BA01981C/07/EN/02.21
71519650
2021-03-09

Valid as of version
01.09.00



# Operating Instructions
# **Liquiline System CA80TN**

Colorimetric analyzer for total nitrogen

Endress+Hauser
People for Process Automation

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# 1 About this document

## 1.1 Warnings

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

## 1.2 Symbols

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

## 1.3 Symbols on the device

- Reference to device documentation
- Caution: Hazardous voltage
- Warning: Health hazard
- Warning: Oxidizing
- Warning: Corrosive
- Warning: Hazardous to the aquatic environment
- Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

## 1.4 Documentation

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

- Brief Operating Instructions Liquiline System CA80TN, KA01440C
- Operating Instructions Memosens, BA01245C
  - Software description for Memosens inputs
  - Calibration of Memosens sensors
  - Sensor-specific diagnostics and troubleshooting
- Guidelines for communication via fieldbus and web server
  - PROFIBUS, SD01188C
  - Modbus, SD01189C
  - Web server, SD01190C
  - EtherNet/IP, SD01293C
- Special documentation on reagents:
  CY80TN, SD02686C

# 2 Basic safety instructions

## 2.1 Requirements for personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

## 2.2 Designated use

The Liquiline System CA80TN is a wet-chemical analyzer for the almost continuous determination of the concentration of total nitrogen in liquid media.

The analyzer is designed for use in the following applications:
- Monitoring of the wastewater treatment plant outlet
- Control of the water quality of surface waters
- Monitoring of industrial wastewater
- Control of industrial wastewater treatment

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

## 2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:
- Installation guidelines
- Local standards and regulations
- Regulations for explosion protection

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

## 2.4 Operational safety

**Before commissioning the entire measuring point:**

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

**During operation:**

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

**⚠ CAUTION**

**Activities while the analyzer is in operation**

Risk of injury and infection from medium!

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

**⚠ CAUTION**

**Risk of injury from door stop mechanism**

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

## 2.5 Product safety

### 2.5.1 State-of-the-art technology

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

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

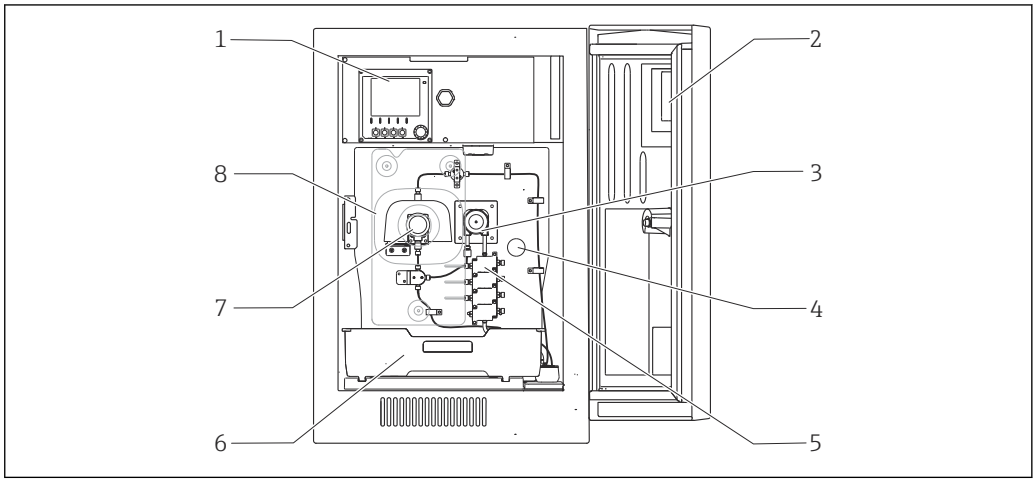
### 2.5.2 IT security

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

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

# 3 Product description

## 3.1 Product design

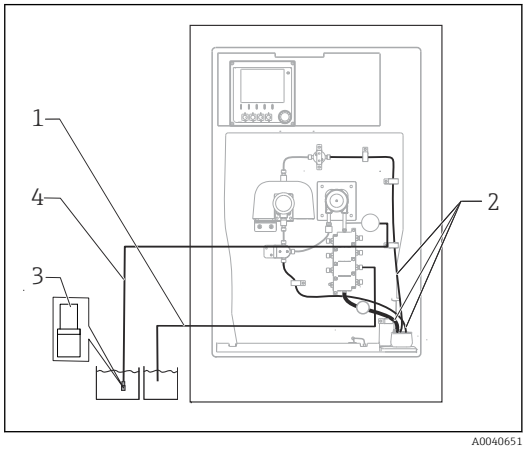



1 *Example of a Liquiline System CA80TN*

1 *Controller*
2 *Window*
3 *Peristaltic pump for sample*
4 *Sample valve*
5 *Valve unit*
6 *Bottle tray for reagents, cleaner and standard*
7 *Reactor (behind safety cover)*
8 *Safety cover*

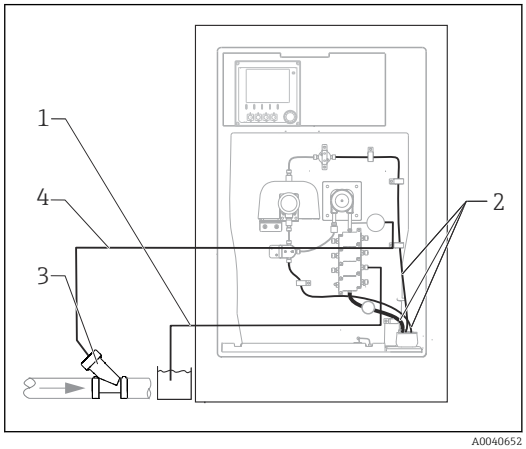
## 3.2 Measuring system

A complete measuring system comprises:
- Analyzer Liquiline System CA80TN with the configuration ordered
- reagents and standard solution (to be ordered separately)
- Suction strainer or optional Y strainer with process connection




2 *Measuring system with suction strainer*

1 *Dilution water*
2 *Outlet*
3 *Suction strainer*
4 *Medium*

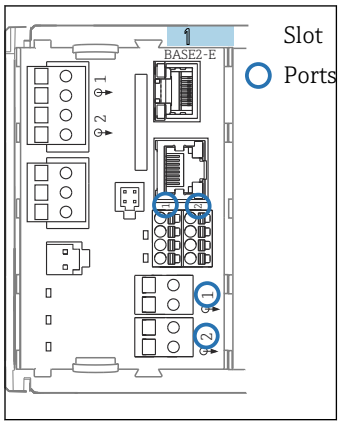



3 *Measuring system with Y strainer*

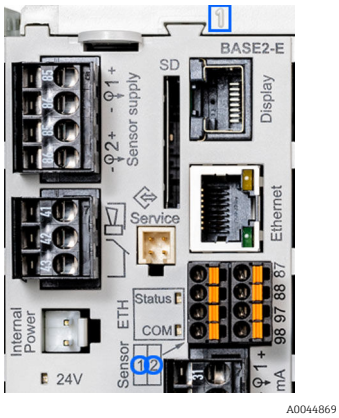
1 *Dilution water*
2 *Outlet*
3 *Y strainer*
4 *Medium*

## 3.3 Equipment architecture

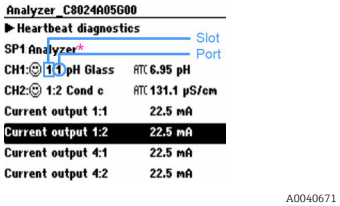
### 3.3.1 Slot and port assignment




4 *Slot and port assignment*




5 *Slot and port assignment*




6 *Slots and ports on the display*

* *Analyzer measured value (parameter-specific)*

- Inputs are assigned to measuring channels in the ascending order of the slots and ports. In the example above:
  "CH1: 1:1 pH glass" means:
  Channel 1 (CH1) is slot 1 (basic module) : Port 1 (input 1), pH glass sensor
- Outputs and relays are named according to their function, e.g. "current output", and are displayed in ascending order with the slot and port numbers
- Display shows SP1: analyzer measuring channel 1 with sampling point SP1 (measured value display is parameter-specific; is not illustrated in the example)

### 3.3.2 Terminal diagram

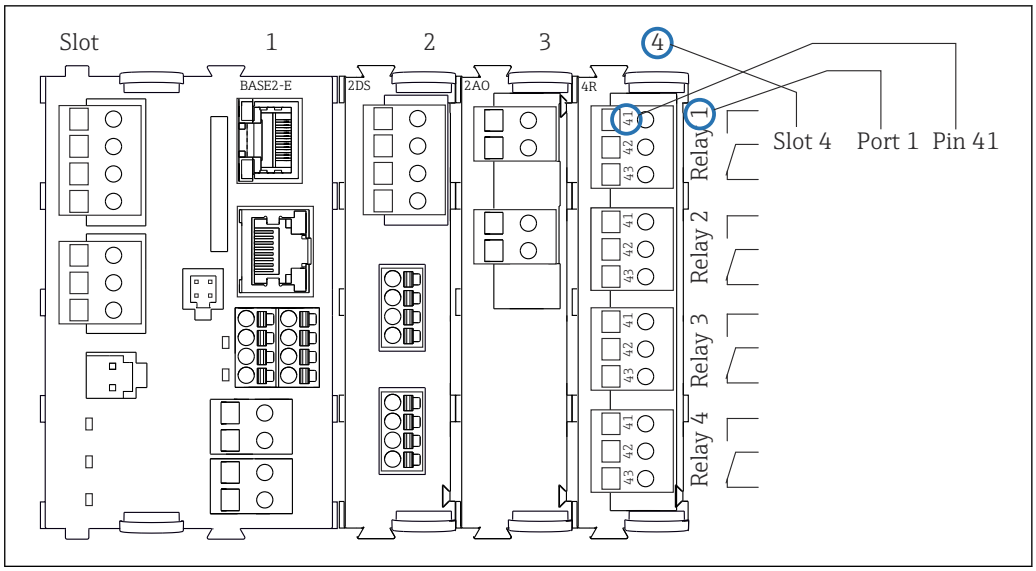
The unique terminal name is derived from:

Slot no. : Port no. : Terminal

**Example, NO contact of a relay**

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

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




7 *Creating a terminal diagram using the example of the NO contact (terminal 41) of a relay*

# 4 Incoming acceptance and product identification

## 4.1 Incoming acceptance

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

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

NOTICE

**Incorrect transportation can damage the analyzer**

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

## 4.2 Product identification

### 4.2.1 Nameplate

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

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Firmware version
- Ambient and process conditions
- Input and output values
- Measuring range
- Activation codes
- Safety information and warnings
- Certificate information
- Approvals as per order version

▶ Compare the information on the nameplate with the order.

### 4.2.2 Product identification

**Interpreting the order code**

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

**Obtaining information on the product**

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

### 4.2.3 Manufacturer address

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

## 4.3 Scope of delivery

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

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

## 4.4 Certificates and approvals

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

# 5 Installation

**⚠ CAUTION**

**Incorrect transportation can cause injury and damage the device**

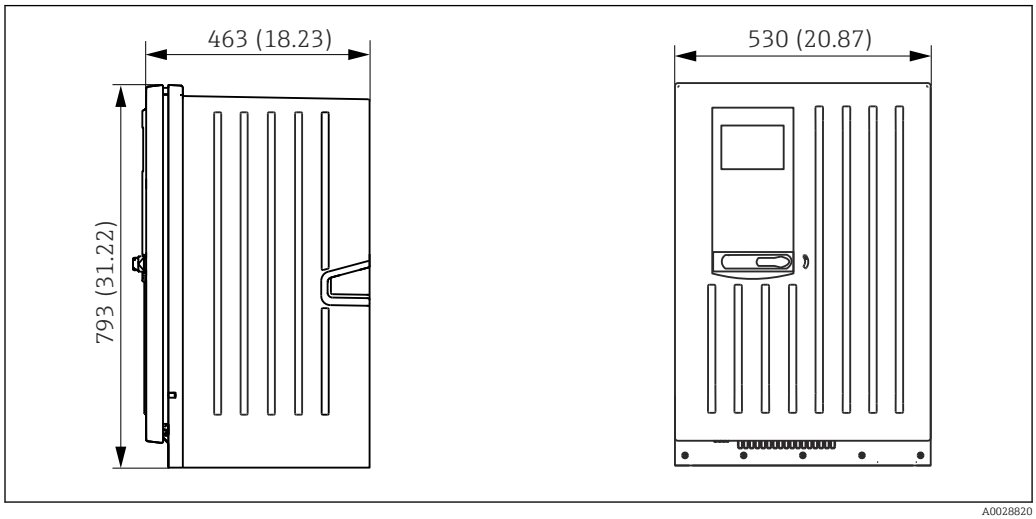
- ▶ Always use a lifting truck or a fork-lift to transport the analyzer. Two people are needed for the installation.
- ▶ Lift the device by the recessed grips.

## 5.1 Installation conditions

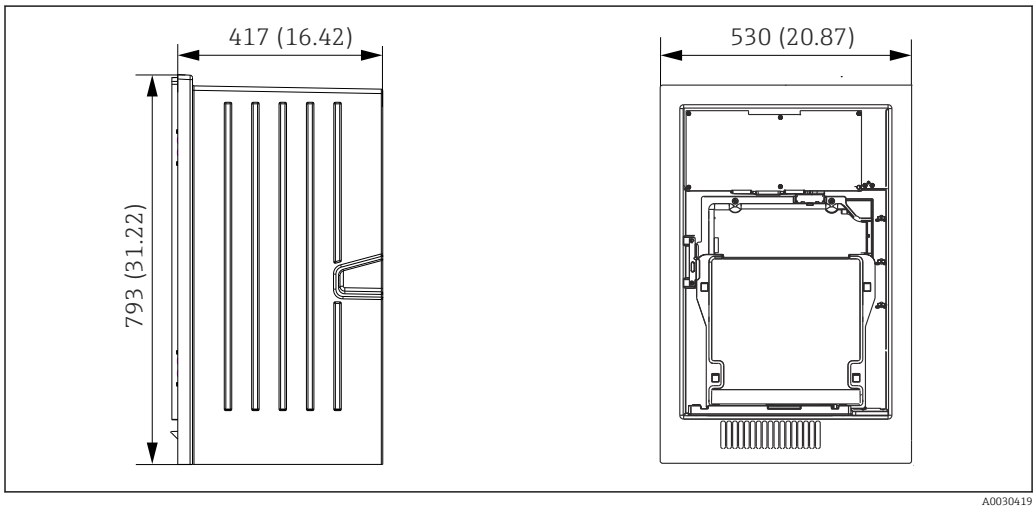
The device can be installed in the following ways:

- Mounted on a wall
- Mounted on a base

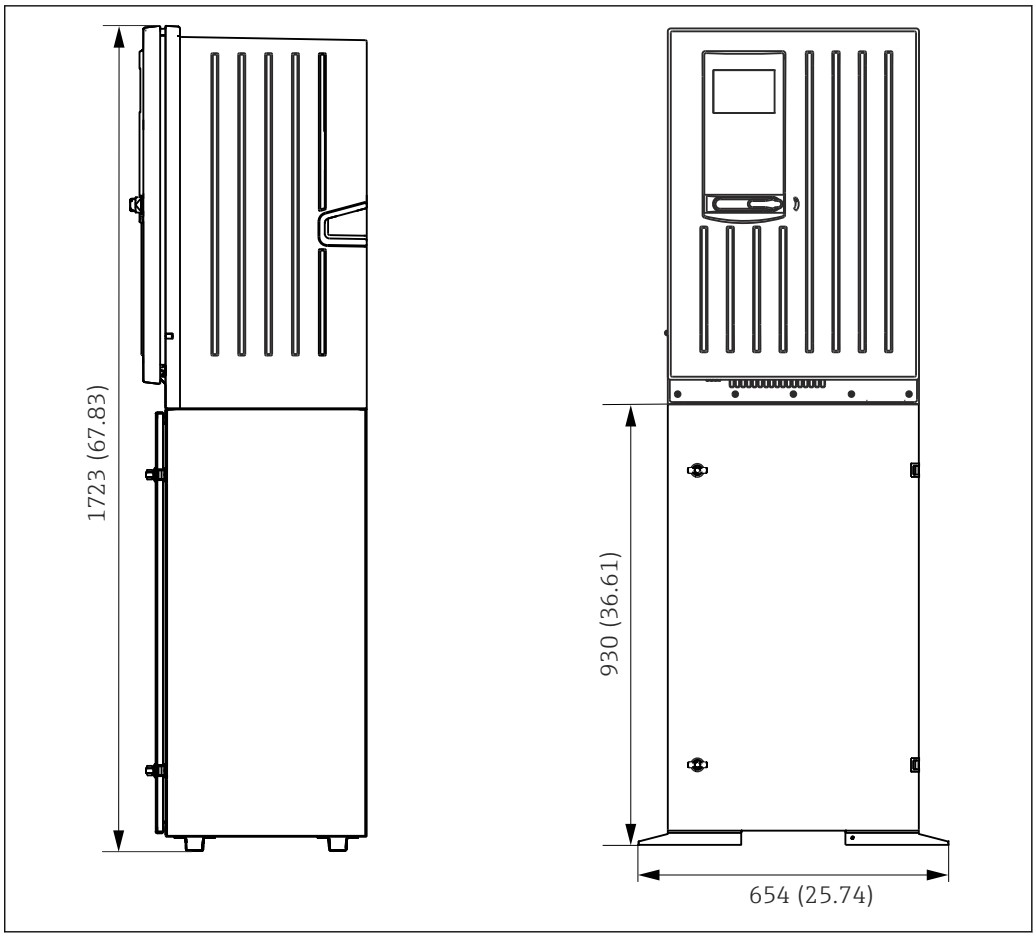
### 5.1.1 Dimensions



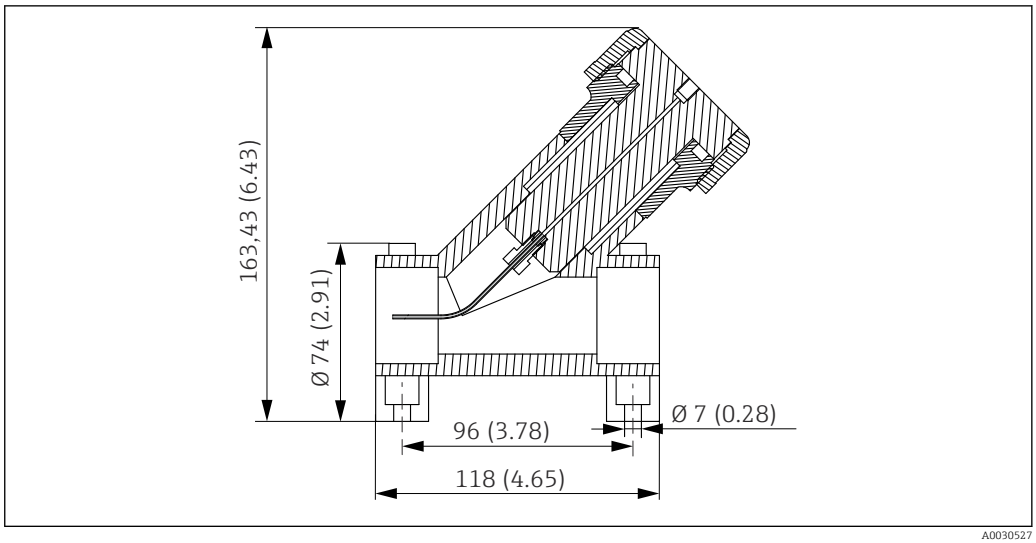

8 *Liquiline System CA80 closed version, dimensions in mm (in)*




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




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




*11 Y strainer (optional), dimensions in mm (inch)*

## 5.1.2 Mounting location

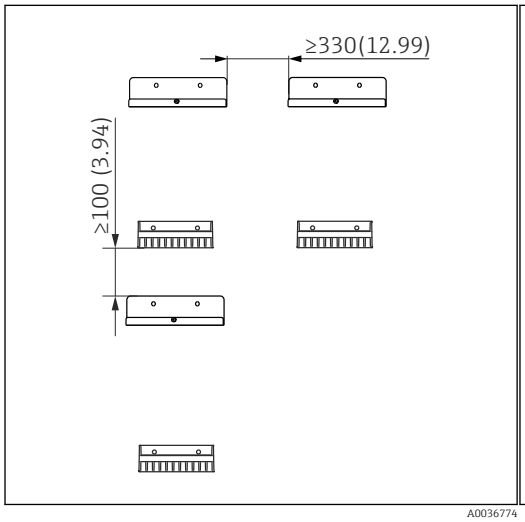
Note the following when erecting the device:

- If mounting on a wall, make sure that the wall has sufficient load-bearing capacity and is fully perpendicular.
- If mounting on a base, erect the device on a level surface.
- Protect the device against additional heating (e.g. from a heating system).

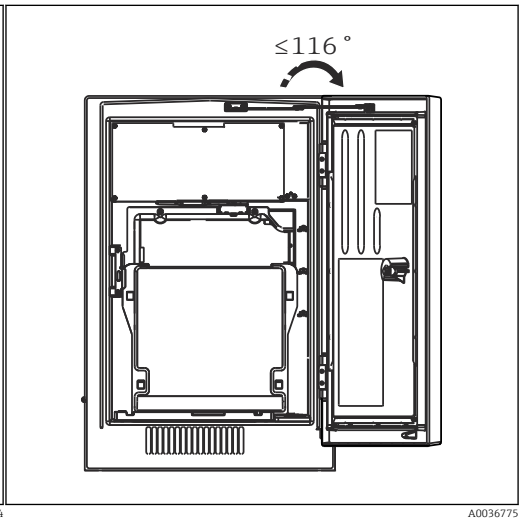
- Protect the device against mechanical vibrations.
- Protect the device against corrosive gases, e.g. hydrogen sulfide ($H_2S$) .
- Make sure to pay attention to the maximum height difference and the maximum distance from the sampling point.
- Ensure that the unit can drain freely, without any siphoning effects.
- Make sure air can circulate freely at the front of the housing.
- Open analyzers (i.e. analyzers that are supplied without a door) may only be erected in closed areas or in a protective cabinet or similar facility.

### 5.1.3 Spacing requirements when mounting

*Spacing required for installing analyzer*

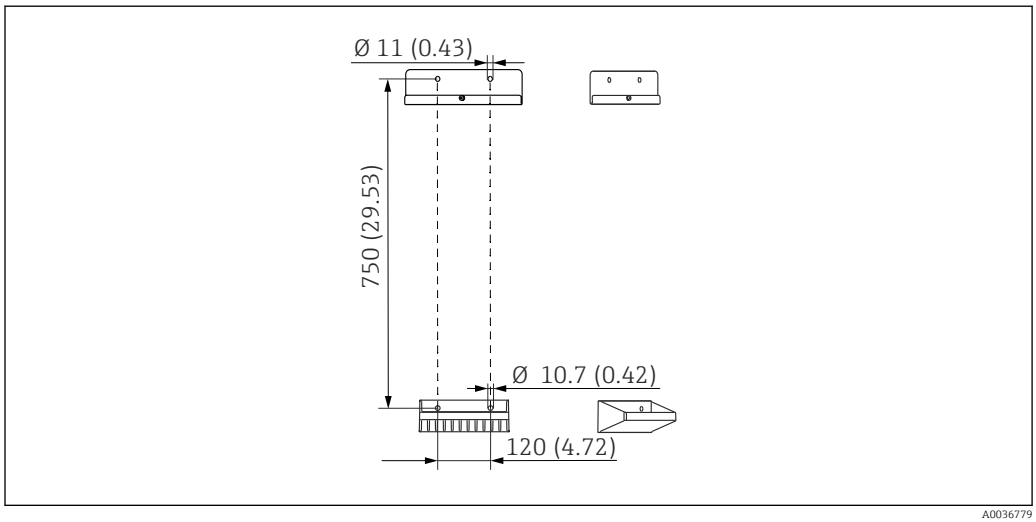



*12 Minimum spacing required for mounting. Engineering unit mm (in).*




*13 Maximum opening angle*

*Spacing required for installing wall-mount version*




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

## 5.2 Mounting the analyzer

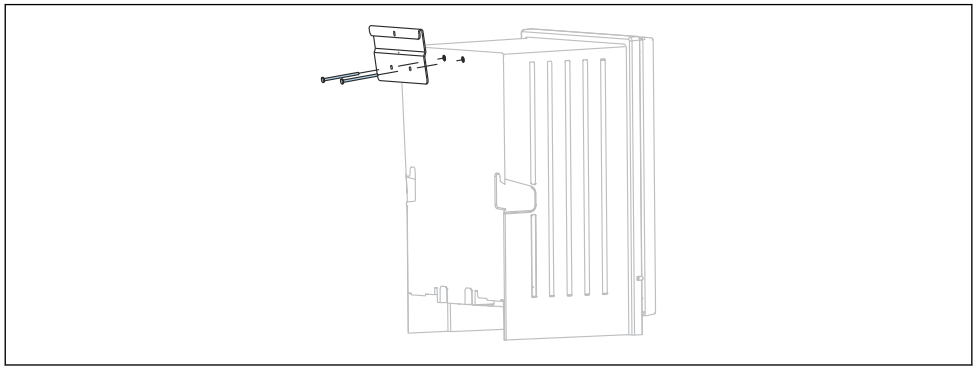
### 5.2.1 Mounting the analyzer on a wall

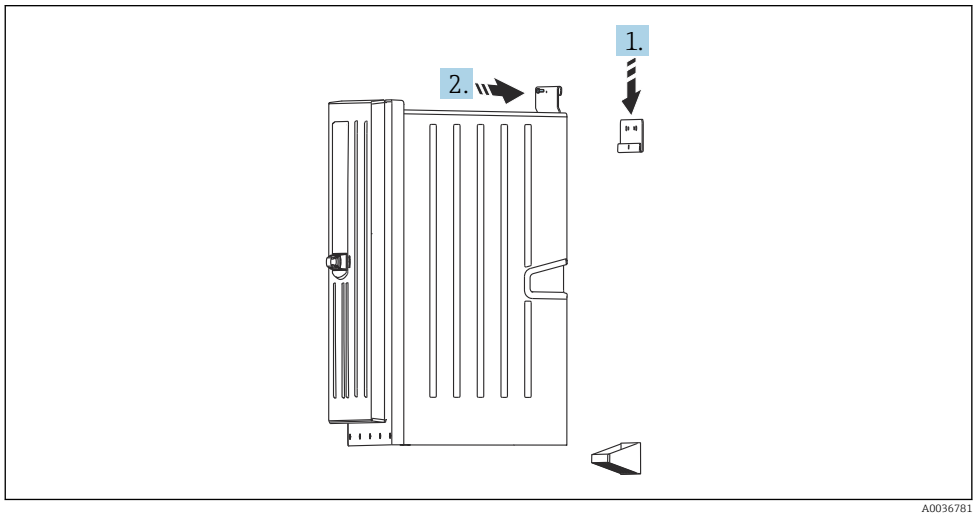
**⚠ CAUTION**

**Incorrect installation can cause injury and damage the device**

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

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

1. Provide the mounting materials to secure the device to the wall (screws, wall plugs) onsite.
2. Mount the wall holder unit (2 parts) on the wall.
3. 

   Secure the mount on the housing.
4. 


   A0036781

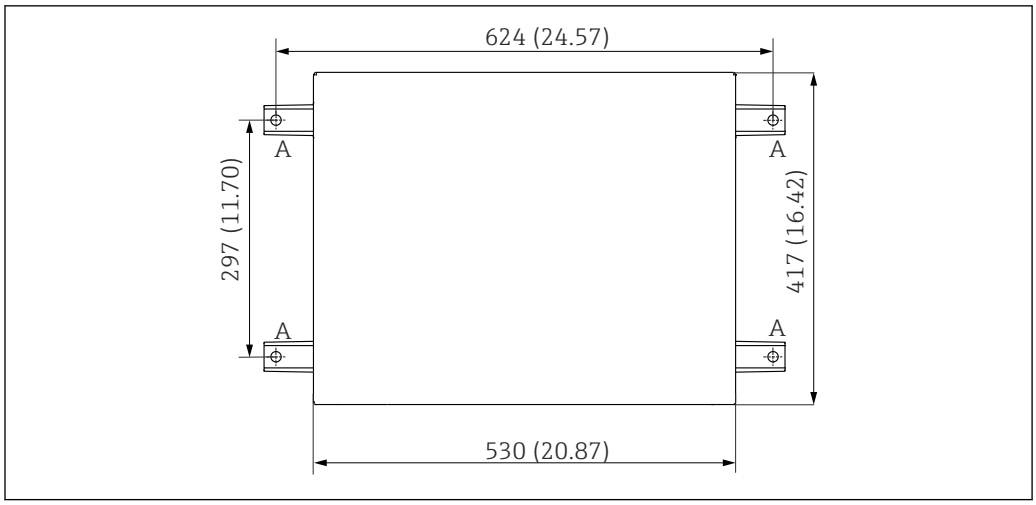
   Hook the analyzer into the wall holder unit (1).
5. Fix the mount and wall holder unit in place with the screw supplied (2).

### 5.2.2 Installing version with analyzer stand

**⚠ CAUTION**

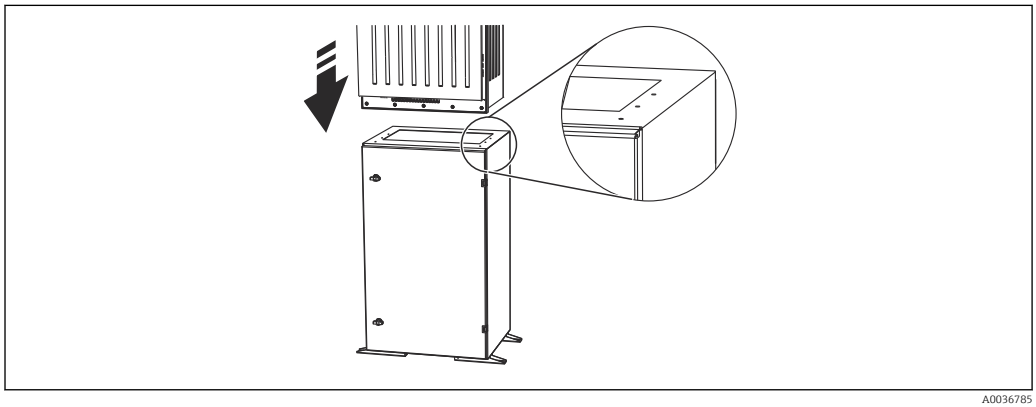
**Incorrect installation can cause injury and damage the device**

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




*15 Foundation plan*

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




*16 Securing the base*

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

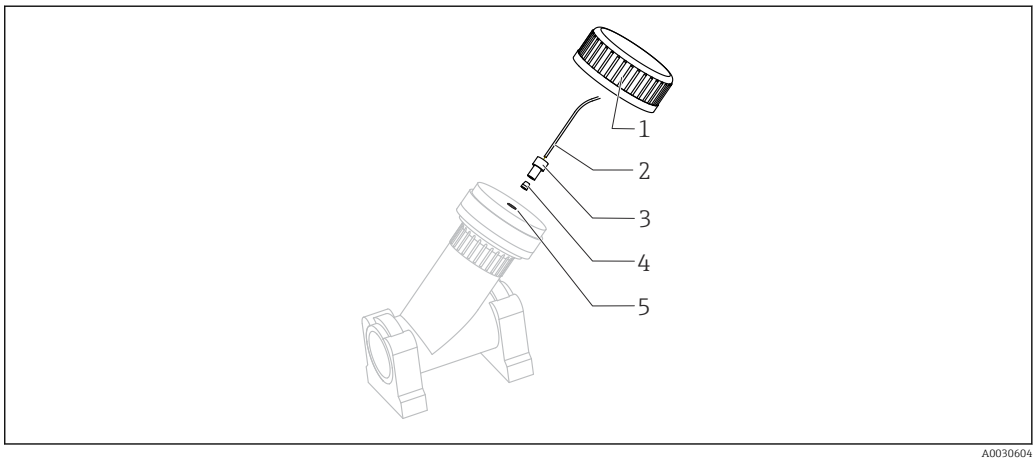
### 5.2.3 Mounting the Y strainer (optional)

The Y strainer is designed to directly tap particle-laden samples from pipes. This makes it possible to determine the total nitrogen. Here, it is necessary to include particles up to a defined size in the measurement.

Mounting materials are not supplied.

► Provide the mounting materials onsite.

### Mounting the Y strainer on an even surface




17 *Y strainer*

1 *Union nut*
2 *Hose to analyzer*
3 *Threaded joint*
4 *Ferrule*
5 *Threaded borehole*

1. Mount the Y strainer on the pipe clamps on an even surface.
2. Align the Y strainer.

### Sticking the adhesive fittings

3. Clean the adhesive surfaces (tube end on outside, sleeve or angle piece on inside) with a cleaning cloth.
4. Allow the cleaned surfaces to dry for approx. 5 minutes.
5. Apply the glue evenly (closed adhesive layer) to the surfaces (first sleeve, then pipe).
6. Join the parts together immediately (screw them together as far as possible).
7. Remove any surplus glue.
8. Allow the glue on the glued parts to set for at least 24 hours before running sample through the system.

### Securing the sample hose

9. Turn the union nut to remove it.
10. Secure the threaded joint and ferrule supplied on the hose to the analyzer.
11. Screw the hose with the ferrule and threaded joint into the threaded borehole.
12. Turn the union nut to secure it.

## 5.3 Post-installation check

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

# 6 Electrical connection

**⚠ WARNING**

**Device is live!**

Incorrect connection may result in injury or death!

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

## 6.1 Connection conditions

| | |
|---|---|
| Power supply cable | Power supply cable with safety plug<br>Cable length 4.3 m (14.1 ft) |
| Mains voltage | The maximum mains voltage fluctuation may not be more than ±10% of the values indicated on the nameplate. |
| Analog, signal and transmission lines | e.g. LiYY 10 x 0.34 $mm^2$ |

## 6.2 Connecting the analyzer

**NOTICE**

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

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

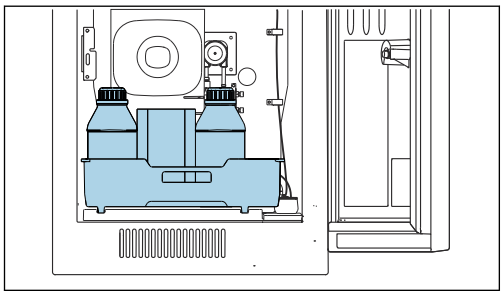
### 6.2.1 Routing the cable in the connection compartment

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

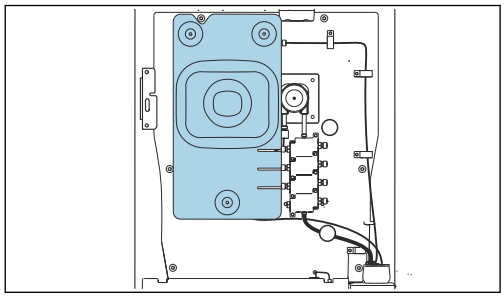
- For cabinet versions, the cable length is approx. 4.3 m (14.1 ft) from the base of the housing.
- For analyzer stands, the cable length is approx. 3.5 m (11.5 ft) from the foundation.

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

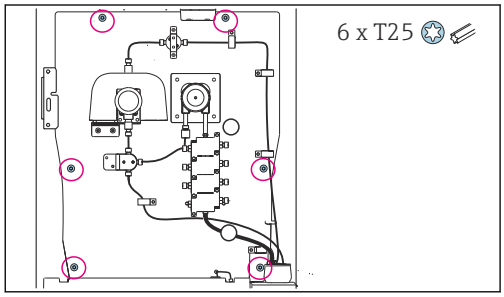
1.



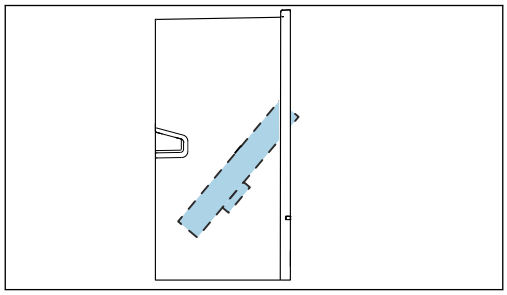
Remove the bottle tray: Lift up the recessed grip slightly and pull it towards the front.

2. 

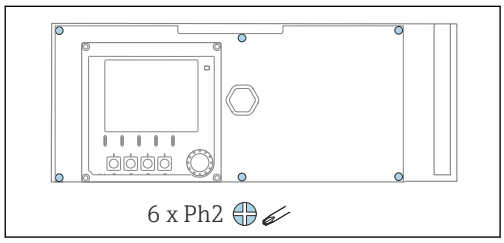
Loosen the screws on the cover and remove the cover.

3. 


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

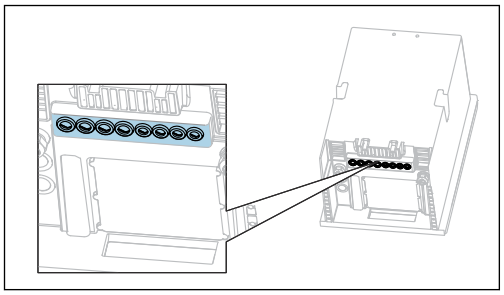
4. 

Fold out the carrier board towards the front .

5. 


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

6. **Only for order versions with G or NPT glands:**
Replace the pre-installed M-thread cable glands with the G or NPT cable glands that are enclosed. This does not affect the M32 hose glands.

7. 

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

**For all versions**

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

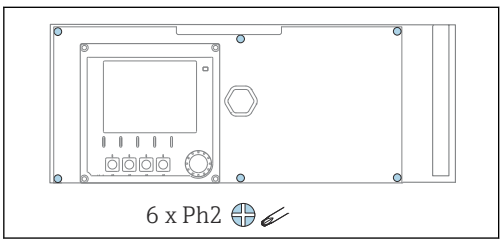
**After connecting:**

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

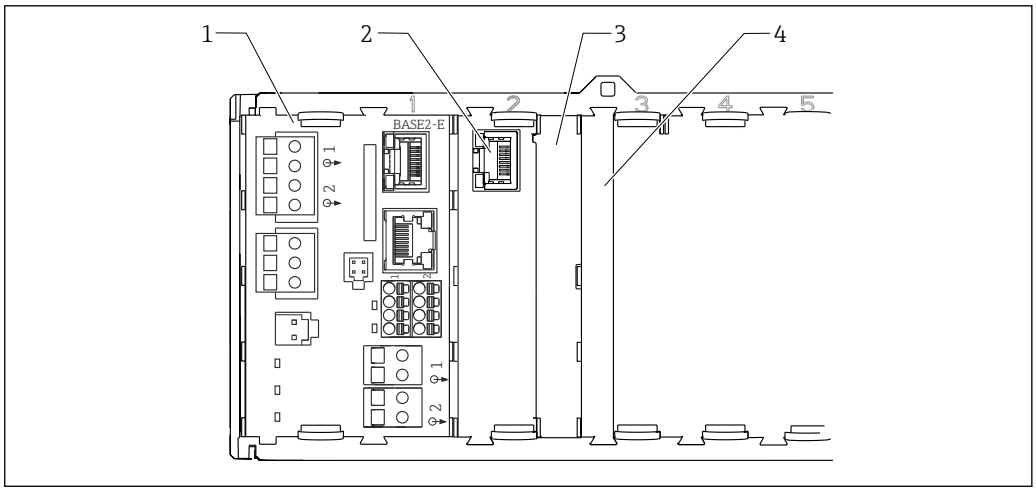
## 6.3 Connecting the sensors and additional modules

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

The controller has a separate connection compartment.

▶ 

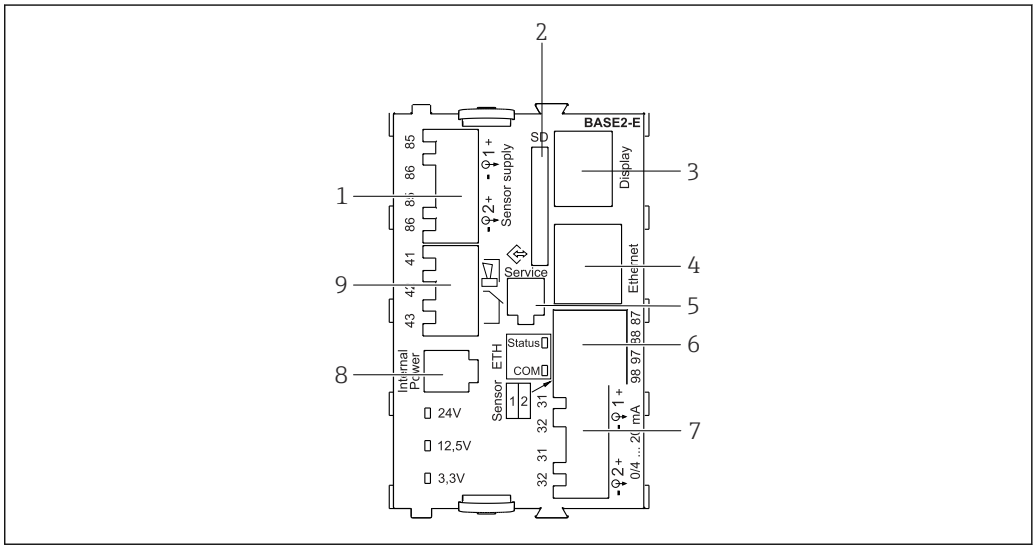

Release the 6 screws on the electronics compartment cover using a Phillips-head screwdriver and fold out the cover towards the front.




18 *Connection compartment in the controller housing*

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

### Base module E



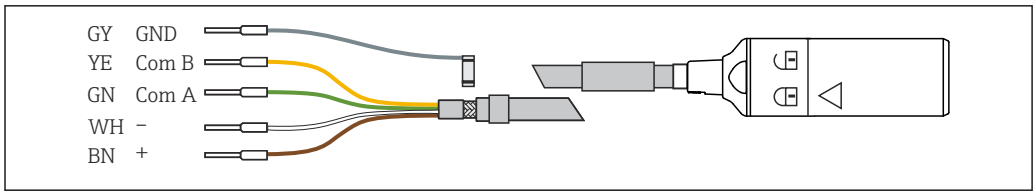

19 *BASE2-E*

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

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

## 6.3.2 Connecting the sensors

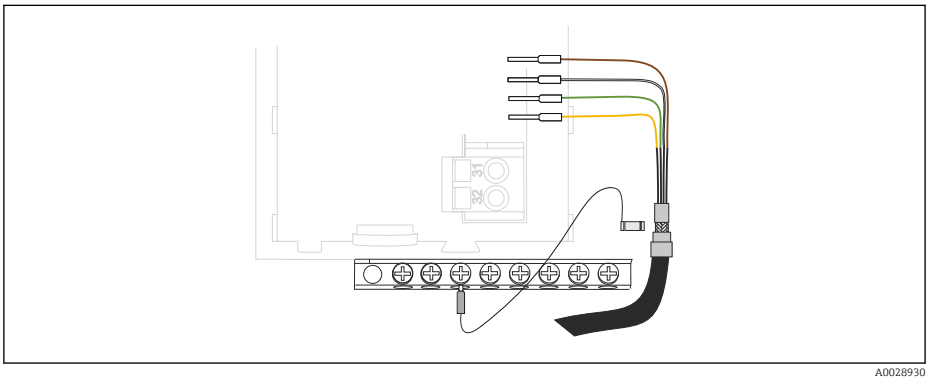
Only use terminated original cables where possible.




20 *Example of a Memosens CYK10 data cable*

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

1. To access the electronics compartment, proceed as described in the "Routing the cables" section .
2. Guide the sensor connecting cable from below through the cable gland on the inner rear panel of the device and feed it up into the electronics compartment.
3. Establish the connection as per → 20, 24.
4. Ground the outer shield of the cable via the metal gland on the grounding rail below the base module E.




21 *Terminal strip*

## 6.3.3 Connecting additional inputs, outputs or relays

**WARNING**

**Module not covered**

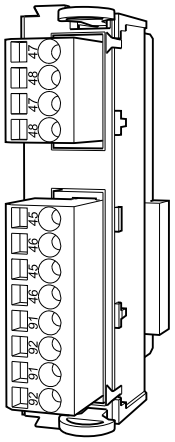
No shock protection. Danger of electric shock!

- Change or extend the hardware for the **non-hazardous area**: always fill the slots from left to right. Do not leave any gaps.
- If all of the slots are not occupied in the case of devices for the **non-hazardous area**: always insert a dummy cover or end cover in the slot to the right of the last module→ 18, 23. This ensures that the unit is shock-protected.
- Always ensure shock protection is guaranteed particularly in the case of relay modules (2R, 4R, AOR).
- Hardware for the **hazardous area** may not be modified. Only the Manufacturer's Service Team may convert a certified device to another certified device version. This includes all modules of the transmitter with an integrated 2DS Ex-i module, as well as changes that concern non-intrinsically safe modules.

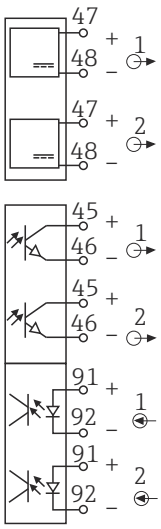
- If additional shields are required, connect them with PE centrally in the control cabinet via terminal blocks supplied by the customer.

### Digital inputs and outputs

**DIO module**



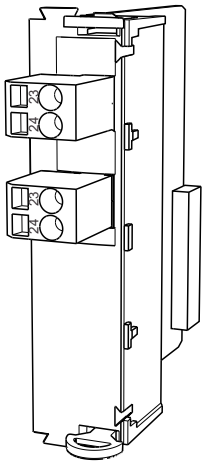

*22 Module*



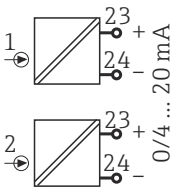

*23 Wiring diagram*

### Current inputs

**Module 2AI**

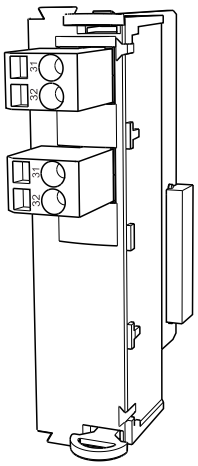
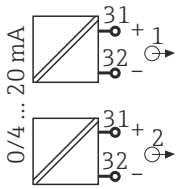
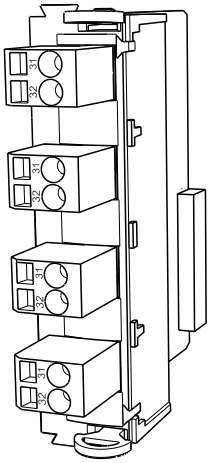
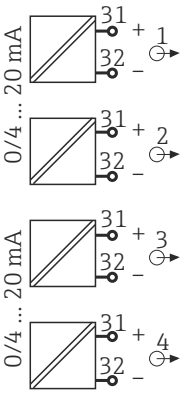



*24 Module*

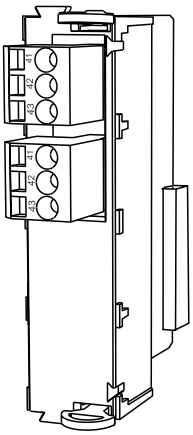
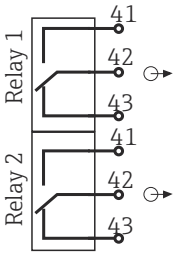
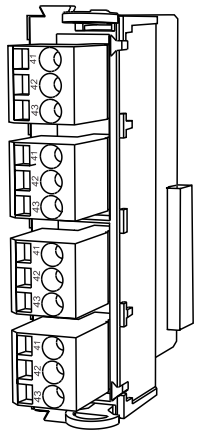
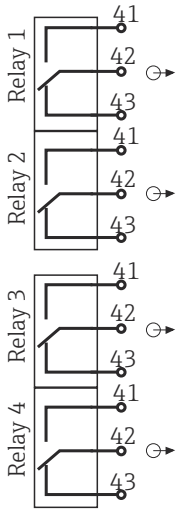



*25 Wiring diagram*

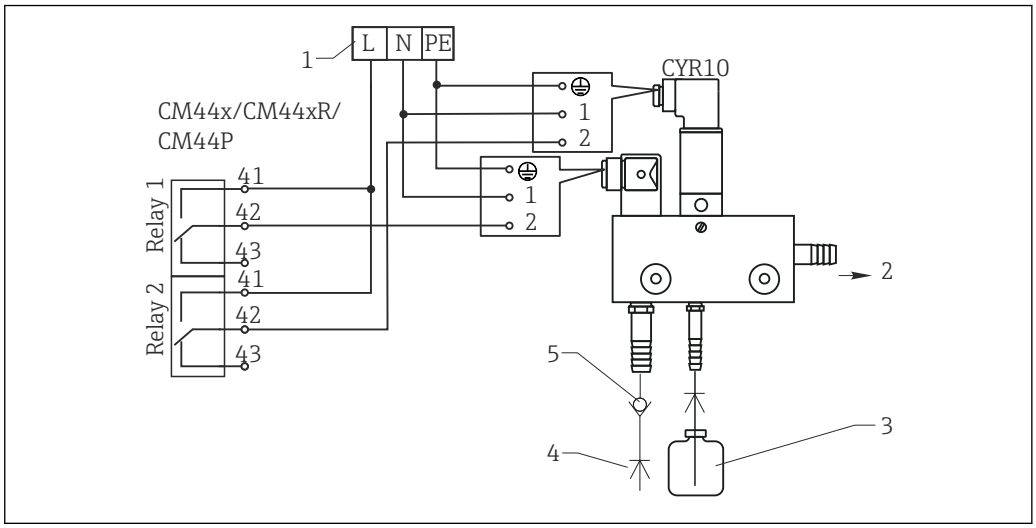
## Current outputs

| 2AO | | 4AO | |
|---|---|---|---|
|  |  |  |  |
| 26 Module | 27 Wiring diagram | 28 Module | 29 Wiring diagram |

## Relays

| Module 2R | | Module 4R | |
|---|---|---|---|
|  |  |  |  |
| 30 Module | 31 Wiring diagram | 32 Module | 33 Wiring diagram |

*Example: Connecting the Chemoclean CYR10 injector cleaning unit*

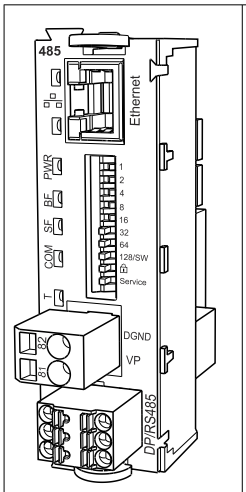



34 *Connecting the CYR10 injector cleaning unit*

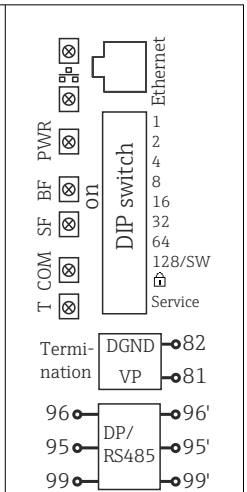
1 *External power supply*
2 *Cleaner to spray head*
3 *Container with cleaner*
4 *Motive water 2 to 12 bar (30 to 180 psi)*
5 *Backflow valve (to be provided by the customer)*

## 6.3.4 Connecting digital communication

### Module 485




35 *Module*




36 *Wiring diagram*

| Terminal | PROFIBUS DP | Modbus RS485 |
|---|---|---|
| 95 | A | B |
| 96 | B | A |
| 99 | Not connected | C |
| 82 | DGND | DGND |
| 81 | VP | VP |

*LEDs on front of module*

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

*DIP switches on front of module*

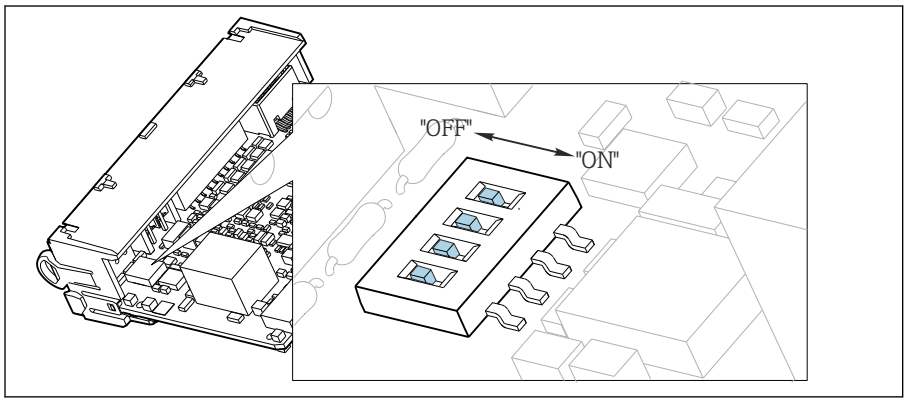
| DIP | Factory setting | Assignment |
|---|---|---|
| 1-128 | ON | Bus address (→ "Commissioning/communication") |
| 🔓 | OFF | Write protection: "ON" = configuration not possible via the bus, only via local operation |
| Service | OFF | The switch has no function |

# 6.4 Hardware settings

## 6.4.1 Bus termination (module 485 only)

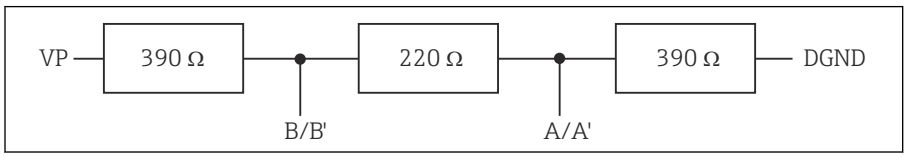
There are 2 ways to terminate the bus:

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




*37 DIP switch for internal termination*

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




*38 Structure of internal termination*

**2. External termination**

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

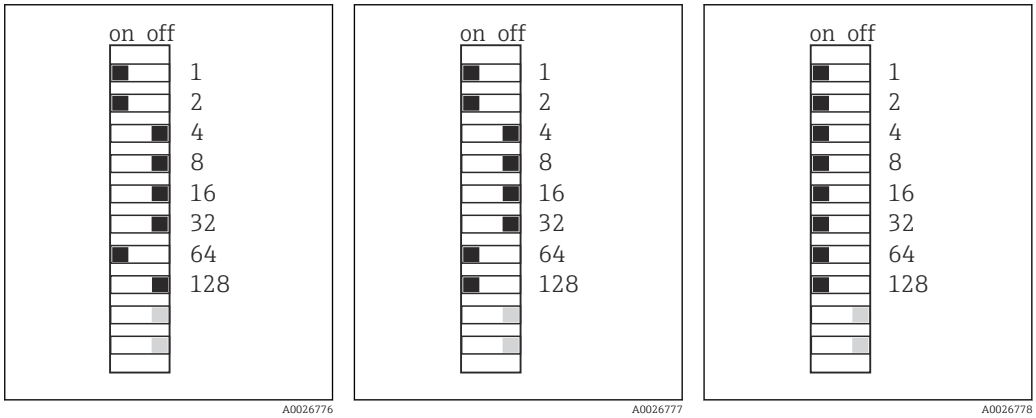
- ▶ Connect the external termination to terminals 81 and 82 on the front of module 485 for 5-V power supply.
  - ↳ The external termination is used.

### 6.4.2 Bus address

**Setting the bus address**

1. Open the housing.
2. Set the desired bus address via the DIP switches of module 485.

For PROFIBUS DP, valid bus addresses are anything between 1 and 126, and anything between 1 and 247 for Modbus. If you configure an invalid address, software addressing is automatically enabled via the local configuration or via the fieldbus.




39 *Valid PROFIBUS address 67* 40 *Valid Modbus address 195* 41 *Invalid address 255* [1)]

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

## 6.5 Ensuring the degree of protection

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

- ▶ Exercise care when carrying out the work.

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

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

## 6.6 Post-connection check

**⚠ WARNING**

**Connection errors**

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

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

Device condition and specifications

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

Electrical connection

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

# 7 System integration

## 7.1 Overview of device description files

### 7.1.1 Device identification

→ 148, protocol-specific data

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

**Downloading device drivers**

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

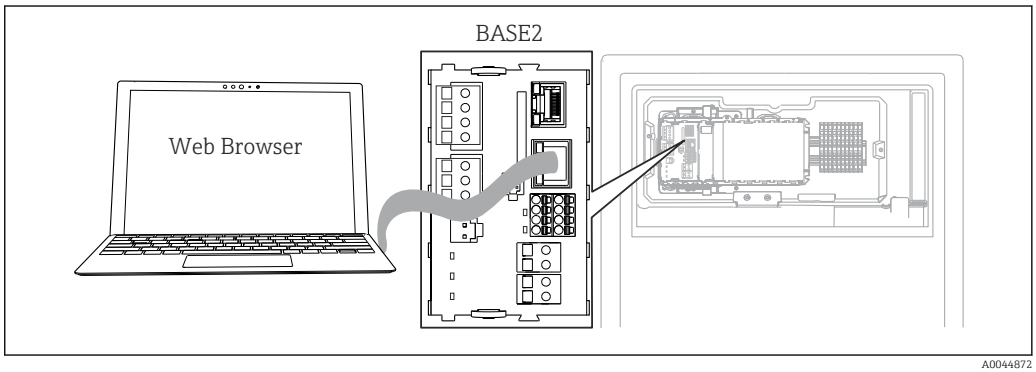
## 7.2 Integrating the measuring device into the system

### 7.2.1 Web server

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

**Connection**

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




42 *Web server/Ethernet connection*

**Establishing the data connection**

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

*All versions including PROFINET:*
The IP address and subnet mask of the device can be found under: **DIAG/System information/Ethernet**.

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

**Example: Microsoft Windows 10**

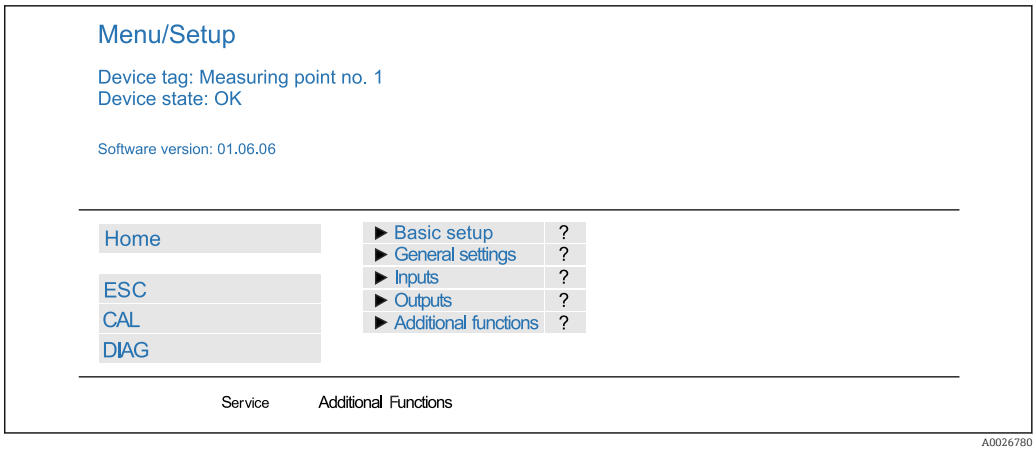
3. Open Network and Sharing Center.
   ↳ Apart from your standard network, you should see an additional Ethernet connection (e.g. as "Unidentified network" ).
4. Select the link to this Ethernet connection.
5. In the pop-up window select the "Properties" button.
6. Double-click "Internet Protocol Version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

Downloads in FDM format can be securely transmitted, saved and visualized with Endress+Hauser's "Field Data Manager Software".

(→ www.endress.com/ms20)

**Operation**

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




43 *Example of web server (menu/language=English)*

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

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

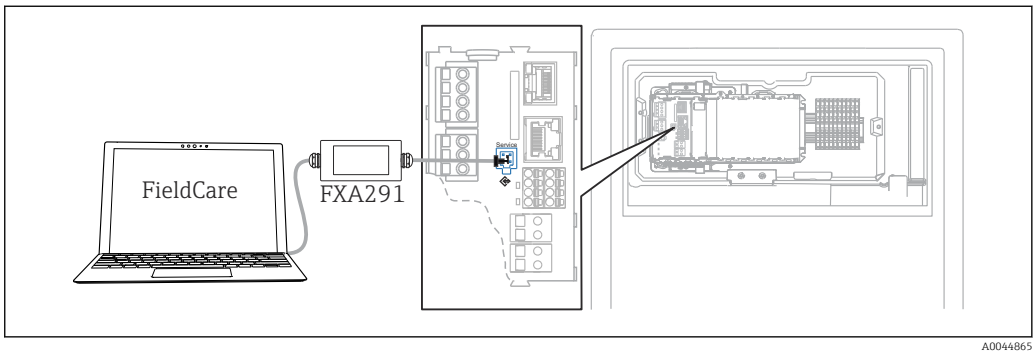
Download: https://portal.endress.com/webdownload/FieldCareDownloadGUI/

## 7.2.2 Service interface

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

### Connection

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




44 *Connection overview*

### Establishing the data connection

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

You can now start online configuration via the DTM.

Online configuration competes with onsite operation, i.e. each of the two options blocks the other one. On both sides it is possible to take away access from the other side.

**Operation**

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

### 7.2.3 Fieldbus systems

**PROFIBUS DP**

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

▶ Connect the PROFIBUS data cable to the terminals of the fieldbus module as described → 27.

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

**Modbus**

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

You use the BASE2 module for Modbus TCP.

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

▶ Connect the Modbus data cable to the terminals of the fieldbus module (RS 485) or to the RJ45 socket of the BASE2 module (TCP) as described.

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

**EtherNet/IP**

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

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

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

**PROFINET**

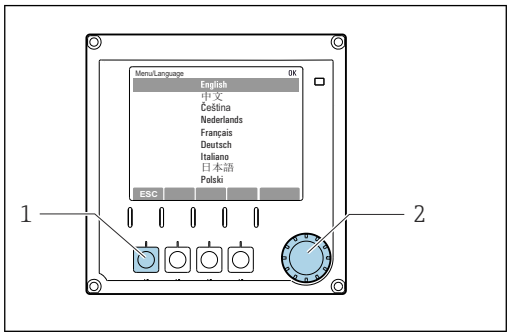
With the BASE2 module and the appropriate device version, you can communicate via PROFINET.

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

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

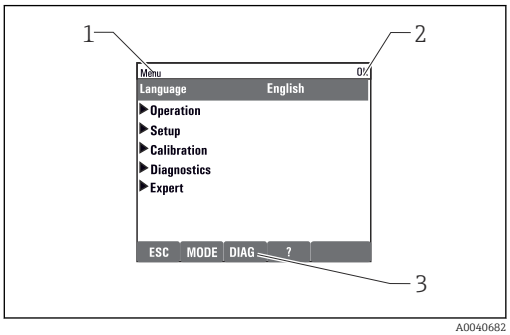
# 8 Operation options

## 8.1 Structure and function of the operating menu




45 *Display (example)*

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




46 *Display (example)*

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

## 8.2 Access to the operating menu via the local display

### 8.2.1 Locking or unlocking operating keys

**Locking operating keys**

1. Press the navigator for longer than 2 s.
   ↳ A context menu for locking the operating keys is displayed.
   You have the choice of locking the keys with or without password protection. "With password" means that you can only unlock the keys again by entering the correct password. Set this password here: **Menu/Setup/General settings/ Extended setup/Data management/Change key lock password**.
2. Select whether to lock keys with or without a password.
   ↳ The keys are locked. No more entries can be made. In the soft key bar, you will see the symbol.

The password is 0000 when the device is delivered from the factory. **Make sure to note down any changes to the password,** as otherwise you will not be able to unlock the keypad yourself.

**Unlocking operating keys**

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

### 8.2.2 Configuration options

**Display only**

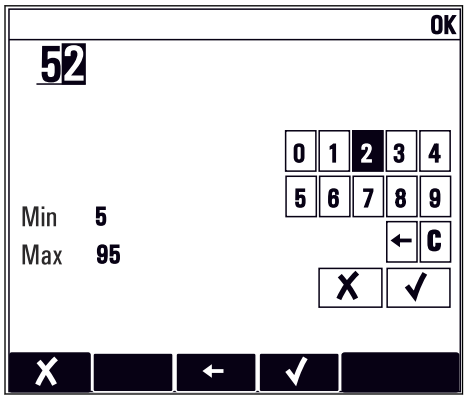
- You can only read the values but cannot change them.
- Typical read-only values are: analyzer data, sensor data and system information
- Example: **Menu/Setup/Analyzer/../Measuring parameter**

**Picklists**

- You receive a list of options. In a few cases, these also appear in the form of multiple choice boxes.
- Usually you just select one option; in rare instances you select one or more options.
- Example: **Menu/Setup/General settings/Temperature unit**

**Numerical values**

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

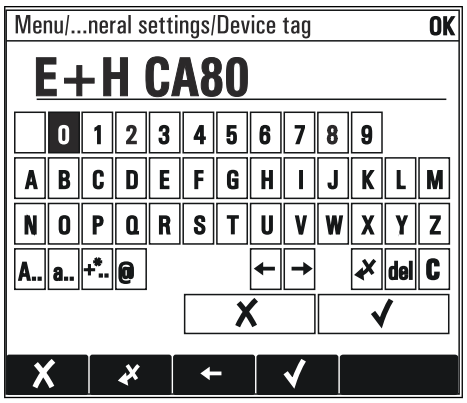



**Actions**

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

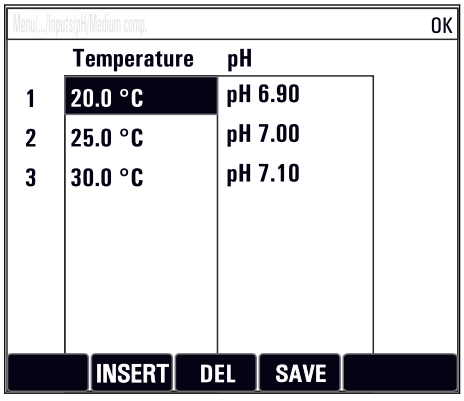
### User-defined text

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




### Tables

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



# 9 Commissioning

**Before the supply voltage is applied**

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

**Activities while the analyzer is in operation**

Risk of injury and infection from medium!

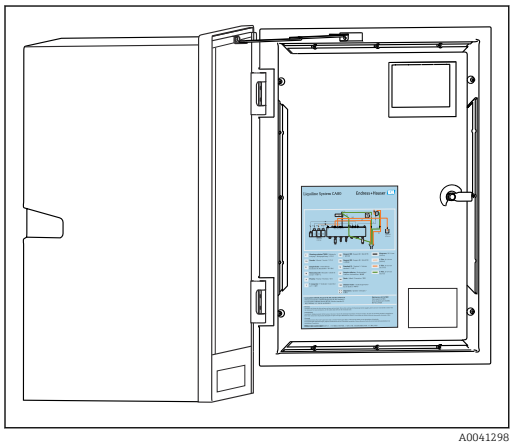
- ▶ Before you release any hoses, make sure that no actions, such as the pumping of sample, are currently running or are due to start shortly.
- ▶ Wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.
- ▶ Wipe up any spilt reagent with a disposable tissue and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

## 9.1 Preparatory steps

### 9.1.1 Commissioning steps

1. Connect the liquid-bearing hose of the sample supply system.→ 🖹 39
2. Optional: connect the dilution water. Minimum quality: deionized water (demineralized water).
3. Check that the hoses are mounted correctly in the hose glands. It should not be possible to remove the hoses without the application of force.
4. Visually inspect all the hose connections to ensure everything is correct. Use the hose connection diagram→ 🖹 38.
5. Insert the bottles and make the most important menu settings.→ 🖹 41
6. Start commissioning via the menu.→ 🖹 42

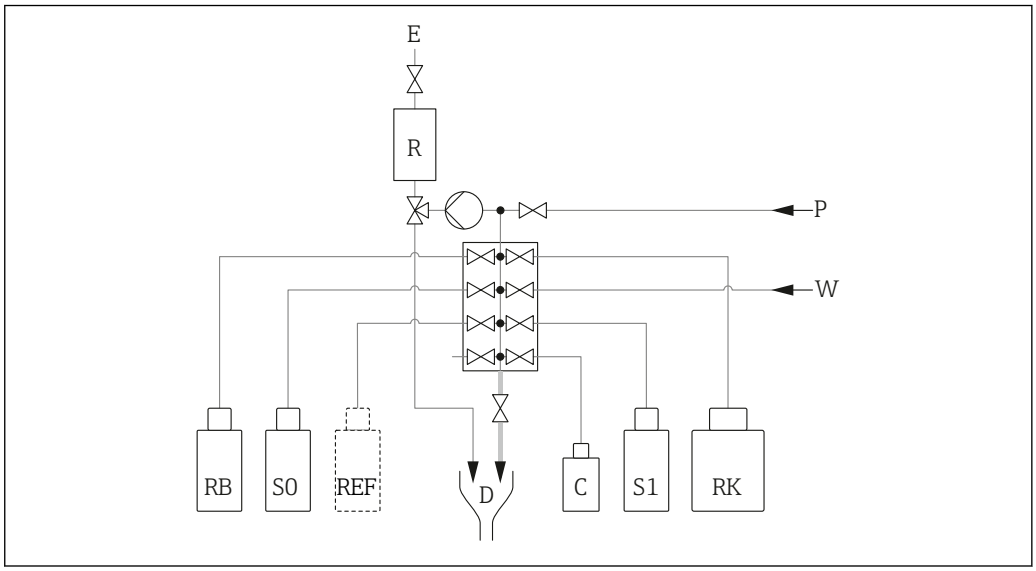
### 9.1.2 Hose connection diagram




47 *Hose connection diagram*

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

- ▶ Only connect the hoses as specified in this diagram.



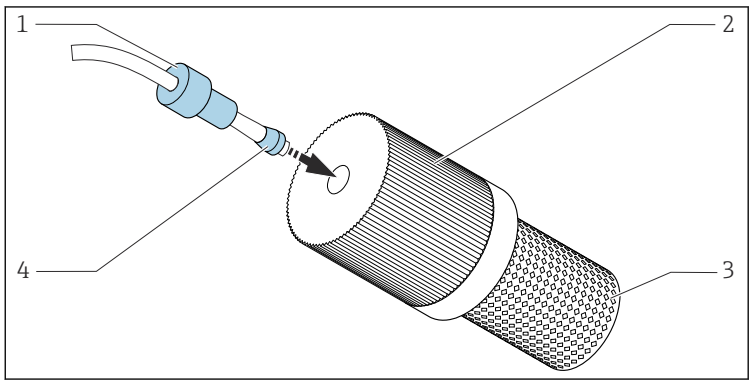

48 *Hose connection diagram*

| | | | |
|---|---|---|---|
| *P* | *Sample* | *S0* | *Zero standard* |
| *W* | *Dilution water* | *S1* | *Calibration standard 1* |
| *RK* | *Reagent RK* | *R* | *Pressure reactor* |
| *RB* | *Reagent RB* | *E* | *Ventilation* |
| *D* | *Outlet* | *C* | *Cleaning solution* |
| *REF* | *Reference sample* [1] | | |

1) Functionally not necessary; only if required by law (China)

### 9.1.3 Connecting the sample inlet hose

Turbidity can affect the measuring performance of your analyzer. You can counteract this effect by diluting the sample.

1. Ensure a constant and sufficient supply of sample at the installation location.
2. Connect the intake hose supplied to the peristaltic pump ("sample", → hose connection diagram) and guide it through the hose gland of the analyzer to the outside.
3. 


49 *Mounting the suction strainer (supplied) on the sample hose*

   Fit the gland (1) and cone (4) onto the hose in the direction indicated and screw into the adapter (2) of the suction strainer (3) together with the hose.
4. Insert the suction strainer into the sampling unit.
5. Ensure that only sample that is aqueous and homogenized is supplied, as otherwise there is a risk of blockage.

## 9.2 Function check

**⚠ WARNING**

**Incorrect connection, incorrect supply voltage**

Safety risks for staff and device malfunctions!

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

**⚠ WARNING**

**Connection errors**

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

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

Device condition and specifications

- ▶ Are the hoses free from damage on the outside?

Pressure reactor

- ▶ Have all of the reactor's connections been installed correctly?
- ▶ Has the reactor's safety cover been installed?

Visual inspection of the liquid-bearing lines

- ▶ Check the hose connections using the hose connection diagram.
- ▶ Are all the hose connections leak-tight?
- ▶ is the sample hose in the hose gland strain-relieved?
- ▶ Have the bottles with reagents, and standard been inserted and connected?

## 9.3 Switching on the measuring device

**⚠ WARNING**

**The strobe lamp produces high-intensity visible and invisible light radiation**

Can cause severe damage to eyes and skin!

- ▶ Never look into the strobe lamp directly.
- ▶ Do not switch on the device if the reactor or the sensor unit are not installed or are damaged.
- ▶ For maintenance work, make sure to always de-energize the device.

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

## 9.4 Access to the configuration (only versions CA80TN-HR)

**Enabling access to the configuration**

Only authorized persons may make settings on the device. Access is password-protected.

1. Call up: **MENU/Enter maintenance level**.
2. Enter 8888 as the password.
   ↳ Access is enabled and you can change the settings.
3. Change the password to a new, secure password: **MENU/General settings/Extended setup/Data management/Change maintenance level password**.

If you forget your password, you can reset it here using the PUK supplied: **Reset password with PUK**.

**Locking access to the configuration**

▶ Call up: **MENU/Exit maintenance level**.
↳ Access is locked again and you cannot change any settings.

## 9.5 Setting the operating language

**Configuring the language**

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

## 9.6 Configuring the measuring device

### 9.6.1 Basic setup analyzer

**Making basic settings**

1. Switch to the menu **Setup/Basic setup analyzer**.
↳ Make the following settings.

- Device tag
  Give your device any name of your choice (max. 32 characters).
- Set date
  Correct the set date if necessary.
- Set time
  Correct the set time if necessary.

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

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

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

### 9.6.2 Starting commissioning

**Starting initial commissioning**

1. Select: **Menu/Operation /Maintenance/Commissioning/Start commissioning**.
   ↳ When commissioning is finished, the device displays the following message: **The operation was successful.**
   If the action was not successful or was canceled, the device displays a message with remedial measures. Implement the corrections and repeat the commissioning.
2. Directly after starting commissioning:
   Press **MODE** and switch to the automatic mode.
   ↳ After the commissioning has been completed successfully, zero point calibration starts automatically; this is followed by the determination of the calibration factor and then the first measurement.

# 10 Operation

## 10.1 Display

### 10.1.1 Soft keys in the measuring mode

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

### 10.1.2 Measuring mode

There are different display modes: (press the navigator button to change the mode)
- (1) Overview of all the inputs and outputs
- (2) Analyzer measured value or main measured value of an input or output or the status of a relay
- (3) Smaller visualization of the analyzer measured value or main and secondary measured value in the case of a sensor input
- (4) Analyzer measured value and pending actions or all measured values in the case of a sensor input
- (5) **Only for analyzer measured value:**
  Graphic display

There are also submenus:
(6) User-definable measuring menus (only available if already defined)
Choice of previously configured screens

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

▶ Turn the navigator.
  ↳ The display changes from channel to channel.

### 10.1.3 Device status

Icons on the display alert you to special device states.

| Icon | Location | Description |
|---|---|---|
| **F** | Header bar | Diagnostic message "Failure" |
| **M** | Header bar | Diagnostic message "Maintenance request" |
| **C** | Header bar | Diagnostic message "Check" |
| **S** | Header bar | Diagnostic message "Out of specification" |
| ⇆ | Header bar | Fieldbus or TCP/IP communication active |
| ⧗ | Header bar | Hold active (for sensors) |
| ⧗ | At measured value | Hold for the actuator (current output, limit switch etc.) is active |
| ⤒ | At measured value [1)] | An offset has been added to the measured value |
| ⊗ | At measured value | Measured value in "Bad" or "Alarm" state |
| ATC | At measured value | Automatic temperature compensation active (for sensors) |
| MTC | At measured value | Manual temperature compensation active (for sensors) |
| SIM | Header bar | Simulation mode active or Memocheck SIM connected |

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

1) Only pH or ORP measurement

If two or more diagnostic messages occur simultaneously, only the icon for the message with the highest priority is shown on the display (for the order of priority according to NAMUR, → 111).

### 10.1.4 Assignment views

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

## 10.2 General settings

### 10.2.1 Basic settings

| Menu/Setup/General settings | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Temperature unit | **Selection**<br>▪ °C<br>▪ °F<br>▪ K<br>**Factory setting**<br>°C | |
| Current output range | **Selection**<br>▪ 0..20 mA<br>▪ 4..20 mA<br>**Factory setting**<br>4..20 mA | In accordance with Namur NE43, the linear range is from 3.8 to 20.5 mA (**4..20 mA**) or from 0 to 20.5 mA (**0..20 mA**). If the range is exceeded or undershot, the current value stops at the range limit and a diagnostic message (460 or 461) is output. |
| Failure current | 0.0 to 23.0 mA<br>**Factory setting**<br>22.5 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. |
| The value for **Failure current** should be outside the measuring range. If you decided that your **Current output range** = **0..20 mA** you should set an error current between 20.1 and 23 mA. If the **Current output range** = **4..20 mA** you could also define a value < 4 mA as the error current.<br>The device allows an error current within the measuring range. In such instances pay attention to any effects this may have on your process. | | |
| Alarm delay | 0 to 9999 s<br>**Factory setting**<br>0 s | The software displays only the errors that are present longer than the set delay time. This makes it possible to suppress messages that only occur briefly and are caused by normal process-specific fluctuations. |
| Device hold | **Selection**<br>▪ Disabled<br>▪ Enabled<br>**Factory setting**<br>Disabled | You can enable an immediate, general hold (for sensors) here. The function acts in the same way as the **HOLD** soft key in the screens. |

### 10.2.2 Date and time

| Menu/Setup/General settings/Date/Time | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Set date | Depends on the format | Editing mode:<br>Day (two-digit): 01 to 31<br>Month (two-digit): 01 to 12<br>Year (four-digit): 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 | **Selection**<br>▪ DD.MM.YYYY<br>▪ YYYY-MM-DD<br>▪ MM-DD-YYYY<br>**Factory setting**<br>DD.MM.YYYY | ▶ Select a date format. |
| Time format | **Selection**<br>▪ hh:mm am (12h)<br>▪ hh:mm (24h)<br>▪ hh:mm:ss (24h)<br>**Factory setting**<br>hh:mm:ss (24h) | ▶ Choose between 12-hour display or 24-hour display. Seconds can also be displayed with the latter version. |
| Time zone | **Selection**<br>▪ None<br>▪ Choice of 35 time zones<br>**Factory setting**<br>None | **None** = Greenwich Mean Time (London). |
| DST | **Selection**<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. Manual means that you can specify the start and end of daylight saving time yourself. Here, two additional submenus are displayed in which you specify the changeover date and time. |

### 10.2.3 Hold settings

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

### 10.2.4 Logbooks

Logbooks record the following events:
- Calibration/adjustment events
- Operator events
- Diagnostic events
- Analyzer events
- Measured values

You define how the logbooks should store the data.

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

1. Assign the logbook name.
2. Select the measured value to be recorded.
3. Set the scan time (**Scan time**).
   ↳ You can set the scan time individually for every data logbook.

Further information on the logbooks: .

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

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

| **Menu/Setup/General settings/Logbooks** | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Logbook ident | Customized text, 16 characters | Part of the file name when exporting a logbook |
| Event logbook | **Selection**<br>▪ Off<br>▪ Ring buffer<br>▪ Fill up buffer<br>**Factory setting**<br>Ring buffer | All diagnostic messages are recorded<br>**Ring buffer**<br>If the memory is full, the most recent entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>If the memory is full, there is an overflow,i. e. you cannot store any new values. The controller displays a corresponding diagnostic message. The memory then has to be cleared manually. |
| Analyzer event logbook | **Selection**<br>▪ Ring buffer<br>▪ Fill up buffer<br>**Factory setting**<br>Ring buffer | All diagnostic messages are recorded<br>**Ring buffer**<br>If the memory is full, the most recent entry automatically overwrites the oldest entry.<br>**Fill up buffer**<br>If the memory is 80 % full, the device displays a diagnostic message.<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. |

| Menu/Setup/General settings/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Overflow warnings<br>**Analyzer calibration logbook = Fill up buffer** | | |
| Calibration logbook | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | ▶ Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows. |
| Diagnostic logbook | | |
| Configuration 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 measuring channel |
| Source of data | Read only | The assigned measuring channel is displayed |
| Measuring parameter | Read only | Plain-text information on the parameter that is being recorded |
| Unit | Read only | Information about the unit in which the data are available |
| Logbook name | Customized text, 16 characters | |
| ▶ Line plotter | | Menu to define the graphic display |
| Axes | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | Should the axes (x, y) be displayed (**On**) or not (**Off**)? |
| Orientation | **Selection**<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**). If you want to display two data logbooks simultaneously, make sure that both logbooks have the same settings here. |
| X-Description | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | ▶ Decide whether a description should be displayed for the axes and whether gridlines should be shown. In addition, you can also decide whether pitches should be displayed. |
| Y-Description | | |
| Grids | | |
| Pitches | | |
| X Pitch/Grid distance | 10 to 50%<br>**Factory setting**<br>10 % | ▶ Determine the pitch. |
| Y Pitch/Grid distance | | |

| Menu/Setup/General settings/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Data logbooks | | For connected Memosens sensors (optional) |
| ▶ New | | You can create a maximum of 8 data logbooks. |
| Logbook name | Customized text, 20 characters | |
| Source of data | **Selection**<br>▪ Sensor inputs<br>▪ Controller<br>▪ Current inputs<br>▪ Temperature<br>▪ Fieldbus signals<br>▪ Mathematical functions<br>**Factory setting**<br>None | ▸ Select a data source for the logbook entries.<br>You can choose from the following:<br>▪ Connected sensors<br>▪ Available controllers<br>▪ Current inputs<br>▪ Fieldbus signals<br>▪ Binary input signals<br>▪ Mathematical functions |
| Measured value | **Selection**<br>Depends on **Source of data**<br>**Factory setting**<br>None | You can record different measured values depending on the data source. |
| Scan time | 0:00:01 to 1:00:00<br>**Factory setting**<br>0:01:00 | Minimum time interval between two entries<br>Format: H:MM:SS |
| Data logbook | **Selection**<br>▪ Ring buffer<br>▪ Fill up buffer<br>**Factory setting**<br>Ring buffer | **Ring buffer**<br>If the memory is full, the most recent 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>**Data logbook** = **Fill up buffer** | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | ▸ Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows. |
| ▷ Add another logbook | Action | Only if you want to create another data logbook immediately. You add a new data logbook at a later date using **New**. |
| ▷ Finished | Action | This allows you to exit the **New** menu. |
| ▷ Start/stop simultaneously | Action | Appears if you have created more than one data logbook. With one mouse click, you can start or stop recording all the data logbooks. |
| ▶ Logbook name | | The name of this submenu is based on the name of the logbook and only appears once you have created a logbook. |
| This menu appears several times if you have several data logbooks. | | |

| Menu/Setup/General settings/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Source of data | Read only | This is for information purposes only. If you want to record another value, delete this logbook and create a new data logbook. |
| Measured value | | |
| Log time left<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** = **Fill up buffer** | Read only | Displays the number of entries remaining until the logbook is full. |
| Logbook name | Customized text, 20 characters | You can change the name here again. |
| Scan time | 0:00:01 to 1:00:00<br>**Factory setting**<br>0:01:00 | As above<br>Minimum time interval between two entries<br>Format: H:MM:SS |
| Data logbook | **Selection**<br>▪ Ring buffer<br>▪ Fill up buffer<br>**Factory setting**<br>Ring buffer | **Ring buffer**<br>If the memory is full, the most recent 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>**Data logbook** = **Fill up buffer** | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | ▶ Decide whether you want to receive a diagnostic message if the fill buffer of the relevant logbook overflows. |
| ▶ Line plotter | | Menu to define the graphic display |
| Axes | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | Should the axes (x, y) be displayed (**On**) or not (**Off**)? |
| Orientation | **Selection**<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**). 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 | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | ▶ Decide whether a description should be displayed for the axes and whether gridlines should be shown. In addition, you can also decide whether pitches should be displayed. |
| X Pitch/Grid distance<br>Y Pitch/Grid distance | 10 to 50%<br>**Factory setting**<br>10 % | ▶ Determine the pitch. |
| ▷ Remove | Action | This action removes the data logbook. Any data that have not been saved are lost. |

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

1. Make the settings:

- Logbook name
  Assign a name. Example: "01".
- Source of data
  Select a data source. Example: Signal of binary input 1.
- Measured value
  Select the measured value to be recorded. Example: pH value.
- Scan time
  Specify the time interval between two logbook entries.
- Data logbook
  Activate the logbook: specify the data storage method.

2. ../**Finished**: Perform the action.
   ↳ The device shows the new logbook in the list of data logbooks.
3. Select data logbook "01".
   ↳ Additional display: **Log time left**.
4. Only in the case of **Fill up buffer**:
   Decide to set **Overflow warning**: **On** or **Off**.
   ↳ **On**: The device displays a diagnostic message in the event of memory overflow.
5. **Line plotter** submenu: Specify the type of graphic representation.

## 10.2.5 Extended setup

### Diagnostics settings

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

| **Menu/Setup/(General settings or Inputs<sensor channel>)/Extended setup/Diagnostics settings/Diag. behavior** | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| List of diagnostic messages | | ▶ Select the message to be changed. Only then can you make the settings for this message. |
| Diag. code | Read only | |
| Diagnostic message | **Selection**<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 failure current at the current output |
| Failure current | **Selection**<br>▪ On<br>▪ Off<br>**Factory setting**<br>Depends on the message | ▶ Decide whether an failure current should be output at the current output if the diagnostic message display is activated.<br>In the event of general device errors, the failure current is output at all the current outputs. In the event of channel-specific errors, the failure current is only output at the assigned current output. |
| Status signal | **Selection**<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. |

| Menu/Setup/(General settings or Inputs<sensor channel>)/Extended setup/Diagnostics settings/Diag. behavior | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Diag. output | **Selection**<br>▪ None<br>▪ Alarm relay<br>▪ Binary output<br>▪ Relay 1 to n (depends on the device version)<br>**Factory setting**<br>None | Before being able to assign the message to an output you must first configure a relay output to **Diagnostics**.<br>(**Menu**/**Setup**/**Outputs**: assign **Diagnostics** function and set **Operating mode** to **as assigned**.) |
| Alarm relays are available, depending on the device version. | | |
| Cleaning program (for sensors) | **Selection**<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. |

## PROFIBUS DP

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

## Modbus

| Menu/Setup/General settings/Extended setup/Modbus | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Enable | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | You can switch off communication at this point. The software can then only be accessed via local operation. |
| Termination | Read only | If the device is the last in the bus, you can terminate via the hardware. |
| Settings | | |
| Transmission Mode | **Selection**<br>▪ TCP<br>▪ RTU<br>▪ ASCII<br>**Factory setting**<br>(Modbus-RS485 only)<br>RTU | The transmission mode is displayed depending on the version ordered.<br>In the case of RS485 transmission, you can choose between **RTU** and **ASCII** . There are no choices for Modbus-TCP. |
| Byte order | **Selection**<br>▪ 1-0-3-2<br>▪ 0-1-2-3<br>▪ 2-3-0-1<br>▪ 3-2-1-0<br>**Factory setting**<br>1-0-3-2 | |
| 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. After this time, input values received via the Modbus are considered to be invalid. |

## Web server

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

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

### EtherNet/IP

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

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

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

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

### Accepting settings

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

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

### Data management

*Firmware update*

Please contact your local sales office for information on firmware updates available for your controller and its compatibility with earlier versions.

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

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

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

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

   The current firmware will be overwritten.
   After this the device will reboot.
   Do you want to proceed?

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

*Saving the setup*

Saving a setup offers the following advantages, among others :
- Copying settings for other devices
- Quick and easy switching between various setups, e. g. for different user groups or for recurring sensor type changes
- Restoring a tried-and-tested setup, e. g. if you have changed a lot of settings and no longer know what the original settings were

1. Insert the SD card into the controller card reader.
2. Go to **Menu/Setup/General settings/Extended setup/Data management/Save setup** .
3. **Name**: Assign a file name.
4. Then select **Save** .
   ↳ If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.
5. Use **OK** to confirm or cancel and assign a new file name.
   ↳ Your setup is stored on the SD card and you can upload it quickly to the device at a later date.

*Loading the setup*

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

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

1. Insert the SD card into the controller card reader. A setup must have been saved to the SD card.
2. Go to **Menu/Setup/General settings/Extended setup/Data management/Load setup** .
   ↳ A list of all the setups on the SD card is displayed.
   An error message is displayed if there is no valid setup on the card.
3. Select the desired setup.
   ↳ A warning is displayed:

   The current parameters will be overwritten and the device will reboot.
   Warning: Please note that cleaning and controller programs can be active.
   Do you want to proceed?
4. Use **OK** to confirm or cancel.
   ↳ If you select **OK** to confirm, the device restarts with the desired setup.

*Exporting the setup*

Exporting a setup offers the following advantages, among others:
- Export in XML format with a stylesheet for formatted display in an XML-compatible application, such as . Microsoft Internet Explorer
- Importing the data (drag and drop the XML file into a browser window)

1. Insert the SD card into the controller card reader.
2. Go to **Menu/Setup/General settings/Extended setup/Data management/Export setup** .
3. **Name**: Assign a file name.
4. Then select **Export** .
   ↳ If you have already assigned the file name, you will be asked whether you want to overwrite the existing setup.

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

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

*Activation code*

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

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

1. Enter the activation code: **Menu/Setup/General settings/Extended setup/Data management/Activation code**.
2. Confirm your entry.
   ↳ The new hardware or software function is activated and can be configured.

*Functions that are enabled by an activation code:*

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

1) Via Ethernet socket of the Base2 module, for versions without an Ethernet fieldbus
2) Availability depends on measuring parameter
3) Mathematical function

*Changing the password*

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

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

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

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

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

## 10.3 Analyzer

| Menu/Setup/Analyzer | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Mode | Read only | Manual, automatic or fieldbus |
| Device tag | Customized text,<br>32 characters<br>**Factory setting**<br>Analyzer_serial number | ▶ Select any name for your analyzer. Use the TAG name for example. |
| Measuring parameter | Read only | |
| Range switch | **Selection**<br>▪ Automatic<br>▪ Manual<br>**Factory setting**<br>Manual | **Automatic**<br>▪ CA80TN-AA/CA/GR<br>  ▪ No options available for measuring range or dilution<br>  ▪ The device uses all the available ranges<br>  ▪ Dilution is not displayed<br>▪ CA80TN-HR<br>  ▪ No options available for measuring range or dilution<br>  ▪ The device uses all the internal ranges, starting with the smallest range up to the range that can measure the limit concentration<br>  ▪ Set the limit concentration: **Menu**/**Setup**/**Analyzer**/**Extended setup**/**Upper range limit**<br>  ▪ Dilution is not displayed<br>**Manual**<br>▪ CA80TN-AA/CA/GR<br>  ▪ Measuring range can be selected from a list<br>  ▪ Internal dilution is displayed in the list for every range<br>  ▪ Dilution factor is displayed again separately<br>▪ CA80TN-HR<br>  ▪ The measuring range cannot be selected<br>  ▪ The internal measuring range is limited by the limit concentration entered (**Upper range limit**)<br>  ▪ Dilution can be selected from a list |
| Measuring range | **Range switch** = **Automatic**<br>No other options<br>**Range switch** = **Manual**<br>The options available depend on the device version ordered. | |
| Internal Dilution<br>*Menu only available for device versions CA80TN-HR* | Options depend on the parameter | ▶ Select the dilution factor from the list.<br>  ↳ The internal measuring range changes depending on the selected dilution. In the measuring range displayed, only the lower limit changes, as the upper limit continues to be defined by the limit concentration. |

## 10.3.1 Extended setup

### Measured value

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

| Menu/Setup/Analyzer/Extended setup | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Upper range limit<br>*Menu only available for device versions CA80TN-HR* | **Configurable**<br>▪ At least 10% of the upper limit value of the smallest available measuring range<br>▪ The maximum upper limit value of the largest available measuring range (factory setting) | Range of adjustment depends on: Menu/Setup/Analyzer/Measuring range<br>▶ Specify the desired value for the measuring range upper limit.<br>↳ Directly affects the display: **Menu/Setup/Analyzer/Measuring range**. |
| Device Range<br>*Menu not available for device versions CA80TN-HR* | **Selection** | The options available depend on the device version ordered.<br>▶ Select the desired measuring range from the list. |

## Signals

| Menu/Setup/Analyzer/Extended setup | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Signal for sample request | | |
| Lead time SPX [1] | **Selection**<br>0.00 to 30.00 (**mm:ss**)<br>**Factory setting**<br>0.00 (**mm:ss**) | In the automatic mode, each measurement only starts once the lead time has elapsed. The request sample signal is active from the start of the lead time until the end of the specified signal duration time. |
| ▶ Signal for process access | | |
| SP1 | **Selection**<br>▪ Always accessible<br>▪ **Binary input** x:y<br>**Factory setting**<br>Always accessible | **Always accessible**: The input signal level at the binary inputs does not affect actions that require sample (measurement, calibration, cleaning).<br>**Binary input** x:y: When the signal is active at the selected input, the analyzer starts actions where sample is required. Otherwise the analyzer defers or skips the action. |

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

## Diagnostic settings

*Bottles*

You can monitor the levels of all the bottles.

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

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Control | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | **On**<br>After the monitoring function is switched on, you can find 2 additional menu items in: **Menu/Operation/Maintenance/Change bottle**<br>▪ Remaining operating time<br>▪ Bottle filling levels |
| **▶ Bottle filling levels** | | |
| **▶ Start volume** | | |
| Cleaner C | 100 to 1000 ml<br>**Factory setting**<br>0 ml | |
| Reagent RB | 100 to 5000 ml<br>**Factory setting**<br>1000 ml | |
| Reagent RK | 100 to 5000 ml<br>**Factory setting**<br>2500 ml | |
| Zero standard S0 | 100 to 1000 ml<br>**Factory setting**<br>1000 ml | |

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Standard S1 | 100 to 1000 ml<br>**Factory setting**<br>1000 ml | |
| ▶ **Warning limits** | Diag. code 726 | Warning limits are intended as an early warning for maintenance tasks that will need to be performed soon.<br>1. Procure spare parts in time.<br>2. Schedule maintenance tasks. |
| Cleaner C | 1 to 20 %<br>**Factory setting**<br>5 % | |
| Reagent RB | 1 to 40 %<br>**Factory setting**<br>10 % | |
| Reagent RK | 1 to 40 %<br>**Factory setting**<br>10 % | |
| Zero standard S0 | 1 to 20 %<br>**Factory setting**<br>5 % | |
| Standard S1 | 1 to 20 %<br>**Factory setting**<br>5 % | |
| ▶ **Alarm limits** | Diag. code 727 | Alarm limits are intended to immediately trigger maintenance tasks.<br>▶ Replace the materials concerned as quickly as possible. |
| Cleaner C | 1 to 20 %<br>**Factory setting**<br>2 % | |
| Reagent RB | 1 to 40 %<br>**Factory setting**<br>5 % | |
| Reagent RK | 1 to 40 %<br>**Factory setting**<br>5 % | |
| Zero standard S0 | 1 to 20 %<br>**Factory setting**<br>2 % | |
| Standard S1 | 1 to 20 %<br>**Factory setting**<br>2 % | |
| ▶ **Remaining operating time** | | |

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Bottles | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ **Warning limits** | | Diag. code 726 |
| Cleaner C | 1 to 14 d<br>**Factory setting**<br>14 d | |
| Reagent RB | 1 to 14 d<br>**Factory setting**<br>14 d | |
| Reagent RK | 1 to 14 d<br>**Factory setting**<br>14 d | |
| Zero standard S0 | 1 to 14 d<br>**Factory setting**<br>14 d | |
| Standard S1 | 1 to 14 d<br>**Factory setting**<br>14 d | |
| ▶ **Alarm limits** | | Diag. code 727 |
| Cleaner C | 1 to 7 d<br>**Factory setting**<br>2 d | |
| Reagent RB | 1 to 7 d<br>**Factory setting**<br>2 d | |
| Reagent RK | 1 to 7 d<br>**Factory setting**<br>2 d | |
| Zero standard S0 | 1 to 7 d<br>**Factory setting**<br>2 d | |
| Standard S1 | 1 to 7 d<br>**Factory setting**<br>2 d | |

*Pump hose limit values*

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Limits pump hoses | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Monitoring | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | Diag. code 733 |
| Operating time | Read only | |
| Pump | 1 to 999 d<br>**Factory setting**<br>180 d | |

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Limits valve hoses | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Monitoring | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | Diag. code 733 |
| Operating time | Read only | |
| Drain D | 1 to 999 d<br>**Factory setting**<br>90 d | |

*Absorption curve recording*

| Menu/Setup/Analyzer/Extended setup/Diagnostics settings/Absorption curve recording | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| In automatic mode | **Selection**<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 | **Selection**<br>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.<br>The data are saved in a logbook. |

### Behavior after power failure and other settings

| Menu/Setup/Analyzer/Extended setup | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| After power failure | **Selection**<br>▪ Last mode<br>▪ Manual mode<br>**Factory setting**<br>Last mode | Setting specifying how the analyzer should behave after a power failure, or when the power is back on.<br>**Last mode**: The analyzer remains in the mode that was last set. Example: The automatic mode was set. The analyzer continues after initialization and after any samples have been discarded.<br>**Manual mode**: The analyzer switches to the manual mode and waits for user action. |
| Turbidity compensation | 0.10 to 5.00<br>**Factory setting**<br>2.00 | Correction factor for turbidity compensation using the reference wavelength |
| Sample hose length | **Selection**<br>0.10 to 10.00 m<br>**Factory setting**<br>3.00 m | |
| Sample discard mode | **Selection**<br>▪ To process<br>▪ To drain<br>▪ Do not discard<br>**Factory setting**<br>To process | Specifies whether the content of the sample hose is discarded after sampling and where.<br>**To process**: The sample is forced back into the process.<br>**To drain**: The sample is forced into the drain.<br>**Do not discard**: The sample is not discarded and remains in the sample hose. |
| Reaction time | 60 to 900 s<br>**Factory setting**<br>60 s | |
| Sample retries | **Selection**<br>▪ unlimited<br>▪ 1 … 5<br>**Factory setting**<br>3 | |

## 10.3.2 Measurement

| Menu/Setup/Analyzer/Measurement | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Start condition | **Selection**<br>▪ Immediate<br>▪ Date/time<br>▪ Continuous<br>**Factory setting**<br>Immediate | **Immediate**: The analyzer immediately starts with the measurement cycle once the system changes to the automatic mode.<br>**Date/time**: The analyzer starts with the measurement cycle at the set date/time.<br>**Continuous**: The analyzer measures continuously, without interruption, between the measurements. |
| Date | 01.01.1970 to 07.02.2106 | *Functions only available for:*<br>**Start condition** = **Date/time** |
| Time | 00:00:00 to 23:59:59 | |
| Measuring interval | 0:45 to 24:00 (**hh:mm**)<br>**Factory setting**<br>1:00 | *Function only available for:*<br>**Start condition** = **Immediate** *or* **Date/time**<br>For configuring the time interval of the measurement |

| Menu/Setup/Analyzer/Measurement | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Digestion time | 0:15 to 2:00 (**hh:mm**)<br>**Factory setting**<br>0:30 | |
| Digestion temperature | 100 to 120 °C<br>**Factory setting**<br>120 °C | |
| Signal delay | 0 to 600 s<br>**Factory setting**<br>0 s | **Measurement active**: You can delay the process of outputting the signal during an active measurement by the defined time. Measuring is paused for the duration of the signal delay time. |

### 10.3.3 Reference measurement

Menu only available for device versions CA80TN-HR.

| Menu/Setup/Analyzer/Reference sample inspection | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Start condition | **Selection**<br>▪ Immediate<br>▪ Date/time<br>▪ Disabled<br>**Factory setting**<br>Immediate | **Immediate**: The reference measurement starts immediately once the system changes to the automatic mode.<br>**Date/time**: The reference measurement starts at the set time.<br>**Disabled**: No reference measurement |
| Date | 01.01.1970 to 07.02.2106 | *Functions only available for:*<br>**Start condition** = **Date/time** |
| Time | 00:00:00 to 23:59:59 | |
| Inspection Interval | 0-12 to 1-00 (**DD-hh**)<br>**Factory setting**<br>1-00 **DD-hh** | *Function only available for:*<br>**Start condition** = **Immediate** *or* **Date/time**<br>Setting the test interval |
| Nominal concentration | 1 to 200 mg/l N<br>**Factory setting**<br>10 mg/l N | Concentration of the reference sample |
| Acceptance limit | Read only | |

### 10.3.4 Calibration

| Menu/Setup/Analyzer/Calibration | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Start condition | **Selection**<br>▪ Immediate<br>▪ Date/time<br>▪ Disabled<br>**Factory setting**<br>Immediate | The calibration can start either immediately or at the set time. |
| If the start condition selected is **Immediate** | | |
| Date | 01.01.1970 to 07.02.2106 | *Functions only available for:*<br>**Start condition** = **Date/time** |
| Time | 00:00:00 to 23:59:59 | |
| Calibration interval | 0-01 to 90-00 (**DD-hh**)<br>**Factory setting**<br>04-00 **DD-hh** | For configuring the time interval of the calibration/adjustment. |

| Menu/Setup/Analyzer/Calibration | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Calibration factor | Read only | Relationship of the measured concentration to the pre-specified concentration of the calibration standard. |
| ▶ Settings | | |
| Nominal concentration | 1.00 to 200.00 ppm<br>**Factory setting**<br>10.00 ppm | 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 | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | For specifying whether cleaning will take place before every calibration/adjustment (only in the automatic mode). |

## 10.3.5 Cleaning

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

## 10.4 Current inputs

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

| **Menu/Setup/Inputs/Current input x:y** [1] | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Mode | **Selection**<br>▪ Off<br>▪ 0 - 20mA<br>▪ 4 - 20mA<br>**Factory setting**<br>4 - 20mA | ▶ Select the same current range as in the data source (connected device). |
| Input variable | **Selection**<br>▪ Parameter<br>▪ Current<br>**Factory setting**<br>Current | ▶ Select the input variable. |
| Meas. value format | **Selection**<br>▪ #<br>▪ #.#<br>▪ #.##<br>▪ #.###<br>**Factory setting**<br>#.# | ▶ Specify the number of decimal places. |
| Parameter name<br>**Input variable** = **Parameter** | Customized text, 16 characters | ▶ Assign a useful name, e.g. the parameter name that the data source also uses. |
| Unit of measure<br>**Input variable** = **Parameter** | Customized text, 16 characters | You cannot choose the unit from a list. If you want to use a unit, you must enter it here as customized text. |
| Lower range value<br>**Input variable** = **Parameter** | -20.0 ... **Upper range value** <unit of measure><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. The system uses the engineering unit which you entered beforehand. |
| Upper range value<br>**Input variable** = **Parameter** | **Lower range value** to 10000.0 <engineering unit><br>**Factory setting**<br>10.0 <engineering unit> | |
| Damping | 0 to 60 s<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

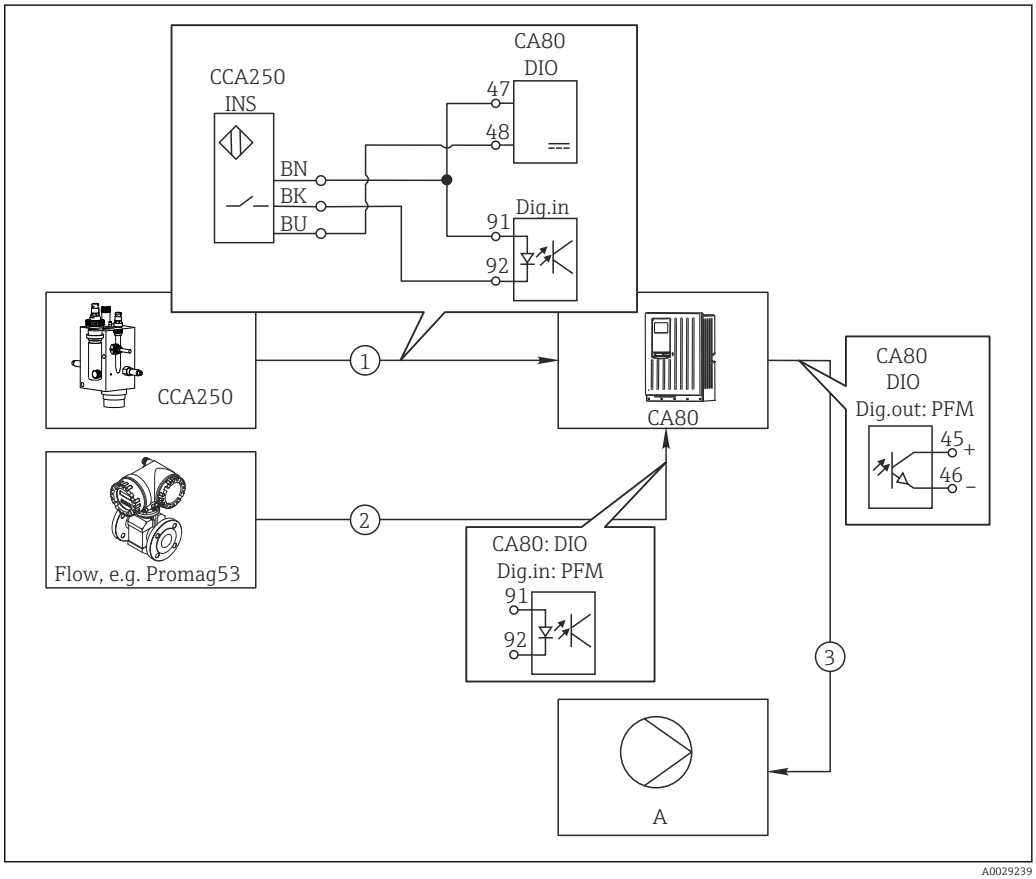
## 10.5 Binary inputs and outputs

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

- Via a digital input signal
  - measuring range switching for conductivity (upgrade code required, → 56)
  - switching between different calibration datasets in the case of optical sensors
  - external hold (for sensors)
  - a cleaning interval to be triggered (for sensors)
  - measurements to be started, interruption of measuring intervals
  - PID controller switch-on/switch-off, e.g. via the proximity switch of the CCA250
  - the use of the input as an "analog input" for pulse-frequency modulation (PFM)
- Via a digital output signal
  - diagnostic states, point level switches, "Active measurement" system state, "Sample required" information or similar states transmitted statically (similar to a relay)
  - the dynamic transmission (comparable to a non-wearing "analog output") of PFM signals, e.g. to control dosing pumps

### 10.5.1 Application examples

**Chlorine regulation with feedforward control**




50 *Example of chlorine control with feedforward control*

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

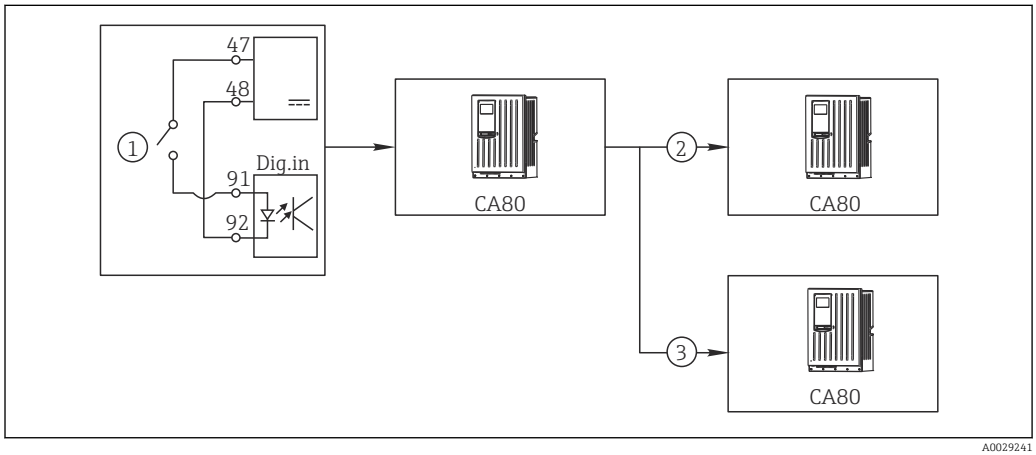
Utilize the advantage of the effectively wear-free control with binary outputs versus a control system with relay. With pulse frequency modulation (PFM), it is possible to achieve virtually continuous dosing using a dosing pump with higher input frequency.

1. Connect the INS proximity switch of the CCA250 assembly to a digital input of the DIO module (e.g. slot 6, port 1).
2. In the software, configure a controller and as the source select the binary input (e.g.**Binary input 1**) to which the proximity switch is connected. (**Menu/Additional functions/Controllers/Controller 1/Controller Enable** = **Binary input 1**)
3. **Signal type**: For the selected input, select the factory setting (**Static signal**).
4. Connect the measured value of a flowmeter to the second input of the DIO module (e.g. slot 6, port 2).
5. **Signal type**: for this input, select **PFM** . (**Menu/Inputs/Binary input 6:2/Signal type** = **PFM**)
6. **Input variable**: select the corresponding measured value (**Flow rate**).
   ↳ You can now use the input you have just configured as the disturbance variable for your controller [1].
7. **Disturbance variable**: in the controller menu, select the binary input to which you have connected the flow measured value. (**Menu/Additional functions/Controllers/Controller 1/Disturbance variable/Source of data** = **Binary input 6:2** and **Measured value** = **PFM value**)
8. You can activate a dosing pump through PFM via a digital output of the DIO module. Connect the pump to an output of the DIO module (e.g. slot 6, port 1) and select the following settings in the menu: **Menu/Outputs/Binary output 6:1/Signal type** = **PFM** and **Source of data** = **Controller 1**.

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

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

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




51 *Example of a central cleaning control*

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

1. An external trigger actuates a cleaning operation at the master.
   A cleaning unit is connected via a relay or a binary output, for example.

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

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

### Interrupting the operation via an external signal

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

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

- Binary inputs:
  **Signal for process access**: The analyzer can only perform activities that require sample (measurement, calibration, cleaning) when the signal is active. The time and the sequence of activities correspond to the settings in the setup. All activities that require sample are delayed as long as the signal is inactive.
- Binary outputs:
  - **Measurement active** signal: Indicates that a measurement is currently running. The signal is not active in the event of a calibration or cleaning.
  - **Sample required** signal: The signal is active for a configurable time before every activity that requires sample. This makes it possible to activate an external pump or a dilution module, for example.

1. Select **Menu/Setup/Inputs/Binary input** x:y.
2. Configure the binary inputs as follows:

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

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

3. Link the binary inputs with the analyzer: select **Menu/Setup/Analyzer/Extended setup/Signal for process access**.
4. Select measuring channel **SP1**.
5. Assign a binary input to the selected measuring channel: select **Binary input** x:y.

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

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

For this, connect the **Signal for process access** to a binary input of the "DIO" module and set the starting time of the measurements to **Continuous**. A measurement starts immediately as soon as the signal at the binary input is active. The only exception is if a

calibration or cleaning is due on the basis of the set time intervals: in this case, these activities are performed first of all and then the measurement follows immediately afterwards. If necessary, connect the **Measurement active** to a binary output to identify when the measurement actually begins. If you do not require any more measurements once the first measurement is finished, you have to already disable the **Signal for process access** during the active measurement.

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

- Binary inputs:
  **Signal for process access**: The analyzer can only perform activities that require sample (measurement, calibration, cleaning) when the signal is active. The time and the sequence of activities correspond to the settings in the setup. All activities that require sample are delayed as long as the signal is inactive.
- Binary outputs:
  - **Measurement active** signal: Indicates that a measurement is currently running. The signal is not active in the event of a calibration or cleaning.
  - **Sample required** signal: The signal is active for a configurable time before every activity that requires sample. This makes it possible to activate an external pump or a dilution module, for example.

1. For the measurement, under **Menu/Setup/Analyzer/Measurement** select **Continuous** as the start condition (analyzer measures continuously, without interruption, between the measurements).
2. Select **Menu/Setup/Inputs/Binary input** x:y.
3. Configure the binary inputs as follows:

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

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

4. Link the binary inputs with the analyzer: select **Menu/Setup/Analyzer/Extended setup/Signal for process access**.
5. Select measuring channel **SP1**.
6. Assign a binary input to the selected measuring channel: select **Binary input** x:y.
7. Select **Menu/Setup/Outputs/Binary output** x:y.
8. Configure the binary outputs as follows:

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

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

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

### Activating an external pump before every measurement

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

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

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

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

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

## 10.5.2 Binary input configuration

| Menu/Setup/Inputs/Binary input x:y [1] | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Binary input | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>On | Switches the input on/off |
| Signal type | **Selection**<br>▪ Static signal<br>▪ PFM<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>**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 | **Selection**<br>▪ Low<br>▪ High<br>**Factory setting**<br>High | Specifies which input signal levels should activate, for example, measuring range switching or a cleaning.<br>**Low**<br>Input signals between 0 and 5 V DC<br>**High**<br>Input signals between 11 and 30 V DC |
| **Signal type** = **PFM** | | |
| Max. frequency | 100.00 to 1000.00 Hz<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 | **Selection**<br>▪ #<br>▪ #.#<br>▪ #.##<br>▪ #.###<br>**Factory setting**<br>#.## | ▶ Specify the number of decimal places. |

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

## 10.5.3 Configuration of binary outputs

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

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

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

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

## 10.6 Signal outputs

### 10.6.1 Current outputs

Liquiline System CA80 has two analog current outputs by default.

You can configure additional current outputs with extension modules.

#### Setting the current output range

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

| Menu/Setup/Outputs/Current output x:y [1] | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Current output | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | Use this function to activate or deactivate a variable being output at the current output |
| Source of data | **Selection**<br>▪ None<br>▪ Connected inputs<br>▪ Controller<br>**Factory setting**<br>None | The sources of data on offer depend on your device version.<br>The main value of the analyzer and all the sensors and controllers connected to inputs are available for selection. |
| Measured value | **Selection**<br>▪ None<br>▪ Depends on the **Source of data**<br>**Factory setting**<br>None | The measured value you can select depends on the option selected under **Source of data**. |
| The list of dependent measured values is provided in the **Measured value** *table, subject to the* **Source of data**→ 🖹 76.<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 select and configure the current output for outputting the controlled variable. | | |
| Range lower value<br>Range upper value | Range of adjustment and factory settings depend on the **Measured value** | You can output the entire measuring range or just some of it at the current output. To do so, specify the upper and lower range values in accordance with your requirements. |
| Hold behavior<br>(for sensors) | **Selection**<br>▪ Freeze last value<br>▪ Fixed value<br>▪ Ignore<br>**Factory setting**<br>Depends on the channel:output | **Freeze last value**<br>The device freezes the last current value.<br>**Fixed value**<br>You define a fixed current value that is output at the output.<br>**Ignore**<br>A hold does not affect this current output. |
| Hold current<br>(for sensors)<br>**Hold behavior** = **Fixed value** | 0.0 to 23.0 mA<br>**Factory setting**<br>22.0 mA | ▶ Specify which current should be output at this current output in the hold state. |

1) x:y = slot:output number

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

| Source of data | Measured value |
|---|---|
| | **Selection**<br>Main value |
| pH Glass<br>pH ISFET | **Selection**<br>▪ Raw value mV<br>▪ pH<br>▪ Temperature |
| ORP | **Selection**<br>▪ Temperature<br>▪ ORP mV<br>▪ ORP % |

| Source of data | Measured value |
|---|---|
| Oxygen (amp.)<br>Oxygen (opt.) | **Selection**<br>▪ Temperature<br>▪ Partial pressure<br>▪ Concentration liquid<br>▪ Saturation<br>▪ Raw value nA<br>*(only* **Oxygen (amp.)***)*<br>▪ Raw value µs<br>*(only* **Oxygen (opt.)***)* |
| Cond i<br>Cond c | **Selection**<br>▪ Temperature<br>▪ Conductivity<br>▪ Resistance<br>*(only* **Cond c***)*<br>▪ Concentration<br>*(only* **Cond i** *and* **Cond c 4-pol***)* |
| Disinfection | **Selection**<br>▪ Temperature<br>▪ Sensor current<br>▪ Concentration |
| ISE | **Selection**<br>▪ Temperature<br>▪ pH<br>▪ Ammonium<br>▪ Nitrate<br>▪ Potassium<br>▪ Chloride |
| TU/TS<br>TU | **Selection**<br>▪ Temperature<br>▪ Turbidity g/l<br>*(only* **TU/TS***)*<br>▪ Turbidity FNU<br>*(only* **TU/TS***)*<br>▪ Turbidity Formazine<br>*(only* **TU***)*<br>▪ Turbidity solid<br>*(only* **TU***)* |
| Nitrate | **Selection**<br>▪ Temperature<br>▪ NO3<br>▪ NO3-N |
| Ultrasonic interface | **Selection**<br>Interface |
| SAC | **Selection**<br>▪ Temperature<br>▪ SAC<br>▪ Transm.<br>▪ Absorption<br>▪ COD<br>▪ BOD |
| Controller 1<br>Current input 1 … 3<br>Controller 2<br>Temperature 1 … 3 | **Selection**<br>▪ Bipolar<br>*(only for 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**
**Unipolar+** Assign to the output to which an actuator that can increase the measured value is connected. **Unipolar-** Assign to the output to which an actuator that can decrease the measured value is connected.
To output the manipulated variable of a two-sided controller, positive manipulated variables and negative manipulated variables generally have to be output to different actuators, as most actuators are able to influence the process in one direction only (not in both). For this purpose, the instrument splits the bipolar manipulated variable y into two unipolar manipulated variables, y+ and y-.
Only the two unipolar manipulated variable parts are available for selection for outputting to modulated relays. If outputting the values via a current output, you also have the possibility of outputting the bipolar manipulated variable y to one current output only (split range).

## 10.6.2 Alarm relay and optional relays

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

**The following functions can be output via a relay:**
- Limit switch status
- Controller manipulated variable for controlling an actuator
- Diagnostic messages
- Status of a cleaning function in order to control a pump or a valve

You can assign a relay to multiple inputs in order to clean several sensors with just one cleaning unit, for example.

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

### Outputting the status of a limit switch

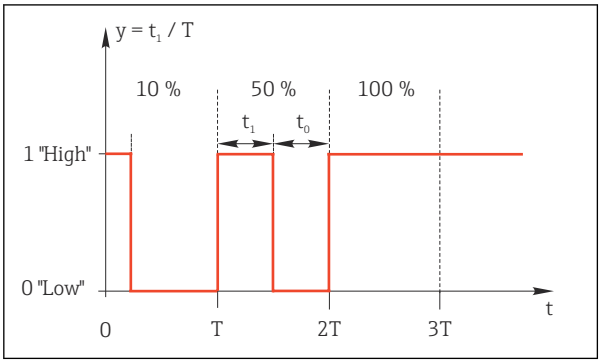
| Function = Limit switch | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Source of data | **Selection**<br>Limit switch 1 ... 8<br>**Factory setting**<br>None | Select the limit switch via which the status of the relay is to be output.<br>The limit switches are configured in the menu: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

### Outputting the manipulated variable of a controller

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

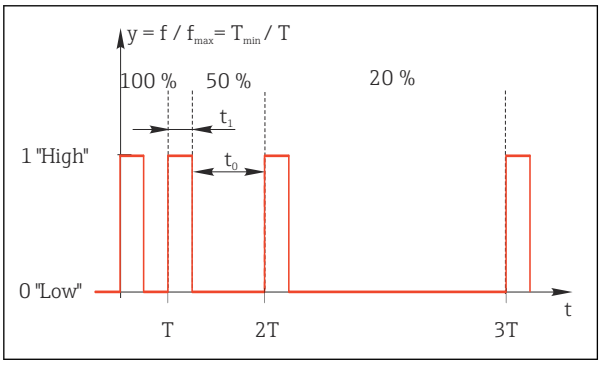
| Function = Controller | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Source of data | **Selection**<br>▪ None<br>▪ Controller 1<br>▪ Controller 2<br>**Factory setting**<br>None | ▶ Select the controller that should act as the data source. |
| Operating mode | **Selection**<br>▪ PWM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

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




52 *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, $t_1 = t_0$.




53 *Typical application: dosing pump*

| **Function = Controller** | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Actuator type | **Selection**<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). Alternatively, select **Unipolar(-)** if you are connecting an actuator to the relay that reduces the controlled variable (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). |
| The settings for **Cycle duration** and **Shortest turn-on time** influence one another. The following applies: **Cycle duration** ≥ **Shortest turn-on time**. | | |
| Shortest turn-on time<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. |

| Function = Controller | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| 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. |
| Hold behavior | **Selection**<br>▪ Freeze last value<br>▪ Fixed value<br>▪ Ignore<br>**Factory setting**<br>Ignore | |

### Outputting diagnostic messages via the relay

If a relay is defined as a diagnostic relay (**Function** = **Diagnostics**), it works in the **"fail-safe mode"**.
This means that the relay is always energized ("normally closed", n.c.) in the basic state if an error is not present. In this way it can also indicate a drop in voltage, for example.
The alarm relay always works in the failsafe mode.

You can output two categories of diagnostic messages via the relay:
- Diagnostic messages from one of the 4 Namur classes
- Diagnostic messages which you have individually assigned to the relay output

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

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

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

### Outputting the status of a cleaning function

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

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

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

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

## 10.6.3 PROFIBUS DP and PROFINET

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

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

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

1. Define the data source.
   ↳ You can choose from sensor inputs, current inputs and mathematical functions.
2. Choose the measured value to be transmitted.
3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**) → 76

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

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

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

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

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

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

**Menu/Setup/Additional functions/Controller 1**

1. In the specified menu, define PROFIBUS as the data source.
2. Select the desired analog output (AO) or digital output (DO) as the measured value.

Further information on "PROFIBUS" can be found in the Guideline for Communication via PROFIBUS, SD01188C

Further information on "PROFINET" can be found in the Guideline for Communication via PROFINET, SD02490C

### 10.6.4 Modbus RS485 and Modbus TCP

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

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

You can define a maximum of 16 device variables.

1. Define the data source.
   ↳ You can choose from the analyzer as well as sensor inputs and controllers.
2. Select the measured value to be output.
3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**) → 76

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

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

### 10.6.5 EtherNet/IP

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

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

1. Define the data source.
   ↳ You can choose from the analyzer as well as sensor inputs and controllers.
2. Select the measured value to be output.
3. Define how the device should behave in the hold state (for sensors). (Configuration options of **Source of data**, **Measured value** and **Hold behavior**) → 76
4. In the case of controllers, also specify the type of manipulated variable.

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

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

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

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

# 10.7 Additional functions

## 10.7.1 Limit switch

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

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

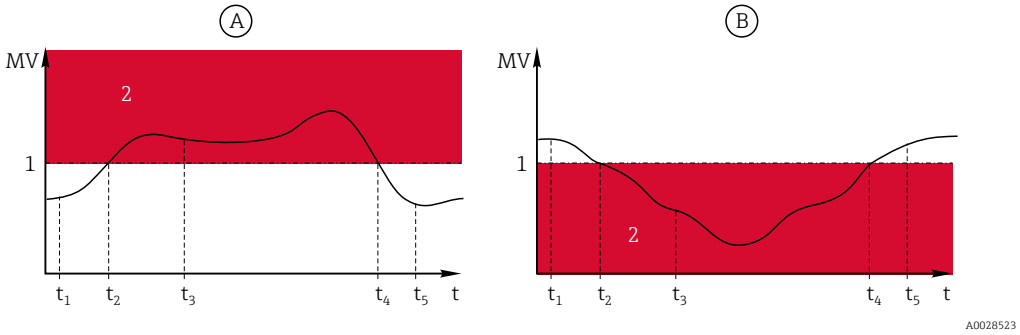
**Measured value** *depending on the* **Source of data**

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

| Source of data | Measured value |
|---|---|
| Cond i<br>Cond c | **Selection**<br>▪ Temperature<br>▪ Conductivity<br>▪ Resistance<br>*(only* **Cond c***)*<br>▪ Concentration<br>*(only* **Cond i** *and* **Cond c 4-pol***)* |
| Disinfection | **Selection**<br>▪ Temperature<br>▪ Sensor current<br>▪ Concentration |
| ISE | **Selection**<br>▪ Temperature<br>▪ pH<br>▪ Ammonium<br>▪ Nitrate<br>▪ Potassium<br>▪ Chloride |
| TU/TS<br>TU | **Selection**<br>▪ Temperature<br>▪ Turbidity g/l<br>*(only* **TU/TS***)*<br>▪ Turbidity FNU<br>*(only* **TU/TS***)*<br>▪ Turbidity Formazine<br>*(only* **TU***)*<br>▪ Turbidity solid<br>*(only* **TU***)* |
| Nitrate | **Selection**<br>▪ Temperature<br>▪ NO3<br>▪ NO3-N |
| Ultrasonic interface | **Selection**<br>Interface |
| SAC | **Selection**<br>▪ Temperature<br>▪ SAC<br>▪ Transm.<br>▪ Absorption<br>▪ COD<br>▪ BOD |
| Controller 1<br>Current input 1 ... 3<br>Controller 2<br>Temperature 1 ... 3 | **Selection**<br>▪ Bipolar<br>*(only for 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. |

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

| Menu/Setup/Additional functions/Limit switches/Limit switch 1 ... 8 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Cleaning program | **Selection**<br>▪ None<br>▪ Cleaning 1 ... 4<br>**Factory setting**<br>None | Use this function to choose which cleaning instance should start when the limit switch is active. |
| Function | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | Activating/deactivating the limit switch |
| Operating mode | **Selection**<br>▪ Above limit check<br>▪ Below limit check<br>▪ In range check<br>▪ Out of range check<br>▪ Change rate<br>**Factory setting**<br>Above limit check | Type of limit value monitoring:<br>▪ Limit value overshoot or undershoot→ 54<br>▪ Measured value within or outside a range → 55<br>▪ Rate of change → 57 |
| Limit value | Settings depend on the measured value | **Operating mode** = **Above limit check** *or* **Below limit check** |



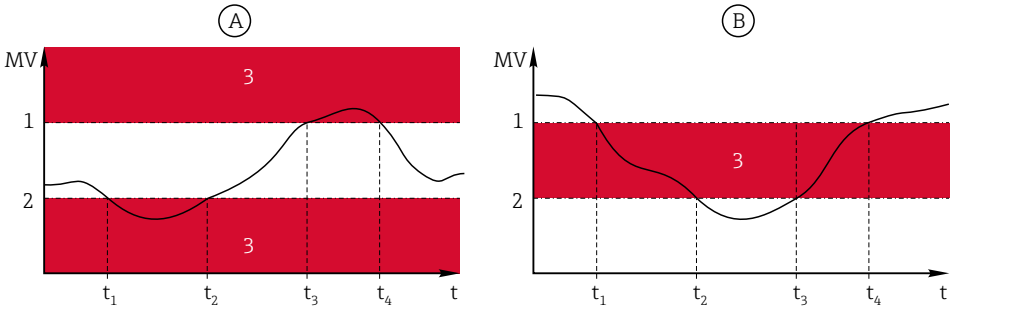

54 *Exceeding (A) and undershooting (B) a limit value (without hysteresis and switch-on delay)*

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

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

**Menu/Setup/Additional functions/Limit switches/Limit switch 1 … 8**

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

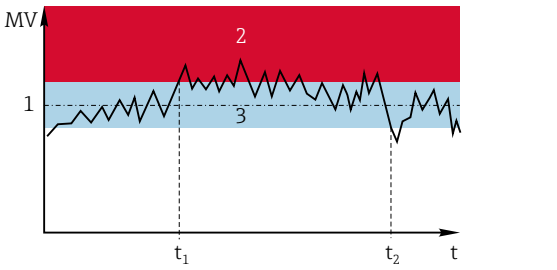



*55 Range monitoring outside (A) and within (B) a range (without hysteresis and switch-on delay)*

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

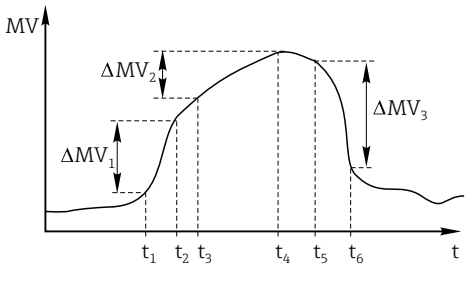
- If measured values (MV) are increasing, the relay contact is closed when the switch-on point is exceeded (**Range lower value** + **Hysteresis**) and the start delay (**Start delay**) has elapsed.
- If measured values are decreasing, the relay contact is reset when the switch-off point is undershot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

| | | |
|---|---|---|
| Hysteresis | Settings depend on the measured value | **Operating mode** ≠ **Change rate**<br><br>The hysteresis is needed to ensure a stable switching behavior.<br>The device software adds or subtracts the value set here to/from the limit value (**Limit value**, **Range lower value** or **Range upper value**). This results in double the **Hysteresis** value for the hysteresis range around the limit value. An event is then only generated if the measured value (MV) completely passes through the hysteresis range. |
| Start delay<br>**Operating mode** ≠ **Change rate** | 0 to 9999 s<br>**Factory setting**<br>0 s | Synonyms: pick-up and drop-out delay |
| Switch off delay<br>**Operating mode** ≠ **Change rate** | | |




*56 Hysteresis taking the example of limit value overshoot*

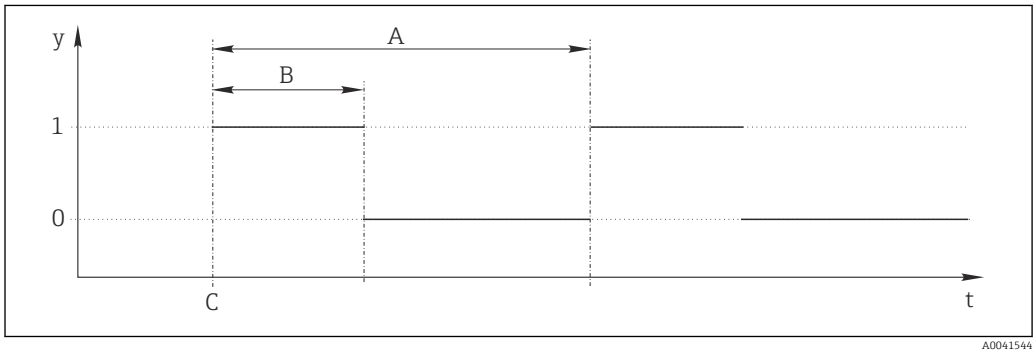
*1 Limit value*
*2 Alarm range*
*3 Hysteresis range*
*$t_{1,2}$ An event is generated*

| Menu/Setup/Additional functions/Limit switches/Limit switch 1 ... 8 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Delta value | Settings depend on the measured value | **Operating mode** = **Change rate**<br>The slope of the measured value (MV) is monitored in this mode.<br>If, in the specified time frame (**Delta time**), the measured value increases or decreases by more than the specified value (**Delta value**), an event is generated. No further event is generated if the value continues to experience such a steep increase or decrease. If the slope is back below the limit value, the alarm status is reset after a preset time (**Auto Confirm**).<br>Events are triggered by the following conditions in the example given:<br>$t_2 - t_1$ < **Delta time** and ΔMV1 > **Delta value**<br>$t_4 - t_3$ >**Auto Confirm** and ΔMV2 < **Delta value**<br>$t_6 - t_5$ < **Delta time** and ΔMV3 > **Delta value** |
| Delta time | 00:00:01 ... 23:59:00<br>**Factory setting**<br>01:00:00 | |
| Auto Confirm | 00:01 to 23:59<br>**Factory setting**<br>00:01 | |
|  | | |

57 *Rate of change*

## 10.7.2 Time switch

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



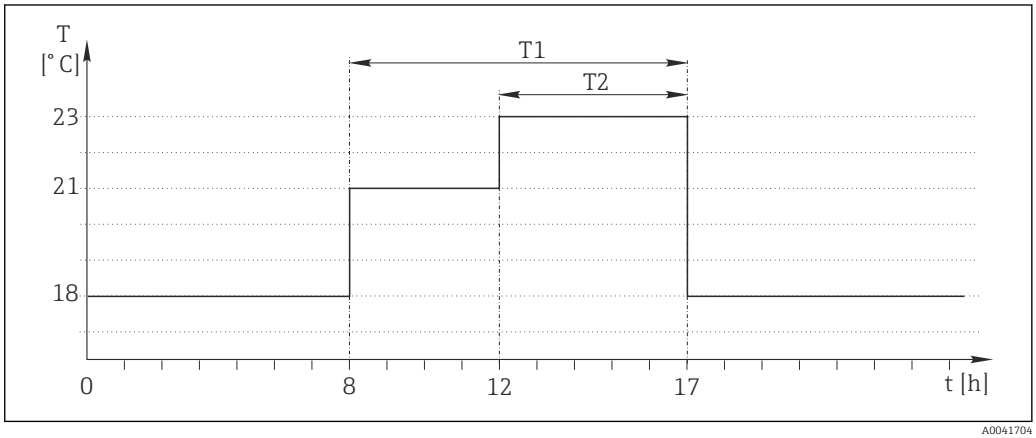

58 *Signal pattern of a time switch*

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

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

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

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




59 *Time-based temperature control*

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

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

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

- **Start date** = 01.01.2020
- **Start time** = 12:00:00
- **Signal duration** = 05:00:00
- **Period** = 24:00:00

3. Create **Formula** mathematical function.

**Menu/Setup/Additional functions/Mathematical functions**
- MF1: Formula
- **Tracking** = **On**
- **Source A** = **Time switch 1**
- **Source B** = **Time switch 2**
- **Formula** = 18.0 + 3*NUM(A) + 2*NUM(B)

Explanation: NUM converts the logical value to a numerical value and thus enables multiplication.
- 3*NUM(A) results in the value 3.0 from 08:00 to 17:00 and 0.0 outside of this time period.
- 2*NUM(B) results in the value 2.0 from 12:00 to 17:00 and 0.0 outside of this time period.

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

**Example 2: Time-based condition**

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

1. Program **Time switch 1**:

- **Start date** = 01.01.2020
- **Start time** = 00:00:00
- **Signal duration** = 00:10:00
- **Period** = 02:00:00

2. Create **Formula** mathematical function.

**Menu/Setup/Additional functions/Mathematical functions**
- MF1: Formula
- **Tracking** = **On**
- **Source A** = **Time switch 1**
- **Source B** = pH value of a Memosens pH input
- **Formula** = A AND(B<4.0)

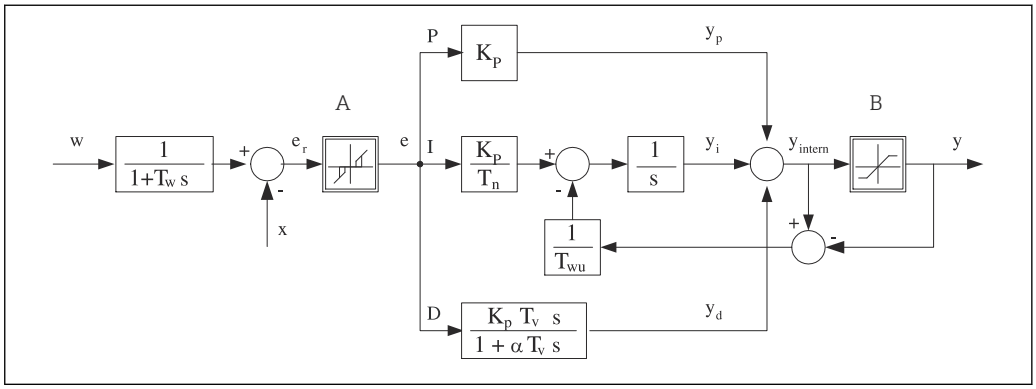
3. Use the formula as the data source of a relay.

**Menu/Setup/Outputs/Relay**[x:y]
- **Function** = **Formula**
- **Operating mode** = **Static signal**
- **Source of data** = **MF1: Formula**

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

## 10.7.3 Controller

### Controller structure in Laplace representation




60 *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 α = 0 to 1* |
| $T_n$ | *Integral action time (I-value)* | *e* | *Control deviation* |
| $T_v$ | *Derivative action time (D-value)* | *w* | *Set point* |
| $T_w$ | *Time constant for set point damping* | *x* | *Controlled variable* |
| $T_{wu}$ | *Time constant for anti-windup feedback* | *y* | *Manipulated variable* |
| *P* | *Proportional value* | | |

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

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

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

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

### Configuration

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

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

| **Menu/Setup/Additional functions/Controller 1 … 2** | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Control | **Selection**<br>▪ Off<br>▪ Automatic<br>▪ Manual mode<br>**Factory setting**<br>Off | ▶ First configure the controller and leave the switch at the factory setting (**Off**).<br>Once you have made all the settings, you can assign the controller to an output and switch it on. |
| ▶ Manual mode | | |
| y | -100 to 100 %<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. |
| Setpoint | | Current set point |
| x | | Current measured value |
| Disturbance variable | | Current measured value of disturbance variable |
| Norm. disturb. value | | |
| Name | Free text | ▶ Give the controller a name so you can identify it later on. |
| Controller Enable | **Selection**<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 | **Selection**<br>▪ Standard<br>▪ Advanced<br>**Factory setting**<br>Standard | Changes the number of parameters that can be configured. → **Parameters** → 📄 96<br>**Standard**: If you choose this, the other controller parameters are active nevertheless. The factory settings are used. These suffice in most cases. |

**Menu/Setup/Additional functions/Controller 1 … 2**

| Function | Options | Info |
|---|---|---|
| Process type | **Selection**<br>▪ Inline<br>▪ Batch<br>**Factory setting**<br>Inline | ▶ Decide what type of process best describes your particular process. |

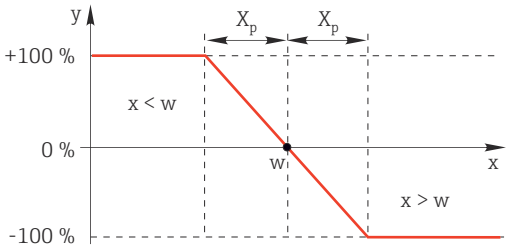
**Batch process**
The medium is in a closed system.
The task of the control system is to dose in such a way that the measured value (controlled variable) changes from its start value to its target value. No more dosing is needed once the set point has been reached and the system is stable. If the target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

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

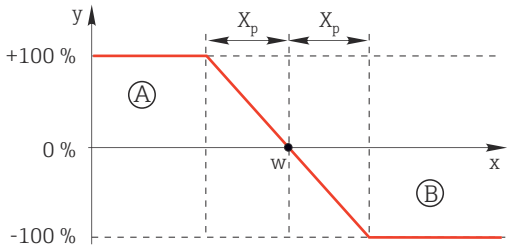
A mixture of both process types can often be found in practice: the semi-batch process. Depending on the ratio between the flow and the container volume, this arrangement behaves either like a batch process or an in-line process.

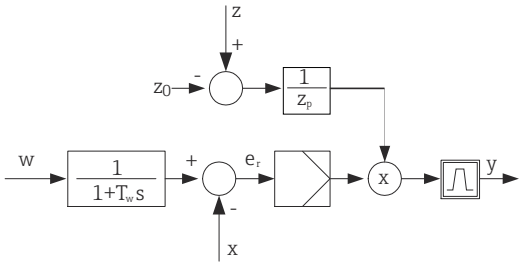
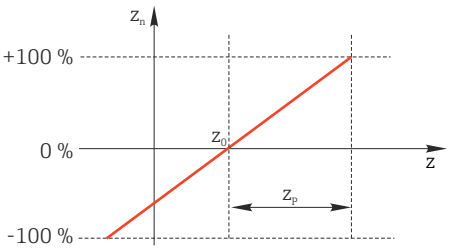
| Function | Options | Info |
|---|---|---|
| Controller type | **Selection**<br>▪ PID 1-sided<br>▪ PID 2-sided<br>**Factory setting**<br>PID 2-sided | Depending on which actuator you have connected, you influence the process in only one direction (e.g . heating) or in both directions (e. g. heating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

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




61 *Relationship y = (w-x)/$X_p$*

| Menu/Setup/Additional functions/Controller 1 ... 2 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Effective direction<br>**Controller type** = **PID 1-sided** | **Selection**<br>▪ Direct<br>▪ Reverse<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)<br>→ **Reverse**<br>▪ The measured value should decrease as a result of dosing (e. g. cooling)<br>→ **Direct** |
| A 1-sided controller has a unipolar manipulated variable, i. e. it can only influence the process in one direction.<br>**Reverse**: If the controller should increase the process value, set this as the direction of action. The controller becomes active when the process value is too small (range A).<br>**Direct**: With this direction of action, the controller acts as a "downwards controller". It becomes active when the process value (e. g. the temperature) is too high (range B).<br>  <br><br>62 *Red: overlap between the curves of the two 1-sided controllers.* | | |
| ▶ Controlled variable | | |
| Source of data | **Selection**<br>▪ None<br>▪ Sensor inputs<br>▪ Current inputs<br>▪ Fieldbus signals<br>▪ Binary inputs<br>▪ Mathematical functions<br>**Factory setting**<br>None | ▶ Specify the input or output which should be the source of data for the controlled variable. |
| Measured value | **Selection**<br>Depends on **Source of data**<br>**Factory setting**<br>None | ▶ Specify the measured value that should be your controlled variable.<br>You can use different measured values depending on the data source. |
| ▶ Setpoint | | Target value of the controlled variable<br>This menu is not displayed if you selected a fieldbus as the source (**Source of data** = fieldbus). |
| Setpoint | Range of adjustment and factory setting depending on the **Source of data** | ▶ Specify the target value for the controlled variable. |
| Tw<br>**Setup Level** = **Advanced** | 0.0 to 999.9 s<br>**Factory setting**<br>2.0 s | Time constant for the set point damping filter |
| ▶ Disturbance variable | | optional, activation code necessary |

| Menu/Setup/Additional functions/Controller 1 ... 2 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| In the case of "flowing medium" (in-line) controls, the flow rate may not be constant. In some circumstances, strong fluctuations are possible. In the case of a settled control system in which the flow rate is suddenly halved, it is desirable that the dosed quantity from the controller is also directly halved. In order to achieve this type of "flow-rate-proportional" dosing, this task is not left to the I-component of the controller, but rather one enters the (to be measured) flow rate as disturbance variable z multiplicative at the controller output.<br>  <br><br>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".<br>For the additive feedforward control that is alternatively available in the device, the (standardized) disturbance variable is added to the controller manipulated variable. This enables you to set up a type of variable base load dosing.<br>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): $z_n = (z - z_0)/z_p$<br>  <br><br>**Example**<br>Flowmeter with measuring range 0 to 200 $m^3$/ h<br>The controller would currently dose 100% without feedforward control.<br>The feedforward control should be configured such that at z = 200$m^3$/h, the controller still doses at 100% ($z_n$ = 1).<br>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).<br>→ Select the zero point $z_0$ = 4 $m^3$/h and the proportional band $Z_p$= 196 $m^3$/h. | | |
| Function | **Selection**<br>▪ Off<br>▪ Multiply<br>▪ Add<br>**Factory setting**<br>Off | Selecting multiplicative or additive feedforward control |
| Source of data | **Selection**<br>▪ None<br>▪ Sensor inputs<br>▪ Current inputs<br>▪ Fieldbus signals<br>▪ Binary inputs<br>▪ Mathematical functions<br>**Factory setting**<br>None | ▶ Specify the input which should be the source of data for the disturbance variable. |

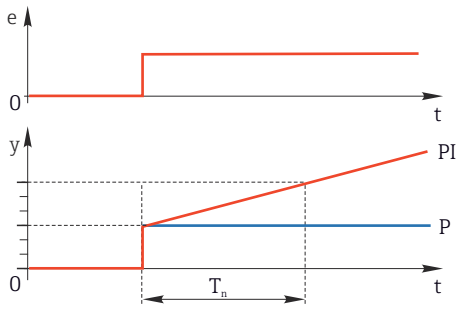
| Menu/Setup/Additional functions/Controller 1 ... 2 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Measured value | **Selection**<br>Depends on **Source of data**<br>**Factory setting**<br>None | ▶ Specify the measured value that should be your disturbance variable.<br>You can use different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

The Liquiline PID controller has been implemented in the serial structural form, i. e. it has the following parameters:
- Integral action time $T_n$
- Derivative action time $T_v$
- Proportional band $X_p$

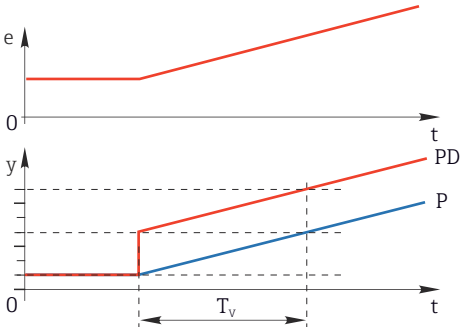
**Setup Level** = **Advanced**: With this setup level, you can also configure the following:
- Time constant $T_{wu}$
- Time constant α
- Width of the neutral zone $X_n$
- Width of the hysteresis range of the neutral zone $X_{hyst}$
- Clock time of the controller

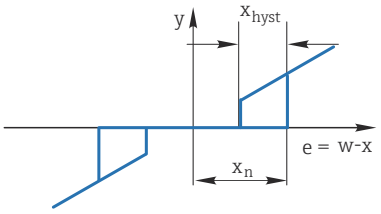
| | | |
|---|---|---|
| Tn | 0.0 to 9999.0 s<br>**Factory setting**<br>0.0 s | The integral action time specifies the effect of the I-value<br>If **Tn** > 0 the following applies: **Clock** < **Twu** < 0.5(**Tn** + **Tv**) |

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




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

| Menu/Setup/Additional functions/Controller 1 ... 2 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Twu | 0.1 to 999.9 s<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 | 0.1 to 999.9 s<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 to 1.0<br>**Factory setting**<br>0.3 | Affects the additional damping filter of the D-controller. The time constant is calculated from $\alpha \cdot T_v$. |
| Process balance<br>**Controller type** = **PID 2-sided** | **Selection**<br>▪ Symmetric<br>▪ Asymmetric<br>**Factory setting**<br>Symmetric | **Symmetric**<br>There is only one control gain and this applies for both sides of the process.<br>**Asymmetric**<br>You can set the control gain individually for both sides of the process. |
| Xp<br>**Process balance** = **Symmetric** | Range of adjustment and factory setting depending on the **Source of data** | Proportional band, reciprocal value of the proportional gain $K_p$<br>As soon as controlled variable x deviates more than $x_p$ from the set point w, manipulated variable y reaches 100%. |
| Xp Low<br>**Process balance** = **Asymmetric** | Range of adjustment and factory setting depending on the **Source of data** | $x_p$ for y < 0 (manipulated variable < 0) |
| Xp High<br>**Process balance** = **Asymmetric** | | $x_p$ for y > 0 (manipulated variable > 0) |
| Xn | Range of adjustment and factory setting depending on the **Source of data** | Tolerance range about the set point that prevents minor oscillations about the set point if using two-sided control loops. |
| XN Low<br>**Process balance** = **Asymmetric** | Range of adjustment and factory setting depending on the **Source of data** | $x_n$ for x < w (controlled variable < set point) |
| XN High<br>**Process balance** = **Asymmetric** | | $x_n$ for x > w (controlled variable > set point) |

| Menu/Setup/Additional functions/Controller 1 ... 2 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| XHyst | 0.0 to 99.9 %<br>**Factory setting**<br>0.0 % | Width of the hysteresis range of the neutral zone, relative component of $x_n$ |
|  <br>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 clock time of the controller if you know exactly what you are doing.<br>**Clock** < **Twu** < 0.5(**Tn** + **Tv**) |
| Max y change rate | 0.00 to 1.00<br>**Factory setting**<br>0.40 | Limits the change of the output variable<br>A value of 0.5 permits a maximum manipulated variable change of 50 % within one second. |
| ▶ Exception behavior | | Hold=measured value is no longer reliable |
| Manipulated Variable | **Selection**<br>▪ Freeze<br>▪ Fixed value<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>**Fixed value**<br>Manipulated variable is set to 0 (no dosing) |
| State | **Selection**<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. |
| Hold as exception | **Selection**<br>▪ All<br>▪ None<br>**Factory setting**<br>All | ▶ Select: Should the hold trigger the previously selected exception behaviour, or should it be ignored? |
| ▶ Outputs | | Goes to the menu **Outputs** |
| ▶ Controller assignment view | | Shows an overview of the inputs and outputs used |

## 10.7.4 Cleaning programs for sensors

**⚠ CAUTION**

**Cleaning not switched off during calibration or maintenance activities**

Risk of injury due to medium or cleaning agent!

- ▶ If a cleaning system is connected, switch it off before removing a sensor from the medium.
- ▶ If you need to test the cleaning function while cleaning is in progress, wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

### Types of cleaning

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

**State of cleaning**: Indicates whether the cleaning program is active or not. This is for information purposes only.

### Selecting the cleaning type

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

### Standard cleaning

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

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

▶ Define the cleaning cycle→ 📄 101.

### Chemoclean

An example is the use of the CYR10 injector unit to clean pH glass sensors. (CYR10 connection → 📄 27)

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

### Chemoclean Plus

An example is the use of the CYR10 injector unit to clean pH glass sensors. (CYR10 connection → 27)

| 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.<br>See below for an example of programming. |
| Failsafe step setup | Table view | ▶ In the table specify the states that the relays or outputs should assume in the event of an error. |
| Limit contacts | 0 to 2 | ▶ Select the number of digital input signals (e. g. from limit position switches of the retractable assembly). |
| Limit contact 1 ... 2 | **Selection**<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 ... 4 | Free text | You can assign a meaningful name to each output, e. g. "assembly", "cleaner 1", "cleaner 2", etc. |

*Programming example: regular cleaning with water and 2 cleaning agents*

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

The pneumatic retractable assembly, e.g. CPA87x, is activated by compressed air via a two-way valve. As a result, the assembly assumes either the "Measure" position (sensor in medium) or the "Service" position (sensor in rinse chamber). Media such as water or cleaning agents are supplied via valves or pumps. Here there are two states: 0 (= "off" or "closed") and 1 (= "on" or "open").

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

### Defining the cleaning cycle

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

### Other settings and manual cleaning

| Menu/Setup/Additional functions/Cleaning/Cleaning 1 … 4 | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Start signal | **Selection**<br>▪ None<br>▪ Fieldbus 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 and weekly programs are executed as normal, i. e. conflicts can occur. Priority is given to the cleaning program that was the first to be started. |
| Hold | **Selection**<br>▪ Off<br>▪ On<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. If cyclical cleaning is enabled, there are times in which it is not possible to manually start the process. |
| ▷ **Stop** or **Stop Failsafe** | Action | End the cleaning process (cyclically or manually) |
| ▶ Outputs | | Goes to the menu **Outputs** |
| ▶ Cleaning program assignment view | | Shows an overview of the cleaning processes |

## 10.7.5 Mathematical functions

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

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

### Difference

You can subtract the measured values of two sensors and use the result to detect incorrect measurements, for example.

To calculate a difference, you must use two measured values with the same engineering unit.

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

### Redundancy

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

| **Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Redundancy** | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Calculation | **Selection**<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 a maximum of 3 different types of sensor that output the same measured value.<br>**Example for temperature redundancy**<br>You have a pH sensor and an oxygen sensor at inputs 1 and 2. Select the pH sensor as **Y1** and the oxygen sensor as **Y2**. **Measured value**: Select **Temperature** in each case. |
| Measured value | | |
| Y2 | | |
| Measured value | | |
| Y3 (optional) | | |
| Measured value | | |

| Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Redundancy | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Deviation control | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | You can monitor the redundancy. Specify an absolute limit value that must not be exceeded. |
| Deviation limit | Depends on the selected measured value | |
| Redundancy | Read only | View this value in a user-defined measuring screen or output the value via the current output. |
| ▶ Mathematical function assignment view | | Overview of the configured functions |

### rH value

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

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

▶ Set the main measured value simply to rH.

| Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = rH calculation | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Calculation | **Selection**<br>▪ Off<br>▪ On<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. |
| ▶ Mathematical function assignment view | | Overview of the configured functions |

### Degassed conductivity

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

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

| Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Degassed conductivity | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Calculation | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | On/off switch for the function |
| Cation conductivity | Connected conductivity sensor | **Cation conductivity** represents the sensor downstream from the cation exchanger and upstream from the "degassing module", **Degassed conductivity** represents the sensor at the outlet of the degassing module.<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. |
| ▶ Mathematical function assignment view | | Overview of the configured functions |

### Dual conductivity

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

| Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Dual conductivity | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Calculation | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | On/off switch for the function |
| Inlet | The options depend on the sensors connected | Select the sensors that should function as the minuend (**Inlet**, e.g. sensor upstream from the ion exchanger) or subtrahend (**Outlet**, e.g. sensor downstream from the ion exchanger). |
| Measured value | | |
| Outlet | | |
| Measured value | | |
| Main value format | **Selection**<br>▪ Auto<br>▪ #<br>▪ #.#<br>▪ #.##<br>▪ #.###<br>**Factory setting**<br>Auto | Specify the number of decimal places. |
| Cond. unit | **Selection**<br>▪ Auto<br>▪ µS/cm<br>▪ mS/cm<br>▪ S/cm<br>▪ µS/m<br>▪ mS/m<br>▪ S/m<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. |
| ▶ Mathematical function assignment view | | Overview of the configured functions |

### Calculated pH value

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

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

### Formula (optional, with activation code)

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

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

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

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

**Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Formula**

| Function | Options | Info |
|---|---|---|
| Calculation | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | On/off switch for the function |
| Source A … C | **Selection**<br>Select source<br>**Factory setting**<br>None | You can use all the sensor inputs, binary and analog inputs, mathematical functions, limit switches, time switches, fieldbus signals, controllers and datasets for measuring range switching as the source for measured values.<br>1. Choose a maximum of three sources (A, B and C) for measured values.<br>2. For each source, choose the measured value to be calculated.<br>↳ All available signals - depending on the selected source - are possible measured values.<br>3. Enter the formula.<br>4. Switch on the calculation.<br>↳ The current measured values A, B and C as well as the result of the calculation using the formula are displayed. |
| Measured value | **Selection**<br>Depends on the source | |
| A … C | The current measured value is displayed | |

| Menu/Setup/Additional functions/Mathematical functions/MF1 to 8/Mode = Formula | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Formula | User-defined text | Table → 105<br>Make sure the exact notation is used (upper case). Blank spaces before and after mathematical characters are irrelevant. Note the operator precedence, i.e. multiplication and division take precedence over addition and subtraction. Use parentheses if necessary. |
| Result unit | User-defined text | You may enter a unit for the calculated value if desired. |
| Result format | **Selection**<br>▪ #<br>▪ #.#<br>▪ #.##<br>▪ #.###<br>▪ #.####<br>**Factory setting**<br>#.## | Select the number of decimal places. |
| Result numeric | Read only | Current, calculated value |
| ▶ Mathematical function assignment view | | Overview of the configured functions |

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

A relay output activates a dosing pump. The pump should switch on when the following 3 conditions are met:
- (1) There is flow
- (2) The volume flow is above a defined value
- (3) The concentration of chlorine drops below a defined value

1. Connect a binary input signal from an "INS" point level switch of the CCA250 assembly to the DIO module.
2. Connect an analog input signal of a volume flow meter to the AI module.
3. Connect the chlorine sensor.
4. Configure the **Formula** mathematical function: **Source A** = binary input DIO, **Source B** = current input AI, **Source C** = input **Disinfection**.
   ↳ Formula:
   **A AND (B > 3) AND (C < 0.9)**
   (where 3 is the lower limit value of the volume flow and 0.9 is the lower limit value of the chlorine concentration)
5. Configure the relay output with the **Formula** mathematical function and connect the dosing pump to the corresponding relay.

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

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

### Example: Load-based control

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

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

2. Configure the **Formula** mathematical function: **Source A** = input signal phosphate and **Source B** = input signal volume flow.
   ↳ Formula:
   **A*B*x**
   (where x is an application-specific proportionality factor)
3. Select this formula as the source e.g. of the current output or of a modulated binary output.
4. Connect the valve or pump.

### 10.7.6 Diagnostic modules

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

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

In addition you can switch off the factory diagnostic code for limit switches. This allows you to:
- Use the limit switch on a purely functional basis (without a message)
- Configure application-specific message texts
- Control diagnostic modules directly by a digital signal or via a limit switch output (enables the use of switch-on/switch-off delay, for example).

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

# 11 Diagnostics and troubleshooting

## 11.1 General troubleshooting

The analyzer continuously monitors its functions itself.

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

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

### 11.1.1 Troubleshooting

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

1. See the Diagnostics menu for details on the diagnostic message.
   ↳ Follow the instructions to rectify the problem.
2. If this does not help, search for the diagnostic message under "Overview of diagnostic information" in these Operating Instructions. Use the message number as a search criterion. Ignore the letters indicating the Namur error category.
   ↳ Follow the troubleshooting instructions provided in the last column of the error tables.
3. If the measured values are implausible, the local display is faulty or you encounter other problems, search for the faults under "Process errors without messages" (→ Operating Instructions Memosens, BA01245C) or "Device-specific errors" (→ 113).
   ↳ Follow the recommended measures.
4. Contact the Service Department if you cannot rectify the error yourself. citing only the error number.

### 11.1.2 Process errors without messages

Operating Instructions "Memosens", BA01245C

### 11.1.3 Device-specific errors

| Problem | Possible cause | Tests and/or remedial measures |
|---|---|---|
| Dark display | No supply voltage | ▶ Check if supply voltage applied. |
| | Base module defective | ▶ Replace base module |
| Values appear on display but:<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.<br>Measuring input test:<br>▶ Connect the Memocheck Sim CYP03D to the input and use it to check the function of the input. |
| | Calibration/adjustment failed | ▶ Repeat calibration |

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

## 11.2 Diagnostic information on local display

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

## 11.3 Diagnostic information via web browser

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

## 11.4 Diagnostic information via fieldbus

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

## 11.5 Adapting the diagnostic information

### 11.5.1 Classification of diagnostic messages

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

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

- Message number
- Error category (letter in front of the message number)
  - **F** = (Failure) a malfunction has been detected
    The measured value of the affected channel is no longer reliable. The cause of the malfunction is to be found in the measuring point. Any control system connected should be set to manual mode.
  - **C** = (Function check), (no error)
    Maintenance work is being performed on the device. Wait until the work has been completed.
  - **S** = (Out of specification), the measuring point is being operated outside its specification
    Operation is still possible. However, you run the risk of increased wear, shorter operating life or lower measurement accuracy. The cause of the problem is to be found outside the measuring point.
  - **M** = (Maintenance required), action should be taken as soon as possible
    The device still measures correctly. Immediate measures are not necessary. However, proper maintenance efforts would prevent a possible malfunction in the future.
- Message text

If you contact the Service Department, please cite the message number only. Since you can individually change the assignment of an error to an error category, the Service Department cannot use this information.

### 11.5.2 Adapting the diagnostic behavior

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

**Example**

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

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

**Possible settings**

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

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

## 11.6 Overview of diagnostic information

### 11.6.1 Device-specific, general diagnostic messages

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 202 | Selftest active | F | On | Off | Wait for self-test to be finished |
| 216 | Hold active | C | On | Off | Output values and status of the channel are on hold |
| 241 | Firmware failure | F | On | On | Internal device error<br>1. Update the software.<br>2. Contact the Service Department.<br>3. Replace the backplane (Service). |
| 242 | Firmware incomp. | F | On | On | |
| 243 | Firmware failure | F | On | On | |
| 261 | Electronics module | F | On | On | Electronics module defective<br>1. Replace the module.<br>2. Contact the Service Department. |
| 262 | Module connection | F | On | On | Electronics module not communicating<br>1. Check the module , replace it if necessary.<br>2. Contact the Service Department. |
| 263 | Incomp. detected | 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.<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 consumption | 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. |
| 335 | Fan defective | F | On | On | Fan defective<br>1. Replace the fan.<br>2. Contact the Service Department. |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 337 | Pump hose warning | M | On | Off | End of pump hose service life will be reached shortly<br>Display under **Menu/Diagnostics/Operating time information/Pump tube life**<br>1. Schedule replacement.<br>2. After replacing, reset the operating time under **Menu/Diagnostics/Operating time information**. |
| 360 | Cooling/Heating | C | On | Off | Temperature range in the housing exceeded<br>1. Check installation conditions and the ambient temperature<br>2. Replace the actuator module.<br>3. Contact the Service Department. |
| 361 | Cooling/Heating | F | On | On | Cooling/heating module defective<br>Defined temperature range not reached. This could affect the functionality of the reagents.<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. |
| 365 | Photometer comm. | F | On | On | Photometer not communicating<br>Possible reasons:<br>Incorrect photometer connection<br>1. Check photometer connection.<br>2. Contact the Service Department. |
| 367 | Module connect. | F | On | On | No communication to sample preparation<br>► Check the connecting cable to the sample preparation system. |
| 370 | Internal voltage | F | On | On | Internal voltage outside the valid range<br>1. Check supply voltage.<br>2. Check inputs and outputs for short-circuiting. |
| 373 | Electronictemp. high | M | On | Off | High electronics temperature<br>► Check ambient temperature and energy consumption. |
| 374 | Sensor check | F | On | Off | No measurement signal from sensor<br>1. Check sensor connection.<br>2. Check the sensor, replace it if necessary. |
| 380 | Temperature sensor | F | On | On | Temperature sensor defective in reactor, cuvette or sample pre-heating system<br>► Contact the Service Department and quote the number displayed. |
| 381 | Valve defective | F | On | On | Indicated valve is defective<br>► Contact the Service Department and quote the number displayed. |
| 385 | Heating temp. low | S | On | Off | Sample pre-heating target temperature not reached<br>1. Check fuse.<br>2. Check cable and connector. |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 386 | Heating temp. high | S | On | Off | Temperature of sample pre-heating too high<br>1. Monitor the temperature of the sample.<br>2. Disconnect the power supply if the sample temperature does not drop. |
| 401 | Factory reset | F | On | On | Factory reset is performed |
| 405 | Service IP active | C | Off | Off | Service switch is switched on<br>The device can be addressed at 192.168.1.212.<br>▶ Switch off the service switch to change to the saved IP settings. |
| 412 | Writing backup | F | On | Off | ▶ Wait for the write process to be finished |
| 413 | Reading backup | F | On | Off | ▶ Wait. |
| 436 | **SD card** (80%) | M | On | Off | SD card 80% full<br>1. Replace SD card with empty card.<br>2. Clear SD card.<br>3. Set logbook properties to ring buffer (**Setup/General settings/Logbooks**). |
| 437 | **SD card** (100%) | M | On | Off | SD card 100% full. No longer possible to write to the card.<br>1. Replace SD card with empty card.<br>2. Clear SD card.<br>3. Set logbook properties to ring buffer (**Setup/General settings/Logbooks**). |
| 438 | SD card removed | M | On | Off | SD card not plugged in<br>1. Check SD card.<br>2. Replace SD card.<br>3. Disable logging. |
| 455 | Mathemat. function | F | On | On | Mathematical function: fault condition<br>1. Check mathematical function.<br>2. Check assigned input variables. |
| 460 | Output below limit | S | On | Off | Reasons<br>▪ Sensor in air<br>▪ Air pockets in assembly<br>▪ Sensor fouled<br>▪ Incorrect flow to sensor<br>1. Check sensor installation.<br>2. Clean sensor.<br>3. Change assignment of current outputs. |
| 461 | Output above limit | S | On | Off | |
| 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. |
| 529 | Diag. setup active | C | Off | Off | ▶ Wait for maintenance to be finished. |
| 530 | Logbook at 80% | M | On | Off | 1. Save the logbook to the SD card and then delete the logbook in the device.<br>2. Set memory to circular buffer.<br>3. Deactivate logbook. |
| 531 | Logbook full | M | On | Off | |
| 532 | License error | M | On | Off | ▶ Contact the Service Department. |
| 540 | Parameter save fail | M | On | Off | Storage of configuration has failed<br>▶ Repeat. |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 541 | Parameter load ok | M | On | Off | Configuration successfully loaded |
| 542 | Parameter load fail | M | On | Off | Loading of configuration has failed<br>► Repeat. |
| 543 | Parameter load abort | M | On | Off | Configuration loading aborted |
| 544 | Parameter reset ok | M | On | Off | Factory default successful |
| 545 | Parameter reset fail | M | On | Off | Setting of device configuration to factory setting has failed |
| 565 | Configuration | M | On | Off | Invalid configuration of sample preparation system<br>1. In **Setup/Sample preparation**, check the number of channels used, their operating mode and type of installation.<br>2. Check the permitted combinations of sample preparation and analyzers, see the Operating Instructions for the sample preparation system. |
| 714 | Filter mats change | M | On | Off | Filter mat change necessary<br>The limit value for operating hours has been exceeded<br>► Replace the filter mats and reset the operating hours counter in the Diagnostics menu. |
| 715 | Calibration expired | M | On | Off | The validity of the last calibration has expired. The date of the last calibration is too far in the past. Measurement can still take place.<br>Possible reasons:<br>Manual intervention has prevented automatic calibration<br>1. Calibrate analyzer manually.<br>2. Check device configuration. |
| 716 | Calibration expired | S | On | Off | Calibration has failed or is not reliable<br>Possible reasons:<br>Stability criteria are not met<br>1. Check the configuration and perform a manual calibration again.<br>2. Contact the Service Department. |
| 717 | Photometer defective | F | On | On | Photometer defective<br>Possible reasons:<br>▪ No lamp voltage<br>▪ No lamp power<br>► Contact the Service Department. |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 726 | Liquids warning | M | On | Off | Consumable liquids, warning<br>Measurement can still take place.<br>Possible reasons<br>▪ The level of one or more liquids is low<br>▪ One or more liquids almost past their shelf life.<br>▶ Top up/replace the liquids in question and reset the counter in **Diagnostics/Operating time information**. |
| 727 | Liquids alarm | F | On | Off | Consumable liquids, alarm<br>Measurement can still take place.<br>Possible reasons<br>▪ The level of one or more liquids is low<br>▪ One or more liquids past their shelf life.<br>▶ Top up/replace the liquids in question and reset the counter in **Diagnostics/Operating time information**. |
| 731 | Leakage detected | F | On | Off | Leak detected in the sample preparation system or analyzer<br>1. Check hoses and connections.<br>2. Check solenoid valves.<br>3. Check leak sensor.<br>4. Check the free outlet on the analyzer.<br>5. Replace defective parts and, if necessary, reset the operating hours counters in the Diagnostics menu. |
| 732 | Wear parts alarm | F | On | On | One or more wear parts has exceeded its service life.<br>▶ Replace the wear parts in question and reset the counter in **Diagnostics/Operating time information**. |
| 733 | Wear parts warning | M | On | Off | One or more wear parts has almost reached the end of its service life.<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 intake<br>▪ Suction line blocked or leaking<br>▪ No inflow of sample<br>1. Check the suction line and suction strainer.<br>2. Check inflow of sample. |
| 937 | Controlled variable | S | On | Off | Controller input warning<br>Status of the controller variable is not OK<br>▶ Check application. |
| 938 | Controller setpoint | S | On | Off | Controller input warning<br>Status of set point is not OK<br>▶ Check application. |
| 939 | Control. disturbance | S | On | Off | Controller input warning<br>Status of disturbance variable is not OK<br>▶ Check application. |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 940 | Process value | S | On | Off | Measured value out of specification<br>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<br>Invalid measured value.<br>1. Change the measuring range.<br>2. Calibrate the system. |
| 951 - 958 | Hold active CH1 .. | C | On | Off | Output values and status of the channels are on hold.<br>► Wait until the hold is deactivated again. |
| 961 - 968 | Diagnostic module 1 (961)<br>...<br>Diagnostic module 8 (968) | S | Off | Off | Diagnostic module is enabled |
| 969 | Modbus Watchdog | S | Off | Off | The device did not receive a Modbus telegram from the master within the specified time. The status of Modbus process values received is set to invalid |
| 970 | Curr. input overload | S | On | On | Current input overloaded<br>The current input is switched off from 23 mA due to overload and reactivated automatically when a normal load is present. |
| 971 | Current Input low | S | On | On | Current input too low<br>At 4 to 20 mA, the input current is less than the lower failure current.<br>► Check the input for short-circuiting. |
| 972 | Curr. input > 20 mA | S | On | On | Current output range exceeded |
| 973 | Current Input < 4 mA | S | On | On | Current output range undershot |
| 974 | Diagnostics confirm. | C | Off | Off | User has acknowledged the message displayed in the measuring menu. |
| 975 | Device restart | C | Off | Off | Device reset |
| 976 | PFM/PWM value high | S | On | Off | Pulse frequency modulation: output signal exceeded/undershot. Measured value outside the specified range.<br>▪ Sensor in air<br>▪ Air pockets in assembly<br>▪ Incorrect flow to sensor<br>▪ Sensor fouled<br>1. Clean the sensor<br>2. Check plausibility.<br>3. Adjust the PFM configuration. |
| 977 | PFM/PWM value low | S | On | Off | |
| 978 | ChemoClean Failsafe | S | On | On | No feedback signal detected within the configured period.<br>1. Check application.<br>2. Check wiring.<br>3. Extend the duration. |
| 990 | Deviation limit | F | On | On | Redundancy: limit value of percentage deviation exceeded |
| 991 | CO2 conc. range | F | On | On | $CO_2$ concentration (degassed conductivity) outside the measuring range |

| No. | Message | Factory settings | | | Tests or remedial action |
|---|---|---|---|---|---|
| | | S [1] | D [2] | F [3] | |
| 992 | pH calculation range | F | On | On | pH calculation outside the measuring range |
| 993 | rH calculation range | F | On | On | rH calculation outside the measuring range |
| 994 | Difference conduct. | F | On | On | Dual conductivity outside the measuring range |

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

### 11.6.2 Sensor-specific diagnostic messages

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## 11.7 Pending diagnostic messages

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

The following messages are directly displayed every time you enter the menu:
- Most important message
  Diagnostic message recorded with the highest criticality level
- Past message
  Diagnostic message whose cause is no longer present.

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

## 11.8 Diagnostic list

All the current diagnostic messages are listed here.

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

## 11.9 Logbooks

### 11.9.1 Available logbooks

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

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

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

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

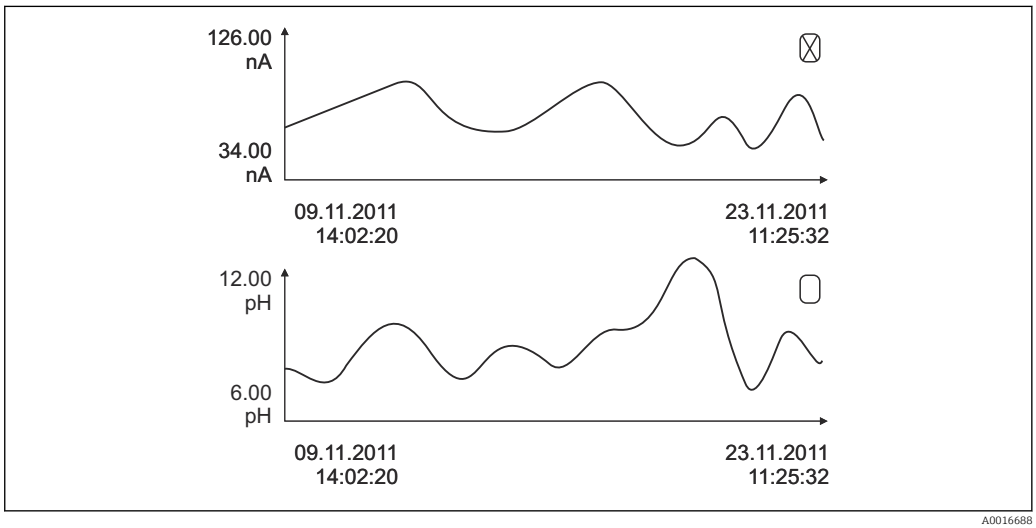
## 11.9.2 Menu Logbooks

| DIAG/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ All events | | Chronological list of all the logbook entries, with information on the type of event |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 entry**<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 entry**<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 use this to delete all the operation logbook entries. |

| DIAG/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Diagnostic events | | Chronological list of the diagnostics events |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 use this to delete all the diagnostics logbook entries. |
| ▶ Analyzer events | | Entries for analyzer events, such as measurement, cleaning and calibration. |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 use this to delete all analyzer event entries. |

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

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




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

| DIAG/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Analyzer data logbooks | | Data logbooks for the data of the wet-chemical analyzers |
| ▶ Data logbook SP1 | | |
| Source of data | Read only | Displays the measuring channel |
| Measuring parameter | Read only | Displays the measurement parameter recorded |
| Unit | Read only | Displays the unit |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 menu **General settings**/ **Logbooks**. |
| ▷ Delete all entries | Action | You can use this to delete all data logbook entries. |
| ▶Absorption data logbook | | |
| Curve | Read only | Displays the absorption curve |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 menu **General settings**/ **Logbooks**. |
| ▷ Delete all entries | Action | You can delete all the absorption data logbook entries here. |
| ▶ Raw data logbook | | |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶Show plot | Graphic display of the logbook entries | The entries are displayed according to your settings in the menu **General settings**/ **Logbooks**. |
| ▶ Set plotting window range | | Here you can specify the start and end times of the logbook entries to be displayed graphically. |
| Plotter begin | **Selection**<br>▪ First entry<br>▪ Date/Time<br>**Factory setting**<br>First entry | ▪ **First entry**: Defines the first entry saved in the logbook as the start time.<br>▪ **Date/Time**: Defines the set date/time as the start time. |
| Plotter end | **Selection**<br>▪ Last entry<br>▪ Date/Time<br>**Factory setting**<br>Last entry | ▪ **First entry**: Defines the last entry saved in the logbook as the end time.<br>▪ **Date/Time**: Defines the set date/time as the end time. |
| ▶ Show plot | Graphic display of the logbook entries | The entries are displayed according to your settings in the menu **General settings**/ **Logbooks**. |
| ▷ Delete all entries | Action | You can delete all the absorption data logbook entries here. |

| DIAG/Logbooks | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Data logbooks | | Chronological list of the data logbook entries for sensors |
| Data logbook 1 … 8<br><Logbook name> | | This submenu is available for each data logbook that you have set up and activated. |
| Source of data | Read only | Input or mathematical function is displayed |
| Measured value | Read only | Measured value being recorded is displayed |
| Log time left | Read only | Display of days, hours and minutes until logbook is full.<br>▸ Pay attention to the information on selecting the memory type in the menu **General settings/Logbooks**. |
| ▶ Show | Events are displayed | Select a particular event to display more detailed information. |
| ▶ Go to date | **User entry**<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 display is according to your settings in the menu **General settings/Logbooks**. |
| Select 2nd plot | Select another data logbook | You can view a second logbook at the same time as the current one. |
| ▷ Delete all entries | Action | You can use this to delete all data logbook entries. |
| ▶ Save logbooks | | |
| File format | **Selection**<br>▪ CSV<br>▪ FDM | ▸ Save the logbook in the preferred file format.<br>You can then open the saved CSV file on the PC in MS Excel, for example, and make further edits here. [1]. You can import the FDM files into FieldCare and archive them so that they are tamper-proof. |
| ▷ All data logbooks<br>▷ Data logbook SP1<br>▷ Absorption data logbook<br>▷ Raw data logbook<br>▷ Data logbook 1 … 8<br>▷ All event logbooks<br>▷ Calibration logbook<br>▷ Diagnostic logbook<br>▷ Analyzer data logbook<br>▷Analyzer event logbook<br>▷Analyzer calibration logbook<br>▷ Configuration logbook<br>▷ HW version logbook<br>▷ Version logbook | Action,<br>commences as soon as the option is selected | Use this function to save the logbook to an SD card.<br>▸ Save the logbook in the preferred file format. You can then open the saved CSV file on the PC in MS-Excel, for example, and edit it. You can import the FDM files into Fieldcare and archive them so they are tamper-proof. |
| The file name is made up of the **Logbook ident** (**Menu/Setup/General settings/Logbooks**), an abbreviation for the particular logbook and a time stamp. | | |

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

## 11.10 System information

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

| DIAG/System information | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ SD card | Read only<br>▪ Total<br>▪ Free memory | |
| ▶ System modules | | |
| Backplane | 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. |
| Base | | |
| Display module | | |
| Extension module 1 … 8 | | |
| ▶ Sensors | 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.<br>The csv file can be read and edited in MS Excel, for example. This file can be used when servicing the device. |

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

## 11.11 Sensor information

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

Information in the following categories is displayed:
- **Extreme values**
  Extreme conditions to which the sensor was previously exposed, e. g. min./max. temperatures [2)]
- **Operating time**
  Operating time of the sensor under defined extreme conditions
- **Calibration information**
  Calibration data of the last calibration
- **Sensor specifications**
  Measuring range limits for main measured value and temperature
- **General information**
  Information on sensor identification

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

## 11.12 Simulation

You can simulate values at inputs and outputs for testing purposes:
- Current values at current outputs
- Measured values at inputs
- Relay contact opening or closing

Only current values are simulated. Via the simulation function, it is not possible to calculate the totalized value for the flow or rainfall.

2) Not available for all sensor types.

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

| DIAG/Simulation | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▶ Current output x:y | | Simulation of an output current<br>This menu appears once for each current output. |
| Simulation | **Selection**<br>▪ Off<br>▪ On<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 | **Selection**<br>▪ Off<br>▪ On<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. |
| State | **Selection**<br>▪ Low<br>▪ High<br>**Factory setting**<br>Low | ▶ Set the desired simulation value.<br>The relay switches in accordance with your setting when you switch on the simulation. On the measured value display, you see **On** (= **Low**) or **Off**(= **High**) for the simulated relay state. |
| ▶ Meas. inputs | | Simulation of a measured value (only for sensors)<br>This menu appears once for each measuring input. |
| Channel : parameter | | |
| Simulation | **Selection**<br>▪ Off<br>▪ On<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 | ▶ Set the desired simulation value. |
| Sim. temperature | **Selection**<br>▪ Off<br>▪ On<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. |
| Binary input x:y<br>Binary output x:y | | Simulation of a binary input or output signal<br>The number of submenus available corresponds to the number of binary inputs or outputs. |
| Simulation | **Selection**<br>▪ Off<br>▪ On<br>**Factory setting**<br>Off | |
| State | **Selection**<br>▪ Low<br>▪ High | |

# 11.13 Device test

## 11.13.1 Analyzer

| DIAG/System testAnalyzer/Photometer | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Photometer status | Read only | Displays the status of the photometer<br>▪ 100 to 70%<br>Good state<br>▪ 70 to 50%<br>▪ Cuvette somewhat dirty<br>▪ Lamp or filter starting to age<br>▪ Measurement is OK, continue monitoring<br>▪ 50 to 20%<br>▪ Cuvette dirty<br>▪ Lamp or filter aging<br>▪ Can affect the measurement<br>▪ < 20%<br>▪ Maintenance needed: reactor, filter or lamp<br>▪ Reliable measurement is no longer possible |
| Number of flashes | Read only | |
| Failed flashes | Read only | |
| ▷ **Start photometer status reevaluation** | | Intensity measurement with zero standard to reevaluate the photometer status |
| ▶ **Photometer test** | | The test determines the following values:<br>▪ Current intensity 1<br>▪ Current intensity 2<br>▪ Lamp Voltage<br>▪ Temperature |
| ▷ **Start for 5 min** | | |

| DIAG/System testAnalyzer/Cooling module [1] | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Temperature (reagent) | Read only | |
| Current consumption | Read only | |
| Temperature (extern) | Read only | |
| Mode | Read only | |
| ▷ **Cooling for 60 minutes** | | |
| ▷ **Off for 60 minutes** | | |

1) Test the cooling function of the Peltier cooler

| DIAG/System testAnalyzer/Reactor | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Reactor temperature | Read only | Displays the temperature of the digestion reactor |
| Reactor current | Read only | Displays the reactor current |
| Reactor state | Read only | |
| Reactor fan | Read only | |
| ▷ On | | |

| DIAG/System testAnalyzer/Valves | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| Valve selection | **Selection**<br>▪ Cleaner C<br>▪ Drain D<br>▪ Exhaust E<br>▪ Reactor R<br>▪ Reagent RB<br>▪ Reagent RK<br>▪ Zero standard S0<br>▪ Standard S1<br>▪ Air A<br>▪ Process P<br>▪ Dilution water W | ▶ Select the valves that should be tested. |
| ▷ Open | | Opens the selected valve. |
| ▷ Close | | Closes the selected valve. |

| DIAG/System testAnalyzer/Pump | | |
|---|---|---|
| **Function** | **Options** | **Info** |
| ▷ Start for 1 minute | | |

### 11.13.2 Power supply

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

## 11.14 Resetting

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

## 11.15 Operating time information

List of functional and operating time counters
- Operating time filter mats
  Displays the period of usage in days
- Operating time photometer
- Remaining operating time

- Operating time pump hose
  Operating time of hoses
  - Process P
  - Dilution water W
- Operating time valve hose
  Operating time of hoses
  - Drain D
  - Dilution module DM
- Operating time cooling module
  The counter can also be reset here.

## 11.16 Firmware history

| Date | Version | Changes to firmware | Documentation |
|---|---|---|---|
| 03/2021 | 01.09.00 | Extension<br>▪ New TN parameter<br>▪ Support for new base module<br>▪ PROFINET<br>▪ Reference measurement function for the versions CA80TN-HR<br>▪ New sub-measuring ranges for the versions CA80TN-HR<br>▪ Password-protected access to the configuration for the versions CA80TN-HR<br><br>Improvements<br>▪ Air bubble detection, measurement is repeated if the threshold value is overshot<br>▪ Minimum time for compressed air cleaning reduced to 1 s | BA01981C/07/../02.21<br>BA01245C/07/../08.20 |

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# 12 Maintenance

Effects on process and process control
- ▶ Take all the necessary precautions in time to ensure the operational safety and reliability of the entire measuring point.

**⚠ WARNING**

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

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

**⚠ CAUTION**

**Maintenance activities in automatic mode**

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

**NOTICE**

**Electrostatic discharge (ESD)**

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

**NOTICE**

**Failure to observe the maintenance intervals**

Possibility of material damage
- ▶ Observe the recommended maintenance intervals.

## 12.1 Maintenance schedule

| Interval | Maintenance work |
|---|---|
| 3 months | ▪ Replace reagent CY80TN (typically; with a measuring interval of 1 h)<br>▪ Replace standard solution CY80TN (typically; with a calibration interval of 96 h) |
| 6 months | ▪ Clean filter mats<br>▪ Replace hose of peristaltic pump<br>▪ Replace sample hose (if necessary)<br>▪ Replace PharMed hoses of pinch valves |
| 12 months | ▪ Replace pump head<br>▪ Replace filter mats |
| 24 months | Replace O-rings of pressure reactor (Endress+Hauser Service) |
| If required | ▪ Clean the housing<br>▪ Check the fan of the cooling module for dirt and vacuum clean if necessary<br>▪ Clean dilution vessel<br>▪ Rinse the system<br>▪ Replace plug-in connectors of hoses<br>▪ Tighten connectors finger-tight<br>▪ Replace PTFE hoses<br>▪ Depending on measuring interval and dilution factor:<br>Visual inspection of the level of the waste vessel |

## 12.2 Maintenance tasks

### 12.2.1 Software menu Maintenance

**Menu/Operation/Maintenance**

- Bottle replacement
  If level monitoring is activated: specify when bottles are replaced.
- Filter mats replacement
  Operating time counter, can be reset here. Replace filter mats: → 134
- Pump hose replacement
  Operating time counter, can be reset here. Replace hose: → 134
- Valve hose replacement
  Operating time counter, can be reset here. Replace hose: → 134
- Commissioning
  Automatic commissioning, no recurring maintenance tasks → 42
- Decommissioning
  → 135
- Empty reactor

### 12.2.2 Setting the manual mode

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

1. Press the **MODE** soft key.
   ↳ The current mode is displayed: **Automatic**
2. Select an action: **Manual mode**
   ↳ The device changes to the manual mode.
3. Wait until all operations have stopped.
4. **Alternatively:**
   Stop actions currently running under: **Menu/Operation/Manual operation**.

### 12.2.3 Cleaning

**⚠ CAUTION**

**Risk of injury from reagents escaping**

▶ Before replacing, always rinse the system first.

**Cleaning the housing**

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

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

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

**NOTICE**

**Cleaning agents not permitted**

Damage to the housing surface or housing seal

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

### Rinsing the system

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

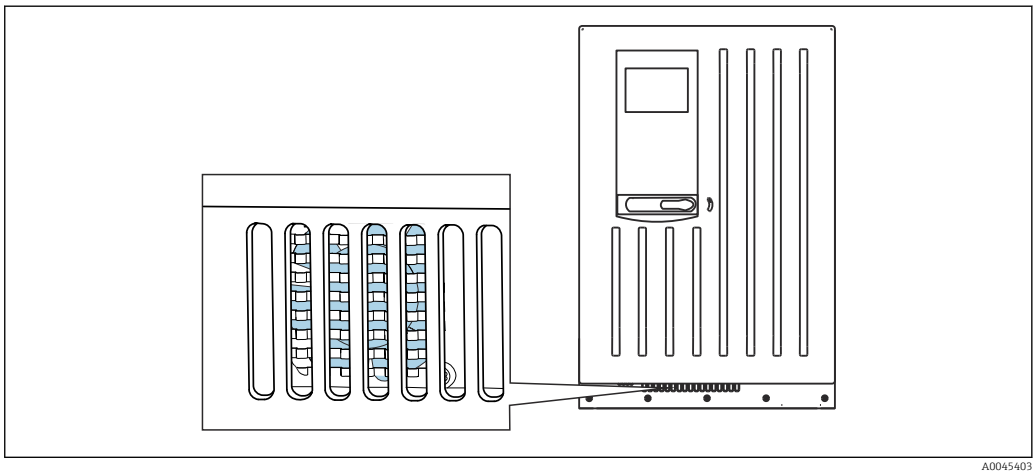
### Emptying the hoses

1. Stop the sample supply.
2. If you have not already done so,
   set the manual mode.
3. Pull all the hoses out of the reagent bottles as far as they will go so that the hose ends are outside of the liquid.
4. In addition, disconnect the sample hose (P) and remove the hose of the dilution water (W) from the bottle so that the hose end is outside of the liquid.
5. Select **Menu/Operation /Maintenance/Decommissioning/Empty hoses** to remove the liquid from the hoses.
   ↳ The hoses are automatically purged with air and emptied. This process takes several minutes.
6. Wait until this action has finished. Under **MODE/Info** you can check whether the action has finished.

### Rinsing the analyzer with water

1. Open all the reagent bottles and carefully remove the hoses together with the covers. Then close the bottles firmly.
2. Dry the ends of the hoses with a clean paper towel.
3. Immerse all the hoses into a beaker with approx. 200 ml of distilled water in order to rinse the system with water.
4. Trigger the action: **Menu/Operation /Maintenance/Decommissioning/Rinse with water**.
   ↳ The system is rinsed automatically and emptied. This process takes approx. 8 minutes.
5. Once the action is finished, remove the hoses from the beaker and dry them with a clean paper towel.
6. To remove the liquid from the hoses: **Menu/Operation/Maintenance/Decommissioning/Empty hoses**.
   ↳ The hoses are automatically purged with air and emptied. This process takes several minutes.
7. Wait until this action has finished. Check whether the action has finished: **MODE/Info**.
8. Put all the hoses back into the bottles and connect the sample hose to the valve.

### Cleaning the fan of the cooling module




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

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

## 12.2.4 Replacing reagents

### Removing bottles

1. Stop the sample supply.
2. If you have not already done so,
   set the manual mode.
3. Pull the hoses (RB, RK, RN, S1, S0, C) out of the reagent bottles as far as they will go so that the hose ends are outside of the liquid.
4. Select **Menu/Operation /Maintenance/Bottle change mode/Bottle removal/ Bottle selection**.
5. Select the bottles that you want to remove and press **OK** to confirm.
6. Select **Confirm bottles removed**.

### Replacing bottles

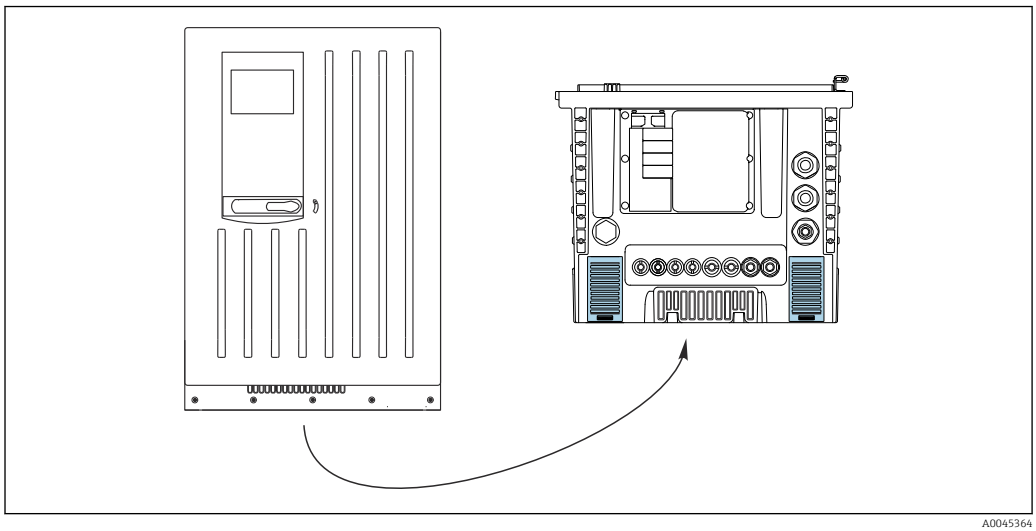
1. Replace the removed bottles with fresh reagent .
   ↳ Reagents must be prepared according to the instructions for mixing a reagent.
2. Select **Menu/Operation /Maintenance/Bottle change mode/Bottle insertion/ Bottle selection**.
3. Select all the bottles that you have replaced and press **OK** to confirm.
4. Select **Confirm bottles inserted**.
5. If bottle level monitoring is activated (**Menu/Setup/Analyzer/Extended setup/ Diagnostics settings/Bottles**), you must reset this under **Menu/Operation/ Maintenance/ Bottle change mode/Bottle insertion/Reset filling levels**.
6. Following the replacement, a zero point calibration must be performed and the calibration factor must be redetermined: **Menu/Operation/Manual operation/ Determine zero point** and **/Determine calibration factor** (in the versions CA80TN-AA/CA/GR, both actions are provided in one function: **Determine zero point and calibr. factor**).
7. Go back to the **MODE/Continue automatic mode** or **MODE/Start automatic mode** to start the normal measurement.

### 12.2.5 Replacing the hoses

1. Rinse the system. → 132
   ↳ There should not be any more sample left in the dosing unit.
2. Remove the bottles and the bottle tray.
3. Replace the hoses with hoses of the same diameter and length. Attach hose labels to the new hoses.
4. Tighten the hose glands carefully; leaks can result in bad measured values.
5. Secure the cover and place the bottle tray back into the housing.
6. Connect the bottles to the appropriate covers and hoses.
7. Select **Menu/Operation /Maintenance/Bottle change mode/Bottle insertion/ Bottle selection**.
8. Select all the bottles and press **OK** to confirm.
9. Select **Confirm bottles inserted**.
10. Press the **MODE** soft key and select **Continue automatic mode** or **Start automatic mode**.

### 12.2.6 Replacing filter mats

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




65 *Fan screen on the bottom*

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

## 12.3 Taking out of service

**⚠ CAUTION**

**Activities while the analyzer is in operation**

Risk of injury and infection from medium!

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

**NOTICE**

**Do not operate the analyzer for longer than 5 days without taking it out of service properly!**

Can result in damage to the device.

- Take the analyzer out of service as described.

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

1. Set the manual mode
2. Empty the hoses
3. Rinse the analyzer
4. Empty the hoses again

### 12.3.1 Setting the manual mode

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

1. Press the **MODE** soft key.
   ↳ The current mode is displayed: **Automatic**
2. Select an action: **Manual mode**
   ↳ The device changes to the manual mode.
3. Wait until all operations have stopped.
4. **Alternatively:**
   Stop actions currently running under: **Menu/Operation/Manual operation**.

### 12.3.2 Emptying the hoses

1. Pull the hoses (RB, RK, C, S1, S0) out of the reagent bottles as far as they will go so that the hose ends are outside of the liquid.
2. Only for version CA80TN-HR:
   Also pull the REF hose out of the liquid as far as it will go.
3. Pull the sample hose (P) out of the bottle, and if the optional dilution module is installed pull the hose to the water for the dilution module (W) out of the bottle, so that the hose end is outside of the liquid.
4. Select **Menu/Operation /Maintenance/Decommissioning/Empty hoses** to remove the liquid from the hoses.
   ↳ The hoses are automatically purged with air and emptied. This process takes several minutes.
   Following the successful completion of the action, the following message appears **The action was successful**.

### 12.3.3 Rinsing the analyzer

1. Open all the reagent bottles and carefully remove the hoses together with the covers. Then close the bottles firmly.
2. Dry the ends of the hoses with a clean paper towel.
3. Immerse all the hoses into a beaker with approx. 200 ml (6.76 fl oz) of distilled water in order to rinse the system with water.
4. Select **Menu/Operation /Maintenance/Decommissioning/Rinse with water**.
   ↳ The system is rinsed automatically and emptied. This process takes approx. 8 minutes.
   Following the successful completion of the action, the following message appears **The action was successful**.
5. Once the action is finished, remove the hoses from the beaker and dry them with a clean paper towel.

### 12.3.4 Emptying the hoses again

1. **Menu/Operation /Maintenance/Decommissioning/Empty hoses** must be selected to remove the liquid from the hoses.
   ↳ The hoses are automatically purged with air and emptied. This process takes several minutes.
2. Wait until this action has finished. Following the successful completion of the action, the following message appears **The action was successful**.
3. The analyzer can now be disconnected from the mains supply.

# 13 Repair

## 13.1 General information

The repair and conversion concept provides for the following:
- The product has a modular design
- Spare parts are grouped into kits which include the associated kit instructions
- Only use original spare parts from the manufacturer
- Repairs are carried out by the manufacturer's Service Department or by trained users
- Certified devices can only be converted to other certified device versions by the manufacturer's Service Department or at the factory
- Observe applicable standards, national regulations, Ex documentation (XA) and certificates

1. Carry out the repair according to the kit instructions.
2. Document the repair and conversion and enter, or have entered, in the Life Cycle Management tool (W@M).

## 13.2 Spare parts

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

www.endress.com/device-viewer

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

## 13.3 Return

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

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

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

## 13.4 Disposal

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

**Dispose of batteries correctly**

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

**Disposing of chemicals**

- ⚠ CAUTION

  **Risk of injury if used reagents and reagent waste are disposed of incorrectly!**
  - When disposing, follow the instructions of the safety data sheets for the chemicals used.
  - Observe the local regulations regarding waste disposal.

# 14 Accessories

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

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

## 14.1 Device-specific accessories

### 14.1.1 Consumables

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

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

The following consumables are available:
- Reagent and standard solutions CY80TN
- Cleaner CY800 (for hoses in the device)

### 14.1.2 Sensors

**pH glass electrodes**

**Memosens CPS11E**
- pH sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps11e

Technical Information TI01493C

**Memosens CPS41E**
- pH sensor for process technology
- With ceramic junction and KCl liquid electrolyte
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps41e

Technical Information TI01495C

**Memosens CPS71E**
- pH sensor for chemical process applications
- With ion trap for poison-resistant reference
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e

Technical Information TI01496C

**Memosens CPS91E**
- pH sensor for heavily polluted media
- With open aperture
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e

Technical Information TI01497C

**Memosens CPS31E**
- pH sensor for standard applications in drinking water and swimming pool water
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps31e

Technical Information TI01574C

**Memosens CPS71E**
- pH sensor for chemical process applications
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps71e

Technical Information TI01496C

**Memosens CPS91E**
- pH sensor for heavily polluted media
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps91e

Technical Information TI01497C

**Ceramax CPS341D**
- pH electrode with pH-sensitive enamel
- Meets highest demands of measuring accuracy, pressure, temperature, sterility and durability
- Product Configurator on the product page: www.endress.com/cps341d

Technical Information TI00468C

**Orbipac CPF81D**
- Compact pH sensor for installation or immersion operation
- In industrial water and wastewater
- Product Configurator on the product page: www.endress.com/cpf81d

Technical Information TI00191C

### ORP electrodes

**Memosens CPS12E**
- ORP sensor for standard applications in process and environmental engineering
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps12e

Technical Information TI01494C

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

Technical Information TI01575C

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

Technical Information TI01576C

**Memosens CPS92E**
- ORP sensor for use in heavily polluted media
- Digital with Memosens 2.0 technology
- Product Configurator on the product page: www.endress.com/cps92e

Technical Information TI01577C

**Orbipac CPF82D**
- Compact ORP sensor for installation or immersion operation in process water and wastewater
- Product Configurator on the product page: www.endress.com/cpf82d

Technical Information TI00191C

### Conductivity sensors with inductive measurement of conductivity

**Indumax CLS50D**
- High-durability inductive conductivity sensor
- For standard and hazardous area applications
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cls50d

Technical Information TI00182C

### Conductivity sensors with conductive measurement of conductivity

**Memosens CLS21E**
- Digital conductivity sensor for media with medium or high conductivity
- Conductive measurement
- With Memosens 2.0
- Product Configurator on the product page: www.endress.com/cls21e

Technical Information TI01528C

### Oxygen sensors

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

Technical Information TI00413C

**Oxymax COS61D**
- Optical oxygen sensor for drinking water and industrial water measurement
- Measuring principle: quenching
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos61d

Technical Information TI00387C

**Memosens COS81D**
- Sterilizable, optical sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cos81d

Technical Information TI01201C

### Chlorine dioxide and chlorine sensors

**Memosens CCS50D**
- Membrane-covered amperometric sensor for chlorine dioxide
- With Memosens technology
- Product Configurator on the product page: www.endress.com/ccs50d

Technical Information TI01353C

**Memosens CCS51D**
- Sensor for measuring free chlorine
- Product configurator on the product page: www.endress.com/ccs51d

Technical Information TI01423C

### Ion-selective sensors

**ISEmax CAS40D**
- Ion selective sensors
- Product Configurator on the product page: www.endress.com/cas40d

Technical Information TI00491C

### Turbidity sensors

**Turbimax CUS51D**
- For nephelometric measurements of turbidity and solids in wastewater
- 4-beam scattered light method
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus51d

Technical Information TI00461C

**Turbimax CUS52D**
- Hygienic Memosens sensor for turbidity measurement in drinking water, process water and in utilities
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cus52d

Technical Information TI01136C

### SAC and nitrate sensors

**Viomax CAS51D**
- SAC and nitrate measurement in drinking water and wastewater
- With Memosens technology
- Product Configurator on the product page: www.endress.com/cas51d

Technical Information TI00459C

**Interface measurement**

**Turbimax CUS71D**
- Immersion sensor for interface measurement
- Ultrasonic interface sensor
- Product Configurator on the product page: www.endress.com/cus71d

Technical Information TI00490C

### 14.1.3 Cable junction with Velcro strip

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

## 14.2 Communication-specific accessories

### 14.2.1 Additional functionality

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

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

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

### 14.2.2 Software

**Memobase Plus CYZ71D**
- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations stored in database
- Product Configurator on the product page: www.endress.com/cyz71d

Technical Information TI00502C

**Field Data Manager Software MS20/21**
- PC software for central data management
- Visualization of series of measurements and logbook events
- SQL database for secure data storage

## 14.3 System components

### 14.3.1 Measuring cables

**Memosens data cable CYK10**
- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk10

Technical Information TI00118C

**Memosens data cable CYK11**
- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: www.endress.com/cyk11

Technical Information TI00118C

**Measuring cable CYK81**
- Unterminated cable for extending sensor cables (e.g. Memosens, CUS31/CUS41)
- 2 x 2 cores, twisted with shielding and PVC sheath (2 x 2 x 0.5 $mm^2$ + shielding)
- Sold by meter, Order No.: 51502543

### 14.3.2 SD card

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

# 15 Technical data

## 15.1 Input

| | | |
|---|---|---|
| Measured variables | Total nitrogen [mg/l, ppm] | |
| Measuring range | CA80TN-**S5: | 0 to 10 mg/l total-N |
| | CA80TN-**S6: | 0 to 50 mg/l total-N |
| | CA80TN-**S7: | 0 to 200 mg/l total-N |
| Types of input | ▪ 1 to 4 digital sensor inputs for sensors with Memosens protocol (optional)<br>▪ Analog current inputs (optional)<br>▪ Binary inputs (optional) | |
| Input signal | Depending on version<br>2 x 0/4 to 20 mA (optional), passive, potentially isolated | |
| Current input, passive | **Span**<br>> 0 to 20 mA<br>**Signal characteristic**<br>Linear<br>**Internal resistance**<br>Non-linear<br>**Test voltage**<br>500 V | |
| Cable specification (for optional sensors with Memosens technology) | **Cable type**<br>Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector (optional)<br>**Cable length**<br>Max. 100 m (330 ft) | |

## 15.2 Output

| | |
|---|---|
| Output signal | Depending on version:<br>▪ 2 x 0/4 to 20 mA, active, potentially isolated (standard version)<br>▪ 4 x 0/4 to 20 mA, active, potentially isolated (version with 2 additional analog outputs)<br>▪ 6 x 0/4 to 20 mA, active, potentially isolated (version with 4 additional analog outputs)<br>▪ Binary outputs |

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

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

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

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

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

| | |
|---|---|
| Signal on alarm | Adjustable, as per NAMUR Recommendation NE 43<br>▪ In measuring range 0 to 20 mA:<br>Failure current from 0 to 23 mA<br>▪ In measuring range 4 to 20 mA:<br>Failure current from 2.4 to 23 mA<br>▪ Factory setting for failure current for both measuring ranges:<br>21.5 mA |
| Load | Max. 500 Ω |
| Transmission behavior | Linear |

## 15.3 Current outputs, active

| | |
|---|---|
| Span | 0 to 23 mA |
| Signal characteristic | Linear |
| Electrical specification | **Output voltage**<br>Max. 24 V<br>**Test voltage**<br>500 V |
| Cable specification | **Cable type**<br>Recommended: shielded cable<br>**Cable specification**<br>Max. 2.5 $mm^2$ (14 AWG) |

## 15.4 Relay outputs

Electrical specification

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

**Maximum load**
- Alarm relay: 0.5 A
- All other relays: 2.0 A

**Relay switching capacity**

*Base module (Alarm relay)*

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

*Extension module*

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

Minimum load (typical)
- Min. 100 mA at 5 V DC
- Min. 1 mA at 24 V DC
- Min. 5 mA at 24 V AC
- Min. 1 mA at 230 V AC

## 15.5 Protocol-specific data

PROFIBUS DP

| | |
|---|---|
| Manufacturer ID | $11_h$ |
| Device type | $155E_h$ |
| Profile version | 3.02 |
| Device database files (GSD files) | www.endress.com/profibus<br>Device Integration Manager DIM |
| Output variables | 16 AI blocks, 8 DI blocks |
| Input variables | 4 AO blocks, 8 DO blocks |
| Supported features | ▪ 1 MSCY0 connection (cyclical communication, master class 1 to slave)<br>▪ 1 MSAC1 connection (acyclical communication, master class 1 to slave)<br>▪ 2 MSAC2 connections (acyclical communication, master class 2 to slave)<br>▪ Device lock: The device can be locked using the hardware or software.<br>▪ Addressing using DIL switches or software<br>▪ GSD, PDM DD, DTM |

Modbus RS485

| | |
|---|---|
| Protocol | RTU/ASCII |
| Function codes | 03, 04, 06, 08, 16, 23 |
| Broadcast support for function codes | 06, 16, 23 |
| Output data | 16 measured values (value, unit, status), 8 digital values (value, status) |
| Input data | 4 setpoints (value, unit, status), 8 digital values (value, status), diagnostic information |
| Supported features | Address can be configured using switch or software |

## Modbus TCP

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

## EtherNet/IP

| | | |
|---|---|---|
| Log | EtherNet/IP | |
| ODVA certification | Yes | |
| Device profile | Generic device (product type: 0x2B) | |
| Manufacturer ID | $0x049E_h$ | |
| Device type ID | 0x109F | |
| Polarity | Auto-MIDI-X | |
| Connections | CIP | 12 |
| | I/O | 6 |
| | Explicit message | 6 |
| | Multicast | 3 consumers |
| Minimum RPI | 100 ms (default) | |
| Maximum RPI | 10000 ms | |
| System integration | EtherNet/IP | EDS |
| | Rockwell | Add-on-Profile Level 3, Faceplate for Factory Talk SE |
| IO data | Input (T → O) | Device status and diagnostic message with highest priority<br>Measured values:<br>▪ 16 AI (analog input) + Status + Unit<br>▪ 8 DI (discrete input) + Status |
| | Output (O → T) | Actuating values:<br>▪ 4 A0 (analog output) + status + unit<br>▪ 8 DO (discrete output) + Status |

PROFINET

| | |
|---|---|
| Protocol | "Application layer protocol for decentral device periphery and distributed automation", PNIO Version 2.34 |
| Communication type | 100 MBit/s |
| Conformance Class | Conformance Class B |
| Netload Class | Netload Class II |
| Baud rate | Automatic 100 Mbps with full-duplex detection |
| Cycle times | From 32 ms |
| Device profile | Application interface identifier 0xF600<br>Generic device |
| PROFINET interface | 1 port, Realtime Class 1 (RT_CLASS_1) |
| Manufacturer ID | $0x11_h$ |
| Device type ID | $0x859F_h$ |
| Device description files (GSD) | Information and files under:<br>▪ www.endress.com<br>On the product page for the device: Documents/Software → Device drivers<br>▪ www.profibus.com<br>On the website under Products/Product Finder |
| Polarity | Auto-polarity for automatic correction of crossed TxD and RxD pairs |
| Supported connections | ▪ 1 x AR (IO Controller AR)<br>▪ 1 x AR (IO-Supervisor Device AR connection allowed)<br>▪ 1 x Input CR (Communication Relation)<br>▪ 1 x Output CR (Communication Relation)<br>▪ 1 x Alarm CR (Communication Relation) |
| Configuration options for measuring device | ▪ Web browser<br>▪ Manufacturer-specific software (FieldCare, DeviceCare)<br>▪ Device master file (GSD), can be read out via the integrated web server of the measuring device |
| Configuration of the device name | DCP protocol |
| Supported functions | ▪ Identification & maintenance<br>Simple device identification via:<br>▪ Process control system<br>▪ Nameplate<br>▪ Measured value status<br>The process variables are communicated with a measured value status<br>▪ Blinking feature (FLASH_ONCE) via the local display for simple device identification and assignment<br>▪ Device operation via operating tools (e.g. FieldCare, DeviceCare) |
| System integration | For information on system integration, see the Operating Instructions<br>▪ Cyclic data transmission<br>▪ Overview and description of the modules<br>▪ Status coding<br>▪ Startup configuration<br>▪ Factory setting |

Web server

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

| | |
|---|---|
| TCP port | 80 |
| Supported features | ▪ Remote-controlled device configuration(1 session)<br>▪ Save/restore device configuration (via SD card)<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

Supply voltage

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

Fieldbus connection

Supply voltage: not applicable

Power consumption

180 VA

Cable entries

- 4 x bores for M16, G3/8, NPT3/8", Memosens connection [3)]
- 4 x bores for M20, G1/2, NPT1/2"

Cable specification

| **Cable gland** | **Permitted cable diameter** |
|---|---|
| M16x1.5 mm | 4 to 8 mm (0.16 to 0.32") |
| M12x1.5 mm (for order version M12 socket for Memosens sensors) | 2 to 5 mm (0.08 to 0.20") |
| M20x1.5 mm | 6 to 12 mm (0.24 to 0.48") |
| NPT$^{3}/_{8}$" | 4 to 8 mm (0.16 to 0.32") |
| G$^{3}/_{8}$ | 4 to 8 mm (0.16 to 0.32") |
| NPT½" | 6 to 12 mm (0.24 to 0.48") |
| G½ | 7 to 12 mm (0.28 to 0.48") |

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

3)

Sensor connection (optional)

*Sensors with Memosens protocol*

| Sensor types | Sensor cable | Sensors |
|---|---|---|
| Digital sensors **without** additional internal power supply | With plug-in connection and inductive signal transmission | ▪ pH sensors<br>▪ ORP sensors<br>▪ Combined sensors<br>▪ Oxygen sensors (amperometric and optical)<br>▪ Conductivity sensors with conductive measurement of conductivity<br>▪ Chlorine sensors (disinfection) |
| | Fixed cable | Conductivity sensors with inductive measurement of conductivity |
| 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

Maximum measured error [4)]

| | |
|---|---|
| 0 to 10 mg/l (ppm) N (undiluted) | 0.1 mg/l (ppm) N ≤ 2 mg/l<br>3 % end of measuring range > 2mg/l |
| 0 to 20 / 50 / 100 mg/l (ppm) N | 3 % end of measuring range |
| 0 to 200 mg/l (ppm) N | 5 % end of measuring range |

Maximum measured error for sensor inputs

→ Documentation of the connected sensor

Maximum measured error for current inputs and outputs

Typical measured errors:

< 20 µA (with current values < 4 mA)

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

at 25 °C (77° F) in each case

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

LOD (limit of detection)

0.06mg/l (ppm) N [5)]

Repeatability [4)]

| Measuring range | Repeatability |
|---|---|
| 0 to 10 mg/l (ppm) N | 0.06 mg/l (ppm) N or 3 % of the measured value |
| 0 to 20 mg/l (ppm) N | 0.12 mg/l (ppm) N or 3 % of the measured value |
| 0 to 50 mg/l (ppm) N | 0.3 mg/l (ppm) N or 3 % of the measured value |
| 0 to 100 mg/l (ppm) N | 0.6 mg/l (ppm) N or 3 % of the measured value |
| 0 to 200 mg/l (ppm) N | 2 mg/l (ppm) N or 5 % of the measured value |

4) Measured errors include all the uncertainties of the analyzer. They do not include the uncertainties from the standard solutions used as a reference.
5) In the undiluted range

| | |
|---|---|
| Repeatability of sensor inputs | → Documentation of the connected sensor |
| Measuring interval | Continuous (approx. 55 min), adjustable 45 min to 24 h |
| Digestion time | 3 to 120 min |
| Sample requirement | Without dilution module<br>27 ml (0.91 fl oz)<br>With dilution module<br>15 ml (0.51 fl oz) |
| Reagent requirement | ▪ **RB**<br>1.35 ml (0.05 fl oz) per reagent and measurement<br>▪ **RK**<br>0.9 ml (0.03 fl oz) per reagent and measurement<br>▪ Given a measuring interval of 1 hour, one set of reagents lasts for 3 months |
| Standard requirement | Given a calibration interval of 96 h approx. 330 ml (11.2 fl.oz) per month |
| Dilution water requirement | Approx. 20 ml (0.68 fl.oz) per measurement<br>Demineralized water is recommended for expected sample concentrations of < 50 mg/l (ppm). |
| Calibration interval | 4 days |
| Cleaning interval | 4 days |
| Maintenance interval | Once weekly, depending on the application |
| Maintenance effort | ▪ Weekly: visual inspection<br>▪ Monthly: 1 hour |

## 15.8 Environment

| | |
|---|---|
| Ambient temperature range | +5 to +40 °C (41 to 104 °F) |
| Storage temperature | –20 to 60 °C (–4 to 140 °F) |
| Humidity | 10 to 95 %, non-condensing |
| Degree of protection | IP55 (cabinet, analyzer stand), TYPE 3R (cabinet) |

| | |
|---|---|
| Electromagnetic compatibility [6] | Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry |
| Electrical safety | According to EN/IEC 61010-1:2010, Class I equipment<br>Low voltage: overvoltage category II<br>For installations up to 2000 m (6500 ft) above MSL |
| Pollution degree | Pollution level 2 |

## 15.9 Process

| | |
|---|---|
| Sample temperature | 4 to 40 °C (39 to 104 °F) |
| Consistency of the sample | Low solids content, aqueous, homogenized |
| Sample supply | **Analyzer (without optional Y strainer):**<br>Unpressurized<br>**Y strainer (optional):**<br>▪ Permitted pressure range: max. 4 bar (58.01 psi)<br>▪ Flow: ensure sufficient flow for a Y strainer that is completely filled [7] |

## 15.10 Mechanical construction

| | |
|---|---|
| Dimensions | → 14 |

Materials

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

| **Parts in contact with medium** | |
|---|---|
| ▪ Manifold<br>▪ Valve seals<br>▪ Pinch valve | ▪ Plastic ETFE<br>▪ Plastic FKM<br>▪ Plastic PP and PCTFE |

6) Sufficient mains quality is required to operate the product as designated.
7) The greater the flow the greater the self-cleaning effect of the suction line. Preferred: > 1 $m^3$/h

| | |
|---|---|
| Hoses | ▪ PTFE<br>▪ Sample hose: PharMed<br>▪ Hoses of reactor valves into waste: C-Flex |
| Reactor<br>▪ Reactor valves<br>▪ Seal | <br>▪ PTFE<br>▪ FFKM plastic |

Hose entries

4 x bores for M32 for sample inflow and outflow

Hose specification

**Analyzer:**
- Clearance: max. 5.0 m (16.4 ft)
- Height: max. 2 m (6.6 ft)
- Hose ID: 1.6 mm ($^{1}/_{16}$ in)

**Y strainer (optional):**
- Hose to analyzer:
  - ID 1.6 mm ($^{1}/_{16}$ in)
  - OD 3.2 mm ($^{1}/_{8}$ in)
- Hose to process:
  - ID 0.8 mm ($^{1}/_{32}$ in)
  - OD 1.6 mm ($^{1}/_{16}$ in)

Process connection, optional Y strainer

Adhesive fitting, ID 40 mm, straight

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