

# Operating instructions

## compEAct N

### Nitrogen Analyzer



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Documentation number   11-0205-001-23

Edition                 A (06/2021)

Technical documentation  
made by:                Analytik Jena GmbH

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# 1 Basic information

## 1.1 Notes on these operating instructions

Contents	<p>The user manual describes the following model of the compEAct series:</p> <ul style="list-style-type: none"><li>▪ compEAct N – Nitrogen analyzer</li></ul> <p>These operating instructions provide information about the design and operation of the compEAct N and provide operating personnel the necessary know-how for the safe handling of the compEAct N and its components. Furthermore, the operating instructions include information on the maintenance and servicing of the device as well as hints on potential causes of malfunctions and their correction.</p>
User requirements	<p>The operating instructions are intended for users who are familiar with the principles of nitrogen analysis. The user should at least be trained as a chemical laboratory assistant or have an equivalent qualification. Knowledge of the safety guidelines for working in a chemical laboratory and for handling the chemicals that are used are required. Furthermore, the user must have basic knowledge of working with a computer.</p>
Conventions	<p><b>Instructions for actions</b> which occur in chronological order are numbered and combined in action units.</p> <p><b>Warnings</b> are indicated by warning triangles and a signal word. The type, source and consequences of the danger are stated together with notes on preventing the danger.</p> <p>The elements of the control and analysis program are indicated as follows:</p> <ul style="list-style-type: none"><li>▪ Program terms are indicated by small caps (e.g., SYSTEM menu).</li><li>▪ Buttons are shown by square brackets (e.g., [OK]).</li><li>▪ Menu items are separated by arrows (e.g., SYSTEM ► DEVICE).</li></ul>
Symbols and signal words	<p>The operating instructions use the following symbols and signal words to indicate hazards or instructions. The warnings are always placed before an action.</p>



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### WARNING

Indicates a potentially hazardous situation which might cause death or very serious injuries (deformities).

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### CAUTION

Indicates a potentially hazardous situation which might cause light or minor injuries.

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### Attention

Provides information on potential material or environmental damage.

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## 1.2 Intended use

The compEAct N is a compact stand-alone elemental analyzer for determining nitrogen contents in liquid, gaseous and LPG samples. The detection takes place through pyrolysis followed by thermal oxidation in accordance with national and international standards.

The compEAct N is equipped with at least one sample introduction module. The compEAct N is equipped with an on-board computer with touchscreen and the operating and control software EAvolution which is used to control the device and to analyze the measured data. There is the alternative option to operate the software using an external keyboard, mouse and monitor or via an external PC. The software EAvolution advanced can be accessed remotely and provides the option to control the device remotely. For this purpose, the compEAct N must be connected to a local network or directly to the Internet.

The compEAct N may only be used for the methods described in these operating instructions for determining nitrogen contents. Any other use is not as intended! The operator is the sole responsible and liable for any damages that result from such unintended use.

The following substances must **not** be analyzed with the compEAct N because they pose a risk of explosion:

- highly flammable organic compounds (e.g. isopentane)
- substances tending to spontaneous decomposition (e.g. peroxides)
- explosives, explosive materials (e.g. trinitrotoluol, inorganic azides)

The following substances must **not** be analyzed with the compEAct N because they could damage the analysis system:

- inorganic substances (e.g. nitric acid)
- substances with a high content of alkaline ions and alkaline earth ions (e.g. sodium acetate)
- organometallic compounds (e.g. metal-organyls)
- phosphorus and organic silicon compounds or samples with a high content of these elements (e.g. the hydraulic fluid Skydrol)
- substances or samples with a high content of fluoride ions



## 1.3 Warranty and liability

The warranty duration and liability comply with the legal requirements and the provisions in the general terms and conditions of Analytik Jena.

Deviations from the intended use described in these operating instructions result in limitations of warranty and liability in the event of a damage. Damage to wearing parts is not included in the warranty.

Warranty and liability claims are excluded for personal injury and property damage due to one or several of the following causes:

- use of the device other than intended
- improper commissioning, operation and servicing of the device
- modifications of the equipment without prior consultation with Analytik Jena
- operation of the device with faulty safety equipment or improperly fitted safety and protection equipment
- inadequate monitoring of the equipment components subject to wear
- use of other than original spare parts, wearing parts or consumables
- improper repairs
- faults due to the non-observance of these operating instructions

## 2 Safety instructions

### 2.1 General notes

For your own safety and to ensure error-free operation of the device, please read this chapter carefully before commissioning.

Observe all safety notes listed in these operating instructions and all messages and notes displayed by the control and analysis software on the monitor.

Besides the safety instructions in these operating instructions and the local safety regulations that apply to the operation of the device, the general applicable regulations regarding accident prevention, occupational health and safety and environmental protection have to be observed and complied with.

References to potential dangers do not replace the work protection regulations which must be observed.

### 2.2 Safety markings on the compEAct N

Warnings and information symbols have been attached to the compEAct N. These must be observed under all circumstances.

Damaged or missing warnings and information symbols can cause incorrect actions leading to personal injury or material damage! Symbol labels must not be removed or wetted with methanol! Damaged symbol labels must be replaced without delay!

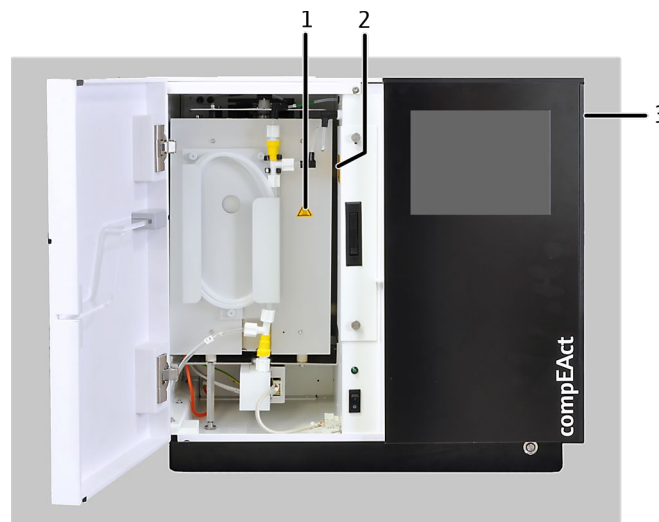




Fig. 1 Safety instructions on the compEAct N

Number	Warning	Position/meaning
1		<p>On the cover plate in front of the combustion furnace + On the cover plate above the combustion furnace (not shown)</p> <p>Warning against burns</p> <p>There is a risk of burns at the combustion furnace. Allow the furnace to cool down sufficiently before carrying out any maintenance on or near the furnace.</p>

Number	Warning	Position/meaning
2 and 3		On the flap inside the furnace chamber and on the removable right side of the device Warning against electric shock inside the device The voltages applied within the device can be life-threatening. Switch off the mains switch and pull the device's mains plug from the power outlet before opening the device.
Not shown in Fig. 1		On the cover plate above the combustion furnace Warning against hazard location Do not reach into the travel path of the autosampler LS while the sampler is moving.
Not shown		On the autosampler LS Warning against injuries caused by crushing Do not reach into the travel path of the injector head while the injector head is moving.
Not shown		For China: The device contains controlled substances. Analytik Jena GmbH guarantees that the substances will not leak within the next 25 years and, therefore, will not cause any environmental danger or health risk within this period of time if the device is used as intended.

## 2.3 Requirements for the operating personnel

The compEAct N may only be operated by qualified specialist personnel instructed in the use of the device. The personal instruction also includes conveying the contents of these operating instructions. We recommend training by qualified employees of Analytik Jena or its representatives.

The operating instructions must be accessible to the operating and service personnel.

## 2.4 Safety instructions – Transport and commissioning

Observe the following notes:

- Incorrect installation can create serious hazards. Therefore, the compEAct N and its system components are always installed by the service engineers of Analytik Jena or its authorized and trained specialist personnel. Unauthorized assembly and installation are not permitted.
- Insufficiently secured components pose a risk of injury! During transport the components of the equipment must be secured in accordance with the specifications in these operating instructions. The combustion tube and the combustion furnace must be removed before transporting the device.
- Two people are required to transport the device or to move it inside the laboratory. They must lift and hold the device on four hand-tightened screwed-in carrying handles. The device weighs approximately 30 kg.

## 2.5 Safety instructions for operation

### 2.5.1 General instructions

Each time before starting up the compEAct N, the operator must make sure that the device and its safety equipment is sound condition. This applies in particular after each modification or extension of the device or its repair.

Observe the following notes:

- The device may only be operated if all protective equipment (e.g. covers and doors) are in place, properly installed and fully operational.
- The operator must have free access to the front door and the mains switch located behind it at any moment during operation.
- The ventilation fittings at the rear and the bottom of the device must be operational. Covered ventilation grilles or slits etc. may cause the device to break down or may cause damage to it.
- The furnace operates with temperatures of up to 1100 °C. Hot components must not be touched during or directly after operating the compEAct N.
- Ensure that no liquid reaches the plug connectors or enters the interior of the device! Danger of electric shock!
- Caution when handling quartz glass and glass parts. There is the risk that glass components may break and cause injuries!
- Keep all combustible materials away from the device.

### 2.5.2 Safety instructions – Protection against explosion and fire

The compEAct N must not be operated in an explosive environment.

Smoking or handling open flames are prohibited in the room in which the device is operated!

### 2.5.3 Safety instructions – Electrical equipment

Contact with live components may cause death, serious injury or painful electrical shock. Lethal voltages may occur in the compEAct N!

Observe the following notes:

- The mains plug must be connected to a proper power outlet to ensure the device's compliance with protection class I (ground connector). The device may only be connected to power sources whose nominal voltage is the same as that on the rating plate of the equipment. The protective effect must not be invalidated by the use of an extension line which does not have a protective conductor.
- The device and the system components may only be connected to the mains when the device is switched off.
- Electrical connection cables between the device and the system components may only be connected or disconnected when the device is switched off.

- Before opening the compEAct N the device must be switched off using the mains switch and the mains plug must be disconnected from the power outlet! Work on the electronics may only be carried out by the customer service of Analytik Jena and specially authorized technicians.

#### 2.5.4 Safety instructions for compressed gas containers and systems

The carrier gas (argon and oxygen) is taken from compressed gas cylinders or local compressed gas systems. Make sure that the carrier gas has the specified purity!

Work on compressed gas cylinders and systems may only be carried out by individuals with specialist knowledge and experience in compressed gas systems.

Observe the following notes:

- The safety instructions and guidelines for operating compressed gas cylinders or compressed gas systems that apply at the operating location must be strictly complied with.
- Compressed air hoses and pressure reducers may only be used for the assigned gases.
- Pipes, hoses, screw connections and pressure reducers for oxygen must be kept free from grease.
- All pipes, hoses and screw connections must be checked regularly for leaks and externally visible damage. Leaks and damaged must be repaired without delay.
- The gas supply must be closed prior to inspections, service and repairs!
- After successful repair and service of the components of the compressed air containers or system the compEAct N must be checked for sound operation prior to recommissioning!
- Unauthorized assembly and installation are not permitted!

#### 2.5.5 Handling of auxiliary and operating materials and samples

The operator is responsible for the selection of substances used in the process as well as for their safe handling. This is particularly important for radioactive, infectious, poisonous, corrosive, combustible, explosive and otherwise dangerous substances.

When handling hazardous substances the locally applicable safety instructions and/or instructions in the EC safety data sheets provided by the manufacturer of the auxiliary and operating materials must be complied with.

The combustion tube is filled with a quartz wool plug. Observe the following instructions when working with quartz wool:

- Only store quartz wool in closed containers.
- When working with quartz wool avoid the formation of dust! Inhaled dust might cause irritation to respiratory tracts.
- Wear personal protective equipment (laboratory coat, protective gloves, safety goggles, breathing mask) when replacing the quartz wool and when cleaning the combustion tube.

- Collect used quartz wool in suitable, sealed containers and dispose of the material in accordance with applicable legal regulations. Contact the responsible waste disposal company to organize the disposal of the waste.

## 2.5.6 Safety instructions – Service and repair

Observe the following notes:

- The compEAct N is usually serviced by the customer service department of Analytik Jena or its authorized and trained specialist personnel. Unauthorized servicing can lead to maladjustment or damage of the device and its system components. Therefore, the tasks that the operator is allowed to carry out are strictly limited to the tasks listed in the chapter "Maintenance and care" on page 40.
- The exterior of the compEAct N may only be cleaned with a piece of cloth wetted with water but not dripping, after the device has been switched off.
- Generally, all service and repair work on the device must be carried out in switched-off condition (unless stated otherwise).
- Service tasks and the replacement of system components (e.g. removal of the combustion tube) may only be carried out after a sufficiently long cooling-down phase.
- Prior to servicing or repair the energy and gas supplies must be turned off and the compEAct N must be vented!
- Only original accessories and original replacement parts from Analytik Jena may be used.
- All protective equipment must be reinstalled correctly immediately after completion of the service and repair work and be checked for operation!

## 2.5.7 Safety instructions for the operation with auto-injector AI and autosampler LS

Observe the following instructions when installing and operating the auto-injector AI and the autosampler LS:

- When positioning the compEAct N with an LS autosampler on the laboratory desk consider the movement range of the injector head during operation. Make sure that the movement range is clear.
- There is a risk of injury within the movement range of the injector head during operation. Keep a safe distance from the device.
- The autosampler LS and the auto-injector AI may only be opened by authorized Analytik Jena service personnel. Disconnect the power supply before opening the sample introduction system. Danger of electric shock!
- Only use the designated connection terminals to connect the autosampler LS and the auto-injector to the compEAct N (9, 10 in Fig. 17).

### 2.5.8 Behavior in case of overpressure faults (gas pressure faults)

Greatest caution is necessary during an overpressure in the system! With incorrect operation the operating personnel may be endangered and the analysis system will be damaged. In case of an overpressure fault, the EAvolution software displays a warning message and starts the routine to reduce the overpressure.

Observe the following notes:

- Never switch off a device that is subject to overpressure!
- Do not introduce any samples.
- Do not shut down the EAvolution software.
- Do not cut the external gas supply.
- Wait until the overpressure in the system has dropped to normal pressure. The routine for reducing the overpressure is an automatic process.
- After the routine has ended, follow the instructions in the software.
- In case the routine does not achieve to reduce the pressure: Pierce a cannula into the septum of the injection port so that the gas can escape via the cannula.

## 2.6 Safety equipment / Behavior during emergencies

Observe the following notes:

- In case of hazardous situations or accidents and if there is no immediate risk of injury, switch off the compEAct N and the connected system components immediately using the mains switch (behind the front door) and/or disconnect the mains plugs from the power outlets, if possible!
- Cut the oxygen supply immediately or as soon as possible after the device is switched off!

## 3 Function and layout of the compEAct N

### 3.1 Principle of operation

The compEAct N is a compact elemental analyzer for determining nitrogen contents in liquid samples. The separately available LPG module 2.0 allows feeding the analyzer with pressurized liquefied gas samples (LPG). The combined GSS/LPG module allows feeding the analyzer with both LPG samples and pressurized gaseous samples.

The samples are digested at temperatures between 1000 and 1100 °C in a two-stage process consisting of a pyrolysis followed by thermal oxidation. During the first phase of the digestion the sample components are vaporized or pyrolyzed in the Argon flow and the generated pyrolysis gases incinerated in the oxygen flow. Next the remaining pyrolysis products are re-incinerated in the pure oxygen flow during the second phase.

The digestion can be summed up by the following equation:



R\* = residual hydrocarbons

NO<sub>x</sub> = mixture of nitrogen monoxide (NO) and nitrogen dioxide (NO<sub>2</sub>) of various compositions

The sample aliquot (liquid, gaseous, LPG) is metered directly into the combustion tube within the sample introduction module (autosampler LS, auto-injector AI, LPG module 2.0, combined GSS/LPG module) via the injection port with septum

After leaving the combustion tube the reaction gas mix is fed to the measuring gas drying process. The measuring gas is dried in a membrane dryer. The dried measuring gas is fed to the chemiluminescence detector (CLD).

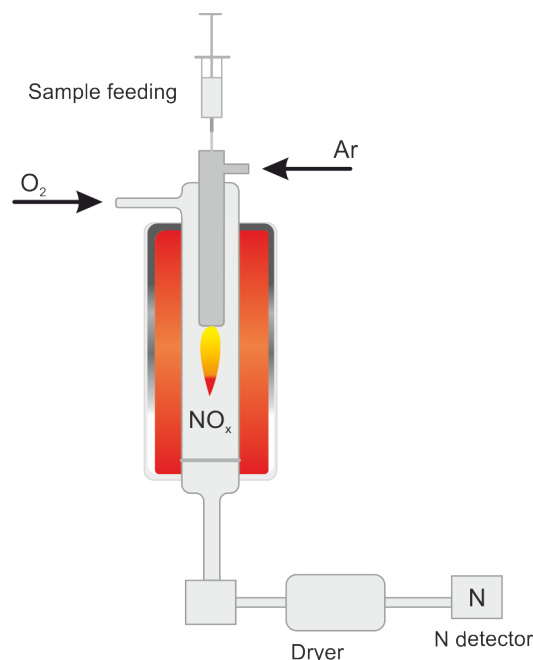
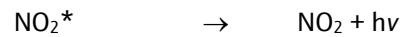
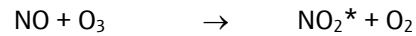


Fig. 2 Principle of operation

The detection is done using the chemiluminescence method. The reaction of nitrogen monoxide (NO) with ozone (O<sub>3</sub>) results in the short-term production of nitrogen



dioxide ( $\text{NO}_2^*$ ) in excited state which emits electromagnetic radiation in the range of visible light when it transforms to normal state. The emitted amount of light is proportional to the  $\text{NO}_2$  concentration. Consequently, the detected light can be used to measure the concentration. NO is the only substance involved in the reaction which means that this method is very selective and not influenced by any other constituents of the measuring gas.



The  $\text{NO}_x$  contained in the measuring gas is a mixture of NO and  $\text{NO}_2$ . The measuring gas is passed through a converter which renders the  $\text{NO}_2$  portion usable for the reaction and hence for detection purposes. Inside the converter the  $\text{NO}_2$  is reduced to NO.

The ozone ( $\text{O}_3$ ) required for the reaction is produced within the device using pure oxygen ( $\text{O}_2$ ) that is fed into the device interior. Excess  $\text{O}_3$  is removed in the ozone decomposer after the reaction and will not be discharged into the environment.

## 3.2 Design of the compEAct N

Main components of the compEAct N

The compEAct N consists of the following main components:

- Electronics
- Internal computer with touchscreen
- Gas supply
- Combustion system
- Auto-protection assembly (APB)
- Measuring gas dryer
- Chemiluminescence detector (CLD)
- Sample introduction system

All components of the compEAct N to be operated or serviced by the user can be reached via the front door and the opening at the top of the device.



Fig. 3 Main components of the compEAct N

1	Touchscreen	5	Combustion furnace
2	ON/OFF switch	6	Membrane dryer
3	Mains switch	7	Head of the combustion tube with injection port and gas terminals
4	Auto-protection assembly		

#### Electrical components and gas supply

Electrical connections, gas connections and the connections for the sample introduction module are located on the rear panel of the compEAct N (→ Fig. 17, p. 30).

The two process gases argon and oxygen are controlled via the gas box in the compEAct N. The gas box does not require any maintenance from the user.

The compEAct N is a stand-alone device with integrated computer. The control and analysis software EAvolution is operated via the touchscreen on the right-hand side of the device.

#### Combustion system

In the compEAct N a resistor-heated combustion furnace is used for digestion temperatures between 700 °C and 1100 °C. Depending on the application, the samples are digested inside the combustion tube at temperatures between 950 °C and 1100 °C.

A combustion tube has been inserted into the combustion furnace of the compEAct N which is used for all standard applications. The combustion tube is made of quartz glass. A quartz wool plug inserted in the inner tube ensures a slow and steady vaporization of the sample. The connection between the combustion tube and the measuring gas dryer is implemented via the auto-protection assembly.

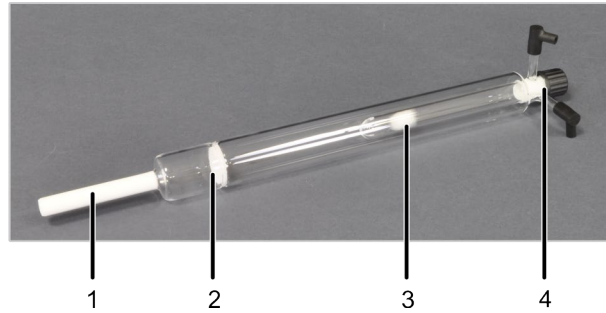


Fig. 4 Combustion tube

- |   |  |   |  |
|---|--|---|--|
| 1 | Connection to the auto-protection assembly | 3 | Internal tube with quartz wool plug        |
| 2 | Glass drip                                 | 4 | Head with injection port and gas terminals |

The injection port and the gas terminals are located on the head of the combustion tube.

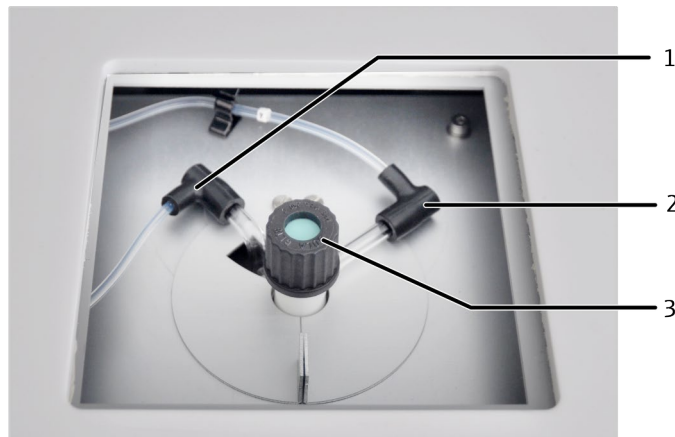


Fig. 5 Connections to the combustion tube

- |   |                                      |   |                |
|---|--------------------------------------|---|----------------|
| 1 | Oxygen connection (hose no. 3, blue) | 3 | Injection port |
| 2 | Argon connection (hose no. 4, gray)  |   |                |

#### Auto-protection assembly

The auto-protection assembly is used to couple the combustion tube to the measuring gas dryer. The assembly has an integrated replaceable filter. The filter protects the downstream membrane dryer and the detector against soot particles and solid pyrolysis products in case of incomplete combustion. The filter also retains condensed water and other aerosols; only water vapor passes through.

The auto-protection assembly is mounted to a plug-in unit below the furnace.

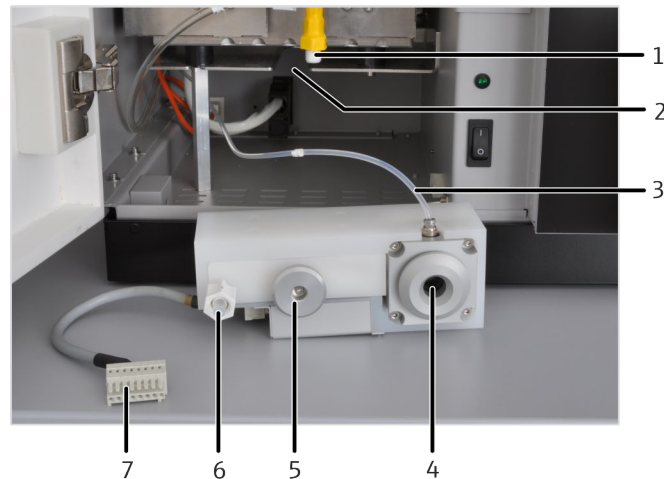


Fig. 6 Auto-protection assembly

1	Membrane dryer	5	Holder
2	Plug-in unit for the auto-protection assembly	6	Connection to the membrane dryer
3	Gas connection for the pneumatic seal (argon)	7	Electrical connection
4	Pneumatic seal		

The combustion tube is plugged into the auto-protection assembly and sealed with a pneumatic seal. The seal is operated using argon.

A toggle switch is used to open and close the seal:

- Toggle switch down: combustion tube is sealed
- Toggle switch up: combustion tube is released

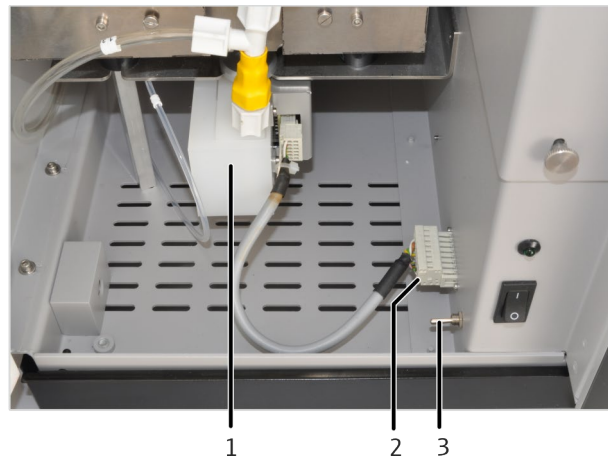


Fig. 7 Toggle switch for pneumatic seal

1	Mounted auto-protection assembly	3	Toggle switch for the pneumatic seal
2	Connection of the auto-protection assembly		

#### Measuring gas dryer

The measuring gas is dried by means of a membrane dryer which is attached to the furnace. Oxygen is used as a purge gas for the operation of the membrane dryer. To increase the drying effectiveness a pump is used to aspirate the rinse gas through the membrane dryer.



Fig. 8 Membrane dryer

#### Detector

The compEAct N uses a chemiluminescence detector. The detector measures the amount of emitted light which is released when nitrogen dioxide is produced in the chemical reaction of nitrogen monoxide and ozone. The initial substances for the reaction are produced by the reactor itself. Excess ozone is decomposed.

The chemiluminescence detector consists of the following components:

Component	Function
Micro-plasma chamber	Preparation of ozone (O <sub>3</sub> ) from oxygen
Converter	Transformation of nitrogen dioxide (NO <sub>2</sub> ) into nitrogen monoxide (NO)
Reactor with sensor	Reaction of nitrogen monoxide (NO) with ozone (O <sub>3</sub> ) to produce nitrogen dioxide (NO <sub>2</sub> *) Detection of the amount of emitted light
Thermal and chemical ozone decomposer	Decomposition of excess ozone (O <sub>3</sub> )
Diaphragm pump	Conveyance of the measuring gas through the detector
Differential pressure sensor	Regulation of the pressure compensation between the variable measuring gas flow (300 to 500 ml/min) and the constant aspiration flow generated by the diaphragm pump (approx. 600 ml/min at 500 mbar)
Absorber	Cleaning of the aspirated air before entering the diaphragm pump

Gas flow diagrams

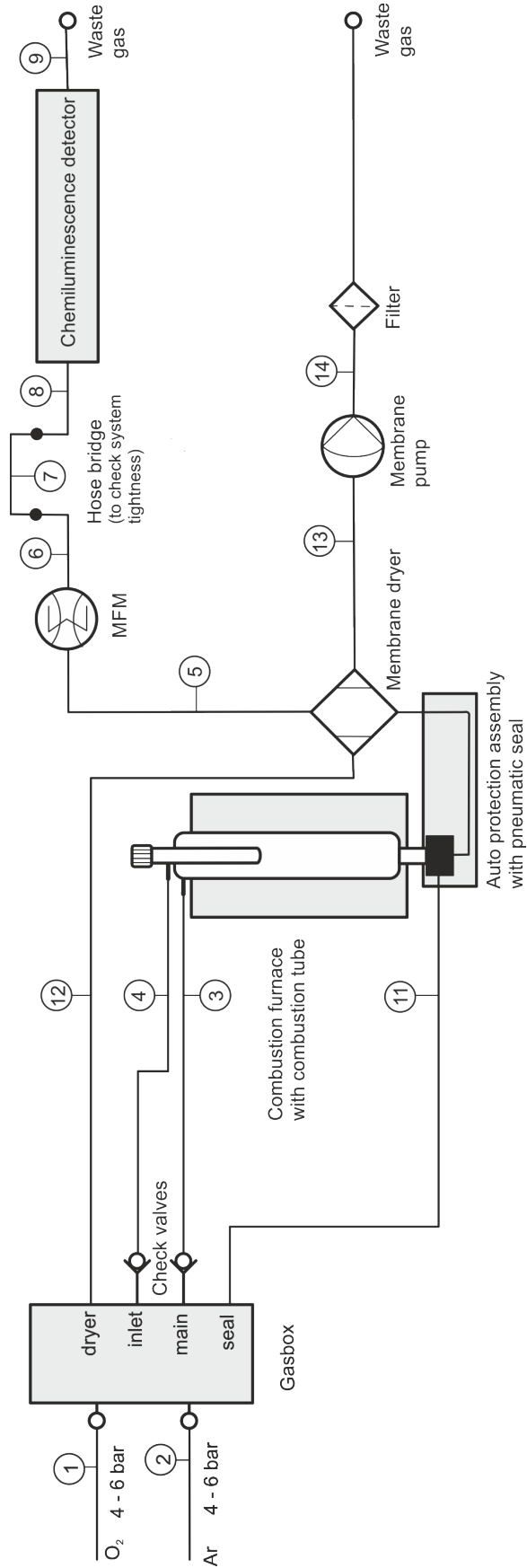


Fig. 9 Gas flow diagram of the compEAct N

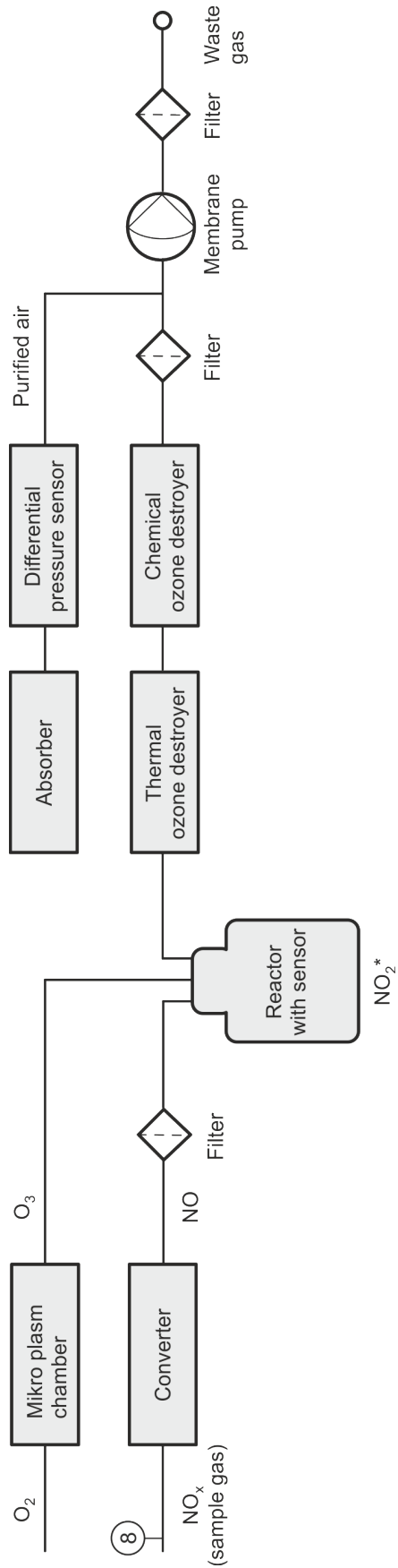


Fig. 10 Gas flow diagram of the chemiluminescence detector

### 3.3 Type plate

The rating plate is located on the rear of the compEAct N next to the mains connection and contains the following information:

- Manufacturer address / logo
- Trading name
- Technical data / electrical connection data
- CE marking
- Disposal instructions (Do not dispose of as domestic waste!)
- Serial number

### 3.4 Sample supply

#### 3.4.1 Auto-injector AI

The auto-injector is used for the safe injection of individual samples up to a volume of 50  $\mu\text{l}$ . For this purpose, the samples are injected directly into the combustion tube. The AI is controlled via the software EEvolution.

Layout

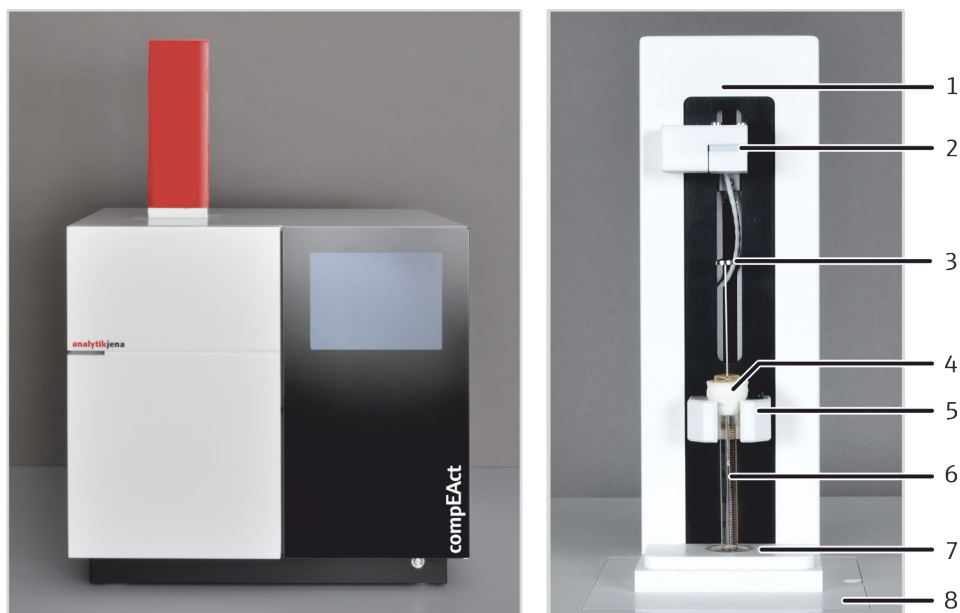


Fig. 11 Layout of the auto-injector AI

- |   |  |   |                             |
|---|--|---|-----------------------------|
| 1 | Base element with mechanics and control electronics                          | 5 | Syringe bracket             |
| 2 | Guiding device to push down the piston of the syringe in a controlled manner | 6 | Syringe cylinder            |
| 3 | Syringe piston   | 7 | Guide on the injection port |
| 4 | Conical guide at the syringe   | 8 | Base plate                  |

The interface on the rear panel of the device is used to control the device and to supply it with electrical current. The AI is supplied with electrical current and controlled by the compEAct N.



### 3.4.2 Autosamplers LS 1 and LS 2

The autosampler LS is an automatic sampler for liquid samples. It is available in 2 versions. The LS 1 is intended for small series with up to 18 samples. The samples are arranged in a linear sequence on the fixed sample rack. The injector head for taking up the samples and injecting them into the combustion tube moves on the rack along the guide arm from left to right towards the injector port.

The LS 2 is designed for up to 120 samples. The samples are arranged in 8 rows on the rack. The rack moves back and forth.

The injection port allots the samples that were taken up by the autosampler directly into the combustion tube. The LS is controlled via the software EEvolution. The maximum sample volume that can be metered is 50  $\mu\text{l}$ .

Layout



Fig. 12 Autosampler LS

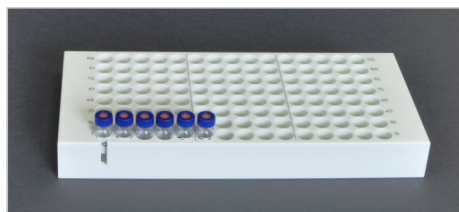


Fig. 13 Sample rack of the LS 2

The solvent and waste containers can be removed to fill and clean the autosampler. The solvent container has a removable lid to facilitate its cleaning. A waste hose is attached to the waste container. This hose must be introduced to an appropriate waste container. The solvents are absorbed and released via ports with integrated septum.

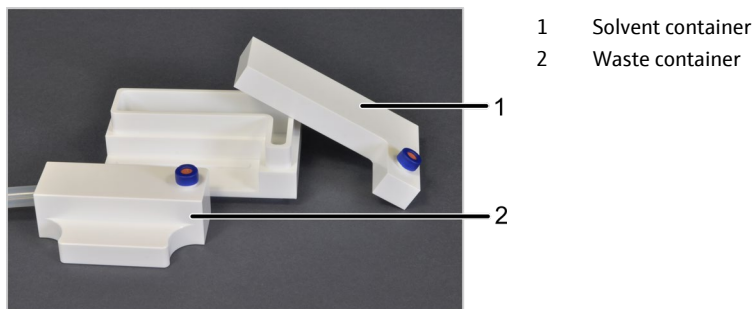


Fig. 14 Solvent and waste containers of the LS

The electrical connections and interfaces of the LS are located on the rear panel of the device. The connections for the serial interface and power supply are effected via terminals on the rear panel of the compEAct N.

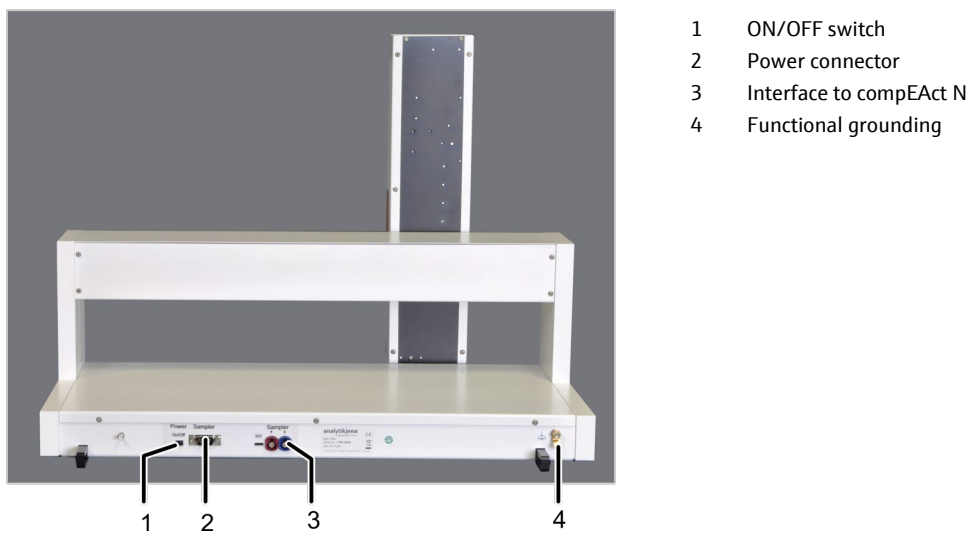


Fig. 15 Electrical connections of the LS

## 4 Installation and commissioning

### 4.1 Installation conditions

#### 4.1.1 Environmental conditions

Ambient conditions	For requirements with regard to the ambient conditions at the installation location refer to "Technical data" p. 75. If required, make sure that the room is temperature-controlled.
Requirements with regard to the installation location	<p>The installation location of the compEAct N should have the characteristics of a chemical laboratory. The installation location must meet the following requirements:</p> <ul style="list-style-type: none"><li>▪ The laboratory atmosphere must be free from dust and sulfur compounds, nitrogen compounds and halogenated compounds as well as corrosive gases and hydrocarbons</li><li>▪ No major temperature fluctuations</li><li>▪ Free from caustic vapors in close proximity of the device Connections and assemblies of the device may corrode.</li><li>▪ Free from draft, do not install the device close to windows or doors</li><li>▪ No electromagnetic sources of interference close-by</li><li>▪ No direct sunlight and away from radiant heaters</li><li>▪ The front door and air vents must not be obstructed by other equipment or furnishings</li><li>▪ Keep a safety distance of at least 10 cm from the rear of the device to other equipment or walls</li></ul>

#### 4.1.2 Energy supply



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#### WARNING

The compEAct N may only be connected to a properly grounded power outlet which complies with the voltage specifications in the technical data on page 76.

---

The compEAct N is operated with single-phase alternating current. The installation of the electrical equipment of the laboratory must comply with the standard DIN VDE 0100. After the connection point an electrical current in accordance with the standard IEC 38 must be available.

Only use the supplied power cord with protective ground conductor to connect the compEAct N to the power supply. The protective effect must not be invalidated by the use of an extension line which does not have a protective conductor.

### 4.1.3 Gas supply

Oxygen and argon are required to operate the compEAct N. Refer to the technical data (→ "Technical data", p. 75) for information on the required gas quality and gas consumption.

The operator is responsible for the gas supply and the corresponding connections and pressure reducers.

The connection hoses with outer diameter 6 mm and inner diameter 4 mm are included with the delivery. The length is 2 m. If other lengths are preferred, please contact the customer service department at Analytik Jena.

### 4.1.4 Device layout and space requirements

The compact compEAct N has a required floor space of 650 x 600 mm (including clearance on the sides). The ventilation slits at the bottom and rear side of the device must not be obstructed by any objects.

The auto-injector AI or the autosampler LS are mounted to the top of the compEAct N. Therefore, the required height is the sum of the height of the compEAct N and the height of the sample introduction module that is connected. There must be a clearance of at least 10 cm between the composed device system and any shelf or cabinet above the system.

Dimensions of the compEAct N and its device components:

Device	Dimensions (width x height x depth) in cm
compEAct N	54 x 51 x 53
LS 1 / LS 2	54 x 41 x 34
AI	9 x 27 x 11

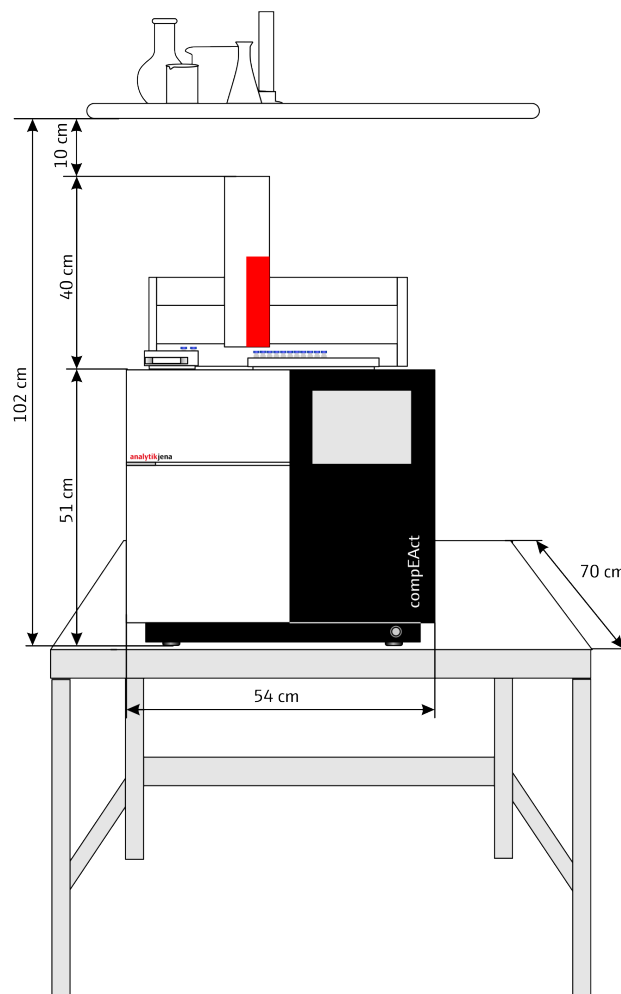


Fig. 16 Installation diagram for the compEAct N with LS

## 4.2 Supply and control connections

The electrical connections and connections for the gas supply are located on the rear panel of the device.

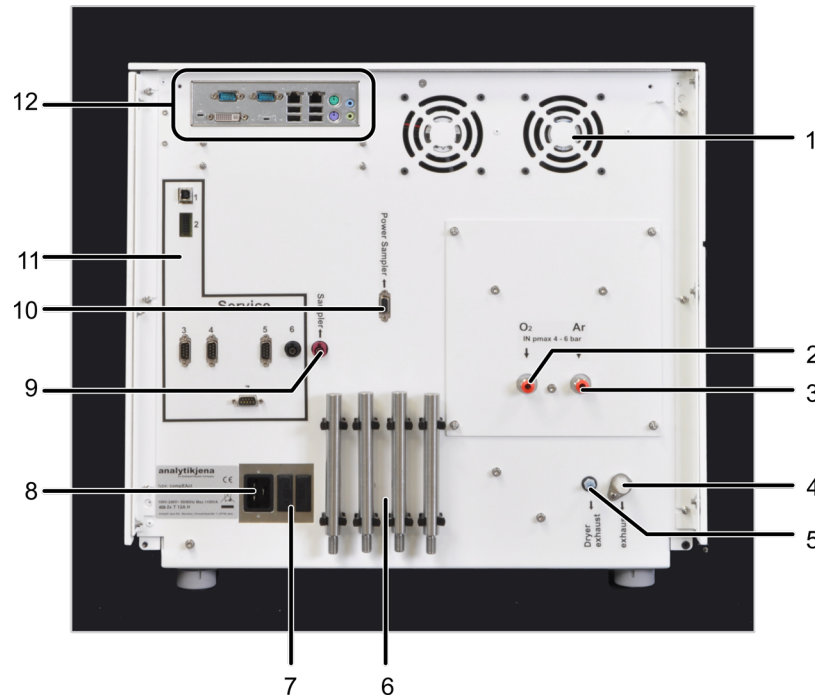


Fig. 17 Connections on the rear of the compEAct N

- |   |  |    |   |
|---|--|----|---|
| 1 | Fan for furnace chamber and electronics    | 8  | Mains connection                                |
| 2 | Connection for oxygen (O <sub>2</sub> )    | 9  | Communication interface for AI and LS (sampler) |
| 3 | Connection for argon (Ar)                  | 10 | Power connector for AI and LS (sampler)         |
| 4 | Exhaust air detector (exhaust)             | 11 | Service connections                             |
| 5 | Exhaust air membrane dryer (dryer exhaust) | 12 | Connections for internal computer               |
| 6 | Carrying handles                           |    |   |
| 7 | Device fuses                               |    |   |

The device is equipped with a hose bridge on its right-hand side for connecting an external flow meter (MFM) for servicing purposes. A USB port is located behind the front door. It is provided for software updates or for backing up the database on a flash drive.

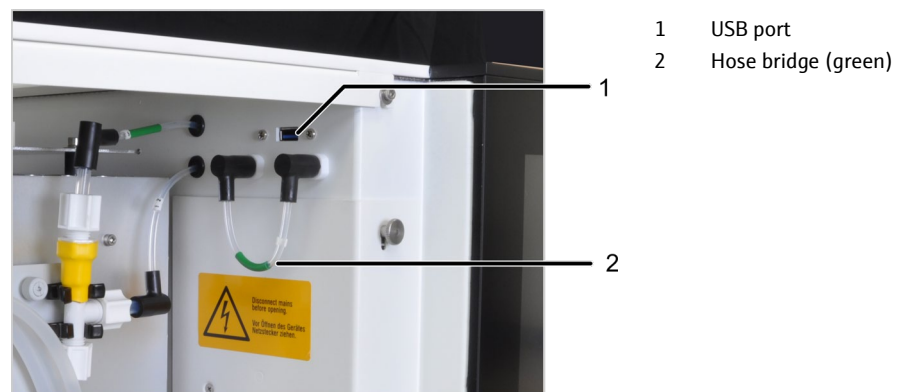


Fig. 18 USB port and hose bridge in the gas path behind the front door

The mains switch is located behind the door, the ON/OFF switch for the device is located on the right-hand side of the front skirting.

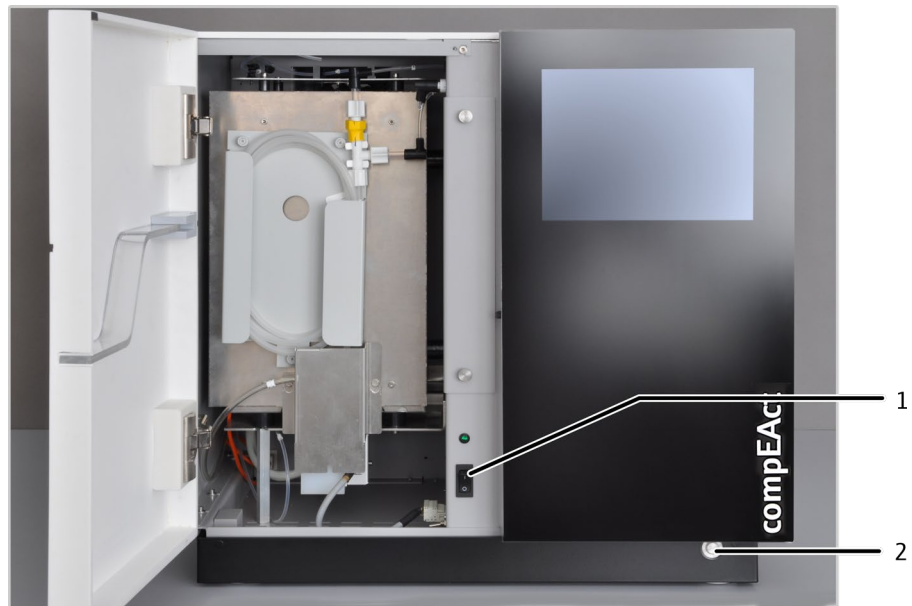


Fig. 19 Location of the switch on the compEAct N

- 1 Mains switch for emergencies or servicing    2 ON/OFF switch

#### Switch functions

The mains switch is used to disconnect or to connect the compEAct N from the electric mains. In normal operation the mains switch remains switched on. It only needs to be switched off for maintenance works or in case of emergencies (→ "Safety equipment / Behavior during emergencies", p. 15).

The ON/OFF switch is used to switch the compEAct N on and off. The following device functions are activated when the device is switched on:

- The software EAvolution is started.
- The detector is switched on and the detector starts warming up.
- The method that was activated before switching the device off is loaded.
- The gas flows are regulated when the gas supply to the device is established.
- The combustion furnace is heated to the temperature that is specified in the method.

When the device is switched off using the ON/OFF switch or the respective command in the user interface of the EAvolution software the system is shut down:

- The combustion furnace heating is switched off.
- The detector is switched off.
- The EAvolution software is shut down.

## 4.3 Installing the compEAct N with sample introduction module

### 4.3.1 Setting up and connecting the compEAct N



#### WARNING

The compEAct N may only be set up, assembled and installed by the customer service department of Analytik Jena or by specialist personnel authorized and trained by Analytik Jena!

Any unauthorized intervention in the compEAct N can endanger the user and the operational safety of the equipment and limits or completely invalidates any warranty claims.



#### Attention

Retain the transport packaging! Return transport for service must be in the original packaging. This alone prevents transport damage.

1. Carefully remove the compEAct N and its components from the transport packaging. Do not damage the transport packaging!
2. Use the provided packing list to verify that the delivery is complete.
3. Place the compEAct N on its intended location.
4. Unscrew and detach the carrying handles. Store the carrying handles by clamping them in the bracket on the rear panel of the device.
5. Attach the black skirting:  
Push the skirting on the device from the front side. The guide pins on the skirting must protrude into the openings on the front and the back of the compEAct N.
6. Attach the gas supply hoses to the connections on the rear panel of the device.
7. Install the combustion furnace (→ "Removing and installing the combustion furnace", p. 58).
8. Install the auto-protection assembly (→ "Removing and installing the auto-protection assembly", p. 50).
9. Connect the membrane dryer (→ "Replacing the membrane dryer", p. 48).
10. Install the combustion tube (→ "Inserting the combustion tube", p. 47).
11. Connect the autosampler LS or the auto-injector AI.
12. Plug in the mains plug to the connection at the rear of the device.
13. Plug in the mains cable to the mains power outlet.

The installation of the LPG module 2.0 and the combined GSS/LPG module is described in the respective user manuals of these accessories.



### 4.3.2 Connecting the autosampler LS



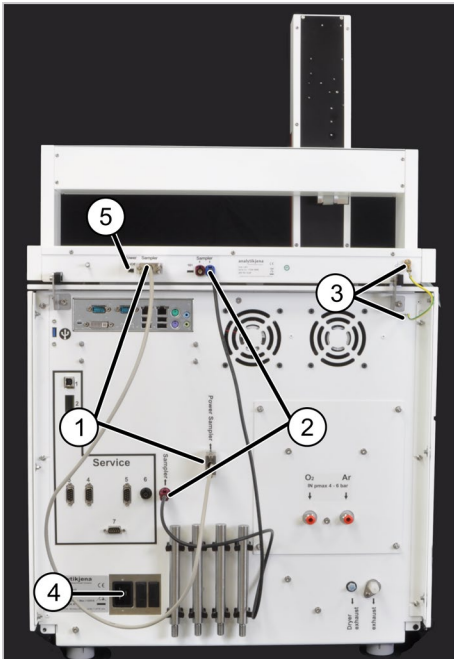
#### Attention

Short circuits during connection can damage the LS! The autosampler LS may only be connected after the compEAct N was switched off using the mains switch and the mains plug was detached from its connection on the compEAct N!

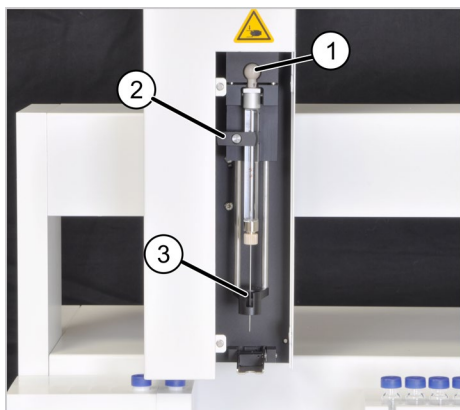
1. Put the cover onto the opening above the combustion tube of the compEAct N.
2. Screw on the attachment angles provided with the autosampler LS to the compEAct N.
3. Place the autosampler LS onto the compEAct N. Ensure that the rearward and the left edge of the LS are flush fitting with the edges of the compEAct N.



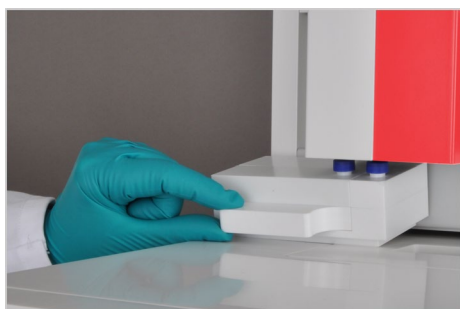
4. Attach the autosampler LS to the attachment angles using the plastic brackets. To do this, insert the nuts to the groove of the plastic bracket. Do not yet tighten the connection. It must still be possible to slightly move the autosampler back and forth within the groove.



5. Establish the electrical connections between the autosampler LS and the compEAct N:
  - Power supply (1)
  - Communication interface (2)
  - Functional grounding (3)
6. Plug in the mains cable to the compEAct N (4).
7. Switch on the ON/OFF switch of the LS (5).



8. Insert the syringe to the injector head:
- Push the cannula through the cannula guide (3)
  - Insert the ball knob of the piston into the bracket (1)
  - Slightly pull out the knob and attach the syringe (2). The spring on the knob pushes the syringe into the bracket.



9. Fill the solvent container with approx. 30 ml of solvent and place it on the bracket of the LS together with the waste container.

**i** Attention

Proceed with care when inserting the filled solvent container and do not tilt the container too far to avoid spilling the solvent.

10. Introduce the waste hose to an appropriate waste container. Route the hose in a constant downward slope.

11. Insert the sample rack.

12. Switch on the compEAct N and adjust the autosampler LS using the EEvolution software (→ Adjusting the autosampler LS, p. 43)

13. Use the two screw connections to fix the autosampler LS in the adjusted position.



✓ The installation of the compEAct N and the autosampler LS is now complete.

### 4.3.3 Connecting the auto-injector AI

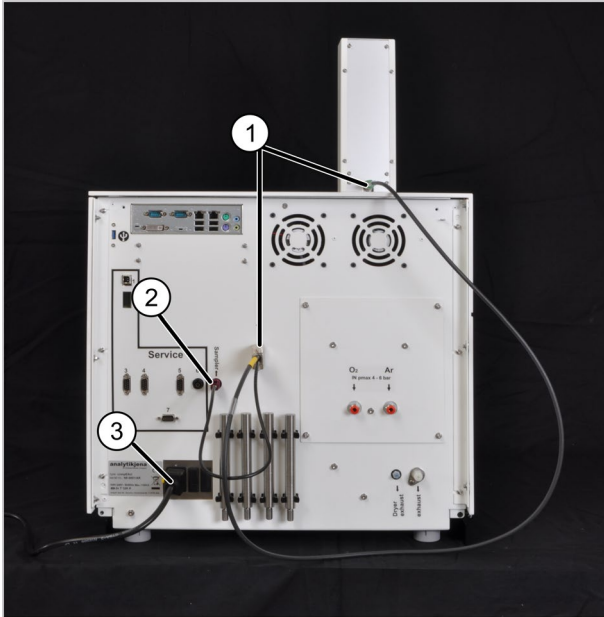


#### Attention

The auto-injector AI may only be connected after the compEAct N was switched off using the mains switch and the compEAct N is not connected to the mains! To move the auto-injector AI do not hold it at the red front cover.

1. Remove the cover above the combustion tube of the compEAct N.
2. Place the auto-injector AI onto the opening at the top of the compEAct N. When doing so, move the base plate until the ring-shaped seating fits onto the injection port of the combustion tube.

The AI is correctly inserted when the ground plate completely sits in the opening and is flush fitting with the surface of the compEAct N.



3. Establish the electrical connections between the auto-injector AI and the compEAct N:
  - Power supply (1)
  - Communication interface (2)
4. Plug in the mains cable to the compEAct N (3).

✓ The installation of the compEAct N and the auto-injector AI is now complete.

## 5 Operation

### 5.1 Switching the compEAct N on and off

Switching on via the mains switch

**Note:** In normal operation the mains switch remains switched on. The compEAct N only needs to be disconnected from the mains by actuating the mains switch in case of emergency, for transport or during maintenance and servicing.

1. Open the external gas supply.
2. Switch on the mains switch behind the front door.
3. Push the ON/OFF switch on the skirting after 30 seconds.
  - ✓ The device system starts up and the EAvolution software is started. The method that was activated before switching the device off is loaded.

Switching on using the ON/OFF switch

The mains switch is already switched on.

1. Open the external gas supply.
2. Switch on the compEAct N using the ON/OFF switch.
  - ✓ The device system starts up and the EAvolution software is started. The method that was activated before switching the device off is loaded.

Switching off using the ON/OFF switch

1. Switch off the compEAct N using the ON/OFF switch. Alternatively, select the item SYSTEM ► POWER OFF in the EAvolution menu.
  - ✓ The combustion furnace heating is switched off. After 2 minutes, the gas flows within the device are shut off and the detector is switched off.
2. Wait for 2 minutes, then cut the external gas supply.
  - ✓ The fans keep running for 30 minutes to ensure that the compEAct N is properly cooled down. During this time, the LED in the front door flashes. After that, the LED is turned off and the device system is shut down.

Switching off the device using the mains switch

For all maintenance and service work:

1. First, switch off the device using the ON/OFF switch (see above).
2. Wait until the LED in the front door stops flashing.
3. Open the door and switch off the mains switch.
  - ✓ The compEAct N is now completely switched off.



#### Attention

Switching off the compEAct N using the mains switch before shutting down the device with the ON/OFF switch and before the LED in the front door has permanently stopped flashing can cause permanent damage to the compEAct N due to overheating. Furthermore, this may cause malfunctioning of the installed software.

Therefore, only switch off the device prematurely via the mains switch in case of emergency!

## 5.2 Measuring with auto-injector AI



### CAUTION

Risk of injury when handling the cannula!

The cannula of the syringe has a very sharp tip. Do not touch the syringe by the cannula. This could result in injuries or contamination of the cannula.



### Attention

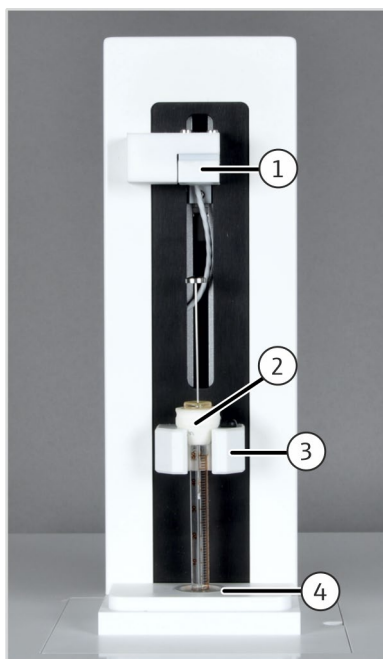
The auto-injector AI may only be fitted with the syringes included in the scope of delivery. The syringes are coded.

Ensure that when inserting the syringe into the auto-injector AI dosing does not start prematurely.

1. Draw the sample into the AI syringe up to the required volume marking.

To do this, immerse the cannula into the sample solution, draw in and eject sample solution several times to rinse the cannula before drawing the required volume. Carefully wipe the outer face of the cannula with cellulose. Otherwise, sample residues could contaminate the septum.

2. Start the measurement in EEvolution.
3. Remove the cover from the AI.



### **i** Attention

When inserting the syringe into the AI, do not touch the piston and do not press it down!

4. Hold the syringe by the white plastic cone (2) and pierce the cannula through the cannula guidance (4) of the AI and through the septum of the combustion tube.
5. Insert the cannula so far into the combustion tube that the cone of the syringe fully rests on the holder of the AI (3).

The positioning pin must sit in the cavity if the syringe is in the right position.

6. Replace the cover.

7. Start measurement.

✓ The software controls the injection of the sample into the combustion tube while the ram moves downward (1). The sample is analyzed.

8. Remove the syringe from the AI after the analysis.

## 5.3 Measuring with LS 1 or LS 2



### CAUTION

Risk of injury when handling the cannula!

The cannula of the syringe has a very sharp tip. Do not touch the syringe by the cannula. This could result in injuries or contamination of the cannula.

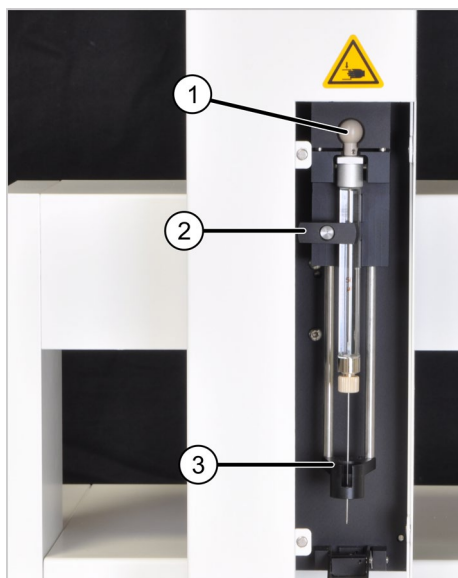
There is a risk of injury within the movement range of the injector head during operation. Keep a safe distance from the device.



### Attention

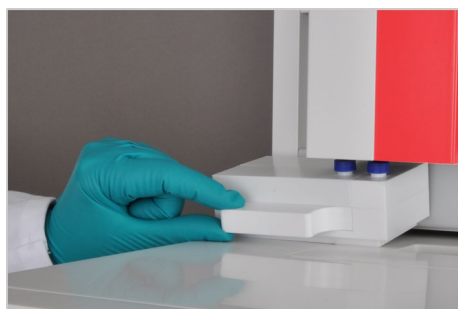
The autosampler LS must be adjusted before starting the measurement (→ "Adjusting the autosampler LS", p. 43).

1. Remove the injector head of the autosampler LS from the magnetic attachment.

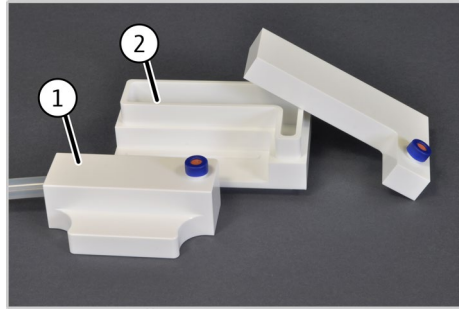


2. Insert the syringe to the injector head:

- Push the cannula through the cannula guide (3)
- Insert the ball knob of the piston into the bracket (1)
- Slightly pull out the knob and rotate into horizontal position (2). The spring on the knob pushes the syringe into the bracket and retains it in this position.



3. Remove the solvent and waste containers from the LS.



4. Fill the solvent container (2) with approx. 30 ml of solvent.
5. Empty and clean the waste container (1).
6. Assemble the containers and attach them to the bracket of the LS.

**i** Attention

Proceed with care when inserting the filled solvent container and do not tilt the container too far to avoid spilling the solvent.

7. Route the hose from the waste container in a constant downward slope to an appropriate receptacle.
8. Insert the sample containers into the rack.
9. Start the measurement in EEvolution.



## 6 Maintenance and care

### 6.1 Maintenance intervals

Analyzer	<b>Maintenance task</b>	<b>Maintenance interval</b>
	Check system tightness	If the EEvolution software reports any leaks
	Clean and maintain the compEAct N	Weekly
	Check hose connections for tight fit	Weekly
	Replace membrane dryer	In case of soiling or damage
	Replace absorber	Annually Or more often in continuous operation in case of an elevated or instable baseline.
Combustion tube	<b>Maintenance task</b>	<b>Maintenance interval</b>
	Check injection port with septum for damage and soiling	Daily and in case of abnormal measurement results (wide scattering, carry-over, excessively high measured values)
	Quartz wool plug: check correct position	Daily and after maintenance work on the injection port
	Replace quartz wool plug	If the plug is damaged or soiled In case of abnormal measured values (wide scattering, carry-over, elevated blank values)
	Check the combustion tube for cracks and damages	Monthly and each time it is cleaned
	Replace combustion tube	In case of devitrification, cracks or other damages and soiling that cannot be removed
	Check the FAST connectors on the inlet of the combustion tube for tight fit, cracks or other damages	Monthly and in case of gas leaks
	Replace septum	If leaking, damaged or contaminated
Auto-protection assembly	<b>Maintenance task</b>	<b>Maintenance interval</b>
	Check filter	Monthly. In case of abnormal measurement results In case of incomplete combustion of the sample
	Replace filter	In case of soiling and in case of abnormal measurement results
	Replace the pneumatic seal	If leaking or damaged



Autosampler LS 1 Autosampler LS 2	Maintenance task	Maintenance interval
	Adjust autosampler	<ul style="list-style-type: none"> <li>▪ When starting up the device</li> <li>▪ After the LS was removed from the device</li> <li>▪ After replacing the combustion tube</li> </ul>
	Clean and maintain the device	Weekly
	Clean or replace syringe	As required, but no later than after 12 months
	Replace cannula	If clogged or damaged
Auto-injector AI	Maintenance task	Maintenance interval
	Clean and maintain the device	Weekly
	Clean or replace syringe	As required, but no later than after 12 months
	Replace cannula	If clogged or damaged

The maintenance of the LPG module 2.0 and the combined GSS/LPG module is described in the respective user manuals of these accessories.

## 6.2 Cleaning the compEAct N and its system components



### WARNING

Risk of short circuit! Before cleaning the device, use the mains switch to switch off the device.

Do not use any dripping wet cloths for cleaning. No liquids are allowed to ingress the device interior.

- Avoid contamination by handling sample substances carefully.
- Immediately wipe up spilled sample or reagents with blotting paper.
- Use a soft, clean cloth to wipe away any contaminations from the device. A commercially available neutral cleaning agent (dishwashing liquid) can be used for maintaining the casing.

## 6.3 Checking system tightness

The system's tightness is monitored automatically. If the system is leaking, the message "Device leaky" appears in the DEVICE STATE window. Starting a measurement is not possible in this case.

Smaller leaks can be detected if the control flow in the system drops when applying additional counter pressure. The flow monitoring set which is provided with the compEAct N can be helpful for finding leaks. The set is assembled as follows (→ Fig. 20):

1. Plug the Luer adapter (d) onto the filter (c).
2. Connect the two short pieces of hose (b, e) to the Luer adapter and the filter outlet.
3. Push the long thin hose (a) into the short hose (b).

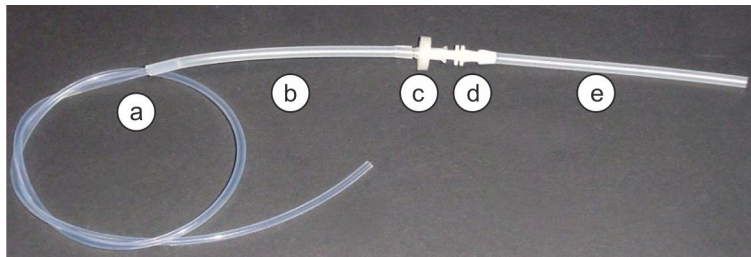


Fig. 20 Flow monitoring set

Proceed as follows to start the device and the gas supply:

1. Open the gas supply to the compEAct N.
2. Switch on the compEAct N (→ "Switching the compEAct N on and off" p. 36).
3. Make sure that the pneumatic seal on the auto-protection assembly is closed. To do this, move the toggle switch (1) down.
  - ✓ After starting up the system, the status window of the EEvolution displays the specified gas flows in the active methods:

Proceed as follows to check for leaks before the detector:

1. Read the control flow under SYSTEM ► DEVICE ► MAINTENANCE ► CONTROL FLOW.
2. Detach the hose bridge (hose no. 7, 2 in Fig. 18) from one of the two FAST connectors.
3. Attach the loose end of hose a (→Fig. 20) to the FAST connector.
4. Plug the other end of the flow monitoring set into the loose end of hose no. 7 using the hose e.
5. Re-read the control flow.

If the impact of the filter causes the control flow to reduce by more than 5 ml/min there is a leak before the detector. Determine and correct possible causes. Contact the customer service department at Analytik Jena if this is not successful.

The control flow may deviate from the indicated gas inflow (sum of Main O<sub>2</sub> and Inlet Argon) because the control flow sensor responds differently to the different gases.

## 6.4 Adjusting the auto-injector AI



During the software-supported adjustment of the auto-injector the system adjusts the number of steps that the stepper motor pushes down the syringe piston to the geometry of the syringe that is used.

1. Select the command SYSTEM ► DEVICE ► MAINTENANCE ► ADJUST AUTOINJECTOR.
2. Start the adjustment with .

3. When being prompted, pull out the syringe piston up to the maximum volume (50 µl) and confirm with OK.
  - ✓ The auto-injector pushes the syringe down to 25 µl.
4. Read the actual value on the syringe piston and enter the value in the input field. Confirm with OK.
  - ✓ The auto-injector is now adjusted.

## 6.5 Adjusting the autosampler LS

The autosampler LS is mounted to the compEAct N and connected (→ "Connecting the autosampler LS", p. 33).


1. Switch on the compEAct N and switch on the autosampler LS using the ON/OFF switch on the rear panel of the LS.
2. Remove the cover of the injector head of the autosampler LS from the magnetic attachment to facilitate the view on the syringe.
3. Put a closed sample container to position 1 of the sample rack.
4. Successively select the following commands in EAvolution: SYSTEM ▶ DEVICE ▶ MAINTENANCE ▶ ADJUST SAMPLER.
5. From the list REFERENCE POSITIONS select the 1<sup>st</sup> RACK POSITION and tap on the adjustment icon .
6. Use LEFT – RIGHT to align the cannula at the center of the septum in the sample cover. Use UP – DOWN to lower the cannula to between 1 and 2 mm above the bottom of the container.  
Only for LS 2: Use BACKWARD – FORWARD to align the depth of the sample rack position.
7. Select the sample position FURNACE and tap on the adjustment icon .
8. Use LEFT – RIGHT and UP – DOWN to position the cannula just above the injection port of the combustion tube.

If the depth position of the needle is not yet centered in the combustion tube loosen the LS attachment at the rear of the compEAct N and move the LS to the required depth position. After that, retighten the screw connection (→ "Connecting the autosampler LS", p. 33).



9. Use UP – DOWN to lower the injector head until the cannula screw connection of the metering syringe (1) is located in the cannula guidance (2).

Only lower the injector head up to a level that allows moving the cannula guidance up and down by hand by approximately 1 or 2 mm.

10. After the adjustment is completed, check the correct positioning in the adjustment positions 1<sup>ST</sup> RACK POSITION and FURNACE by tapping the icon  to move to these positions.

## 6.6 Combustion furnace – maintenance

### 6.6.1 Removing and cleaning the combustion tube



#### CAUTION

Risk of burns on the combustion tube!

Only remove the combustion tube when the device is cold or allow the device to cool down sufficiently!

#### CAUTION

Use personal protective equipment (laboratory coat, protective gloves, safety goggles) when cleaning the combustion tube and replacing the quartz wool. Wear a respiratory mask or work underneath an exhaust vent because quartz wool dust irritates the respiratory tracts.

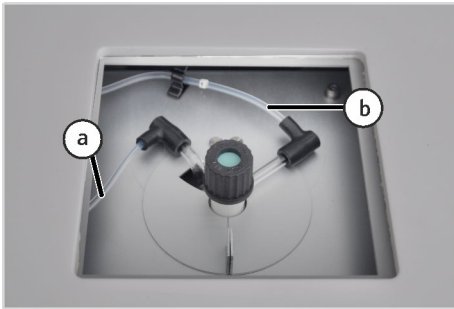
1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36).
2. Clear the opening at the top of the compEAct N.
 

Autosampler LS: Slide the injector head over the rack. The injector head must only be moved by hand when the compEAct N is switched off from the mains switch! Remove the cover from the opening.

Auto-injector AI: Remove the auto-injector AI from the compEAct N and put it aside. Do not tear off the connecting pipes!



3. Open the pneumatic seal on the auto-protection assembly. Move the toggle switch up.
  - ✓ This releases the combustion tube and it can now be pulled out of the auto-protection valve assembly.



4. Pull hose 3 (a, blue), and hose 4 (b, gray) out of the FAST connectors.



5. Open the two-part heat guard above the opening of the combustion furnace.
6. Carefully pull the combustion tube out of the furnace.



7. Check the combustion tube for devitrification, cracks and blown out spots.

**Note:** Only reuse intact combustion tubes.

8. If contaminated:

- Remove the screw cap with septum and the 2 angled FAST connectors.
- Remove the quartz wool plug from the combustion tube.
- Clean the inside of the combustion tube with a suitable solvent and a cotton bud or a bottle brush. Clean the side arms with pipe cleaners. Rinse with distilled water if the solvent mixes with water. Otherwise rinse with ethanol.
- Dry the combustion tube (e.g. by blowing it through with an inert gas).
- Push new quartz wool loosely up to the positioning mandrel in the inner tube using a glass rod (→ "Replacing quartz wool plug" p. 46).

**Note:** Product of incomplete combustion, such as soot, or solid pyrolysis residue can deposit in the combustion tube. These deposits can also be removed by burning off in the muffle furnace at 750 – 900 °C or with a suitable burner flame, e.g. propane gas burner.

- ✓ The combustion furnace is cleaned.

## 6.6.2 Replacing quartz wool plug



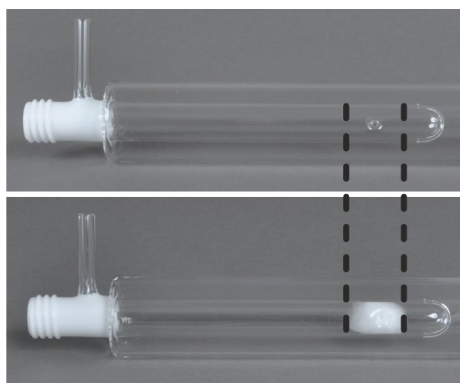
### Attention

Only use the pure quartz wool supplied by Analytik Jena. Contaminated quartz wool may damage the combustion tube and clog the filter.

Make sure that the quartz wool plug is correctly positioned. When the plug is not in correct position the sample does not vaporize evenly.



1. Remove the combustion tube (→ "Removing and cleaning the combustion tube", p. 44).
2. Roll a small amount of quartz wool into a loose plug approx. 2 to 4 cm long.



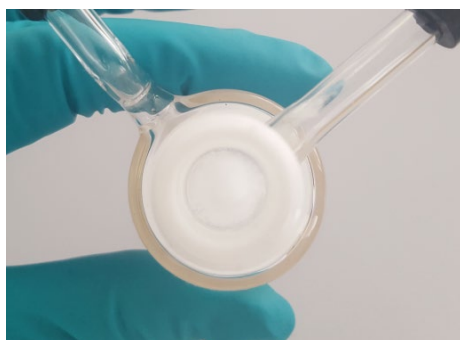
3. Insert the quartz wool plug with the glass rod supplied into the inner tube of the combustion tube.



### Attention

Clean all tools prior to use.

4. Push the quartz wool plug into the tube until the positioning mandrel is at the center of the plug.



### Attention

The plug must not seal the bottom slot in the inner tube.

The plug should cover the entire cross section of the inner tube. When viewed from above the slot must no longer be visible in the tube.

After replacing the quartz wool the analysis system must be cleaned through a minimum of 3 measurements with pure solvent (e.g. isooctane, toluene, xylene). Repeat the blind measurements until the nitrogen blind value is below 20 AU/ $\mu$ l solvent (AU/ $\mu$ l: area unit per microliter of solvent). The blank value may vary dependent on the solvent that is used.

### 6.6.3 Inserting the combustion tube



#### WARNING

Risk of explosion or carbonization!

The gas hoses on the combustion tube must not be mixed up.

#### CAUTION

Risk of burns and possible damage of the auto-protection assembly!

Only install when the device is cold.



#### Attention

Alkaline salts (hand perspiration) cause devitrifications in the quartz glass when heating the combustion furnace. These reduce the service life of the combustion tube.

Do not touch the combustion tube with your bare hands during installation. Wear protective gloves. Wipe the combustion tube externally by with ethanol and cellulose prior to installing it in the combustion furnace.

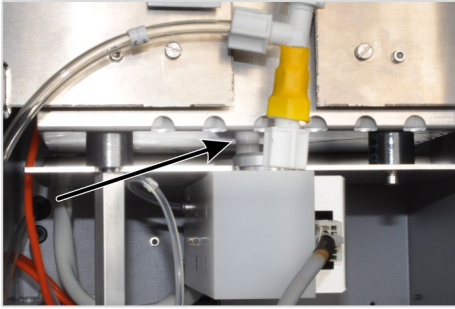
1. Slide the angled FAST connectors onto the gas connections of the combustion tube.
2. Close the injection port of the combustion tube with septum and screw cap.
3. Wipe the combustion tube on the outside with a cellulose wetted with ethanol.
4. Open the two-part heat guard at top of the combustion furnace.



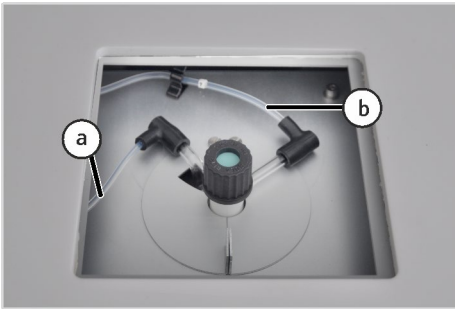
5. Slide the auto-protection assembly into the mount below the furnace.
6. Insert the combustion tube into the combustion furnace.
7. When inserting the tube, change the position of the auto-protection assembly until the combustion tube slides easily into the opening of the assembly.

#### Attention

The combustion tube is fragile. If pressure is applied to the tube it might break.



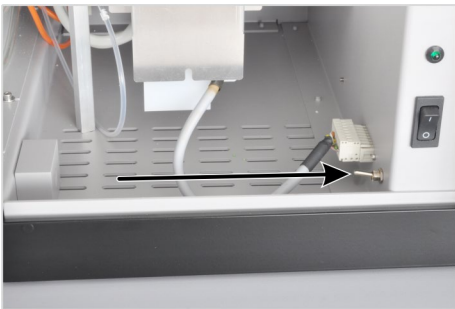
8. In the gap between the combustion furnace and the auto-protection assembly check that the combustion tube sits correctly in the assembly.
9. Fit the heat guard in front of the auto-protection assembly. Hook the heat guard into the knurled head screws at the combustion furnace.



10. Slide hose 3 (a, blue), and hose 4 (b, gray) into the FAST connectors at the combustion tube.

**⚠ WARNING**

Risk of explosion and carbonization! The hoses at the combustion tube must not be mixed up!



11. Open the gas supply at the pressure reducer.
12. Close the pneumatic seal on the auto-protection assembly. Move the toggle switch down.

13. Assemble the sampler module:

Auto-injector AI: Place the auto-injector AI on the combustion tube.

Autosampler LS: Place the cover over the opening to the combustion tube.

- ✓ The compEAct N is ready for operation and can be switched on from the mains switch.



### Attention

When using the autosampler LS: After servicing the combustion tube, the adjustment of the injector head must be checked (→ "Adjusting the autosampler LS", p. 43).

## 6.7 Replacing the membrane dryer



### CAUTION

Risk of burns on the combustion furnace!

Only remove the membrane dryer when the device is cold or allow the device to cool down sufficiently!



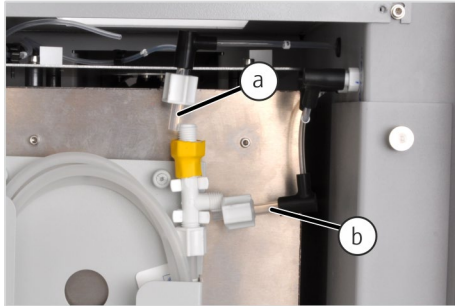


### Attention

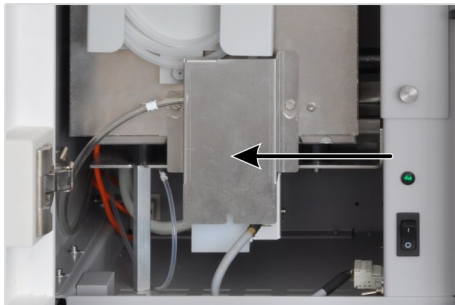
Damage to the membrane dryer!

The membrane dryer is equipped with a sensitive membrane for exchanging water vapor. Squeezing or twisting the hose of the membrane dryer will damage the membrane. The connectors are particularly sensitive. Make sure that the connectors are not twisted during installation.

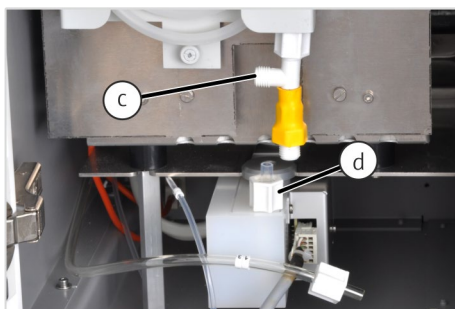
1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36).
2. Switch off the gas supply.
3. Open the pneumatic seal on the auto-protection assembly. Move the toggle switch up.
4. Allow the device to cool down sufficiently.



5. At the top of the membrane dryer unscrew the hose olives at the top and side connection and pull the hose adapter for the hoses 5 (a) and 12 (b) out of the connectors.



6. Remove the heat guard in front of the auto-protection assembly.



7. At the bottom of the membrane dryer unscrew the hose olives at hose 13 (c) and at the connection of the auto-protection assembly.



8. Remove the old membrane heater from the mount.
9. Carefully insert and clamp the new membrane dryer in the mount.  
The gas connection at the top end must point to the right and the gas connection at the bottom end to the left.
10. Screw the gas connections back on in reverse order. Whilst doing so, hold the connections at the membrane dryer from the yellow shrink tubes to prevent them from twisting.

**i** Attention

The connections at the membrane dryer must never be twisted. The sensitive internal membrane could be damaged and the membrane dryer rendered useless.

- ✓ The membrane dryer is installed and ready for operation.

## 6.8 Servicing the auto-protection assembly

The following maintenance tasks must be performed at the auto-protection assembly:

- Check the filter for contamination: during maintenance of the combustion tube, after incomplete combustion or carbonization of the system, in case of overpressure faults and analytical problems.
- Replace the filter
- Replace the pneumatic seal: If the seal no longer seals.

### 6.8.1 Removing and installing the auto-protection assembly

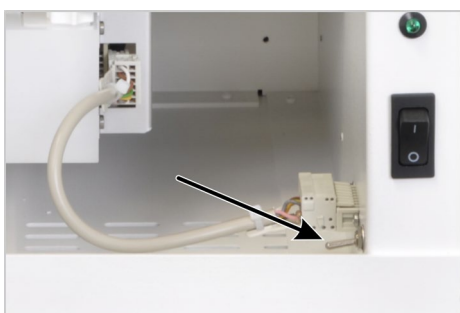


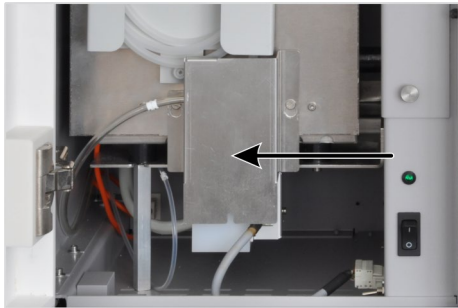
#### CAUTION

Risk of burns on the combustion furnace!

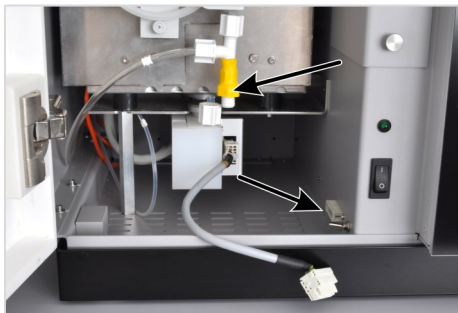
Only remove the auto-protection assembly (APB) when the device is cold or allow the device to cool down sufficiently!

1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36).
2. Switch off the gas supply. Allow the device to cool down sufficiently.
3. Open the pneumatic seal on the auto-protection assembly. Move the toggle switch up.
4. Remove the combustion tube from the combustion furnace (→ "Removing and cleaning the combustion tube" p. 44).





- Remove the heat guard in front of the auto-protection assembly.



- Unscrew the union nut from the gas connection between the membrane dryer and the auto-protection assembly. Whilst doing so, hold the connections at the membrane dryer from the yellow shrink tubes to prevent it from twisting.

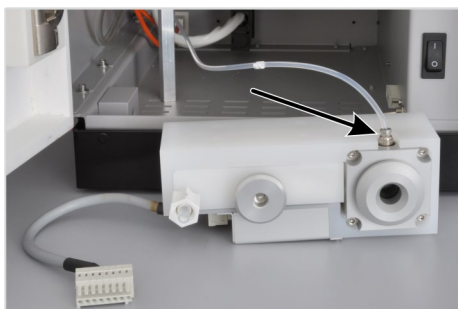
**i** Attention

The connections at the membrane dryer must never be twisted. The sensitive internal membrane could be damaged and the membrane dryer rendered useless.

- Unplug the connector of the auto-protection assembly from the electrical connection in the right side panel.



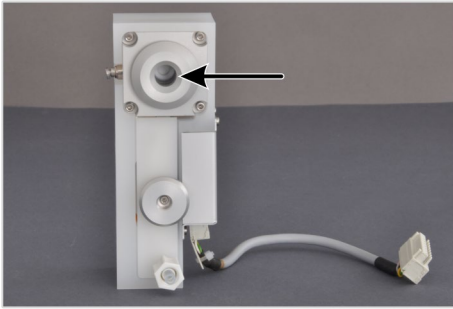
- Pull the auto-protection assembly out of the mount under the combustion furnace.



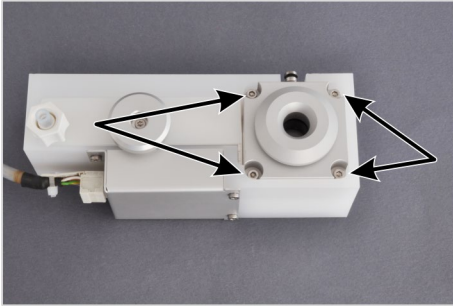
- Press the ring of the connector of hose no. 11 down and pull the hose out of the connection.
- The installation of the auto-protection assembly is in reverse order.

## 6.8.2 Checking and replacing the filter

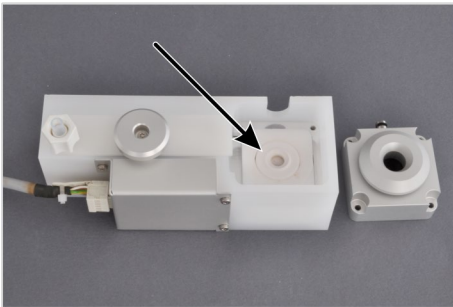
- Remove the combustion tube (→ "Removing and cleaning the combustion tube", p. 44).
- Remove the auto-protection assembly (→ "Removing and installing the auto-protection assembly", p. 50).



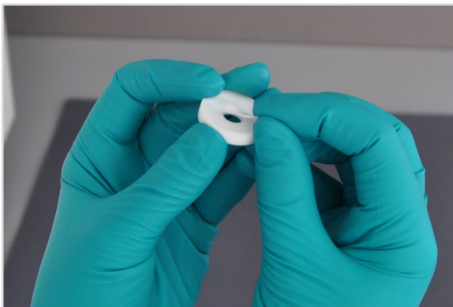
3. Look into the opening of the seal and inspect the filter for carbonization, other contamination or cracks.  
If the filter is OK, re-install the auto-protection assembly.  
If the filter needs replacing, follow the remaining instructions.



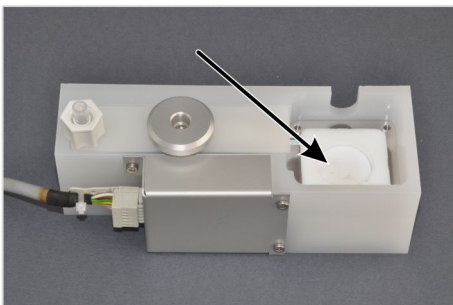
4. Unscrew the 4 screws attaching the pneumatic seal to the auto-protection assembly.
5. Remove the seal from the assembly.



6. Remove the intermediate ring.



7. Remove the filter from the intermediate ring. If required, carefully wipe the intermediate ring or the Teflon base element of the APB to clean it.



8. The filter consists of a PTFE filter and a carrier fabric which are pressed against one another. Insert the new filter to the assembly with the carrier fabric facing downwards.

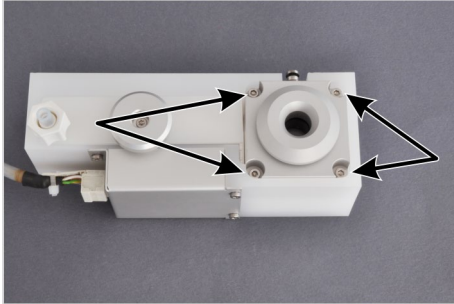
9. Insert the intermediate ring.

10. Reinsert the pneumatic seal and attach it using the 4 screws.

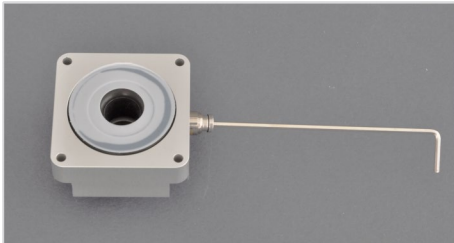
- ✓ The filter has been replaced. The auto-protection assembly may now be reinstalled underneath the furnace (→ "Removing and installing the auto-protection assembly", p. 50).

### 6.8.3 Replacing the pneumatic seal

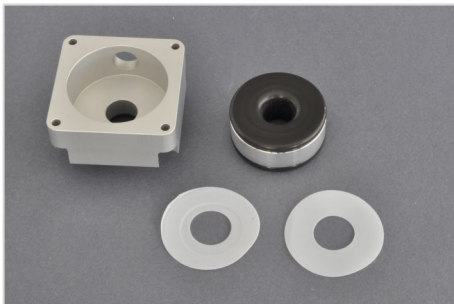
1. Remove the combustion tube (→ "Removing and cleaning the combustion tube", p. 44).
2. Remove the auto-protection assembly (→ "Removing and installing the auto-protection assembly", p. 50).



3. Unscrew the 4 screws attaching the pneumatic seal to the auto-protection valve assembly.
4. Remove the housing of the pneumatic seal from the auto-protection assembly.



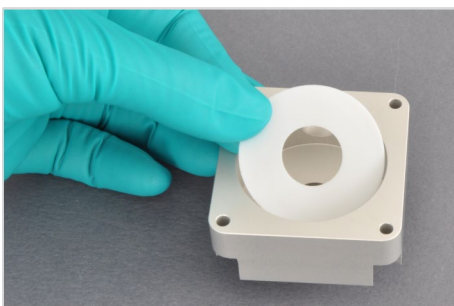
5. Remove the gas connection. Insert a hexagon socket wrench into the connection and unscrew the connection.



6. Remove the seal from the housing.
7. Pull the PTFE intermediate films from the seal.

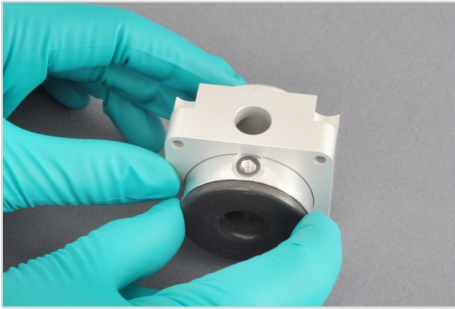


8. Separate the seal from the ring.
9. Insert a new seal into the ring.



10. Insert the PTFE intermediate film into the housing.





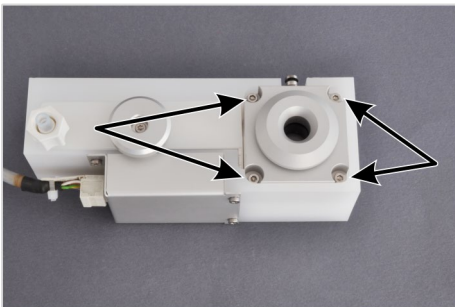
11. Insert the seal into the housing. The openings for the gas connection in the sealing ring and housing must be above each other.



12. Screw in the gas connection. Tighten with the hexagon socket wrench.



13. Place the PTFE intermediate film onto the intermediate ring in the auto-protection assembly.



14. Insert the pneumatic seal into the auto-protection assembly and attach it with 4 screws.

- ✓ The pneumatic seal has been replaced. The auto-protection assembly may now be reinstalled underneath the furnace (→ "Removing and installing the auto-protection assembly", p. 50).

## 6.9 Opening and closing the side panel of the compEAct N

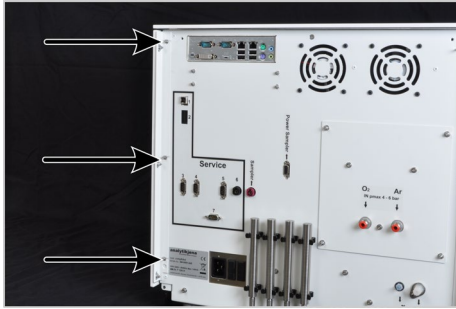


### WARNING

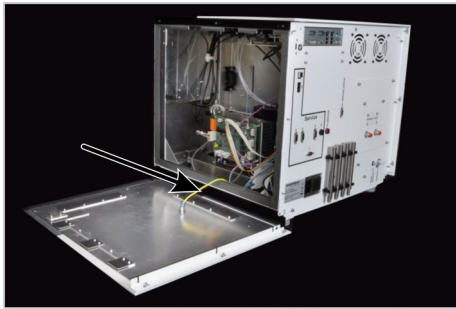
Danger of electric shock!

Before opening the side panels, switch off the compEAct N using the mains switch behind the front door and pull the mains plug from the connection on the rear panel of the compEAct N.

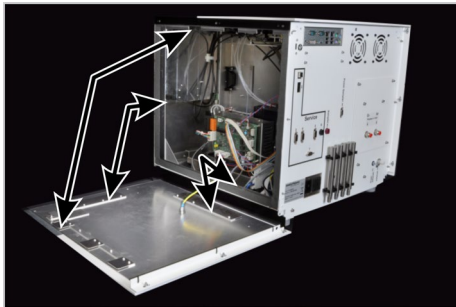
The side panel must be opened for some maintenance tasks at the compEAct N.



1. Unscrew the 3 hexagon nuts securing the side panel to the rear panel of the device and remove the washers.



2. Push the side panel back until it slips out of the attachment.
3. Pull the functional grounding off the side panel. Place the side panel aside.



4. To close the side panel first plug the functional grounding into the housing and side panel.
5. First place the side panel against the housing in a way that the clamping plate at the bottom of the panel sits behind the housing frame and the top clamping plates offset with the top attachments of the housing. The panel then sits flat against the housing.
6. Push the panel forward. The front clamping plate of the panel then moves behind the housing frame. The screw pins at the rear of the compEAct N protrude into the corresponding slots in the panel rail.

7. Push the washers onto the screw pin and re-attach the panel with 3 hexagon nuts (see above).

✓ The compEAct N is closed again.

## 6.10 Replacing the absorber



### WARNING

Danger of electric shock!

Before carrying out any maintenance work in the device interior, switch off the compEAct N using the mains switch behind the front door and pull the mains plug from the connection on the rear panel of the compEAct N.

### CAUTION

Risk of burns on components in the device interior! Only replace the absorber when the device is cold!

In the compEAct N the diaphragm pump aspirates the measuring gas with a constant aspiration flow through the CLD detector. In order to equalize pressure differences caused by differing gas flows, it is possible to use an absorber to allow air to enter the device. The absorber filters constituents from the air which may distort the analysis.

The absorber must be replaced once a year but no later than when the baseline has been increased or become unstable. The absorber is located inside the device directly in front of the chemical ozone decomposer.

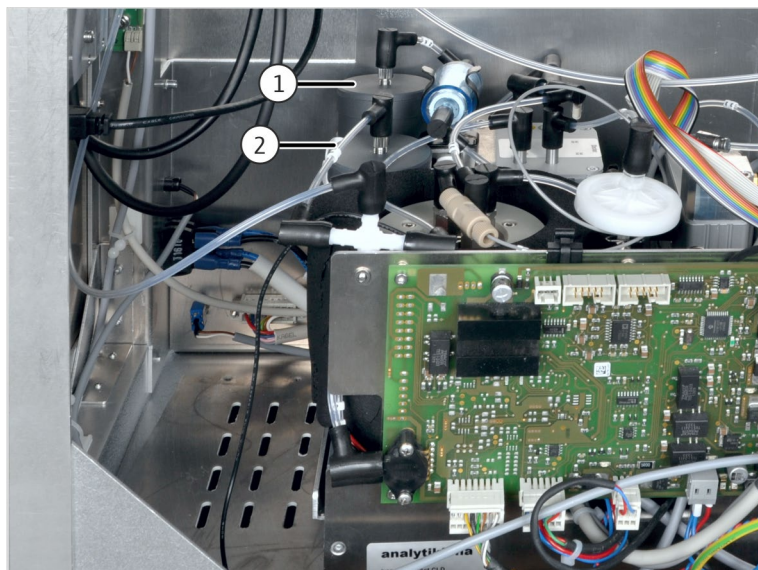


Fig. 21 Components in the device interior

- 1 Chemical ozone decomposer                      2 Absorber

1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36). Pull the mains plug at the rear of the device out of the connection.
2. Allow the device to cool down.
3. Open the side panel, pull the functional grounding off the side panel. Safely put the side panel aside (→ "Opening and closing the side panel of the compEAct N" p. 54).
4. Pull the absorber out of the mount in the device interior.
5. Pull hose no. 32 with FAST connector off the top of the absorber.  
(From the underside the absorber absorbs ambient air. There is no hose connection here.)
6. Connect the new absorber with the FAST connector to hose no. 32.
7. Clamp the absorber into the bracket.
8. Close the side panel.
  - ✓ The absorber has been replaced. The compEAct N is ready for operation again.



## 6.11 Replacing chemical ozone decomposer and filter



### WARNING

Danger of electric shock!

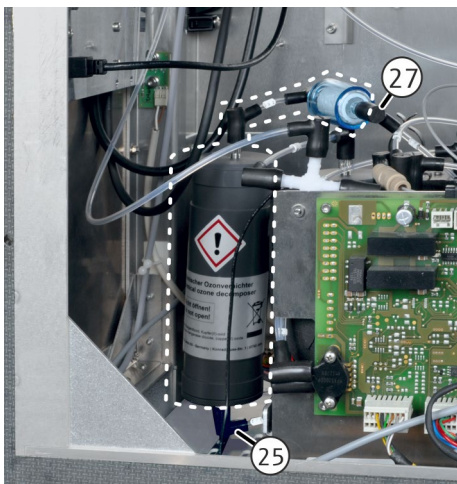
Before carrying out any maintenance work in the device interior, switch off the compEAct N using the mains switch behind the front door and pull the mains plug from the connection on the rear panel of the compEAct N.

### CAUTION

Risk of burns on the ozone decomposer! Only replace when the device is cold!

The chemical ozone decomposer must be replaced once a year but no later than when an ozone odor is noticeable at the "exhaust" gas outlet. Otherwise the intake pump of the CLD detector could be destroyed. The ozone decomposer is replaced together with the solids filter as a unit. The ozone decomposer is located directly behind the absorber (→ Fig. 21 p. 56).

1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36). Pull the mains plug at the rear of the device out of the connection.
2. Allow the device to cool down.
3. Open the side panel, pull the functional grounding off the side panel. Safely put the side panel aside (→ "Opening and closing the side panel of the compEAct N" p. 54).



4. Pull the chemical ozone decomposer and the solids filter out of their mounts in the device interior.
5. Pull hose no. 27 with FAST connector off the solids filter.
6. Pull hose no. 25 with FAST connector off the bottom of the ozone decomposer.
7. Connect the new set of ozone decomposer and filter via the FAST connectors to the following hoses:  
Filter – hose no. 27, bottom ozone decomposer – hose no. 25
8. Clamp the ozone decomposer and the filter into the mounts.
9. Close the side panel.

- ✓ The chemical ozone decomposer and the solids filter have been replaced. The compEAct N is ready for operation again.

## 6.12 Removing and installing the combustion furnace



### WARNING

Danger of electric shock!

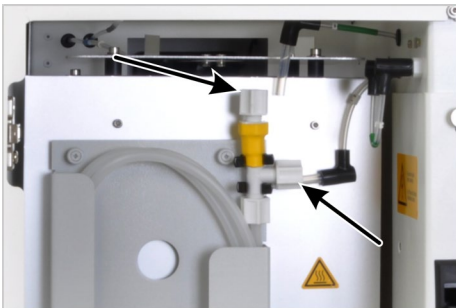
Before removing and installing the combustion furnace, switch off the compEAct N using the mains switch behind the front door and pull the mains plug from the connection on the rear panel of the compEAct N.

### CAUTION

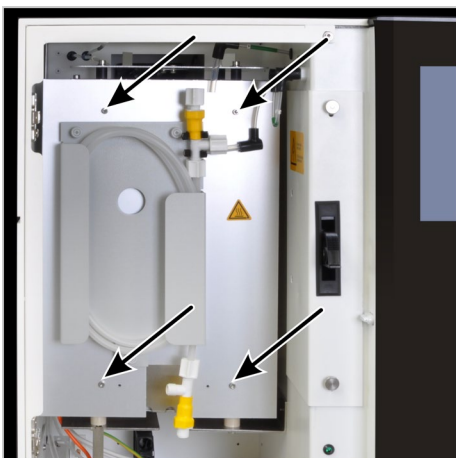
Risk of burns on the furnace! Only remove when the device is cold!

### 6.12.1 Removing the combustion furnace

1. First switch off the compEAct N from the ON/OFF switch and then, after the system has been shut down completely, from the mains switch (→ "Switching the compEAct N on and off" p. 36). Disconnect the mains plug from the mains socket.
2. Open and unhook the front door.
3. Remove the combustion tube (→ "Removing and cleaning the combustion tube", p. 44).
4. Remove the auto-protection assembly (→ "Removing and installing the auto-protection assembly", p. 50).



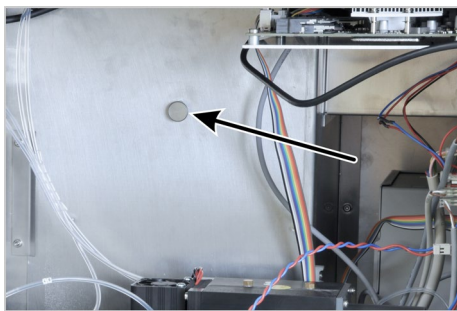
5. Release the top screw connections of the top connections at the membrane dryer and pull out the gas hoses.
6. Unscrew the bottom screw connection for the rinse flow of the membrane dryer.



7. Unscrew the 4 screws for holding the heat guard in front of the furnace and remove the heat guard together with the membrane dryer.

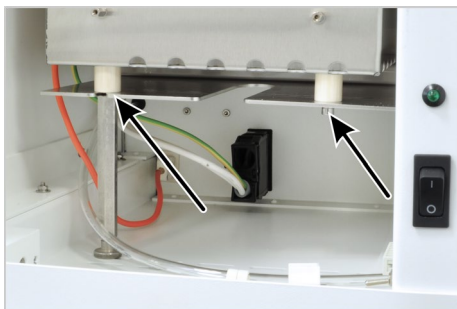


8. Open the inspection flap.
9. Unscrew the knurled head screw for furnace attachment to the inside wall of the electronics chamber.

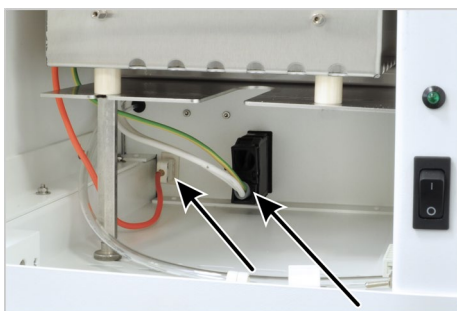


If the knurled head screw is difficult to reach through the inspection flap:

- Open the side panel, pull the functional grounding off the side panel. Safely put the side panel aside (→ "Opening and closing the side panel of the compEAct N" p. 54).
- Unscrew the knurled head screw.



10. Unscrew furnace from the mount in the furnace space (2 screws).

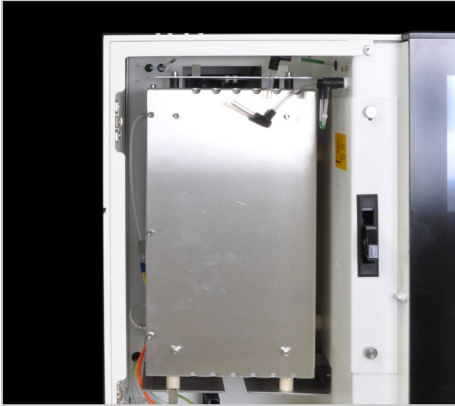


11. Pull the connectors for the furnace heating and thermocoupler (orange cable) from the connections under the furnace at the rear of the furnace space.

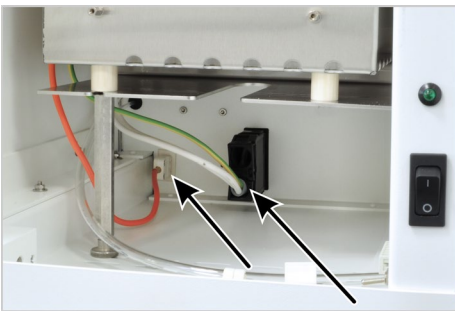
12. Lift the furnace out of the furnace space and package it.
  13. Close the inspection flap or plug the functional grounding into the side panel and close the side panel. Hook the front door back in and close it.
- ✓ The furnace is completely removed.

### 6.12.2 Installing the combustion furnace

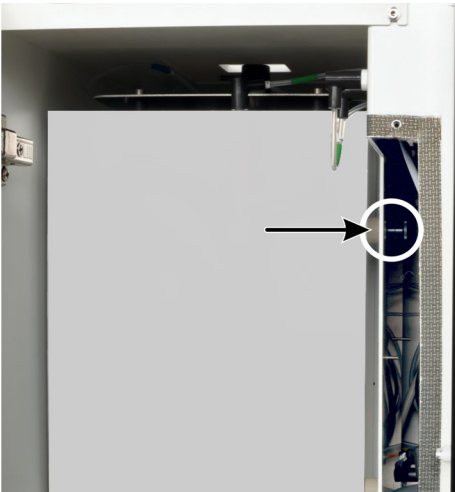
1. Check that the compEAct N is not connected to the mains!
2. Open and unhook the front door.



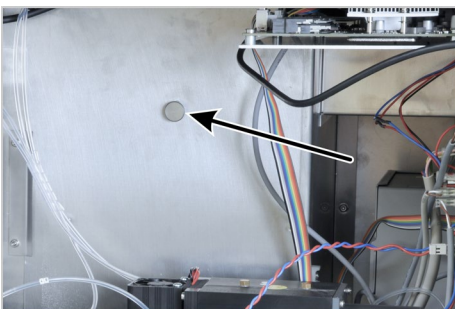
3. Insert the furnace into the furnace space.



4. Plug the connectors for the furnace heating and thermocoupler (orange cable) into the connections under the furnace at the rear of the furnace space.

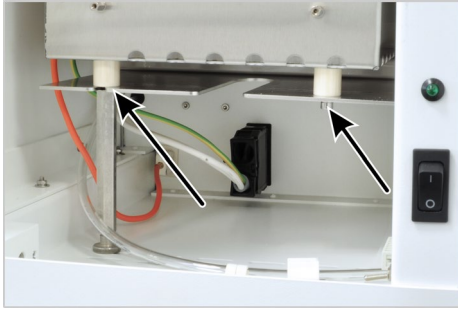


5. Open the inspection flap.
6. At the inside wall of the electronics chamber attach the furnace with the knurled head screw. Do not tighten the screw yet.

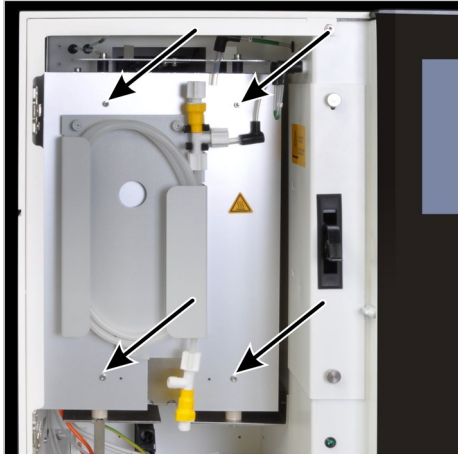


If the screw connection is difficult to reach through the inspection flap:

- Open the side panel, pull the functional grounding off the side panel. Safely put the side panel aside (→ "Opening and closing the side panel of the compEAct N" p. 54).
- At the inside wall of the electronics chamber attach the furnace with the knurled head screw. Do not tighten the screw yet.



7. Screw the furnace with 2 Allen screws to the mount in the furnace space.
8. Evenly tighten all 3 fastening screws (knurled head screw and Allen screws).



9. Attach the heat guard with membrane dryer to the front of the furnace with 4 Allen screws.
  - ✓ The combustion furnace is fully installed.

# 7 Troubleshooting

## 7.1 Troubleshooting according to software messages

	Error message	
100002	<b>Communication with companion chip is disturbed.</b>	
	<b>Cause</b>	<b>Remedy</b>
	The communication with the companion chip is disturbed.	Inform the customer service department.
101001	<b>Main mfm defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	The flow meter is defective.	Inform the customer service department.
	The membrane dryer is defective.	Replace the membrane dryer (→ "Replacing the membrane dryer", p. 48).
101200	<b>Control flow too high</b>	
	<b>Cause</b>	<b>Remedy</b>
	The measured control flow is too low.	Inform the customer service department.
101201	<b>Device leaky</b>	
	<b>Cause</b>	<b>Remedy</b>
	The device has a leak.	<ul style="list-style-type: none"> <li>▪ Check whether the pneumatic seal on the APB is closed, also refer to chapter "Equipment fault", p. 67.</li> <li>▪ Use the flow monitoring set to check the tightness of the system. Remove the leak (→ "Checking system tightness", p. 41).</li> <li>▪ Inform the customer service department.</li> </ul>
101501	<b>Communication with gasbox is disturbed.</b>	
	<b>Cause</b>	<b>Remedy</b>
	The communication with the gas box is disturbed.	Inform the customer service department.
101703	<b>Hardware error in furnace temperature</b>	
	<b>Cause</b>	<b>Remedy</b>
	A hardware error has occurred in the controller for the furnace temperature.	Inform the customer service department.
101723	<b>Hardware error in furnace temperature</b>	
	<b>Cause</b>	<b>Remedy</b>
	The measured temperature of temperature controller furnace temperature is out of specified sensor range.	Inform the customer service department.
101743	<b>Temperature in furnace temperature not reached</b>	
	<b>Cause</b>	<b>Remedy</b>
	The requested temperature could not be achieved by temperature controller furnace temperature.	Inform the customer service department.

101760	<b>Gas flow in Main-O<sub>2</sub> insufficient</b>	
	<b>Cause</b>	<b>Remedy</b>
	The required gas flow could not be achieved with the Main-O <sub>2</sub> flow controller.	<ul style="list-style-type: none"> <li>▪ Check gas supply and connections.</li> <li>▪ Inform the customer service department.</li> </ul>
101764	<b>Hardware error in flow sensor Main-O<sub>2</sub></b>	
	<b>Cause</b>	<b>Remedy</b>
	A hardware error has occurred in the Main-O <sub>2</sub> flow sensor.	<ul style="list-style-type: none"> <li>▪ Inform the customer service department.</li> </ul>
101768	<b>Hardware error in flow valve Main-O<sub>2</sub></b>	
	<b>Cause</b>	<b>Remedy</b>
	A hardware error has occurred in the Main-O <sub>2</sub> flow valve.	<ul style="list-style-type: none"> <li>▪ Inform the customer service department.</li> </ul>
10176C	<b>Gas pressure error</b>	
	<b>Cause</b>	<b>Remedy</b>
	Overpressure was detected in the gas path.	<ul style="list-style-type: none"> <li>▪ Wait until the routine for reducing the overpressure is completed. Follow the instructions of the software.</li> <li>▪ Pierce a cannula into the septum of the injection port so that the gas can escape via the cannula.</li> <li>▪ Cut the gas supply.</li> <li>▪ Search for cause for overpressure and correct the defect.</li> <li>▪ Reopen the gas supply and restart the device.</li> </ul>
102002	<b>No connection to sampler LS I</b>	
	<b>Cause</b>	<b>Remedy</b>
	It is not possible to establish a connection to the autosampler LS 1.	<ul style="list-style-type: none"> <li>▪ Check the connections.</li> <li>▪ Inform the customer service department.</li> </ul>
102003	<b>No connection to autoinjector</b>	
	<b>Cause</b>	<b>Remedy</b>
	It is not possible to establish a connection with the auto-injector AI.	<ul style="list-style-type: none"> <li>▪ Check the connections.</li> <li>▪ Inform the customer service department.</li> </ul>
102004	<b>No connection to sampler LS II</b>	
	<b>Cause</b>	<b>Remedy</b>
	It is not possible to establish a connection to the autosampler LS 2.	<ul style="list-style-type: none"> <li>▪ Check the connections.</li> <li>▪ Inform the customer service department.</li> </ul>
102100	<b>No connection to LPG 2.0</b>	
	<b>Cause</b>	<b>Remedy</b>
	It is not possible to establish a connection to the sample introduction module LPG 2.0.	<ul style="list-style-type: none"> <li>▪ Check the connections.</li> <li>▪ Inform the customer service department.</li> </ul>
102101	<b>No connection to GSS/LPG</b>	
	<b>Cause</b>	<b>Remedy</b>
	It is not possible to establish a connection to the combined GSS/LPG module.	<ul style="list-style-type: none"> <li>▪ Check the connections.</li> <li>▪ Inform the customer service department.</li> </ul>

<b>102200</b>	<b>Drive of autoinjector is defective.</b>	
	<b>Cause</b>	<b>Remedy</b>
	The drive or the drive sensor of the auto-injector AI have failed.	Inform the customer service department.
<b>102210</b>	<b>Sampler error</b>	
	<b>Cause</b>	<b>Remedy</b>
	A general sampler error has occurred (zero).	Inform the customer service department.
<b>102211</b>	<b>Error in sampler x-axis</b>	
	<b>Cause</b>	<b>Remedy</b>
	The drive of the sampler on the X axis does not move or the sensor for the zero point has failed.	Inform the customer service department.
<b>102220</b>	<b>LPG 2.0: argon system pressure too low.</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The primary argon pressure is insufficient to run the module.	Check gas supply and connections.
<b>102221</b>	<b>LPG 2.0: cooling defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The cooling of the dosing valve has failed.	Inform the customer service department.
<b>102222</b>	<b>LPG 2.0: cooling temperature sensor defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The temperature sensor of the cooling has failed.	Inform the customer service department.
<b>102223</b>	<b>LPG 2.0: heating defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The heating of the expansion chamber has failed.	Inform the customer service department.
<b>102224</b>	<b>LPG 2.0: heating temperature sensor defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The temperature sensor of the heating has failed.	Inform the customer service department.
<b>102225</b>	<b>LPG 2.0: housing fan defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	LPG 2.0: The housing fan has failed.	Inform the customer service department.
<b>102230</b>	<b>GSS/LPG: argon system pressure too low.</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The primary argon pressure is insufficient to run the module.	Check gas supply and connections.
<b>102231</b>	<b>GSS/LPG: cooling defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The cooling of the dosing valve has failed.	Inform the customer service department.
<b>102232</b>	<b>GSS/LPG: cooling temperature sensor defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The temperature sensor of the cooling has failed.	Inform the customer service department.



102233	<b>GSS/LPG: heating defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The heating of the expansion chamber has failed.	Inform the customer service department.
102234	<b>GSS/LPG: heating temperature sensor defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The temperature sensor of the heating has failed.	Inform the customer service department.
102235	<b>GSS/LPG: heating defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	GSS/LPG: The housing fan has failed.	Inform the customer service department.
105101	<b>Communication with N-CLD is disturbed.</b>	
	<b>Cause</b>	<b>Remedy</b>
	The communication with the N-CLD is disturbed.	Inform the customer service department.
105130	<b>N-CLD: error ozone generator</b>	
	<b>Cause</b>	<b>Remedy</b>
	The ozone generator is in an error condition.	Inform the customer service department.
105131	<b>N-CLD: Sensor unit defective</b>	
	<b>Cause</b>	<b>Remedy</b>
	The sensor unit has failed or is not connected correctly.	Inform the customer service department.
105132	<b>N-CLD: error ozone annihilator</b>	
	<b>Cause</b>	<b>Remedy</b>
	The thermal ozone decomposer is in an error condition.	Inform the customer service department.
105133	<b>N-CLD: error ozone annihilator</b>	
	<b>Cause</b>	<b>Remedy</b>
	The temperature sensor of the thermal ozone decomposer has failed.	Inform the customer service department.
105134	<b>N-CLD: error operating voltage</b>	
	<b>Cause</b>	<b>Remedy</b>
	The operating voltage is outside the permitted range.	Inform the customer service department.
105135	<b>N-CLD: measured value exceeds measuring range</b>	
	<b>Cause</b>	<b>Remedy</b>
	The measured value exceeds the measuring range of 30 µg/l to 10000 mg/l N.	<ul style="list-style-type: none"> <li>▪ Dilute the sample.</li> <li>▪ Repeat the measurement.</li> </ul>
105136	<b>N-CLD: differential pressure too low</b>	
	<b>Cause</b>	<b>Remedy</b>
	The differential pressure is too low.	Inform the customer service department.
105137	<b>N-CLD: differential pressure too high</b>	
	<b>Cause</b>	<b>Remedy</b>
	The differential pressure is too high.	Inform the customer service department.

201100	<b>Last active method not available.</b>	
	<b>Cause</b>	<b>Remedy</b>
	The method that was active before switching off the device is no longer available and cannot be activated.	Creating a new method.
201101	<b>Transferring method parameters failed</b>	
	<b>Cause</b>	<b>Remedy</b>
	The method parameters could not be transferred to the device. The device may not be ready to carry out the measurement.	Wait until the device is ready for measurements.
201200	<b>Service septum in 300 injections</b>	
	<b>Cause</b>	<b>Remedy</b>
	The maintenance interval for the septum is due after 300 additional injections.	Replace the injection port with septum in due course.
203001	<b>Automatic backup success</b>	
	<b>Cause</b>	<b>Remedy</b>
	The automatic backup was completed successfully.	None. The message is for informational purpose only.
203002	<b>Automatic backup failure</b>	
	<b>Cause</b>	<b>Remedy</b>
	The automatic backup has failed due to a system error.	Restart the device. Repeat the backup process.
204000	<b>Calibration point import failed</b>	
	<b>Cause</b>	<b>Remedy</b>
	The automatic import of a measured calibration point has failed.	Repeat the process or inform the customer service department, if required.
206003	<b>Sequence canceled with errors</b>	
	<b>Cause</b>	<b>Remedy</b>
	A sequence was aborted with errors.	Check the sequence for errors. Resume the measurement.
207001	<b>Simulation activated</b>	
	<b>Cause</b>	<b>Remedy</b>
	The simulation mode was activated.	None. The message is for informational purpose only.
207002	<b>Simulation deactivated</b>	
	<b>Cause</b>	<b>Remedy</b>
	The simulation mode was deactivated.	None. The message is for informational purpose only.

## 7.2 Equipment faults and analytical problems

### 7.2.1 General notes

Other problems not detected by the system monitoring can also occur. Starting a measurement is possible. Such errors are usually detected on the basis of implausible measuring results (analytical problems) or are clearly visible in the equipment technology. If the suggested solutions are not successful, inform the customer service department of Analytik Jena.

## 7.2.2 Equipment fault

Error	Possible cause	Remedy
Furnace does not heat	Temperature set incorrectly in the software	Check temperature configuration in the method
	No method loaded	Load method
	Malfunction in power supply	<ul style="list-style-type: none"> <li>▪ Switching the device on</li> <li>▪ Check the internal fuse</li> </ul>
	Malfunction in the internal electronics	Inform customer service department
Furnace temperature is outside tolerance limits or target temperature is not reached	Temperature controller faulty	Inform customer service department
	Malfunction in electronics	
Process gases (inlet flow) are not supplied	Gas supply not connected / not opened	Connect / open gas supply
	Primary gas pressure too low	Set primary gas pressure at the delivery point to between 4 and 6 bar
	Gas supply leaking	Check gas supply
	No method loaded	Load method
	Gas box faulty	Inform customer service department
Target flow at the outlet to the detector too low / message "Device leaky"	Connection between hose, FAST connector and combustion tube incorrect	Check connection and ensure correct fit at the connection points
	Pneumatic seal in the auto-protection assembly does not seal combustion tube	<ul style="list-style-type: none"> <li>▪ Check Ar supply</li> <li>▪ Move toggle switch for pneumatic seal down</li> </ul>
	Septum sits incorrectly in the injection port or is leaking	Check position of the septum, insert new septum if necessary
	Connection of membrane dryer or transfer line to the auto-protection assembly leaking	Check connections (do not jam thread, tighten finger-tight)
Gas escapes from pneumatic seal (audible hiss)	Hose no. 11 connector loose	Press hose no. 11 tightly into the quick-release connector
	Pneumatic seal defective	Replace pneumatic seal (→ "Replacing the pneumatic seal", p. 53)
Auto-protection assembly does not heat up	Connector not connected	Connect the APB connector (→ "Removing and installing the auto-protection assembly", p. 50)
	Heating of the APB defective	Inform customer service department
	Temperature controller faulty	Inform customer service department
Door LED flashes, ozone generator off	Warm-up phase not yet completed	Wait until warm-up phase is completed (approx. 30 min)
	Device in standby	Initialize the device
	Process gases switched off	Switch on gases
	No method loaded	Load method
	Device state TRANSFERRING METHOD PARAMETERS	Wait until the device is ready for measurements
Ozone smell	Ozone decomposer not effective	Replace ozone decomposer (→ "Replacing chemical ozone decomposer and filter", p. 57).

Error	Possible cause	Remedy
Pressure error	Device leaking or defective	Inform customer service department
	Gas outlet at the detector outlet or the membrane dryer clogged	Check gas outlet
	Absorber used up	Replace absorber (→ "Replacing the absorber", p. 55).
	Converter used up or worn out	Inform customer service department
Exhaust gas temperature outside range	Pump faulty	Inform customer service department
	Warm-up phase not yet completed	Wait until warm-up phase is completed (approx. 30 min)
	Heating thermal ozone decomposer or converter defective	Inform customer service department
Device operation via touchscreen not possible or restricted	Temperature sensor of the heating defective	Inform customer service department
	System crash	Shut down system and switch off mains switch; wait for 30 s; switch on device again

### 7.2.3 Analytical problems

Error	Possible cause	Remedy
Combustion at the cannula	Argon and oxygen connection at the combustion tube swapped	Connect process gases correctly (→ "Inserting the combustion tube", p. 47)
	Septum damaged	Replace septum in injection port
Lower results	Metering fault	Check metering
	System leaking	Check system tightness
	Temperature set too low	Check temperature configuration in the method
	Incorrect or unsuitable calibration	Check calibration, if necessary recalibrate
	Sample loss due to vaporization or spillage	Keep liquid samples sealed Check sampler function for solids
	Post-combustion period insufficient	Increase the post-combustion time
Excessively high results	Incomplete combustion	Clean or replace contaminated parts
Carry-over	Insufficient rinsing of the metering syringes in AI or LS	Rinse metering syringes adequately prior to sampling
	Combustion tube not rinsed adequately	Rinse combustion tube adequately with clean solvent, i.e. blank measurements until values are constant
	Metering faulty	Check metering
	Contamination of injection port or combustion tube	Wipe or replace septum, clean combustion tube (→ "Removing and cleaning the combustion tube", p. 44)
	Sample contains inorganic nitrogen compounds	Clean or replace contaminated parts
	HNO <sub>3</sub> / HNO <sub>2</sub> condensation products in the system (combustion tube, APB, membrane dryer)	Clean or replace affected assemblies

Error	Possible cause	Remedy
Scattering measured values	Incomplete combustion	Clean or replace contaminated parts
	Metering faulty	Check metering
	Combustion tube contaminated or severely crystallized	Clean or replace combustion tube
	Incomplete combustion	Clean or replace contaminated parts
	Clogged cannula in autosampler LS or auto-injector AI	Use the wire provided for this purpose to clean the cannula or replace it
	Oxygen supply to micro plasma chamber interrupted	Connect / open gas supply
Absorber used up	Replace absorber (→ "Replacing the absorber", p. 55).	

## 8 Transport and storage

### 8.1 Preparing the device for transport



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**WARNING**

Risk of damage to health due to improper decontamination!

Perform a professional and documented decontamination of the device before returning it to Analytik Jena. The decontamination report is available from the customer service department when registering the return. Analytik Jena must refuse acceptance of contaminated devices. The sender may be liable for any damage caused by inadequate decontamination of the device.

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**CAUTION**

Risk of burning at the hot furnace! Only remove the combustion furnace when the device is cold or allow the device to cool down sufficiently!

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**CAUTION**

When removing the glass components there is a risk of injury from glass breakage! Remove all glass components carefully from the analyzer!

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#### 8.1.1 Packing the autosampler LS



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**Attention**

The autosampler LS may only be disassembled after the compEAct N was switched off using the mains switch and the mains plug was detached from its connection on the compEAct N!

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1. Remove, empty and dry the solvent and waste containers.
2. Remove the sample rack and the sample containers.
3. Remove the metering syringe from the injector head and pack it separately.
4. Detach the electrical connections on the rear panel of the compEAct N and the autosampler LS.
5. Put the autosampler LS into its original packaging.

### 8.1.2 Packing the auto-injector AI

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#### Attention

The auto-injector AI may only be disassembled after the compEAct N was switched off using the mains switch and the mains plug was detached from its connection on the compEAct N!

To move the autoinjector AI do not hold it at the red front cover.

---

1. Detach the electrical connections on the rear panel of the compEAct N and the auto-injector AI.
2. Remove the auto-injector AI from the compEAct N.
3. Pack the metering syringe separately.
4. Put the auto-injector AI into its original packaging.

### 8.1.3 Packing the compEAct N

---



#### CAUTION

There is a risk of burning on the combustion furnace!

Only remove the combustion tube when the device is cold! Allow the compEAct N to cool down before packing it!

---

1. Shut down the compEAct N using the ON/OFF switch.
2. Open the pneumatic seal on the auto-protection assembly. Move the toggle switch up.
3. Wait 30 min. until the fans no longer rotate and the door LED goes out. Then switch off the mains switch behind the door. Allow the device to cool down.
4. Cut the external gas supply.
5. Remove auto-injector AI or autosampler LS from the compEAct N and pack them.
6. Detach all connections on the rear panel of the compEAct N.
7. Remove the combustion tube (→ "Removing and cleaning the combustion tube", p. 44).
8. Remove the auto-protection assembly (→ "Removing and installing the auto-protection assembly", p. 50).
9. Remove the membrane dryer (→ "Replacing the membrane dryer", p. 48).
10. Remove the combustion furnace (→ "Removing the combustion furnace", p. 58).
11. Pack open hose ends in protective bags and attach them with adhesive tape.
12. Close the door of the compEAct N.
13. Pull off the black skirting towards the front of the device.
14. Take the carrying handles from the bracket on the rear panel of the compEAct N and screw them hand-tight into the lateral openings at the base of the device.

15. Place the top cover and secure it with adhesive tape.
16. Carefully pack the combustion tube and additional accessories in their original packaging. Especially the glass components must be packed safely against breakage.

## 8.2 Transporting the compEAct N

Observe the safety instructions in chapter "Safety instructions – Transport and commissioning" p. 11. Avoid the following during transport:

- Impacts and vibrations  
Risk of damage due to shock, impacts or vibrations!
- Major temperature fluctuations  
Risk of condensate build-up!

## 8.3 Moving the compEAct N in the laboratory



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### CAUTION

Dropping the device poses a risk of injury and damage to the device!

Move the compEAct N extremely carefully! Two persons are required to lift and carry the device. The device may only be lifted by the carrying handles.

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1. Shut down the compEAct N using the ON/OFF switch. Wait 30 min. until the fans no longer rotate and the door LED goes out. Then switch off the mains switch behind the door. Allow the device to cool down.
2. Close the door.
3. Switch off the gas supply.
4. Remove any loose parts:
  - Autosampler LS: Remove the solvent and waste containers and the sample rack.
  - Auto-injector AI: Remove the AI and unplug the connections on the rear panel of the compEAct N.
5. Detach all connections on the rear panel of the compEAct N.
6. Pull off the black skirting towards the front of the device.
7. Take the carrying handles from the bracket on the rear panel of the compEAct N and screw them into the lateral openings at the base of the device.
8. Move the device with 2 people who must lift and hold the device by its carrying handles.

The following must be observed for the compEAct N:

- Observe the guide values and adhere to the legally mandated limits for lifting and carrying without auxiliary means!



- For installation at the new location observe the notes in section "Installation conditions" p. 27.



Fig. 22 compEAct N with screwed-in carrying handles

## 8.4 Storage



### Attention

Environmental influences and condensate formation can destroy individual components of the device!

The device may only be stored in air-conditioned rooms. The atmosphere must be low in dust and free from aggressive vapors.

If the device is not installed immediately after delivery or not required for prolonged periods, it should be stored in its original packaging. A suitable desiccant should be added to the equipment to prevent damage from moisture.

Ambient conditions

For requirements with regard to the ambient conditions at the storage location refer to "Technical data" p. 75.

## 9 Disposal

At the end of its service life the compEAct N and all its electronic components must be disposed of as electronic waste in accordance with the applicable regulations.

The chemical ozone decomposer contains metal oxides. The absorber is filled with activated carbon and soda lime. The used cartridges must be disposed of in accordance with local regulations.

## 10 Specification

### 10.1 Technical data

#### 10.1.1 Technical data of the compEAct N

General characteristics	Designation/type		compEAct N
	Dimensions (width x height x depth)		54 x 51 x 53 cm
	Mass		approx. 30 kg
Procedural data	Digestion principle		Pyrolysis followed by thermal oxidation
	Digestion temperature		700 to 1100 °C
	Analysis parameter		Total nitrogen TN
	Detection principle		Chemiluminescence of NO
	Measuring range		30 µg/l to 10000 mg/l of N (for liquid samples)
	Sample volume		1 to 50 µl
Gas supply	Oxygen	Quality	4.5
		Pressure	4 to 6 bar
		Consumption	1000 ml/min
	Argon	Quality	4.6
		Pressure	4 to 6 bar
		Consumption	100 to 250 ml/min (depending on the method)
Electrical variables	Connection		100 to 240 V ~, 50/60 Hz
	Fuses		12 A T
	Power consumption		Max. 1100 VA
	Operating system of the internal computer		Linux
Ambient conditions during operation	Temperature range		21 – 35 °C
	Humidity		Max. 90% at +30 °C
	Air pressure		0.7 – 1.06 bar
Ambient conditions during storage	Temperature range		15 – 55 °C
	Humidity		10 to 30 % (use desiccant)

#### 10.1.2 Technical data of the auto-injector AI

General characteristics	Designation/type		Auto-injector AI (type AI-SC)
	Dimensions (width x height x depth)		9 x 27 x 11 cm
	Mass		1.5 kg
	Sample volume		50 µl

Electrical variables	Connection	with 24 V = 2.0 A
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### 10.1.3 Technical data of the autosampler LS

General characteristics	Designation/type	LS 1	LS 2
	Dimensions (width x height x depth)	54 x 41 x 34 cm	
	Mass	4.5 kg	5 kg
	Number of samples	18	120
	Capacity of the sample containers	2 ml	
Electrical variables	Connection	with 24 V = 2.0 A	

## 10.2 Guidelines and standards

Safety class and safety type The compEAct N is classified as protection class I. The casing is protection type IP 20.

Device safety The compEAct N complies with the safety standards

- EN 61010-1
- EN 61010-2-081
- EN 61010-2-010

EMC compatibility The compEAct N has been checked for interference emission and noise immunity.

- It meets the requirement for transient emissions according to EN 61326-1 (EN 55011, group 1, class B)
- It meets the immunity requirements according to EN 61326-1 (requirements for use in a basic EMC environment)

Environmental compatibility The compEAct N has been tested for environmental compatibility and meets the requirements of

- ISO 9022-3
- ISO 9022-2

EU directives The compEAct N is designed and tested in accordance with standards meeting the requirements of EU directives 2014/35/EU, 2014/30/EU and 2011/65/EU. The device leaves the factory in a sound condition as far as technical safety is concerned. To maintain this condition and to ensure safe operation, the operator must strictly observe the safety and operating instructions contained in this operating manual. For accessories delivered with the device and system components from other manufacturers, the information in the respective operating instructions have priority.

## Guidelines for China

The device contains substances subject to regulation (according to directive "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products"). Analytik Jena guarantees that the substances will not leak within the next 25 years and, therefore, will not cause any environmental danger or health risk within this period of time if the device is used as intended.