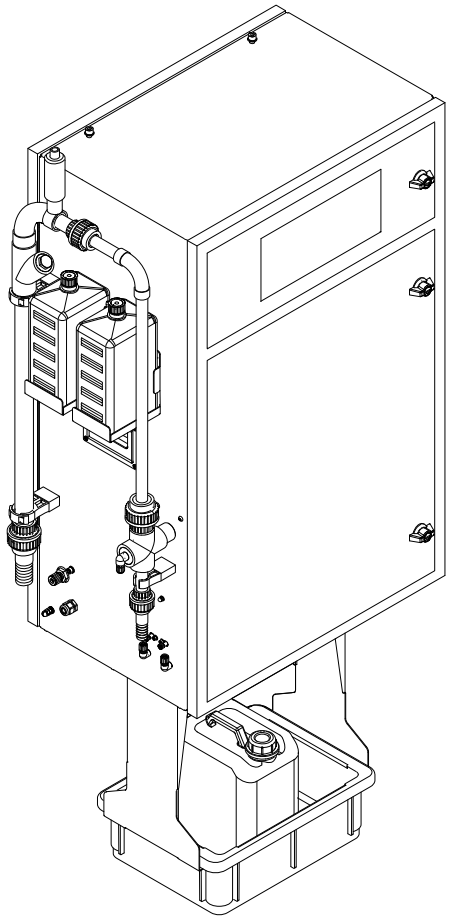
BA00448C/07/EN/16.20
71486437
2020-04-30

Operating Instructions
TOCII CA72TOC

Analyzer for online determination of TOC in aqueous media using thermic catalytic combustion



Endress+Hauser
People for Process Automation

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1 About this document

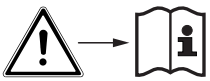
1.1 Warnings

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

1.2 Symbols

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

1.3 Symbols on the device

Symbol	Meaning
	Reference to device documentation

1.4 Documentation

The following manual which complements these Operating Instructions can be found on the product page on the Internet:
Technical Information TOCII CA72TOC, TI00448C

2 Basic safety instructions

2.1 Requirements for personnel

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

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

2.2 Designated use

The analyzer is a compact thermo-catalytic analytical system. It is designed to monitor the TOC content of industrial and municipal wastewater.

The device is particularly suited for use in the following applications:
- Monitoring of industrial wastewater, in the inlet and outlet
- Control of process wastewater
- Monitoring of surface run-off in industrial systems
- Monitoring of surface run-off in airports
- Municipal wastewater monitoring
- Measurement of carbon load for nutrient dosing

NOTICE

Non-designated use

Incorrect measurements, malfunctions and even measuring point failure could result!
- ▶ Use the product only in accordance with the specifications.
- ▶ Observe the technical data indicated on the nameplate.

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

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.

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

During operation:

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

2.5 Product safety

2.5.1 State-of-the-art technology

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

2.5.2 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

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

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

3.2 Product identification

3.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code (device version)
- Serial number
- Measuring range
- Outputs and communication
- Power connection
- Degree of protection
- (Permitted) ambient conditions

▶ Compare the information on the nameplate with the order.

3.2.2 Product identification

Product page

www.endress.com/CA72TOC

Interpreting the order code

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

Obtaining information on the product

1. Go to www.endress.com.
2. Call up the site search (magnifying glass).
3. Enter a valid serial number.

4. Search.
   ↳ The product structure is displayed in a popup window.
5. Click on the product image in the popup window.
   ↳ A new window (**Device Viewer**) opens. All of the information relating to your device is displayed in this window as well as the product documentation.

3.2.3 Manufacturer address

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

3.3 Scope of delivery

The scope of delivery comprises:
- 1 analyzer in the version ordered
- 1 accessories package for leak test
- Tool kit for glass ball and media removal
- Accessories for acid filter
- Accessories for commissioning the strip and separation chamber
- Accessories for combustion furnace maintenance
- Hose set
- 1 canister, 5 liter
- 2 canisters, 2 liter
- Set of cabinet keys
- 10 ml graduated cylinder
- Sponge cloth
- Protective goggles
- Gloves, acid-proof and base-proof
- Protective gloves, heat-resistant
- Silicone grease
- 1 x Operating Instructions

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

3.4 Certificates and approvals

3.4.1 EU Declaration of Conformity

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.

3.4.2 CSA C/US General Purpose (optional)

The device meets the requirements of "Class 8721 06, laboratory equipment, electrical; Class 8721 86, electrical equipment for laboratory use - certified to US standards" for indoor use.

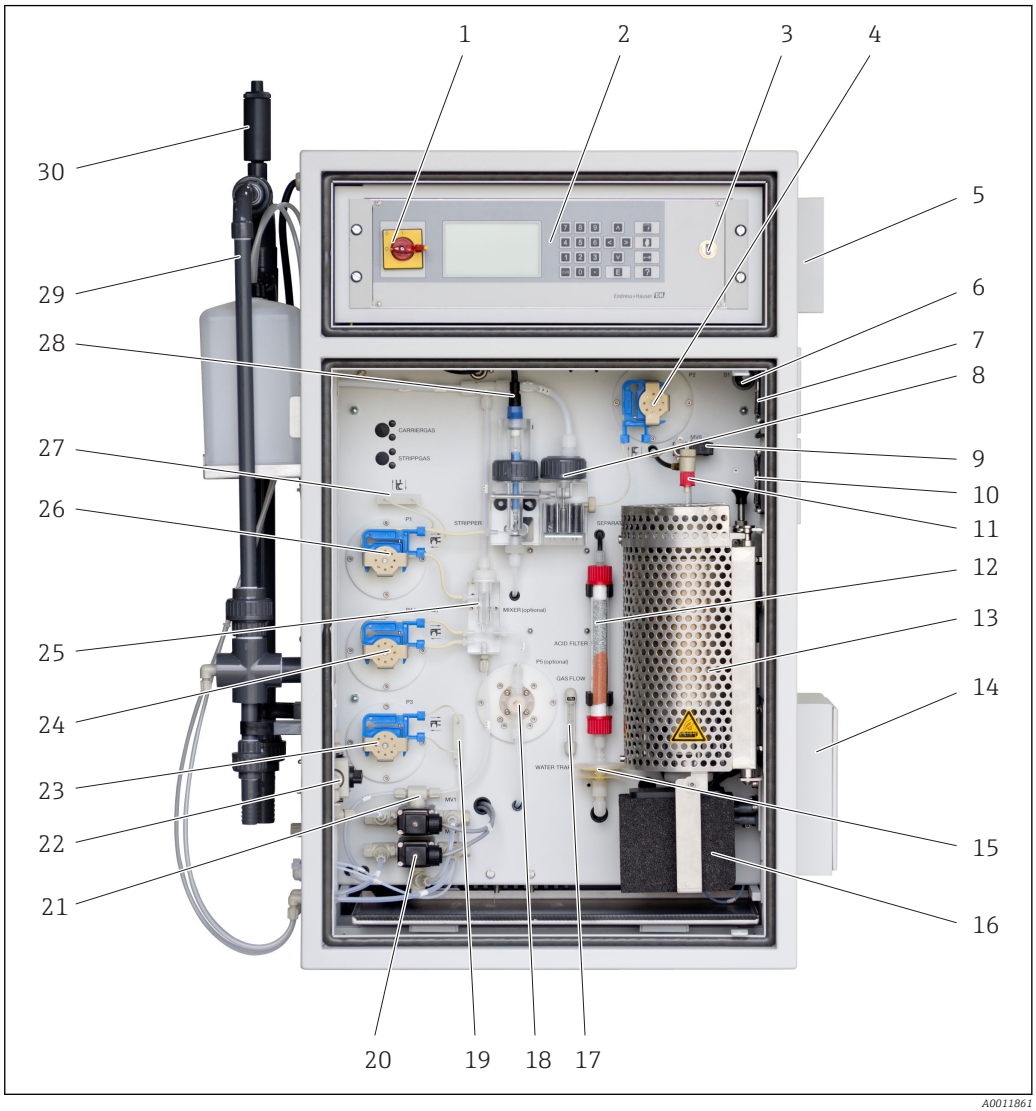
Certificate no.: 2577401

3.4.3 Electrical safety

In accordance with IEC 61010-1, Protection class I, Installation category II. Fluctuations in the supply voltage may not exceed 10 percent of the nominal voltage.

4 Product description

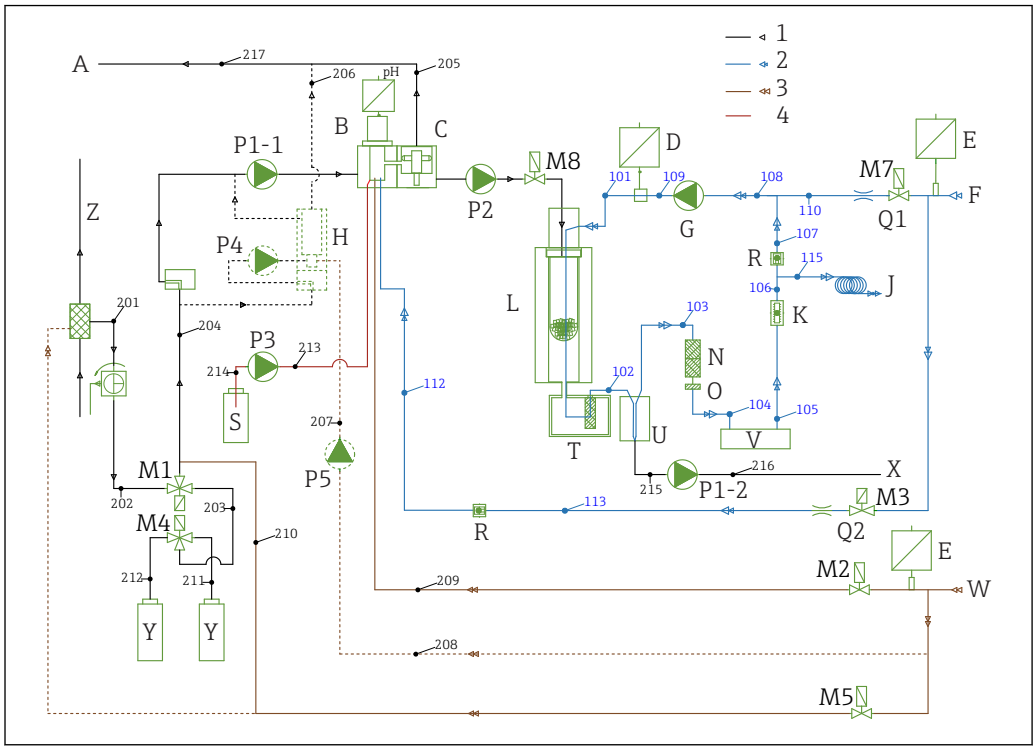
4.1 Product design



1 *Product design*

1	*Main switch*	11	*Injection unit*	21	*Solenoid valve 1 (wastewater/calibration standard)*
2	*Display and operating elements*	12	*Acid filter*	22	*Valve for online sample/ manual sample*
3	*USB port*	13	*Tube furnace with catalyst*	23	*Pump P3, acid dosing*
4	*Pump P2, sample - analysis*	14	*Air outlet (filter mat)*	24	*Pump P4, sample - dilution (optional)*
5	*EMC junction box*	15	*Combined filter (water trap)*	25	*Mixing chamber (optional)*
6	*Compressor switch*	16	*Heated salt trap (optional)*	26	*Pump P1, sample - strip chamber/condensate extraction*
7	*Ventilator*	17	*Circuit gas flowmeter*	27	*Condensate hose connector*
8	*Separation chamber*	18	*Pump P5, dilution water (optional)*	28	*Strip chamber with pH electrode*
9	*Dosing valve*	19	*Acid hose connector*	29	*Sample conditioning*
10	*Ventilator*	20	*Solenoid valve 4 (calibration standard C1/C2)*	30	*Vent valve with throttle*

4.2 Process diagram



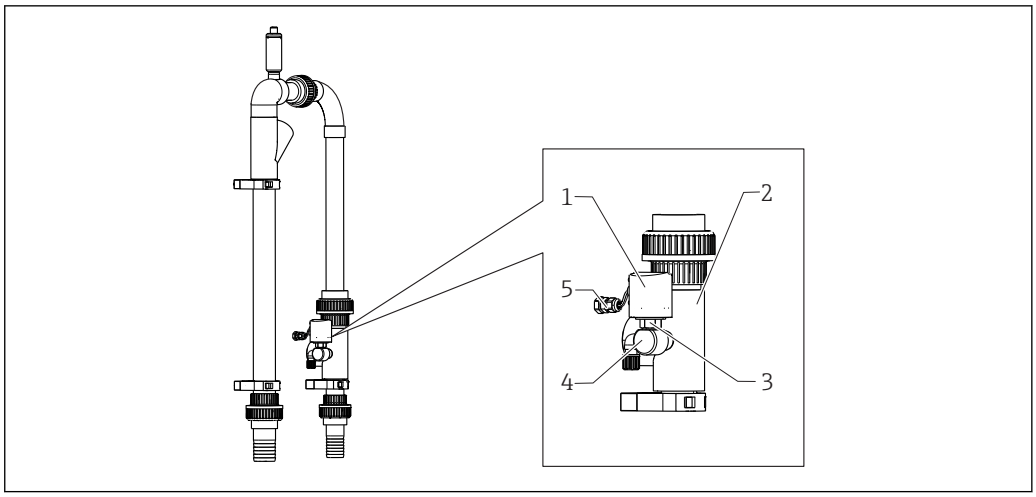
2 *Process diagram*

1 *(black) sample*
2 *(blue) oxygen or air, CO_2-free*
3 *(brown) water*
4 *(red) acid*

A	*Analyzer outlet*	*L*	*Furnace*	*Q1*	*Carrier gas*
B	*Strip chamber*	*M1 to 8*	*Solenoid valves*	*Q2*	*Stripping gas*
C	*Separation chamber*	*N*	*Acid filter*	*R*	*Check valves*
D	*Pressure sensor*	*O*	*Water block*	*S*	*Acid*
E	*Pressure switch*	*P1-1*	*Sample pump*	*T*	*Heated filter*
F	*Gas supply*	*P2*	*Sample pump*	*U*	*Cooler*
G	*Membrane compressor*	*P3*	*Acid pump*	*V*	*CO_2 detection*
H	*Mixer (optional)*	*P4*	*Sample pump (optional)*	*X*	*Condensate drain*
J	*Gas discharge*	*P5*	*Dilution water pump (optional)*	*Y*	*Standard*
K	*Circuit, flow reading*	*P1-2*	*Condensate pump*	*Z*	*Bypass*

4.3 Standby mode

The standby mode can be used to operate the analyzer at measuring points where the flow of sample is interrupted intermittently. The option is available in the one-channel version with the PA-2 or PA-3 sample conditioning system.



3 Standby control

1 Protection cap
2 Bypass screen
3 Pressure monitor ¼"
4 Adapter for pressure monitor
5 Signal connection

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:
- All pumps are stopped.
- Pump P2 is drained.
- The strip chamber is rinsed.
- The analyzer is on standby and waits for sample.

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

4.4 Chemicals

Chemical solutions are required to operate the device. (→ 97)

Stripper solution
25% nitric acid, HNO_3 (CAS: 7697-37-2). Nitric acid does not form lyophobic salts in the strip chamber. The resulting nitrogen oxides in the combustion gas are filtered out with an acid filter upstream from the IR detector.
It is used to acidify the sample following appropriate dilution. As a result, the carbonate ion CO_3^{2-} is converted to CO_2 and the dissolved CO_2 is removed from the solution (TIC stripping).

Parent solution 1
Potassium hydrogen phthalate, KHP (CAS: 877-24-7) with a concentration of 5000 mg/l TOC
Is used for calibrating and adjusting the analyzer as a diluted standard in the measuring range from 0 to 600 mg/l TOC. In the event of high KHP concentrations and sample acidification (pH < 2.5), there is the risk of KHP precipitating in the solution.

Parent solution 2
Citric acid (CAS: 5949-29-1) with a concentration of 100 000 mg/l TOC
This parent solution is used as a diluted standard for calibrating and adjusting the analyzer in the measuring range from 600 mg/l TOC.

5 Installation

5.1 Installation conditions

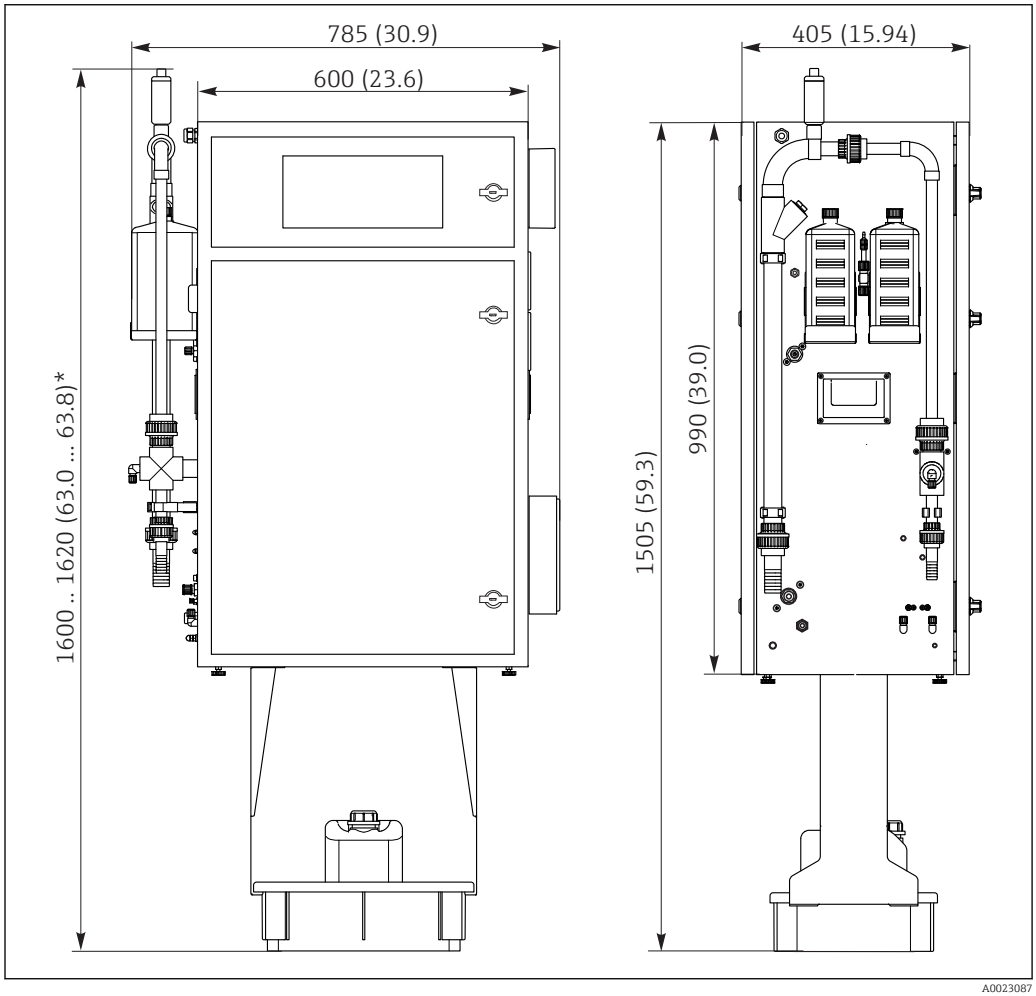
The analyzer requires a drain beneath the device.

- ▶ Use a 6/8 mm drain pipe made of PTFE. No backpressure should form in the drain.

Halogens or other vapors may not build up in enclosed spaces.

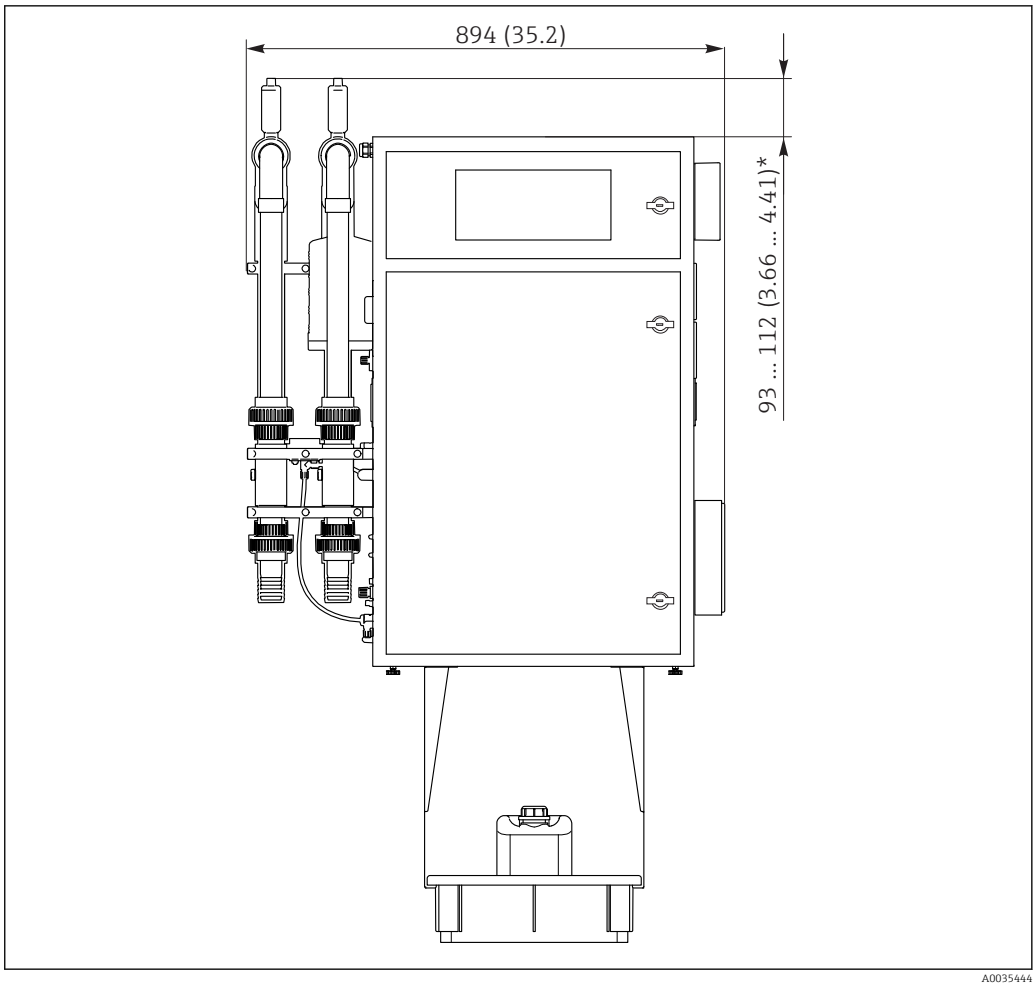
- ▶ Use an exhaust gas connection. No backpressure should form in the 4/6 mm exhaust gas hose.
- ▶ Avoid exposure to direct sunlight.
- ▶ Observe ambient conditions (technical data).

5.1.1 Dimensions



4 *Dimensions in mm (in)*

* *Depending on sample preparation*



5 *Dimensions in mm (in)*

* *Depending on sample preparation*

5.1.2 Mounting 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 the rear for maintenance purposes.

5.1.3 Compressed air and water supply

Compressed air supply

▶ Only use CO_2-free air to operate the analyzer.

The air must be dry and oil-free and must meet the following conditions:
- < 3 ppm CO_2
- < 3 ppm hydrocarbons
- Constant pressure of 2 bar (29 psi)
- Pressure tolerance ± 5 %

The compressed air supply must be fitted with a CO_2 scrubber (supply pressure 4 to 10 bar (58 to 145 psi) and a pressure regulator.
- Connection: 4/6 mm DN
- Required quantity of compressed air:
  - 600 l/h (21.2 ft^3/h) for the CO_2 gas generator adsorber (Domnick Hunter)
  - 60 l/h (2.12 ft^3/h) for the soda lime CO_2 scrubber

Water supply
A water connection is absolutely essential for the correct operation of the CA72TOC analyzer.
- The water is connected via a 6/8 mm DN or G3/8 coupling
- Pressure is between 2 and 4 bar (29 to 58 psi), except for the version with sample dilution
- Version with sample predilution:
  - Use deionized water (DI water) or drinking water with a water hardness level < 10 °dH (< 179 ppm $CaCO_3$)
  - Pressure 3 ± 0.2 bar (43.5 ± 3 psi)

5.1.4 Gas flow

Circuit gas
The flowmeter for the circuit gas is used to perform function checks and is set at the factory. The flow rate during operation is between 0.7 and 1.2 l/min (1.5 to 2.5 ft^3/h).

Carrier gas
The volume flow for the carrier gas is regulated using a precision restrictor. The flow is approx. 0.8 l/min (1.7 ft^3/h) at a pressure of 2 bar (29 psi).

Stripping gas
The volume flow for the stripping gas is regulated also using a precision restrictor. The flow is approx. 0.15 l/min (0.3 ft^3/h) at a pressure of 2 bar (29 psi).

5.2 Mounting the analyzer

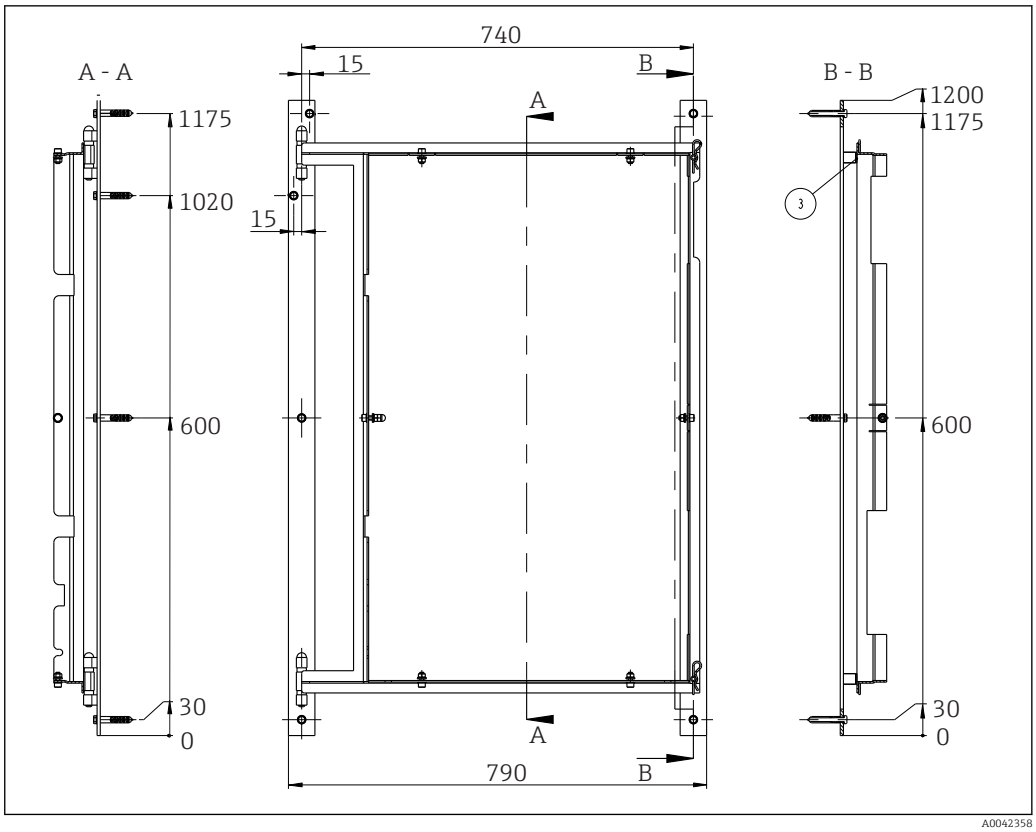
⚠ WARNING
Device is live
Risk of electric shock!
- ▶ Do not connect the analyzer to the electricity supply until the installation work has been completed and the liquid and gaseous media have been connected.
- ▶ Follow the instructions in the "Electrical connection" section.

5.2.1 Mounting sequence

1. Mount the analyzer on the base frame, a table or in the pivoting frame.
2. Mount the reagent tray under the analyzer.
3. Mount the CO_2 adsorber.
4. Mount the vent valve on the sample conditioning system (only for PA-2 / PA-3 or PA-9).
5. Connect the media.

5.2.2 Mounting on the wall with a 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").



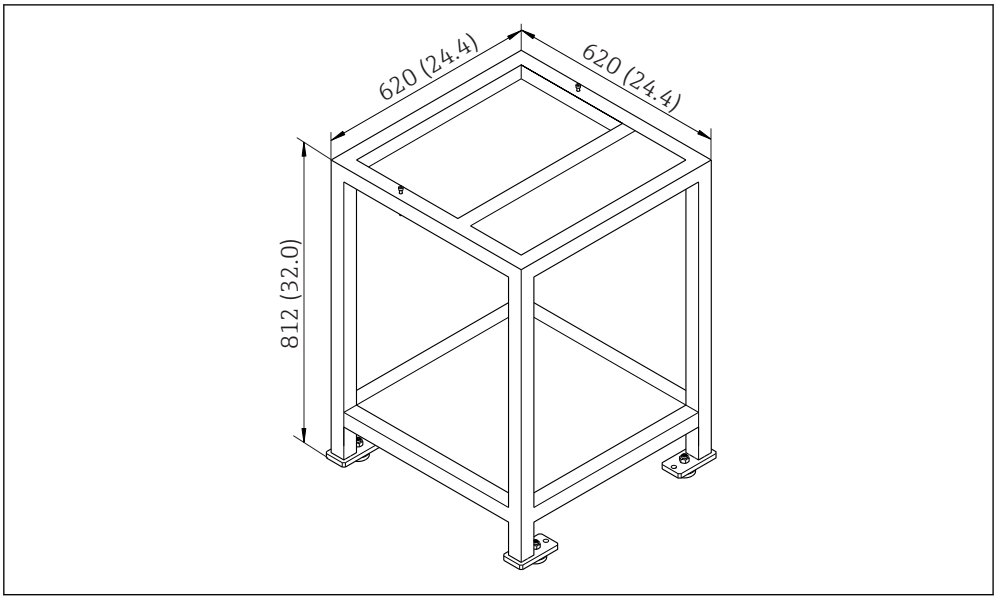
6 *Pivoting frame for wall mounting, dimensions in mm (inch)*

1. First mount the left rail.
2. Hook the analyzer into the hinges 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.

5.2.3 Mounting on a base frame

▶



7 *Mounting on a base frame in mm (in), height without height-adjustable feet*

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

5.2.4 Mounting the CO_2 adsorber

CO_2-free air can be provided in one of two ways:
- With a gas generator
- With a soda-lime scrubber

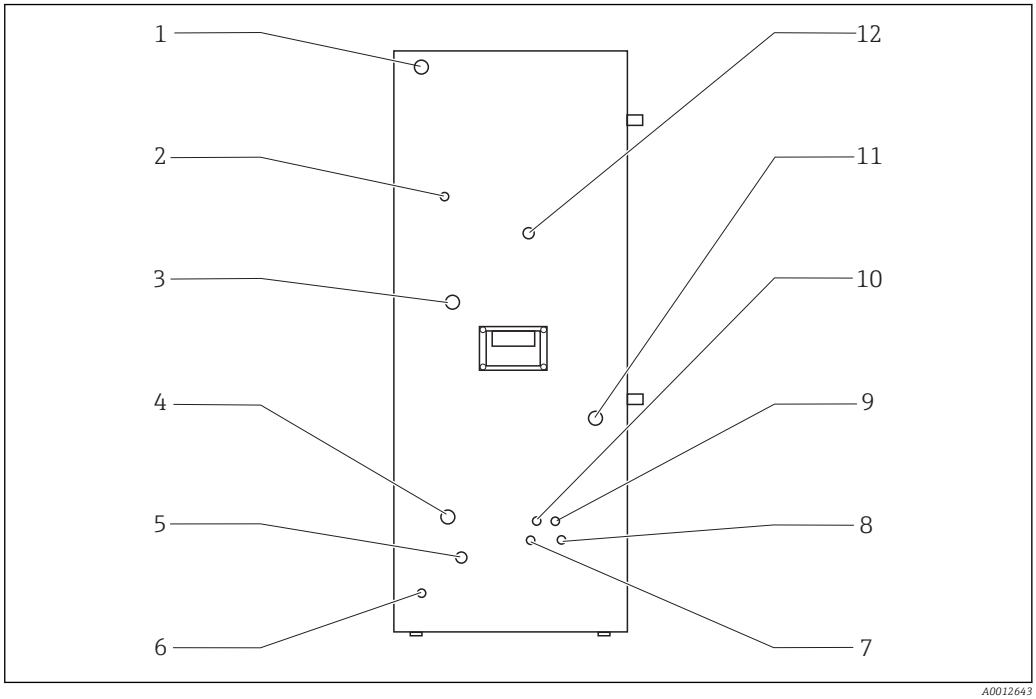
Gas generator version (cartridge gas generator)

1. Place the gas generator on the ground or mount it on the wall in accordance with the enclosed drawing.
2. Connect it to the analyzer according to the drawing.

Soda-lime scrubber version

▶ Mount and connect the soda-lime scrubber in accordance with the enclosed Operating Instructions BA01243C.

5.2.5 Connecting the media



8 Analyzer, left side panel

1	*Power connection*	*5*	*Bypass rinse water*	*9*	*Acid connection*
2	*Gas outlet*	*6*	*External grounding*	*10*	*Condensate drain*
3	*Gas connection*	*7*	*Standard C2 connection*	*11*	*Sample supply*
4	*Water connection*	*8*	*Standard C1 connection*	*12*	*Sample outlet*

Sample conditioning connections

Sample conditioning	Inlet connection, outer diameter in mm (in)	Drain connection, outer diameter in mm (in)
PA2	40 (1.57)	50 (1.97)
PA3	20 (0.79)	30 (1.18)
PA9	20 (0.79)	32 (1.26)

Analyzer sample outlet

Sample is drained off unpressurized via a DN 6/8 mm hose connection (compression fitting) on the left side panel (→ 8, item 12) into an open channel or pipe.

► Route the hose in such a way that backpressure cannot form.

Condensate drain

Condensate is drained off unpressurized via a hose gland (PE, DN 1.6/3.2 mm, scope of delivery) on the left side panel (item 10):
- into a collecting vessel
- into an open channel
- into a pipe

The condensate discharge is acidic (pH = 2 to 2.5).

► Route the hose in such a way that backpressure cannot form.

Connecting the acid

1. Place the acid cistern in the reagent tray.
2. Connect the acid hose to the left side panel (item 9).

Connecting the standards

1. Put the standard containers in the holders on the left side panel.
2. Connect the standards to the left side panel (C1 to item 8 and C2 to item 7).

Gas outlet

Gas escapes via a hose gland (DN 4/6 mm) on the left side panel (item 2).

▶ Ensure that there is adequate ventilation in the room, or remove the exhaust gas from the room via a hose (DN 4/6 mm).

The end of the hose must be pressure-free and protected from frost.

5.3 Post-installation check

1. Check whether all the connections are secure and do not have any leaks.
2. Inspect all the hoses for any damage.
   ↳ Replace damaged hoses.

6 Electrical connection

⚠ WARNING

Device is live!

Incorrect connection may result in injury or death!

- The electrical connection may be performed only by an electrical technician.
- The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- **Prior** to commencing connection work, ensure that no voltage is present on any cable.

6.1 Connection instructions

⚠ WARNING

Device is live

Risk of electric shock! The line filter, the overvoltage module and the main switch are still connected to the power supply 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:
$50\ V < R^{*}I_{max}$

Imax= maximum current at which the failure current protection switch is not yet triggered

R = resistance between the protective ground and the device ground

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

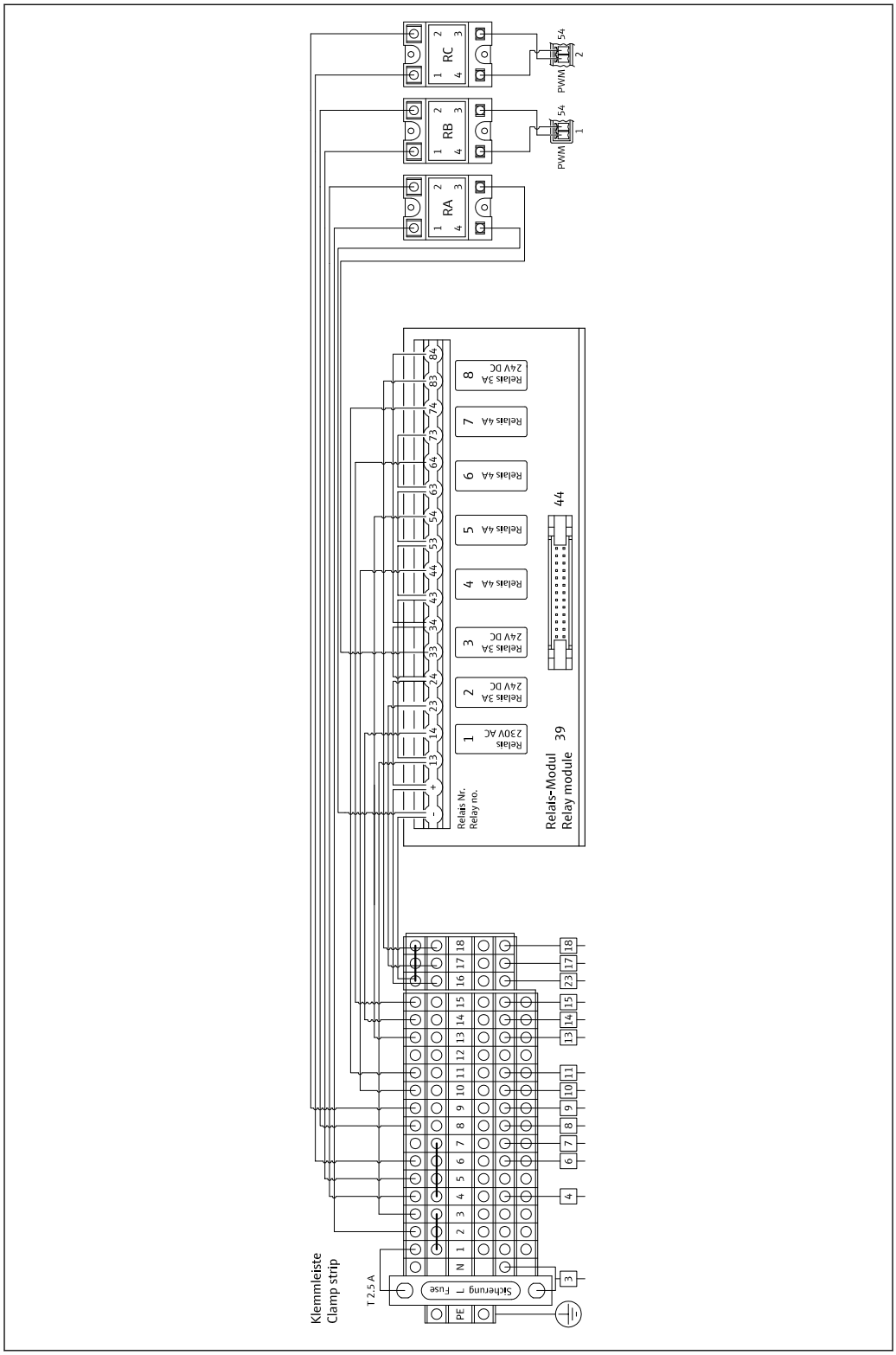
The signal connections are in the EMC shield box on the right-hand cabinet side. The connection for external grounding is on the left-hand cabinet side at the bottom.

Make the following connections:

1. Connect analog 0/4 to 20 mA outputs.
2. Connect binary inputs and outputs.
3. Connect the RS-232 interface.
4. Establish external grounding if necessary.
5. Connect the alternating current via the mains plug.

6.2 Connecting the analyzer

6.2.1 Power distribution



9 *Power distribution wiring diagram*

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

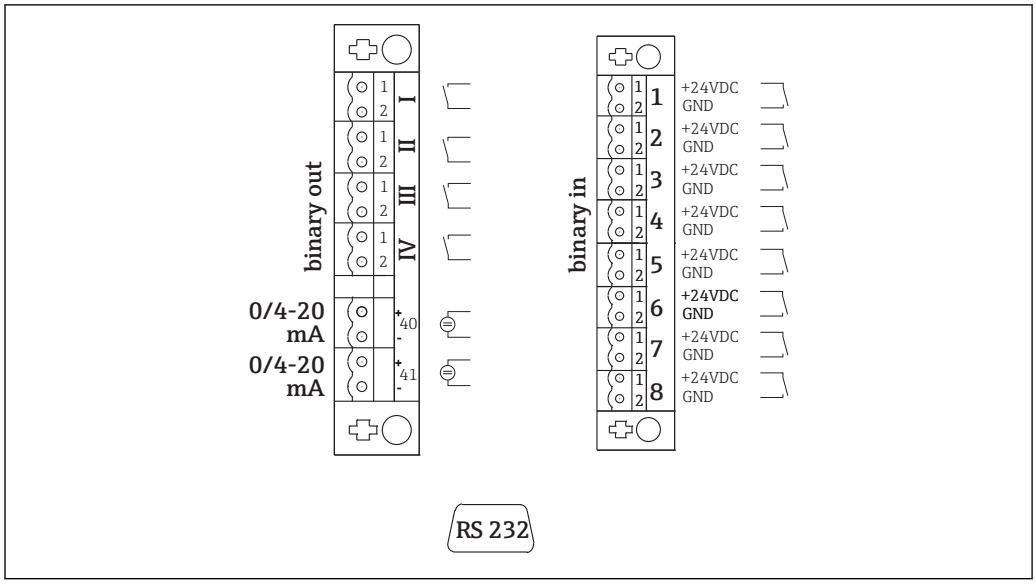
Terminal strip assignment

Connection	Description
3	Main switch, power distribution
4	Solenoid valve 3, stripping gas
6	Peltier cooler regulator
7	Membrane compressor
8	Tube furnace
9	External salt trap
10	Solenoid valve 4, standard 1 + 2
11	Solenoid valve 7, carrier gas
13	Solenoid valve 5, bypass screen rinsing
14	Solenoid valve 1, sample/standard
15	Solenoid valve 6, channel switchover
16	24 V power supply
17	Solenoid valve 2, strip chamber
18	Solenoid valve 8, dosing

Relay module assignment

Relay No.	Relay type	Function
1	4A	Solenoid valve 1, sample/standard switchover
2	3A	Solenoid valve 2, strip chamber rinsing
3	3A	Solenoid valve 3, stripping gas, tube furnace regulator, external salt trap regulator, Peltier cooler regulator, membrane compressor
4	4A	Solenoid valve 4, standard C1/standard C2 switchover
5	4A	Solenoid valve 5, bypass rinsing
6	4A	Solenoid valve 6, channel switchover
7	4A	Solenoid valve 7, carrier gas
8	3A	Solenoid valve 8, dosing
RA	25A	Emergency stop
RB	25A	Heater, furnace regulator
RC	25A	Heater, salt trap

6.2.2 Connecting signals



10 *Signal connection*

I	*Fault messages*	*1*	*Calibration external trigger*
II	*Collective alarm for limit values*	*2*	*Adjustment external trigger*
III	*Standby*	*3*	*Screen flush external trigger*
VI	*Operational control*	*4*	Power flush, external activation
40	*Signal output, channel 1*	*5*	*Not assigned*
41	*Signal output, channel 2 (optional)*	*6*	*Not assigned*
		7	*Standby external trigger*
		8	Channel switchover, external activation (optional)

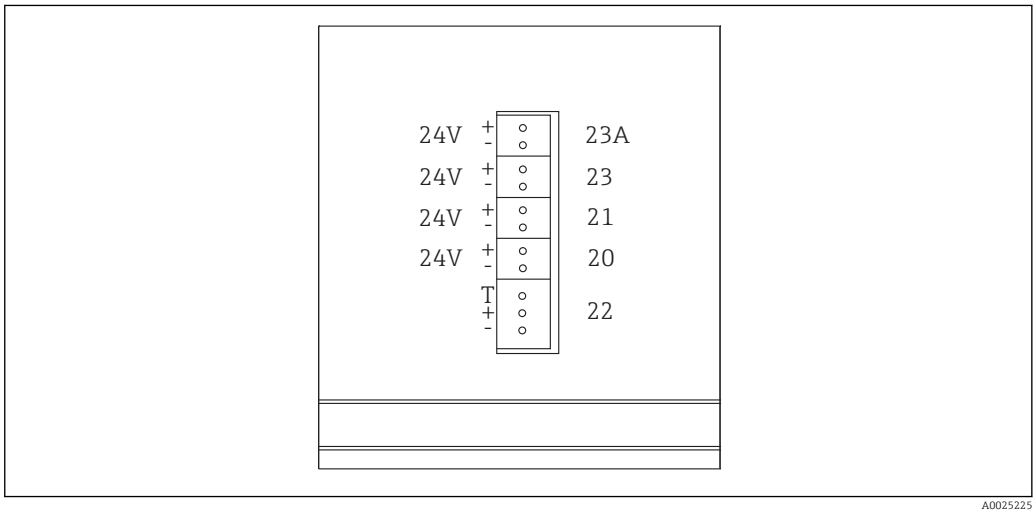
Signal outputs	Description
Messages I to IV	Potential-free relay contact (max. 0.2 A and 50 V), normally closed (NC) Relay contact I closed = no error messages Relay contact II closed = no collective alarm Relay contact III closed = standby Relay contact IV closed = operational control At the end of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

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	Power flush, external activation	Analyzer is in measuring mode	Power flush is triggered

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	Channel switchover, external activation (optional)	Analyzer is in the measuring mode of the selected channel.	The channel is switched.

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

6.2.3 Power unit

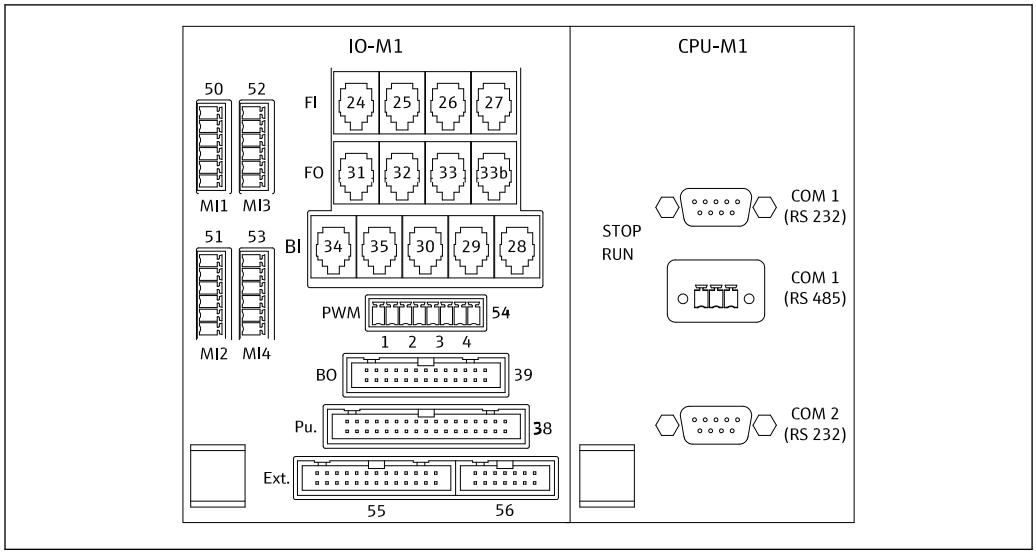


11 *Power unit assignment*

Connection	Description
20	Pump control 24 V DC
21	Magnetic stirrer controller 24 V DC
22	Motor
23	Relay module 24 V DC
23A	Ventilator 24 V DC

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

6.2.4 Connecting the distributor



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

Distributor assignment:

Connection	Description
FI-24	NDIR detector
FI-26	pH amplifier
BI-28	Carrier gas pressure switch DI 06
BI-29	DI 05 leak detector
BI-30	Standby internal DI 04
BI-34	Peltier cooler regulator DI 01 + 02
BI-35	Dilution water pressure switch DI 03
PWM-1	Furnace regulator (pin 1 black, pin 2 blue)
PWM-2	Salt trap regulator (pin 3 brown, pin 4 gray)
BO-39	Relay module
PU-38	Pump control
Ext. 55	External junction box
MI1	Temperature sensor, furnace regulator, type K (pin 4 green, pin 6 white)
MI2	Temperature sensor, furnace monitoring, type K (pin 4 green, pin 6 white)
MI3	Temperature sensor, salt trap regulator, type J (pin 4 black, pin 6 white)
MI4	Pressure sensor (pin 1 VS brown, pin 3 signal + black, pin 4 signal – gray, pin 6 GND blue)

6.3 Ensuring the degree of protection

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

▶ Exercise care when carrying out the work.

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) that are loose or insufficiently secured.

6.4 Post-connection check

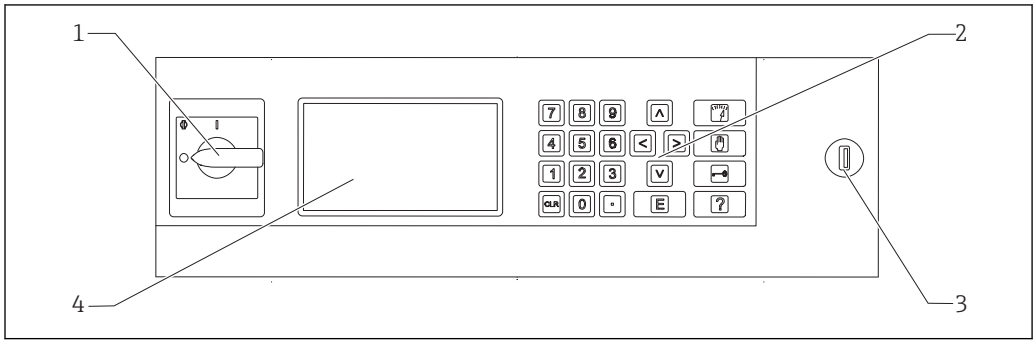
Carry out the following checks once you have made the electrical connection:

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?	

7 Operation options

7.1 Overview of operation options



13 *Operating elements*

1 *Main switch*
2 *Numerical keypad (→ 27)*
3 *USB port*
4 *Screen, 16 lines with 40 characters per line*

7.2 Structure and function of the operating menu

7.2.1 Operating modes

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

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

7.2.2 Recording mode

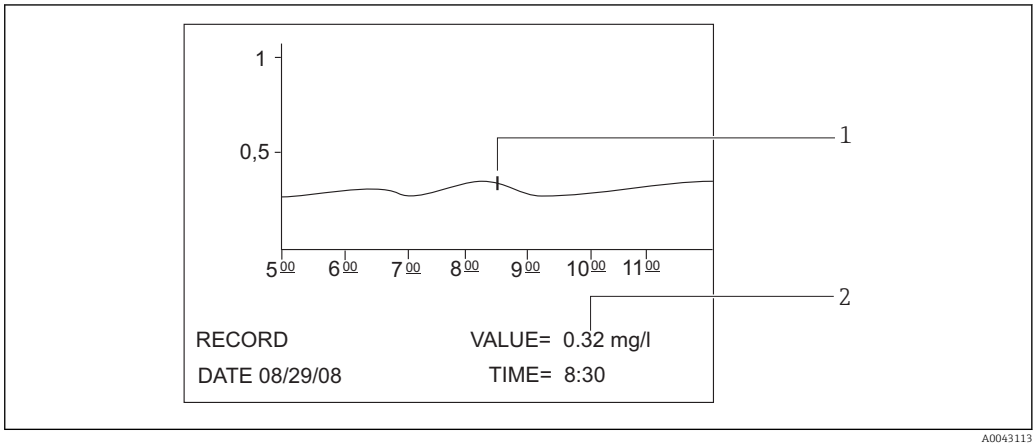
In the recording mode, you can display measured values that have been recorded.
Recording time:
- 14 days for one-channel operation
- 7 days for two-channel operation

1. Press ⏎ in the measuring mode.
   ↳ This takes you to the recording mode.
2. With the arrow keys, scroll through the recorded measured values:

- ^: 1 day earlier
- v: 1 day later
- <: 2 hours earlier
- >: 2 hours later

3. Once you have selected the desired measured value:
   Press E.
   ↳ The spot view is enabled.

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



14 Spot view (example, English)

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

1. Press E.
   ↳ The spot view is disabled.
2. Press .
   ↳ You exit the recording mode.

7.3 Access to the operating menu via the local display

Button	Function
	OPERATION ▶ Press the key. ↳ This takes you to the measuring mode. The progression of the measured values over the past six hours is graphically illustrated on the display.
	SERVICE ▶ Press the key. ↳ This takes you to the service mode. The following menu items are displayed: ▪ Pumps ▪ Adjustment ▪ Cleaning ▪ Filter

Button	Function
	P R O G R A M M I N G 1. Press the key. ↳ You are asked to enter the four-digit numerical code indicated on your code card. 2. Enter the code. ↳ This takes you to the programming mode. The following menu items are displayed: ▪ 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. 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.
E	**User entry** The following functions are available: ▪ Call up a menu item. ▪ Start a program item. ▪ You always confirm an entry. ▪ If performing maintenance tasks, acknowledge every maintenance step once it has been performed by pressing the "Enter" key.
?	**Help** 1. Press the key. ↳ A short help text on the program item is displayed. 2. Press the key. ↳ The help text disappears.
4	**Limit value list** ▶ Press the key. ↳ The current instances where the limit value has been overshot are displayed.
5	**Error list** ▶ Press the key. ↳ The current errors and alarms are displayed.
6	**Automatic services** ▶ Press the key. ↳ The selected service and the time remaining - in seconds - until the next service are displayed.
7	**To change channel** On devices with two sample flows, you can toggle between the values displayed on the screen for the two flows.
	Process step 1. Press the key. ↳ Displays the current process step in the measuring process. 2. Press the key. ↳ The following information is displayed: temperature, pH value, pressure in the gas circuit and the feed rate of pump P3. 3. Press the key. ↳ Reduces the information shown on the display again to the minimum elements necessary.
CLR	**Clear** You can display the following information on the screen with the "CLR key": ▪ Device type ▪ Software program version ▪ Device options

7.4 Access to the operating menu via the operating tool

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 5 = channel 2 measuring operation enabled
3	Leak (0 = off, 1 = on)
4	Temperature too high (0=off, 1 = on)
5	Low carrier gas supply (0 = off, 1 = on)
6	IR detector fault (0 = off, 1 = on)
7	Temperature too low (< 85 % T_{set}) (0 = off, 1 = on)
8	Outside the measuring range (0 = off, 1 = on)
9	Temperature deviation of Peltier cooler (Tset ± 3 °C) (0 = off, 1 = on)
10	pH alarm (0 = off, 1 = on)
11	Temperature deviation (< T_{set} -30 °C) (0 = off, 1 = on)
12	Standby (0 = off, 1 = on)
13	Limit value exceeded (0 = off, 1 = on)
14	Limit value undershot (0 = off, 1 = on)
15	Slope alarm (0 = off, 1 = on)
16	Unstable dosing, sample failure (furnace) (0 = off, 1 = on)
17	Water supply failure (0 = off, 1 = on)
18	Gas circuit pressure monitoring 0 = OK 1 = 70 % of max. permitted pressure 2 = > max. permitted pressure
19	Check CO_2 baseline (0 = off, 1 = on)
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	Flushing strip and separation chamber with supply water

Byte	Description
27	0 = error shutdown active, no power is supplied to any of the units powered by the power relay 1 = power supply active
28	0 = standard C1 is dosed 1 = standard C2 is dosed If relay 1 (byte 25) is set to 1
29	Sample conditioning rinsing
30	Only relevant for two-channel operation 0 = sample is taken from sample channel 1 1 = sample is taken from sample channel 2
31	Flushing with carrier gas
32	A 0-1-0 change indicates that the process of dosing the sample into the furnace is finished.
33	Separator
34...39	TOC measured value (mg/l) 1 decimal place for measuring range A and B 0 decimal places for measuring range C and D
40	Separator
41 to 46	Only for channel 2 TOC measured value (mg/l) 1 decimal place for measuring range A and B 0 decimal places for measuring range C and D
47	Separator
48 ... 53	CO_2 (ppm) 1 decimal place; current value of the gas card
54	Separator
55 ... 60	CO_2 (ppm) 1 decimal place; CO_2 difference calculated from the measuring cycle
61	Separator
62 ... 67	pH value, 2 decimal places
68	Separator
69 ... 74	Number of drops dosed into furnace, no decimal places
75	Separator
76 ... 81	Batch 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

8 Commissioning

8.1 Preparatory steps

8.1.1 Commissioning sequence

1. Prepare the chemicals.
2. Prepare the analyzer.
3. Switch on the analyzer.

8.1.2 Preparing the chemicals

Many chemicals are toxic or corrosive, and some are explosive - either on their own or combined with other substances. Other chemicals pose a hazard as they can easily enter the body either through the skin or through respiratory channels. Accidents with chemicals can result in death, blindness, burns or lung damage!

- When working with chemicals, follow the instructions in this manual and in the safety data sheets.
- Carefully read the safety data sheet that is supplied with every chemical to determine the hazards posed and the precautionary measures that need to be taken.
- In case of doubt, ask the advice of a certified expert.

Never prepare chemicals alone. You may need assistance in the event of an accident!

- Always make sure that someone is close by.
- Only prepare chemicals in a properly equipped laboratory.

Lack of protective equipment can result in injury!

- Always wear protective goggles, rubber gloves and a rubber apron.
- In addition, wear a dust mask or face shield when working with fine-powder chemicals.

Recklessness!

- Never inhale, taste or swallow chemicals or solutions.

Danger of confusion and incorrect disposal!

- Always affix a label to the containers indicating the contents and the date of preparation.
- Dispose of unlabeled or expired solutions in accordance with local regulations and guidelines.

Some chemicals are very reactive when dissolved in water or mixed with other substances. Dangerous accidents can occur as a result!

- Do not mix chemicals with other substances if you do not know how they react.
- Never mix chemicals that are known to react severely.

Specifying the standard concentrations

The right choice of standard concentration is critical to the accuracy of the measurement method.

1. Before specifying the concentrations of the standard solutions:
   Define the measuring range. The most common concentrations must be covered by the standard solutions.
2. Maintain a concentration ratio of between 1:4 and 1:20 between the two standard solutions.
3. If a limit value must be respected in an application:
   Select the limit value as the concentration for one of the standards.
   ↳ This guarantees the greatest precision when monitoring.

Example
- Concentration to be measured: 3 to 300 mg/l
- Most common concentration: 50 to 150 mg/l
- Limit value to be monitored: 200 mg/l

20 and 200 mg/l should be selected here as the standard solutions. The analyzer can then measure accurately in the range from 10 to 300 mg/l (taking the measuring range of the system into account). A higher measured error can be expected below a concentration level of 10 mg/l and above a concentration level of 300 mg/l.

Reagent quality
The quality of the standard solutions affects the accuracy of the measurements.
- Use "pro analysis" (p.a.) grade reagents.
- Ideally, only use original reagents.

1. Rinse all glass parts and plastic containers thoroughly with deionized water.
2. For best measurement results:
   Before use, wash once more with acid and rinse thoroughly with deionized water.
3. Weigh out the calibration solution as accurately as possible prior to mixing.
4. Keep the containers closed to avoid contamination and a deterioration in quality.

Preparing the KHP parent solution

The accurate preparation of the standard is essential for the accurate calibration or adjustment of the analyzer. Inaccurate preparation will result in incorrect calibration or adjustment, which in turn will yield incorrect results.

The KHP and citric acid parent solutions can also be purchased as ready-to-use solutions from Endress+Hauser (→ 97). This helps you to save time preparing the solutions and you can rely on consistent solution quality.

⚠ CAUTION

Potassium hydrogen phthalate (KHP)
Can irritate the skin and eyes and cause respiratory problems!
- ▶ Do not inhale the powder.
- ▶ Do not swallow any of the solution prepared.
- ▶ Observe the warnings in the safety data sheets.

1. For an organic carbon solution with a concentration of 5000 mg/l:
   Use a 1-liter volumetric flask to dissolve 10.627 g KHP p.a. in 500 to 700 ml of deionized water.
2. Once the KHP has dissolved:
   Fill the volumetric flask up to the mark with deionized water.
3. Stir the solution once more.
4. Label the container, indicating the contents and the date of preparation.

Storable parent solutions with concentrations of 5000 mg/l are stable for 12 months if stored in a cool, dark place at 4 to 8 °C (40 to 46 °F). Prepared standard solutions must be used within 4 weeks even if stored in a cool, dark place.

Diluting the parent solution

Perform serial dilutions to produce lower concentrations.

1. Dilute 10 ml of the parent solution (5000 mg/l) with 90 ml of deionized water.
   ↳ Standard with a concentration of 500 mg/l
2. Dilute 10 ml of the 500 mg/l standard with 90 ml of deionized water.
   ↳ Standard with a concentration of 50 mg/l

3. Dilute 10 ml of the 50 mg/l standard with 90 ml of deionized water.
   ↳ Standard with a concentration of 5 mg/l

Serial dilution is the preferred method for producing lower concentrations.

Do not dilute 1 ml of the 5000 mg/l parent solution with 99 ml of water, as this carries a higher risk of measurement errors.

NOTICE

The use of standards that are stored incorrectly or have expired results in measurement errors!

- Store parent solutions in a cool, dark and air-tight space. Parent solutions with concentrations of 1000 and 5000 mg/l are stable for several weeks at room temperature. The quality of a 10 mg/l solution begins to deteriorate at room temperature within 3 to 5 days.
- For improved stabilization of KHP standard solutions, use nitric acid or sulfuric acid for acidification purposes: 4 ml of 25% nitric acid or 4 ml of 20% sulfuric acid for one liter standard.
- If parent solutions with a high KHP content are acidified, there is the risk of the KHP precipitating.
- Keep the container with the crystalline KHP sealed at all times. If the crystalline KHP comes into contact with air, it absorbs water very quickly and must be dried before use. Otherwise you will get inaccurate measurements since the concentration of carbon is lower in the hydrous salt.
- Dry KHP that has come into contact with air for one hour at 105 °C (221 °F).

Preparing the citric acid parent solution

⚠ WARNING

Nitric acid and citric acid

Nitric acid is highly caustic! Citric acid can irritate the skin and eyes and cause respiratory problems!

- Wear protective goggles, protective gloves and protective clothing.
- Always add acids to water, not vice versa.
- Do not swallow any of the solution prepared.
- Observe the warnings in the safety data sheets.

1. For an organic carbon solution with a concentration of 100 000 mg/l:
   Use a 1-liter volumetric flask to dissolve 291.6 g of citric acid monohydrate ($C_6H_8O_7 \cdot H_2O$, p.a.) in 500 ml of deionized water.
2. Carefully add 55.0 ml (77.0 g) of nitric acid (HNO_3, 65 %, p.a.).
3. Top up with water to the 1 liter mark.
4. Stir the solution once more.
5. Label the container, indicating the contents and the date of preparation.

Storable parent solutions with concentrations of 100 000 mg/l are stable for 12 months if stored in a cool, dark place at 4 to 8 °C (40 to 46 °F). Prepared standard solutions must be used within 4 weeks even if stored in a cool, dark place.

For parent solutions of other concentrations, e.g. 50 000 mg/l, use less citric acid monohydrate accordingly. The amount of nitric acid to be added always remains the same, however: 55 ml.

Diluting the parent solution

Perform serial dilutions to produce lower concentrations.

1. Dilute 10 ml of the parent solution (100 000 mg/l) with 90 ml of deionized water.
   ↳ Standard with a concentration of 10 000 mg/l

2. Dilute 10 ml of the 10 000 mg/l standard with 90 ml of deionized water.
   ↳ Standard with a concentration of 1000 mg/l
3. Dilute 10 ml of the 1000 mg/l standard with 90 ml of deionized water.
   ↳ Standard with a concentration of 100 mg/l

Preparing the stripping reagent

Stripping reagent dosing is regulated via the pH sensor. The regulation range for dosing is approx. 300 times the minimum feed rate of the acid pump. The necessary acid quantity varies greatly from measuring place to measuring place. Ideally, the strength of the acid in the feeder tank is set in a way that enables regulation in both directions, but the regulation range should be higher for higher volumes of acid dosed.

1. Prepare 0.5 l of deionized water with 0.125 l of nitric acid (25 %, p.a.) for the acid feeder.
2. Fill the acid hose.
3. Start the measuring operation with a real sample.
4. Allow the acid dosing to adjust.
   ↳ The aim should be to achieve a feed rate of 2 to 5 % (17 µl/min to 44 µl/min) for pump P3 (current feed rate: **P R O G R A M M I N G /OUTPUT TEST/PUMPS**).
5. If the feed rate is in the desired range between 2 and 5 %:
   Note down the acid concentration and use for future mixtures.
6. If the feed rate is less than 2 %:
   The acid concentration is too high, dilute (→ see Table, add acid preparation to deionized water, not vice versa).
7. If the feed rate is greater than 5 %:
   The acid concentration is too low, increase the concentration (→ see Table, add more acid to the preparation).

	Deionized water [ml]	HNO_3, 25 % [ml]	HNO_3 concentration
Original preparation	500	125	5 %
Increase the concentration		+125	8.3 %
		+125	10.7 %
		+125	12.5 %
Original preparation	500	125	5 %
Dilute	+ 500		2.8 %
	+ 500		1.5 %
	+ 500		0.8 %

8. Replace the contents of the acid hose.
9. Allow the acid dosing system to adjust, read the feed rate.

8.1.3 Preparing the analyzer

1. Install the pH sensor in the strip chamber and connect the sensor cable to the amplifier.
2. Remove the transportation lock (cable ties) on the furnace unlocking device.
3. Place the combustion pipe insert with the catalyst into the furnace (see the "Maintenance" section).
4. Optionally, depending on the device version:
   Install the heated salt trap.

5. Mount the hose cassettes (see the "Maintenance" section).
6. Place the stripping reagent in the reagent tray beneath the measuring device, and put the standards C1 and C2 in the reagent bottle holders provided for this purpose on the left side panel.

8.2 Function check

Incorrect or improperly connected hose connections cause liquid to leak and can cause damage!
- ▶ Check all connections and ensure they have been established correctly.
- ▶ In particular, check all hose connections to ensure they are secure and liquid cannot escape.

Incorrect power supply will damage the device!
- ▶ Ensure that the supply voltage matches the voltage indicated on the nameplate.

8.3 Switching on the measuring device

1. Switch on the analyzer.
   ↳ The furnace begins to heat up.
2. In the programming mode, configure the operating parameters of the analyzer.
3. Adjust the pH sensor (**CALIBRATION/ADJUSTMENT PH SENSOR**).
4. Adjust the peristaltic pumps P1 and P4 (**PUMPS/REPLACE HOSE PUMP P1/4**).
5. Adjust the peristaltic pump P2 and determine the empty volume (**PUMPS/ADJUSTMENT PUMP P2** and **CALIBRATION/EMPTY VOLUME DOSING**).
6. Once the analyzer is in operation following the warm-up process and the temperature is stable:
   Check the gas circuit for leaks (**CLEANING/LEAKAGE TEST**).
7. Perform a 2-point adjustment (**CALIBRATION/ANALYZER ADJUSTMENT**).

8.4 Setting the operating language

You specified the operating language in your order.

Changing the operating language

- ▶ Contact the Service Department.

8.5 Configuring the measuring device

You can update the analyzer software via the USB port.

⚠ WARNING

Connection of unpermitted mass storage devices

Risk of electric shock by connecting faulty storage media with an external power supply!
- ▶ Only use passive storage media (e.g. USB stick).

1. Switch off the analyzer.
2. Plug the USB stick with the desired software into the USB port.
3. Switch on the analyzer.
   ↳ The Endress+Hauser logo appears.

4. Press CLR.
   ↳ 3 options are displayed.

2 and 3 are reserved for Endress+Hauser Service.

5. Press 1.
   ↳ 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.

6. If you do not want to update:
   Press CLR.
   ↳ Cancel and start the existing analyzer software.
7. Search for the desired software version.

Operation:

▲ ▼: Scroll up and down

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

·: Select the software version (* = marking)

CLR: Delete the software version (! = marking)

E: Confirm

The analyzer goes to the measuring mode as soon as the software is started. You can check the software version in the measuring mode (CLR).

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.

8. Remove the USB stick after updating the software.

8.5.1 Main menu

You set the operating parameters of the analyzer in the programming mode.

1. Press →0.
   ↳ You are asked to enter the four-digit numerical code indicated on the code card supplied.
2. Enter the code. Press E.
   ↳ The following menu appears on the display:

PROGRAMMING

> **SETTING**	> RANGE DATA
LISTS	BASIC DATA
INPUT TEST	ALARM LIMITS
OUTPUT TEST	SET CLOCK
DEFAULTS	SET BRIGHTN./CONTR.
	MEASURING SITE

8.5.2 SETTING

P R O G R A M M I N G/SETTING/RANGE DATA

Parameters	Unit	Factory setting	Description
SCALE	mg/l TOC	1000	Enter the maximum concentration for your measuring point here. This value determines the scale end value for the graphics screen. Enter two independent values for the two-channel version.
SCREEN FLUSH	n/Day	0	The number of automatic bypass screen flushes per day (recommended value: 2).
DURA.SCREEN FLUSH[s]	s	15	The flush duration can be varied if screen flushing is enabled. If the flush time is longer than 15 seconds, 2/3 of the flush time is assigned to flushing the screen and 1/3 to flushing the strip chamber.
POWER FLUSH	n/Day	0	The number of automatic power flush cycles for the stripping vessel and separation chamber per day (recommended value: 2).
PAUSE CYCLE [s]	s	0	Interval between 2 measurements
P1 (B) [ml/min]	ml/min	7.5	Feed rate of pump P1
P2 (B) [ul/min]	µl/min	250	Feed rate of pump P2
P4 (B) [ml/min]	ml/min	5.0	Feed rate of optional pumps. The feed rates of pumps P4 and P5 determine the dilution ratio.
P5 (B) [ml/min]	ml/min	25.0	
BATCH VOL. [ul]	µl	300	Dosing volume for a batch. Increasing the volume increases the sensitivity of the measuring system but also increases the salt load.
STANDARD C1 [mg/l]	mg/l	0.2	Concentration of standard solution C1
STANDARD C2 [mg/l]	mg/l	2.0	Concentration of standard solution C2
CAL./ADJUSTMENT	n days	3	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	23.00	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 function is executed 90 minutes before the day changes.

P R O G R A M M I N G/SETTING/BASIC DATA

Parameters	Unit	Factory setting	Description
DC OUT 0/4-20 mA	mV	0	Sets the signal output to 0 to 20 mA or 4 to 20 mA.
DC OUT STANDBY	mV	0	Sets the signal output as follows: ▪ 0: Signal output is set to 0 mA ▪ 1: Signal output is set to 3.6 mA ▪ 2: Signal output in mA is held (last measured value) ▪ 3: Signal output is set to 21 mA
DC OUT CALIBRATION	mV	0	Sets the signal output as follows: ▪ 0: In the event of a calibration, the last measured value is transmitted to the analog output. This output is 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. ▪ 1: Signal output in mA is held (last measured value) until a new measured value has been determined.
SCALE AO	mg/l	1000	Scale end value of the analog output, e.g. 1000 mg/l = 20 mA
EMPTY VOLUME P2 [ul] [1)]	µl	220	Empty volume of pump P2 from the separation chamber to the end of the capillary
P1 100% [ml/min] [1)]	ml/min	8.6	Feed rate of pump P1 at 100 % pump capacity
P2 100% [ul/min] [1)]	µl/min	870	Feed rate of pump P2 at 100 % pump capacity
P3 100% [ul/min] [1)]	µl/min	870	Feed rate of pump P3 at 100 % pump capacity
P4 100% [ml/min] [1)]	ml/min	5.6	Feed rate of optional pump P4 at 100 % pump capacity
P5 100% [ml/min] [1)]	ml/min	30	Feed rate of optional pump P5 at 100 % pump capacity
ADJUSTMENT CONSTANTS			Do not change!
X0 [1)]		0	Offset, value is overwritten during adjustment
KP [1)]		50	Slope, value is overwritten during adjustment
PH CONTROL		1.00	The measuring device is equipped with automatic pH control in the stripping vessel. You can use this parameter to switch pH control on or off. ▪ 1.00 = pH control is switched on, reading on display = TOC ▪ 0.00 = pH control is switched off, reading on display = TC
PH NOMINAL		2.5	Target value in the stripping vessel The pH value must be between 1 and 4 for complete stripping. If the sample becomes too acidic in municipal wastewater treatment plants, there is the problem of humic acid precipitating, which could mask carbonates. This inorganic carbon component enters the furnace and results in higher readings than expected.

Parameters	Unit	Factory setting	Description
PH ADJ.OFFSET [1]		2.4	Offset of the pH sensor; the value is overwritten during the adjustment of the pH sensor.
PH ADJ.SLOPE [1]	mV/ decade	57.5	Slope of the pH sensor; the value is overwritten during the adjustment of the pH sensor.

1) These parameters are adapted by menu-guided adjustments.

P R O G R A M M I N G/SETTING/ALARM LIMITS

Parameters	Unit	Factory setting	Description
HIGH ALARM LIMIT	mg/l	12 000	Limit value for alarm when value is overshot
LOW ALARM LIMIT	mg/l	0	Limit value for alarm when value is undershot

P R O G R A M M I N G/SETTING/SET CLOCK

SET CLOCK

1. ◀▶: Place the cursor at the position to be changed.
2. ▲▼: Change the value at the cursor position.
3. E: Confirm the changes.

P R O G R A M M I N G/SETTING/SET BRIGHTN./CONTR.

Setting the brightness and contrast

The range of adjustment is between 0 and 100 %.

1. ◀▶: Switch between brightness and contrast.
2. ▲▼: Change the value.
3. E: Confirm the changes.

P R O G R A M M I N G/SETTING/MEASURING SITE

Entering the name of the measuring site

The factory default name is **MEASURING SITE**. You can change the name.

1. ◀▶: Position the cursor. 1: Goes to letter A.
2. ▲▼: Change the character at the cursor position.
3. E: Confirm the changes.

8.6 Simulation

8.6.1 P R O G R A M M I N G/INPUT TEST

Test programs for checking the function of the analyzer

1. Select the input.
2. Press E.

ANALOG INPUTS
The following values are displayed:
- Current CO_2 measured value
- T1 = temperature, furnace monitoring
- T2 = temperature, furnace heating regulation, PWM performance display
- T3 = temperature, salt trap heating regulation, PWM performance display
- pH value in stripping vessel
- Pressure level in gas circuit

BINARY INPUTS
Switching state of the binary inputs:
- Ix = 0 = **OFF**
- Ix > 0 = **ON**
- IN1= Peltier cooler, Peltier regulator BI34
- IN2= Peltier cooler, Peltier regulator
- IN3= dilution water BI35
- IN4= standby BI30
- IN5= leak detector BI29
- IN6= carrier gas pressure switch BI28

8.6.2 P R O G R A M M I N G/OUTPUT TEST

Test programs for checking the function of the analyzer

1. Select the output.
2. Press E.

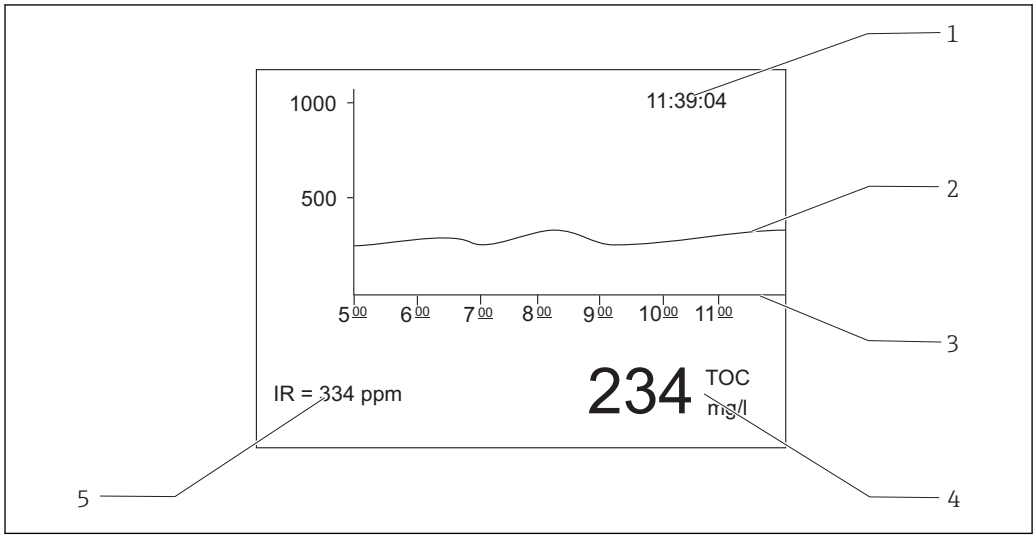
Display	Description
MEASUREM.OFF	Deactivates the measurement mode, status shown: MEASUREM.OFF ► Select the function. ↳ Tests for the outputs do not trigger an alarm.
DC-SIGNAL	Sets the analog current outputs to any value between 0 and 20 mA.
PUMPS	Parameter for testing the function of the pumps Negative value changes the direction of flow.
BINARY OUTPUTS	Displays the switching states of the switch outputs (→ see the following table). E: **ON/OFF**
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	OFF (contacts open)	ON (contacts closed)
SA1	Switch between standard and sample	Sample	Standard solution
SA2	Flushing valve for power flushing	Strip chamber flushing switched off	Strip chamber flushing switched on
SA3	Stripping gas supply, tube furnace regulator, Peltier cooler regulator, membrane compressor	Consumer load switched off	Switch status during measuring operation
SA4	Switch between standard 1 and standard 2	Standard 1	Standard 2
SA5	Screen flush valve	Screen flush off	Screen flush on
SA6	Changeover between channel 1 and channel 2 (optional)	Channel 1	Channel 2

Output	Description	OFF (contacts open)	ON (contacts closed)
SA7	Carrier gas flushing valve	Carrier gas flushing off	Carrier gas flushing on
SA8	Dosing valve	Dosing valve open	Dosing valve closed
SA9	Collective alarm for relay I error (e.g. acid failure, 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 measurement.	The contact is closed during measuring operation as soon as the displayed measured value is reliable, (e.g. after servicing this contact is closed after the first measured value has been determined).

9 Operation

9.1 Reading measured values



15 *Display in the measuring mode*

1 *Time*
2 *Load curve of the last six hours*
3 *Timeline*
4 *Measured value*
5 *Measured value of the IR detector*

9.2 Adapting the measuring device to the process conditions

9.2.1 Two-channel operation

External changeover

The analyzer is equipped with one or two separate sample supply systems.

The current sample selected is controlled externally by signal input 8 (binary in 8).
- Signal input 8 = 0 → channel 1
- Signal input 8 = 1 → channel 2

Analyzer operated with one sample conditioning system:
The operator must ensure that the right sample is at the bypass when a channel switch is requested.

Analyzer operated with two sample conditioning systems:
- The solenoid valve MV6 is used to switch the channels.
- If the signal status at signal input 8 changes, the measuring cycle is terminated immediately and the channel switchover commences.
- : If the "Operation" key is pressed during channel switchover, the process of switching channels is canceled and the measuring cycle is resumed in the active channel. Conditioning of the analyzer to the sample in the active channel is suppressed.

The measuring channel cannot be switched manually.

Settings for the graphics screen

1. Press , enter the numerical code.
2. Open the menu: **P R O G R A M M I N G/SETTING/RANGE DATA**
3. **SCALE CH1**: Enter the maximum concentration [mg/l] for channel 1.
   ↳ Scale end value for channel 1 in the graphics screen
4. **SCALE CH2**: Enter the maximum concentration [mg/l] for channel 2.
   ↳ Scale end value for channel 2 in the graphics screen

7: Changes the channel displayed on the screen.

Settings for the analog outputs

5. Open the menu: **P R O G R A M M I N G/SETTING/BASIC DATA**
6. **SCALE AO CH1**: Enter the maximum concentration for channel 1.
   ↳ Scale end value of the analog output of channel 1
7. **SCALE AO CH2**: Enter the maximum concentration for channel 2.
   ↳ Scale end value of the analog output of channel 2

Settings for the limit values

8. Open the menu: **P R O G R A M M I N G/SETTING/ALARM LIMITS**
9. **HI ALARM LIMIT CH1**: Enter the upper limit value [mg/l] for channel 1.
   ↳ Alarm limit value for when the value of channel 1 is overshot
10. **LO ALARM LIMIT CH1**: Enter the lower limit value [mg/l] for channel 1.
    ↳ Alarm limit value for when the value of channel 1 is undershot
11. **HI ALARM LIMIT CH2**: Enter the upper limit value [mg/l] for channel 2.
    ↳ Alarm limit value for when the value of channel 2 is overshot
12. **LO ALARM LIMIT CH2**: Enter the lower limit value [mg/l] for channel 2.
    ↳ Alarm limit value for when the value of channel 2 is undershot

All the limit values affect the same signal output II (binary out II). A limit value alarm is also retained following channel switchover until the limit value for the channel in question is undershot.

Time-controlled changeover

The analyzer is equipped with two separate sample supply systems.

Settings for the graphics screen

1. Press , enter the numerical code.
2. Open the menu: **P R O G R A M M I N G/SETTING/RANGE DATA**
3. **SCALE CH1**: Enter the maximum concentration [mg/l] for channel 1.
   ↳ Scale end value for channel 1 in the graphics screen
4. **SCALE CH2**: Enter the maximum concentration [mg/l] for channel 2.
   ↳ Scale end value for channel 2 in the graphics screen

7: Changes the channel displayed on the screen.

Configuring the measuring duration

The measuring duration can be individually configured for each channel.

5. Open the menu: **P R O G R A M M I N G/SETTING/BASIC DATA**
6. **DURATION CH1 [min]**: Enter the measuring duration [min] for channel 1.
7. **DURATION CH2 [min]**: Enter the measuring duration [min] for channel 2.

If you configure a duration of 0 minutes in one channel, measurement will be performed permanently in the other channel. You must set a duration greater than 0 minutes for at least one channel.

Irrespective of the measuring duration configured, any measuring cycle that has started will always be completed before the system switches to the other channel.

Settings for the analog outputs

8. Open the menu: **P R O G R A M M I N G/SETTING/BASIC DATA**
9. **SCALE AO CH1**: Enter the maximum concentration for channel 1.
   ↳ Scale end value of the analog output of channel 1
10. **SCALE AO CH2**: Enter the maximum concentration for channel 2.
   ↳ Scale end value of the analog output of channel 2

Settings for the limit values

11. Open the menu: **P R O G R A M M I N G/SETTING/ALARM LIMITS**
12. **HI ALARM LIMIT CH1**: Enter the upper limit value [mg/l] for channel 1.
   ↳ Alarm limit value for when the value of channel 1 is overshot
13. **LO ALARM LIMIT CH1**: Enter the lower limit value [mg/l] for channel 1.
   ↳ Alarm limit value for when the value of channel 1 is undershot
14. **HI ALARM LIMIT CH2**: Enter the upper limit value [mg/l] for channel 2.
   ↳ Alarm limit value for when the value of channel 2 is overshot
15. **LO ALARM LIMIT CH2**: Enter the lower limit value [mg/l] for channel 2.
   ↳ Alarm limit value for when the value of channel 2 is undershot

All the limit values affect the same signal output II (binary out II). A limit value alarm is also retained following channel switchover until the limit value for the channel in question is undershot.

Interrupting the time control system
Irrespective of the time-based control system, the channel can be switched via a manual entry, or by remote control via the external signal input 8.
- 1 or 2: Switch the channel manually.
- Switch the channel remotely via signal input 8
  - Signal 0 = no effect
  - Signal 1 (for approx. 10 s) = channel is switched

If you trigger channel changeover by using the keyboard or the signal input, the measuring cycle is terminated immediately and the channel changeover initiated.

9.2.2 Optimizing the measuring range

Depending on its configuration, the analyzer can measure from just a few mg/l to several 10 000 mg/l.

The analyzer can be optimized in two ways:
- **Optimization by changing a component**
  - Change the infrared detector
  - Fit a predilution system (can only be performed by the manufacturer's service department)
- **Optimization via the device settings** (feed rate of dosing pump P2 is optimized)
  - Optimization of the sensitivity by selecting a higher dosing volume
  - Optimization of the salt load

Please note that action to optimize the sensitivity or the salt load often requires conflicting settings on the analyzer. Select settings that offer the best compromise for your measuring task.

Optimizing the dosing volume

An increase in the dosing volume (pump P2) increases the measuring signal, with a 50 % increase in the feed rate being equivalent to a signal increase of approx. 50 %.

1. Press , enter the numerical code.
2. Open the menu: **P R O G R A M M I N G/SETTING/RANGE DATA/BATCH VOL. [ul]** (**BATCH VOL. CH1 [ul]**, **BATCH VOL. CH2 [ul]** for two-channel operation).
3. Enter the desired volume [µl].
   ↳ Resulting measuring range: → Table.

Please note that if the dosing volume is increased, the salt load also increases to the same extent.

The maximum measuring range indicated on the nameplate is the range at a dosing volume of 100 µl/batch (for the detection of the end of the measuring range) or 1200 µl/batch (for the detection of the start of the measuring range).

Version	Dosing	Resulting measuring range
CA72TOC-A* 0.25 to 600 mg/l TOC	100 µl/batch 300 µl/batch [1)] 1200 µl/batch	3 to 600 mg/l 1 to 200 mg/l 0.25 to 50 mg/l
CA72TOC-B* 1 to 2400 mg/l TOC	100 µl/batch 300 µl/batch [1)] 1200 µl/batch	12 to 2400 mg/l 4 to 800 mg/l 1 to 200 mg/l
CA72TOC-C* 2.5 to 6000 mg/l TOC	100 µl/batch 300 µl/batch 1200 µl/batch [2)]	20 to 6000 mg/l 8 to 2400 mg/l 2.5 to 500 mg/l
CA72TOC-D* 5 to 12 000 mg/l TOC	100 µl/batch 300 µl/batch 1200 µl/batch [2)]	60 to 12000 mg/l 24 to 4800 mg/l 5 to 1000 mg/l

1) Factory setting
2) Factory setting: 250 µl/batch

Optimizing the salt load

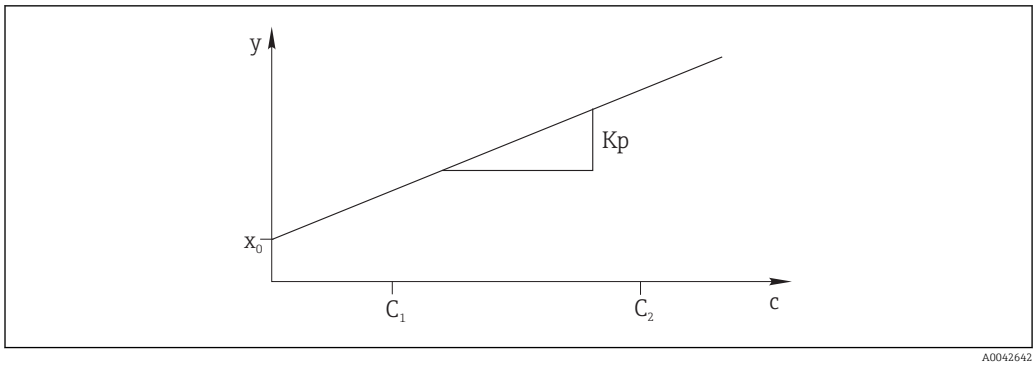
High salt loads can occur in many applications, making it necessary to reduce the salt load. The following options are available:
- Reduce the dosing volume (dosing pump P2)
- Program a break in the measurement
- Optional dilution module for very high salt loads
  Dilution ratios between 1:5 and 1:20 are possible. The effective TOC concentration in the diluted wastewater should be in the analyzer's measuring range.

9.2.3 Adjusting the analyzer

Adjustment principle

Two different standard solutions that are connected to the device are measured to adjust the analyzer.

1. The baseline is measured.
2. The analyzer measures the concentration of standard C1.
3. The baseline is measured.
4. The analyzer measures the concentration of standard C2.
5. The offset x_0 and the slope k_p are calculated from these measured values.



16 Adjustment curve

c Concentration
y Measured signal
x0 Offset
k_p Slope
C1 Concentration of standard C1
C2 Concentration of standard C2

ADJUSTMENT CONSTANTS: The offset and the reciprocal standardized slope of the adjustment curve (measuring signal per concentration) are saved in the maintenance record log.

The analyzer adjustment can be started in three different ways:
- Manually via local operation
- Remotely via a floating contact
- Automatically

1. **Manually**
   Press .
   ↳ **S E R V I C E**
2. **CALIBRATION/ANALYZER ADJUSTMENT**.
3. **Remotely via a floating contact**
   Use input 2 of the "binary in" terminal strip. → 10, 22
4. **Automatically**
   Press .
   ↳ You are asked to enter the four-digit numerical code indicated on the code card supplied.
5. Enter the code. Press .
6. **P R O G R A M M I N G/SETTING/RANGE DATA**.
7. **CAL./ADJUST.[n Days]**: Specify the number of days after which the analyzer should be adjusted.
   ↳ Recommendation: Not more often than one adjustment every 3 days.
8. **CAL./ADJUSTMENT**: Enter 2. (1 = **CALIBRATION**, 2 = **ADJUSTMENT**)

9.2.4 Calibrating the analyzer

The analyzer measures the standard solution C2 connected to the device and in doing so checks the current recovery. In contrast to an adjustment, the adjustment constants are not modified.

The analyzer calibration can be started in three different ways:
- Manually via local operation
- Remotely via a floating contact
- Automatically

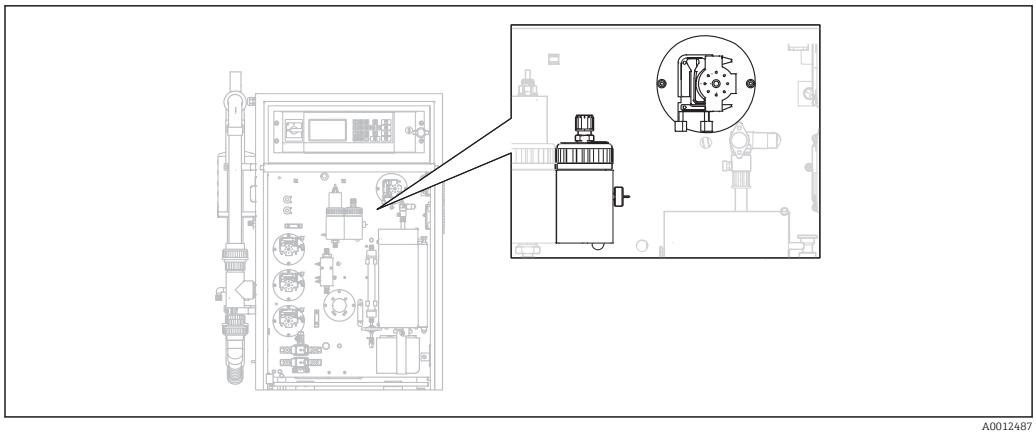
1. **Manually**
   Press .
   ↳ S E R V I C E
2. **CALIBRATION/ANALYZER CALIBRATION**.
3. **Remotely via a floating contact**
   Use input 1 of the "binary in" terminal strip. → 10, 22
4. **Automatically**
   Press .
   ↳ You are asked to enter the four-digit numerical code indicated on the code card supplied.
5. Enter the code. Press .
6. **P R O G R A M M I N G/SETTING/RANGE DATA**.
7. **CAL./ADJUST.[n Days]**: Specify the number of days after which the analyzer should be calibrated.
   ↳ Recommendation: Not more often than one calibration every 3 days.
8. **CAL./ADJUSTMENT**: Enter 1. (1 = **CALIBRATION**, 2 = **ADJUSTMENT**)

Analog value output during calibration
P R O G R A M M I N G/SETTING/BASIC DATA/DC OUT CALIBRATION
- 0
  In the event of a calibration, the last measured value is transmitted to the analog output. This output is 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.
- 1
  Signal output in mA is held (last measured value) until a new measured value has been determined.

During calibration, relay IV is open until a new measured value is present in the measuring mode. If the analog output is used for control purposes, this signal can be used to declare the analog output as invalid.

9.2.5 Empty volume dosing

You determine the empty volume of pump P2 from the separation chamber to the end of the capillary.



A0012487

1. **Manually**
   Press [0].
   ↳ S E R V I C E
2. **CALIBRATION/EMPTY VOLUME DOSING**.
   ↳ **PLEASE WAIT.PUMP CONVEYS BACKWARDS**.
   The hose of pump P2 is drained.
3. Wait until: **PUMP CONVEYS SAMPLE FOR INJECTION**.
   ↳ The pump pumps automatically in the direction of the capillary.

Pumping stops if:
- (A) A drop is detected or
- (B) The system times out (after 180 s)

(A) A drop is detected

The new volume value determined is shown on the display and saved.

Check the value: **EMPTY VOLUME DOSING/EMPTY VOLUME P2 [ul]**.

► Press [E].
↳ Measuring operation is restarted.

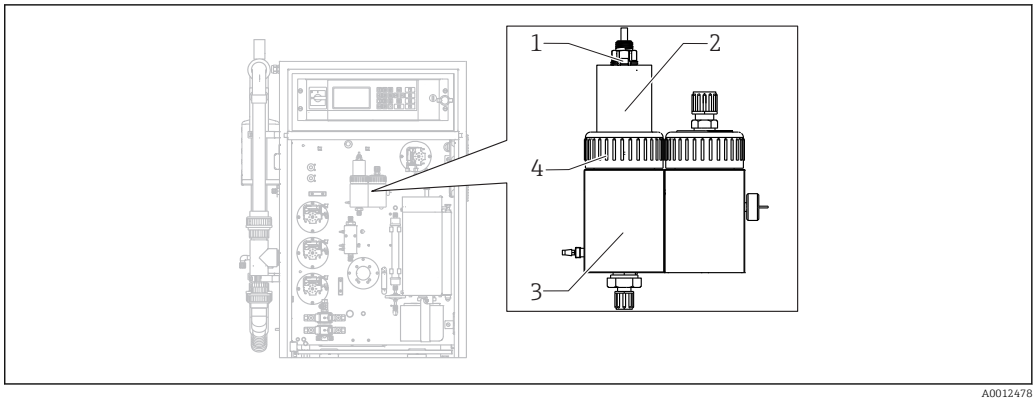
(B) The system has timed out

Display: **DROP DETECTION FAILED.MANUAL CONFIRMATION REQUIRED!**

You must determine the empty volume manually.

1. Press [E].
   ↳ The service is restarted and the automatic determination function is disabled.
   PLEASE WAIT.PUMP CONVEYS BACKWARDS.
   The hose of pump P2 is drained.
2. [E]: Start the pump.
   ↳ **PUMP CONVEYS SAMPLE FOR INJECTION**.
3. Wait for the first drop to fall.
4. Once the first drop has fallen:
   [E]: Stop the pump.
   ↳ The new volume value determined is shown on the display and saved.
   Check the value: **EMPTY VOLUME DOSING/EMPTY VOLUME P2 [ul]**.
5. Press [E].
   ↳ Measuring operation is restarted.

9.2.6 Adjusting the pH sensor



17

1 pH sensor
2 Cover
3 Strip chamber
4 Thread adapter nut

Prepare the following the adjust the pH sensor:
- Deionized water
- Buffer solution pH = 4.00
- Buffer solution pH = 7.00
- Paper towels to absorb liquid
- Vessel to hold liquids

1. Press .
   ↳ S E R V I C E
2. **CALIBRATION/ADJUSTMENT PH SENSOR**.
3. Release the thread adapter nut. (→ 17, item 4)
4. Remove the cover (2) with the pH sensor (1) from the strip chamber.
5. Press E.
6. Follow the instructions. Rinse the sensor and then immerse in the vessel with buffer 4.00.
7. Press E.
   ↳ Wait until the measured value stabilizes (a bar appears to the right of the measured value).
8. Press E.
9. Follow the instructions. Rinse the sensor and then immerse in the vessel with buffer 7.00.
10. Press E.
    ↳ Wait until the measured value stabilizes (a bar appears to the right of the measured value).
    Calibration values (offset, slope) are calculated. Typical slope value: between 55 mV/decade and 58 mV/decade
11. Follow the instructions. Put the sensor with the cover back into the strip chamber, and tighten the thread adapter nut by hand.
12. Press E.
    ↳ Measuring operation starts again.

ERROR PH ADJUSTMENT: The calibration data are not accepted in this case.

Check the buffer and sensor, replace the sensor if necessary. Repeat the adjustment.

9.3 Showing measurement data history

9.3.1 P R O G R A M M I N G/LISTS/MAX MIN AVERAGE

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

9.3.2 P R O G R A M M I N G/LISTS/RECORD DATA

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

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.

1. Press 1.
   ↳ You are prompted to plug in the USB storage medium.
2. Plug the USB storage medium into the USB port.
   ↳ Data are written to the medium.
3. When prompted:
   Remove the USB storage medium.
4. Press E.
   ↳ The user exits the menu.

10 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

Bacteria or germs in the wastewater

Risk of infection and injury!

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

10.1 Diagnostic information on local display

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

Message	Cause	Possible defect	Tests or remedial action
VALUE>MEASURING RANGE	The IR detector continuously returns a signal that is larger than the specification.		The measured values in the flow of sample are continuously higher than the measuring device configuration. If the "pre-dilution" option is being used, the dilution function has failed.
TEMPERATURE TOO HIGH	The temperature at the tube furnace is 70 °C above the set point.	▪ Temperature sensor ▪ Relay RB ▪ PWM1 ▪ I/O card	1. Select **P R O G R A M M I N G/INPUT TEST**. ↳ The temperatures are displayed. [1)] 2. If there is a significant difference in the temperatures: Check the temperature sensors. 1. Select **P R O G R A M M I N G/INPUT TEST**. ↳ If the PWM controller continuously outputs 200 %, there is a malfunction in the PWM. 2. Switch the main switch off and on again. 3. If the error persists: Replace the I/O card. It may be the case that the furnace is permanently heated. 1. Remove the PWM connection (cable 54). 2. If the temperature continues to rise: Check the relay RB.

Message	Cause	Possible defect	Tests or remedial action
TEMPERATURE TOO LOW	The temperature is 15 % below the set point.	▪ Temperature sensor ▪ Relay RB ▪ PWM1 ▪ I/O card	1. Select **P R O G R A M M I N G/INPUT TEST**. ↳ The temperatures are displayed. 2. If the temperature rises: Wait until the heating process has stabilized. 3. If there is a significant difference in the temperatures: Check the temperature sensors: ensure they are securely fixed and arranged correctly on the furnace pipe. 4. Check the following: are the contacts on the furnace connection socket and the I/O card correctly connected? 1. Select **P R O G R A M M I N G/INPUT TEST**. ↳ If the PWM control system does not regulate and continuously outputs 200 % or 0 %, there is a malfunction in the PWM. 2. Switch the main switch off and on again. 3. If the error persists: Replace the I/O card. It is possible that the furnace is not heated. ▶ Check the relay RB.
TEMPERATURE BELOW XXX °C	The measured temperature is 30 °C below the set temperature.	▪ Temperature sensor ▪ Relay RB ▪ PWM1 ▪ I/O card	
CARRIER FAILURE	The pressure sensor for monitoring the carrier gas has been triggered. Pressure < 1.5 bar, carrier gas supply failure	▪ Pressure sensor ▪ Cable ▪ I/O card	▶ Monitor the carrier gas supply. Check signal processing (I/O card slot no. 28 switch input DI06) 1. Call up: **P R O G R A M M I N G/INPUT TEST/ BINARY INPUTS**. 2. Release the connecting cable on the pressure switch and short-circuit the contacts. ↳ The switch state of DI06 should react on the display. 3. **If it does:** Replace the pressure switch. 4. **If it does not:** Use a multimeter to check that there are no interruptions in the cable. 5. If there are no interruptions: Replace the cable. 6. If there are interruptions: Replace the I/O card.

Message	Cause	Possible defect	Tests or remedial action
LEAKAGE	The leak detector has been triggered. Leaks in the measuring device if the springs of the leak detector have been bridged.	▪ Leak detector ▪ Cable ▪ I/O card	1. Check for leaks. 2. Leak found? Fix the leak. ↳ The error message disappears. 3. No leak found? Check the leak detector for electrical short-circuiting of the spring contacts. 4. Short circuit? Eliminate the bridge (creating the short-circuit). 5. No short circuit? Is the BI29 plug plugged in? If not, plug in the plug. If it is, check signal processing. Check signal processing (I/O card slot no. 29 switch input DI05) 1. Call up: **P R O G R A M M I N G/INPUT TEST/ BINARY INPUTS**. 2. Check whether another cable, e.g. the cable of the carrier gas pressure switch, is working correctly by plugging the BI-28 plug in and out again. ↳ The signal must change. 3. Plug a functioning BI-28 cable into the BI-29 socket. ↳ The display at switch input DI05 must change when the connecting contacts on the pressure switch are bridged manually: No leak (no error): DI05 = on Leak: DI05 = off 4. **If the display changes:** Replace the leak detector. 5. **If the display does not change:** Replace the I/O card.
MALFUNCTION PELTIER	The Peltier cooler deviates > 3 °C from the set point. Following servicing or maintenance, in the event of high ambient temperatures, in the event of unfavorable ventilator suction conditions	▪ Ventilator failure ▪ Cable ▪ Power supply outage	1. **No LED on**: Check the power supply of the Peltier cooler regulator. 2. **Green LED on** (Peltier cooler at operating temperature): Check the transmission cable to the I/O card and the I/O card itself. 3. If the cable is OK, replace the I/O card. 4. **Red > °C LED on** (Peltier cooler is too hot): Check the function of the ventilator on the cooler. Can the ventilator not draw in a sufficient amount of air? Is the air temperature too high? 5. **Red < °C LED on** (Peltier cooler is too cold, control system is defective): Replace the Peltier controller.

Message	Cause	Possible defect	Tests or remedial action
MALFUNCT. IR-DETECTOR	The measuring signal of the IR detector has failed. f < 10 000 Hz	▪ Cable ▪ I/O card ▪ IR detector	The IR detector switches to an automatic warm-up phase following a power outage. It does not supply a current output signal during this time. This phase is finished after approx. 30 s and the analyzer switches automatically to the measuring mode. In the event of an error (malfunction constantly present after 60 s): 1. Replace the connecting cable between the I/O card (FI-24, → 12, 24) and the IR detector with a replacement cable. ↳ If the measuring signal is > 10 000 Hz, the cable was defective and must be replaced. Otherwise check the signal input on the I/O card. 2. Connect another cable to FI-24 (e.g. unplug cable from pH sensor, FI-26, and plug into FI-24). 3. Call up: **P R O G R A M M I N G/INPUT TEST/ ANALOG INPUTS**. 4. Check signal (FI2 frequency input). ↳ Plausible signal (> 10 000 Hz): → the I/O card is OK, the IR detector must be replaced. Signal not plausible (< 10 000 Hz): → replace the IO card.
ACID FAILURE	If the pH value permanently deviates by more than ±2.5 from the set point. Severely fluctuating buffer capacity values	▪ Cable interruption ▪ Pump hose ▪ Leakage ▪ Pump control ▪ pH measurement	1. Check the acid cistern. 2. Is the acid concentration sufficient? Does the acid pump operate at a maximum feed rate of 200 %? Increase the acid concentration in the feeder. 3. Is acid being dosed? **P R O G R A M M I N G/OUTPUT TEST/ PUMPS**: Test pump P3 by specifying values manually. 4. Check the pump hose for leaks. 5. Adjust the pH sensor. Check signal processing (I/O card slot no. 26 frequency input FI4) 1. Disconnect the modular jack at I/O card slot no. 26. ↳ Does the measured value drop? 2. If the display value does not change: Replace the I/O card.

Message	Cause	Possible defect	Tests or remedial action
UNSTABLE DOSING	The drop monitor does not count any, or too few, drop events.		Is sample in the separation chamber? Is pump P2 pumping medium? Can dripping be observed at the dosing head? Is the pressure sensor OK? ▶ **P R O G R A M M I N G/INPUT TEST/ANALOG INPUTS**: Observe the pressure sequence when medium drips. ↳ Can a pressure increase > 10 mbar be observed? Is the furnace fitted with the combustion pipe insert? Check signal processing 1. Disconnect the connector at MI4 (cable 53) and plug it back in. ↳ If the display has frozen, the I/O card has a malfunction. 2. Switch off the main switch, wait a few seconds and switch it back on. 3. If the error persists: Replace the I/O card.
WATER PRESS. FAILURE	The pressure sensor for monitoring the water supply has been triggered. Water pressure < 1 bar	▪ Pressure monitor ▪ Cable ▪ I/O card	1. Check the water supply. Check signal processing (I/O card slot no. 35 switch input DI03) 2. Call up: **P R O G R A M M I N G/INPUT TEST/ BINARY INPUTS**. 3. Release the connecting cable on the pressure switch and short-circuit the contacts. ↳ The switch state of DI03 should react on the display. 4. **If it does:** Replace the pressure switch. 5. **If it does not:** Use a multimeter to check that there are no interruptions in the cable. 6. If the cable is OK: Replace the I/O card.

Message	Cause	Possible defect	Tests or remedial action
CIRCUIT PRESSURE HIGH	The pressure sensor measures a high pressure in the gas circuit. A blockage is forming in the gas circuit.	▪ Pressure monitor ▪ Cable ▪ I/O card	1. Check the gas circuit for blockages. In particular check the acid filter, water trap and reactor, and the heated salt trap if necessary. 2. Has the gas circuit flow rate dropped below 0.7 l/min? Eliminate the blockage. 3. Is the pressure sensor OK? **P R O G R A M M I N G/INPUT TEST/ ANALOG INPUTS**: Observe the pressure sequence. 4. Increase the pressure by manually squeezing the gas circuit hose for dosing. ↳ Can a pressure increase be observed? Check signal processing. Is the plug correctly inserted in the Multi In on the I/O card? 1. Disconnect the connector at MI4 (cable 53) and plug it back in. ↳ If the display has frozen, there is a malfunction in the I/O card. 2. Switch off the main switch, wait a few seconds and switch it back on. 3. If the error persists: Replace the I/O card.
CIRCUIT PRES.TOO HIGH	The pressure sensor measures too high a pressure in the gas circuit. A blockage has occurred in the gas circuit.	▪ Pressure monitor ▪ Cable ▪ I/O card	
VALUE>MEASURING RANGE	The TOC concentrations of the sample are too high, sample dilution missing or failed	Optional sample dilution	The message appears if the IR signal is continuously above the detector measuring range. ► Check the dilution.
ADJUSTMENT FAULT ADJUSTMENT CONSTANTS 1	CO_2 concentrations measured for standard C1 or C2 are above the measuring range for the IR detector. Incorrect standard solution	Gas circuit leaking	Is the gas circuit leak-tight? 1. Check the gas-tightness of the analyzer. 2. Replace standard solutions. 3. Repeat the adjustment.
ADJUSTMENT FAULT ADJUSTMENT CONSTANTS 2	Calculated X_0 value is above the maximum value permitted for the IR detector used.	▪ Gas circuit leaking ▪ Standard solutions	Is the gas circuit leak-tight? 1. Check the gas-tightness of the analyzer. 2. Check the adjustment values in the service log. ↳ Do one of the two log values deviate from the typical value? 3. Replace standard solutions.
ADJUSTMENT FAULT ADJUSTMENT CONSTANTS 3	The calibration line slope is negative or zero. The CO_2 concentration measured for standard 1 is higher than that for standard 2.	▪ MV1, MV4 ▪ Standard solutions ▪ Vessel empty	1. **P R O G R A M M I N G/OUTPUT TEST/ BINARY OUTPUTS**: Switch on output SA1 for MV1 and output SA4 for MV4. ↳ If the solenoid valves do not switch: Replace the relevant solenoid valve. 2. Check the concentration of the prepared standard solutions. 3. Check the assignment of the standard vessels. 4. Check the level of the standard vessels.

Message	Cause	Possible defect	Tests or remedial action
ADJUSTMENT FAULT ADJUSTMENT CONSTANTS 4	KP value is less than 30 or greater than 150	▪ Gas circuit leaking ▪ Standard solutions	Is the gas circuit leak-tight? 1. Check the gas-tightness of the analyzer. 2. Have the standard solutions been prepared properly? Replace standard solutions. 3. Biological growth in the standard vessel. Replace the vessel. 4. Dilution option - feed rate of pump P4 deviates from the values determined. **S E R V I C E/ PUMPS/REPLACE HOSE PUMP P1/4**: Replace the pump hose to determine the feed rate for pump P4.
ADJUSTMENT FAULT ADJUSTMENT CONSTANTS 5	CO_2 concentration < min. permitted CO_2 value. (~ -9.4 % gas card measuring range)		Is the IR detector OK? 1. Convey pure supply gas through the IR detector. 2. **P R O G R A M M I N G/INPUT TEST/ ANALOG INPUTS**: Check whether the IR detector displays a negative offset. 3. If the frequency displayed has dropped below 10000 Hz: Replace the IR detector.
CO2 BASELINE	Baseline value ≥5 % of IR detector full scale value	▪ New catalyst ▪ Pellets for soda-lime scrubbers are used up ▪ Gas generator malfunction ▪ Defective carrier gas valve ▪ Leak in gas circuit ▪ Pump adjustment for pump P2 is no longer up-to-date	The catalyst may outgas following a catalyst replacement. This can cause an error message, particularly in low CO_2 measuring ranges. The problem resolves itself after a few measuring cycles. 1. Are the pellets completely discolored? Replace the pellet filling. 2. Check the function of the gas generator. ↳ Does the carrier gas valve allow sufficient gas through to allow for adequate flushing? Is the carrier gas valve leak-tight? 3. Carry out a pump adjustment for pump P2. 4. Is the gas circuit leak-tight? Perform a leak test.
INPUT ERROR C1>C2	Input value for C1 is higher than for C2		▶ Enter the correct concentrations.
Calibration marked with an asterisk	The IR signal is less than 75% of the value for C2 from the last adjustment		1. Replace the standard solution for C2. 2. Repeat calibration.

Message	Cause	Possible defect	Tests or remedial action
INTERNAL COM-FAULT 1	IO not responding during INIT process		1. Switch the main switch off and, after a short period of time, switch it back on again. 2. If the error persists: Contact the manufacturer's service department.
INTERNAL COM-FAULT 2	IO not responding during the NOINIT process		
INTERNAL COM-FAULT 10	Keyboard not responding		
INTERNAL COM-FAULT 20	CRC error between I/O and CPU or between keyboard and CPU		

1) There are 2 temperature sensors: one to check the temperature, the other for the furnace heater. The furnace is adjusted to the set temperature (850°C). If there is a significant difference between the two temperature values, it is necessary to check whether a temperature sensor is defective or whether there are other reasons for the difference in temperature.

10.2 Diagnostic list

10.2.1 P R O G R A M M I N G/LISTS/ALARM RECORDS

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

Alarm	Description
ALARM T<Tmin	Furnace temperature drops below 85 % of the set value 1. Operation stops. 2. System starts as soon as 90 % of the set value is reached.
TEMPERATURE TOO HIGH	Furnace temperature exceeds the set value by more than 70 °C (126 °F) 1. The furnace and stripping gas supply are switched off. 2. Restart the analyzer manually.
TEMPERATURE TOO LOW	Furnace temperature drops below the set value by more than 30 °C (54 °F)
ACID FAILURE	Acid failure
CARRIER FAILURE	The supply pressure has dropped below 1.5 bar (21 psi). ► Restart the analyzer manually.
MALFUNCTION PELTIER	Peltier cooler malfunction 1. Operation stops. 2. The analyzer restarts automatically once the error status is reset.
VALUE>MEASURING RANGE	The value is outside the measuring range The IR detector has been working above its maximum value for over 10 minutes or the measuring device has been measuring 0 mg/l for over an hour.
MALFUNCTION IR	IR detector is defective 1. Operation stops. 2. The analyzer restarts automatically once the error status is reset.
LEAKAGE	Leak in the system 1. The furnace and carrier gas supply are switched off. 2. Restart the analyzer manually.
ADJUSTMENT FAULT	An error number is assigned to the error.

Alarm	Description
UNSTABLE DOSING	Error when dosing the sample The minimum number of drops to be expected was undershot.
WATER PRESS. FAILURE	Failure in the supply of water for flushing and dilution 1. The minimum permitted pressure of approx. 1.5 bar (21 psi) was undershot. Operation stops. 2. The analyzer restarts automatically once the error status is reset.
CO2 BASELINE	The limit value for the CO_2 drift [ppm/min] or for the CO_2 threshold value [ppm] was overshot in the baseline measurement ▪ Value 1: Baseline drift slope [ppm/min] ▪ Value 2: Baseline offset [ppm]
INPUT ERROR C1>C2	Error entering the standard concentrations The concentration of standard C1 must be lower than the concentration of standard C2.
CIRCUIT PRESSURE HIGH	At 175 mbar, the pressure in the gas circuit is 70 % above the pressure permitted in the gas circuit (250 mbar).
CIRCUIT PRES.TOO HIGH	The maximum permitted pressure in the gas circuit has been exceeded **MAX. PRESSURE [mbar]**: The default value is 250.
INTERNAL COM-FAULT	Fault in internal communication between I/O card, keyboard and Modbus connection 1. Operation stops. 2. The analyzer restarts automatically once the error status is reset.

10.3 Event logbook

10.3.1 P R O G R A M M I N G/LISTS/COMPLETE RECORDS

Displays all the saved events in chronological order. The last 200 events are saved in the list.

10.3.2 P R O G R A M M I N G/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.

Alarm	Description
PROGRAM STARTED	Date and time when the program was started
CHANGE DATA	Date and time when configuration data are changed
CHANGE TIME	Date and time when the clock changes. The newly set time and the time 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	Date and time when the analyzer and the CO_2 concentrations of the standard solutions are adjusted ▪ Value 1: CO_2 concentration of C1 [ppm] ▪ Value 2: CO_2 concentration of C2 [ppm]
ADJUSTMENT CONSTANTS	Date and time and the adjustment constants obtained during adjustment ▪ Value 1: Offset [ppm] ▪ Value 2: Standardized slope [ppm]

Alarm	Description
CALIBRATION	Date and time of the calibration of the analyzer and the calibration value found, and the recovery with regard to the specified concentration of standard C2 ▪ Value 1: TOC [mg/l] ▪ Value 2: Recovery [%]
BASELINE DRIFT	Date and time of the baseline drift when calibrating and adjusting ▪ Value 1: Baseline offset [ppm] ▪ Value 2: Baseline drift increase [ppm/min]
EMPTY VOLUME DOSING	Date and time when selected in the service menu ▪ Value 1: Duration of the filling process [s] ▪ Value 2: Volume [µl]
ADJUSTMENT PUMP P1	Date and time of the adjustment for pump P1 ▪ Value 1: New feed rate (ml/min) ▪ Value 2: Old feed rate (ml/min)
ADJUSTMENT PUMP P2	Date and time of the adjustment for pump P2 ▪ Value 1: New feed rate (µl/min) ▪ Value 2: Old feed rate (µl/min)
ADJUSTMENT PUMP P4	Date and time of the adjustment for pump P4 ▪ Value 1: New feed rate (ml/min) ▪ Value 2: Old feed rate (ml/min)
ADJUSTMENT PH SENSOR	Date and time and the adjustment constants obtained during adjustment ▪ Value 1: Offset [mV] ▪ Value 2: Slope [mV/log pH]
REPLACE HOSE PUMP P1	Date and time when the hose of pump P1 is changed
REPLACE HOSE PUMP P2	Date and time when the hose of pump P2 is changed
REPLACE HOSE PUMP P3	Date and time when the hose of pump P3 is changed
REPLACE HOSE PUMP P4	Date and time when the hose of pump P4 is changed (when sample pre-dilution is provided)
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
POWER FLUSH	Date and time when selected in the service menu Automatic power flushing is not logged.
STRIPPING+SEPARATION	Date and time when selected in the service menu
OPEN GAS CIRCUIT	Date and time when selected in the service menu
COMBUSTION PIPE	Date and time when selected in the service menu
LEAKAGE TEST	Date and time when the leak tightness display is quit ▪ Value 1: Current pressure ▪ Value 2: Current leakage rate [mbar/min] ▪ Typical value: -0.5 to -2.0 mbar/min
REPLACE ACID FILTER	Date and time when selected in the service menu
REPLACE GAS FILTER	Date and time when selected in the service menu
REPLACE HEATED FILTER	Date and time when selected in the service menu (heated salt trap)
REPLACE GAS PREFILTER	Date and time when selected in the service menu
STANDBY	Date and time of a standby event
SAVE DEFAULTS	Date and time when selected in the menu **P R O G R A M M I N G/SETTING**
SET DEFAULTS	Date and time when selected in the menu **P R O G R A M M I N G/SETTING**

10.4 Firmware history

Date	Version	Changes to firmware	Documentation
07/2020	01.00.07		BA00448C/07/../16.20
07/2018	01.00.07	Extension Name of the measuring point recorded in the daily log and in the daily data record Improvement ▪ Time-controlled automatic service ▪ **WATER PRESS. FAILURE**: Entry in daily log	BA00448C/07/../15.19 BA00448C/07/../14.17
09/2017	01.00.06	Extension ▪ Modified signal output in standby mode and during calibration ▪ Introduction of new parameters for signal output in standby mode and during calibration Improvement ▪ Limit changed for slope CO_2 baseline parameter ▪ Process steps for manual service in standby mode	BA00448C/07/../13.15
05/2017	01.00.05	Improvement ▪ **ACID FAILURE**: Error detection in standby mode ▪ **ACID FAILURE**: Error detection in measuring mode ▪ Parameters and process steps for 2-channel measurement ▪ Hardware and software revision status displayed	BA00448C/07/../13.15
04/2017	01.00.04	Improvement Process steps for acid regulation in the standby function	BA00448C/07/../13.15
11/2016	01.00.03	Improvement ▪ Functions for long-term data storage ▪ Display format	BA00448C/07/../13.15
08/2016	01.00.02	Improvement ▪ Time calculation for process steps in sample conditioning and the measuring cycle ▪ **SCREEN FLUSH**, **WATER PRESS. FAILURE**: Error detection ▪ Possible to adjust temperature for heating in the furnace	BA00448C/07/../13.15
06/2016	01.00.01	Extension Default parameters are saved as a data set on a USB data storage medium Improvement Current output for 2-channel measurement	BA00448C/07/../13.15
12/2015	01.00.00	Original software	BA00448C/07/../13.15

11 Maintenance

Incorrect maintenance can result in inaccurate operation and pose a safety hazard!

- ▶ All the maintenance processes described in this section must only be performed by a properly qualified technician.
- ▶ Before every maintenance activity: The specialist staff must be completely familiar with the entire process and have perfectly understood all the steps involved.

11.1 Maintenance schedule

Regular maintenance guarantees the efficient operation of the analyzer.

Window	Maintenance work
At least once a week	1. Visual inspection 2. Check sample conditioning (see appropriate Operating Instructions)
At least once a month	1. Check feed rate of pump P1/P4 and P2 2. Replace standard
Every 3 months at the latest	1. Clean strip and separation chamber 2. Replace glass ball 3. Adjust the pH sensor 4. Change pump hoses 5. Check the filter mats of the ventilators and replace if necessary
If salt quantity > 1 g/l, then perform the following every 3 months at the latest	1. Replace the acid filter 2. Replace the catalyst 3. Clean the combustion pipe
Once a year	1. Check the filter mats of the ventilators (do not clean) 2. Replace membrane filter (gas filter)

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!

11.2 Maintenance tasks

11.2.1 Cleaning the housing

NOTICE

Incorrect cleaning and incorrect cleaning agents can cause damage!

- ▶ Do not use cleaners that contain solvents.
- ▶ Do not damage the nameplate on the analyzer.

Regularly

- ▶ Clean the housing with fluoride-free cleaner and a lint-free cloth.

11.2.2 Visual inspection

⚠ CAUTION

Risk of injury from hot components!

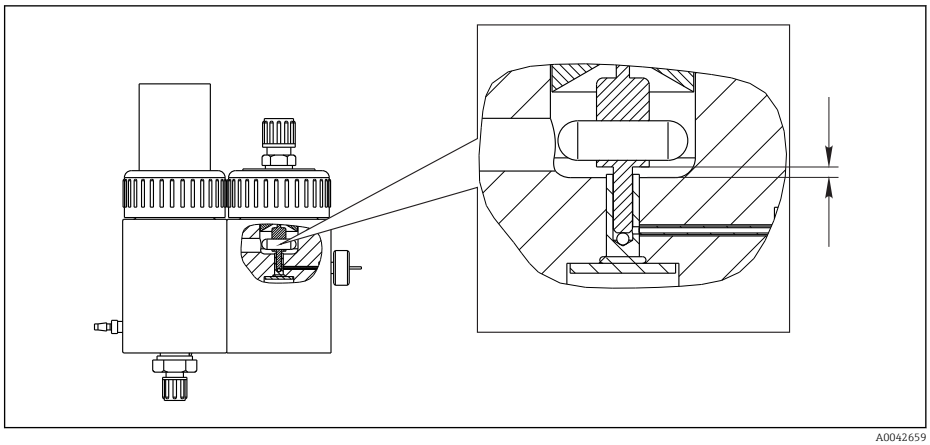
- ▶ Wear heat-resistant gloves when in contact with hot components in the vicinity of the combustion furnace.

Visual inspection (at least once a week)

1. Are the measured values within the measuring range?
2. Is the sample supply line OK? To check, place a receptacle under the valve and set it briefly to Manual Sample.
   - ↳ Does sample flow out of the bypass?
3. Is sample being dosed into the furnace?
4. Check whether hoses P1 to P3 (optionally P4) are leak-tight.
5. Check whether sufficient C1 and C2 standard and sufficient stripping acid are still available.
6. If the condensate is being collected in a container:
   Check if the container is full and empty it if necessary.

Visual inspection of media supply (at least once a week)

1. Check the gas supply.
   - ↳ Pressure regulator at 2 bar (29 psi)? Circuit gas (right flowmeter) at 0.7 to 1.2 l/min (0.18 to 0.32 gal/min)?
2. Check the water supply pressure.
   - ↳ Target value: 3 ± 0.2 bar (43 ± 3 psi)
3. Check that the acid filter is free of condensate and not severely discolored.
4. Check gas sparging in the strip chamber.
5. Check the rotating slit filter.
   - ↳ It must rotate uniformly. There must be a visible slit between the rotating body and the base of the chamber.



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18 Rotating slit filter

11.2.3 Service menu: Overview

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

- PUMPS
  - REPLACE HOSE PUMP P1/4
  - REPLACE HOSE PUMP P2
  - REPLACE HOSE PUMP P3
  - ADJUSTMENT PUMP P2
- CALIBRATION
  - ANALYZER ADJUSTMENT
  - ANALYZER CALIBRATION
  - EMPTY VOLUME DOSING
  - ADJUSTMENT PH SENSOR
- CLEANING
  - SCREEN FLUSH
  - POWER FLUSH
  - BYPASS SCREEN
  - STRIPPING+SEPARATION
  - OPEN GAS CIRCUIT
  - COMBUSTION PIPE
  - LEAKAGE TEST
- FILTERS
  - REPLACE ACID FILTER
  - REPLACE GAS FILTER
  - REPLACE GAS PREFILTER
  - REPLACE HEATED FILTER

11.2.4 Service menu: PUMPS

Replacing the hoses of pumps P1 and P4

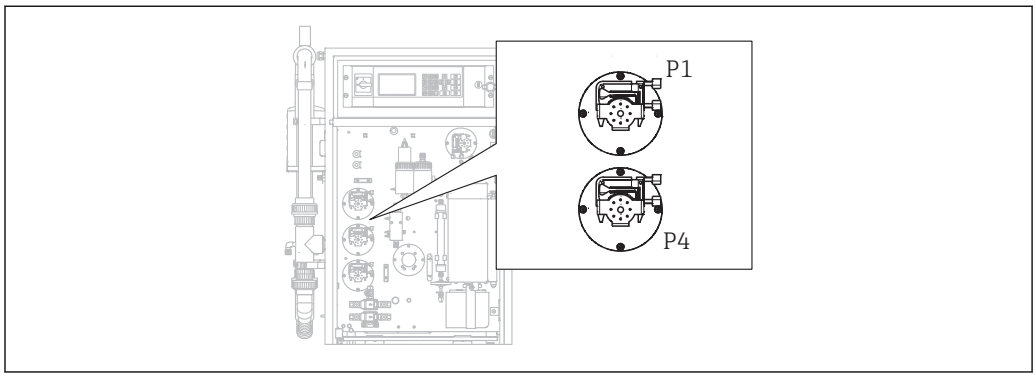
Releasing the hoses

⚠ CAUTION

Rotating parts

Danger of crushing!

► Never reach into the pump head while the pump is in operation.



19 *Position of the pumps*

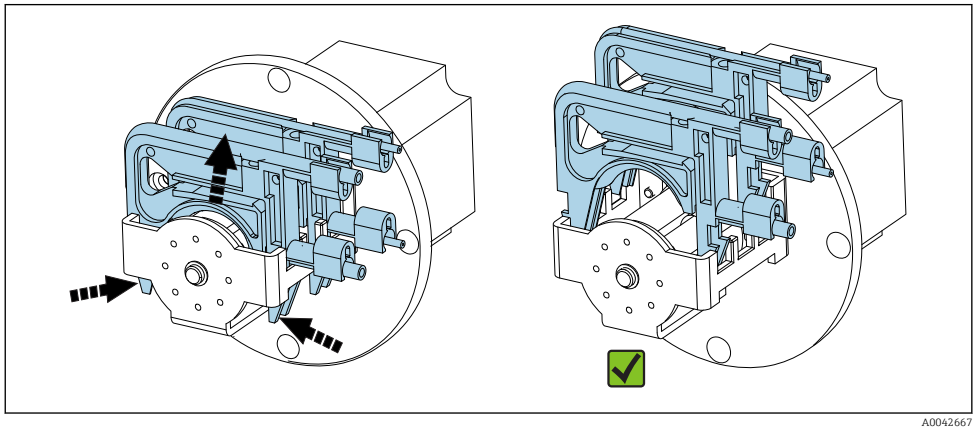
Required tools and materials:

- Graduated cylinder, 10 ml
- Allen key, 2.5 mm
- Dosing needle (injector, included in the delivery)

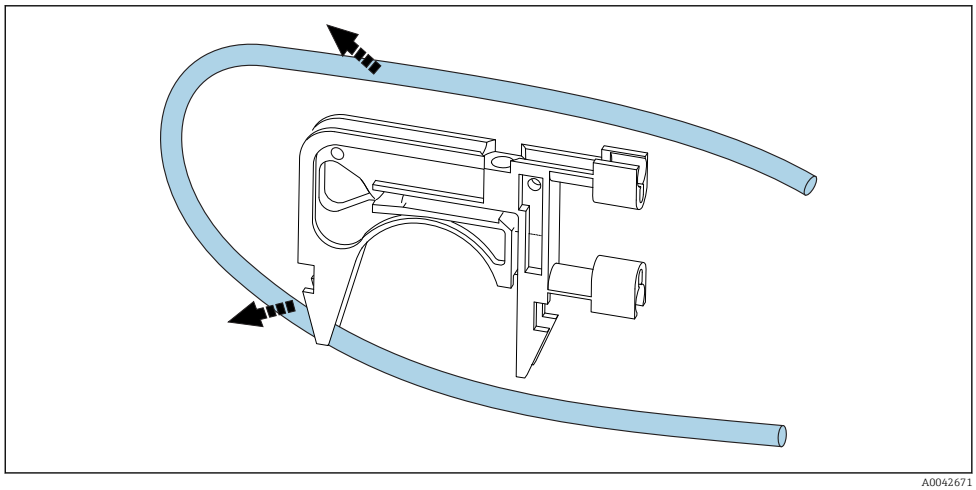
- Absorbent paper
- Collecting vessel, approx. 150 ml (5 fl.oz)
- Silicone grease

The procedure for replacing hoses on pumps P1 and P4 is described below. All steps and information relating to pump P4 do not apply for device versions without the predilution function.

1. /S E R V I C E/PUMPS/REPLACE HOSE PUMP P1/4.
2. **CAUTION**
   Wastewater
   Risk of infection from bacteria!
   ▶ Wear protective gloves, protective goggles and protective clothing.

   Follow the instructions. Press E.
   ↳ The strip and separation chambers are flushed with pressurized water.
3. Turn the valve to manual sample, place a collecting vessel under the hose connection for manual sampling and press E.
4. 

   20 *Hose cassettes (pump P1: sample hose at front, condensate hose at rear)*

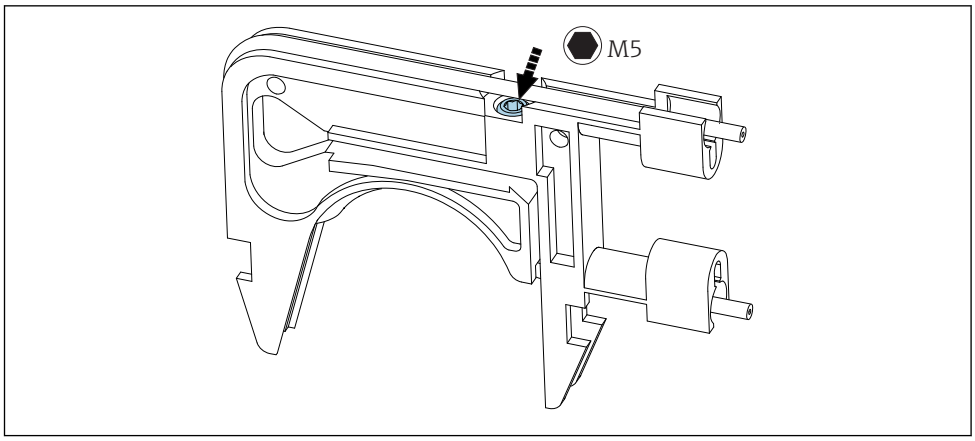
   Open the hose cassettes of the pumps, first P1 then P4 (only for version "with predilution").
   ↳ The pump hoses and strip chambers are drained.
5. Press E.
6. 

   21 *Removing the hose from a cassette*

   Place the absorbent paper under the hose connections, release the hoses from the connections and remove them from the cassettes.

Mounting new hoses (display: REPLACE PUMP HOSE)

Hose markings
- Pump P1
  - Sample hose to strip chamber: violet-white color coding (VT-WH), ID 2.79 mm (0.11")
  - Hose of condensate extraction unit: black-black color coding (BK-BK), ID 0.76 mm (0.03")
- Pump P4 (only for version "with predilution")
  Sample hose to static mixer: violet-white color coding (VT-WH), ID 2.79 mm (0.11")

1. Grease the new hoses with a light coating of silicone grease.
2. Fit the hoses on the cassettes.
3. Lock the hose cassettes in place in the retainer. Make sure the hose cassettes are seated correctly in the retainer.
4. Press E.
5. Connect the suction side (bottom end in the cassette) of P4 and P1: P4 to lowest connection of the mixing chamber (→ 1, 9, item 25), P1 to top connection or, in the version without the dilution function, connect directly to the sample supply at solenoid valve MV1 (item 21).
6. Press > (pump start/stop).
   ↳ The hoses are filled with sample. Observe the drip pattern.
7. Press E.
8. 

   22 *Adjusting screw*

   Set the contact pressure of pump P4:
   Release the adjusting screw until no more medium is conveyed. Tighten the screw again until the unit starts to pump medium.
   ↳ The sample must be pumped evenly across all pump heads.
9. Tighten the adjusting screw one more turn. Press E.

Measuring the capacity of pump P4

If required, you can measure the capacity of pump hose P4. If you prefer to skip this step, press E.

1. Measuring the capacity:
   Place the delivery side of the hose into the 10 ml graduated cylinder (near pump P4).
2. >: Start the pump.
   ↳ Pump P4 pumps liquid into the graduated cylinder for 60 s.
3. After 60 s have elapsed:
   Read the sampling volume and enter the value.
   ↳ The value typically lies between 5.5 and 7 ml (0.18 and 0.24 fl.oz).

4. Press E.
5. Connect the delivery side of pump 4 to the mixing chamber (middle connection).

Pumping sample (P1)

1. Seal the strip chamber inlet with a separate seal (e.g. plug for seal test).
2. If necessary:
   Expand the condensate hose. Use the nozzle of the injector for this purpose.
3. Connect the suction side of the P1 condensate hose (at mixing chamber). Press E.
4. Place the delivery side of the condensate hose into a glass of water.
5. ▶: Start the pump.
   ↳ The sample hose fills.
6. Observe the drip pattern of the sample hose and check the air bubbles in the glass of water (even feed rate).
7. Check the contact pressure of the two hoses of P1: Release the adjusting screw (→ 22), tighten it again until medium is pumped evenly and then tighten the screw one more turn.
   ↳ The sample must be pumped evenly across all pump heads.
8. E: Acknowledge.
9. Where necessary:
   Measure the capacity of pump P1. Proceed as explained above: Place the hose (delivery side) into the graduated cylinder, start the pump, after 60 s read the level in the graduated cylinder and enter the value in the device.
   ↳ The value typically lies between 5.5 and 7 ml (0.18 and 0.24 fl.oz).
10. Press E.
11. Connect the delivery side of sample hose P1 to the strip chamber, press E again.

Final steps

1. Set the valve to bypass.
2. ▶: Pump sample out of the bypass and acknowledge by pressing E.

Automatic filling of the strip chamber, conditioning of the strip chamber with active acid dosing.

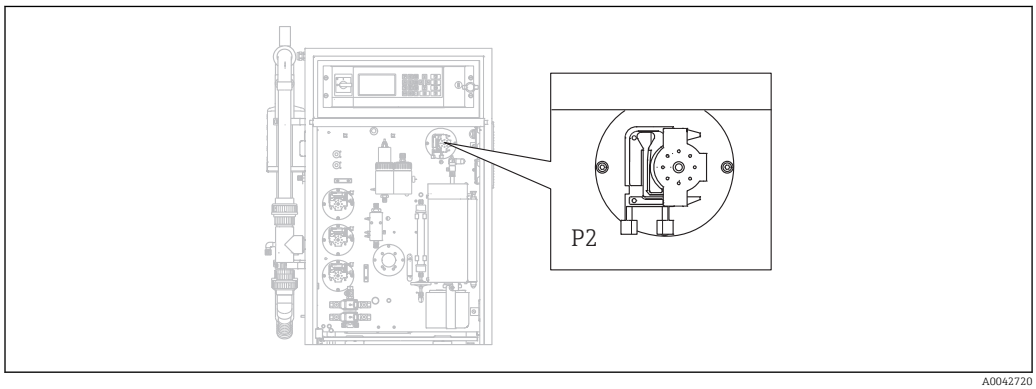
Changing the hose of pump P2

⚠ CAUTION

Rotating parts

Danger of crushing!

► Never reach into the pump head while the pump is in operation.



23 Pump P2

Required tools and materials:

- Graduated cylinder, 10 ml
- Allen key, 2.5 mm
- Dosing needle (injector, included in the delivery)
- Absorbent paper
- Collecting vessel, approx. 150 ml (5 fl.oz)
- Silicone grease

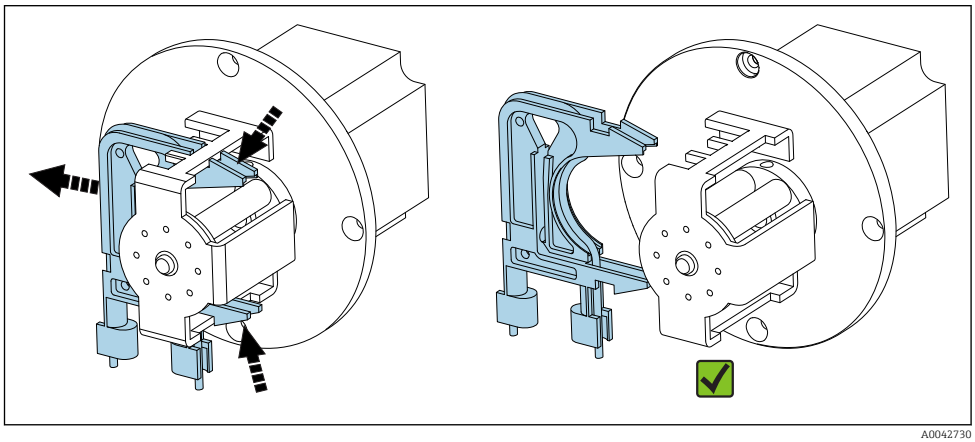
1. → **S E R V I C E/PUMPS/REPLACE HOSE PUMP P2**.
2. **⚠ CAUTION**

   Wastewater

   Risk of infection from bacteria!

   ► Wear protective gloves, protective goggles and protective clothing.

   Follow the instructions. Press **E**.

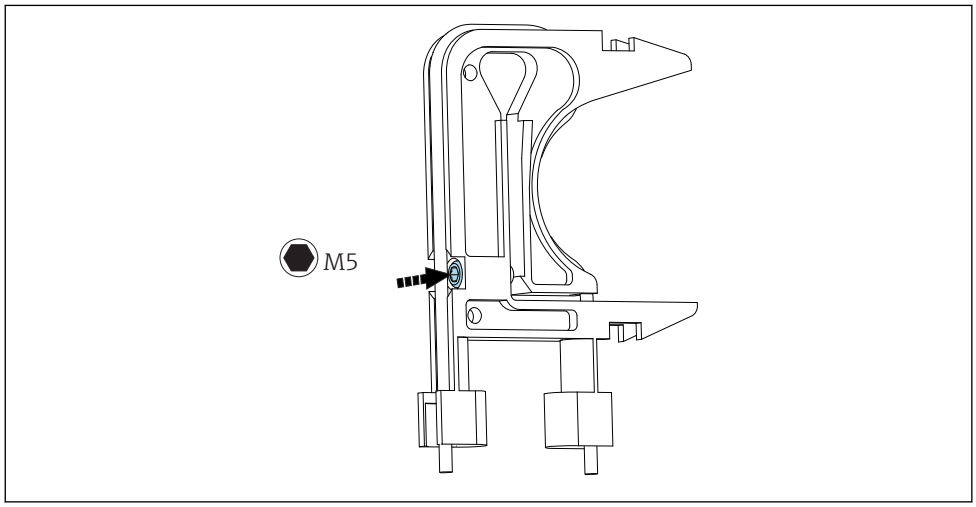
   ↳ The hose is drained.
3. Open the cover of the separation chamber.
4. Empty the separation chamber with the injector and press **E**.
5. Release the hose at the injection unit and separation chamber.
6. 

   24 Hose cassette P2

   Release the hose cassette from pump P2, remove the hose.
7. Grease the new hose ((BK-BK) 0.76 mm (0.03")) with a light coating of grease.

8. Fit the new hose in place.
9. If necessary:
   Widen the openings with the dosing injector.
10. Lock the hose cassette back in place in the retainer. Make sure the hose cassette is seated correctly in the retainer.
11. Press E.

Setting the contact pressure

1. Seal the separation chamber.
2. Connect the pump hose on the suction side.
3. Press >.
   ↳ The hose fills.
4. Observe the drip pattern.
5. 

   25 *Adjusting screw*

   To set the contact pressure:
   Release the adjusting screw until no more medium is conveyed. Tighten the screw again until the unit starts to pump medium.
   ↳ The sample must be pumped evenly across all pump heads.
6. Tighten the adjusting screw one more turn. Press E.
7. Connect the hose to the injection unit (delivery side). Press E.
   ↳ Measuring operation starts.

Adjusting the pump and checking the empty volume

The accuracy of the feed rate of pump P2 affects the measurement result. The **ADJUSTMENT PUMP P2** and **EMPTY VOLUME DOSING**. service menus are used to configure and check the pumps. New hoses are subject to deterioration and aging in the first hours of operation. For this reason, repeat the actions in these two menus after 24 hours.

1. **ADJUSTMENT PUMP P2**: Start. → 72
2. **EMPTY VOLUME DOSING**: Starts automatically afterwards. (→ 47)

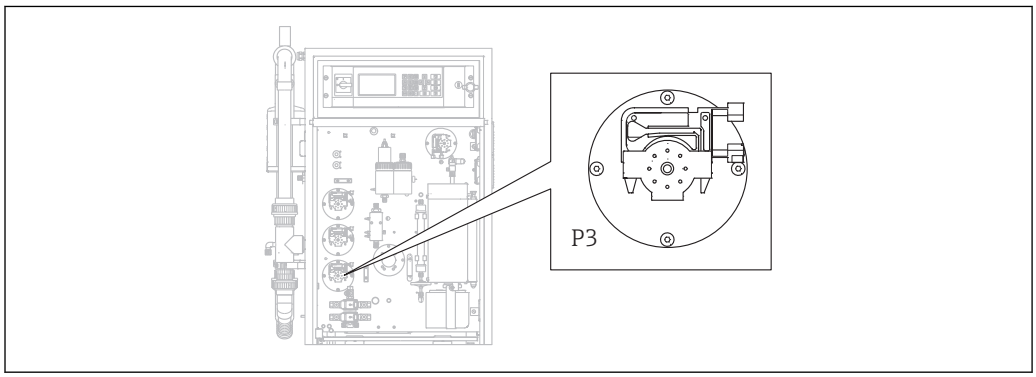
Changing the hose of pump P3

⚠ CAUTION

Rotating parts

Danger of crushing!

- ▶ Never reach into the pump head while the pump is in operation.



26 *Pump P3*

Required tools and materials:

- Acid-resistant protective gloves, protective goggles and protective clothing
- Graduated cylinder, 10 ml
- Allen key, 2.5 mm
- Dosing needle (injector, included in the delivery)
- Absorbent paper
- Collecting vessel, approx. 150 ml (5 fl.oz)
- Silicone grease

1. **/S E R V I C E/PUMPS/REPLACE HOSE PUMP P3**.
2. Follow the instructions. Press **E**.
   ↳ The strip and separation chambers are flushed with pressurized water.
3. Place a vessel to catch the liquid under the hose connection from pump P1 to the strip chamber.
4. Release the hose connection from pump P1 to the strip chamber.
   ↳ Liquid runs out of the strip chamber.
5. Empty the strip chamber with the injector and press **E**.
6. **⚠ CAUTION**

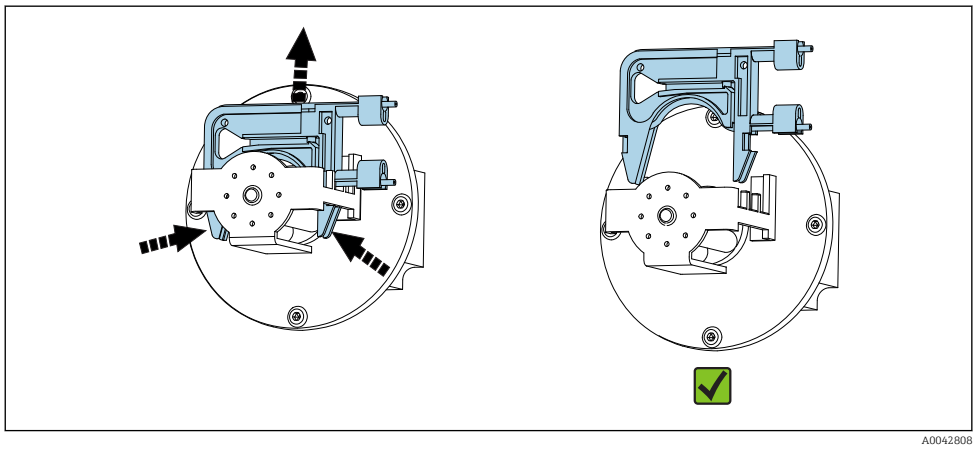
   Acid

   Risk of injury!

   - ▶ Wear acid-resistant protective gloves, protective goggles and protective clothing.
   - ▶ Observe the warnings in the safety data sheets for the acids.
   - ▶ Rinse areas splashed with acid immediately with plenty of water and a 1% solution of sodium hydrogen carbonate.
   - ▶ Consult a physician and show him/her the instructions on the canister.

   Remove the acid suction hose from the acid cistern and place the end in a collecting vessel.

7.



27 Hose cassette P3

Release the hose cassette from pump P3, drain the hose into the collecting vessel and press E.

8. Release the old hose from the connection on the strip chamber and remove from the cassette.
9. Grease the new hose ((BK-BK) 0.76 mm (0.03")) with a light coating of grease.
10. Fit the new hose in place and press E.
11. Connect the hose of pump P1 to the strip chamber again and press E.
12. NOTICE

TOC contamination

TOC in the acid circuit can result in incorrect measurements!

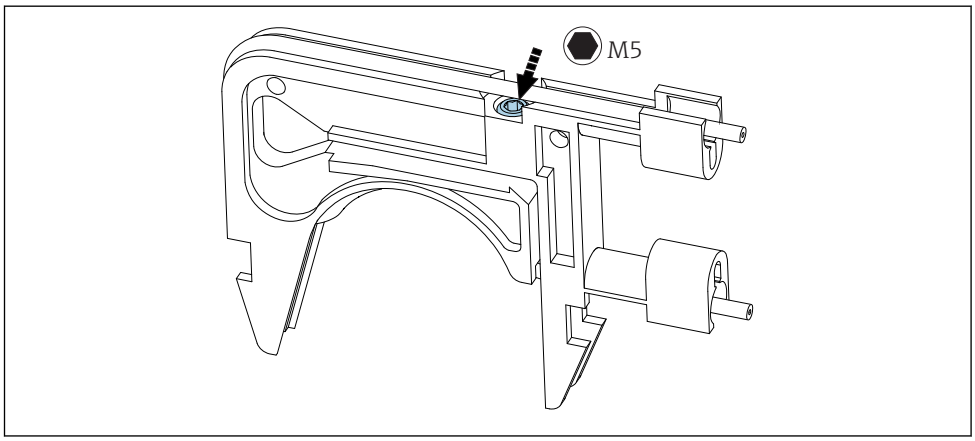
- ▶ Do not allow any medium containing TOC to enter the acid feeder.
- ▶ Do not contaminate hoses with traces containing TOC.

Rinse the suction hose of acid pump P3 and then guide it into the acid feeder tank.

13. If necessary:
    Widen the hose opening with the dosing injector.
14. Lock the hose cassette back into place in the retainer and connect the hose to the hose fitting of the strip chamber.

Setting the contact pressure

1. Press >.
   ↳ The hose fills.
2. Observe the drip pattern.

3. 

28 Adjusting screw

To set the contact pressure:
Release the adjusting screw until no more medium is conveyed. Tighten the screw again until the unit starts to pump medium.
↳ The sample must be pumped evenly across all pump heads.

4. Tighten the adjusting screw one more turn. Press E.
5. Only for versions with predilution:
Wait for the dilution to stabilize.
↳ Dilution stabilizes for 120 s.

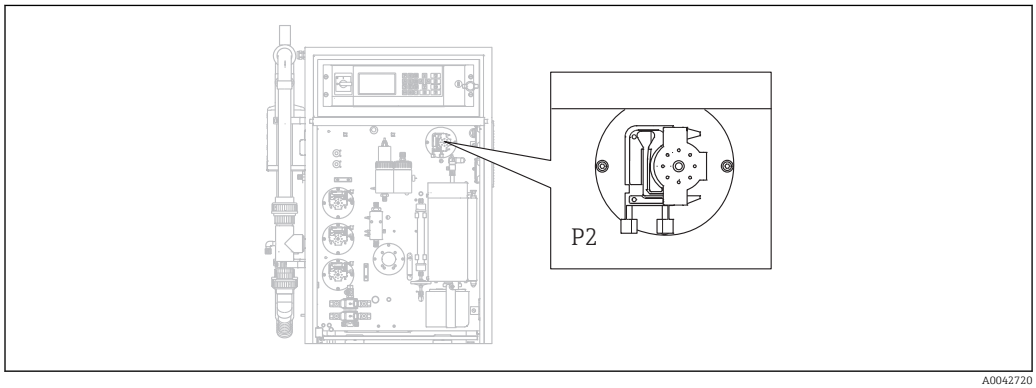
The strip chamber then fills automatically and is conditioned with active acid dosing.

Measuring operation is started automatically.

Adjusting pump P2

⚠ CAUTION

Rotating parts
Danger of crushing!
► Never reach into the pump head while the pump is in operation.



29 Pump P2

Required tools and materials:
- Graduated cylinder, 10 ml
- Allen key, 2.5 mm
- Dosing needle (injector, included in the delivery)
- Absorbent paper
- Collecting vessel, approx. 150 ml (5 fl.oz)
- Silicone grease

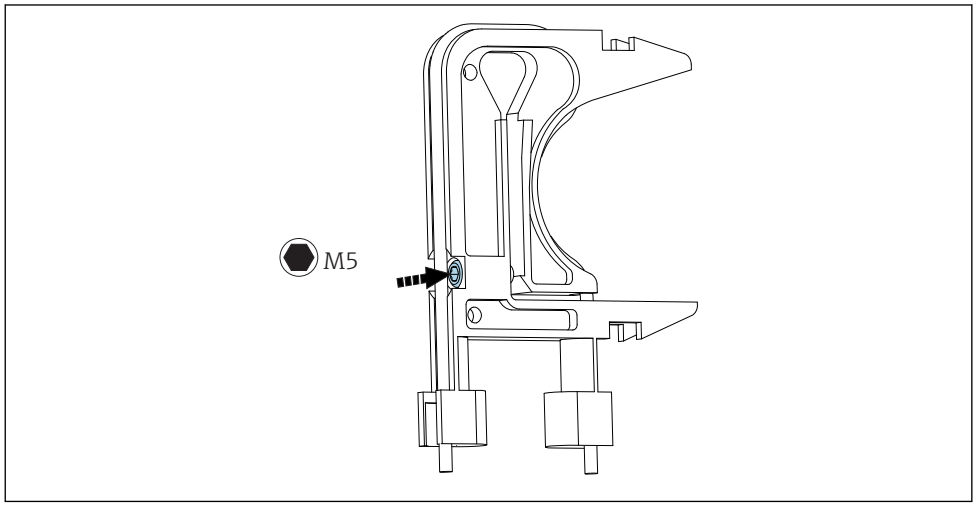
1. **/S E R V I C E/PUMPS/ADJUSTMENT PUMP P2**.

2. **⚠ CAUTION**
   Wastewater
   Risk of infection from bacteria!
   ▶ Wear protective gloves, protective goggles and protective clothing.

   Follow the instructions. Press E.
3. Release the hose at the injection unit (dosing nozzle) and place it into the collecting vessel.
4. ▶: Start the pump.
   ↳ The hose fills.
5. Wait until there is a steady flow of sample. No air bubbles should be conveyed; dosing must be even over all the rollers of the pump head.
6. When a steady flow of medium is pumped:
   ▶: Stop the pump.

If the pump is pumping at a steady rate, press E by way of acknowledgment.

If a steady flow of medium does not occur, set the contact pressure:

1. 

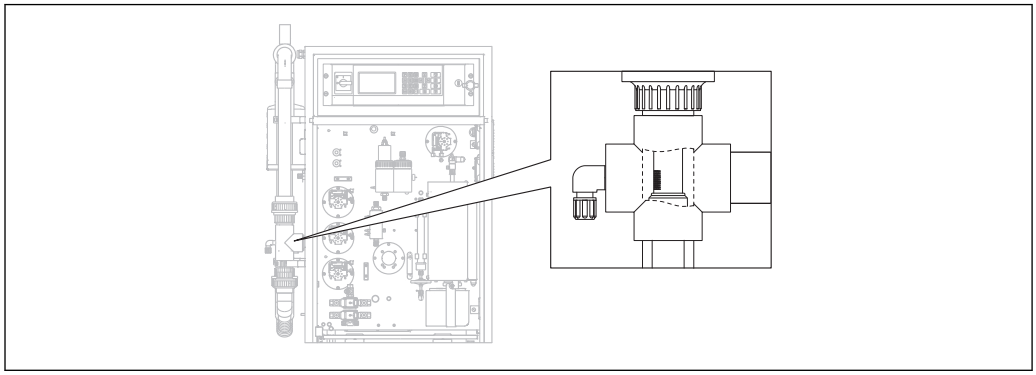
   30 Adjusting screw

   Release the adjusting screw until no more medium is conveyed.
2. Tighten the screw again until the unit starts to pump medium.
   ↳ The sample must be pumped evenly across all pump heads.
3. Tighten the adjusting screw one more turn. Press E.

1. Hold the hose into the graduated cylinder. Press E.
   ↳ The pump pumps at 100 % for 10 minutes.
2. Enter the delivery volume determined.
   ↳ The value typically lies between 8.5 and 9.5 ml (0.29 and 0.32 fl.oz).
3. Press E.
4. Connect the hose again and press E.
   ↳ **EMPTY VOLUME DOSING**: The service menu starts automatically. (→ 47)

11.2.5 Service menu: CLEANING

Bypass screen flush



31 Position of the screen

In the version with the pipe backflush option, water is supplied via the solenoid valve MV1. This means that, in addition to the sample conditioning system, the pipe is backflushed all the way to the bypass screen.

Flushing can be started in three different ways:
- Manually
- Remotely
- Automatically

Manual activation of screen flushing

▶ → **S E R V I C E/CLEANING/SCREEN FLUSH**.
↳ Screen flushing runs automatically, no other actions are required.

Operation starts automatically when the screen flush process is finished.

Remote activation of screen flushing

Screen flushing can be activated via a floating contact.

▶ Use **input 3** of the "binary in" terminal strip. → 10, 22
↳ Screen flushing runs automatically, no other actions are required.

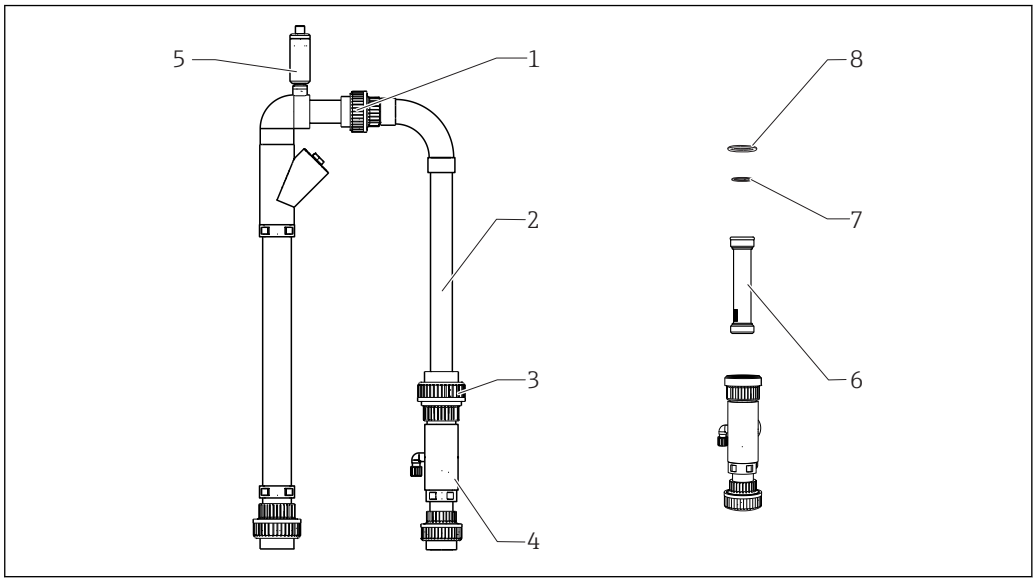
Operation starts automatically when the screen flush process is finished.

Automatic activation of screen flushing

1. Press .
   ↳ You are asked to enter the four-digit numerical code indicated on the code card supplied.
2. Enter the code. Press E.
3. **P R O G R A M M I N G/SETTING/RANGE DATA**.
4. **SCREEN FLUSH [n/Day]**: Enter the number of flushes per day. The factory setting is 2.
5. **DURA.SCREEN FLUSH[s]**: Specify the duration of a flush. The factory setting is 15 s.

Operation starts automatically when the screen flush process is finished.

Cleaning the bypass screen manually



32 *Sample conditioning*

1 Upper thread adapter nut
2 Bypass elbow
3 Lower thread adapter nut
4 Bypass screen housing
5 Vent valve
6 Bypass screen
7, 8 O-rings

Required tools:
- Bottle brush
- Paper towels

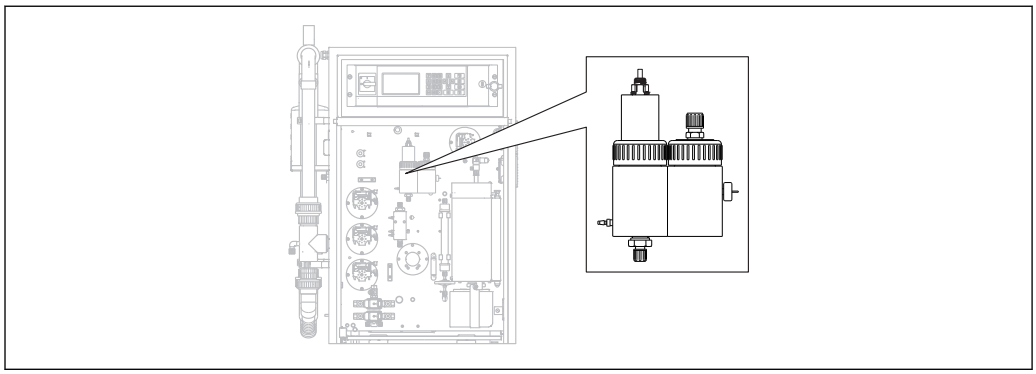
As a precaution, place a vessel under the suction line as water could flow back.

1. → **S E R V I C E/CLEANING/BYPASS SCREEN**.
2. **⚠ CAUTION**
   Wastewater
   Risk of infection from bacteria!
   ▶ Wear protective gloves, protective goggles and protective clothing.

   Shut off the external supply of sample.
3. Set the "online sample/manual sample" valve to "manual sample".
   ↳ Bypass line is emptied.
4. Set the valve back to the previous position.
5. Release the lower and upper thread adapter nut (items 1 and 3).
6. Remove the bypass elbow (2) and bypass screen (6).
7. Clean the bypass screen and the housing with the bottle brush.
8. Unscrew the vent valve (5) and open it.
9. Clean the vent valve and make sure the bearing is able to move freely.
10. Reassemble the parts again in the reverse order. Make sure that the O-rings (7, 8) are undamaged and are correctly positioned.
11. Switch the supply of wastewater back on.
12. Press E.

Measuring operation starts.

Power flush



33 Strip and separation chamber

The strip and separation chambers are flushed with the connected pressurized water via the solenoid valve MV2.

Flushing can be started in three different ways:
- Manually
- Remotely
- Automatically

Manual activation of power flushing

▶ → **S E R V I C E/CLEANING/POWER FLUSH**.
↳ Power flushing runs automatically, no other actions are required.

Operation starts automatically when the power flush process is finished.

Remote activation of power flushing

Power flushing can be activated via a floating contact.

▶ Use **input 4** of the "binary in" terminal strip. → 10, 22
↳ Power flushing runs automatically, no other actions are required.

Operation starts automatically when the power flush process is finished.

Automatic activation of power flushing

1. Press .
   ↳ You are asked to enter the four-digit numerical code indicated on the code card supplied.
2. Enter the code. Press E.
3. **P R O G R A M M I N G/SETTING/RANGE DATA**.
4. **POWER FLUSH [n/Day]**: Enter the number of flushes per day. The factory setting is 2.

Operation starts automatically when the power flush process is finished.

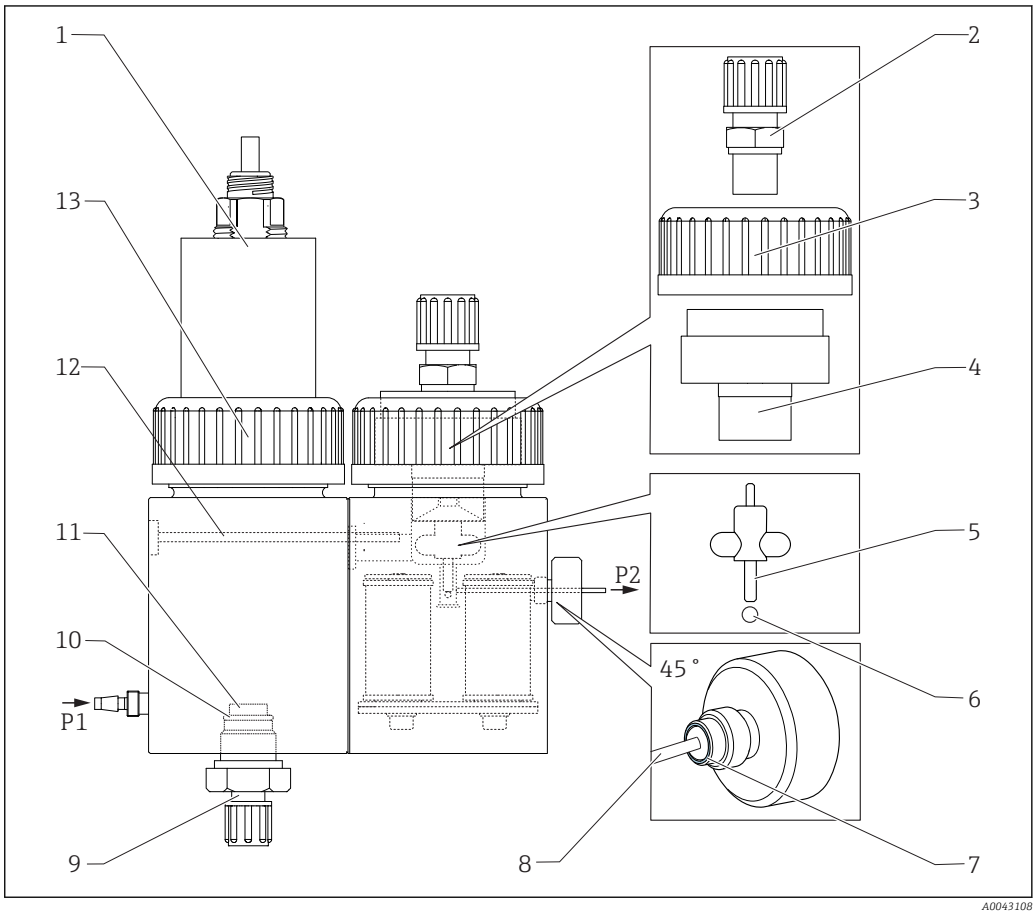
Cleaning the strip and separation chamber manually

→ 33, 76

Required tools and materials
- Pliers
- Paper towels
- Injector

- 4 mm Allen key
- Soft brush
- Vessel with volume of approx. 150 ml (5 fl. oz) to collect liquid
- Glass ball

Disassembling



34 *Strip and separation chamber*

1	*pH sensor and strip chamber cover*	*8*	*Capillary*
2	*Coupling (drain)*	*9*	*Stripping gas connection*
3	*Thread adapter nut*	*10*	*O-ring*
4	*Separation chamber cover*	*11*	*Glass frit*
5	*Magnetic stir bar*	*12*	*Coupling*
6	*Ball*	*13*	*Thread adapter nut*
7	*Seal of knurled head screw*		

1. → **S E R V I C E/CLEANING/STRIPPING+SEPARATION**.
2. **CAUTION**

   Wastewater

   Risk of infection from bacteria!

   ▶ Wear protective gloves, protective goggles and protective clothing.

   Press E.

   ↳ The strip and separation chamber are automatically flushed with pressurized water for 10 s.
3. Have a vessel at the ready to collect the liquid and release the hose connection of pump P1 at the strip chamber.
4. Drain the strip chamber, absorb any drops of water with paper towels.
5. Press E.

6. Release the thread adapter nut on the strip chamber (→ 34, item 13).
7. Release the cable of the pH sensor and remove with the cover (1) from the strip chamber.
8. Release the coupling of the connection for the stripping gas (9) and remove the coupling along with the O-ring (10) and glass frit (11).
9. Release the coupling of the drain (2) and remove the hose connection.
10. Release the thread adapter nut (3) and remove the cover (4).
11. Use the pliers to remove the magnetic stir bar (5) from the separation chamber.
12. Empty the separation chamber with the injector.
13. Connect the empty injector to the suction nozzle for the sample (P2) and inject air quickly to force the glass ball out of the bore hole.

Maintenance tasks

1. Clean both chambers with a soft brush.
2. In the event of severe fouling:
   Separate the strip chamber and separation chamber from one another by releasing the securing screw (12) using the 4mm Allen key. For complete removal, you must disconnect the connector of the magnetic stirrer controller.
3. Clean the pH sensor.

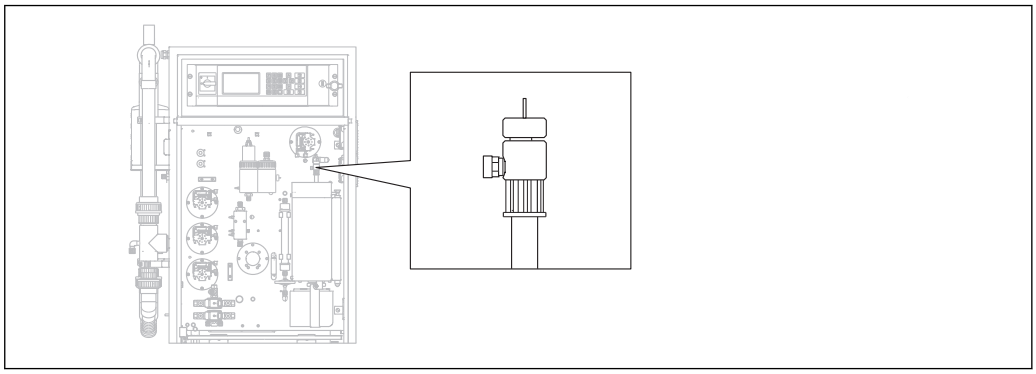
Operating Instructions for pH and ORP sensors, BA01572C

Assembly

1. Insert a new glass ball.
2. Insert the magnetic stir bar (5) (thin shaft pointing upwards).
3. Release the knurled head screw and remove the capillary (8).
4. Insert a new capillary. Slide in the capillary as far as it will go (end stop). In doing so, ensure that the seal (7) is seated correctly in the knurled head screw.
5. Tighten the knurled head screw.
6. Fit the hose (P2) onto the capillary.
7. Put the cover on the separation chamber and tighten the thread adapter nut hand-tight.
8. Fit the drain pipe onto the coupling (2) and screw the coupling closed.
9. Insert the pH sensor with cover and connect the cable.
10. Tighten the thread adapter nut hand-tight.
11. Reinstall the cleaned or new glass frit (11), O-ring (10) and coupling (9).
12. Press E.
13. Connect the hose of pump P1 to the strip chamber.
14. Press E.
    ↳ The strip and separation chamber are automatically flushed with pressurized water for 180 s. Measuring operation then starts automatically.

▶ After cleaning the strip and separation chamber, adjust the pH sensor (→ 49).

Opening the circuit (cleaning the dosing head)

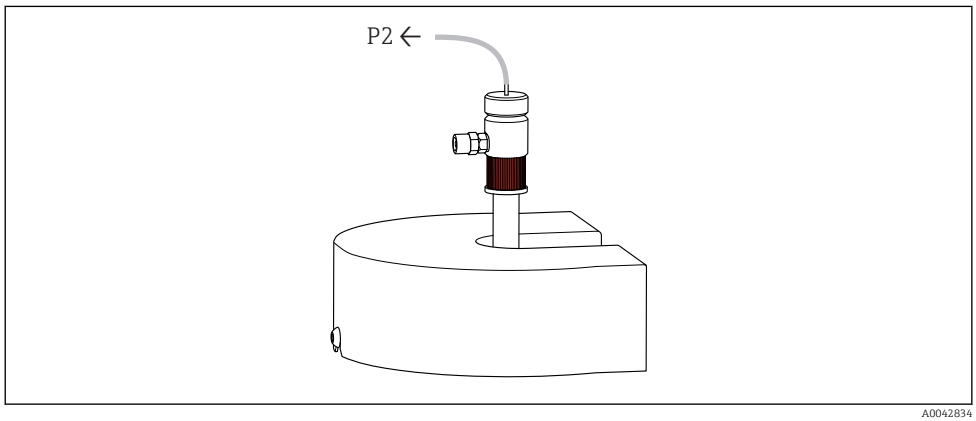


A0042831

35 *Dosing head*

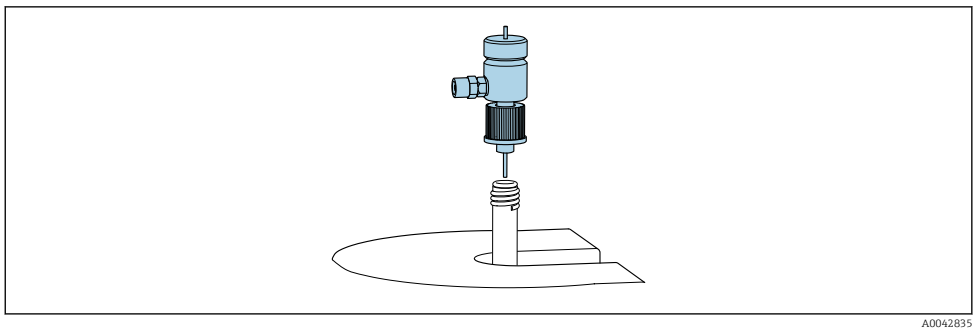
The furnace temperature is not reduced to clean or replace the dosing head (capillary) and sample conditioning (stripping) is continued.

Required tools
Damp cloth

1. → **S E R V I C E/CLEANING/OPEN GAS CIRCUIT**.
2. 

A0042834

Remove hose P2 from the capillary and release the red screw plug.

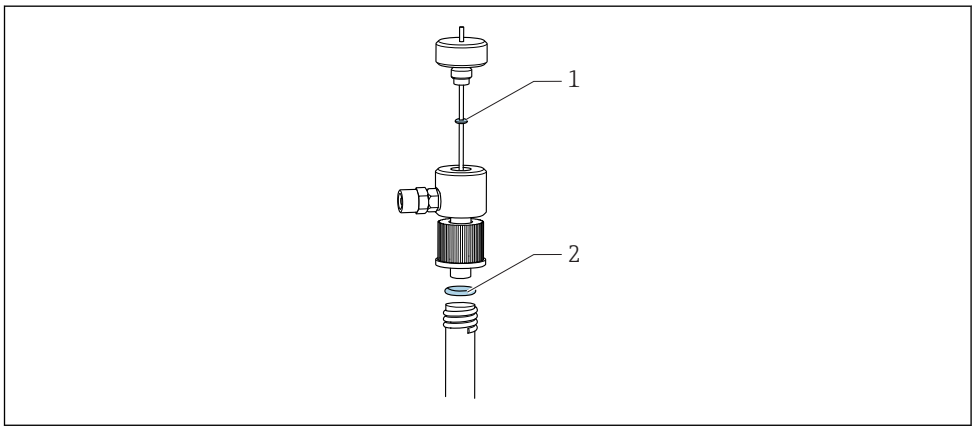
3. 

A0042835

Remove the dosing head.

4. Using a damp cloth, remove salt residue on the capillary.
5. If necessary:
Replace the capillary. Ensure that the new capillary protrudes 10mm (0.4") out of the bottom of the dosing head.

6.



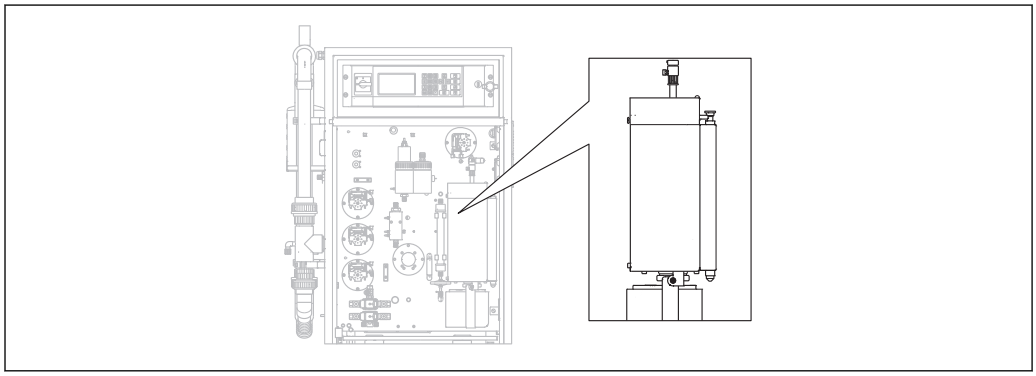
A0042836

Check the O-rings (1 only if replacing the capillary).

7. Insert the dosing head and tighten the red screw plug.
8. Fit the hose P2 back onto the capillary.
9. Press E.

Measuring operation starts.

Cleaning or replacing the combustion pipe



A0043062

36 Furnace

The furnace heating system is switched off when the combustion pipe is cleaned or replaced.

Required tools
- Auxiliary tool for the combustion pipe insert
- Crucible tongs
- Heat-resistant gloves

Preparing the furnace, releasing the optional salt trap

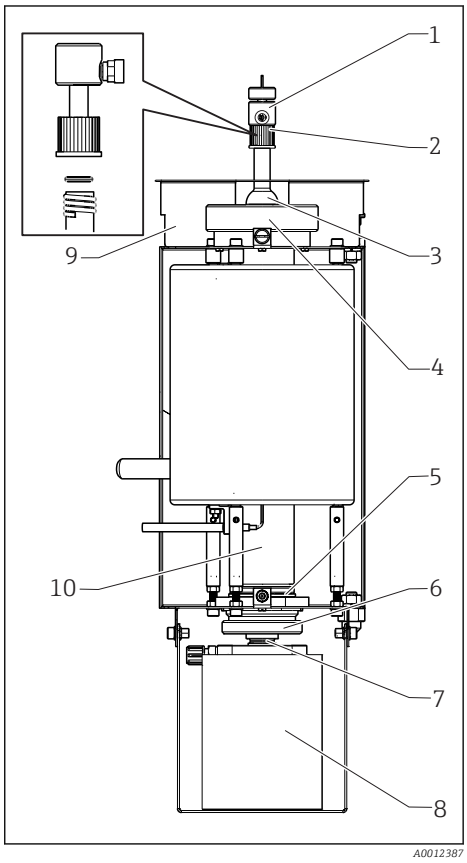
If the insert in the combustion pipe is removed when the pipe is very hot (over 300 °C), cracks may form in the insert and the combustion pipe if they cool down too quickly. This causes a higher baseline and has a negative impact on the operation of the measuring device.

1. → **S E R V I C E/CLEANING/COMBUSTION PIPE**.
   ↳ The power supply for the combustion furnace is switched off. The furnace cools down.
2. Release the hose on the dosing head (item 1).
3. Press E.

4. Only with optional salt trap:
   Release the hose connection and electrical connection to the heated salt trap.
5. **⚠ CAUTION**
   Hot parts
   Contact with hot parts of the combustion furnace may cause injury!
   ▶ Use heat-resistant gloves!

   Unlock the furnace, fold it out and remove the safety guard.
6. Pull the heated salt trap down from the furnace outlet by turning the trap gently back and forth.
7. Swivel the furnace back in and lock it.
8. When the temperature has dropped below 300 °C:
   Slacken the lower knurled head screw.
9. Allow the furnace to cool to below 50 °C.
10. Press E.

Removing the combustion pipe



1 *Dosing head*
2 *Red screw plug with O-ring*
3 *Furnace cover*
4 *Thread adapter nut at furnace entry*
5 *Furnace outlet with O-ring*
6 *Knurled head screw with support ring and sealing ring*
7 *Clamp screw*
8 *Salt trap*
9 *Safety guard*
10 *Combustion pipe*

37 *Furnace*

1. Only for versions without a salt trap:
   Release the hose connection between the furnace outlet and the mounting plate (→ 37, item 5).
2. Remove the knurled head screw (6) and then remove the furnace outlet and the O-ring from the combustion pipe.
3. Release the red screw plug (2) and remove the dosing head (1).
4. Release the thread adapter nut on the furnace entry (4) and remove the furnace cover (3).

5. Remove the O-ring and support ring.
6. Unlock the furnace and fold it out.
7. Using the auxiliary tool, pull the combustion pipe insert approx. 10 mm (0.4") out of the combustion pipe and then remove it completely using the crucible tongs.
8. Place the filler of the combustion pipe insert (catalyst) into a container for inorganic materials.
   ↳ Dispose of the waste in accordance with local laws and safety regulations. Do not pour it down the drain or into a garbage bin!
9. Lift the combustion pipe under the furnace and using the crucible tongs remove it from the furnace from the top.
10. If necessary, clean the combustion pipe using a brush.

Reassembling the combustion unit

1. Insert the combustion pipe into the furnace.
2. Fill the insert with 32 g high-temperature catalyst and place the insert into the combustion pipe.
3. Check, clean and insert the support ring and O-ring for the furnace cover.
4. Fit the cleaned furnace cover and thread adapter nut on the furnace entry and tighten the thread adapter nut.
5. Mount the dosing head with the O-ring, and tighten the red screw plug.
6. Version **without** a salt trap:
   Fit the furnace outlet with a glass fiber fabric as the salt trap. To do so, roll two fabrics together loosely and put them into the furnace outlet.
   ↳ Approx. 10 mm (0.4") must remain free at the top end to catch the salt.
7. Version **with** a salt trap:
   Leave the furnace outlet empty.
8. Insert the cleaned furnace outlet with a support ring and a clean O-ring into the combustion pipe and tighten the knurled head screw hand-tight.
9. Version **without** a salt trap:
   Connect the hose from the furnace outlet to the bulkhead gland of the mounting plate.

Additionally for versions with a salt trap

1. Turn the salt trap to push it onto the furnace outlet nozzle.
   ↳ Ensure that the seal seals the glass nozzle with a slight suction effect. Adjust with the clamp screw if necessary. The seal should not be too tight, however.
2. Push the salt trap under the furnace.
3. Fold down the retaining bracket and rest the filter on the bracket.
4. Plug in the electrical contact and lock it.
5. Fit the hose on the salt trap and screw it down.

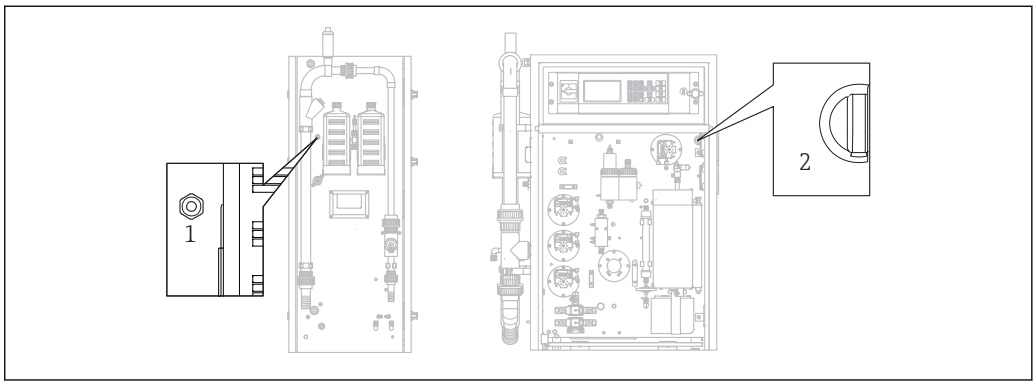
Putting the furnace back into operation

1. Press E.
2. Connect the hose to the injection unit.
3. Make sure that the hose is correctly inserted into solenoid valve 8.
4. Press E.

The carrier gas valve MV7 (relay #7) is opened as soon as 85% of the set temperature is reached. The system flushes permanently with carrier gas. Sample conditioning takes place (strip chamber) after the furnace has heated up. Operation starts automatically.

▶ Perform a leak test. (→ 83)

Leak test



38 *Left side and front*

1 Gas outlet
2 Switch for membrane compressor

Required tools:
Drain plug from the accessories supplied

To locate a leak, the following tools are provided in the "maintenance toolkit" (see the "Spare parts" section) to bridge components:
- Hose D 3/5 mm FPM
- Hose connector 1/8 - 1/8 PP
- To seal the gas outlet on the furnace:
  - Protection cap
  - Reducer 8/4 mm, straight
- To seal the gas outlet on the housing:
  Sealing cap M3 EPDM

Check the leak-tightness of the gas circuit after each modification to the furnace.

Possible points where a leak might be present:
- Furnace seals
- Acid filter seal at the glass
- Condensate drain
- Gas filter

1. → **S E R V I C E/CLEANING/LEAKAGE TEST**.
2. Switch off the membrane compressor (→ 38, item 2).
3. Seal the gas outlet (1) with a plug.
4. Press E and then >.
   ↳ The carrier gas valve is opened and pressure is applied to the gas circuit. The pressure is shown on the display.
   The carrier gas valve is closed automatically if the pressure has exceeded 100 mbar or after 7 seconds at the latest.

The pressure loss rate is displayed (mbar/min) after 30 s. The pressure loss must be < 3 mbar/min. Values are typically between -0.5 and -2.0 mbar/min.

If the pressure of 100 mbar is not reached, this indicates that a larger leak is present.

If the pressure loss exceeds 3 mbar/min, divide the leak test into smaller sections.

5. Bridge individual components using a hose and repeat the leak test until you have found the leak.
   ↳ If no pressure loss occurs when testing with a bridged component e.g. the furnace with the salt trap, the leak is in the bridged component.
6. Finish the leak test:
   Press E.
7. Remove the sealing cap from the gas outlet.
8. Switch on the compressor.
9. Press E.

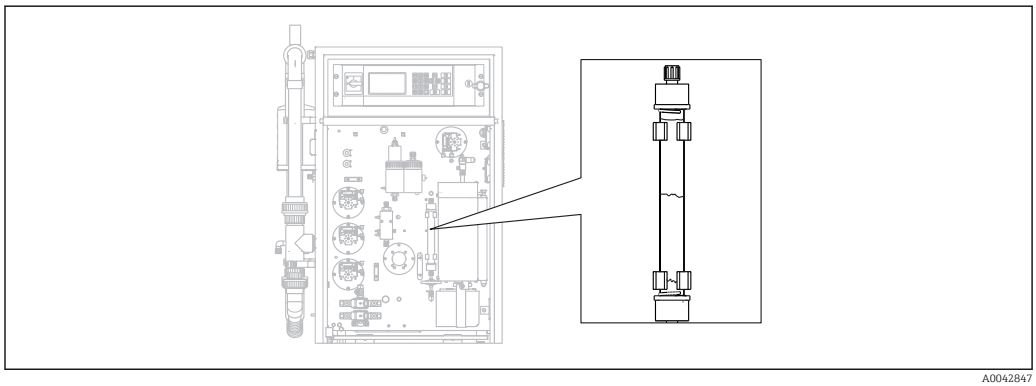
Measuring operation starts.

11.2.6 Service menu: CALIBRATION

→ 45 ff.

11.2.7 Service menu: FILTERS

Replacing the acid filter



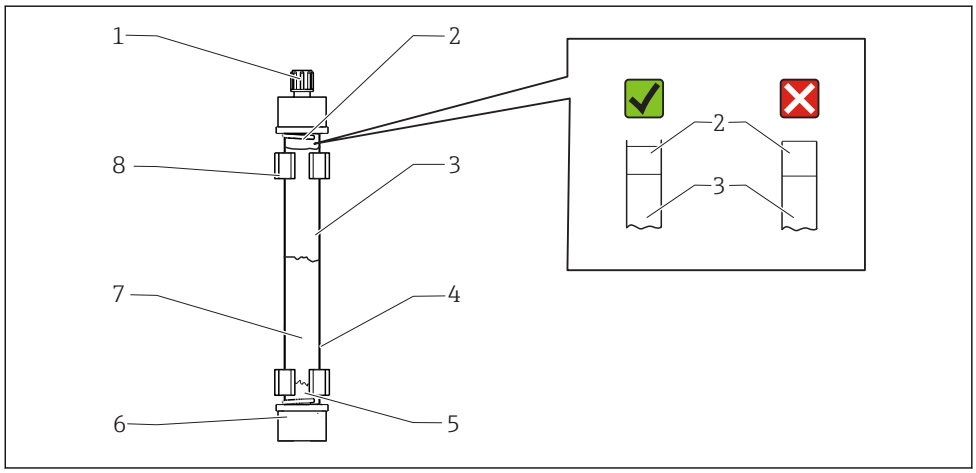
39 Acid filter

Required materials (included in the wear parts kit):
- Glass fiber fabric
- Zinc pellets
- Copper powder

Replace the acid filter:
- If it is blocked or worn out. This is noticeable from the flow rate and pressure level of the gas circuit.
- If zinc or copper become completely and obviously discolored.

1. → **S E R V I C E/FILTERS/REPLACE ACID FILTER**.

2.



40 *Acid filter*

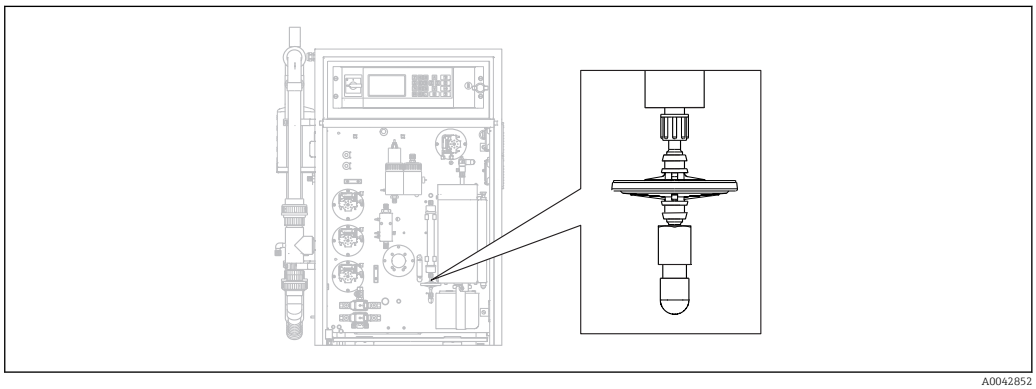
1 Gland
2, 5 Glass fiber fabric
3 Zinc
4 Glass body
6 GL coupling (GL = glass thread)
7 Copper
8 Retaining clip

Release the couplings (1, 6).

3. Remove the filter from the retaining clips.
4. Remove the filler.
5. Clean the glass body.
6. Roll the fabric into a roll and push it into the filter glass (5). Do not press it in too hard. Shorten the fabric if necessary.
7. Fill the glass up to the halfway mark with copper (7) and then with zinc (3). Allow enough room for the second piece of fabric.
8. Roll the fabric (2) into a roll and use it to close the filling in the acid filter.
9. Clean the O-rings with distilled water and seal the acid filter. To ensure the filter housing is sealed properly, make sure that the fabric does not extend as far as the plug (→ 39, zoom detail).
10. Fit the acid filter into the retaining clips and connect the filter.
11. Press E.

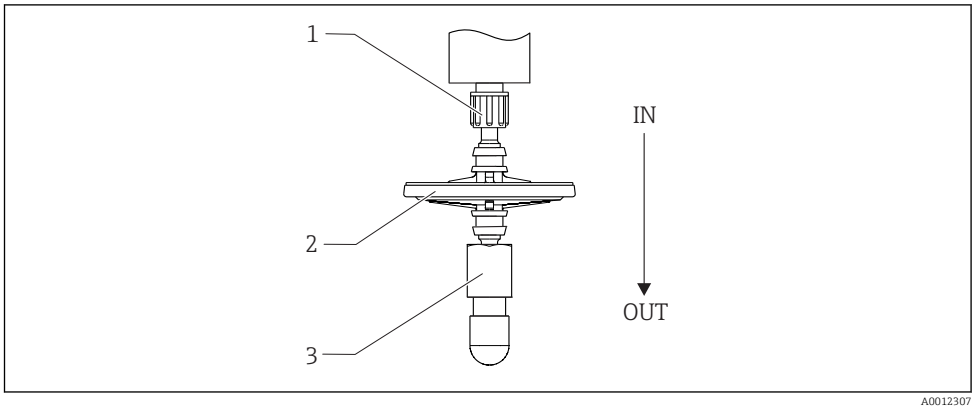
Operation starts (initially without a measured value).

Replacing the gas filter



41 *Gas filter*

Replace the gas filter if it is blocked.

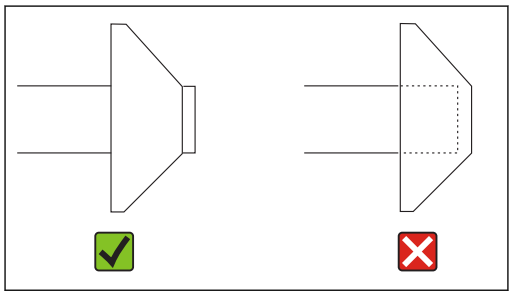
1. → **S E R V I C E/FILTERS/REPLACE GAS FILTER**.
2. 

42 Gas filter

1, 3 Gland
2 Gas filter

Release the couplings (1, 3).

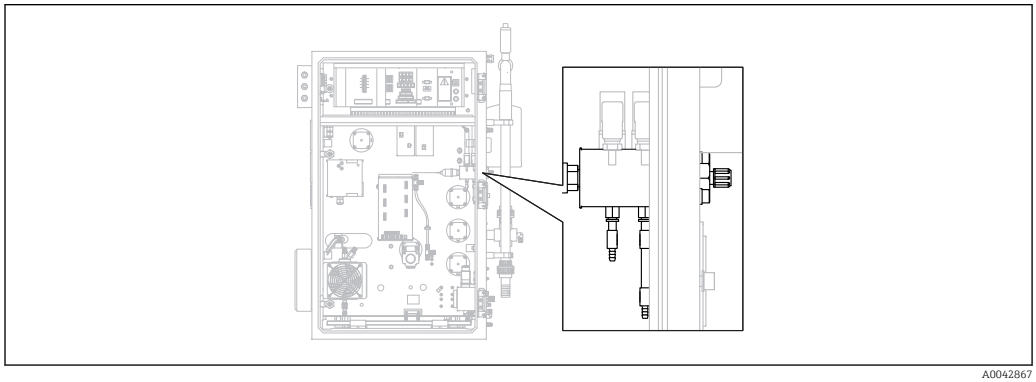
3. Remove the gas filter.
4. Pay attention to the direction of flow.
Connect the new gas filter first to coupling 3 and then to coupling 1 (on the acid filter). Make sure that the cone is properly positioned on the filter.
↳



5. Tighten the couplings.
6. Press E.

Operation starts (initially without a measured value).

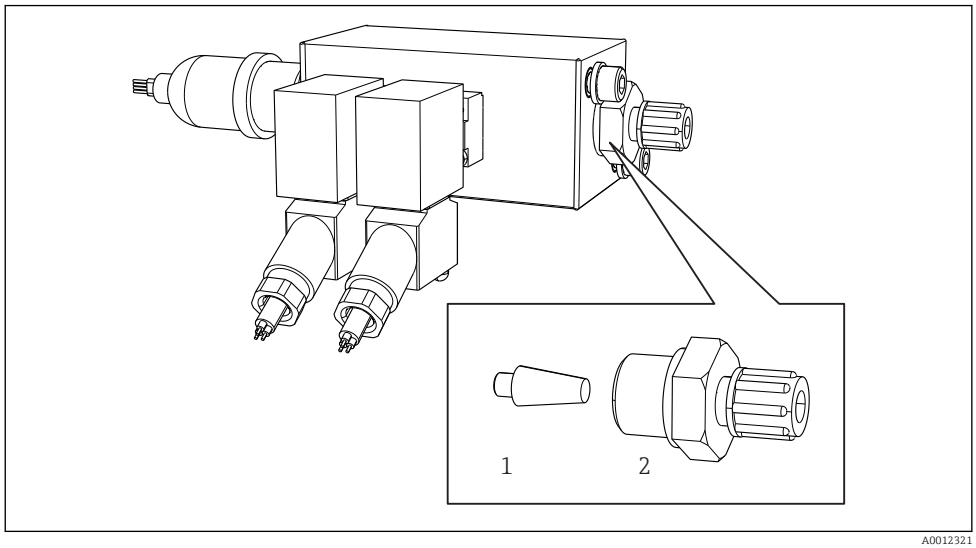
Replacing the prefilter



43 Rear (open) with gas connection block and prefilter

Required tool:
- Open-ended wrench
- Long-nose pliers

1. → **S E R V I C E/FILTERS/REPLACE GAS PREFILTER**.
2. Close the valve for the carrier gas supply.
3. **⚠ CAUTION**
   Risk of injury from release of pressure!
   ▶ Wear protective goggles.

   Relieve the pressure on the pressure line before opening the hose connection to prevent injury from the uncontrolled release of pressure.
4. Press E.
5. 

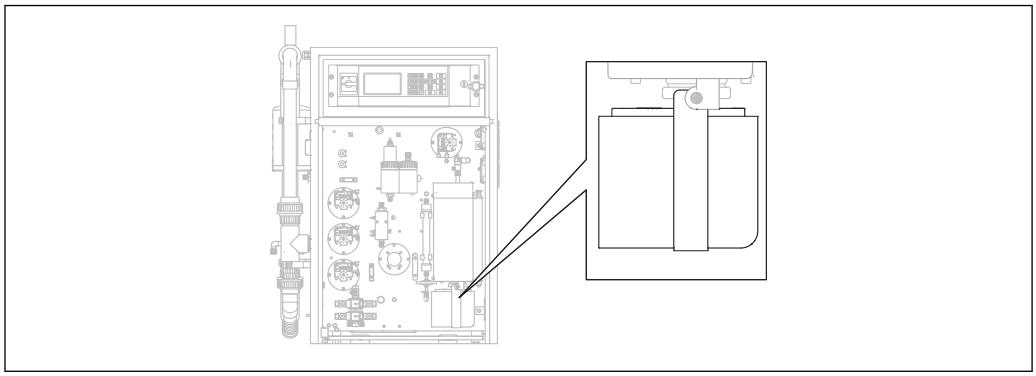
   44 *Gas connection block with solenoid valves and prefilter (side panel of the analyzer)*

   1 Prefilter
   2 Coupling

   Release the coupling (2) on the side panel.
6. Inspect the prefilter for wear. Replace it if necessary.
7. Screw the couplings back on.
8. Press E.
9. Reconnect the hose connection and open the valve of the carrier gas supply.
10. Press E.
    ↳ The furnace is heated after 10 seconds. The analyzer remains in the service mode until 90% of the set temperature is reached and the CO_2 value has dropped below the threshold value. During the heat-up time, sample conditioning takes place (strip chamber) and pH regulation is activated.

Measuring operation commences when both conditions are met.

Cleaning the filter of the salt trap



45 *Heated salt trap*

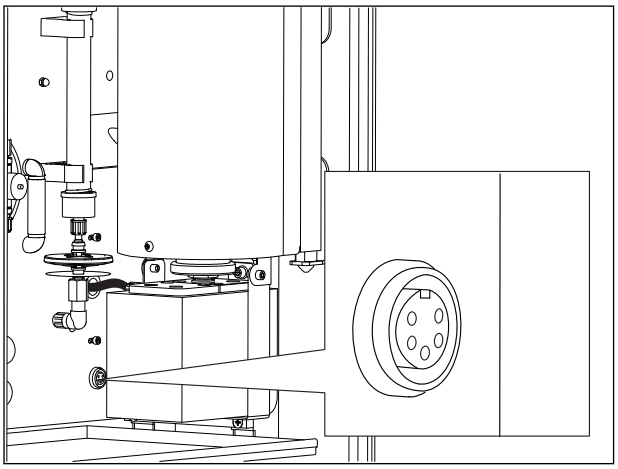
Required tool:
- 4 mm Allen screw
- Deionized water
- Heat-resistant gloves

Preparatory steps

To ensure that the furnace does not cool down too much during the cleaning process, it continues to be heated between the removal of the salt trap and the installation of the salt trap. Extended measuring device downtime results if the furnace cools down too much, and should therefore be avoided.

Carry out the following tasks quickly to ensure the furnace does not cool down too much.

1. → **S E R V I C E/FILTERS/REPLACE HEATED FILTER**.
2. Release the hose connections on the dosing head.
3. **CAUTION**
   Hot surface
   Contact with hot parts of the combustion furnace causes injury!
   ▶ Use heat-resistant gloves.

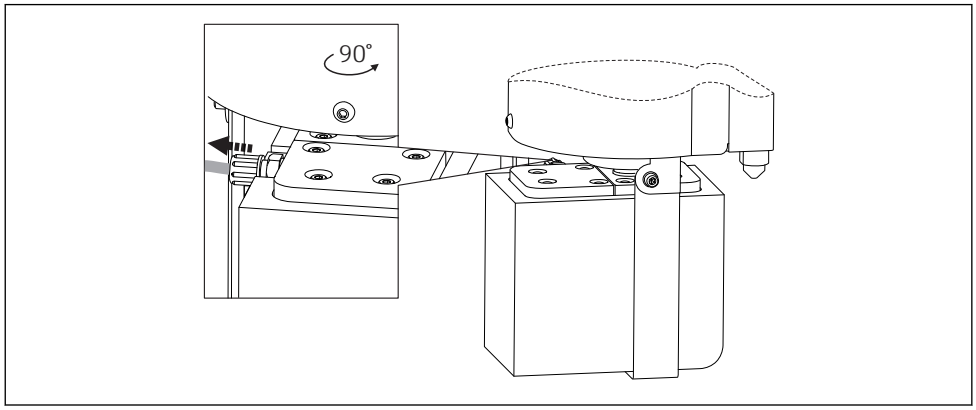
   Unlock the furnace and swivel it outwards.
4. 

   46 *Socket for electrical connection on the mounting plate (without cable)*

   Release the electrical connection to the salt trap (disconnect the plug at the socket).
5. Press **E**.

6. Confirm that you have disconnected the electrical connection to the salt trap and press E.
   ↳ The furnace is reheated and the temperature displayed.

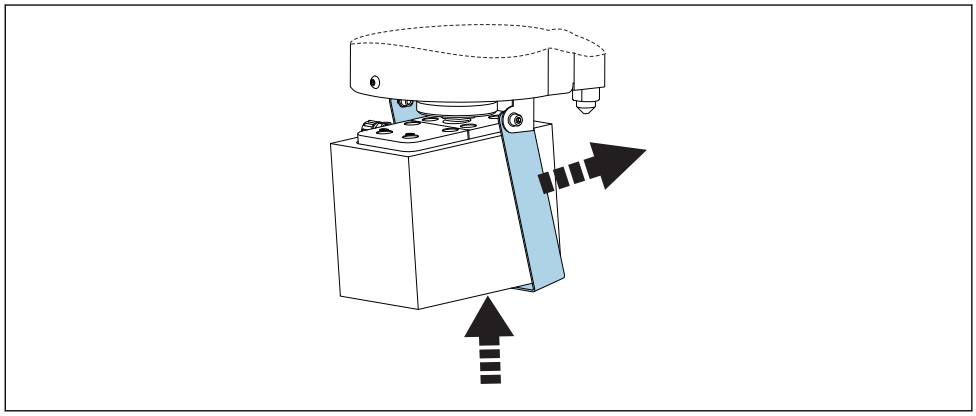
Cleaning the filter

1. 

A0042876

47

Release the hose on the outlet of the salt trap.

2. 
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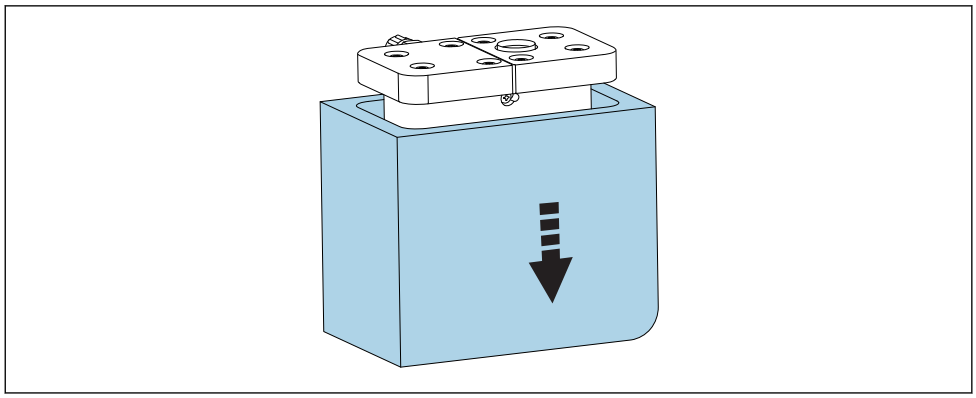
48

Raise the salt trap slightly and fold the retaining bracket to the side.

3. 
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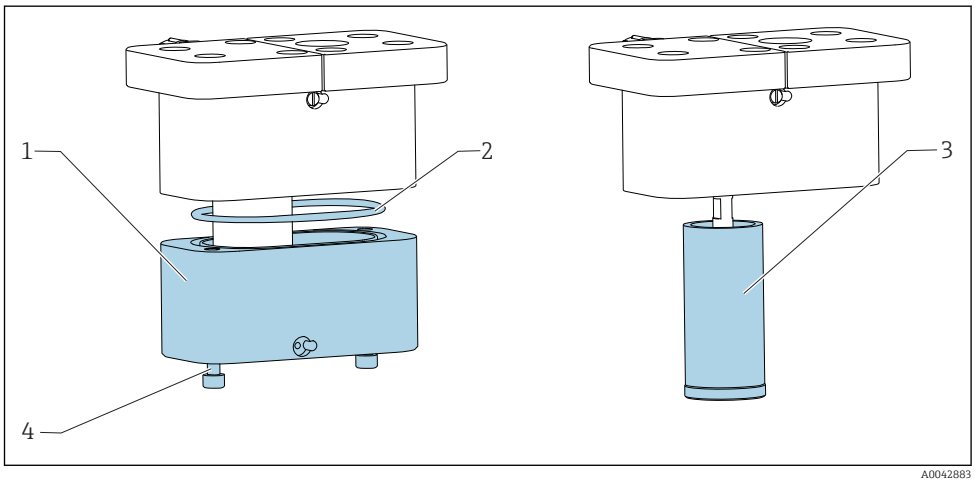
49

Remove the salt trap from below and remove the insulation.

4.



50

1 Bottom part
2 Seal
3 Filter
4 Threaded bolts

Release the threaded bolts (4) and remove the bottom part (1) of the filter housing.

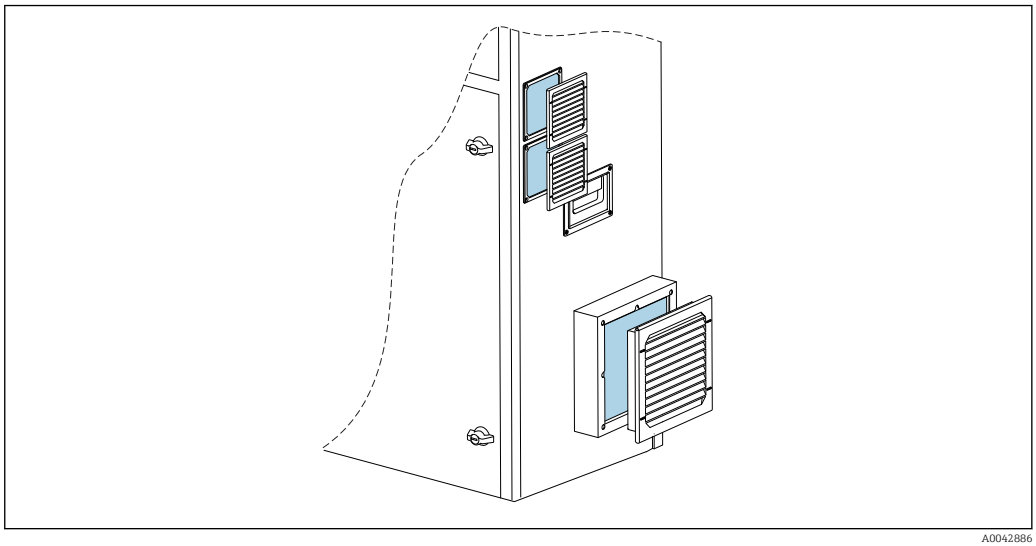
5. Clean the inside of the filter (3), seal (2) and filter housing with deionized water.
6. Place the seal in the groove, fit the filter and bottom part, screw together and put the insulation back on.
7. Press E.

Mounting the salt trap

Carry out the following tasks quickly to ensure the furnace does not cool down too much.

1. Fit the salt trap on the glass nozzle of the furnace. Ensure that the seal seals the glass nozzle with a slight suction effect. Adjust with the clamp screw if necessary. The seal should not be too tight, however.
2. Slide the salt trap under the furnace, fold down the retaining bracket and rest the salt trap on the bracket.
3. Reestablish the electrical connection.
4. Press E.
   ↳ The furnace is reheated and the temperature displayed.
5. Connect the hose to the outlet of the salt trap.
6. Swivel the furnace back and ensure that the hose passes comfortably through the rear panel and does not buckle. Lock the furnace.
7. Reestablish the hose connection at the dosing head.
8. Press E.
   ↳ The analyzer waits until the temperature is 30 °C below the set temperature. Then a message regarding a leak test is displayed.
9. Press E.
   ↳ Measuring operation starts.
10. Perform a leak test. (→ 🖹 83)

Replacing the filter mats in the ventilators



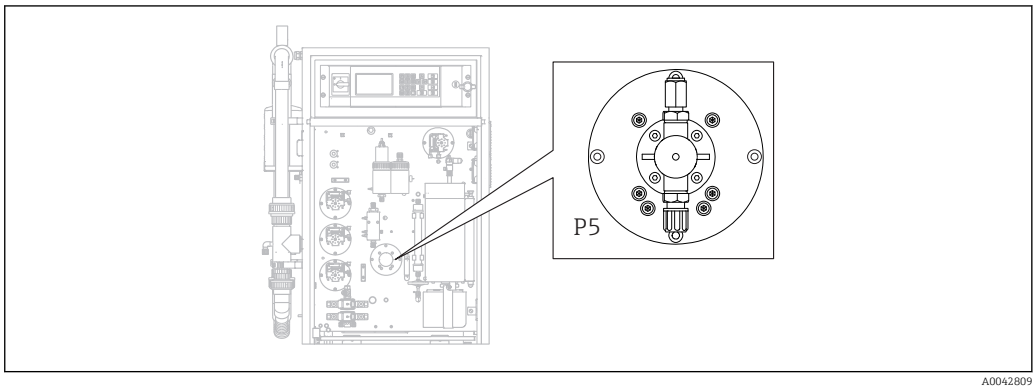
51 *Ventilator mats and protective guard*

Required materials:
- Replacement filter mat AM 115P (x 2)
- Replacement filter mat AM 335P (x 1)

1. Remove the guard (no tool required).
2. Check if the filter mats are dirty.
3. Replace dirty filter mats.
4. Put the protective guard back in. Ensure that the ventilation slits point downwards.

11.3 Endress+Hauser services

Having the optional dilution water pump cleaned



52 *Dilution water pump P5*

If you use deionized water as the dilution medium, the P5 pump need only be cleaned as part of the annual maintenance tasks performed by Endress+Hauser Service.

- If you use drinking water as the dilution medium, the maintenance intervals may be shorted depending on the hardness of the water.
  Please contact Endress+Hauser Service should this be the case.

12 Repair

12.1 Spare parts

Spare parts

Spare part	Order number
KIT CA71 pump head for peristaltic pump	51512085
KIT CA71 hose cassette for pump	51512086
Kit CA72TOC repair kit for standby	71092619
Kit CA72xx leak sensor	71092621
Kit CA72xx mains filter	71092625
Kit CA72xx 3-way ball valve	71092636
Kit CA72TOC standby circuit PA-2	71092637
Kit CA72TOC standby circuit PA-3	71092638
Kit CA72TOC heatable salt trap	71101532
Kit CA72TOC dilution water pump	71101535
Kit CA72TOC stripping vessel type II	71101536
Kit CA72TOC separation chamber type II	71101537
Kit CA72TOC flowmeter 0.2 - 2 l/min	71101538
Kit CA72TOC MV1 standard and MV4	71101539
Kit CA72TOC MV1 for aggressive media	71101540
Kit CA72TOC relay MV1, aggressive media	71101541
Kit CA72TOC water connection w/o dilution	71101545
Kit CA72TOC water connection with dilution	71101546
Kit CA72TOC peristaltic pump for P1/P2/P3/P4	71101547
Kit CA72TOC adapter for condensate and acid	71101548
Kit CA72TOC adapter for acid pump	71101555
Kit CA72TOC adapter for sample pump	71101557
Kit CA72TOC IR detector 500 ppm	71101559
Kit CA72TOC IR detector 2000 ppm	71101563
Kit CA72TOC IR detector 5000 ppm	71101566
Kit CA72TOC IR detector 10 000 ppm	71101567
Kit CA72TOC membrane compressor 50 Hz	71101568
Kit CA72TOC membrane compressor 60 Hz	71101569
Kit CA72TOC pressure sensor	71101570
Kit CA72TOC tube furnace, complete	71101572
Kit CA72TOC combustion pipe	71101578
Kit CA72TOC combustion pipe insert type II	71101579
Kit CA72TOC combustion pipe insert type I	71101580
Kit CA72TOC furnace outlet, optical heating filter	71101581
Kit CA72TOC furnace outlet, standard	71101582
Kit CA72TOC injection unit 4th version	71101584
Kit CA72TOC acid filter with membrane filter	71101585

Spare part	Order number
Kit CA72TOC solenoid valve, dosing (MV8)	71101587
Kit CA72TOC Peltier cooler	71101589
Kit CA72TOC regulator for Peltier cooler	71101591
Kit CA72xx pH amplifier and cable	71101598
Kit CA72xx magnetic stirrer controller	71101599
Kit CA72TOC temperature amplifier	71101601
Kit CA72xx cable for pH electrode	71101602
Kit CA72TOC hoses for gas area	71101614
Kit CA72TOC insert, Peltier cooler TOCII	71102254
Kit CA72TOC maintenance tools	71102317
Kit CO_2 scrubber, pressure regulator Not to be used for Parker CO_2 adsorber	71232257
Kit CO_2 scrubber, humidifier Not to be used for Parker CO_2 adsorber	71232258
Kit CO_2 scrubber, absorber container Not to be used for Parker CO_2 adsorber	71232259
Kit CO_2 scrubber, couplings Not to be used for Parker CO_2 adsorber	71232263
Kit CA72TOC water connection 24 V	71295731
Kit CA72xx M1 backplane	71303187
Kit CA72xx M1 multi I/O	71303188
Kit CA72xx M1 CPU module	71303253
Kit CA72xx M1 keyboard controller 1010	71303254
Kit CA72xx M1 LC display	71303255
Kit CA72xx M1 EMC filter	71303257
Kit CA72TOC water connection pressure monitor	71312862
Kit CA72TOC mixing chamber	71341850
Kit CA72TOC MV5	71363638
Kit CA72TOC relay 2+8	71363643
Kit CA72TOC temperature sensor, type II	71371085
Kit CA72TOC pressure sensor with cable	71373210
Kit CA72TOC MV gas supply	71414586
Kit CA72TOC restrictor, carrier gas	71414588
Kit CA72TOC restrictor, stripping gas	71414589
Kit CA72TOC pump controller, type III	71440164
Kit CA72TOC gas connection, type III	71440885
Kit CA72TOC relays and fuses	71450809

Wear parts

Wear part	Order number
Kit CA72TOC volatile salts/heating filter	71095149
Kit CA72TOC volatile salts	71095156
Kit CA72TOC non-volatile salts	71095158
Kit CA72TOC membrane filter	71101586

Wear part	Order number
Kit CA72TOC maintenance, strip/separation chamber	71101606
Kit CA72TOC maintenance, acid filter	71101607
Kit CA72TOC maintenance, dilution pump	71101608
Kit CA72xx membrane for solenoid v. EPDM	71101610
Kit CA72xx membrane, solenoid valve, KALREZ	71101611
Kit CA72TOC hoses for liquid area	71101613
Kit CA72xx hose 2.79 violet/white	71101615
Kit CA72xx hose 0.76 black-black	71101616
Kit CA72TOC couplings and fittings	71101617
Kit CA72TOC O-rings and seals	71101618
Kit CA72TOC furnace filler, non-volatile salts	71102294
Kit CA72TOC furnace filler, volatile salts	71102295
Kit CA72TOC capillary	71144072
Kit CA72xx maintenance PA-9	71206103
Kit CO_2 scrubber, annual consumption Not to be used for Parker CO_2 adsorber	71232256
Kit CO_2 scrubber, sorbent Not to be used for Parker CO_2 adsorber	71232261
Kit CO_2 scrubber, filter pads FP 60 Not to be used for Parker CO_2 adsorber	71232262
Kit CO_2 scrubber, accessories Not to be used for Parker CO_2 adsorber	71232264
Kit CA72TOC screen for water connection block	71304484
Kit CA72TOC wear parts, salt trap	71250117
Kit CA72TOC seals for furnace	71254334
pH sensor for strip chamber	CPS71-1TB2GSA

12.2 Return

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

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

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

12.3 Disposal

12.3.1 Decommissioning

⚠ CAUTION

Wastewater

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

- Wear safety gloves, protective goggles and a protective gown.

Pumps

1. Switch off the wastewater pump.
2. If sample preparation is present:
   Activate screen flushing (**S E R V I C E/CLEANING/SCREEN FLUSH**). Allow the bypass to drain.
3. Optional dilution water pump P5:
   Rinse the pump directly from the feeder tanks first with 5 % acid and then with deionized water (**P R O G R A M M I N G/OUTPUT TEST/PUMPS**).

Rinsing the hoses

1. Set valve 1 to "Manual sample" and place a container with deionized water under the valve.
2. **P R O G R A M M I N G/OUTPUT TEST/PUMPS**: Enter 400% for pump P1 and pump P4 (optional) and let the pumps pump for some time.
3. Remove the acid hose of pump P3 from the acid canister and insert it into a container with deionized water.
4. Also let this pump run at 400 % for some time.

Cleaning the vessels

1. **S E R V I C E/CLEANING/POWER FLUSH**: Activate automatic flushing of the strip chamber.
2. Afterwards, perform manual cleaning of the strip and separation chamber.
   (→ 76)
3. Remove the pH sensor.
   ↳ The sensor must be stored wet. For this purpose, pour some 3-mole KCl solution into the protection cap and insert the sensor into the cap.

Emptying the hoses

1. Open the hose cassettes of the pumps P1, P2, P3 and P4 (for optional dilution).
2. Allow the rinse water to drain out of the hoses.
3. Remove the canister with the standard.

4. **P R O G R A M M I N G/OUTPUT TEST/BINARY OUTPUTS**: Switch on SA1 and SA4.
5. Wait until the lines for standard 1 and 2 are empty.
6. Switch off the switch outputs again and remove the feeder tank.

Switching off the analyzer

- Switch off the main switch.

Combustion pipe insert

1. Disassemble the combustion pipe. (→ 80)
2. Drain the combustion pipe insert (catalyst, fiberglass precut part for version with salt trap).
3. Drain the furnace outlet (glass insert), (salt residue and fiberglass precut part for standard version).
4. Assemble the combustion unit.
   ↳ If transporting, assemble without the combustion pipe insert and without the furnace outlet (danger of breakage)!

Gas pipes

1. Remove the exhaust gas pipe (if present).
2. Close off the carrier gas supply.
3. To prevent injury from the uncontrolled release of pressure:
   Relieve the pressure on the pressure line before opening the hose connection.
4. Unscrew the hose for the carrier gas supply on the left side panel.
5. Detach the hose on the pressure-reducing valve of the carrier gas cylinder or gas preparation system.

12.3.2 Disposing of the analyzer

⚠ CAUTION

Risk of injury if used reagents and reagent waste are disposed of incorrectly!

- When disposing, follow the instructions of the safety data sheets for the chemicals used.
- Observe the local regulations regarding waste disposal.

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

13 Accessories

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

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

13.1 Device-specific accessories

Retrofitting of dilution unit
- To be used in the event of high salt loads or high measured values
- Order number: 71189243

Retrofitting of salt trap, type II
- To be used in the event of high salt loads
- Order number: 71375329

Conversion of PA-2 to PA-3
- To be used with sample flow volumes of 0.1 – 1 m^3/h
- Order number: 71295866

Sample conditioning PA-9 PP
- Recommended for problematic wastewater due to its high chemical resistance properties (except in the case of oxidizing acids and halogens)
- Order number: 71101588

CO_2 scrubber, soda lime
- Can be used as a replacement for the Parker CO_2 adsorber
- Order number: 71232260

Pipe backflushing
- To be used in the event of severe deposit formation in the inlet from the bypass to the MV 1
- Order number: 71414592

13.2 Service-specific accessories

Reagent and parent solutions
- CAY450-V10AAE, 1000 ml stripping reagent for CA72TOC
- CAY451-V10C01AAE, 1000 ml parent solution (KHP) 5 000 mg/l TOC
- CAY451-V10C10AAE, 1000 ml parent solution (citric acid) 100 000 mg/l TOC

High-quality buffer solutions from Endress+Hauser - CPY20
The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) or to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a laboratory accredited by the DAkkS (German accreditation body) according to DIN 17025. Product Configurator on the product page: www.endress.com/cpy20

13.3 System components

Kit CA72TOC heated salt trap
- For replacement for maintenance tasks (shortens the maintenance time) or as a substitute
- Order number: 71101532

14 Technical data

14.1 Input

Measured variable	Total organic carbon (TOC)
Measuring range	▪ CA72TOC-A: 0.25 to 600 mg/l TOC ▪ CA72TOC-B: 1 to 2400 mg/l TOC ▪ CA72TOC-C: 2.5 to 6000 mg/l TOC ▪ CA72TOC-D: 5 to 12 000 mg/l TOC With optional predilution, the measuring range can be expanded by a factor of 20.
Input signal	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	Service, trigger power flush
Input #5	Not assigned
Input #6	Not assigned
Input #7	Trigger standby
Input #8	Trigger channel switchover (optional)

14.2 Output

Output signal	**Measuring channel 1** 0/4 to 20 mA, galvanically isolated **Measuring channel 2 (optional)** 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)

14.3 Power supply

Supply voltage	115/230 V AC, 50/60 Hz
Power consumption	800 VA
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

14.4 Performance characteristics [1)]

Maximum measured error	0.4 %, systematic measured value deviation at 20 % of the measuring range (BIAS) 2.4 %, systematic measured value deviation at 80 % of the measuring range (BIAS)
Measured value resolution	1.1 %, resolution limit at 20 % of the measuring range (LDC) 4.6 %, resolution limit at 80 % of the measuring range (LDC)
Repeatability	0.4 %, repeatability precision at 20 % of the measuring range 1.6 %, repeatability precision at 80 % of the measuring range
Short-term drift	0.5 %/day
Limit of detection LOD	0.75 % of end of measuring range
Limit of quantification LOQ	2.5 % of end of measuring range

14.5 Environment

Ambient temperature	+5 to 35 °C (41 to 95 °F)
Humidity	20 to 80 %, non-condensing
Degree of protection	IP54

1) The performance characteristics have been determined in accordance with ISO 15839, Annex B. 300 µl of sample were metered into the CA72TOC-B1A0B1 per measurement. This resulted in a measuring range from 4 to 800 mg/l. The following data refer to this device. Slight deviations should be factored in if applying the performance characteristics to other measuring ranges.

Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry

14.6 Process

Medium temperature range	4 to 40 °C (39 to 104 °F)
Medium pressure range	Non-pressurized infeed to the analyzer from sample preparation
Sample flow rate	20 ml/min (0.32 US gal/h)
Sample consistency	Water-based Flammable substances must not occur in combustible concentrations. Sample dilution is then necessary.
Sample feeder volume	90 ml (3 fl.oz)

14.7 Mechanical construction

Design, dimensions	→ 12
Weight	Approx. 75 kg (165 lbs)

Materials

Housing	Aluminum, powder-coated
Front window	Glass, conductive coating
Valve seals	EPDM, FPM, FFKM
Pump hoses	Ismaprene
Pump and pump seals	PTFE, FFKM
Reagent and sample hoses	PTFE, PE
Exhaust gas and ventilation hoses	PTFE, PE
Outflow hoses	PTFE

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