

Operating Manual

APU*sim*

Sample Preparation Unit



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Documentation number 11-0606-001-23

Edition B (01/2021)

Implementation of the
Technical Documentation Analytik Jena GmbH

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1 Basic Information

1.1 Using the *APU_{sim}*

The *APU_{sim}* sample preparation unit is an automatic adsorption system for the sample preparation for AOX determination using the column method in accordance with DIN EN ISO 9562 and DIN 38409/14.

Up to 6 samples can be processed simultaneously with the *APU_{sim}*. For the adsorption process the sample volume, rinse volume and dosing speed can be varied. The AOX columns may be of different sizes.

The *APU_{sim}* has been designed for two operating modes:

1. Automatic dosing of sample and rinse solution.
2. Manual dosing of sample and rinse solution.
This operating mode should be preferred for particulate samples.

The sample preparation unit may only be used for the above-mentioned methods of sample enrichment for AOX determination. Any other use is not as intended! Only the operator is liable for any damages that result from this.

The operational safety of the sample preparation unit *APU_{sim}* is only ensured during proper use according to the information in this user manual.

The intended use also includes the adherence to the installation conditions prescribed by Analytik Jena which are available from the customer service address stated above.

1.2 About this user manual

This user manual is aimed at qualified specialist personnel with knowledge of sample preparation for AOX determination. The user manual informs about the design and function of the sample preparation unit and provides the necessary know-how for the safe handling of the equipment. It further includes notes on the maintenance and service of the equipment and potential causes and remedies of any faults.

Typographical conventions

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

Instructions for actions consisting of only a single step are identified with "□".

Lists which are not in chronological order are shown as itemized lists, sub-listings as bullet points.

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



WARNING

This signal word indicates medium risk hazards. If not avoided, they can lead to death or serious injuries.



CAUTION

This signal word indicates low risk hazards. If not avoided, they can lead to minor or moderate injuries.



ATTENTION

Follow the instructions marked in this way in order to avoid material damage and operating errors.

1.4 Warranty and liability

The warranty duration and liability comply with the legal requirements and the provisions in the general terms and conditions of Analytik Jena.

Deviations from the intended use described in this user manual results in limitations of warranty and liability during a damage event. Damage to wearing parts is not included in the warranty.

Warranty and liability claims are excluded for personal injury and property damage due to one or several of the following causes:

- use of the sample preparation unit other than intended
- improper commissioning, operation and service of the sample preparation unit
- modifications of the equipment without prior consultation with Analytik Jena
- unauthorized intervention in the equipment
- operation of the device with faulty safety equipment or improperly fitted safety and protection equipment
- inadequate monitoring of the equipment components subject to wear
- use of other than original spare parts, wearing parts or consumables
- improper repairs
- faults due to the non-observance of this user manual

2 Safety instructions

2.1 General notes

- ❑ For your own safety and for a trouble-free operation, read this chapter with care before commissioning the *APU_{sim}*.
- ❑ Observe all safety notices contained in the user manual.
- ❑ Besides the safety instructions in this user manual and the local safety regulations that apply to the operation of the device the general applicable regulations regarding accident prevention, occupational health and safety and environmental protection of the respective country of use have to be observed and complied with. The operator must ascertain the latest version of these regulations.
- ❑ References to potential dangers do not replace the work protection regulations which must be observed.

2.2 Warning and information labels at the *APU_{sim}*

There are no warning or information symbols attached to the *APU_{sim}*. The storage bottle for nitric sodium nitrate rinse solution (pH \approx 2) and the waste container have been labeled using the following danger pictogram. Its meaning must always be heeded:



Warning against corrosive substances

Damaged or missing pictograms can cause incorrect actions leading to personal injury or material damage! The pictogram must not be removed! A damaged pictogram must be replaced without delay!

2.3 Requirements for the operating personnel

- ❑ The *APU_{sim}* must only be commissioned, operated and serviced by trained personnel instructed in technical safety. The instruction also includes imparting the contents of this user manual.
- ❑ It must be ensured that only authorized personnel works at the device.
- ❑ The operating personnel must be familiar with the dangers arising from samples to be analyzed and excipients used. The appropriate protective equipment must be used.

2.4 Safety instructions, transport and installation

- ❑ Only transport the sample preparation unit *APU_{sim}* in its original packaging! Prepare the *APU_{sim}* for transport, i.e. drain the equipment completely and remove all loose parts
- ❑ To prevent health damage the following must be observed when moving the device in the laboratory (lifting and carrying):
 - For reasons of safety 2 persons are required to transport the device and must position themselves on both sides of the equipment.
 - Because the device does not have carrying handles, grip the device firmly with both hands at the lower end.
- ❑ The guide values and statutory limits for lifting and carrying loads without auxiliary equipment must be observed and adhered to.

2.5 Safety instructions - operation

2.5.1 General

- ❑ The operator of the *APU_{sim}* must make sure before each commissioning that the condition of the device is sound. This applies in particular after each modification or extension of the device or its repair.
- ❑ During operation unobstructed access to the mains switch and mains socket must always be ensured.
- ❑ The *APU_{sim}* must only be operated if all protective equipment (drainage channel for chemicals, plastic cover at the pump units) are in place, properly installed and operational.

2.5.2 Safety instructions - Protection against explosion and fire

- ❑ The sample preparation unit may not be operated in an explosive environment.
- ❑ The operating personnel must be familiar with the location of the fire-fighting equipment in the operating room of the sample preparation unit.

2.5.3 Safety instructions - electrical equipment

- ❑ Any work on the electronics (behind the device enclosure) may only be carried out by the customer service of Analytik Jena and specially authorized technicians.
- ❑ The device must be switched off immediately at the mains switch (on the equipment back-plate) and the power supply disconnected from the mains socket if there is any interference with the electric components.
- ❑ The electrical components must be checked regularly by a qualified electrician. Any defects, such as loose connections, faulty or damaged cables, must be repaired without delay.

2.5.4 Handling of samples and reagents

- The operator is responsible for the selection of substances used in the process as well as for their safe handling. This is particularly important for radioactive, infectious, poisonous, corrosive, combustible, explosive and otherwise dangerous substances.
- When handling dangerous substances local safety instructions and guidelines must be observed. The notes in this user manual do not replace the specific local regulations or the regulations in the EC safety data sheets of the manufacturers for the auxiliary and operating materials.
- The instructions and notes in the safety data sheet for the preparation and handling of nitric sodium nitrate solution (rinse solution with $\text{pH} \approx 2$) and methanol (SPE-AOX) must always be observed!
- Protective goggles and rubber gloves have to be worn when handling reagents.
- The operator is responsible for carrying out suitable decontamination should the device be contaminated externally or internally with dangerous substances.
- Splashes, drops or larger spillages of reagents should be removed using an absorbent material such as cotton wool, laboratory wipes or cellulose.

2.5.5 Safety instructions - service and repair

- The APUsim system is usually serviced by the customer service department of Analytik Jena GmbH or its authorized and trained specialist personnel.
- Independent servicing can maladjust or damage the device. Therefore, the operator may generally only carry out the tasks listed in chapter "Maintenance and care" p. 23.
- The exterior of the APUsim may only be cleaned with a damp, not dripping, cloth after the device has been switched off.
- Any service and repair work at the device may usually only be carried out in the switched-off condition (unless stated otherwise).
- Only use original accessories and original replacement parts from Analytik Jena.

2.6 Behavior during emergencies

During situations of danger or accidents the APUsim must be switched off immediately from the mains switch at the equipment backplate and the mains plug be disconnected from the mains socket.

3 Technical data

General characteristics	
Designation/type	<i>APU_{sim}</i>
Basic device dimensions (W x H x D)	450 mm x 600 mm x 205 mm
Mass	app. 20 kg
Procedural data	
Number of samples AOX	6
Sample volume	5 – 100 mL, 1 mL step
Rinse volume	0 – 100 mL, 1 mL step
Dosing rate	1 – 6 mL/min., 0.5 mL/min step
Particle handling capacity	< 1 mm
Operation	internal control module
Stirring function	none
Syringe volume	max. 100 mL
Electrical variables	
Operating voltage	24 V via external power supply
Power consumption	50 W max.
Current consumption	2.1 A max.
Grid voltage of external power supply	100 – 240 V
Interference suppression (electromagnetic compatibility)	in accordance with the provisions of EN 55022 class A
Environmental conditions	
Temperature	+10 to +40 °C
Humidity	Max. 90 % at +30 °C
Air pressure	0.7 – 1.06 bar

The requirements for the environmental conditions are identical for the operation and the storage of the *APU_{sim}*. Use a desiccant when storing the *APU_{sim}* to prevent damage from condensate forming.

4 Installation conditions

4.1 Environmental conditions

The *APU_{sim}* may only be operated in closed rooms. The location must have the appearance of a chemical laboratory.

- it must be devoid of dust, drafts, vibrations and caustic fumes. Smoking is prohibited in the room where the *APU_{sim}* is operated.
- Do not place the *APU_{sim}* near sources of electromagnetic interference.
- Avoid direct sunlight and heater radiation on the *APU_{sim}*. Air conditioning is recommended at the location. The cool air emanating from the air conditioning unit should not be directed at the device.

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

Temperature range	+10 to +40 °C
Humidity	Max. 90 % at +30 °C
Air pressure	0.7 bar to 1.06 bar

Summary 1 Environmental conditions for operation

The requirements for the environmental conditions are identical for the operation and the storage of the *APU_{sim}*. Use a desiccant when storing the *APU_{sim}* to prevent damage from condensate forming.

4.2 Energy supply



WARNING

Observe the mains connection!

During electrical installation, observe the VDE (German Association for Electrical Engineers) electrotechnical guidelines and local regulation requirements!

The mains supply must be correctly earthed.

The *APU_{sim}* is operated on single-phase alternating current.

Switching-on conditions

Voltage	24 V via external power supply
Power consumption	50 W max.
Current consumption	2.1 A max.
Grid voltage of external power supply	100 – 240 V
Interference suppression (electromagnetic compatibility)	in accordance with the provisions of EN 55022 class A

Overview 2 Power supply

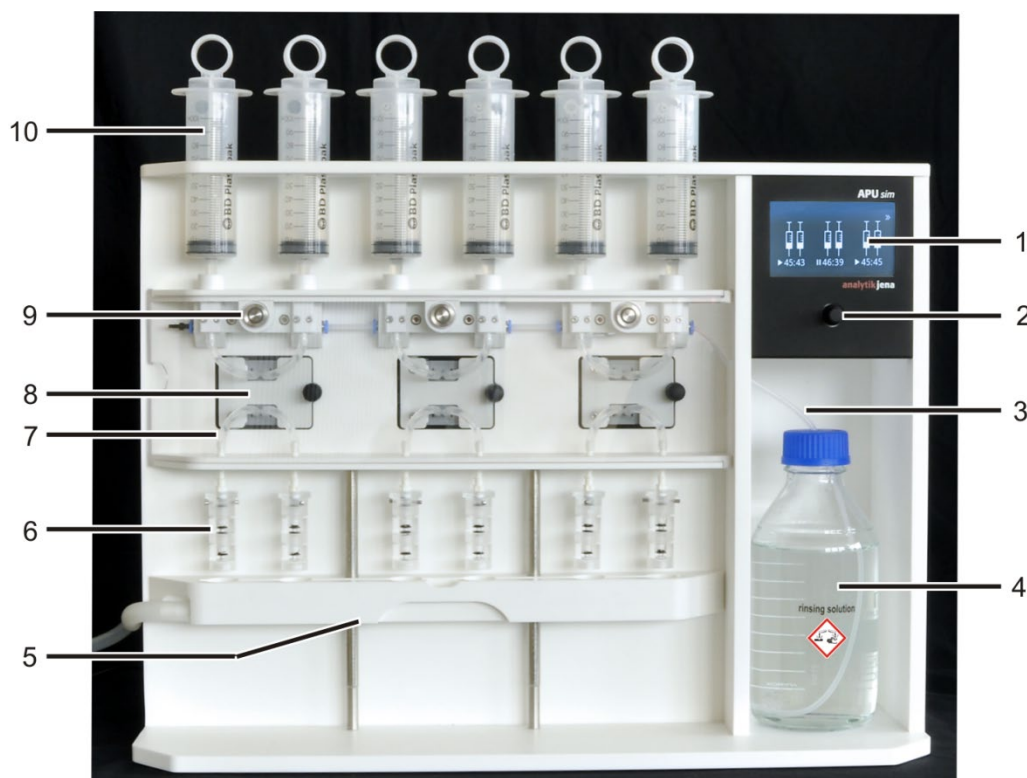
4.3 Space requirement

Height	600 mm
width	450 mm
Depth	205 mm
Mass	app. 20 kg

Overview 3 Space requirement and mass

During operation unobstructed access to the mains connection at the equipment backplate must always be ensured. A safety distance of at least 10 cm to other equipment or walls should be maintained.

5 Design and operation of the APUsim



1	Display	6	AOX columns (here: duplex columns)
2	Control knob	7	Sample tube
3	Rinse tube	8	Service flap with tube pump
4	Storage bottle for rinse solution	9	Start button (for the 1st pump unit)
5	Drainage channel	10	Syringe for sampling

Figure 1 Design of the APUsim

The sample preparation unit APUsim is an automatic adsorption system for the sample preparation for AOX determination based on the column method.

Up to six samples can be processed simultaneously with the APUsim. For the adsorption process the sample volume, rinse volume and dosing speed can be varied.

The APUsim features three pump units with two channels each, controlled separately by the internal control software. The parameters for sample preparation can be configured individually for each pump unit. The two channels of a pump unit must be operated using identical configurations. They are frequently used for duplicate measurements.

Figure 2 shows the sample path through the sample preparation unit: The samples are filled into the plastic syringes. The three tube pumps then automatically pump the samples across the AOX columns. After adsorption has completed, the residual sample runs via the drainage channel to the waste container. After the valve has been switched over, the dosing pump rinses the AOX columns with the pre-configured volumes of nitric rinse solution and thereby prepares them for the AOX determination.



Figure 2 Tube diagram

The sample preparation unit ensures a high particle handling capacity up to 1 mm. The tube pumps and their tube system (internal diameter 2 mm) are robust against clogging. No sample passes through the change-over valves, only clear rinse solution (see Figure 4 p. 13). This protects the valves against particles and they cannot get clogged up.

With samples with high particle loads incompletely dissolved parts of the sample may sediment in the syringe and are thus not included in the AOX determination. In this case, the manual procedure (see "Manual sample preparation for samples with particles" p. 18) is recommended.

In the sample preparation unit up to five AOX columns can be used per channel. Generally, two AOX columns (duplex columns) are used and filled with disposable tubes of 50 mg active carbon. If two AOX columns are not sufficient for the complete adsorption, three columns (triplex column) must be used. Since the drainage channel is adjustable in height, columns of different sizes can be used in the APUsim.

With a high particle load a pre-column filled with a suitable filter material (e.g. ceramic wool, quartz wool) can be screwed upstream of the AOX columns. The pre-column separates particles and prevents the system from clogging during the sample preparation.

The backplate of the APUsim contains the electrical connections for the external power supply and mains switch. The rating plate is also attached there. The rating plate also contains the electrical connection data:

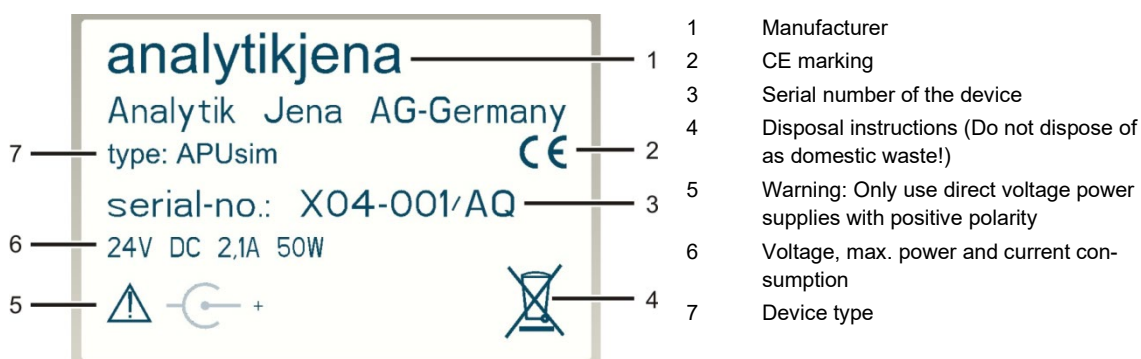


Figure 3 Rating plate

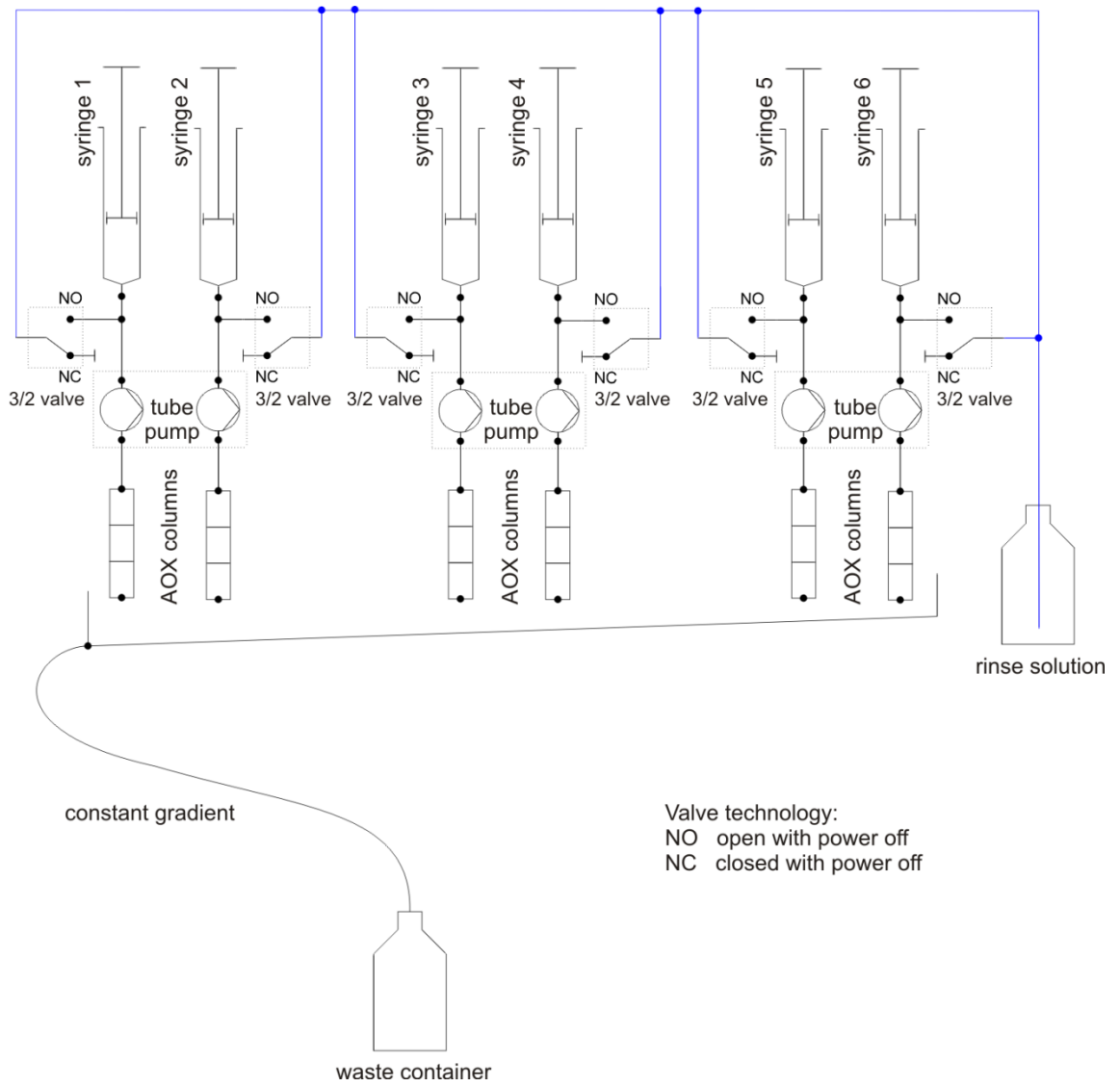


Figure 4 Tube diagram

6 Commissioning



CAUTION! Prevent any unauthorized interference!

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



ATTENTION

The APUsim must be switched off prior to each installation!

Connecting or disconnecting electrical plug-in contacts might damage the sensitive electronics.

The first commissioning of the APUsim is usually carried out by the customer service department of Analytik Jena or persons authorized by Analytik Jena. The presence of all persons designated for operation of the device during the briefing of the service technician is imperative. After transport or storage the customer can commission the sample preparation unit independently. This installation is being described below.

Prior to commissioning, check that all installation requirements are met at the installation location (see section "Installation conditions" p. 9).

1. Insert the drainage channel (5 in Figure 1) into the support rods of the APUsim using the snap fasteners.
2. Install the waste tube with the tube protection to the drainage channel.
Note: The tube protection prevents the waste tube from kinking.
3. Insert the waste tube into the waste container (volume 5 L).
Note: Lay the waste tube with a constant incline. If required, shorten tube. Otherwise the waste channel might easily overflow.
4. Fill the storage bottle for the rinse solution (4 in Figure 1) with nitric sodium nitrate solution (pH \approx 2).
5. Place the storage bottle into the adapter of the APUsim. Immerse the rinse tube (no. 1) in the rinse solution.
6. Fill the AOX columns with disposable tubes or quartz containers (with 50 mg active carbon each). Screw max. 5 AOX columns together. Attach the AOX columns (6 in Figure 1) via the Luer lock to the respective channel of the APUsim.
7. Slide the drainage channel directly under the column units.
Note: There is a risk of splashing if the drainage channel is located too low under the column unit.
8. Insert plastic syringes (10 in Figure 1, volume 100 mL) from above into the syringe adapter of the APUsim. Ensure the tight closure of the connection using the sealing ring.
9. Connect the power supply unit to the equipment backplate. Switch the APUsim on from the mains switch.

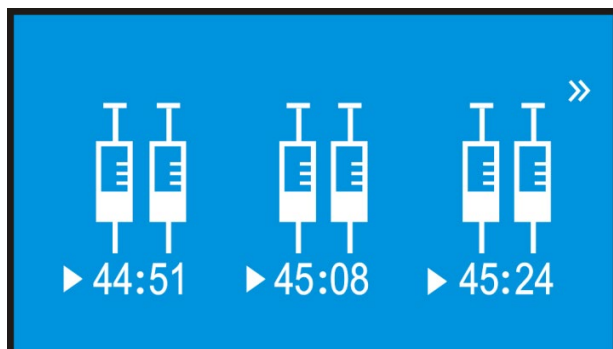
✓ **The APUsim is operational.**

After commissioning the entire system must be rinsed with distilled water through the plastic syringes.

7 Operation

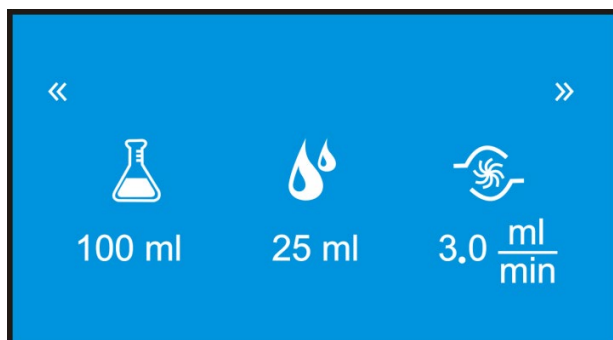
7.1 Screen layout

By rotating the control knob you can select one of three windows in the display:



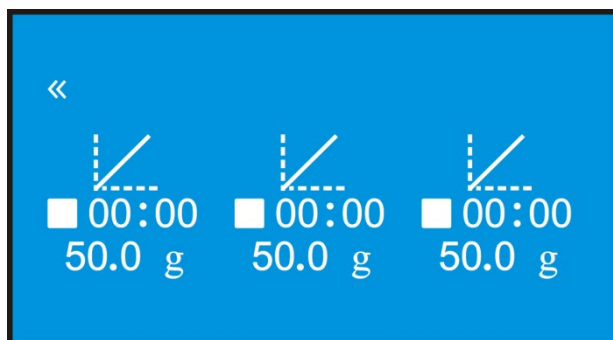
Start window

Display of the processing time for each pump unit



Input window

Parameter configuration:
Sample volume, rinse volume and dosing speed



Calibration window

Enable the calibration mode
Enter the calculated masses in
 50.0 ± 10.0 g.

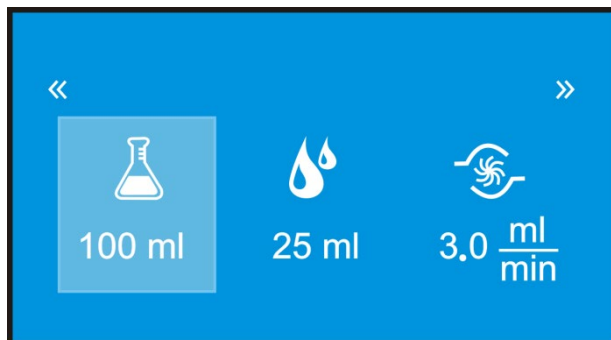
7.2 Configuring the parameters for the sample preparation

The sample preparation unit *APU_{sim}* has three pump units with two channels each. The parameters for sample preparation can be configured individually for each pump unit. DIN EN ISO 9562 specifies the following parameters for AOX determination using the column method: Sample volume 100 mL, rinse volume 25 mL, dosing speed 3 mL/min. Other, customer-specific configurations are possible.



ATTENTION

The *APU_{sim}* can only dose the correct sample volume if the sample volume in the syringe is identical to the configured sample volume.

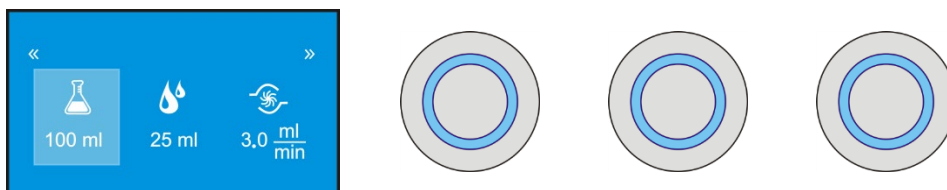


1. Select the input window by rotating the control knob (2 in Figure 1).
2. Within the window, select the parameter by rotating the control knob.
3. Confirm the parameter selection by pressing the control knob.
 - ✓ The parameter is highlighted in light blue.

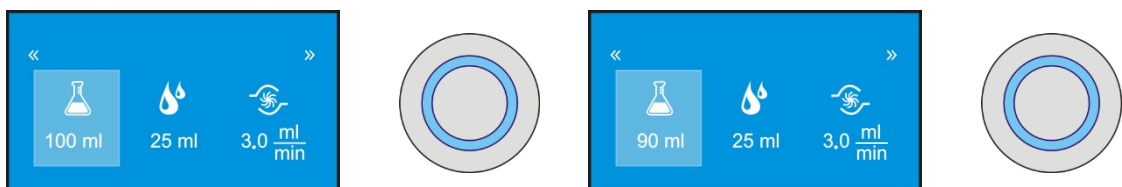
4. Configure the parameter by rotating the control knob.
5. Confirm the configuration by pressing the control knob.
6. Start the desired pump unit by pressing the start button (9 in Figure 1).
 - ✓ The sample preparation starts at the selected pump unit.

During the start the parameter configurations for the selected pump unit are transferred. The configurations can no longer be modified during the sample preparation.

- To operate several pump units with identical parameters, start the desired pump units consecutively.



- To operate the pump units with different configurations, configure new parameters in the input window after starting a pump unit, confirm the input and start the corresponding pump unit(s).



Starting or stopping the sample preparation

The start buttons at the pump units (9 in Figure 1) are used to start or stop the sample preparation. The start window displays the calculated processing time briefly at the start of the measurement. The time then counts down to 00:00. The end of processing is indicated by a signal tone.

Start button functions

Start the sample preparation

Briefly press the start button.	The start button illuminates light blue. The time indication in the start window is running.	The sample preparation starts.
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Interrupt the sample preparation briefly.

Briefly press the start button with the sample preparation running.	The start button flashes. The time indication stops. The pause symbol (II) is shown.	The sample preparation stops. By briefly pressing the button, the sample preparation is resumed.
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Cancel the sample preparation

Press and hold the start button.	The device issues a signal tone. The start button is no longer illuminated. The time indication is reset to 00:00.	The sample preparation stops.
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Note: After canceling the sample preparation the system must be rinsed with rinse solution to remove the sample residue from the tube system.

7.3 Automatic sample preparation

In the automatic sample preparation the *APU_{sim}* automatically performs the adsorption of the samples by the active carbon and the rinse step with NaNO₃ solution. The sample preparation must in this case be continued to the end with syringe pistons inserted. Otherwise the system would aspire air during the rinse setp instead of automatically dosing the rinse solution.

1. Empty the waste container, if necessary.
2. If necessary, fill the storage bottle for the rinse solution with nitric sodium nitrate solution (pH ≈ 2).
3. Place the storage bottle into the adapter of the *APU_{sim}*. Immerse the rinse tube (no. 1) in the rinse solution.
4. Fill the AOX columns with disposable tubes or quartz containers (with 50 mg active carbon each). Screw the AOX columns together.
5. Attach the AOX columns via the Luer lock to the respective channel of the *APU_{sim}*.
6. Slide the drainage channel directly under the column units.

Note: There is a risk of splashing if the drainage channel is located too low under the column unit.

7. Fill the plastic syringes with the desired volume of the acidified samples. Insert the syringes into the *APU_{sim}*. Ensure the tight closure of the connection using the sealing ring.
8. Switch on the *APU_{sim}* from the mains switch at the equipment backplate.
 - ✓ **The display shows the start window.**
9. Configure the sample volume, rinse volume and dosing speed (see "Configuring the parameters for the sample preparation" p. 16). Configure the sample volume to be identical to the sample volume in the syringe.
10. Start the desired pump units by pressing the start buttons.
 - ✓ **The sample preparation (adsorption, rinsing) takes place automatically.**

The processing time is indicated in the start window. It is composed as follows:

Processing time	Example
	$V_{\text{sample}} = 50 \text{ mL}, V_{\text{rinse}} = 25 \text{ mL}, v_{\text{dosing}} = 3 \text{ mL/min}$
Sample dosing time	1000 s
+ 10 % dosing time as buffer	+ 100 s
Rinse solution dosing time	500 s
+ time for dosing 1 mL rinse solution as buffer	+ 20 s
+ 4 s for valve change-over	+ 4 s
	1624 s $\hat{=}$ 27 min 4 s
Display in the start window	27:04

7.4 Manual sample preparation for samples with particles

The manual sample preparation is recommended for samples with high particle loads. Here, there is a risk that some parts of the sample sediment in the syringe and thus escape the AOX determination. Unlike with automatic sample preparation, the rinse solution is therefore dosed manually into the open syringe. The two process steps (adsorption, rinse) are started individually via the control software.

1. Empty the waste container, if necessary.
2. If necessary, fill the storage bottle for the rinse solution with nitric sodium nitrate solution (pH \approx 2).
3. Place the storage bottle into the adapter of the *APU_{sim}*. Immerse the rinse tube (no. 1) in the rinse solution.
4. Fill the AOX columns with disposable tubes or quartz containers (with 50 mg active carbon each). Screw the AOX columns together. Use a pre-column, if necessary.
 - Note:** With a high particle load a pre-column with a suitable filter material can prevent the system from clogging.
5. Attach units with the AOX columns via the Luer lock to the respective channel of the *APU_{sim}*.

6. Slide the drainage channel directly under the column units.
Note: There is a risk of splashing if the drainage channel is located too low under the column unit.
7. Fill the desired volume of the acidified samples into the plastic syringes.
Note: Use syringes without pistons in the manual mode.
8. Switch on the *APU_{sim}* from the mains switch at the equipment backplate.
✓ **The display shows the start window.**
9. Configure the sample volume and dosing speed in the control software. Set the rinse volume to 0 mL (see "Configuring the parameters for the sample preparation" p. 16).
10. Start the desired pump units by pressing the start buttons.
✓ **Adsorption takes place.**
11. Dose the rinse fluid into the open syringes.
12. Configure the rinse volume in the control software.
Note: Configure the rinse solution volume as "sample volume", because the rinse solution is to be pumped through the system via the syringes.
13. Start the pump units by pressing the start buttons.
✓ **The rinse step takes place.**

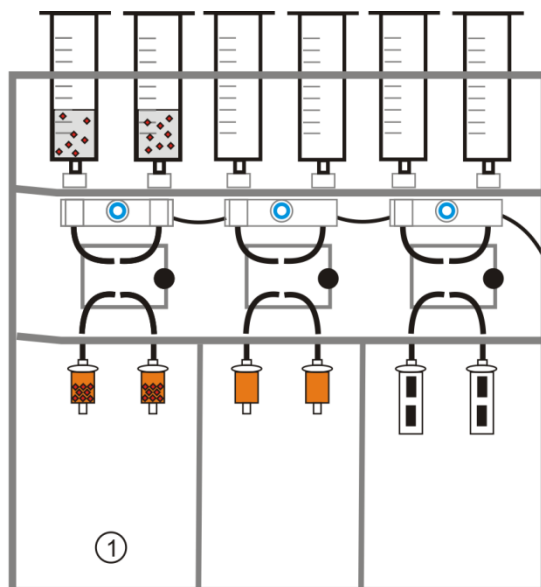
When using a pre-column, the filter material loaded with particles contains parts of the sample and must therefore be analyzed together with the active carbon.

7.5 Manual sample preparation with solid phase extraction (SPE-AOX)

Samples with a high content of inorganic chloride (> 1 g/L) can be analyzed with the *APU_{sim}* using the SPE-AOX method. The pump tubes are resistant to methanol. The processing of the samples with solid phase extraction, elution and subsequent adsorption in active carbon takes place in manual mode. Sample and reagents are dosed via the open plastic syringes. Depending on the phase of the sample preparation, SPE cartridges or AOX columns are inserted into the *APU_{sim}*.

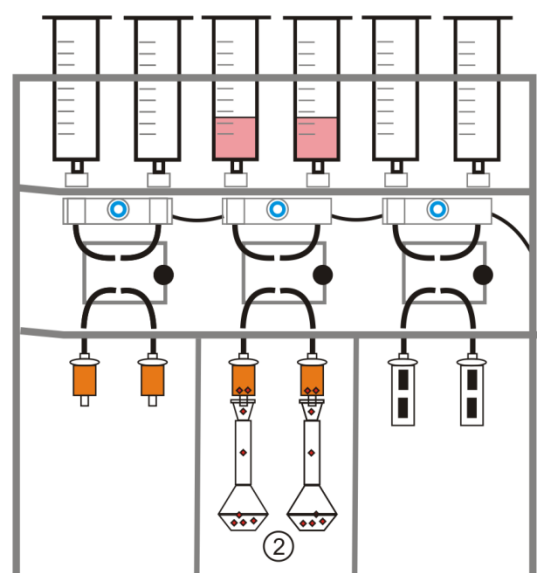
Below, the method for enriching organically bonded halogen during the solid phase, usually polystyrene-divinylbenzene adsorber resin, will be described. The separation of the interfering inorganic chlorides is also possible using the solid phase.

Note: Particulate samples must be filtered through a 0.45 µm membrane filter prior to the solid phase extraction.



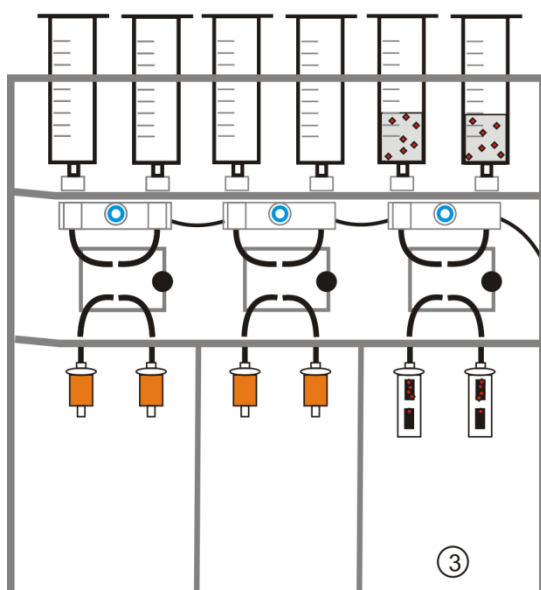
① Solid phase extraction

1. Attach SPE cartridges via the Luer lock.
2. Condition the SPE cartridges with methanol.
3. Add filtered and acidified samples to the SPE cartridges.
4. Rinse SPE cartridges with nitric NaNO_3 solution to flush out interfering matrix components.



② Elution

5. Elute the desired compounds with 5 mL methanol. Rinse SPE cartridges with distilled water. Catch the eluates in 100 mL volumetric flasks.
6. Rinse the SPE cartridges with nitric NaNO_3 solution.
7. Fill the eluted samples with distilled water to 100 mL.



③ Adsorption in active carbon

8. Dispose of the SPE cartridges. Attach the AOX columns.
 9. Add eluted samples to the AOX columns.
 10. Rinse the AOX columns with nitric NaNO_3 solution.
- ✓ The loaded active carbon can be analyzed.

7.6 Performing a calibration

A calibration is necessary:

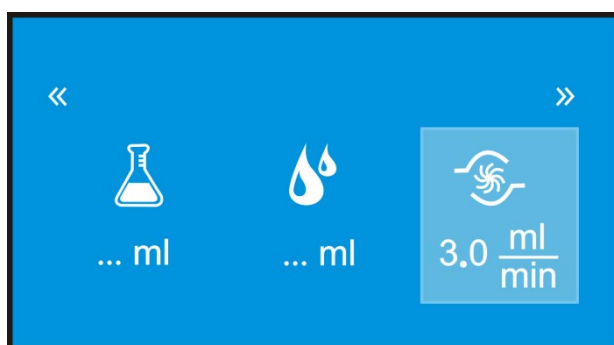
- after replacing the tube system
- if the syringe is not fully emptied during the processing time
- in case of deviations from the standard conditions ($V_{\text{dosing}} \neq 3 \text{ mL/min}$)

Each pump unit can be calibrated individually; however, the two channels of a pump unit can only be calibrated together. The calibration is performed without adsorption columns. 50 g distilled water is pumped through the system at a time. The water volumes collected are weighed with a precision of 0.1 g and used for the correction of the sample volumes. The average value of the two channels of a pump unit must be calculated.

Carrying out the calibration

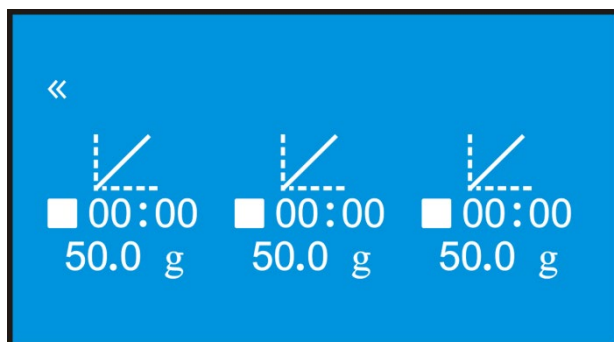


1. Fill the pump tubes with distilled water through the syringe.
2. Fill the syringe with min. 70 mL distilled water.
3. Weigh 2 beakers (50 or 100 mL) with a precision of 0.1 g and note the masses.
4. Position the beakers with the aid of the drainage channel under the column unit to completely collect the water.



5. Configure the dosing speed in the input window as for the subsequent sample preparation.

Note: The sample and rinse volumes do not need to be configured. The configurations are stored in the control software.
Sample volume 50 mL,
rinse volume 0 mL

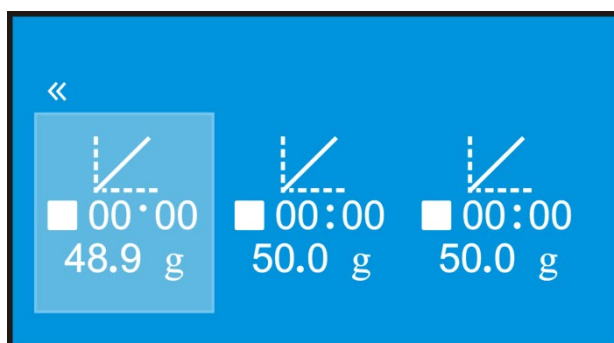


6. Select the calibration window by rotating the control knob.

7. Start the calibration by pressing the start button at the pump unit.
8. Let the calibration run to completion.
 - ✓ **A signal tone sounds at the end of the calibration.**
9. Weigh the two beakers with the collected water. Calculate the mass of the water by calculating the difference:

$$m_{\text{beaker+water}} - m_{\text{beaker}} = m_{\text{water}}$$

10. Calculate the average of both measurements of a pump unit.



11. Enable the pump unit by pressing the control knob.
 - ✓ **The pump unit is highlighted in light blue.**
12. Configure the calculated mass of the water with a precision of 0.1 g by rotating the control knob.
13. Confirm the input by pressing the control knob.

- ✓ **The calibration data are accepted and used for all subsequent sample preparations.**

The three pump units can be calibrated next to each other. However, whilst a calibration is running, no sample preparation can take place on another pump unit. Likewise, no calibration can be started with a sample preparation running.

8 Maintenance and care

8.1 Maintenance overview

Maintenance item	Action	Frequency
Base device	Clean Remove fluid from the drainage channel	daily during decommissioning in case of residue in the drainage channel
Pump and connection tubes	Rinse with ultrapure water Replace complete tube system.	daily during decommissioning Annually
Sealing rings in the syringe adapter	Replace.	if the connection is leaking, detectable by bubbles in the pump tubes annual replacement recommended
Zero rings for AOX columns	Replace.	Annually
Rinsing solution	Replace.	daily during decommissioning (recommended)
Storage bottle for rinse solution	Clean	monthly, before filling if necessary

8.2 Replacing the tube system

With prolonged use the internal diameter and length of the pump tubes change. The entire tube system consisting of pump and connection tubes must therefore be replaced once a year as a prevention. For the replacement, the tube lifter supplied and a new tube set per pump unit are required.

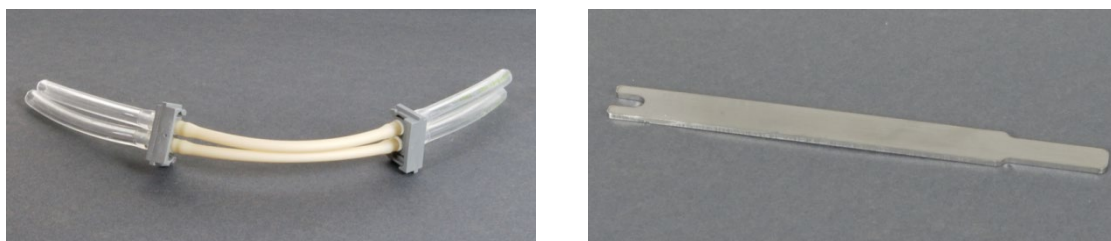


Figure 5 Tube set of pump and connection tubes with tube clamps, tube lifter

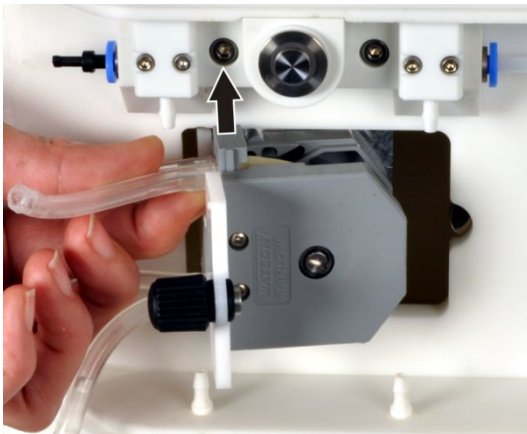


1. Detach the connection tubes with the tube lifter from the top and bottom connections.

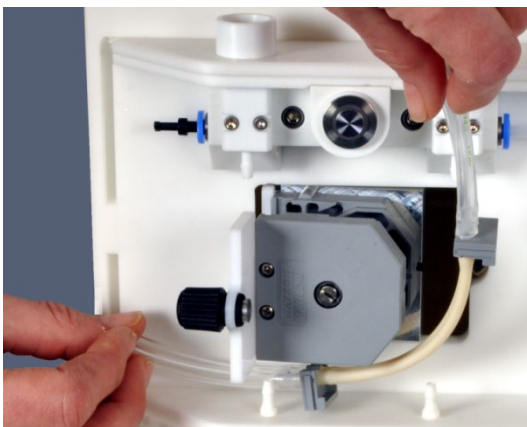
To this end, slightly lift the tube with the tube lifter and pull it off with the other hand.



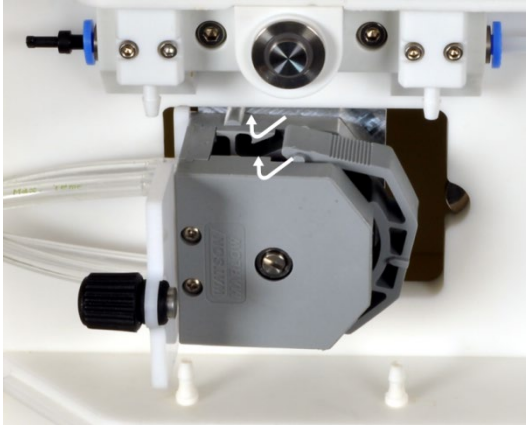
2. Open the service flap.
3. Detach the tension clamp with light pressure. Put the tension clamp safely aside.



4. Slide the tube clamp out of the pump at the top and bottom.
Remove the old tube set.



5. Insert the new tube set.
Insert the tube clamp into the pump at the top and bottom.



6. Close the pump with the tension clamp.

Note: Make sure that the tension clamp engages in its guide.

It is easier for the clamp to engage with the pump running. Therefore, switch on the pump after inserting the tension clamp and press against the center of the tension clamp.

7. To align the pump tubes allow the open pump to run briefly, then stop manually.
8. Close the service flap.
9. Attach the new connection tubes.
 - ✓ The system is operational.

After replacing the tube system, a calibration must be performed (see "Performing a calibration" p. 21).

8.3 Replacing the sealing rings in the syringe adapter

The sealing rings in the syringe adapter should be replaced once a year. In addition, they must be replaced whenever there are leaks. Leaks can be detected by air bubbles in the pump tubes.



1. Unscrew the upper part of the syringe adapter.
2. Replace the sealing ring with a new ring.
3. Retighten the syringe adapter finger-tight.

9 Fault removal

Error	
Sample is not being pumped through the system.	
Cause	Remedy
Clogging due to particles being too big	Cancel the sample preparation, fill ultrapure water into the plastic syringes, rinse the system via the control software
Pump faulty	Inform customer service
Error	
Air bubbles in the tube system	
Cause	Remedy
Connection between plastic syringe and syringe adapter leaking	Insert plastic syringes into the syringe adapter again Replacing the sealing rings in the syringe adapter
Rinse tube does not immerse into the rinse solution	Fill storage bottle for rinse solution
Error	
Drainage channel overflows	
Cause	Remedy
The waste tube has kinked or does not enter the waste container with a constant incline	Remove kink in the waste tube, shorten waste tube, if necessary
Waste container overflows	Empty the waste container
Error	
poor recovery, reproducibility	
Cause	Remedy
Plastic syringes leaking	Replace plastic syringes
System contaminated	Replace plastic syringes Rinse system with ultrapure water
System leaking	Check tube connection Replace the tube system

10 Transport and storage



CAUTION

Risk of injury!

2 persons are required to transport the device and must position themselves on both sides of the equipment. Because the device does not have carrying handles, grip the device firmly with both hands at the lower end.



ATTENTION

Unsuitable packaging material can cause damage to the equipment!!

Only transport the *APU_{sim}* in its original packaging. Drain the equipment and remove all loose parts. Use a desiccant to prevent damage from condensate forming.

1. Rinse the hose system through the plastic syringes with ultrapure water.
2. Remove the storage bottle for rinse solution. Collect and dispose of rinse solution escaping from the tube. Empty and clean the storage bottle.
3. Pump the tube system empty.
4. Switch the *APU_{sim}* off from the mains switch. Disconnect the power supply from the *APU_{sim}*.
5. Remove the plastic syringes and AOX column units.
6. Rinse drainage channel with ultrapure water. Move the drainage channel into the lowest position. Remove the drainage channel with waste tube. Empty and clean the waste container.
Note: The drainage channel can only be removed in the lowest position.
7. Clean the housing of the *APU_{sim}* with a moist but not dripping cloth, allow to dry.
8. Pack the *APU_{sim}* complete with accessories in the original packaging. Use a desiccant.

11 Disposal

During operation liquid waste arises in the sample preparation unit. This contains sodium nitrate, diluted nitric acid and sample. Samples processed using solid phase extraction (SPE-AOX) also contain methanol. The waste must be disposed of correctly in accordance with statutory regulations.

At the end of its service life the sample preparation unit *APU_{sim}* must be disposed of as electronic waste in accordance with the statutory regulations.