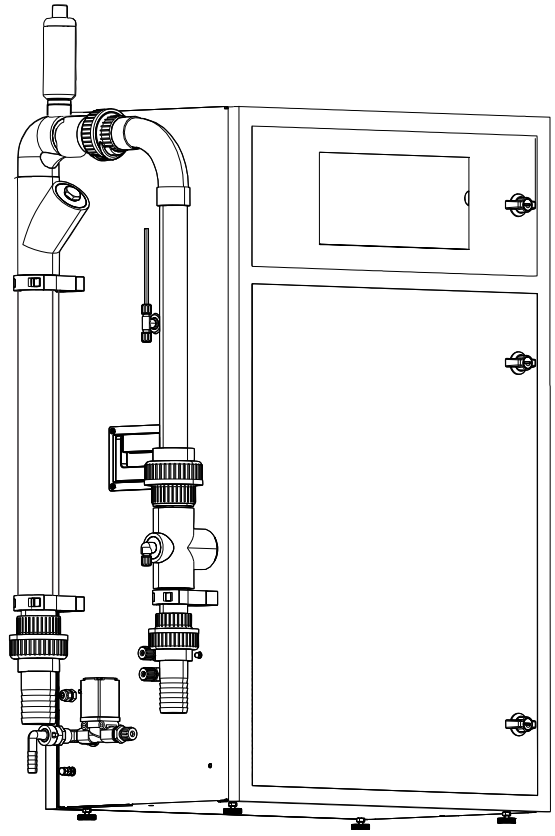
Operating Instructions
SPECTRON TP CA72TP-C/D

Analyzer for the spectrophotometric determination of total phosphorus using the molybdate-vanadate method



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1 Document information

1.1 Warnings

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

1.2 Symbols

- Additional information, tips
- Permitted or recommended
- Forbidden or not recommended

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.
- Measuring point faults may be repaired only by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided may only be carried out directly by the manufacturer or by the service organization.

2.2 Designated use

The analyzer is a compact photometric analytical system. It is designed for monitoring the content of phosphorus in sewage treatment plants and surface waters.

The CA72TP is particularly suited to the following applications:
- Monitoring process waters
- Monitoring surface waters
- Environmental monitoring of phosphorus

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

Electromagnetic compatibility
- The product has been tested for electromagnetic compatibility in accordance with the applicable European 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

1. Before commissioning the entire measuring point, verify that all connections are correct. Ensure that electrical cables and hose connections are undamaged.
2. Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Label the damaged product as defective.
3. If faults cannot be rectified:
   Take the products out of operation and safeguard them to ensure that they are not operated inadvertently.

2.5 Product safety

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 European standards have been observed.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify your supplier of any damage to the packaging.
   Keep the damaged packaging until the matter has been settled.
2. Verify that the contents are undamaged.
   ↳ Notify your supplier of any damage to the delivery contents.
   Keep the damaged products until the matter has been settled.
3. Check the delivery for completeness.
   ↳ Check it against the delivery papers and 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.
   The permitted ambient conditions must be observed (see "Technical data").

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

3.2 Product identification

3.2.1 Nameplate

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
- Safety information and warnings

Compare the data on the nameplate with your order.

3.2.2 Product identification

Product page

www.endress.com/CA72TP

Interpreting the order code

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

Obtaining information on the device

1. Go to the product page for your device on the internet.
2. In the navigation area on the right-hand side, select "Check your device features" under "Device support".
   ↳ An additional window opens.
3. Enter the order code from the nameplate into the search field.
   ↳ You will receive information on each feature (selected option) of the order code.

3.3 Scope of delivery

The scope of delivery comprises:
- 1 analyzer in the version ordered
- 1 accessories pack
- 1 Operating Instructions
- 1 manufacturer's certificate

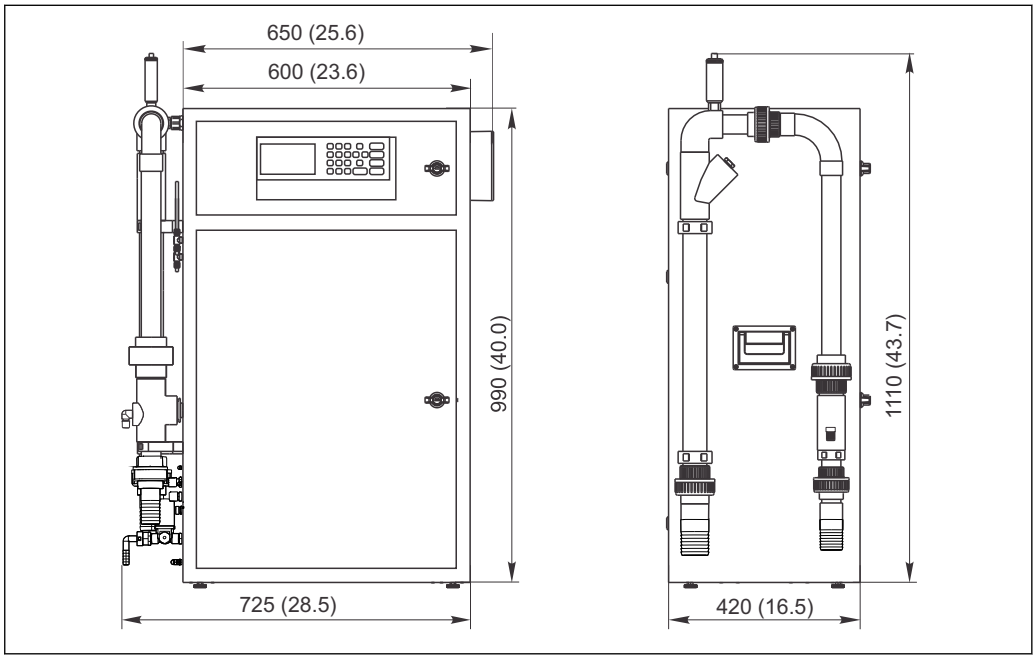
3.4 Certificates and approvals

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

4 Installation

4.1 Installation conditions

4.1.1 Dimensions



1 *CA72TP analyzer with sample conditioning, dimensions in mm (inch)*

4.1.2 Installation options

The analyzer can be mounted in three different ways:
- Bench mounting
- Wall mounting
- On a base frame

Mount the device in such a way that it is also accessible from behind for servicing purposes.

4.1.3 Environment

- An exhaust air connection is required in closed spaces. Halogens or other vapors must not be able to accumulate in such spaces. Backpressure must not form in the 4/6 mm exhaust air hose.
- Ambient temperature range: 5 to 40°C (41 to 104°F)
- Humidity: 20 to 80 %, non-condensating
- Pollution level 2
- The analyzer must be accessible from the front and back.
- ≤ 2000 m (6500 ft) over mean sea level
- No direct sunshine

4.2 Installation

⚠ WARNING

Device is live

Risk of electric shock!

- ▶ Do not connect the analyzer to the electricity supply until the installation work has been completed and the liquid and gaseous media have been connected.
- ▶ To connect the analyzer to the electricity system, follow the instructions in the "Electrical connection" section.

4.2.1 Mounting sequence

When setting up the unit in enclosed areas, make sure there is sufficient ventilation!

1. Mount the analyzer on the base frame, a bench or in the pivoting frame.
2. Mount the EMC connection box (right-hand side of the device).
3. Mount the bleeder on the sample conditioning system (only for PA-2 / PA-3 or PA-9).
4. Check whether the 3-way ball cock in your analyzer is closed.
5. Connect the media.→ 15
6. If you have a sample conditioning system, connect the freshwater connection.

System integrity

1. Switch on the wastewater pump.
2. Check the connecting tubes for leaks.
3. Connect the hoses for ventilation and the sample outlet.

Make sure the cables fed in have sufficient play for you to be able to reach the analyzer from the rear at a later stage.

Connect the tube bed

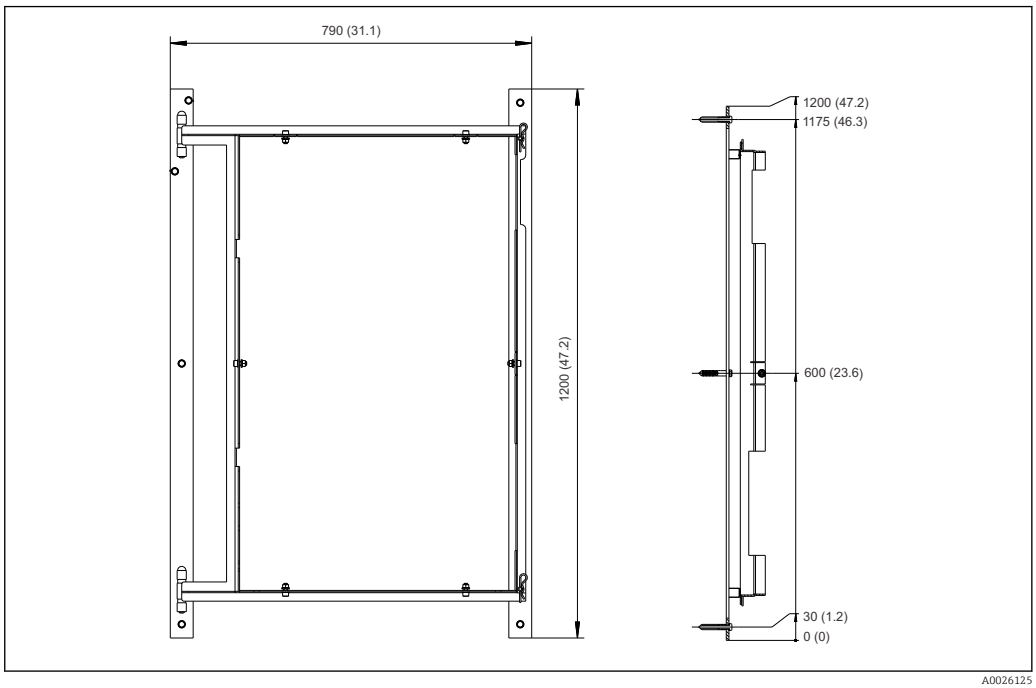
- ▶ Connect the hose bed of pump P1. Make sure that the tube coming from the tension side is straight.

Electrical connection

1. Connect the signal outputs, limit value alarms and error alarm contacts.→ 17
2. Plug the mains plug into the socket (230 V, 50/60 Hz or optionally 115 V, 50/60 Hz) or connect the power cable.→ 17

4.2.2 Wall mounting with pivoting frame

In the case of the "Wall mounting" version, the analyzer is mounted on the wall with a pivoting frame. All bore holes for wall mounting have a diameter of 8.5 mm (0.33").



2 *Pivoting frame for wall mounting, dimensions in mm (inch)*

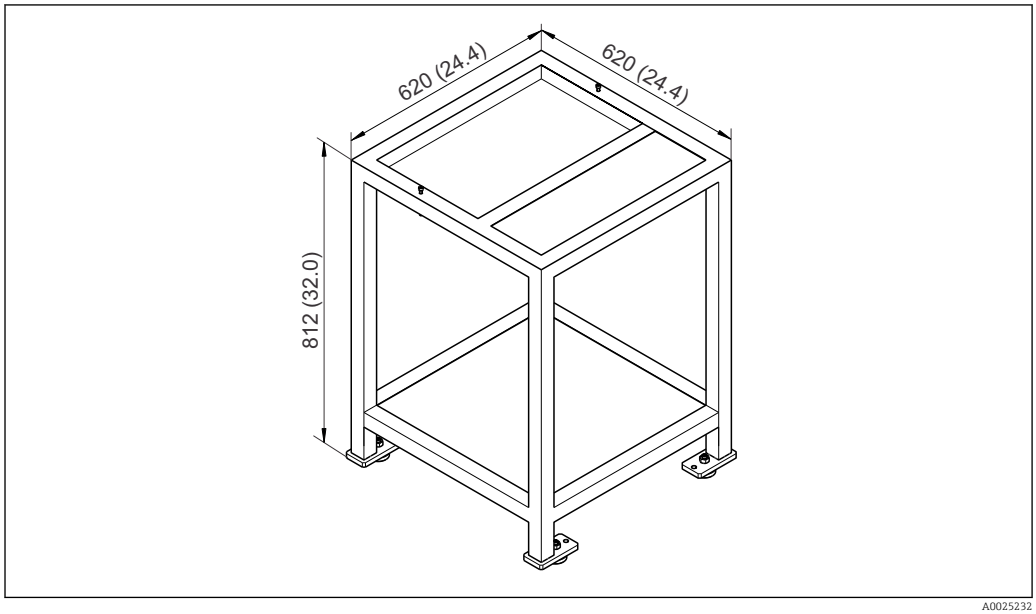
1. First mount the left rail.
2. Hook the analyzer into the hinge provided.
3. Then mount the right rail such that the weight of the analyzer is evenly distributed on both rails.

Use suitable wall plugs that meet the requirements of the mounting surface and can carry the weight of the analyzer.

4.2.3 Mounting on a base frame

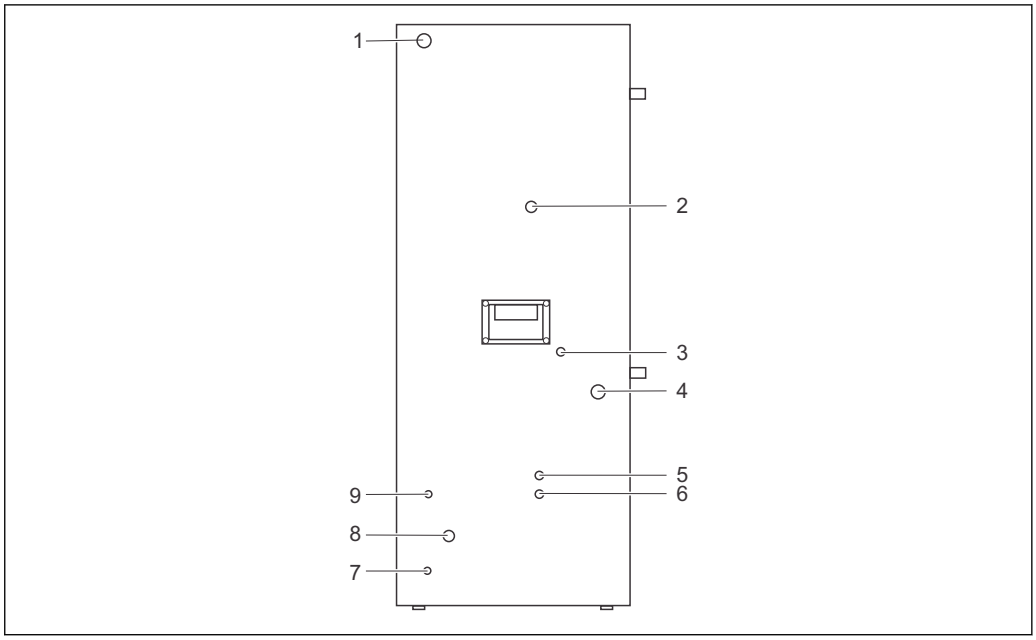
In the case of the "Base frame" version, the analyzer is mounted on a base frame.

Mount the device in such a way that it is also accessible from behind for servicing purposes.



3 Mounting on base frame in mm (inch). Height dimensions without height-adjustable feet.

4.2.4 Connecting the media



4 *Analyzer, left side panel*

1 Power connection
2 Measuring chamber ventilation / overflow
3 Standby cable entry
4 Analyzer sample supply
5 Analyzer sample outlet
6 Optics chamber sample outlet
7 Ground connection
8 Fresh water connection, MV screen flush (optional, for sample conditioning PA-2, PA-3)
9 Cable entry, MV screen flush (optional, for sample conditioning PA-2, PA-3)

Sample supply
When a sample conditioning system is mounted, supply the sample as specified in the table below.

Sample conditioning	Supply connection (mm / inch) outer diameter	Outlet connection (mm / inch) outer diameter
PA2	40 / 1.57	50 / 1.97
PA3	20 / 0.79	30 / 1.18
PA9	20 / 0.79	32 / 1.26

Analyzer outlet
- 1x DN4/6 - overflow (2)
- 1x DN4/6 - sample outlet (5)

Optics chamber outlet
DN6/8 - reactor outlet (6), tube connection DN 6/8 mm (compression fitting) on the left side panel.

The outlet must be unpressurized.

Freshwater supply
- G3/4 connection
- Pressure from 3.0 to 7.0 bar (45 to 105 psi)

A freshwater connection is always required; a separate sample conditioning system is optional and can only be ordered through TSP.

4.3 Post-installation check

- After installation, check whether all the connections are secure and do not have any leaks.
- Inspect all the tubes for any damage.

5 Electrical connection

5.1 Wiring

⚠ 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 the connection work, make sure no voltage is applied at any cable.

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.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example, to covers being left off or cable (ends) which are loose or insufficiently secured.

5.1.1 Wiring preparation

⚠ WARNING

Device is live

The line filter and the main switch are still energized even when the main switch is switched off.

- ▶ Disconnect the device from the power supply (unplug the mains plug).
- ▶ Before connecting, ensure that the mains voltage matches the voltage indicated on the nameplate.
- ▶ Ensure that the analyzer is sufficiently grounded via the mains connection.

The analyzer is available for the following mains voltage ratings:

- 115 V AC 50 Hz
- 115 V AC 60 Hz
- 230 V AC 50 Hz
- 230 V AC 60 Hz

The following condition applies for grounding the analyzer via the mains connection:
$50V < R*I^{max}$

Imax= the maximum current above which the error current protection switch is triggered.

R = the resistance between the protective ground and the device ground.

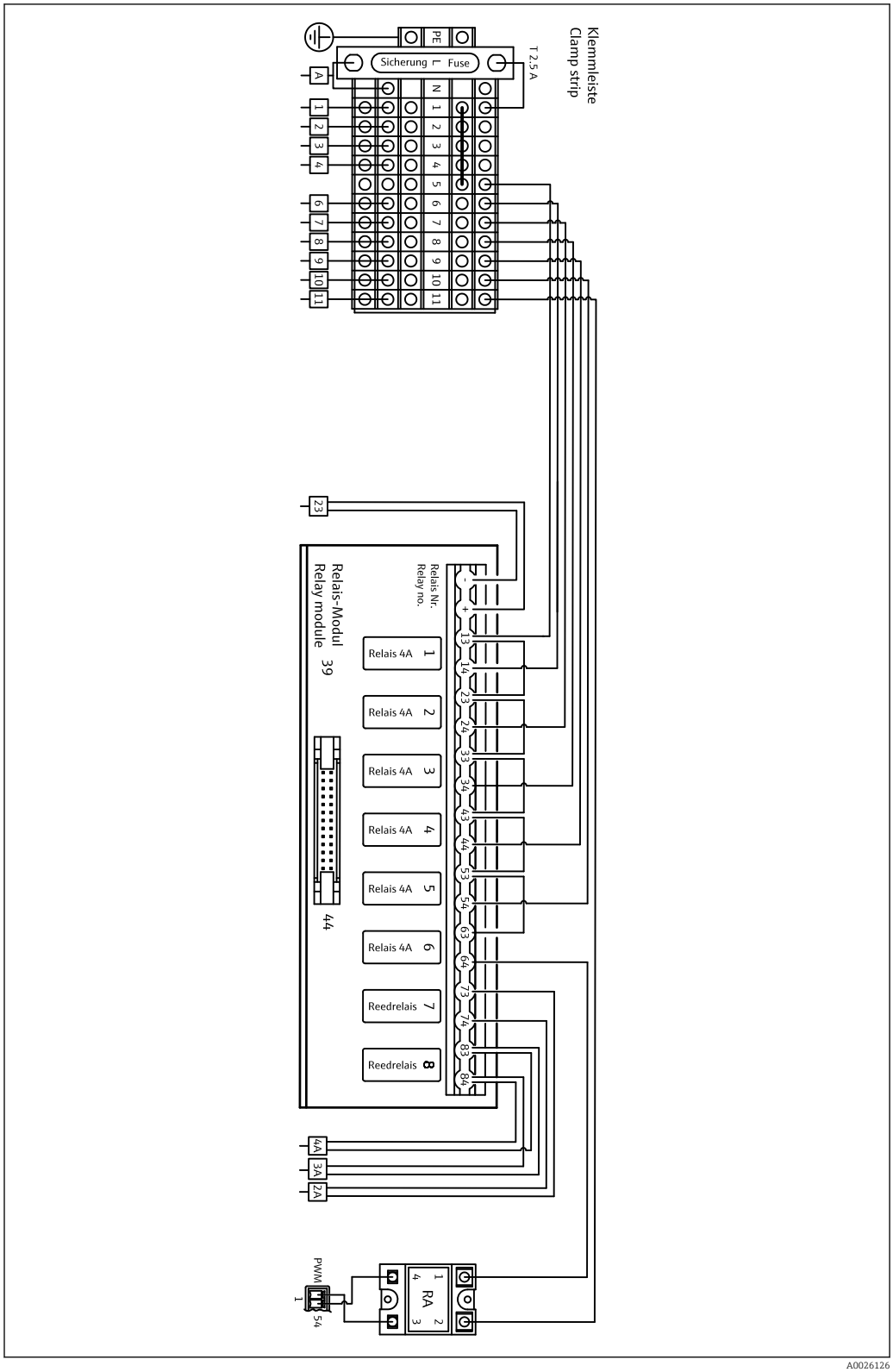
If this cannot be ensured, the device must be grounded locally on site.

You must make the following connections:

- Alternating current connection via mains plug
- External grounding if necessary
- Analog 0/4 to 20 mA outputs
- Binary outputs
- Binary inputs
- RS-232

The signal connections are in the EMC shield box on the right-hand cabinet side. The connection for external grounding is on the left-hand cabinet side at the bottom.

5.1.2 Power distribution TP



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5 *Power distribution wiring diagram*

The power distribution system is located at the back in the top door.

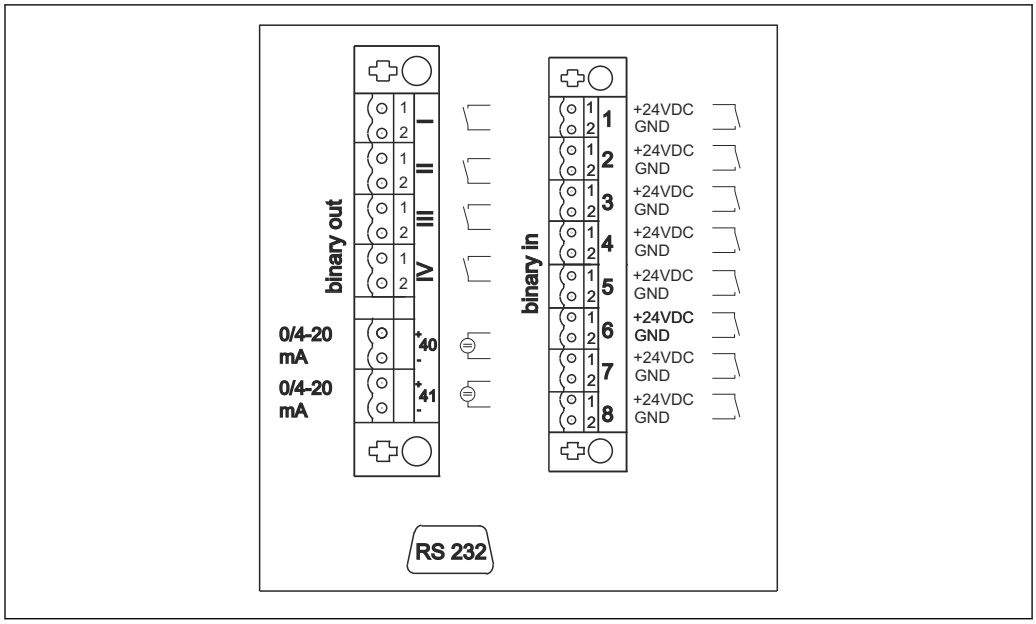
Terminal strip assignment plan:

Connection	Description
A	Main switch, power distribution
1	Spectrometer electronics
2	Power supply for pump 3
3	Power supply for pump 4
4	Free
5	Free
6	Sample to measuring chamber
7	Solenoid valve 2 / measuring chamber seal
8	Solenoid valve 3, sample/standard switchover
9	Solenoid valve 4, standard C1/standard C2 switchover
10	Solenoid valve 5, screen flush
11	Power supply for measuring chamber heater
23	Power supply for relay module

Relay module assignment plan:

Relay No.	Relay type	Function
1	4A	Solenoid valve 1, sample to measuring chamber
2	4A	Solenoid valve 2, measuring chamber seal
3	4A	Solenoid valve 3, sample/standard switchover
4	4A	Solenoid valve 4, standard C1/standard C2 switchover
5	4A	Solenoid valve 5, screen flush
6	4A	Power supply for heater
7		Pump 3
8		Pump 4
RA		Heater control

5.1.3 Signal connection



6 *Signal connection*

I	*Fault messages*
II	*Collective alarm for limit values*
III	*Standby*
VI	*Operational control*
40	*Signal output, channel 1*
41	*Not assigned*

1	*Calibration external trigger*
2	*Adjustment external trigger*
3	*Screen flush external trigger*
4	*Caustic flush external trigger*
5	*Not assigned*
6	*Not assigned*
7	*Standby external trigger*
8	*Not assigned*

Signal outputs	Description
Messages I to IV	Floating relay contact (max. 0.2 A and 50 V), normally closed (NC contact) Relay contact I closed = no error messages Relay contact II closed = no collective alarm Relay contact III closed = standby Relay contact IV closed = operational control At the end of a measuring cycle, relay IV opens for 2 seconds to indicate the end of the measuring cycle.
Signal outputs 40 to 41	Switchable: 0 to 20 mA or 4 to 20 mA, galvanically isolated, load max. 500 Ω
Signal inputs 1 to 8	24 V DC active, load max. 500 Ω

Signal input	Description	Switching state off (open)	Switching state on (closed)
1	Calibration external trigger	Analyzer is in measuring mode	Calibration is triggered
2	Adjustment external trigger	Analyzer is in measuring mode	Adjustment is triggered
3	Screen flush external trigger	Analyzer is in measuring mode	Screen flush is triggered
4	Not assigned		

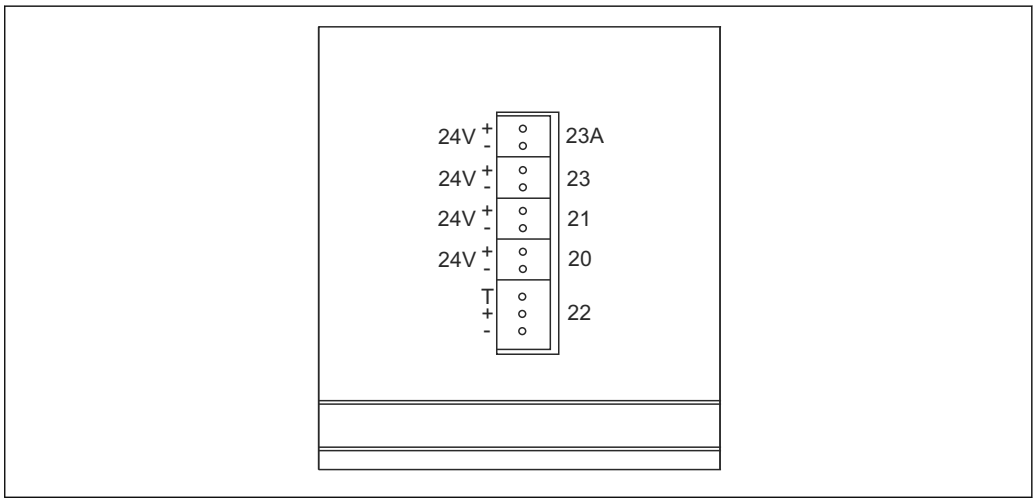
Signal input	Description	Switching state off (open)	Switching state on (closed)
5	Not assigned		
6	Not assigned		
7	Standby external trigger	Analyzer ends the standby mode and returns to the measuring mode or is in the measuring mode.	Standby is triggered. Analyzer is prepared for standby. Standby is maintained as long as the switching state is closed.
8	Not assigned		

The floating contact must be closed for approx. 2 seconds for the switching state to be triggered.

In accordance with EN 61326-1, Class A CA72TP is suitable for connection to industrial power supply systems.

It is recommended to open the floating contacts again after the function has been triggered. If they remain closed, the service is triggered again after execution. This does not apply for signal input 7.

5.1.4 Power unit

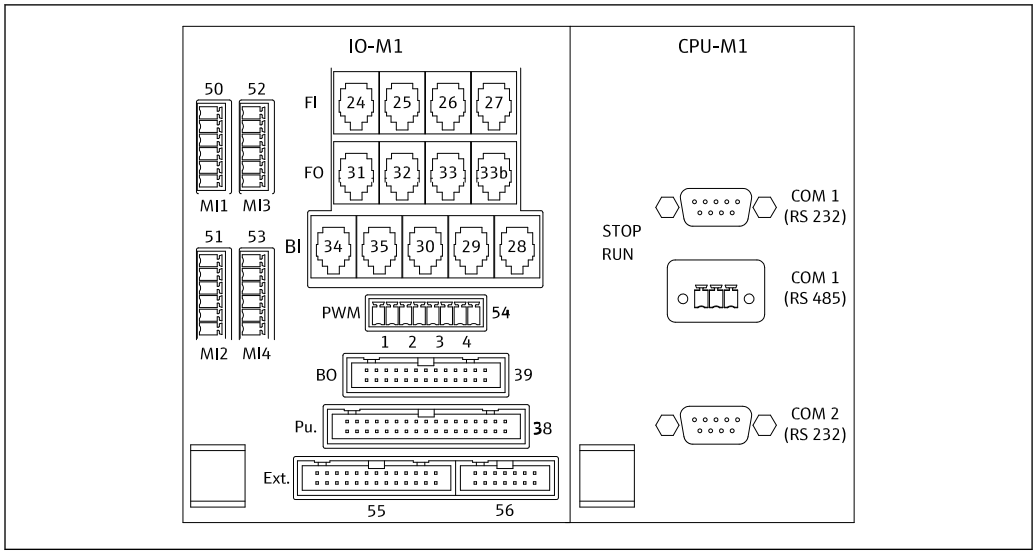


7 *Power unit assignment*

Terminal	Description
20	Pump control 24 V DC
21	Not assigned
22	Not assigned
23	Relay module 24 V DC
23A	Not assigned

The power unit terminals are located on the rear of the computer.

5.1.5 Distributor connection



8 Distributor (= pin 1 for MI1 - MI4 and for PWM)*

Distributor assignment plan:

Terminal	Description
F0-31	Pump control system
BI-29	DI 05 leak detector
BI-30	Standby internal DI 04
PWM-1	Measuring chamber heater control (pin 1 black, pin 2 blue)
BO-39	Relay module
Ext. 55	External junction box
MI1	Measuring chamber temperature sensor control, type K (pin 4 black (+), pin 6 white (-))

Processor assignment plan:

Terminal	Description
COM 1	Serial interface
COM 2	Spectrometer electronics
COM 1	BUS interface

5.1.6 Fuses

Assembly	Fuses
Power distribution	2.5 A, slow-blow design: fine-wire fuse 6.3 x 32
relays	4 A per relay, slow-blow, design: TR5
Power unit	2 A, slow-blow, design: fine-wire fuse 5 x 20

5.2 Post-connection check

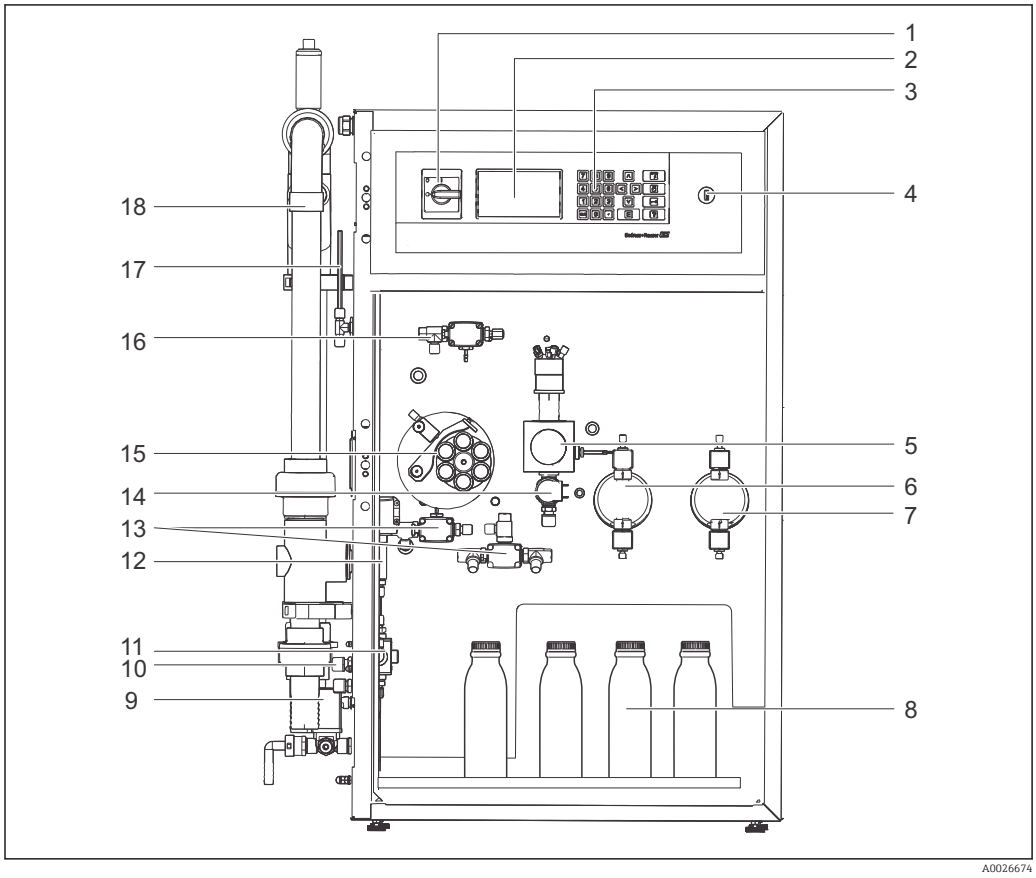
Carry out the following checks once you have made the electrical connection:

Device status and specifications	Notes
Are the sensor and cable free from damage on the outside?	Visual inspection

Electrical connection	Notes
Does the supply voltage of the connected transmitter match the data on the nameplate?	230 V AC 50/60 Hz 115 V AC 50/60 Hz
Are the current outputs shielded and connected?	
Are the connected cables provided with strain relief?	
Are the cable types properly isolated from one another?	Route the power cable and signal cables separately from one another over the entire route. Separate cable ducts are ideal.
Is the cable run correct, without loops and cross-overs?	
Are the power cable and signal cables connected correctly and in accordance with the wiring diagram?	
Are all the screw terminals tightened?	
Are all the cable entries fitted, tightened and leak-proof?	

6 Operation

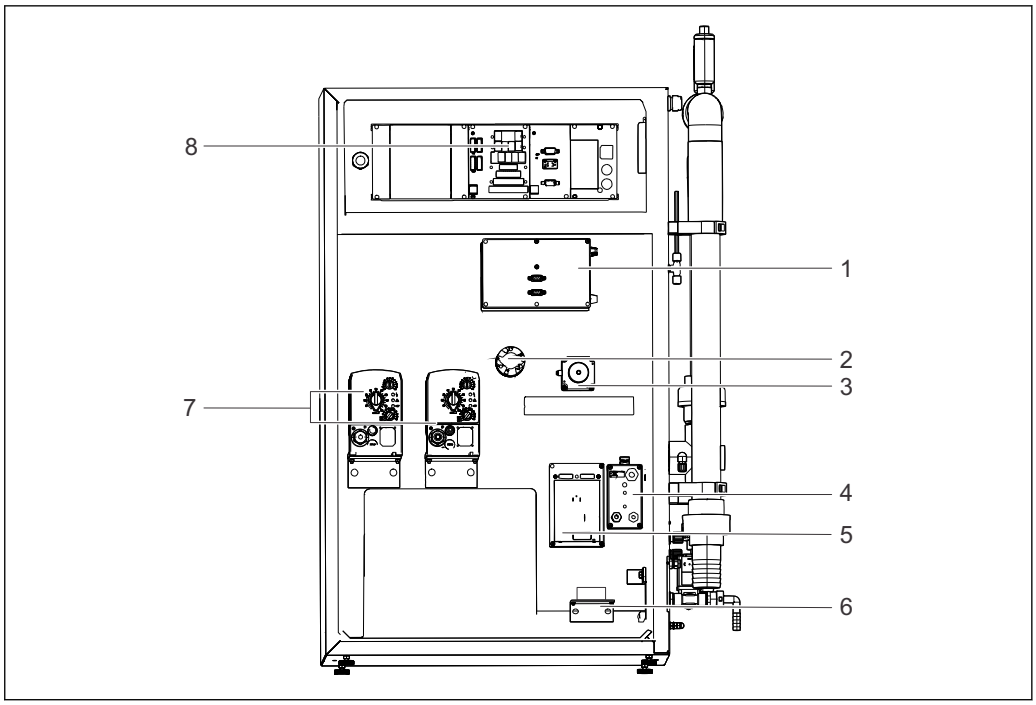
6.1 Operating elements



9 Analyzer, front view

1	*Main switch*	*10*	Optics chamber sample outlet
2	*Display*	*11*	3-way ball valve (online sample/manual sample)
3	*Operating unit*	12	*Standby internal (pressure cell)*
4	*USB*	*13*	*Solenoid valve MV3 and MV4*
5	*Optics chamber/measuring chamber*	*14*	*Solenoid valve MV2 (outlet of optics chamber)*
6	*Reciprocating piston pump P3*	*15*	*Peristaltic pump P1 with tube bed and throttle*
7	*Reciprocating piston pump P4*	*16*	*Solenoid valve MV1 (inlet of optics chamber)*
8	Standard / reagent vessel	*17*	Measuring chamber ventilation (overflow)
9	MV screen flush, freshwater valve	*18*	*Sample conditioning PA-2 (option) with screen cartridge*

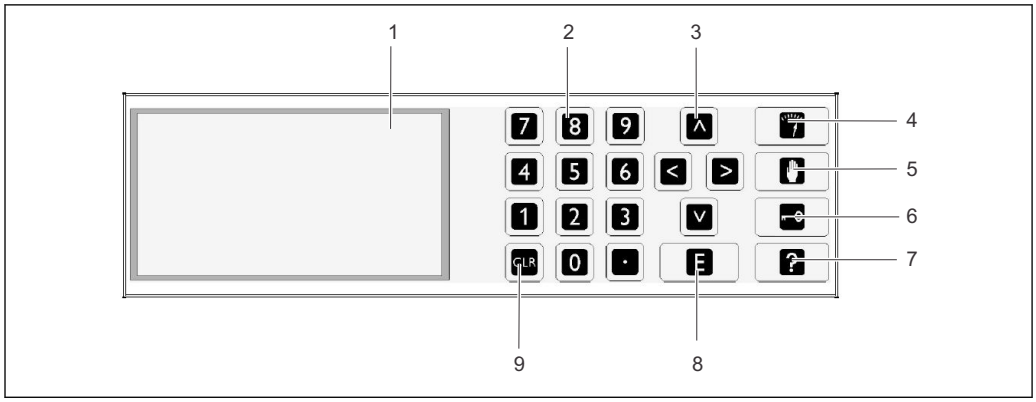
The special key supplied opens the doors on the rear of the analyzer.



10 *Analyzer, rear view*

1	*Spectrometer electronics*	*5*	Pump control system P1
2	*Optical unit light*	*6*	*Leak detector*
3	P1 motor	*7*	*Motor of reciprocating piston pump (P3, P4)*
4	*Distributor heater*	*8*	*Power unit, IO and CPU*

6.1.1 Display and keypad



11 Display and operating elements

1 Screen, 16 lines with 40 characters per line
2 Numerical keypad
3 Arrow keys (move the cursor)
4 "Operation" function key
5 "Service" function key
6 "Programming" function key
7 "Help" function key
8 "Enter" key
9 "CLR" key

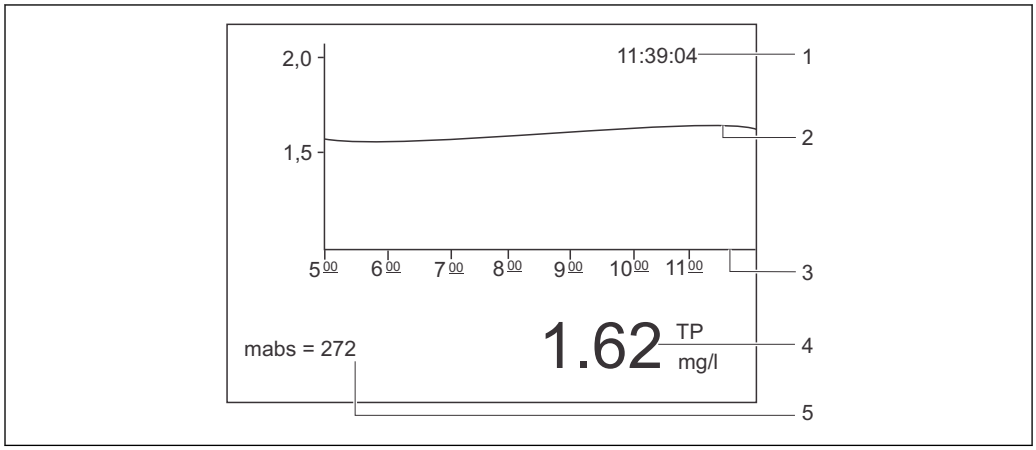
Key	Function
	**"Operation" key** Press the "Operation" key to return to the measuring mode. The progression of the measured values over the past six hours is graphically illustrated on the display.
	**"Service" key** Press the "Service" key to enter the maintenance mode. It contains the following menu items: ▪ Pumps ▪ Adjustment ▪ Cleaning ▪ Reagent
	**"Programming" key** You enter the Programming menu after pressing the "Programming" key and entering the four-digit code (see the code card supplied). It contains the following menu items: ▪ Setting You can configure the measuring device here. ▪ Lists You can list the records and alarms on the display here. ▪ Test You can test the functions of the measuring device with test programs here. ▪ Defaults The last parameter value settings made can be saved or reloaded here. The Help key [?] provides additional information about the current date and program version.
	**Arrow keys** Use the arrow keys to set the position of the cursor on the display. You can enter negative values for certain parameters with the "right" arrow key. A minus sign appears when this key is pressed.

Key	Function
	**"Enter" key** The "Enter" key has the following functions: ▪ To call up a menu item. ▪ To start a program item. ▪ You always press the "Enter" key to confirm an entry. ▪ If performing maintenance tasks, acknowledge every maintenance step once it has been performed by pressing the "Enter" key.
	**"?" key** A short help text on the program item in question appears when you press the "?-key". You exit the help text by pressing the "?-key" a second time.
	**"4" key** Calls up the limit value list. The current instances where the limit value has been overshot are displayed.
	**"5" key** Calls up the error list. The current errors and alarms are displayed.
	**"6" key** Calls up the selected automatic service. The selected service and the time remaining - in seconds - until the next service are displayed.
	**"." key (period key)** The period key indicates the current process step in the measuring process. Pressing the period key again displays the absorption of the sample at the end of reaction 1. Pressing the key a second time reduces the information shown on the display once again to the minimum elements necessary.
	**"CLR" key** You can display the following information on the screen with the "CLR key": ▪ Device type ▪ Software program version ▪ Device options

6.2 Operation during the measuring process

The analyzer has three operating modes:
- Measuring mode
- Service mode
- Programming mode

The measuring process is fully automated. Manual intervention is not possible.



12 Display in the measuring mode

1 Time
2 Load curve of the last six hours
3 Timeline
4 Measured value
5 Current absorption in the measuring chamber

6.2.1 Recording mode

1. Press the ⊟ key in measuring mode to go to recording mode.
2. With the arrow keys, scroll through the recorded measured values:

- ⊡ 1 day earlier
- ⊡ 1 day later
- ⊟ 2 hours earlier
- ⊟ 2 hours later

▶ When you have selected the desired time period, press the Enter key ⊡.

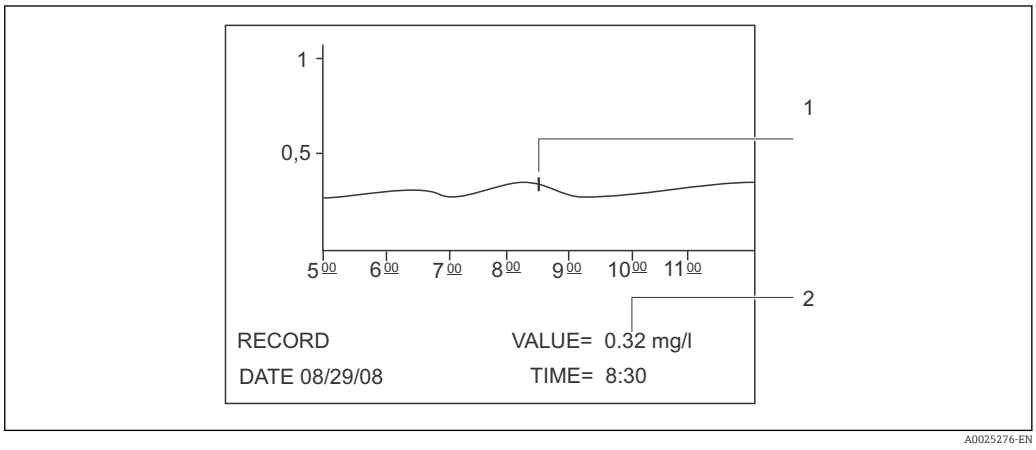
Recording duration:
14 days

▶ Use the operating key ⊘ to exit recording mode.

6.2.2 Zoom function

The zoom function is activated in the recording mode by pressing the Enter key.

The following is displayed:
- Load curve
- Measured value
- Date (refers to the start of the timeline displayed.)
- Time

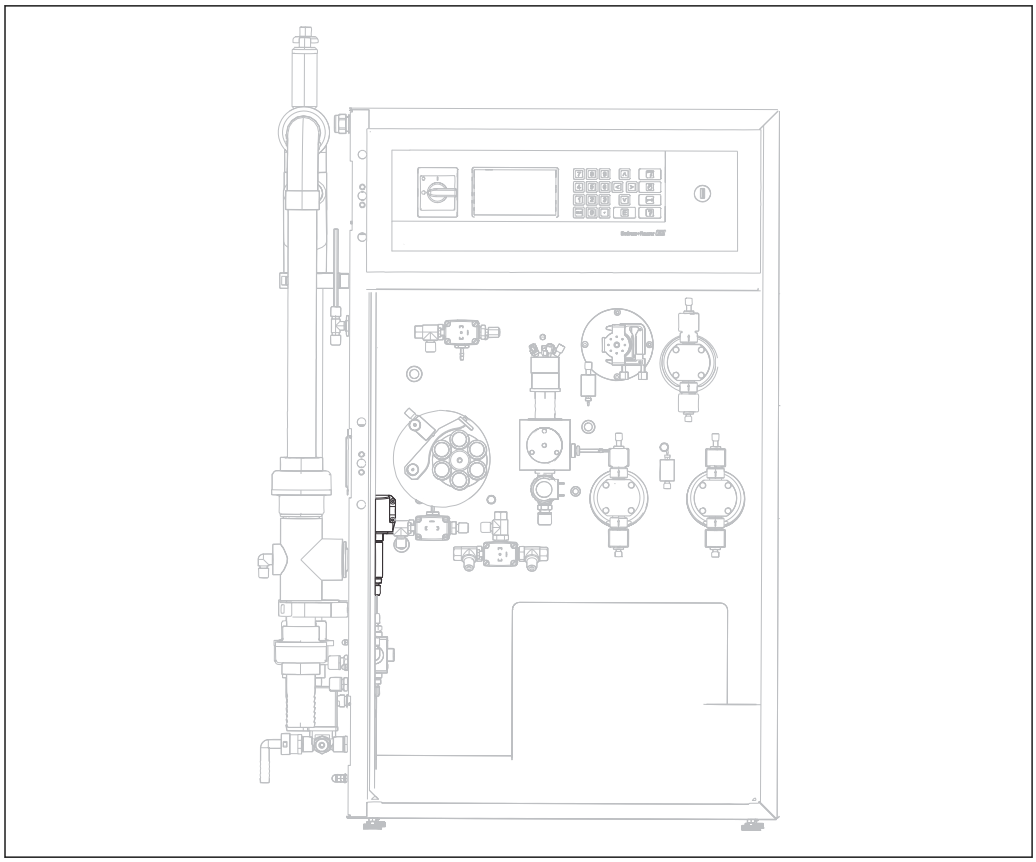


13 Zoom function (example)

1 Time indicator on the load curve
2 Measured value for the selected time

▶ Press the Enter key E to switch off the zoom function.

6.3 Standby mode



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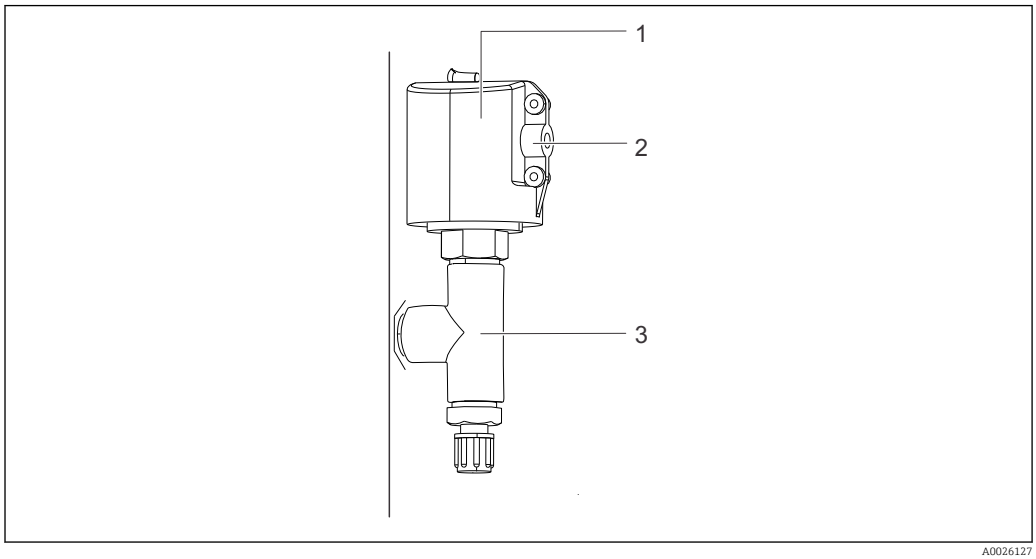
14 Standby position

To protect the measuring chamber, the standby function monitors any failure in the flow of sample.

A pressure of 50 bar on the sample must be guaranteed.



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15 Standby control

1 Protection cap
2 Signal connection
3 Adapter for pressure monitor

Function
If the flow of sample is interrupted, the pressure monitor reports this to the computer via the DI 04 switch input. This has the following effect:
- Pump P1 is stopped.
- The current output is set to 0.0 mA.
- The relays are switched off.

Measuring mode starts again automatically as soon as the flow of sample is re-established.

7 Commissioning

7.1 Function check

⚠ CAUTION

Damage from incorrect hoses or incorrect hose connection.
If liquid escapes, this can result in malfunctions during operation.
- ▶ Check that all connections have been established correctly. In particular, check all hose connections to ensure they are secure and liquid cannot escape.

7.2 Start

7.2.1 Commissioning sequence

To prepare to commission the device, proceed as described in the "Connecting the media" section → 15.

When commissioning the analyzer in enclosed areas, observe the following:
- Check whether the medium that is directed through the sample conditioning system gives off toxic gases (e.g. H_2S ...).
- The ventilation of the sample conditioning system must be ensured externally via a tube.
- Sufficient ventilation must be ensured if servicing the sample conditioning system.

Starting the analyzer:

1. If you have ordered inactive reagents, produce the reagent solutions in accordance with the mixing guidelines supplied, and produce the standard solutions in accordance with the "Producing the adjustment standards" section.
2. Place the canisters of the (active) standard, reagent and cleaning solutions in the analyzer as specified on the labeling.
3. Connect the canisters to the appropriate tubes.

7.2.2 Updating the analyzer software

You can update the analyzer software via the USB port.

1. Switch off the main switch.
2. Insert the USB stick containing the desired software into the USB port.
3. Switch on the main switch again.
   ↳ The Endress+Hauser logo appears
4. Press the [CLR] key

You can now choose from three ways to update the analyzer.

Keys [2] and [3] are reserved for Endress+Hauser Service.

1. Press key [1]
2. Use the [CLR] key to cancel and start the analyzer software available.

A list of all the software versions available is displayed.

Only one version can be selected to update the software, while several versions can be selected to delete the software.

Operation:

[▲▼] Scroll up and down

[◀▶] Scroll from page to page (if over 12 versions are available)

[.] Select the software version (marked with *)

[CLR] Delete the software version (marked with !)

[E] Confirm

The analyzer goes to the measuring mode as soon as the software is started. You can check the software version with the [CLR] key in the measuring mode.

If the software versions are not deleted, they are available to you in the memory. For a better overview, it can be advantageous to delete these versions during other updates.

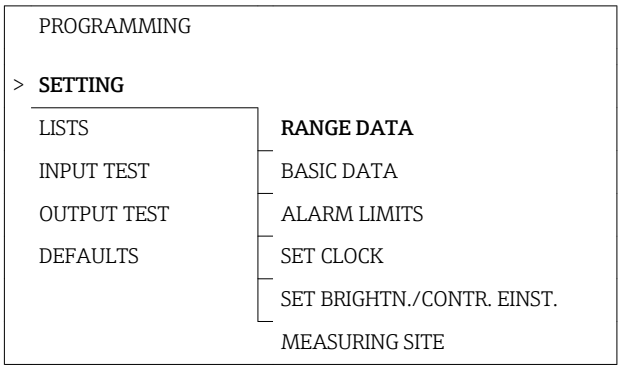
▶ Remove the USB stick after updating the software.

7.3 Programming mode

Set the operating parameters of the analyzer in the programming mode.

1. Press the Programming key.
2. Enter the "key". The key is a four-digit numerical code which can be found on the code card supplied with your analyzer.
3. Press the E key.

The following menu appears on the display:



7.3.1 Menu SETTING - RANGE DATA

Path: Programming/Setting/Range data

Parameter	Unit	Factory setting	Description
CAL./ADJUST[n Days]	mg TP/l	1	Here you can specify after how many days a calibration or an adjustment should be performed. The automatic function is switched off if 0 is set as the value.
CAL./ADJUSTMENT TIME	xx.xx	22.5	Here you can specify the start time of the calibration or adjustment. The value is entered as a decimal number. Example: 22.50 means 22:30 (10.30 p.m.)
CAL/ADJUSTMENT		2	Here you can specify which function should be executed. ▪ 1 - Calibration ▪ 2 - Adjustment The Cal./Adjust [n Days] parameter is used to define whether calibration/adjustment takes place.
SCREEN FLUSH	n/Day	0	The number of automatic bypass screen flushes per day (recommended value: 2).
DURA.SCREEN FLUSH	s	15	The flush duration can be varied if screen flushing is enabled. If a value of over 15 sec is set, pump P1 is additionally operated at a higher pump rate for the remaining time and the inner sample line is also flushed.
RANGE		1	Defines the measuring range. 1.00, 2.00 or 3.00 can be entered; range 2 and 3 not to be used without prior consultation.
SCALE	mg/l	8	Enter the maximum concentration for your measuring point here. This value determines the scale end value for the graphics screen.
STANDARD C1	mg/l	0.8	Concentration of standard solution C1.
STANDARD C2	mg/l	8.0	Concentration of standard solution C2.

7.3.2 Menu SETTING - BASIC DATA

Path: Programming/Setting/Basic data

Parameter	Unit	Factory setting	Description
METHOD		1	Select a method to analyze the absorption: ▪ Method 1: The difference in the case of two different wavelengths is analyzed. Method 1 is selected by default. ▪ Methods 2+3 are not to be used without prior consultation. ▪ Method 4 is used only for version A+B. ▪ Method 5: The absorption difference between reaction 2 (color reaction) and reaction 1 (oxidation) is analyzed.
P1 (B)	[ml/min]	7.5	Here specify the pumping volume P1 during operation. This value should not be changed for standard applications.
TIME (R1) SAMPLE	[s]	960	Specifies the duration for reaction 1 (oxidation).
TP-CORR.OFFSET	[mg/l)	0	Value for correcting constant deviations from the laboratory measured value. The offset can be both negative and positive. Negative values reduce the analyzer measured value. Positive values increase the measured value. The parameter should be modified for substances that do not oxidize easily and can be increased to up to 3600sec.
MEAS.PAUSE MIN	[s]	0	Shortest interval in seconds between two measuring cycles.
MEAS.PAUSE MAX	[s]	0	Longest interval in seconds between two measuring cycles.
MP THRESHOLD	[%]	20	Percentage difference between two consecutive measured values which, if exceeded, causes the smaller MEAS.PAUSE MIN. to be selected. Otherwise the MEAS.PAUSE MAX is activated to save reagent.
EXCHANGE VOL.	[ml]	10	Specifies the sample volume of the pipe system to be replaced when measuring operation commences.
DC OUT 0/4-20	mA	4	Select whether the signal output is set to 0-20 mA or 4-20 mA.
SCALE AO	mg/l	2	Here, enter the measured value (mg/l) TP that corresponds to the analog current value at 20 mA.

7.3.3 Menu SETTING - ALARM LIMITS

Path: Programming/Setting/Alarm limits

Parameters	Unit	Factory setting	Description
HIGH ALARM LIMIT	mg/l	1000.00	Here you can specify the limit value for the "value exceeded" alarm.
LOW ALARM LIMIT	mg/l	0	Here you can specify the limit value for the "value undershot" alarm.

7.3.4 Menu SETTING - SET CLOCK

Path: Programming/Setting/Set clock

Key	Description
↑	Increases the value by 1.
↓	Reduces the value by 1.
←	Value back.
→	Value forward.
E	Confirms the value displayed.

7.3.5 Menu SETTING - SET BRIGHTN./CONTR. EINST.

Path: Programming/Setting/Set brightn./contr.

Key	Description
← →	Switches between brightness and contrast.
↑	Increases the value by 1.
↓	Reduces the value by 1.
E	Confirms the value displayed.

7.3.6 Menu SETTING - MEASURING SITE

Path: Programming/Settings/Measuring site

Key	Description
→ ←	Position of the character
↑ ↓	Character selection
E	Confirms the value displayed.

7.3.7 Menu LISTS - DISPLAY COMPLETE RECORDS

Displays all the saved events in chronological order. The last 400 events are saved in the list.

Path: Programming/Lists/Complete list

7.3.8 Menu LISTS - ALARM RECORD

All the alarms along with the date and time of the event are logged in the alarm record.

Path: Programming/Lists/Alarm record

Alarm	Description
VALUE<>MEASURING RANGE	The absorption determined during the measurement process step exceeds a maximum value or the calculated concentration is continuously (over 10 measuring cycles) less than 0.001 mg/l.
INPUT ERROR C1>C2	Error entering the standard concentrations. The concentration of standard C1 must be lower than the concentration of standard C2.
SPECTROMETER ???	Error communicating with the spectrometer box. The analyzer must be started manually.
LEAKAGE	System leak. The analyzer must be started manually.
TEMPERATURE TOO HIGH	The target value is exceeded by more than 30 °C. The analyzer must be started manually.
ADJUSTMENT ERROR	Error during adjustment. An error number is assigned to the error.
LIMIT ALARM HIGH CH1	Alarm if the upper limit value is exceeded
LIMIT ALARM LOW CH1	Alarm if the lower limit value is undershot

7.3.9 Menu LISTS - MAINTENANCE RECORDS

All the maintenance procedures are sorted and logged by the maintenance actions in the maintenance records. Maintenance procedures which have not been performed cannot be selected.

Path: Programming/Lists/Maintenance record

Alarm	Description
PROGRAM STARTED	Date and time when the program was started
STANDBY	Date and time of a standby event
CHANGE DATA	Date and time when configuration data are changed
CHANGE TIME ÄNDERN	Date and time when the time setting is changed. The new time setting and the difference in hours between the old time and new time is documented. ▪ Negative value: the clock was put back. ▪ Positive value: the clock was put forward.
ADJUSTMENT OPTIC	The date and time of exposure and the intensity at the zero measurement ▪ Value 1: exposure time [ms] ▪ Value 2: exposure intensity [counts]
ADJUSTMENT VALUES I	Date and time of absorptions for the standards at the end of reaction 1 (digestion to produce orthophosphate) ▪ Value 1: C1 [mabs] ▪ Value 2: C2 [mabs]
ADJUSTMENT VALUES II	Date and time of absorptions for the standards at the end of reaction 2 (color reaction of orthophosphate) ▪ Value 1: C1 [mabs] ▪ Value 2: C2 [mabs]
ADJUSTMENT CONSTANTS	Date and time and the adjustment constants obtained during adjustment ▪ Value 1: offset ▪ Value 2: slope [mabs/mg]
CALIBRATION	Date and time of the analyzer calibration and the TP value found and recovery with regard to the indicated concentration of the C2 standard: ▪ Value 1 TP [mg/l] ▪ Value 2: recovery [%]
ADJUSTMENT PUMP P1	Date and time of the adjustment for pump P1 ▪ Value 1: new pump rate (ml/min) ▪ Value 2: old pump rate (ml/min)
ADJUSTMENT PUMP P3	Date and time of the adjustment for pump P3 ▪ Value 1: new pump rate (ml/min) ▪ Value 2: old pump rate (ml/min)
ADJUSTMENT PUMP P4	Date and time of the adjustment for pump P4 ▪ Value 1: new pump rate (ml/min) ▪ Value 2: old pump rate (ml/min)
REPLACE HOSE P1	Date and time when the hose of pump P1 is changed
MEAS. CHAMBER	Date and time when selected in the Service menu
SCREEN FLUSH	Date and time when selected in the Service menu. Automatic screen flushes are not logged.
BYPASS SCREEN	Date and time when selected in the Service menu.
EXCHANGE REAGENT	Date and time when the corresponding point in the Service menu is selected
SAVE DEFAULTS	Date and time when selected in the Programming/Setting menu
SET DEFAULTS	Date and time when selected in the Programming/Setting menu

7.3.10 Menu LISTS - MAX MIN AVERAGE

Logs the maximum, minimum and average measured values for the 14 days saved.

Path: Programming/Lists/Max. Min. Average

7.3.11 Menu LISTS - RECORD ALL DATA

Use this menu item to save the measured data and reports of the last 14 days to a USB stick. The data records are available as csv files.

Path: Programming/Lists/Record all data

If the time or date is changed during these 14 days, the date of the data is updated accordingly. If the date change is outside these 14 days, then the data memory is cleared completely.

7.3.12 Menu TEST - INPUT TEST

The TEST programming menu contains test programs for testing the function of the analyzer.

Path: Programming/Input test

Alarm	Description
ANALOG INPUTS	▪ The current absorption is displayed in the individual process steps. ▪ The absorption values for methods 1-4 are only displayed at the end of reaction 1 and 2. Otherwise, the absorption that was calculated in the previous process step is displayed. ▪ Temperature of the temperature sensor in the heating cartridge. ▪ PWM power display
BINARY INPUTS	Displays the switching states of the binary inputs: ▪ Switching state of the binary inputs – Ix = 0 = OFF – Ix > 0 = ON ▪ IN1= Not assigned ▪ IN2= Not assigned ▪ IN3= Not assigned ▪ IN4= Standby No. BI30 ▪ IN5= Leak detector No. BI29 ▪ IN6= Not assigned ▪ IN6= Not assigned ▪ IN7= Not assigned ▪ IN8= Not assigned
SPRECTROM INFO	Displays the parameter values of the spectrometer.

7.3.13 Menu TEST - OUTPUT TEST

Path: Programming/Output test

Alarm	Description
MEASUREMENT OFF	Deactivates measurement operation. The MEASUREMENT OFF operating state is displayed. Select this state to tests the inputs without triggering an alarm.
CURRENT OUTPUT	Sets the analog current outputs to any value between 0 and 20 mA.
PUMPS	Parameter for checking pump function.
BINARY OUTPUTS	Displays the switching states of the binary outputs (see the following table). ON/OFF with the Enter key
TEST COM	Displays the transmission data for the RS 232 computer interface. The menu item makes it possible to test data transmission with an external terminal. If the data connection is established, a data string is sent every 2 seconds. Key strokes at the external terminal are shown on the display. Carriage return must be pressed to send data entered at the terminal.

Output	Description	Switching state OFF (contacts open)	Switching state ON (contacts closed)
SA1	Switch between sample feed to measuring chamber and outlet	Sample past measuring chamber	Measuring chamber inlet
SA2	Measuring chamber seal	Measuring chamber seal closed	Measuring chamber seal open
SA3	Switch between sample and standard 1	Sample	Standard 1
SA4	Switch between standard 1 and standard 2	Standard 1	Standard 2
SA5	Screen flush valve	Screen flush off	Screen flush on
SA6	Heater power supply	Off	On
SA7	Pump 3	Pump off	Pump on
SA8	Pump 4	Pump off	Pump on
SA9	Collective alarm for relay I error (e.g. temperature too high, leak)	Error on	Error off
SA10	Collective alarm for relay II limit values	Limit value alarm on	Limit value alarm off
SA11	Standby relay III	Standby off	Standby on
SA12	Relay IV operational control	At the end of the measuring cycle in the measuring mode, the contact is opened for 2 seconds to report the end of the measuring cycle. The contact is opened if the analyzer is in service or in a fault condition that does not allow TP measurement.	The contact is closed during measuring operation, e.g. after servicing this contact is closed after the first TP measured value has been determined.

7.4 Optimizing the analyzer

7.4.1 Measurement method

The total phosphorus content is determined following previous digestion with an oxidizer and subsequent photometric determination as an orthophosphate according to the molybdenum blue method.

The analyzer covers different measuring ranges depending on the analyzer version:
- Version C: Measuring range 0.3 - 8.0 mg/l
- Version D: Measuring range 0.5- 25 mg/l
  The version can only be modified by changing the components. (Endress+Hauser service)

7.4.2 Measurement method

The Spectron CA72TP-C/D uses the following methods to analyze absorption:
- Method 1 (standard)
  This method calculates the absorption difference in the case of two different wavelengths. This method involves linear analysis of the absorption. Method 1 produces good results that are not affected by the turbidity of the sample.
- Method 5 (option)
  This method also involves linear analysis of the absorption. Here, the difference between the absorption from reaction 1 (oxidation) and the actual absorption from reaction 2 (color reaction) is calculated and used to determine the measured value. This method has the advantage that the measurement result is not affected by inherent color.

Methods 2 and 3 should be used only in certain applications and only following consultation with Endress+Hauser Service.

Please note that method 4 is not used for CA72TP C/D.

7.4.3 Optimizing the measurement method

The analyzer must be adjusted to obtain correct measurement results. Since the analyzer measuring task can change after the analyzer has been in operation for a long time, the standard concentrations selected must be reexamined.

You can improve the accuracy of the measurement by choosing the right adjustment standard.

You can save reagent if you only measure with the number of measuring cycles that are really required. With the MEAS. PAUSE MIN, MEAS. PAUSE MAX and MP THRESHOLD parameters, the analyzer allows you reduce the frequency of measurement when there is little change in the concentration.

Example:

MEAS. PAUSE MIN = 120 s

MEAS. PAUSE MAX = 600 s

MP THRESHOLD = 20%

If a new measured value deviates by 20% or more from the previous measured value, the MEAS. PAUSE MIN of 120 s applies. If the measured value deviates by less than 20% from the previous value, then the MEAS. PAUSE MAX. applies. The analyzer then waits 600 s between two measurements.

7.5 Communication

The analyzer is fitted with an RS-232 serial interface. Data transmission is unidirectional and performed with the following parameters:

- Baud rate: 9600 baud
- Bits: 8 bit
- Parity: N
- Stop bit: 1 bit
- Handshake: no
- The string is 104 bytes long and is sent every 2 seconds.

Byte	Description
0	Start byte
1	0 = measuring operation disabled 1 = measuring operation enabled
2	0 = emergency stop 1 = channel 1 operation enabled 2 = adjustment or calibration 3 = service 4 = programming
3	Leak (0 = off, 1 = on)
4	Temperature too high (0=off, 1 = on)
5	Spectrometer ??? (0 = off, 1 = on)
6	0
7	0
8	Outside the measuring range (0 = off, 1 = on)
9	0
10	0
11	0
12	Standby (0 = off, 1 = on)
13	Limit value exceeded (0 = off, 1 = on)
14	Limit value undershot (0 = off, 1 = on)
15	0
16	0
17	0
18	0
19	0
20	Adjustment error (0 = off, 1 = on)
21	0
22	0
23	0 = no valid measured value available 1 = valid measured value available 2 = new measured value determined (present for approx. 4 seconds)
24	Separator
25	0 = sample 1 = standard is dosed
26	0= MV2 closed 1= empty measuring chamber
27	Service adjustment 0 = off 1 = standard C1 is dosed

Byte	Description
28	0 = off 1 = standard C2 is dosed
29	Sample conditioning rinsing
30	Heating in measuring mode 0 = off 1= on
31	SA 7 reagent pump P3; only in the test menu 0= off 1= on
32	SA 8 reagent pump P4; only in the test menu 0= off 1= on
33	Separator
34...39	PO4-P measured value (mg/l)
40	Separator
41...46	not used
47	Separator
48 ... 53	Current absorption value
54	Separator
55 ... 60	Absorption value used to calculate the PO4-P value
61	Separator
62 ... 67	Heater temperature
68	Separator
69 ... 74	0
75	Separator
76 ... 81	4-digit numerical value; measuring cycle status
82	Separator
83 ... 92	Date DD.MM.YYYY
93	Separator
94 ... 101	Time HH:MM:SS
102	Carriage return
103	Line feed
104	End of transmission

7.6 Adjustment

Once all the parameters have been configured, the analyzer must be adjusted. The reagent solutions prepared in accordance with the specifications in the "Preparing the adjustment standards" section are required for this purpose.

1. Go to the Service menu
2. Select Service menu/Reagent/Exchange reagent.
3. Using key "3" or "4", vent the reciprocating piston pump P3, P4. Comply with the protective measures .
4. Start measuring operation and after about one hour start an adjustment. To do so, go to the Service menu/Calibration/Adjustment
   ↳ An adjustment is started. The analyzer goes to the measuring mode automatically following this adjustment.

- Users are recommended to perform another adjustment after measuring operation has been in progress for approx. one hour. This is because the overall system will have been run in at this stage and the heating will have caused the optics chamber to reach operating temperature.
- The analyzer is preadjusted on leaving the factory!

8 Diagnostics and troubleshooting

⚠ WARNING

Device is live

Incorrect troubleshooting may result in injury or death.

- ▶ Troubleshooting on components behind the mounting plate may only be performed by an electrical technician.

⚠ CAUTION

Cause (/consequence) bacteria or germs in the wastewater.

Risk of infection and injury

- ▶ Wear acid-proof protective gloves, protective goggles and a lab coat!
- ▶ When working, be careful not to damage the reagents.

The analyzer monitors its functions automatically. If an error detected by the device occurs, this is indicated on the display.

8.1 Error messages

Message	Reason	Tests or remedial action
“Spectrometer ???”	No communication possible with the spectrometer. Transmission cable or contacts defective; power supply to the spectrometer disconnected	▪ Go to measuring mode. Check the red LED on the spectrometer. It flashes in the measuring mode. ▪ Check the connecting cable from COM2 on the CPU to the COM port on the spectrometer. ▪ Check the spectrometer power supply. (When the analyzer is switched on and off at the main switch, the red LED of the spectrometer flashes briefly).
Leak	The leak detector has been triggered. Leaks in the measuring device if the contacts of the leak detector are bridged. Possible defect: leak detector, cable, I/O card	▪ Check for leaks. ▪ Check the leak detector for electrical short-circuiting of the female contacts. ▪ Check signal processing (I/O card socket no. 29 switch input DI05) Go to the program module PRG/TEST/INPUTS/ BINARY INPUTS. Plug the cable of internal standby cable 30 into socket 29. By manually bridging the standby connection contacts (pressure cell) the display at switch input SI05 should change. If it does, replace the leak detector. If it does not, replace the I/O card.
Value<>measuring range	The spectrometer constantly delivers a signal outside the permitted upper limit, the concentration of the sample is too high, optical waveguide defective	▪ Check the concentration of the sample. Excessively high concentrations result in absorption above the permitted measuring range (dark blue sample solution). ▪ Check the optical path. Is the optical waveguide mounted? Is the LED lit?
	The spectrometer constantly delivers a signal below the permitted limit	▪ Check the sample supply. ▪ Check the level of the reagent containers for reagent 1 and reagent 2. ▪ Check the phosphate concentration of the sample.

Message	Reason	Tests or remedial action
Incorrect adjustment, adjustment constants 1	No communication with the spectrometer	▪ Check the connecting cable from COM2 on the IO card to the COM port on the spectrometer. ▪ Check the spectrometer power supply. (When the analyzer is switched on and off at the main switch, the red LED of the spectrometer flashes briefly).
Incorrect adjustment, adjustment constants 2	The slope is smaller or greater than the specified limit MV3, MV4, standard solutions or reagents empty	▪ Are the standard solutions prepared correctly. ▪ Do both standard solutions have the same concentration. ▪ Have the standard solutions been mixed up. ▪ Are the standard vessels empty. ▪ Check the function of solenoid valves MV3 and MV4. Confirm the output for SA03 for MV3 and SA04 for MV4 in the program module PRG/TEST/OUTPUTS/ BINARY OUTPUTS. If the solenoid valves do not switch replace the solenoid valve in question.
Incorrect adjustment, adjustment constants 3	The offset is smaller or greater than the specified limit, standard solutions used incorrectly.	▪ Are the standard solutions prepared correctly. ▪ Do both standard solutions have the same concentration. ▪ Have the standard solutions been mixed up.
Incorrect adjustment, adjustment constants 4	The measured absorption for standard C1 is smaller or greater than the specified limit, standard vessel empty, check standard solution C1	▪ Is the standard vessel for standard C1 empty ▪ Is the standard solution for standard C1 prepared correctly?
Incorrect adjustment, adjustment constants 5	The measured absorption for standard C2 is smaller or greater than the specified limit, check standard solution C2	▪ Is the standard vessel for standard C2 empty ▪ Is the standard solution for standard C2 prepared correctly?
Incorrect adjustment, adjustment constants 6	The spectrometer constantly delivers a signal outside the permitted upper limit, check the standard solution, optical waveguide	▪ Is the standard solution for standard C2 prepared correctly? ▪ Is the optical waveguide mounted? ▪ Is the LED lit?
Input error C1<C2	Input value for C1 is higher than for C2	Enter the correct concentrations.
Calibration has asterisk	The measured absorption is smaller than 75% of the value for C2 from the last adjustment	Replace the standard solution for C2. Repeat the calibration.
Temperature too high	The temperature of the heating cartridge is 30 °C higher than the target value. Possible defect: relay RB, PWM1, I/O card	▪ Press the "Operation" key to resume measuring operation. Select INPUT TEST. The temperature is displayed. ▪ The heating cartridge is possibly being heated constantly. Disconnect the PWM connection (cable 54). If the temperature continues to rise, check relay RB. ▪ Select INPUT TEST. If the PWM controller constantly outputs 100 %, there is a malfunction in the PWM. Switch the main switch off and on. If the error persists, replace the I/O card.

9 Maintenance

Regular maintenance guarantees the efficient operation of the analyzer.

Before you attempt to service the device, you must be completely familiar with the maintenance processes and have understood them precisely. All the maintenance processes described in this section should only be performed by a properly qualified technician. Incorrect maintenance can result in inexact operation and give rise to safety hazards.

Window	Maintenance work
At least once a week	▪ Visual inspection ▪ Check sample conditioning (see appropriate Operating Instructions)
At least once a month	▪ Check delivery rate of pump P1, pump P3 and P4 ▪ Replace reagents ▪ Replace standard
Every 3 months at the latest	▪ Clean optics chamber ▪ Change pump hoses
If required	Replace cleaning solution; clean solenoid valves, hose bed throttle and pump rolls, check adjusting screw P1 to ensure it runs smoothly

The maintenance intervals depend greatly on the application. Therefore adapt the maintenance intervals to your specific needs but make sure that these maintenance tasks are always performed regularly!

9.1 Cleaning the housing

During cleaning, make sure not to damage the nameplate on the analyzer! Do not use cleaners that contain solvents!

Clean the analyzer housing as follows:
Use fluoride-free cleaner and a lint-free cloth.

9.2 Visual inspection

⚠ WARNING

Risk of infection

When working with wastewater, bacteria or germs can damage the immune system and cause infection.

▶ Therefore wear protective gloves, protective goggles and protective clothing.

Perform the visual inspection at least once a week:

- Check whether the measurement is in the standard range. Are the measured values plausible?
- Is the sample supply line OK? To check, place a receptacle under the tap and set it briefly to Manual Sample. Does sample flow out of the bypass?
- Is the solenoid valve MV2 leak-tight?
- Are sufficient amounts of standard and reagent solutions available? Make sure that sufficient amounts of reagent and standard solution are still available in the canisters.
- Is the pump hose OK? Check the hose for embrittlement, leaks and drop formation.

9.3 Service menu

The maintenance work is supported by the service software. This software is divided into four sections:

- Pumps
  - Replace hose pump P1
  - Adjust P3, P4
- Adjustment
  - Analyzer adjustment
  - Analyzer calibration
- Cleaning
  - Measuring chamber
  - Screen flush
  - Bypass screen
- Reagent
  Exchange reagent

9.4 Pumps

The peristaltic pump P1 used in the analyzer combines the methods of vacuum pumps and displacement pumps to convey the medium. The delivery rate depends on the elasticity of the pump. The elasticity of the pump is reduced and the delivery rate drops with increasing mechanical load. This wear depends on the level of stress and load (cleaning interval, pump contact pressure). Calibration can offset this wear effect to a certain extent. If the hose loses too much elasticity, the delivery rate of the pumps can no longer be reproduced. This results in incorrect measurements.

9.4.1 Blocking of pump P1

⚠ CAUTION

Running pump

Danger of crushing or pinching.

- ▶ Do not reach into rotating pump parts.
- ▶ Switch off the pump.

In an overload situation, the peristaltic pump P1 can come to a standstill, become sluggish or not run smoothly.

Path: Programming/Output test/Pumps

1. Set pump P1 to 0%.
2. Check the hose bed and loosen the setscrew of the hose bed throttle if necessary
3. Also check the pump head for damage or corrosion
4. Set the pump P1 in the menu Programming/Output test/ Pumps to 50%.
   ↳ The peristaltic pump starts briefly.
5. Go to the menu Service/Replace hose pump P1 and perform pump adjustment directly.

Pump adjustment is absolutely essential after the hose bed throttle has been changed.

9.4.2 Replacing the hose of pump P1

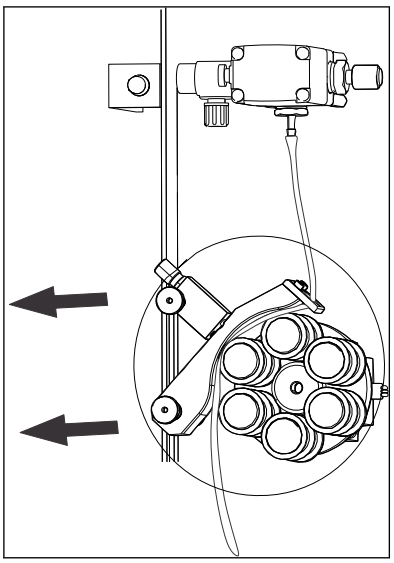
This service includes measuring the capacity of the pump.

The SPECTRON TP has a program item that performs calibration for Pump P1. You require a 25 ml graduated cylinder for this purpose.

1. In the menu go to Service/Pumps/Replace hose pump P1 and press E to confirm.
2. Follow the instructions on the display until the "Replace pump hose" instruction.

Removing the Plexiglas disk

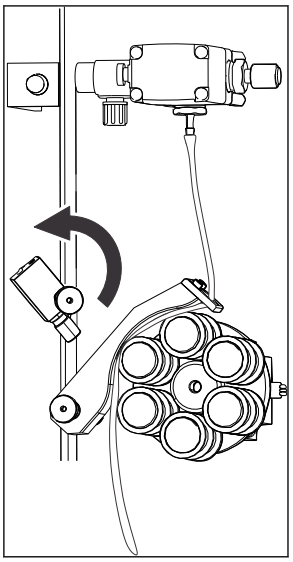
1. Remove the Plexiglas disk by loosening the two knurled nuts.

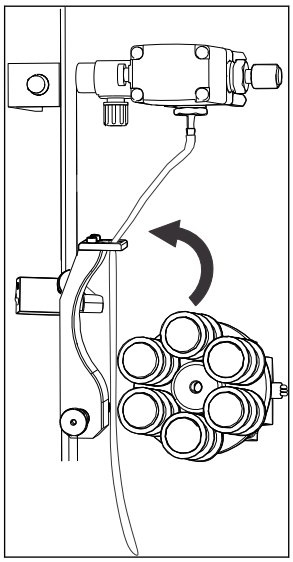


2. Close the 3-way cock in the direction of the sample supply line.
3. To drain the pump hose, place a receptacle under the 3-way cock and open the cock in the direction of the receptacle.

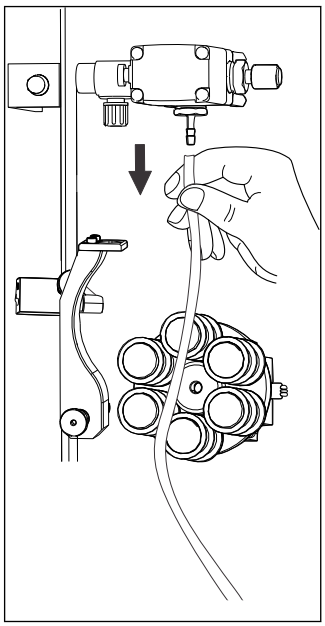
Opening the hose bed

1. Open the hose bed throttle.



2. Then open the hose bed.
   ↳

3. Place a vessel under the tap.
4. Open the hose case.
   ↳ The hose can now be drained into the vessel.

Replacing the pump hose

1. Turn the hose clockwise and counterclockwise to release it from the hose connection nipples.
   ↳

2. Remove the hose.
3. Insert a new hose into the pump.
4. Position the hose on the hose connection nipples and fit it in place by turning it in a clockwise direction.
5. Make sure that the hose is in position and is not twisted.

Closing the hose bed

The contact pressure should be set before the reagent hose is inserted into the reagent solution. If you cannot fill the hose without air bubbles, adjust the setscrew for the pump contact pressure:

1. Push the hose bed onto the retaining bolt in such a way that the hose coming from the tension side is straight.
2. Lubricate the hose with silicone grease, if necessary, and close the hose bed throttle.
3. Check the contact pressure of the hose bed and, if necessary, correct the setting of the setscrew on the hose bed throttle.

Checking pump startup

1. In the menu go to Service/Pumps/Replace hose pump P1 and press E to confirm.
2. Using the →key, start the peristaltic pump briefly and then stop the pump again.
   ↳ The pump head should turn smoothly, without jerks or jolts.

If the pump does not start, the setscrew of the hose bed throttle is set too tightly. Slacken the setscrew slightly.

Opening the sample supply

- Operate the 3-way cock as indicated in the system diagram on the display.
  ↳ The measuring device returns to the measuring mode and initially displays the message "PAUSE VALUE".

9.4.3 Adjusting pumps P3, P4

The SPECTRON TP has a program item that performs calibration for pump P3, P4. You require a 10 ml graduated cylinder for this purpose.

1. In the menu go to Service/Pumps/Adjust P3, P4 and press E to confirm.
2. Follow the instructions on the display.
3. Release the GL cap on the optics chamber.
4. Carefully remove the dosing element of the optics chamber and hold it over the graduated cylinder.
5. Press the Ekey.
   ↳ You can now select the pump you want to calibrate.
6. Using the "1", "3" or "4" key, select the desired pump and follow the instructions. If bubbles are visible in the dosing hoses, remove the bubbles by pressing the →key.
   ↳ As soon as pump calibration is completed, the display goes to the main level.
7. Put the GL cap back on the optics chamber.
8. You can now adjust additional pumps.

Always calibrate pump P1 after replacing the pump hose. P3 and P4 do not necessarily have to be calibrated. All the pumps are calibrated at the factory so you do not have to calibrate the pumps when you put the measuring device into operation for the first time.

9.5 Adjustment

9.5.1 Analyzer adjustment

This section describes how to adjust the analyzer. The analyzer is adjusted using two-point adjustment. For this purpose, two different standard solutions are measured. These standard solutions are connected in the analyzer.

Path: Service/Adjustment

Adjustment procedure
- Caustic flushing is performed.
- The analyzer determines the absorption of standard C1 and C2.
- The offset and the slope are calculated from these values.

9.5.2 Producing adjustment standards

Endress+Hauser Conducta makes different parent and standard solutions available for a range of parameters to be measured. A parent solution is a concentrated solution with an exact concentration of the substance to be measured.

Adjustment standards can be made by suitably diluting the parent solution. You can also order ready-to-use standard solutions directly from Endress+Hauser.

To mix an adjustment standard, transfer a precise quantity of parent solution into a volumetric flask of sufficient size and then fill the flask with distilled water. The quantity of parent solution to be added can be easily calculated by applying the "Rule of Three".

Example:

To create 1 liter of standard solution with a concentration of 2 mg/l total-P, take 2 ml of a parent solution with a concentration of 1000 mg/l total-P and add distilled water until the 1 liter-mark.

NOTICE

Imprecision when mixing the standard solutions.
Any mistakes made when mixing the standard solutions have a direct impact on the subsequent measurement operation.
- ▶ Please note that standard solutions should not be used for longer than 4 weeks. Exercise caution when mixing the standard solutions.
- ▶ You must always be sure that the standard prepared has the required concentration. For this reason, always work with clean vessels. In case of doubt, prepare a new standard.
- ▶ Please note that using a reference method (e.g. cell test) to check the concentration of the standard is considerably more susceptible to errors than the actual production of the standard.

In the device, always enter the concentration which you mixed. The values of the reference system are not entered. They are only used to check the plausibility of the values. If the values deviate too much from the target concentration, prepare a new standard or perform the comparative test again.

9.5.3 Determining the standard concentrations

The right choice of standard concentration is critical to the accuracy of the measurement method. Before specifying the concentrations of the standard solutions, determine the concentration range in which the analyzer should measure. The standard solutions should cover the most frequent concentrations.

NOTICE

Inaccurate measured values

No measurement method can measure accurately over a range greater than 1:20.

- Please note that the concentration ratio between the two standard solutions should be between 1:5 and 1:20.

If a limit value is to be monitored, it makes sense for the concentration of the limit value to correspond to the concentration of a standard solution since this guarantees maximum precision when monitoring.

Example:

Concentration to be measured:	0.3-8.0 mg/l total-P
Most common concentration:	2 to 6mg/l total-P
Limit value to be monitored:	6 mg/l total-P

0.8 - 8.0 mg/l total-P should be selected as the standard solutions here.

The system can then measure accurately in the range from 0.8 - 8.0 mg/l total-P (taking the measuring range of the system into account). A higher measured value deviation can be expected below a concentration of 0.8 mg/l total-P and above a concentration of 8 mg/l total-P.

9.5.4 Entering the concentration of the standard solution

Path: Programming/Setting/Range data

1. Under "STANDARD 1", enter the concentration of the standard solution with the lowest concentration.
2. Press the E key to confirm your entry.
3. Under "STANDARD 2", enter the concentration of the standard solution with the highest concentration.
4. Press the E key to confirm your entry.

9.5.5 Starting the adjustment

The analyzer adjustment can be started in three different ways:
- Activated manually
- Activated remotely
- Activated automatically

Use manually-activated adjustment to make the system operational again after it has been cleaned or serviced.

NOTICE

Deviations in the measuring unit (optics)

Please note modifications to the measuring system (optics) may cause deviations in the subsequent measurements.

▶ Always activate a manual adjustment after modifying the measuring system.

Manual adjustment

▶ To start the manual adjustment, select Calibration/Adjustment

Adjustment activated remotely

The adjustment can activated by a floating contact.

▶ Use input 2 of the "binary in" terminal strip → 6, 20

Automatic adjustment

The measuring device can also be adjusted automatically. This ensures that the measuring system always returns precise measurement results. At the same time, automatic adjustment also checks the operational reliability of the overall system.

1. In the menu select Setting/Range data
2. Under "CAL./ADJUSTM. n DAYS" enter the number of adjustments which the measuring device should perform per day. It is generally not necessary to perform more than one adjustment per day.
3. Confirm the entry with the E key.

9.5.6 Calibrating the analyzer

This section describes how to calibrate the analyzer. By measuring the standard solution C2, the analyzer checks the current recovery. In contrast to an adjustment, the adjustment constants are not modified. The standard solution C2 is connected to the analyzer.

The analyzer calibration can be started in three different ways:
- Activated manually
- Activated remotely
- Activated automatically

Manual calibration

▶ To start the manual calibration, select Service/Calibration/Calibration.

Calibration activated remotely

The calibration can activated by a floating contact.

▶ Use input 1 of the "binary in" terminal strip → 6, 20

Automatic calibration

The measuring device can also be calibrated automatically.

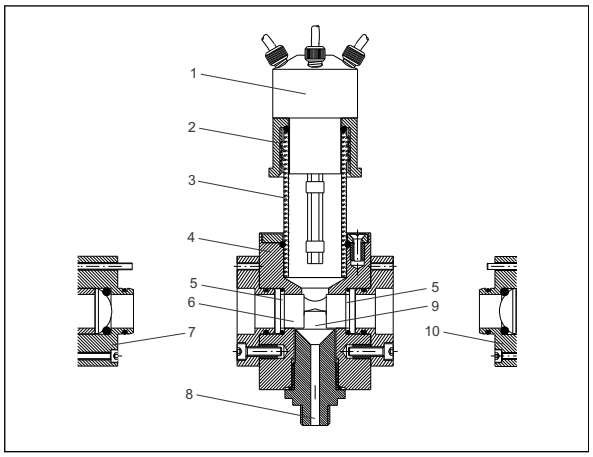
1. In the menu select Setting/Range data
2. Under "CAL./ADJUST. n DAYS" specify the number of days after which a calibration should be performed. It is generally not necessary to perform more than one calibration every three days.
3. Enter the value 1 for CAL./ADJUSTMENT (value 2 = adjustment).

Analog value output during calibration

During calibration, the last TP value is transmitted to the analog output and set to hold until the calibration value has been determined. The calibration value is then transmitted to the analog output until a new measured value has been determined for the current sample. During calibration, relay IV (OPERATIONAL CONTROL) is open until a new measured value is present in the measuring mode. If the analog output is used for control purposes, this OPERATIONAL CONTROL signal can be used to declare the analog output as invalid.

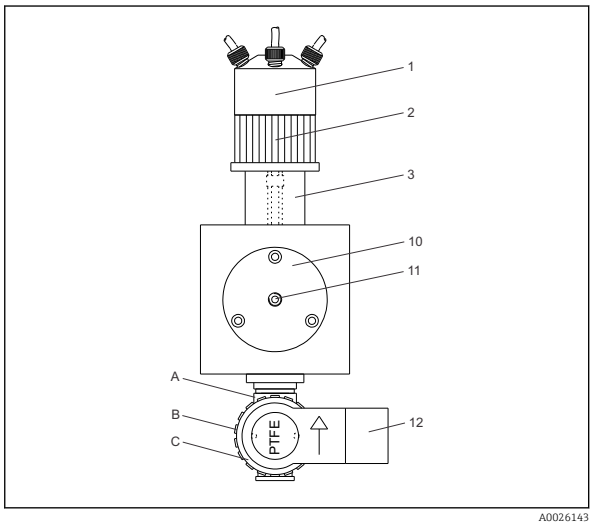
9.6 Cleaning

9.6.1 Measuring chamber



1 Dosing
2 GL cap
3 Glass tube
4 Measuring block
5 O-ring
6 Graduation glasses
7 Light
8 Optics chamber outlet
9 Measuring chamber

16 *Side view of optics chamber*



10 Detector
11 Connection for optical waveguide
12 Solenoid valve
A Valve body
B Thread adapter nut
C Coil housing

17 *Front view of the measuring chamber*

Structure and design
The optics chamber comprises a rectangular measuring block (4) with a fitted dosing element (1), a light (7), a detector (10).

9.6.2 Cleaning the optics chamber

Cleaning is always triggered by following the path name. Afterwards, the measuring chamber can still be cleaned manually. However, this is normally not necessary. If you do, however, decide to clean the optics chamber, place a large collecting vessel under the optics chamber.

Path: Service/Clean/Measuring chamber

1. Release the GL cap (2) from the dosing element (1).
2. Remove the dosing element with the GL cap and screw the dosing element with the GL cap onto the glass sealing cap (accessory).
3. Now clean the optics chamber from above.

NOTICE

Wear from sample matrix

The surface of the graduation glasses becomes dull.

► Replace the graduation glasses.

Removing and cleaning the graduation glasses

Proceed as follows if you want to remove the graduation glasses in the optics chamber:

1. Release the thread adapter nut of the optical waveguide cable (11) on the detector (10) and remove the optical waveguide cable from the detector.
2. Seal the end of the optical waveguide cable with a protection cap.
3. Unscrew the detector (10) from the holder.
4. Remove the detector holder.
5. At the rear of the device, release the cable connection of the light.
6. Unscrew the light (7) from the holder and remove the light.
7. Release the light holder from the measuring block (4) and remove it.
8. Remove the graduation glasses (6) using the suction cup (accessory).
9. Clean the graduation glasses.

NOTICE

Damaged O-rings

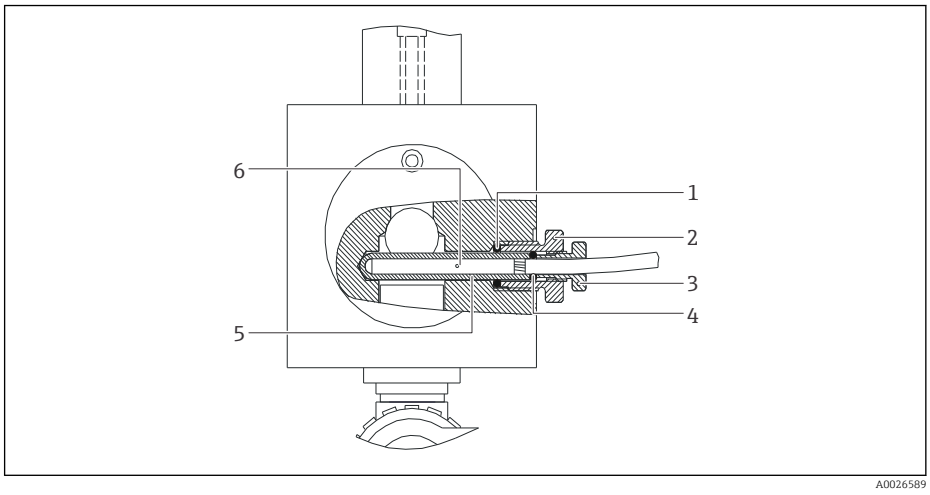
The optics chamber is not leak-tight.

► When removing the graduation glasses, pay attention to the sealing O-rings (5). Replace them if necessary.

Cleaning the measuring block

1. Press the main switch on the device and switch the device off.
2. Allow the analyzer heater to cool.
3. Release the hose from the solenoid valve MV2
4. Release the thread adapter nut of the solenoid valve MV2 (B) completely, unfasten the coil housing (C) and remove it from the valve body (A). Make sure not to turn the coil housing around its axis!
5. Remove the three slotted screws located at the top of the measuring block and remove the glass tube (3) of the dosing element along with the O-ring (5) and the retaining ring.

6. Unscrew the heater (2) and remove it.



1 O-ring ID 7x2 mm for glass tube
2 Coupling for heater
3 Cable gland
4 Cable seal
5 Glass tube (heating sleeve)
6 Heating element

7. Now clean all the bores of the measuring block thoroughly with demineralized water and a bottle brush.
8. Also clean all the removed parts thoroughly.

Assembly

Reassemble the measuring chamber block in the reverse order:

1. After cleaning, fit the glass tube (3) of the dosing element on top of the measuring block (4) together with the retaining ring and O-ring (5).
2. Press down the glass tube until the stop and tighten the three slotted screws.
3. Put the heater back in.
4. Place the coil housing of the solenoid valve (C) into the valve housing (A) in such a way that the device socket is pointing to the right. The O-ring can be wetted slightly with demineralized water to make insertion easier.
5. Tighten the thread adapter nut (B) of the solenoid valve by hand.
6. Insert the O-rings (5).
7. Place the graduation glasses (6) into the optics chamber with the suction cup. Make sure that the suction cup is clean and does not leave any marks on the glasses.
8. Screw on the detector holder (10). Pay attention to the markers indicating the correct position of the detector. If there are no markers, make sure that the detector orifice plate is installed in a horizontal position
9. Screw on the light holder.
10. Then secure the detector (10) to the measuring block.
11. Insert the optical waveguide cable (11) and tighten the thread adapter nut.
12. The integrity of the measuring chamber can be checked as soon as the solenoid valve, the graduation glasses and the heater are mounted. Fill the measuring chamber with water up as far as the cooling fins.
13. Using a paper towel, check the outlet of the solenoid valve (12) several times for moisture. The paper must remain dry.
14. Screw on the light (7).

15. Now fit the connecting cable on the light and tighten the nut fingertight.
16. Unscrew the GL cap (2) of the dosing element from the safety glass.
17. Fit the dosing element (1) on the glass holder of the optics chamber and tighten it. When inserting the dosing element, make sure that the three Teflon tubes are pointing straight down into the optics chamber and not towards the glass tube or the optics chamber body! If necessary, realign the hoses with the optics chamber.
18. Switch on the main switch again.
    ↳ Once the main switch has been switched on, service is no longer active and measuring operation commences immediately.

Adjustment

▶ Trigger an adjustment manually after two to three measuring cycles.

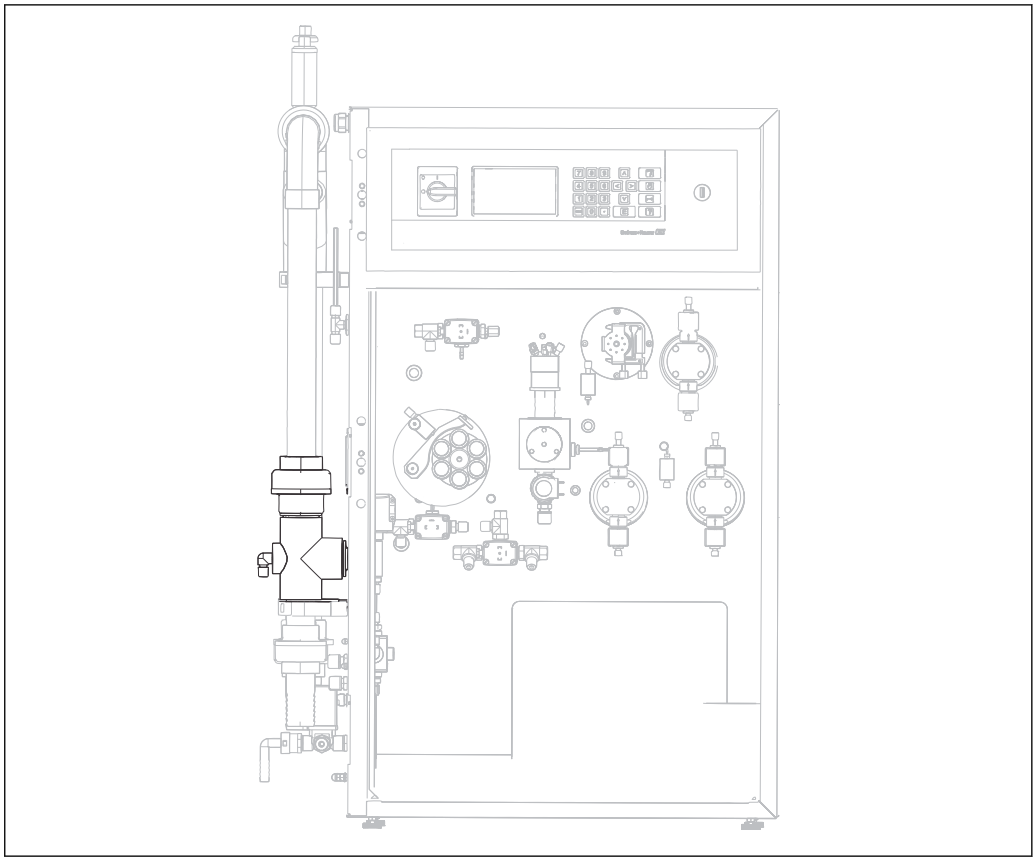
NOTICE

Cause/situation

Ggf. Consequences of non-compliance (if applicable)

▶ The analyzer has to be readjusted after disassembling a component of the optical system (e.g. light, detector).

9.6.3 Screen flush



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18 Position of the screen

If the device is fitted with the optional pipe backflush function, water is fed in via the solenoid valve MV1. This means that in addition to the sample conditioning system, the pipe is backflushed as far as the bypass screen.

Screen flushing runs automatically after startup and can be started in three different ways:
- Activated manually
- Activated remotely
- Activated automatically

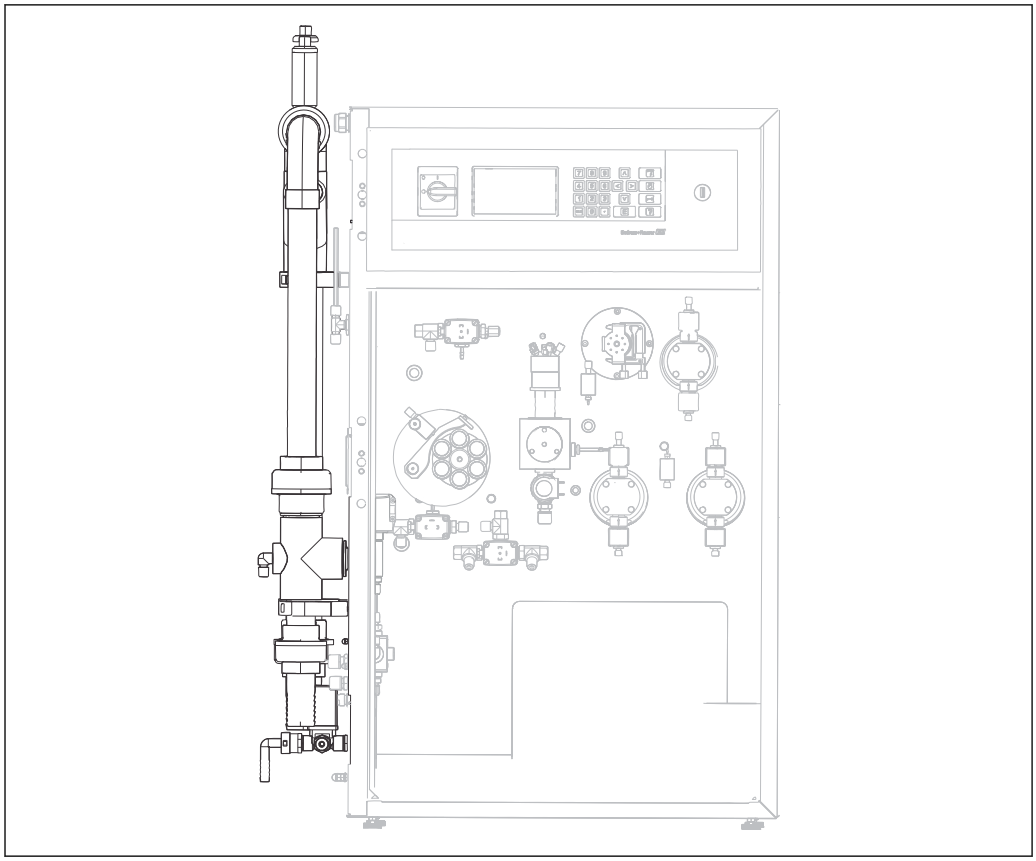
Screen flushing activated manually
Path: Service/Clean/Screen flush

Screen flushing activated remotely
Screen flushing can activated by a floating contact. Use input 3 of the "binary in" terminal strip for this → 6, 20.

Screen flushing activated automatically
Screen flushing can be activated automatically. Select the Programming mode for this:
Path: Programming/Setting/Range data

1. Under SCREEN FLUSH n/DAY enter the number of flushes per day. The default setting is two screen flushes per day.
2. Set the screen flushing duration [s].
   ↳ If a value of over 15 seconds is set, pump P1 is additionally operated at a higher pump rate for the remaining time and the inner sample line is also flushed.

9.6.4 Bypass screen



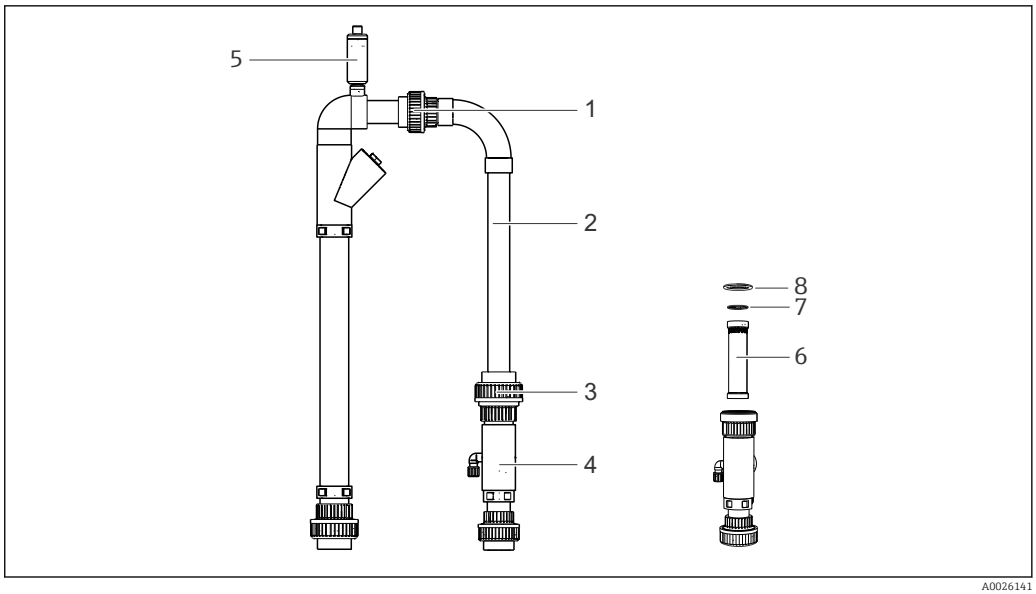
19 *Position of the bypass*

WARNING

Bacteria can enter the organism.

There is a risk of infection when working with wastewater!

► Wear protective gloves, protective goggles and protective clothing.



20 Sample conditioning

1 Upper thread adapter nut
2 Bypass elbow
3 Lower thread adapter nut
4 Bypass screen housing
5 Bleeder
6 Bypass screen
7 O-ring
8 O-ring

You require the following parts:
- Bottle brush
- Paper towels

Path: Service/Clean/Bypass

Clean the bypass screen as follows:

1. Cut off the supply of wastewater (external sample supply).
2. As a precaution, place a vessel under the suction line as water could flow back.
3. Set the "online sample/manual sample" tap to "manual sample". Allow the bypass line to empty.
4. Turn back the tap again.
5. Release the upper and lower thread adapter nut (item 1 +3).
6. Remove the bypass elbow
7. Remove the bypass screen.
8. Clean the bypass screen and the housing with a brush.
9. If necessary, unscrew the bleeder and open it. Clean the bleeder and make sure the bearing runs smoothly.
10. Insert the parts in the reverse order. Make sure that the O-rings (item 7 and 8) are not damaged and are correctly seated.
11. Switch the supply of wastewater back on.
12. Press the [E]-key.

Measuring operation starts.

9.7 Reagent

9.7.1 Reagents

⚠ CAUTION

Carelessness when working with reagents.
Risk of injury from chemicals.
- ▶ Pay attention to the warning notices in the safety data sheets.
- ▶ Wear acid-proof protective gloves, a protective lab coat and protective goggles!
- ▶ In addition, also comply with the local regulations regarding the handling of caustic chemicals that apply in your country for your field of work. Wash dispensers immediately with plenty of water and a 1% solution of sodium hydrogen carbonate. Consult a doctor and show the doctor the instructions on the canister.

Only use genuine containers for the measurement. We are not liable for any damage resulting from the use of other chemicals. The stripping reagent and standards C1 and C2 must be topped up or replaced. See the "Preparing the chemicals" section for information on how to prepare the reagents.

The following reagent components are needed to determine the total phosphorus content:

Parent solution
1000 mg/l (1000 ppm) PO4-P; for preparing standard solutions 1 and 2
– Order number: 1000 ml (33.8 fl.oz.): CAY248-V10C00AAE
– Order number: 100 ml (3.38 fl.oz.): CAY248-V01C00AAE

Standard solutions ready for use, 1 liter each (33.8 fl.oz.)
- Standard 1.0 mg/l (1 ppm) PO4 - P; Order No. CAY242-V10C01AAE
- Standard 1.5 mg/l (1.5 ppm) PO4 - P; Order No. CAY242-V10C03AAE
- Standard 2.0 mg/l (2 ppm) PO4 - P; Order No. CAY242-V10C02AAE
- Standard 5 mg/l (5 ppm) PO4 - P; Order No. CAY242-V10C05AAE
- Standard 10 mg/l (10 ppm) PO4 - P; Order no. CAY242-V10C10AAE
- Standard 15 mg/l (15 ppm) PO4 - P; Order no. CAY242-V10C15AAE
- Standard 20 mg/l (20 ppm) PO4 - P; Order no. CAY242-V10C20AAE
- Standard 25 mg/l (25 ppm) PO4 - P; Order no. CAY242-V10C25AAE

Reagent set, active
Order no. CAY249-V22AAE reagent set consisting of:
- Digestion agent sodium peroxodisulfate R1, 2x 40 g (1.41 oz., powder)
- Color reagent R2, 2 l (67.6 fl.oz.) (molybdate-vanadate reagent);

Reagent 1 (sodium peroxodisulfate R1) contains the oxidizing agent and is prepared on site in accordance with the mixing instructions supplied.

Prepare the second liter of reagent only after the first liter has been used.

You will receive reagent 2 (molybdate-vanadate reagent) in active form. The active reagent can be used directly but can only be stored for a limited period. It also has to be stored in a dark place at 4 to 8 °C (39 to 46 °F).

9.7.2 Exchange reagent

It is advisable to have a damp cloth at hand to clean up any drops of reagent that may accidentally drip.

Proceed as follows to replace the reagents:

1. To replace the reagent, go to the menu: Service -> Reagent -> Exchange.
2. Remove the cover from the new reagent.
3. Open the cover of the canister in the device and remove it together with the hose projecting into the canister.
   ↳ The canister can be removed and replaced by a full one.
4. Connect the canisters to the appropriate hoses:

Solution	Function
Reagent 1	Pump P3
Reagent 2	Pump P4
Standard 1	Solenoid valve MV4 (left)
Standard 2	Solenoid valve MV4 (right)

Every solution should be pumped into the pipe after being replaced. A key is provided for every solution.

1-C1 (P1)

2-C2 (P1)

3-R1 (P3)

4-R2 (P4)

▶ Press keys "3" and "4" to convey reagent until bubble-free reagent is conveyed.

If you have changed the concentration of the standard solution, enter the new concentration in the "Range data" menu item and then trigger an adjustment.

10 Repairs

10.1 Spare parts

Kit CA72TP yellow consumables,1 year

Order no.: 71092157 for CA72TP yellow C/D

Description	Quantity
Hose D 1.6/4.8 mm EPDM mm PE	1.1 m
O-ring D 17.17 x 1.78 mm FPM	2
O-ring D 26.64 x 2.62 mm FPM	1
Membrane for solenoid valve 330A EPDM	3

Kit CA72TP hoses

Order No.: 71092462

Description	Quantity
Hose D 4/6 mm PE, natural color	0.04 m
Hose D 4/6 mm PE, natural color	0.16 m
Hose D 4/6 mm PE, natural color	0.60 m
Hose D 4/6 mm PTFE, natural color	0.12 m
Hose D 4/6 mm PTFE, natural color	0.42 m
Hose D 6/8 mm PTFE, natural color	0.42 m
Hose D 4/6 mm FPM, black	0.32 m
Hose D 4/6 mm silicone, transparent	0.4 m
Hose D 4/6 mm silicone, transparent	0.4 m

Kit CA72TP couplings

Order No.: 71092463

Description	Quantity
Straight coupling DM4/6 -G1/4"AG, PP	1
Sealing ring G 1/4"PVC	5
Adapter for outlet venting	1
T-male coupling DM 4/6x1/8" PV	1
Schott coupling D 4/6 6/8 PP	1
Schott coupling D 6/8 PVDF	1

Kit CA72TP, accessories

Order No.: 71092530

Description	Quantity
Suction cup	1
Protection cap for glass dosing element	1
Glass 25ml graduated cylinder	1

Description	Quantity
Sponge cloth	1
Protective goggles	1
Acid-proof/alkali-proof gloves, large (1 pair)	1
Cabinet key set	1
Hose D 4/6 mm PE, natural	4 m
Hose D 6/8 mm PE, transparent	4 m
Hose set DM 1.6/4.8 270mm EPDM	1
EMC terminal box	1

10.2 Decommissioning

⚠ CAUTION

Risk of infection

There is a risk of infection if you come in contact with wastewater.

▶ Wear protective goggles, safety gloves and a lab coat.

Proceed as follows to take the analyzer out of service:

1. Switch off the wastewater pump and make sure that the wastewater flows back and empties the bypass.
2. Feed the reagent back into the canister by opening the lower connection on pump P3 and P4.
3. Release the hose case of pump P1 and allow the reagent to flow back into the canister.
4. Connect the empty hose back to the hose fitting.
5. Take a collecting vessel containing approx. 2 l of distilled water.
6. Remove the reagent canister and put the collecting vessel with the distilled water in its place.
7. To rinse the pump hoses of pump P3 and P4, select Service/Reagent/Exchange reagent:
8. Press keys "3" or "4" to rinse the pipes of pump P3 or P4 with the distilled water from the collecting vessel. Once the key has been pressed once, the pumps run until keys are pressed a second time.
9. Trigger automatic measuring chamber cleaning under Service/Clean/Measuring chamber.
10. Perform manual cleaning of the optics chamber.
11. Release the hose bed throttle of pump P1.
12. Hold a collecting tray under the 3-way cock and drain any sample still in the manual sample suction hose and seal off the supply of sample.
13. Remove the canisters.
14. Press the main switch on the device and switch the device off.

Keep open reagents and standard solutions refrigerated. Observe the best-before date.

10.3 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 swift, safe and professional device returns, please read the return procedures and conditions at www.endress.com/support/return-material.

10.4 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

Observe the local regulations.

11 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.

Parent solution

Description	Order number
1000 mg/l (1000 ppm) PO4-P	
For preparing standards C1 and C2 (see Operating Instructions):	
1000 ml (33.8 fl.oz.)	CAY248-V10C00AAE
100 ml (3.38 fl.oz.)	CAY248-V01C00AAE
Standard solutions ready for use, 1 liter each (33.8 fl.oz.):	
Standard 1.0 mg/l (1 ppm) PO4 - P	CAY242-V10C01AAE
Standard 1.5 mg/l (1.5 ppm) PO4 - P	CAY242-V10C03AAE
Standard 2.0 mg/l (2 ppm) PO4 - P	CAY242-V10C02AAE
Standard 5 mg/l (5 ppm) PO4 - P	CAY242-V10C05AAE
Standard 10 mg/l (10 ppm) PO4 - P;	CAY242-V10C10AAE
Standard 15 mg/l (15 ppm) PO4 - P	CAY242-V10C15AAE
Standard 20 mg/l (20 ppm) PO4 - P	CAY242-V10C20AAE
Standard 25 mg/l (25 ppm) PO4 - P	CAY242-V10C25AAE

Reagent set CA72TP-C/D

Description	Order number
Active	
Digestion agent sodium peroxodisulfate R1, 2x 40 g (1.41 oz., powder)	CAY249-V22AAE
Color reagent R2, 2 l (67.6 fl.oz.) (molybdate-vanadate reagent)	

12 Technical data

12.1 Input

Measured variable	Total phosphorus (TP) [mg/l]
Measuring range	▪ CA72TP-C: 0.3 to 8.0 mg/l ▪ CA72TP-D: 0.5 to 25 mg/l
Signal inputs	8 signal inputs 24 V DC, active, load max. 500 Ω

Input #1	Service, trigger calibration
Input #2	Service, trigger adjustment
Input #3	Service, trigger screen flush
Input #4	Not assigned
Input #5	Not assigned
Input #6	Not assigned
Input #7	Trigger standby
Input #8	Not assigned

Wavelength	403 nm

12.2 Output

Output signal	0/4 to 20 mA, galvanically isolated
Signal on alarm	4 outputs: ▪ Limit value alarm ▪ Fault message ▪ Standby message ▪ Operational control Floating, normally closed (max. 0.25 A / 50 V)
Load	Max. 500 Ω
Data interface	RS 232 C, proprietary, for outputting data and remote operation (optional)
Loading capacity	230 V AC, max. 2 A

12.3 Power connection

Supply voltage	115/230 V AC, 50/60 Hz
Power consumption	161 VA
Current consumption	0.7 A
Fuses	**Power distribution** 2.5 A, slow-blow, design: fine-wire fuse 6.3 x 32 () **relays** 4 A per relay, slow-blow, design: TR5 **Power unit** 2 A, slow-blow, design: fine-wire fuse 5 x 20 In accordance with EN 61326-1, Class A CA72TP is suitable for connection to industrial power supply systems.

12.4 Performance characteristics

Measured error	±5 % of end of measuring range
Measuring interval	Approx. 2 measurements per hour (at a digestion time of 15 min.)
Time between two measurements	▪ t_{meas} = sample dosing (150 s) + oxidation time (960 s) + color reaction time (180 s) + measured value calculation (180 s) + discard sample + break in measuring (optional) + rinse time (210 s) = 28 min ▪ Only the oxidation time can be adjusted (0 to 3600 s)
Sample requirement	40 ml (1.35 fl.oz.) / measurement
Reagent requirement	▪ Oxidizing agent REG1: 370 ml (12.5 fl.oz.) / month with 30-minute measuring interval ▪ REG2: 1 liter (16.9 fl.oz.) / month with 30-minute measuring interval (for measuring range of 25 mg/l and under, the amount of REG1 and REAG 2 required increases)
Calibration interval	▪ Selectable, 1-4 calibrations per day up to one calibration per week ▪ Standard: once per day at ambient temperatures < 30 °C (86 °F)
Rinsing interval	Caustic flush: Selectable, 4 flushes per day up to one flush per week
Maintenance interval	6 months (typical)
Maintenance effort	▪ Daily: visual inspection ▪ Every 2 weeks: replace or top up reagents and standards ▪ Every 6 weeks: clean sample conditioning system (if available) ▪ Every 12 weeks: replace pump hoses and calibrate all pumps

12.5 Environment

Ambient temperature	2 to 40 °C (36 to 100 °F)
Humidity	10 to 90 %, non-condensating
Degree of protection	IP 54

12.6 Process conditions

Sample temperature	5 to 40 °C (40 to 104 °F)
Sample flow rate	Sample flow rate for analysis: 5 to 12 ml/min (0.17 to 0.4 fl.oz./min); pay attention to delivery rate of the pump! Sample flow rate for bypass: ▪ 0.1-1m³ PA3 ▪ 1-8m³ PA2
Sample consistency	Low level of solids, particle size < 500 ppm
Sample outlet	Unpressurized

12.7 Mechanical construction

Design, dimensions	Values will be submitted subsequently
Weight	Approx. 83 kg (183 lbs)

Material

Housing	Aluminum, powder-coated
Front window	Glass, conductive coating
Valve seals	EPDM, PTFE
Pump hoses	EPDM, Tygon®
Pump and pump seals	PTFE
Reagent and sample hoses	PTFE, PFA
Hose for exhaust air and venting	Norprene, PE
Discharge hoses	PTFE, PE

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