analytikjena
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Operating Manual

contrAA 800

High-Resolution Continuum Source
Atomic Absorption Spectrometer

Manufacturer

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For a proper and safe use of this product follow the instructions.
Keep the operating manual for future reference.

General information

http://www.analytik-jena.com

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Implementation of the Technical Documentation

Analytik Jena GmbH+Co. KG

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1 Basic information

1.1 User manual notes

The user manual describes the following two models of the contrAA series:

- contrAA 800 D – Combined device for flame and graphite tube techniques
- contrAA 800 F for flame technique
- contrAA 800 G for graphite tube technique

In the text below these devices are collectively called contrAA 800. Differences are explained in the corresponding section. Unless stated differently, the figures show the combined device contrAA 800 D.

The contrAA 800 is intended for operation by qualified specialist personnel observing this user manual.

The user manual informs about the design and function of the contrAA 800 and provides the necessary know-how for the safe handling of the device and its components to personnel familiar with analysis. The user manual further includes notes on the maintenance and service of the equipment and potential causes and remedies of any faults.

Conventions

Instructions for actions which occur in chronological order are numbered and combined in action units.

Warnings are indicated by a warning triangle and signal word. The type, source and consequences of the danger are stated together with notes on preventing the danger.

The elements of the **control and analysis program** are indicated as follows:

- Program terms are identified with SMALL CAPS (e.g., Menu FILE).
- Buttons are shown by square brackets (e.g., [OK])
- Menu items are separated by arrows (e.g. FILE ▸ OPEN)

Symbols and signal words

The user manual uses the following symbols and signal words to indicate hazards or instructions. The warnings are always placed before an action.

WARNING

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

CAUTION

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

ATTENTION

Provides indications of potential material and environmental damage.

1.2 Intended use

The contrAA 800 is a high-resolution continuum source atomic absorption spectrometer for flame, hydride and graphite tube techniques. It is suited for the sequential detection of metallic and non-metallic traces in solid, liquid and dissolved samples. Combined with an autosampler the contrAA 800 can be used as a multi-element automatic unit to be used during routine analysis.

The contrAA 800 may only be used for the measurement solutions described in this user manual. Any other use is not as intended! The operator is exclusively liable for any damages as a result.

The contrAA 800 is suited for working with solutions containing hydrofluoric acid. The local safety regulations for handling hydrofluoric acid must be observed. Special provisions must also be made for operations involving organic solvents. In addition to apparatus-related and methodical aspects, fire and health protection for the particular organic solvent must be observed.

2 Safety instructions

For your own safety and to ensure error-free operation of the contrAA 800, please read this chapter carefully before using the appliance.

Observe all safety notes listed in this user manual and all messages and notes displayed by the control and analysis program on the monitor.

Besides the safety instructions in this user manual and the local safety regulations applicable to the operation of the device, the general applicable regulations regarding accident prevention, occupational health and safety and environmental protection must be observed and complied with.

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

2.1 Safety markings at the device

Warnings and notice symbols have been attached to the contrAA 800 which must always be observed.

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

Rear of the device

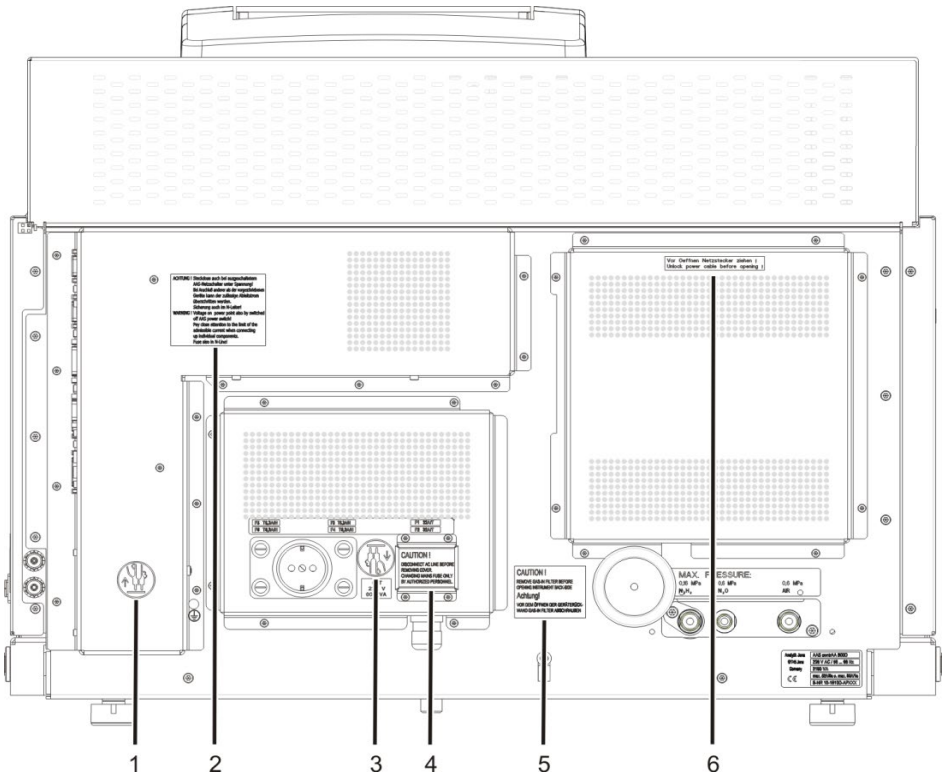


Fig. 1 Warnings and notice signs at the rear of the device

Number	Warning / notice symbol	Meaning and scope
1, 3		Before opening the device hood switch off the device and disconnect the mains plug from the mains connection.
2	Achtung! Steckdose auch bei ausgeschaltetem AAS-Netzschalter unter Spannung! Bei Anschluss anderer als der vorgeschriebenen Geräte kann der zulässige Ableitstrom überschritten werden. Sicherung auch im N-Leiter! Warning! Voltage on power point also by switched off AAS power switch! Pay close attention to the limit of the admissible current when connecting up individual components. Fuse also in N-Line!	Warning only for contrAA 800 D + contrAA 800 G (For meaning see warning text)
	Achtung! Bei ausgeschaltetem Gerät liegt Netzspannung an! Warning! Unit carries line voltage even if device has been switched off! Vor Öffnen Netzstecker ziehen! Unlock power cable before opening! Zubehöre nur bei ausgeschaltetem Gerät ein- oder ausstecken! Switch off instrument before connecting or disconnecting accessories!	Warning only for contrAA 800 F (For meaning see warning text)
4	Caution! Disconnect AC line before removing cover. Changing mains fuse only by authorized personnel.	Warning only for contrAA 800 D + contrAA 800 G Before opening the device hood switch off the device and disconnect the mains plug from the mains connection. The main inlet fuses (F1, F2) may only be replaced by Analytic Jena customer service and authorized technical personnel.
5	Caution! Remove gas-in filter before opening instrument back-side. Achtung! Vor dem Öffnen der Geräterückwand Gas-in Filter abschrauben.	(For meaning see warning text)
6	Vor Öffnen Netzstecker ziehen! Unlock power cable before opening!	Before opening the device hood switch off the device and disconnect the mains plug from the mains connection.

Device front and side panels

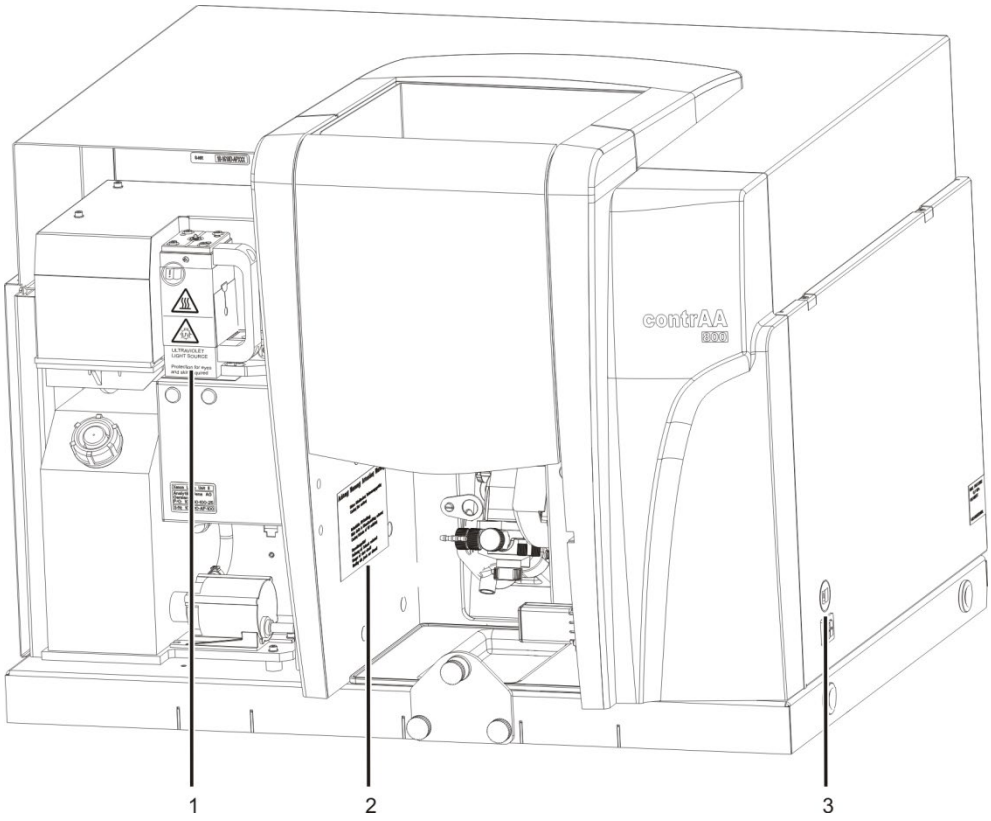


Fig. 2 Warnings and notice signs at the front and side panels

Number	Warning / notice symbol	Meaning and scope
1 (Lamp chamber)		Read the operating manual before commencing work.
		Hot surfaces! Risk of burns at the lamp housing!
	 Ultraviolet light source Protection for eyes and skin required	Dangerous UV radiation! Do not look into the lamp beam without UV protection goggles. Protect your skin against UV radiation.
2	Achtung! Warnung! Attention! Warning! Heiße Oberflächen! Verbrennungsgefahr! Caution! Hot surface! Gefährliche UV-Strahlung! Nicht direkt in Ofenstrahlung / Flamme schauen! Caution! Emission of UV radiation!	(For meaning see warning text)
	Kurzschlussgefahr! Bedienung mit Schmuck verboten! Danger of short circuit! Handling with jewels not allowed!	Short circuit warning only applicable to contrAA 800 D + G!
3		Read the operating manual before commencing work.

Number	Warning / notice symbol	Meaning and scope
– (on height adjustment)		Hot surfaces! Risk of burns at the hot graphite tube furnace and burner!
– (Terminal strip)	Zubehöre nur bei ausgeschaltetem Gerät ein- oder ausstecken! Switch off instrument before connecting or disconnecting accessories!	(For meaning see warning text)
– (left side panel)		Before opening the cover switch off the device and disconnect the mains plug from the mains connection.

Following warning symbol is placed on the autosamplers:

Warning symbol	Meaning and scope
	Warning of sharp object There is a risk of puncture injuries on the autosampler cannula.

2.2 Requirements for the operating personnel

The contrAA 800 must only be operated by qualified specialist personnel instructed in the use of the device. The instruction must also include conveying the content of this user manual and the user manuals of other system components (e.g. solids sampler).

In addition to the safety at work instructions in this user manual the generally applicable safety and accident prevention regulations of the respective country of operation must be observed and adhered to. The operator must ascertain the latest version of these regulations.

The user manual must be accessible to the operating and service personnel at any time!

2.3 Safety instructions, transport and commissioning

Observe the following notes:

- The contrAA 800 is always installed by the customer service department of Analytik Jena or its authorized and trained specialist personnel. Independent assembly and installation are not permitted. Incorrect installation can create serious hazards.
- The various models of the contrAA 800 device family weigh between 140 and 170 kg. Use a lift truck for transport.
- Four people are required to move the device in the laboratory by holding the device on four firmly screwed-in carrying handles.

2.4 Safety instructions - operation

2.4.1 General

Observe the following notes:

- The operator of the contrAA 800 must make sure before each commissioning that the condition of the device including the safety equipment is sound. This applies in particular after each modification or extension of the device or its repair.
- The device must only be operated if all protective equipment (e.g. covers and doors) are in place, properly installed and fully operational. The sound condition of the protection and safety equipment must be checked regularly. Any defects must be corrected as soon as they occur. Protective and safety equipment must never be removed, modified or decommissioned during operation.
- Modifications, conversions and extensions to the device are only permitted after consultation with Analytik Jena. Unauthorized modifications can jeopardize the device's operational safety and may lead to limitations regarding the warranty and access to customer service.
- During operation unobstructed access to the connection at the rear of the device and the mains switch on the ride device panel must always be ensured.
- The ventilation equipment on the device must be in good working condition. Covered ventilation grilles or slits etc. may cause the device to break down or may cause damage to it.
- Prevent any liquids from entering the inside of the instrument. The liquids might get into contact with electronic components and cause a short circuit.
- Caution when handing quartz glass and glass parts. Risk of broken glass and therefore risk of injury!

2.4.2 Safety instructions relating to ambient conditions

- The contrAA 800 may not be operated in hazardous areas. Smoking or open flames in the operating room of the contrAA 800 are prohibited! Keep all combustible materials away from the device.

2.4.3 Safety instructions - electrical equipment

Work on the electrical components of the contrAA 800 may only be performed by a qualified electrical technician according to applicable electro-technical regulations. Lethal voltages may occur in the device! Contact with live components may cause death, serious injury or painful electrical shock.

Observe the following notes:

- The mains plug must be connected to a proper CEE power socket to ensure that the device meets protection class I (ground connector). The device may only be connected to power sources whose nominal voltage is the same as that on the nameplate 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 contrAA 800 and its system components must always be switched off before being connected to the mains.
- Before opening the device, it must be switched off at the device switch and the mains connector must be disconnected from the mains outlet! Any work on the electronics (behind the device enclosure) may only be carried out by the customer service of Analytik Jena and specially authorized technicians.

2.4.4 Safety instructions for flame and graphite techniques

- The Xenon short arc lamp and the frame radiate highly intensive light in the visible and UV range. Do not look into the beam of the Xenon short arc lamp or the flame without UV protection glasses. Protect your skin against UV radiation.
  Never insert a handheld mirror into the beam path e.g. to monitor the drying of liquid samples in the graphite tube furnace. There is a danger of UV radiation being reflected.
- In flame mode, only allow the flame to burn with the sample chamber door locked (safety glass) and not without supervision. Ensure the functionality of the flame guard.
- In hydride technique only work with the sample chamber door locked.
- Danger of UV radiation being reflected!
  Modifications and maintenance in the sample chamber may maladjust the atomization unit. The maladjustment of the atomization unit may result in UV radiation emerging from the sample chamber.

  In the contrAA 800 D the atomization unit is automatically adjusted prior to each measurement start. If the atomization unit is maladjusted during an ongoing measurement, e.g. by an impact, stop and restart the measurement.

  Check the alignment of the atomization unit in the contrAA 800 F. If necessary, realign the atomization unit in the beam path using the adjustment screw (→ section "Aligning the atomization unit in the beam path" p.87).

  Only a few interventions are required in the graphite tube furnace of the contrAA 800 G. The risk of maladjustment is thus precluded.
- High temperatures develop in flame and graphite tube mode. Do not touch hot components, such as the burner head or the Xenon short arc lamp during or immediately after a measurement. Observe the required cooling times.
- The fuel pressure must not drop below 70 kPa to prevent flame backfire. The internal pressure monitor automatically shuts down the contrAA 800 if this condition is not met. Additionally, monitor the pressure at the gas supply manometer.
- When using the graphite tube technique, do not look into the graphite tube opening without protective goggles. Sputtering sample substances and hot graphite particles may cause eye and face injuries.
- No (metallic) jewelry, in particular necklaces, may be worn when working at the contrAA 800 D and G. Otherwise there is a danger of causing a short circuit of the electrically heated graphite tube. Jewelry may also get excessively hot and cause burns.
- Electromagnetic dispersion fields with flux densities ≤ 100 µT occur in the vicinity of the sample chamber due to the heating of the graphite tube.

- The sound level in the graphite tube technique may be up to 55 dBA. If the nitrous oxide/acetylene flame blows back into the mixing chamber, the momentary sound level is below 130 dBA.

2.4.5 Safety instructions relating to ozone and toxic vapors

The UV radiation of the Xenon short arc lamp and the cathode lamps (HCL, D2E) and the nitrous oxide burner flame lead to an interaction with the surrounding air to form high concentrations of ozone. Additionally, toxic byproducts may escape from the samples and during sample processing.

Observe the following notes:

- The contrAA 800 may only be operated with an active exhaust unit.

2.4.6 Safety instructions for compressed gas containers and systems

Observe the following notes:

- The operating gases (argon, acetylene and nitrous oxide) are obtained from compressed gas containers or local liquid gas systems. The required purity of the gases must be ensured.
- Pure oxygen or oxygen-enriched air may not be used as an oxidant in the flame technique. There is a risk of explosion.
- Work on compressed gas containers and systems must only be carried out by individuals with specialist knowledge and experience in compressed gas systems.
- For gas cylinder or gas plant operation, the safety instructions and guidelines which are valid at the operating location must be strictly complied with.
- High pressure tubing and pressure reducers may only be used for the assigned gases. All pipes, hoses and screw connections must be checked weekly for leaks and externally visible damage. Possible pressure losses from closed systems and lines under pressure must be determined. Leaks and damaged must be repaired without delay.
- Incoming piping, screwed joints and pressure reducers for nitrous oxide (N_2O) must be kept free of grease.
- Caution should be taken with escaping acetylene! Acetylene forms highly flammable mixtures with air. The gas is clearly distinguishable from its garlic-like odor.
- Operate the acetylene cylinder only in an upright position and secured against falling over. When the cylinder pressure is lower than 100 kPa, the acetylene cylinder must be replaced to avoid acetone entering the automatic gas control.
- The operator must carry out weekly safety checks regarding the status and for leaks on all gas supplies and connectors up as far as the device itself. Possible pressure losses from closed systems and lines under pressure are to be determined. Leaks and damaged must be repaired without delay.
- The gas supply must be closed prior to servicing and repairs!

- After successful repair and service of the components of the compressed air containers or system the device must be checked for sound operation prior to recommissioning!
- Independent assembly and installation are not permitted!

2.4.7 Handling of samples, auxiliary and operating materials

Observe the following notes:

- 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 dangerous substances local safety codes and guidelines must be observed.
- Warnings on the labels must always be observed. Only use labeled containers. Use suitable body protection (coat, safety glasses and rubber gloves) when handling samples, auxiliary and operating materials. Ensure sufficient ventilation.
- High temperatures develop in flame and graphite tube mode. Do not move flammable and explosive substances close to hot components, such as the burner head or the Xenon short arc lamp.
- Cleaning with hydrofluoric acid must be carried out in an exhaust chamber. When handling hydrofluoric acid rubber aprons, gloves and face masks must be worn.
- **Biological samples** must be handled according to local guidelines regarding the handling of infectious material.
- When measuring **material containing cyanide** you have to make sure that **prussic acid** cannot be generated in the waste bottle, i. e. the waste solution must not be acidic.
- Ensure that all residue liquid from the nebulizer and the automatic sampler is directed into the collection bottle supplied.
- The operator is responsible for ensuring that **waste materials** such as drained coolant, compressor filter residue or residue liquid from the collection bottle are disposed of in an environmentally responsible manner and according to local regulations.

Special care is required when handling organic solvents. Prior to use the safety data sheet must be reviewed for potential risks.

Organic solvents	Potential risks
Methyl isobutyl ketone (MIBK)	Flammable, highly volatile, noxious-smelling
Toluene	Flammable, hazardous to health
Kerosene	Flammable, hazardous to the aquatic environment, hazardous to health
Methanol, ethanol, propanol	Flammable, partly acutely toxic
Tetrahydrofuran (THF)	flammable, hazardous to health, extremely volatile, dissolves polyethylene and polystyrene

The above list is in so far incomplete that other solvents might also be used in the contrAA 800. If uncertain about the risk potential, consult the manufacturer.

2.4.8 Decontamination after biological contamination

Observe the following notes:

- The operator is responsible for carrying out suitable decontamination should the device be contaminated externally or internally with dangerous substances.
- Spots, drops or larger spillages should be removed and cleaned using an absorbent material such as cotton wool, laboratory wipes or cellulose. Next wipe the affected areas with a suitable disinfectant, e.g. Incidin Plus solution.
- Before using a cleaning or decontamination procedure other than that prescribed by the manufacturer, the user is required to check with the manufacturer that the intended procedure will not damage the device.

2.5 Safety equipment / behavior during emergencies

Observe the following notes:

- If there is no immediate danger of injury, during emergency situations or incidents, shut down the contrAA 800 without delay from the mains switch at the right side panel.
- Disconnect the mains plug from the mains outlet.
  In the contrAA 800 F disconnect the 5-way socket (with the connections for AAS and accessories) from the mains outlet.
- Close the gas supply as soon as possible after switching off the device.

2.6 Safety instructions for service and repair

Observe the following notes:

- The contrAA 800 is usually serviced by the customer service department of Analytik Jena or its authorized and trained specialist personnel. Independent servicing can maladjust or damage the device. The operator may generally only carry out the tasks listed in chapter "Service and maintenance" p. 76ff.
- The exterior of the contrAA 800 may only be cleaned with a damp, not dripping, cloth. Use only water and, if required, customary surfactants.
- For cleaning the sample compartment and transport channels (hose system) of the contrAA 8000 the operator is responsible for establishing appropriate safety precautions – particularly in terms of contaminated and infectious materials.
- If water or other liquids are found to leak out of the instrument, contact the service engineers.
- Use only original spare parts, wear parts and consumables. They have been tested and ensure safe operation. Glass parts are wear parts and are not subject to the warranty.
- Clean all device components from biologically hazardous, chemical and radioactive contamination before returning the device to Analytik Jena. The decontamination report is available from service when registering the return. Complete the form and attach the signed decontamination declaration to the outside of the shipment.

3 Installation conditions

3.1 Environmental conditions

The contrAA 800 may only be operated in closed rooms. The location must have the appearance of a chemical laboratory. The location must meet the following conditions:

- It must be devoid of dust, drafts, vibrations and caustic fumes.
- Do not place the contrAA 800 near sources of electromagnetic interference.
- Avoid direct sunlight and heater radiation on the contrAA 800. In extreme cases, provide acclimatized conditions in the room.
- A separate room is recommended for sample preparation and storing chemicals.

The following requirements are placed on the climatic conditions in the operating room of the contrAA 800:

Temperature range	+5 °C to +40 °C
Max. humidity:	90% at 40 °C
Air pressure	0.7 bar to 1.06 bar
Recommended max. altitude	2000 m

The requirements for the environmental conditions are identical for the operation and the storage of the contrAA 800.

3.2 Energy supply

WARNING

Observe the mains connection!

During electrical installation, observe the VDE (German Association for Electrical Engineers) electrotechnical guidelines and local regulation requirements! The mains supply must be correctly earthed. Do not use an adapter in the mains cabling.

contrAA 800 D + G

The models contrAA 800 D and contrAA 800 G are operated from a single phase alternating current mains. The current load can reach 85 A for a short period (1 s) during maximum heating. The mains voltage at the contrAA 800 should not decrease by more than 6 % during this period. For any deviation from these values, please contact Analytik Jena. Appropriate accessories can be supplied.

Optimum device function strongly depends on a correct mains connection with adequate cable cross-section. The mains connection shall be protected on the input (building) side with a 35 A slow-blow fuse and must be installed prior to delivery of the contrAA 800 near the installation location. The instrument cable is 3 m long. The CEE surface socket (2 pole + E Blue 5UR 3 206-2 220/32, Siemens) is supplied according to the terms of delivery.

All other components (e.g. PC, hydride system etc.) are connected via the 5-way socket strip supplied, which is plugged into the rear of the contrAA 800 D and G and connected to the same phase as the base device itself. If you use your own PC-printer configuration, and if it is connected via the 5-way adapter, please observe the limit of the permitted line current. To avoid sudden voltage fluctuations, do not connect the contrAA 800 to the same electrical circuit as other power-intensive devices.

Connection conditions

Voltage	230 V ~ or different if specified in conditions and terms of supply
frequency	50 / 60 Hz or different if specified in conditions and terms of supply
Typical average power consumption	2100 VA
Maximum current consumption	85 A over a 1-sec period or 52 A over 8 s
Fuse provided (mains side)	35 A, safety fuse, slow blow, single phased Do not use automatic fuse devices!
Power consumption of the hydride system	650 VA while heating the cell 400 VA in continuous operation

contrAA 800 F

The contrAA 800 F is operated from a single phase alternating current mains. Optimum device function strongly depends on a correct mains connection with adequate cable cross-section. The mains connection must be protected with a 16 A slow blow fuse in the building. The instrument cable is 2 m long.

All other components (e.g. PC, hydride system etc.) are connected via the 5-way socket strip supplied to the same phase as the base device. If you use your own PC-printer configuration, and if it is connected via the 5-way socket strip, please observe the limit of the permitted line current. To avoid sudden voltage fluctuations, do not connect the contrAA 800 to the same electrical circuit as other power-intensive devices.

Connection conditions

Voltage	100-240 V ~ or different if specified in conditions and terms of supply
frequency	50 / 60 Hz or different if specified in conditions and terms of supply
Typical average power consumption	460 VA
Fuse provided (mains side)	16 A single phase
Power consumption of the hydride system	650 VA while heating the cell 400 VA in continuous operation

3.3 Gas supply

WARNING

Explosion hazard from escaping acetylene! Danger of a low oxygen atmosphere developing due to escaping gas!

The operator must ensure that the connector type used on the outlet side of the gas pressure controller is adequate for the national requirements that shall apply.

The operator must carry out the necessary safety leakage tests weekly on all gas supplies up as far as the device. For this, possible pressure losses from closed systems and lines under pressure are to be determined. The leak is to be localized and corrected immediately.

If the gas is supplied by pressure cylinders, these must be secured to the wall in an upright position with cylinder mounts outside the laboratory space.

3.3.1 Gases in the graphite tube technique

The inert gas argon is used to protect the graphite components of the atomizer, which are subjected to extreme temperatures. The inert gas is also used as a means of transport for the pyrolysis components accrued during the analysis. The purity of the inert gas is extremely important for the analysis and for the lifetime of the graphite tube.

By the introduction of an additional gas during the pyrolysis step (e.g. compressed air), the ashing of the sample, i.e. the removal of the matrix components, can be accelerated. The auxiliary gas is fed in through the “Gas Auxiliary” connection (5 in Fig. 28 p.50) on the rear of the device.

The inlet pressure to the spectrometer must be between 6 and 7 bar (600-700 kPa).

The required pressure reducing valve for the argon gas cylinder, and the argon pressure tubing are supplied. The standard hose length is 5 m. If other hose lengths are preferred, please contact the customer service of Analytik Jena.

Recommended inert gas		Inlet pressure	Consumption
Argon 4.8 or superior		6-7 bar	max. 2 L/min (depending on the temperature/time program)
Permitted components:			
Oxygen	≤ 3 ppm		
Nitrogen	≤ 10 ppm		
Hydrocarbon	≤ 0.5 ppm		
Humidity	≤ 5 ppm		
Additive gas Compressed air, oil-free, grease-free, particle-free		6-7 bar	

3.3.2 Gases in the flame technique

For the flame technique, oxidants (compressed air or nitrous oxide) as well as acetylene are required as fuel. The purity of the gases is of decisive importance for the analysis. For the compressed air supply the piston compressor PLANET L-S50-15 is available. If compressed air is supplied by the operator’s own compressed air connection, please consult the customer service of Analytik Jena. Nitrous oxide and acetylene is supplied by pressure cylinders or by an existing mains line.

The pressure tubes are supplied. The pressure reducing valves are optional.

- Hose length for cylinder connection 5 m
- Hose length for compressor 5 m

It is also possible to connect other tube lengths. Please consult the customer service of Analytik Jena.

Fuel gas and oxidant	Inlet pressure	Consumption
Compressed air, oil-free, grease-free, particle-free	4-6 bar (≙ 400-600 kPa)	Max. 825 NL/h
N_2O, oil-free, grease-free, purity 2.5	4-6 bar (≙ 400-600 kPa)	Max. 660 NL/h
Acetylene Purity 2.5 (for flame photometry): Superior to 99.5 vol% relative to C_2H_2, without acetone	0.8-1.6 bar (≙ 80-160 kPa)	Max. 315 NL/h

3.4 Exhaust unit

CAUTION

Risk of gas poisoning!

Switch on the exhaust unit before switching on the contrAA 800. Direct waste air out of the laboratory and avoid blockages!

The exhaust unit should remove health-damaging burning residues from the flame as well as ozone. Ozone is caused by the reaction of air and UV radiation from the Xenon short arc lamp and the burner flame. Use an exhaust unit made of heat and corrosion-resistant material. The first 6 m of the exhaust unit should be made of metal.

Parameter	Properties
Material	Heat and corrosion resistant (recommended: V2A steel)
Exhaust performance for nitrous oxide flame	Approx. 8 to 10 m^3/min
Exhaust performance for air flame	Approx. 5 m^3/min
Hood opening	Approx. 300 × 300 mm
Distance to the upper edge of the device	Approx. 200 to 300 mm
Tube diameter	Approx. 100 to 120 mm

3.5 Device layout and space requirements

The contrAA 800 is a compact device designed for table-top operation. The required space depends on the number of components needed for measurement. A minimum distance of 15 cm from the device and system components to walls and adjacent installations must be maintained.

The PC with the monitor, the printer and the keyboard are arranged beside the base device. PC and printer may also be placed on a separate table.

Arrange the workbench to allow easy access from all sides. In addition, the workbench must meet the following requirements:

- Minimum dimensions:
  1800 mm × 700 mm, select the height according to ergonomic requirements
- Load capacity of the workbench: min. 200 kg
- Table tops resistant to wiping, scraping and corrosion, water-repellent

The samplers for the flame mode AS-F or AS-FD are hung in the sample chamber of the contrAA 800. The storage bottle for wash liquid of the AS-F or the Fluidik module of the AS-FD are placed next to the AAS device.

The accessories for the graphite tube technique are also suspended in the sample chamber: Autosampler AS-GF for dissolved samples or Solid Autosampler SSA 6 or SSA 600.

The accessories for the hydride technique (e.g. HS 60 modular) are placed on an additional table in front of the contrAA 800.

The following are located on the floor near the device:

- the collection bottle for sample liquid residue, autosampler wash liquid residue and residue liquid of the hydride system
- the piston compressor PLANET L-S50-15 (flame technique only)

Components	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
On the workbench				
contrAA 800	780	625	775	D: 170 G: 170 F: 140
AS-GF	250	550	380	7.2
AS-F	340	350	460	6.5
AS-FD				
Sampler	340	350	460	6.5
Fluidik module	360	310	165	3.5
HS 60 modular	360	370	240	14
HS 55 modular	360	370	240	14
HS 50	270	210	190	2
Under the workbench				
Compressor PLANET L-S50-15	∅ 400	490		27
Waste bottle	∅ 200	400		

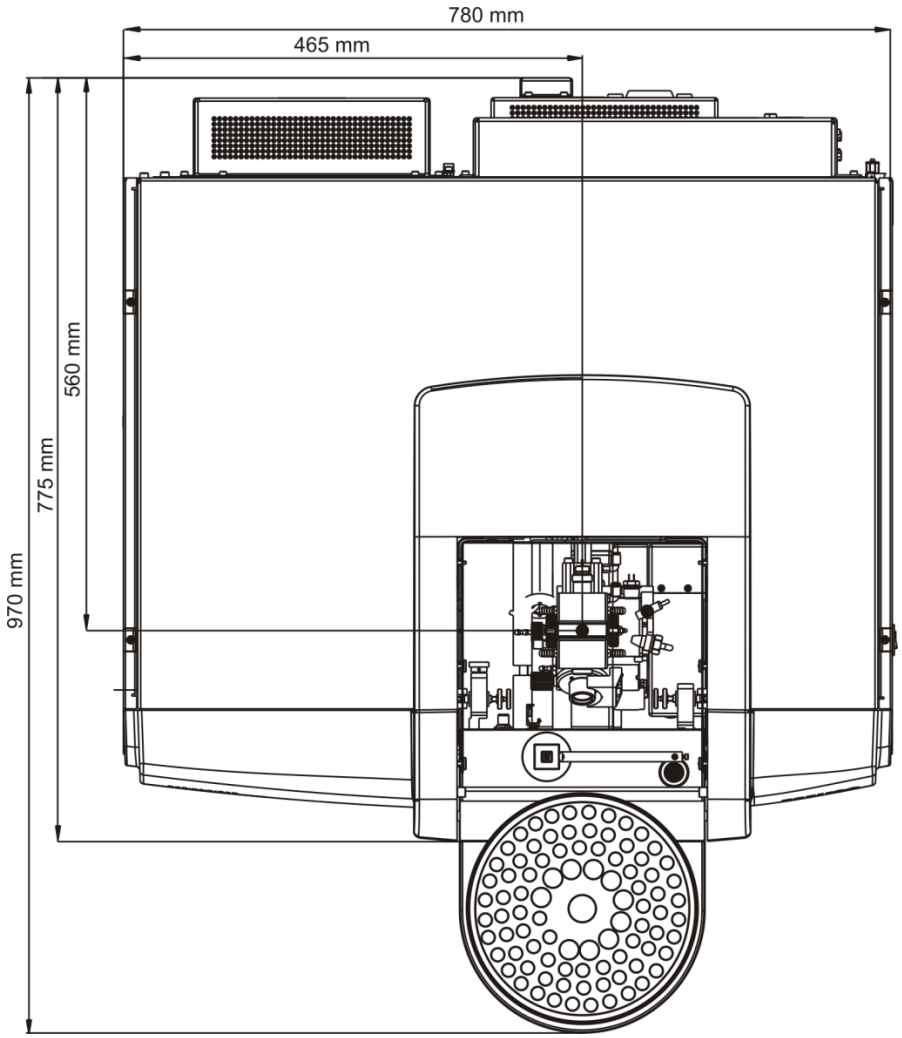


Fig. 3 contrAA 800 dimensions – top view (with autosampler AS-GF)

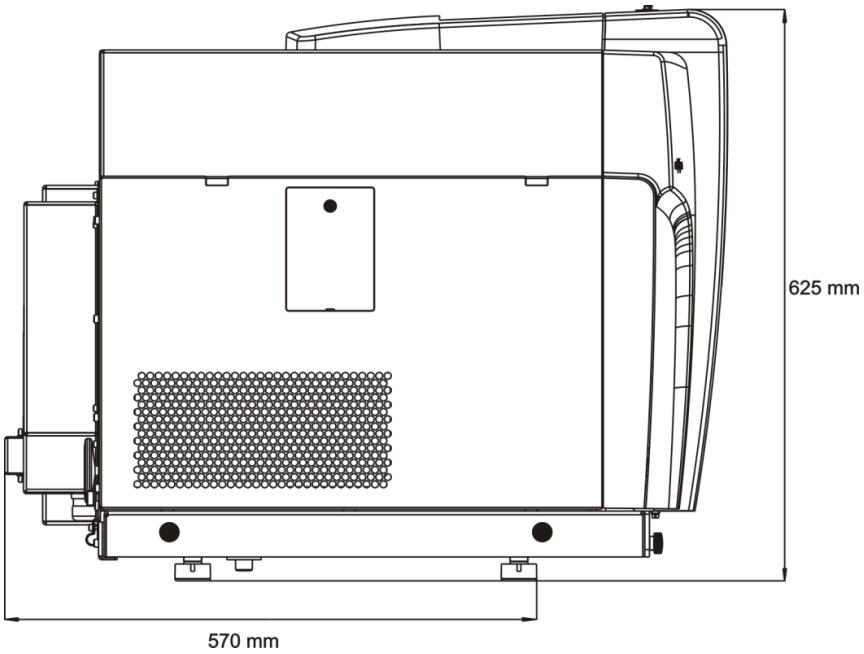


Fig. 4 contrAA 800 dimensions – side view

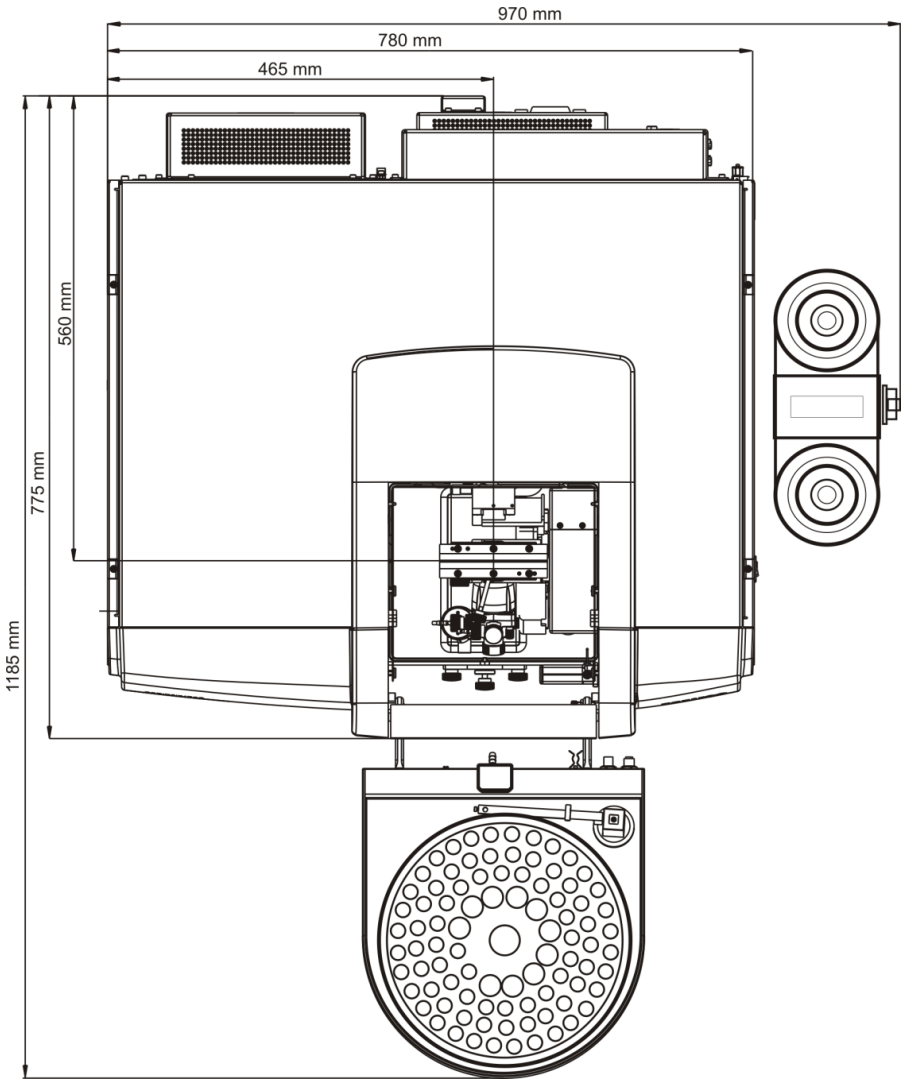


Fig. 5 contrAA 800 dimensions – top view (with autosampler AS-FD)

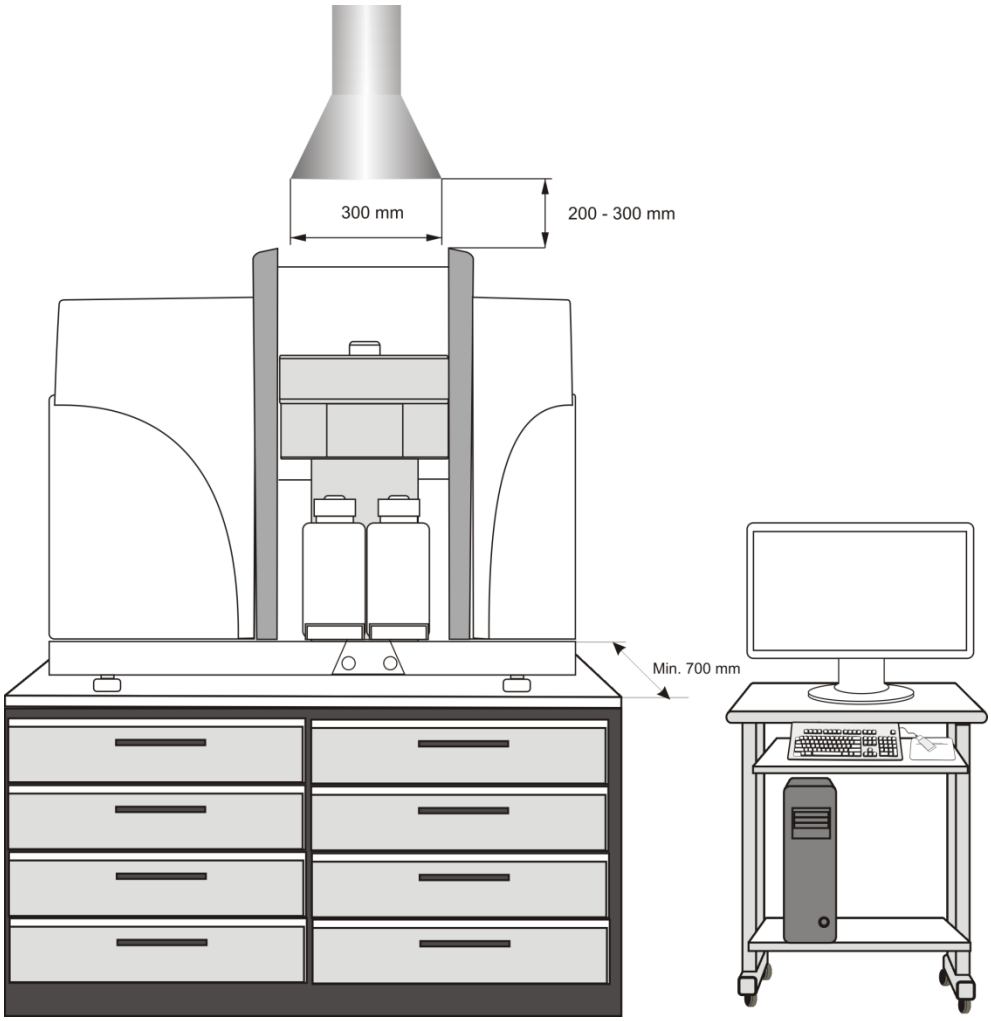


Fig. 6 contrAA 800 workspace with exhaust unit

4 Functions and layout

4.1 Physical principle of measurement HR-CS AAS

The principle of measurement of the High Resolution Continuum Source Atomic Absorption spectrometry (HR-CS AAS) as well as the classic line radiator AAS (LS AAS) is the absorption of a primary radiation by analyte atoms n the basic state. In this, the absorption signal is a measure for the concentration of the relevant element in the analyzed sample.

Each AAS device consists of the following basic components:

- Radiation source
- Atomizer
- Monochromator
- Detector
- Evaluation unit (PC)

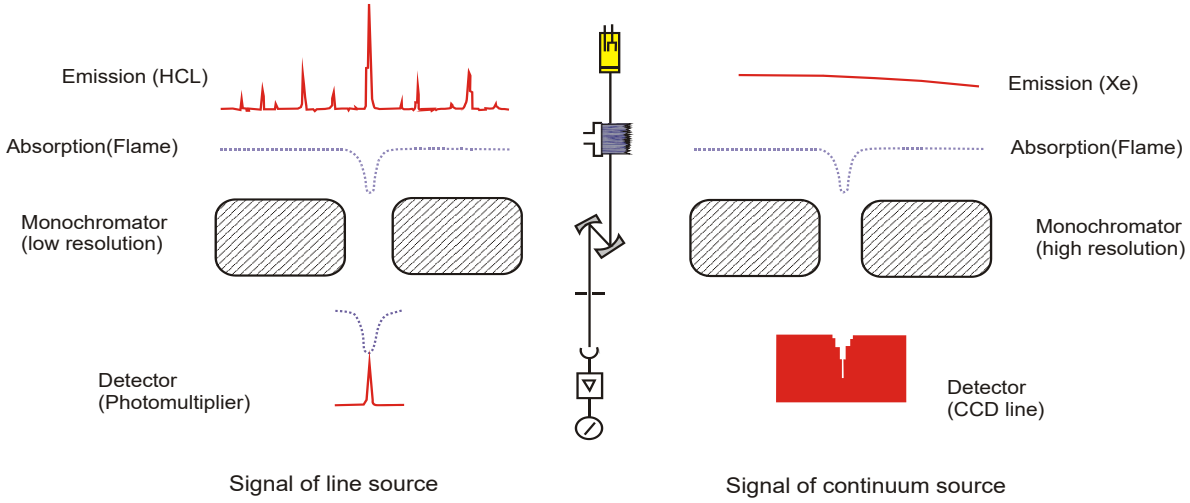


Fig. 7 principle of measurement of LS AAS and HR-CS AAS

Radiation source

In the HR-CS AAS the element-specific radiation source of the classic LS AAS (hollow cathode lamp, HCL) has been replaced with a single continuous radiator for all elements and lines – a Xenon short arc lamp–. With the special electrode geometry and the characteristic internal pressure of the Xenon short arc lamp a hot spot is formed that guarantees a radiation temperature of approx. 12 000 Kelvin and a seamless emission across the entire spectral range (185 nm-900 nm). Sufficient radiation energy is therefore available at any time for all analysis lines of interest – both at the resonance wavelengths of the analysis elements and at all secondary wavelengths. Restrictions due to the specifics of HCL, such as outlet windows and emission intensity, do not apply. In addition absorption lines or bands of two-atom molecules (PO, CS, ...) can be utilized analytically for element detection.

Atomizer

The following atomizer techniques are intended for the various models of the contrAA 800 device family:

Atomizing technique	contrAA 800 F	contrAA 800 G	contrAA 800 D
Burner/nebulizer system (flame technique)	✓	–	✓
Transverse-heated graphite tube (graphite tube technique)	–	✓	✓
Cell unit (hydride and mercury cold vapor technique)	✓	–	✓
Transverse-heated graphite tube with Ir/Au coating (HydrEA technique)	–	✓	✓

The graphite tube atomizer and the burner/nebulizer system (BNS) are located in a single sample chamber in the combination unit contrAA 800 D. The change of atomizing technique and its alignment in the beam path are software-controlled. Thanks to the motorized swivel arm not device conversion is required. Only some accessories need to be removed prior to the change.

Fig. 8 Sample chamber of the contrAA 800 D

The contrAA 800 F (flame) and contrAA 800 G (graphite) only have one atomizer each. The height of the atomization technique can be aligned in the beam path through software control. The depth has been adjusted at factory and can be manually readjusted using an adjustment screw or adapted to different accessories.

Fig. 9 Sample chamber of the contrAA 800 F

The cell unit of the hydride systems is placed onto the mixing chamber instead of the burner in the contrAA 800 D and F.

Alternatively, the hydride technique can be coupled to the graphite tube technique in the combination unit contrAA 800 D and the contrAA 800 G. They hydrEA technique ("**Hydr**ide technique with **e**lectrothermal **A**tomization") is based on the metal hydrides or mercury vapor being enriched on the iridium or gold coated preheated graphite tube and atomized at 2100 °C (metal hydride) or 800 °C (mercury). This achieves a very high sensitivity.

Finally, the models of the contrAA 800 device family with graphite tube technique (contrAA 800 D and G) are also suited for direct solids analysis in combination with the special solids samplers SSA 6z or SSA 600. By detecting the trace elements directly in the solid sample, the time-consuming and contaminating sample digestion representing the major error source in solution analysis is eliminated.

Monochromator

The selectivity of analysis is implemented by the high-resolution double monochromator on the basis of a prism and an echelle grating monochromator (High-Resolution Optics). This achieves a very compact design and a high spectral resolution which corresponds to a spectral resolution of < 2 pm per pixel at 200 nm. The monochromator uses an integrated neon radiator for wavelength stabilization. The spectrometer has been calibrated for air and the selectable argon optics rinse and ensures high reproducibility when approaching a wavelength. During operation the prism is also automatically recalibrated with the aid of a swivel mercury cell at a wavelength of 253 nm. The integrated prism calibration contributes to the high wavelength stability of the spectrometer.

The operator can flush the entire optics of the contrAA 800 software-controlled with argon or air. Flushing with argon increases the sensitivity of the analysis system in the UV range at wavelengths λ < 200 nm. Here, the detection of elementary lines is interfered with by the wide molecule bands of oxygen. Argon flushing improves in particular the detection of the elements arsenic and selenium. Oxygen flushing of the spectrometer is recommended for working in dusty environments, such as prevalent in a mine. The dispersion of the radiation by solid particles can be significantly reduced by flushing.

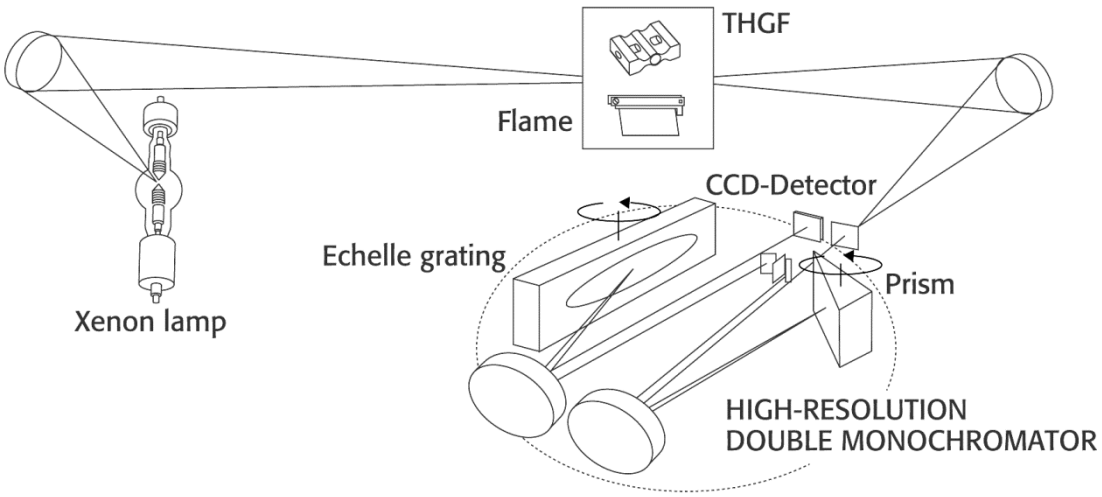


Fig. 10 Beam path in the contrAA 800

Detector

A low noise, UV-sensitive semiconductor detector (CCD matrix detector) is located at the exit slit of the monochromator. This detector not only registers the intensity of the analysis line, but also its spectral neighborhood in a preselectable pixel range.. In this way, a spectral range of up to 1 nm in the vicinity of the analysis line is detected simultaneously and at a high resolution.

Evaluation unit

Background correction is either through polynom forming across selected support points or optimized filter functions (IBC). The user can select the support points directly. However, by default they are selected automatically by the software. A special algorithm calculates the support points dynamically for each spectrum and approximates the baseline as precisely as possible to the actual baseline at the measuring pixel. A multivariate method automatically corrects overlaps of the analysis wavelength and finely structured background. To this end reference spectra are used for matrix components to adapt the polynom-forming "least squares". The spectrum is then corrected with the aid of adjacent spectral lines of the interfering elements located in the observation width of the detector (e.g. correction of the spectral interference of Fe on the analysis wavelength of Zn at 213 nm or Se at 196 nm).

The available background correction methods immediately remove all wide-band effects and lamp drift from the spectrum. This implements a simultaneous two-beam system with only one optical path. The measuring signals are clearly more stable than in the classic LS AAS. With sensitivity comparable to that of the LS AAS the contrAA 800 further achieves a significantly improved signal/noise ratio and thus lower verification and detection limits. The extremely low noise CCD matrix detector and very high radiation intensity of the high energy Xenon short arc lamp prove to be most beneficial.

4.2 Xenon short arc lamp

The contrAA 800 features a Xenon short arc lamp as continuous radiator.

With its special electrode geometry and physical-technical parameters a hot spot forms to emit a high radiation intensity across the entire spectral range relevant for AAS of 185-900 nm.

During the analysis the position of the hot spot is controlled and adjusted automatically. No warm-up effects due to lamp drift are therefore expected. Any drift of the Xenon short arc lamp is simultaneously removed from the spectra by calculation using correction pixel referencing.

Fig. 11 Xenon short arc lamp without housing

4.3 Cooling water circuit

A low maintenance cooling system is integrated in the spectrometer for heat dissipation from the Xenon short arc lamp and graphite tube furnace. It is based on the water/air heat exchange principle and can be operated with tap water (with additives for frost protection and biocide). The pump starts automatically as soon as water is present in the system. Elaborate venting is not necessary.

The temperature of the cooling water circuit is measured using two safety circuits. These prevent temperature-sensitive components from overheating. The cooling water flow is monitored to prevent the pump from running dry.

The pump is coupled directly to the cooling water tank. The complete unit consisting of pump and tank can be removed easily from the lamp chamber for maintenance.

4.4 Electrothermal atomizer

The electrothermal atomizer (EA) is an integral part of the contrAA models contrAA 800 G and D and the key component for working in EA mode and the HydrEA technique.

The furnace system is equipped with a graphite tube, which is heated through contact pieces aligned transversely to the tube jacket. The transversely heated graphite tube serves as atomizer for the liquid sample injected by means of the autosampler AS-GF or the sample carrier populated with a small solid sample volume supplied via the solid sampler. The graphite tube is moved to the desired temperature in the furnace by a microprocessor-controlled resistance heating.

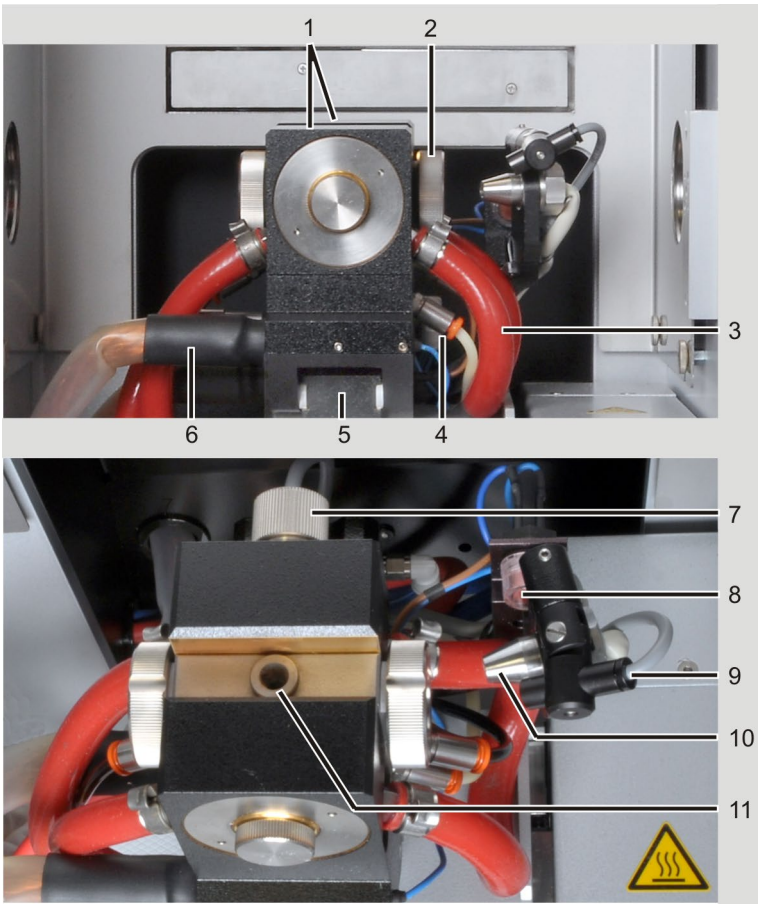


Fig. 12 Graphite tube furnace in the sample chamber

1 Furnace jaws with electrodes
2 Furnace window
3 Cooling water connections: red hoses
4 Gas connections: white and black hoses
5 Position adjustment
6 High voltage cable
7 Sensor connection for cooling water temperature
8 Fuse at the graphite tube furnace
9 Illumination for furnace camera
10 Radiation sensor
11 Dosing opening with graphite funnel insert

Graphite tube furnace characteristics

- Constant temperature ratios along the entire tube length
- Realization of linear temperature-time runs according to a sensorless control model on the basis of saved thermoelectrical parameters and an adaptive control
- Protective gas flows, independent of each other and symmetrical to the furnace center, which ensure effective graphite tube and furnace window cleaning, and which also ensure fast and safe transport of the thermally disintegrated products of the sample for disposal
- Low consumption of protective gas, at the same time ensuring effective protection against interference with atmospheric oxygen.

In combination with the background correction the graphite tube technology achieves high selectivity and sensitivity allowing for traces and ultra-traces to be detected even in samples with complicated matrix.

In the analysis, each sample runs through a furnace program (temperature-time program). The furnace program consists of four basic steps:

- Drying the sample
- Thermal pretreatment, separating (ashing or pyrolysis of) distorting sample incidental substances (matrix)
- Atomizing the sample
- Cleaning the graphite tube and preparing for the next measurement

The operator can optimize these basic steps for each analysis problem with the ASpect LS control software.

4.4.1 Graphite tube furnace

The height of the graphite tube furnace is automatically adjustable to position the graphite tube optimally within the beam path. In the combination unit contrAA 800 D the graphite tube can also be aligned in depth with the beam path through software control. In the contrAA 800 G the depth of the graphite tube furnace is set at factory but can be readjusted manually via an adjustment screw.

The transversely heated graphite tube is pneumatically pushed and held against the ring-shaped electrodes. The electrodes are installed in two water-cooled metal bodies, the fixed and the movable furnace parts. There is another graphite component located between the metal bodies that support the electrodes, the furnace jacket. Together with the electrodes it forms an enclosure around the graphite tube, which stabilizes the thermal radiation conditions of the graphite tube and also guarantees chemically inert conditions. The graphite tube is pre-adjusted through defined support points in the furnace when the atomizer is open. When the movable furnace part is closed, the tube is reproducible lifted into the final position and pressed into the contacts, without coming into contact with the furnace jacket.

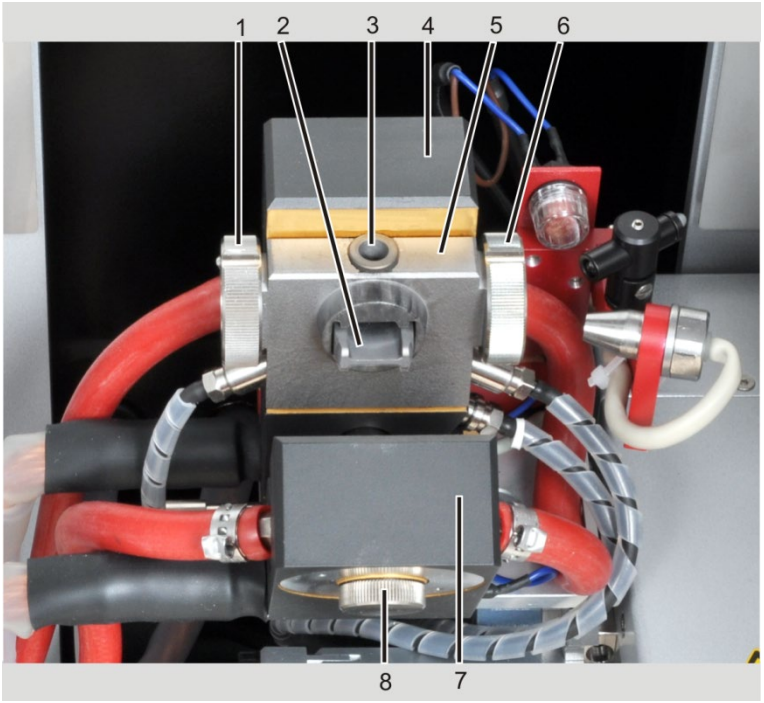


Fig. 13 Graphite tube furnace, open

1 Furnace window
2 Graphite tube, inserted
3 Dosing opening with graphite funnel insert
4 Fixed furnace part
5 Furnace jacket
6 Furnace window
7 Upper furnace part, open
8 Water channel lock

4.4.2 Gas flows in the furnace jacket

The furnace jacket houses the gas channels for the separate supply of the primary gas flow (purge gas) and the outer gas flow (protective gas). To support pyrolysis, oxidizing or reducing gases can be added to the primary gas flow. When using compressed air, temperatures > 500 °C should be avoided since the graphite tube itself will then be attacked.

The primary gas flow has the task of removing all gases which occur in the graphite tube during drying and pyrolysis.

At the same time the primary gas flow prevents condensation of the analytes on the furnace windows and of influencing the residence time of the analyte atoms in the beam path. During atomization, the primary gas flow is generally interrupted in order to achieve the longest possible residence time for the atoms in the beam path of the graphite tube. The desired result is a high sensitivity.

The outer gas flow sweeps the graphite tube and is directed through the funnel insert to the outside. The outer gas flow is responsible for ensuring that the graphite tube is surrounded by inert gas and thus protects it against oxidation by atmospheric oxygen.

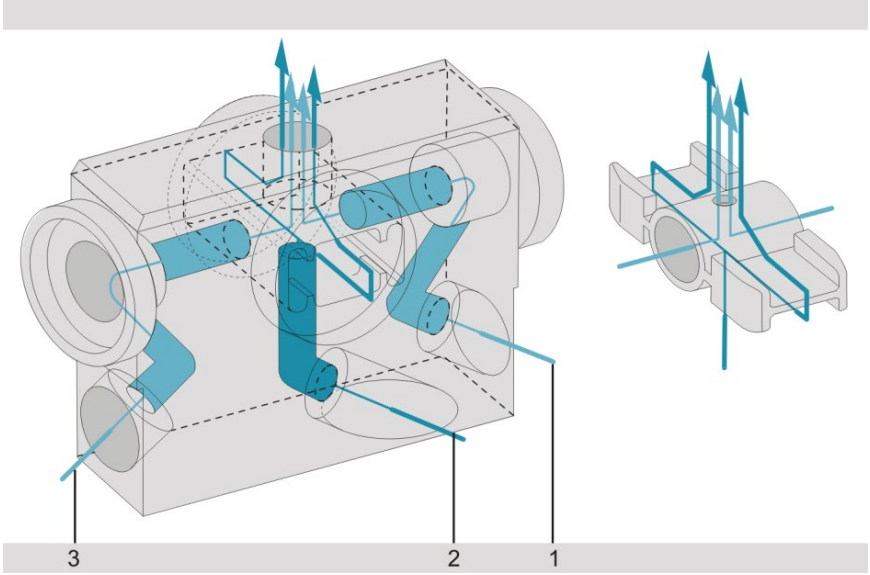


Fig. 14 Primary and outer gas flows in the graphite tube furnace

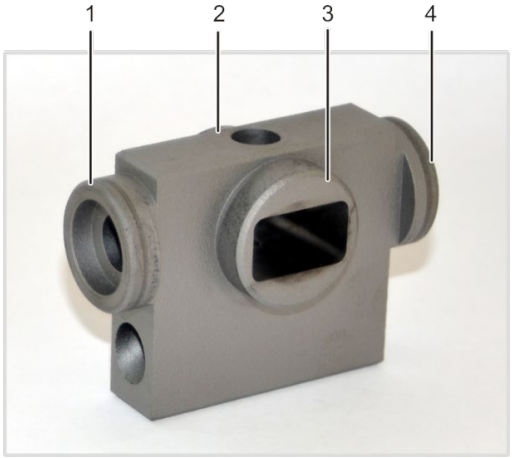
1, 3 Primary gas flow (purge gas)
2 Outer gas flow (protective gas)

The heat flows inside the furnace jacket via a cylindrical attachment to the fixed furnace part. This may increase the temperature of the atomizer's internal walls to the extent that condensation of the analytes (the sample) is avoided.

The cone attachment on the opposite side of the furnace jacket forms together with the insulating ring an exactly defined gap in the rotatable part of the furnace, ensuring that the cell interior is sealed against ingress of ambient air. In the event of a tube rupture in the furnace jacket, the insulating ring in the movable furnace part prevents a short circuit between the furnace parts.

The furnace jacket is drilled through in the direction of the optical axis, the outer cylinders support the furnace windows (quartz cell windows). For cleaning, the windows can be pulled off with a twisting motion.

When changing from the wall tube to the platform tube or to the solid tube for solids analysis, it should be remembered that these special graphite tubes intersect the free opening for the beam passage on one side. When selecting the corresponding technique, the motorized height adjustment moves software-controlled to the optimum height position.



1, 4 Cylinder for furnace windows
2, 3 Mount: Cone attachment

Fig. 15 Graphite tube jacket

4.4.3 Graphite tube versions, furnace parts and inserts

Three graphite tube versions are available:

- Standard graphite tube (wall tube)
- Graphite tube for solid analysis
- Graphite tube with PIN platform

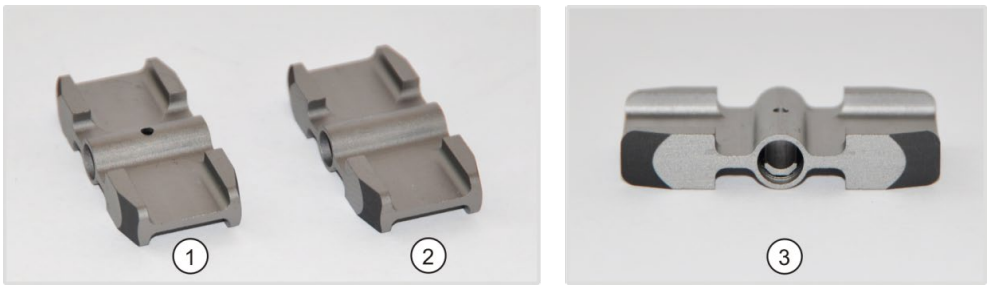


Fig. 16 Graphite tube versions

1 Graphite tube, standard
2 Graphite tube for solid analysis
3 Graphite tube with PIN platform

Graphite tube version	Total addable volume
Standard graphite tube	max. 50 µL
Graphite tube with PIN platform	max. 40 µL
Standard graphite tube for solid analysis (without dosing opening)	Max. 3 mg

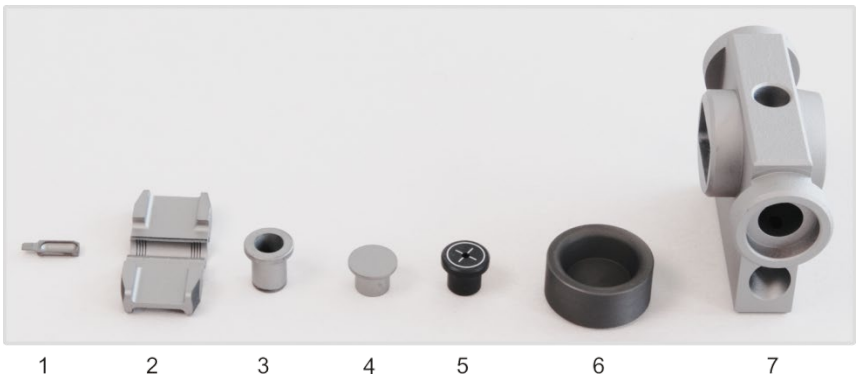


Fig. 17 Furnace jacket, adapters and inserts

No.	Furnace Part / Insert	Function
1	Solid sample carrier	Adapter for solid samples
2	Solids adjustment aid internal & external	Adjusting the solid autosampler SSA 600
3	Pipetter insert	Funnel opening to the pipetting channel
4	Solid adapter	Sealing cap for pipetter opening
5	Liquid adjustment aid	Adjusting the autosampler AS-GF
6	Electrode (2 per furnace)	Electrical contact to the tube wing
7	Furnace jacket	Adapter for graphite tube

4.4.4 Radiation sensor

The radiation sensor is located on the right side of the graphite tube furnace and is inclined in relation to the direction of radiation (10 in Fig. 12 p.33). It recalibrates the tube temperatures by receiving radiation from the interior of the graphite tube on a sandwich receiver. Using two wavelengths for detection, an independent quotient signal is derived for temperature measurement which is independent of the degree of radiation of the graphite tube. Recalibration takes place when formatting the graphite tube.

4.4.5 Furnace camera

The furnace camera can be activated through software control. The image of the furnace camera is then displayed on the ASpect CS workspace in a separate window. The furnace camera monitors the process, beginning with the injection of the sample into the graphite tube through to completion of drying. The user can thus check and correct the dipping of the dosing tube into the graphite tube, the dispensing of the sample and other components as well as the drying procedure. Prior to the pyrolysis the furnace camera switches off automatically. To illuminate the graphite tube an illumination device (9 in Fig. 12) has been fitted to the side of the furnace and is witched on with the furnace camera.

4.5 Accessories for the graphite tube technique

4.5.1 Autosampler AS-GF

The autosampler AS-GF is used in the graphite tube technique for feeding liquid samples. In the HydrEA technique it supplies the reaction gas to the graphite tube. Manual pipetting is not recommended because of poor reproducibility.

1 Autosampler arm with cannula restraint
2 Hose guide with dosing hose
3 Sample tray with sample tray cover
4 Dosing unit (500 µL)
5 Waste bottle
6 Storage bottle for wash solution (or diluent)

Fig. 18 Autosampler AS-GF

The autosampler AS-GF accepts defined volumes of different solutions and places them into the graphite tube. It enables the

- Addition of up to five modifiers to the sample solution
- Transport of the sample solution to the thermal pretreatment in the tube
- Enrichment of samples
- Placement of components in the preheated tube
- Separate transport of components with intermediate washing
- Automatic preparation of standards by dilution or by different volumes
- Fixed, preselected or intelligent sample dilution
- Fully automatic multi-element mode (night mode possible)

The sample tray of the AGS-GF has space for 100 sample cuts (with V = 1.5 mL) and 8 central cups for diluent, special samples, standards, modifiers etc. (with V = 5 mL).

The AS-GF is hung in the adapters provided in the sample chamber and electrically connected to the contrAA 800. The device parameters of the AS-GF are set with the ASpect CS control software.

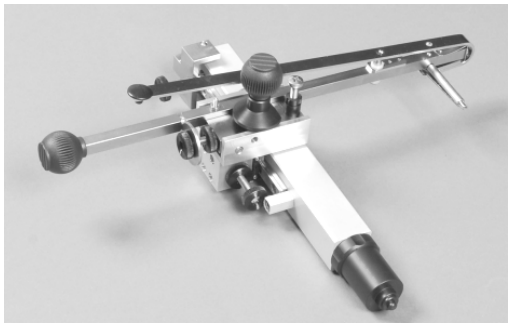
4.5.2 Solid samplers SSA 600 and SSA 6z

The solid autosamplers SSA 600 and SSA 6z are a condition for solids analysis in the graphite tube technique. They alone feed the IC sample carriers populated with solid sample reproducibly into the graphite tube.

The solid autosampler SSA 600 transports the solid samples fully automated into the graphite tube furnace. The integrated micro-scale weighs the samples and takes care of the sample weights for analysis. The solid autosampler SSA 600 has 84 sample positions when using two sample plates. The model SSA 600L can also dose liquid standards to the contrAA 800 with its liquid dosing unit.

The SSA 6z has been conceived for manual operation and requires an external balance. The sample mass must be transferred manually to the sample table.

A full description of the solid autosamplers can be found in the operating instructions "Solid Autosampler SSA 600" or "Solid Autosampler SSA 6z".



Top: SSA 6z for manual sample supply

left side: SSA 600 for automatic sampling
Model SSA 600L with liquid dosing unit

Fig. 19 Solid autosamplers SSA 600 and SSA 6z

4.6 Flame system

Flame atomic absorption spectroscopy is used for the determination of trace elements in the concentration range from µg/L to mg/L and for the determination of main components. It requires a flame with constant properties. The flame composition must also be compatible with the respective element.

The height of the nebulizer mixing chamber can be automatically adjusted by 12 mm to move the flame zone with the greatest absorption into the beam direction. In the combination unit contrAA 800 D the nebulizer mixing chamber burner system can also be automatically aligned in depth with the beam path. In the contrAA 800 F the depth of the atomizer is set at factory but can be readjusted via an adjustment screw.

A pneumatic nebulizer with ring-shaped slot aspires the sample solution and sprays it into the mixing chamber. In the mixing chamber the sample aerosol is mixed with acetylene and oxidant before it emerges from the burner slot. The flame is either 5 or

10 cm long and a few millimeters wide. It is irradiated over its full length. For the measurement of main components, the burner can be rotated by max. 90° on the mixing chamber tube (transverse position). This shortens the absorption path. The sensitivity is correspondingly lower. The burner rotation can be reproducibly adjusted using a scale at the burner neck.

4.6.1 Gas automatic

The gas automatic ensures that the supply of acetylene and oxidant to the flame is free from pressure fluctuations. It enables safe and hazard-free ignition and quenching of the flame. The automatic gas control has three gas inlets for acetylene, air and nitrous oxide.

The fuel flow is set in steps of 5-L-, between 40 and 315 NL/h acetylene, by a proportional valve in the control path. The air flow first fills the reservoir with a capacity of 500 cm^3 and is then released to the nebulizer. Air from the reservoir is responsible for normal flame quenching and also for flame quenching in the event of an accident. The oxidant flow to the nebulizer is defined by its setting and the inlet pressure. If additional oxidant is used, the additional oxidant flow (air/nitrous oxide) is regulated in three levels.

A filament ignites the flame. The filament is rotated out of the back of the sample chamber to the center of the burner. It is possible to switch over from the acetylene-air flame to the acetylene nitrous oxide flame by blocking the air supply and adding nitrous oxide. This also increases the acetylene flow. The acetylene nitrous oxide flame is quenched in reverse order. The change-over is performed automatically by the ASpect CS software.

4.6.2 Burner-nebulizer system

Aerosol required by the sample solution for atomization in the flame is generated by the nebulizer. The oxidant flows into the nebulizer via a side connection and flows through the ring-shaped slit formed by the corrosion-proof platinum-rhodium alloy cannula and the PEEK nozzle. The resulting low pressure pulls the sample solution out of the cannula and aspirates more sample solution. The positioning of the cannula tip relative to the nozzle determines the aspiration rate and the fineness of the aerosol. It can be set manually with an adjusting screw and lock nut.

The resulting sample aerosol strikes the baffle ball. Larger droplets condense on the baffle ball and run off via the siphon. The fuel flow strikes the surface of the baffle ball at a right angle. The generated aerosol flows through the mixing chamber to the burner. On the way through the mixing chamber, equilibrium is reached. Other large droplets are separated by gravity and run off via the siphon. The aerosol is atomized in the flame. It must have a small droplet size. Fast evaporation of drops when entering the flame is a precondition for atomizing the sample in the hot zone of the flame. If the sample does not fully evaporate, this has a negative effect on the accuracy of the analysis results. At the same time the background absorption is increased through scattering of the radiation by unevaporated droplets.

The mixing chamber nebulizer system has been designed to allow very fine aerosol to form from the aspired samples. The system is low maintenance, because the siphon is located in the immediate vicinity of the nebulizer. Large drops drain off immediately and do not enter the mixing chamber. The mixing impeller retains droplets and

stabilizes the aerosol cloud. Potential liquid residues can continuously rise in the mixing chamber tube and drain off to the siphon. Finally, the baffle ball is permanently centered on the nebulizer. It does not need readjusting after cleaning the mixing chamber nebulizer system.

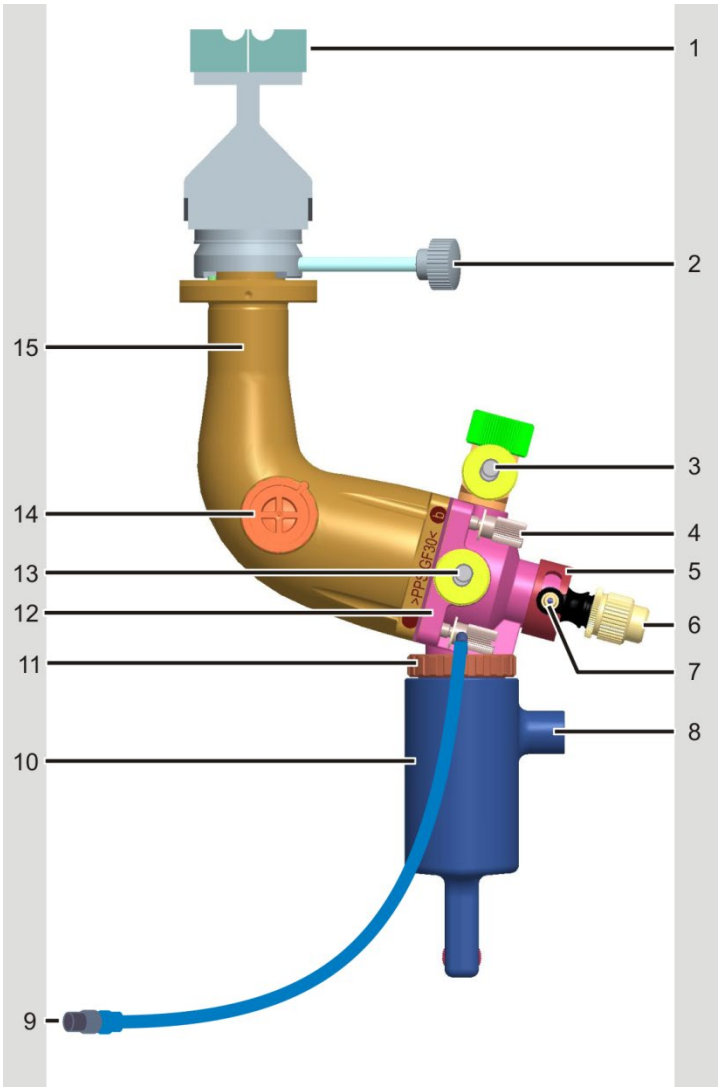


Fig. 20 Nebulizer mixing-chamber burner-system

1 Burner
2 Fixing screw for burner
3 Combustion gas supply
4 Screw joints of mixing chamber parts
5 Locking ring for nebulizer
6 Nebulizer (sample liquid supply)
7 Oxidant supply
8 Siphon drainage
9 Siphon sensor connection
10 Siphon
11 Siphon sensor
12 Mixing chamber head
13 Additional oxidant supply
14 Safety plug
15 Mixing chamber tube

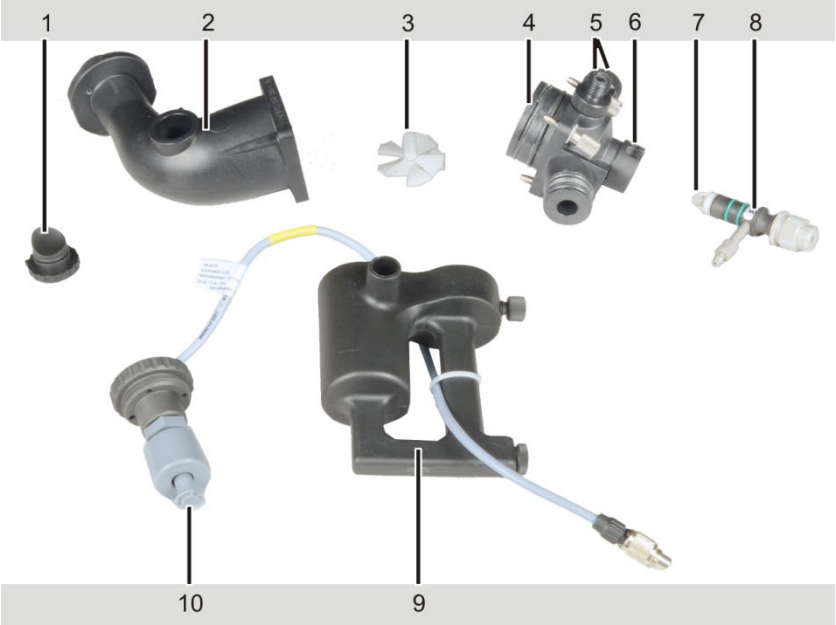


Fig. 21 Mixing chamber and nebulizer, disassembled

1 Safety plug
2 Mixing chamber tube
3 Mixing impeller
4 Mixing chamber head with connections for gases, nebulizer and siphon
5 Connections for additional oxidant and combustion gas (pointing to the rear)
6 Nebulizer connection with locking ring
7 Baffle ball
8 Nebulizer with connection for oxidant and connection for sample tube
9 Siphon
10 Siphon sensor

4.6.3 Burner and flame type

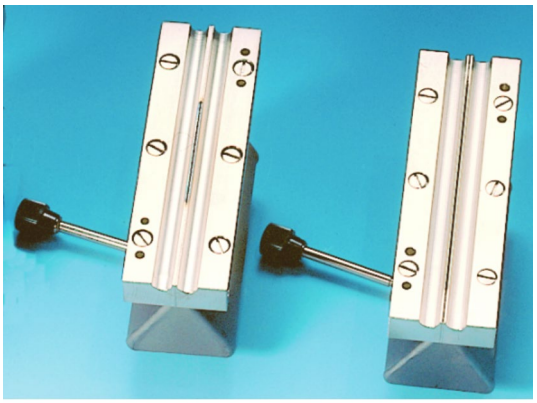
The contrAA 800 F and D can be operated with the following types of flames and their corresponding burners:

- Acetylene-air flame with 50 mm one-slit burner (universal burner) or 100-mm-one-slit burner for higher sensitivity
- Acetylene nitrous oxide flame with a 50 mm one-slit burner

If both easy and difficult to atomize elements are to be detected during laboratory operation, the 50 mm one-slit burner (universal burner) is recommended, because not burner change is required between measurements.

Uses of the different flame types:

- The acetylene-air flame can be used for most elements.
- The acetylene nitrous oxide flame is required for difficult-to-atomize elements such as boron, aluminum and silicon.



1 50 mm one-slit burner (standard burner)
2 100 mm one-slit burner

Fig. 22 Burner types

The burners made of titanium are inert with respect to the influences of aggressive sample solutions. The burners can be exchanged easily and can be infinitely variably rotated up to 90° between 2 stops. One stop is positioned in such a way that the burner is aligned with the optical axis. The 90° stop sets the non-sensitive diagonal position of the burner for determining the main components.

4.6.4 Sensors

The burner-nebulizer system is checked by various sensors so as to guarantee the operational safety.

- A float switch in the siphon indicates the correct level of 80 mm in the water column.
- Two reflex couplers identify the burner type by a code.
- A UV-sensitive sensor monitors the burning flame.

In addition to the above-mentioned sensors, the mixing chamber is also equipped with a safety plug which will fall out if the flame backfires into the mixing chamber.

The ASpect CS control software evaluates the sensor signals and also monitors the gas pressures and the gas flows as well as the status of the flame.

4.7 Accessories for flame technique

4.7.1 Autosamplers AS-F and AS-FD

Manual or automatic sample supply may be employed in the flame technique and the hydride technique. An autosampler facilitates the automated operation during multiple element analysis. The device parameters for the sample supply are configured with the control software ASpect CS.

The contrAA 800 can be operated with the following autosamplers:

- The autosampler AS-F is an automatic autosampler.
- The autosampler AS-FD also has a dilution function.

The autosamplers use sample trays with the same diameter. The following sample tray types are available:

139 positions	Sample tray with 129 sample positions for 15 mL cups on the outer track and 10 sample positions for 50 mL cups on the inner track
54 positions	Sample tray with 54 positions for 50 mL cups

The sample trays should be selected in accordance with the following aspects:

- Available sample volume
- Type of signal evaluation

The software controlled autosampler arm reaches all the positions intended for sample-taking. The dipping depth into the sample and the special cups is preset, however, it can be adjusted via the control software.

The contrAA 800 supplies the autosamplers with operational voltage. Tray and autosampler arm are driven by stepping motors. The sample tray is rotated into the desired position. The autosampler arm is rotatable and can be lowered by 120 mm.

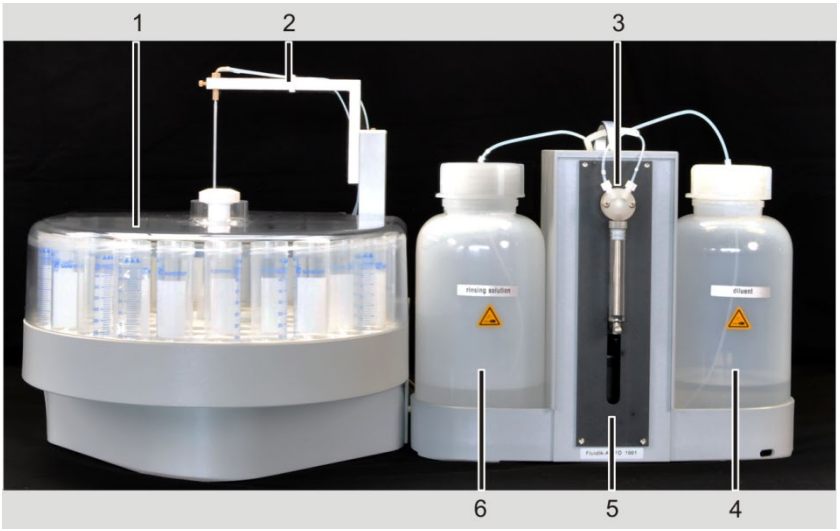


Fig. 23 Autosampler AS-FD with Fluidik module

1 Sample tray with cover
2 sampler arm
3 dosing unit (5000 µL)
4 Storage bottle for diluent
5 Fluidik module
6 Storage bottle for washing liquid

On the top of the autosampler AS-F there is a wash cup with overflow next to the sample tray. In the autosampler AS-FD the wash cup is located in a plastic block together with a mixing cup. A diaphragm pump delivers the washing liquid from the supply bottle into the wash cup – this action cleans the dipped cannula by washing it inside and out. Excess washing liquid flows through the overflow into the waste receptacle, which is under the table during the wash cycle.

The autosampler AS-FD features a separate Fluidik module with a dosing unit (5000 µL). The Fluidik module is electrically connected to the autosampler and is supplied with operating voltage via the contrAA 800. Standards or samples are diluted in the mixing cup by first placing the concentrate into the mixing cup. Then the diluent is added at a high dosing speed (max. volume V = 25 mL). A fixed waiting time ensures complete mixing. A second diaphragm pump extracts the residual liquid that has not been taken up by the nebulizer.

The autosampler AS-FD with dilution function features the following advantages:

- Preparation of standards for the calibration by diluting one or several stock standards in the mixing cup

- Dilution of the sample if its concentration is too high, i. e., its element content is higher than 110 % of the calibration standard with the highest concentration
- Dilution of all samples at freely selectable dilution ratios up to a ratio of 1:500

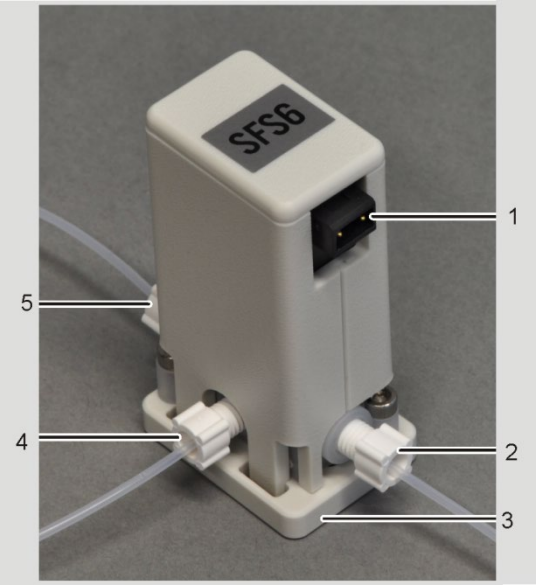
4.7.2 Piston compressor PLANET L-S50-15

If no in-house compressed air supply is available, a compressor should be used to provide the air required for the acetylene/air flame.

Analytik Jena offers the piston compressor PLANET L-S50-15 as optional accessory. The compressed air is free from water, dust and oil. At a maximum operating pressure of 800 kPa and with a 15-L air container, the compressor is sufficient to meet the requirements for compressed air supply. For installation and maintenance note the information in the operating instructions of the piston compressor PLANET L-S50-15.

4.7.3 Injection module SFS 6

The injection module SFS 6 (Segmented Flow Star) is available as an optional accessory. It can be used together with an autosampler or in manual mode.



1 Control cable connection
2 Hose to washing solution
3 Suspension
4 Short piece of hose to nebulizer cannula
5 Sample aspiration tube (at the energized inlet)

Fig. 24 Injection module SFS 6

The SFS 6 ensures reproducible conditions in the flame. It continuously aspires wash or carrier solution to keep the burner at a constant temperature. Small sample volumes can be reproducible measured against a carrier solution.

The operating principle of the injection module SFS 6 is based on a magnetic valve with two inlets and one outlet to the nebulizer. The sample aspiration tube is located at the energized inlet. It is dipped directly into the sample or is connected to the autosampler cannula. The non-energized inlet is connected to the aspiration tube for the wash solution. There are two switching states:

- Basic state: Sample path is blocked, carrier solution path is free
- Active state: Sample path is free, carrier solution path is blocked

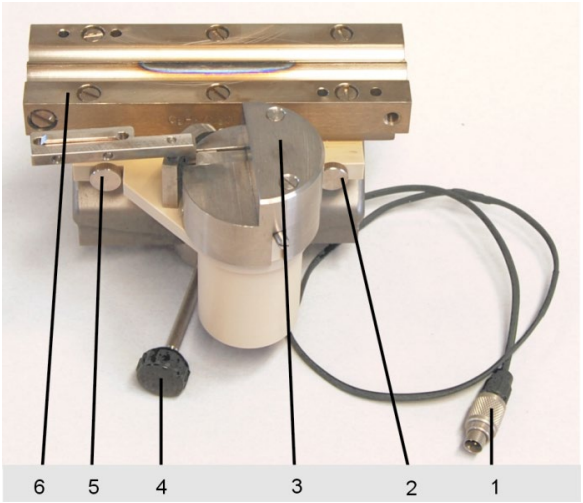
The injection module SFS 6 is controlled with the ASpect CS software.

4.7.4 Scraper – automatic burner head cleaner

The automatic burner head cleaner (scraper) is recommended for continuous and fully automated operation with the nitrous oxide flame. When using the nitrous oxide flame and especially with a fuel-rich flame as e.g. used in the detection of the elements silicon, tungsten, molybdenum and tin, carbon deposits at the burner slot over time. If these deposits are not removed continuously, the burner slot closes up. This would result in a low reproducibility of the measuring results.

Once activated in the ASpect CS software and stored as a method parameter, the scraper guarantees a continuous and reproducible measuring process without any disturbances and interruptions. Dependent on the flame composition and analysis task, the burner head can be cleaned automatically at various frequencies. On the other hand, the scraper can also be used for the automation of the burn-in process of the nitrous-oxide flame. When activated in the window FLAME / CONTROL a cleaning step is performed every 30 s.

The scraper is fixed to the burner head with two knurled head screws. It can be detached if it is not needed. The scraper can be retrofitted on a 50 mm burner.



1 Scraper connection cable
2 Knurled head screw
3 Scraper
4 Fixing screw for burner
5 Knurled head screw
6 50 mm burner head

Fig. 25 Scraper an the 50 mm burner head

4.8 Supplementary accessories – hydride systems

The hydride systems available range from the simple batch systems for users with small samples through to fully automated continuous devices with flow injection.

HS 50	basic batch system with pneumatic principle of operation. The quartz cell is heated by the acetylene/air flame.
HS 55 modular	batch system with electrically heated cell unit with or without "Hg Plus" module for Hg detection. The reduction agent solution is metered by a 1-channel hose pump.
HS 60 modular	Hg/hydride system for continuous flow injection operation with electrically heated cell unit with or without "Hg Plus" module for Hg detection.

More information on the hydride systems can be found in the relevant accessory manuals.

5 Installation and commissioning

CAUTION

Prevent any unauthorized interference!

The device may only be assembled, installed and repaired by service engineers from Analytik Jena or by technical personnel authorized by Analytik Jena.

CAUTION

Observe the safety instructions!

When installing and starting up your device, please observe the instructions provided in the section "Safety instructions" p. 11. Compliance with these safety instructions is a requirement for the error free installation and the proper functioning of your AAS measuring environment. Always observe all warnings and instructions which are displayed on the device itself or which are displayed by the control and analysis program of the ASpect CS.

The contrAA 800 will be delivered directly to the final instrument location by a transportation company. The delivery by this company requires the presence of a person responsible for instrument installation.

The presence of all persons designated for operation of the device during the briefing by the customer service of Analytik Jena is imperative.

Prior to installation, the installation conditions required by Analytik Jena at the installation location must be ensured by the customer (→ section "Installation conditions" p.20).

5.1 Supply and control connections

The supply lines are connected during the assembly of the contrAA 800 by the customer service of Analytik Jena.

The mains switch is located on the right side of the contrAA 800. The right side also features an easily accessible connection strip with interfaces for PC and accessories.

A pair of carrying handles is fastened to the left and right of the device for transport and installation. After installation the handles are unscrewed and the openings sealed with the stoppers supplied.

1 Connection strip
2 Carrying handle
3 Mains switch

Fig. 26 contrAA 800 – Side view with carrying handles

contrAA 800 D + G

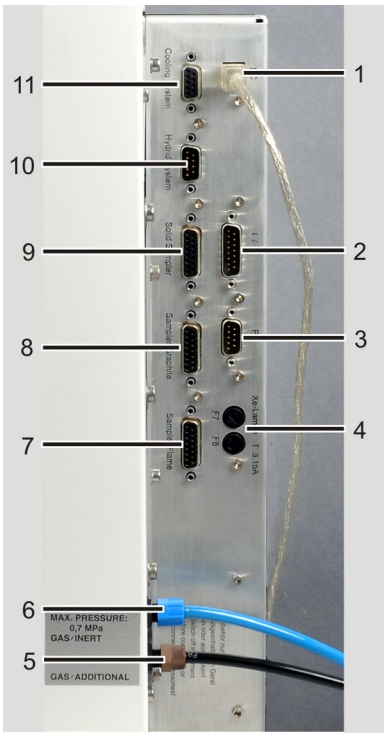
In the contrAA 800 D and G the media connections for gases and power and the fuses are located at the rear of the device. It also has the mains connection for the mains distribution strip for accessories.

The contrAA 800 D has connections for the following gases: inert gas (argon) and additive gas (e.g. compressed air) for the graphite tube technique and fuel gas (acetylene), nitrous oxide and compressed air for the flame technique. In the contrAA 800 G no connections for the flame gases are present.

Fig. 27 Rear view contrAA 800 D with connections and fuses

1 Inert gas (argon) connection, additive gas
2 Fuses F5, F6
3 Mains connection for accessories (5-way distribution strip)
4 Fuses F3, F4
5 Fuses F1, F2
6 Mains connection cable for contrAA 800
7 Compressor air filter
8 Fuel gas connection (C_2H_2)
9 Nitrous oxide connection (N_2O)
10 Compressed air connection
11 Rating plate

The interfaces for PC, autosampler and hydride system and the fuses for the Xenon short arc lamp are located at the connection strip at the right side of the device.



1 PC connection
2 Free COM port for accessories
3 contrAA PC connection (service use only)
4 Xenon lamp fuses F7/F8 T 3.15 A/H
5 Additive gas connection for graphite tube furnace
6 Inert gas connection for graphite tube furnace (argon)
7 Connection for flame autosampler
8 Connection for graphite autosampler
9 Solid sampler connection
10 Hydride system connection
11 External mobile cooling unit connection (free)

Fig. 28 contrAA 800 D and G connection strip

contrAA 800 F

In the contrAA 800 F with flame technique the media connections for gases are located at the rear of the device: fuel gas, nitrous oxide and compressed air for the flame and argon for spectrometer purging.

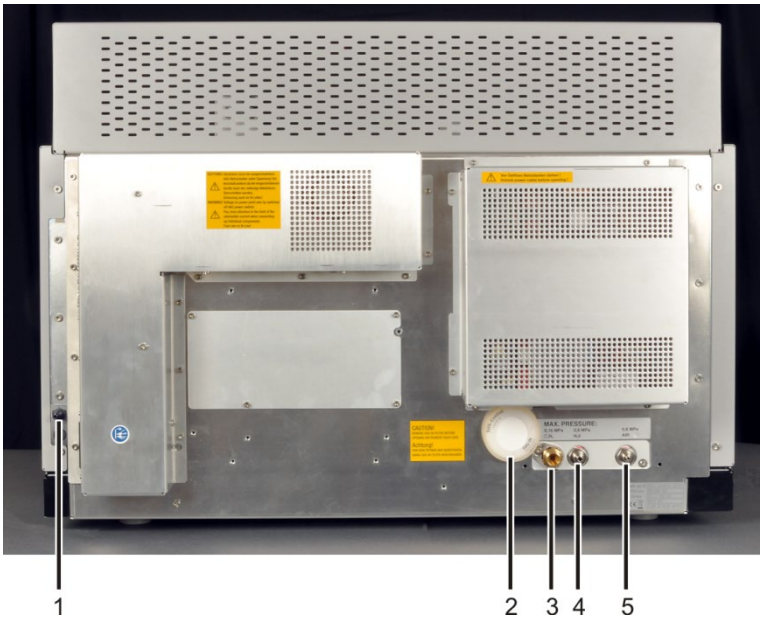
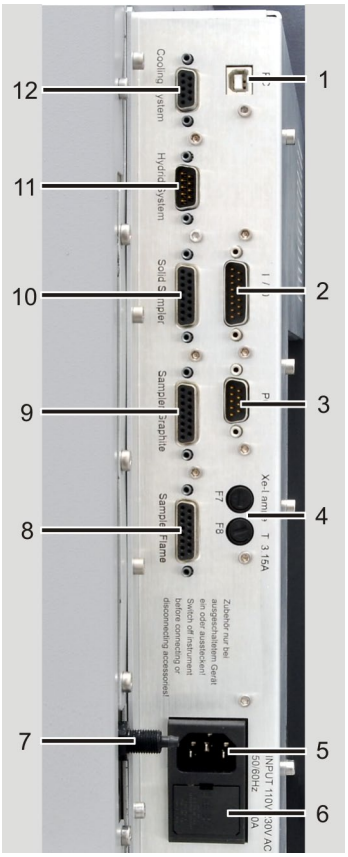


Fig. 29 contrAA 800 F rear view with connections

1 Inert gas (argon) connection
2 Compressor air filter
3 Fuel gas connection (C_2H_2)
4 Nitrous oxide connection (N_2O)
5 Compressed air connection

In the contrAA 800 F the transformer block with mains connection and fuses is missing at the rear of the device. The mains connection for the device and all fuses are located at the connection strip (→ Fig. 30). The contrAA 800 F does not have a mains connection for accessories at the AAS device. The base device, the PC and the

accessories (printer, hydride system etc.) are connected jointly to the electric mains via the 5-way distribution strip supplied.



1 PC connection
2 Free COM port for accessories
3 contrAA PC connection (service use only)
4 Xenon lamp fuses F7/F8 T 3.15 A/H
5 Mains connection cable for contrAA
6 Fuses F1/F2 T 10 A/H (under the cover plate)
7 Argon connection for spectrometer purging
8 Connection for flame autosampler
9 Connection for graphite autosampler (free)
10 Solid sampler connection (free)
11 Hydride system connection
12 External mobile cooling unit connection (free)

Fig. 30 Connection strip of the contrAA 800 F

Rating plate

The rating plate is located at the rear of the device. You fin followinThe rating plate shows the serial number and the electrical connection data.

- Manufacturer (incl. address)
- Device type and model
- CE marking
- UKCA marking
- Symbol for waste disposal in accordance with WEEE directive
- Voltage/ frequency
- Typical average power consumption
- max. current consumption
- Serial number

The serial number is also attached in the lamp chamber (top).

5.2 Installing the contrAA 800

The contrAA 800 may only be installed and connected by the customer service of Analytik Jena or by technical personnel authorized by Analytik Jena. The graphite tube or burner-nebulizer system and the connections in the sample chamber must be installed by the customer in accordance with the maintenance instructions. Descriptions of these installation procedures are provided in the chapters below. The installation of the autosamplers AS-GF and AS-F/AS-FD will also be described. The installation of the solids autosampler is performed in accordance with a separate user instruction.

Tools

- 4 plugs, plastic (included in the scope of delivery)
- Open-ended wrench 12 mm, 14 mm and 19 mm

Work steps

1. Unscrew and remove the four handles and keep in a safe place.
2. Seal the openings with stoppers.
3. Install the gas supply at the rear of the device (→ section "Supply and control connections" p.48):
   - Plug the hoses for inert gas (argon) and additive gas, if applicable, onto the hose screw joint and tighten the union nut by hand.
   - If not additive gas is used: Connect the additive gas connection via a T piece and short hose piece to the inert gas connection.

   Flame technique:
   - Tighten the acetylene gas connection with a 19 mm open-end wrench. Left hand thread!
   - Tighten the compressed air gas connection with a 12 mm open-end wrench.
   - Tighten the nitrous oxide gas connection by hand or with a 14 mm open-end wrench.
4. Check the gas connections for leaks (→ Section "Checking the gas connections for leaks" p.86).
5. **In the contrAA 800 D:** Remove the red transport lock from the sample chamber and keep it safe.

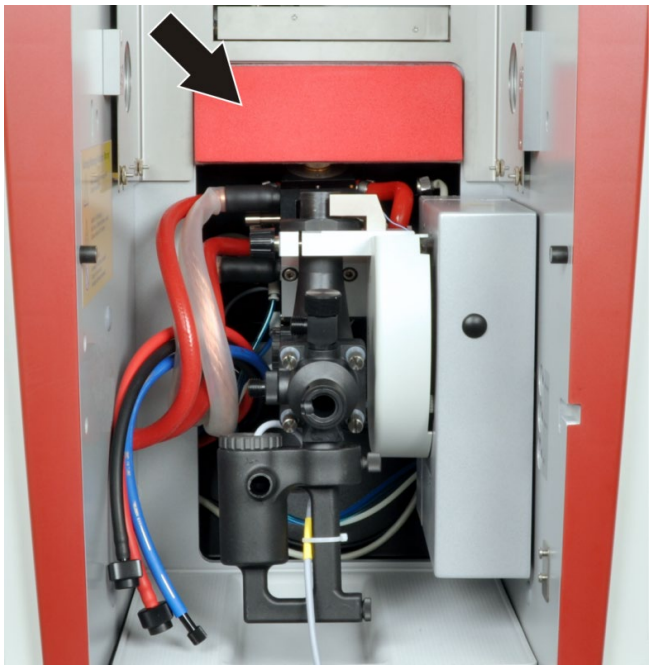


Fig. 31 Transport lock in the sample chamber of the contrAA 800 D

6. Fill the cooling water tank in the lamp chamber with approx. 4 liters tap water up to the "max" marking. Mix very hard tap water (conductivity σ ≥1 mS/cm) 50/50 with deionized water. Make sure that the rear chamber of the cooling water tank is also filled.

   Note: The cooling water circuit has been filled at factory with a sufficient quantity of cooling water additive. Therefore, no cooling water additive needs to be added during initial commissioning.

Fig. 32 Cooling water tank in the lamp chamber

7. Establish the electrical connection (→ Section "Energy supply" p. 20).
8. Connect the PC and contrAA 800 with USB cables (1 in Fig. 28 p.50 and Fig. 30 p.51).

   ✓ The supply and control connections have been installed.

5.3 Installing and starting ASpect CS

For the installation and start of the control and analysis program ASpect CS refer to the manual "ASpect CS".

5.4 Graphite tube technique

WARNING

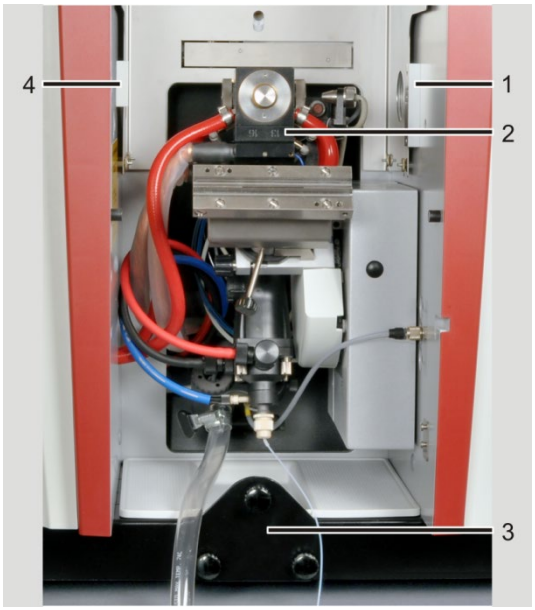
Danger of UV radiation being reflected!

During the installation work in the sample chamber the graphite tube furnace can be maladjusted. The maladjustment of the atomization unit may result in UV radiation emerging from the sample chamber.

In the contrAA 800 D the atomization unit is automatically adjusted prior to each measurement start. If the atomization unit is maladjusted during an ongoing measurement, e.g. by an impact, stop and restart the measurement.

In the contrAA 800 G the risk of maladjustment can be precluded.

5.4.1 Connections in the sample chamber for the graphite tube technique



1 AS-GF support on the right sample chamber
2 Graphite tube furnace with connections
3 Depth-adjustable stop for AS-GF
4 AS-GF support on the left sample chamber

Fig. 33 Elements in the sample chamber for the graphite tube technique

The connections for gas and cooling water and power are permanently installed on the graphite tube furnace.

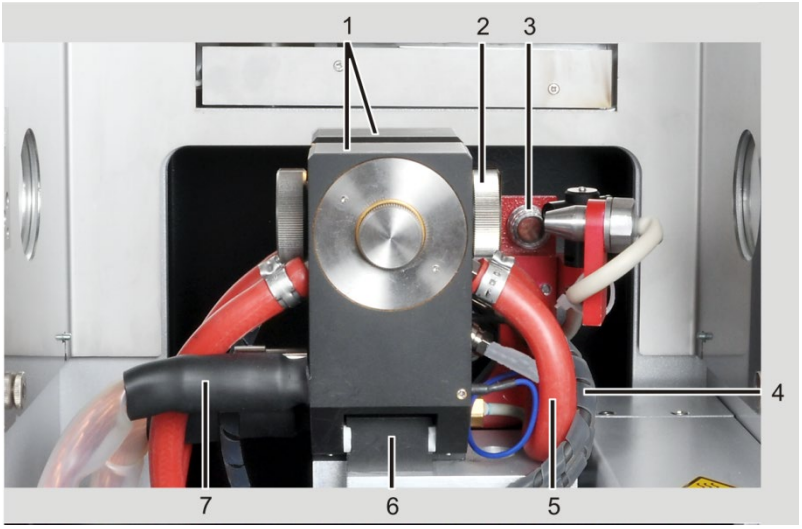


Fig. 34 Connections at the graphite tube furnace

1 Furnace jaws with electrodes
2 Furnace window
3 Fuse at the graphite tube furnace
4 Gas connections: white and black hoses
5 Cooling water connections: red hoses
6 Position adjustment
7 High voltage cable

5.4.2 Software presettings for the graphite tube technique

In the QUICKSTART window of the ASpect CS software, you must select the atomization technique used (see the ASpect CS operating instructions/help). Through initialization the software interface is adjusted with the method and device parameters.

In the contrAA 800 D the graphite tube furnace is moved software-controlled into position during the initialization of the graphite tube technique and aligned in height and depth in the beam path. In the contrAA 800 G the furnace is automatically aligned in height. The depth is preset at factory.

ATTENTION

Danger of equipment damage in the contrAA 800 D!

Before changing the atomizing technique, remove the burner, cell heating and autosampler, since these accessories might be damaged during rotation.

5.4.3 Inserting the graphite tube into the furnace

ATTENTION

The graphite tubes of the contrAA 800 are manufactured specifically and may only be ordered from Analytik Jena. Do not use any other graphite tube. They might damage the contrAA 800

Never touch the graphite tube with your bare fingers! Fingerprints burn into the surface, and this causes premature damage to the pyrolysis coating of the tube.

Inserting the graphite tube

1. In ASpect CS open the window FURNACE with . Go to the CONTROL tab.

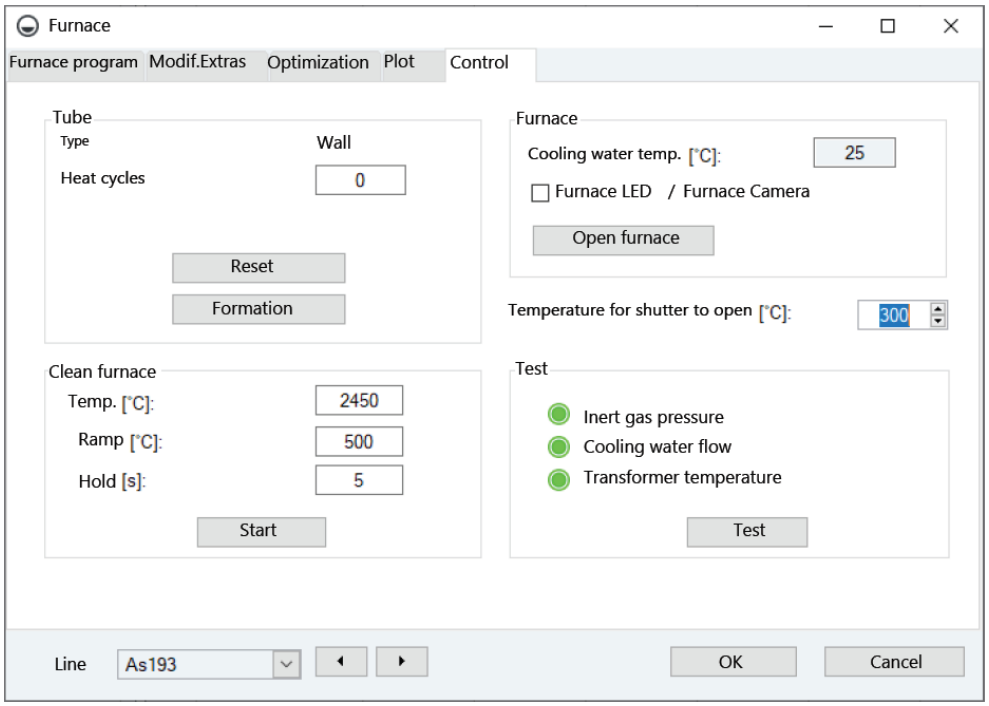


Fig. 35 Furnace / Control dialog window

2. Open the graphite tube furnace using the button [OPEN FURNACE].
3. Insert the graphite tube using tweezers into the graphite tube furnace so that it is loosely seated on the supports of the furnace jacket and the pipetter opening faces up. Wear gloves during insertion.

   In the graphite tube for solid analysis without pipetter opening, any side may face up.
4. Close the graphite tube furnace with the [CLOSE FURNACE] button.
5. In the TUBE area enter the HEAT CYCLES and LIFETIME parameters of the inserted graphite tube.

   ✓ The graphite tube has been inserted into the furnace.

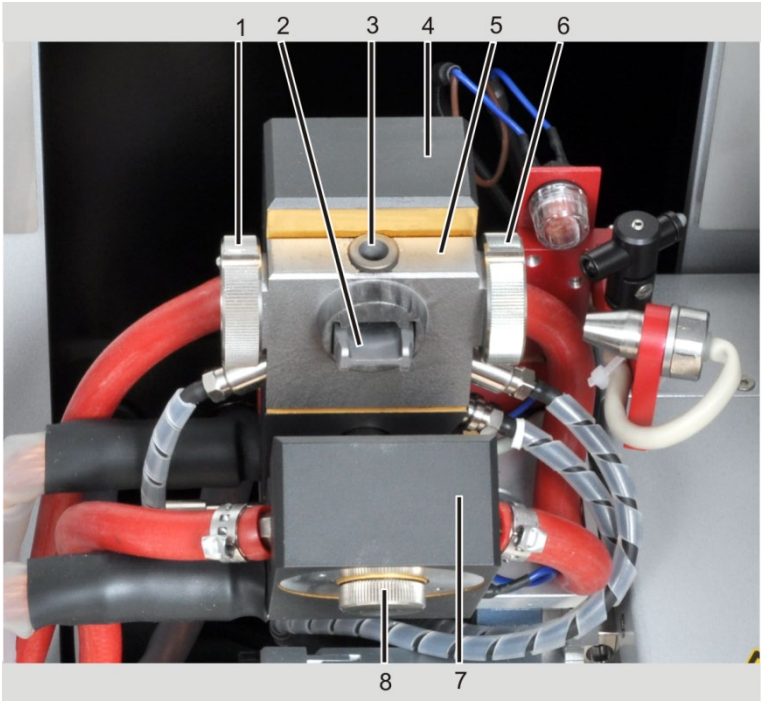


Fig. 36 Open graphite tube furnace with inserted graphite tube

1 Furnace window
2 Graphite tube, inserted
3 Dosing opening with graphite funnel insert
4 Fixed furnace part
5 Furnace jacket
6 Furnace window
7 Upper furnace part, open
8 Water channel lock

Removing the tube

CAUTION

Risk of burns!

Allow the graphite tube furnace to cool down before removing the graphite tube.

ATTENTION

Never touch the graphite tube with your bare fingers!
Fingerprints burn into the surface, and this causes premature damage to the pyrolysis coating of the tube.

1. Open graphite tube furnace using the button [OPEN FURNACE] in the window FURNACE / CONTROL.
2. Remove the graphite tube with tweezers, or wear gloves if removing by hand.
3. Insert a new graphite tube and close the graphite tube furnace using the button [CLOSE FURNACE].

5.4.4 Formatting the graphite tube

When the graphite tube is formatted the following takes place

- Atmospheric oxygen is expelled from the oven and the force on the movable furnace part is adjusted
- The tube temperature is recalibrated
- The pyrolysis coating is conditioned in the newly inserted graphite tube
- The furnace is cleaned after pausing

It is recommended to format the furnace after the following steps:

- after power to the spectrometer is turned on
- after inserting a new graphite tube
- after closing a previously open furnace.
- periodically every 50-100 measurements

The complete formatting program contains nine pre-programmed temperature stages.

Formatting is started in the FURNACE / CONTROL window. During formatting, the current temperature stage, time and ramp are displayed in the FORMAT TUBE window. In the first five stages, the furnace and the graphite tube are cleaned and conditioned (contacts between the graphite tube and the electrodes are aligned). By means of a special sensor technique, the tube temperature in the remaining four stages is measured. The corrected furnace temperature ensures correct measurement results.

The ASpect CS software issues an onscreen message as soon as the formatting factor is outside the tolerance limits. The following maintenance measures must then be checked consecutively:

- Repeat formatting
- Heat graphite tube and clean contact surfaces of the electrodes (see "Cleaning the graphite surfaces" p. 91)
- Replace graphite tube (see "Cleaning and changing the graphite tube" p. 91).
- Replace electrodes and furnace jacket (see "Replacing the electrodes and furnace jacket" p.92)

1. In ASpect CS open the window FURNACE / CONTROL with  .
2. In the TUBE group field enter data specific to the current graphite tube:

New graphite tube	Heat cycles	0
	Lifetime	0
Used graphite tube	Heat cycles	Current value of the graphite tube
	Lifetime	Current value of the graphite tube

3. Actuate the [FORMATTING] button.
   - ✓ The graphite tube can be used for measurements.

5.4.5 Cleaning / clean out of the graphite tube

1. In ASpect CS open the window FURNACE / CONTROL with  .
2. In the CLEAN FURNACE group field set the following parameters:

TEMP. [°C]	End temperature to be reached during clean out. The final temperature should be at least 50 °C higher than the previous atomization temperature.
RAMP [°C/S]	Ramp
HOLD [S]	Set the hold time

3. Start the clean out with the [START] button in the CLEAN FURNACE group field. Repeat the clean out several times at a higher temperature if required.

HydrEA technique

The following temperature program must be used for the clean-out of the gold or iridium coated graphite tube (see also operating instructions of the hydride system). For the nebulization of the metal coating a higher end temperature must be selected.

	Clean-out		**Evaporation**	
ELEMENT	Au	Ir	Au	Ir
TEMP.[°C]	1000 °C	2200 °C	1800 °C ≤ T ≤ 2600 °C	≤ 2600 °C
RAMP [°C/S]	500 °C/s		500 °C/s	
HOLD [S]	10 s		10 s	
	Do not select a longer hold time as this may exceed the load limit of the furnace.			

Clean out or evaporation can be repeated several times.

5.5 Installing and adjusting the AS-GF autosampler

5.5.1 Installing the autosampler

ATTENTION

Always switch off the contrAA 800 prior to the installation and uninstallation of the AS-GF! Connecting or disconnecting electrical contacts might damage the sensitive electronics of the contrAA 800.

ATTENTION

Choose a safe location for the completion of the AS-GF. The device can tilt easily.

In the contrAA 800 D the burner must be removed from the mixing chamber-nebulizer system before the autosampler AS-GF can be suspended in the sample chamber.

Fig. 37 AS-GF installed

1 Left support in the sample chamber
2 Adjusting screw 1 (for Y coordinate)
3 Adjusting screw 2 (for X coordinate)
4 Tube holder
5 Tube guide with clamp nut
6 Adjusting screw 3 (for X coordinate)
7 Right support in the sample chamber
8 Purge position
9 Sample tray with cover
10 T valve of the dosing unit
11 Dosing syringe
12 Lock screw for piston rod

1. Switch off the contrAA 800.
2. Install the tube guide (5 in Fig. 37) to the autosampler arm of the AS-GF and attach using the lock screw.

   Note: The autosampler arm can be moved manually in the deactivated state.
3. Screw the dosing tube into the right opening of the T valve (10 in Fig. 37) on the dosing unit. Feed the dosing tube through the tube holder on the back of the autosampler and on the autosampler arm. Insert the dosing tube into the tube guide (5 in Fig. 37) until the tube end protrudes approx. 8 mm from the tube guide at the bottom; attach the tube using a clamp nut.
4. Plug the control cable into the socket at the back of the AS-GF and screw it tight.
5. Hang the AS-GF on the supports in the sample chamber (1 and 7 in Fig. 37). Check whether the autosampler is suspended horizontally; if necessary, align the autosampler using the depth-adjustable stop in the sample chamber (3 in Fig. 33 p. 54).
6. If necessary, align the AS-GF with the furnace (rough adjustment):
   Manually rotate the autosampler arm over the dosing opening in the graphite

tube. If the dosing tube does not align with the opening, move the suspension of the autosampler forward or back. Remove the autosampler from the sample chamber to do so. Move the left and right suspension mounts with the aid of adjusting screw 1 and set screw (2 and 4 in Fig. 38). Use a screwdriver to adjust the adjustment screw. Hook the autosampler back in and check the rough adjustment. Repeat the process, if necessary.

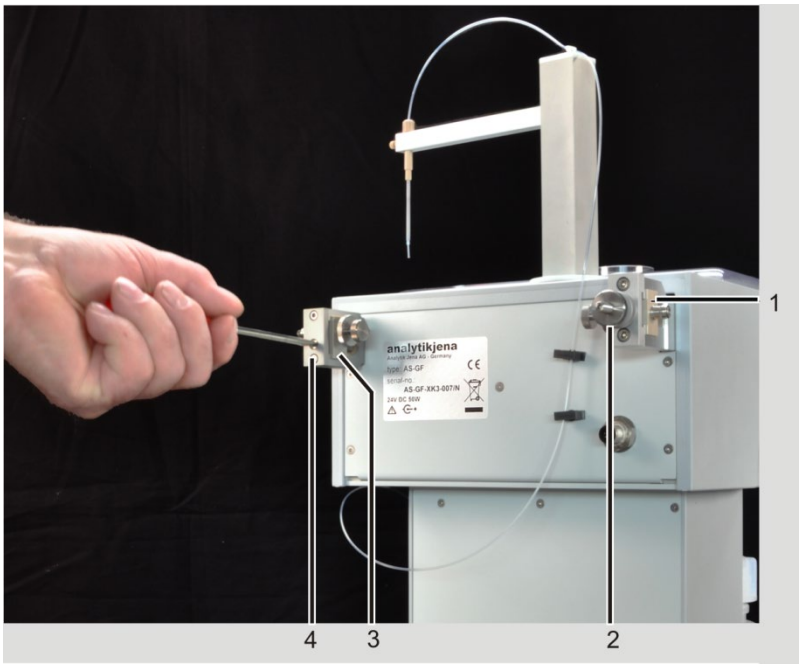


Fig. 38 AS-GF with screws for furnace alignment

1 Slider with left suspension mount
2 Adjusting screw 1
3 Slider with right suspension mount
4 Set screw

7. Plug the control cable into the socket on the connection strip of the AAS device (autosampler graphite connection, 8 in Fig. 28 p. 50).
8. Place and fix the sample tray on the axis of the AS-GF.
9. Place the sample cover until it sits in the guide rail.
10. If necessary, fit the dosing syringe to the dosing unit (→ Section "Replacing the dosing syringe" p.108).
11. Switch on the PC and contrAA 800 and wait for the initialization of the spectrometer (approx. 3 min.), start the ASpect CS software and initialize the system.

    ✓ The AS-GF autosampler is installed in the sample chamber.

Preparing the contrAA 800 for the HydrEA technique

Prior to installing the HydrEA technique the graphite tube must be coated with iridium or gold (see hydride system manual). Use the AS-GF autosampler with the dosing tube used during graphite operation. Alternatively, the iridium or gold stock solution (c = 1 g/L) may be pipetted manually into the graphite tube.

1. Coat the graphite tube with iridium or gold using the autosampler.

   Attention: Do not use the titanium cannula for the coating process.

2. Switch off the contrAA 800 and install the hydride system (e.g. HS 60 modular).

3. For the HydrEA technique detach the clamping nut of the hose guide and pull out the dosing tube. Remove the dosing tube from the hose mount at the autosampler arm.
4. Plug the titanium cannula into the hose guide and allow it to protrude approx. 8 mm at the bottom. Attach the titanium cannula with the clamping nut.
5. Attach the reaction gas tube (from the hydride system) to the titanium cannula.

Suitable autosamplers for continuous sample supply to the hydride system HS 60 modular are the AS-F and the AS-FD.

5.5.2 Adjusting the sampler

The AS-GF has already been installed in the sample chamber in accordance with section "Installing the autosampler" S.59. The fine alignment of the AS-GF to the furnace is supported by software. The autosampler is aligned for the dosing tube to optimally deposit the samples in the graphite tube without touching the dosing insert. The injection depth for the sample is also adjusted.

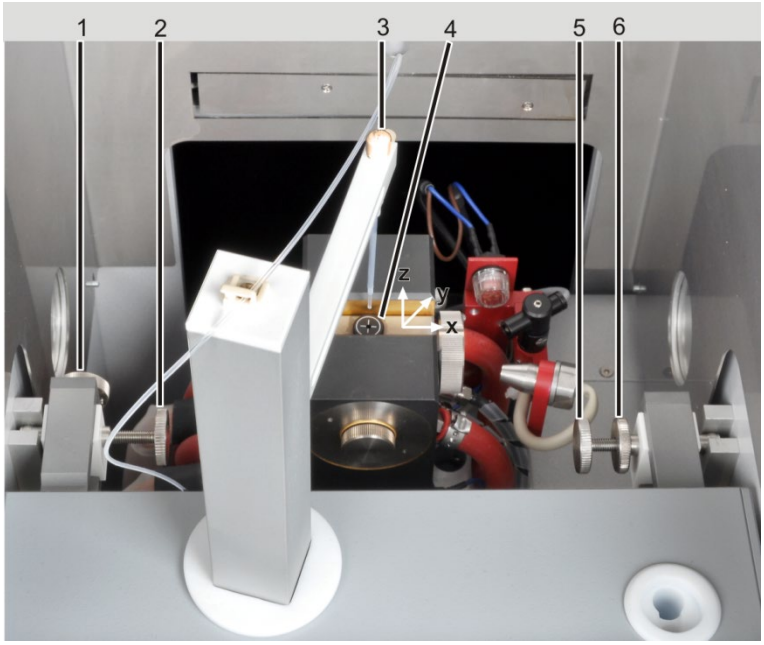


Fig. 39 AS-GF adjusted

1 Adjusting screw 1 with lock nut
2 Adjusting screw 2 with lock nut
3 Clamp nut
4 Adjusting aid with crosshair
5 Adjusting screw 3
6 Lock nut of alignment screw 3

1. Start the ASpect CS software and open the AUTOSAMPLER window with the symbol  , change to the tab TECHN. PARAMETERS
2. Start aligning using the [ALIGN SAMPLE TO FURNACE] button.
3. Follow the prompts in the dialog fields of the software.

   Align the AS-GF with the furnace:

   - Withdraw the dosing tube approx. 8 mm from the cannula of the autosampler and secure it with a clamping nut.

- Replace the pipetter insert in the graphite tube furnace with the adjusting aid with crosshair.
- Lower the autosampler arm to the height of the adjusting aid using the buttons [UP]/[DOWN].
- Align the x direction (parallel to the optical axis) with the buttons [LEFT]/[RIGHT] to the crosshair. Perform the fine adjustment in the x direction with the adjustment screws 2 and 3.
- Adjust the y direction using the adjustment screw 1 at the autosampler.
- Tighten the screws and secure the adjustment with lock nuts.
- Adjust the z direction software-controlled.
  Lower the autosampler arm up to the upper edge of the adjusting aid until the dosing tube just dips into the dosing opening.
- By clicking on the [NEXT] button save the adjustments in the x and z direction in the software.
  - ✓ The autosampler arm returns to the initial state.
- Remove the adjusting aid and re-insert the dosing funnel.

Adjust the injection depth of the sample in the graphite tube:

- Loosen the clamp nut, place the dosing tube onto the tube bottom, check position with furnace camera if necessary, fasten with a clamping nut.
- Adjust the autosampler arm software-controlled to the optimum injection depth above the tube floor (approx. -0,8 mm for 20 µL pipetting volume).
- Complete the adjustment with [FINISH].
  - ✓ The AS-GF autosampler has been adjusted and is now ready to take measurements.

For further configurations of the autosampler see the instruction manual "ASpect CS" section "Technical autosampler parameters".

5.5.3 Populating the sample tray

1. Populate the positions of the AS-GF as follows:

Positions 1-100	1.5 mL sample cups
Positions 101 – 108	5 mL special cups

2. Place the sample cover with a tight fit.
3. Next steps: Fill the wash bottle with wash solution (e.g. 1 % HNO_3). If necessary, empty the waste bottle and dispose of the waste correctly.

Note: The population of the sample tray must match the software configuration in the method or in the sample ID.

5.5.4 Uninstalling the autosampler

1. Switch off the contrAA 800 and accessories, paying attention to the shutdown sequence.

2. **For HydrEA coupling**:
   Remove the tube for the reaction gas from the titanium cannula. Remove the titanium cannula from the hose guide by loosening the clamping nut.
3. Remove the control cable from the socket in the right side wall of the AAS device (autosampler graphite connection).
4. Detach adjustment screws 2 and 3 and remove the autosampler AS-GF from the sample chamber.

5.6 Flame technique

WARNING

Danger of UV radiation being reflected!

Modifications and maintenance in the sample chamber may maladjust the atomization unit. The maladjustment of the atomization unit may result in UV radiation emerging from the sample chamber.

In the contrAA 800 D the atomization unit is automatically adjusted prior to each measurement start. If the atomization unit is maladjusted during an ongoing measurement, e.g. by an impact, stop and restart the measurement.

Check the alignment of the atomization unit in the contrAA 800 F. If necessary, realign the atomization unit in the beam path using the adjustment screw (→ section "Aligning the atomization unit in the beam path" p.87).

In the flame and hydride techniques only work with the sample chamber door locked. The safety glass protects against UV radiation being emitted.

5.6.1 Connections in the sample chamber for the flame technique

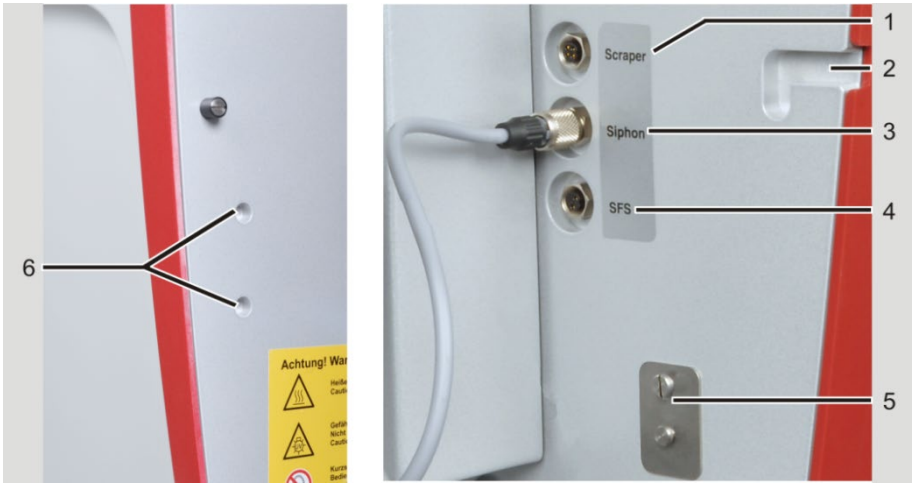


Fig. 40 Connections at the sample chamber walls

1 Scraper connection
2 Suspension for autosampler
3 Siphon monitoring connection
4 Connection for injection module SFS 6
5 SFS 6 suspension
6 Mounting holes for autosampler

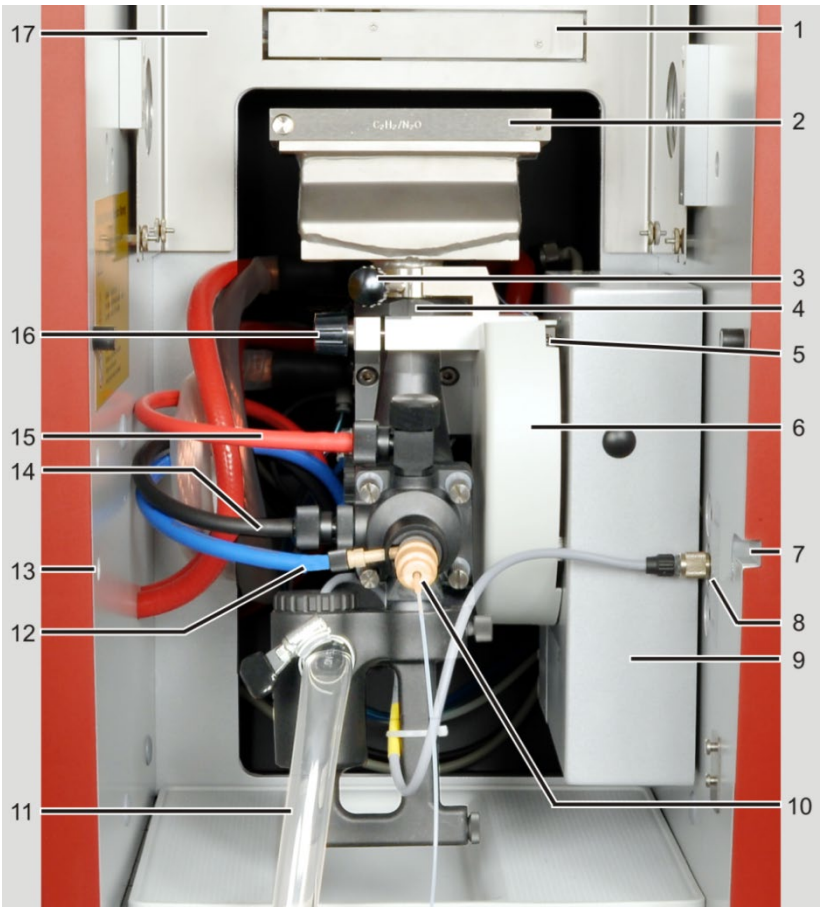


Fig. 41 Connections at the burner-nebulizer system

1 Automatic ignition unit
2 Burner
3 Screw for burner attachment
4 Markings for burner alignment on the mixing chamber tube and the mount
5 Depth stop screw
6 Motorized depth adjustment
7 Suspension for AS-F/AS-FD, right
8 Connecting sockets for siphon sensor, injection module SFS6 and scraper
9 Height adjustment
10 Sample liquid supply
11 Outlet tube from the siphon
12 Oxidant connection (blue hose)
13 Suspension for AS-F/AS-FD, left
14 Auxiliary oxidant connection (black hose)
15 Fuel gas connection (red hose)
16 Attachment screw for the support bracket
17 Heat protection plate

5.6.2 Software settings for the flame technique

In the QUICKSTART window of the ASpect CS software, you must select the atomization technique used (see the ASpect CS operating instructions/help). Through initialization the software interface is adjusted accordingly with the method and device parameters.

In the contrAA 800 D the burner-nebulizer system is moved software-controlled into position during initialization and aligned in height and depth in the beam path. In the contrAA 800 F the atomization unit is automatically aligned in height. The depth of the atomization unit is set at factory.

ATTENTION

Danger of equipment damage in the contrAA 800 D!

Before changing the atomizing technique, remove the burner, cell unit with hydride

cell and autosampler, since these accessories might be damaged during rotation.

5.6.3 Installation for manual sample supply

With manual sample supply the sample is loaded directly to the burner-nebulizer system. The use of the injection module SFS 6 is possible.

ATTENTION

Switch off the novAA 800 prior to installation! Connecting or disconnecting electrical plug contacts might damage the sensitive electronics of the contrAA 800.

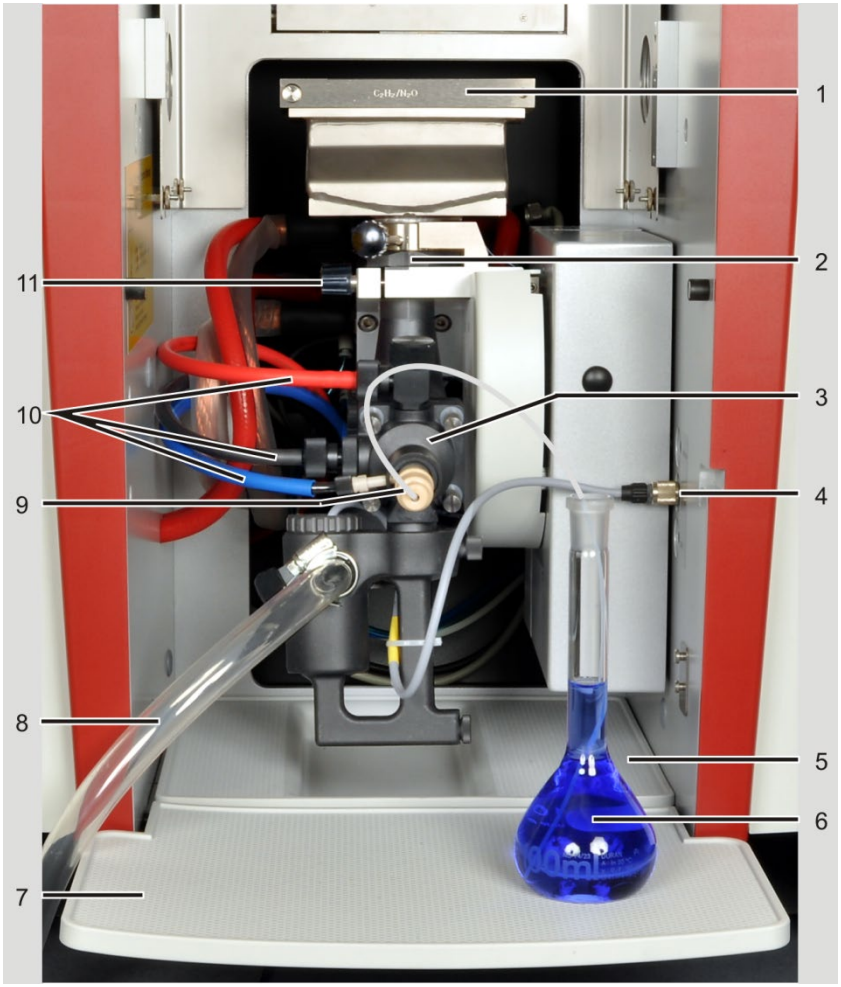


Fig. 42 Flame technique, manual sample supply

1 Burner
2 Markings for burner alignment on the mixing chamber tube and the mount
3 Mixing chamber nebulizer system
4 Siphon sensor connection cable
5 Collection pan
6 Sample cup
7 Sample tray
8 Outlet tube from the siphon
9 Sample aspiration hose on the nebulizer
10 Gas connections
11 Holding fixture for the height adjustment

1. Switch off the contrAA 800 and accessories, paying attention to the shutdown sequence.
2. Check the tight fit of the mixing chamber-nebulizer system in the holding fixture of the height adjustment. The plate of the mixing chamber tube must make contact.

The marking on the mixing chamber tube must be positioned above the edge of the holding fixture (2 in Fig. 42).

3. Plug the nebulizer into the mixing chamber head and lock with the ring.
4. Fit the collection pan below the burner-nebulizer system.
5. Hook the sample tray into the guides at the front of the device and screw them tight.
6. Plug the outlet tube from the connector of the siphon to the connector or the corresponding opening in the lid of the collection bottle. Secure the hose with the hose clamp at the siphon.
   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. The hose must not dip in the liquid of the collection bottle.
7. Fill the siphon with water via the mixing chamber tube until water flows out via the outlet tube.

   Note: In the contrAA 800 D re-fill the siphon after changing the atomization technique. Some water drains through the drainage tube if the flame atomizer is in the bottom position.
8. Connecting the gas supply (10 in Fig. 42):
   - Hose for fuel gas (red) at the top of the mixing chamber head
   - Hose of oxidant (blue) at the side of the nebulizer
   - Hose for auxiliary oxidant (black) at the side of the mixing chamber
9. Place the required burner (50 mm/100 mm) onto the mixing chamber tube, turn to the stop position and clamp. Ensure that the burner is positioned correctly.
10. Plug the connector of the siphon sensor into the connection on the right sample chamber wall.
11. **Injection module SFS 6**
    If you are working with injection module SFS 6, install injection module SFS 6 (→Section "Installing the injection module SFS 6 " p. 72).
12. Place the sample and wash cups onto the sample tray or a separate table.
13. Attach the aspiration tube to the nebulizer cannula. Dip the other tube end into the sample.
14. Hang the safety glass in and slide it in front of the burner.
15. Switch on the contrAA 800 and start the ASpect CS control software.
    - ✓ The burner-nebulizer system is installed and ready for manual sample supply.

5.6.4 Installation for continuous working mode with autosampler

In continuous working mode, the samples are loaded using the autosampler AS-F or AS-FD.

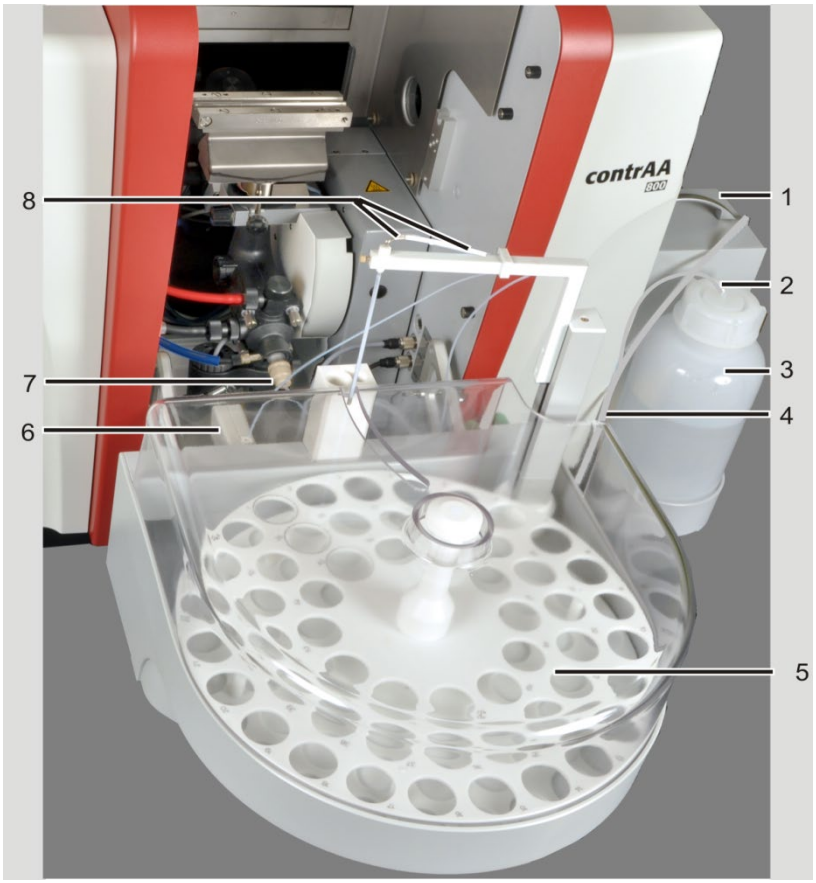


Fig. 43 Flame technique with autosampler AS-FD and SFS 6

1 Fluidik module with dosing unit
2 Hose for washing liquid
3 Storage bottle for washing liquid
4 Encased tubes for washing liquid and diluent
5 Autosampler AS-FD with sample tray
6 Injection module SFS 6 (where applicable)
7 Sample liquid supply
8 Tube for diluent (thick cannula) and sample intake tube (thin cannula)

ATTENTION

Switch off the contrAA 800 prior to installation!

Connecting or disconnecting electrical plug contacts might damage the sensitive electronics of the contrAA 800.

Installing the burner/nebulizer system

1. Switch off the contrAA 800 and accessories, paying attention to the shutdown sequence.
2. Check the tight fit of the mixing chamber-nebulizer system in the holding fixture of the height adjustment. The plate of the mixing chamber tube must make contact.

   The mixing chamber must be aligned to the height adjustment, the marking on the connector must be above the edge of the holding fixture (4 in Fig. 41 p. 65).
3. Plug the nebulizer into the mixing chamber head and lock with the ring.
4. Fit the collection pan below the burner-nebulizer system in the sample chamber.

5. Plug the outlet tube from the connector of the siphon to the connector or the corresponding opening in the lid of the collection bottle. Secure the hose with the hose clamp at the siphon.

   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. The hose must not dip in the liquid of the collection bottle.

6. Fill the siphon with water via the mixing chamber tube until water flows out via the outlet tube.
7. Plug the connector of the siphon sensor into the connection on the right sample chamber wall (3 in Fig. 40 p.64).
8. Connecting the gas supply:
   - Connect the hose for fuel gas (red) at the top of the mixing chamber head (15 in Fig. 41 p.65)
   - Connect the hose for oxidant (blue) at the nebulizer (12 in Fig. 41 p.65)
   - Connect the hose for auxiliary oxidant (black) at the side of the mixing chamber (14 in Fig. 41 p.65)
9. Place the required burner (50 mm/100 mm) onto the connector, turn to the stop position and clamp. Ensure that the burner is positioned correctly.
10. Hang the safety glass in and slide it in front of the burner.

    ✓ The burner-nebulizer system is installed complete with connections.

Installing the injection module

If you are working with injection module SFS 6, install injection module SFS 6 (→Section "Installing the injection module" p.72).

Installing the autosampler

1. Hang the autosampler in the corresponding supports of the sample chamber (2, 6 in Fig. 40 p. 64).

   Adjust the adjusting screw at the right suspension mount in such a way that the autosampler cannot slip out of the mounting hole (3 in Fig. 44 p. 70).

2. Place the Fluidik module (for AS-FD) or storage bottle for washing liquid (for AS-F) next to the AAS device.
3. Plug the control cables for connecting the autosampler to the Fluidik module and the AAS device into the connections on the rear of the autosampler and lock them in place (1 and 2 in Fig. 44 p. 70). To do so, unhook the autosampler on the right.
4. Plug the control cable into "Sampler flame" connection on the right-hand wall of the contrAA 800 (7 in Fig. 28, p. 50 or 8 in Fig. 30 p. 51) and lock it in place.
5. Attach the outlet tube to the outlet connector of the autosampler (backplate, 4 in Fig. 44 p. 70).

   Attach the outlet tube to the connector or the corresponding opening in the lid of the receiving bottle.

   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. Tube must not dip in the liquid.

6. Screw the tube for the washing liquid to the rear of the autosampler (5 in Fig. 44 p. 70).

   Note: In the AS-FD the hoses for the connection between the autosampler and the Fluidik module are connected to each other with a casing and numbered. The tubes

are attached to the rear of the autosampler using the attachment lug. Wash tube "2" marking.

7. Insert the cannula(s) with guide into the opening in the autosampler arm and secure with the lock screw.

   Note: The autosampler arm can be moved manually in the deactivated state.

8. In the AS-FD feed the dosing tube for the diluent (marking "1") through the tube guide at the autosampler arm and plug it onto the thicker cannula of the autosampler arm.
9. Plug the sample intake tube through the tube guide at the autosampler arm onto the thin cannula of the autosampler arm.
10. Stick the sample aspiration tube onto the nebulizer cannula.
11. Lay the sample tray on the autosampler casing, make sure it clicks into place.

    Note: The control does not start the autosampler, or stops it automatically, if there is no sample tray.

12. Place the sample cover until it sits in the guide rail.

1 Fluidik module connection
2 AAS connection
3 Suspension mount with adjusting screw
4 Connector for outlet tube
5 Screw for wash tube
6 Suspension mount for injection module SFS 6

Fig. 44 Rear of the autosampler AS-FD

Preparing the Fluidik module (AS-FD only)

1. If necessary, fit the dosing syringe to the dosing unit (→ Section "Replacing the dosing syringe" p.108).
2. Place the storage bottles for the wash liquid (left) and diluent (right) into the bottle holders of the Fluidik module.
3. Immerse the short tube (marking at the tube "3") into the storage bottle for the diluent. Screw the second tube end to the valve (2 in Fig. 45 p. 71).
4. Screw the dosing tube for the diluent (encased, marking "1") to the second connection of the valve (3 in Fig. 45).
5. Immerse the hose for the wash liquid (marking "2") into the storage bottle.

   ✓ The burner-nebulizer system is installed and ready for continuous sample supply with the AS-F or AS-FD.

1 Storage bottle for washing liquid
2 Diluent connection
3 Dosing tube connection (to AS-FD)
4 Dosing syringe with piston and glass cylinder
5 Drive rod with attachment screw
6 Storage bottle for diluent

Fig. 45 Dosing unit at the Fluidik module of the AS-FD

Uninstalling the autosampler

1. Switch off the contrAA 800 and accessories, paying attention to the shutdown sequence.

Uninstalling the autosampler

2. Detach the sample intake tube from the thin cannula of the autosampler arm.
3. Detach the tube for the wash liquid from the rear of the autosampler.
4. For the AS-FD detach the dosing tube for the diluent from the thicker cannula. Pull the two encased tubes out of the attachment lug at the rear of the autosampler.
5. Pull the outlet tube from the connector of the autosampler (backplate).
6. Detach both control cables at the rear of the autosampler.
7. Remove the autosampler from the sample chamber.

Uninstalling the injection module

8. If the injection module SFS 6 was used during operation, decommission the injection module SFS 6 (→Section "Uninstalling the injection module" p. 72).

5.6.5 Installing the injection module SFS 6

Installing the injection module

Fig. 46 Installing the SFS 6 for manual sample supply

1 Tube to the sample / autosampler
2 Tube to nebulizer
3 Injection module SFS 6
4 Hose to washing solution
5 Connection cable to the control of the SFS 6

1. Screw the intake tubes into the injection module:
   - medium length hose in the top connection – to the sample (1 in Fig. 46)
   - short hose in the side connection – to the nebulizer cannula (2)
   - long hose in the bottom connection – to the wash solution (4)
2. Manual working mode: Hook the injection module into the suspension mount in the sample chamber. Work with an autosampler: Hook the injection module onto the bracket at the rear of the autosampler (6 in Fig. 44 p. 70).
3. Plug the control cable (5 in Fig. 46) into the two pin socket in the sample chamber wall.
4. Plug the short tube (2) onto the nebulizer cannula.
5. Immerse the long tube (4) into the storage bottle with wash solution.
6. Immerse the medium length tube into the sample cup or connect it to the intake cannula of the autosampler.

   ✓ The injection module SFS 6 is ready for measurements.

Uninstalling the injection module

1. Remove the intake tubes out from the washing liquid bottle and the sample cup (for manual operation), or pull them off the intake cannula of the autosampler, allowing the system to drain.
2. Pull off the short piece of tube from the nebulizer cannula.
3. Detach the control cable of the SFS 6 from the AAS, remove the injection module.

5.6.6 Replacing the burner

CAUTION

Risk of burns!

To remove the hot burner, use the burner bracket (optional accessory). Otherwise wait until the burner has cooled down.

1. Push the safety glass upwards.
2. Loosen the fixing screw of the burner and take the burner off. Use the burner bracket if available.
3. Place the new burner on the mixing chamber tube, turn against the 0° stop and fasten with the fixing screw.

   ✓ The new burner is fully installed.

5.6.7 Installing the scraper

When working with the nitrous oxide flame, it is recommended to use scraper, because it automatically cleans carbon deposits from the burner head during operation with the nitrous oxide flame. Alternatively, carbon deposits can be manually removed from the burner slot with the cleaning rod.
The scraper is delivered ready installed on the 50 mm burner by the manufacturer upon request. It can also be retrofitted on a 50 mm burner.

ATTENTION

For combustion gas flows > 250 NL/h pay attention to stubborn deposits. Remove these where necessary to ensure the functionality of the scraper.

1. Unscrew the screws from the front burner jaw (arrows in Fig. 47).
2. Unscrew the fastening rail (1 in Fig. 48) with knurled head screws (3 in Fig. 48) from the scraper.

   The captive knurled head screws remain attached in their holder in the scraper.
3. Fit the fastening screws to the burner body as shown in Fig. 48. Use the three long titanium screws and nuts supplied. Place the screws from the top through the front burner jaw and screw down the fastening rail with nuts.

   Attach the scraper to the guide pins of the fastening rail (2 in Fig. 48) and tighten with knurled head screws (3 in Fig. 48).

   ✓ The scraper is installed.

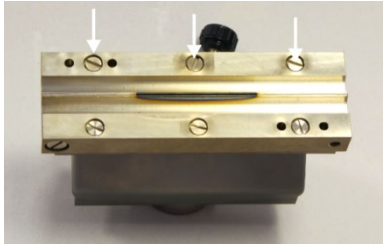
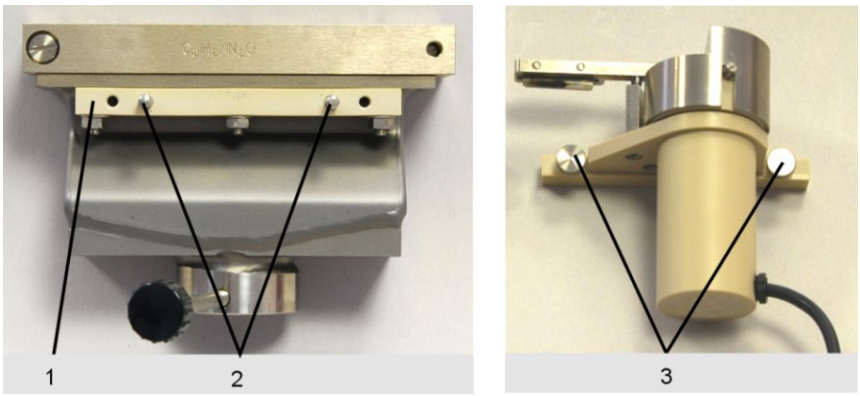


Fig. 47 Screws on the front burner jaw



1 Fastening rail for scraper, fitted to the burner
2 Guide pins
3 Knurled screws

Fig. 48 Fastening rail / knurled screws at the scraper

5.7 Commissioning the contrAA 800 with accessories

5.7.1 Switching on sequence

ATTENTION

Danger of equipment damage in the contrAA 800 D!

Before changing the atomizing technique, remove the burner, cell unit with hydride cell and autosampler, since these accessories will be damaged during rotation.

1. Switch on the exhaust unit.
2. Switch on the PC and wait for the operating system to initialize: The application icons appear on the screen, including the ASpect CS program icon.
3. Switch on the contrAA 800: Press the green ON/OFF switch on the right side wall. Wait until the spectrometer has fully completed its automatic initialization (approx. 3 min.).
4. Start the ASpect CS program: Double-click with the mouse cursor on the ASpect CS icon.
5. In the ASpect CS software in the MAIN SETTINGS window make the configurations for the atomization technique and initialize the system.
6. Connect the printer and the compressor if they are needed.

   ✓ The AAS system is now switched on, work (analysis preparation and measurement) may begin.

5.7.2 Switching off sequence

ATTENTION

Danger of lamp damage!

After switching off the Xenon short arc lamp the cooling circuit of the Xenon short arc lamp should continue to run for 30 s before the AAS unit is switched off.

1. On the PC close the control software ASpect CS: Click on the menu FILE ▸ EXIT.
2. For unsaved values decide whether data or information should be saved before exiting the program.
3. If the Xenon short arc lamp is still switched on or was switched off less than 30 s ago:
   A prompt asks whether the Xenon short arc lamp should be switched off. If the lamp is switched off, ASpect CS will exit after a delay of 30 s.
4. Shut down the PC.
5. Use the respective mains switches to switch off (in this order):
   - Compressor
   - AAS accessories (e.g. hydride system)
   - contrAA 800
   - Printer
   - PC

   ✓ The AAS system is now switched off.

6 Service and maintenance

WARNING

Electric shock!

The contrAA 800 must be switched off and the mains plug disconnected before carrying out any maintenance work. The safe disconnection of the contrAA 800 from the mains can only be achieved by pulling out the mains plug. Power is still supplied to both certain areas of the spectrometer, as well as the output socket, after the device has been switched off at the main switch.

This excludes maintenance work during which the operation of the AAS device and the control software is explicitly required, such as the clean out of the graphite tube.

WARNING

Danger of eye and skin damage from UV radiation!

The Xenon short arc lamp and the frame radiate highly intensive light in the visible and UV range. Do not look into the beam of the Xenon short arc lamp or the flame without UV protection glasses. Protect your skin against UV radiation.

WARNING

Danger of UV radiation being reflected!

Modifications and maintenance in the sample chamber may maladjust the atomization unit. The maladjustment of the atomization unit may result in UV radiation emerging from the sample chamber.

In the contrAA 800 D the atomization unit is automatically adjusted prior to each measurement start. If the atomization unit is maladjusted during an ongoing measurement, e.g. by an impact, stop and restart the measurement.

Check the alignment of the atomization unit in the contrAA 800 F. If necessary, realign the atomization unit in the beam path using the adjustment screw (→ section "Aligning the atomization unit in the beam path" p.87).

In the contrAA 800 G the risk of maladjustment can be precluded.

WARNING

Danger of explosion!

The lamp bulb of the Xenon short arc lamp is pressurized (1.5-1.6 MPa cold pressure) and might burst. Only handle the lamp bulb in its safety packaging. Always store new and used lamp bulbs in the safety packaging.

Analytik Jena recommends wearing face protection during the lamp replacement.

Insert the new Xenon short arc lamp in accordance with specifications in the correct direction and with the correct polarity. Do not allow moisture to enter the lamp housing. Only operate the lamp once it has been inserted into the lamp chamber.

Dispose of used bulbs in accordance with the national regulations for high pressure lamps (short arc lamp), paying attention to the packing label supplied. Do not dispose in domestic waste! For queries about disposal please contact the Analytik Jena customer service.

WARNING

The operator is responsible for carrying out suitable decontamination prior to maintenance or repair. This applies whenever the device has been contaminated with hazardous substances externally or internally.

CAUTION

The operator may not undertake any service or maintenance work to this device and its components other than those specified and described in this chapter. Observe the notes in section "Safety instructions" p. 11. Compliance with these safety instructions is a requirement for error-free operation. Always observe all warnings and instructions which are displayed on the device itself or which are displayed by the control program ASpect CS.

CAUTION

Risk of burns at hot surfaces! Before any maintenance of the graphite tube furnace and the burner-nebulizer system pay attention to the cooling down phases.

6.1 Maintenance overview

Maintenance item	Action	Frequency
Base device		
Fuses	Exchanging fuses	When required
Sample chamber	Cleaning Remove fluid from the collection pan	Regularly If there are residues in the tray
	Clean the windows for beam entry and exit in the sample chamber	With visible contamination or if there is a loss of energy and after prompting by ASpect CS
Continuous radiator	Replace lamp bulb	If necessary.
Recirculating chiller for Xenon short arc lamp and graphite tube furnace	Check the cooling water level in the cooling water tank Fill cooling water Replace cooling water, clean tank	Monthly If necessary. Annually
Fans (rear of the device)	Check the ventilation grid for contamination, clean if necessary	Monthly
Air filter (rear of the device)	Visual inspection for contamination Replace.	Regularly, in dusty environments (e.g. mines) daily As required, but no later than after 12 months
Gas connectors	Check for leaks	Weekly and each time when new connections are made or if there is a noticeable pressure drop at the manometer of the external gas supply

Maintenance item	Action	Frequency
Atomization unit	align in the beam path	contrAA 800 D: automatic height and depth adjustment contrAA 800 G: automatic height adjustment, depth adjustment possible via adjustment screw contrAA 800 F: automatic height adjustment, adjust depth after installation and maintenance work via adjustment screw
Graphite tube furnace		
Furnace window	Wipe with a lint-free cloth soaked in alcohol	Daily to weekly, dependent on the sample matrix
	Clean with a mild surfactant.	For stubborn contamination
Graphite surfaces	Clean the contact surfaces of the electrodes with a cotton swab, a lint-free cloth soaked in alcohol or cotton swab.	Daily
Graphite tube	Clean by clean-out via control software	Daily
	Replace.	With marked burn-up, severe loss of sensitivity and very high RSD% values If an error message indicates that the formatting factor is outside of tolerances
iridium or gold coated graphite tube	Evaporate the metal coating	After approx. 500 atomizations or for a new coating (faults lead to distorted measuring results)
electrodes and furnace jacket	Clean contact surfaces of the electrodes	Daily to weekly, when working with matrix modifiers ($MgNO_3$) immediately after use
	Check for wear, replace if necessary	Monthly, if necessary
Pipetter insert	Clean and wash	May be necessary on a daily basis, depending on the type of samples
Burner-nebulizer system		
Burner-nebulizer system	Dismantle and clean, optimize sensitivity if necessary	Depending on analyzed sample material, biological samples or samples with a high salt content require more frequent cleaning
Sensor for burner detection	Clean with alcohol	With visible contamination or if an installed burner is not correctly detected by the software
Injection module SFS 6	Check hoses for deposits, kinks and cracks, replace if necessary	Regular inspection, replace hoses if necessary
Autosamplers AS-GF, AS-F and AS-FD		
Dosing tube / cannulas	Check for deposits, kinks and cracks, replace if necessary	Check regularly since deposits can falsify the measurement results.

Maintenance item	Action	Frequency
Wash cup, mixing cup	Cleaning Check wash cup for freedom of bubbles	Regularly Regularly, especially after filling
Dosing syringe at the dosing unit	Replace.	As required (if leaks occur)
Piston compressor PLANET L-S50-15		
Pressure reservoir, liquid separator at the filter pressure reducer	Drain condensate	Weekly
Intake filter	Check Clean, replace if necessary	Monthly Semi-annually
Oil	Check oil level Replace oil	Weekly Annually

6.2 Base device

6.2.1 Replacing the fuses

WARNING

Danger of electric shock!

Switch off the contrAA 800 from the mains switch and disconnect it from the mains prior to replacing the fuses.

The power supply fuses (F1, F2) of the contrAA 800 D and G may only be changed by the customer service of Analytik Jena or by technical personnel authorized by Analytik Jena.

contrAA 800 D + G

The fuses of the contrAA 800 D and G are located at the rear of the device at the connection strip and in the sample chamber. They are marked.

Fuses rear of device

For fuses see 2, 4 in Fig. 27 p.49

Fuse number	Type	Protected circuit
F3	T 6.3 A/H	Mains outlet
F4	T 6.3 A/H	Mains outlet
F5	T 6.3 A/H	Spectrometer
F6	T 6.3 A/H	Spectrometer

Fuses connection strip

For lamp fuse see 4 in Fig. 28 p.50

Fuse number	Type	Protected circuit
F7	T 3.15 A	Xenon short arc lamp
F8	T 3.15 A	Xenon short arc lamp

Furnace fuse

For furnace fuse see 8 in Fig. 12 p.33

Type	Protected circuit
TR5-T 100 mA	Graphite tube furnace

contrAA 800 F

The fuses of the contrAA 800 F are located at the connection strip (see 4, 6 in Fig. 30 p.51).

Fuse number	Type	Protected circuit
F1	T 10 A/H	Power supply
F2	T 10 A/H	Power supply
F3	T 3.15 A/H	Xenon short arc lamp
F4	T 3.15 A/H	Xenon short arc lamp

6.2.2 Cleaning the sample chamber

- Clean the sample chamber regularly using a lint-free cloth moistened with alcohol.
- If liquid residue is found in the collection pan, e.g. drained off the siphon, carefully remove the collection pan, drain it and rinse it under a tap.
- If a loss of energy is noticed, check the radiation inlet and outlet windows and clean if necessary.
  In the contrAA 800 D and F remove the heat protection plate (17 in Fig. 41 p. 65). Turn the windows to unscrew them from the bayonet lock. Wipe the windows free of streaks with a lint-free cloth soaked in alcohol (optical cloth) and re-insert them.

  Note: After cleaning the windows with alcohol it takes approx. 1 h before the complete UV transmission has been restored.

6.2.3 Replacing the Xenon short arc lamp

WARNING

Danger of electric shock!

Switch off the contrAA 800 and disconnect it from the mains before replacing the lamp

CAUTION

Risk of burns at hot surfaces! During operation the lamp housing may reach temperatures of up to 60 °C. Allow the housing to cool down for a few minutes.

ATTENTION

Avoid contamination of the lamp window!

Do not touch the (quartz glass) lamp window during the lamp replacement. Finger prints may burn in and impair the lamp properties.

1. Close the ASpect CS software and switch off the contrAA 800 and accessories. Disconnect the device from the mains and allow it to cool down for a few minutes.

2. Open the lamp chamber door (at the front, to the left of the sample chamber).

3. Place a cloth or similar under the cooling water couplings.

   Disconnect the quick-release coupling for cooling water from the underside of the lamp housing.

   To disconnect the coupling press the (metal) lock inwards until it releases and pull the coupling down and out.

   Note: The couplings contain valves that automatically close when disconnected. However, a few drops of water will escape.

4. Using the hexagon socket wrench 5 mm (included in the scope of delivery), fully unscrew the horizontal fastening screw of the lamp housing.

   This presses the lamp housing forward on the two guide bolts and disconnects the electrical plug connection (not visible).

5. Hold the lamp housing from the handle with one hand and from the underside with the other and pull it off the guide bolts towards the front.

   Note: Hold the lamp housing well, it is heavy.
   Do not touch the lamp window!

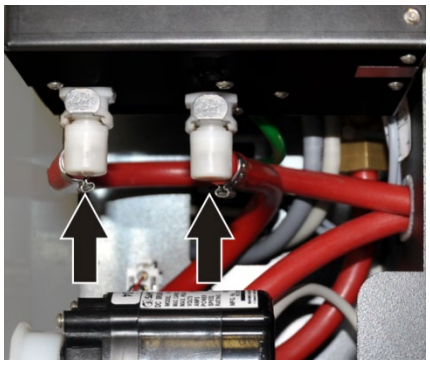
6. Install the new lamp housing back in the lamp chamber. Place the lamp housing onto the guide bolts and slide it back.

   Note: Do not touch the lamp window!

7. Using the hexagon socket wrench 5 mm tighten the fastening screw of the lamp housing.

   This presses the lamp housing back on the two guide bolts and into the electrical multi-pole plug connection.

   Note: The lamp housing must allow tightening without noticeable resistance! Do not use force!



8. Connect the cooling water hoses at the underside of the lamp housing.

   To this end insert the plug-in couplings into each counterpart in the lamp housing (left hose – left inlet, right hose – right inlet) and press in up to the stop.

   Note: When pressing it in a "click" must be heard, the lock of the quick-release coupling disengages.

9. Switch on the contrAA 800 and wait for the device initialization to complete.
10. Check that the lamp is burning, the recirculation pump is working and cooling water flows back to the cooling water tank.

    Note: If no cooling water flows back with the recirculating pump running, one (or both) plug-in couplings are not inserted correctly. In this case switch off the device and disconnect and reconnect the couplings again.

11. Check the filling level in the cooling water tank. Fill the cooling water tank if necessary (→ section "Checking the cooling water level and replacing the cooling water" p.82).

    The filling level drops slightly after installing the lamp since the system fills with cooling water. The displaced air escapes after a few seconds via the cooling water tank.

    Attach the sealing lid of the cooling water tank and screw it on finger-tight.

12. Wipe away any escaped drops of water and close the lamp chamber door.

    ✓ The new xenon lamp is ready for operation.

6.2.4 Protection against overheating and uncontrolled furnace heating

The temperature of the cooling water circuit is measured using two safety circuits.

Overheating protection for the Xenon lamp

The first safety circuit automatically switches off the Xenon short arc lamp with a cooling water temperature of ≥60 °C. If the cooling water temperature has dropped below the limit value, the lamp is re-ignited after switching the contrAA 800 back on and initialization.

Protection against uncontrolled furnace heating

A second safety circuit protects the contrAA 800 D and G during a possible communication fault between the control (PC) and the AAS against continued uncontrolled heating of the graphite tube furnace.

The temperature sensor is located at the rear of the fixed furnace part (7 in Fig. 12 p.33). This safety circuit disconnects the hardware mains connection of the device at a cooling water temperature of ≥95 °C. Device damage from continued heating of the furnace is prevented. Once the cooling water temperature has dropped below the limit value, the contrAA 800 switches back on automatically.

6.2.5 Checking the cooling water level and replacing the cooling water

Check the cooling water level monthly. The tank for the cooling liquid to cool the graphite tube furnace and Xenon short arc lamp is located in the lamp chamber.

1 Lamp chamber door
2 Cooling water tank
3 Pump
4 Xenon short arc lamp

Fig. 49 Cooling water tank in the lamp chamber

Filling cooling water

1. Open the lamp chamber door (at the front, to the left of the sample chamber).
2. Fill the cooling water tank with approx. 4 liters tap water up to the "max" marking.

   Mix very hard tap water (conductivity σ ≥ 1mS/cm) 50/50 with deionized water.

   Make sure that the rear chamber of the tank is also filled.
3. Screw on the cover finger-tight.
4. Close the lamp chamber door.

Replacing the cooling water

The cooling water must be replaced annually. At the same time the cooling water tank must be cleaned to prevent contamination of the spectrometer. The cooling water tank and pump assembly can be easily removed from the lamp chamber for this purpose.

ATTENTION

Danger of equipment damage!

Add Analytik Jena cooling water additive to the cooling water. Damage at the contrAA 800 due to not having used cooling water additive is excluded from the warranty!

1. Switch off the contrAA 800 and accessories, taking the shutdown sequence into account. Disconnect the contrAA 800 from the mains and allow to cool down for a few minutes.
2. Open the lamp chamber door (at the front, to the left of the sample chamber).

Remove the continuous radiator:

3. Place a cloth or similar under the cooling water couplings.

   Disconnect the quick-release coupling for cooling water from the underside of the lamp housing.

   To disconnect the coupling press the (metal) lock inwards until it releases and pull the coupling down and out.

   Note: The couplings contain valves that automatically close when disconnected. However, a few drops of water will escape.

4. Using the hexagon socket wrench 5 mm (included in the scope of delivery), fully unscrew the horizontal fastening screw of the lamp housing.

   This presses the lamp housing forward on the two guide bolts and disconnects the electrical plug connection (not visible).

5. Hold the lamp housing from the handle with one hand and from the underside with the other and pull it off the guide bolts towards the front.

   Note: Hold the lamp housing well, it is heavy.
   Do not touch the lamp window!

6. Safely put the removed lamp housing aside.

Removing and cleaning the cooling water tank assembly:

7. Detach the hose connection at the rear of the cooling water tank from the snap fasteners.

8. Detach the pump connector from the rear panel.

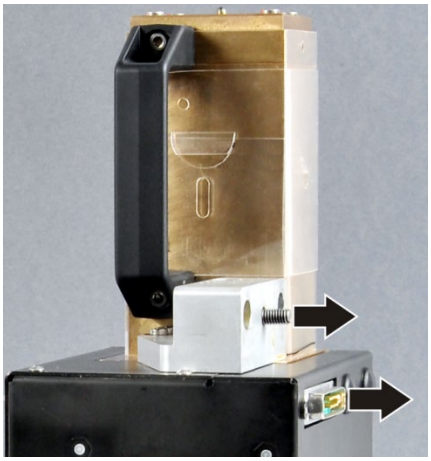
9. Detach the screws securing the assembly (see arrows).
10. Lift the assembly out of the lamp chamber.
11. Drain the cooling water tank. Clean with hot water and detergent. Rinse with tap water.

Reinstalling the cooling water tank assembly:

12. Insert the assembly into the lamp chamber.
13. Tighten the 3 screws securing the assembly.
14. Plug in the pump connector.
15. Plug in the hose connection at the rear of the cooling water tank.

    To do so, plug the plug-in coupling of the hose into its counterpart at the cooling water tank and press in up to the stop.

Note: When pressing it in a "click" must be heard, the lock of the connection piece disengages.

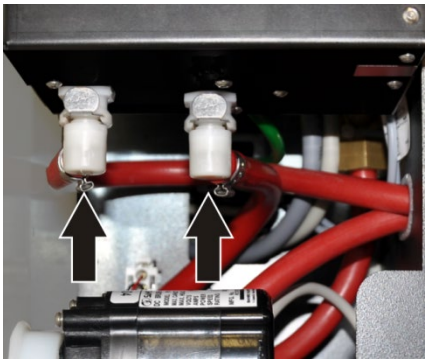


Reinstalling the lamp housing:

16. Insert the **lamp housing** into the lamp chamber.
17. Using the hexagon socket wrench 5 mm tighten the fastening screw of the lamp housing.

    This presses the lamp housing back on the two guide bolts and into the electrical multi-pole plug connection.

    Note: The lamp housing must allow tightening without noticeable resistance! Do not use force!



18. Connect the cooling water hoses at the underside of the lamp housing.

    To this end insert the plug-in couplings into each counterpart in the lamp housing (left hose – left inlet, right hose – right inlet) and press in up to the stop.

    Note: A "click" must be heard when it engages.

Refilling the cooling water tank:

19. Dissolve 100 mL of the Analytik Jena cooling water additive in 4 L tap water. Mix hard tap water (≥ 1mS/cm) 50/50 with deionized water.
20. Fill the cooling water tank with the prepared solution up to the "max" marking. Make sure that both chambers of the tank are filled.
21. Attach the cover to the cooling water tank and screw it on finger-tight.
    ✓ The contrAA 800 can be re-commissioned.

6.2.6 Replacing the air filter

Air for spectrometer purging is aspired from the rear wall into the device interior through the air filter (7 in Fig. 27 p.49 or 2 in Fig. 29 p.50) and the integrated compressor. The air filter acts as a dust filter. It must be checked regularly for contamination. In very dusty environments (e.g. a mine) the inspection must be performed daily. The air filter must be replaced as required but no later than after 12 months.

- Unscrew the air filter counterclockwise from the counter thread in the device backplate. Insert a new filter.

6.2.7 Checking the gas connections for leaks

The gas connections (at the rear of the device) must be checked for leaks:

- Weekly as a safety check
- If a gas connection was opened during re-commissioning

To check for leaks, close the stop cock of the gas supply system and monitor the pressure indication in the downstream manometer. If the pressure drops significantly, look for and fix the gas leak as follows:

1. Brush connections with a heavily foaming liquid (e.g., soap solution). If bubbles form in the gas supply during commissioning, switch off the contrAA 800 and disconnect the gas supply.
2. Unscrew leaking gas connections and check for correct fit. Replace worn out sealing rings. Cut off worn hose ends.
3. Tighten gas connections manually or with a suitable open-ended wrench, ensuring correct fit.
4. Re-check the gas connections for leaks.

6.3 Aligning the atomization unit in the beam path

WARNING

Danger of UV radiation being reflected!

A maladjustment of the atomization unit may result in UV radiation emerging from the sample chamber. Carefully align the atomization unit in the beam path.

Conversion and maintenance work in the sample chamber may lead to a maladjustment of the atomization unit in relation to the sample chamber depth. If the atomization unit is maladjusted, the beam path no longer optimally strikes the atomized sample and the downstream optics. The quality of analytical detection suffers. With extremely severe maladjustment the UV radiation may be reflected of the atomization unit. Dangerous UV radiation may escape from the sample chamber.

Alignment in the contrAA 800 D

In the contrAA 800 D the atomization unit is automatically aligned in the sample chamber depth.

- The ASpect CS control software automatically checks the position of the atomization unit and corrects it if necessary before starting a measurement.
- If the atomization unit has been severely maladjusted due to manual intervention, the ASpect CS control software automatically performs a re-initialization. To this end some accessories, such as autosampler, must be removed. The software will issue the corresponding prompts.
- If the atomization unit is maladjusted during an ongoing measurement, e.g. by an impact, stop and restart the measurement manually.

Alignment in the contrAA 800 F + G

In the contrAA 800 F and G the atomization unit can be aligned in the sample chamber depth via an adjustment screw.

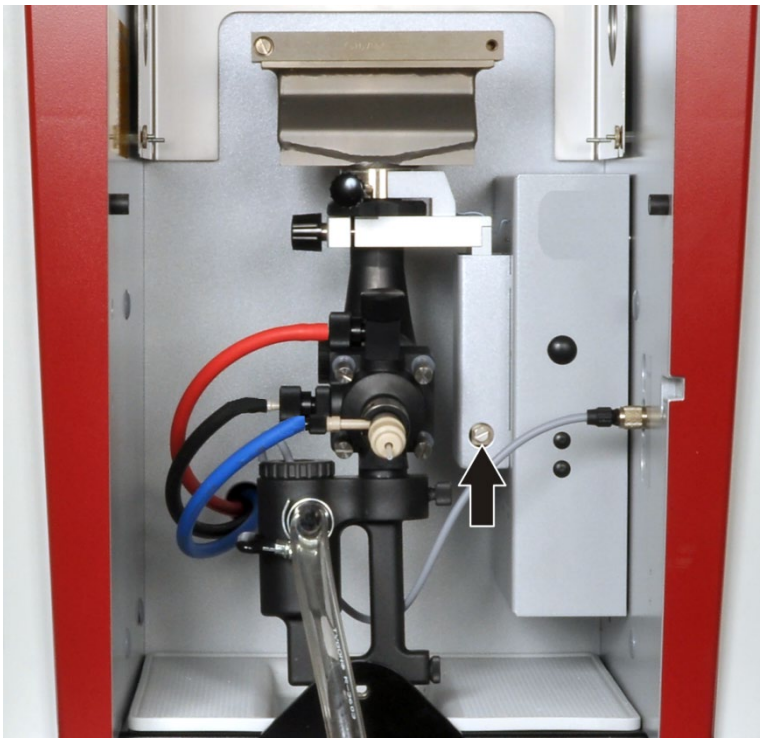


Fig. 50 Adjustment screw for aligning the atomization unit

- In the contrAA 800 F the alignment must always take place after conversion and maintenance at the burner-nebulizer system or at the cell unit. The sample chamber depth must be optimally adjusted to the position of the corresponding accessories (different burners, cell units).
- In the contrAA 800 G the factory adjustment can be used for all measuring tasks. Conversion and maintenance consists of only a few interventions in the graphite tube furnace. The risk of maladjustment can be precluded in this model.

Depth adjustment in the contrAA 800 F

1. In the ASpect CS software initialize the flame technique and use the  button to open the FLAME / CONTROL window.
2. In the group field SETTINGS adjust the ratio Gas C_2H_2 – oxidant (air or N_2O).
3. Use the [IGNITE FLAME] button to ignite the flame.
4. Change to the MANUAL OPTIMIZATION tab.
5. Select an element line, e.g. Cu324, and click on [SET].
6. Aspirate a test solution, e.g. Cu / 2 mg/L, via the nebulizer and start the continuous measurement value display with [START]. Evaluate the signal.
7. If the required sensitivity is not achieved, change the position of the adjustment screw with a screwdriver until the absorbance reaches a maximum at the selected element line.

Note: The height of the atomization unit is automatically set in all three device models after selecting the atomization technique in the MAIN SETTINGS window.

6.4 Graphite tube furnace

After a prolonged operation time, sample residues, modifiers and sublimated carbon from the graphite tube is deposited on the contact surfaces of the electrodes, the furnace jacket, the radiation sensor and the pipetter insert. These deposits may lead to deviations in the effective tube temperature and contaminate the analysis samples.

Damage to the furnace, ceramic ring, graphite tube or electrodes may also cause poor analysis results.

CAUTION

Risk of burning at the hot furnace!

Allow the graphite tube furnace to cool down before attempting any service or maintenance work.

6.4.1 Cleaning the furnace windows

ATTENTION

Do not touch the quartz panes of the furnace windows with your bare fingers. Fingerprints burn in.
Do not clean the furnace windows in an ultrasonic bath. This may lower the UV permeability of the windows.

Danger of brittleness for rubber seals. When cleaning the furnace windows with a cloth soaked in alcohol, make sure that the rubber seals do not come in contact with the alcohol.

The furnace windows must be cleaned weekly streak-free with a lint-free cloth soaked in alcohol (optical cloth). **Note:** After cleaning the furnace windows with alcohol it takes approx. 1 h before the complete UV transmission has been restored.
A mild surfactant should be used to clean stubborn contamination. Prepare the cleaning solution: Use a mixture of demineralized water and 1 Vol% cleaning solution.

1. Pull off the furnace windows by hand with a twisting motion. Do not touch the windows!
2. Fill a beaker with cleaning solution until the furnace windows are fully immersed in the solution.
3. Allow the solution to take effect for approx. 30 min at 25 to 30 °C.
4. Take the furnace windows out of the cleaning bath (e.g. using plastic tweezers, do not touch the optical surfaces) and rinse with demineralized water ($\sigma < 1$ µS/cm) .
5. Blow dry with compressed air or argon.
6. Re-insert the furnace windows.
   Identical markings must point up (→ Fig. 51)!

   If the furnace windows are too loose or if the sealing rings of the furnace windows exhibit brittleness and cracks, replace the sealing rings.

   ✓ The furnace windows are cleaned and re-installed.

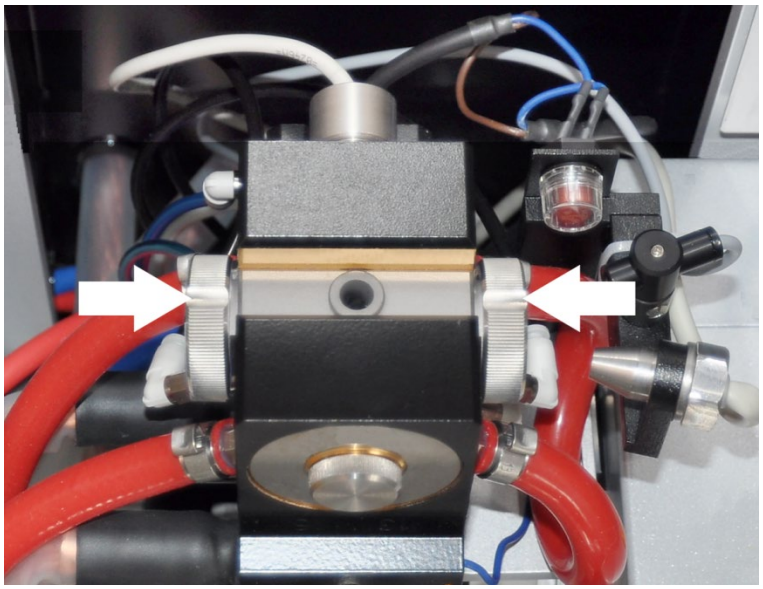


Fig. 51 Markings at the furnace windows

6.4.2 Cleaning the graphite surfaces

After using the device, the graphite surfaces must be cleaned daily.

1. Switch on the contrAA 800 and start the ASpect CS software (the movable furnace part must be pressurized to be opened/closed).
2. In ASpect CS open the window FURNACE with . Go to the CONTROL tab.
3. Open the furnace with the [OPEN FURNACE] button.
4. Remove the pipetter inset from the furnace jacket part and clean in 0.1-1 molar HNO_3.
   Then rinse with slightly acidic or demineralized water.
5. Clean the contact surfaces of the electrode in the movable furnace part with a cotton swab, a lint-free cloth soaked in alcohol, or blotting paper.
6. Clean inner surfaces of the furnace jacket with a cotton swab.
7. Close the graphite tube furnace via [CLOSE FURNACE].
   ✓ The graphite tube furnace is operational again.

6.4.3 Cleaning and changing the graphite tube

Clean the graphite tube

- Clean the graphite tube daily through clean out.

For the work steps see chapter "Cleaning / clean out of the graphite tube" p. 59.

Cleaning the coated graphite tube

- Clean the coated graphite tube in HydrEA technique through clean out.

For the work steps see chapter "Cleaning / clean out of the graphite tube" p. 59.

Evaporating the iridium coating

- Evaporate the iridium or gold coating from the graphite tube after approx. 500 atomizations or before recoating.

For the work steps see chapter "Cleaning / clean out of the graphite tube" p. 59.

Replacing the graphite tube

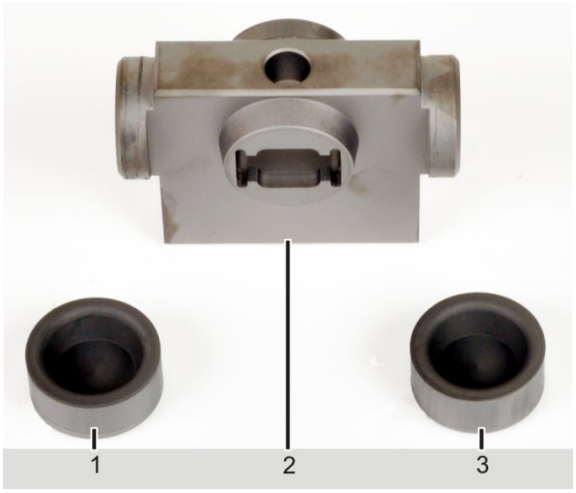
The graphite tube must be replaced if it shows clear burn out or no longer meets analytic requirements. The pyrolysis coating is then worn out.

If the formatting factor is outside of tolerances, an automatic temperature correction no longer takes place; the graphite tube can then only has limited use. The graphite tube should be replaced. The ASpect CS software then issues a corresponding onscreen prompt.

For the work steps see chapter "Inserting the graphite tube into the furnace" p. 56.

6.4.4 Replacing the electrodes and furnace jacket

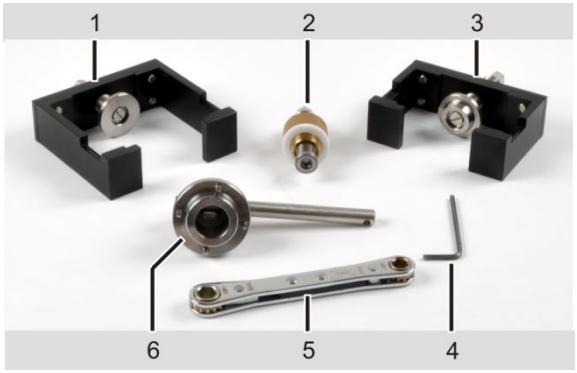
Electrodes and furnace jacket must be replaced if consistently poor analytic results occur that cannot be corrected by cleaning and replacing the graphite tube.



1, 3 Electrodes
2 Furnace jacket

Fig. 52 Electrodes and graphite tube jacket

You can arrange for this work to be done during the regular maintenance by Customer Service. To do your own maintenance you need the optionally available furnace tools.



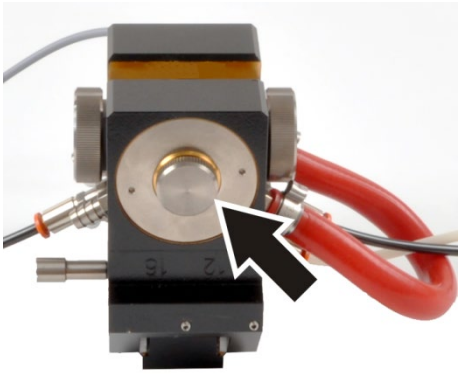
1 Inserting tool for furnace jacket
2 Press-out tool
3 Inserting tool for electrodes
4 Hexagon socket wrench
5 Ratchet wrench
6 Pin wrench

Fig. 53 Furnace tools

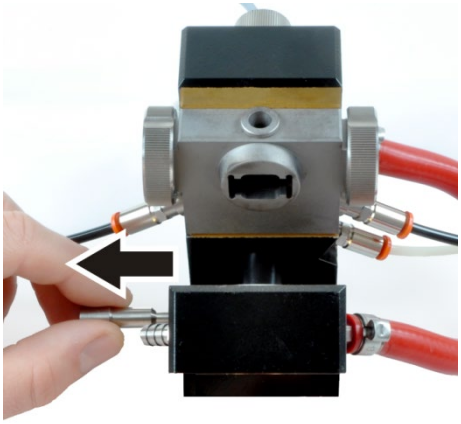
ATTENTION

For improved visibility of the individual work steps the series of photos below shows a removed graphite tube furnace. However, it is not necessary for maintenance to remove the graphite tube furnace from the sample chamber of the contrAA 800.

1. Switch on the contrAA 800 and start the ASpect CS software (the movable furnace part must be pressurized to be opened/closed).
2. In ASpect CS initialize the graphite tube technique and open the window FURNACE / CONTROL with  .
3. Open the furnace with the [OPEN FURNACE] button.
4. Remove the graphite tube from the open graphite tube furnace with tweezers. Wear gloves during removal.



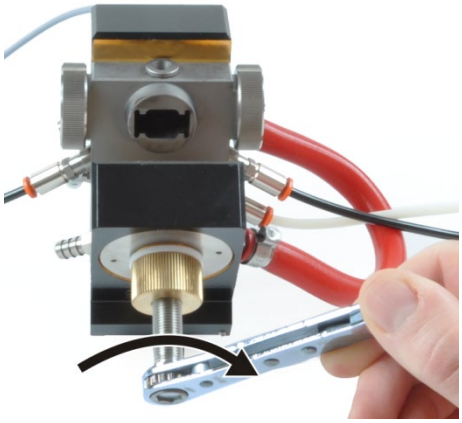
5. Unscrew the covering screw from the movable furnace part.



6. Pull out the lock pin for the movable furnace part and fold the movable furnace part all the way down.

7. Release the insulating ring carefully with the pin wrench and unscrew it completely by hand.

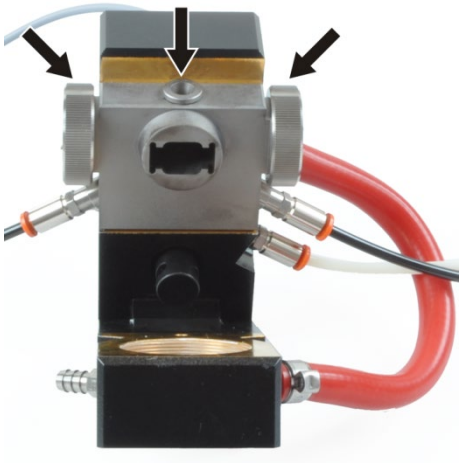
   Risk of fracture within the insulating ring! Do not wedge the pin wrench!



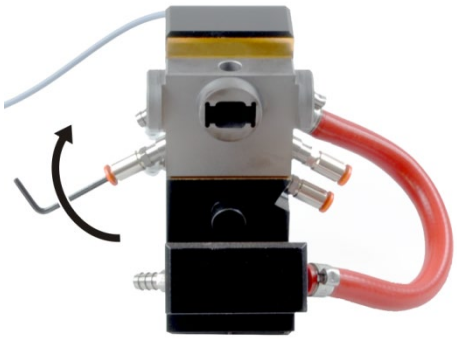
8. Screw the press-out tool with the spindle turned back to the stop into the movable furnace part.

   Press out the electrode completely with the ratchet wrench.

   Remove the press-out tool again from the furnace part.

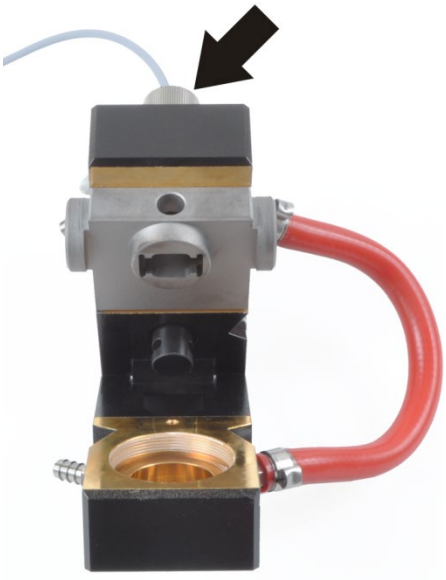


9. Pull the furnace windows off the furnace jacket. Remove the pipetter insert.



10. Remove the three gas hoses. To this end press in the quick-release lock and pull off the hose.

    Carefully unscrew the three gas connectors with the hexagon socket wrench. To this end insert the hexagon socket wrench into the gas connectors and turn them counterclockwise.



11. Detach the union nut at the cooling water temperature sensor.

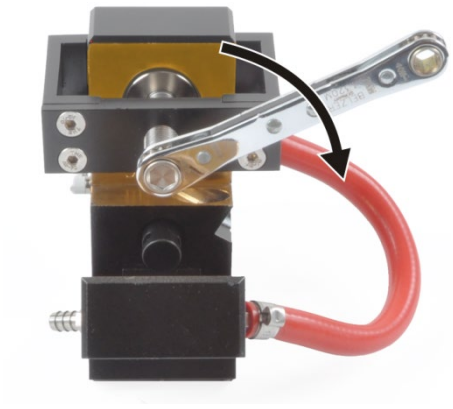
    Pull the sensor out of the sensor sleeve at the rear of the fixed furnace part.

12. Unscrew the sensor sleeve carefully by hand.

13. Screw the press-out tool with the spindle turned back to the stop into the fixed furnace part.

    Using the ratchet wrench fully press out the furnace jacket and electrode.

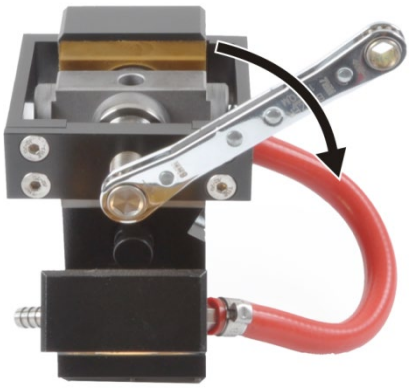
    Loosen the press-out tool and unscrew it again fully.



14. Position a new electrode parallel to the fixed furnace part and secure it with the inserting tool (small bracket).

15. Using the ratchet wrench insert the electrode up to the stop. Loosen the inserting tool and remove it.

    Risk of electrode fracture!
    Make sure that the electrode and the furnace part are parallel when positioning and inserting the electrode. If the electrode jams, remove the electrode and start again.

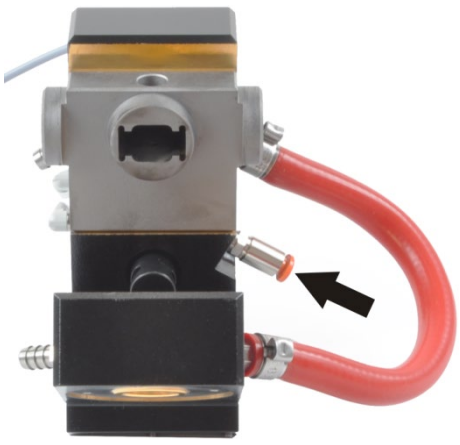


16. Align the furnace jacket with the cylindrical adapter parallel to the furnace body and fasten it with the inserting tool (large bracket).
17. Insert the furnace jacket to the stop. Loosen the inserting tool and remove it.

    Risk of furnace jacket fracture!
    During insertion always ensure that the furnace jacket and the furnace part are parallel. If the furnace jacket jams, press it out completely and start again.

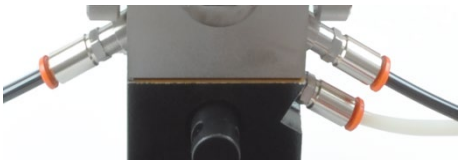
18. Screw the sensor sleeve for the cooling water temperature sensor carefully by hand into the fixed furnace part.
19. Insert the sensor into the sensor sleeve and tighten it with the union nut.

20. Check the sealing rings of all three gas connectors and replace if damaged.



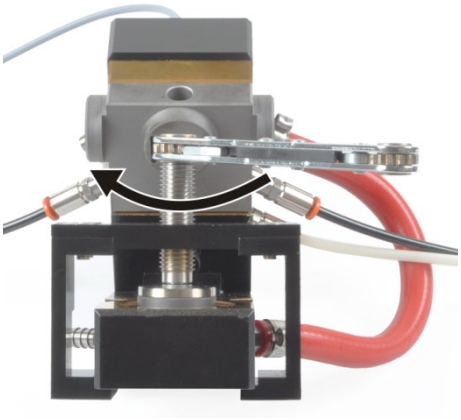
21. Screw the gas connectors for the outer gas flow transversely from below finger-tight into the fixed furnace part.

    Attach the white gas hose to the gas connector.



22. Screw the two other connectors (for the inner gas flow) on both sides into the furnace jacket.

    Attach the two black gas hoses to the gas connectors.

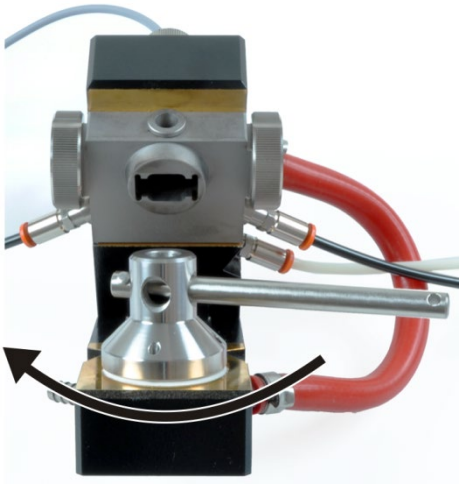


23. Position a new electrode parallel to the movable furnace part and secure it with the inserting tool (small bracket).

    Insert the electrode to the stop into the furnace jaw using the ratchet wrench.

    Risk of electrode fracture!
    Do not wedge the electrode.

    Remove by suction or blow away any graphite dust which is present.

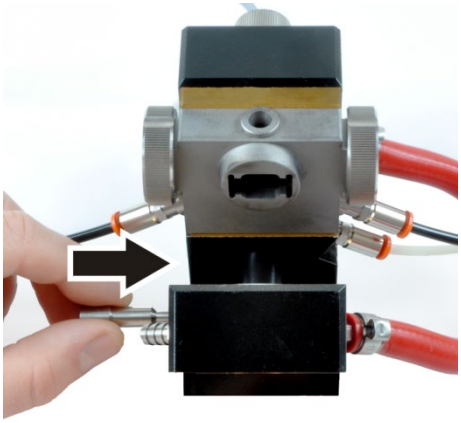


24. Attach the furnace windows to the furnace jacket. Insert the pipetter insert.

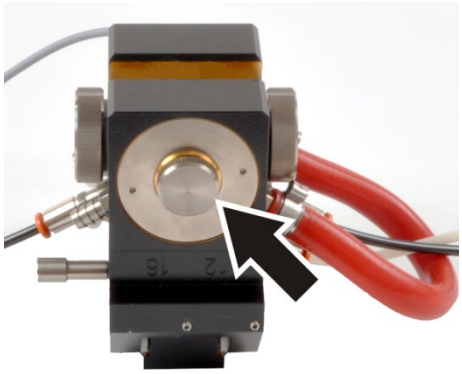
    Note: Identical markings at the furnace windows must point up (see Fig. 51 on page 91).

25. Screw in the insulating ring by hand and tighten it moderately up to the stop using the pin wrench.

    Risk of fracture within the insulating ring!
    Do not wedge the pin wrench!



26. Insert the locking pin into the furnace jaw and connecting rod (arrow) up to the stop. The connecting rod must be in the front position.



27. Screw the covering screw to the movable furnace part.
28. Close the furnace with the [CLOSE FURNACE] button.
    ✓ The electrodes and furnace jacket are fully installed in the graphite tube furnace.

Prior to re-commissioning of the furnace insert the graphite tube into the furnace (→ section "Inserting the graphite tube into the furnace" p.56). Form the graphite tube.

6.5 Burner-nebulizer system

The burner-nebulizer system must be cleaned at regular intervals, which can be seen from the following indications:

- Irregularities in the flame hem of the burner flame. Washing with diluted acid in the active program and blowing the burner out does not bring about any improvement.
- The sensitivity given in the cookbook for an individual element is not achieved despite changing the composition of the gas.
- Build-up on the burner slit, which occurs during analysis of solutions with a high salt content, cannot be removed with the cleaning strips.

CAUTION

Risk of burns!

Allow the burner to cool down before attempting any service or maintenance work.

Undertake the following maintenance work to the burner-nebulizer system:

1. Taking the burner-nebulizer system apart
2. Cleaning the burner
3. Cleaning the nebulizer
4. Cleaning the siphon
5. Cleaning the mixing chamber
6. Assembling the burner-nebulizer system
7. Optimize the sensitivity of the burner-nebulizer system.

6.5.1 Taking the burner-nebulizer system apart

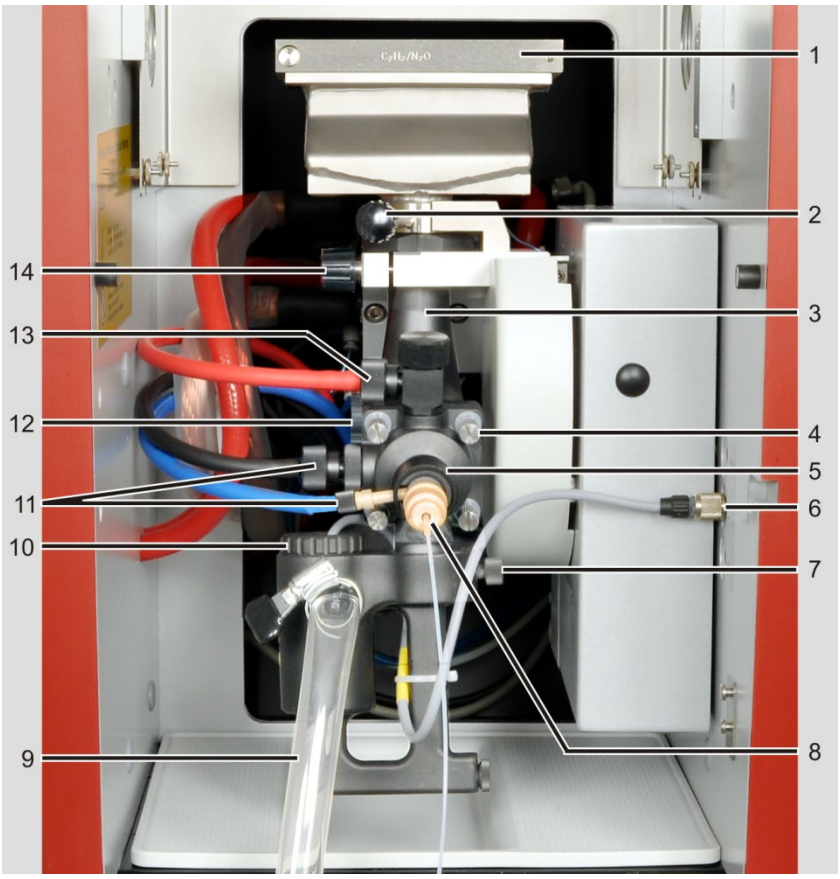


Fig. 54 Burner-nebulizer system

1 Burner
2 Lock screw at the burner
3 Mixing chamber tube
4 Mixing chamber screw joints (4 x)
5 Locking ring for nebulizer
6 Siphon sensor connection
7 Clamping screw of the siphon
8 Nebulizer
9 Outlet tube from the siphon
10 Siphon sensor
11 Screwed tube connections on the mixing chamber head and the nebulizer
12 Safety plug
13 Hose screw joint at the mixing chamber head
14 Knurled head screw on the mounting bracket

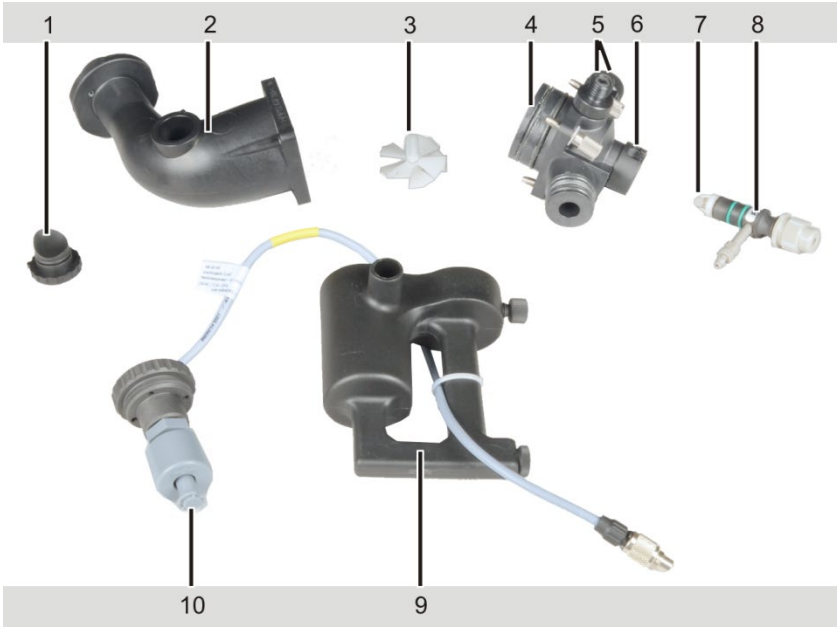


Fig. 55 Mixing chamber and nebulizer disassembled for cleaning

1 Safety plug
2 Mixing chamber tube
3 Mixing impeller
4 Mixing chamber head with connections for gases, nebulizer and siphon
5 Connections for additional oxidant and combustion gas (pointing to the rear)
6 Nebulizer connection with locking ring
7 Baffle ball
8 Nebulizer with connection for oxidant and connection for sample tube
9 Siphon
10 Siphon sensor

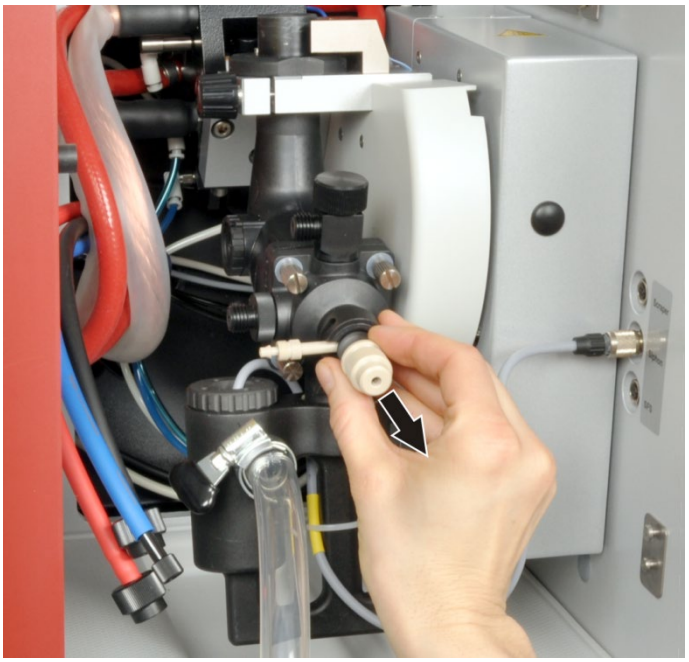


Fig. 56 Withdrawing the nebulizer from the mixing chamber

1. Loosen the lock screw (2 in Fig. 54 p. 99) on the burner and remove the burner from the burner neck.
2. Unscrew the screwed tube connections on the mixing chamber head and the nebulizer (11, 13 in Fig. 54) and pull off the sample intake tube from the nebulizer.
3. Turn the locking ring of the nebulizer (5 in Fig. 54) to open the locking.

4. Withdraw the nebulizer from the mixing chamber head, holding the nebulizer in the groove (Fig. 56).
   Risk of fracture for the connector!
   The connector for the gas connection may break when being pulled.
5. Unscrew and pull off the siphon sensor from the connection in the sample chamber wall (6 in Fig. 54).
6. Remove the draining hose from the drainage connector of the siphon (9 in Fig. 54). Release the hose clamp to do so.
7. Release the clamping screw of the siphon (7 in Fig. 54) and pull off the siphon downwards. Empty the siphon.
   ⚠ CAUTION
   The solution in the siphon is acidic. Wear protective goggles and clothing.
8. Unscrew the insert of the siphon sensor, pull the sensor out of the siphon (10 in Fig. 55).
9. Hold the system tightly, unscrew the knurled head screw on the mounting bracket of the mixing chamber tube (14 in Fig. 54), rotate the mounting bracket backwards and remove the system.
10. Withdraw the safety plug (1 in Fig. 55) from the mixing chamber.
11. Loosen the four screw joints of the mixing chamber (4 in Fig. 54) and disassemble the mixing chamber into the chamber head and the chamber tube.
12. Remove the mixing impeller (3 in Fig. 55) from the chamber tube.
13. Unscrew the gas connections for fuel gas and auxiliary oxidant (5 in Fig. 55) from the mixing chamber head.

6.5.2 Cleaning the burner

1. Clean the burner under running water.
2. Clean the burner with the burner jaws facing downwards in an ultrasonic bath for 5 – 10 min with diluted HNO_3 (c = 0.1 mol/L). If there is no ultrasonic bath: Place the burner overnight in diluted HNO_3.

   Do not use hydrochloric or hydrofluoric acid as they might damage the burner!
3. Rinse the burner with distilled water. Let the burner dry.

Removing hard deposits

Perform the following working steps only when hard deposits haven´t been removed by the procedure described above.

1. Undo the screw joints (item 2 in Fig. 57) of the burner jaws on the burner body and remove the burner jaws.
2. Remove incrustations with the cleaning tips (paper strips).
3. Clean the burner jaws in 0.1 molar HNO_3, and then rinse with distilled water.
4. Screw the burner jaws onto the burner body. The dowel pins (3 in Fig. 57) on the burner ensure correct positioning.

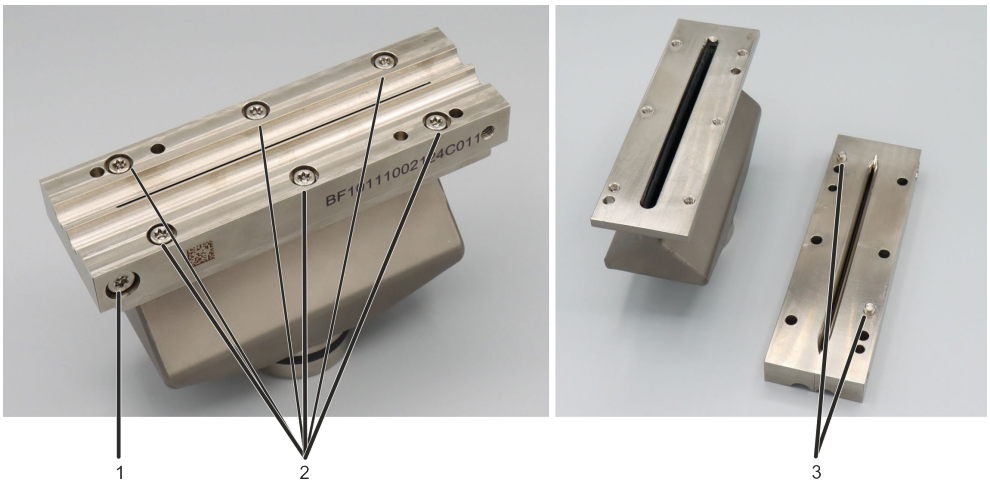


Fig. 57 Burner screw joints

1 Burner jaw screw joints against each other (Do not loosen the screws)
2 Screw joints of the burner jaws with the burner body
3 Dowel pins on the underside of the burner jaws

6.5.3 Cleaning the nebulizer

1. Turn the baffle ball (7 in Fig. 55 p. 99) slightly and pull it off the nebulizer. If the baffle ball is seized, immerse the nebulizer in an ultrasonic bath with ultrapure water for a few minutes.
2. Insert the cleaning wire into the nebulizer cannula and clean the cannula by moving it up and down several times.
3. Connect the nebulizer (without baffle ball) to the compressed air hose.
4. Activate the compressed air supply in the software:

   In the ASpect CS software initialize the flame technique and use the  button to open the FLAME / CONTROL window. In the group field FUNCTION TESTS click on TEST N2O.
5. Immerse the nebulizer in a beaker of deionized water to a depth of approx. 1 cm for a few minutes.
6. Place the baffle ball on the nebulizer and lock it in place by turning it slightly.

6.5.4 Cleaning the mixing chamber

Clean the mixing chamber, consisting of the chamber tube and the chamber head, as follows:

1. Remove the sealing rings from the chamber head.
2. Clean with diluted mineral acid (HNO_3, HCl, H_2SO_4) or, dependent on the substances analyzed, with the appropriate organic solvents.
3. If the mixing chamber is cleaned with diluted acid, rinse thoroughly with distilled water afterwards.

6.5.5 Cleaning the siphon

1. Clean with diluted mineral acid or, dependent on the substances analyzed, with the appropriate organic solvents. Clean the channels and float tank with a round brush.
2. If the siphon is cleaned with a diluted mineral acid, rinse thoroughly with distilled water afterwards.

6.5.6 Assembling the burner-nebulizer system

WARNING

Risk of explosion if gas connections are leaking!

When connecting the supply tubes, ensure correct connection. Insert the seals and check for air-tightness. Only tighten all screw joints finger-tight.

CAUTION

Never use the acetylene nitrous oxide flame for sensitivity fine adjustment of the nebulizer! Sudden changes in flow rate may cause a flame flashback into the mixing chamber.

1. Check all sealing rings of the chamber head, connections and the nebulizer, replace worn out sealing rings, pull on seals and ensure correct positioning.
2. Hold the mixing impeller at the handle (3 in Fig. 55 p. 100) and insert it into the mixing chamber tube. Lock by pressing slightly.
3. Connect the mixing chamber parts (chamber tube and chamber head), align the sides so that they are flush and screw them together (2, 4 in, p. Fig. 55). Ensure that the sealing rings are seated correctly.
4. Screw the siphon sensor (10 in Fig. 55 p. 99) into the siphon. Attach the siphon to the chamber head with the drainage connector pointing forward. Secure the siphon with a clamping screw (7 in Fig. 54).
5. Attach the safety plug (1 in Fig. 55) on the chamber tube.
6. Screw the connections for fuel gas and auxiliary oxidant (5 in Fig. 55) with the sealing rings into the mixing chamber head.
7. Insert the nebulizer (8 in Fig. 55) into the chamber head and secure it with the locking ring (6 in Fig. 55).

   Note: If the nebulizer cannot be stuck easily into the chamber head, slightly grease the sealing rings with the lubricant supplied (Apiezon grease).
8. Attach the mixing chamber nebulizer system to the height adjustment in the sample chamber using the mounting bracket (14 in Fig. 54). The marking must be above the edge of the holding fixture. The plate of the mixing chamber tube must make contact with the mount. Screw the knurled head screw at the holding bow tightly.
9. Plug the cable of the siphon sensor (6 in Fig. 54) into the connection at the side panel of the sample chamber (take care with the lug) and tighten.
10. Attach the drain hose to the drainage connector of the siphon (9 in Fig. 54). Secure with a hose clamp. Feed the drain hose with a steady inclination into the waste bottle.

11. Fill the siphon with water via the mixing chamber tube until water flows out via the drain hose.
12. Set the burner on the mixing chamber tube and turn against the 0° stop. Clamp on using the locking screw (2 in Fig. 54).
13. Screw the hose for fuel gas (red) to the connector at the top of the mixing chamber head (13 in Fig. 54).
14. Screw the hose for oxidant (blue) to the nebulizer connector (11 in Fig. 54 p.)
15. Screw the hose for auxiliary oxidant (black) to the connector at the side of the mixing chamber (11 in Fig. 54 p.)
16. Hang the safety glass in and slide it in front of the burner.

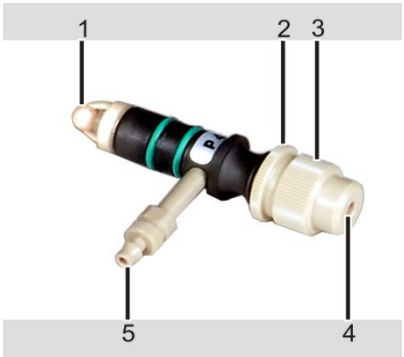
Sensitivity adjustment

1. In the ASpect CS software initialize the flame technique and use the  button to open the FLAME / CONTROL window.
2. In the group field SETTINGS adjust the ratio Gas C_2H_2 – air.

   CAUTION
   Sensitivity fine adjustment must not be carried out with C_2H_2 - N_2O flame. Sudden changes in flow rate may cause a flame flashback into the mixing chamber.
3. Use the [IGNITE FLAME] button to ignite the flame.
4. Change to the MANUAL OPTIMIZATION tab.
5. Select an element line, e.g. Cu324, and click on [SET].
6. Aspirate a test solution, e.g. Cu / 2 mg/L, via the nebulizer and start the continuous measurement value display with [START]. Evaluate the signal.
7. If the required sensitivity is not achieved, adjust the nebulizer until the absorbance reaches a maximum at the selected element line.
   - Loosen the lock nut (2 in Fig. 58).
   - Adjust the depth of the cannula with the adjustment nut (3 in Fig. 58).

   After completing the adjustment, secure the adjustment with lock nut.

   ✓ The burner-nebulizer system has been cleaned and installed.



1 Baffle ball
2 Lock nut
3 Adjustment nut for cannula
4 Inner cannula
5 Connection for oxidant

Fig. 58 Nebulizer components

6.5.7 Cleaning the sensor for burner detection

Sensors monitor whether the burner has been placed onto the mixing chamber neck before the flame is ignited. The sensor openings must be cleaned if

- deposits are found in the openings (e.g. salt incrustations)
- the program issues an error message although the burner has been mounted onto the mixing chamber tube

1. Hold the burner-nebulizer system tightly, unscrew the knurled head screw on the mounting bracket of the mixing chamber tube (14 in Fig. 54), rotate the mounting bracket backwards, remove the system and deposit it safely.
2. Carefully clean the sensor opening with a small brush (e.g. toothbrush) with alcohol. e.g. isopropanol.
3. Allow the sensor opening to dry.

   Refit the burner-nebulizer system into the height adjustment.

   ✓ The sensor has been cleaned, the burner-nebulizer system is re-installed.

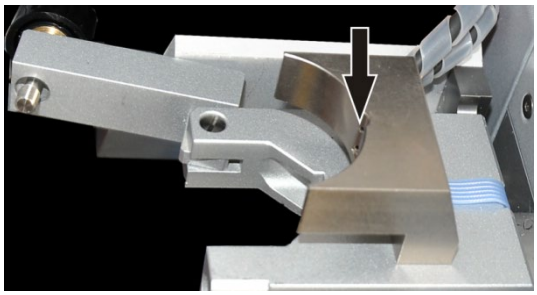


Fig. 59 Sensor openings for the burner detection

6.6 Autosampler graphite AS-GF

The following maintenance work must be performed on the AS-GF:

- Remove any contamination from the sample tray and the casing with a dry cloth on a daily basis
- Clean, shorten, replace the dosing tube
- Replace the dosing syringe
- Clean the housing once the wash cup has overflowed

6.6.1 Washing the dosing tube

The dosing tube must be washed prior to and after work. Washing solution is taken software-controlled from the storage bottle, pumped via the dosing syringe into the dosing tube and dispensed into the wash cup.

1. Switch on the contrAA 800 and start the ASpect CS software./ graphite technique:
2. In ASpect CS open the window AUTOSAMPLER with  .
3. Use the [WASH] button to start the wash cycle.

4. During the wash process the dosing tube must be immersed in the wash cup until just below the hose guide to ensure adequate washing.

   Note: If the dosing tube is not immersed sufficiently into the wash cup during washing, the autosampler must be realigned in the wash position.

   - On the FUNCTION TESTS tab enable the [ADJUST SAMPLER] button.
   - In the ADJUST SAMPLER window in the group field ALIGNMENT POSITION enable the option WASH POSITION. In the group field WASH POSITION ADJUSTMENT enter the immersion depth in the list field (approx. 40 mm).
   - Correct the alignment of the swivel arm with the arrow keys.
   - Save the settings via the corresponding buttons and close the window.

   Note: When opening the ADJUST SAMPLER window again, DEPTH displays a value of 13 MM, not the actually saved value.

5. The wash cycle can be repeated several times if required.

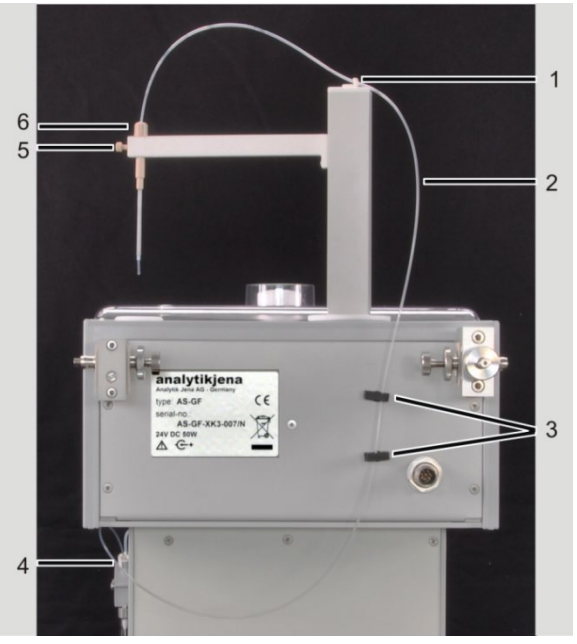
Note: The wash cycle can be defined in the method and thus performed automatically prior to and after the measurement.

If a method is active, pressing the [WASH] button in the AUTOSAMPLER window results in the processing of the number of Wash cycles set in the method.

6.6.2 Servicing the dosing tube

A damaged, kinked or contaminated dosing tube can be the cause of distorted measurement results. Maintenance work is:

- Cleaning the dosing tube
- Shorten the dosing tube
- Replace the dosing tube



1 Tube holder
2 Dosing tube
3 Tube holder
4 Screw top at the dosing unit
5 Tube guide lock screw
6 Tube guide clamping nut

Fig. 60 Dosing tube at the AS-GF

Cleaning the dosing tube

The dosing tube requires cleaning, dependent on the sample material, when:

- The pH levels of the sample, the wash liquid and the air bubble are blurred, or if the bubble is segmented.
- The sample is carried over because the tube is contaminated on the inside.

An 8 to 13% sodium hypochlorite solution (NaOCl) is recommended as a cleaning solution. Repeat the cleaning process several times if required.

1. Fill the sodium hypochlorite solution into a 5 mL special cup and mount tray position 101 with it.
2. Switch on the contrAA 800 and start the ASpect CS software.
3. In ASpect CS open the window AUTOSAMPLER with  . Change to the tab FUNCTION TESTS.
4. In the group field TRACKER/ROTATOR enter "101" in the field and enable the option CUP NO.
   The autosampler arm moves to position "101".
5. In the area DIPPING ARM in the list field DEPTH lower the autosampler arm into the special cup with the arrow keys (approx. 50 mm).

   Note: The autosampler is only lowered if the arrow keys are used. After entering the value directly into the list field, click the arrow keys once again!
6. In the PIPETTER area, in the VOLUME [µL] list field, use the arrow keys to set the volume to be taken (approx. 100-200 µL). The volume can be set in steps of 50 µL.
7. Press the button [TAKE UP]. The autosampler fills the dosing tube with the cleaning liquid.
8. Allow the cleaning liquid to work for approx. 20 min.
9. In the area TRACKER/ROTATOR enable the option WASH POSITION.
10. The autosampler arm moves to the wash position.
11. In the area DIPPING ARM in the list field DEPTH lower the autosampler arm into the wash cup with the arrow keys (approx. 40 mm). When entering the value directly into the list field, click the arrow keys once again!
12. Use the [DISPENSE] button to empty the dosing tube into the wash cup.
13. Start 5 wash cycles. (Press the [WASH] button 5x).

    ✓ The dosing tube has been cleaned.

Shortening the dosing tube

1. Loosen the clamp nut at the tube guide (6 in Fig. 60) and remove the dosing tube by pulling upwards.
2. Cut off approx. 70 mm of the dosing tube with a razor blade or a scalpel at an angle of 10° to 15°.
3. Push the dosing tube as far as possible into the tube guide until the dosing tube protrudes by approx. 8 mm at the bottom.
4. Lock the dosing tube with the clamp nut.
5. Readjust the injection depth of the sample (→ section Adjusting the sampler p. 62).

✓ After removing contaminated or damaged hose sections, the autosampler is operational again.

Replace the dosing tube

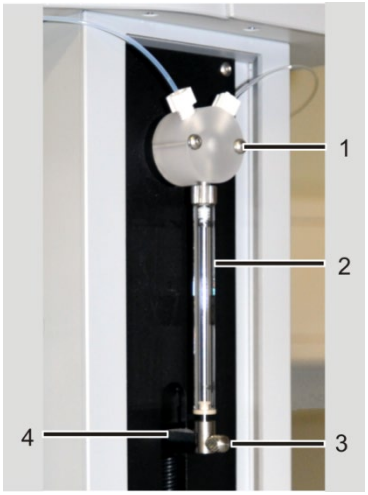
1. Loosen the clamp nut at the tube guide (6 in Fig. 60) and pull out the tube. Remove the tube from the tube holders at the sample arm and the back of the autosampler (1, 3 in Fig. 60).
2. Detach the screw top from the T valve of the dosing unit (4 in Fig. 60).
3. Screw the new dosing tube to the valve and feed it through the tube holders.
4. Push the dosing tube as far as possible into the tube guide until the dosing tube protrudes by 8 mm underneath, lock with the clamping nut.
5. Readjust the injection depth of the sample (→ section Adjusting the sampler p. 62).

✓ The autosampler is operational with a new dosing tube.

6.6.3 Replacing the dosing syringe

The details below apply to the samplers AS-GF (graphite tube technique) and AS-FD (flame technique). The dosing units only differ in the size of the dosing syringe (500 or 5000 µL).

1. Switch on the contrAA 800 and start the ASpect CS software. Select the technique in the MAIN SETTINGS window. GRAPHITE FURNACE (AS-GF) or FLAME (AS-FD).
2. Use  to open the AUTOSAMPLER window. Change to the tab FUNCTION TESTS.
3. In the PIPETTER area, in the VOLUME [µL] list field, use the arrow keys to set a volume to be picked up (AS-GF: 500 µL; AS-FD: 5000 µL). Increase the speed to 6-7.



1 T valve
2 Dosing syringe, consisting of piston and glass cylinder
3 Fastening screw
4 Drive rod

Fig. 61 Dosing unit at AS-GF and AS-FD

4. Press the button [TAKE UP].
   The piston of the dosing syringe moves down.
5. Unscrew the fixing screw (3 in Fig. 61).
6. Unscrew and remove the dosing syringe (2 in Fig. 61).

7. Screw the new dosing syringe to the valve.
8. Carefully pull the piston down until the eyelet at the piston end is aligned with the hole in the drive rod.

   Screw the piston with the fastening screw finger-tight to the drive rod.

   ATTENTION
   Excessive force can lead to material damage! Do not tighten the screw too much.
9. In the AUTOSAMPLER window click the [INITIALIZE] button.
   The piston of the dosing unit returns to the initial state.

   ✓ The autosampler is operational with a new dosing syringe.

6.6.4 Cleaning the autosampler after cup overflow

If during the process a wash cup has overflowed, immediately interrupt the process and clean the device.

1. Instantly stops the analysis process.
2. Take up the liquid with cellulose wadding or cloth. Wipe the device surface dry.
3. Ensure that the outlet can be drained, i. e., remove any sharp bends in the draining tube or make sure that the draining tube does not dip into the liquid in the waste bottle.

   ✓ The analysis process can continue.

6.7 Flame sampler AS-F, AS-FD

Contamination on the tray and the casing can be removed with a dry cloth on a daily basis as required. In addition according to conditions:

- Washing the sample paths
- Wash the mixing cup
- Replace the cannula(s) at the autosampler arm
- Replace the aspiration tube and dosing tube
- Replace the dosing syringe (→ section "Replacing the dosing syringe" p. 108).
- Clean the housing after a wash or mixing cup has overflowed.

6.7.1 Washing the sample paths

1. In ASpect CS software / Flame technique open the FLAME / CONTROL window with  and ignite the flame via the button.
2. Use  to open the AUTOSAMPLER window.
3. On the PARAMETERS tab, set approx. 60 s in the WASH TIME field.

4. Use the [WASH] button to start the wash cycle.
   ✓ The cannula of the autosampler dips into the wash cup. The wash liquid is aspirated through the system.

6.7.2 Washing the mixing cup of the AS-FD

The mixing cup must be washed before and after the operation to prevent adhesion and scaling. Before measuring the first standard / first sample the mixing cup is washed automatically. Further washing processes might be useful during continuous operation.

Washing the mixing cup prior to/after the measurement

1. In ASpect CS / Flame technique open the window AUTOSAMPLER with  .
2. On the PARAMETERS tab in the WASH MIX CUP group field, enter a volume of 25 mL.
3. Use the [START] button to start the wash cycle.
4. The wash cycle can be repeated several times if required.

25 mL of washing liquid is dispensed from the storage bottle into the mixing cup and automatically drained off afterwards.

Washing the system prior to decommissioning

If salts were added to the diluent (demineralized or acidic demineralized water), the dosing unit and valve must be washed with methanol or ethanol prior to extended periods of decommissioning. Otherwise incrustations and blocking may also occur.

1. Fill the storage bottle for the diluent with methanol or ethanol.
2. Perform the wash cycle as described in Section "Washing the system prior / after the measurement". Repeat the washing process several times.

6.7.3 Replacing the cannulas and guide at the AS-FD

The cannulas and guide must be replaced if there is a significant contamination or mechanical damage (detectable by large standard deviations in the measurements).

1. Pull the hoses off the cannulas.
2. Detach the locking screw at the autosampler arm.
3. Pull the cannula guide with cannulas up and out.
4. Insert new cannulas with guide into the opening in the autosampler arm and secure with the lock screw.

ATTENTION

Risk of fracture! Set the cannula height for them to terminate 1-2 mm above the block with the wash and mixing cup.

5. Plug the sample intake tube onto the thinner cannula. Plug the dosing tube for the diluent onto the thicker cannula.
   ✓ The autosampler is operational with new cannulas.

6.7.4 Replacing the cannula at the AS-F

The cannulas for picking up the sample must be replaced if there is a significant contamination or mechanical damage (detectable by large standard deviations in the measurements). The cannula can be replaced with and without guide.

1. Pull the intake tube off the cannula.
2. Loosen the lock screw at the autosampler arm and pull out the cannula (with guide).
3. Insert the new cannula (with guide) at an equal distance and fix with the lock screw.

ATTENTION

Risk of fracture! Set the cannula height for it to terminate 1-2 mm above the washing cup.

4. Plug the intake tube onto the new cannula.
   ✓ The autosampler AS-F is operational with a new cannula.

6.7.5 Replacing the intake tube

If the sample intake tube is contaminated, it must be replaced.

1. Pull off the intake tube from the thinner cannula at the autosampler arm and then from the nebulizer cannula.
2. Cut a new tube to the required size and attach it on both cannulas at the autosampler arm and nebulizer.

6.7.6 Replacing the tube set at the AS-F

1. Pull the dosing tube for diluent (8 in Fig. 43 p. 68) off the thicker cannula at the autosampler arm and feed it through the tube guide.
2. Detach the tube for the washing liquid from the screw at the rear of the autosampler (5 in Fig. 44 p. 70).
3. Pull the encased tubes out of the attachment lug at the rear of the autosampler.
4. Pull the tube for the washing liquid off the storage bottle.
5. Unscrew the dosing tube from the change-over valve (3 in Fig. 45 p. 71).
6. Screw the new tube set with dosing tube (marking "1") to the change-over valve and attach the encased tubes with the attachment lug to the rear of the autosampler.
7. Insert the tube with the marking "2" into the storage bottle for the washing liquid.
8. Screw the other end of the tube for the washing liquid to the rear of the autosampler.
9. Slide the other end of the dosing tube through the tube guide onto the thicker cannula of the autosampler arm.

✓ The autosampler AS-FD is operational with a new tube set.

6.7.7 Cleaning the autosampler after cup overflow

If during the process the washing cup or mixing cup (with AS-FD) has overflowed, interrupt the process and clean the device.

1. Stop the measuring process immediately.
2. Take up the liquid with cellulose wadding or cloth. Wipe the device surface dry.
3. **Wash cup:** Ensure that the outlet can be drained, i. e., remove any sharp bends in the draining tube or make sure that the draining tube does not dip into the liquid in the waste bottle.

Mixing cup (only in AS-FD):

Use  to open the AUTOSAMPLER window. Change to the tab FUNCTION TESTS.
Enable the MIX CUP PUMP checkbox in the PUMPS group field to start the pump.
Allow the pump to run until the liquid has been pumped out.
Disable the MIX CUP PUMP checkbox to stop the pump.

✓ The measuring process can continue.

6.8 Piston compressor PLANET L-S50-15

(Selected technique: Flame technique)

Note: Please observe the maintenance and care instructions in the separate instruction manual of the compressor.

- Pressure reservoir and liquid separator at the filter pressure reducer:

  Drain oily condensate weekly from the pressure vessel by opening the drain cock.

  Caution! Danger of splashing! The boiler is pressurized. To avoid splashing, attach a hose to the cock, slowly open the cock and carefully drain liquid into a waste bottle.

  Drain oily condensate weekly from the filter pressure reduce by pressing the pin at the bottom of the fluid separator.

- Intake filter: Check the filter monthly, clean or replace semi-annually.
- Oil: Only use the special oil SE -32! Dispose waste oil in accordance with regulations.

  Check the oil level weekly at the inspection glass. Replenish oil if necessary. Change the oil every 12 months.

  - To do so remove the ribbed cover after detaching the 4 screws.
  - Tilt the container to allow the oil to drain completely. Protect the motor block with one hand against falling out.
  - Remove contamination from the housing.
  - Check the O-ring at the ribbed cover and replace if necessary; clean the sealing surfaces.

- Fill approx. 0.6 L oil (SE-32).
- Refit the ribbed cover. Check the tightness of the ribbed cover during operation.

7 Fault removal

7.1 Fault removal in accordance with software messages

The following chapter describes a number of possible problems that the user can partially remedy independently. If such problems occur frequently, the customer service department of Analytik Jena must always be informed.

System monitoring takes place as soon as the contrAA 800 is switched on. Any errors that occur are displayed in a window after start-up.

The user must acknowledge the error messages by clicking on the [OK] button.

ATTENTION

Danger of equipment damage!

If the errors below cannot be remedied using the corresponding fault removal notes, the customer service department of Analytik Jena must always be informed. This also applies for the repeated occurrence of individual faults.

Error code	Error message
3762	**Wavelength correction incorrect!**
3765	**No correction peak found!**
3766	**Correction range exceeded!**
3782	**No neon peaks found!**
3783	**Too many neon peaks found!**

Cause	Remedy
■ The neon or prism correction is incorrect	■ Switch the device off and on again ■ In the event of repeated occurrence, determine which correction is faulty in the SPECTROMETER / PARAMETERS window ■ Inform Service / create diagnosis file and send to Service

3811	**No wavelength offsets stored in instrument!**

Cause	Remedy
■ There is no production data for line offset present in the device memory	■ Contact service for line offsets
■ Faulty device flash memory	■ Inform service

1008	**Invalid Parameter [100] or download system has been started!**

Cause	Remedy
■ Invalid device parameters	■ Restart the device and software
■ Basic system loaded	■ If the error recurs, inform Service

Error code	Error message
2113	**Cooling water flow too low!**

Cause	Remedy
■ Partial blockage of the cooling water channels in the graphite tube furnace and Xenon lamp ■ Cooling water flow too low	■ Inform service ■ Check the cooling water level in the cooling water tank ■ Replenish cooling water

3850	**Status: drive error!**

Cause	Remedy
■ Device communication error ■ The step motor for grating, prism, shutter is faulty	■ Restart PC followed by AAS unit ■ Inform Service / create diagnosis file and send to Service

4011	**Flame does not ignite – fuel/oxidant pressure may be too low or flame sensor detects light; Eliminate problem and retry!**

Cause	Remedy
■ Faulty gas supply	■ Check gas supply (air, fuel gas)

4233	**Cooling system sensor error (Status)**

Cause	Remedy
■ Cooling water tank not filled sufficiently	■ Check water level in the cooling water tank, replenish cooling water.

4231	**No argon pressure (Status)**
4234	**No aux. Gas pressure (Status)**

Cause	Remedy
■ Gas supply closed before device connection	■ Check gas supply, open gas supply before device connection

Error code	Error message
4232	**Toroidal transformer temperature error (Status)!**

Cause	Remedy
■ Transformer overheated	■ Allow device to cool down for 1 h, reduce thermal load in the temperature/time program, if necessary

4301	**Firmware update communications error!**
4302	**Invalid checksum of firmware application!**
4303	**Invalid firmware block!**
4304	**Invalid firmware block sequence!**
4305	**Write-error firmware update!**

Cause	Remedy
■ The firmware update has failed	■ Repeat firmware update, avoid moving the mouse during the update ■ Inform service

7.2 Equipment faults and analytical problems

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, customer service must be informed.

No signal	
Cause	**Remedy**
■ Atomization unit not or insufficiently aligned in the beam path	■ In the contrAA 800 F adjust the depth via the adjustment screw
■ Leakage or blocking in the sample supply system	■ Check cannula and dosing tube for deposits, kinks and cracks, clean, replace if necessary
■ The sample is not injected correctly into the graphite tube (graphite tube technique)	■ Check pipetting, adjust autosampler
■ Nebulizer blocked (flame technique)	■ Check nebulizer for obstructions and clean ■ Filter sample solution if necessary
■ The nebulizer gas is set too low (flame technique)	■ Optimize the nebulizer flow (air / N_2O)
The measured value is too low	
Cause	**Remedy**
■ Calibration is incorrect	■ Check the calibration solutions
■ Low solubility substances lead to low results ■ Low solubility substances are not completely digested	■ Optimize sample preparation
■ Formation of low soluble compounds in the flame (oxide, carbide, phosphate)	■ Increase the flame temperature, e.g. by changing to the acetylene/nitrous oxide flame ■ Add "release agent", such as lanthanum chloride to bind e.g. the interfering phosphate
■ Volatile substances escape during sample preparation	■ Optimize sample preparation
■ Contamination / carry-over in the cal/zero solution	■ Remedy the cause of carry-over / contamination
■ The sample solution is viscous / has a higher density/ different surface tension than the calibration solution	■ 1. Adjust the matrix (add to calibration solutions or dilute) ■ 2. Standard addition
■ Analytes evaporate too early / too late (graphite tube technique)	■ Perform standard addition ■ Optimize furnace program (e.g. reduce pyrolysis temperature)
■ The analyte is an alkali metal (or an easily excitable atomic line)	■ Alkali effect, addition of ionization buffers ionized instead of the analyte
■ The peak position has slightly shifted	■ Perform wavelength correction

The measured value is too high	
Cause	**Remedy**
■ Calibration is incorrect	■ Check the calibration solutions
■ Contamination / carry-over	■ Find and remedy the causes
■ The warm-up phase of the device has not been observed	■ Allow flame to burn longer before calibrating
■ The sample foams when shaken	■ surface-active substances in the measurement solutions 1. Optimize sample preparation 2. Add the surface-active substances to the calibration solutions
■ Line overlap with matrix element	■ Use of matrix modifiers in graphite tube technique, optimization of the furnace program (thermal pre-treatment) ■ Optimizing the flame temperature
■ The sample solution is viscous / has a higher density/ different surface tension than the calibration solution	■ 1. Adjust the matrix (add to calibration solutions or dilute) ■ 2. Standard addition
Precision is poor	
Cause	**Remedy**
■ Dispersion at solid matrix components (soot, oxides, salt particles) and gases (solvent vapor)	Graphite tube technique: ■ Optimize furnace program (drying phase, thermal pre-treatment) ■ Use matrix modifier Flame technique: ■ For soot: Increase the flame temperature (more air), use the acetylene/nitrous oxide flame
■ Contamination / carry-over in the graphite tube (graphite tube technique)	■ Clean the graphite tube through clean out. ■ Optimize the furnace program (cleaning phase)
■ Wash time between the samples too short (flame technique)	■ Increase wash time
■ Fluctuations in the burner temperature (flame technique)	■ Use injection module SFS 6
■ Contamination / carry-over in the nebulizer (flame technique)	■ Check nebulizer for obstructions and clean ■ Filter sample solution if necessary
■ Nebulizer gas flow is not optimal (flame technique)	■ Optimize the nebulizer gas flow
Drift	
Cause	**Remedy**
■ Atmospheric oxygen still in the graphite tube at measurement start	■ Format graphite tube before measurement start

8 Transport and storage

8.1 Preparing the contrAA 800 for transport

Tools

- 4 carrying handles (included in the scope of delivery)
- Open-ended wrench 12 mm, 14 mm and 19 mm

CAUTION

Risk of injury!

The various models of the contrAA 800 device family weigh between 140 kg and 170 kg. The device must be transported by at least 4 persons using the permanently screwed in carrying handles.

CAUTION

Risk of burns at hot surfaces!

Observe the cooling down phases when preparing the contrAA 800 for transport.

ATTENTION

Unsuitable packaging material and a missing transport lock may cause damage to the device!

Only transport the contrAA 800 in its original packaging! In the contrAA 800 D insert the transport lock in the sample chamber to lock the graphite tube furnace in the parking position.

ATTENTION

Risk of damage to the device due to the cooling water freezing!

The ambient temperature may fall below freezing during transport. Before transport cooling water additive must be added to the cooling water, because the cooling water lines, graphite tube furnace and heat exchanger remain filled even during transport. The cooling water tank must be drained completely.

Work steps

1. Add 2 mL cooling water additive to the cooling water. Allow the cooling water circuit to run for approx. 5 minutes before switching off the contrAA 800 to allow the antifreeze agent to disperse.
2. Uninstall all components and accessories (→ section "Installation and commissioning" S.48). Remove the autosampler from the sample chamber.
3. **contrAA 800 D:**
   - Switch off the contrAA 800 from the mains switch (right). Switch back on after approx. 2 minutes.
   - In the MAIN SETTINGS window of the ASpect CS software select the FLAME technique. Initialize the system by clicking on the [INITIALIZE] button.
     The burner-nebulizer system is aligned in the sample chamber; the graphite tube furnace is moved to the parking position.

- Exit the ASpect CS application. Switch off the PC and contrAA 800, taking the shutdown sequence into account (→ section "Switching off sequence" p. 75).
- Insert the transport lock into the opening behind the sample chamber for the wedge to lock the graphite tube furnace in the parking position.

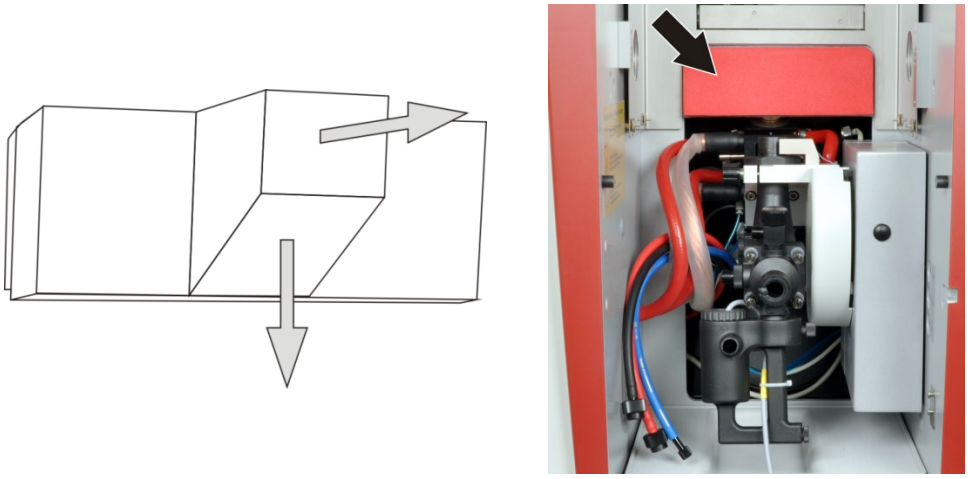
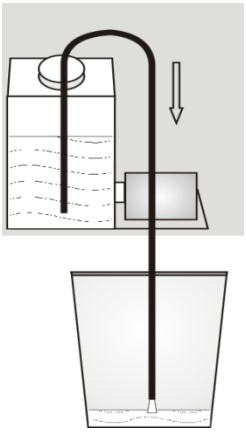


Fig. 62 Installation of the transport lock in the sample chamber

4. **contrAA 800 G and F:** Exit the ASpect CS application. Switch off the PC and contrAA 800, taking the shutdown sequence into account (→ section "Switching off sequence" p. 75).



5. Drain the cooling water tank:
   - Open the lamp chamber door (at the front, to the left of the sample chamber).
   - Unscrew the cover of the cooling water tank. Drain the water through a hose (vacuum suction principle) from both chambers of the tank. Provide a suitable collection container (V > 5 L).
6. **Flame technique:** Ensure that the drain hose of the siphon has been removed from the sample chamber. Remove the sample chamber door.
7. Empty the waste bottle; dispose of waste.
8. Close the gas supply upstream of the device connections.
9. Detach the gas connections at the rear of the contrAA 800:
   - Detach the gas connections for inert gas (argon) and, where applicable, auxiliary gas manually.
   - Detach the acetylene gas connection with a 19 mm open-ended wrench. Left hand thread!
   - Detach the compressed air gas connection by hand or with a 12 mm open-ended wrench.
   - Detach the nitrous oxide gas connection by hand or with a 14 mm open-ended wrench.
10. Undo the electrical connections.

11. Remove the four stoppers from the holes for the handles on both sides of the device and keep in a safe place.
12. Screw the four carrying handles (included in the scope of delivery) securely up to the stop into the holes.

    ✓ The contrAA 800 has been prepared for transport.

8.2 Ambient conditions for transport and storage

ATTENTION

Risk of damage to the device due to the cooling water freezing!

The ambient temperature may fall below freezing during transport. Before transport antifreeze must be added to the cooling water, because the cooling water lines, graphite tube furnace and heat exchanger remain filled even during transport. The cooling water tank must be drained completely.

Observe the safety instructions in section "Safety instructions, transport and commissioning" p. 14. Transport the contrAA 800 and its components carefully to prevent damage from impact or vibration. The device should be transported in such a way that major temperature fluctuations are avoided and the formation of condensate is thus prevented.

The following requirements are placed on the climatic conditions during transport and storage:

Temperature range	
Transport	-40 °C to +70 °C
Storage	+5 °C to +40 °C
Max. humidity:	90 % at 40 °C

If the contrAA 800 and add-on devices are not installed immediately after delivery or are not required for a prolonged period of time, the devices should best be stored in their original packaging. A suitable desiccant should be added to the packaging to prevent damage from moisture.

9 Disposal

Atom absorption spectrometry usually creates only liquid waste. The liquid waste contains metal ions or heavy metal ions, but mostly different mineral acids which were used during sample preparation.

For safe removal of this waste, all solutions must be neutralized with a base solution, for example diluted sodium hydroxide solution. The neutralized waste must be disposed of correctly in accordance with statutory regulations.

At the end of its service life, the contrAA 800 and all its electronic components must be disposed of as electronic scrap in accordance with valid regulations.

Please dispose the Xenon short arc lamp in accordance with the country-specific regulations for high pressure radiators (short arc lamp), paying attention to the packing label supplied or contact the customer service of Analytik Jena.

10 Specification

10.1 Technical data

10.1.1 contrAA 800 data

Optical system

Reflection optics with protective coating and optical system with lightproof encapsulation

Monochromator	Echelle grating double monochromator with a focal length of F=380 mm and variable gap; pre-monochromator with quartz prism. Wavelength selection via additional reflected Neon radiator, calibrated for air and argon, prism calibration via integrated mercury cell to wavelength λ = 253 nm
Wavelength range	185-900 nm
Spectral bandwidth	2 pm at 200 nm
Grating	Echelle grating
Optical bank	Optics in modular design on compact cast baseplate for stability and robustness
Photometer encapsulation	Protection against moisture, exhaust gas and ambient chemical effects
Flushed optics	Optional flushing of the optics with argon or air to improve analysis in the UV range with λ < 200 nm and for operation in high dust environments
Detector	Two-dimensional FFT backlit CCD with high quantum efficiency and increased UV sensitivity

Lamp

Xenon short arc lamp with UV focus in hot spot mode; automatic hot spot adjustment; simultaneous drift correction; easy to replace

Lamp current	9-16 A / 8 A standby operation
Mode	DC, monitoring of burning time and ignition pulses
Power supply	Power supply unit integrated into the spectrometer

Display

Absorbance	0 to 3.99
Concentration	Value range: 5 characters (0.001 to 99999), unit freely selectable
Energy	0 - 65000 effective counts
Emission	Possible in flame mode, standardized energy 0 % to 100 %

Signal evaluation

The control software ASpect CS includes comprehensive display and storage options for measured signals and GLP-compliant logging.

time resolved	mean value, maximum absorption, integral value of absorption
spectrally resolved	specters of 20 pixels to a maximum of 200 pixels in width

Power supply contrAA 800 D + G

Supply voltage frequency	230 V ~ 50 / 60 Hz	
Mains fuse installation in the building	Safety fuse 35 A, slow blow No automatic fuse devices!	
Typical average power consumption	Base device: basic device with PC, monitor and autosampler:	2100 VA 2800 VA
Maximum current consumption	52 A for a period of 8 s or 85 A for 1 s	
Output socket	as input socket (230 V ~, 50 / 60 Hz) For connection of accessories: PC, hydride system, potentially monitor, printer, compressor	
Overvoltage category	II according to DIN EN 61010-1	
Degree of contamination	2 according to DIN EN 61010-1	
Safety class	I	
Protection type	IP 20	

If you connect further components besides the specified accessories to the output socket you are in danger of exceeding the permissible limit value for the drain current.

Instrument fuses

Instrument fuse fittings (5×20 mm²) according to IEC 60127

Fuse number	Type	Protected circuit
F3	T 6.3 A/H	Accessory socket
F4	T 6.3 A/H	Accessory socket
F5	T 6.3 A/H	Spectrometer
F6	T 6.3 A/H	Spectrometer
F7	T 3.15 A/H	Xenon short arc lamp
F8	T 3.15 A/H	Xenon short arc lamp

Furnace fuse

Type	Protected circuit
TR5-T 100 mA	Graphite tube furnace

Mains input fuse

The power supply fuses may only be changed by service engineers from Analytik Jena or by technical personnel authorized by Analytik Jena.

gL-instrument fuse fittings (10×38 mm²) according to 60947-3.

Fuse number	Type	Protected circuit
F1	32 A/T	Power supply
F2	32 A/T	Power supply

Power supply contrAA 800 F

Supply voltage frequency	100-240 V ~ 50 / 60 Hz
Mains fuse	16 A (installation in the building)
Typical average power consumption	Base device: 460 VA basic device with PC, monitor and autosampler: 650 VA

Overvoltage category	II according to DIN EN 61010-1
Degree of contamination	2 according to DIN EN 61010-1
Safety class	I
Protection type	IP 20

The contrAA 800 F and accessories (PC, hydride system, potentially: monitor, printer, compressor) are plugged into the 5-way socket supplied and connected through it to the mains voltage.

Instrument fuses

Instrument fuse fittings (5x20 mm^2) according to IEC 60127

Fuse number	Type	Protected circuit
F1	T 10 A/H	Power supply
F2	T 10 A/H	Power supply
F3	T 3.15 A/H	Xenon short arc lamp
F4	T 3.15 A/H	Xenon short arc lamp

Ambient conditions

according to DIN ISO 90022-2:2003 / 01

Corrosion protection	The device is corrosion-proof for the samples used in the analysis
Working temperature	+5 °C to +40 °C
Max. humidity:	90 % at +40 °C
Transport temperature (desiccant)	-40 °C to +70 °C
Air pressure	0.7 bar to 1.06 bar
Recommended max. altitude	2000 m

The requirements for the environmental conditions are identical for the operation and the storage of the contrAA 800.

Dimensions and weights

The models of the contrAA 800 family have identical dimensions but different weights.

Mass	contrAA 800 D 170 kg contrAA 800 G 170 kg contrAA 800 F 140 kg
Dimensions: (W x H x D)	780 mm x 625 mm x 775 mm
Transport of device	Only possible using the corresponding carrying handles which must be securely screwed into place

10.1.2 Minimum requirements for the control computer

Computer	Graphics resolution 1024x768 pixels or better Mouse / trackball 2 USB ports
Operating system	PC with Windows 7, 8.1 or 10 (32 bit or 64 bit)

10.1.3 Data for the graphite tube technique

Graphite tube furnace

Sample type	Liquid Solid
Tube type	IC tube (wall atomization) IC tube with 1 PIN platform IC tube for solids All tube types are pyro-coated.
Sample volume	max. 50 µL (IC tube) max. 40 µL (IC tube with 1 PIN platform) max. 3 mg (IC tube for solids)
Temperature setting	Temperature can be set between room temperature and 3000 °C, adjustable in steps of 1 °C
Temperature/time programming (furnace program)	Up to 20 steps can be freely programmed within determined limits, 0 to 999 s/step, in intervals of 1 s Temperature increase (Ramp): 1 °C/s to 3000 °C/s linear and maximum non-linear ramps (Full Power FP / No Power NP) Control of inert gas and auxiliary gas Inserting injection and enrichment steps Determining the starting point for autozero and integration
Cooling water	integrated cooling, free from sediment 20 to 40 °C Operation possible with tap water (σ < 1 mS/cm) with added cooling water
Inert gas	Argon 4.8 and superior Permitted components: Oxygen ≤ 3 ppm Nitrogen ≤ 10 ppm Hydrocarbon ≤ 0.5 ppm Humidity ≤ 5 ppm Consumption: max. 2 L/min (depending on the temperature/time program) Inlet pressure: 600 to 700 kPa
	Additive gas Compressed air, oil-free, grease-free, particle-free Inlet pressure: 600 to 700 kPa
Safety circuits ensuring protection against	furnace heating transformer overheating graphite tube breaking graphite tube furnace being operated whilst open operation with insufficient of cooling water flow operation with inert gas inlet pressure being too low

Cooling

Low maintenance cooling system integrated into the spectrometer for the heat dissipation from the Xe lamp and graphite tube furnace based on the water/air heat exchanger principle.

Safety circuits

Monitoring of the cooling water circuit using two safety circuits

Monitoring of	the temperature for Xenon short arc lamp and graphite tube furnace Shutdown at T ≥ 60 °C (Xenon short arc lamp) or T ≥ 95 °C (graphite tube furnace)

Furnace adjustment

Software-controlled adjustment of the graphite tube furnace in the beam path

Height	4 to 16 mm, automated
Depth	0±3 mm, automated for contrAA 800 D manual adjustment for contrAA 800 G

Autosampler AS-GF

Autosampler for adding liquid samples, complete PC control

Sample tray	108 positions
Sample cups Special cups	100 pieces, 1.5 mL 8 pieces, 5 mL
Pipetter volume	1 to 50 µL
Rinse volume	0.5 mL, number of wash cycles can be selected
Program methods	Standard Modifier Dilution Addition Automatic enrichment
Mass	7.2 kg

Sampler
SSA 6z / SSA 600

Solids sampler for automatic sampling with integrated micro scales (SSA 600) or solids sampler for manual sampling (SSA 6z)

SSA 600	Solids sampler for automatic operation with integrated micro scales, optionally with dosing unit for liquid standards
SSA 6z	Solid autosampler for manual operation

10.1.4 Data for the flame technique

Types of flame

Acetylene air flame (standard), acetylene nitrous oxide flame for difficult-to-atomize elements such as boron, aluminum and silicon

Acetylene/air	One-slit burner 50 mm, coded (standard) One-slit burner 100 mm, coded (optional)
Acetylene/nitrous oxide	One-slit burner 50 mm, coded

Oxidant

Compressed air and nitrous oxide (N_2O)	Inlet pressure:	400 to 600 kPa
Nebulizer flow		
air		400 to 600 NL/h
N_2O		320 to 480 NL/h
Additional oxidant (air or N_2O)		
Air		3 levels: 75 / 150 / 225 NL/h
N_2O		3 levels: 60 / 120 / 180 NL/h
Total oxidant		
Air		400 to 825 NL/h
N_2O		320 to 660 NL/h

Fuel gas

Acetylene	Inlet pressure:	80 to 160 kPa
	Consumption:	40 to 315 NL/h

Nebulizer

Generation of the sample aerosol

Mode of action	Pneumatic radial clearance nebulizer
Material	Platinum/rhodium cannula, PEEK nozzle

Nebulizer	Throughput rate 4 to 6 mL/min

Siphon

Siphon with integrated monitoring of the correct filling level (800 mm water column)

Mode of action	Float, corrosion proof

Burner adjustment

Software-controlled adjustment of the burner in the beam path

Height	4 to 15 mm, automated
Depth	0±3 mm, automated for contrAA 800 D manual adjustment for contrAA 800 F
Rotation	0° to 90°, manual

Safety circuits

Monitoring of the burner/nebulizer system

Monitoring of	Burner and burner type Fuel gas pressure Inlet pressure oxidant (air and N_2O) Siphon filling level Flame Level of the waste bottle

10.1.5 Data for the flame technology accessories

Autosampler AS-F

Autosampler without dilution function, completely PC-controlled

Sample tray 139/15	
Sample cups Special cups	129 pieces, 15 mL 10 pieces, 50 mL
Sample tray 54/50	
Sample cups	54 pieces, 50 mL
Power supply	Via AAS basic instrument
Wash bottle	2 L
Mass	6.5 kg

Autosampler AS-FD

Autosampler with dilution function, completely PC-controlled

Sample tray 139/15	
Sample cups Special cups	129 pieces, 15 mL 10 pieces, 50 mL
Sample tray 54/50	
Sample cups	54 pieces, 50 mL
Dosing unit in the Fluidik module	5 mL
Power supply	Via AAS basic instrument
Wash bottle	2 L
Bottle for diluent	2 L
Mass (total)	10.0 kg
Sampler	6.5 kg
Fluidik module	3.5 kg

Injection module

Model: SFS 6 (Segmented Flow Star), PC-controlled

Guaranteed stable burner conditions through continuous flushing and constant temperature

Sample volume for individual analysis	300 µL (minimum volume)
Power supply	Via AAS basic instrument

Piston compressor

Model: PLANET L-S50-15 Standard compressed air supply in flame technique

Tank capacity	15 L
Dimensions (diameter, height)	Ø 400 mm, 490 mm
Power supply	230 V, 50 Hz or 230 V, 60 Hz
Mass	27 kg
max. operating pressure	800 kPa

Scraper

Automatic burner head cleaning for nitrous oxide flame, PC-controlled

Power supply	Via AAS basic instrument

Hydride systems

Chemical hydride generation in flow injection and batch mode; devices with modular design for easy adaptation to changed requirements

Models	HS 60 modular, HS 55 modular, HS 50
Techniques	HydrEA, Hg cold vapor technique and hydride technique

For additional information see instruction manual for hydride systems

10.2 Guidelines and standards

Compliance with the following regulations and directives applicable to the product is declared:

- 2014/30/EU EMC Directive
- 2014/35/EU Low Voltage Directive
- 2011/65/EU RoHS Directive

Applied harmonized standards are:

- EN 61010-1:2010+A1:2019
- EN 61010-2-61:2015
- EN 61326-1:2013
- IEC 63000:2018

Directives for China

The device contains restricted substances (according to directive "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products"). Analytik Jena guarantees, that those hazardous substances may not leak out during the next 25 years when the device is used in accordance with its intended purpose.

11 Abbreviations / terminology

EA:	Electrothermal atomizer
BZS	Burner-nebulizer system
TZP	Temperature/time program / furnace program
EA Operation	Operation with electrothermal atomizer
Analytical line	A spectral line defined by an analyzing instruction
Analyte	Element to be analyzed.
Atomizing	Sample is vaporized to produce atoms
Clean-out	Clean out of the graphite tube furnace to a temperature at which all sample residues in the furnace have been evaporated (i.e. furnace cleaning).
AZ	Autozero during analysis
Limit of quantitation	The minimum weight (concentration) of the element to be analyzed that can be determined with a defined precision. See also detection limit
Reference solution	Solution which can contain the analyte in a known concentration, and according to requirements, the chemicals used for creating the sample solution, in addition it may contain the matrix components which influence the measurements and which are also contained in the sample solution
Blank value solution	Solution which contains the chemicals which are used for creating the but does not contain the sample matrix.
Characteristic mass	Mass of the element to be analyzed which yields an absorbance of A = 0.0044 (corresponds to 1 % absorption); analog: “Characteristic concentration).
Formatting	Heating the graphite tube furnace via several predefined temperature set-points to the maximum temperature. The actual temperatures are measured and by comparing rated and actual temperatures, a correction factor for controlling the graphite tube is calculated. Function 2: A new graphite tube is “burned in”.
ID/Wt	Identity and Weight. Identity data and weight/mass of a sample
Ionization buffer	Addition which increases the concentration of free electrons in the sample in order to reduce the degree of ionization in the analyte
Continuous radiator	Radiator, whose radiation is continually distributed over a large wavelength range In the contrAA 800 a Xenon short arc lamp is used as excitation source
Empty value solution	Solution which contains the chemicals which are used for creating the sample solution, and also the components which influence the measurement, in the same or similar concentration as the sample to be analyzed. No analyte is added to this solution.
Methods	A method contains all data which are required for analysis of samples of a specific element, i.e., spectrometer, atomizer, calibration, sample, autosampler and QC settings, if necessary, also the settings for the QC charts and the results windows (provided these parameters have been considered in the method). Methods can be saved and reloaded. When changing from one method to another, all settings are transferred to the new analysis task.
Measuring solution	Any solution which is added directly to the measurement.

Measuring program	A collection of methods which requires compatible analysis conditions (i.e., the same analysis technique, the same autosampler, etc.) and which are put together in a specific order. A measurement program is used to analyze a sample sequence (semi) automatically for different elements “simultaneously”. (“Simultaneously” means that all samples are analyzed first for one element and then for the next element).
	A measurement program can also consist of only one method.
Modifier	Addition for changing the physical and chemical characteristics of samples.
Detection limit	The weight (concentration) of the element to be analyzed that can be detected with a defined statistical certainty. See also detection limit
Zero solution	Solution which is used to set the zero point. It can be the solvent, the blank value solution or the empty value solution.
Precision	Measure of the statistical deviation of the measurement values from mean (standard deviation, relative standard deviation)
Sample solution.	Solution which originates after treating the sample to be analyzed according to the analysis instructions. If additional processing steps are not required, this is now the measuring solution.
Pyrolysis	Greatest possible removal of accompanying substances from the sample by heating in graphite tube furnace, without evaporating any of the analyte.
QC	Quality control. Concerned with samples and processes for monitoring the quality of the analysis over time.
Serial precision	Precision of several measurements over several days (e.g., 20 part determination in medicine: 20 days, each with 20 measurements)
Statistics series	For calculating the statistical accuracy of an analysis, the individual sample is analyzed for the current element several times in a row.
Stock solution	Solution of a suitable and specific composition (diluent, acid type, acidic content, etc.) which contains the analyte in high and known concentrations. The stock solution is used for producing reference solutions.
Stock solution	See stock solution
Background compensation	Evaluation of measurement value with no background. In the contrAA 800 the background compensation is simultaneous.
Background measurement	Measurement of the spectral background in the environment or under the analysis line.

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