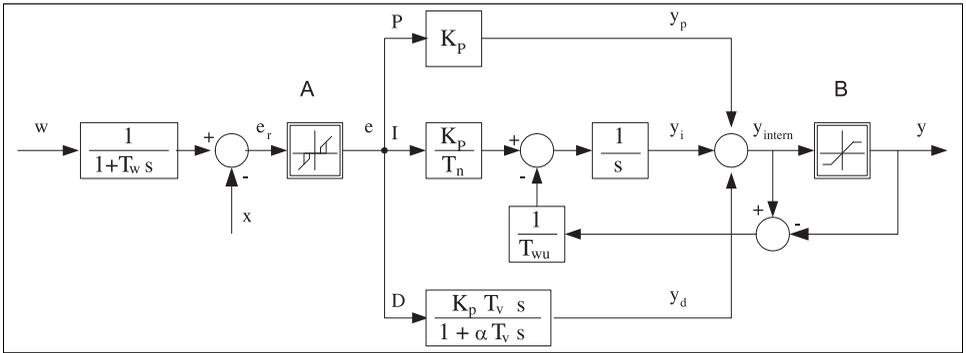


*Fig. 75: Block diagram of the controller structure*

| | | | |
|---|---|---|---|
| *A* | *Neutral zone* | *I* | *Integral value* |
| *B* | *Output limiting* | *D* | *Derivative value* |
| $K_p$ | *Gain (P-value)* | $\alpha T_v$ | *Damping time constant with $\alpha$= 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 three 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 /s").

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 when configuring 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. Define the parameters for the controller:
   – Setpoint, -->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?
   – At the end of a hold, continue or restart the control loop (affects I-value)?
7. How should the actuator be triggered?
   – Assign "Unipolar+" to the output for an actuator which can increase the measured value.
   – Assign "Unipolar-" to the output for an actuator which can decrease the measured value.
   – Select "Bipolar" if you want to output the manipulated variable via one current output
     only (split range).
8. Configure the outputs and switch on the controller.

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Control | Options<br>• Off<br>• Automatic<br>• Manual mode<br><br>**Factory setting**<br>Off | First configure the controller and leave the switch at "Off" during this time.<br>Once you have made all the settings, you can assign the controller to an output and switch it on. |
| ▶ Manual mode | | |
| Y | -100 ... 100 %<br><br>**Factory setting**<br>0 % | Specify the manipulated variable that should be output in manual mode. |
| Y Actual output | Read only | Manipulated variable actually output. |
| Name | Customized text | Give the controller a name so you can identify it later on. |

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Controller Enable | Options<br>• None<br>• Binary inputs<br>• Limit switches<br>• Fieldbus variables<br>**Factory setting**<br>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 | Options<br>• Standard<br>• Advanced<br>**Factory setting**<br>Standard | The Setup Level changes the number of parameters that can be configured.<br>If you choose "Standard" the other controller parameters are active nevertheless. The system uses the factory settings which usually suffice in most cases. |
| Process type | Options<br>• Inline<br>• Batch<br>**Factory setting**<br>Inline | Decide what type of process best describes your particular process (see the explanation below). |

**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 setpoint 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 setpoint.

**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 setpoint. 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.

ℹ️  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.

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Controller type | Options<br>• PID 1-sided<br>• PID 2-sided<br><br>**Factory setting**<br>PID 2-sided | Depending on the actuator connected, you influence the process in just 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 setpoint 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 setpoint w. The following graphic illustrates the relationship $y = (w-x)/X_p$:



| Effective direction<br>*Controller type="PID 1-sided"* | Options<br>• Direct<br>• Reverse<br><br>**Factory setting**<br>Reverse | In what direction should the controller influence the measured value?<br>• The measured value should increase as a result of dosing (e.g. heating) --> "Reverse"<br>• 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. If the controller should increase the process value, set "Reverse" as the effective direction. The controller then becomes active when the process value is too small (range A).
With the "Direct" effective direction, the controller acts as a "downwards controller". It becomes active when the process value (e.g. the temperature) is too high (range B).
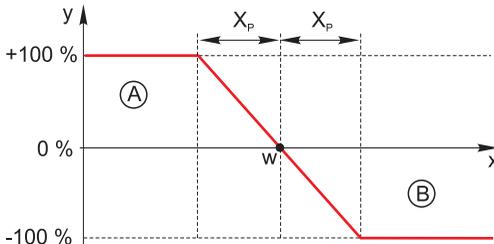


The red curve shows overlap between the curves of the two 1-sided controllers.

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| ▶ Controlled variable | | |
| Source of data | Options<br>• Sensors<br>• Current inputs<br>• Fieldbus signals<br>• Binary inputs<br>• Mathematical functions<br><br>**Factory setting**<br>None | Specify the input or output which should be the source of data for the controlled variable. |
| Measured value | Options<br>• None<br>• Depends on theSource of data<br><br>**Factory setting**<br>None | Specify the measured value that should be your controlled variable.<br>The measured value you can select depends on the option selected under "Source of data". |
| ▶ Setpoint | | Not available if a fieldbus has been selected as the "Source of data" |
| Setpoint | **Range of adjustment and factory setting**<br>Depends on the "Source of data" | Specify the setpoint for the controlled variable. |

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| ▶ Disturbance variable | | optional, activation code necessary |

With "flowing medium" (inline) controls, it can happen that the flow rate is non-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.
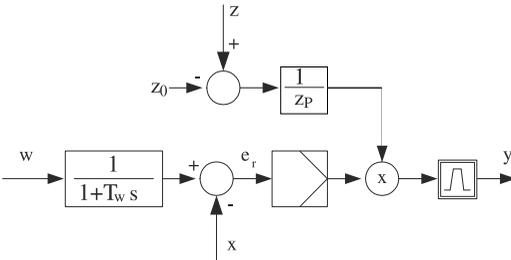


Strictly speaking, feedforward control involves an open-loop control system, since its effect is not measured directly. That means that the feed flow is directed exclusively forward. Hence the designation "feedforward control."
For the additive feedforward control that is alternatively available in the device, the (standardized) disturbance variable is added to the controller actuating 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): $z_n = (z - z_0)/z_p$
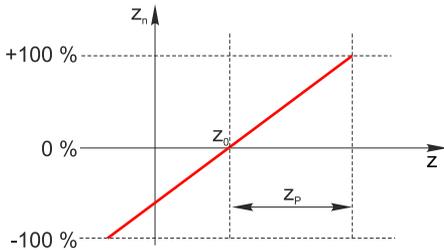


**Example:**
Flowmeter with measuring range 0 ... 200 $m^3$/h
The controller would currently dose 100% without feedforward control.
The feedforward control should be configured such that at z = 200$m^3$/h, the controller still doses at 100%   ($z_n$ = 1). If the flow rate drops, the dosing rate should 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 | Options | Selecting multiplicative or additive feedforward control |
|---|---|---|
|  | • Off<br>• Multiply<br>• Add<br><br>**Factory setting**<br>Off |  |

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Source of data | Options<br>• Sensors<br>• Current inputs<br>• Fieldbus signals<br>• Binary inputs<br>• Mathematical functions<br><br>**Factory setting**<br>None | Specify the input or output which should be the source of data for the disturbance variable. |
| Measured value | Options<br>• None<br>• Depends on theSource of data<br><br>**Factory setting**<br>None | Specify the measured value that should be your disturbance variable.<br>The measured value you can select depends on the option selected under "Source of data". |
| 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 $X_p$

You can also configure the following for Setup Level="Advanced":
• Time constant $T_{wu}$
• Time constant Alpha
• Width of the neutral zone $X_n$
• Width of the hysteresis range of the neutral zone $X_{hyst}$
• Cycle time of the controller

| Tn | 0.0 to 9999.0 s<br><br>**Factory setting**<br>0.0 s | The integral action time specifies the effect of the I-value<br>If Tn > 0, then the following holds true:<br>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 (setpoint controlled variable)

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Twu | 0.1 to 999.9 s<br><br>**Factory setting**<br>20.0 s | Time constant for anti-windup feedback<br>The lower the value the greater the integrator inhibition. Exercise extreme caution when making changes.<br>Clock < Twu < 0.5(Tn + Tv) |
| Tv | 0.0 to 9999.0 s<br><br>**Factory setting**<br>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.<br><br> | | |
| alpha | 0.0 ... 1.0<br><br>**Factory setting**<br>0.3 | Affects the additional damping filter of the D-controller. The time constant is calculated from alpha * $T_v$. |
| Process balance<br><br>*Controller type="PID 2-sided"* | Options<br>• Symmetric<br>• Asymmetric<br><br>**Factory setting**<br>Symmetric | **Symmetric**<br>There is only one control gain and this applies for both sides of the process.<br><br>**Asymmetric**<br>You can set the control gain individually for both sides of the process. |
| Xp<br><br>*Process balance="Symmetric"* | **Range of adjustment and factory setting**<br>Depends on the "Source of data" | Proportional band, reciprocal value of the proportional gain $K_p$<br>As soon as X deviates more than $X_p$ from the set point, Y reaches 100%. |
| Xp Low<br><br>Xp High | **Range of adjustment and factory setting**<br>Depends on the "Source of data" | *Process balance="Asymmetric"* |

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| Xn<br><br>*Process balance="Symmetric"* | **Range of adjustment and factory setting**<br>Depends on the "Source of data" | Tolerance range about the setpoint that prevents minor oscillations about the setpoint if using two-sided control loops. |
| XN Low<br><br>XN High | **Range of adjustment and factory setting**<br>Depends on the "Source of data" | *Process balance="Asymmetric"* |
| XHyst | 0.0 ... 99.9 %<br>**Factory setting**<br>0.0 % | Width of the hysteresis range of the neutral zone, relative component of Xn |
| 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<br>**Factory setting**<br>1.000 s | **Expert setting!**<br>Only change the cycle time of the controller if you know exactly what you are doing!<br>Clock < Twu < 0.5(Tn + Tv) |
| Max Y change rate /s | 0.00 ... 1.00<br>**Factory setting**<br>0.40 | Limits the change of the output variable |
| ▶ Hold behavior | | Hold=measured value is no longer reliable |
| Manipulated Variable | Options<br>▪ Freeze<br>▪ Set to zero<br>**Factory setting**<br>Freeze | How should the controller react to a measured value that is no longer reliable?<br>**Freeze**<br>The manipulated variable is frozen at the current value<br>**Set to zero**<br>Manipulated variable is set to 0 (no dosing) |
| State | Options<br>▪ Freeze<br>▪ Reset<br>**Factory setting**<br>Freeze | Internal controller status<br>**Freeze**<br>No change<br>**Reset**<br>After a hold, the control system starts from scratch, and settling time takes place again. |

The graphic embedded in the XHyst row:

**Path: Menu/Setup/Additional functions/Controller 1 or Controller 2**

| Function | Options | Info |
|---|---|---|
| ▶ Manual mode | | |
| Y | -100 ... 100 %<br>**Factory setting**<br>0 % | Editable manipulated variable, which is output in the manual mode. |
| Y Actual output | Read only | Manipulated variable actually output:<br>Input manually for "Control" = "Manual mode", calculated by the controller for Control" = "Automatic" |
| Setpoint | Read only | Configured setpoint (damped)<br>If the controller is running and the set point is reconfigured, here you can see how the (effective) set point gradually moves towards the new value. |
| X | | Current measured value |
| ▶ Output selection | | Goes to the "Outputs" menu<br>--> "Outputs" section |

### 10.8.3 Cleaning programs for sensors

> **⚠ CAUTION**
>
> **The cleaning system is 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 are not switching off the cleaning system because you wish to test the cleaning function, wear protective clothing, goggles and gloves or take other appropriate measures.

**Selecting the cleaning type**

1. Select a cleaning program in the menu Setup/Additional functions/Cleaning.

   ↳ You can configure 4 different types of cleaning which you can assign individually to the inputs.

2. For each cleaning program use the "Cleaning type" to decide which type of cleaning should be performed.

The user can choose from the following cleaning types:
- Standard clean
- Chemoclean
- Chemoclean Plus

ℹ Under "State of cleaning" you can see whether the cleaning program is active or not. This is for information purposes only.

**Standard cleaning**

Standard cleaning involves cleaning a sensor with compressed air, for instance, as performed with the ion-selective sensor.

Path: Menu/Setup/Additional functions/Cleaning/Cleaning 1 ... 4/Standard clean

| Function | Options | Info |
|---|---|---|
| Cleaning time | 5 to 600 s<br><br>**Factory setting**<br>10 s | Cleaning time... Cleaning duration<br><br>The cleaning duration and interval depend on the process and sensor. Determine the variables empirically or based on experience. |

Defining the cleaning cycle → 🖹 121

**Chemoclean**

Path: Menu/Setup/Additional functions/Cleaning/Cleaning 1 ... 4/Chemoclean

| Function | Options | Info |
|---|---|---|
| Cleaning time | 0 to 900 s<br><br>**Factory setting**<br>5 s | Cleaning duration<br><br>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. |
| Prerinse time | 0 to 900 s<br><br>**Factory setting**<br>0 s | |
| Postrinse time | 0 to 900 s<br><br>**Factory setting**<br>0 s | |

## Chemoclean Plus

Use the "Chemoclean Plus" function for measuring cycles in aggressive media or for regular cleaning operations with acids, bases or special cleaners.

Path: 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 program examples. |
| 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. of limit position switches of the retractable assembly). |
| Limit contact 1 ... 2 | Options<br>• Binary inputs<br>• 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 to 4 | Text | You can assign a meaningful name to each output, e.g. "assembly", "acid", "base" etc. |

Sample program: regular cleaning with acid and base

| Limit switch | Duration [s] | Assembly | Water | Acid | Base |
|---|---|---|---|---|---|
| ES1 0 (Assembly in "Measure" position) | 1 | 0 | 0 | 0 | 0 |
| ES1 1 (Assembly in "Service" position) | 5 | 1 | 0 | 0 | 0 |
| ES1 1 | 10 | 1 | 1 | 0 | 0 |
| ES1 1 | 2 | 1 | 1 | 1 | 0 |
| ES1 1 | 10 | 1 | 1 | 0 | 0 |
| ES1 1 | 2 | 1 | 1 | 0 | 1 |
| ES1 1 | 10 | 1 | 1 | 0 | 0 |
| ES1 1 | 2 | 1 | 0 | 0 | 0 |
| ES1 0 | 5 | 0 | 0 | 0 | 0 |

The pneumatic retractable assembly is activated by compressed air via a two-way valve. As a result, the assembly assumes either the position 0 ("Measure" - sensor in medium) or position 1 ("Service" - sensor in rinse chamber). Media such as water, acids or bases are supplied via valves or pumps. Here there are two states: 0 (= "off" or "closed") and 1 (= "on" or "open").

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

### Defining the cleaning cycle

Path: Menu/Setup/Additional functions/Cleaning/Cleaning 1 ... 4

| Function | Options | Info |
|---|---|---|
| Cleaning cycle | Options<br>• Off<br>• Interval<br>• Weekly program<br><br>**Factory setting**<br>Off | Choose from a cleaning routine that is restarted at set intervals and a user-definable weekly program. |
| *Cleaning cycle = "Interval"* | | |
| Cleaning interval | 00-00:01 to 07-00:00 (DD-hh:mm)<br><br>**Factory setting**<br>01-00:00 | The interval value can be between 1 minute and 7 days. Example: You have set the value "01-00:00". Each day, the cleaning cycle starts at the same time you started the first cleaning cycle. |
| *Cleaning cycle = "Weekly program"* | | |
| ▶ Daily event times | 00:00 to 23:59 (HH:MM) | 1. "Event time 1 to 6": Define up to 6 times.<br><br>↳ You can then choose from these for each weekday afterwards.<br><br>2. For each day of the week, individually choose which of the 6 times is to be used for a cleaning routine on this particular day.<br><br>In this way you create weekly programs that are perfectly adapted to your process. |
| ▶ Weekdays | Monday ... Sunday | |

## Other settings and manual cleaning

**Path: Menu/Setup/Additional functions/Cleaning/Cleaning 1 ... 4**

| Function | Options | Info |
|---|---|---|
| Start signal | Options<br>• Bus signals<br>• Signals of digital or analog inputs<br>**Factory setting**<br>None | In addition to cyclic cleaning, you can also use an input signal to start event-controlled cleaning.<br>Choose the trigger for such a cleaning process here.<br>Interval programs 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 | Options<br>• On<br>• Off<br>**Factory setting**<br>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.<br>If cyclical cleaning is enabled, there are times in which it is not possible to manually start the process. |
| ▷ Manual mode | Action | You start the manual mode by acknowledging the warning. You can now start each possible cleaning step manually. If you want to return to cyclical cleaning, you must set "Manual mode" to "Off". |
| ▷ Stop or Stop Failsafe | Action | End the cleaning process (cyclical or manual) |
| ▶ Output selection | | Goes to the "Outputs" menu<br>You can assign the cleaning program directly to one or more outputs.<br>--> "Outputs" section |

### 10.8.4 Mathematical functions

In addition to "true" process values provided by connected physical sensors or analog inputs, you can have maximum 6 "virtual" process values calculated using mathematical functions.

The "virtual" process values can be:
- issued via a current output or fieldbus
- used as a control variable
- assigned as a measured variable to a limit contactor
- 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.

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

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

**Redundancy**

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

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

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

**rH value**

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

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

| Function | Options | Info |
|---|---|---|
| Calculation | Options<br>• Off<br>• On<br><br>**Factory setting**<br>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. |

## Degassed conductivity

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

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

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

| Function | Options | Info |
|---|---|---|
| Calculation | Options<br>• Off<br>• On<br><br>**Factory setting**<br>Off | On/off switch for the function |
| Cation conductivity | Connected conductivity sensor | "Cation conductivity" is the sensor downstream from the cation exchanger and upstream from the "degassing module", "Degassed conductivity" is the sensor at the outlet of the degassing module.<br>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. |

## Dual conductivity

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

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

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

## Calculated pH value

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

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

| Function | Options | Info |
|---|---|---|
| Calculation | Options <br> • Off <br> • On <br><br> **Factory setting** <br> Off | On/off switch for the function |
| Method | Options <br> • NaOH <br> • NH3 <br> • LiOH <br><br> **Factory setting** <br> 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)). <br><br> **NaOH** <br> $pH = 11 + \log\{(\kappa_v - 1/3\ \kappa_h)/273\}$ <br> **NH3** <br> $pH = 11 + \log\{(\kappa_v - 1/3\ \kappa_h)/243\}$ <br> **LiOH** <br> $pH = 11 + \log\{(\kappa_v - 1/3\ \kappa_h)/228\}$ <br><br> $\kappa_v$ ... "Inlet" ... direct conductivity <br> $\kappa_h$ ... "Outlet" ... acid conductivity |
| Inlet <br><br> Outlet | Choice of conductivity sensor | Inlet <br> Sensor upstream from the cation exchanger, "direct conductivity" <br> Outlet <br> Sensor downstream from the cation exchanger, "acid conductivity" <br> The choice of measured value is obsolete since it must always be "Conductivity". |
| Calculated pH | Read only | View this value in a user-defined measuring screen or output the value via the current output. |

# 11    Diagnostics and troubleshooting

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

## 11.1    General troubleshooting

### 11.1.1    Troubleshooting

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

1. See the Diagnostics menu for the 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" (→ 🖹 134) in this manual. 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 onsite display is faulty or you encounter other problems, search for the faults under "Device-specific errors" (→ 🖹 130).

    ↳ Follow the recommended measures.

4. Contact the Service Department if you cannot rectify the error yourself. Only cite the error number.

### 11.1.2    Process errors without messages (for sensors)

See Operating Instructions for "Memosens", BA01245C

## 11.1.3  Device-specific errors

| Problem | Possible cause | Tests and/or remedial measures |
|---|---|---|
| Values appear on display but: <br> – Display does not change and / or <br> – 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 |
| | Calibration / adjustment failed | Repeat calibration |
| | No reagents / sample | • Check levels <br> • Check hose R2 <br> • Check sample (only for self-priming) |
| | Cell is dirty | Calibration with zero standard <br> Cleaning with manual cleaning, then new calibration with zero standard |
| | Incorrect reagent | Check the configured measurement parameter and the reagents used |
| | Incorrect concentration of the standard solution | Check the setting for the concentration of the standard solution |
| | Reagents past shelf-life | |
| | Incorrect hose system connection | Check the hose system using the hose connection plan (see "Installation" section). |
| Measurement / cleaning / 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) |
| | The device is in the fieldbus mode; no manual actions are possible | |
| | Syringe operating times have expired | |
| Calibration has failed | Stability criterion not met | • Check the configuration and perform a manual calibration again <br> • Check hose R2 |
| 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 | Basic module defective | Check with integrated current simulation, connect mA meter directly to current output. |

## 11.2    Diagnostic information on the onsite 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 diagnostic information as for the onsite 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 capabilities of the respective fieldbus systems

## 11.5    Adjusting diagnostic information

### 11.5.1    Classification of diagnostics messages

In accordance with Namur specification NE 107, the diagnostics messages are characterized by:
- Message number
- Error category (letter in front of the message number)
  - **F** = (Failure) a malfunction has been detected
  - **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 accuracy levels. The cause of the problem is to be found outside the measuring point.
  - **M** = (Maintenance required) Action should be taken as soon as possible
- Message text

### 11.5.2 Adapting the diagnostic behavior

All the diagnostics 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 diagnostics message can be disabled.

**Example**
The controller returns diagnostics message 531 "Logbook full". You want to change this message so that an error is not indicated on the display for example.
1.   Go to:
     –   Menu/Setup/General settings/Extended setup/Diagnostics/Device behavior
         for device-specific diagnostics messages (as in this example)
     –   Menu/Setup/Analyzer/Extended setup/Diagnostics settings
         for analyzer-specific diagnostic messages.
     –   Menu/Setup/Inputs/<Sensor type>/Extended setup/Diagnostics settings/Diag.
         behavior
         for sensor-specific diagnostics messages.
2.   Select the diagnostics message and press the navigator button.
3.   Decide:
     a.   Should the message be deactivated?
     b.   Do you want to change the error category?
     c.   Should an error current be output?
     d.   Do you want to trigger a cleaning program?

4.   Deactivate the message, for example (Diagnostics message to "Off").

## Configuration options

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

Path:    ... /Extended setup/Diagnostics settings/Diag. behavior

| Function | Options | Info |
|---|---|---|
| List of diagnostic messages | | Select the message to be changed. Only then can you make the settings for this message. |
| Diag. code | Read only | |
| Diagnostic message | Options <br> • On <br> • Off <br> **Factory setting** <br> Depends on the message | You can deactivate or reactivate a diagnostic message here. <br> Deactivating means: <br> • No error message in the measuring mode <br> • No error current at the current output |
| Error current | Options <br> • On <br> • Off <br> **Factory setting** <br> Depends on the message | Decide whether an error current should be output at the current output if the diagnostic message display is activated. |
| Status signal | Options <br> • Maintenance (M) <br> • Out of specification (S) <br> • Function check (C) <br> • Failure (F) <br> **Factory setting** <br> Depends on the message | The messages are divided into different error categories in accordance with NAMUR NE 107. <br> Decide whether you want to change a status signal assignment for your application. |
| Diag. output | Options <br> • None <br> **Factory setting** <br> None | Before you can assign the message to an output, you must first configure a relay output to "Diagnostics" (Menu/Setup/Outputs, assign the "Diagnostics" function and set the Operating mode to "as assigned"). |
| Cleaning program (for sensors) | Options <br> • None <br> • Cleaning 1 <br> • Cleaning 2 <br> • Cleaning 3 <br> • Cleaning 4 <br> **Factory setting** <br> None | Decide whether the diagnostic message should trigger a cleaning program. <br> 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. |

# 11.6    Overview of diagnostic information

## 11.6.1    Device-specific, general diagnostic messages

| No. | Message | Factory settings | | | Tests or remedial measures |
|-----|---------|------|-----------------|------------------|-----------------------------|
|     |         | Cat. | Diag. on/off | Error current |                             |
| 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 | Device error | F | On | On | Internal device error<br>1.    Update the software<br>2.    Contact the Service Department<br>3.    Replace the  backplane (Service) |
| 242 | Software incomp. | F | On | On | |
| 243 | Device error | F | On | On | |
| 261 | Electr. module | F | On | On | Electronics module defective<br>1.    Replace the module<br>2.    Contact the Service Department |
| 263 | Electr. module | F | On | On | Wrong kind of electronics module<br>1.    Replace the module<br>2.    Contact the Service Department |
| 284 | Firmware update | M | On | Off | Update completed successfully |
| 285 | Update error | F | On | On | Firmware update failed<br>1.    Repeat update<br>2.    SD card error --> use another card<br>3.    Incorrect firmware --> repeat with suitable firmware<br>4.    Contact the Service Department |
| 302 | Battery low | M | On | Off | Buffer battery of real time clock is low<br>The date and time are lost if the power is interrupted.<br>--> Contact the Service Department (battery replacement) |
| 304 | Module data | F | On | On | At least 1 module has incorrect configuration data<br>1.    Check the system information<br>2.    Contact the Service Department |
| 305 | Power consum. | F | On | On | Total power consumption too high<br>1.    Check installation<br>2.    Remove sensors/modules |
| 306 | Software error | F | On | On | Internal firmware error<br>--> Contact the Service Department |

| No. | Message | Factory settings | | | Tests or remedial measures |
|-----|---------|------|-----------------|---------------|----------------------------|
|     |         | Cat. | Diag. on/off | Error current |                            |
| 312 | Temp. sensor | F | On | On | Temperature sensor PT3 for ambient temperature measurement is defective. <br> • Winter operation regulation not possible <br> • Sampling and distribution arm blocked to protect against freezing <br><br> -> Disable winter operation under Setup/Inputs/Temperature S:3/Winter operation <br> -> Replace sensor |
| 335 | Fan | F | On | On | Fan defective. <br> -> Replace the fan <br> -> Contact the Service Department |
| 337 | Pump tubing | M | On | Off | Pump tube operating time reached shortly Display under Diagnostics/Runtime info/Tubing age <br> -> Schedule replacement <br> -> After replacement, reset the operating time under Diagnostics/Runtime info |
| 360 | Cooling/Heating | S | On | Off | Temperature range in the housing exceeded <br><br> 1. Check installation conditions and the ambient temperature <br> 2. Replace the FMAB1 module <br> 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. <br><br> 1. Check whether the insulation cap is seated correctly over the reagents <br> 2. Replace cooling/heating module <br> 3. Contact the Service Department |
| 362 | Photometer temp. | F | On | Off | Temperature of the photometer too high <br><br> -> Contact the Service Department <br> -> Replace photometer |
| 363 | Photometer temp. | F | On | Off | Temperature of the photometer too low <br><br> -> Contact the Service Department <br> -> Replace photometer |
| 364 | Timeout | F | On | On | The liquid manager/linear drive has timed out. <br><br> Possible reasons: <br> • Photoelectric barrier defective <br> • Blocking <br><br> -> Contact the Service Department |

| No. | Message | Factory settings | | | Tests or remedial measures |
|-----|---------|------|-----------------|------------------|----------------------------|
|     |         | Cat. | Diag. on/off | Error current |                            |
| 365 | Photometer comm. | F | On | On | Photometer not communicating<br><br>Possible reasons:<br>• Incorrect photometer connection<br><br>-> Check photometer connection<br>-> Contact the Service Department |
| 367 | Modul connect. | F | On | On | No communication to sample preparation<br><br>-> Check connecting cable to sample preparation system. |
| 370 | Intern. Voltage | F | On | On | Internal voltage outside the valid range<br>--> Check supply voltage |
| 373 | Electr. temp. | M | On | Off | High electronics temperature<br>--> Check ambient temperature and energy consumption |
| 401 | Reset to default | F | On | On | Factory reset is performed |
| 406 | Param. active | C | Off | Off | --> Wait for configuration to be finished |
| 407 | Diag. active | C | Off | Off | --> Wait for maintenance to be finished |
| 412 | Writing backup | F | On | Off | --> Wait for the write process to be finished |
| 413 | Reading backup | F | On | Off | --> Wait |
| 460 | Curr. under-run | S | On | Off | Reasons<br>• Sensor in air<br>• Air pockets in assembly<br>• Sensor fouled<br>• Incorrect flow to sensor<br>Measures<br>1. Check sensor installation<br>2. Clean sensor<br>3. Adjust assignment of current outputs |
| 461 | Current exceeded | S | On | Off | |
| 462 | Output Deviation | S | On | Off | When the current output is read back, the value deviates from the target value displayed.<br>Possible reasons: Current load outside specification, short-circuit or open current loop, module defective<br>1. Check installation of current loop<br>2. Check module<br>3. Contact the Service Department |
| 502 | No text catalog | F | On | On | --> Contact the Service Department |
| 503 | Language change | M | On | Off | Language change failed<br>--> Contact the Service Department |
| 530 | Logbook at 80% | M | On | Off | 1. Save the logbook to the SD card and then delete the logbook in the device<br>2. Set memory to ring memory<br>3. Deactivate logbook |
| 531 | Logbook full | M | On | Off | |

| No. | Message | Factory settings | | | Tests or remedial measures |
|---|---|---|---|---|---|
| | | Cat. | Diag. on/off | Error current | |
| 532 | License error | M | On | Off | --> Contact the Service Department |
| 540 | Parameter save | M | On | Off | Configuration saving has failed, --> repeat |
| 541 | Parameter load | M | On | Off | Configuration successfully loaded |
| 542 | Parameter load | M | On | Off | Configuration loading has failed, --> repeat |
| 543 | Parameter load | M | On | Off | Configuration loading aborted |
| 544 | Parameter reset | M | On | Off | Factory default successful |
| 565 | Configuration | M | On | Off | Invalid configuration of sample preparation system<br><br>-> In Setup/Sample preparation check the number of channels used, their mode of operation and installation method.<br>-> Check the permitted combinations of sample preparation and analyzers, see the Operating Instructions for the sample preparation system. |
| 714 | Filter mats | M | On | Off | Filter mat change necessary<br>The limit value for operating hours has been exceeded<br><br>-> Replace the filter mats and reset the operating hours counter in the Diagnostics menu |
| 715 | Calibration | M | On | Off | The validity of the last calibration has expired. The date of the last calibration is too far in the past.<br>Measurement can still take place.<br>Possible reasons:<br>• Manual intervention has prevented automatic calibration<br>-> Calibrate analyzer manually<br>-> Check device configuration |
| 716 | Calibration | S | On | Off | Calibration has failed or is not reliable<br>Possible reasons:<br>• Stability criteria are not met<br>-> Check the configuration and perform a manual calibration again<br>-> Contact the Service Department |
| 717 | Photometer LED | F | On | On | Photometer defective<br>Possible reasons:<br>• No LED voltage<br>• No LED current<br>-> Contact the Service Department |

| No. | Message | Factory settings | | | Tests or remedial measures |
|---|---|---|---|---|---|
| | | Cat. | Diag. on/off | Error current | |
| 726 | Liquids | M | On | Off | Consumable liquids, warning<br>Level monitoring or shelf life<br>Measurement can still take place.<br><br>Possible reasons:<br>• The level of one or more liquids is low or the expiry date of one or more liquids is approaching.<br><br>Top up/replace liquids in question and reset counter in Diagnostics/Operating time information |
| 727 | Liquids | F | On | Off | Consumable liquids, alarm<br>Level monitoring or shelf life<br>Measurement can still take place.<br><br>Possible reasons:<br>• The level of one or more liquids is low or one or more liquids have exceeded their expiry date.<br><br>Top up/replace liquids in question and reset counter in Diagnostics/Operating time information |
| 728 | Level cleaner | M | On | Off | Level monitoring, warning<br>Measurement can still take place.<br><br>1. Top up cleaner and reset counter in Diagnostics/Operating time information |
| 729 | Filter candle | M | On | Off | • Filter cartridge change necessary<br>• The limit value for operating hours has been exceeded<br><br>-> Replace the filter cartridge for the sample preparation system and reset the operating hours counter in the Diagnostics menu |
| 730 | Clean. solution | M | On | Off | • Fill level warning for the sample preparation system's cleaner<br>• Depending on the duration of cleaning, the cleaning interval and external events, the remaining quantity is sufficient for a few hours or days<br><br>-> Refill the cleaner for the sample preparation system<br>-> Check the fill level switch for the cleaning solution |

| No. | Message | Factory settings | | | Tests or remedial measures |
|-----|---------|------|-------------------|------------------|----------------------------|
|     |         | Cat. | Diag. on/off | Error current |                            |
| 731 | Liquids | F | On | Off | Leak detected in the sample preparation system or analyzer<br>-> Check hoses and connections<br>-> Check solenoid valves<br>-> Check leak sensor<br>-> Check the free outlet on the analyzer<br>-> Replace defective parts and reset the operating hours counters in the Diagnostic menu where necessary |
| 732 | Wear parts | F | On | On | One or more wear parts has exceeded its service life.<br><br>-> Replace the wear parts in question and reset the counter in Diagnostics/Operating time information |
| 733 | Wear parts | M | On | Off | One or more wear parts has almost reached the end of its service life.<br><br>-> 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 aspiration<br>• Suction line blocked or leaking<br>• No inflow of sample<br><br>-> Check suction line and suction strainer<br>-> Check sample flow |
| 931 | Sampling time | M | On | Off | Standard pumping time exceeded<br>Possible reasons:<br>• Filter cartridge clogged<br>• Sample line partially blocked<br><br>1.  Clean the filter cartridge<br>2.  Clean the sample line<br>3.  Replace the filter or sample line |
| 932 | Cleaning failure | F | On | On | Cleaning failed<br>Possible reasons:<br>• Suction line blocked or leaking<br>• Compressed air supply defective<br>• No inflow of cleaner or sample<br><br>1.  Check the suction line<br>2.  Check the compressed air supply and hoses<br>3.  Check the cleaner and cleaner pump<br>4.  Check inflow of sample |

| No. | Message | Factory settings | | | Tests or remedial measures |
|---|---|---|---|---|---|
| | | Cat. | Diag. on/off | Error current | |
| 936 | Temp. range | S | On | Off | Outside temperature for sample preparation system out of specification<br>1. Check application<br>2. Check temperature sensor<br>3. Check configuration of the temperature sensor, sample preparation system and the heating |
| 940 | Process value | S | On | Off | Measured value out of specification Uncertain measured value.<br>1. Change the measuring range<br>2. Calibrate the system |
| 941 | Process value | F | On | On | Measured value out of specification Invalid measured value.<br>1. Change the measuring range<br>2. Calibrate the system |
| 951 - 958 | Hold active CH1 ... 8 | C | On | Off | Output values and status of the channels are on hold. Wait until the hold is released again. |
| 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 | 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 | Input low | S | On | On | Current input too low At 4 to 20 mA, the input current is less than the lower error current. --> Check the input for short-circuits. |
| 972 | Input > 20 mA | S | On | On | Current output range exceeded |
| 973 | Input < 4 mA | S | On | On | Current output range undershot |
| 974 | Diag. confirmed | C | Off | Off | User has acknowledged the message displayed in the measuring menu. |
| 975 | Device reset | C | Off | Off | Device reset |
| 978 | ChemoCl.Failsafe | S | On | On | No feedback signal detected within the configured period.<br>1. Check the application<br>2. Check the wiring<br>3. Extend the duration |

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### 11.6.2 Sensor-specific diagnostics messages

See Operating Instructions for "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"
  Diagnostics message recorded with the highest criticality level
- "Past message"
  Diagnostic message whose cause is no longer present.

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

## 11.8 Diagnostics list

All the current diagnostics messages are listed here.
A time stamp is available for each message. Furthermore, the system also displays the
configuration and description of the message as saved in "Menu/Setup/General
settings/Diagnostics/Device 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 | 1000 | 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 | 2500 | No | No | Yes | Yes |
| Analyzer data logbook | Analyzer data logbooks | 5000 | No | No | Yes | Yes |
| Version logbook | All events | 50 | No | No | No | Yes |
| Hardware version logbook | All events | 125 | No | No | No | Yes |

| Logbook | Visible in | Max. entries | Can be disabled [1] | Logbook can be deleted | Entries can be deleted | Can be exported |
|---|---|---|---|---|---|---|
| Data logbook for sensors (optional) | Data logbooks | 150,000 | Yes | Yes | Yes | Yes |
| Debugging logbook | Only accessible with the special activation code (Service) | 1000 | Yes | No | Yes | Yes |

1)      Data in brackets means this depends on the overall logbook

## 11.9.2   Logbooks menu

**Diagnostics/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 input<br>• Go to date<br>• 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 input<br>• Go to date<br>• 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 input<br>• Go to date<br>• 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 operation logbook entries here. |
| ▲ Diagnostic events | | Chronological list of the diagnostics events. |
| ▲ Show | Events are displayed | Select a particular event to display more detailed information. |

**Diagnostics/Logbooks**

| Function | Options | Info |
|---|---|---|
| ▶ Go to date | User input<br>• Go to date<br>• 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 diagnostics logbook entries here. |
| ▶ Analyzer events | | Entries for analyzer events, such as measurement, cleaning, calibration |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | User input<br>• Go to date<br>• 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 analyzer event entries here. |

You can view your data logbook entries graphically on the display ("Show plot").
You can also adapt the display to suit your individual requirements:
- If you 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.
- Furthermore, you can also define a cursor. If you select this option, you can move along the graph with the navigator and view the logbook entry (date stamp/measured value) in text form for every point in the graph.
- Simultaneous display of two logbooks ("Select 2nd plot" and "Show plot"), → ⊡ 76:
  - A small cross marks the currently selected graph for which the zoom can be changed or a cursor used, for example.
  - You can select the other graph in the context menu (by pressing the navigator button), and 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 allows you to use the zoom function simultaneously on both graphs, for example.
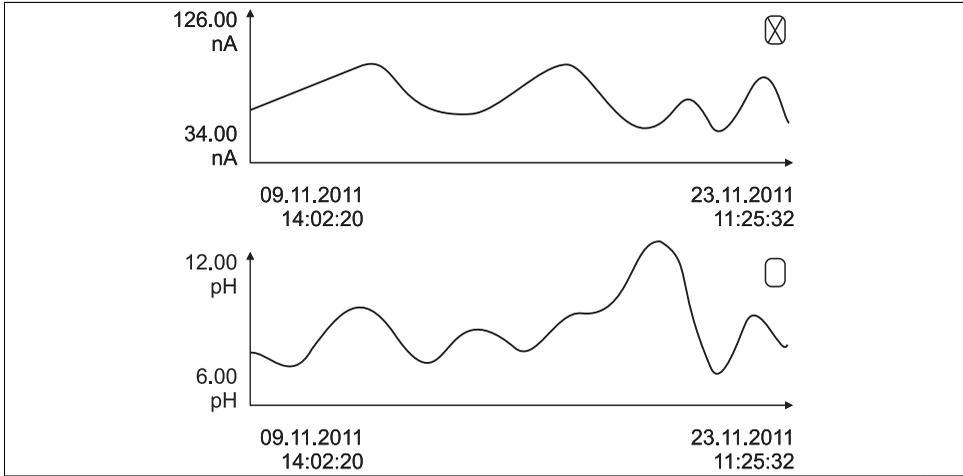
*Fig. 76: Two graphs displayed simultaneously. The top graph is "selected".*

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**Diagnostics/Logbooks**

| Function | Options | Info |
|---|---|---|
| ▶ Analyzer data logbooks | | Data logbooks for the data of the wet-chemical analyzers |
| ▶ Data logbook SP1 | | Data logbook SP2 is also displayed for a two-channel device. |
| Source of data | Read only | Displays the measuring channel |
| Meas. param | Read only | Displays the measuring parameter that is being recorded |
| Main value | Read only | Displays the main value in which the measured value is recorded |
| Unit | Read only | Displays the unit. |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | User input<br>• Go to date<br>• 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 General settings/Logbooks menu. |
| Select 2nd plot | Choice of another data logbook | You can view a second logbook at the same time as the current logbook. |
| ▷ Delete all entries | Action | You can delete all the data logbook entries here. |

**Diagnostics/Logbooks**

| Function | Options | Info |
|---|---|---|
| ▶ Absorption data logbook | | |
| Curve | Read only | Displays the selected LED |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | User input<br>• Go to date<br>• 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 General settings/Logbooks menu. |
| ▷ 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 <Logbook name> | | This submenu is available for each data logbook that you have set up and activated. |
| Source of data | Read only | Displays the input or the mathematical function |
| Measured value | Read only | Displays the measured value that is recorded |
| Log time left | Read only | Displays the days, hours and minutes until the logbook is full. Please note the instructions regarding the selection of the memory type in the General settings/Logbooks menu (--> BA "Operation and settings"). |
| ▶ 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 General settings/Logbooks menu. |
| Select 2nd plot | Choice of another data logbook | You can view a second logbook at the same time as the current logbook. |
| ▶ Go to date | User input<br>• Go to date<br>• 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 data logbook entries here. |
| ▶ Save logbooks | | |
| File format | Options<br>• CSV<br>• FDM | Save the logbook in the preferred file format.<br>You can then open the file you saved (.csv) on the PC and process it in MS-Excel for example.[1].<br>You can import the FDM files into Fieldcare and archive them so they are tamper-proof. |

**Diagnostics/Logbooks**

| Function | Options | Info |
|---|---|---|
| >All data logbooks<br>>Data logbook SP1<br>>Absorption data logbook<br>>Data logbook 1...n<br>>All event logbooks<br>>Calibration logbook<br>>Diagnostic logbook<br>>Analyzer data logbook<br>>Configuration logbook<br>>HW version logbook<br>>Version logbook | The action commences as soon as the option is selected | Use this function to save the logbook to an SD card.<br>▶   Insert the SD card into the device card reader and select the logbook to be saved. |
| ⓘ | 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

**Diagnostics/System information**

| Function | Options | Info |
|---|---|---|
| Device tag | Read only<br>**Factory setting**<br>Analyzer_serial number | Individual  device tag, --> "General settings" |
| Order code | Read only | You can order identical hardware with this code.<br>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 find out what device version you have, enter the order code in the search screen at the following address: www.products.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. | Customized text | 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:<br>www.products.endress.com/device-viewer |
| Software version | Read only | Current version |
| Measuring parameter | Read only | Set measuring parameter |
| MPL version | Read only | Current version |

**Diagnostics/System information**

| Function | Options | Info |
|---|---|---|
| ▶ FXAB1 control module | Read only<br>• Firmware version<br>• Hardware version | |
| ▶ Photometer | Read only<br>• Firmware version<br>• Hardware version<br>• Raw value<br>• Temperature | |
| ▶ Sample preparation 1 | Read only<br>• Operating mode | Depends on the sample preparation<br>In the case of a two-channel device, Sample preparation 2 is also displayed. |
| ▶ General information | Read only<br>• Current status<br>• SP type<br>• Order code<br>• Serial number<br>• Hardware version<br>• Software version<br>• Orig. order code ext. | This information is provided for every electronics module available. Specify the serial numbers and order codes when servicing, for example. |
| ▶ Bottle status | Read only<br>• Cleaner<br>• Standard 1<br>• Reagent 1<br>• Reagent 2 | Indicates the status specifying whether a bottle is available. |
| ▶ Modbus<br><br>*Only with the Modbus TCP or Modbus RS485 option* | Read only<br>• Enable<br>• Bus address<br>• Termination<br>• Modbus TCP Port 502 | Modbus-specific information |
| ▶ Ethernet<br><br>*Only with the Ethernet, Modbus TCP or Modbus RS485 option* | Read only<br>• Enable<br>• Webserver<br>• IP-Address<br>• Netmask<br>• Gateway<br>• MAC-Address<br>• Modbus TCP Port 502<br>• Webserver TCP Port 80 | Ethernet-specific information |
| ▶ System modules | | |
| Depends on the electronics module available, e.g.:<br><br>Base | Read only<br>• Description<br>• Serial number<br>• Order code<br>• Hardware version<br>• Software version | This information is provided for every electronics module available. Specify the serial numbers and order codes when servicing, for example. |

**Diagnostics/System information**

| Function | Options | Info |
|---|---|---|
| ▶ Sensors | | |
| Depends on the sensors connected | Read only<br>• Description<br>• Serial number<br>• Order code<br>• Hardware version<br>• Software version | This information is provided for every sensor available. Specify the serial numbers and order codes when servicing, for example. |
| ▶ Save system information | | |
| ▷ Save to SD card | File name assigned automatically (includes a time stamp) | The information is saved on the SD card in a "sysinfo" subfolder. The csv file can be read and edited in MS Excel for example. |

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

## 11.11 Simulation

You can simulate values at inputs and outputs for testing purposes:
• Current values at current outputs
• Measured values at inputs

**Diagnostics/Simulation**

| Function | Options | Info |
|---|---|---|
| ▶ Current output x:y | | Simulation of an output current<br>This menu appears once for each current output. |
| Simulation | Options<br>• On<br>• Off<br>**Factory setting**<br>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<br>**Factory setting**<br>4 mA | Set the desired simulation value. |
| ▶ Alarm relay<br>▶ Relay x:y | | Simulation of a relay state<br>This menu appears once for each relay. |
| Simulation | Options<br>• On<br>• Off<br>**Factory setting**<br>Off | If you simulate the relay state, this is indicated on the display by a simulation icon in front of the relay display. |

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**Diagnostics/Simulation**

| Function | Options | Info |
|---|---|---|
| State | Options<br>■ Low<br>■ High<br>**Factory setting**<br>Low | Set the desired state.<br>The relay switches in accordance with your setting when you switch on the simulation. The display shows "On" (="Low") or "Off" (="High") for the simulated relay state. |
| ▶ Meas. inputs | | Simulation of a measured value (only for sensors)<br>This menu appears once for each measuring input. |
| ▶ Channel : parameter | | |
| Sim. main value | Options<br>■ On<br>■ Off<br>**Factory setting**<br>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<br>**Factory setting**<br>Depends on the sensor | Set the desired simulation value. |
| Sim. temperature | Options<br>■ On<br>■ Off<br>**Factory setting**<br>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<br>(-58.0 to 482.0 ˚F)<br>**Factory setting**<br>20.0 ˚C (68.0 ˚F) | Set the desired simulation value. |

# 11.12 Systemtest/Reset

**Diagnostics/Systemtest/Reset**

| Function | Options | Info |
|---|---|---|
| ▶ Analyzer | | |
| ▶ Bottle change | | |
| ▶ Bottle removal | | |
| Bottle selection | Options<br>• None<br>• Cleaner<br>• Standard 1<br>• Reagent 1<br>• Reagent 2 | Select the bottles that you would like to remove.<br>It is possible to select multiple bottles. |
| If at least one **Bottle selection** is selected: | | |
| ▷ Confirm bottles removed | | |
| ▶ Bottle insertion | | |
| Bottle selection | Options<br>• None<br>• Cleaner<br>• Standard 1<br>• Reagent 1<br>• Reagent 2 | Select the bottles that you would like to insert.<br>It is possible to select multiple bottles. |
| If at least one **Bottle selection** is selected: | | |
| ▷ Confirm bottles inserted | | |
| ▶ Dispenser replacement | | |
| Dispenser selection | Options<br>• None<br>• 2<br>• 3<br>• 4<br>• 7 | Select the syringes that you would like to replace.<br>It is possible to select multiple syringes. |
| If at least one **Dispenser selection** is selected: | | |
| ▷ Move dispenser to top | | |
| ▷ Move dispenser to bottom | | |
| ▷ Reset operating hours counter | | |
| ▶ Sample collector | | Is only displayed if a collecting vessel is provided. |
| ▷ Empty sample collector | | The sample collecting vessel can be automatically emptied in this menu. |
| ▷ Start | | |
| ▷ Stop | | |

**Diagnostics/Systemtest/Reset**

| Function | Options | Info |
|---|---|---|
| ▶ Sample preparation 1 *(CAT820/CAT860)* | | Depends on the connected sample preparation system |
| ▶ 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 in line with 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 in line with 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 in line with 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. |
| ▶ Photometer | | |
| Cleaning factor | Read only | |
| ▶ Liquidmanager actuator | | The functional safety of the liquid manager is tested. |
| ▷ Move to reference position | | |
| ▷ Move to position 1 … 8 | | |
| ▷ Stop test | | |

**Diagnostics/Systemtest/Reset**

| Function | Options | Info |
|---|---|---|
| ▶ Decomissioning | | Preparation for taking the unit out of service. |
|   ▶ Sample collector | | Optional |
|     ▷ Empty sample collector | | The sample collecting vessel can be automatically emptied in this menu. |
|     ▷ Start | | |
|     ▷ Stop | | |
|   ▷ Rinse | | |
| ▷ Device reset | Options<br>• OK<br>• ESC | Restart and keep all the settings |
| ▷ Factory default | Options<br>• OK<br>• ESC | Restart with factory settings<br>Settings that have not been saved are lost. |
| ▶ Power supply | Read only<br>• Digital Supply 1: 1.2V<br>• Digital Supply 2: 3.3V<br>• Analog Supply: 12.5V<br>• Sensor Supply: 24V<br>• Temperature | Detailed list of power supply to instrument.<br><br>ℹ The actual values can vary without a malfunction being present. |

## 11.13 Operating time information

**Diagnostics/Operating time information**

| Function | Options | Info |
|---|---|---|
| ▶ Operating time filter mats | | |
|    Filter mats | Read only | Displays the period of usage in days |
| ▶ Operating time photometer | | |
|    Photometer | Read only | Displays the hours of operation in hours |
| ▶ Remaining operating hours | | |
|    ▶ Dispensers | | Displays the remaining period of usage in days; i.e. the individual syringes can still be used for this many days. |
|       Remaining operating hours | Read only | |
|       Dispenser 1 ... 7 | Read only | |
|       Dispenser selection | Options<br>■ 2<br>■ 3<br>■ 4<br>■ 7<br><br>**Factory setting**<br>None | |
| ▶ Operating time cooling module (optional): | | |
|    Operating time cooling module | Read only | Displays the operation duration in days |
| ▶ Operating time sample preparation 1 *(CAT820, CAT860)* | | In the case of a two-channel device, Sample preparation 2 is also displayed. |
|    Device | Read only | |
|    Filter | Read only | Displays the period of usage in days and hours |
|    Pump hose | Read only | Displays the period of usage in days and hours |
|    Operation < -20 ℃ | Read only | Displays the period of usage in days |
|    Operation > 50 ℃ | Read only | Displays the period of usage in days |
|    Membrane pump *(CAT860)* | Read only | Displays the period of usage in days |

Set the specific counter reading to zero with "Reset".

## 11.14  Firmware history

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

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# 12 Maintenance

**⚠ WARNING**

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

Danger! Risk of serious or fatal injury!
▶ De-energize the device before opening it.
▶ Power can be supplied to switching contacts from separate circuits. De-energize these circuits before working on the terminals.

When performing any work on the device, bear in mind any potential impact this may have on the process control system or on the process itself.

**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, only use genuine spare parts. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

**⚠ CAUTION**

**Automatic mode during calibration or maintenance work**

Risk of injury from chemicals or contaminated media
▶ Before hoses are released make sure that no action is currently running or is due to start soon.
▶ Set the device to the manual mode
▶ Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

## 12.1    Cleaning

**⚠ CAUTION**

**Risk of injury from reagents escaping**

▶ Clean the system every time before replacing consumables.

### 12.1.1    Housing

Only clean the front of the housing with commercially available cleaning agents.

The front is resistant to the following as per DIN 42 115:
- Ethanol (short periods)
- Diluted acids (max. 2% HCl)
- Diluted bases (max. 3% NaOH)
- Soap-based household cleaners

**NOTICE**

**Prohibited cleaning agents**

Danger of damaging the housing surface or housing seal!

▶ For cleaning purposes, never use concentrated mineral acids or bases.

▶ Never use organic cleaners such as acetone, benzyl alcohol, methanol, methylene chloride, xylene or concentrated glycerol cleaner.

▶ Never use high-pressure steam for cleaning purposes.

### 12.1.2    Automatic cleaning of Liquiline System CAT8x0

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 (see "Sample preparation" section).

### 12.1.3    Flushing the system

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

1. Open the analyzer.

2. Stop the sample supply.

3. Press the soft key "MODE" and select "Manual mode".

4. Wait until all the actions are finished and "Current mode - Manual" appears on the display.

5. Press the soft key "MODE" and select "Decomissioning/Sample collector/Empty sample collectorStart".

   ↳ The system is automatically rinsed with sample and emptied. This operation takes about 4 minutes.

6. Open all the chemical bottles and carefully remove the hoses.

   ↳ Open all the bottles if you want to replace syringes or hoses.

7.  Dry the ends of the hoses with a clean paper towel.

8.  Immerse all the hoses (R1, R2, S1, C, P) into a beaker containing approx. 200 ml of distilled water in order to rinse the system with water.

9.  Select "MODE/Decomissioning/Rinse" once the action is finished.

10. Remove the hoses from the beaker and dry them with a clean paper towel.

### 12.1.4   Sample collector (optional)

Cleaning interval:
• Depends on the application; recommendation: every 3 months

1.  Open the analyzer.

2.  Press the soft key "MODE" and select "Manual mode".

3.  Disconnect or stop pumping of the sample.

    ↳ There should not be any more sample left in the sample collecting vessel.

4.  Select "MODE/Decomissioning/Sample collector/Empty sample collector" and press "Start".

5.  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.

6.  Open the sample collector by turning the cover in the clockwise direction.

7.  Clean it with a small brush and plenty of water.

8.  Return the collector to the holder unit and connect up all the hoses again correctly.

9.  Start the sample preparation system.

10. Press the soft key MODE and select "Continue automatic mode" to start normal measurement.

## 12.2    Replacing reagents, standard and cleaner

Replacement interval for CA80AM with cooling module:

| | |
|---|---|
| Reagent CY80AM | Every 3 months |
| Standard solution CY80AM | Every 6 months (typically; depending on the calibration interval) |
| Cleaner CY800 | Every 6 months (typically; depending on the cleaning interval) |

Replacement interval for CA80AM without cooling module:

| | |
|---|---|
| Reagent CY80AM | Every 6 weeks (typically; depending on the temperature and measuring range) |
| Standard solution CY80AM | Every 6 months (typically; depending on the calibration interval) |
| Cleaner CY800 | Every 6 months (typically; depending on the cleaning interval) |

1.  Remove the bottles that you want to replace by removing the hoses at the liquid manager. Use a paper towel to catch any chemicals that may escape and replace them with fresh reagent, standard solution or cleaner.

2.  Press the soft key "MODE" and select "Bottle change mode/Bottle removal/Bottle selection".

3.  Select the bottles that you want to remove and click OK to confirm.

4.  Select "Confirm bottles removed".

5.  Replace the bottles previously removed with fresh reagent, standard or cleaner.

    ↳ Reagents must be prepared according to the instructions for mixing a reagent.

6.  Press the soft key "MODE" and select "Bottle change mode/Bottle insertion/Bottle selection".

7.  Select all the bottles that you replaced and press "OK" to confirm.

8.  Select "Confirm bottles inserted".

9.  If bottle level monitoring is enabled (Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles), you can reset it under "MODE/Bottle replacement/Bottle insertionReset filling levels".

10. The system must be calibrated after a replacement routine. Select "Menu/Setup/Manual operation/Start calibration (1 point)".

11. After the calibration return to "MODE/Continue automatic mode" or "MODE/Start automatic mode", to start normal measurement.

## 12.3    Zero point calibration

1. Press the "MODE" soft key. Switch to the manual mode if you are not already in this mode.

2. Remove the standard solution that is present, together with the hose. Alternatively, remove the hose from the liquid manager, allow the hose to drain and dry the hose well. This prevents any contamination of the zero standard.

   ↳ We recommend the use of a separate hose.

3. Connect the zero standard to the liquid manager.

4. Press the soft key "MODE" and select "Bottle replacement/Bottle insertion/Bottle selection".

5. Select "Standard 1" and confirm with "OK".

6. Select "Confirm bottles inserted".

7. Go to "Menu/Setup/Manual operation" and select " Start calibration (zero-point)".

8. Perform zero point calibration twice, one directly after the other.

   ↳ The values should only differ marginally (0.1 mg/l $NH_4$-N).

9. Remove the zero standard. Either use the additional hose in order to reconnect the standard calibration solution or allow the hose to drain and dry the hose well.

10. Connect the standard calibration solution to the liquid manager.

11. Press the soft key "MODE" and select "Bottle replacement/Bottle insertion/Bottle selection".

12. Select "Standard 1" and confirm with "OK".

13. Select "Confirm bottles inserted".

   It is advisable to then perform a manual calibration with the standard solution.

## 12.4    Changing the hose

Recommendation for the hose change interval:
- C-Flex, white                    Every 12 months

You need the following parts:

| | |
|---|---|
| • C-Flex hose, ID 1.6 mm | |
| • C-Flex hose, ID 3.2 mm | Part of the CAV800 maintenance kit |
| • C-Flex hose, ID 16.4 mm | |
| • Hose fitting | |
| • 1 pair of gloves that are resistant to the reagents used | |

1. Rinse the system (see the "Rinsing the system" section).
   ↳ 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 all the white C-Flex hoses with hoses of the same diameter and length. Attach hose labels to the new hoses.
   ↳ The drain hose D6 must be routed behind syringe 7.

5. Secure the cover and put the bottle tray back into the housing.

6. Connect the bottles to the appropriate covers and hoses.

7. Press the soft key "MODE" and select "Bottle replacement/Bottle insertion/Bottle selection".

8. Select all the bottles and press "OK" to confirm.

9. Select "Confirm bottles inserted".

10. Press the soft key "MODE" and select "Continue automatic mode" or "Start automatic mode".

## 12.5    Changing the filter mats

Interval at which the filter mats need to be replaced:
• Depends on the application; recommendation: every 12 months

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

1. Open and remove the fan screen on the right and left underside of the analyzer.

2. Remove the used filter mats and replace them with new ones from the maintenance kit.

3. Reattach the fan screens.

## 12.6    Changing the syringes

Interval at which the syringes need to be replaced:
• 10 ml syringes (S7 = sample + standard)
• 10 ml syringes (S2 = waste))          Every 90 days (depending on the application)
• 2.5 ml syringes (S3 = reagent R2;     Every 180 days
  S4 = reagent R1)

You need the following parts:

| | |
|---|---|
| • 10 ml syringes with adapter, mounted | |
| • 2.5 ml syringes with adapter, mounted | Part of the CAV800 maintenance kit |
| • 2.5 mm Allen screw | |
| • 1 pair of gloves that are resistant to the reagents used | |

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.

4. Press the soft key "MODE" and select "Dispenser replacement/Dispenser selection".

5. Select the syringes that you would like to replace, e.g. syringe 2 and 7 (10 ml) or syringe 3 and 4 (2.5 ml).

6. Select "Move dispenser to bottom".

7. Open the syringe holder unit with a 2.5 mm Allen key and remove it.

8. Turn the syringe clockwise to remove it from the liquid manager.

9. Remove the adapter and the syringe from the syringe drive.

10. Screw a new syringe onto the liquid manager.
    ↳ Make sure that the end of the syringe is parallel to the liquid manager as the syringe holder unit cannot be closed otherwise.

    Make sure that the syringe is connected correctly.

11. Screw the syringe holder unit closed again with a 2.5 mm Allen key.
    ↳ Make sure that the drain hose D6 is routed behind syringe 7.

12. Secure the cover and put the bottle tray back into the housing.

13. Connect the bottles to the appropriate covers and hoses.

14. Press the soft key "MODE" and select "Bottle replacement/Bottle insertion/Bottle selection".

15. Select all the bottles and press "OK" to confirm.

16. Then select "Confirm bottles inserted".

17. Press the soft key "MODE" and select "Dispenser replacement/Dispenser selection".

18. Select the syringes that you replaced and click "OK" to confirm.

19. Select "Reset operating hours counter".

20. The system must be calibrated after a replacement routine. Select "Menu/Setup/Manual operation/Start calibration (1 point)".

21. Press the soft key "MODE" and select "Continue automatic mode" or "MODE/Start automatic mode".

## 12.7    Decommissioning

If the analyzer has not been in operation for more than 5 days, it must be decommissioned to avoid any damage to the device.

To do so, proceed as follows:

1.  Open the analyzer.

2.  Stop the sample supply.

3.  Press the soft key "MODE" and select "Manual mode".

4.  Wait until all the actions are finished and "Current mode - Manual" appears on the display.

5.  Press the soft key "MODE" and select "Decomissioning/Sample collector/Empty sample collectorStart".

    ↳ The system is automatically rinsed with water and emptied. This operation takes about 4 minutes.

6.  Open all the chemical bottles and carefully remove the hoses.

7.  Dry the ends of the hoses with a clean paper towel.

8.  Immerse all the hoses (R1, R2, S1, C and P) into a beaker containing approx. 200 ml of distilled water in order to rinse the system with water.

9.  Select "MODE/Decomissioning/Rinse" once the action is finished.

10. Remove the hoses from the beaker and dry them with a clean paper towel.

11. Select "MODE/Decomissioning/Rinse" once again to rinse the hoses with air.

12. The analyzer can now be disconnected from the mains supply.

# 13      Repair

## 13.1    Spare parts
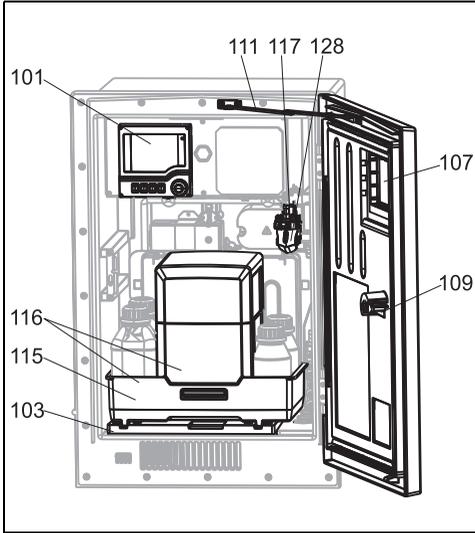


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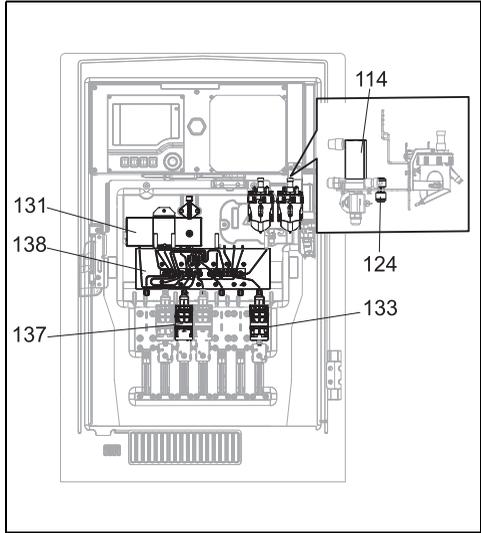


a0023552
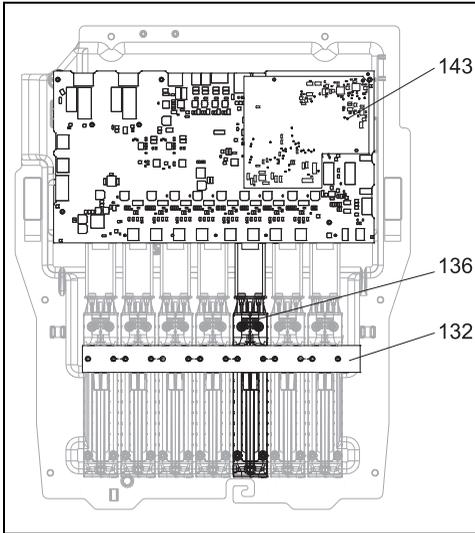


a0023558
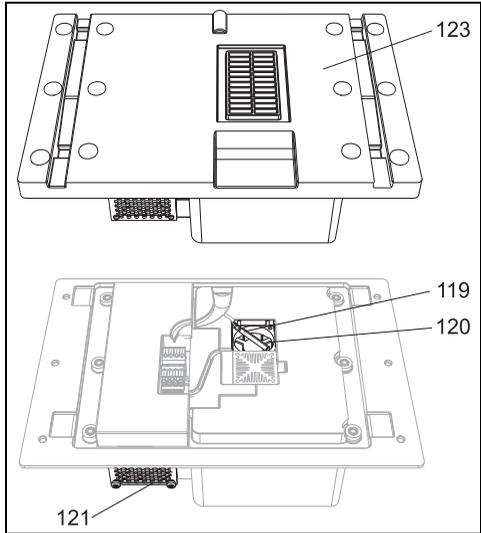


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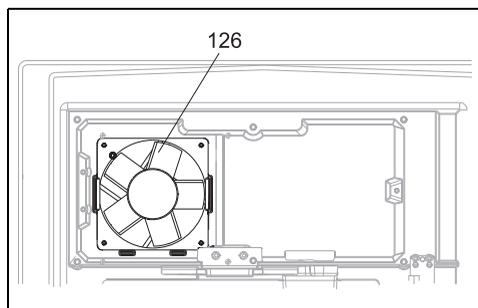
a0023563
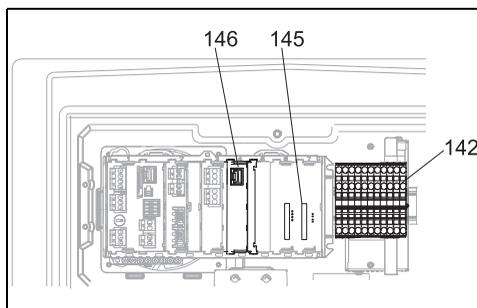


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| Item | Kit CA80 | Order number |
|------|----------|--------------|
| 101 | Kit CA8x: controller with display<br>• Kit instructions, CA8x housing parts | 71218395 |
| 102 | Kit CA8x/CAT860: wall holder unit<br>• Kit instructions, CA8x housing parts | 71218400 |
| 103 | Kit CA8x/CAT860: base of the housing<br>• Kit instructions, CA8x housing parts | 71218402 |
| 105 | Kit CA8x: liquid detection (1 pc.)<br>• Kit instructions, CA80 collecting vessel | 71218403 |
| 107 | Kit CA8x: door with window<br>• Kit instructions, CA8x housing parts | 71218409 |
| 108 | Kit CA8x: M12 socket digit. sensor<br>• Kit instructions, CA8x electronic parts | 71218419 |
| 109 | Kit CA8x/CAT860: closing cylinder<br>• Kit instructions, CA8x housing parts | 71218425 |
| 111 | Kit CA8x/CAT860: door stop<br>• Kit instructions, CA8x housing parts | 71218429 |
| 113 | Kit CA8x: drain pipe<br>• Kit instructions, CA8x housing parts | 71218431 |
| 114 | Kit CA8x: valve<br>• Kit instructions, CA80 collecting vessel | 71218433 |
| 115 | Kit CA8x: bottle tray, no cooling<br>• Kit instructions, CA8x housing parts | 71218434 |
| 116 | Kit CA8x: bottle tray for cooling<br>• Kit instructions, CA8x housing parts | 71218471 |
| 117 | Kit CA8x: collecting vessel, complete<br>• Kit instructions, CA80 collecting vessel | 71218472 |
| 118 | Kit CA8x: analyzer stand | 71218473 |
| 119 | Kit CA8x: T-sensor cooling module (1 pc.)<br>• Kit instructions, CA8x cooling module | 71239297 |

| Item | Kit CA80 | Order number |
|------|----------|--------------|
| 120 | Kit CA8x: small fan 40x40 mm<br>• Kit instructions, CA8x cooling module | 71218481 |
| 121 | Kit CA8x: Peltier fan, large 60x60 mm<br>• Kit instructions, CA8x cooling module | 71218482 |
| 122 | Kit CA8x: hose fitting, straight, 4 mm<br>• Kit instructions: CA8x/CAT8xx hose connection | 71229910 |
| 123 | Kit CA8x: cooling module, complete<br>• Kit instructions, CA8x cooling module | 71218483 |
| 124 | Kit CA8x: double hose conn. (10 pcs.)<br>• Kit instructions: CA8x/CAT8xx hose connection | 71218484 |
| 126 | Kit CA8x: housing fan, complete<br>• Kit instructions, CA8x electronic parts | 71218486 |
| 127 | Kit CA8x: carrier board cover<br>• Kit instructions, CA8x process engineering | 71218487 |
| 128 | Kit CA8x: collecting vessel, beaker (10 pcs.)<br>• Kit instructions, CA80 collecting vessel | 71229918 |
| 131 | Kit CA8x: photometer module (5 mm)<br>• Kit instructions, CA8x process engineering | 71218488 |
| 132 | Kit CA8x: linear drive (1 pc.)<br>• Kit instructions, CA8x process engineering | 71218490 |
| 133 | Kit CA8x: syringe holder 10ml (10 pcs.)<br>• Kit instructions, CA8x process engineering | 71222105 |
| 134 | Kit CA8x: syringes 10 ml (20 pcs.)<br>• Kit instructions, CA8x process engineering | 71222106 |
| 135 | Kit CA8x: syringes 2.5 ml (20 pcs.)<br>• Kit instructions, CA8x process engineering | 71222107 |
| 136 | Kit CA8x: light barrier, linear drives<br>• Kit instructions, CA8x process engineering | 71218491 |
| 137 | Kit CA8x: syringe holder 2.5ml (10 pcs.)<br>• Kit instructions, CA8x process engineering | 71222108 |
| 138 | Kit CA8x: liquid manager, complete (1 pc.)<br>• Kit instructions, CA8x process engineering | 71218492 |
| 139 | Kit CA8x: stepping motor, liquid manager<br>• Kit instructions, CA8x process engineering | 71218493 |
| 140 | Kit CA8x: 10x Y-connector 6.4 x 6.4 x 6.4<br>• Kit instructions: CA8x/CAT8xx hose connection | 71229919 |
| 141 | Kit CA8x: 10x Y-connector 3.2 x 3.2 x 3.2<br>• Kit instructions: CA8x/CAT8xx hose connection | 71229920 |
| 142 | Kit CA8x: power unit 100-240 V AC<br>• Kit instructions, CA8x electronic parts | 71218503 |

| Item | Kit CA80 | Order number |
|------|----------|--------------|
| 143 | Kit CA8x: FXAB1 control module<br>• Kit instructions, CA8x electronic parts | 71218504 |
| 144 | Kit CA8x: DC/DC converter 24V<br>• Kit instructions, CA8x electronic parts | 71218505 |
| 145 | Kit CA8x: backplane CM44<br>• Kit instructions, CA8x electronic parts | 71239304 |
| 146 | Kit CA8x: interface module CM44<br>• Kit instructions, CA8x electronic parts | 71218507 |
| 149 | Kit CA8x: 10x hose conn. PP 1.6 mm ID<br>• Kit instructions: CA8x/CAT8xx hose connection | 71239300 |
| 150 | Kit CA8x: 10x hose conn. PP 3.2 mm ID<br>• Kit instructions: CA8x/CAT8xx hose connection | 71239302 |
| 151 | Kit CA8x: Sys base module<br>• Kit instructions, CA8x electronic parts | 71239305 |

| Item | Kit CA80 | Order number |
|------|----------|--------------|
| No graphic | C-Flex hose, ID 3.2 mm, price per meter | 51504114 |
| No graphic | C-Flex hose, ID 6.4 mm, material sold by the meter | 51504115 |
| No graphic | Hose, NORPRENE A, ID 1.6 mm, price per meter | 51504116 |
| No graphic | Safety bottle, black 1l | 51505802 |
| No graphic | Safety bottle, colorless 1l | 51505808 |
| No graphic | Kit: buffer battery for backplane | 71104102 |
| No graphic | Kit: 1x terminal set, basic module | 71107452 |
| No graphic | Kit: 1x terminal set, module 4R | 71155581 |
| No graphic | Kit: 1x terminal set, module 4AO | 71155582 |
| No graphic | Kit: 1x terminal set, module 2x AI, 485 | 71155583 |
| No graphic | Kit: 1x terminal set, module DIO | 71219748 |
| No graphic | Kit: display cable | 71101762 |
| No graphic | Kit, extension backplane module | 71141366 |

## 13.2    Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong product has been ordered or delivered. According to legal regulations Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with the medium.

To ensure the safe, reliable and professional return of your product to the manufacturer, visit our website to obtain information about the procedure and basic conditions.
www.services.endress.com/return-material

## 13.3    Disposal

The product contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.
Please observe local regulations.

⚡  The battery  must be disposed of in accordance with local regulations governing the disposal of batteries.

# 14    Accessories

The most important accessories that could be delivered at the time this document went to print are listed below. Contact your Service Department or sales center for accessories that are not listed here.

## 14.1    Sample preparation

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

Liquiline System CAT820
- Sampling + membrane filtration
- Order as per product structure
  (--> Online Configurator, www.products.endress.com/cat820)
- Technical Information TI01131C/07/EN

Liquiline System CAT860
- Sampling + membrane filtration
- Order as per product structure
  (--> Online Configurator, www.products.endress.com/cat860)
- Technical Information TI01137C/07/EN

## 14.2    Consumables for CA80AM

### 14.2.1    Reagent set CY80AM

**NOTICE**

**Reagents can be harmful to the environment**
▶ Pay particular attention to the information provided in the safety data sheets concerning the disposal of reagents.

A graduated cylinder (1000 ml) is not included in the delivery.

- Premixed reagent R1+R2, ready-to-use solution, 1 l in each case (33.81 fl.oz.)
- Order No. CY80AM-AA+SB

### 14.2.2    Standard solution CY80AM

1 l (34 fl.oz.) standard solution in each case with different concentrations of ammonium.
- 5 mg/l $NH_4$-N (6.45 mg/l $NH_4$, 6.05 mg/l $NH_3$); Order No. CY80AM-AA+T1
- 10 mg/l $NH_4$-N (12.90 mg/l $NH_4$, 12.10 mg/l $NH_3$); Order No. CY80AM-AA+T2
- 30 mg/l $NH_4$-N (38.7 mg/l $NH_4$, 36.30 mg/l $NH_3$); Order No. CY80AM-AA+T4
- 50 mg/l $NH_4$-N (64.50 mg/l $NH_4$, 60.50 mg/l $NH_3$); Order No. CY80AM-AA+T3

### 14.2.3  Cleaner CY800

- 500 ml (16.91 fl.oz.) container; Order No. CY800-AA11

## 14.3  Maintenance kit CAV800

Maintenance kit CAV800 for CA80
- Standard
  - Syringes, 4 x 2.5ml and 8 x 10 ml, including mounted adapter
  - Hoses for reagents, standard solution and cleaner
  - Silicone grease, medium-viscosity, tube 2 g
  - Blind plug
  - Screw caps
  - Filter mats
- Optional
  - Inlet and outlet hoses
  - Maintenance Manual
- Order according to product structure

## 14.4  Cleaner for hoses CY820

Cleaning concentrates to clean the hoses of the sample preparation system and the sample collecting vessel
- Base cleaner, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+TA
- Acid cleaner, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+T1
- Oxidizing cleaning solution, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+UA

## 14.5  Upgrade kits CAZ800

Kit to upgrade from one channel to two channels
- 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-AAA2

Kit for upgrade with cooling system
- Cooling module integrated in base of housing
- Bottle tray with recess and insulation
- Activation code
- Order No. CAZ800-AAN1

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-AAA1

Kit for upgrade for second, downstream analyzer
• Valve for switching sample flow
• Hoses, connection adapters
•  Activation code
• Order No. CAZ800-AAM1

## 14.6    Measuring cable

Measuring cable CYK81
• Unterminated cable for extending sensor cables (e.g. Memosens)
• 2 x 2 cores, twisted with shielding and PVC sheath (2 x 2 x 0.5 mm$^2$ + shielding)
• Material sold by the meter, Order No.: 51502543

## 14.7    Sensors

### 14.7.1   Glass electrodes

Orbisint CPS11D
• pH sensor with Memosens technology
• Dirt-repellent PTFE junction
• Order as per product structure (--> Online Configurator, www.products.endress.com/cps11d)
• Technical Information TI00028C/07/EN

Memosens CPS31D
• pH sensor with Memosens technology
• Gel-filled reference system with ceramic diaphragm
• Order as per product structure (--> Online Configurator, www.products.endress.com/cps31d)
• Technical Information TI00030C/07/EN

Ceraliquid CPS41D
• pH sensor with Memosens technology
• Ceramic junction and KCl liquid electrolyte
• Order as per product structure (--> Online Configurator, www.products.endress.com/cps41d)
• Technical Information TI00079C/07/EN

Ceragel CPS71D
• pH sensor with Memosens technology
• Poison-resistant reference with ion trap
• Order as per product structure (--> Online Configurator, www.products.endress.com/cps71d)
• Technical Information TI00245C/07/EN

Orbipore CPS91D
• pH sensor with Memosens technology
• Open aperture junction for media with high potential for fouling
• Order as per product structure (--> Online Configurator, www.products.endress.com/cps91d)
• Technical Information TI00375C/07/EN

Orbipac CPF81D
- pH compact sensor for installation or immersion operation in industrial water and wastewater
- Order as per product structure (--> Online Configurator, www.products.endress.com/cpf81d)
- Technical Information TI191C/07/EN

### 14.7.2   Enamel pH electrodes

Ceramax CPS341D
- Electrode with pH sensitive enamel
- For the toughest requirements in terms of precision, pressure, temperature, sterility and durability
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps341d)
- Technical Information TI00468C/07/EN

### 14.7.3   ORP sensors

Orbisint CPS12D
- ORP sensor with Memosens technology
- Dirt-repellent PTFE junction;
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps12d)
- Technical Information TI367C/07/EN

Ceraliquid CPS42D
- ORP sensor with Memosens technology
- Ceramic junction and KCl liquid electrolyte
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps42d)
- Technical Information TI373C/07/EN

Ceragel CPS72D
- ORP sensor with Memosens technology
- Poison-resistant reference with ion trap
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps72d)
- Technical Information TI374C/07/EN

Orbipac CPF82D
- ORP compact sensor for installation or immersion operation in industrial water and wastewater
- Order as per product structure (--> Online Configurator, www.products.endress.com/cpf82d)
- Technical Information TI191C/07/EN

Orbipore CPS92D
- ORP sensor with Memosens technology
- Open aperture junction for media with high potential for fouling
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps92d)
- Technical Information TI435C/07/EN

### 14.7.4 pH-ISFET sensors

Tophit CPS471D
- Sterilizable and autoclavable ISFET sensor with Memosens technology
- For food and pharmaceutical industry, process engineering, water treatment and biotechnology
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps471d)
- Technical Information TI283C/07/EN

Tophit CPS441D
- Sterilizable ISFET sensor with Memosens technology
- For low-conductivity media, with liquid KCl electrolyte
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps441d)
- Technical Information TI352C/07/EN

Tophit CPS491D
- ISFET sensor with Memosens technology
- Open aperture junction for media with high potential for fouling
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps491d)
- Technical Information TI377C/07/EN

### 14.7.5 pH/ORP combined sensors

Memosens CPS16D
- Combined pH/ORP sensor for process technology, with dirt-repellent PTFE diaphragm
- With Memosens technology
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps16d)
- Technical Information TI00503C/07/EN

Memosens CPS76D
- Combined pH/ORP sensor for process technology, hygiene and sterile applications
- With Memosens technology
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps76d)
- Technical Information TI00506C/07/EN

Memosens CPS96D
- Combined pH/ORP sensor for chemical processes
- With poison-resistant reference with ion trap
- With Memosens technology
- Order as per product structure (--> Online Configurator, www.products.endress.com/cps96d)
- Technical Information TI00507C/07/EN

### 14.7.6  Inductive conductivity sensors

Indumax CLS50D
- Inductive conductivity sensor with very good resistance properties for standard, Ex and high-temperature applications
- Memosens protocol
- Order as per product structure (--> Online Configurator, www.products.endress.com/cls50d)
- Technical Information TI182C/07/EN

### 14.7.7  Conductive conductivity sensors

Condumax CLS15D
- Conductive conductivity sensor for pure water, ultrapure water and applications in hazardous areas
- Order as per product structure (--> Online Configurator, www.products.endress.com/cls15d)
- Technical Information TI00109C/07/EN

Condumax CLS16D
- Hygienic, conductive conductivity sensor for pure water, ultrapure water and applications in hazardous areas
- With EHEDG and 3A approval
- Order as per product structure (--> Online Configurator, www.products.endress.com/cls16d)
- Technical Information TI227C/07/EN

Condumax CLS21D
- Two-electrode sensor in plug-in head and fixed cable version
- Order as per product structure (--> Online Configurator, www.products.endress.com/cls21d)
- Technical Information TI085C/07/EN

### 14.7.8  Oxygen sensors

Oxymax COS51D
- Amperometric sensor for dissolved oxygen, with Memosens technology
- Order as per product structure (--> Online Configurator, www.products.endress.com/cos51d)
- Technical Information TI00413C/07/EN

Oxymax COS61D
- Optical oxygen sensor for drinking water and industrial water measurement
- Measuring principle: quenching
- Memosens protocol
- Material: stainless steel 1.4571 (AISI 316Ti)
- Order as per product structure (--> Online Configurator,  www.products.endress.com/cos61d)
- Technical Information TI387C/07/EN

Oxymax COS22D
- Sterilizable sensor for dissolved oxygen
- Order as per product structure (--> Online Configurator, www.products.endress.com/cos22d)
- Technical Information TI446C/07/EN

### 14.7.9   Chlorine sensors

CCS142D
- Membrane-covered amperometric sensor for free available chlorine
- Memosens technology
- Measuring range 0.01 to 20 mg/l
- Order as per product structure (--> Online Configurator, www.products.endress.com/ccs142d)
- Technical Information TI419C/07/EN

### 14.7.10  Ion-selective sensors

ISEmax CAS40D
- Ion-selective sensors
- Order as per product structure  (--> Online Configurator, www.products.endress.com/cas40d)
- Technical Information TI491C/07/EN

### 14.7.11  Turbidity sensors

Turbimax CUS51D
- For nephelometric turbidity and solids measurement in wastewater
- 4-beam alternating light method based on scattered light
- With Memosens protocol
- Order as per  product structure (--> Online Configurator, www.products.endress.com/cus51d)
- Technical Information TI461C/07/EN

### 14.7.12  SAC and nitrate sensors

Viomax CAS51D
- SAC and nitrate measurement in drinking water and wastewater
- With Memosens protocol
- Order as per product structure (--> Online Configurator,  www.products.endress.com/cas51d)
- Technical Information TI459C/07/EN

### 14.7.13  Interface measurement

Turbimax CUS71D
- Immersion sensor for interface measurement
- Ultrasonic interface sensor
- Order as per  product structure (--> Online Configurator, www.products.endress.com/cus71d)
- Technical Information TI490C/07/EN

## 14.8    Additional functionality

### 14.8.1    Hardware extension modules

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module AOR
- 2 x relay, 2 x 0/4 to 20 mA analog output
- Order No. 71111053

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module 2R
- 2 x relay
- Order No. 71125375

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module 4R
- 4 x relay
- Order No. 71125376

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module 2AO
- 2 x 0/4 to 20 mA analog output
- Order No. 71135632

Kit CM444/CM448/CM444R/CM448R/CSF48/CA80: extension module 4AO
- 4 x 0/4 to 20 mA analog output
- Order No. 71135633

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module 2AI
- 2 x 0/4 to 20 mA analog input
- Order No. 71135639

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module DIO
- 2 x digital input
- 2 x digital output
- Auxiliary voltage supply for digital output
- Order No. 71135638

Kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80: extension module 485
- Ethernet configuration
- Can be extended to PROFIBUS DP or Modbus RS485 or Modbus TCP or EtherNet/IP. This requires an additional activation code which can be ordered separately (→ 🖹 177).
- Order No. 71135634

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80:
- Extension module 485
- Modbus RS485 (+ Ethernet configuration)
- Order No. 71140889

Upgrade kit CM442/CM444/CM448/CM442R/CM444R/CM448R/CSF48/CA80:
• Extension module 485
• Modbus TCP (+ Ethernet configuration)
• Order No. 71140890

### 14.8.2  Firmware and activation codes

SD card with Liquiline firmware
• Industrial Flash Drive, 1 GB
• Order No. 71127100

Activation code for Modbus RS485
• Order No. 71135636

Activation code for Modbus TCP
• Order No. 71135637

Kit CA80: activation code for 1st digital sensor input
• Order No. 71249548

Kit CA80: activation code for 2nd digital sensor input
• Order No. 71249555

Activation code for feedforward control
• Order No. 71211288

Activation code for measuring range switch
• Order No. 71211289

## 14.9   Software

Memobase Plus CYZ71D
• PC software to support laboratory calibration
• Visualization and documentation of sensor management
• Sensor calibrations saved in the database
• Order as per product structure, www.products.endress.com/cyz71d
• Technical Information TI00502C/07/EN

## 14.10  Other accessories

SD card
• Industrial Flash Drive, 1 GB
• Order No. 71110815

# 15    Technical data

## 15.1    Input

### 15.1.1    Measured variables

$NH_4$-N, $NH_4$, $NH_3$ [mg/l, ppm]

### 15.1.2    Measuring range

| | |
|---|---|
| CA80AM-AAA1: | 0.05 to 20 mg/l $NH_4$-N |
| CA80AM-AAA2: | 0.5 to 50 mg/l $NH_4$-N |
| CA80AM-AAA3: | 1 to 100 mg/l $NH_4$-N |

### 15.1.3    Types of input

- 1 or 2 measuring channels
- 1 to 4 digital sensor inputs for sensors with Memosens protocol (optional)
- Analog current inputs (optional)

### 15.1.4    Input signal

Depending on version
- Max. 4 x binary sensor signal (optional)
- 2 x 0/4 to 20 mA (optional), passive, potentially isolated from one another and from the sensor inputs/sample preparation system

### 15.1.5    Current input, passive

**Span**

> 0 to 20 mA

**Signal characteristic**

Linear

**Internal resistance**

Non-linear

**Test voltage**

500 V

### 15.1.6 Cable specification

**Cable type**

Memosens data cable  or fixed sensor cable, each with cable end sleeves or M12 round-pin connector (optional)

**Cable length**

Max. 100 m (330 ft)

## 15.2 Output

### 15.2.1 Output signal

Depending on version:
- 2 x 0/4 to 20 mA, active, potentially isolated from one another and from the sensor circuits/sample preparation system
- 4 x 0/4 to 20 mA, active, potentially isolated from one another and from the sensor circuits/sample preparation system
- 6 x 0/4 to 20 mA, active, potentially isolated from one another and from the sensor circuits/sample preparation system

**Modbus RS485**

| Signal coding | EIA/TIA-485 |
| --- | --- |
| Data transmission rate | 2400, 4800, 9600, 19200, 38400, 57600 and 115200 Baud |
| Galvanic isolation | Yes |
| Bus termination | Internal slide switch with LED display |

**Ethernet and Modbus TCP**

| Signal coding | IEEE 802.3 (ethernet) |
| --- | --- |
| Data transmission rate | 10 / 100 MBd |
| Galvanic isolation | Yes |
| IP address | DHCP or configuration via menu |

### 15.2.2 Signal on alarm

Adjustable, as per NAMUR Recommendation NE 43
- In measuring range 0 to 20 mA:
  Error current from 0 to 23 mA
- In measuring range 4 to 20 mA:
  Error current from 2.4 to 23 mA
- Factory setting for error current for both measuring ranges:
  21.5 mA

### 15.2.3 Load

Max. 500 Ω

### 15.2.4 ÜTransmission behavior

Linear

## 15.3 Current outputs, active (optional)

### 15.3.1 Span

0 to 23 mA

### 15.3.2 Signal characteristic

Linear

### 15.3.3 Electrical specification

**Output voltage**

Max. 24 V

**Test voltage**

500 V

### 15.3.4 Cable specification

**Cable type**

Recommended: shielded cable

**Cable cross-section**

Max. 2.5 mm$^2$ (14 AWG)

## 15.4    Relay outputs

### 15.4.1    Electrical specification

**Relay types**

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

**Relay switching capacity**

Basic 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 modules

| 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 with 5 V DC
- Min. 1 mA with 24 V DC
- Min. 5 mA with 24 V AC
- Min. 1 mA with 230 V AC

## 15.5    Protocol-specific data

### 15.5.1    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 via switches or the software |

### 15.5.2    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 via DHCP or the software |

### 15.5.3    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 router with a user-defined IP address.

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

## 15.6    Power supply

### 15.6.1    Supply voltage

The analyzer is fitted with a connector with a cable length of 5 m (10 ft).

- 100 to 120 VAC / 200 to 240 VAC ± 10%
  or
  24 VDC ± 10%
- 50 ± 1 or 60 ± 1.2 Hz

### 15.6.2    Fieldbus connection

Supply voltage: not applicable

### 15.6.3    Power consumption

130 VA + 660 VA per hose heating system, max. 1450 VA (version with cooling)

### 15.6.4    Mains fuse

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

### 15.6.5    Cable entries

- 4 x bores for M16, G3/8, NPT3/8", Memosens connection
- 4 x bores for M20, G1/2, NPT1/2"

### 15.6.6    Hose entries

- 4 x bores for M32 for sample inflow and outflow

### 15.6.7    Cable specification

| Cable gland | Permitted cable diameter |
|---|---|
| M16x1.5 mm | 4 to 8 mm (0.16 to 0.32") |
| M12x1.5 mm | 2 to 5 mm (0.08 to 0.20") |
| M20x1.5 mm | 6 to 12 mm (0.24 to 0.48") |
| NPT3/8" | 4 to 8 mm (0.16 to 0.32") |
| G3/8 | 4 to 8 mm (0.16 to 0.32") |
| NPT1/2" | 6 to 12 mm (0.24 to 0.48") |
| G1/2 | 7 to 12 mm (0.28 to 0.48") |

## 15.6.8  Sensor connection (optional)

**Sensors with Memosens protocol**

| Sensor types | Sensor cable | Sensors |
|---|---|---|
| Digital sensors **without** additional internal power supply | with plug connection and inductive signal transmission | • pH sensors<br>• ORP sensors<br>• Combined sensors<br>• Amperometric oxygen sensors<br>• Conductive conductivity sensors<br>• Chlorine sensors |
| | Fixed cable | Inductive conductivity sensors |
| Digital sensors **with** additional internal power supply | Fixed cable | • Turbidity sensors<br>• Sensors for interface measurement<br>• Sensors for measuring the spectral absorption coefficient (SAC)<br>• Nitrate sensors<br>• Optical oxygen sensors<br>• Ion-sensitive sensors |

# 15.7    Performance characteristics

## 15.7.1  Maximum measured error

| CA80AM-AAA1: | | $\pm$ 2 % of the display value + 0.05 mg/l $NH_4$-N |
|---|---|---|
| CA80AM-AAA2: | 0.5 to 20 mg/l $NH_4$-N | $\pm$ 2 % of the display value + 0.05 mg/l $NH_4$-N |
| | > 20 to 50 mg/l $NH_4$-N | $\pm$ 2 % of the display value + 0.5 mg/l $NH_4$-N |
| CA80AM-AAA3: | 1.0 to 50 mg/l $NH_4$-N | $\pm$ 3 % of the display value + 0.5 mg/l $NH_4$-N |
| | > 50 to 100 mg/l $NH_4$-N | $\pm$ 3 % of the display value + 1.0 mg/l $NH_4$-N |

## 15.7.2  Maximum measured error Sensor inputs

--> Documentation of the connected sensor

## 15.7.3  Measured error current inputs and outputs

Typical measured errors:
< 20 µA (for current values < 4 mA)
< 50 µA (with current values 4 to 20 mA)
at 25 ˚C (77˚F) each

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

### 15.7.4 Repeatability

± 2% of the display value + 0.05 mg/l $NH_4$-N

### 15.7.5 Repeatability Sensor inputs

--> Documentation of the connected sensor

### 15.7.6 Measuring interval

Continuous (approx. 8 min), adjustable > 15 min

### 15.7.7 Sample requirement

22 ml/measurement

### 15.7.8 Reagent requirement

- Approx. 70 µl per reagent and measurement
- With a measuring interval of 15 min, approx. 250 ml per reagent and month

### 15.7.9 Calibration interval

1 to 90 days, depending on the application and ambient conditions

### 15.7.10 Cleaning interval

1 to 90 days, depending on the application

### 15.7.11 Maintenance interval

Every 3 - 6 months, depending on the application

### 15.7.12 Servicing requirements

- Weekly: visual inspection
- Quarterly: 1 hour
- Annually: 2 hours

## 15.8 Environment

### 15.8.1 Ambient temperature range

5 to 40 ˚C (41 to 104 ˚F)

### 15.8.2 Storage temperature

-20 to 60 ˚C (-4 to 140 ˚F)

### 15.8.3 Humidity

10 to 95%, not condensing

### 15.8.4  Degree of protection

IP55 (cabinet, analyzer stand)

### 15.8.5  Electromagnetic compatibility

Interference emission and interference immunity as per EN 61326-1: 2006, class A for industry

### 15.8.6  Electrical safety

IEC 61010-1, Class I equipment
Low voltage: overvoltage category II
Environment < 2000 m (< 6562 ft) above MSL

### 15.8.7  Pollution degree

The product is suitable for pollution degree 2.

## 15.9  Process

### 15.9.1  Sample temperature

4 to 40 ˚C (40 to 104 ˚F)

### 15.9.2  Sample flow rate

Min. 5 ml/min (0.17 fl.oz./min)

### 15.9.3  Consistency of the sample

Low solids content (TS < 50 mg/l (ppm))

### 15.9.4  Sample supply

Unpressurized

### 15.9.5  pH value of the sample

pH 5 to 9

## 15.10  Mechanical construction

### 15.10.1 Dimensions

See "Installation" chapter.

### 15.10.2 Weight

|  | Weight with cooling module | Weight without cooling module |
|---|---|---|
| Cabinet version | 42 kg (92.6 lbs) | 39.5 kg (87.1 lbs) |
| Open installation | 34 kg (74.96 lbs) | 31.5 kg (69.45 lbs) |
| Analyzer stand | 75 kg (165.3 lbs) | 72.5 kg (159.8 lbs) |

### 15.10.3 Materials

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

| Parts in contact with medium | |
|---|---|
| Syringes | Plastic PP and elastomer TPE |
| Liquid manager | Plastic PP and elastomer FKM |
| Hoses | C-Flex, NORPRENE |
| Cell<br>• Outer material<br>• Optical window<br>• Molded seal | • PP-GF30<br>• Glass<br>• Elastomer EPDM |
| Drain pipe | Plastic PP |
| Collecting vessel (optional)<br>• Beaker<br>• Cover<br>• Level detector<br>• Seal | • Plastic PMMA<br>• Plastic PP<br>• Stainless steel 1.4404 (V4A)<br>• EPDM |
| Valve (optional) | PVDF |

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