

Operating Manual

Automatic Boat Drive



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

General Information <http://www.analytik-jena.com>

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1 Basic information

1.1 Notes on the operating manual

The Automatic Boat Drive (ABD) is a system module of the modular analyzer models multi EA 5000 / multi EA 5100 and multi X 2500. The ABD is controlled via the multiWin software.

This operating manual is therefore only valid in conjunction with the following documents:

- multi EA 5000 / multi EA 5100 or multi X 2500 user manual
- multiWin software manual

The sample feeding module is intended for operation by qualified specialist personnel observing this operating manual.

The operating manual gives information about the design and operation of the sample feeding module and provides operating personnel familiar with analysis the necessary know-how for the safe handling of the device and its components. It further includes notes on the maintenance and service of the equipment and potential causes and remedies of any faults.

Conventions

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

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

Elements of the control and analysis program are indicated as follows:

- Program terms are in bold (e.g., the **System** menu).
- Buttons are indicated by square brackets (e.g., [OK]).
- Menu items are separated by vertical lines (e.g., **System** | **Device**).

Symbols and signal words used in this manual

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



WARNING

Indicates a potentially hazardous situation which can cause death or very serious (possibly permanent) injury.



CAUTION

Indicates a potentially hazardous situation which can cause slight or minor injuries.



NOTICE

Provides information on potential material or environmental damage.

1.2 Intended use

The ABD is intended for the horizontal operating mode of the multi EA 5000 / multi EA 5100 or the multi X 2500. The ABD can be used to introduce solid or liquid samples that have been placed in quartz glass boats into the analyzer's combustion system. Via the injection port of the sample sluice, it is also possible to introduce gaseous samples.

The ABD can only be used in conjunction with the multi EA 5000 / multi EA 5100 or the multi X 2500. The modules are controlled by the multiWin control and analysis software.

The ABD may only be used for the sample feeding procedures described in this operating manual. Any other use is not as intended!

The intended use also requires that you observe the notes in the user manuals for the multi EA 5000 / multi EA 5100 and multi X 2500 and in the multiWin software manual.

2 Safety instructions

2.1 General notes



NOTICE

This user manual is only valid in conjunction with the following documents: user manual of the analyzer and software manual of the multiWin control and analysis software.

Observe in particular the notes in the "Safety notes" chapters of the user manuals. The notes included there apply analog also to the ABD without any limitations. Special danger emanating from the ABD is referred to in the following chapters.

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

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

2.1.1 Safety markings

The warning labels and safety symbols attached to the device are an integral part of the device and must be strictly observed.



CAUTION

Danger of incorrect actions leading to personal injury and material damage due to missing warning notes!




Warning notes and safety symbols must not be removed!

Before switching on the device, check that warning notes and safety symbols are complete and intact.

Do not put the device into operation if warning notes or safety symbols are missing or damaged.

Damaged or missing warning notes or safety symbols must be replaced without delay.

The following symbols are attached to the device:

Symbol	Meaning	Remark
	Disconnect the power supply before opening the device cover.	Before opening the device cover, switch off the device and disconnect the mains plug from the mains socket.
	Observe the operating manual	Before starting work, read the operating manual.
	Warning against a hazard location!	Warning against mechanical danger from moving equipment parts!




Symbol	Meaning	Remark
	Warning of hand injuries!	Warning against crushing resulting from device components which are moving!
	For People's Republic of China only	The device contains controlled substances. Analytik Jena warrants that these substances will not be released from the device within the next 25 years provided the device is employed as intended.

Table 1: Warning symbols

2.2 Safety notes on the ABD

Observe the following notes when connecting and operating the ABD:

- Position the ABD in such a manner that unintentional pushing or moving of the device is prevented. Pushing or moving the device can cause the ABD connection piece or the combustion tube to break!
- For safe positioning and easy and correct alignment of the ABD, always fit the guide rail to the analyzer to protect the ABD connection piece or the combustion tube against glass breakage.
- Never operate the ABD without the protective cover placed over the guide tube! In case of a faulty gas supply there may be explosive detonations of the sample with destruction of the guide tube!
- Only connect the ABD to a properly grounded mains outlet in accordance with the voltage specifications on the type plate. Observe in particular the notes in the "Electrical safety notes" chapters of the user manuals for the analyzer and also the notes in chapter (→ "Power supply"  15) of this user manual.
- Connect the ABD only via the provided interfaces to the analyzer:
 - "RS 232 multi EA" interface at the rear of the device
 - Interface "sampler" at the rear of the analyzer



CAUTION

In case of an emergency shutdown, observe the notes in the manual of the analyzer.

- The supply of hazardous substances (for a definition, see the manual of the analyzer) is the exclusive responsibility of the operator. Always wear goggles and protective gloves!
- Do not touch components directly involved in the analysis process (sluice, quartz boats, adsorption material, ...) with your bare hands. Touching these components with your bare hands can result in problems with blank values. Always wear suitable protective gloves.
- The device may only be connected to power sources whose nominal voltage is the same as that on the rating plate of the equipment. Do not replace the removable power cable of the device with a power cable that does not meet the specifications (with no protective ground conductor). Extensions of the supply cable are not permitted!

2.3 Decontamination after soiling

Observe the following:

- The operator is responsible for carrying out suitable decontamination should the device become contaminated externally or internally with dangerous substances.
- Splashes, drops or larger liquid spillages should be removed using an absorbent material such as cotton wool, laboratory wipes or cellulose.
- For biological contamination, wipe the affected area with a suitable disinfectant, such as an Incidin Plus solution. Then wipe the cleaned areas so that they are dry.
- The only suitable cleaning method for the housing is wipe disinfection. If the disinfectant has a spray nozzle, apply disinfectant to a suitable cloth before using it on the device.
Particular care must be taken if infectious materials are analyzed with the device, as the device cannot be decontaminated as a single unit.
- Before using a cleaning or decontamination procedure other than that prescribed by the manufacturer, the user is required to check with the manufacturer that the intended procedure will not damage the device. Safety labels attached to the device must not have methanol applied.

2.4 Safety instructions – maintenance and repair

The device is generally maintained by the customer service department of Analytik Jena or specialist personnel trained and authorized by them.

Unauthorized maintenance can damage the device. For this reason, only the activities described in the user manual in the "Maintenance and care" chapter may be performed by the operator.

- Only clean the exterior of the device with a slightly moistened, non-dripping cloth. Use only water and, if required, customary surfactants.
- All maintenance and repair work on the device must only be carried out when the device is switched off (unless specified otherwise).
- Allow the device to cool down before any maintenance work or replacement of system components.
- The gas supply must be shut off before performing any maintenance or repair work (unless specified otherwise).
- Use only original spare parts, wear parts and consumables. They have been tested and ensure safe operation. Glass parts are wear parts and are not subject to the warranty.
- All protective equipment must be reinstalled and checked for proper function when the maintenance or repair work is complete.
- Check that all hose connections are gas-tight after maintenance.

2.5 Behavior in hazardous situations

In hazardous situations or in the event of an accident, immediately switch off the ABD at the main switch and pull the mains connector from the power outlet (see manual of the analyzer)!

3 Technical description

3.1 Structure of the ABD

3.1.1 Main components

The ABD sampler module is a system module for the horizontal operating mode of the modular analyzer models multi EA 5000 / multi EA 5100 and multi X 2500.

The ABD is used to transport quartz boats into the combustion tube of the analyzer. The boats can accept liquid or solid substances. The ABD can also be used for the analysis of gas or liquid gas samples (refer to the user manuals of the gas samplers).

The ABD consists of the following main components:

- cooled sample sluice with flap
- injection port for liquids and gases
- guide tube
- hook
- protective cover
- guide rail
- control elements, LED indicators

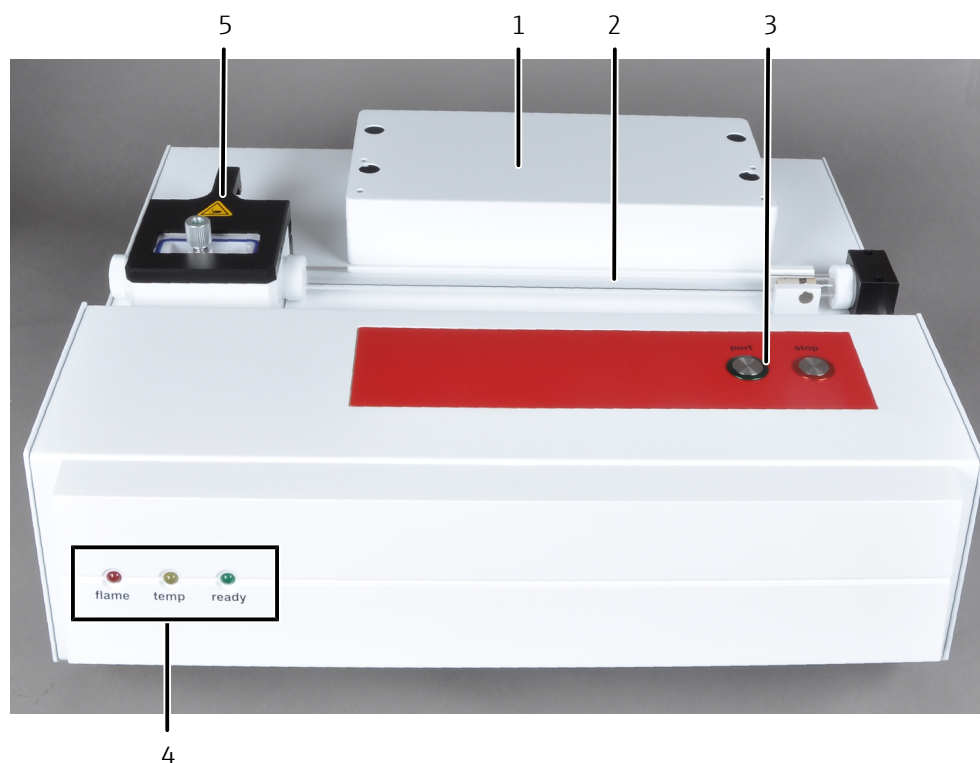


Figure 1 ABD main components

- | | |
|--|---|
| 1 Attachment option for sampler | 2 Guide tube (protective cover not shown) |
| 3 Control elements | 4 LED displays |
| 5 Sample sluice with flap and injection port | |

3.1.2 Guide tube with hook

The guide tube includes a hook with magnetic coupling by which the quartz boat is transported into the combustion tube. A protective cover has been placed over the guide tube to protect the operator.

The hook with magnetic coupling has been packed separately in a protective tube. It must be inserted into the guide tube when setting up the ABD.

3.1.3 Device switch/interfaces/LED indicators

The main switch for switching the ABD on and off is located on the right of the back-plate (viewed from the front). The equipment fuse and mains connector are positioned below.

The RS 232 interface for connection to the analyzer ("sampler" interface) and the connection for the connection cable of the flame sensor are in the center at the rear of the device.



Figure 2 Rear of the device

- | | |
|---|--|
| 1 Equipotential bonding connection | 2 Connection for connection hose 16 from the "ABD" gas outlet of the analyzer (Ar/O ₂) |
| 3 Power connection | 4 Equipment fuse |
| 5 Mains switch | 6 Connection for the connection cable of the flame sensor |
| 7 Communication interface to the analyzer | |

At the front of the ABD, LED indicators are arranged with the following meaning:

- | | |
|-------|--|
| flame | illuminates red as soon as the flame is present or has been detected; illuminates proportionate to the brightness of the flame |
| temp | illuminates yellow if the set cooling temperature of the sample sluice has been reached |
| ready | illuminates green if the ABD is ready for operation or the next action can be performed (is not illuminated whilst an action is being performed) |



Figure 3 LED displays

- 1 "flame" LED indicator
- 2 "temp" LED indicator
- 3 "ready" LED indicator

3.1.4 Sample sluice with flap and injection port

The cooled sample sluice is used for feeding samples in horizontal operating mode. Quartz glass boats (solids) filled with sample are transferred into the ABD by means of the flap. Liquids are metered directly via the injection port of the flap into a quartz glass boat. Gas and liquid gas samples are metered by means of a special cannula (gas metering module) through the injection port directly into the ABD connection piece. A quartz glass boat is not required.

In addition, for liquids in the sample sluice, the used quartz glass boats are cooled to room temperature after combustion (cooling time at least 200 s) to prepare them for the next analysis.

The opening and closing of the sample sluice during measurement and the transport of the quartz boat into the combustion tube is controlled via the multiWin control and analysis software.

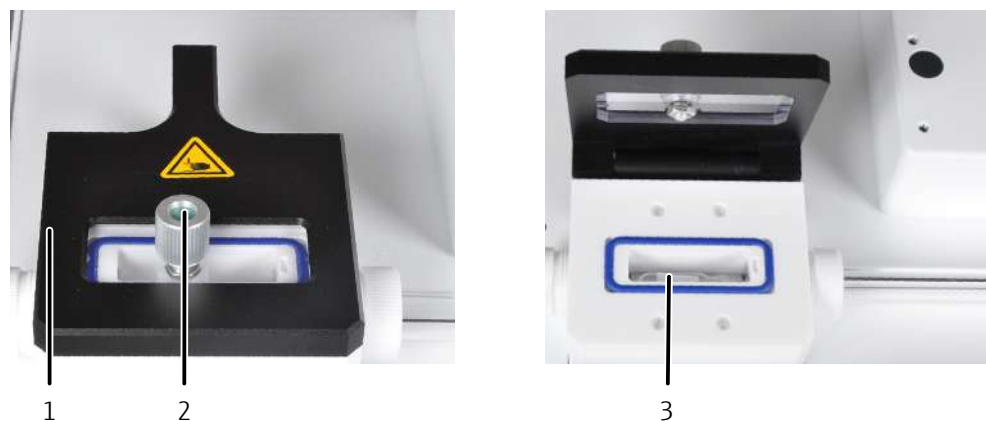


Figure 4 Sample sluice/injection port

- 1 Flap
- 2 injection port
- 3 Quartz boat with carrier material

3.1.5 ABD connection piece

The connection between the ABD and the combustion tube of the analyzer is established via a connection piece with seals and screwed connection (see fig.).

The installation of the connection piece to the combustion tube of the analyzer is described in chapter (→ "Connecting the ABD to the analyzer" 35).

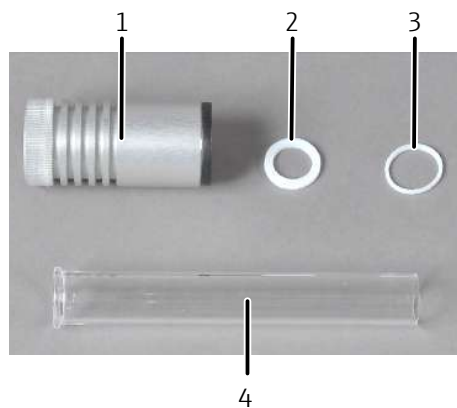


Figure 5 ABD connection pieces

- | | |
|--|---|
| <p>1 Screwed connection</p> <p>3 Sealing element between screwed connection and ABD connection piece</p> | <p>2 Sealing element between combustion tube and connection piece</p> <p>4 ABD connection piece</p> |
|--|---|

3.1.6 Control elements

The two buttons on the device cover have the following functions:

- "port" button
Actuating the button opens or closes the sample sluice.

Note:

The button is locked during measurements.

- "stop" button
The button is used to shut down the ABD immediately in case of danger. After actuating the button the ABD must be switched off and back on.



NOTICE

A defined stop is always possible via the multiWin control and analysis software.

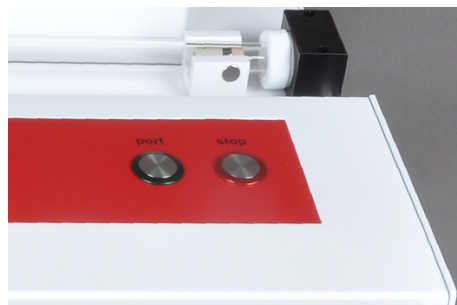


Figure 6 Control elements (push buttons)

3.1.7 Type plate

This type plate is attached to the rear of the device.

The type plate contains the following information:

- Manufacturer address
- Trading name
- Electrical connection data
- WEEE marking
- CE marking

3.2 Principle of operation

Extending the multi EA 5000 / multi EA 5100 or the multi X 2500 by the ABD sampler module allows determination of the sulfur, nitrogen, chlorine and carbon content particularly in solids, but also in liquids and gases. The ABD can only be used in horizontal operating mode.

Solids are weighed into quartz boats and transferred into the sample sluice. Liquids are metered onto the quartz boat through the injection port at the sluice flap. The sample is supplied either manually or automatically using the Multi Matrix Sampler or autoX 112 Multi Matrix sampler.

The quartz boat is moved out of the cooled sluice into the combustion tube with the aid of a quartz glass hook. The boats are transported according to the program chosen in the multiWin control and analysis software.

The ABD can be operated in three different modes:
parameter, automatic, automatic plus

Parameter mode

The boats are transported, according to the parameters chosen in multiWin, without flame sensor control. The following parameters can be configured:

- Hold points (max. 3)
- Waiting times (max. 3)
- Feed speeds before and between hold points (max. 3)

A program that has been created can be saved and combined with methods (of the same aggregate condition) in the multiWin control and analysis software.

Automatic mode

The combustion is controlled fully-automatically via the evaluation of the flame sensor. This mode is universal and can be used for liquid and solid samples, varying sample matrices and varying sample quantities.

Automatic plus mode

The combustion is controlled fully-automatically via the evaluation of the flame sensor. Via a test drive of the ABD, a time-optimized combustion takes place. This is adjusted to the specific sample matrix and the selected sample quantity. A program that has been created must be saved and combined with a method (of the same aggregate condition) before it can be used.

For metering of gaseous samples, a flexible cannula including screw cap and septum is placed onto the sluice port of the ABD. The cannula is connected with the gas metering module. The ABD is merely the connecting link between the gas metering module and the combustion system. Mechanical feeding or control of combustion via the flame sensor does not take place in this case. The sample sluice is not cooled.

4 First commissioning

4.1 Location requirements

4.1.1 Installation conditions

The climatic conditions in the operating room of the ABD are defined by the requirements of the overall system:

- Temperature range: +20 to +35 °C
- Max. humidity: 90 % at 30 °C
- Air pressure: 0.7 to 1.06 bar
- Maximum altitude: 2000 m

The following requirements are placed on the location of the ABD:

- This laboratory device is designed for inside use.
- Do not use the device in wet and damp environments. Keep the device surface clean and dry.
- Avoid direct sunlight and radiation from heaters onto the device. If necessary, provide air conditioning.
- Place the device on a heat-resistant and acid-resistant surface.
- Do not locate the device near sources of electromagnetic interference.
- Avoid mechanical shocks and vibrations.
- Do not use the device in explosion-hazard environments.
- Position the ABD in such a manner that unintentional pushing or moving of the device is prevented. Pushing or moving the device can cause the ABD connection piece or the combustion tube to break!
- Never cover the air vents of the ABD with other equipment or installations!
- Keep a safety distance of at least 5 cm from the rear to other equipment or walls!

4.1.2 Spatial requirements

The ABD must be placed to the right of the analyzer. The arrangement of further system components can be adapted to the local conditions.

The space requirement results from the system modules required for the measuring task. Sufficient space should also be provided for a PC, monitor and printer.

4.1.3 Power supply

The ABD may only be connected to a properly grounded mains outlet in accordance with the voltage specifications on the type plate.

The ABD is operated with single-phase alternating current.

The installation of the electrical equipment in the laboratory must comply with the DIN VDE 0100 standard. At the connection point, an electrical current in accordance with the standard IEC 38 must be available.

4.1.4 Gas supply

The gas supply is realized via the appropriate analyzer (refer to the user manual of the multi EA 5000 / multi EA 5100 or multi X 2500).

4.2 Unpacking and setting up the ABD



NOTICE

The ABD may only be positioned, assembled and installed by the customer service department of Analytik Jena or by specialist personnel authorized and trained by Analytik Jena!

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



NOTICE

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

Please check when unpacking the device for completeness and soundness of the delivery in accordance with the packing list included.

After assembly the customer service checks the operation of the system components and documents the test.

5 Operation

5.1 Basic Information

The ABD can only be operated in conjunction with the analyzer. To operate the ABD, the user manual for the respective analyzer and the manual for the multiWin control and analysis software should, therefore, also be consulted.

If a sampler is mounted on the ABD, please also observe the instructions in the respective user manual.



NOTICE

Do not touch components directly involved in the analysis process (sluice, quartz boats, adsorption material, ...) with your bare hands. Touching these components with your bare hands can result in problems with blank values. Always wear suitable protective gloves.



NOTICE

Type and source of the hazard

Observe the maximum permissible sample quantities (→ "Specifications" 39).

5.2 Preparing the quartz boat for the analysis



NOTICE

Temper the quartz boats and the quartz-fiber material prior to first use to avoid problems with blank values.

Only touch the tempered boats with gloves.

Keep the boats free from contamination in the exsiccator or in a screw-top bottle.

The carrier material should be used for all measurements of liquids and solids to prevent the rapid and uncontrolled evaporation/splashing of the samples and the resulting system contamination or incomplete combustion. It also acts as sacrificial material and binds any ionic contamination contained in the samples (e.g. alkaline and heavy metal ions etc.) and can thus contribute to an increased service life of the quartz glass components.

As an exception, AOX, EC/OC measurements do not require carrier material.

- ▶ Using a clean pair of scissors, cut a sufficiently large piece of carrier material from the quartz fleece supplied. The piece must cover the floor of the boat and must not protrude at the sides.
- ▶ Place the carrier material onto the floor of the boat.
- ▶ Temper the quartz boat with the carrier material prior to first use.

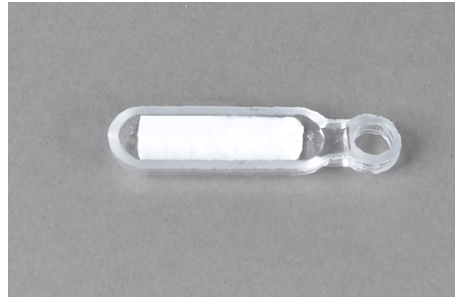


Figure 7 Quartz boat with the carrier material inserted



NOTICE

Only use a single undamaged piece of quartz fleece as carrier material! When using several small or damaged pieces, correct functionality cannot be ensured.

5.3 Manual sampling

Solid sample

Prerequisite: System components have been switched on, the multiWin control and analysis software is running, an appropriate method has been selected.

- ▶ Fill a quartz boat with carrier material (→ "Preparing the quartz boat for the analysis" 17).



NOTICE

Temper both components or use tempered components. As an exception, AOX and EC/OC measurements do not require carrier material.

- ▶ Weigh the solid sample into a quartz boat.
- ▶ When prompted by the software to do so, use tweezers to insert the quartz boat into the open sample sluice, making sure that the eye is placed onto the hook.
- ▶ Click on [OK] to confirm that the quartz boat has been inserted.
 - ✓ The sample sluice closes. After a rinsing time has elapsed, which can be configured in a method, the quartz boat is transported into the combustion tube according to the parameters specified in the method.

Liquid sample

Prerequisite: System components have been switched on, the multiWin control and analysis software is running, an appropriate method has been selected.

- ▶ Fill a quartz boat with carrier material (→ "Preparing the quartz boat for the analysis" 17).



NOTICE


Temper both components or use tempered components. If no quartz fleece is used, uncontrolled spontaneous evaporation of the complete sample or splashing of the sample may occur. In the worst case, the system is contaminated!

- ▶ Open the sample sluice by pressing the "port" button.
- ▶ Using tweezers, insert the quartz boat into the open sample sluice. making sure that the eye is placed onto the hook.
- ▶ Close the sample sluice by pressing the "port" button again.
- ▶ When prompted by the software to do so, meter the liquid sample using a microliter syringe through the septum of the injector port directly onto the boat filled with carrier material.
- ▶ Click on [OK] to confirm metering.
- ▶ Start the measurement.
 - ✓ The quartz boat is transported into the combustion tube according to the parameters specified in the method.

5.4 Sampling using the sampler

Solid sample

Prerequisite: System components have been switched on, the multiWin control and analysis software is running.

- ▶ Fit the AOX/solids rack to the sampler and insert the gripper into the metering head (refer to the user manual of the sampler).
- ▶ Adjust the sampler.
- ▶ Fill a quartz boat with carrier material
(→ "Preparing the quartz boat for the analysis"  17).



NOTICE

Temper both components or use tempered components.

As an exception, AOX and EC/OC measurements do not require carrier material.

- ▶ Weigh the solids sample into quartz boats and place these into the AOX/solids rack of the sampler.
- ▶ Create a method via the **Method | Method - new** menu item or select a method from the method library. Activate the method via the **Method | Method - activate** menu item.
- ▶ Start the measurement.
 - ✓ The analyzer starts processing the analysis sequence.


Liquid sample



NOTICE

Before opening the sluice, remove the solvent container (if present) of the sampler.

Prerequisite: System components have been switched on, the multiWin control and analysis software is running.

- ▶ Fit the EOX/liquids rack to the sampler and insert the metering syringe into the metering head.
- ▶ Fill a quartz boat with carrier material
(→ "Preparing the quartz boat for the analysis"  17).



- ▶ Temper both components or use tempered components.
-

NOTICE

ATTENTION!

If no quartz fleece is used, which is prohibited in liquid mode, uncontrolled spontaneous evaporation of the complete sample or splashing of the sample may occur. In the worst case, the system is contaminated!

- ▶ Open the sample sluice by pressing the "port" button.
- ▶ Using tweezers, insert the quartz boat into the open sample sluice. making sure that the eye is placed onto the hook.
- ▶ Adjust the sampler.
- ▶ Insert the sample cups containing the liquid samples into the EOX/liquid rack of the sampler.
- ▶ Start the measurement.
 - ✓ The analyzer starts processing the analysis sequence.

6 Troubleshooting

6.1 General notes

For fault analysis, log files can be recorded. Log file recording should be activated after consultation with Analytik Jena customer service for specific faults.

The save location of the log files can be defined via the **Extras | Configuration** menu item on the **Error analysis** tab.



NOTICE

If faults cannot be remedied by the customer, the Service department must always be informed. This also applies for the repeated occurrence of individual faults. Send the correspond files to the service department via email for fault diagnosis (address on inside of the front cover).



NOTICE

For information on error messages and status displays of the control and analysis software, see the respective user manual of the analyzer.

6.2 Equipment faults and analytical problems

6.2.1 General notes

This chapter only deals with problems that can occur when working with the ABD and can usually be resolved independently by the user.



NOTICE

If faults cannot be remedied by the customer, the Analytik Jena service department must always be informed. This also applies for the repeated occurrence of individual faults. Send the corresponding files to the Service department via e-mail for fault diagnosis.

6.2.2 Device error

Error	Possible cause	Remedy
Target flow at the tube outlet too low (leak at the ABD)	Finger-tight screwed connection at the ABD gas inlet leaking	Check screwed connection (ferrule), tighten finger-tight
	Connection hose 16 not connected to the analyzer	Connect the connection hose to the "out ABD" connection of the analyzer
	Connection between ABD connection piece and sample sluice leaking	Check orientation and position of the ABD connection piece and correct if necessary: ABD connection piece must be horizontally and vertically correctly aligned with the combustion tube ABD connection piece must be inserted to the stop in the sample sluice – if necessary, loosen the clamping ring, correct the position and firmly re-tighten the clamping ring
Explosion-like deflagration of the sample (Caution!)	Screw connection between ABD connection piece and combustion tube leaking	Check screw connection and seat of the seals, replace seals, if required
	Septum at the injection port of the sample sluice leaking or incorrectly installed	Check whether the septum fits properly Replace septum
	Sluice lid not correctly connected or sluice seal defective	Connect the lid correctly Carry out maintenance and care Replace the sluice seal
Explosion-like deflagration of the sample (Caution!)	Argon as pyrolysis gas not present	Check if argon is present at the "out ABD" gas outlet of the analyzer and if the connection hose between analyzer and ABD is connected correctly
	Massive leakiness of the system	Check the system for leaks and correct any leaks (see user manual of the analyzer)

Table 2: Error table

6.2.3 Analytic problems

Error	Possible cause	Remedy
Carryover	Sample sluice contaminated with sample	Remove sample material from the sample sluice, wipe out the sluice, lid and injection port with alcohol and allow them to dry.
	ABD connection piece contaminated	Clean the ABD connection piece and seal elements and replace them if necessary.
	Inadequate cooling of the sample sluice	Check cooling, if necessary inform Service

7 Maintenance and care

7.1 Maintenance intervals

Maintenance task	Maintenance interval
Clean and maintain the device	weekly
Check hose connection (hose 16) for tight fit and leaks	daily
Clean ABD connection piece	as required (in the case of sample component deposits)
Clean sluice	as required
Check seals	weekly
Replace septum 12.5 mm	as required if leaking or contaminated
Replace quartz boat	as required, in the case of surface devitrification
Replace carrier material in the quartz boat	as required in the case of discoloration, breakage, hardening, change in shape or transparency, analytic problems (blank value)

Table 3: Maintenance overview



NOTICE

When performing maintenance or care work, always wear appropriate protective gloves. In particular, do not touch components directly involved in the analysis process (hook, sluice, ABD connection piece, ...) with your bare hands. Touching these components with your bare hands can result in problems with blank values (especially during nitrogen determination).

7.2 Gas tightness

Ensure that all connections are gas-tight again after servicing:

- Tighten the finger-tight screw connection (hose 16) finger-tight!
- Ensure that the screw connections are not skewed!
- Ensure that the ABD connection piece is installed correctly!
- Check the system for tightness (see user manual of the analyzer).

7.3 Installing/disconnecting the ABD at the combustion tube

For maintenance of the combustion tube and to replace/clean the hook and the guide tube, the ABD must be disconnected from the combustion tube.

The connection and disconnection of the ABD at the combustion module must be performed with utmost care. Otherwise the combustion tube can break easily. Adhere exactly to the notes below to minimize the risk of breakage!



Note:

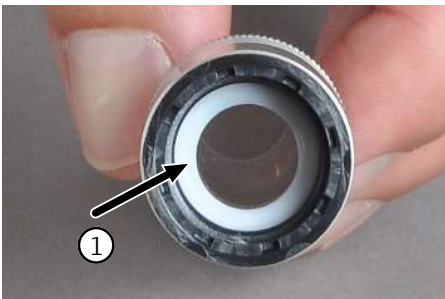
Use the face spanner included in the scope of delivery to loosen and to firmly tighten the PEEK clamping rings at the sample sluice.

7.3.1 Installing the ABD at the combustion tube



NOTICE

During all work on the combustion tube or the ABD connection piece, the pneumatic seal must be depressurized. Otherwise it may be damaged.



- ▶ Switch off the basic module and the ABD at the device switch.
- ▶ Place the narrow seal (1) in the screw connection of the ABD connection piece.



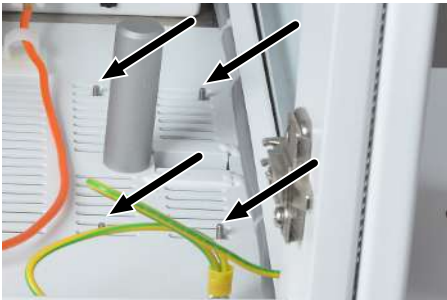
- ▶ Push the screw connection all the way onto the ABD connection piece (2).
- ▶ Place the broad seal onto the sealing surface of the ABD connection piece in the screw connection.



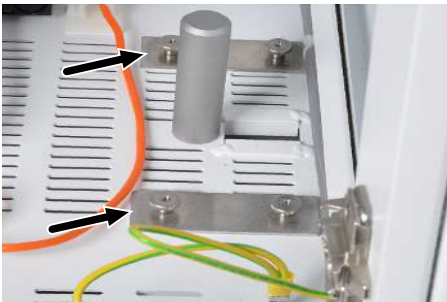
- ▶ Using the face spanner supplied, loosen the left clamping ring at the sample sluice.
- ▶ Push the prepared ABD connection piece into the clamping ring until its end touches the stop in the sample sluice.



- ▶ Using the face spanner, carefully tighten the clamping ring.



- ▶ First mount the guide on which the ABD is aligned towards the basic module. Then open the front doors of the basic module.
- ▶ Turn the combustion furnace into the vertical position.
- ▶ Push the guide under the right side of the basic module until the mounting pins protrude through the front and rear ventilation slots in the floor of the basic module (see arrows).



- ▶ Place the perforated plates on the mounting pins of the guide and screw the plates on loosely. The guide must still be movable.

- ▶ Turn the combustion furnace into the horizontal position and insert the combustion tube in the furnace.
- ▶ Carefully move the ABD towards the basic module until the ABD connection piece and the combustion tube almost touch.
- ▶ The connection piece and the combustion tube must be at the same height so that both can be easily connected. If necessary, use the adjustable feet of the ABD to adjust the height.

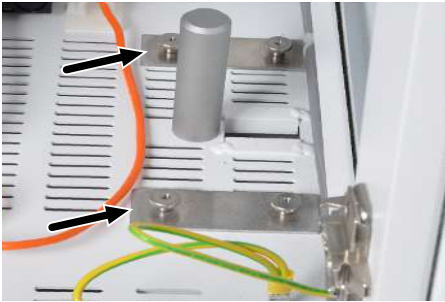


NOTICE

Danger of glass breakage

Perform the height adjustment with care. The combustion tube must not be jammed or be under stress during the subsequent coupling in the sample sluice.

- ▶ Screw the two knurled screws onto the front attachment of the guide.
- ▶ Carefully slide the ABD back on the guide. Be careful not to move the guide. Pull the combustion tube out of the furnace.
- ▶ Turn the furnace into the vertical position.



- ▶ Tighten the knurled screws for fastening the guide finger-tight.



- ▶ Turn the furnace back into the horizontal position.
- ▶ Carefully push the ABD back onto the basic module and check whether the ABD connection piece can be mounted without offset.
- ▶ Now push the ABD further onto the combustion tube by mean of the guide until the screw connection engages with the thread of the combustion tube.
- ▶ Tighten the screw connection finger-tight. Make sure that the broad seal is seated correctly!
 - ✓ The guide of the ABD has been mounted!

7.3.2 Disconnecting the ABD from the combustion tube



NOTICE

During all work on the combustion tube or the ABD connection piece, the pneumatic seal must be depressurized. Otherwise it may be damaged.



- ▶ Switch off the basic module and the ABD at the device switch.
- ▶ Caution
Risk of burning! The screw connection and the combustion tube may be hot!
Only perform the maintenance in cooled-down state.
- ▶ Loosen the screw connection of the combustion tube.

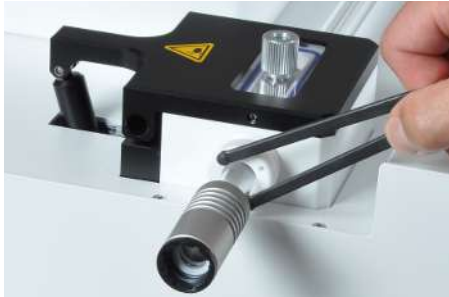


- ▶ Pull back the screw connection.
When the screw connection is pulled back, the seal between the combustion tube and the ABD connection piece falls off.
- ▶ Slightly lift the right-hand side of the ABD and pull the ABD to the side until you have enough space to work in.



NOTICE

Pay special attention to the connection cables on the rear of the ABD (for flame sensor and sampler cable). These could easily tear off.



- ▶ Only carry out the following if necessary during maintenance:
Loosen the clamping ring at the sample sluice.
- ▶ Remove the ABD connection piece from the sample sluice.

7.4 Replacing the septum and cleaning the sluice at the ABD



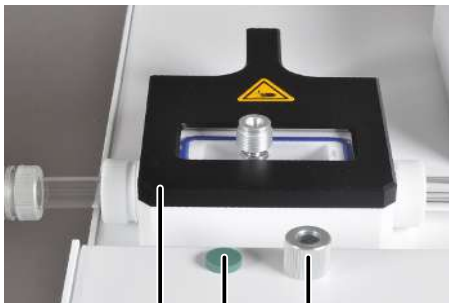
CAUTION

Crushing risk when closing the sample sluice!

High forces occur when closing the sample sluice of the ABD. Do not reach into the sluice area during closing.

Replace septum

If necessary, replace the septum at the injection port of the sample sluice as follows:



1 3 2

- ▶ Unscrew the cap (2) from the injection port (1) and remove the used septum (3) from the cap.
- ▶ Insert a new septum into the cap.
- ▶ Screw the cap onto the injection port and tighten it finger-tight.
✓ The septum has been replaced.

Clean sluice

- ▶ Open the sample sluice. Push the "port" button at the ABD.
- ▶ Clean the interior of the sluice with cellulose soaked in Ethanol. Then allow the sluice to dry out well.
- ▶ Close the sluice by pushing the "port" button again.
- ▶ The sluice closes.

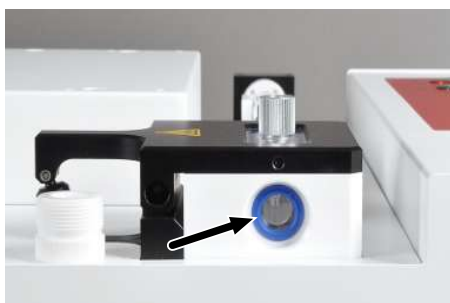
7.5 Replacing the seal at the sample sluice of the ABD



CAUTION

Risk of burning at hot screw connections of the combustion tube!

Only perform the maintenance in the cooled-down state.



- ▶ Disconnect the ABD from the basic module (→ "Installing/disconnecting the ABD at the combustion tube" 25).
- ▶ Push the ABD to the side until you can easily unscrew the clamping ring of the sample sluice.
- ▶ Completely unscrew the clamping ring from the sample sluice.
- ▶ Replace the sealing ring in the sample sluice.
- ▶ Completely unscrew the clamping ring from the sample sluice.
- ▶ Replace the sealing ring in the sample sluice.
- ▶ Screw the clamping ring loosely back in the sample sluice.
- ▶ Re-install the ABD at the basic module (→ "Installing/disconnecting the ABD at the combustion tube" 25).
 - ✓ The sealing ring in the sample sluice has been replaced.

7.6 Cleaning the ABD connection piece



NOTICE

Risk of contamination through touching the inner part of the ABD connection piece with your hand. Wear protective gloves while cleaning the ABD connection piece.

If the ABD connection piece is contaminated with sample, it must be removed and cleaned:

- ▶ Remove the ABD connection piece (→ "Disconnecting the ABD from the combustion tube" 27).
- ▶ Pull the screw connection off the ABD connection piece.
- ▶ Clean the ABD connection piece by wiping it with ethanol and cellulose and then allow the sluice to dry thoroughly.
- ▶ Remove any contamination from the broad sealing element or replace the sealing element.
- ▶ Re-install the ABD connection piece (→ "Installing the ABD at the combustion tube" 25).

7.7 Cleaning and replacing the hook at the ABD



CAUTION

Risk of burns

Risk of burns from the hot side panel and the combustion tube! Only perform the maintenance in the cooled-down state.

If a sampler has been fitted to the ABD, this can be removed prior to pulling out the hook for easier handling (see user manual of the sampler).

If the hook is contaminated or needs replacing, proceed as follows:

- ▶ Disconnect the ABD from the basic module (→ "Disconnecting the ABD from the combustion tube" 27).
- ▶ Switch off the ABD at the mains switch at the rear side.
- ▶ Push the ABD to the side until you have enough space to remove the hook. You can also lift the ABD from the guide.
- ▶ Note the length of the connection cables on the rear of the ABD (flame sensor, sampler cable). These could easily tear off.
- ▶ Remove the protective cover from the guide tube.
- ▶ Push the magnetic coupling with hook carefully up to the stop towards the sample sluice (see arrow).
- ▶ Carefully pull the hook first out of the magnetic coupling and then fully out of the sample sluice of the ABD.
 - ✓ You can now clean or replace the hook.



- ▶ Insert the cleaned hook or a new hook into the sample sluice of the ABD. **NOTICE! Wear gloves when doing so to prevent contaminating the hook.**
- ▶ Carefully slide the hook through the sample sluice until the coupling sleeve of the hook is pulled into the magnetic coupling. The hook must point upward during insertion!



- ▶ Slide the magnetic coupling to the right up to the stop at the block of the gas supply until the hook has been pulled in completely into the guide tube.
- ▶ Put the protective cover back onto the guide tube.
 - ✓ The hook is now installed.

- ▶ Re-install the ABD at the basic module (→ "Installing the ABD at the combustion tube" ☰ 25).
- ✓ The system is now ready for operation again.

7.8 Cleaning or replacing the guide tube

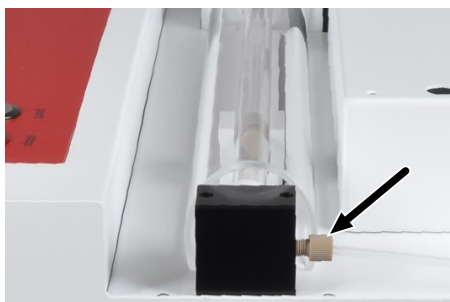


NOTICE

If a sampler has been fitted to the ABD, this must be removed prior to removing the guide tube (see user manual Multi Matrix Sampler).

If the guide tube needs cleaning or replacing, proceed as follows:

- ▶ Switch the ABD off from the equipment switch.
- ▶ Disconnect the ABD from the basic module (→ "Disconnecting the ABD from the combustion tube" ☰ 27).
- ▶ Remove the hook from the guide tube (→ "Cleaning and replacing the hook at the ABD" ☰ 30).
- ▶ Unscrew the argon hose (arrow) at the block of the gas supply.



- ▶ Using the face spanner, loosen the clamping ring at the right side of the sample sluice.



- ▶ Loosen the clamping ring at the block.



- ▶ Unscrew the screws at the block of the gas supply.
- ▶ Remove the guide tube with the block from the ABD.
- ▶ Remove the magnetic coupling from the guide tube.
 - ✓ You can now clean or replace the guide tube and hook.



- ▶ Insert the guide tube in the block without jamming.
- ▶ Push the magnetic coupling into the guide tube. The short piece of the magnetic coupling in front of the metal ring must face the block of the gas supply.

- ▶ Attach the guide tube in reverse order to its removal (see above).
- ▶ Insert the cleaned hook or a new hook into the sample sluice of the ABD (→ "Cleaning and replacing the hook at the ABD" 📖 30).
- ▶ Re-install the ABD at the basic module (→ "Installing the ABD at the combustion tube" 📖 25).
 - ✓ The system is now ready for operation again.

8 Transport and storage

8.1 Transport

8.1.1 Preparing the ABD for transport



CAUTION

When removing glass components there is a risk of injury from broken glass!

Use care when removing the glass components from the ABD!



NOTICE

Unsuitable packaging material can cause damage to individual components of the ABD!

Only transport the ABD in its original packaging! Ensure that the sample sluice is completely empty!

Prepare the ABD for transport as follows:

- ▶ Switch off the ABD from the equipment switch and disconnect the mains plug from the mains outlet.
- ▶ Remove the interface cable ("RS 232 multi EA" connector) and the flame sensor cable ("flame" connector).
- ▶ Disconnect the gas supply and remove the connection hose 16 from the ABD.
- ▶ If necessary, remove the sampler from the ABD and prepare it separately for transport (refer to the user manual of the sampler).
- ▶ Disconnect the ABD from the basic module (→ "Disconnecting the ABD from the combustion tube" ☞ 27). Loosen the clamp screw at the sample sluice and remove the ABD connection piece.
- ▶ Place the ABD connection piece with seals and screwed connection in the original packaging.
- ▶ Remove the protective cover for the guide tube.
- ▶ Remove the hook from the guide tube (→ "Cleaning and replacing the hook at the ABD" ☞ 30) and place it in the original packaging.
- ▶ Carefully package the ABD and accessories in the original packaging.
 - ✓ The ABD is now ready to be transported.

8.1.2 Transport notes

Transport the ABD very carefully to prevent damage from impact, shock or vibration. The ABD should be transported in such a way that major temperature fluctuations are avoided and the formation of condensate is thus prevented.

Observe the safety notes in the user manuals of the analyzer.

8.1.3 Moving the ABD in the laboratory




NOTICE

Falling out of loose parts as well as unintentional dropping of the ABD creates a risk of injury and damage to the device.


Before moving the ABD, remove all loose parts and dismount the sampler from the ABD if necessary!

Move the ABD with great care! Securely hold the ABD with both hands from below.

To move the ABD within the laboratory:

- ▶ Switch off the ABD from the equipment switch and disconnect the mains plug from the mains outlet.
- ▶ Remove the interface cable ("RS 232 multi EA" connector) and the flame sensor cable ("flame" connector).
- ▶ Disconnect the gas supply and remove the connection hose 16 from the ABD.
- ▶ If necessary, remove the sampler from the ABD and move it separately in the lab (see user manual of the sampler).
- ▶ Disconnect the ABD from the furnace of the basic module (→ "Disconnecting the ABD from the combustion tube"  27).

Securely hold the device with both hands from below.

For installation at the new location, observe the location requirements (→ "Location requirements"  15).

8.2 Storage



NOTICE

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

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


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


The following requirements are placed on the climatic conditions in the storage room of the ABD:

- Temperature range: +15 to +55 °C
- Max. humidity: 10 to 30 % (use desiccant)
- Air pressure: 0.7 to 1.06 bar

8.3 Re-commissioning

8.3.1 Setting up the ABD

When setting up the ABD, observe the instructions in section (→ "Location requirements"  15).

- ▶ Carefully remove the ABD and accessories from the transport packaging. Ensure that the transport packaging does not get damaged.
- ▶ Place the ABD to the right of the analyzer.
- ▶ Install the hook in the guide tube (→ "Cleaning and replacing the hook at the ABD"  30) and put the protective cover on the guide tube.

8.3.2 Connecting the ABD to the analyzer

Before connecting the ABD to the analyzer always observe the following safety notes:



DANGER

The ABD must always be switched off during connection to the mains supply and to the analyzer!

Prior to connecting make sure that the equipment switches at the equipment backplates of the ABD and the analyzers are in the "0" position!

Only use the mains cable included in the scope of delivery for the connection to the mains supply (VDE label, 1.5 m long). Extensions of the supply cable are not permitted!



DANGER

Risk of burns! The furnace and combustion tube of the combustion module may be hot!



NOTICE

Settled condensation and temperature differences can damage individual components of the ABD during recommissioning.

Allow the ABD to acclimatize for at least one hour after positioning in the operating room before recommissioning.

The gas supply is realized via the analyzer. The operator is responsible for providing the necessary gas connections.

For safe positioning and easy and correct alignment of the ABD, always fit the guide rail to the analyzer to protect the ABD connection piece or the combustion tube against glass breakage.

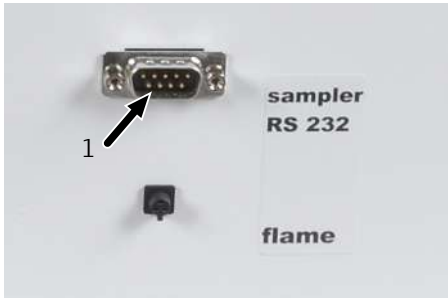
Connect the ABD to the analyzer as follows:



- ▶ Connect the mains supply cable to the mains connection on the equipment backplate and to an isolated ground receptacle.

Note

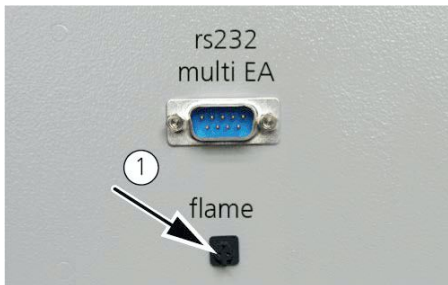
Observe the permitted operating voltage on the type plate.



- ▶ Connect the ABD via the serial interface cable to the analyzer:
 - "RS 232 sampler" interface at the rear of the ABD (1)

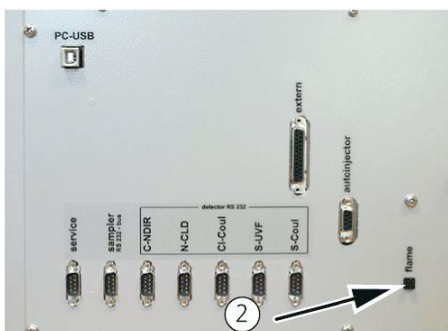


- Interface „Sampler“ at the rear of the analyzer (2) or via another sampler module



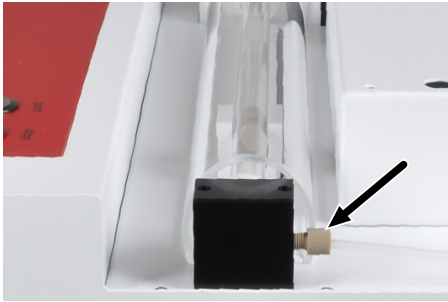
If the optional flame sensor is used, connect the connection cable between ABD and analyzer:

- Interface "flame" at the rear of the ABD (1)

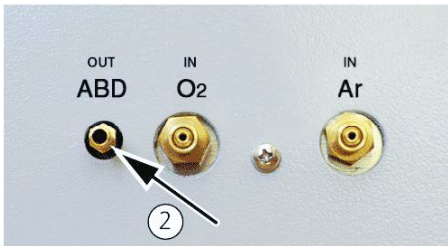


- Interface "flame" at the rear of the analyzer (2)


The flame sensor is located at the combustion tube and is directly connected to the contact strip inside the analyzer (refer to the user manual of the sampler).



- ▶ Connect connection hose 16 to the screw connection at the end of the guide tube on the ABD.



- Connection „out ABD“ at the rear of the analyzer (2)
The ABD is now connected to the analyzer.

- ▶ If required, install the sampler to the ABD (refer to the user manual of the sampler).
- ▶ Install the ABD to the combustion tube of the basic module (→ "Installing the ABD at the combustion tube"  25).
 - ✓ The ABD is now ready for operation.

9 Disposal

9.1 Consumables

The chemicals used during analysis are special waste and must not be discharged into the sewage system, surface water or ground water nor into the ground! The applicable regulations for disposal must be meticulously observed.

Dispose of materials used during sampling (carrier material, quartz boats, septums) in accordance with the legal and local regulations for proper waste disposal.

9.2 ABD

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

10 Specifications

General characteristics	Designation/type	Automatic Boat Drive
	Dimensions of the basic device (W x H x D)	520 x 210 x 500 mm
	Mass	10 kg
Sample matrix and supply	Solids	direct transfer of solid samples in quartz glass boats into the multi purpose combustion tube
	Liquids	Injection of liquids via injection port with septum into quartz glass boats and transfer into the multi purpose combustion tube
	Gases	Injection of gaseous samples by means of a gas metering module via flexible injection cannula in the injection port
Operation modes	Automatic	Supply of the sample in the quartz glass boat with fully automated control of the combustion via evaluation of the flame sensor
	Automatic plus	Supply of the sample in the quartz glass boat with time-optimized combustion, fully automated control of the combustion via evaluation of the flame sensor
	Parameter mode	Supply of the sample controlled by a parameter set, adjusted to a known and non-varying sample matrix and sample quantity, without flame sensor Parameters: <ul style="list-style-type: none"> ▪ Waiting position ▪ Waiting time at waiting position ▪ Travel time before and between waiting positions
Sample volume	Solids	0.001 – 110 mg
	Liquids	1 – 100 µl
	Non-pressurized gases ▪ GSS module	▪ 1 – 100 ml
	Pressurized gases ▪ GSS/LPG combination module ▪ GSS with adapter box	▪ 1 – 20 ml ▪ 1 – 100 ml
	LPG	1 – 50 µl
Gas supply (at the analyzer)	Process gases	Gas supply with argon and oxygen via the analyzer, refer to the user manual of the analyzer

Electrical variables	Power supply	110 to 240 V +10/-5 %
	Frequency	50/60 Hz
	Overvoltage category	II
	Degree of contamination	2
	Fuses	2 x T 3.15 A H
	Max. power consumption	55 VA
	Analyzer interface	RS 232 (special bus)
Environmental conditions	Temperature during storage	+15 to +55 °C
	Temperature during operation	+20 to +35 °C
	Humidity during operation	max. 90 % at 30 °C
	Humidity during storage	10 to 30 % (use desiccant)
	Air pressure	0.7 to 1.06 bar
	Maximum altitude	2000 m

10.1 Standards and directives

Protection class and protection type	The device is protection class I. The housing is protection type IP 20.
Device safety	The device complies with the following safety standards <ul style="list-style-type: none"> ▪ EN 61010-1 ▪ EN 61010-2-081 ▪ EN 61010-2-010
EMC compatibility	The device has been checked for transient emissions and noise immunity. It meets the requirements for transient emissions according to <ul style="list-style-type: none"> ▪ EN 61326-1 (EN 55011 group 1, class B) The device meets the requirements for noise immunity according to <ul style="list-style-type: none"> ▪ EN 61326-1 (requirements for use in a basic environment)
Environmental compatibility	The device has been tested for environmental compatibility and meets the requirements according to <ul style="list-style-type: none"> ▪ ISO 9022-2 ▪ ISO 9022-3
EU directives	The device meets the requirements of the directive 2011/65/EU. The device is designed and tested in accordance with standards meeting the requirements of EU directives 2014/35/EU and 2014/30/EU. The device leaves the factory in a sound condition with regard to technical safety. To maintain this condition and to ensure safe operation, the user must strictly observe the safety and operating instructions contained in this operating manual. For accessories delivered with the device and system components from other manufacturers, the information provided in their respective operating manuals has priority.

Guidelines for China

The device contains substances subject to regulation (according to the directive GB/T 26572-2011). Analytik Jena guarantees that, if the device is used as intended, these substances will not leak within the next 25 years and therefore will not pose a threat to the environment or health within this time period.

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