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contrAA 700

High Resolution Continuum Source Atomic Absorption Spectrometer

User Manual

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Subject to change!

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1 Fundamental Information

1.1 Intended Use

The contrAA 700 is an atom absorption spectral photometer to allow sequential analysis of metal and non-metal traces in liquid and dissolved samples. Running under PC control, the contrAA 700 provides a high resolution continuum source atom absorption spectrometer tool for flame, hydride and graphite tube technique. It is intended for determination of metal and non-metal traces in liquid and dissolved samples.

Combined with an autosampler, the contrAA 700 can work as a multi-element automatic setup for routine analytical jobs. It performs an initial calibration of the elements under analysis by sequentially processing the related calibration standards at first and sequentially processing the actual samples in a second step. Hence, after each sample measurement, the results are available for all elements that were subject to analysis.

All operating selections such as spectrometer settings, burner height and fuel gas values and temperature-versus-time programs for electro-thermic atomization are automatically assigned in accordance with actual methodology parameters so they may differ from element line to element line. The control software relies on the Windows operating system to accomplish full operation control of the basic equipment unit and connected accessory items plus related data acquisition and data evaluation processes. Including the analytical background is automatically determined and simultaneously available on the analysis line. The control software includes standard values for methodological settings that relate to an analysis line. Prefabricated line parameter settings are available for each measurable element of the periodic table (also referred to as "cookbook") to facilitate getting started in analytics. They can be used as an initial base for editing one's own multi-element methodologies. The control software also provides comprehensive representation and storage capabilities for signals and parameters measured, for GLP-compliant logging and various quality control options, including a possibility to maintain and update quality control cards.

1.2 User manual conventions

The following warning and information symbols are used in this manual:

WARNING

Indicates a potentially hazardous situation.
If it is not prevented, death or serious injuries (incapacitation) may result.

CAUTION

Indicates a potentially hazardous situation.
If it is not prevented, minor or moderate injuries and material damage may result.

CAUTION! HOT SURFACE!

Touching the hot surface can cause burns.

WARNING! DANGER OF ELECTRIC SHOCK IF TOUCHED!

IMPORTANT

Indicates application hints and other especially useful information without any resulting hazardous or damaging situations.

The manual uses the following conventions:

- Chapters and illustrations are numbered consecutively.
- Every illustration has its own caption.
- Instructions for actions/steps of operation are numbered consecutively and united in action units.
- Menu and option sequences in software are subdivided by "/", e.g. FILE / OPEN. Buttons or keys are marked by square brackets, e.g. [OK].

2 Safety instructions

For your personal safety and for the trouble free and safe operation of the contrAA 700, read this section carefully before starting it up.

Follow all safety instructions given in this manual and pay attention to all messages and notes displayed on the screen by control software.

In addition, follow the safety instructions for system components of other manufacturers (e.g. PC, printer, autosampler) supplied together with the device. In particular, read and follow the safety notes given on the labels of reagents and the information on their handling, storage and disposal.

INTENDED USE!

The contrAA 700 may only be used for the atomic absorption spectrometry techniques as described in this manual.

LOCAL REGULATIONS!

Comply with the local safety regulations relevant to the operation of the device (e.g. occupational safety regulations, accident prevention regulations).

References to potential hazards made in this manual do not replace the relevant occupational safety regulations to be complied with.

PERSONNEL!

The contrAA 700 may only be operated by qualified persons who have been additionally trained for this type of work and have familiarized with the information given in this manual and in the accompanying manuals of accessories and system components.

Work on electrical equipment may only be performed by qualified and approved electricians.

EXPLOSION AND FIRE PROTECTION

The contrAA 700 must not be operated in explosion-risk environments.

Smoking is not allowed in the operating room of the contrAA 700.

The operator is responsible for establishing a control regime that ensures that nitrous oxide and acetylene connections are leak-proof.

INSTALLATION AND INITIAL START-UP

Work for installation, assembly and repair of the contrAA 700 may not be performed by anyone other than Customer Service personnel of Analytik Jena AG or technicians specifically authorized by Analytik Jena AG. Any unautho-rized intervention will create potential danger to users and in terms of operational safety and will restrict actual warranty claims.

SHUTDOWN IN EMERGENCY SITUATIONS!

Switch off the contrAA 700 with the power switch on the right side panel. Disconnect the power cable from the power outlet.

Switch off installed system components with the power switch of the connected multiple socket outlet, which should be placed in a way to allow fast access.

Caution! In doing so, there is the risk of data loss and damage to the operating system on the PC!

ELECTRIC SHOCK!

The contrAA 700 is powered by electrical voltage. **Extremely hazardous electrical voltages** are applied to several components in the system!

To ensure the specified class I product protection standard (PE conductor connection), the line power plug may not be connected to any power point other than a CEE-compliant line socket. The electric PE device must not be rendered ineffective by adding cable extensions without a protective conductor (→ section "Energy supply" p.22).

To perform work on its electrical system, turn power to the contrAA 700 off in all cases and **detach the line power plug**. There will be no safe cutting of line power supply, unless the line plug is removed. After turning off with the main power switch, some parts of the spectrometer, including its outlet socket, will continue to carry line voltage.

Only service technicians of Analytik Jena AG and authorized specialists are allowed to remove the back panel of the device.

Only service technicians of Analytik Jena AG and specially qualified electricians are allowed to open system components, particularly the housing of the xenon lamp.

ELECTRIC SHORTS TRIGGERED BY PIECES OF JEWELLERY

There is potential danger of electric shorts between the two furnace parts or a furnace part and the furnace substructure. Shorting pieces of jewellery will heat up strongly and are likely to cause skin burns.

Do not wear (metallic) jewellery (notably, no necklaces) while working at or with the contrAA 700. Disregarding this rule may imply potential danger of shorts with the electrically heated graphite tube.

OPERATING MATERIALS, HAZARDOUS SUBSTANCES

The operator is responsible for the selection of the substances used in the process as well as for their safe handling. This applies, in particular, to radioactive, infectious, toxic, corrosive, combustible, explosive and otherwise hazardous substances.

In handling hazardous substances, comply with the relevant local safety regulations and guidelines.

Always observe the notes given on labels.

Always use labeled vessels, protective goggles and rubber gloves.

The contrAA 700 may only be operated under an **active** laboratory fume hood to withdraw ozone, combustion gases of samples, and toxic and combustible byproducts of sample preparation.

Treat **biological samples** in compliance with the relevant local regulations for the handling of infectious material.

The operator is responsible for disposing of **waste material**, such as filter residues of the compressor, in an environmentally conscious manner and in compliance with the relevant local regulations.

COMBUSTIBLE AND EXPLOSIVE GASES

Be careful if acetylene is escaping! Acetylene is an explosive gas that is easily detected by its smell.

Shut down the contrAA 700 if gas paths are leaking and fuel gas valves or safety devices of the automatic gas control system are defective.

Keep vessels holding combustible solvents or samples containing volatile and combustible substances away from the flame.

XENON LAMP AND LAMP HOUSING

Inside the quartz bulb of the xenon lamp, there is an overpressure of 2 MPa, which may increase up to 7 MPa in operation!
Only service technicians employed with or authorized by Analytik Jena AG are allowed to open the lamp housing.

UV RADIATION AND DAZZLING HAZARD

Protect your eyes!
Never look at the radiation of the xenon lamp or the burner flame without wearing UV protective goggles.

In flame mode, always keep the door of the sample compartment closed while the flame is ignited.

The xenon lamp, in particular, emits very intense light in the visible and UV region!

OZONE

Inadmissibly high toxic ozone concentrations are produced by the interaction of the UV radiation of the xenon lamp and the N_2O burner flame with the ambient air.

The contrAA 700 may only be operated under an active fume hood.

OPERATION OF HIGH-PRESSURE GAS CYLINDERS AND GAS PLANTS

Fuel gas and oxidant are supplied by high-pressure gas cylinders or local gas plants.

Make sure to fully comply with the local safety regulations and guidelines relevant to the operation of high-pressure gas cylinders and gas plants.

High-pressure tubes and pressure-reducing valves may only be used for the specified gases.

Keep supply tubes, fittings and pressure-reducing valves for N_2O (nitrous oxide) free from grease.

Weekly perform leak tests of all gas connections including nebulizer and mixing chamber.

Carefully ventilate the cylinder location after having replaced the gas cylinder.

HIGH TEMPERATURES

In flame mode, high temperatures are generated.

Allow for appropriate cooling times!

Do not touch hot components during or directly after measurements.

Allow for appropriate cooling times before undertaking maintenance or replacing such components as burner head and lamps.

Keep combustible materials away from the device.

VENTILATION

Take care to ensure that the ventilation systems on the contrAA 700 and the accessory units are always functional. Covered vents, ventilation slots, etc. may result in malfunction or damage to the device.

CLEANING AND MAINTENANCE

Except for the work described in Section "Care and maintenance" p.71, service, maintenance and repair work on the contrAA 700 may only be carried out by service technicians employed with or authorized by Analytik Jena AG. Non-compliance involves the risk of misalignment or damage to the device.

To externally clean the contrAA 700, only use a slightly moistened, but **not dripping cloth**.

For cleaning in the sample compartment of the contrAA 700, take suitable precautions, especially for the protection against **contaminated and infectious materials**.

FLAME MODE

Do not use pure oxygen or air enriched with oxygen as oxidant.

Ensure that the flame sensor is always functional.

If gas paths are leaking, or if detect a fault on the fuel gas valves or the safety devices of the automatic gas control system, switch off the contrAA 700 until the fault has been remedied.

Use the acetylene cylinder only in an upright position and secured against falling over. When the cylinder pressure drops below 100 kPa, replace the cylinder to prevent acetone from entering the automatic gas control system.

Keep vessels holding combustible solvents and samples containing volatile, combustible constituents away from the flame.

Ignite and operate the flame only with the sample compartment door being closed.

Never leave burning flames unattended.

The nebulizer pressure must not drop below 70 kPa.

When working with the nitrous oxide flame, use a scraper or remove carbon deposits manually with the scraper from the burner slot. For combustion gas flows exceeding 250 NL/h pay attention to stubborn deposits. Remove these where necessary to ensure the functionality of the scraper.

When carrying out maintenance work on the nebulizer/burner system, clean all contaminated parts.

GRAPHITE TUBE TECHNIQUE

Use only that type of inert gas which this User Manual specifies for graphite tube technique.

Do not look into the graphite tube opening, unless you have put on safety goggles. Splashes of sample matter and hot graphite particles may cause eye or face injury.

REPLACEMENT OF GRAPHITE TUBES, SPARE PARTS

Use solely spare parts from Analytik Jena AG in all cases.

Graphite tubes for the contrAA 700 are custom-manufactured units and are only available (for ordering) from Analytik Jena AG. Refrain from using graphite tubes of any other type. Failure to comply may damage the contrAA 700.

SENSITIVE ELECTRONICS

System components must not be electrically connected to, or disconnected from, the contrAA 700, unless they are de-energized. This also applies to electrical connection between different system components.

3 Specifications

3.1 Technical data

3.1.1 Technical data of contrAA 700

Optical system

Reflecting optics with protective coating and optical system in light-proof casing

Monochromator	Echelle grating double monochromator of F=380 mm focal length, with variable intermediate slit; preliminary monochromator with quartz prism. Wavelength selection is accomplished via extra neon radiation source reflected into the beam
Wavelength range	185 – 900 nm
Spectral band width	2 pm at 200 nm
Grating	Echelle grating
Optical bench encased photometer	Optics mounted to solid base plate for stability and robustness. Protection against humidity and waste gas.
Detector	Two-dimensional FFT backside illuminated CCD with high quantum efficiency and enhanced UV sensitivity

Lamp

Xenon short-arc lamp with UV arc in hot spot mode; automatic hot-spot tracking; simultaneous drift correction

Lamp current	9-16 A / 8 A in stand-by mode
Operating mode	DC, for monitoring of lamp operating life and ignition pulses
Power supply	Power supply unit integrated in spectrometer

Display modes

Absorption	0 … 3.99
Concentration	Range of values: 5-place (0.001 … 99999), freely selectable unit
Energy	0 - 35000 counts

Signal analysis

Time resolved	Mean value, maximum value of absorption, integral of absorption
Spectrally resolved	Spectrum with 50 to max. 200 pixels

Power supply

Power requirements Frequency	200 / 220 / 240V ±10% factory-selectable 50/60 Hz	
In-house line fuse protection, installation side	Fusible link ≥ 35 A inert No automatic circuit breakers!	
Typical mean power consumption	Basic unit: Basic unit with PC, monitor and autosampler:	2100 VA 2800 VA
Maximum current consumption	52 A for 8 s or 85 A for 1 s, respectively	

Outlet socket	Same as inlet socket (200/220/240V ±10%, 50/60Hz) for connection of accessory units: PC, compressor, hydride system
Overvoltage category	II acc. to DIN EN 61010-1
Pollution degree	2 acc. to DIN EN 61010-1
Protection class	I
Internal protection standard	IP 20

When connecting components other than a PC or monitor to the output socket, there is the risk of exceeding the admissible limit value of leakage current.

Instrument fuses

G-type fuse links (5×20 mm²) under IEC 60127.

Number of fuse	Type	Protected current circuit
F3	T 6,3 A/H	Power socket
F4	T 6,3 A/H	Power socket
F5	T 6,3 A/H	Spectrometer
F6	T 6,3 A/H	Spectrometer
F7	T 3,15 A	XE power supply
F8	T 3,15 A	XE power supply

Furnace fuse

Type	Protected current circuit
TR5-T 100 mA	Graphite tube furnace

Line input fusing

Line input fuses may not be replaced by anyone other than Customer Service personnel of Analytik Jena AG or technicians duly authorized to handle such jobs by Analytik Jena AG.

gL-G-fuse inserts (10×38 mm²) according to 60947-3.

Number of fuse	Type	Protected current circuit
F1	32 A/T	Line power input
F2	32 A/T	Line power input

Ambient conditions

acc. to DIN ISO 90022-2:2003 / 01

Corrosion protection	Device is corrosion-proof against the samples to be analyzed
Operating temperature	+10 °C to 40 °C
Humidity	Max. 93% at +40 °C
Storage temperature (desiccant)	–40 °C to +70 °C

Dimensions and weights

Weight	185 kg
Dimensions (W x H x D):	1200 mm × 570 (645) mm × 765 mm
Transportation	Only with transporting handles firmly screwed in.

3.1.2 Control computer data

Computer (minimum requirements)	PC Pentium 1 GHz with 512 Mbyte RAM 40 Gbyte hard disk, 43-cm color monitor (17") VGA graphic card 800x600 pixels resolution or higher , CD ROM Ports: – Mouse port – Printer port - USB port (USB 1.1 or 2.0) for contrAA 700
Printer	HP DeskJet Ink Jet Printer HP Laser Jet Laser Printer
Operating system	Windows XP Professional

3.1.3 Data for graphite tube technique

Graphite Tube Furnace

Type of sample	Liquid Solid
Type of tube	IC tube (wall atomization) IC tube with 1-PIN platform IC-Rohr solid sample All tube types are pyro-coated.
Volume	max. 50 µL
Temperature setting	Temperature can be set between room temperature and 3000 °C 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 max. non-linear ramps (Full Power FP / No Power NP) Control of inert gas and aux. gas Inserting injection and enrichment steps Determining starting point for autozero and integration
Cooling water	Integrated cooling, sediment-free 20 to 40°C
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 temperature-time program) Inlet pressure 0.6 to 0.7 MPa

Safety circuits report errors	if transformer for furnace heating is overheated if the graphite tube is broken if the graphite tube furnace is overheated if the graphite tube furnace is open during operation if there is a shortage of cooling water if the inlet pressure of the inert gas is too small

Autosampler AS-GF

Autosampler with Dilution Function, 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
Wash volume	0.5 mL, number of wash cycles can be selected
Program methods	Standard Modifier Dilution Addition Automatic enrichment
Mass	7.2 kg

Cooling

A cooling system requiring no scheduled maintenance which is integrated with the spectrometer for heat removal from the Xe-lamp and the graphite furnace, working based on the water-air exchange principle.

Accessories for Direct Solid Analysis

SSA 600	Solid autosampler for automated mode
SSA 6	Solid autosampler for manual mode

3.1.4 Data for flame technique

Types of Flame

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

Oxidant

Compressed air and N_2O (nitrous oxide)	Inlet pressure: 300 to 600 kPa
Nebulizer flow rates Air N_2O	 400 to 600 NL/h 320 to 480 NL/h
Auxiliary oxidant (air or N_2O)	30 to 315 NL/h
Total oxidant Air N_2O	 400 to 700 NL/h 320 to 700 NL/h

Fuel gas

Acetylene	Inlet pressure: 80 to 150 kPa Consumption: 40 to 315 NL/h

Nebulizer

Operating principle	Pneumatic concentric jet nebulizer
Material	Platinum/Rhodium tube, PEEK nozzle, PEEK cap
Nebulizer 0.7	Flow rate 4 to 7 mL/min

Siphon Monitoring

Operating principle	Float, corrosion-proof

Burner Adjustment

Height	4 to 16 mm, automated
Depth	3 mm, manual
Rotation	0 to 90 degrees, manual

Safety Circuits

Monitoring	Burner and burner type Fuel as pressure Siphon fill level Flame Oxidant inlet pressure (air and N_2O)

3.1.5 Data regarding flame technique 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) Autosampler Fluidik module	10.0 kg 6.5 kg 3.5 kg

Injection Module

PC-controlled

Sample volume for single analysis	300 µL (minimum volume)
Power supply	Via spectrometer

Piston Compressor JUN-AIR 6/S Standard

Tank capacity	15 L
Dimensions (diameter × height)	400 mm × 480 mm
Power supply	230 V, 50 Hz or 230 V. 60 Hz
Weight	28 kg

Scraper

PC-controlled

Power supply	Via spectrometer

Hg/Hydride Systems

HS 60 modular; HS 55 modular; HS 50

Refer to Hg/Hydride Systems user manual.

3.2 Guidelines and standards

Protection Class and Degree of Protection

The contrAA 700 is classified in Protection Class I.
The Degree of Protection of the casing is IP 20.

Device Safety

The contrAA 700 complies with the following safety standards

- DIN EN 61010-1 (VDE 0411T.1; IEC 61010-1)
- DIN EN 61010-2-061 (IEC 61010-2-061)

Electromagnetic Compatibility (EMC)

The contrAA 700 has been tested for radio interference suppression and noise immunity. It complies with the requirements of

- DIN ISO 9022-3:2000
- DIN ISO 9022-32-03-0
- DIN ISO 9022-2:2003/01

EC Directives

The contrAA 700 has been manufactured and tested in compliance with standards that meet the requirements of EC Directives 2006/95/EG and 2004/108/EG. The device was delivered in perfect, technically safe condition. To maintain this condition and ensure safe operation, observe the safety and operating instructions given in this manual. In addition, observe the operating instructions supplied along with accompanying accessories and system components of other manufacturers.

4 Installation requirements

CAUTION

The device may only be set up, installed and repaired by service technicians employed with or authorized by Analytik Jena AG. Any unauthorized tampering with the device will limit the rights to claim under warranty.

For system installation, temporary assistant labour is required. Customer Service personnel will perform system testing and document the results in a special contrAA 700 test certificate.

The owner/operator will be responsible in connection with anything not directly included in contrAA 700 delivery, but necessary for normal operation. For contrAA 700 operation, certain local and specific utility requirements must be met:

- ❑ Suitable installation site
- ❑ Sufficient floor space
- ❑ Ambient conditions
- ❑ Supply of fuel gas and oxidant
- ❑ Laboratory fume hood
- ❑ Mains connection

CAUTION

Pay attention to the instructions given in Section "Safety instructions" p. 9.
See to it that occupational safety regulations are complied with. References to potential hazards do not replace the valid occupational safety regulations!

Potential hazards when working with the contrAA 700 include:

- ❑ Burn hazard by flame and hot burner components
- ❑ Hazard from electric current
- ❑ UV radiation hazard
- ❑ Hazard from the generation of ozone and nitrogen oxides
- ❑ Hazard in handling high-pressure gas cylinders
- ❑ Hazard from toxic and chemically aggressive substances

4.1 Ambient conditions

- ❑ Do not set up the contrAA 700 directly beside a door or window. The installation site of the contrAA 700 should be free of draft, dust, corrosive vapours and vibration.
- ❑ Do not set up the contrAA 700 near sources of electromagnetic interference.
- ❑ Avoid direct exposure of the contrAA 700 to sunlight and radiation from heaters. In extreme cases, provide room air conditioning.
- ❑ You are advised to prepare samples and store wet-chemical materials in a separate room.
- ❑ In the operating room of the contrAA 700, smoking is not allowed.

- ❑ Operating temperature range: +10°C to 40°C
- ❑ Storage temperature range -40°C to 70°C, use desiccant.
- ❑ Max. operating humidity 93% at 40°C
- ❑ Storage humidity 10% to 30%, use desiccant

4.2 Floor space requirements and weight

- ❑ Minimum size of work bench:
  1880 mm × 700 mm, height to be selected according to ergonomic aspects
- ❑ Carrying capacity of work bench: 230 kg
- ❑ Additional floor space for JUN-AIR S6 piston compressor and PC where included
- ❑ Bench surface quality: wipe-proof, scratch-proof and corrosion-proof, not moisture-absorbing

Set up the work bench to allow easy access from all sides.

Component	Width [mm]	Height [mm]	Depth [mm]	Weight [kg]
On the work bench				
contrAA 700	1180	570(645)	765	185
AS-GF	250	550	380	7,2
AS-F	340	350	460	6,5
AS-FD Autosampler Fluidik module	 340 360	 350 310	 460 165	 6,5 3,5
HS 60 modular	360	370	240	14
HS 55 modular	360	370	240	14
HS 50	270	210	190	2
Under the work bench				
Compressor JUN-AIR 6/S	∅ 400	480		28

Table 1 Dimensions and weights of the contrAA 700 and its system components

4.3 Energy supply

WARNING! NOTE CONNECTION DETAILS OF AVAILABLE MAINS SUPPLY!

Comply with VDE (*German Electrical Engineering Association*) rules and local provisions when performing electrical installation work!
The mains connection point must be properly grounded.
Do not use adapters in line power supply cabling.
Do not use automatic circuit breakers.

The contrAA 700 requires single-phase AC current supply for operation. Its current loading rate can be as high as 85 A at the maximum heating rate for a short time (1 s). During this phase, line voltage at the contrAA 700 should not drop by more than 6%. If actual values are found to differ from these specifications, you are requested to consult with us. Adequate accessory units can be additionally supplied.

For optimal system function, it is essential that mains connection be performed in a proper manner and using adequate cross-sections for cabling. The mains connection point must be protected with 35 A inert on the facility side and must have been installed near the operating site prior to contrAA 700 delivery. The power supply cord is 3 meters long. A CEE surface-type socket outlet (2-pole + E Blue 5UR 3 206-2 220/32 from Siemens) is provided under the contract of delivery.

All other components of the contrAA 700 (e.g. PC, printer, etc.) are connected to the same phase as the basic system unit via a 5-position manifold that is plugged into a socket on the back of the contrAA 700. If you use your own PC and printer configuration and want to connect this configuration via the 5-position manifold, then make sure that the specified limit value for permissible working current is not exceeded. To prevent dramatic variations in voltage level, you should not connect the contrAA 700 to a current circuit that is shared with other power-intensive consumers.

Power Requirements

Voltage	200 / 230 /230 V ±10% factory-set to Customer request, or such other voltage level as provided for in contract of delivery
Frequency	50/60 Hz or such other frequency as specified in contract of delivery
Mean typical power consumption	2100 VA
Maximum current consumption	85 A for 1 second or 52 A for 8 seconds, respectively
Fusing (on line side)	35 A, fusible link, inert, single-phase Do not use automatic circuit breakers!
Power consumption of hydride subsystem	700 VA while cell is heated 400 VA in steady operation

Table 2 Power requirements

4.4 Gas supply

4.5 Gases in graphite tube technique

The required inert gas is used to protect the graphite components of the atomizer, which are subjected to extreme temperatures. The inert gas is 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 additionally inserting oxidizing gas (e.g. air or oxygen) during the pyrolysis step, the pyrolysis of the sample, i.e. the divide off of the matrix components, may be accelerated. The oxidizing gas is inserted via the "Gas Additional" connector on the device's rear side.

The gas pressure at the spectrometer must be between 0.6 and 0.7 MPa.

VORSICHT

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

The required pressure reducing valve for the inert gas cylinder, and the argon pressure tube are supplied. The standard tube length is 5 m. If other tube lengths are preferred, please contact the customer service department at Analytik Jena AG.

Recommended Inert Gas	Input Pressure	Consumption
Recommended for graphite tube mode: Argon 4.8 or superior Permitted components: Oxygen ≤ 3 ppm Nitrogen ≤ 10 ppm Hydrocarbon ≤ 0.5 ppm Humidity ≤ 5 ppm	6 - 7 bar	max. 2 L/min (depending on the temperature-time program)

Table 3 Gases in the Graphite Tube Technique

4.5.1 Gases for flame technique

For the flame technique, oxidant (compressed air and N_2O if necessary) and fuel are required. The purity of the gases is extremely important for the analysis. The piston compressor JUN-AIR 6/S can be used to supply the compressed air. If compressed air is supplied by the operator's own compressed air connection, please consult the service department at Analytik Jena AG. N_2O is supplied by pressure cylinders or by an existing mains line.

CAUTION! INSTALLATION OF HIGH-PRESSURE GAS CYLINDERS

If fuel gas supply is from high-pressure cylinders, the cylinders must be installed upright in gas cylinder cabinets or mounted to the wall with cylinder holders outside the laboratory room.

The pressure gas tubes are supplied with the device, the pressure-reducing valves are optional.

- ❑ Tube length for connection to cylinder 5 m
- ❑ Tube length for connection to compressor 5 m

On request, you may also use tubes of other lengths. If you intend to do so, please consult the Service Department of Analytik Jena AG.

Fuel gas and oxidant	Inlet pressure	Consumption
Compressed air, oil-free, grease-free, particle-free	4 - 6 bar	Max. 700 NL/h
N_2O, oil-free, grease-free, purity 2.5	4 - 6 bar	Max. 700 L/h
Acetylene Purity 2,5 (for flame photometry): better than 99.5 Vol% relative to C_2H_2, without acetone. Minor constituents: Hydrogen compounds of As, S and P	0,8 – 1,5 bar	Max. 315 NL/h

Table 4 Gases for flame technique

4.6 Laboratory fume hood

CAUTION! TURN SUCTION DEVICE (FUME HOOD) ON FOR NORMAL OPERATION!

Do not operate the contrAA 700 without fume hood!
Direct waste gas to the outside and avoid blockage!

The laboratory fume hood shall exhaust noxious combustion residues of the flame and any produced ozone. Ozone is produced by the interaction of air and the UV radiation emitted by the xenon lamp and the burner flame. The used fume hood should be made of material that is resistant to heat and corrosion. The first six meters of the fume hood should be made of metal.

Parameters	Properties
Material	V2A
Exhaust capacity with nitrous oxide flame	Approx. 8 to 10 m^3/min
Exhaust capacity with air flame	Approx. 5 m^3/min
Hood opening	Approx. 200 × 200 mm
Distance to top edge of device	Approx. 200 to 300 mm
Tube diameter	Approx. 100 to 120 mm

Table 5 Laboratory fume hood requirements

4.7 System layout and general view

The contrAA 700 provides a compact tool that has been conceived for desktop operation. Its footprint requirements follow from the total of components included in a given analytical workplace.

Located beside the basic system unit are the PC with monitor, printer, keyboard and mouse pad. The PC and printer can also be placed on a standard available PC trolley.

The samplers for the flame mode AS-F or AS-FD are hung in the right sample chamber of the contrAA 700. 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 – autosampler AS-GF for dissolved samples or Solid Autosampler SSA 6 or SSA 600 for solid samples – are hung in the left sample chamber.

For placement of accessory items for Hg/hydride technique (HS 55/60 modular), an extra table on the left-hand side in front of the contrAA 700 is used.

Located on the floor in a position directly beside the product are these components:

- collector flask for undispersed sample liquid, washing liquid of autosamplers and residual liquid of mercury hydride subsystem
- JUN-AIR 6/S compressor.

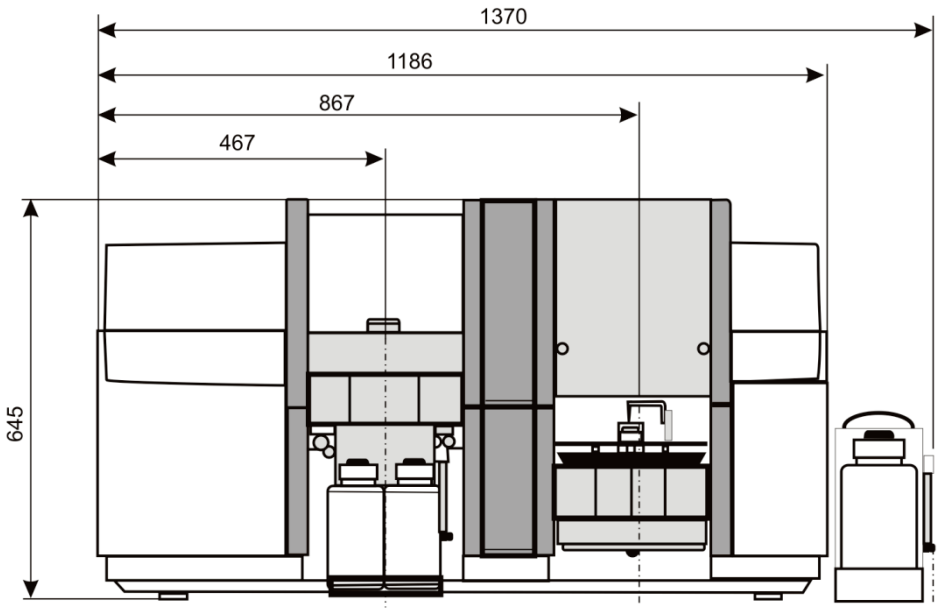


Fig. 1 Dimensional front-side view of contrAA 700

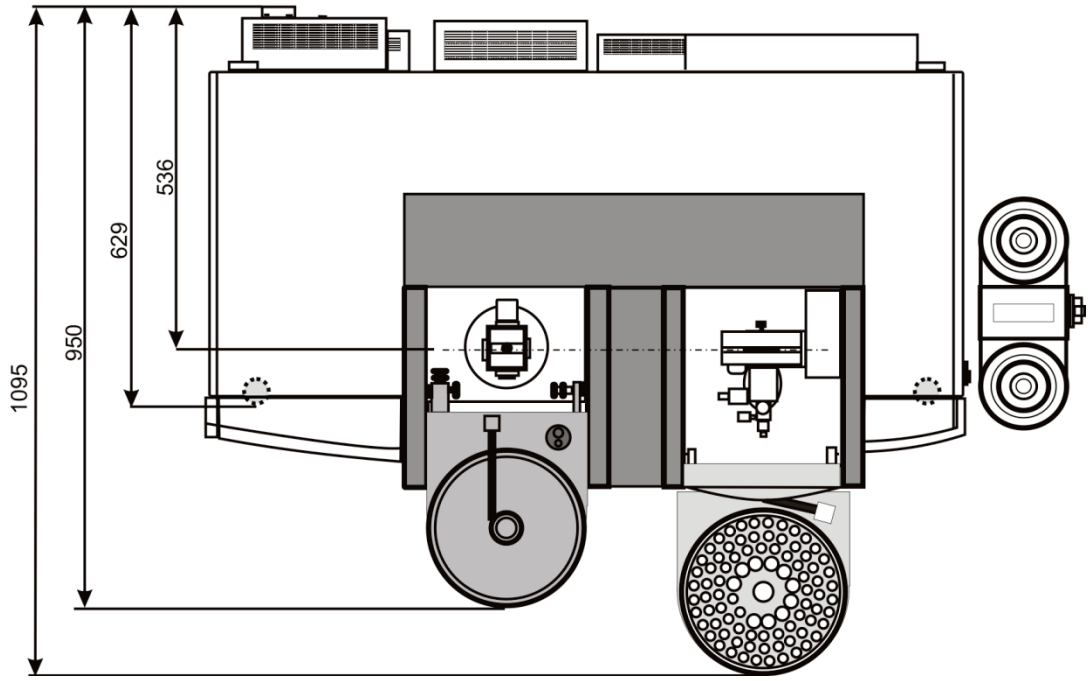


Fig. 2 Top-side dimensional view of contrAA 700

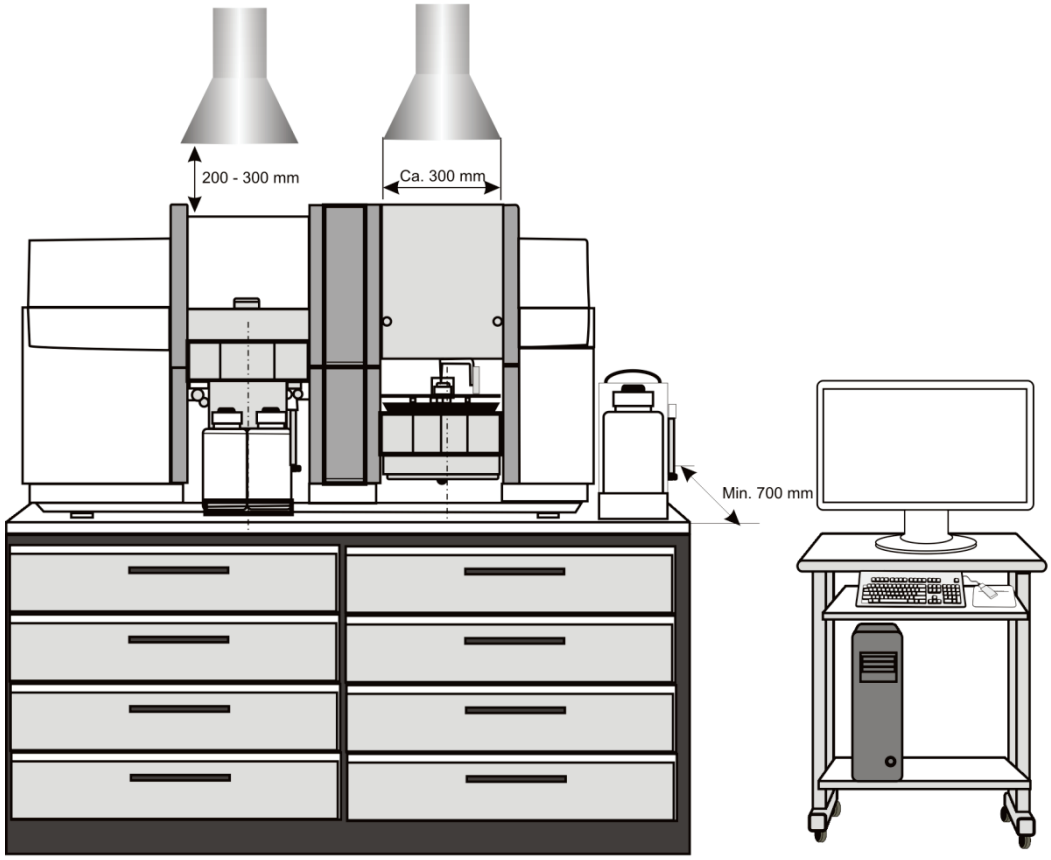


Fig. 3 Layout view of contrAA 700

5 Functions and design of the contrAA 700

5.1 Physical measuring principle of HR-CS AAS

The measuring principle of both High Resolution Continuum Source Atomic Absorption Spectrometry (HR-CS AAS) and classical Line Source AAS (LS AAS) is based on the absorption of primary radiation by the analyte atoms in their ground state. The measured absorbance signal constitutes a measure of concentration of the respective element in the analyzed sample.

Every AAS device consists of the following basic modules:

- ❑ Light source
- ❑ Atomizer
- ❑ Monochromator
- ❑ Detector
- ❑ Evaluation unit (PC)

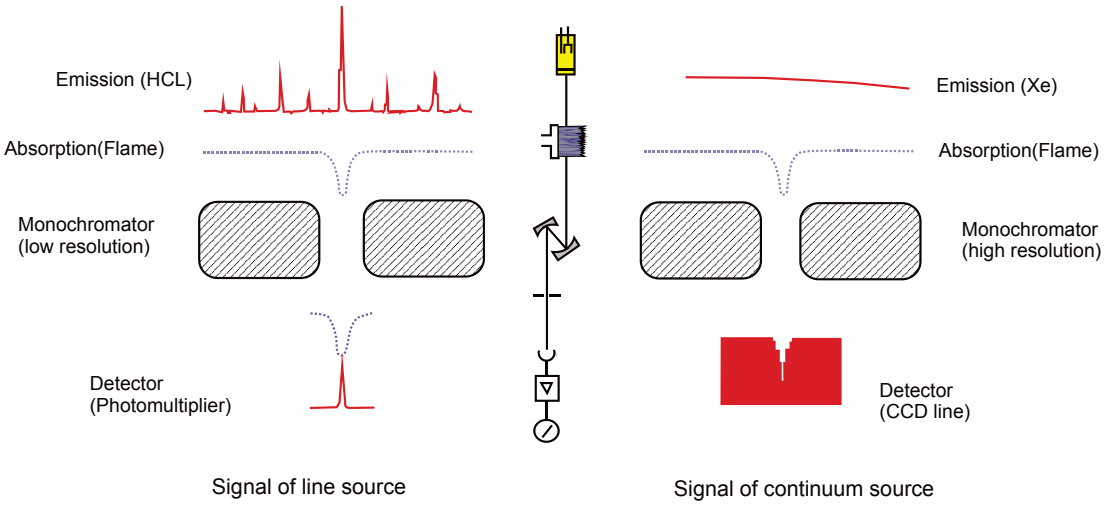


Fig. 4 **Schematic comparison of physical measuring principles of LS AAS and HR-CS (with flame techniques)**

Light source

In HR-CS AAS, the element-specific light source of classical AAS (hollow cathode lamp (HKL)) is replaced by a single continuum source, a xenon short-arc lamp, which is used for all elements and lines. Due to the special electrode geometry of the xenon short-arc lamp, a hot arc spot ("Hot-Spot") is caused that ensures very high radiation density and continuous emission throughout the entire spectral range (190 – 900 nm). This way, all analysis lines of interest are available without any restrictions and at any time – concerning both the resonance wavelengths of the elements to be analyzed and all secondary wavelengths without the technical limitations caused by specific properties of the HCL, such as exit window and emission intensity. In addition, absorption lines or bands of diatomic molecules (PO, CS, ...) can be used analytically for element determination.

Atomizer

The contrAA 700 is designed to allow the following atomization techniques:

- ❑ burner and nebulizer system in flame mode
- ❑ cross-heated graphite tube in EA mode
- ❑ cell unit in hydride and Hg cold vapour technique
- ❑ SSA 600 solid sampler combined with a graphite tube

The graphite tube atomizer and the burner and nebulizer system (BZS) are firmly installed in the sample compartment of the contrAA 700. For this reason, no retrofitting is required for conversion to another atomization technique.

The cell unit of Hg/hydride systems must be mounted onto the mixing chamber in lieu of the burner head.

Alternatively, hydride technique may be combined with graphite tube technique. HydrEA technique ("Hydride technique with electrothermic atomization") relies on the fact that metal hydrides or mercury vapour are enriched and atomized at 2100°C or 800°C, respectively, on a preheated graphite tube which is coated with indium or gold.

With its graphite tube technique, the contrAA 700 is also suited for direct solid sample analysis with special SSA 600 sample peripherals. Through direct determination of trace elements in a solid sample, the otherwise time-consuming and contamination-inducing procedures for sample decomposition – a major error source in analytical solution routines – are excluded.

Monochromator

The selectivity of the analysis is realized by a high-resolution double monochromator based on a prism and an Echelle grating monochromator. In this way, a very compact design and a high spectral resolution (high spectral dispersion of radiation) of λ/Δλ =145 000 is achieved, which corresponds to a spectral band width of < 2 pm per pixel at 200 nm. The monochromator is wavelength-stabilized by the use of an integrated neon source. The wavelength accuracy is achieved by monochromator calibration, when a wavelength is adjusted based on the physically defined neon lines.

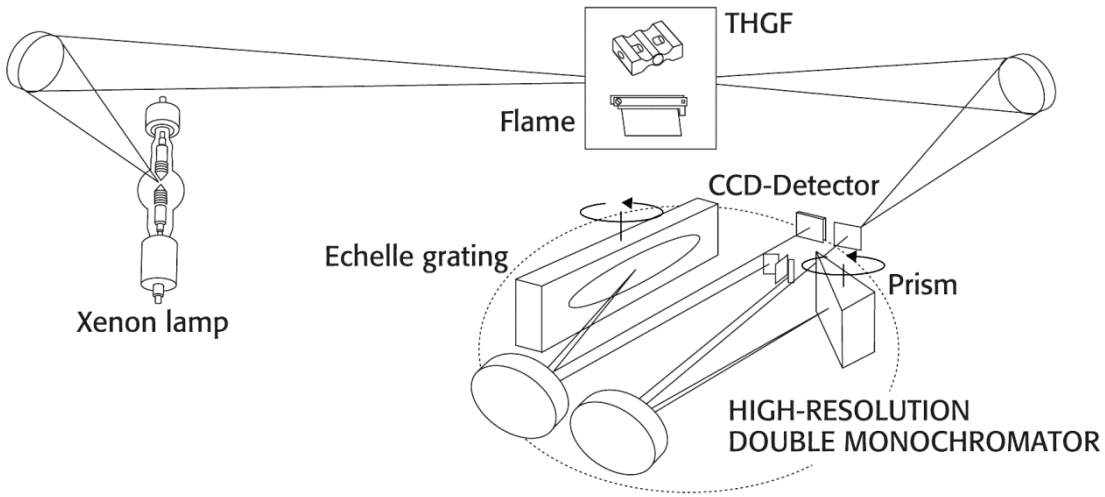


Fig. 5 Optical path in contrAA 700

Detector

In place of the exit slit of the monochromator, which in classical LS AAS isolates the analysis line from other radiation emitted by the HCL before it reaches the detector, in HR-CS AAS a low-noise, UV-sensitive semiconductor detector is used (CCD line detector). This detector does not only detect the intensity on the analysis line, but also its spectral neighborhood. In this way, a spectral region of up to 1 nm around the analysis line is detected simultaneously and at a high resolution.

Evaluation unit

Background correction is by polynomial formation through selected reference points. The selection of these reference points may be performed manually by the user; by default, however, it is done automatically through software. The reference points are dynamically selected for every spectrum using a special algorithm and based on criteria ensuring approximation to the actual baseline on the measuring pixel that is as accurate as possible. If a fine-structured background overlaps the analysis wavelength, a multivariant method can be applied. To this end, reference spectra of matrix constituents are used for the polynomial forming least-squares fit. If atom lines directly overlap with the analysis wavelength, it is also possible to perform interelement correction (IEC). For this correction, spectral lines are used, which are adjacent to the interfering element and captured by the observation width of the detector (e.g.: correction of spectral interference of Fe at the analysis wavelength of Zn at 213 nm or Se at 196 nm).

Lamp drift and all broad-band effects are instantly eliminated from the spectrum by automatic and simultaneous background correction with correction pixel assignment. In this way, a simultaneous double-beam system is realized with only one optical path, which results in clearly higher measurement stability compared to classical LS AAS. While the sensitivity of this technique is comparable to that of LS AAS, it features clearly improved signal-to-noise ratios and thus lower detection and determination limits. These are achieved by the use of the CCD line detector of the contrAA 700 with extremely low noise compared to the photomultipliers customary in LS AAS and to the use of the high-energy xenon short-arc lamp with its very high light intensity.

5.2 Xenon lamp

The continuum source used on the contrAA 700 is a xenon short-arc lamp.

Due to the special electrode geometry of the xenon short-arc lamp, a hot arc spot ("hot spot”) is formed that emits a very high radiation density throughout the entire spectral range (185 – 900 nm).

During the analysis, the position of the arc spot is monitored and automatically readjusted. This way, warm-up effects by lamp drift are avoided. All drifts of the xenon lamp are simultaneously corrected for in the spectra through correction pixels.

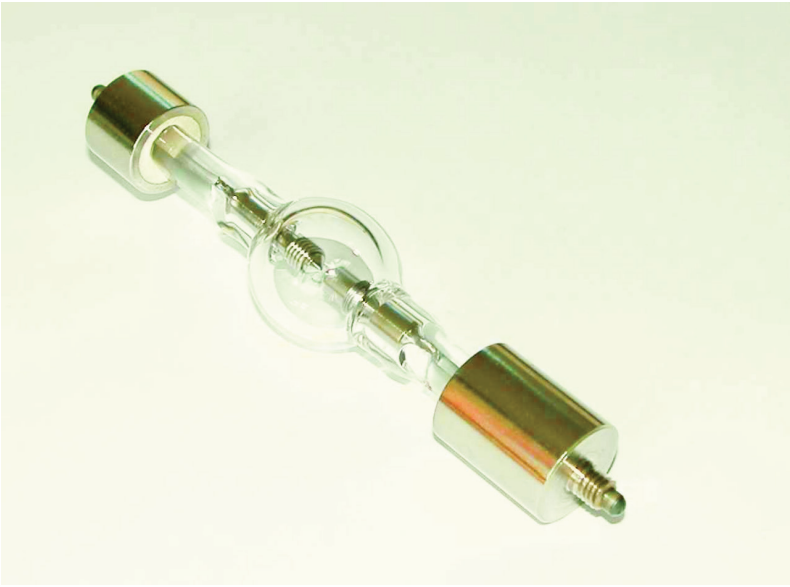
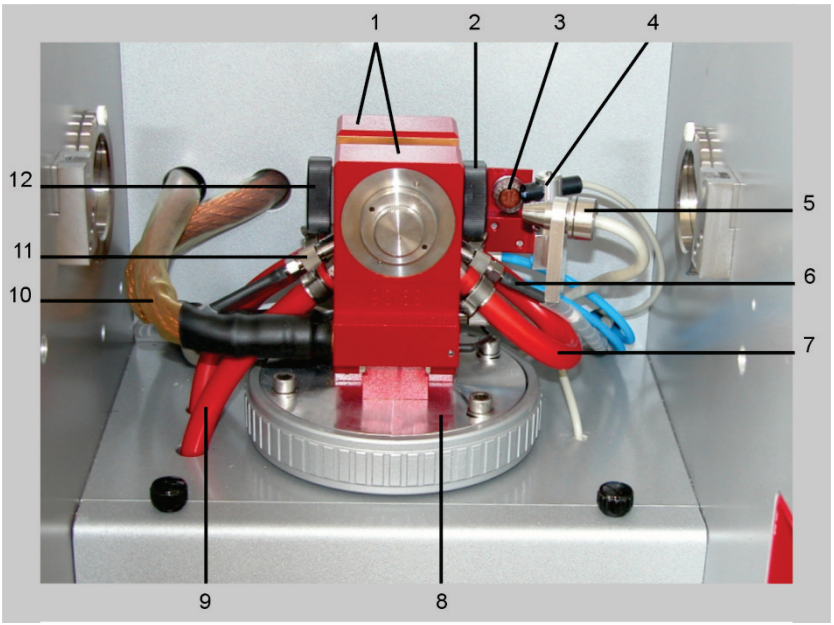


Fig. 6 Xenon lamp without housing

5.3 Graphite tube atomizer

The electrothermic atomizer (EA) is an integral part of the contrAA 700. It is also a core part for working in EA mode and HydrEA technique.



1	Furnace jaws	7	Cooling water connector
2	Furnace window	8	Vertical adjustment
3	Fuse at graphite tube furnace	9	Cooling water connections
4	Furnace camera illuminator	10	Heavy current cable
5	Radiation sensor	11	Gas connector, black tube
6	Gas connector, black tube	12	Furnace window

Fig. 7 View of graphite tube atomizer

The furnace system includes a graphite tube with lateral contact pieces located on the jacket side for tube heating in transversal direction. This cross-heated graphite tube is an essential function unit. It serves as atomizer for liquid sample volumes injected with the autosampler AS-GF or an IC sample carrier containing a small amount of solid substance introduced with the help of solid sample peripherals. At the same time, the cross-heated graphite tube also serves as a heating resistance of the electric furnace.

Remarks relating to graphite tube furnace operation

- ❑ 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
- ❑ Simple design and simple to manufacture, and therefore cost-effective geometries of the transverse-heated graphite tube and the other graphite components.
- ❑ 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.
- ❑ Small consumption of protective gas, at the same time ensuring effective protection against interference with atmospheric oxygen.

The analytical advantages of the graphite tube technique, in conjunction with the background compensator, consist of the high selectivity and problem-free trace and ultra-trace analysis of real samples with a complex matrix.

In the analysis, each sample runs through a furnace program (temperature-time program) with the aim of drying wet samples and of separating out any distorting incidental substances before atomizing.

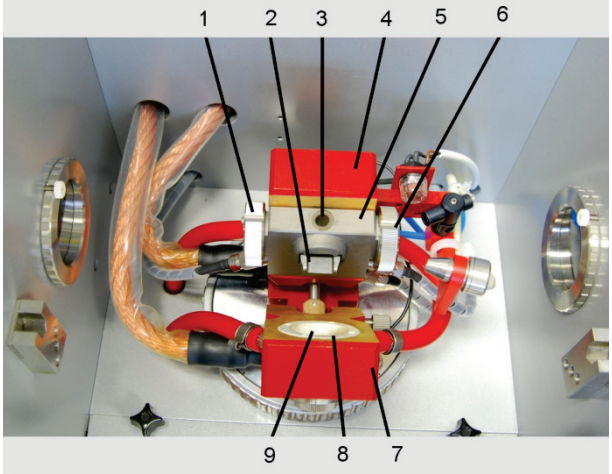
The furnace program runs in four basic steps:

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

The operator optimizes these basic steps for each analysis problem with the control software Aspect Cs.

5.3.1 Graphite tube furnace

The transverse-heated graphite tube, with its contact surfaces, is pneumatically pressed and held against annular shaped graphite electrodes which are in water-cooled metal bodies. Between the metal bodies, which carry the electrodes, there is an additional graphite component: The furnace shroud. Together with the graphite electrodes, it forms a closed inner chamber around the graphite tube which stabilizes the heat emission conditions of the graphite tube and also guarantees chemically inert ratios. For pre-adjustment of the position of the graphite tube when the atomizer is open, the furnace shroud has defined supports on the inside. When closing the movable furnace component, the tube is raised to the resting position and pressed into the contacts, without touching the furnace shroud. This action can be reproduced.



1	Furnace window
2	Graphite tube, installed
3	Dosage opening with graphite funnel insert
4	Fixed furnace component
5	Furnace shroud
6	Furnace window
7	Movable furnace component, open
8	Graphite electrode in the movable furnace component
9	Ceramic ring

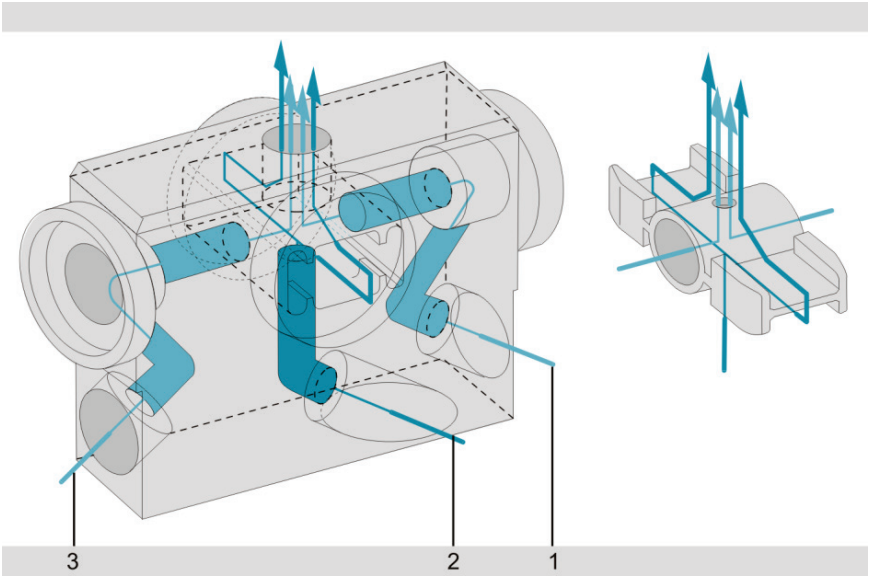
Fig. 8 Graphite furnace structural view

5.3.2 Gas flows in furnace shroud

The gas channels for separate supply of the primary gas flow (cleaning gas) and the secondary gas flow (protection gas) are housed in the furnace shroud. Oxidizing or reducing gases (O_2 or H_2) can be added to the primary gas flow if necessary. The have a positive effect on the charring step. When using oxygen, 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 the drying and charring step; of preventing condensation effects of the samples on the furnace windows and of influencing the residence time of the analyte atoms in the path of the beam. During atomization, the primary gas flow is generally interrupted in order to achieve the longest possible residence time for the atom in the path of the and to increase the sensitivity of the measurement. The secondary gas flow sweeps the graphite tube and also reaches the outside through the funnel of the dosage opening.

The secondary gas flow is responsible for ensuring that the graphite tube is surrounded by inert gas, even when the primary gas flow has stopped, and thus provides protection against oxidation by atmospheric oxygen



1, 3 Primary Gas Flow (cleaning gas)

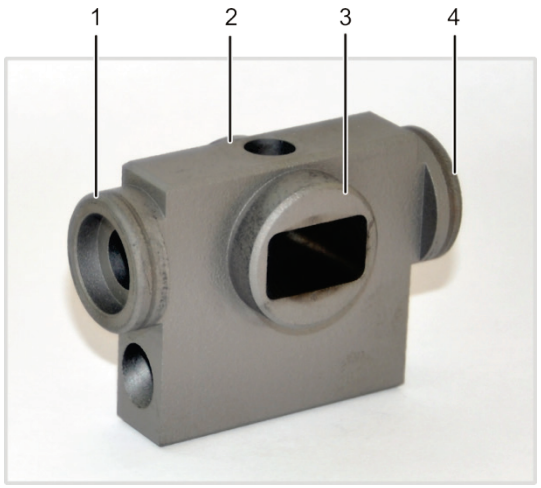
2 Secondary Gas Flow (protection gas)

Fig. 9 Primary and Secondary Gas flows in the Graphite Tube Furnace

The thermal flow in the furnace shroud is realized via a cylindrical attachment to the fixed furnace component. The operating temperature of the atomizer is thus increased by desired amounts so that, at its inner walls, condensation effects of the analyte (the sample) are avoided.

The conical attachment on the opposite side of the furnace shroud, together with the sealing ring in the rotatable furnace component, forms an exactly defined slit and thus guarantees a safe sealing of the cell inner chamber from any penetrating surrounding air. If the tube in the furnace shroud is broken, the sealing ring in the movable furnace component prevents a short circuit between the furnace components.

The furnace shroud is bored in the direction of the optical axis, the outer cylinders support the furnace window (quartz cell window). These can be pulled off easily for cleaning purposes by a twisting.



1, 4 Cylinder for the furnace window

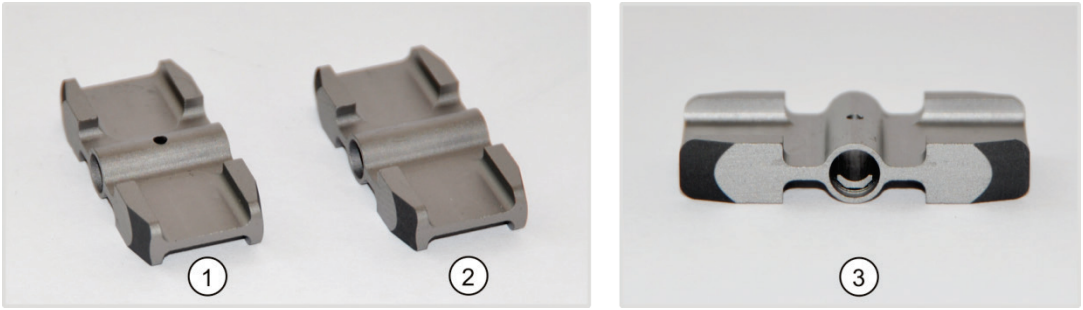
2, 3 Mount: Conical attachment

Fig. 10 Graphite tube furnace shroud

When changing from the normal tube to the platform tube, or to solid analysis, please ensure that the platform tube limits the free opening for the beam on one side. The graphite tube furnace can be aligned to the HCL beam path by a delicate vertical movement of the mount.

5.3.3 Graphite tube variations, furnace parts and inserts

- ❑ Standard graphite tube
- ❑ Graphite tube for solid analysis
- ❑ Graphite tube with PIN platform



1 Graphite tube, standard

2 Graphite tube for solid analysis

3 Graphite tube with PIN platform

Fig. 11 Graphite tube variations

Graphite tube variation	Sample volumes	Use
Standard graphite tube	max. 50 µL	Aqueous samples (samples not requiring complex analysis) Alternative for solids (solid technology)
Graphite tube with PIN platform	max. 50 µL	Aqueous samples
Standard graphite tube for solids analysis (without dosing opening)		Solids (solid technology)

Table 6 Use and sample volume of different graphite tube variations

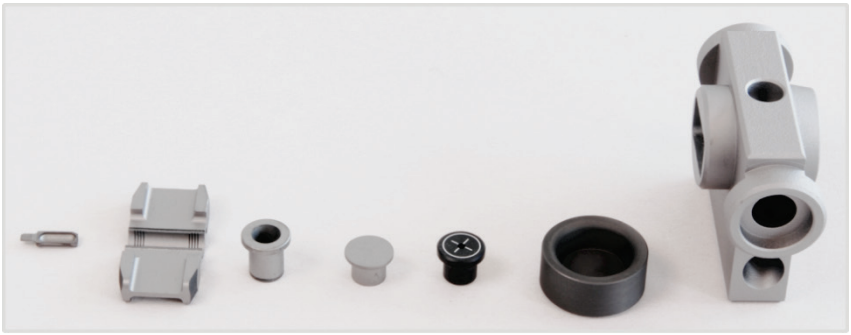


Fig. 12 Furnace jacket, adapters and inserts

No.	Furnace part / insert	Function
1	Platform (sample carrier)	Accommodates solids samples.
2	Adjusting aid for SSA 600	Adjusts the solid autosampler SSA 600.
3	Pipetter insert	Funnel opening to the pipetting channel.
4	Solid adapter	Seals the pipetter opening.
5	Adjusting aid	Adjusts the autosampler AS-GF.
6	Electrode	Contacts tube wings.
7	Furnace jacket	Accommodates the graphite tube.

Table 1 Furnace parts and inserts

5.3.4 Radiation sensor

On the side of the graphite tube furnace, diagonal to the direction of the beam, is a measuring layout for recalibration of tube temperatures. This radiation sensor uses a semi-conducting receiver to pick up radiation from the inner chamber of the graphite tube. 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.

5.3.5 Furnace camera

A furnace camera is turned on and off under software control. The user screen of ASpect CS provides a separate window with a furnace camera image. The furnace camera monitors a process sequence from the point of sample injection into the graphite tube to completion point of drying. This makes it possible to directly supervise, and correct if necessary, motion for submergence of the dosing tube into the graphite tube, for dispensing of a sample, as well as other process components, including the drying process. Prior to pyrolysis, the furnace camera is automatically turned off.

To illuminate the graphite tube, an illuminator unit is mounted in a lateral position (to be turned on concurrently with the furnace camera.

5.4 Accessories for graphite tube technique

5.4.1 Autosampler AS-GF

The autosampler AS-GF is used in EA mode for feeding liquid samples and in the HydrEA method for feeding reaction gas into the graphite tube.

IMPORTANT

Manual pipetting is not recommended because of the poor reproducibility rate.

1 autosampler arm with canula restraint
2 tube guide
3 sample tray with sample tray cover
4 dosing unit (500 µL)
5 waste bottle
6 storage bottle for wash solution (or diluent)

Fig. 13 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 700. The device parameters of the AS-GF are set with the ASpect CS control software.

5.4.2 Solid autosamplers SSA 600 and SSA 6z

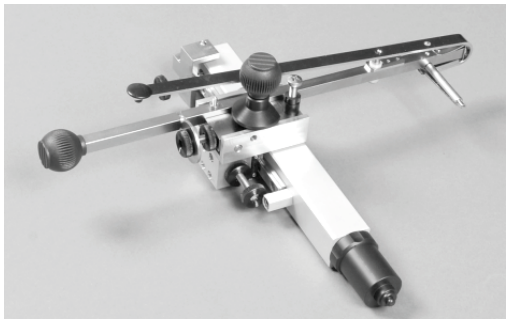
The solid samplers SSA 600 and SSA 6z are absolute preconditions for the solids analysis in the graphite tube technique. These enable reproducible placement of the IC sample carrier mounted with the solid sample into the graphite tube.

The solid autosampler SSA 600 enables automatic transport of solid samples into the graphite tube furnace. Weighing is performed fully automatically with an integrated microbalance. The solid autosampler SSA 600 has 84 sample positions when using two sample plates.

The SSA 6z is 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".

SSA 600 with liquid dispensing



SSA 6z for manual sample supply

Fig. 14 Solid sampler

5.5 Flame system

Flame atomic absorption spectroscopy is used for the determination of trace elements in the concentration range from mg/L to µg/L and for the determination of principal components. The technique requires a flame with constant properties. The composition of the flame must be adjusted to the element to be analyzed. The device provides the motorized vertical adjustment of the nebulizer-mixing chamber-burner system by 12 mm thus making it possible to move the flame zone with the maximum absorption into the beam path. For the measurement of principal components, the burner head can be swiveled by 90° on the burner neck until it is at right angles to the beam thus shortening the absorption path of light through the flame.

The sample solution is aspirated by a pneumatic concentric jet nebulizer and sprayed into the mixing chamber. In the mixing chamber, the sample aerosol is mixed with acetylene and auxiliary oxidant before it emerges from the burner slot. The flame is either 5 or 10 cm long and a few millimeters wide depending on the burner type used. The beam transmits the full length of the flame.

5.5.1 Automatic gas control system

The automatic gas control system ensures acetylene and oxidant supply to the flame at defined flow rates and free from pressure fluctuations. It allows reliable and safe ignition and quenching of the flame. The automatic gas control system has three gas inlets for acetylene, air and nitrous oxide.

The fuel gas flow is adjusted in 5-L steps between 40 and 315 NL/h acetylene via a proportional valve integrated in the control path. The air flow first fills the 600 cm³ gas tank, before it is released to the nebulizer. In both normal and emergency cases, the flame is quenched by an air flow coming from the tank. The oxidant flow through the nebulizer is defined by its setting and the admission pressure. An additional flow of oxidizing agent (air or nitrous oxide) can be turned on in three pre-set flow rates.

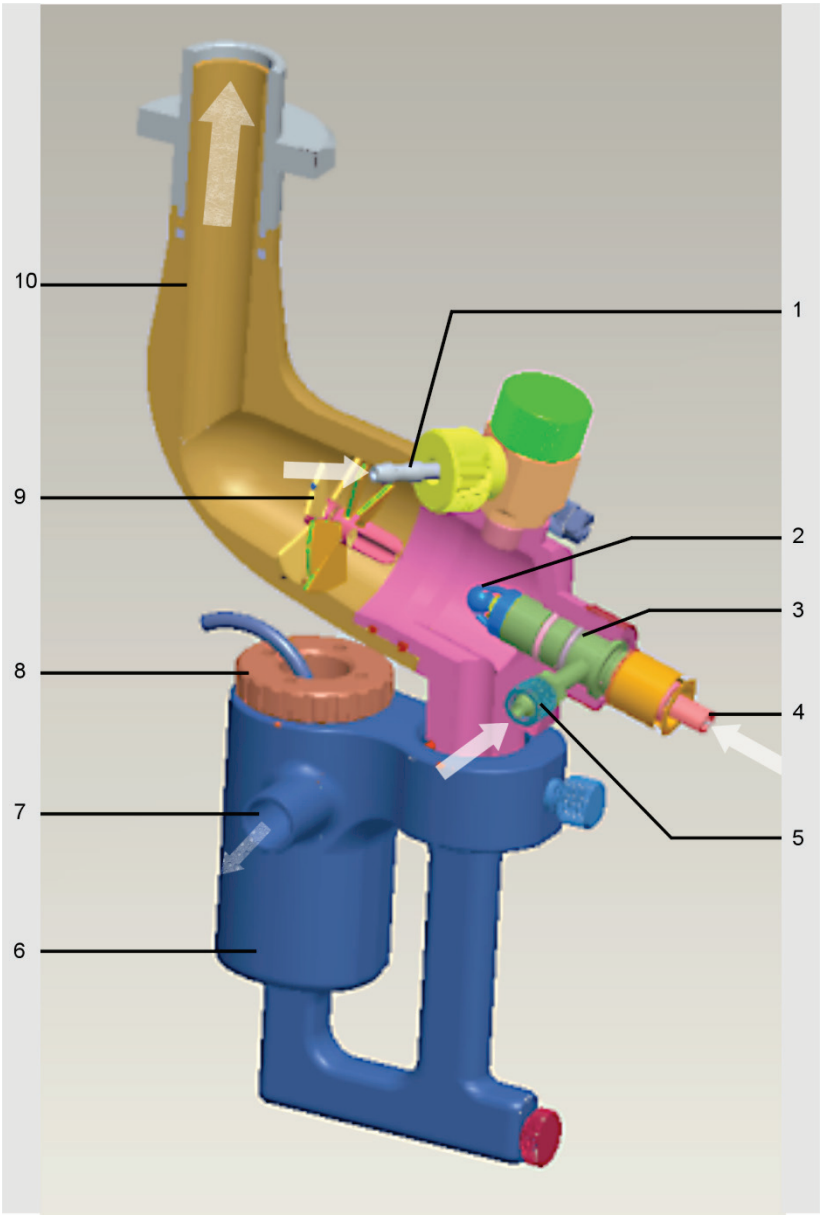
Initially, the air flow is enabled, the fuel gas flow is then turned on. A spiral-wound filament comes out of the sample compartment’s back wall to swing over the burner center and ignite the flame. One may switch from acetylene-air flame mode to acetylene-laughing-gas flame mode by disabling air supply while releasing nitrous oxide supply and increasing the rate of fuel gas supply. A burning acetylene-laughing-gas flame is extinguished in reverse order.

5.5.2 Burner-nebulizer system unit

The nebulizer produces the aerosol of the sample solution needed for the atomization in the flame. The oxidant is supplied to the nebulizer through a lateral connector. It flows through the concentric jet formed by the corrosion-proof platinum-rhodium tube and the plastic nozzle made of PEEK. Sample solution is expelled from the tube and further sample solution aspirated by the produced negative pressure. The position of the tube end relative to the nozzle determines the aspiration rate and the aerosol output. It is manually adjustable by means of an adjusting screw and lock nut.

The sample aerosol hits the impact bead, where larger droplets condense and then drain away through the siphon. The fuel gas flow hits the impact bead at right angles. Once generated, the aerosol flows through the mixing chamber to the burner. On passing through the mixing chamber, it reaches equilibrium conditions. More great droplets are then separated out as a result of gravitational force effects, equally draining away through the siphon. Aerosol is atomized by the flame. The aerosol containing smaller droplets is evaporated when entering the flame and then atomized in its hot zone. If the solvent

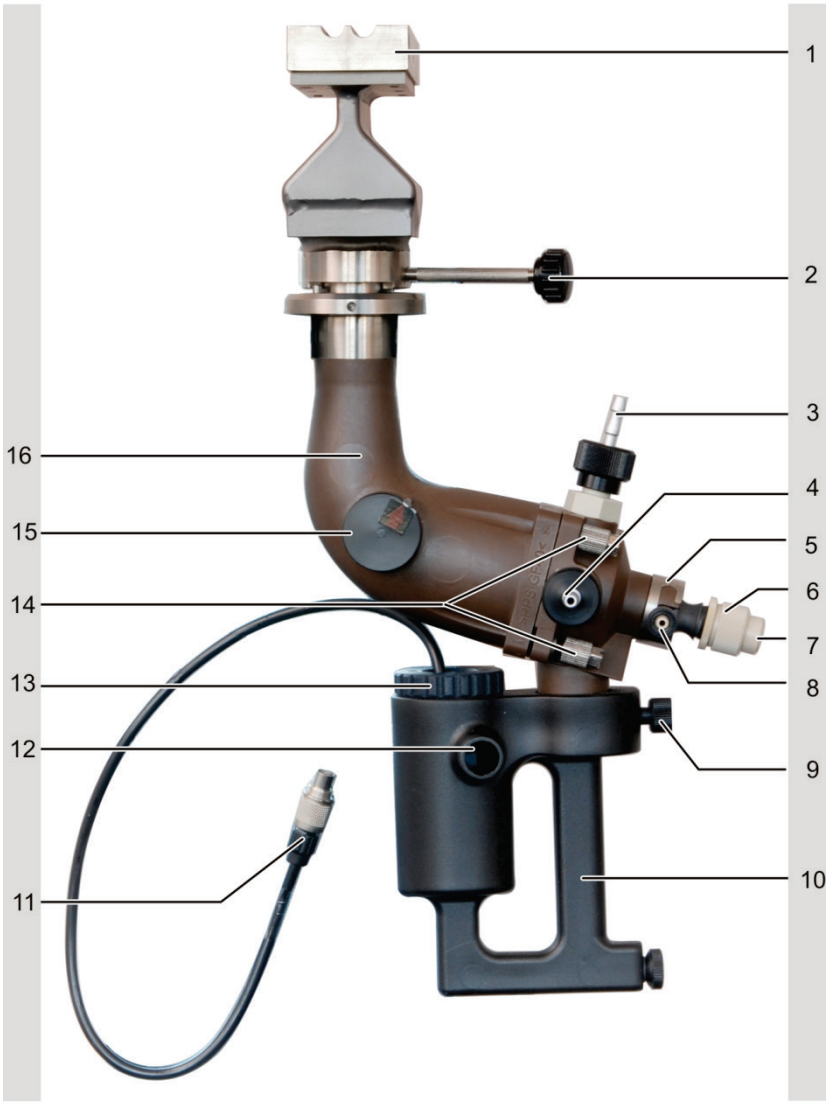
evaporates incompletely, the accuracy of the analytical result is adversely affected, as background absorption is increased by the scattering of radiation on unevaporated droplets.



1	Combustion gas supply	6	Siphon
2	Baffle ball	7	Outflow from siphon
3	Nebulizer	8	Float switch
4	Sample liquid supply	9	Impeller
5	Oxidant supply	10	Mixing chamber tube

Fig. 15 Setup of the burner-nebulizer system

The setup of the mixing chamber nebulizer system optimizes the aerosol formation and ensures that the system is easy to maintain. The outlet into the siphon is located in the immediate vicinity of the nebulizer. Large drops drain off immediately and do not enter the mixing chamber. The impeller retains droplets and stabilizes the aerosol cloud. Potential liquid residues can continuously rise in the mixing chamber tube towards the nebulizer and drain off to the siphon. Furthermore, the baffle ball is permanently centered on the nebulizer so that a readjustment after cleaning the mixing chamber nebulizer system is not required.



1	Burner	9	Fixing screw for siphon
2	Fixing screw for burner	10	Siphon
3	Combustion gas supply	11	Connection of siphon sensor
4	Additional oxidant supply	12	Siphon outlet
5	Locking ring for nebulizer	13	Siphon sensor
6	Nebulizer	14	Screw joints of mixing chamber parts
7	Sample liquid supply	15	Safety plug
8	Oxidant supply	16	Mixing chamber tube

Fig. 16 Nebulizer mixing chamber burner system

5.5.3 Burner and flame type

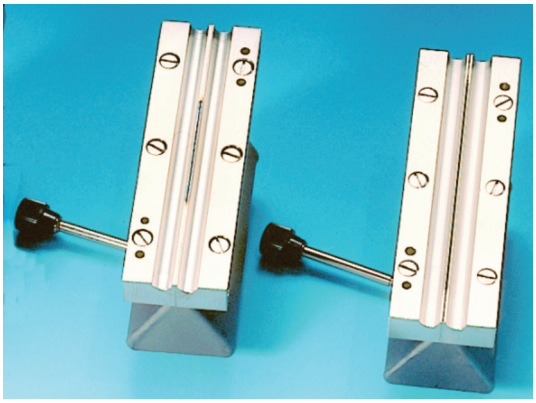
The contrAA 700 can be operated with the following types of flames and corresponding burners:

- ❑ Acetylene/air flame with 50-mm single-slot burner (standard burner) or 100-mm single-slot burner for more sensitivity
- ❑ Acetylene/nitrous oxide flame with 50-mm single-slot burner

If the range of elements to be analyzed includes both elements that are easy to atomize and those hard to atomize, only the standard 50-mm single-slot burner should be used to avoid the need to change the burner between measurements.

Use of the different flame types:

- ❑ Acetylene/air flame can be used for most of the elements.
- ❑ Acetylene/nitrous oxide flame is requited for elements that are hard to atomize, such as boron, aluminum and silicon.



1 50-mm single-slot burner (standard)

2 100-mm single-slot burner

1 2

Fig. 17 Burner types

The burners are made of titanium and thus inert against aggressive sample solutions. The burners can be easily exchanged and continuously rotated up to 90° between two stops. One of the stops is adjusted in such a way that the burners are in alignment with the optical axis. The 90° stop ensures the insensitive position of the burner at right angles used for the determination of the principal components.

5.5.4 Sensors

The burner-nebulizer system is monitored by various sensors that ensure operational safety.

- ❑ A float switch in the siphon signals the correct fill level of 80 mm water column.
- ❑ Two reflective couplers identify the burner type by means of a code.
- ❑ A UV-sensitive sensor is used to monitor the flame.

In addition to the above mentioned sensors, the mixing chamber is equipped with a pressure relief valve. This valve opens should the flame flash back into the mixing chamber.

The control software evaluates the sensor signals and additionally monitors gas pressures, gas flow rates and the status of the flame.

5.6 Accessories for flame technique

5.6.1 AS-F and AS-FD autosamplers

Manual or automatic sample supply may be employed in the flame technique and the mercury/hydride technique. Automatic operation and multi-element analysis are possible if an autosampler is used. The parameters are set and the function is controlled with the contrAA 700 control software.

The contrAA 700 P 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 Sarstedt cups on the outer track and 10 sample positions for 50 mL Sarstedt cups on the inner track
54 positions	Sample tray with 54 positions for 50 mL Sarstedt cups

The sample trays should be selected according to the requirements of the sample analysis:

- 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.

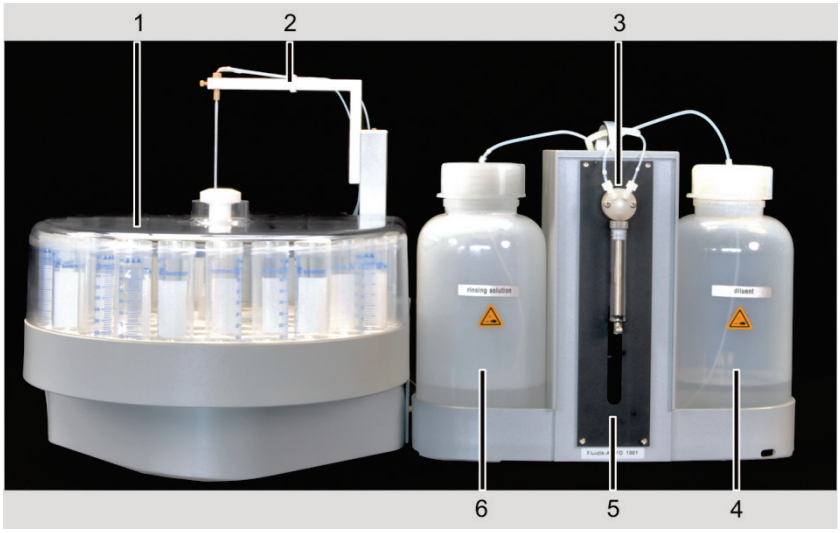
The contrAA 700 supplies the autosamplers with operational voltage. Tray and autosampler arm are driven by stepping motors. The tray is rotated. The autosampler arm is rotatable and can be lowered by 120 mm.

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 canula 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 an extra 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 700. 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



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

Fig. 18 **Autosampler AS-FD with separate Fluidik module**

5.6.2 JUN-AIR 6/S piston compressor

If no in-house compressed-air supply is available, it is useful to use a compressor that produces the air required for the acetylene/air flame.

The JUN-AIR 6/S Piston Compressor is available as option. The produced compressed air is free from water, dust and oil. With a maximum operating pressure of 800 kPa and a 15-L air tank, the compressor meets the demands on compressed air supply. For its operation, observe the instructions given in the operating manual of the JUN-AIR 6/S Piston Compressor.

5.6.3 SFS 6 injection module

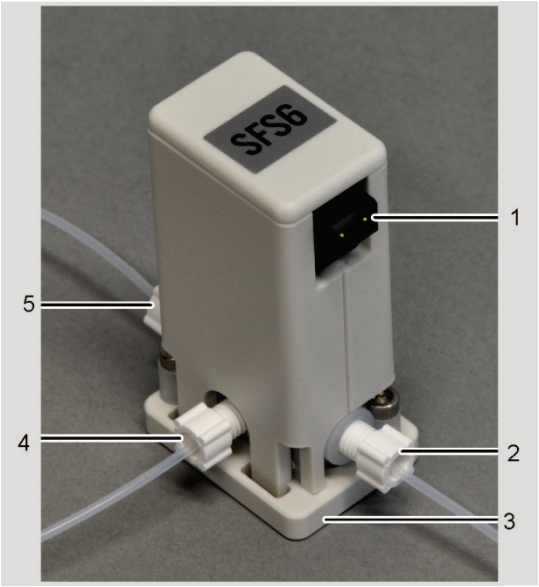
SFS 6 Injection Module (Segmented Flow Star) is available as optional accessory. It may be used in combination with an autosampler or in manual mode.

On the one hand, it allows washing or carrier solution to be aspirated continuously thus keeping the burner at a constant temperature by the aerosol; on the other hand, it allows small sample volumes to be measured reproducibly against a carrier solution (e.g. n-butanol).

The operating principle of the SFS 6 Injection Module is based on a magnet with two inlets and one outlet to the nebulizer. The sample aspiration tube is located at the energized inlet. It is immersed directly into the sample or connected to the aspiration capillary of the autosampler. The non-energized inlet is connected to the aspiration tube for the washing or carrier solution. These are the two switching states:

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

The parameters for controlling the SFS 6 Injection Module are entered via the control software.



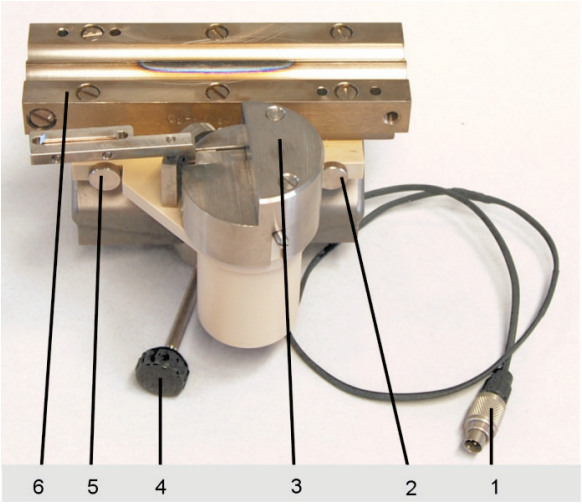
1 Control cable port
2 Tube to washing solution
3 Support
4 Short piece of tube to nebulizer capillary
5 Sample tube

Fig. 19 SFS6 injection module

5.6.4 Scraper – Automatic burner head cleaner for nitrous oxide flame

The Scraper, an intelligent burner head cleaner, is recommended for the continuous and fully automated operation with the nitrous oxide flame. When working with the nitrous-oxide flame and particularly the fuel-rich C_2H_2/N_2O flame, as is used for the analysis of such elements as Si, W, Mo and Sn, carbon will deposit on the burner slot over longer periods. If these deposits are not removed completely, this will lead to clogging of the burner slot, which in turn will result in irreproducible measurement results.

Using the scraper, the cleaning procedure will be fully automated. Once activated in software and stored as method parameter, the scraper guarantees a continuous and reproducible measuring process without any disturbances and interruptions. You can choose among various cleaning intervals depending on flame composition and need. On the other hand, the scraper can also be used for the automation of the burn-in process of the nitrous-oxide flame. If activated in the flame monitor, a cleaning step is carried out every 30 s. This way, undisturbed burning in of the nitrous oxide flame is possible.



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

Fig. 20 Scraper mounted to 50-mm burner head

The scraper is attached to the burner head with the help of two knurled thumb screws. It can be removed if not required.

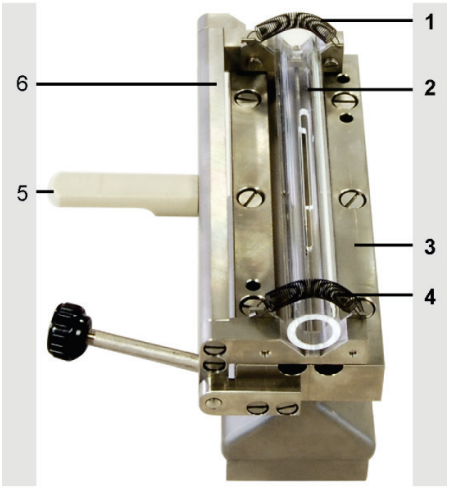
The scraper can be retrofitted to a 50mm burner.

5.6.5 HPT burner head

The HPT burner head, which consists of a 50 mm burner, hinged holder and slit quartz tube, is available as an option for the air-acetylene flame. The HPT burner head is used to increase the residence time of the atoms in the flame, which helps to achieve higher sensitivity particularly for lightly volatile elements such as Cd, Pb, Zn and Hg.

The quartz glass has a slit with a length of 50 mm on opposite sides to allow the flame to pass through. The holder ensures that the slits are aligned to the burner head.

The HPT burner head is recommended for use up to an acetylene-air ratio of 0.16 to prevent the deposit of soot on the quartz tube.



1, 4 Tension spring
2 Slit quartz glass
3 50 mm burner
5 Handle
6 Hinged holder

Fig. 21 HPT burner head

5.7 Supplementary accessories to Hg/hydride systems

The range of available Hg/hydride systems covers anything from a simple batch system for users with small sample rates to fully automated continuous system.

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 flow injection operation with electrically heated cell unit with or without "Hg plus" module for Hg detection.

For a description of Hg/hydride systems, you should refer to the relevant accessory unit manuals.

6 Installation and start-up

CAUTION

No unauthorized tampering!

The device may only be set up, installed and repaired by service technicians employed with or authorized by Analytik Jena AG.

Any unauthorized tampering will limit the right to claim under warranty. For the installation and start-up of the device, the instructions given in Section "Safety instructions" p. 9 must be observed. Compliance with these safety instructions is a requirement for the trouble-free installation and functioning of your AAS measurement environment. Always observe all warning and information labels affixed to the device or displayed by the contrAA 700 control software.

To ensure trouble-free operation of the contrAA 700 take care to always keep the ambient conditions specified in Section "Installation requirements" p. 20. If you intend to relocate the contrAA 700, proceed as described in Section "Transportation of the contrAA 700" p. 100.

6.1 Utility supply and control terminals

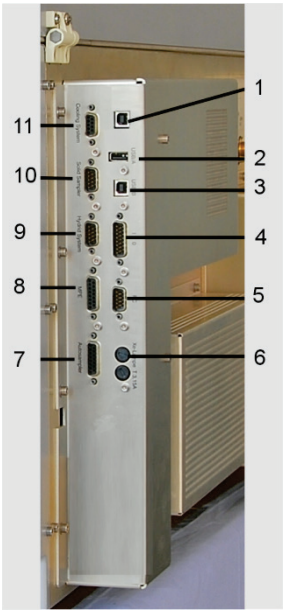
Supply cabling and tubing is connected by Customer Service personnel of Analytik Jena AG as part of the contrAA 700 installation work package.

The main power switch is located on the right-hand side of the contrAA 700. Also located on the right-hand side are the terminals for PC and accessory units in easily accessible positions. Utility supply inlet ports for 0gas and current are provided on the back.

For transportation and installation work, a pair of carrying handles must be screwed in on the right-hand and the left-hand side. On completion of installation work, these handles must be unscrewed and the openings sealed with plugs.

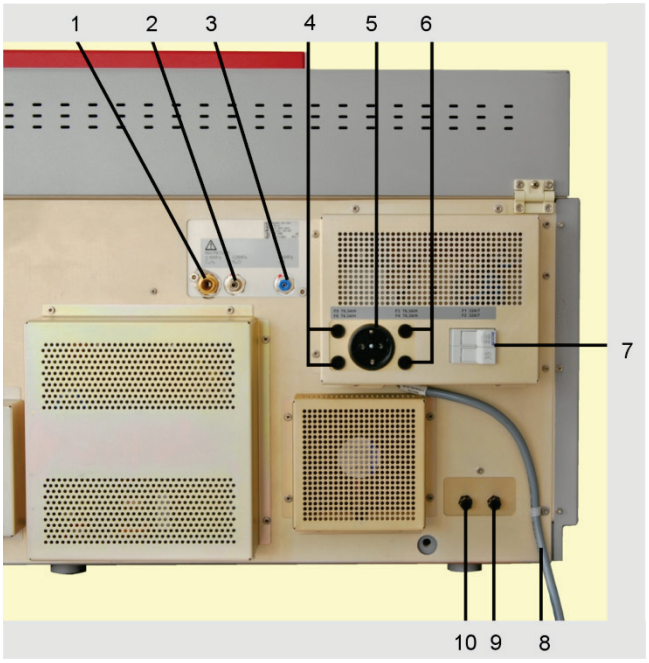
1 Utility supply terminals for gas, electric power and fuses
2 Connector strip
3 Carrying handle
4 Main power switch
5 Carrying handle

Fig. 22 Main power switch and connector strip terminals for utility supplies and controls on the right-hand side of the contrAA 700



1 Port for furnace camera PC
2 Unassigned USB port
3 Port contrAA 700 – PC
4 Unassigned I/0 port for triggering
5 Port contrAA 700 – PC (for service only)
6 Fuses for xenon lamp F7/F8 T 3,15 A
7 Port for AS-FD, AS-F autosampler
8 AS-GF port
9 Port for SSA 600 solid autosampler
10 Port for hydride systems
11 Unassigned port

Fig. 23 Connector strip with supply and control connector terminals



1 Fuel gas port (C_2H_2)
2 Nitrous oxide port (N_2O)
3 Air inlet
4 Fuses F5, F6
5 Linie power outlet for accessory units (5X distributor strip)
6 Fuses F3, F4
7 Fuses F1, F2 (only may changed by service technicians authorized by Analytik Jena AG)
8 Power supply cord for contrAA 700
9 Extra gas supply port for graphite furnace (standard: argon)
10 Inert gas supply port for graphite furnace (argon)

Fig. 24 Rear panel view of contrAA 700 with ports and terminals for gas and electric power supply, including fuse holders

6.2 Installing and connecting the contrAA 700

CAUTION! INSTALLATION ONLY BY CUSTOMER SERVICE!

nitial installation by authorized Customer Service personnel of Analytik Jena only!

CAUTION!

Ensure that new operating site complies with installation requirements!

Refer to chapter "Installation requirements" p. 20.

Follow safety instructions in chapter "Safety instructions" p.9.
Take care that applicable rules of industrial and occupational safety are observed.
References to potential danger cannot be regarded as replacement of valid laws of industrial labour safety!

Aids and auxiliary tooling

- ❑ 4 plastic sealing plugs
- ❑ 17 mm W/F open-end wrench (included in delivery)
- ❑ 19 mm W/F open-end wrench (included in delivery)

Working steps

1. Unscrew four carrying handles and store them away.
2. Cap the mounting holes with sealing plugs.
3. Install gas supply tubing:
   Tighten acetylene gas connector with 19 mm W/F open-end wrench. Left-hand threading!
   - Slide argon tube onto tube clip.
   - Tighten air supply connector with 17 mm W/F open-end wrench.
   - Tighten acetylene gas connector with 19 mm W/F open-end wrench. Left-hand threading!
   - Tighten nitrous oxide connector with 19 mm W/F open-end wrench.
4. Inspect gas connection points for absence of leakage (refer to section "Utility supply and control terminals" p. 45).
5. Check cooling water level and refill if necessary (refer to section "Check cooling water level" p. 76).
6. Provide electrical connections for contrAA 700 operation (refer to section "Energy supply" p. 22).
7. Use USB cable for connection between PC and contrAA 700 (3 in Fig. 22 p. 45).
8. Further required working steps:
   - Install ASpect CS software.
   - Complete contrAA 700 configuration as required for selected atomization technique.

6.3 Installation and start of ASpect CS software

Installation and start of the ASpect CS software required for the control of the spectrometer are described in the ASpect CS user manual.

6.4 Graphite tube technique

6.4.1 Terminals in sample compartment for graphite technique

1 AS-GF suspension bracket at left sample compartment wall

2 Graphite tube furnace with terminals

3 AS-GF suspension bracket at right sample compartment wall

4 Fixing screw for protective cover

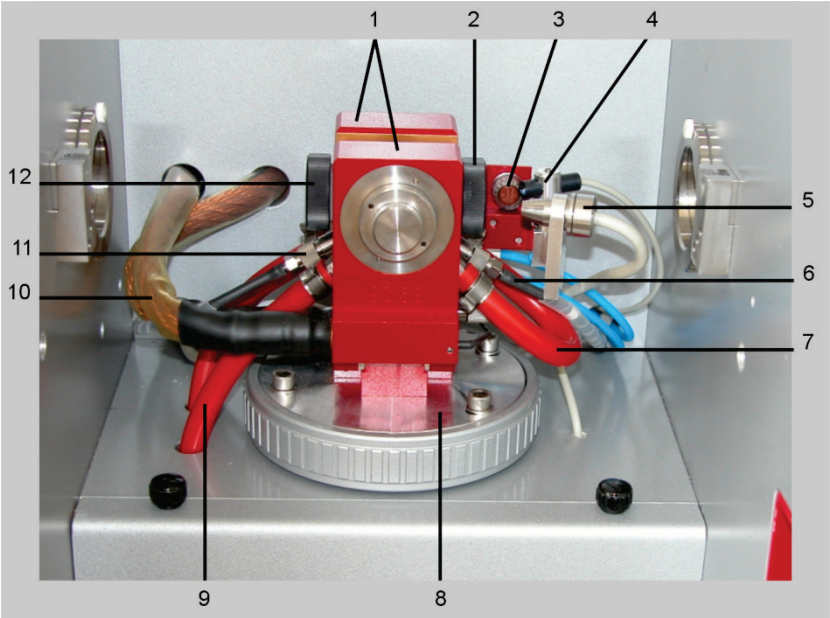
5 In-depth adjustable mechanical stop for AS-GF

6 Fixing screw for protective cover

Fig. 25 Elements in sample compartment for graphite tube technique

The graphite tube furnace comes factory-adjusted. Its supply facilities for gas and cooling water are firmly attached to the graphite tube furnace.

A cooling water tank is located behind the protective cover below the furnace space.



1	Furnace jaws with electrodes	7	Cooling water terminals
2	Furnace window	8	Vertical adjustment
3	Fuse at graphite furnace	9	Cooling water terminals
4	Illuminator for furnace camera	10	Heavy current cable
5	Radiation sensor	11	Gas inlet, black tube
6	Gas inlet, black tube	12	Furnace window

Fig. 26 Terminals at graphite tube furnace

6.4.2 Software presettings for graphite tube technique

The preview screen of ASpect CS software provides options for desired graphite tube technique settings. The software user screen with methodological and operating parameters needs to be adapted accordingly.

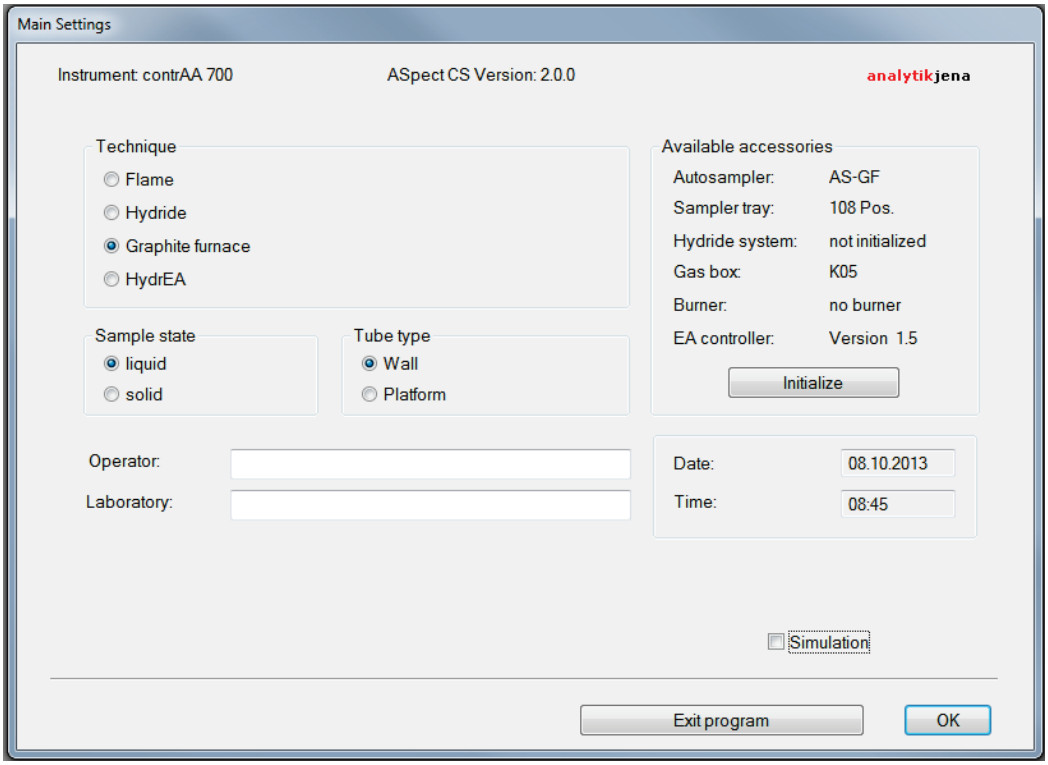


Fig. 27 Preview screen of ASpect CS with graphite-tube related setting options

Selectable options are:

Group	Option	Description
TECHNIQUE	GRAPHITE FURNACE	Uses graphite tube furnace for atomizing technique
	HYDREA	Uses hydride systems HS 55 or HS 60 modular in combination with graphite tube furnace
SAMPLE STATE	LIQUID	Analyzes liquid samples (uses AS-GF as autosampler).
	SOLID	Analyzes solid samples (uses SSA 600 or SSA 6z).
TUBE TYPE	Only with liquid samples.	
	WALL	Uses IC graphite tube.
	PLATFORM	Uses IC graphite tube with 1-PIN platform.

6.4.3 Inserting the graphite tube into the graphite tube furnace

Installing and removing a graphite tube is necessary after changing the atomization method and also after a certain number atomizations have been executed with the same graphite tube.

CAUTION

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

Inserting the graphite tube into the graphite tube furnace

1. Click **Furnace** dialog screen  in ASpect CS. Change to **Control** tab.

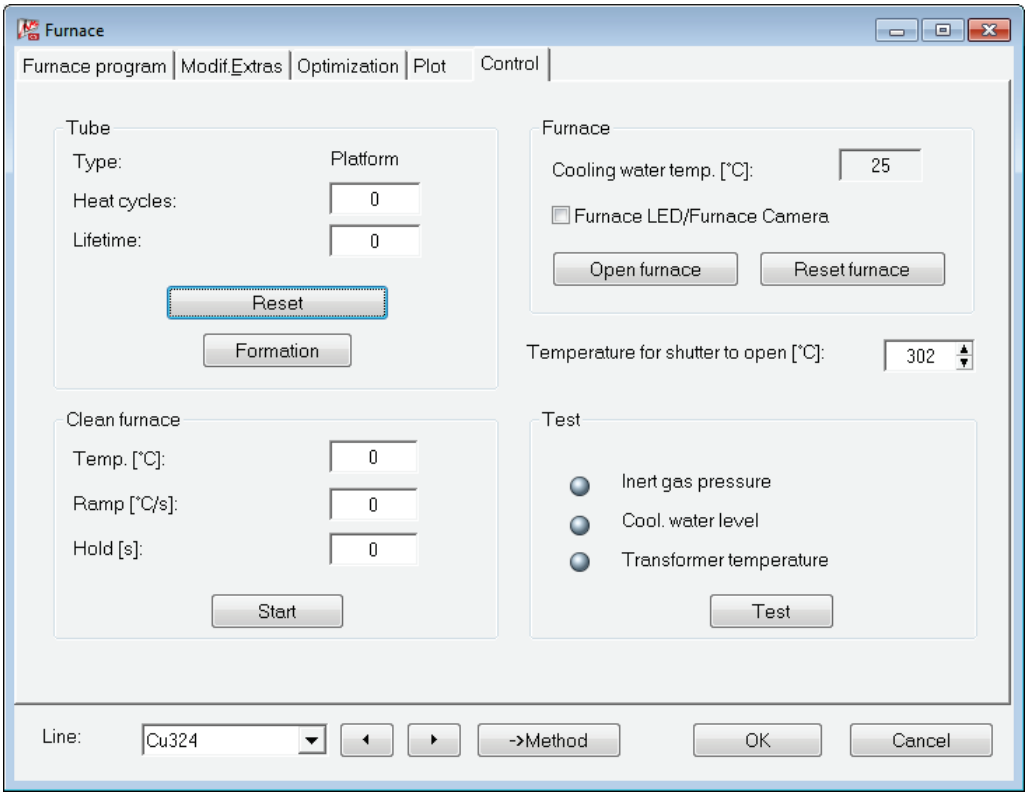
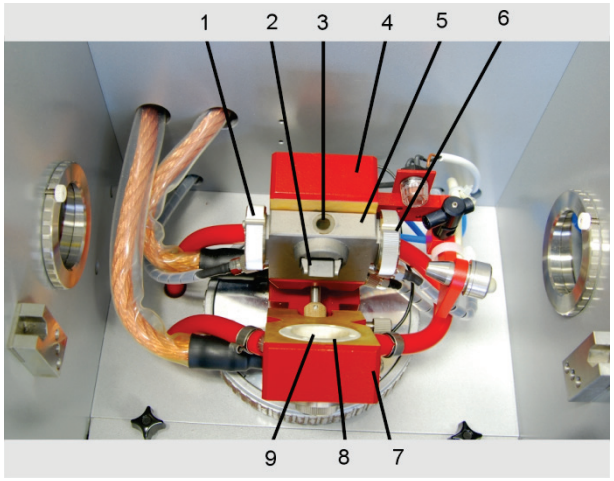


Fig. 28 FURNACE / CONTROL window

2. Open graphite tube furnace by clicking the [OPEN FURNACE] control button.
3. Clean furnace shroud and electrodes if necessary (→ section "Cleaning the graphite surfaces" p. 79).
4. Use tweezers or wood pulp to manually insert the graphite tube into the graphite tube furnace space in such a position that the tube is freely supported of the furnace shroud pads and the pipettor opening faces toward the top.
   For working with a graphite tube for solid substance analysis with not pipettor opening, any of its sides may be turned upward.
5. Close graphite tube furnace by clicking the [CLOSE FURNACE] control button.
6. Enter parameter settings for HEAT CYCLES and LIFE TIME in TUBE subarea as required for the currently installed graphite tube.

7. Format graphite tube. Actuate [FORMATION] control button (→ section "Graphite tube formatting" p.52).



1 Furnace window
2 Graphite tube, installed
3 Dosage opening with graphite funnel insert
4 Fixed furnace component
5 Furnace shroud
6 Furnace window
7 Movable furnace component, open
8 Graphite electrode in the movable furnace component
9 Ceramic ring

Fig. 29 Graphite tube furnace open with graphite tube installed

Removing the graphite tube from the granite tube furnace

CAUTION! DANGER OF SKIN BURNS!

Allow enough time for the graphite tube furnace to cool down before you remove the graphite tube.

CAUTION!

Do not touch the graphite tube with bare fingers under any circumstances!

Fingerprint marks will burn in, thus causing early destruction of the tube's pyrolysis coating.

1. Open graphite tube furnace by clicking onto button [OPEN FURNACE] in the FURNACE / CONTROL screen (Fig. 26 p. 49).
2. Use plastic tweezers to extract the graphite tube, use wood pulp for manual removal.
3. Insert new graphite tube (see above) and/or close graphite tube furnace.

6.4.4 Graphite tube formatting

Graphite tube formatting is performed to:

- ❑ force air oxygen out of the furnace and adapt the contact pressure force of the movable furnace part,
- ❑ recalibrate the tube temperature,
- ❑ format a newly inserted graphite tube,
- ❑ clean the furnace after a break in operation.

The furnace must be formatted:

- ❑ after turning the spectrometer on
- ❑ after closing the previously open furnace

A running formatting program includes nine pre-programmed temperature stages.

A formatting sequence can be triggered in the FURNACE / CONTROL window. While formatting is in process, the FORMAT FURNACE window will display the current values for temperature stage, time and heating rate. During the first five stages, the furnace and the graphite tube will be cleaned and conditioned (contact points between graphite tube and electrodes are adapted accordingly). Specific sensor technology is then used to measure the tube temperature in the remaining four stages. On completion of the last temperature stage, the formatting factor for tube temperature correction will be output. Once corrected, the furnace temperature will ensure proper measuring results.

If the formatting factor is found to be ≥ +10%, there will be no automatic temperature correction, yet the current temperature-versus-time program can be launched after a respective screen message was acknowledged.

1. In ASpect CS use  to switch to the FURNACE / CONTROL window.
2. Enter specific data on 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. In the TUBE area click the [FORMATION] button.

6.4.5 Cleaning the graphite tube / cleanout

1. In ASpect CS use  to open the FURNACE / CONTROL window.
2. In the CLEAN FURNACE area set the following parameters:

TEMP. [°C]	Final temperature to be reached during clean out. The final temperature should be approx. 50 °C higher than the previous atomization temperature.
RAMP [°C/S]	Heating rate
HOLD [S]	Set the hold time

3. Start the cleanout with the [START] button in the furnace area. Cleaning may be repeated several times, if required at a higher temperature.

Clean out/evaporation of iridium-coated graphite tube (HydrEA technique)

The following temperature program must be used for the iridium-coated graphite tube (see also operating instructions for the accessories):

	Clean-out	**Evaporation**
TEMP. [°C]	2200° C	2600°C or more
RAMP [°C/S]	500° C/s	500° C/s
HOLD [S]	10 s	Do not select a higher hold time than 10 s otherwise this may exceed the load limit of the furnace.

Clean out or evaporation can be repeated several times.

6.5 Completing and installing the AS-GF autosampler

6.5.1 Installing AS-GF

VORSICHT! ELECTRONICS MAY BE DAMAGED!

Turn the contrAA 700 off before beginning work for installation of the AS-GF!

Action for making or breaking an electrical plug-in contact may cause a short with destroying effect.

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

Fig. 30 Installing the AS-GF

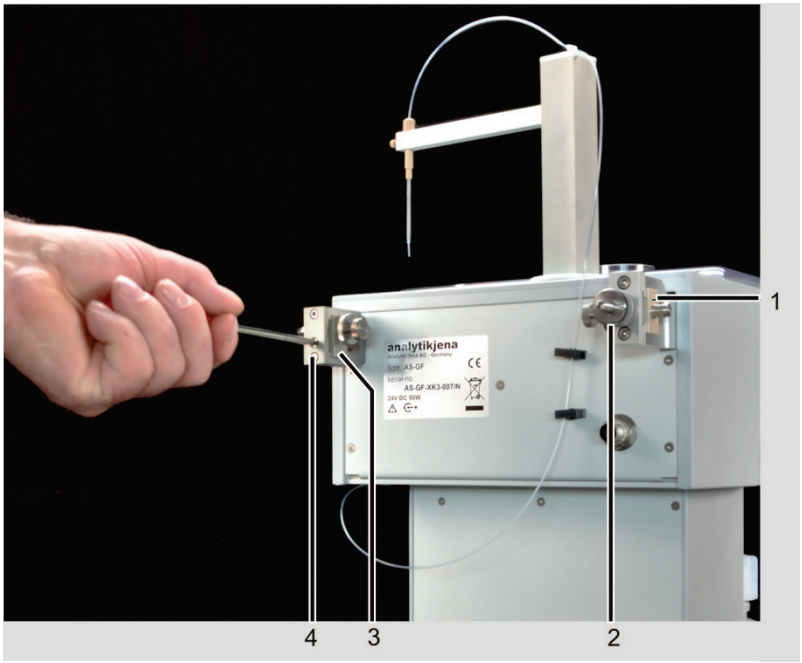
NOTE

Select a safe location to perform completion of the AS-GF. The device can tilt easily.

1. **Turn the contrAA 700 off before you proceed to work for AS-GF installation!**
2. Install the tube guide (5 in Fig. 30) to the autosampler arm of the AS-GF and attach using the lock screw.
3. Screw the dosing tube into the right opening of the T valve (10 in Fig. 30) 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. 30) 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 lock it in place.
5. Hang the AS-GF on the supports in the sample chamber (1 and 7 in Fig. 30). Using a spirit level, check whether the autosampler is suspended horizontally; if necessary, align the autosampler using the depth-adjustable stop in the sample chamber (5 in Fig. 25 p. 48).
6. If necessary, align the AS-GF with the furnace (coarse adjustment):
   manually rotate the autosampler arm over the dosing opening in the graphite tube. If the dosing tube does not align with the opening, the suspension of the autosampler must be moved forward or back. To this end unhook the autosampler from the sample chamber. Move the left and right suspension mounts with the aid of adjusting screw 1 and the set screw (2 and 4 in Fig. 31). Hook the autosampler back in.



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

Fig. 31 **Aligning the AS-GF with the furnace using the set screw and adjusting screw 1**

7. Plug the control cable into the socket on the connection strip of the AAS device on the right side (autosampler graphite connection, 8 in Fig. 23 p. 46).
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. Switch on the computer and the contrAA 700, wait for the initialization steps to complete, start the Aspect CS software.
11. If necessary, fit the dosing syringe to the dosing unit (→ Section "Replacing the metering syringe" p. 95).
12. Perform a fine adjustment of the autosampler (→ Section "Adjusting the AS-GF“ p. 56).

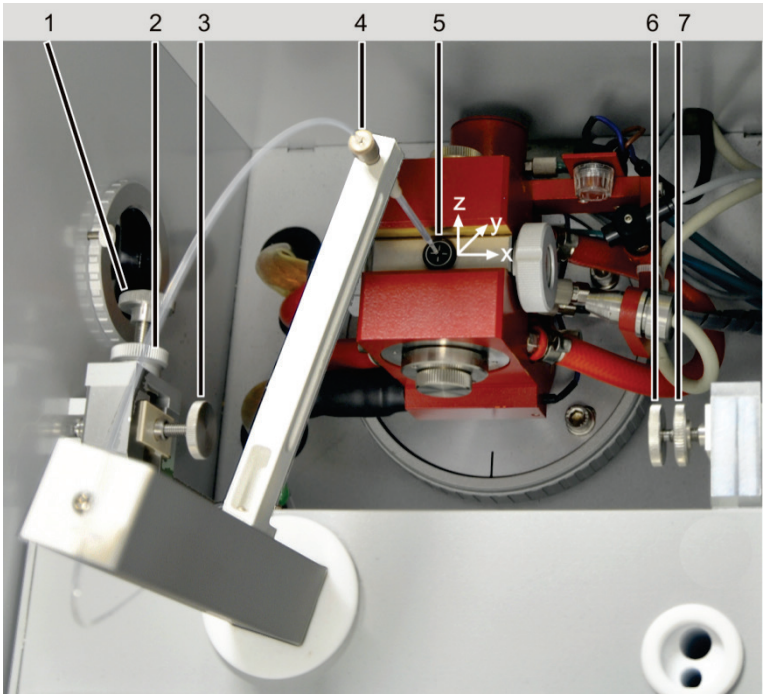
Preparing the autosampler for the HydrEA technique

Prior to installing the HydrEA technique the graphite tube must be coated with iridium or gold (see hydride system manual). Use the dosing tube used during graphite operation for this purpose.

1. Switch off the AAS device and install the hydride system (e.g. HS 60 modular).
2. For the HydrEA technique remove the tube guide and dosing tube from the autosampler arm of the AS-GF. Install the titan canula to the autosampler arm and attach it using the lock screw.
3. Attach the reaction gas tube to the titan canula.

6.5.2 Adjusting the AS-GF

The AS-GF has already been installed in the sample chamber in accordance with section "Installing AS-GF" p. 54. The fine alignment of the AS-GF to the furnace is supported by software. The autosampler is aligned such that samples can be optimally deposited in the graphite tube.



1	Adjusting screw 1	5	Adjusting aid with crosshair
2	Lock nut of alignment screw 1	6	Adjusting screw 3
3	Adjusting screw 2	7	Lock nut of alignment screw 3
4	Clamp nut		

Fig. 32 AS-GF adjustment

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

   In the running program the following takes place:

   – Alignment of the AS-GF with the furnace

– Adjustment of the dipping depth

Carry out the following work steps successively:

– Withdraw the dosing tube approx. 8 mm from the canula of the autosampler and fix it with a clamp nut.
– Replace the pipetter insert in the graphite tube furnace by the adjusting aid with crosshair.
– Lower the autosampler via the software to the adjusting aid.
– Align the X direction with the buttons [LEFT]/[RIGHT] to the crosshair.
– Adjust the Y direction using the adjusting screw 1.
– If required, readjust the X direction using the adjusting screws 2 and 3.
– 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.

Adjustments for X and Z direction are saved in the software.

– Secure the positions of the adjusting screws with lock nuts.
– Remove the adjusting aid and insert the dosing funnel.

Adjust the injection depth in the graphite tube:

– Lower the autosampler arm via the software. The dosing tube dips into the graphite tube.
– Loosen the clamp nut, place the dosing tube onto the tube bottom, check position with furnace camera if necessary, and fasten with clamp nut.
– Move the autosampler arm software-controlled to the optimum dispensing depth (approx. - 0.8 mm for 20 µL sample volume).

IMPORTANT

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

Populating the sample tray of the AS-GF

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

   Positions 1-100 1.5 mL sample cups

   Positions 101 – 108 5 mL special cups

5. Place the sample cover with a tight fit.
6. Next step: fill the wash bottle. If necessary, empty the waste bottle and dispose of the waste correctly. Measure.

IMPORTANT

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

6.5.3 Uninstalling the autosampler AS-GF

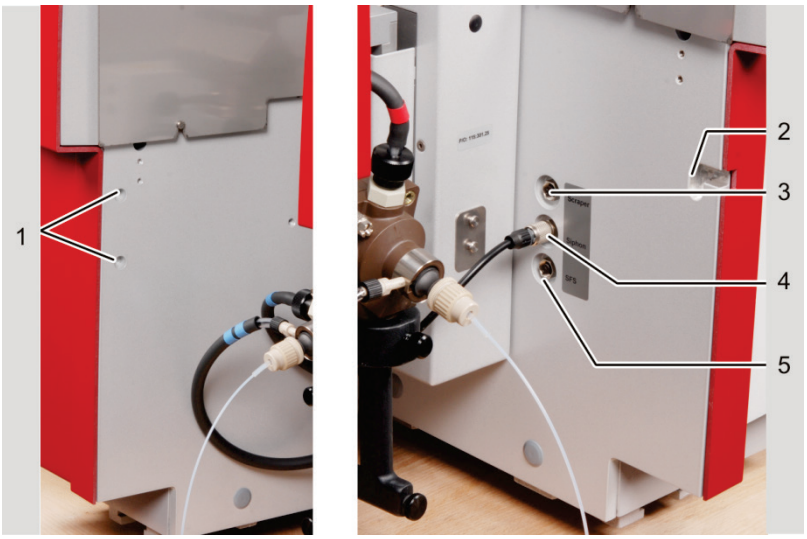
7. Switch off the contrAA 700!
8. For *HydrEA coupling*:
   Remove the reaction gas tube from the titan canula. Remove the titan canula from the autosampler arm, by loosening the clamp nut.
9. Remove the control cable from the socket in the right side wall of the AAS device (autosampler graphite connection).
10. Release adjusting screw 1 and unhook the autosampler AS-GF.

6.6 Flame technique

6.6.1 Flame technique terminals in sample compartment

1	Automatic ignition unit	9	Sample liquid supply
2	Burner	10	Siphon drain tube
3	Markings for alignment on the mixing chamber tube and the holding fixture	11	Connection for oxidant (tube with two blue markings)
4	Stud bolt for fastening the burner	12	Suspension AS-F / AS-FD, left
5	Suspension for SFS 6	13	Connection for additional oxidant (tube with a blue marking)
6	Suspension AS-F / AS-FD, right	14	Connection for fuel gas (tube with red marking)
7	Connecting sockets for siphon sensor, injection switch SFS 6 and scraper	15	Fixing screw for holder bracket of burner-nebulizer system unit
8	Vertical adjustment of burner-nebulizer system unit		

Fig. 33 Terminals at the burner-nebulizer system unit available for flame technique



1	Mounting holes for autosampler	4	Terminal for siphon monitoring
2	Suspension point for autosampler	5	Terminal for SFS 6 injection switch
3	Scraper terminal		

Fig. 34 Terminal facilities provided in sample compartment walls

6.6.2 Software presettings for flame technique

Use the preview screen of ASpect CS software (Fig. 27 p. 50) to select **Flame** option in **Technique** group. The software user screen with methodology and operating parameters will be adapted accordingly.

6.6.3 Installation for manual sample feeding

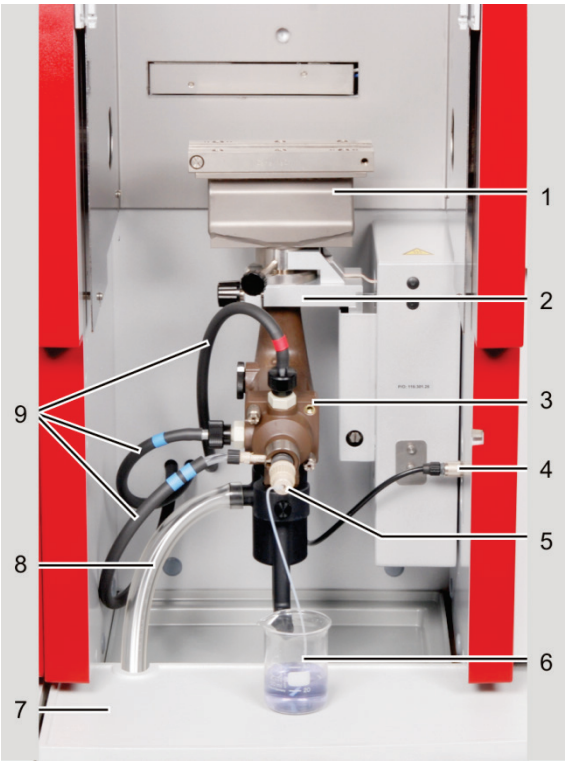
Manual sample feeding means that a sample is directly delivered to the burner-nebulizer system unit.

The SFS6 injection switch can be optionally used.

WARNING! ELECTRONICS MAY BE DAMAGED!

Turn the contrAA 700 off before beginning work for installation!

Action for making or breaking an electrical plug-in contact may cause a short with destroying effect.



1	Burner	6	Sample container
2	Holder bracket at vertical adjustment mechanism	7	Sample tablet Collector trough
3	Mixing-chamber-nebulizer system unit	8	Siphon drain tube
4	Supply cable of siphon sensor	9	Gas terminals
5	Sample aspiration tube		

Fig. 35 Flame technique, manual sample delivery

1. Remove the red protective cap from the mixing chamber tube.
2. Attach the mixing chamber nebulizer system without burner to the holding fixture for the height adjustment.
   The marking on the mixing chamber tube must be positioned above the edge of the holding fixture (12 in Fig. 33 p. 59).
3. Put the collection under the burner-nebulizer system.
4. Hang the sample tray in the guides under the device.
5. Lead the outlet tube from the connector of the siphon through the opening in the tray and attach it on 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. Fill the siphon with water via the mixing chamber tube until water flows out via the outlet tube.
7. Connecting the gas supply:
   - Connect fuel gas (tube with red marking) (14 in Fig. 33 p. 59)
   - Connect oxidant (tube with 2 blue markings) (11 in Fig. 33 p. 59)
   - Connect additional oxidant (tube with 1 blue marking) (13 in Fig. 33 p. 59)

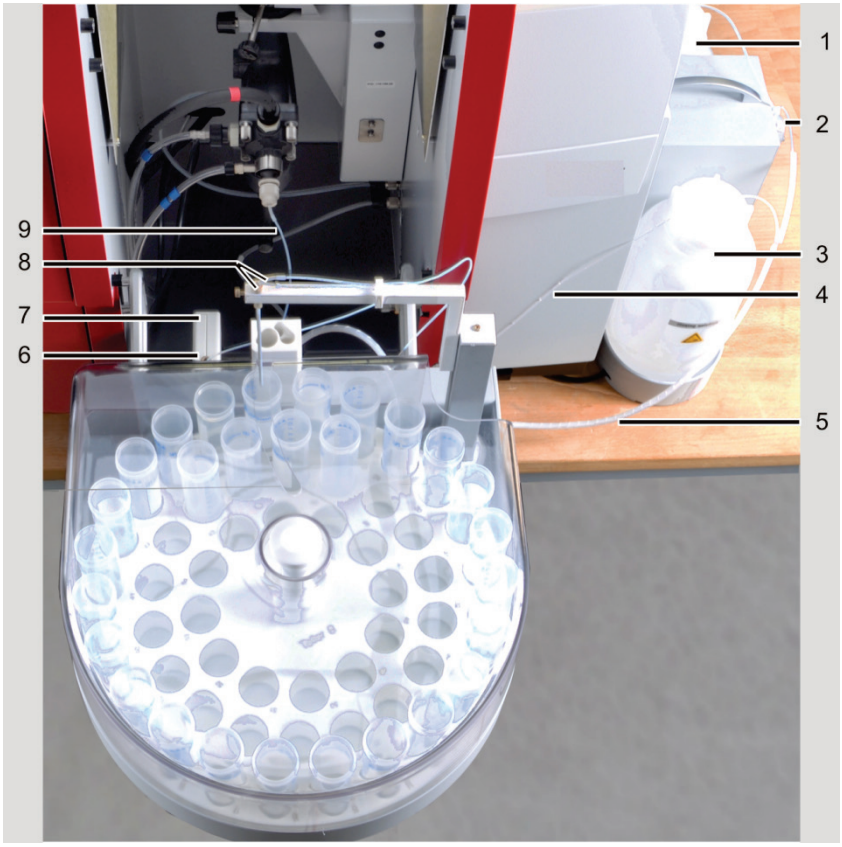
8. Attach the required burner (50 mm or 100 mm depending on the measurement task) on the mixing chamber tube, turn to the stop position and clamp. Ensure that the burner is positioned correctly.
9. Injection module SFS 6
   If you are working with injection module SFS 6, install injection module SFS 6 (→Section "Installation of SFS 6 injection module" p. 66).
10. Place the sample and wash cups on the tray.
11. Attach the aspiration tube to the nebulizer canula.
12. Hang the safety glass in and slide it in front of the burner.
13. Switch on the contrAA 700 and start the software.

Deinstallation for manual sample feeding

1. Turn the contrAA 700 off.
2. If operation included the SFS 6 injection module, the SFS 6 injection module must be shut down (→section "Installation of SFS 6 injection module" on page 66).
3. Remove sample and wash cups from the tray.

6.6.4 Installation for continuous operation mode / with samples delivered by autosampler

In continuous operation mode, sample feeding is accomplished by an AS-F or an AS-FD autosampler.



1	Storage bottle for diluent	6	Tube from autosampler arm to the SFS 6
2	Fluidik module with dosing unit	7	Injection module SFS 6 (where applicable)
3	Storage bottle for washing liquid	8	Tube for diluent (thick canula) and sample intake tube (thin canula)
4	Tube for washing liquid to the SFS 6	9	Sample intake tube
5	Encased tubes for washing liquid and diluent		

Fig. 36 **Flame mode, continuous with autosamplers AS-FD and SFS 6**

CAUTION! RISK OF DAMAGE TO THE ELECTRONICS!

Switch off the contrAA 700 P prior to any installation!

Connecting or disconnecting electrical contacts might damage the sensitive electronics of the contrAA 700.

Installing the burner/nebulizer system

1. Switch off the contrAA 700.
2. Remove the red protective cap from the mixing chamber tube.
3. Attach the mixing chamber nebulizer system without burner to the holding fixture for the height adjustment.
   The mixing chamber must be aligned to the height adjustment, the marking on the connector must be above the edge of the holding fixture (3 in Fig. 33 p. 59).
4. Slide the collection tray under 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.
   Note: Position the outlet tube at a constant incline. If necessary shorten the tube. Tube must not dip in the liquid.
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 to the connection on the right sample chamber wall (4 in Fig. 34 p. 59).
8. Connecting the gas supply:
   - Connect fuel gas (tube with red marking) (14 in Fig. 33 p. 59)
   - Connect oxidant (tube with 2 blue markings) (11 in Fig. 33 p. 59)
   - Connect additional oxidant (tube with 1 blue marking) (13 in Fig. 33 p. 59)
9. Attach the required burner (50 mm or 100 mm depending on the measurement task) on the connector, turn to the stop position and clamp. Ensure that the burner is positioned correctly.

Installing the injection module

If you are working with injection module SFS 6, install injection module SFS 6 (→Section "Injection module SFS 6" p. 66)

Installing the autosampler

1. Hang the autosampler in the corresponding supports of the sample chamber (Fig. 33 p. 59). 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. 37 p. 65).
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. 37 p. 65).
4. Plug the control cable into "Sampler flame" connection on the right-hand wall of the contrAA 700 (7 in Fig. 23 p. 46) and lock it in place.
5. Attach the outlet tube to the outlet connector of the autosampler (backplate, 4 in Fig. 37). Attach the outlet tube to the connector or the corresponding opening in the lid of the collection 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. 37).
   Note: In the AS-FD the tubes for connecting the autosampler and the Fluidik module are attached to each other by encasing and are numbered. The tubes are attached to the rear of the autosampler using the attachment lug. Marking Wash tube "2".
7. 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 canula of the autosampler arm.
   Note: The autosampler arm can be moved manually when switched off.
8. Attach the sample intake tube to the nebulizer.
9. Plug the sample intake tube through the tube guide at the autosampler arm onto the thin canula of the autosampler arm.
10. Place the sample tray onto the autosampler housing, make sure it latches.
    Note: The controller does not start the autosampler or stops automatically if no sample tray has been placed.

11. 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

Fig. 37 Rear of the autosampler AS-FD

Preparing the Fluidik module (for AS-FD)

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

Fig. 38 Dosing unit at the Fluidik module of the AS-FD

1. If necessary, fit the dosing syringe to the dosing unit (→ Section "Replacing the metering syringe" p. 95).
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. 38)
4. Screw the dosing tube for the diluent (encased, marking "1") to the second connection of the valve (3 in Fig. 38).
5. Immerse the hose for the wash liquid (marking "2") into the storage bottle.

6.6.5 Uninstalling the autosampler AS-F/AS-FD

1. Switch off the contrAA 700.

Uninstalling the autosampler

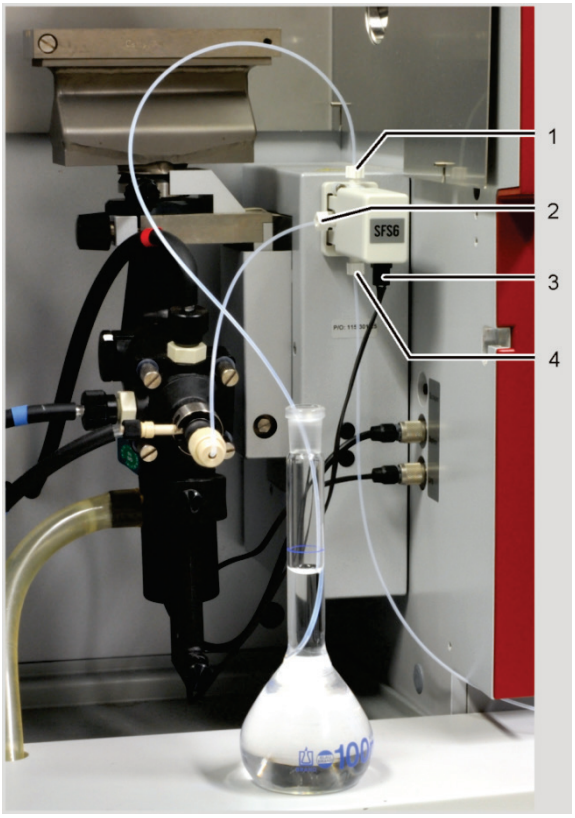
2. Detach the sample intake tube from the thin canula of the autosampler arm.
3. Detach the tube for the wash liquid at the rear of the autosampler.
4. For the AS-FD detach the dosing tube for the diluent from the thicker canula. Pull the two encased tubes out of the attachment lug at the rear of the 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. Take the autosampler out of the sample chamber.

Uninstalling the injection module

If the injection module SFS 6 was used during operation, decommission the injection module SFS 6 (→Section "Shutting the SF 6 injection module down" p. 67).

6.6.6 Installation of SFS 6 injection module

Installing SFS 6 injection module



1	Tube connecting to sample/autosampler	3	Communication cable to controller
2	Tube connecting to nebulizer	4	Tube connecting to rinsing solution

Fig. 39 SFS 6 installed at the contrAA 700 for manual sample delivery

1. Screw aspiration tubes into free ports of the injection module as follows:
   - medium-long tube into upper port – to sample or autosampler
   - short tube into sidewayse port – to nebulizer
   - long tube into lower port – to rinsing solution
2. Manual operation mode: Hinge injection module into its designated suspension points at the front of the vertical adjustment mechanism.

   Working with an autosampler: Hang injection module into position at the right holder of the autosampler.
3. In the default setting (not powered), the tube for carrier solution is now released for flow.
4. Plug control cable into the lower two-pole jack terminal at the right sample compartment wall and screw it firmly on.
5. Mount short tube piece onto the nebulizer needle.
6. Dip tube for rinsing solution (long tube) into the storage bottle for rinsing solution.
7. Dip sample tube (tube of medium length) into the sample container and connect with the aspiration needle of the autosampler.

Shutting the SF 6 injection module down

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

6.6.7 Replacement of burner

CAUTION! DANGER OF SKIN BURNS!

Use burner fork (optional accessory item) to remove the burner when in hot state. Or wait until burner has cooled down sufficiently.

1. Push sample compartment door up.
2. Release fixing screw of burner and take burner off. If burner fork is available, us burner fork this purpose.
3. Place new burner onto the mixing-chamber tube, rotate it into 0° (mechanical stop) position and lock it with the fixing screw.

6.6.8 Add-on installation of scraper

When working with the nitrous oxide flame it is recommended to use a scraper. Alternatively, carbon deposits can be manually removed from the burner slot with the scraper. The scraper is delivered ready installed on the 50 mm burner upon request. It can also be retrofitted to a 50 mm burner.

CAUTION

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

On special request the scraper comes factory-installed to the 50 mm burner. It can also be retrofitted to a 50 mm burner.

1. Turn screws out of front-side burner jaw (arrows in Fig. 40).
2. Unscrew fixing rail (1 in Fig. 41) using knurled thumb screws (2 in Fig. 41) from the scraper.
   The knurled thumb screws are captive so they will be kept inside the holder device of the scraper.
3. Mount fixing rail to burner head. Use long titanium screws and nuts (included in delivery) for this purpose. Pass screws through front-side burner jaw and screw fixing rail on with nuts.
4. Set scraper onto the guide pins of the fixing rail (2 in Fig. 41) and use knurled thumb screws to fix the scraper (3 in Fig. 41).

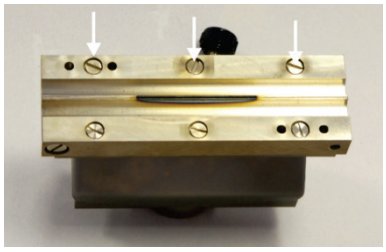
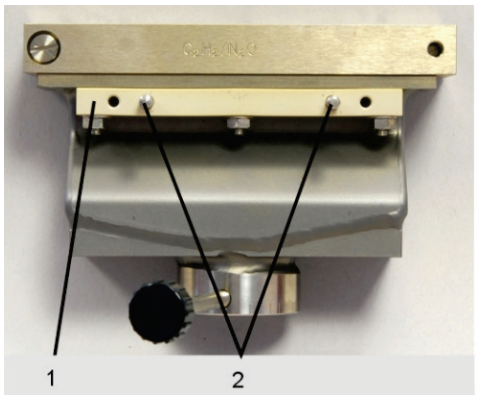
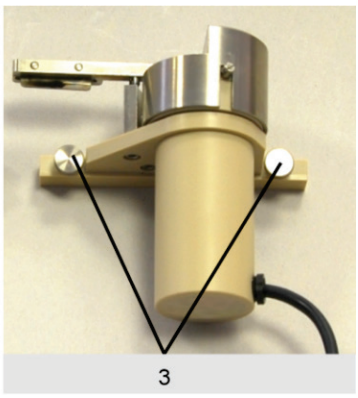


Fig. 40 Screws in front-side burner jaw





1 Fixing rail for scraper

2 Guide pins

3 Knurled thumb screws

Fig. 41 Fixing rail with burner mounted / knurled thumb screws at scraper

6.6.9 Operation of the HPT burner head

CAUTION!

The HPT burner head can only be used for the air-acetylene flame up to a fuel gas-air ratio of 0.16.

1. Insert the quartz tube in the holder.
   Make sure that the pin in the left V bearing is positioned in the existing groove on the face side of the quartz tube. This ensures that the quartz tube slits are aligned to the burner slit.
2. Set the HPT burner head on the connector of the mixing chamber and clamp.
3. Set a burner height of 12 mm or more for flame ignition and operation.
4. To ignite the flame, tilt the holder with quartz tube forwards. As soon as the flame has ignited, already fold back the holder during the active ignition process.

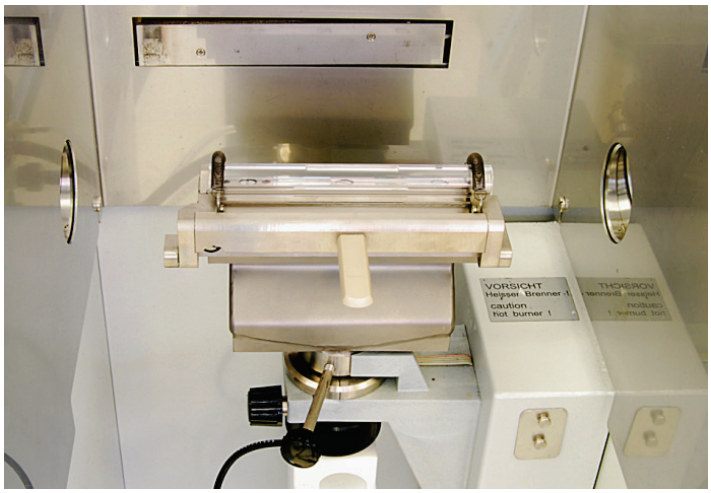


Fig. 42 HPT burner head mounted on the mixing chamber

6.7 Starting the contrAA 700 with accessory units up

6.7.1 Turn-on sequence, daily start of work

1. Turn power to the contrAA 700 on: Actuate green ON/OFF switch at the right lateral wall panel for this purpose.
2. Turn PC on and wait for computer program to be completely initialized. The monitor will display some application icons, among them the ASpect CS program icon.
3. Launch ASpect CS program session. Double-click with the mouse pointer onto the ASpect CS icon to do this.
4. Once the ASpect CS software session has started, trigger initialization of accessory units using software tools in MAIN SETTINGS window.
5. Turn printer and compressor on if required.

✓ **The AAS system is operational now and you may proceed to actual work (for preparation of analytical jobs and measurement).**

6.7.2 Turn off sequence

NOTE

Having turned the xenon lamp off, one should wait for another 30 seconds allowing the lamp's cooling loop to continue in operation before shutting the AAS system actually down.

1. At PC, ASpect CS application program: select FILE / CLOSE.
2. If settings have not been saved so far, define whether unsaved data/ unsaved information is to be saved before the program will be terminated.
3. If xenon lamp is still on or was turned off after a time less than 30 seconds:
   The screen will inquire if the xenon lamp is to be shut down. If the lamp is turned off, the running ASpect CS session will be terminated after a delay time of 30 seconds.
4. Ramp PC down.
5. Transfer all main power switches into Off position (in this order):
   - PC
   - AAS
   - Printer
   - Compressor

   ✓ **The AAS system is completely shut down.**

7 Care and maintenance

CAUTION! OBSERVE THE SAFETY INSTRUCTIONS!

The user must not perform any care and maintenance on the device and its components other than those described in this Section.

Only service technicians employed with or authorized by Analytik Jena AG are allowed to carry out repairs on the contrAA 700.

In maintenance work, observe all guidelines, standards and safety instructions specified in Section "Safety instructions" p. 9.

To ensure perfect and safe functioning of the contrAA 700, it should be inspected on an annual basis by service technicians from Analytik Jena AG.

Only use spares from Analytik Jena AG. Laboratory items used for routine operation can be ordered from Analytik Jena AG.

WARNING! ELECTRIC SHOCK!

Turn power off and **remove the line power plug** from its socket before you proceed to service work of any kind on the contrAA 700. Removal of the line power plug will safely break line power supply to the contrAA 700. After turning off with the main power switch, some parts of the spectrometer, including its outlet socket, will continue to carry line voltage.

7.1 Maintenance summary table

System component	Action	Reason / Periodicity
Basic unit		
Fuse	Fuse change	As required
Sample compartment	Cleaning of sublimed substances Removal of residual liquids from the tray	Regularly When residues are found in the tray
	Cleaning of beam entrance and exit windows in the sample compartment	On visual inspection When energy loss is detected
Graphite tube furnace		
Graphite tube	Clean by performing a bake cycle via cleaning program of control software.	Daily
Iridium-coated graphite tube	Bleed iridium layer.	After approximately 500 atomization cycles or for re-coating (irregularities will falsify measured results)
Furnace window	Use non-shedding piece of cloth slightly moistened with alcohol for wiping down. Use a commercially available detergent for UV-cells (e.g. HELLMA NEX II) to clear away stubborn dirt.	weekly

Graphite electrodes	Clean contact faces of elec-trodes with cotton wool wad, non-shedding piece of cloth slightly moistened with alco-hol or using blotting paper.	At regular intervals
	Check for wear, replace if necessary.	Every six months
Pipetting insert	Clean and rinse.	May be required on a daily basis, depending on the type of samples
Autosamplers AS-GF / AS-F and AS-FD		
Dosing tube/ needles	Check for freedom from deposits, kinks and cracks.	Regular inspection, since sedimentation may falsify measured results
Wash cup, mixing cup	Clean	At regular intervals
Gas connection ports		
	Check for absence of leakage	When tubing connections were restored and on noticing a distinct drop of pressure at a manometer
Burner-nebulizer system unit		
	Disassemble and clean	Depending on sample material being analyzed (medical samples or samples with high salt contents)
JUN-AIR 6/S piston compressor		
Air tank	Drain condensed water under pressure	Monthly
Pressure reducer Filter	Drain condensed water	Monthly
Water separator	Drain warter.	Every three months
Recirculation cooling of Xe-lamp and graphite tube furnace		
Compensation tank	Check compensation tank for fill level. Refill tap water as necessary.	Monthly
Fans (in back wall)	Keep dirt/contamination away	At any time

Table 7 Maintenance summary table

7.2 Basic system unit

7.2.1 Fuse change

WARNING!

Make sure to switch off the contrAA 700 before changing a fuse!

Protective fusing is located at the back of the contrAA 700, at the terminals bar and the sample compartment of the graphite tube furnace. All fuses are provided with special labelling.

Fuses at the back panel (see Fig. 24 p. 46)

Number of fuse	Type	Protected current circuit
F3	T 6,3 A/H	Power socket
F4	T 6,3 A/H	Power socket
F5	T 6,3 A/H	Spectrometer
F6	T 6,3 A/H	Spectrometer

Fuses at the terminal bar (see Fig. 23 p. 46)

Number of fuse	Type	Protected current circuit
F7	T 3,15 A	Xenon lamp
F8	T 3,15 A	Xenon lamp

Furnace fuse (see Fig. 7 p. 30)

Type	Protected current circuit
TR5-T 100 mA	Graphite tube furnace

Table 8 Fuses

WARNING!

The fuses of the line power inlet (F1 and F2) may only be changed by service technicians employed with or authorized by Analytik Jena AG!

7.2.2 Reactivating the safety circuits of the cooling water circuit

The temperature of the cooling water circuit is monitored by means of two safety circuits.

Protection of the xenon lamp from overheating

The first safety circuit automatically deactivates the xenon lamp if the cooling water temperature exceeds 60°C. When the cooling water temperature is below the limit value again, the lamp is switched on when the contrAA 700 is reactivated and initialized.

Protection from uncontrolled furnace heating

A second safety circuit protects the AAS in the event of a possible communication error between control (PC) and spectrometer from uncontrolled heating of the furnace. In the event of a failure, this safety circuit switches off the power supply of the device hardware if the cooling water temperature exceeds 65°C. Damage to the device that would be caused if

the furnace is still heating can be avoided. If the second safety circuit has switched off the power supply, the error message "Timeout autosampler" appears when the contrAA 700 with graphite tube technique is reactivated.

The second safety circuit can be reactivated manually:

1. Open the right front door of the lamp chamber.
2. Operate the small red switch on the back of the lamp chamber (arrow in Fig. 43).
3. Switch the contrAA 700 back on and start the software ASpect CS.

If the lamp ignites and no error message appears, the device is ready.

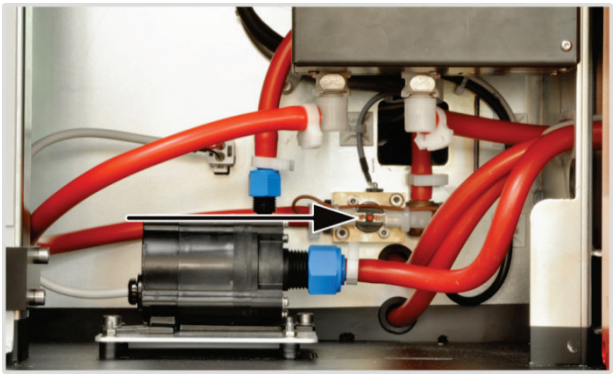


Fig. 43 Safety circuit switch for hardware

7.2.3 Cleaning the sample compartments

- ❑ Clean the sample compartment regularly with a lintfree cloth moistened with alcohol.
- ❑ If there are liquid residues in the sample compartment tray, e.g. from the drain of the siphon or the autosampler, pull the tray frontward, empty it and wipe it with a dry cloth.
- ❑ When you notice detect energy losses, check the beam entrance and exit windows for cleanness:
  Clean the windows with a lintfree cloth (optics cloth) moistened with alcohol taking care to leave no streaks.

IMPORTANT

After cleaning the sample chamber window with alcohol, it takes approx. 1 h until the complete UV transmission has been restored.

7.2.4 Removing and installing the xenon lamp

WARNING! ELECTRIC SHOCK!

Switch off the contrAA 700 at the mains switch. It is very important that you also remove the mains plug from the 35 A connection before replacing fuses!

CAUTION! CONTAMINATION OF THE LAMP WINDOW!

Do not touch the lamp window when exchanging the lamp! Decontaminations have a negative impact on the lamp properties!

1. Open the lamp chamber door (at the front on the left of the sample chamber of the graphite tube furnace).
2. Place a cloth or similar under the couplings. Small amounts of water may occur when disconnecting the couplings.
   Disconnect the quick couplings for the cooling water at the bottom of the lamp housing. To disconnect the couplings, press on the (metal) interlock until it clicks into place, then pull out the coupling part to the bottom.
   The coupling parts contain valves that close automatically when they are being disconnected. This keeps cooling water from escaping. A few drops, however, will still escape from the coupling parts.
3. Use the hexagon socket wrench (5 mm) with T-handle (part of the scope of delivery) to unscrew the horizontal attachment screw of the lamp housing completely.
   This pushes the lamp housing forward on the two guiding pins and the electric plug connection (not visible) is removed.
4. Pull on the handle of the lamp housing with one hand and hold the housing at the bottom with the other hand. Pull the housing to the front and off of the guiding pins.

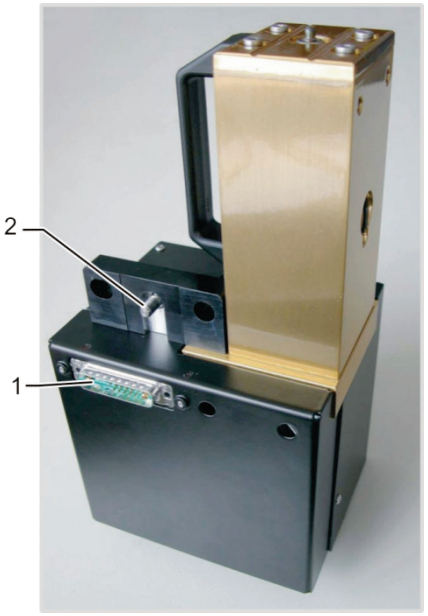
   Note: Keep a firm grip on the lamp housing when pulling it off the guiding pins. The housing is heavy!
   Do not touch the lamp window!
5. Put the removed lamp housing to the side.
6. Stick the new lamp housing on the guiding pins and push it toward the back.

   Note: Do not touch the lamp window!
7. Screw in the attachment screw of the lamp housing completely using a hexagon socket wrench and tighten the screw.
   This presses the lamp housing to the back on the two guiding pins and into the electrical multipole plug connection.
   Note: It must be possible to screw in the lamp housing without noticeable resistance! Do not use force!
8. Connect the cooling water hoses to the bottom of the lamp housing.
   Press the plug connectors of the hoses into their counterparts at the lamp housing (left hose - left inlet; right hose - right inlet) and push them in as far as they will go.

   Note: There should be an audible click when the hoses are plugged in and the interlock in the connection piece of the lamp housing should pop out.
9. Switch on the contrAA 700.
10. Make sure that circulation pump works and cooling water flows back to the stabilization vessel.

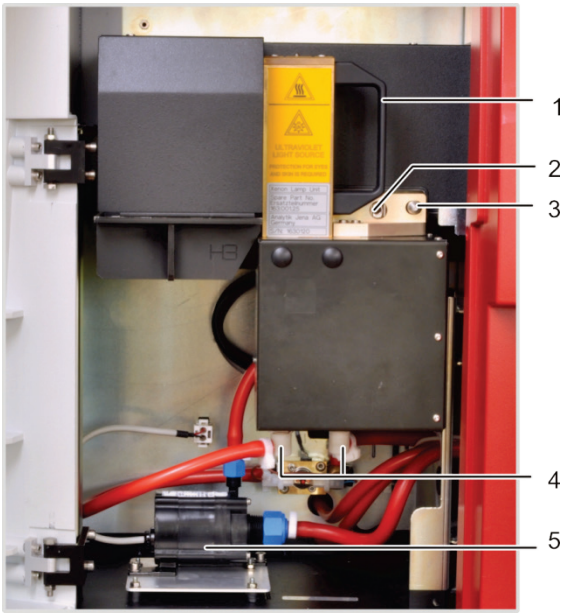
    Note: If the pump is running and no cooling water flows back, one (or both) plug connector/s is not adjusted correctly. In this case disconnect the couplings again and press them in properly.

11. Check the filling level in the stabilization vessel of the circulating pump and fill with tap water if required (→ Section "Check cooling water level" p. 76).
    The fill level will decrease slightly after the lamp has been installed. This is due to the heat sink of the lamp filling with cooling water. The displaced air is released via the stabilization vessel after a few seconds.
    Tighten the cover of the stabilization vessel by hand only.
12. Mop up any drops of water.
13. Close the lamp chamber door.



1 Fixing screw
2 Electric plug connector

Fig. 44 Xenon lamp housing

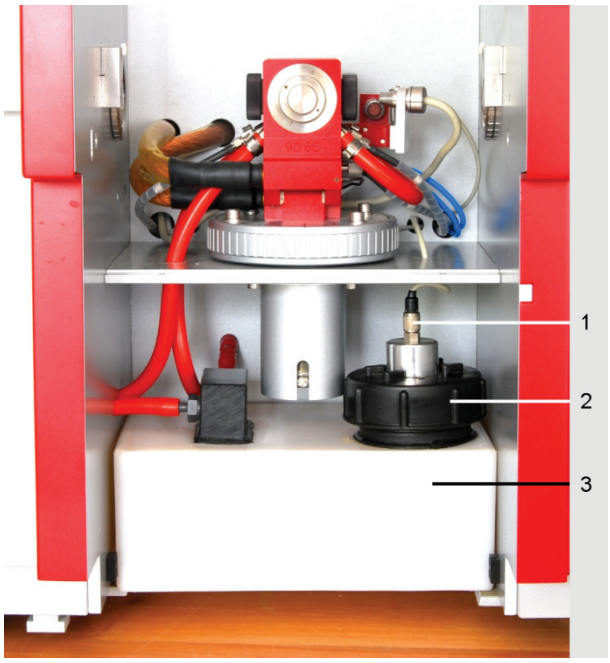


1 Handle
2 Fixing screw
3 Guiding pin
4 Couplings for cooling water connection
6 Pump

Fig. 45 Xenon lamp, installed

7.2.5 Check cooling water level

Inspect for proper cooling water level on a monthly basis. The tank containing the liquid volume for cooling the graphite tube furnace and the xenon lamp is located below the graphite tube furnace.



1 Sensor to monitor cooling water level
2 Cover
3 Cooling water tank

Fig. 46 Cooling water tank below graphite tube furnace

1. Unscrew fixing screws from cover sheet (4 and 6 in Fig. 25, p. 48), then remove cover sheet.
2. Unscrew and pull off sensor terminal for cooling water level (1 in Fig. 46).
3. Unscrew cover (2 in Fig. 46).
4. Refill cooling water tank with tap water until water level reaches 2 cm above the upper edge of the square tank.
5. Screw on cover with moderate force.
6. Screw cooling water level sensor firmly on.
7. Attach cover sheet with the help of screws.

7.3 Maintaining the graphite tube furnace

After a prolonged operation time, sample residues, modifiers and sublimated carbon particles of the graphite tube are deposited on the contact surfaces of the graphite electrodes, the furnace jacket, the radiation sensor and the pipetter insert. These deposits can be a source of contamination and can lead to increased deviations of the formatting factor.

A damaged furnace jacket, ceramic ring and graphite tube can be the cause of substandard analysis results.

CAUTION! THERE IS A RISK OF BURNING YOURSELF ON THE HOT GRAPHITE TUBE FURNACE!

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

CAUTION! DO NOT DAMAGE THE FURNACE WINDOW!

Do not touch the quartz panes of the furnace windows with your bare fingers! Fingerprints burn in.

7.3.1 Cleaning the furnace windows

CAUTION!

Do not clean the furnace windows in an ultrasonic bath. This may lower the UV permeability of the windows.

Do not touch the quartz panes of the furnace windows with your bare fingers! Fingerprints burn in.

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

IMPORTANT

After cleaning the sample chamber window with alcohol, it takes approx. 1 h until the complete UV transmission has been restored.

Only use cleaning solution for cleaning (order no. 407-320.002).

Preparation of 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.
2. Fill the glass beaker with cleaning solution until the furnace window is fully immersed.
3. Allow the solution to soak at 25 to 30 °C for approx. 30 min.
4. Remove the furnace window from the cleaning bath (use plastic tongs or similar, do not touch optical surfaces) and rinse under deionized water (<1 µS/cm).
5. Blow dry with compressed air or argon.
6. Re-attach the furnace windows.
   The furnace windows are tilted in the holders. Identical markings must face upward!

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

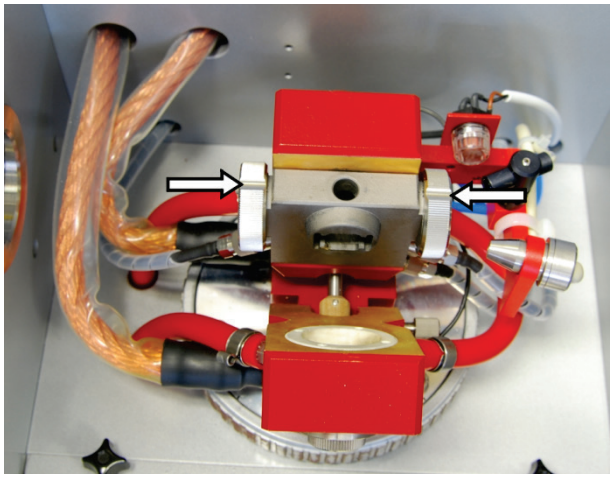


Fig. 47 Identical markings at the furnace windows facing upward

7.3.2 Cleaning the graphite surfaces

The graphite surfaces must be cleaned after daily use as required.

1. Switch on the contrAA 700 and start the ASpect CS software (the movable furnace part must be pressurized to be opened/closed).
2. In ASpect CS use  to open the FURNACE window. Go to the CONTROL tab.
3. Open the furnace with the [OPEN FURNACE] button.
4. Remove the pipetter insert from the furnace jacket and clean it in 0.1 - 1 N HNO_3. Then wash thoroughly with slightly acidic or demineralized water.
5. Clean the contact surfaces of the electrodes in the movable furnace part with cotton swab, lint-free cloth soaked in alcohol or blotting paper.
6. Clean the inner surfaces of the furnace jacket with a cotton swab.

7.3.3 Cleaning and changing the graphite tube

Clean the standard graphite tube

Daily

Work steps, see Chapter "Cleaning the graphite tube / cleanout" p. 53.

Clean the iridium-coated graphite tube

Daily

Work steps, see Chapter "Cleaning the graphite tube / cleanout" p. 53.

Evaporation of iridium coating in the graphite tube

After approx. 500 atomizations or for a new coating.

Work steps, see Chapter "Cleaning the graphite tube / cleanout" p. 53.

Replacing the graphite tube

If the graphite tube appears to be burnt, the pyrolytic coating is worn out.

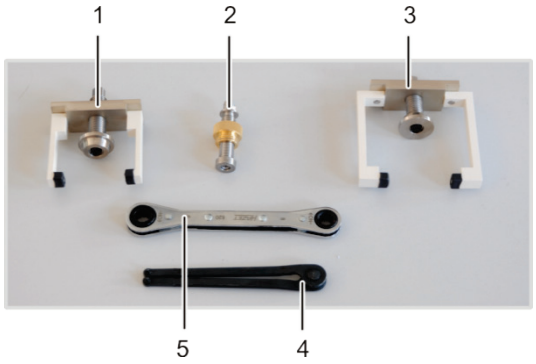
At a formatting factor ≥ +10 % an automatic temperature correction no longer takes place. Further use of the graphite tube is limited. The graphite tube should be replaced.

Work steps, see Chapter "Inserting the graphite tube into the graphite tube furnace" p. 51.

7.3.4 Replacing the electrodes and the furnace jacket

If the electrodes have been cleaned and the graphite tube has been exchanged and the formatting factor is still > 10 the electrodes and the furnace jacket must be replaced. You can have the customer service perform these tasks as part of the annual maintenance.

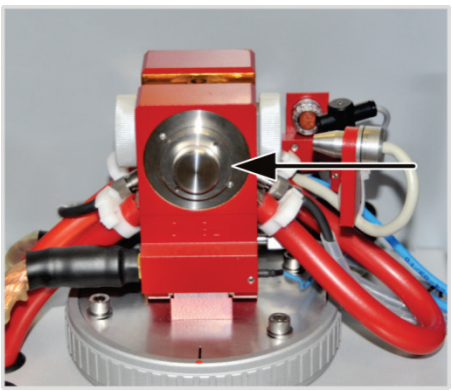
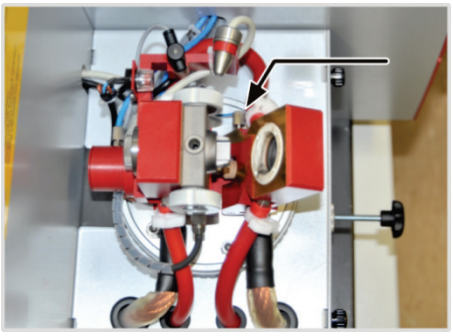
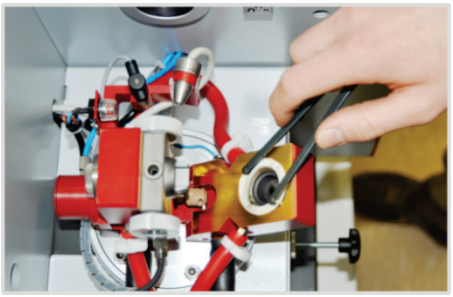
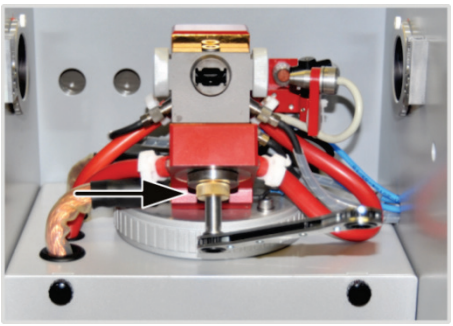
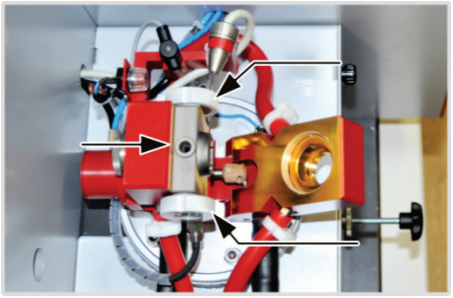
If you wish to replace these parts yourself, you will need furnace tools which can be supplied optionally.

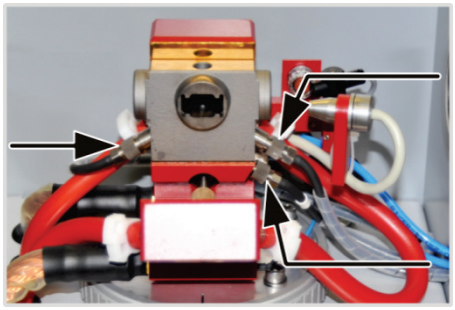
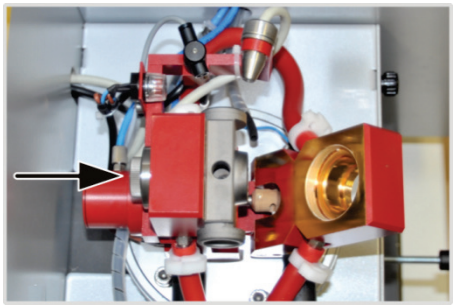
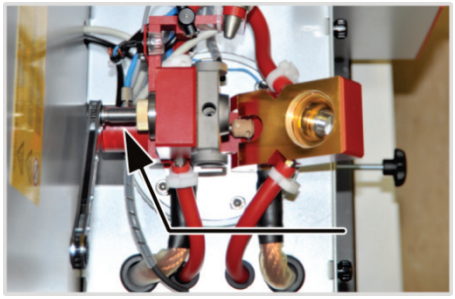


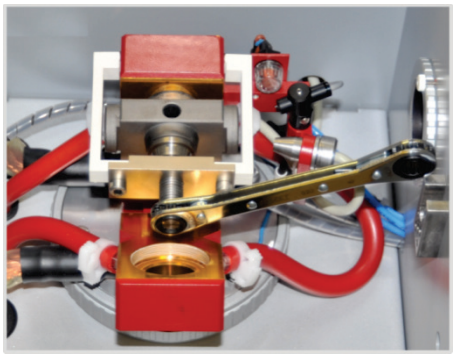
1 Inserting tool for electrodes
2 Press-out tool
3 Inserting tool for furnace jacket
4 Face spanner
5 Ratchet wrench

Fig. 48 Furnace tools

1. Switch on the contrAA 700 and start the ASpect CS software (the movable furnace part must be pressurized to be opened/closed).
2. In ASpect CS use  to open the FURNACE / CONTROL window.
3. Open the furnace with the [OPEN FURNACE] button.

	4. Unscrew the covering screw from the movable furnace part.
	5. Withdraw the knurled pin and fold the movable furnace part down.
	6. Loosen the insulating ring carefully with the face spanner and unscrew it completely by hand. **Caution!** **Risk of breaking the insulating ring!** Do not jam the face spanner!
	7. Screw the press-out tool into the movable furnace part with the spindle turned back all the way to the stop and press out the electrode completely using a ratchet wrench. Unscrew the press-out tool from the furnace part completely.
	8. Pull the furnace window off of the furnace jacket and remove the pipetter insert.

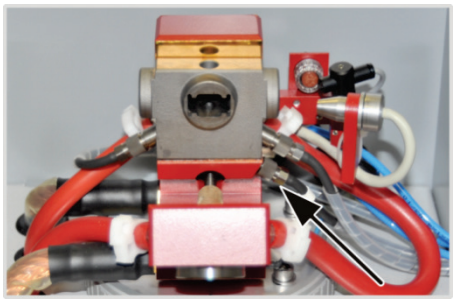
	9. Pull out the three gas tubes and carefully screw out the three gas connectors.
	10. Screw out the covering screw at the rear of the fixed furnace part by hand.
	11. Screw the press-out tool into the fixed furnace part with the spindle turned back all the way to the stop and press out the electrode and the furnace jacket completely using a ratchet wrench. Loosen the press-out tool and unscrew it completely.
	12. Arrange a new electrode parallel to the fixed furnace part and secure it with the inserting tool (small bracket). 13. Use the ratchet wrench to insert the electrode to the stop. Loosen the inserting tool and remove it. **Caution! Risk of breaking the electrode!** Make sure that the electrode and the furnace part are parallel when positioning and inserting the electrode. If the electrode is unintentionally positioned askew, remove completely and start again.



14. Align the furnace jacket with the rectangular opening parallel to the furnace body and fasten it with the inserting tool (large bracket).
15. Insert the furnace jacket to the stop. Loosen the inserting tool and remove it.

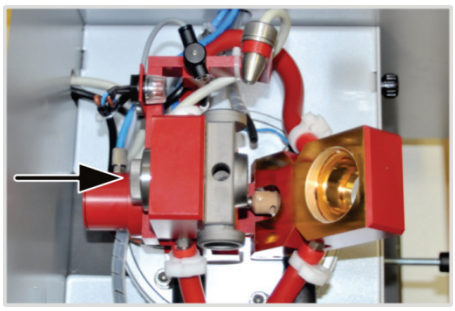
    Caution! Risk of breaking the furnace jacket!

    When inserting, always make sure that the furnace jacket and the fixed furnace part are in parallel. If the furnace jacket has unintentionally been positioned askew, remove completely and start again.

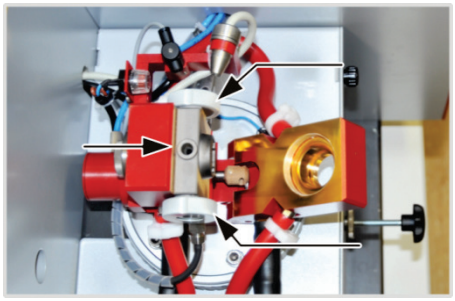


16. Check the sealing rings of all three gas connectors and replace if damaged.
17. Screw the long gas connector (arrow in figure on left) (for the outer gas flow) transversely from below finger-tight into the fixed furnace part.
    Attach the gas tube that is marked with a white ring onto the long gas connector.
18. Screw the two short gas connectors (for the inner gas flow) into the furnace jacket on both sides.

    Attach the two other gas tubes to the corresponding gas connectors.



19. Screw in the covering screw at the rear of the fixed furnace part by hand.



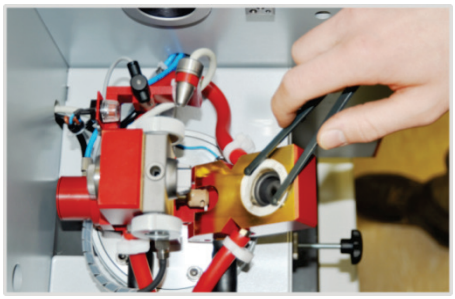
20. Attach the furnace window to the furnace jacket and insert the pipetter insert.

    Caution! Similar markings at the furnace windows must face upward.

21. Arrange 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 jaw using the ratchet wrench.

    Caution! Do not tilt the electrode. It may break!

22. Any graphite dust should be removed by suction or blown away.

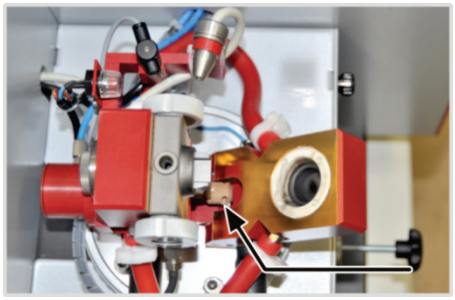


23. Screw in the insulating ring by hand and tighten it moderately using the face spanner.

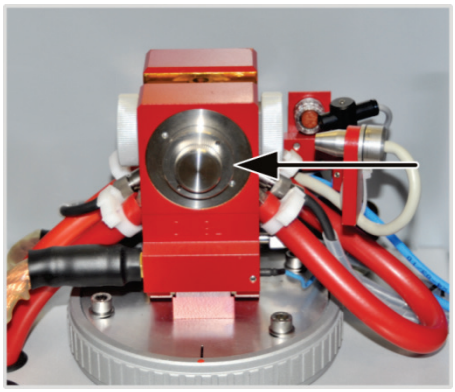
    Caution!
    Risk of breaking the insulating ring!
    Do not jam the face spanner!

24. Check visually that the insulating ring protrudes approx. 0.3 mm from the jaw.

25. Attach the furnace window to the furnace jacket and insert the pipetter insert.



26. Insert the knurled pin (arrow) to the stop into the furnace jaw and the connecting rod. 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.

7.4 Burner-Nebulizer System

The burner-nebulizer system has to be cleaned at regular intervals, indicated by the following:

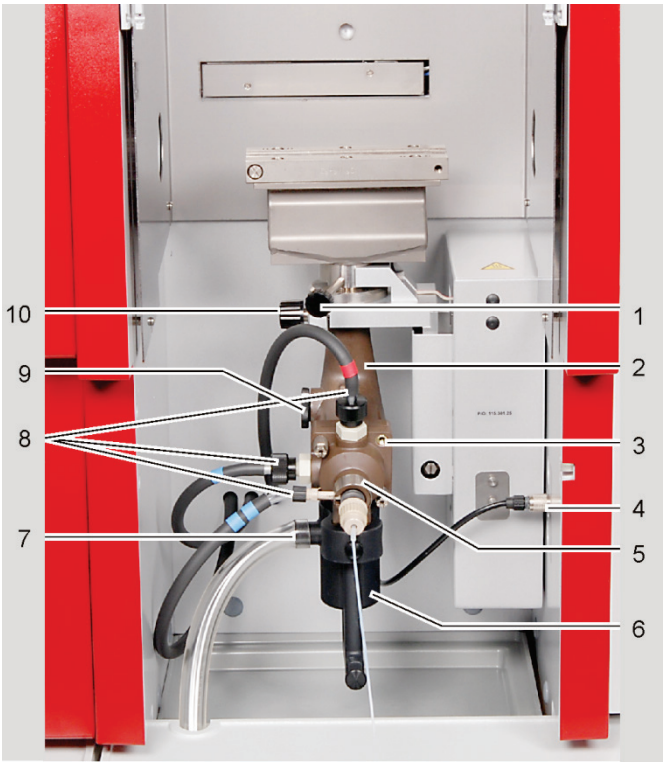
- ❑ Irregularities in the flame hem of the burner flame. Washing with diluted acid in the active program and blowing the burner out does not bring about any improvement.
- ❑ The sensitivity given in the cookbook for an individual element is not achieved despite changing the composition of the gas.
-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

WARNING! SERIOUS RISK OF BURNING!

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

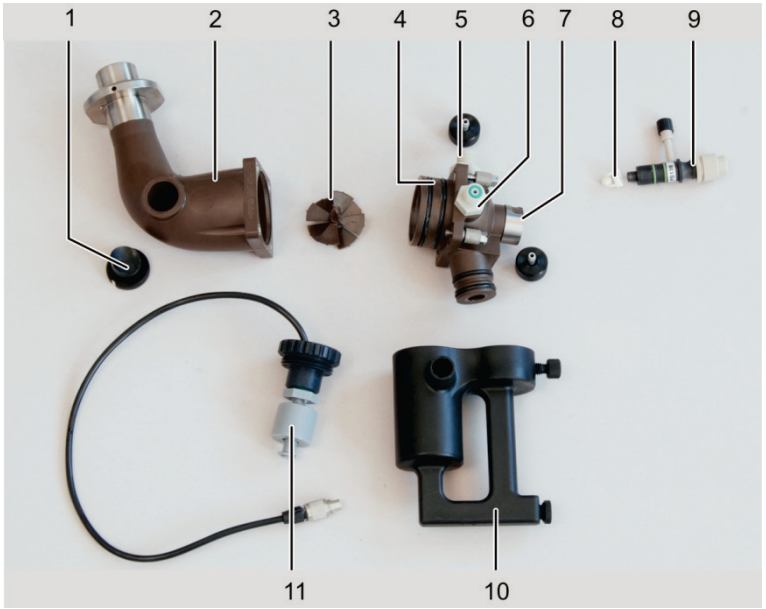
1. Take burner-nebulizer system apart.
2. Clean burner.
3. Clean nebulizer.
4. Clean siphon.
5. Clean mixing chamber.
6. Assemble burner-nebulizer system.
7. Adjust burner-nebulizer system (optimize flame).

7.4.1 Disassemble burner-nebulizer system unit



1 Stud bolt on the burner
2 Mixing chamber tube
3 Mixing chamber screw joints (4 x)
4 Locking ring for nebulizer
5 Fixing screw for siphon
6 Connection of siphon sensor
7 Outlet tube from the siphon
8 Screwed tube connections on the mixing chamber head and the nebulizer
9 Safety plug
10 Knurled head screw on the holding bow

Fig. 49 Deinstalling and taking the burner-nebulizer system unit apart



1 Safety plug
2 Mixing chamber tube
3 Impeller
4 Mixing chamber head with connections for gases, nebulizer and siphon
5 Connection for fuel gas
6 Connection for additional oxidant
7 Nebulizer connection with locking ring
8 Impact bead
9 Nebulizer with connection for oxidant and connection for sample tube
10 Siphon
11 Siphon sensor

Fig. 50 Mixing chamber and nebulizer disassembled

Fig. 51 Withdrawing the nebulizer from the mixing chamber

1. Loosen the stud bolt (1 in Fig. 49, p. 86) on the burner and remove the burner from the connector.
2. Unscrew the screwed tube connections on the mixing chamber head and the nebulizer (8 in **Fehler! Verweisquelle konnte nicht gefunden werden.**) and pull off the tube from the nebulizer connector.
3. Turn the locking ring of the nebulizer (4 in Fig. 49) to open the locking. Withdraw the nebulizer from the mixing chamber head, holding the nebulizer in the groove (Fig. 51, p. 87).
   Caution: Connector for gas connection may break when being pulled.
4. Unscrew the connection of the siphon sensor (6 in Fig. 49) on the rotating arm and pull it off.
5. Pull off the outlet tube from the outlet connector of the siphon (7 in Fig. 49).
6. Loosen the knurled head screw of the siphon (5 in Fig. 49) and pull the siphon down.
7. Empty the siphon.
   Caution! The solution in the siphon is acidic.
8. Unscrew the insert of the siphon sensor, remove the sensor from the siphon (11 in Fig. 50 p. 86).
9. Hold the system tightly, loosen the knurled head screw on the holding bow of the mixing chamber tube (10 in Fig. 49), rotate the holding bow backwards and remove the system.
10. Withdraw the safety plug (1 in Fig. 50) from the mixing chamber.
11. Loosen the four screw joints of the mixing chamber (3 in Fig. 49) and disassemble the mixing chamber into the chamber head and the chamber tube.
12. Remove the impeller (3 in Fig. 50) from the chamber tube.
13. Unscrew the gas connections for fuel gas and additional oxidant.

7.4.2 Clean burner

1. Clean the burner, exposing it to a jet of running water.
2. Clean the burner, keeping it for 5 to 10 minutes in an ultrasound bath of 0.1% HNO_3 with the burner jaws facing down.

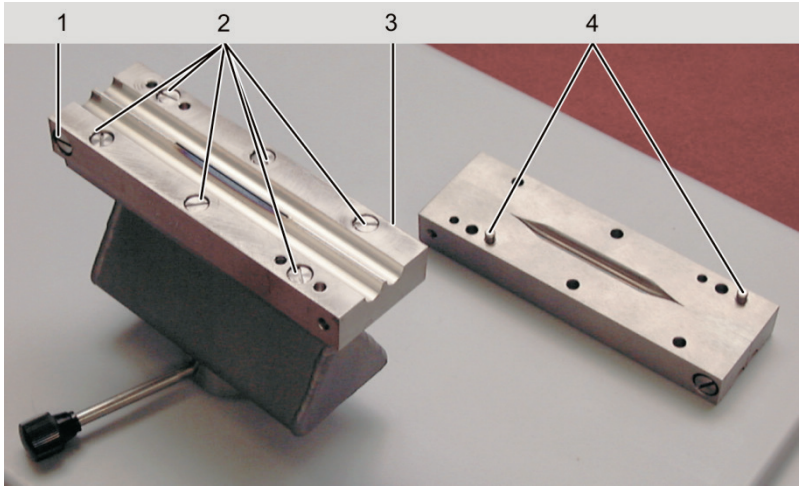
Working steps in cases of very tenacious encrustation

3. Undo the fittings (2 in Fig. 52) of the burner jaws on the burner body and remove the burner jaws.
4. Undo the fittings of the burner jaws against each other (1 and 3 in Fig. 52).
5. Remove the burnt residue build-up with the burner cleaner (timber wedge).
6. Clean the burner jaws in 0.1 N HNO_3, and then wash with distilled water.
7. Screw the burner jaws together, making sure that the ends of the spacers on the burner slit extension and the end faces are flush .

   Caution: The spacers must not protrude over the upper side of the burner jaws (arrow in Fig. 54)! When using a scraper, it remains attached.
8. Screw the burner jaws onto the burner body, the dowel pins (4 in Fig. 52) on the burner ensure correct positioning.

CAUTION! USING THE SCRAPER!

When the spacers protrude over the upper side of the burner jaws, the scraper can get caught and burn!

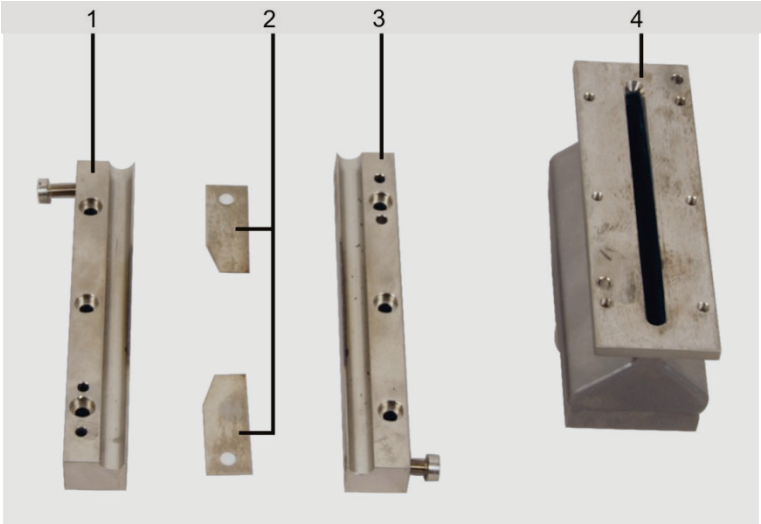


1;3 Burner jaw fittings against each other

2 Fittings of the burner jaws with the burner body

4 Dowel pins on the underside of the burner jaws

Fig. 52 Fittings of the burner



1 Burner jaw
2 Spacers
3 Burner jaw
4 Burner body

Fig. 53 Burner, disassembled

Fig. 54 Spacers inserted in burner jaws

7.4.3 Clean Nebulizer

1. Put the nebulizer for several minutes in an ultrasonic bath with approx. 1% nitric acid or organic solvent (isopropanol).
2. Turn the impact bead (8 in Fig. 50, p. 86) slightly and pull it off the nebulizer. Should the impact bead stuck; put the nebulizer again in the ultrasonic bath.
3. Insert the cleaning wire into the nebulizer canula and clean the canula by moving it up and down several times.
4. Attach the baffle ball on the nebulizer and lock it by turning slightly.

7.4.4 Clean mixing chamber

Mixing chamber tube and chamber head:

1. Clean with saltpeter, diluted mineral acid, or the appropriate solvent according to the substances analyzed.
2. If the mixing chamber is cleaned with a diluted mineral acid, wash thoroughly with distilled water after cleaning.

7.4.5 Clean siphon

1. Clean with saltpeter, diluted mineral acid, or the appropriate solvent according to the substances analyzed. Clean the channels with a round brush.
2. If the siphon is cleaned with a diluted mineral acid, wash thoroughly with distilled water after cleaning.
3. Wash the float holder.

7.4.6 Assemble burner-nebulizer system unit

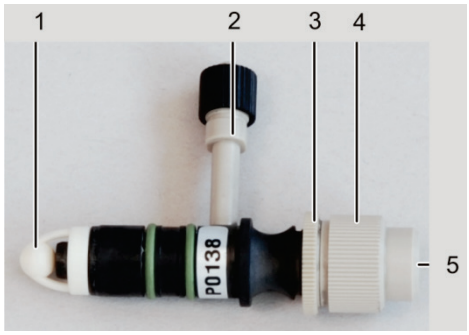
CAUTION! CHECK CONNECTIONS FOR LEAKAGE!

When connecting the supply tubes, ensure correct connection. Insert the seals and check for leakage.
Tighten all screws by hand only.

1. Working steps for assembly 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 impeller at the handle and insert it into the mixing chamber tube. Lock by pressing slightly.
3. Stick the mixing chamber parts (chamber tube and chamber head) together, align the sides so that they are flush and screw (3 in Fig. 49 p. 86).
4. Screw the siphon sensor (11 in Fig. 50, p. 86) in the siphon. Stick the siphon on the chamber head, align the sides so that they are flush and fasten with knurled head screw (5 in Fig. 49).
5. Attach the safety plug (1 in Fig. 50) on the chamber tube.
6. Screw the connections for fuel gas and additional oxidant (5 and 6 in Fig. 50) with the sealing rings into the mixing chamber head.
7. Stick the nebulizer (9 in Fig. 50) into the chamber head and fasten using the locking ring.
   Note: If the nebulizer cannot be stuck easily into the chamber head, slightly grease the sealing rings with the lubricant supplied (Apiezon grease).
8. Fasten the mixing chamber nebulizer system at the height adjustment using the holding bow (10 in Fig. 49). The marking must be above the edge of the holding fixture. Screw the knurled head screw at the holding bow tightly.
9. Plug the cable of the siphon sensor (6 in Fig. 49) into the connection on the rotating arm (take care with the lug) and screw tight.
10. Set the burner on the mixing chamber tube and turn against the 0° stop. Clamp with stud bolt.
11. Screw the tube for fuel gas (red marking) on the connector.
12. Screw the tube for oxidant (1 blue mark) on the connector.
13. Connect the tube for oxidant (2 blue marks) to the nebulizer connector.

Sensitivity control / adjustment

1. Select the FLAME window of ASpect CS software.
2. Open the CONTROL tab and set oxidant-to-fuel-gas ratio.
3. Align burner head in relation to the optical axis in terms of height, depth and parallelism (beam passage of xenon lamp).
4. Open the MANUAL OPTIMIZATION tab.
5. Let the nebulizer draw in test solution, for example, Cu / 2 mg/L, then trigger continuous display mode of measured values. Evaluate the signal.
6. If the sensitivity is not reached, readjust the nebulizer:
   Loosen the lock nut (3 in Fig. 55).
   Adjust the depth of the canula (4 in Fig. 55) with the adjustment nut.
7. After completing the adjustment, secure the adjustment with lock nut (3 in Fig. 55).



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

Fig. 55 Components of the nebulizer

7.4.7 Cleaning the sensor of the burner

The sensor monitors if the burner is mounted correctly before igniting the flame. Clean the sensor of the burner if

- there are deposits (for example salt incrustations) on the openings of the sensor
- the inserted burner cannot be detected (shown by an error message in the software).

1. Remove the burner-nebulizer-system by loosening the knurled head screw on the holding bow (10 in Fig. 49).
2. Clean the sensor cautiously with the help of a little brush, for example a toothbrush, using alcohol, for example Isopropanol.
3. Reinstall the burner-nebulizer-system on the holding bow.

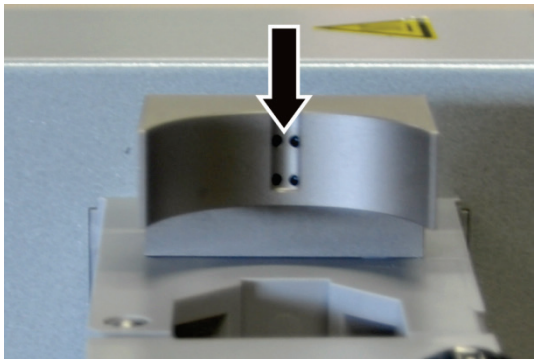


Fig. 56 Sensor of the burner

7.5 Autosampler 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.
- ❑ Wash, service, replace the dosing tube.
- ❑ Clean, after a wash or mixing cup has overflowed.

7.5.1 Washing the dosing tube

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

1. Switch on the contrAA 700 and start the ASpect CS software.
2. In ASpect CS open the window AUTOSAMPLER with  .
3. Use the [WASH] button to start the wash cycle.

   Note: If the dosing tube is not immersed properly into the wash cup during washing, the autosampler must be realigned in the wash position.
4. In the window FUNCTION TESTS enable the button [ADJUST AUTOSAMPLER].
   In the area ALIGNMENT POSITION enable the option WASH POSITION. In the area ALIGNMENT WASH POSITION enter the immersion depth in the list field (approx. 40 mm). Correct the alignment of the swivel arm with the arrow keys. Save the configurations and exit the window.
   Caution: When opening the window [ADJUST SAMPLER] again, a value of 13 MM is shown under DEPTH, not the stored value.
5. The wash cycle can be repeated several times if required.

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

IMPORTANT

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

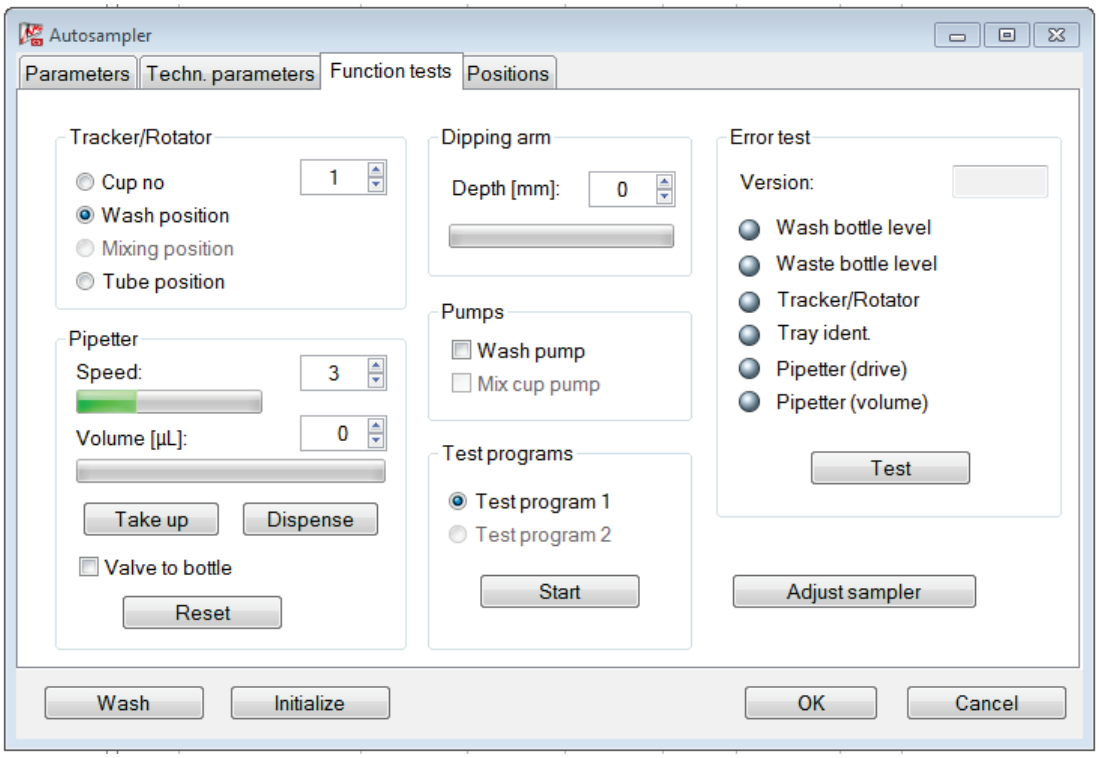
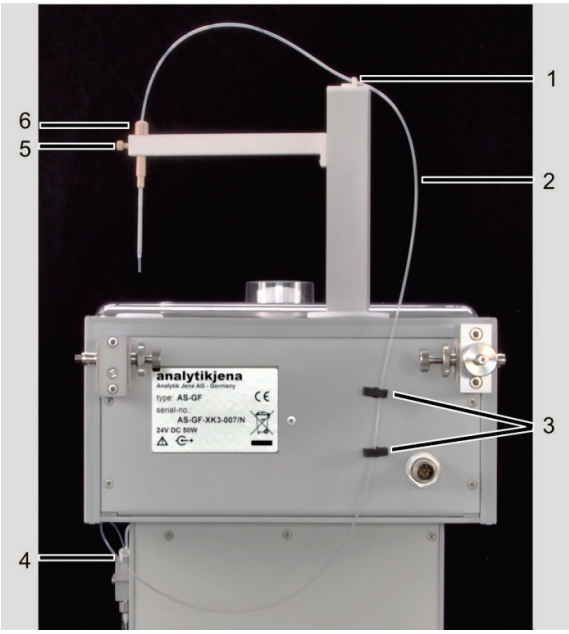


Fig. 57 **Window "Autosampler / Function tests" in the ASpect CS software**

7.5.2 Servicing the dosing tube

A defective or kinked dosing tube or one with sediment deposits 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 clamp nut

Fig. 58 **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 spread out in the tube (tube is contaminated on the inside).

An 8 to 13% sodium hypochlorite solution (NaOCl) is recommended as a cleaning solution. The following cleaning procedure should be repeated as often as is necessary.

1. Fill the sodium hypochlorite solution into a 5 mL special cup and mount tray position 101 with it.
2. Switch on the contrAA 700 and start the ASpect CS software.
3. In ASpect CS open the window AUTOSAMPLER with  . Change to the tab FUNCTION TESTS (Fig. 57 p. 93).
4. In the area TRACKER/ROTATOR enter "101" into the list 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 area PIPETTER, in the list field VOLUME [µL], use the arrow keys to set the volume to be picked up (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. (Click the [WASH] button 5 times.)

Shortening the dosing tube of the AS-GF

1. Loosen the clamp nut at the tube guide (6 in Fig. 58) and remove the dosing tube by pulling upwards.
2. Cut 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 AS-GF" p. 56).

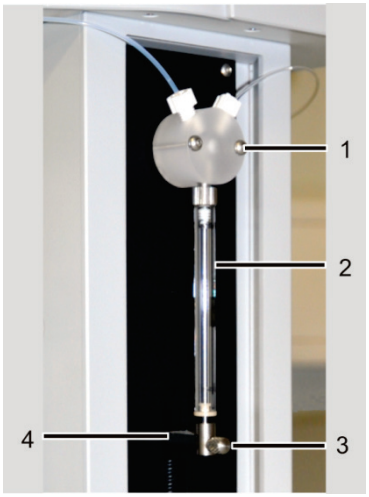
Replacing the dosing tube of the AS-GF

1. Loosen the clamp nut at the tube guide (6 in) and pull out the tube. Remove the tube from the tube holders at the sample arm and the back of the autosampler (1 and 3 in Fig. 58).

2. Detach the screw top from the T valve of the dosing unit (4 in Fig. 58).
3. Screw the new dosing tube to the valve and feed it through the tube holders.
4. Push the dosing tube into the tube guide until it protrudes 8 mm at the bottom, lock with the clamp nut.
5. Readjust the injection depth of the sample (→ section "Adjusting the AS-GF" p. 56).

7.5.3 Replacing the metering syringe

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



1 Valve
2 Dosing syringe, consisting of piston and glass cylinder
3 Attachment screw
4 Drive rod

Fig. 59 Dosing unit at AS-GF and AS-FD

1. Switch on the contrAA 700 and start the ASpect CS software. In the window MAIN SETTINGS Select technique: 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 list field VOLUME [µL] , use the arrow keys to set the volume to be picked up (AS-GF: 500 µL; AS-FD 5000 µL). Increase the speed to 6-7.
4. Press the button [TAKE UP].
   The piston of the dosing syringe moves down.
5. Unscrew the fixing screw (3 in Fig. 59).
6. Unscrew and remove the dosing syringe (2 in Fig. 59).
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.
9. Screw the piston with the attachment screw finger-tight to the drive rod.
   Caution: Excessive force can lead to material damage! Do not tighten the screw too much.
10. In the window AUTOSAMPLER click on the [INITIALIZE] button.
    The piston of the dosing unit moves back to the original position.

7.5.4 Clean-up after cup overflow

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

1. Stop the process immediately.
2. Take up the liquid with cellulose wadding or cloth. Wipe the 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.

7.6 Automatic samplers 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 canula(s) at the autosampler arm
- ❑ Replace the aspiration tube and dosing tube
- ❑ Replace the dosage syringe, as for AS-GF (→ Section "Replacing the metering syringe" p. 95)
- ❑ Clean, after a wash or mixing cup has overflowed

7.6.1 Washing the sample paths

1. In the software ASpect CS use  to open the FLAME window and ignite the flame.
2. Use  to open the AUTOSAMPLER window.
3. In the tab TECHN. PARAMETERS set approx. 60 s in the input field WASH TINE WASH CUP.
4. Use the [WASH] button to start the wash cycle.

The canula of the autosampler dips into the wash cup. The wash liquid is aspirated through the system.

7.6.2 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 preparing 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 and after the measurement

1. In ASpect CS open the window AUTOSAMPLER with  .
2. In the tab TECHN. PARAMETERS enter a volume of 25 mL in the group WASH MIX CUP.

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 an extended period of decommissioning

If salts were added to the diluent (bidistilled or acidic bidistilled water), the dosing unit and valve must be washed with methanol or ethanol prior to extended periods of decommissioning. Otherwise scaling 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 to and after the measurement". Repeat the washing process several times.

7.6.3 Replacing the canulas and guide on the autosampler arm of the AS-FD

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

1. Pull off the hoses from the canulas.
2. Loosen the fixing screw on the autosampler arm.
3. Pull the canula guide with canulas upwards and out.
4. Fit the guide with the new canulas into the autosampler arm and fix in place with the locking screw.

CAUTION! RISK OF FRACTURE!

Set the canula 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 canula. Plug the dosing tube for the diluent onto the thicker canula.

7.6.4 Replacing the canula on the autosampler arm of the AS-F

The canula for picking up the sample (thin canula) must be replaced if there is a significant contamination or mechanical damage (detectable by large standard deviations in the measurements).

1. Pull the intake tube off the canula.
2. Loosen the lock screw at the autosampler arm and pull out the canula.
3. Insert the new canula and fix with the clamp nut.

CAUTION! RISK OF FRACTURE!

Set the canula height for it to terminate 1-2 mm above the washing cup.

4. Plug the intake tube onto the new canula.

7.6.5 Replacing the intake tube

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

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

7.6.6 Replacing the tube set for diluent and washing liquid at the AS-FD

1. Pull the dosing tube for diluent off the thicker canula at the autosampler arm and feed it through the tube guide (8 in Fig. 36 p. 63).
2. Detach the tube for the washing liquid at the rear of the autosampler (5 in Fig. 37 p. 65).
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. 38 p. 65).
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 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 canula of the autosampler arm.

7.6.7 Clean-up after cup overflow

If during the process the washing cup or mixing cup (with AS-FD) has overflowed, immediately 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 surface dry.
3. *Washing 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 for AS-FD):

   Use  to open the AUTOSAMPLER window. Change to the tab FUNCTION TESTS.
   In the area PUMPS enable the checkbox MIX CUP PUMP to start the pump.
   Run the pump until the liquid has been drained off.
   Disable the checkbox MIX CUP PUMP, to stop the pump

7.7 Compressor JUN-AIR 6/S

IMPORTANT

Observe the maintenance and care instructions in the separate instruction manual "Compressor JUN-AIR 6/S".

Maintenance work

1. Drain the water separator at the filter and the pressure cylinder:
   Drain off the oily condensation water every one to three months by opening the drainage tap.

CAUTION!

Condensation water sprays out when released under pressure.

Open the drainage tap carefully. Drain off the oily condensation water into a narrow necked bottle with a tube.

2. Clean the aspirating filter:
   A dirty aspirating filter impairs compressor performance. Clean or replace the filter at least every six months.
3. Refill/change oil:
   Note: Only use the special oil SJ 27!
   Check the oil level in the gauge regularly. Refill the oil at the oil screw if necessary. Change the oil every 12 months. To do this, unscrew the gauge glass and tilt the compressor enough so that the used oil can drain off completely. Screw the gauge back on and refill with approx. 0.75 liter of oil at the oil screw. Check the oil level.
4. Check the safety valve:
   Allow air to escape from time to time by turning the knurled nut. The valve position is thus prevented from sticking and the functioning is guaranteed.
   Note: Do not damage the seal and do not alter the setting of the safety valve!

8 Transportation of the contrAA 700

Auxiliary tooling

- ❑ 4 carrying handles
- ❑ 19 mm W/F open-end wrench (included in delivery)
- ❑ 17 mm W/F open-end wrench (included in delivery)

Working steps

CAUTION! RISK OF INJURY!

- ❑ Handles which are screwed in too loosely may give rise to damage during transport. Screw in the handles up to the end stop.
- ❑ The device must be transported by at least 4 persons using the fixed screw-in carrying handles (included in scope of supply).
  The contrAA 700 is too heavy for two persons (→ Section "Technical data of contrAA 700" p. 13). In addition, it is not possible to get an adequate grip for transport without the screw-in handles. There is a risk of injury if transport is attempted without using the handles or by too few people.

1. Deinstall all components (refer to chapter "Installation and start-up" p.45. Make sure that drain tube was removed from sample compartment.
2. Unscrew door before flame sample compartment.
3. Break gas supply up-line of all gas inlet ports.
4. Detach gas supply tubing on the back of the contrAA 700:
   - Detach argon tube from tube clip.
   - Use 17 mm W/F open-end wrench for air supply port.
   - Use 19 mm W/F open-end wrench for acetylene gas port.
     Left-hand threading!
   - Use 19 mm W/F open-end wrench for nitrous oxide supply port.
5. Use 19 mm W/F open-end wrench for acetylene gas supply port. Left-hand threading!
6. Detach electrical cables.
7. Remove four seal plugs from the mounting holes for carrying handles on both sides of the contrAA 700 and keep them in a safe place.
8. Screw all four carrying handles fully in until they are firmly seated in mechanical stop position.

9 Disposal

Typically, atom absorption spectrometry generates only liquid waste which, besides metal or heavy metal ions, mainly contains various mineral acids that are involved in sample preparation procedures. For safe removal, such resulting waste solutions must be neutralized, using, for example, diluted sodium hydroxide solution.

Once neutralized, such waste must be made available for proper disposal in accordance with currently valid rules of law.

Under currently binding legislation, the contrAA 700, including its electronic components, must be disposed as electronic waste on expiry of the rated service life.

You are requested to dispose of the xenon lamp in accordance with local rules or contact the Customer Service of Analytik Jena AG for this purpose.

10 Abbreviations / terms

EA	Electrothermal atomizer
TTP	Temperature-time programming / furnace program
EA operation	Operation with electrothermal atomizer
Analysis 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 for the analysis
Determination limit	The minimum weight (concentration) of the element to be analyzed that can be determined with a defined precision. Also see 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. It may also 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 sample solution 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 specific graphite tube is calculated. A new graphite tube is "burned in" during this process.
ID/Wt	Identity and weight. Identity data and weight/mass of a sample.
Continuum source	Radiator, the radiation of which is continually distributed over a large wavelength range. The contrAA 700 uses a xenon lamp as an excitation source.
Neutral value solution	Solution which contains the chemicals 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 includes all data required for the analysis of samples of a specific element, i.e. the spectrometer, atomizer, calibration, sample, autosampler and QC settings, if necessary also the settings for the QC charts and the results windows (if these parameters have been included in the method). Methods can be saved and reloaded. When changing from one method to another, all ASpect CS settings are transferred to the new analysis task.
Measurement solution	Any solution that is measured directly.
Measuring program	A collection of methods which requires compatible analysis

	conditions (i.e., the same analysis technique, the same autosampler, etc.) and which has been put together in a specific order. A measurement program is used to analyze a sample sequence (semi)automatically for different elements "at the same time". ("At the same time" 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. Also see determination limit.
Zero solution	Solution which is used to set the zero point. This can be the solvent or the blank value solution or neutral value solution.
Precision	Measure of the statistical deviation of the measurement values from a mean value (standard deviation, relative standard deviation)
Sample solution	Solution which originates after treating the sample to be analyzed according to the analysis instructions. If no additional processing steps are required, this is the measuring solution.
Pyrolysis	Most effective removal of incidental substances from the sample by heating in the graphite tube furnace, without vaporizing any part of the analytes.
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-fold determination in medicine: 20 days, each with 20 measurements)
Statistical series	For calculating the statistical accuracy of an analysis, the individual sample is analyzed for the current element several times in a row. This sample analysis series is defined as a statistical series in this manual.
Stock solution	Solution of a suitable composition (diluent, acid type, acidic content, etc.) which contains the analytes in high and known concentrations. The stock solution is used for making reference solutions.
Background compensation	Evaluation of measurement value with no background. The background compensation occurs simultaneously.
Background measurement	Measurement of the spectral background in the environment or under the analysis line.

analytikjena

EG-Konformitätserklärung

EC Declaration of Conformity

Analytik Jena AG ● Konrad-Zuse-Straße 1 ● 07745 Jena

Wir erklären hiermit die Übereinstimmung des genannten Gerätes mit der EG-Richtlinie 89/336/EWG über die elektromagnetische Verträglichkeit geändert durch EG-Richtlinie 93/68/EWG und dem EMV-Gesetz vom 18.09.98, sowie der Niederspannungsrichtlinie 73/23/EWG für die Gerätesicherheit geändert durch EG-Richtlinie 93/68/EWG

Bei Änderungen am Produkt, die nicht von uns autorisiert wurden, verliert diese Erklärung ihre Gültigkeit.

We declare the compliance of that device with the requirements of the Electromagnetic Compatibility Council Directive 89/336/EEC amended by Council Directive 93/68/EEC and the Low Voltage Council Directive 73/23/EEC for device security amended by Council Directive 93/68/EEC

Any modification to the product, not authorized by us, will invalidate this declaration.

Gerätebezeichnung / Device name

contrAA® 700

Normen / Standards

DIN EN 61326-1 :2006
DIN EN 61010-1:2002

Grundlage-Prüfbericht EMV Nr. / Basis-Testreport EMC No.

SJ-QP/EMV 006/2008
SJ-QP/GS 001/2008

Das Gerät ist gekennzeichnet mit / The device is marked with: CE

Prüfung / Test:

Carl Zeiss Jena GmbH
Service-Center
Qualität Prüfzentrum

Klaus Berka
Vorstandsvorsitzender
CEO

Jena, den 26.03.2008

Dr. Friese
Qualitätsmanager
Quality Manager

Die Erklärung bescheinigt die Übereinstimmung mit der Richtlinie und dem Gesetz Gewährleistung und Haftung sind in unseren Allgemeinen Lieferbedingungen geregelt.
The declaration certifies the compliance with the Directive and the Law. Conditions of guarentee and liability are dealt within our General conditions of Sale.