

# Operating Manual

## Temperature-controlled Sampler LS-T



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Manufacturer                      Analytik Jena GmbH+Co. KG  
Konrad-Zuse-Straße 1  
07745 Jena / Germany  
Phone: +49 3641 77 70  
Fax: +49 3641 77 9279  
Email: [info@analytik-jena.com](mailto:info@analytik-jena.com)

Technical Service                      Analytik Jena GmbH+Co. KG  
Konrad-Zuse-Straße 1  
07745 Jena / Germany  
Phone: +49 3641 77 7407  
Fax: +49 3641 77 9279  
Email: [service@analytik-jena.com](mailto:service@analytik-jena.com)



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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# Table of contents

<b>1 Basic information .....</b>	<b>5</b>
1.1 About this user manual .....	5
1.2 Intended use .....	6
<b>2 Safety instructions .....</b>	<b>7</b>
2.1 General notes .....	7
2.2 Safety labeling on the device .....	7
2.3 Safety instructions .....	8
2.4 Decontamination after soiling .....	8
2.5 Safety instructions – maintenance and repair .....	9
2.6 Behavior during emergencies .....	9
<b>3 Function and design .....</b>	<b>10</b>
3.1 Type plate.....	12
3.2 Temperature-controlled components .....	12
3.3 Device switch/interfaces .....	17
<b>4 Installation and commissioning .....</b>	<b>19</b>
4.1 Installation conditions.....	19
4.1.1 Environmental conditions .....	19
4.1.2 Spatial requirements .....	19
4.1.3 Power supply.....	19
4.2 Installation and commissioning.....	19
4.2.1 Unpacking and setting up .....	19
4.2.2 Installing and connecting the autosampler.....	20
4.2.3 Setting up and connecting temperature-controlled components.....	22
<b>5 Operation.....</b>	<b>28</b>
5.1 Dispensing liquids.....	28
5.2 Working without temperature control .....	29
<b>6 Maintenance and care .....</b>	<b>31</b>
6.1 Maintenance intervals.....	31
6.2 Maintaining and adjusting the autosampler .....	31
6.3 Replacing the temperature-controlled syringes .....	34
6.4 Draining the liquid system .....	34
6.5 Removing the hose set.....	35
<b>7 Troubleshooting .....</b>	<b>37</b>
7.1 Troubleshooting according to software messages .....	37
7.2 Analytic problems .....	38
<b>8 Transport and storage .....</b>	<b>39</b>
8.1 Transport.....	39
8.1.1 Transport notes .....	39
8.1.2 Preparing for transport .....	39

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8.2	Storage .....	40
<b>9</b>	<b>Disposal .....</b>	<b>41</b>
<b>10</b>	<b>Specifications.....</b>	<b>42</b>
10.1	Standards and directives .....	43
	<b>Index .....</b>	<b>45</b>

# 1 Basic information

## 1.1 About this user manual

The temperature-controlled autosampler LS-T is a system module for the compact elemental analyzer compEAct N / compEAct S / compEAct S MPO or multi EA 5010 N / multi EA 5010 S / multi EA 5010 S MPO.

The autosampler is mounted on the analyzer and operated in combination with a thermostat.

This user manual therefore only applies in conjunction with the following documents:

- The compEAct N / compEAct S / compEAct S MPO or multi EA 5010 N / multi EA 5010 S / multi EA 5010 S MPO user manual
- The software manual for the EAcvolution 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 occurring in chronological order are numbered and combined into 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).
- 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. These warnings are always placed before an action.



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### WARNING

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

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### CAUTION

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

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### NOTICE

Provides information on potential material or environmental damage.

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## 1.2 Intended use

The temperature-controlled autosampler must only be used for the procedures described in the user manuals for the devices compEAct N / compEAct S / compEAct S MPO and multi EA 5010 N / multi EA 5010 S / multi EA 5010 S MPO for determining the sulfur or nitrogen content in liquid samples. Any other use is not as intended! The operator is solely responsible and liable for any damages that result from such unintended use.

The temperature-controlled autosampler can be used for metering normal and demanding liquids. The autosampler allows easy and safe metering of liquids with very low boiling temperatures or elevated viscosity.

The autosampler can also be operated without using the temperature control function.

The following substances must not be analyzed with the device as these substances pose a risk of explosion:

- substances tending to spontaneous decomposition (e.g. peroxides)
- explosives, explosive materials (e.g., trinitrotoluene solutions or inorganic azides)

The following substances must not be analyzed with the device as they could damage the analysis system:

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

## 2 Safety instructions

### 2.1 General notes

#### Applicable documents

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

- The compEAct N / compEAct S / compEAct S MPO or multi EA 5010 N / multi EA 5010 S / multi EA 5010 S MPO user manual
- The software manual for the EAvolution 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.  
Work particularly carefully and cleanly with infectious material because the device cannot be decontaminated as a whole.
- 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 parts 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 LS-T is a system module for the compact elemental analyzer compEAct N / compEAct S / compEAct S MPO or multi EA 5010 N / multi EA 5010 S / multi EA 5010 S MPO.

The temperature-controlled autosampler LS-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.

The autosampler is mounted on the analyzer and meters liquid samples directly into the combustion system of the analyzer.



**Fig. 1 Analysis system with temperature-controlled autosampler**

- |                                      |   |
|--------------------------------------|---|
| 1 Temperature-controlled autosampler | 2 Analyzer compEAct N / compEAct S / compEAct S MPO |
| 3 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



**Fig. 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

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## NOTICE

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

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

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## NOTICE

The thermostat is not included in the scope of delivery!

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### 3.1 Type plate

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

The type plate contains the following information:

- manufacturer address, trademark
- Designation of the device, serial number
- Electrical connection data
- Conformity markings
- WEEE marking

### 3.2 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

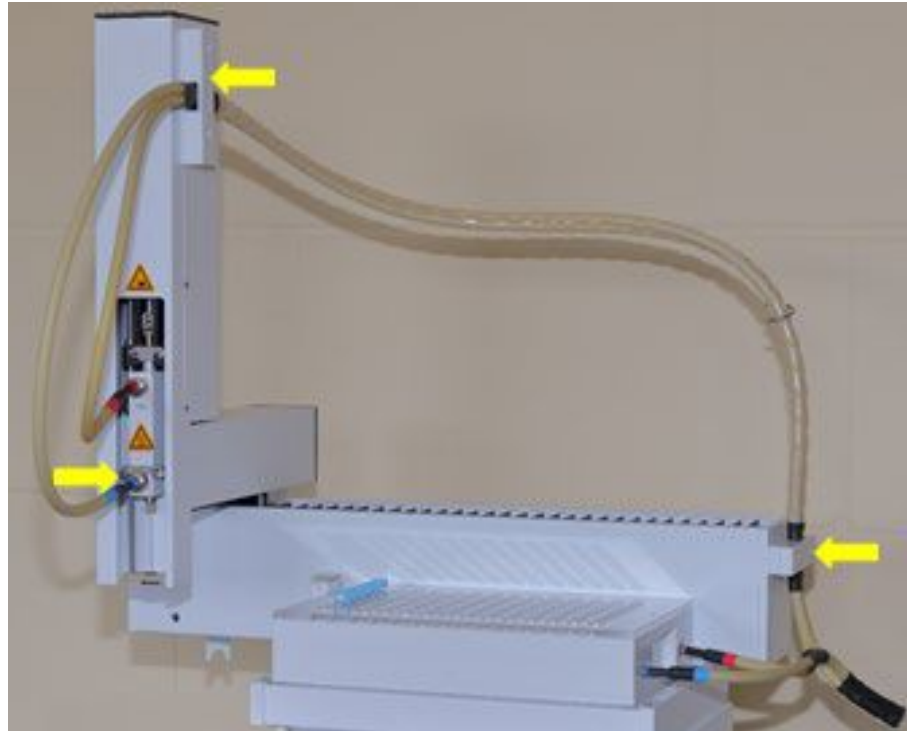


Fig. 3 LS-T autosampler

### Temperature-controlled syringes

#### Nominal volume

The package includes two temperature-controlled syringes with a nominal volume of 50  $\mu\text{l}$  and 100  $\mu\text{l}$ . 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.

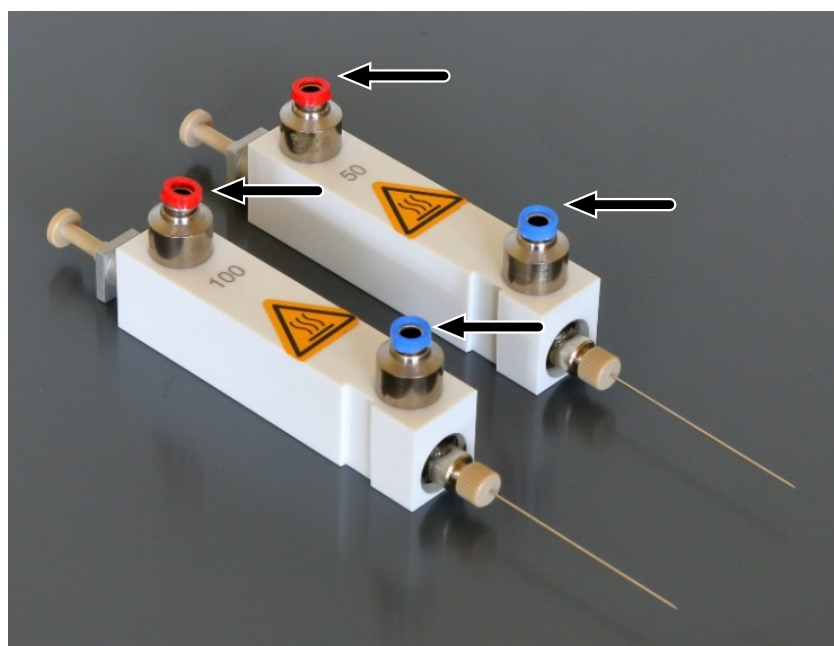


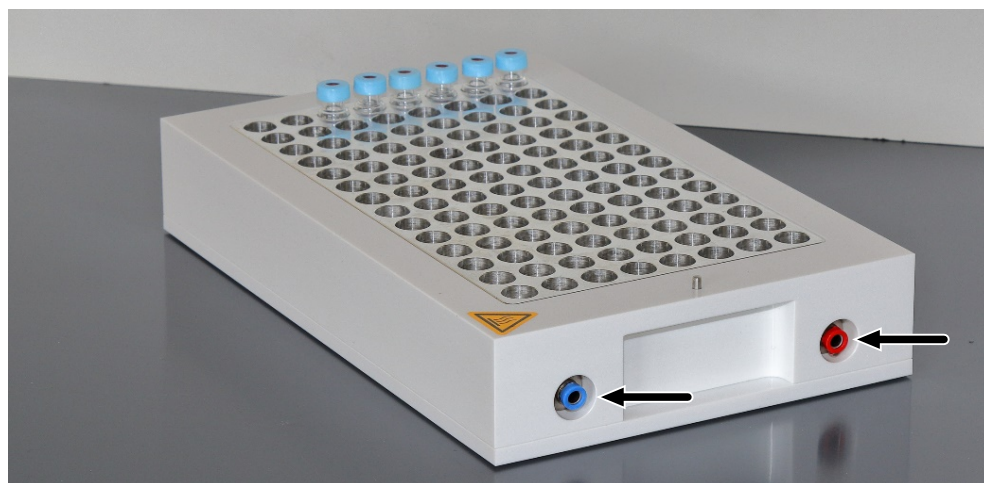
Fig. 4 Temperature-controlled syringes

### 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.



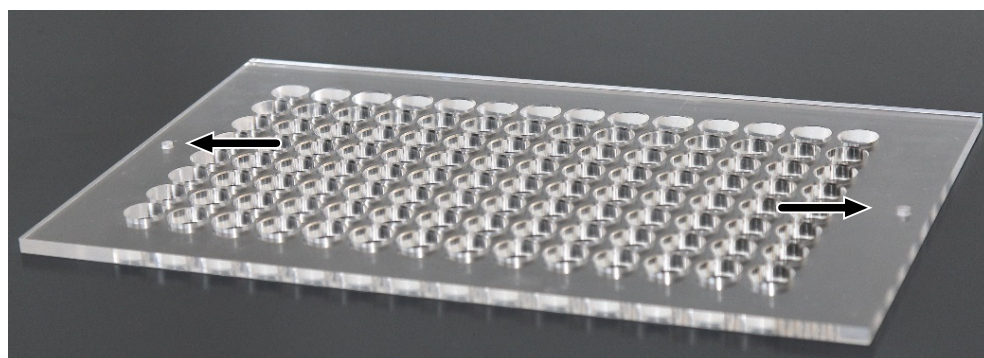
**Fig. 5** Temperature-controlled sample tray

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).



**Fig. 6** Cover



## NOTICE

The cover must always be removed for temperatures > 40 °C!  
Otherwise, there is the risk that the cover is deformed and collides with the injector head.

## Hose set

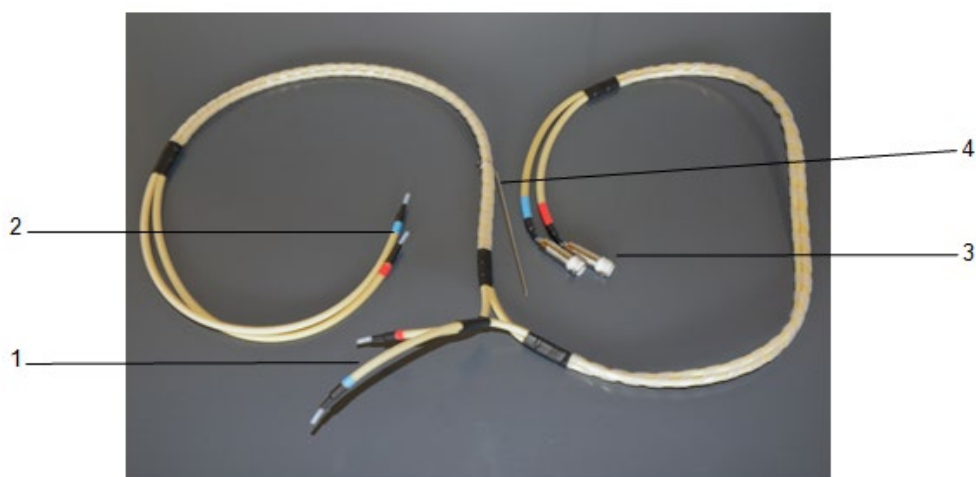
The hose set connects the components temperature-controlled syringe and temperature-controlled sample tray with the cold-recirculating thermostat.

The hoses of the liquid system are made of PTFE and their size is Ø 4 x 0.5 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.



**Fig. 7**    **Hose set**

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

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.



Fig. 8 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.

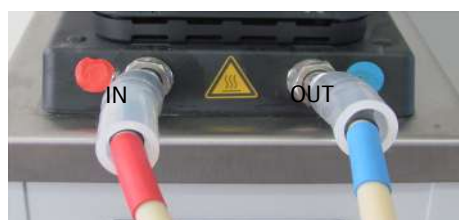
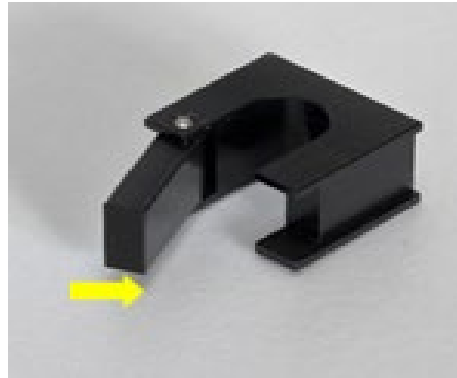


Fig. 9 Thermostat – connections

## 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.





**Fig. 10** 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.



**Fig. 11** Sealing plugs and sealing caps, tool

## 3.3 Device switch/interfaces

The autosampler is connected to the single-phase AC grid via an external table-top power supply unit.



**Fig. 12** Wide-range table-top 100 to 240 V PSU

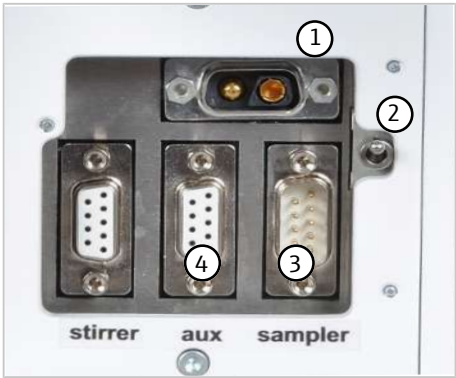


Fig. 13    Rear – connections

- 1    Socket for the  
      wide-range table-top 100 to 240 V PSU
- 2    Device switch
- 3    Socket for the interface cable
- 4    Socket for the boat sensor (not used)

The socket for the power supply unit and the device switch are located on the rear panel of the autosampler.

The autosampler is connected to the analyzer via a connection cable with RS 485 special bus. The cable is connected by means of a special connector. The connector is inserted into the sockets on the rear panel of the autosampler.



Fig. 14    Connector for connecting the analyzer (right: attached to the autosampler)

- 1    Socket (blue)  
      for direct connection to the analyzer
- 2    DIP switch 1+2 with positions on/off
- 3    Socket (red)

The special connector has two sockets (blue and red). The second socket can be used to create a series connection between the autosampler and additional autosampler modules, such as a gas sampler.

How to connect the autosampler modules is described in the manual of the respective gas sampler. Please observe the setting of the two DIP switches.

Position of the DIP switches 1+2: on (default setting)	The autosampler is the last module in the series.
DIP switches 1+2: off	There are further modules connected to the series after the autosampler.

## 4 Installation and commissioning

### 4.1 Installation conditions

#### 4.1.1 Environmental conditions

The laboratory device is intended to be used indoors. The installation conditions are the same as for the analyzer (see user manual of the analyzer).

#### 4.1.2 Spatial requirements

The autosampler is mounted onto the analyzer and fixed in place. The height required depends on the height of the analyzer and the height of the autosampler module. There must be a clearance of at least 10 cm between the device system and any shelf or cabinet above the system.

The thermostat is placed next to the analyzer.

#### 4.1.3 Power supply



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#### 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 60038 must be available.

### 4.2 Installation and commissioning

#### 4.2.1 Unpacking and setting up



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#### 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.

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## 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 Installing and 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 low-voltage cable of the table-top power supply unit with the 2-pin Sub-D connector to the socket on the rear panel of the device (see arrow). Do not connect the power cable to the mains, yet.



- ▶ Plug the special connector into the socket on the rear panel of the autosampler.
- ▶ Insert the blue connector of the RS 485 interface cable to the blue socket.



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



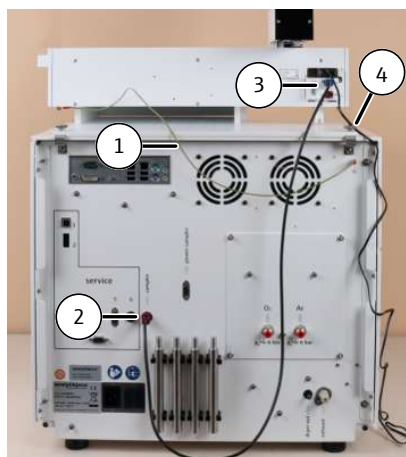
- ▶ Insert the solvent container into the rear pin on the left-hand side of the rack receptacle (see arrow).



- ▶ Attach the retaining plate on the analyzer. Use the two attachment angles on the rear panel of the analyzer to do this. Lock the retaining plate in place on the device top by tightening the two knurled nuts.



- ▶ Place the autosampler onto the retaining plate. Use the four Allen screws to attach the rack receptacle to the retaining plate.



- ▶ Connect the analyzer:  
Cable for potential equalization (1)  
Communication interface: "Sampler" socket on the analyzer (2) – blue connector on the autosampler (3)  
Note: The "power sampler" socket on the rear panel of the analyzer remains unoccupied.
- ▶ Plug the power supply unit (4) into the mains socket.
- ▶ Use the switch on the device rear to turn the autosampler on.  
✓ The autosampler is mounted onto the analyzer and connected.

Before operations, the autosampler must be adjusted (→ "Maintaining and adjusting the autosampler" 31).

### 4.2.3 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

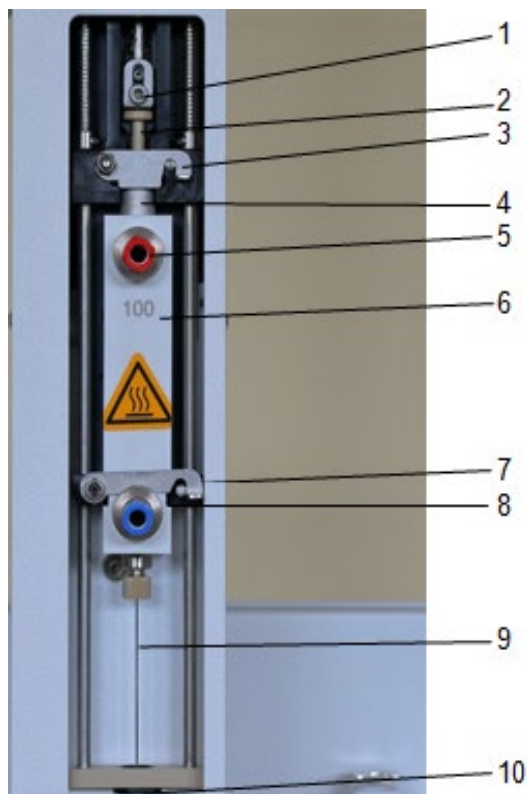
##### Risk of injury from the syringe

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.



**Fig. 15 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.
- ▶ 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.

Mounting the temperature-controlled sample tray



**Fig. 16 Temperature-controlled sample tray – connectors**

Placing the cold-recirculating thermostat

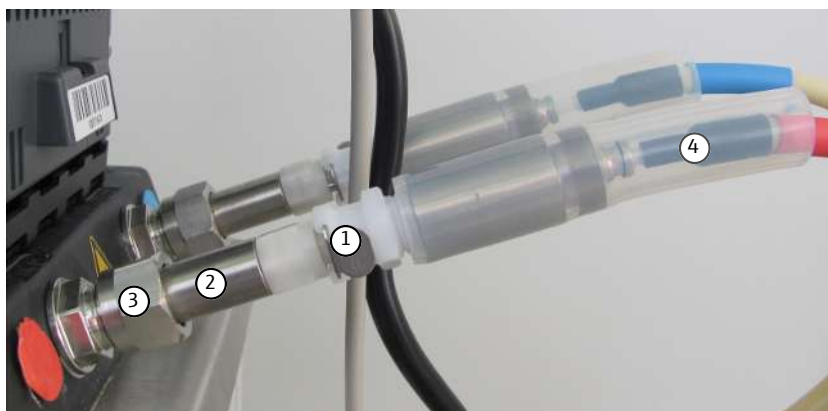
- ▶ Place the cold-recirculating thermostat to the right of the analysis system and observe the operating instructions for this device.
  - Make sure that the temperature is set only slightly above 80 °C (protection against inadmissible maximum temperatures) to avoid damage to the autosampler or to the 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)



**Fig. 17 Thermostat – connections**

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



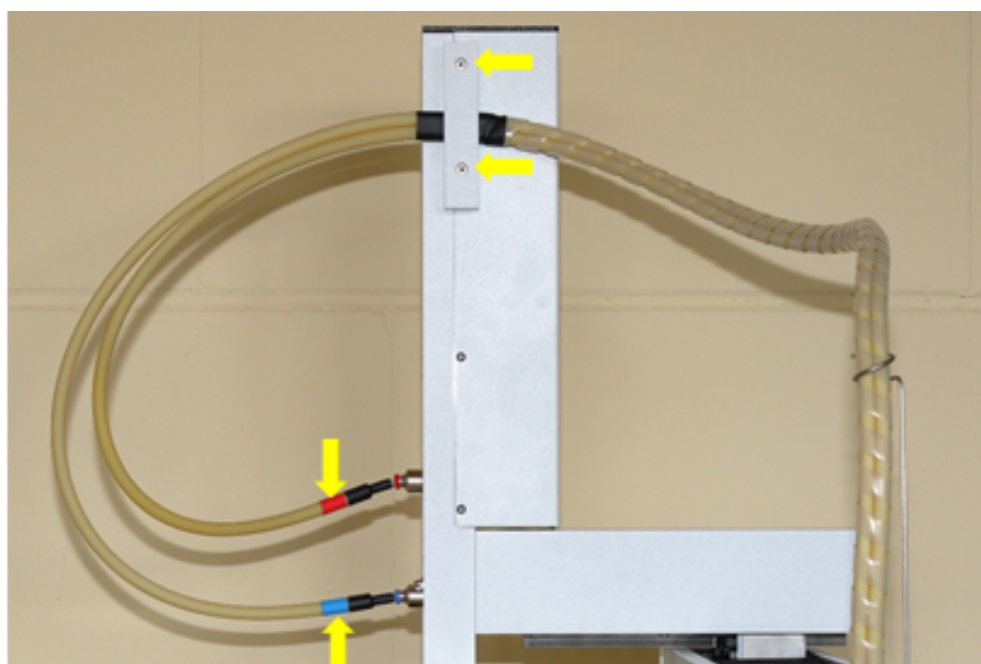
The CPC adapters are part of the included accessories. The blind plugs or transition pieces on the thermostat must be replaced by these adapters. This requires an SW-19 open-end wrench.



**Fig. 18 Thermostat – connections at the rear**

Attaching the hose set:

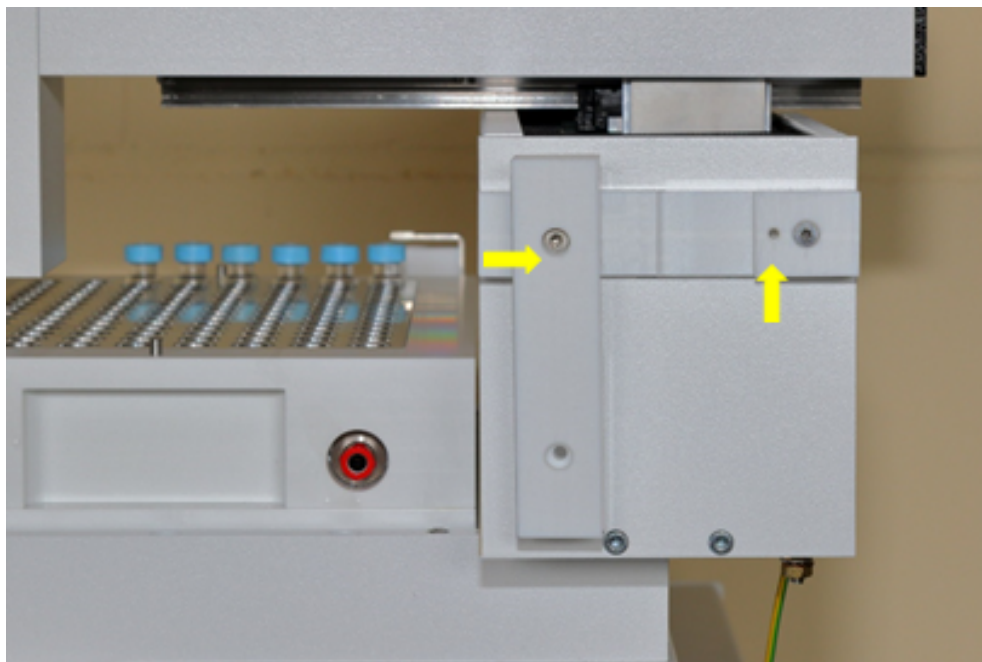
- ▶ First, open the upper hose guide on the autosampler. To do this, loosen the lower screw and remove the upper screw so that the hose guide can be opened. Use the TX10 Allen key for this (included).
- ▶ Use the second long hose pair of the hose set to connect the hose set to the syringe.



**Fig. 19 Attachments**

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.



**Fig. 20 Attachments**

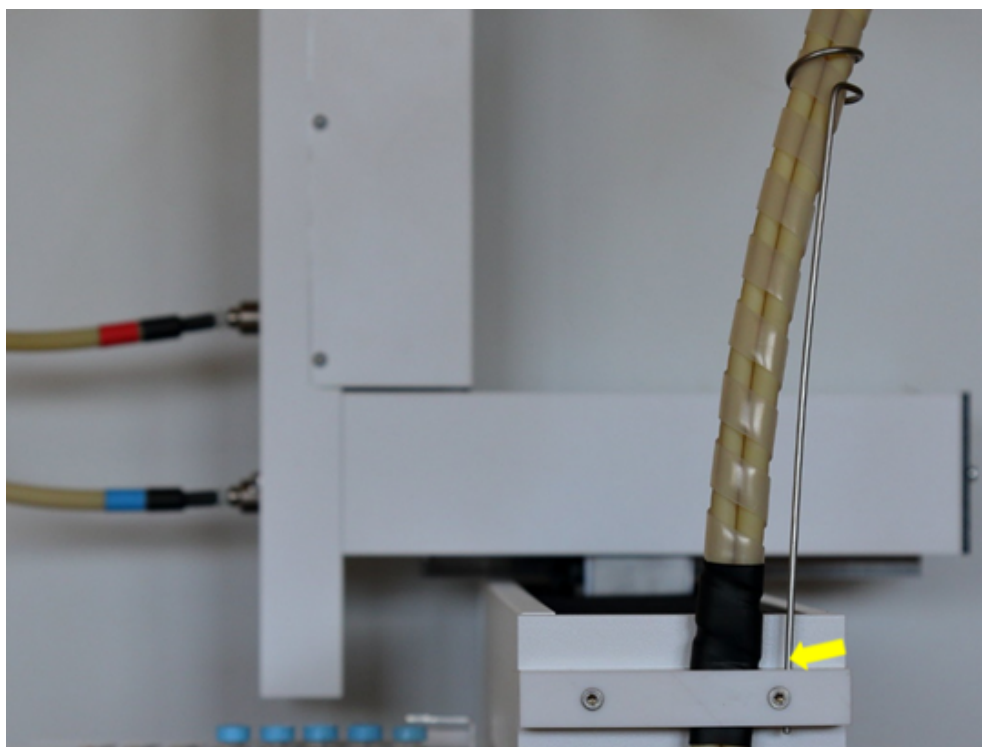
- ▶ Now, route the hose pair through the hose guide.

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.



**Fig. 21 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)

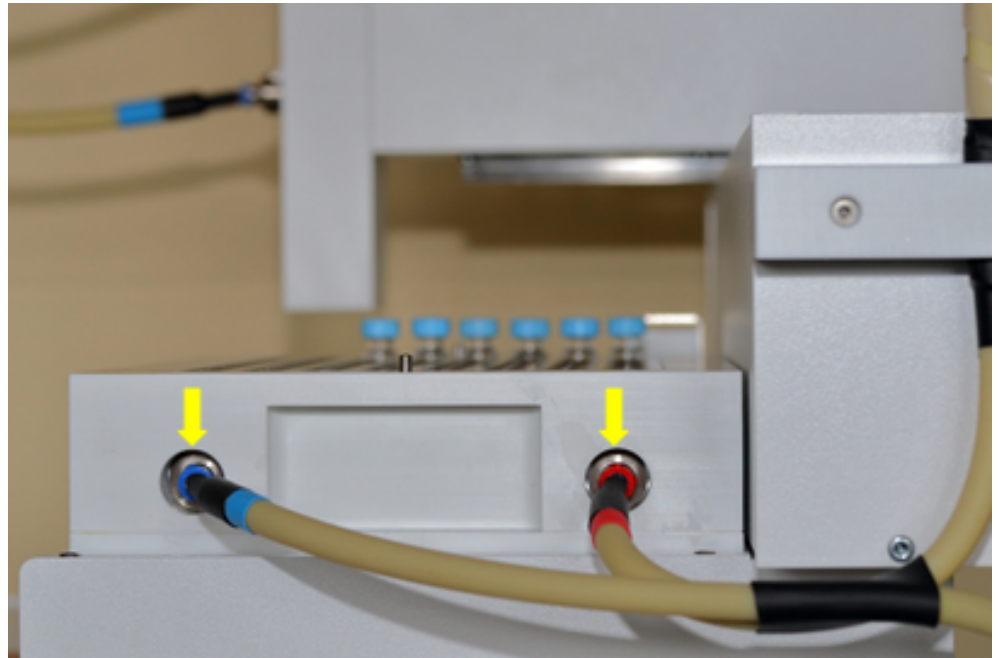


Fig. 22 Connection to the temperature-controlled sample tray

### 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.
-



## NOTICE

### Risk of leaking syringe

The temperature-controlled syringe may begin to leak if the switch from maximum to minimum temperature (80 °C to 5 °C) is too rapid.

- Avoid rapidly switching from maximum to minimum temperature.
- Allow the thermostat to first cool down to room temperature. Only set a lower temperature after this.

- 
- ▶ 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 in the waste container.
  - ▶ Switch on the autosampler and all other system components.
  - ▶ Launch the control and analysis software. The metering syringe and the 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.

## 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.



Fig. 23 Syringe adapter and interlocking tabs



## 6 Maintenance and care

### 6.1 Maintenance intervals

Maintenance task	Maintenance interval
Cleaning and servicing the device	Weekly
Adjusting the sampler	During commissioning, after every rearrangement, and after transport and storage
Replacing the septum of the solvent container	As required
Cleaning the cannula guide	As required
Replacing the cannula	As required

### 6.2 Maintaining and adjusting the autosampler



#### CAUTION

##### Risk of crushing

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

- Maintain a safety distance from the autosampler during operation.
- Change the preset values carefully and in steps to find the correct adjustment position.



#### CAUTION


##### Risk of injury from the syringe

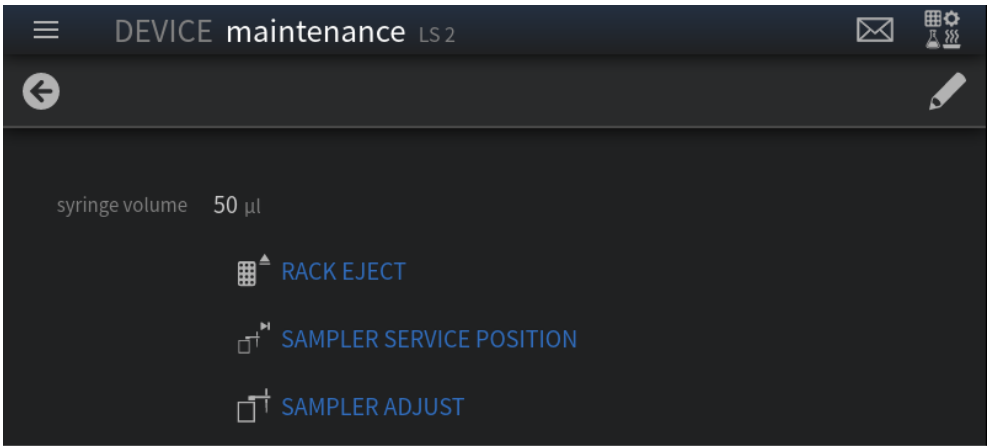
The syringe is very sharp and pointy.

- 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.

The following maintenance and adjustment instructions apply to all autosampler modules (LS 1 / LS 2, LS-T) which can be used with the compact elemental analyzer. Particular requirements for the temperature-controlled autosampler LS-T are highlighted in the text.


The maintenance functions for the autosamplers are described under **maintenance LS 1 (LS 2 or LS-T)**. This page can be accessed by selecting menu item **system | device | maintenance | LS 1 (LS 2 or LS-T)**.

Alternatively, you can tap  on the **Device Status** page to open the **maintenance** page of the connected sample feeding module.



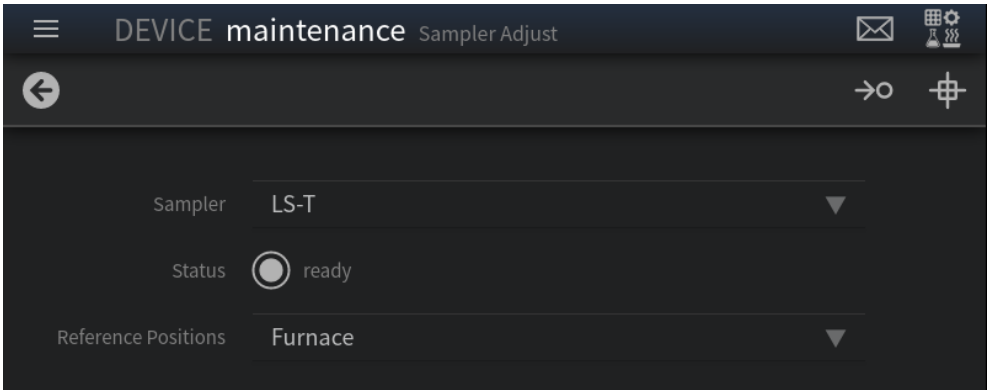
Functions on the page maintenance

The **maintenance** page contains the following functions:

Function	Description
Syringe volume	<p>Display of the volume of the syringe that is set</p> <p>This value can be edited by tapping </p> <p>The temperature-controlled LS-T autosampler has an automatic syringe detection system. Information on the syringe volume is retrieved automatically and applied in the software.</p>
Eject rack	<p>LS 2 only: Eject the LS 2 tray for loading</p>
Service Position	<p>Move the injector head to the service position</p> <p>Always use the software to move the injector head to its service position when performing maintenance work on the combustion tube or while attaching or removing the solvent or waste container on the autosampler.</p> <p><b>Note:</b> Once the analyzer is switched on using the power switch and the autosampler is switched on using the ON/OFF switch, the injector head must no longer be moved by hand. The sensors and the mechanical systems for positioning the injector head may become damaged otherwise.</p>
Sampler Adjust	<p>Adjusting the autosampler</p>



Adjusting the sampler

The autosampler is adjusted on the page Adjusting the autosampler.







The **Sampler Adjust** page contains the following functions:

Field / Function	Description
<b>Sampler</b>	Connected autosampler The autosampler is either automatically detected during the device initialization or may be selected from the list.
<b>Status</b>	Display of readiness for operation
<b>Reference Positions</b>	List of positions that can be adjusted or moved to by the autosampler The following positions must be adjusted: <ul style="list-style-type: none"> <li>▪ <b>1st Rack Position:</b> Position 1 on the sample rack</li> <li>▪ <b>Furnace:</b> Injection port of the combustion tube (furnace)</li> </ul> The device can be moved to the following positions for checking: <ul style="list-style-type: none"> <li>▪ <b>Origin:</b> Initialization position</li> <li>▪ <b>Waste Position:</b> Waste container</li> <li>▪ <b>Solvent Position:</b> Solvent container</li> <li>▪ <b>Service Position:</b> Injector head moves to the right to allow the maintenance personnel to access the solvent container and the waste container</li> </ul>
	Move to selected position Only tap this button if it is guaranteed that this reference position was already adjusted or no adjustment is required.
	Adjust selected position on the page

#### Adjusting positions

The positions of the autosampler can be adjusted as follows:

- ▶ Tap **Sampler Adjust** on the **maintenance LS 1 (LS 2 or LS-T)** page.
- ▶ Select the position **1st Rack Position** or **Furnace** from the **Reference Positions** list.
- ▶ Tap .
- ▶ Use the buttons to move the injection head of the autosampler to the correct position.
  - **[++], [--]:** Move injection head in large steps
  - **[+], [-]:** Fine adjust injection head in small steps
- ▶ Tap **OK** to confirm the parameters and return to the **Sampler Adjust** page.
  - ✓ The configured position is stored. You can now move the device to the position by tapping .

#### Correct adjustment of sample position 1 (all autosamplers)

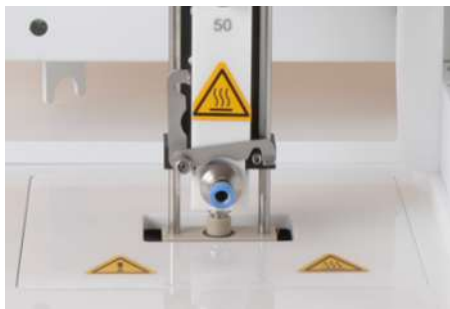
Place a sample cup closed with a septum in sample position 1 for adjustment. The autosampler is precisely adjusted at sample position 1, if the following conditions are met:

- ▶ Direction **left-right:** Move the injector head to the position in which the cannula is located in central position above the septum of the sample cup.
- ▶ Direction **backward-forward:** Move the sample rack (for LS 2) or the injector head (for LS-T) to the position in which the cannula is located in central position above the septum of the sample cup.

**Note:** The direction **backward-forward** cannot be adjusted for the LS 1.
- ▶ Direction **up-down:** Lower the cannula until the cannula tip is 1 to 2 mm above the bottom of the vessel. The cannula must not touch the bottom of the vessel!

Adjusting the furnace position  
(only for LS-T)

In furnace position the cannula must hit the injection port of the combustion tube in central position.



- ▶ Directions **left-right** and **backward-forward**: Move the injector head to the position in which the cannula is located in central position above the injection port.
- ▶ Direction **up-down**: Lower the syringe until the cannula screw connection of the metering syringe is located in the cannula guide of the holding-down device. It must still be possible to move the holding-down device up by approx. 1 to 2 mm.

## 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

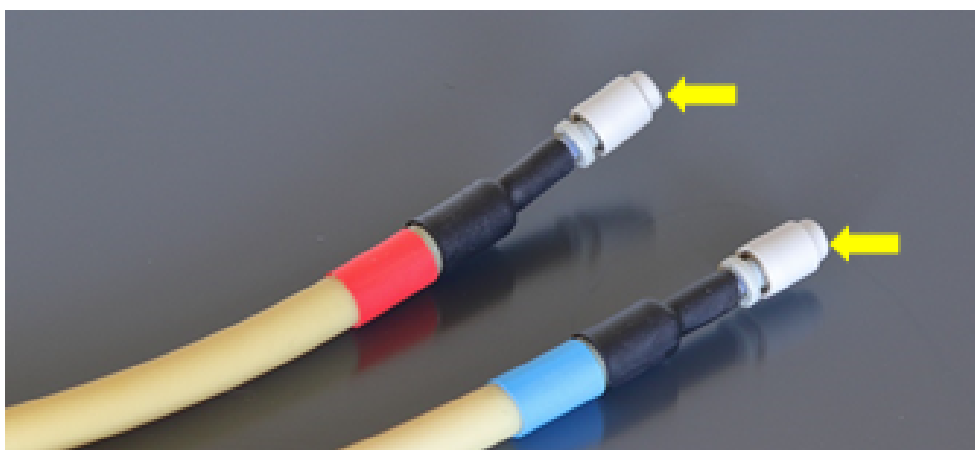
Make sure that the hoses are drained before removing them!

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.



**Fig. 24** Sealing plugs

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



**Fig. 25** Hose bushings on the hose set.

## 7 Troubleshooting

### 7.1 Troubleshooting according to software messages



#### NOTICE

##### Risk of device damage

Contact customer service in the following cases:

- The troubleshooting measures described do not eliminate the error.
- The error occurs repeatedly.
- The error message is not featured in the following list or the list refers to customer service for troubleshooting the error.

The system is monitored as soon as the device is switched on. After starting the control software, all malfunctions of the device are reported using error messages. Error messages consist of an error code and an error message.

The following section describes a number of possible malfunctions which the operator can partly troubleshoot without the help of a customer service technician. Confirm the error message and carry out the troubleshooting measures.

Error code	Error message	
102007	No connection to sampler LS-T.	
	Cause	Remedy
	Connection to the autosampler cannot be established.	<ul style="list-style-type: none"> <li>■ Check the connections.</li> <li>■ Contact customer service, if necessary.</li> </ul>
102210	sampler error	
	Cause	Remedy
	A general error occurred in the autosampler.	<ul style="list-style-type: none"> <li>■ Contact customer service.</li> </ul>
102211	Error in the autosampler's X axis	
	Cause	Remedy
	The drive for the autosampler's X axis does not move or the zeroing sensor has failed.	<ul style="list-style-type: none"> <li>■ Contact customer service.</li> </ul>
102214	sampler emergency stop	
	Cause	Remedy
	The sampler is in non-stop operation.	<ul style="list-style-type: none"> <li>■ Check the autosampler and remove any objects blocking the path. Initialize the device.</li> <li>■ Contact customer service, if necessary.</li> </ul>

102215	There is no rack on the LS-T sampler installed.	
	Cause	Remedy
	No tray is placed onto the autosampler.	<ul style="list-style-type: none"> <li>■ Insert a sample tray into the rack receptacle.</li> <li>■ Initialize the device.</li> </ul>
102216	There is no syringe in the LS-T sampler installed.	
	Cause	Remedy
	No syringe is inserted into the autosampler.	<ul style="list-style-type: none"> <li>■ Insert the syringe into the injector head.</li> <li>■ Initialize the device.</li> </ul>

## 7.2 Analytic problems

This section describes a number of analytic problems which the user can rectify independently. Most of the analytic problems lead to implausible measurement results. If the suggested solutions do not eliminate the errors/problems, and if such problems occur frequently, contact the customer service department of Analytik Jena GmbH+Co. KG.

Error	Possible cause	Remedy
Low results	Dosing error	Check metering process.
	Loss of sample due to vaporization or spillage	<ul style="list-style-type: none"> <li>■ Close the sample cup</li> <li>■ Cool down volatile samples inside the autosampler</li> </ul>
Carryover	Inadequate rinsing of the syringe	Properly rinse the syringe before sampling.
	Dosing faulty	Check the metering process.
Scattering measurements	Clogged syringe	Use a cleaning wire to remove clogged material from the cannula or replace it, if necessary.
	Dosing faulty	Check the metering process.

## 8 Transport and storage

### 8.1 Transport

#### 8.1.1 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.

#### 8.1.2 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 unexpectedly 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!**

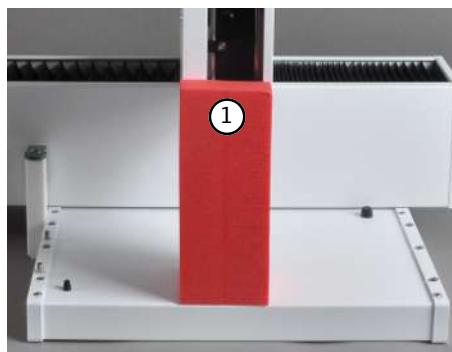
Only transport the autosampler with the transport locks applied between the injector head and the rack receptacle, and only in the original packaging!

#### 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" 35). Make sure that the connectors are sealed to prevent liquid from draining while handling the equipment.

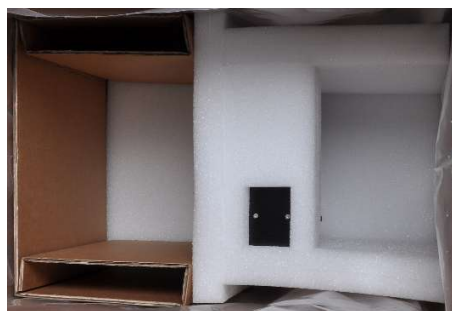
- ▶ Drain the liquid system (→ "Draining the liquid system" 34).
- ▶ Dismount the autosampler from the analyzer.



- ▶ 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.

## 8.2 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



## 9 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.

## 10 Specifications

Designation/type	LS-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)
Connection to the analyzer	with special plug and RS 485 interface cable

### 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: ■ 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: ■ Aluminum, stainless steel
Hose set	Pre-assembled hose system with connectors for thermostat, syringe and tray ■ 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	21 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**

## 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"> <li>■ EN 61010-1</li> <li>■ EN 61010-2-081</li> <li>■ EN 61010-2-010</li> </ul>
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"> <li>■ EN 61326-1 (EN 55011 group 1, class B)</li> </ul> <p>The device meets the requirements for noise immunity according to</p> <ul style="list-style-type: none"> <li>■ EN 61326-1 (requirements for use in a basic environment)</li> </ul>
Environmental and ambient influences	<p>This device has been tested in environmental simulations under operation and transport conditions and is in accordance with the requirements in:</p> <ul style="list-style-type: none"> <li>■ ISO 9022-2</li> <li>■ ISO 9022-3</li> </ul>
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.

## Table of figures

Fig. 1	Analysis system with temperature-controlled autosampler.....	10
Fig. 2	Main components of the autosampler .....	11
Fig. 3	LS-T autosampler .....	13
Fig. 4	Temperature-controlled syringes.....	13
Fig. 5	Temperature-controlled sample tray.....	14
Fig. 6	Cover .....	14
Fig. 7	Hose set .....	15
Fig. 8	Thermostat – front view .....	16
Fig. 9	Thermostat – connections.....	16
Fig. 10	Syringe adapter .....	17
Fig. 11	Sealing plugs and sealing caps, tool .....	17
Fig. 12	Wide-range table-top 100 to 240 V PSU .....	17
Fig. 13	Rear – connections.....	18
Fig. 14	Connector for connecting the analyzer (right: attached to the autosampler).....	18
Fig. 15	Syringe – inserted .....	23
Fig. 16	Temperature-controlled sample tray – connectors.....	24
Fig. 17	Thermostat – connections.....	24
Fig. 18	Thermostat – connections at the rear .....	25
Fig. 19	Attachments .....	25
Fig. 20	Attachments .....	26
Fig. 21	Hose bracket.....	26
Fig. 22	Connection to the temperature-controlled sample tray .....	27
Fig. 23	Syringe adapter and interlocking tabs .....	30
Fig. 24	Sealing plugs .....	36
Fig. 25	Hose bushings on the hose set.....	36

# Index

## A

Acclimatization	20
Allen key	17
Antifreezing agent	27
Anti-kink protection	24

## C

Change-over lever – thermostat	24
Condensate	20

## G

Glass components	39
------------------	----

## H

Hose bracket	26
--------------	----

## N

Needle	23
--------	----

## R

Return	24
--------	----

## S

Sealing plugs	35
Supply	24
Syringe adapter	29

## T

Transport lock	40
----------------	----

## W

Waste hose	21
------------	----