

Operating Manual

Temperature-controlled Sampler MMS-T



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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 About this user manual

The temperature-controlled autosampler MMS-T is a system module for the modular multi EA 5000 / multi EA 5100 or multi X 2500 analyzers.

The autosampler can be installed on the analyzer or on the Automatic Boat Drive (ABD). The autosampler is operated in combination with a thermostat.

The user manual also applies to Multi Matrix Sampler devices which were ordered or retrofitted together with a kit for temperature-controlled liquid operation (Kit "TMP"). A retrofit requires the modification of the autosampler. Therefore, a retrofit may only be carried out by the customer service or by authorized and specifically trained skilled personnel.

Applicable documents

For this reason, the user manual is only valid in conjunction with the following documents:

- The user manual for multi EA 5000 / multi EA 5100 or multi X 2500
- The user manual for the Automatic Boat Drive (ABD)
- The software manual for the multiWin control and analysis software

Please also refer to the thermostat's user manual.

The device is intended to be operated by qualified specialist personnel observing this user manual.

This user manual provides information about the design and operation of the device and provides the operating personnel with the necessary know-how for the safe handling of the device and its components. Furthermore, the user manual includes information on the maintenance and servicing of the device as well as hints on potential causes for malfunctions and their correction.

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 temperature-controlled autosampler MMS-T must only be used for the procedures described in this user manual for injecting liquid samples and for adding solid samples to the combustion system of the analyzers multi EA 5000 / multi EA 5100 or multi X 2500.

Any other use is not as intended!

In particular, the following samples must not be added with the autosampler:

Impermissible misuse

- Substances tending to spontaneous decomposition (e.g. peroxides) – risk of explosion!
- Explosives, explosive materials (e.g. trinitrotoluol, inorganic azides) – risk of explosion!
- Highly saline samples, especially alkaline and alkaline earth samples (e.g. soil, fertilizer, fodder, construction materials)
- Inorganic compounds, such as metals, alloys, minerals etc.
- Sample materials for which digestion temperatures >1100 °C are required

Applicable documents

Also observe the information in the multi EA 5000 / multi EA 5100 or multi X 2500 user manuals.

2 Safety instructions

2.1 General notes

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

Applicable documents

- The multi EA 5000 / multi EA 5100 or multi X 2500 user manual
- The software manual for the multiWin control and analysis software

In particular, observe the information in the "Safety notes" chapters of the user manuals. The information included there also applies to the autosampler without restrictions.






The temperature-controlled autosampler is operated in combination with a thermostat. Please also observe the safety instructions given in the thermostat's user manual.

2.2 Safety labeling on the device

Warning and mandatory action labels have been attached to the device and must always be observed.

Damaged or missing warning and mandatory action labels can cause incorrect actions leading to personal injury or material damage. The labels must not be removed. Damaged warning and mandatory action labels must be replaced immediately!

The following warning and mandatory action labels have been attached to the device:

Warning symbol	Meaning	Remark
	General hazard area warning	
	Warning against crushing	On the injector head: Risk of injury due to moving parts.
	Warning about hot surface	On the temperature-controlled syringe and the sample tray: There is a risk of burns when touching temperature-controlled components.
Mandatory action labels/information symbols	Meaning	Remark
	Observe the user manual	On the device switch: Before starting work, read the user manual.
	For People's Republic of China only	The device contains controlled substances. Analytik Jena guarantees that these substances will not escape in the next 25 years if the device is only used for the intended purpose.

2.3 Safety instructions

Observe the following information when connecting and operating the autosampler:

Connection and operation

- When setting up the device, take into account the movement range of the arm during operation. Ensure that the entire potential movement range behind the device is unobstructed.
- Also exercise caution near the movement range of the arm guiding the sampling tool. Risk of injury from the sampling tool during operation.
- The autosampler may be operated at temperatures of up to 80 °C. In heating mode, there is the risk of burning when touching temperature-controlled components or the temperature control fluid. Only operate the autosampler within the specified temperature range and avoid contact with hot components during operation. The sample vials get very hot as well! Wear protective gloves when removing the sample vials from the sample tray.
- The operating personnel is prohibited from opening the device. Opening the device is only permissible when carried out by authorized Analytik Jena service personnel. Always disconnect the power plug before opening the housing! Danger of electric shock!
- Modifications, conversions and extensions to the device are only permitted after consultation with Analytik Jena. The operator is responsible for changing the dosing tools and the sample trays. Any unauthorized modifications going beyond these changes can jeopardize the device's operational safety and may result in limiting the manufacturer's warranty and access to customer service.
- Ensure that no liquid reaches the cable connections or the interior of the device! Danger of electric shock!
- Caution when handling glass components. Risk of broken glass and therefore risk of injury!

2.4 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.

2.5 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.
- Do not use organic solvents or abrasives to clean the device. Exercise caution when decontaminating the device with disinfectants containing alcohol. The alcohol can damage the safety labeling on the device.
- 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.
- There is a risk of burns especially when touching the temperature-controlled components of the autosampler or the temperature control fluid. Switch off the thermostat and let the temperature-controlled components and the temperature control fluid cool down before beginning to replace components or draining the liquid system.
- Use only original spare parts, wear parts and consumables. They have been tested and ensure safe operation. Glass part are wear parts and are not subject to the warranty.
- The gas supply must be shut off before performing any maintenance or repair work (unless specified otherwise).
- Check that all hose connections are gas-tight after maintenance.
- All protective equipment must be reinstalled and checked for proper function when the maintenance or repair work is complete.

2.6 Behavior during emergencies

In hazardous situations or accidents, use the device switch on the rear of the device to switch off the autosampler and disconnect the plug from the power supply!

In emergencies, also observe the safety instructions in the user manual of the analyzer.

3 Function and design

The temperature-controlled autosampler MMS-T is a system module for the modular elemental analyzer multi EA 5000 / multi EA 5100 or multi X 2500.

The temperature-controlled autosampler MMS-T is used for metering normal and demanding liquids. The autosampler provides a safe option to meter fluids with a very low boiling point or with elevated viscosity. Please observe the manufacturer's instructions (-> "Intended use" 6) when selecting the samples.

Depending on the operating mode, the autosampler is either placed on the analyzer (vertical mode) or the ABD (horizontal mode). The design of the hose set allows using it for both variants.

In vertical operating mode, the autosampler meters the liquid samples directly through the injection port into the analyzer's combustion tube.

In horizontal operating mode, the autosampler dispenses the liquid samples through the injection port of the sample transfer point (sluice) of the ABD into a quartz glass boat inside the device. The ABD will then transfer the boat to the combustion system of the analyzer.

The optional solid kit expands the range of applications of the autosampler to handling solid samples, high-viscosity liquids and AOX samples. Such samples can be transferred to the combustion system of the analyzer via the ABD in horizontal operating mode.

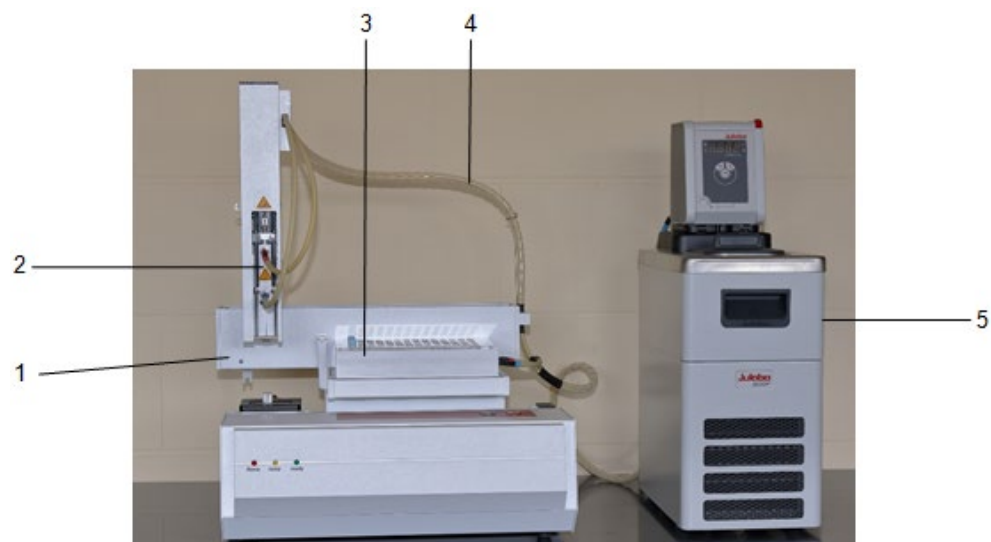


Figure 1 Temperature-controlled autosampler (placed on ABD)

- | | |
|---|----------------------------------|
| 1 Autosampler | 2 Temperature-controlled syringe |
| 3 Temperature-controlled sample tray | 4 Hose set |
| 5 Cold-recirculating thermostat
(not included) | |

The autosampler is operated in combination with a thermostat.

The temperature-controlled autosampler consists of the following main components:

- Basic unit with guide arm X
- Injector head with syringe drive
- Receptacle for the sample tray
- Waste container with waste hose
- Solvent container



Figure 2 Main components of the autosampler

- | | |
|------------------------------------|--------------------------------------|
| 1 Injector head with syringe drive | 2 Temperature-controlled syringe |
| 3 Basic unit with guide arm X | 4 Waste container |
| 5 Solvent container | 6 Temperature-controlled sample tray |
| 7 Receptacle for the sample tray | |

The following temperature-controlled components are used on the autosampler:

- Temperature-controlled sample tray
- Temperature-controlled syringes

The autosampler can be operated without temperature control.

Temperature control range

It is possible to control either the samples or the syringe within the range of 5 °C to 80 °C (active cooling or heating). The temperature of the sample tray and the syringe is controlled synchronously, i.e. the assemblies are cooled down or heated to the same selected target temperature.

A hose set is used to connect the temperature-controlled sample tray and the temperature-controlled syringe to the cold-recirculating thermostat.

Medium

Temperature control operation requires a medium suited for the temperature range 5 °C to 80 °C. The standard medium suggested by the manufacturer is water.



Thermostat

NOTICE

Please consult the manufacturer before using any other medium than water.

The thermostat referred to for the description of the device is the model CORIO CD 200F (julabo) which is recommended by the manufacturer.



NOTICE

The thermostat is not included in the scope of delivery!

3.1 Device switch/interfaces

The autosampler is connected to the single-phase AC grid via an external table power supply unit (110 to 240 V +10/-5 %).



Figure 3 Wide-range table power supply unit

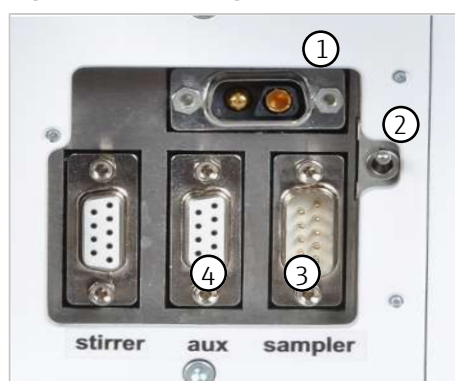


Figure 4 Rear – connections

- | | |
|--|--|
| 1 Connection socket for the wide-range table power supply unit | 2 Device switch |
| 3 Connection socket for interface cable | 4 Connection socket for boat sensor (optional) |

The connection sockets (1) and the device switch (2) for switching the device on and off are located on the left of the rear panel (viewed from the front).

3.2 Type plate

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

The type plate contains the following information:

- Manufacturer address
- Trade name
- Electrical connection data
- WEEE device label
- CE marking

3.3 Temperature-controlled components

The autosampler is intended to be used with temperature-controlled syringes and a temperature-controlled sample tray. Furthermore, it consists of the following special parts:

On the injector head

- Special syringe holder for coupling the temperature-controlled syringe
- Clamping strip for the hose set

On the running gear

- Clamping strip and hose guiding bracket for the hose set

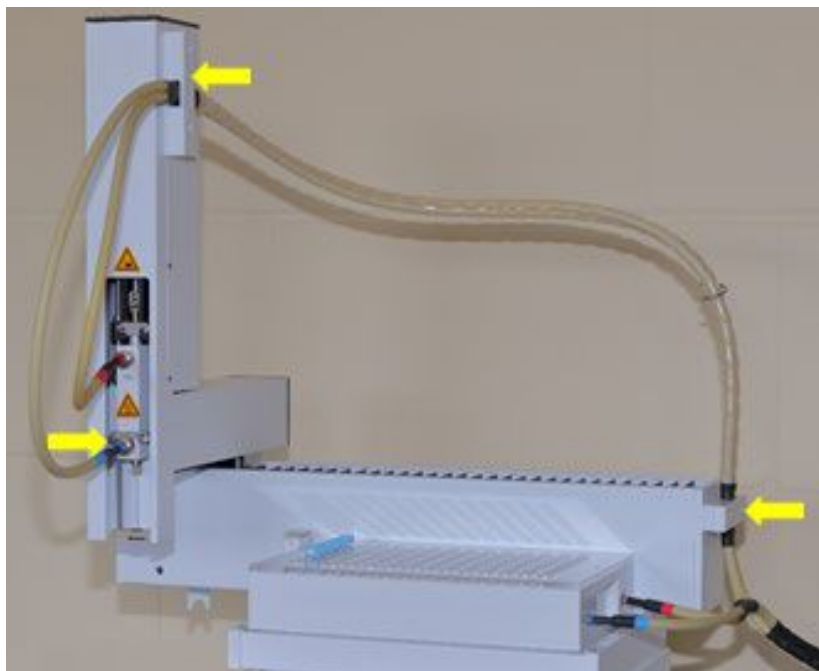


Figure 5 MMS-T autosampler

Temperature-controlled syringes

Nominal volume

The package includes two temperature-controlled syringes with a nominal volume of 50 μl and 100 μl . The syringes are coded allowing the autosampler to read out the type of the syringe that is used.

In order to connect the syringes to the liquid circuit of the recirculation thermostat, the syringes have two plug-in connections for PTFE hoses with a diameter of 4 mm from the hose set.

The plug-in connections are color-coded.

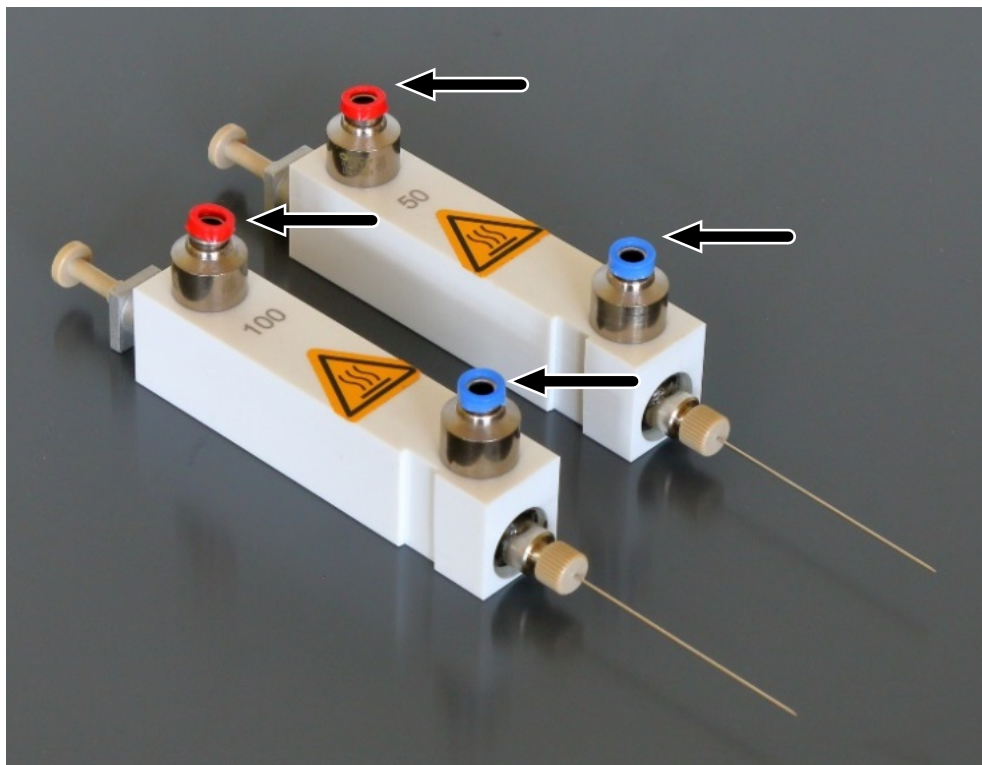


Figure 6 Temperature-controlled syringes

Temperature-controlled sample tray

The temperature-controlled sample tray has 112 sample positions and is compatible with the autosampler. The temperature-controlled sample tray is coded and will be identified automatically.

In order to connect the tray to the liquid circuit of the recirculation thermostat, the temperature-controlled sample tray has two plug-in connections for PTFE hoses with a diameter of 4 mm from the hose set.

The plug-in connections are color-coded.

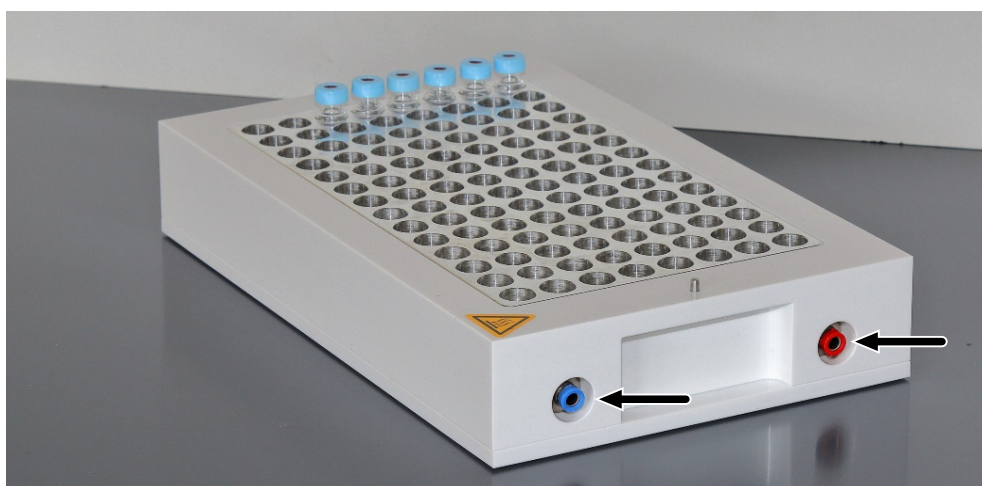


Figure 7 Temperature-controlled sample tray

Note: The structure of the temperature-controlled sample tray is higher than that of the sample trays without temperature control. Keep this in mind when adjusting the autosampler and when changing the sample tray.

Cover

When samples are chilled, the cover ensures that no water condenses on the metal block of the sample tray.

Please remember the following when placing the cover: The cover is held in place by the two guide pins provided on the sample tray which fit into the two drilled holes on the cover (see arrows).

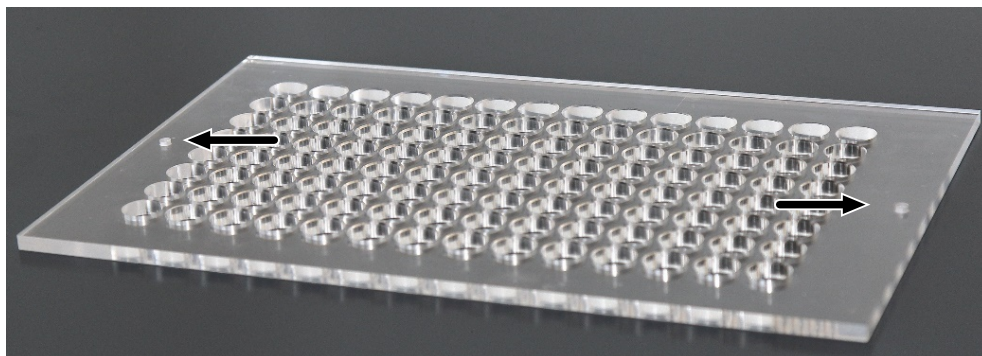


Figure 8 Cover



NOTICE

The cover must always be removed for temperatures $> 40\text{ }^{\circ}\text{C}$! Otherwise, there is the risk that the cover is deformed and collides with the injector head.

Hose set

The hose set connects the components temperature-controlled syringe and temperature-controlled sample tray with the cold-recirculating thermostat.

The hoses of the liquid system are made of PTFE and their size is $\text{Ø } 4 \times 0.5\text{ mm}$.

These hoses are covered with thermally insulated tubes which do not get in contact with the temperature control fluid.

The ends of the hose connectors are color-coded.

The hose set is ready for installation with pre-assembled spiral cable wraps, heat-shrunk tubing and CPC fittings.

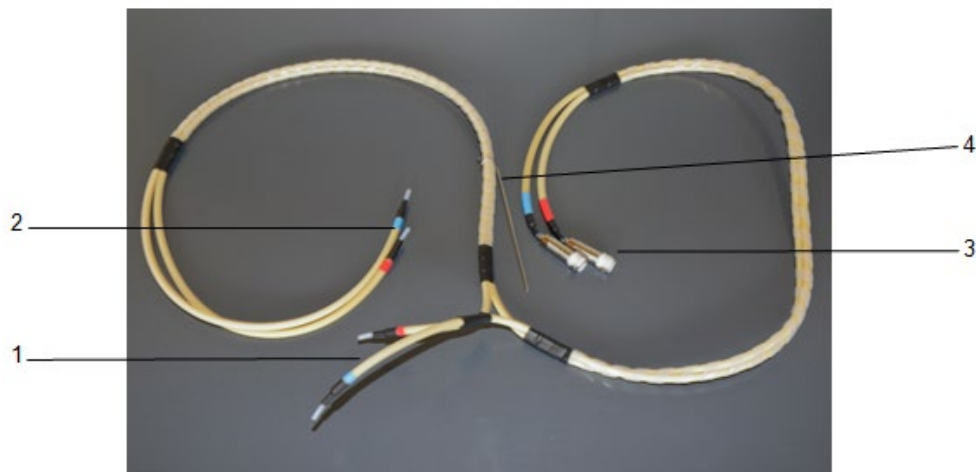


Figure 9 Hose set

- | | |
|---|---|
| <p>1 Connectors for temperature-controlled tray (red – rear, blue – front)</p> <p>3 Connectors for cold-recirculating thermostat (blue – supply line (out), red – return line (in))</p> | <p>2 Connectors for temperature-controlled syringe (red – top, blue – bottom)</p> <p>4 Hose bracket</p> |
|---|---|

The connections for the cold-recirculating thermostat are equipped with quick-release fittings that are sealed automatically after uncoupling them (from the cold-recirculating thermostat) to avoid temperature control fluid leaking from the hose set when the hoses are detached from the syringe or the sample tray. The thermostat is equipped with the corresponding quick-release connectors.

The hose bracket is inserted to the 2-mm-Ø drill hole on the right side wall of the autosampler when attaching the hose set with the hose clamping device.

Cold-recirculating thermostat

We recommend using the cold-recirculating thermostat CORIO CD 200F (julabo) (not included) for recirculating the liquid inside the temperature control circuit.

Please refer to the user manual provided with the device when operating this unit.

Make sure that the black lever is set to external pump supply (far left position).



NOTICE

Set the temperature only slightly above 80 °C (protection against inadmissible maximum temperatures) to avoid damage to the autosampler or to the temperature-controlled components.



Figure 10 Thermostat – front view

OUT/IN

The hose set is connected to the thermostat via the ports on the rear of the thermostat. Please connect OUT with the hose with the blue color coding and IN with the hose with the red color coding.

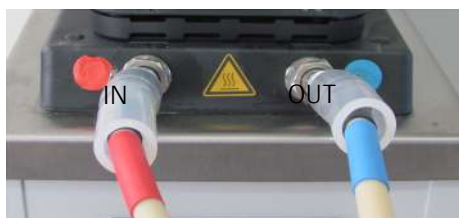


Figure 11 Thermostat – connections

Syringe adapter

The syringe adapter is needed when using a standard syringe instead of the temperature-controlled syringe. The syringe adapter must be inserted first before inserting the standard syringe. Then, the black cover is closed and locked with the lower clamp. In this application, the clamp is used like the clamping knob on the standard version of the injector head.

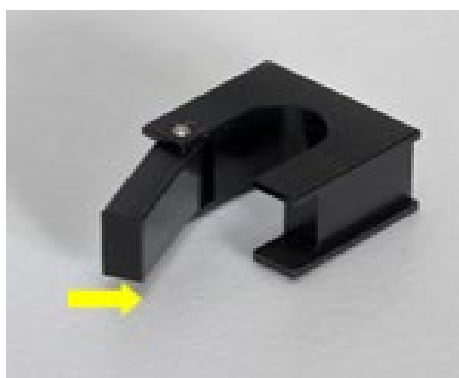


Figure 12 Syringe adapter

Blind plug kit/tool

To prevent temperature control liquid leaks, the fittings or the hose ends must be sealed during the deinstallation process of the hose set. This is done with the sealing plugs and sealing caps provided.

Allen key TX10: The clamping strips must be opened and bolted for mounting the hose set to the autosampler.



Figure 13 Sealing plugs and sealing caps, tool

Solid mode (optional)

Analytik Jena offers a special kit for solid mode. The kit is used to expand the autosampler's range of applications to solid samples and AOX samples (using the column or batch method).

The kit includes a special gripper, a sample tray for 35 positions, an adjustment aid and a set of quartz boats.



Figure 14 Special gripper



Figure 15 Sample tray for solids and AOX samples

The following parts must be removed on the injector head for installing the special gripper:

- Bottom interlocking tab
- Fasteners of the tab (self-locking nut and threaded pins)

4 Installation and commissioning

4.1 Location requirements

4.1.1 Installation conditions

The climate conditions in the room the autosampler is operated in are defined by the overall system requirements:

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

As far as possible, the atmosphere in the laboratory should be free of hydrocarbons, sulfur and halogen, low in nitrogen oxide and dust and free from drafts and corrosive vapor. Smoking is prohibited in the operating room of the analysis system!

Also observe the following:

- 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.
- Ensure sufficient space toward the rear of the device during installation. The guide arm can protrude beyond the rear panel of the ABD/analyzer when running.
- Always fasten the autosampler to the ABD/analyzer with the fastening screws included in the delivery to prevent accidental collision with or movement of the autosampler. Collisions and movement can necessitate readjustment of the device!

The following fastening points are provided on the ABD or analyzer:

- Use of the rear and the middle borehole on the ABD (autosampler in horizontal mode)
- Use of the rear and the front boreholes on the analyzer (autosampler in vertical mode)

4.1.2 Spatial requirements

The autosampler is positioned and fastened on an ABD or analyzer.

The required height results from the height of the analyzer or ABD and the height of the autosampler. There must be a clearance of at least 10 cm between the device system and any shelf or cabinet above the system.

4.1.3 Power supply



CAUTION

The table power supply unit of the autosampler must only be connected to a properly grounded outlet in accordance with the voltage specifications on the type plate!

The autosampler is connected to the single-phase AC grid via an external table power supply unit (24 V).

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.

4.2 Installation and commissioning

4.2.1 Unpacking and setting up



NOTICE

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

Any unauthorized activity with the autosampler can endanger the user and the operational safety of the device, 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.

The autosampler is unpacked and assembled by customer service or authorized and trained specialist personnel.

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

Customer service tests the analyzer after assembly and documents the test.

4.2.2 Setting up the sampler

Observe the safety information when setting up the autosampler.

- ▶ Carefully remove the autosampler and its accessories from the transport packaging. Ensure that the transport packaging does not get damaged!
- ▶ Place the autosampler on the ABD or analyzer and fasten it with the fastening screws included in the delivery.

4.2.3 Connecting the autosampler

Always observe the following safety information when connecting the device:



CAUTION

Always connect the device to power or to further system module when it is switched off!

- Ensure that the device switches on the rear of the device are at the "0" position before connection!
- Only use the table power supply unit and the accompanying power cable included in the delivery to connect the device to power (VDE label, 1.5 m length). Extending the supply cable is not permitted!



NOTICE

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

Allow the autosampler at least one hour for acclimatization after positioning it in the room it will operate in before recommissioning.

Connect the autosampler to the ABD/analyzer:



- ▶ Connect the green and yellow potential equalization cable of the autosampler to the ABD or analyzer.
- ▶ To do this, plug the flat plug receptacle of the cable onto the corresponding flat plug.



- ▶ Connect the low-voltage cable of the table power supply unit with the 2-pin Sub-D connector to the corresponding socket on the rear of the device (see arrow).



- ▶ Connect the special bus cable to the RS 232 interface (see arrow).
- ▶ Connect the other end of the interface cable to the "Sampler" interface on the rear of the analyzer, or to the RS 232 bus system.
NOTICE! Secure all plug connections with the screws located on the grips.



- ▶ Connect the waste hose to the waste container (see arrow).
- ▶ Hang the other end of the hose into a waste container.
NOTICE! Ensure sufficient slack for the hose, and that is not kinked or obstructed.

4.2.4 Setting up and connecting temperature-controlled components



CAUTION

Risk of burns

In case of improper handling, there is a risk of burns when touching the temperature-controlled components of the autosampler or the temperature control liquid.

- Only operate the autosampler within the specified temperature range of 5 °C to 80 °C.
- Avoid touching the syringe and sample tray during operation.



CAUTION

Risk of injury from the syringe

The syringe is very sharp and pointy.

- Do not touch the syringe on the needle. The syringe can also become contaminated.
- Keep a safe distance from the movement range of the syringe during operation.

Installation of the temperature-controlled syringe

- ▶ First, loosen the screw for clamping down the syringe plunger inside the injector head (2-mm Allen key, included) to facilitate the introduction of the upper end of the syringe plunger when inserting the syringe into the receptacle of the plunger drive.

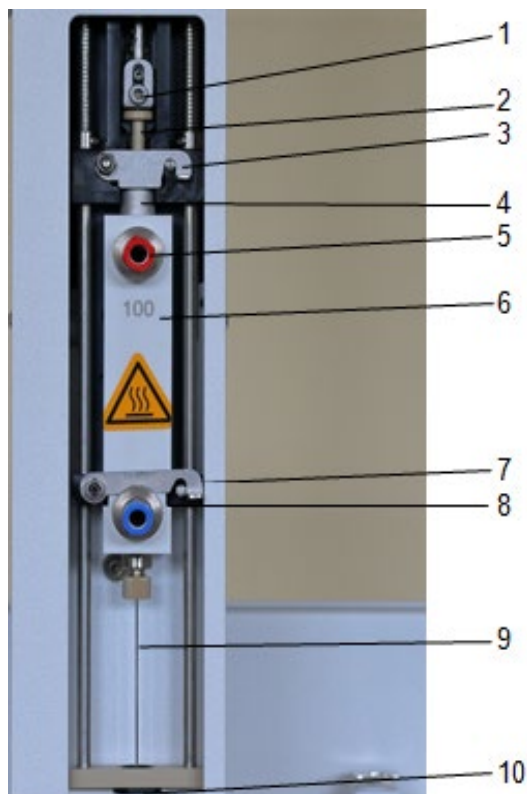


Figure 16 Syringe – inserted

- | | |
|--------------------------------------|----------------------------------|
| 1 Clamping screw for syringe plunger | 2 Syringe plunger |
| 3 Upper interlocking tab | 4 Syringe head |
| 5 Plug-in connectors | 6 Insulating body of the syringe |
| 7 Lower interlocking tabs | 8 Grooves in the insulating body |
| 9 Needle | 10 Needle guide |

- ▶ Open both interlocking tabs on the injector head.
- ▶ Now, insert the temperature-controlled syringe into the autosampler's injector head.
- ▶ Hold the syringe so that the plug-in connectors are facing forward.
- ▶ Then, insert the syringe into the cannula guide by a few millimeters.
- ▶ Push the grooves on the syringe's insulating body into the guide at the lower clamping lever and the syringe head into the slot at the upper clamping lever until you hit the stop so that you can lock both clamping levers. At the same time, the upper end of the syringe plunger should be in the receptacle of the plunger drive now.
 - There are two interlocking tabs at the bottom. Use the front bottom interlocking tab to attach the temperature-controlled syringe.
 - The rear bottom interlocking tab must be flat against the syringe body. Check that the stud bolt is firmly attached. If necessary, retighten the stud bolt.
- ▶ Use the clamping screw to attach the syringe plunger in the receptacle. Use the Allen key for this.

Mounting the temperature-controlled sample tray

- ▶ Place the temperature-controlled sample tray onto the autosampler.
 - Use the same locating pins for placing the device. The terminal fittings for the hoses must be on the right-hand side of the device when doing so.



Figure 17 Temperature-controlled sample tray – connectors

Placing the cold-recirculating thermostat

- ▶ Place the cold-recirculating thermostat to the right of the analysis system and observe the operating instructions for this device.
 - Make sure that the temperature is set only slightly above 80 °C (protection against inadmissible maximum temperatures) to avoid damage to the autosampler or to the temperature-controlled components.
 - Also make sure that the change-over lever for controlling the recirculation pump on the clip-on thermostat is set to external supply (left position).

Attaching the hose set to the thermostat

The hose set contains 3 pairs of hose ends.

Use the pair with the white CPC quick-release fittings matching the CPC quick-release connectors preinstalled on the thermostat to connect the cold-recirculating thermostat.

The hose ends are also marked by long color codes (red and blue heat-shrunk tubes of 30 mm length).

- ▶ Plug these connectors into the corresponding port on the thermostat. When doing this, please remember the following:
 - BLUE mark on the hose of the supply line(OUT)
 - RED mark on the hose of the return line(IN)

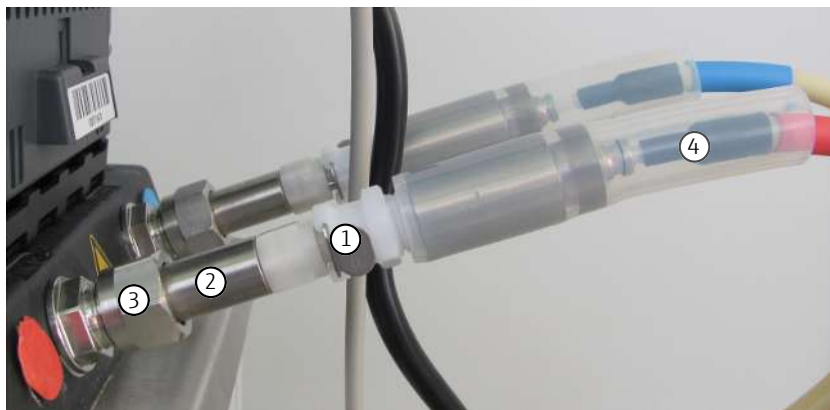


Figure 18Thermostat – connections

- | | |
|--|------------------------|
| 1 CPC quick-release fitting | 2 CPC adapter |
| 3 Union nut SW 19 (part of the thermostat) | 4 Anti-kink protection |

The CPC adapters are part of the included accessories. The blind plugs or transition pieces on the thermostat must be replaced by these adapters. This requires an SW-19 open-end wrench.



Figure 19Thermostat – connections at the rear

Attaching the hose set:

- ▶ First, open the upper hose guide on the autosampler. To do this, loosen the lower screw and remove the upper screw so that the hose guide can be opened. Use the TX10 Allen key for this (included).
- ▶ Use the second long hose pair of the hose set to connect the hose set to the syringe.

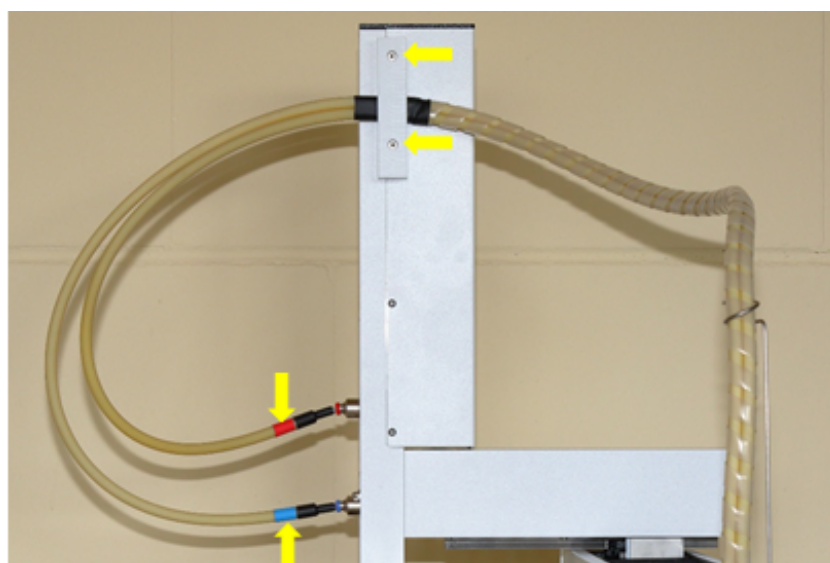


Figure 20Attachments

Please remember when connecting the hoses:

- Upper plug-in connector: Hose with the red marking (slightly shorter)
- Lower plug-in connector: Hose with the blue marking (slightly longer)
- ▶ After inserting the hose set, push the cover back up and use the screws to fix it to close the upper hose guide. Use the section marked with the black heat-shrunk tubing on the hose set for clamping the set.
- ▶ Now, lay the hoses in the set to the autosampler's right sidewall.
- ▶ Loosen this hose guide, too, as described above.

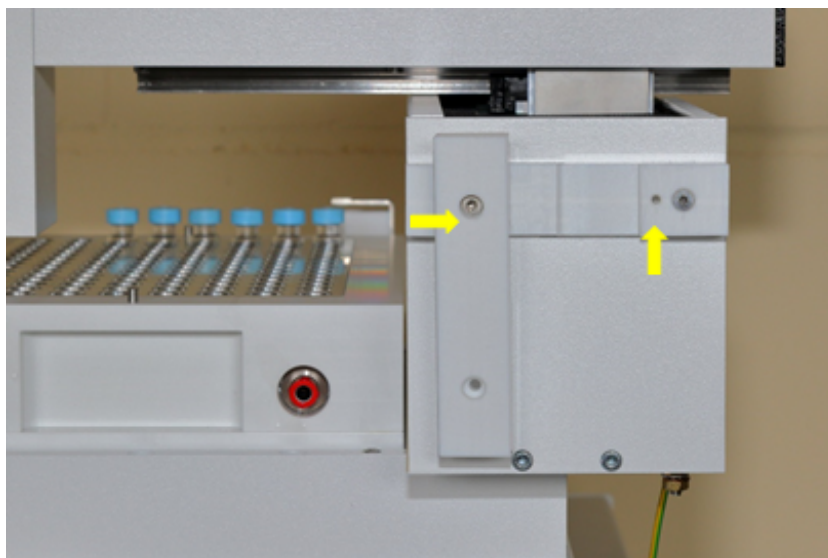


Figure 21 Attachments

- ▶ Now, route the hose pair through the hose guide.

A black heat-shrunk tubing marks the section that is supposed to be used for clamping the hoses of this pair of hoses, too.

- ▶ Retighten both screws. Use the Allen key TX10 to do this.

Hose bracket

- ▶ Put the hose bracket into the 2-mmØ drilled hole and attach the hose as shown.

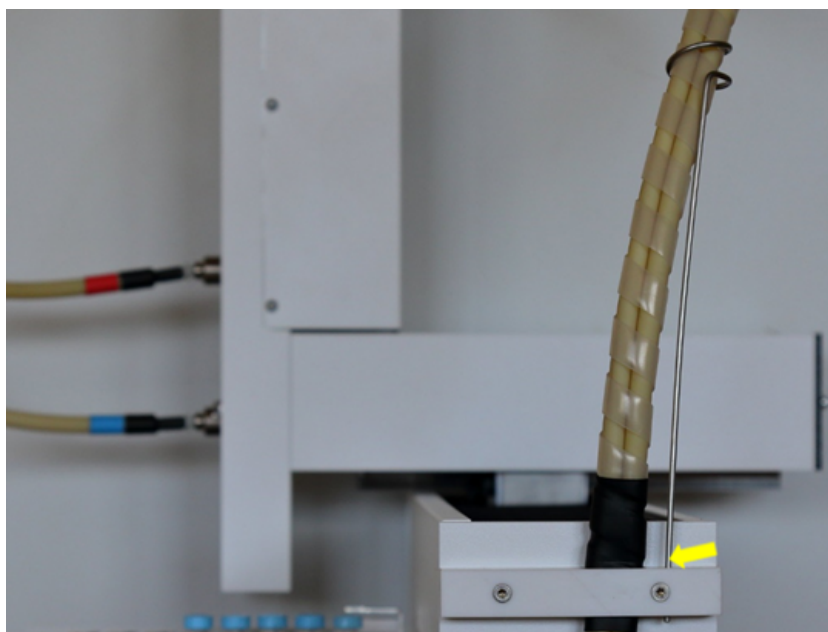


Figure 22 Hose bracket

Connection to the temperature-controlled sample tray

Use the remaining short pair of hoses of the hose set to do this.

Please remember the following when connecting the hoses:

- Rear plug-in connector: Hose with the red marking (shorter)
- Front plug-in connector: Hose with the blue marking (longer)



Figure 23 Connection to the temperature-controlled sample tray

Filling the liquid system

After the external hosing is completely installed, the system can be filled with liquid. When working at temperatures between 5 °C and 80 °C the easiest would be to use water and to add an antifreezing agent, if required.

Please follow the instructions given in the thermostat's user manual. Make sure that the filling level in the thermostat's reservoir reaches the required level and does not exceed this level.

When turning the thermostat on, the external circuit will fill automatically within seconds as soon as the pump is running. Please check all hose connections for tight fit and tightness before beginning any work. In case of leaks, immediately switch off the thermostat and eliminate the cause.



NOTICE

Doublecheck the filling level after powering the thermostat for the first time and filling the external circuit.

5 Operation



CAUTION

Risk of burns

In case of improper handling, there is a risk of burns when touching the temperature-controlled components of the autosampler or the temperature control liquid.

- Only operate the autosampler within the specified temperature range of 5 °C to 80 °C.
 - Avoid touching the syringe and sample tray during operation.
-



CAUTION

Risk of crushing

There is a risk of crushing within the movement range of the injector head with sampling tool.

- Keep a safe distance from the autosampler during operation.
-



NOTICE

Risk of device damage

When the autosampler is maladjusted or not adjusted at all, the autosampling tool can hit a hard surface during operation. This can destroy the autosampling tool and the drive.

- Adjust the autosampler before it is used for the first time and after each modification as well as after transporting or storing it for a longer period of time.
-

5.1 Dispensing liquids



CAUTION

Risk of injury from the syringe

The syringe is very sharp and pointy.

- Do not touch the syringe on the needle. The syringe can also become contaminated.
 - Keep a safe distance from the movement range of the syringe during operation.
-
- ▶ Install the temperature-controlled metering syringe.
 - ▶ Place the temperature-controlled sample tray onto the rack receptacle.
 - ▶ Connect the hose set to the thermostat, the sample tray and the syringe.
 - ▶ Turn the thermostat on and set a temperature between 5 °C and 80 °C.
 - ▶ Check whether the liquid system fills automatically.
 - ▶ Place the solvent container into the rack receptacle.

- ▶ Check the connection of the waste hose. Suspend the loose end of the waste hose into the waste container.
- ▶ Switch on the autosampler and all other system components.
- ▶ Launch the control and analysis software. Metering syringe and sample tray are automatically detected by the software.
- ▶ Adjust the sampler.
- ▶ Insert the sample vials into the sample tray. Let the device adjust the temperature of the sample vials to the set temperature.
- ▶ Activate a method in the control and evaluation software and follow the instructions given.

Note: When using the autosampler to inject liquid samples via the sample sluice of the ABD (horizontal mode), remove the solvent container before opening the sample sluice.

5.2 Working without temperature control

Working without heating/cooling function (option I)

Temperature-controlled syringe You can work without using the heating function by leaving the thermostat switched off.

Working without heating/cooling function (option II)

Standard syringe

As an option, it is possible to operate the temperature-controlled autosampler with a standard syringe without temperature control and a sample tray for liquids.

The standard syringe can only be used with a syringe adapter.

Perform the following steps:

- ▶ Remove the temperature-controlled syringe.
- ▶ Insert the syringe adapter into the guide at the bottom interlocking tab.
 - There are two interlocking tabs at the bottom. Fix the syringe adapter with the rear bottom interlocking tab.
- ▶ Insert the standard syringe.
- ▶ Close the syringe adapter by turning the black cover by 90 degrees.
- ▶ Turn the upper/lower interlocking tabs clockwise and let them engage in the locking bolts.



Figure 24 Syringe adapter and interlocking tabs

5.3 Adding solid samples

The temperature-controlled autosampler can be converted to solid mode. Operation in this mode requires the use of a particular variant of the solid gripper.



Figure 25 Special gripper

The injector head must be converted as follows in order to convert the temperature-controlled autosampler to solid mode:

- ▶ Remove the lower interlocking tab.
- ▶ Unscrew one stud bolt for the rotary bearing and one stud bolt for the plunger pin on the injector head.
- ▶ Use the two threaded holes for attaching the special gripper.

The standard gripper cannot be attached here because the distance between the holes on the standard gripper is smaller.

Proceed as follows for measurement operation:

- ▶ Install the autosampler on the ABD.
- ▶ Place the sample tray with 35 positions onto the rack receptacle.
- ▶ Insert the optional boat sensor into both pins on the left-hand side of the rack receptacle (recommended for demanding sample matrices such as AOX samples).
- ▶ Switch on the autosampler and all connected system components. The software automatically detects the gripper and the sample tray.
- ▶ Adjust the gripper.
- ▶ Place the quartz boats with solid samples, AOX samples or high-viscosity liquids into the sample tray.
- ▶ Activate a method in the software and follow the instructions on the screen.

6 Maintenance and care

6.1 Maintenance intervals

Maintenance task	Maintenance interval
Cleaning and caring for the device	Weekly
Adjusting the autosampler	During commissioning, after every re-arrangement, and after transport and storage
Replacing the septum of the solvent container	As required
Cleaning the cannula guide	As required
Replace the cannula	As required
Replacing the quartz boats (due to surface divitrification)	As required
Replacing the carrier material in quartz boats (due to discoloration, hardening or increased brittleness, deformation or dissolution)	As required

6.2 Adjustment and setup tasks

6.2.1 Adjusting the metering syringe (EOX/liquid sample tray)



CAUTION

Risk of crushing

There is a risk of crushing within the movement range of the injector head with sampling tool.

- Keep a safe distance from the autosampler during operation.



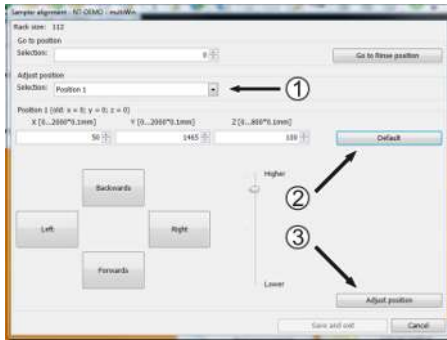
CAUTION

Risk of injury from the syringe

The syringe is very sharp and pointy.

- Do not touch the syringe on the needle. The syringe can also become contaminated.
- Keep a safe distance from the movement range of the syringe during operation.

- ▶ Open the **Adjust - sampler** window via menu **System | Adjust - sampler** in the control and evaluation software.



Position 1

- ▶ Select **Position 1** in the **Adjust position** drop-down field (1).
- ▶ Click on the **[Default]** (2) button.
 - ✓ The presets for position 1 are accepted.
- ▶ Ensure that a sample container is at position 1 on the sample tray.
- ▶ Click on the **[Adjust position]** (3) button.
 - ✓ The device moves to position 1 on the sample tray.

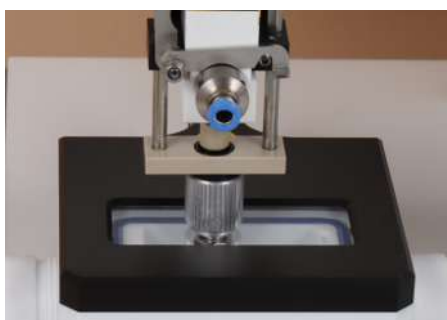


- ▶ Perform a fine adjustment by carefully modifying the preset values and moving the device to position 1 via the **[Adjust position]** button, repeatedly if necessary:
 - X/Y direction: Position the injector cannula above the middle of the sample container.
 - Z direction: Position the injector cannula so that it is immersed in the sample container almost to its bottom (1 to 2 mm distance).
- ▶ The metering syringe is adjusted to position 1.
- ▶ Click on **[Save and exit]** to confirm the set values.



Sluice of the ABD (horizontal operating mode only)

- ▶ Select **Sample port** in the **Adjust position** drop-down field (1).
- ▶ Click on the **[Default]** (2) button.
 - ✓ The presets stored in the software for the sluice position are accepted.
- ▶ Click on the **[Adjust position]** (3) button.
 - ✓ The device moves to the sluice position.



- ▶ Perform a fine adjustment by carefully modifying the preset values and moving the device to the sluice position via the **[Adjust position]** button, repeatedly if necessary:
 - X/Y direction: Position the metering syringe over the middle of the septum of the injection port of the sluice.
 - Z direction: Position the metering syringe so that the injector cannula touches the carrier material in the quartz boat.
- ▶ The metering syringe is adjusted to the sluice position.
- ▶ Click on **[Save and exit]** to confirm the set values.



Furnace (vertical operating mode only)

- ▶ Select **Furnace** in the **Adjust position** drop-down field (1).
- ▶ Click on the **[Default]** (2) button.
 - ✓ The presets stored in the software for the furnace position are accepted.
- ▶ Click on the **[Adjust position]** (3) button.
 - ✓ The device moves to the furnace position.



- ▶ Perform a fine adjustment by carefully modifying the preset values and moving the device to the furnace position via the **[Adjust position]** button, repeatedly if necessary:
 - X/Y direction: Position the metering syringe over the middle of the septum of the injection port of the combustion tube.
 - Z direction: Position the syringe so that the cannula screw connection of the metering syringe is inside the cannula guide of the holding-down clamp. It must still be possible to move the holding-down clamp approx. 1 - 2 mm upward.
- ▶ The metering syringe is adjusted to the furnace position.
- ▶ Click on **[Save and exit]** to confirm the set values.



NOTICE

Adjustment of the piston is necessary if a gap can be seen between the piston and the syringe body, or if the piston hits the syringe body with a loud and audible impact.

Piston

- ▶ Select **Piston** in the **Adjust position** drop-down field (1).
NOTICE! After selecting the piston adjustment position, the piston moves approx. 1.2 cm upward. After the piston has moved upward, the piston must be adjusted, as this position will otherwise be saved as the start position!
- ▶ Enter the value 100 in the Z field and move to the position via **[Adjust position]**.
- ▶ First change the value in increments of 10 and move to the position via **[Adjust position]**, repeatedly if necessary.
- ▶ If the piston is almost at the bottom position, change the value in increments of 1.
- ▶ Move to the position via **[Adjust position]**, if necessary repeatedly, until a crack can be heard.
- ▶ Set the value back by 1.
 - ✓ This adjusts the piston stroke.
- ▶ Click on **[Save and exit]** to confirm the set values.

6.2.2 Adjusting the gripper (AOX/solid sample trays)

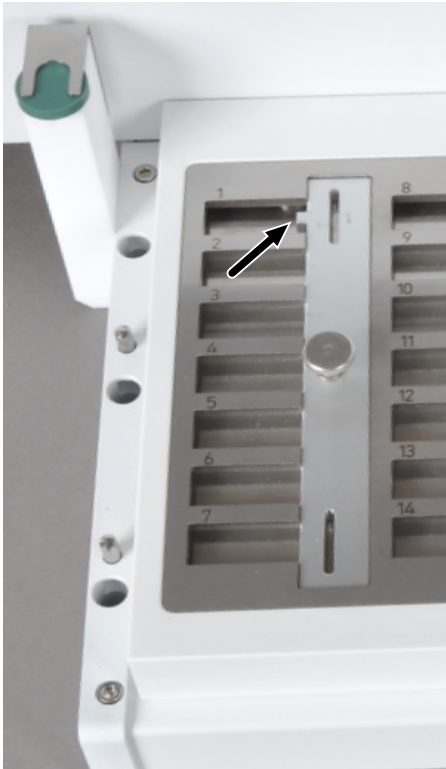


CAUTION

Risk of injury and device damage due to incorrect position values!

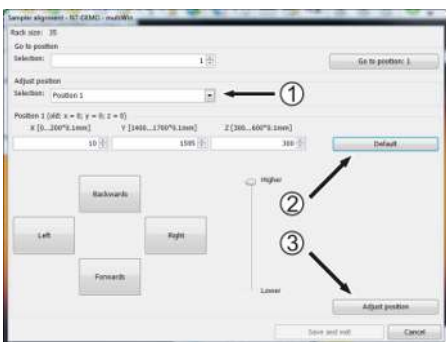
Change the preset values carefully and in steps to find the correct adjustment position.

- ▶ Open the **Adjust - sampler** window via menu **System | Adjust - sampler** in the control and evaluation software.

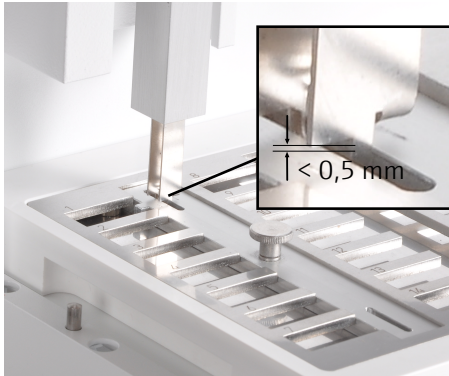


Position 1

- ▶ Place the adjusting aid on the empty sample tray.
- ▶ Position the adjusting aid so that the lug on the side (see arrow) points toward position 1.



- ▶ The software presets for position 1 are accepted.
- ▶ Click on the **[Adjust position]** (3) button.
- ▶ The device moves to position 1 on the sample tray.



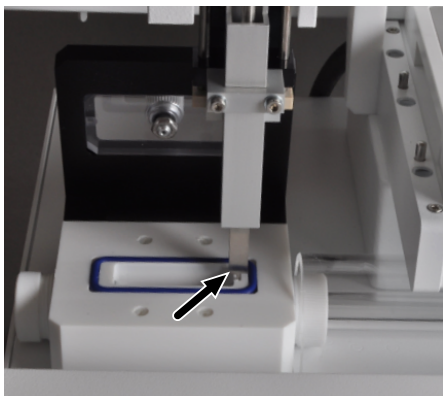
- ▶ Perform a fine adjustment by carefully modifying the preset values and moving the device to position 1 via the **[Adjust position]** button, repeatedly if necessary:
 - X/Y direction: Position the gripper above the middle of the adjustment marking.
 - Z direction: Position the gripper so that it dips into the adjustment marking and the gripper edges are max. 0.5 mm above the surface of the adjusting aid.
- ▶ Click on **[Save and exit]** to confirm the set values.
- ▶ Check the adjustment by moving the device to the lower adjustment marking.
 - ✓ The gripper has been adjusted to position 1.
- ▶ Remove the adjusting aid and place the boats on the sample tray.

Sample sluice

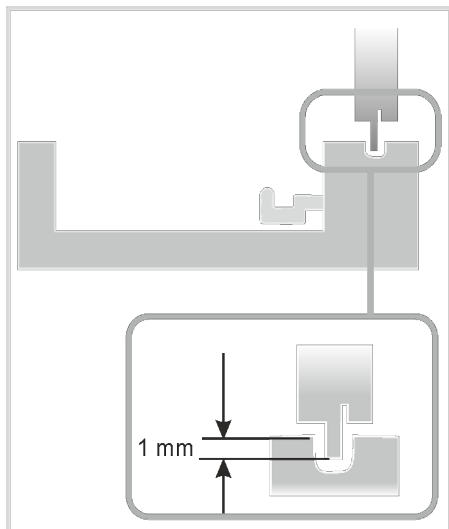
There is an adjustment marking on the right edge of the open sample port. The gripper must be adjusted until it dips into the adjustment marking without touching the edges of the marking.



- ▶ Select **Sample port** in the **Adjust position** drop-down field (1).
- ▶ Click on the **[Default]** (2) button.
 - ✓ The presets stored in the software for the sluice position are accepted.
- ▶ Click on the **[Adjust position]** (3) button.
 - ✓ The device moves to the position.



- ▶ Perform a fine adjustment by carefully modifying the preset values and moving the device to the adjustment marking of the sluice via the **[Adjust position]** button, repeatedly if necessary:
 - X/Y direction: Position the gripper above the middle of the adjustment marking.
 - Z direction: Position the gripper so that it dips into the adjustment marking by approx. 1 mm (the gripper must not rest on the adjustment marking).
- ▶ The gripper has been adjusted to the sluice position.



- ▶ Click on **[Save and exit]** to confirm the set values.

6.3 Replacing the temperature-controlled syringes



NOTICE

It is not necessary to drain or remove the hose system!

Proceed as follows to replace a temperature-controlled syringe:

- ▶ Switch off the pump at the thermostat and allow the temperature-controlled components to cool down.
CAUTION! Risk of burning when touching temperature-controlled components or the temperature control fluid
- ▶ Detach the quick coupling (on the thermostat).
- ▶ Remove the hose connections – starting with the upper red end of the hose at the temperature-controlled syringe. (Attention: Remove one hose after the other and begin with the red one to avoid liquid draining from the syringe).
Note: Seal each of the ends of the hoses with the respective hose bushing provided and all openings (plug-in connectors) on the syringe with the sealing plugs provided.
- ▶ Loosen the clamping screw of the syringe plunger and dismount the syringe.
CAUTION! Risk of injury when handling the syringe
- ▶ Proceed with caution when removing the syringe from the injector head.
Note: The dismantled syringe is still filled with temperature control liquid and can be drained into a sink or a vessel by pulling the sealing plug.
- ▶ Insert the required temperature-controlled syringe into the autosampler.

6.4 Draining the liquid system



CAUTION

Risk of burns

There is the risk of burning when touching temperature-controlled components or the temperature control fluid.

- Switch off the thermostat before conducting any maintenance work and allow the hot components and the temperature control fluid to cool down.

The system is generally emptied into the drain of the thermostat's reservoir (behind the removable front panel). Please follow the instructions given in the thermostat's user manual to do this. However, be aware that residual liquid will remain inside the hoses, in the syringe's casing and the temperature-controlled sample tray.

- ▶ First, detach the two hose fittings of the hose set on the thermostat.



NOTICE

After removing the individual hoses of the temperature-controlled sample tray one by one, immediately attach the sealing plugs to prevent liquid from draining. It is then possible to empty the temperature-controlled sample tray into a sink or a container by pulling the sealing plugs.

The self-sealing fittings ensure that the hose system remains sealed. It is now possible to open the system at its lowest point (front connector on the sample tray) without liquid draining from the system. You may insert a drain hose into the plug-in connector of the sample tray (Ø 4 mm, PTFE, PE or a similarly resistant material) to drain the system.

The open hose of the hose set can be sealed with a blind plug (included).

To ensure sufficient flow inside the system, the quick couplings must be plugged back into the thermostat to vent the hose system.

The thermostat's pump must not be operated during this process, especially as long as there is still liquid inside the reservoir.

6.5 Removing the hose set



CAUTION

Risk of burns

There is the risk of burning when touching temperature-controlled components or the temperature control fluid.

- Switch off the thermostat before conducting any maintenance work and allow the hot components and the temperature control fluid to cool down.

Proceed in reverse order to the attachment process for removing the hose set.



NOTICE

Make sure that the hoses are drained before removing them!

Sample tray and syringe can be sealed with the sealing plugs provided with the system in order to prevent residual fluid from draining from the cooling circuits in the sample tray and the syringe.



Figure 26 Sealing plugs

The ends of the hoses can also be sealed with hose bushings.

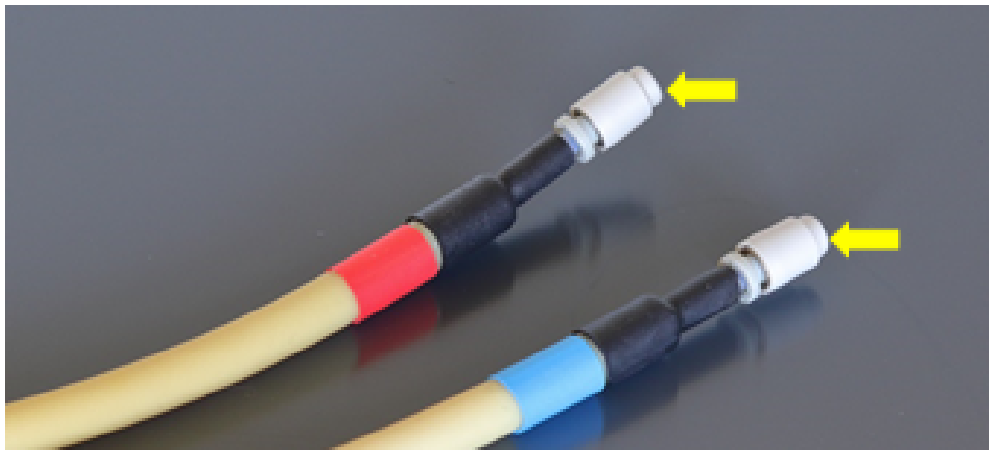


Figure 27 Hose bushings on the hose set.

7 Troubleshooting

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

Log files

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



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

Observe the user manual of the control and evaluation software for fault messages and status displays.

8 Disposal

The operator must dispose of any waste material generated during measurements (sample materials) in accordance with statutory and local regulations.

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

9 Transport and storage

9.1 Transport

9.1.1 Transport notes

Transport the autosampler very carefully to prevent damage from impact, shock or vibration.

The autosampler should be transported in such a way that major temperature fluctuations are avoided, preventing any condensate formation.

9.1.2 Preparing for transport



CAUTION

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

Exercise caution when removing glass components from the autosampler!



CAUTION

Risk of injury from the movable guide arm with injector head!

Only lift or carry the autosampler horizontally! Otherwise, the guide arm can move unexpected and lead to injury. When carry and setting down the device, note that it can be slightly imbalanced toward the front due to the position and geometry of the injector head.



NOTICE

Unsuitable packaging material can lead to damage to the individual components of the autosampler! Risk of possible damage to the guide arm and the injector head if transport locks are not applied!

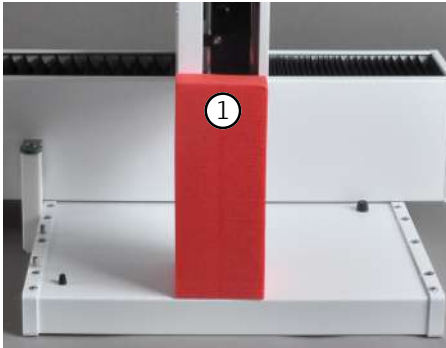
Only transport the autosampler with the transport locks applied between the injector head and the rack receptacle, and only in the original packaging!

Preparing for transport

Proceed as follows to prepare the autosampler for transport:

- ▶ Switch off the autosampler via the device switch. Switch off the thermostat. Allow the temperature-controlled components to cool down.
- ▶ Remove the connector of the external tabletop power supply unit on the rear of the device and disconnect the power plug from the socket.
- ▶ Remove the interface cable (RS-232 connection).
- ▶ Remove all sample containers, the sample tray and the solvent container.
 - To do this, first remove the hoses connecting the thermostat with the sample tray and the temperature-controlled syringe (→ "Removing the hose set" 38). Make sure that the connectors are sealed to prevent liquid from draining while handling the equipment.

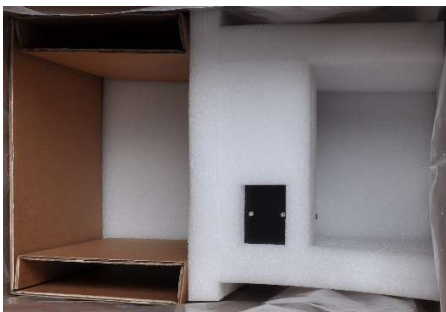
- ▶ Drain the liquid system (→ "Draining the liquid system" 📄 38).
- ▶ If necessary, remove the boat sensor (disconnect the interface cable on the rear of the device).
- ▶ Remove the autosampler from the ABD or analyzer.



- ▶ Push the injector head over the rack receptacle and apply the transport lock (1).



- ▶ Place the device in the original packaging.



- ▶ Insert the foam insert so that the injector head is seated in the corresponding recesses.
- ▶ Carefully package the device in the original packaging.

9.2 Storage



NOTICE

Environmental influences and condensation can destroy individual components of the device!

Only store the autosampler in air-conditioned rooms.

The atmosphere must be low in dust and free from aggressive vapors.

If the autosampler 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:

- Temperature range: 15 to 55 °C
- Max. humidity: 10 to 30 °C
- Air pressure: 0.7 to 1.06 bar

10 Specifications

Designation/type	MMS-T autosampler
Dimensions (W x H x D), weight	ca. 510 x 500 x 410 mm, ca. 9.5 kg
Sample matrix	Liquids
Waste container	PTFE container with waste hose
Solvent and acid vessel	25 ml

Table 1: General specifications

Electrical variables

Power supply unit voltage supply	110 to 240 V +10/-5 %
Frequency	50/60 Hz
Overvoltage category	II
Degree of contamination	2
Nominal voltage	24 V DC, 1.25 A
Typical average power consumption	30 W
Interfaces	RS 232 (special bus)

General characteristics

Syringes	50 µl and 100 µl without vent, temperature controlled with coding for nominal volume Materials in contact with the temperature control circuit: <ul style="list-style-type: none"> ■ Glass, PET-P, stainless steel
Sample tray	112 sample positions for 2-ml vials with SnapCap and coding for tray geometry (for liquid samples) Materials in contact with the temperature control circuit: <ul style="list-style-type: none"> ■ Aluminum, stainless steel
Hose set	Pre-assembled hose system with connectors for thermostat, syringe and tray <ul style="list-style-type: none"> ■ Hose: PTFE Ø 4 x 0.5 mm ■ CPC quick couplings

Table 2: General characteristics

Procedural data

Temperature control range	5 °C to 80 °C
Temperature control accuracy	< ± 1 K within the sample tray
Deviation from the reservoir temperature	< ± 1 K difference tray/syringe
Heating time room temp. to 80 °C	up to approx. ± 2 K
Cooling time room temp. to 5 °C	approx. 15 to 20 min
Cooling time 80 °C to 5 °C	approx. 20 to 25 min

Table 3: Procedural data

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 °C (use desiccant)
	Air pressure	0.7 to 1.06 bar
	Maximum altitude	2000 m

Table 4: Environmental conditions

Optional solid kit	Sample matrix	<ul style="list-style-type: none"> ■ Solids ■ AOX container ■ occupied quartz fiber (EC/OC) and polycarbonate filters (AOX)
	Sample application tool	Special gripper for quartz boats
	Sample tray	AOX/solid sample tray (for 35 quartz boats 40 x 9 mm)

Table 5: General specifications

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	<p>The device complies with the following safety standards</p> <ul style="list-style-type: none"> ■ EN 61010-1 ■ EN 61010-2-081 ■ EN 61010-2-010
EMC compatibility	<p>The device has been checked for transient emissions and noise immunity.</p> <p>It meets the requirements for transient emissions according to</p> <ul style="list-style-type: none"> ■ EN 61326-1 (EN 55011 group 1, class B) <p>The device meets the requirements for noise immunity according to</p> <ul style="list-style-type: none"> ■ EN 61326-1 (requirements for use in a basic environment)
Environmental compatibility	<p>The device has been tested for environmental compatibility and meets the requirements according to</p> <ul style="list-style-type: none"> ■ ISO 9022-2 ■ ISO 9022-3
EU directives	<p>The device meets the requirements of the directive 2011/65/EU.</p> <p>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.</p>

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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