

# Technical Information

## Liquiline System CA80AL

Colorimetric analyzer for aluminum



Integrated controller with up to 2 measuring channels and digital Memosens technology

### Application

- Monitoring of precipitants in drinking water and wastewater treatment plants
- Monitoring of geogenic entry of aluminum into drinking water reservoirs
- Monitoring of excess dosage of aluminum salts for phosphate precipitation

### Your benefits

- Easy upgrade to measuring station by connecting with up to four Memosens sensors
- Low maintenance costs thanks to long reagent life
- Digital communication for remote access
- Two-channel device available
- Supports predictive maintenance with advanced diagnostic functions
- Digital fieldbuses (Profibus DP, Modbus TCP, Modbus RS485 and Ethernet IP) and web server

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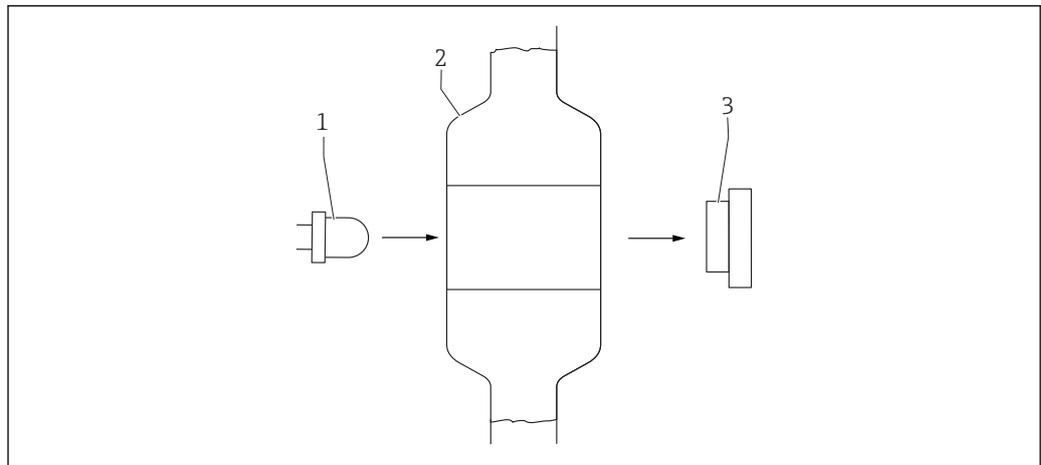
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## Function and system design

### Colorimetric measuring principle

After application-specific sample preparation, some of the permeate is pumped into the mixing/ reaction chamber. The specific color reagent is metered exactly in a defined mixture ratio. The chemical reaction causes the characteristic change in the color of the sample. The multispectral photometer measures the level of absorption by the sample or the stain solution at defined wavelengths. The analyzed wavelengths, and their relationships to one another, are parameter-specific.

Based on proportionality the amount of light absorption is a direct indicator of the concentration of the parameter under analysis in the sample. To compensate for any interference influences resulting from turbidity and fouling, as well as from the deterioration and aging of the LEDs, a reference measurement is performed before the actual measurement. This reference signal is subtracted from the measuring signal. The temperature in the photometer is kept constant to ensure a reproducible reaction that takes place with a short period of time.



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#### 1 Colorimetric measuring principle

- 1 Multispectral LED unit (for measurement/reference)
- 2 Photometer cuvette - mixing and reaction vessel
- 3 Detector (for measurement/reference)

### Aluminum

Aluminum's favorable mechanical properties (malleability) make it one of the most commonly used light metals. The vehicle construction sector and packaging industry are among the primary consumers of aluminum. Aluminum occurs in the environment, particularly in soil and in many ores (feldspars, mica). A low concentration of aluminum is a natural constituent of surface water and groundwater. Aluminum in the soil can be released at low pH levels and thereby enter the groundwater and ultimately the food chain. Aluminum is predominantly harmful to human health. Various health effects of aluminum in food and deodorants are currently being debated. Higher concentrations in drinking water can be toxic. According to the German Drinking Water Ordinance (Trinkwasserverordnung), the limit concentration for aluminum is 0.2 mg/l Al.

### Photometric determination of aluminum

#### Pyrocatechol violet method according to DIN ISO 10566

Catechol violet reacts with Al (III) in a solution buffered to pH 5.8 - 6.0 to form a blue dye. The absorption is measured at a wavelength of 568 nm. The amount of light absorption is proportional to the concentration of aluminum in the sample.

**Cross-sensitivity**

The ions listed were checked with the specified concentrations. A summary effect has not been studied. No cross-sensitivities were observed up to the concentration levels indicated.

1000 mg/l (ppm)	Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup>
500 mg/l (ppm)	Ca <sup>2+</sup> , K <sup>+</sup> , Na <sup>+</sup>
100 mg/l (ppm)	NO <sub>3</sub> <sup>-</sup>
10 mg/l (ppm)	Zn <sup>2+</sup>
2 mg/l (ppm)	F <sup>-</sup>

**Measuring system**

A complete measuring system comprises:

- Liquiline System CA80AL analyzer in the specified configuration
- Reagents and standard solutions (to be ordered separately)
- Liquiline System CAT8x0 sample preparation (optional)

Microfiltration (Liquiline System CAT810)

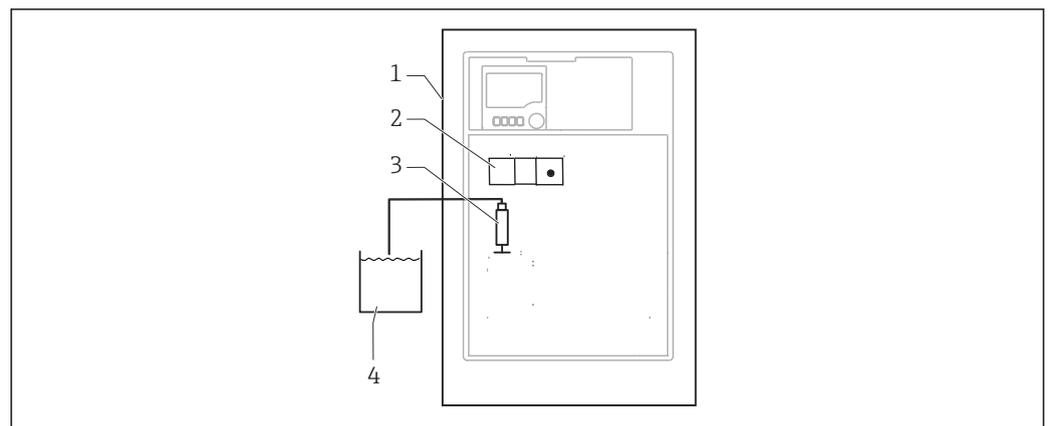
- Function: pressure pipe sampling + filtration
- Sieve filter, 50 µm
- Control via CA80
  - Optional: time control via integrated timer
- Backflushing, with compressed air or water
- Panel version or integration into analyzer stand
- Application: drinking water, industrial wastewater

Membrane filtration (Liquiline System CAT820), ceramic filter version

- Function: sampling + filtration
- Ceramic membrane filter cartridge; pore size 0.1 µm
- Communication via Memosens protocol, control via CA80
- Backflushing with compressed air (version with Memosens technology)
- Easy installation with Flexdip CYH112 (TI00430C)
- Application: sludge activation, drinking water, industrial wastewater, surface water

Membrane filtration (Liquiline System CAT860)

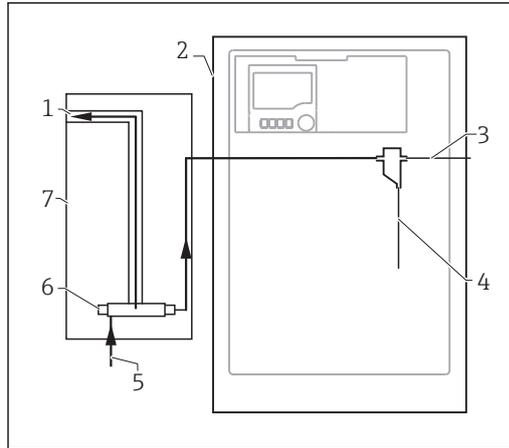
- Function: sampling + filtration
- Ceramic membrane filter cartridge; pore size 0.1 µm
- Communication via Memosens protocol, control via CA80
- Automatic backflush function with cleaning solution and compressed air
- Easy installation with Flexdip CYH112 (TI00430C)
- Application: wastewater treatment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



2 Measuring system with Liquiline System, self-priming

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

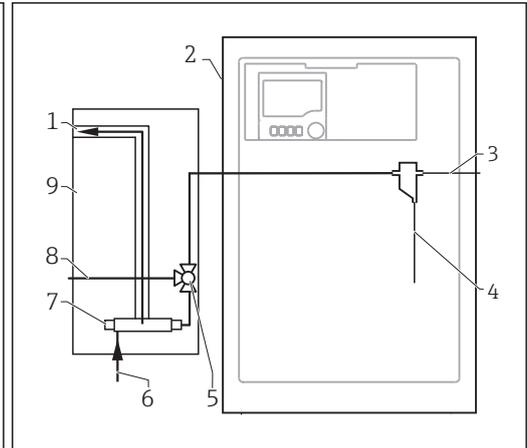
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3 Measuring system with Liquiline System CAT810

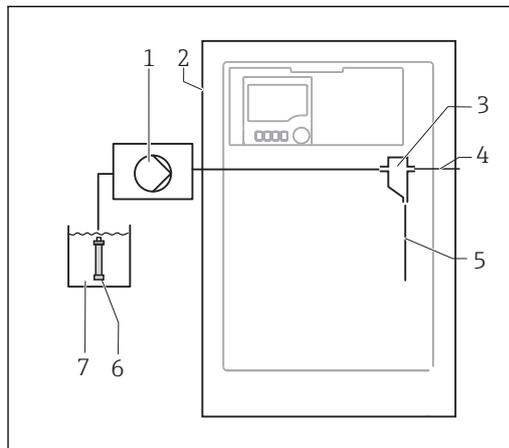
- 1 Overflow
- 2 Liquiline System CA80
- 3 Sample collecting vessel overflow
- 4 Sample
- 5 Pressurized sample
- 6 Filter unit
- 7 Liquiline System CAT810



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4 Measuring system with Liquiline System CAT810 and cleaning valve

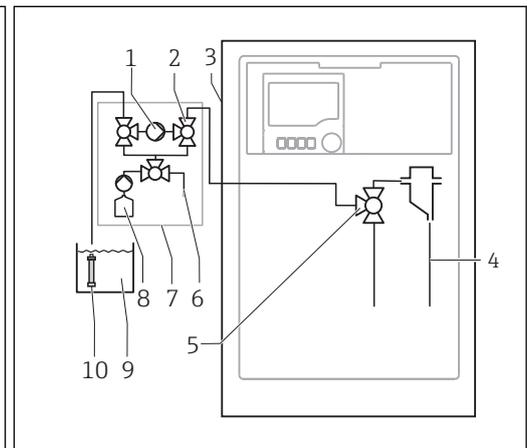
- 1 Overflow
- 2 Liquiline System CA80
- 3 Sample collecting vessel overflow
- 4 Sample
- 5 Cleaning valve
- 6 Pressurized sample
- 7 Filter unit
- 8 Purge connection (compressed air or water)
- 9 Liquiline System CAT810



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5 Measuring system with Liquiline System CAT820

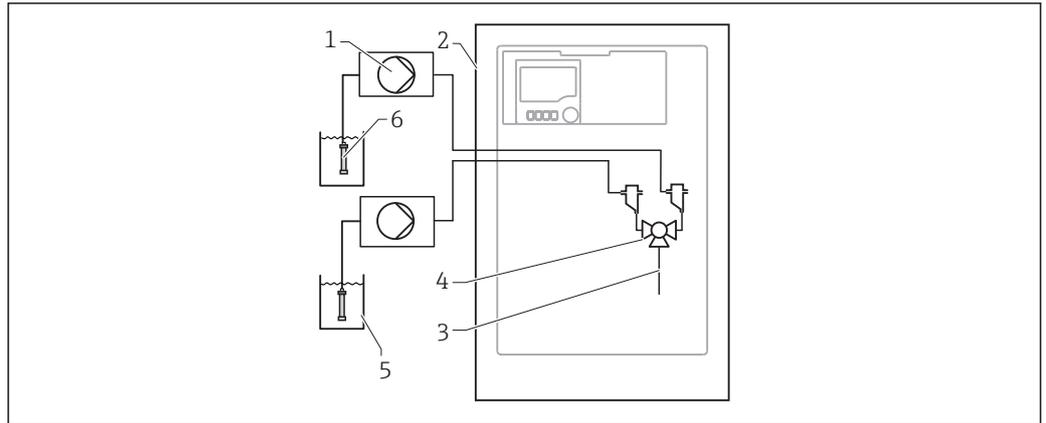
- 1 Pump
- 2 Liquiline System CA80
- 3 Sample collecting vessel
- 4 Sample collecting vessel overflow
- 5 Sample
- 6 Filter (ceramic)
- 7 Medium



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6 Measuring system with Liquiline System CAT860

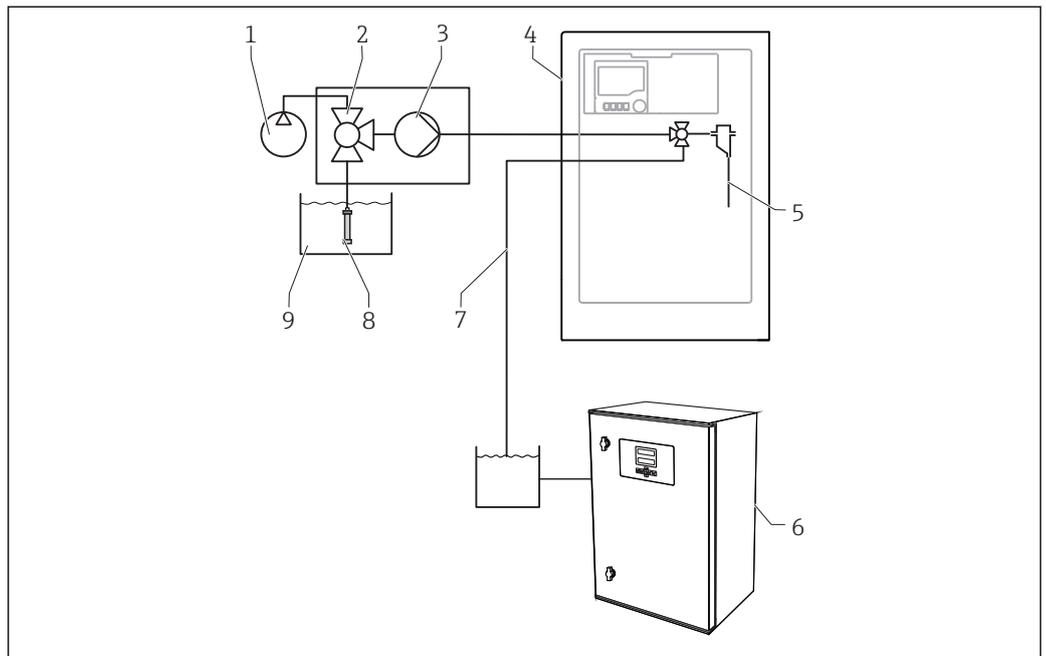
- 1 Pump
- 2 Valve
- 3 Liquiline System CA80
- 4 Sample
- 5 Valve
- 6 Compressed air
- 7 Liquiline System CAT860
- 8 Cleaning solution
- 9 Medium
- 10 Filter (ceramic)



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7 Measuring system with two Liquiline Systems CAT820

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



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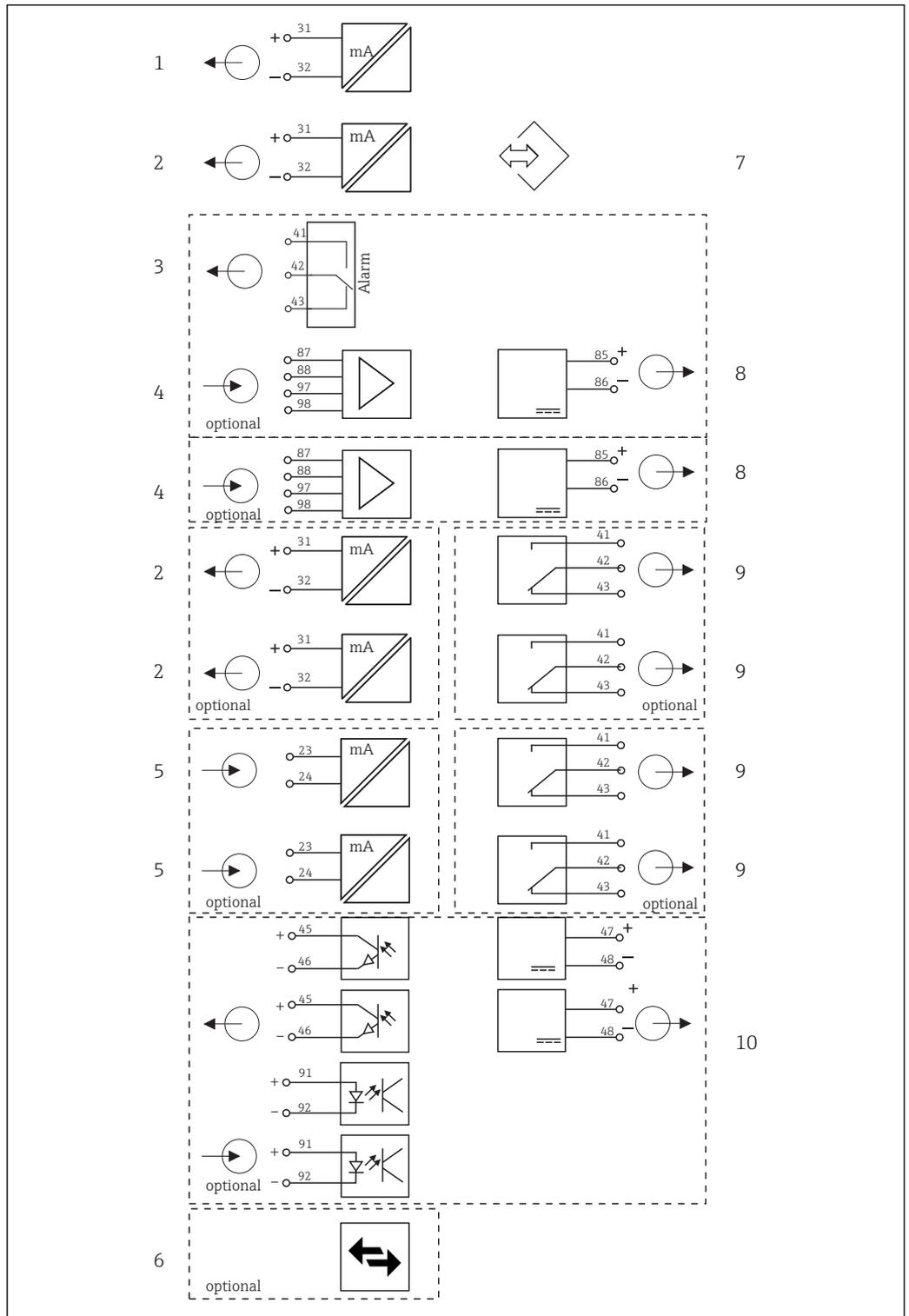
- 1 Backflushing with compressed air (optional)
- 2 Valve (optional)
- 3 Pump
- 4 Liquiline System CA80
- 5 Sample
- 6 Second analyzer
- 7 Sample to second analyzer
- 8 Filter (ceramic)
- 9 Medium

**Customer-specific solution**

Prior to analysis, the sample must be prepared at the customer site so that it is particle-free and homogeneous (representative sample). The sample can either be supplied to an external collecting vessel or pumped directly into the sample collecting vessel of the analyzer. The customer-specific sample preparation system must have its own individual control unit.

## Equipment architecture

**Block diagram**



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9 Block diagram CA80

1 Current output 1:1

2 Current outputs

3 Alarm relay

4 2 x Memosens input (1 x optional)

5 2 x current input (optional)

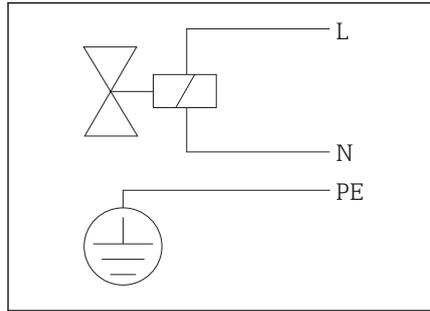
6 Modbus/Ethernet (optional)

7 Service interface

8 Power supply, fixed cable sensors

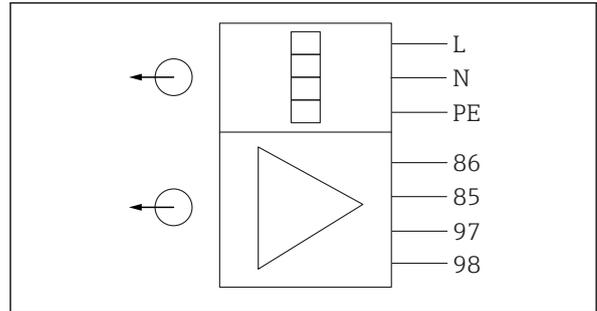
9 2 or 4 x relays (optional)

10 2 digital inputs and outputs (optional)



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10 Sample preparation block diagram, Liquiline System CAT810 with cleaning valve



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11 Sample preparation block diagram, Liquiline System CAT820 and CAT860

85, Connection for 24-V power supply

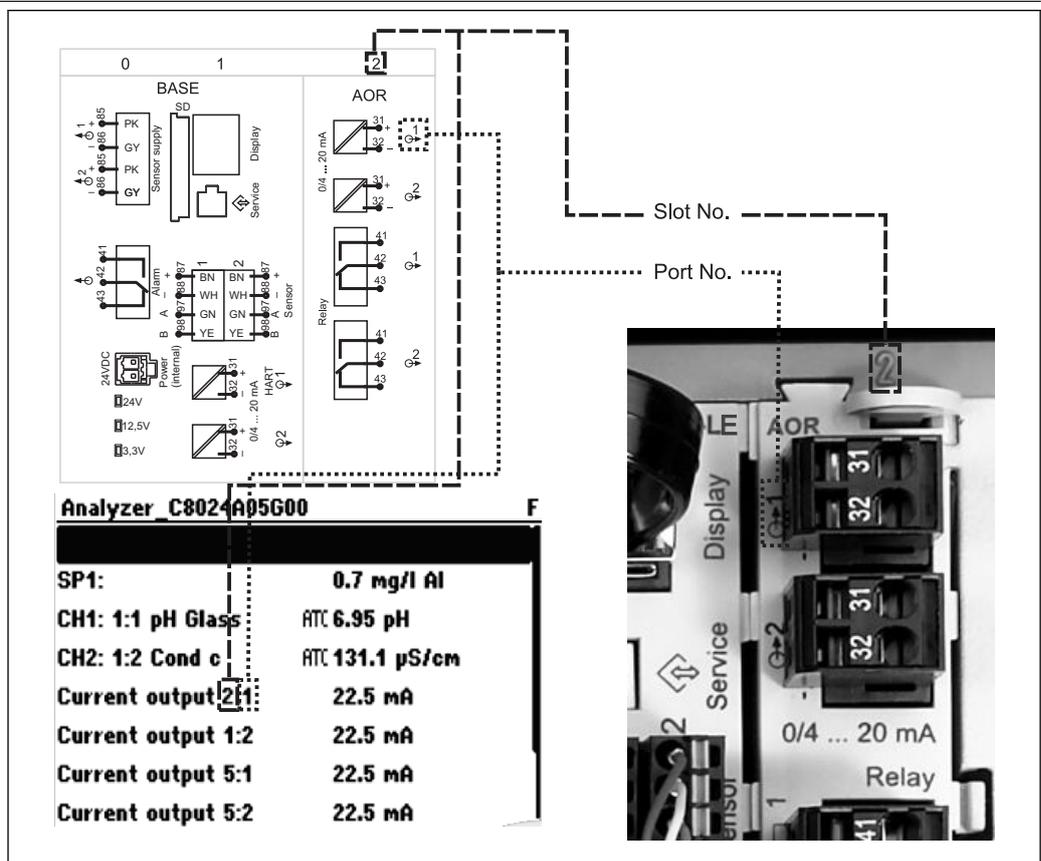
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97, Communication connection

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2 x communication via Memosens protocol (1 x optional), hose heating system

Slot and port assignment



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12 Slot and port assignment of hardware and presentation on the display

The electronics configuration follows a modular concept:

- There are several slots for electronics modules. These are referred to as "slots".
- These slots are numbered consecutively in the housing. Slots 0 and 1 are always reserved for the basic module.
- Each electronics module has one or more inputs and outputs or relays. Here they are all collectively known as "ports".

- Ports are consecutively numbered per electronics module and are recognized automatically by the software.
- 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.  
Example:  
"Current output 2:1" shown on the display means: slot 2 (e.g. AOR module) : port 1 (current output 1 of the AOR module)
- Inputs are assigned to measuring channels in the ascending order of "slot:port number"  
Example:
  - "SP1: **Aluminum**" shown on the display means:  
Sampling point SP1 is assigned to analyzer measuring channel 1.
  - "CH1: 1:1 pH glass" shown on the display for sensors means:  
Channel 1 (CH1) is slot 1 (basic module) : port 1 (input 1) and a pH glass sensor is connected here.

## Communication and data processing

### Types of communication:

- Fieldbuses
  - PROFIBUS DP (Profile 3.02)
  - Modbus TCP or RS485
- Configuration via Ethernet
- EtherNet/IP

### Extension module 485 and current outputs

For Modbus and Ethernet communication protocols:  
Max. of 2 current outputs can be used in parallel.

### Extension module ETH and current outputs

- Communication via Ethernet or EtherNet/IP
- Max. of 4 current outputs can be used in parallel.

### Bus termination on the device

- Via slide switch at bus module 485
- Displayed via LED "T" on bus module 485

## Dependability

### Reliability thanks to Memosens technology

### Memosens

Memosens makes your measuring point safer and more reliable:

- Non-contact, digital signal transmission enables optimum galvanic isolation
- Completely watertight
- Sensor can be calibrated in a lab, thus increasing the availability of the measuring point in the process
- Predictive maintenance thanks to recording of sensor data, e.g.:
  - Total hours of operation
  - Hours of operation with very high or very low measured values
  - Hours of operation at high temperatures
  - Number of steam sterilizations
  - Sensor condition

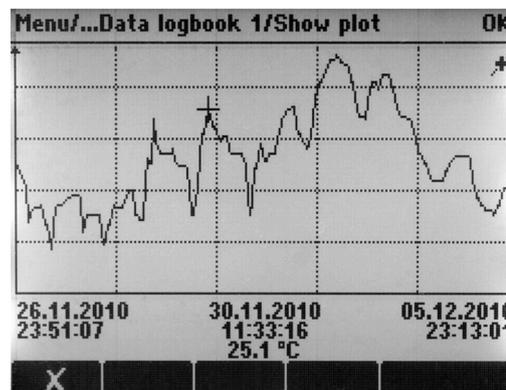
**Maintainability****Modular design**

The modular analyzer can be easily adapted to suit your needs:

- Retrofit extension modules for new or extended range of functions, e.g. current outputs, relays and digital communication
- Upgrade from one-channel to two channel analyzer
- Upgrade to measuring station with digital sensors with Memosens technology
- Optional: M12 sensor connector for connecting any kind of Memosens sensor

**Memory**

- Independent, integrated ring memories (FIFO) or stack memories for recording:
  - An analog value (e.g. flow, pH value, conductivity)
  - Events (e.g. power failure)
- Analyzer data logbook
  - Scan time: automatically adjusted to the measuring interval
  - Max. 2 data logbooks
  - 90,000 entries per logbook
  - Graphic display (load curves) or numerical list
  - Factory setting: enabled for all channels, ring memory (FIFO)
- Data logbooks for digital sensors:
  - Adjustable scan time: 1 to 3600 s (1 h)
  - Max. 8 data logbooks
  - 150,000 entries per logbook
  - Graphic display (load curves) or numerical list
- Calibration logbook: max. 75 entries
- Hardware logbook:
  - Hardware configuration and modifications
  - Max. 125 entries
- Version logbook:
  - Including software updates
  - Max. 50 entries
- Event logbook
- Analyzer event logbook
  - Analyzer-specific events
  - Max. 2500 entries, ring memory or fill-up buffer for recording
- Operations logbook: max. 250 entries
- Diagnostic logbook: max. 250 entries



13 Data logbook: Graphic display

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**Mathematical functions (virtual process values)**

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 6 "virtual" process values.

The "virtual" process values can be:

- Output via a current output or a fieldbus
- Used as a regulating control variable
- Assigned as a measured variable to a limit contactor
- Used as a measured variable to trigger cleaning
- Displayed in user-defined measuring menus

**The following mathematical functions are possible:**

- Calculation of pH from two conductivity values according to VGB Standard 405, e.g. in boiler feedwater
- Difference between two measured values from different sources, e.g. to monitor membranes
- Differential conductivity, e.g. to monitor the efficiency of ion exchangers
- Degassed conductivity, e.g. for process controls in power plants
- Redundancy to monitor two or three redundant sensors
- rH calculation from the measured values of a pH and an ORP sensor

**FieldCare and Field Data Manager****FieldCare**

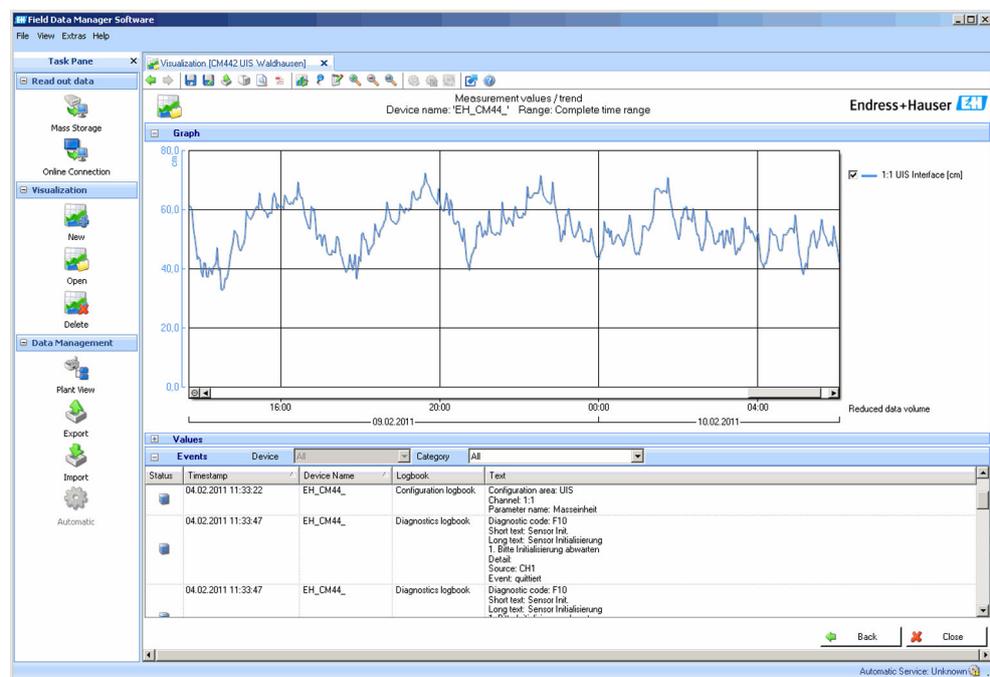
Configuration and asset management software based on FDT/DTM technology

- Complete device configuration when connected via FXA291 and service interface
- Access to a number of configuration parameters and identification, measuring and diagnostic data when connected via HART modem
- Logbooks can be downloaded in CSV format or binary format for "Field Data Manager" software

**Field Data Manager**

Visualization software and database for measuring, calibration and configuration data

- SQL database which is protected against manipulation
- Functions to import, save and print out logbooks
- Load curves to display measured values



14 Field Data Manager: Load curves

**SD card**

The exchangeable storage medium enables:

- Quick and easy software updates and upgrades
- Quick and easy updates and upgrades to measuring parameter lists
- Data storage of internal device memory (e.g. logbooks)
- Transfer of complete configurations to a device with an identical setup (backup function)
- Transfer of configurations without the TAG and bus address to devices with an identical setup (copy function)

Endress+Hauser offers industry-approved SD cards as accessories. These memory cards provide maximum data security and integrity.

Other SD cards can also be used. However, Endress+Hauser does not accept any responsibility for the data security of such cards.

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**Self-monitoring functions**

**Electronics**

- Current inputs are deactivated in the event of overcurrent and reactivated once the overcurrent stops.
- Board voltages are monitored and the board temperature is also measured.

**Counter**

Counters monitor consumables such as reagents or dispensers.

**Photometer**

- Automatic temperature monitoring
- Active monitoring of communication between the photometer module and the analyzer electronics

**Sample preparation (optional)**

- Active monitoring of communication between sample preparation with Memosens communication and the analyzer
- Counter for consumables, such as hoses of the peristaltic pump

**Sample collecting vessel (optional)**

Active monitoring of liquid level in the sample collecting vessel to ensure the supply of liquid to the analyzer

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**Data security**

All settings, logbooks etc. are stored in a non-volatile memory to ensure that the data are retained even in the event of a disruption to the power supply.

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**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.

## Input

<b>Measured values</b>	Al [ $\mu\text{g/l}$ , ppb]
<b>Measuring range</b>	15 to 1000 $\mu\text{g/l}$ (ppb) Al
<b>Types of input</b>	<ul style="list-style-type: none"> <li>▪ 1 or 2 measuring channels (analyzer main parameter)</li> <li>▪ 1 to 4 digital sensor inputs for sensors with Memosens protocol (optional)</li> <li>▪ Analog current inputs (optional)</li> </ul>
<b>Input signal</b>	Depending on version 2 x 0/4 to 20 mA (optional), passive, potentially isolated
<b>Current input, passive</b>	<p><b>Span</b> &gt; 0 to 20 mA</p> <p><b>Signal characteristic</b> Linear</p> <p><b>Internal resistance</b> Non-linear</p> <p><b>Test voltage</b> 500 V</p>
<b>Hose specification (self-priming)</b>	<ul style="list-style-type: none"> <li>▪ Clearance: max. 1.0 m (3.3 ft)</li> <li>▪ Height: max. 0.5 m (1.6 ft)</li> <li>▪ Hose ID: 1.6 mm (1/16 inch)</li> </ul>
<b>Cable specification (for optional sensors with Memosens technology)</b>	<p><b>Cable type</b> Memosens data cable CYK10 or sensor fixed cable, each with cable end sleeves or M12 round-pin connector (optional)</p> <p><b>Cable length</b> Max. 100 m (330 ft)</p>

## Output

### Output signal

Depending on version:

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

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

Ethernet 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

### Signal on alarm

Adjustable, as per NAMUR Recommendation NE 43

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

### Load

Max. 500 Ω

### Transmission behavior

Linear

## Current outputs, active

**Span** 0 to 23 mA

**Signal characteristic** Linear

**Electrical specification**  
**Output voltage**  
 Max. 24 V  
**Test voltage**  
 500 V

**Cable specification**  
**Cable type**  
 Recommended: shielded cable  
**Cable specification**  
 Max. 2.5 mm<sup>2</sup> (14 AWG)

## 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, $\cos\Phi = 0.8$ to 1	0.1 A	700,000
	0.5 A	450,000
115 V AC, $\cos\Phi = 0.8$ 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, $\cos\Phi = 0.8$ to 1	0.1 A	700,000
	0.5 A	450,000
	2 A	120,000
115 V AC, $\cos\Phi = 0.8$ 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

## Protocol-specific data

### 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

### Web server

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

TCP port	80
Supported features	<ul style="list-style-type: none"> <li>▪ Remote-controlled device configuration</li> <li>▪ Save/restore device configuration (via SD card)</li> <li>▪ Logbook export (file formats: CSV, FDM)</li> <li>▪ Access to web server via DTM or Internet Explorer</li> <li>▪ Login</li> <li>▪ Web server can be switched off</li> </ul>

## EtherNet/IP

Protocol	EtherNet/IP	
ODVA certification	Yes	
Device profile	Generic device (product type: 0x2B)	
Manufacturer ID	0x049E <sub>h</sub>	
Device type ID	0x109F	
Polarity	Auto-MIDI-X	
Connections	CIP	12
	I/O	6
	Explicit message	6
	Multicast	3 consumers
Minimum RPI	100 ms (default)	
Maximum RPI	10000 ms	
System integration	EtherNet/IP	EDS
	Rockwell	Add-on-Profile Level 3, Faceplate for Factory Talk SE
IO data	Input (T → O)	Device status and diagnostic message with highest priority Measured values: <ul style="list-style-type: none"> <li>■ 16 AI (analog input) + Status + Unit</li> <li>■ 8 DI (discrete input) + Status</li> </ul>
	Output (O → T)	Actuating values: <ul style="list-style-type: none"> <li>■ 4 AO (analog output) + status + unit</li> <li>■ 8 DO (discrete output) + Status</li> </ul>

## Power supply

### Supply voltage



The analyzer is fitted with a connector with a cable length of 4.3 m (14.1 ft).

Analyzers with order specification CA80xx-CA (CSA C/US General Purpose) are fitted with a power cable for North America.

- 100 to 120 V AC / 200 to 240 V AC  
or 24 V DC
- 50 or 60 Hz

#### NOTICE

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

- ▶ The customer must provide a protected circuit breaker in the vicinity of the device.
- ▶ The circuit breaker must be a switch or power switch, and you must label it as the circuit breaker for the device.
- ▶ At the supply point, the power supply for the 24 V versions must be isolated from dangerous live cables by double or reinforced insulation.

### Fieldbus connection

Supply voltage: not applicable

### Power consumption

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

### Fuse

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

### Cable entries

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

### Hose entries

4 x bores for M32 for sample inflow and outflow

### Cable specification

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



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

Connecting optional modules

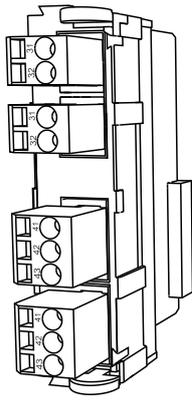
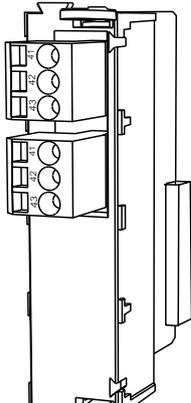
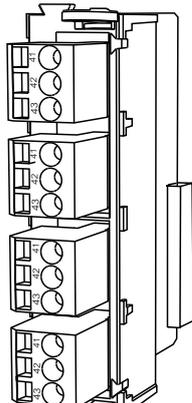
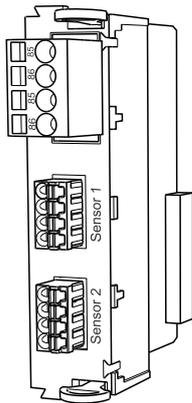
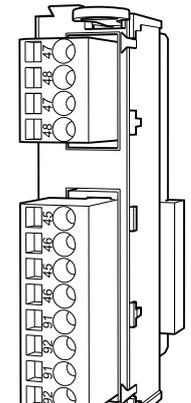
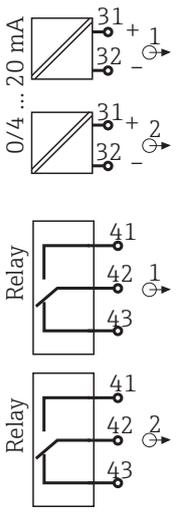
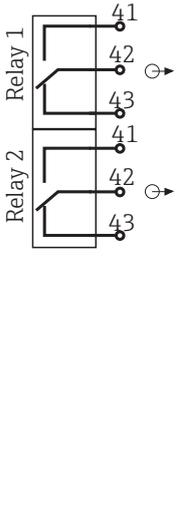
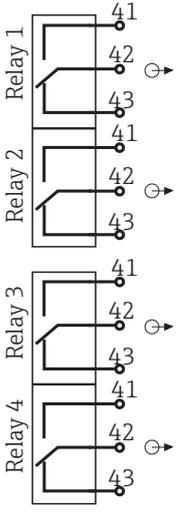
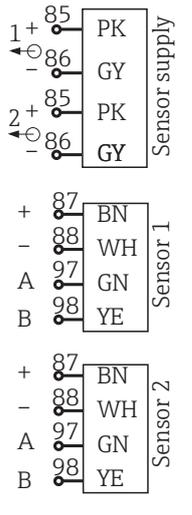
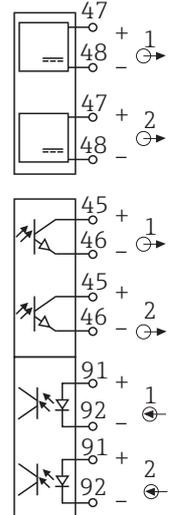
**NOTICE**

**Unacceptable hardware combinations (due to conflicts in power supply)**

Incorrect measurements or total failure of the measuring point as a result of heat build-up or overloading

- ▶ Find out if the planned extension for your controller results in a permitted hardware combination (Configurator on [www.endress.com/CA80AL](http://www.endress.com/CA80AL)).
- ▶ Remember that the sum of all current inputs and outputs may not exceed 8.
- ▶ Make sure not to use more than two "DIO" modules. More "DIO" modules are not permitted.
- ▶ Please contact your Endress+Hauser sales center should you have any questions.

Overview of all the modules available

Module name				
AOR	2R	4R	2DS	DIO
				
<ul style="list-style-type: none"> <li>▪ 2 x 0/4 to 20mA analog outputs</li> <li>▪ 2 relays</li> <li>▪ Order No. 71111053</li> </ul>	<ul style="list-style-type: none"> <li>▪ 2 relays</li> <li>▪ Order No. 71125375</li> </ul>	<ul style="list-style-type: none"> <li>▪ 4 relays</li> <li>▪ Order No. 71125376</li> </ul>	<ul style="list-style-type: none"> <li>▪ 2 digital sensor inputs</li> <li>▪ 2 power supply systems for digital sensors</li> <li>▪ Order No. 71135631</li> </ul>	<ul style="list-style-type: none"> <li>▪ 2 digital inputs</li> <li>▪ 2 digital outputs with auxiliary voltage</li> <li>▪ Order No. 71135638</li> </ul>
				

Module name				
2AO	4AO	2AI	485	ETH
<ul style="list-style-type: none"> <li>2 x 0/4 to 20mA analog outputs</li> <li>Order No. 71135632</li> </ul>	<ul style="list-style-type: none"> <li>4 x 0/4 to 20mA analog outputs</li> <li>Order No. 71135633</li> </ul>	<ul style="list-style-type: none"> <li>2 x 0/4 to 20mA analog inputs</li> <li>Order No. 71135639</li> </ul>	<ul style="list-style-type: none"> <li>Ethernet (web server or Modbus TCP)</li> <li>Order No. 71135634</li> </ul>	<ul style="list-style-type: none"> <li>Web server and Ethernet/IP or Modbus TCP</li> <li>Order No. 71272410</li> </ul>



**PROFIBUS DP (module 485)**

Contacts 95, 96 and 99 are jumpered in the connector. This ensures that PROFIBUS communication is not interrupted if the connector is disconnected.

**Sensor connection (optional)** *Sensors with Memosens protocol*

Sensor types	Sensor cable	Sensors
Digital sensors <b>without</b> additional internal power supply	With plug-in connection and inductive signal transmission	<ul style="list-style-type: none"> <li>▪ pH sensors</li> <li>▪ ORP sensors</li> <li>▪ Combined sensors</li> <li>▪ Oxygen sensors (amperometric and optical)</li> <li>▪ Conductivity sensors with conductive measurement of conductivity</li> <li>▪ Chlorine sensors (disinfection)</li> </ul>
	Fixed cable	Conductivity sensors with inductive measurement of conductivity
Digital sensors with additional internal power supply	Fixed cable	<ul style="list-style-type: none"> <li>▪ Turbidity sensors</li> <li>▪ Sensors for interface measurement</li> <li>▪ Sensors for measuring the spectral absorption coefficient (SAC)</li> <li>▪ Nitrate sensors</li> <li>▪ Optical oxygen sensors</li> <li>▪ Ion-sensitive sensors</li> </ul>

## Performance characteristics

<b>Measured error</b> <sup>1)</sup>	±2 % of end of measuring range ±20 µg/l (ppb)		
<b>Measured error for sensor inputs</b>	→ Documentation of the connected sensor		
<b>Measured error for current inputs and outputs</b>	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		
<b>Repeatability</b>	<ul style="list-style-type: none"> <li>■ ±10 µg/l (ppb) (to 300 µg/l (ppb))</li> <li>■ ±20 µg/l (ppb) (300 to 1000 µg/l (ppb))</li> </ul>		
<b>Repeatability of sensor inputs</b>	→ Documentation of the connected sensor		
<b>Measuring interval</b>	Continuous (10.5 min), adjustable 10 min to 24 h		
<b>Sample requirement</b>	20.5 ml/measurement		
<b>Reagent requirement</b>	RB, RK:	60 µl (0.002 fl.oz) per measurement	0.173 l (5.85 fl.oz) per month given a measuring interval of 15 minutes
	RN:	100 µl (0.003 fl.oz) per measurement	0.288 l (9.74 fl.oz) per month given a measuring interval of 15 minutes
<b>Standard requirement</b>	given a calibration interval of 48 h approx. 800 ml (27.048 fl.oz) per month		
<b>Calibration interval</b>	1 h to 90 days, depending on the application and ambient conditions		
<b>Maintenance interval</b>	Every 6 months, depending on the application		
<b>Maintenance effort</b>	<ul style="list-style-type: none"> <li>■ Weekly: visual inspection</li> <li>■ Half-yearly: 2 hours</li> </ul>		

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

## Environment

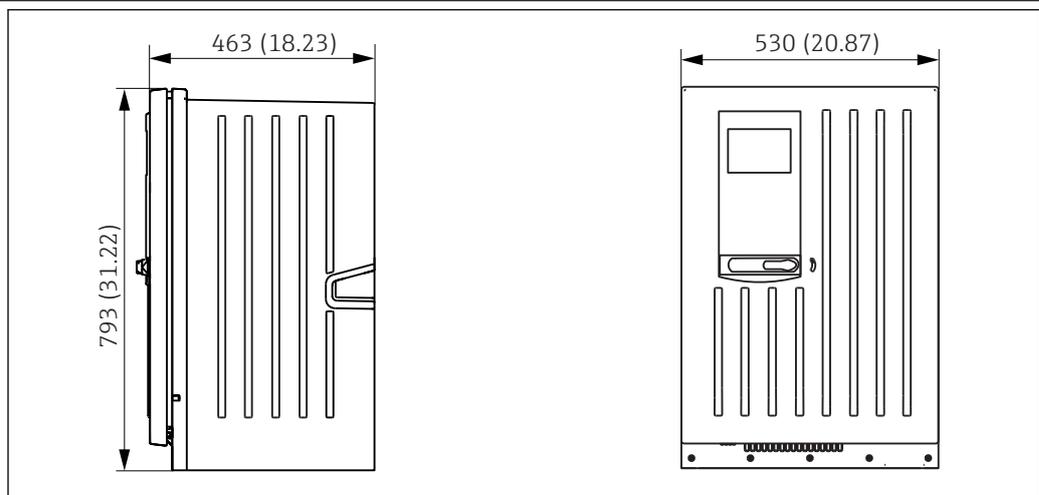
<b>Ambient temperature range</b>	+5 to +40 °C (41 to 104 °F)
<b>Storage temperature</b>	-20 to +60 °C (-4 to 140 °F)
<b>Humidity</b>	10 to 95%, not condensing
<b>Degree of protection</b>	IP55 (cabinet, analyzer stand)
<b>Electromagnetic compatibility</b>	Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry
<b>Electrical safety</b>	According to EN/IEC 61010-1:2010, Class I equipment Low voltage: overvoltage category II For installations up to 2000 m (6500 ft) above MSL
<b>Degree of contamination</b>	The product is suitable for pollution degree 2.

## Process

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

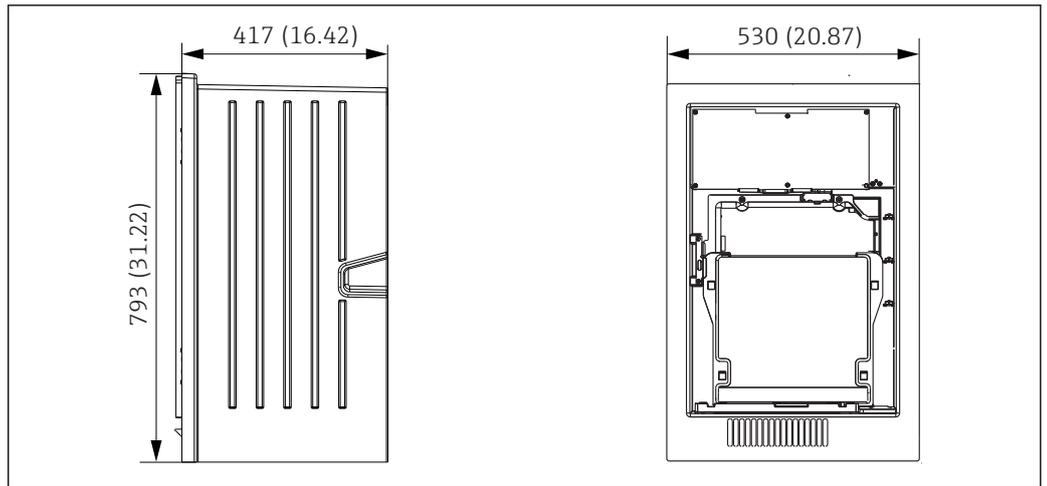
## Mechanical construction

### Dimensions



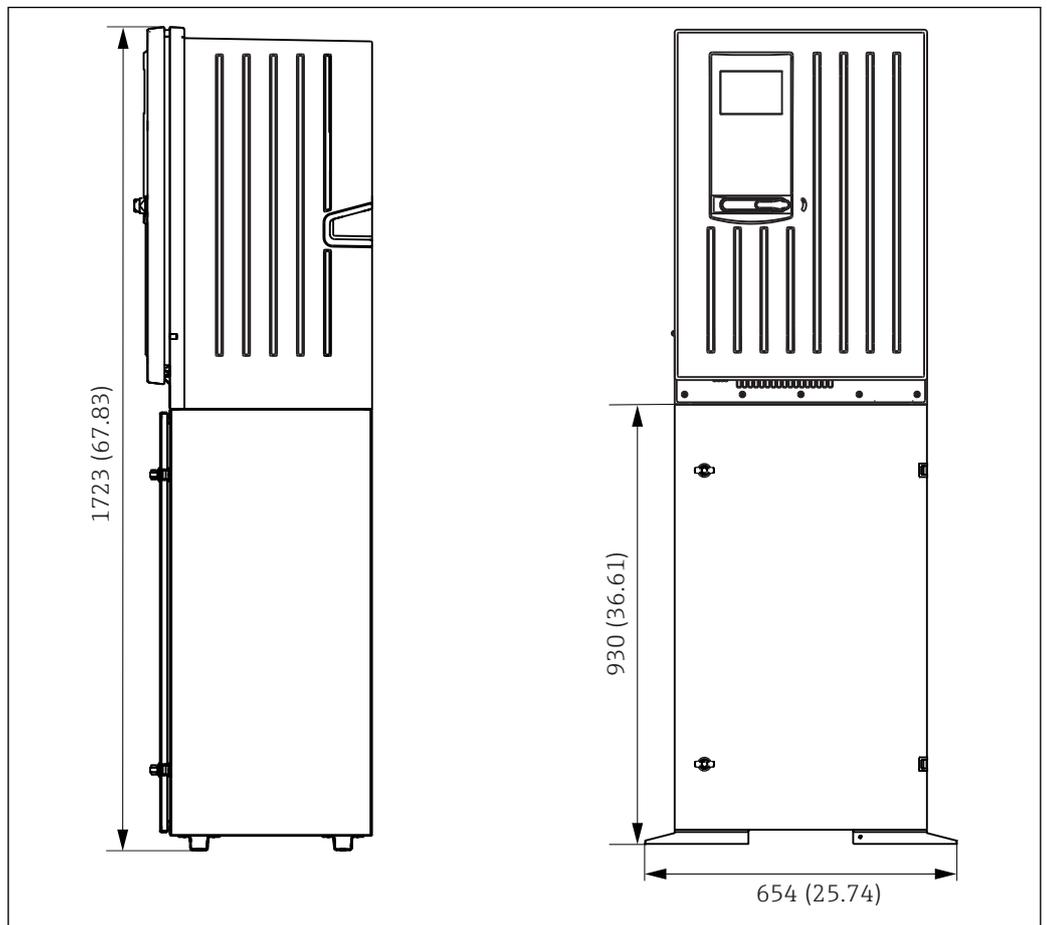
15 Liquiline System CA80 closed version, dimensions in mm (inch)

A0028820



A0030419

16 Liquiline System CA80 open version, dimensions in mm (inch)



A0028821

17 Liquiline System CA80 with base, dimensions in mm (inch)

**Weight**

**Order version**

- Cabinet version
- Open installation
- Analyzer stand

**Weight**

- 39.5 kg (87.1 lbs)
- 31.5 kg (69.45 lbs)
- 72.5 kg (159.8 lbs)

**Materials**

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

<b>Parts in contact with medium</b>	
Dispensers	Plastic PP and elastomer TPE
Liquid manager	Plastic PP and elastomer FKM
Hoses	C-Flex, NORPRENE
Optical window	Glass
Molded seal	Elastomer EPDM
Drain pipe	Plastic PP
Sample collecting vessel (optional) <ul style="list-style-type: none"> <li>▪ Beaker</li> <li>▪ Cover</li> <li>▪ Level detector pins</li> <li>▪ Seal</li> </ul>	<ul style="list-style-type: none"> <li>▪ Plastic PMMA</li> <li>▪ Plastic PP</li> <li>▪ Stainless steel 1.4404 (V4A)</li> <li>▪ EPDM</li> </ul>
Valve (optional)	PVDF

## Operability

### Operating concept

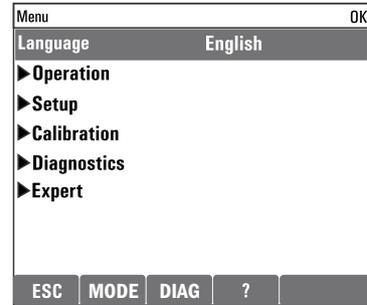
The simple and structured operating concept sets new standards:

- Intuitive operation with the navigator and soft keys
- Fast configuration of application-specific measurement options
- Easy configuration and diagnosis thanks to plain-text display
- All languages that can be ordered are available in every device



18 Easy operation

A0028642-EN



19 Plain-text menu

A0023002-EN

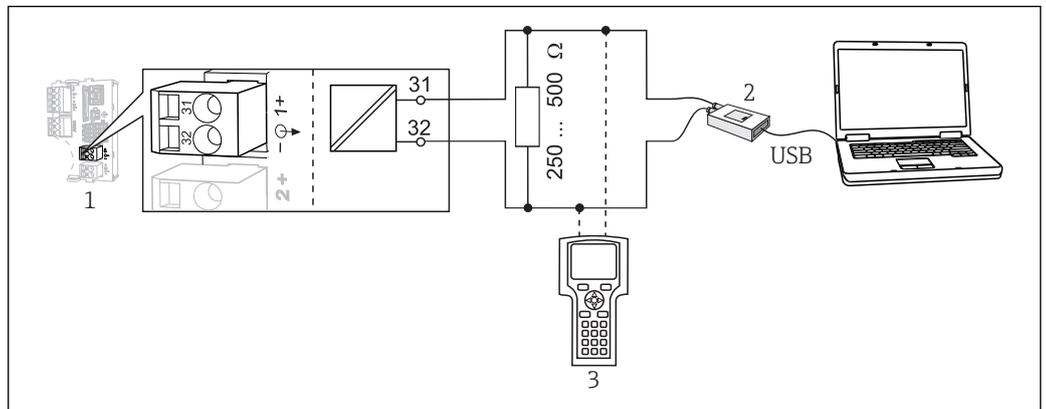
### Display

Graphic display:

- Resolution: 240 x 160 pixel
- Back light with switch-off function
- Red display background for alarms alerts users to errors
- Transflective display technology for maximum contrast even in bright environments
- User-definable measuring menus mean you can always keep track of the values that are important for your application.

### Remote operation

Via HART (e.g. using HART modem and FieldCare)



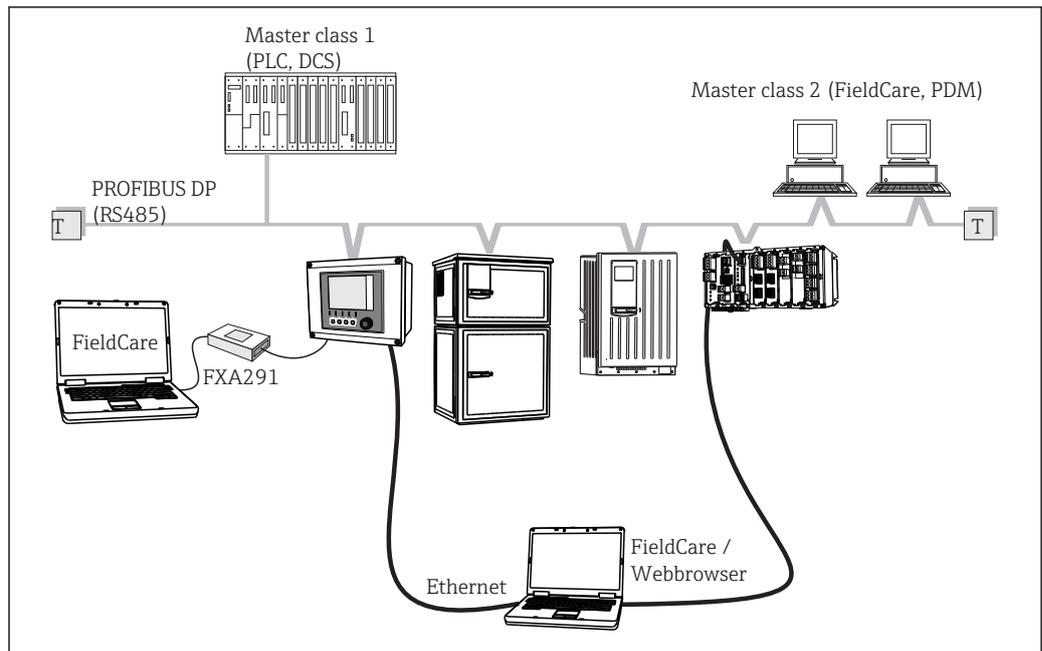
A0028995

20 HART using modem

- 1 Device module Base E: current output 1 with HART
- 2 HART modem for connection to PC, e.g. Commubox FXA191 (RS232) or FXA195<sup>1)</sup> (USB)
- 3 HART handheld terminal

<sup>1)</sup> Switch position "on" (substitutes the resistor)

**Via PROFIBUS DP**

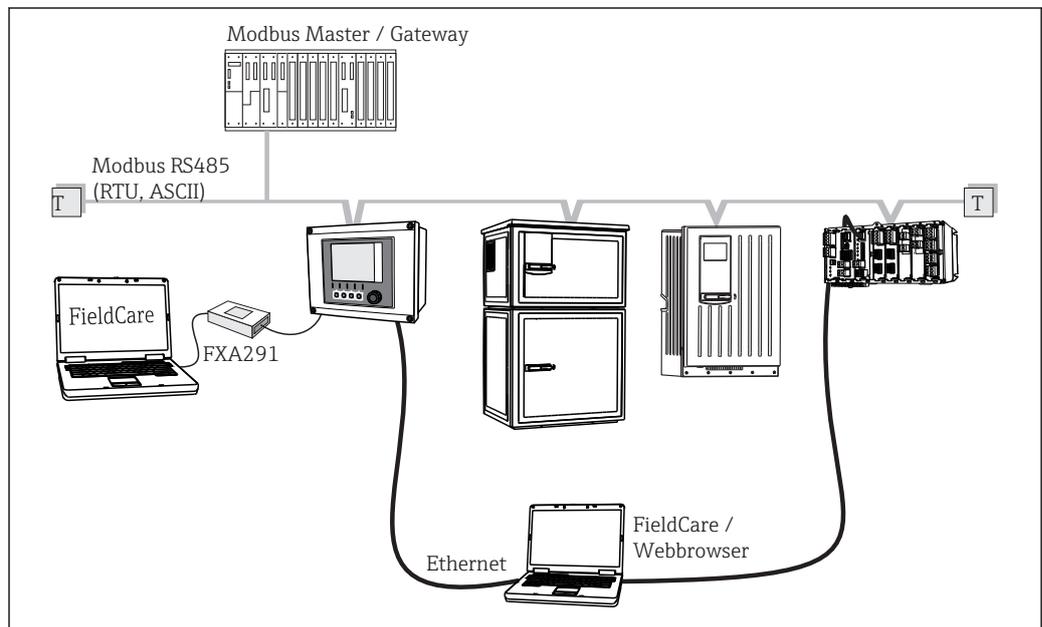


A0028991

21 PROFIBUS DP

T Terminating resistor

**Via Modbus RS485**

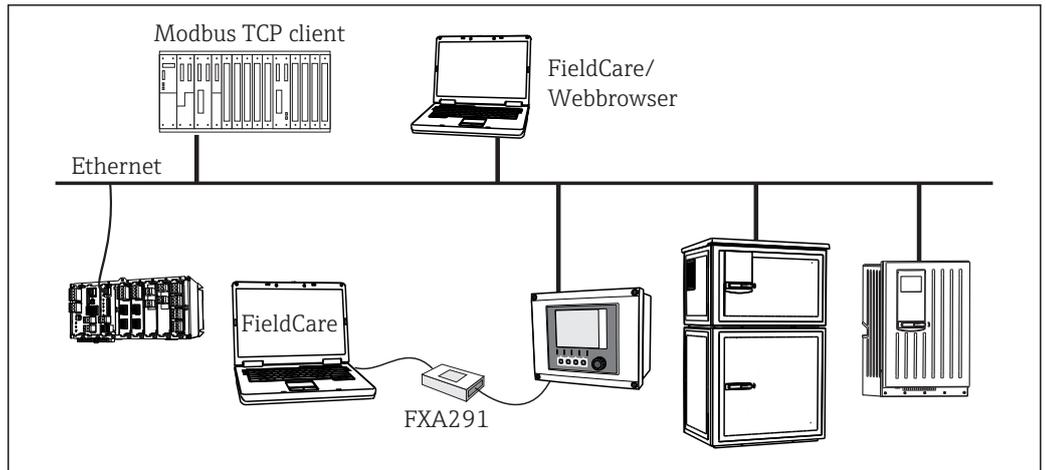


A0028993

22 Modbus RS485

T Terminating resistor

Via Ethernet/Web server/Modbus TCP/EtherNet/IP



A0028994

23 Modbus TCP and/or EtherNet/IP

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**Language packages**

The language selected in the product structure is the operating language preset at the factory. All other languages can be selected using the menu.

- English (US)
- German
- Chinese (Simplified, PR China)
- Czech
- Dutch
- French
- Italian
- Japanese
- Polish
- Portuguese
- Russian
- Spanish
- Turkish
- Hungarian
- Croatian
- Vietnamese

The availability of other languages can be checked via the product structure at [www.endress.com/ca80al](http://www.endress.com/ca80al).

## Certificates and approvals

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**CE mark**

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

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**EAC**

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

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**cCSAus**

The product complies with "CLASS 2252 05 - Process Control Equipment" and "CLASS 2252 85 - Process Control Equipment - Certified to US Standards" requirements.

## Ordering information

Product page [www.endress.com/ca80al](http://www.endress.com/ca80al)

### Product Configurator

On the product page there is a "Configure" button to the right of the product image **Configure**.

1. Click this button.
  - ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
  - ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.



For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the tab for this **CAD** and select the desired file type using picklists.

### Scope of delivery

The scope of delivery comprises:

- 1 analyzer in the version ordered with optional hardware
- 1 print version of Brief Operating Instructions in the language ordered
- 1 Maintenance Manual
- Optional accessories

## 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 office.

### Sample preparation

Liquiline System CAT810

- Pressure pipe sampling + microfiltration
- Order according to product structure  
(--> Online Configurator, [www.endress.com/cat810](http://www.endress.com/cat810))
- Technical Information TI01138C/07/EN

Liquiline System CAT820

- Sampling + membrane filtration
- Order according to product structure  
(--> Online Configurator, [www.endress.com/cat820](http://www.endress.com/cat820))
- Technical Information TI01131C/07/EN

Liquiline System CAT860

- Pressure pipe sampling + membrane filtration
- Order according to product structure  
(--> Online Configurator, [www.endress.com/cat860](http://www.endress.com/cat860))
- Technical Information TI01137C/07/EN

### Consumables for CA80AL

Reagent set CY80AL

#### NOTICE

**Reagents can be harmful to the environment**

- ▶ Pay particular attention to the information provided in the safety data sheets concerning the disposal of reagents.

A powder funnel is not included in the delivery.

Ready-to-prepare reagent, 3 x 1 l (33.81 fl.oz.)

Order No. CY80AL-N1+SN

**Standard solution CY80AL****1 l (34 fl.oz.) Standard solution with different concentrations of aluminum.**

- 0 mg/l (ppm) Al; Order No. CY80AL-N1+TA
- 0.1 mg/l (ppm) Al; Order No. CY80AL-N1+TH
- 0.5 mg/l (ppm) Al; Order No. CY80AL-N1+TK
- 1.0 mg/l (ppm) Al; Order No. CY80AL-N1+TL

**Cleaner CY800 (for hoses in the device)**

500 ml (16.91 fl.oz.) Container; Order No. CY800-N111

**Maintenance kit CAV800**

Order according to product structure

**Standard**

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

**Optional**

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

**Cleaner CY820 (hoses for sample preparation and sample collecting vessel)**

Cleaning concentrates to clean the hoses of the sample preparation system and the sample collecting vessel

- Base cleaner, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+TA
- Acid cleaner, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+T1
- Oxidizing cleaning solution, concentrate 1 l (33.81 fl.oz.), Order No. CY820-1+UA

**Upgrade kits CAZ800**

Kit for upgrade with sample collecting vessel

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

Kit for upgrade from one-channel device to two-channel device

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

Kit for upgrade for second, downstream analyzer

- Valve for switching sample flow
- Hoses, connection adapters
- Activation code
- Order No. CAZ800-N1M1

**Sensors****pH glass electrodes****Orbisint CPS11D**

- pH electrode for process technology
- Optional SIL version for connecting to SIL transmitter
- With dirt-repellent PTFE diaphragm
- Product Configurator on the product page: [www.endress.com/cps11d](http://www.endress.com/cps11d)



Technical Information TI00028C

**Memosens CPS31D**

- pH electrode with gel-filled reference system with ceramic diaphragm
- Product Configurator on the product page: [www.endress.com/cps31d](http://www.endress.com/cps31d)



Technical Information TI00030C

#### **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](http://www.endress.com/cps341d)



Technical Information TI00468C

#### **Ceragel CPS71D**

- pH electrode with reference system including ion trap
- Product Configurator on the product page: [www.endress.com/cps71d](http://www.endress.com/cps71d)



Technical Information TI00245C

#### **Orbipore CPS91D**

- pH electrode with open aperture for media with high dirt load
- Product Configurator on the product page: [www.endress.com/cps91d](http://www.endress.com/cps91d)



Technical Information TI00375C

#### **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](http://www.endress.com/cpf81d)



Technical Information TI00191C

#### **ORP electrodes**

##### **Orbisint CPS12D**

- ORP sensor for process technology
- Product Configurator on the product page: [www.endress.com/cps12d](http://www.endress.com/cps12d)



Technical Information TI00367C

##### **Ceraliquid CPS42D**

- ORP electrode with ceramic junction and KCl liquid electrolyte
- Product Configurator on the product page: [www.endress.com/cps42d](http://www.endress.com/cps42d)



Technical Information TI00373C

##### **Ceragel CPS72D**

- ORP electrode with reference system including ion trap
- Product Configurator on the product page: [www.endress.com/cps72d](http://www.endress.com/cps72d)



Technical Information TI00374C

##### **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](http://www.endress.com/cpf82d)



Technical Information TI00191C

##### **Orbipore CPS92D**

- ORP electrode with open aperture for media with high dirt load
- Product Configurator on the product page: [www.endress.com/cps92d](http://www.endress.com/cps92d)



Technical Information TI00435C

#### **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](http://www.endress.com/cls50d)



Technical Information TI00182C

**Conductivity sensors with conductive measurement of conductivity****Condumax CLS21D**

- Two-electrode sensor in plug-in head version
- Product Configurator on the product page: [www.endress.com/CLS21d](http://www.endress.com/CLS21d)



Technical Information TI00085C

**Oxygen sensors****Oxymax COS51D**

- Amperometric sensor for dissolved oxygen
- With Memosens technology
- Product Configurator on the product page: [www.endress.com/cos51d](http://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](http://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](http://www.endress.com/cos81d)



Technical Information TI01201C

**Chlorine sensors****CCS142D**

- Membrane-covered amperometric sensor for free chlorine
- Measuring range 0.01 to 20 mg/l
- With Memosens technology
- Product Configurator on the product page: [www.endress.com/ccs142d](http://www.endress.com/ccs142d)



Technical Information TI00419C

**Ion-selective sensors****ISEmax CAS40D**

- Ion selective sensors
- Product Configurator on the product page: [www.endress.com/cas40d](http://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](http://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](http://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](http://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](http://www.endress.com/cus71d)



Technical Information TI00490C

**Additional functionality**

	<b>Communication; software</b>
51516983	Commubox FXA291 (hardware)
71127100	SD card with Liquiline firmware, 1 GB, industrial flash drive You must quote the serial number of the device when ordering the activation code.
71135636	Activation code for Modbus RS485
71135637	Activation code for Modbus TCP
71219871	Activation code for EtherNet/IP
71279813	Activation code for Modbus TCP for module ETH
71279830	Activation code for EtherNet/IP for module ETH
71211288	Activation code for feedforward control
71249548	Kit CA80: activation code for 1st digital sensor input
71249555	Kit CA80: activation code for 2nd digital sensor input

	<b>Retrofit kits</b>
71136999	Kit CSF48/CA80: retrofit service interface (CDI flange connector, counter nut)
71218507	KitCA80: interface module CM44
71111053	Kit CM442/CM444/CM448/CSF48/CA80: extension module AOR; 2 x relay, 2 x 0/4 to 20 mA analog output
71125375	Kit CM442/CM444/CM448/CSF48/CA80: extension module 2R; 2 x relay
71125376	Kit CM442/CM444/CM448/CSF48/CA80: extension module 4R; 4 x relay
71135632	Kit CM442/CM444/CM448/CSF48/CA80: extension module 2AO; 2 x 0/4 to 20 mA analog output
71135633	Kit CM442/CM444/CM448/CSF48/CA80: extension module 4AO; 4 x 0/4 to 20 mA analog output
71135631	Kit CM444/CM448/CSF48/CA80: extension module 2DS; 2 x digital sensor, Memosens
71135634	Kit CM442/CM444/CM448/CSF48/CA80: extension module 485; Ethernet configuration; can be extended to PROFIBUS DP or Modbus RS485 or Modbus TCP or EtherNet/IP. This requires an additional activation code, which can be ordered separately (see kit CM444/CM448/CSF48/CA80: extension module DIO; 2 x digital input; 2 x digital output; auxiliary power supply for digital output communication; software).
71135638	Kit CM444/CM448/CSF48/CA80: extension module DIO; 2 x digital input; 2 x digital output; auxiliary power supply for digital output
71135639	Kit CM442/CM444/CM448/CSF48/CA80: extension module 2AI; 2 x 0/4 to 20 mA analog input

	Retrofit kits
71140889	Upgrade kit CM442/CM444/CM448/CSF48/CA80; extension module 485; Modbus RS485 (+ web server)
71140890	Upgrade kit CM442/CM444/CM448/CSF48/CA80; extension module 485; Modbus TCP (+ web server)
71219868	Upgrade kit CM442/CM444/CM448/CSF48/CA80; extension module 485; EtherNet/IP (+ web server)
71279809	Upgrade kit CM442/CM444/CM448/CSF48/CA80; extension module ETH + Modbus TCP
71279812	Upgrade kit CM442/CM444/CM448/CSF48/CA80; extension module ETH + EtherNet/IP
71141366	Kit CM442/CM444/CM448/CSF48/CA80: extension backplane

## Measuring cable

### CYK10 Memosens data cable

- For digital sensors with Memosens technology
- Product Configurator on the product page: [www.endress.com/cyk10](http://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](http://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<sup>2</sup> + shielding)
- Sold by meter, Order No.: 51502543

## Software

### Memobase Plus CYZ71D

- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations saved in the database
- Order as per product structure, [www.endress.com/cyz71d](http://www.endress.com/cyz71d)



Technical Information TI00502C

### Field Data Manager Software MS20

- PC software for central data management
- Visualization of series of measurements and logbook events
- SQL database for secure data storage
- Order No. 71129799

## Other accessories

### SD card

- Industrial Flash Drive, 1 GB
- Weight: 2 g
- Order No. 71110815

### Cable junction with Velcro strip

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

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[www.addresses.endress.com](http://www.addresses.endress.com)

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