analytikjena
An Endress+Hauser Company

Operating Manual

APU sim
Probenvorbereitungseinheit

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

General Information

http://www.analytik-jena.com

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Technical Documentation

Analytik Jena GmbH+Co. KG

Table of contents

1 Basic information

1.1 About this manual

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

The operating manual is aimed at qualified specialist personnel with knowledge of sample preparation for AOX, AOF and EOF determination.

Conventions

Instructions for actions are combined into action units and marked with a triangle (▸).

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.

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.

WARNING

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

CAUTION

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

NOTICE

Provides information on potential material or environmental damage.

1.2 Intended use

The APU sim sample preparation unit can be used for the following sample preparations:

- AOX or AOF samples according to the column method
- SPE-AOX/AOF samples
- EOF samples

The APU sim is suitable for samples containing particles and salt.

The device and its components must only be used for the sample preparations described in this user manual. Only this specified use is regarded as the intended use, ensuring the safety of the user and the device.

2 Security

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

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

2.1 Safety labeling on the device

The following GHS pictographs are affixed to the storage bottles and the canister for safety labeling of the chemicals:

GHS pictograph	Meaning	Comment
	Corrosiveness warning	On the storage bottle for acidic sodium nitrate rinsing solution (pH < 2) The acidic rinsing solution causes skin burns and severe eye damage.

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

2.2 Requirements for the operating personnel

The device must only be operated by qualified specialist personnel instructed in the use of the device. This instruction also includes conveying the contents of these operating instructions. We recommend training by qualified employees of Analytik Jena or its representatives.

The user manual must be accessible to the operating and service personnel.

2.3 Safety instructions, transport and commissioning

Insufficiently secured components pose a risk of injury.

- During transport, secure the device components as specified in this operating manual.
- Loose parts must be removed from the system components and packed separately.

To prevent health damage, the following must be observed when moving the device in the laboratory (lifting and carrying):

- For safety reasons, two persons are required to transport the device who must hold the device by either side of the equipment.
- The device does not have any carrying handles. Therefore the device must be gripped firmly with both hands at the lower end.
- Risk of damage to health due to improper decontamination! Perform a professional and documented decontamination of the device before returning it to Analytik Jena. The decontamination report is available from Service when register-

ing the return. Without a completed decontamination report, the acceptance of the device will be refused. The sender may be liable for damage caused by inadequate decontamination of the device.

2.4 Safety instructions: during operation

2.4.1 Summary of safety instructions

- The operator of the device must ensure that the device is in sound condition before each commissioning. This applies especially after any modification or adaptation of the device or any repair.
- Free access to the device switch and the mains socket must be ensured at all times during operation.
- The device must only be operated if all protective equipment (drainage channel for chemicals, covers in front of the pump units) are in place, properly installed and operational.

2.4.2 Safety instructions: protection against explosion and fire

The device may not be operated in an explosive environment.

2.4.3 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 device switch and the power supply unit unplugged from the socket if there are any faults in electrical components.
- The electrical components must be checked regularly by a qualified electrician. Any defects such as loose connections or faulty or damaged cables must be repaired without delay.

2.4.4 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 hazardous substances, the locally applicable safety instructions and instructions in the safety data sheets from the manufacturers of the auxiliary and operating materials must be complied with.

- For operation of the sample preparation system, nitric acid nitrate solution (pH < 2) is used as a rinsing solution for AOX determination.
- Non-acidified nitrate solution is used for AOF sample preparation.
- For the SPE-AOX, SPE-AOF and EOF processes, methanol is also required as an eluent.

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 absorbent cotton, laboratory wipes or cellulose.

- In case of biological contamination, wipe the affected area with a suitable disinfectant. 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.
  Proceed with particular care and ensure utmost cleanliness when working with infectious material because the device cannot be decontaminated as a whole.
- Before using a cleaning or decontamination procedure other than the one 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 be moistened or wiped with methanol.

2.4.5 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.
- All maintenance and repair work on the device must only be carried out when the device is switched off (unless specified otherwise).
- Use only original spare parts, wear parts and consumables. They have been tested and ensure safe operation. Glass part are wear parts and are not subject to the warranty.
- All protective equipment must be reinstalled and checked for proper function when the maintenance or repair work is complete.

2.5 Behavior during emergencies

If there is no immediate risk of injury, switch off the device at the device switch and disconnect the power plug from the power outlet immediately in hazardous situations or in the event of an accident.

Always ensure free access to the device switch on the rear of the device and to the mains connection.

3 Design and function

Design

The APU sim sample preparation unit is an automatic adsorption system for the following sample preparations:

- AOX and AOF determinations using the column method
- SPE-AOX and SPE-AOF determinations
- EOF determinations

Up to 6 samples can be processed simultaneously with the device. For the adsorption process the sample volume, rinse volume and dosing rate can be varied.

The device has 3 pump units with 2 channels each, which are regulated via the internal control unit. The parameters for sample preparation can be configured separately for each pump unit. The 2 channels of a unit are operated with the same settings. They are frequently used for duplicate measurements.

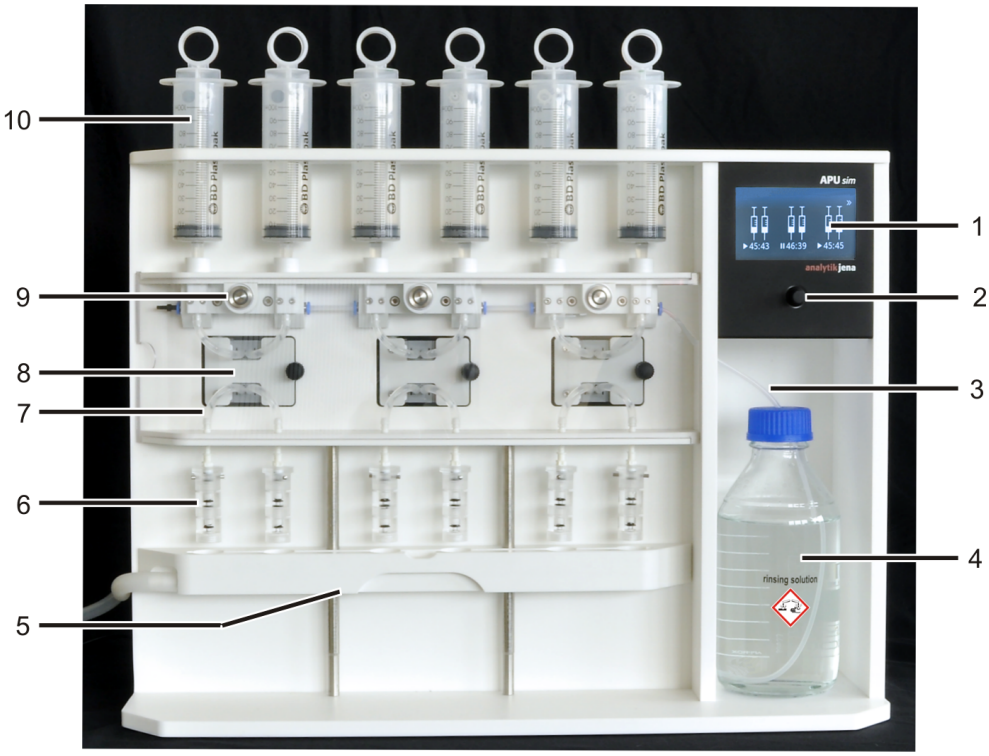


Fig. 1 Design of APU sim

1 Display	2 Control knob
3 Rinse tube	4 Supply bottle for washing solution
5 Drainage channel	6 AOX/AOF columns (here duplex columns)
7 Sample hose	8 Service flap with tube pump
9 Start button for pump unit	10 Syringe

Up to 5 activated carbon columns can be used per channel in APU sim. Generally, a duplex column is used with 2 disposable tubes, each filled with 50 mg activated carbon. If 2 activated carbon columns are not sufficient for complete adsorption, 3 columns (triplex columns) or more can be used. The height of the drainage channel can be adjusted, allowing you to adapt it to the column height.

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 activated carbon columns. The pre-column separates the particles and prevents the activated carbon columns from clogging

during sample preparation. To prevent incompletely dissolved components in these samples from settling in the syringe and thus preventing the AOX or AOF determination, sample preparation can be carried out manually.

Function

The samples are filled into the plastic syringes. The 3 tube pumps pump the samples over the activated carbon columns according to the program settings. 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 activated carbon columns with the pre-configured volume of rinsing solution and prepares them for the AOX or AOF determination.

In manual mode, both samples and rinsing solution are dosed into the syringes. This method is used for the preparation of AOX/AOF samples with a high particle load, AOX-SPE/AOF-SPE samples and EOF samples.

Fig. 2 Sample path

The APU sim ensures a high particle handling capacity up to 1 mm. The tube pumps and the tube system with an internal diameter of 2 mm are robust against clogging. Only rinsing solution passes through the valves in the tube system. This protects them against particles and they cannot get clogged up.

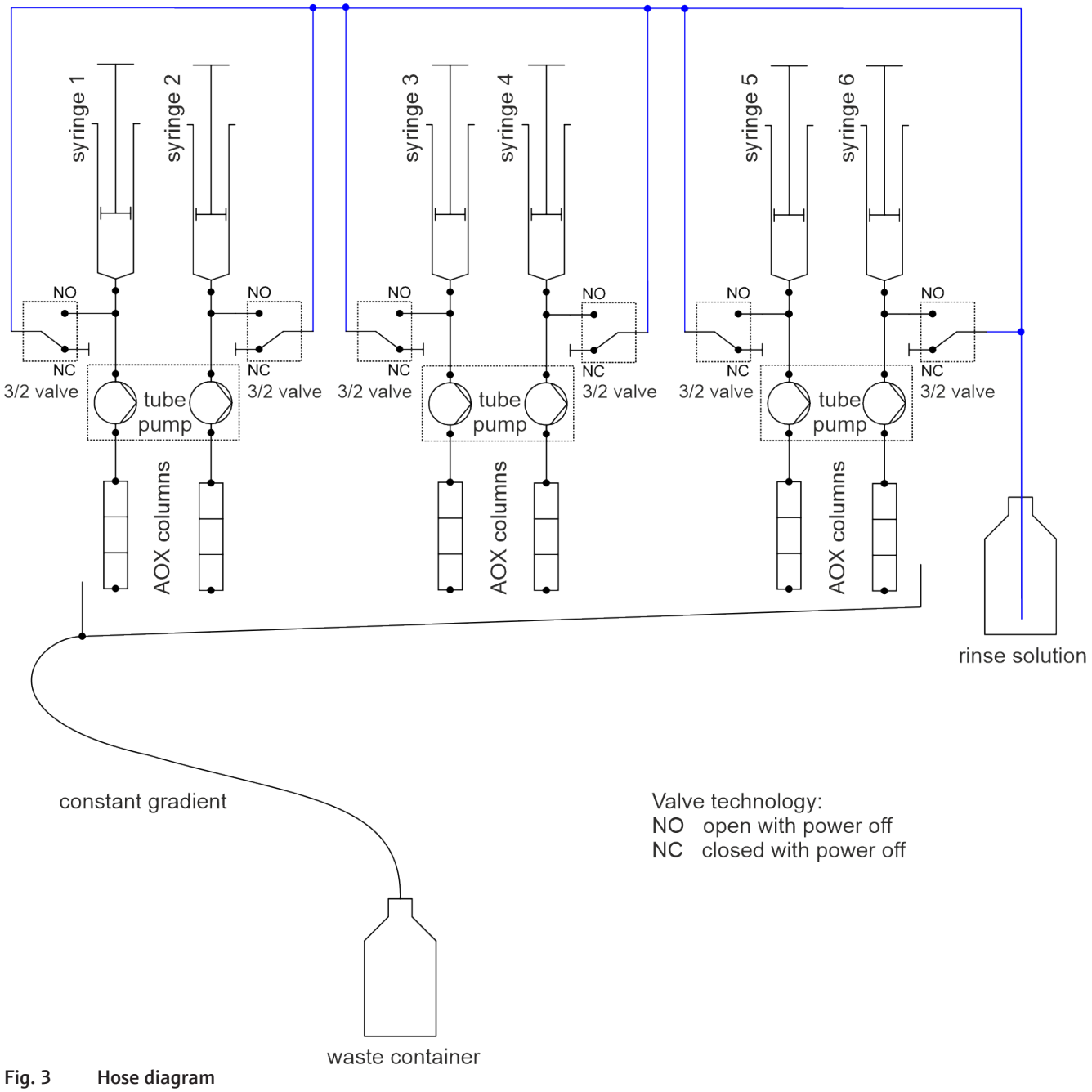


Fig. 3 Hose diagram

Type plate

The type plate is located on the rear of the device.

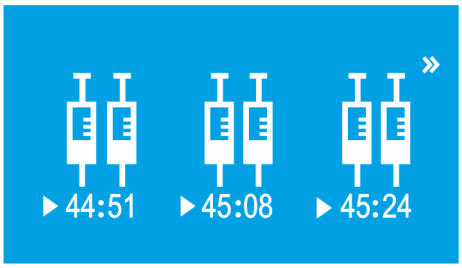
The type plate contains the following information:

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

4 Operation

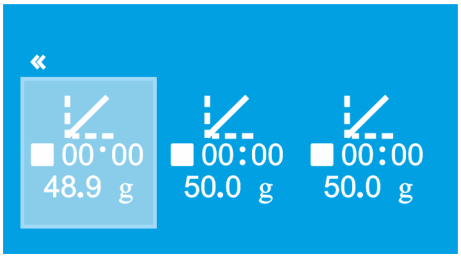
4.1 Screen layout

The device software is operated via the display with the control knob. You can switch between the 3 displays by turning the control knob.



Time sequence of sample preparation for each pump unit

Setting the program parameters: Sample volume, rinse volume, dosing rate



Calibration of the pump unit

4.2 Setting the program and starting sample preparation

APU sim has 3 pump units with 2 channels each. You can specify different program parameters for each pump unit or start the pump units with the same program.

NOTICE

Damage to the pump due to dry running

The pump hoses are subjected to excessive stress and wear out more quickly if pumping is carried out without flowing liquid.

- If only one channel of a pump unit is required for sample preparation, fill the syringe of the second channel with deionized water and connect an empty duplex column to the channel.

Standard parameters for AOX and AOF determination

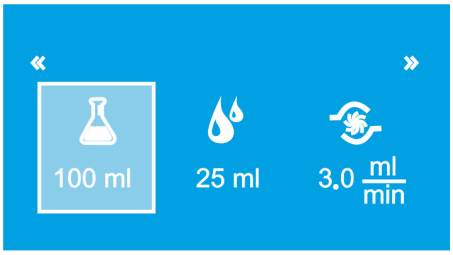
The following parameters are specified in DIN EN ISO 9562 and DIN 38409-59 for AOX and AOF determination using the column method:

Parameter	Value
Sample volume	100 ml
Rinsing volume	25 ml
Dosing rate	3 ml/min

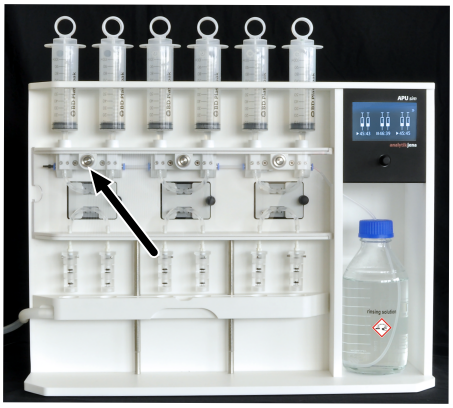
Setting the program

Use the control knob below the display to operate the control software of the device:

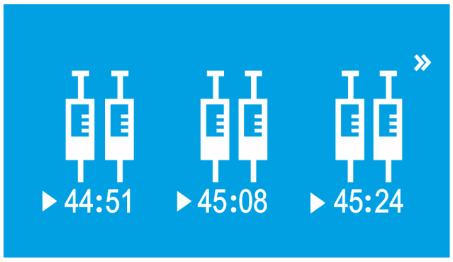
Movement	Function
Turn knob	■ Scroll through the 3 screens: Time course of sample preparation, program setting, calibration ■ Select function on a screen ■ Set value
Press the knob	■ Confirm selection or value



- Turn the control knob until the program settings appear and then press the knob.
  - ✓ You can now configure settings in the window.
- Turn the knob again and select the parameter you want to change. Confirm the selection by pressing the knob.
  - ✓ The selected parameter is highlighted in light blue.
- Set the value and confirm the setting by pressing the knob.



- When all parameters have been set, press the start button of the pump units on which sample preparation is to run with these parameters.



- To operate the pump units with different settings, configure new settings in the program window after starting a pump and then start the corresponding pump unit.
  - ✓ After starting, the start button of the pump unit lights up blue. Sample preparation with these pumps begins and the display changes to show the time remaining until the end of sample preparation. The end is also signaled by a sound from the device.

Starting or stopping the sample preparation

The start buttons on the pump units are used to start or stop the sample preparation.

Function	Press the start button	Device signal
Start the sample preparation	Briefly press the start button	Start button lights up The remaining time appears on the screen
Stop sample preparation	Briefly press the start button	The start button flashes The time display stops Pause symbol is shown

Function	Press the start button	Device signal
Continue stopped sample preparation	Briefly press the start button	Start button lights up Time display continues
Cancel the sample preparation	Press and hold the start button	Device generates a signal tone Start button no longer lights up The time indication is reset to 00:00

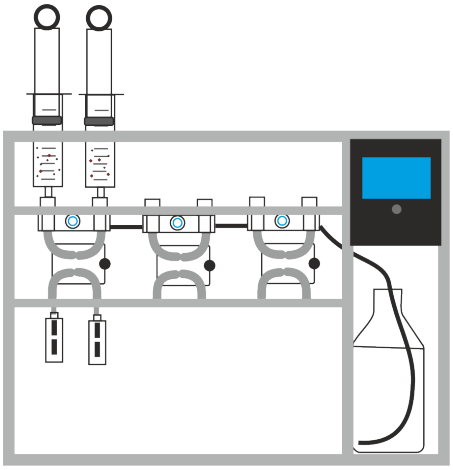
Sample preparation time

The sample preparation time is made up of the sample volume, rinsing volume and pump speed. For sample volumes of less than 100 ml, a 10% dosing time is added for the sample as a buffer. For sample volumes over 100 ml, this additional dosing time does not apply. In the example, the sample preparation time is calculated for the standard settings of sample volume (100 ml), rinsing volume (25 ml) and pump speed (3 ml/min).

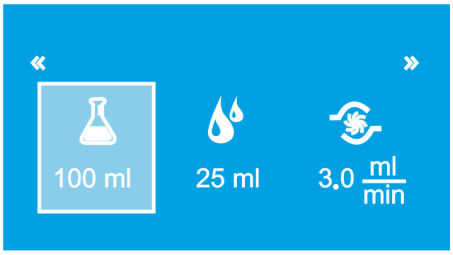
Sample dosing time	2000 s
+ 10 % dosing time as buffer	200 s
Rinse solution dosing time	500 s
+ time for dosing 1 ml rinse solution as buffer	20 s
+ 4 s for valve change-over	4 s
Total time	2724 s = 45 min 24 s
Display at start	45:24

4.3 Automatic AOX and AOF sample preparation

In the automatic sample preparation the APU sim automatically performs the adsorption of the samples by the activated carbon and the rinse step with sodium nitrate solution. The sample preparation must in this case be continued to the end with syringe pistons inserted. If air enters the sample path, the samples can mix with the rinse solution when the valve is opened and contaminate the system.



- Empty the waste container.
- Fill the storage bottle for the rinse solution with sodium nitrate solution. Place the storage bottle into the adapter of the device. Immerse the rinse tube (no. 1) in the rinse solution.
- Fit the duplex columns with disposable tubes filled with 50 mg activated carbon. Screw the duplex columns together.
  NOTICE! To avoid contamination, only insert tubes with tweezers and do not touch them by hand.
- Attach the duplex columns to the respective channel using the Luer attachment.
- Slide the drainage channel directly under the column units.
  NOTICE! Sample and rinse solution may splash if the drainage channel is positioned too low under the column unit.
- If necessary, rinse syringes with ultrapure water to remove sample residue.
- Insert syringes without plungers into the device. Note that there should be slight resistance when inserting. This means the syringe is correctly inserted into the sealing ring.
- Add the sample to the syringe.
- Attach the plunger and press it down to the liquid. Tilt the plunger slightly back and forth so that the air can escape along the seal. There must not be any air cushion between the plunger and the liquid.

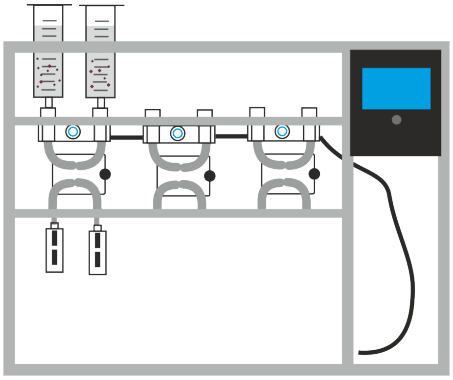


- Switch on the device using the switch on the rear.
  ✓ The display switches on and shows the process window.
- Configure the sample volume, rinse volume and dosing rate in the control software. The defined sample volume must be identical to the volume added to the syringe.
- Press the start button on the pump unit.
  ✓ The AOX or AOF sample preparation starts. The remaining time until the end is counted down in the process window.

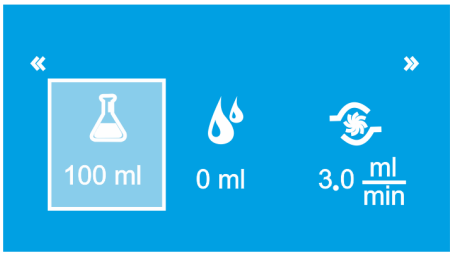
4.4 Manual AOX or AOF sample preparation for samples with particles

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

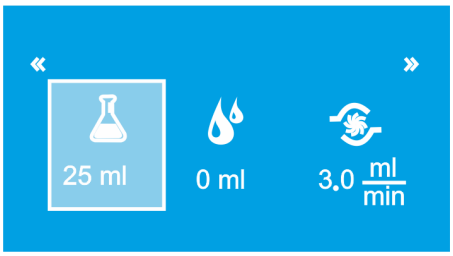
If required, a pre-column with suitable filter material can be attached in front of the activated carbon columns. This is intended to catch the particles so that the activated carbon columns do not clog.



- Empty the waste container.
- Provide sodium nitrate solution as a rinsing solution.
- Fit the duplex columns with disposable tubes filled with 50 mg activated carbon. Screw the duplex columns together.
  NOTICE! To avoid contamination, only insert tubes with tweezers and do not touch them by hand.
- If required, attach a pre-column with particle filter in front of the activated charcoal columns. Here too, only insert the filter tube with tweezers.
- Attach the duplex columns to the respective channel using the Luer attachment.
- Slide the drainage channel directly under the column units.
  NOTICE! There is a risk of splashing if the drainage channel is located too low under the column unit.
- If necessary, rinse syringes with ultrapure water to remove sample residue.
- Insert syringes without plungers into the device. Note that there should be slight resistance when inserting. This means the syringe is correctly inserted into the sealing ring.
- Add the sample to the syringe. Do not attach the plunger. The syringe remains open.



- Switch on the device using the switch on the rear.
  ✓ The display switches on and the process window is shown.
- Set the sample volume in the control software. The defined sample volume must be identical to the volume added to the syringe. Set the rinse volume to "0 ml".
- Press the start button on the pump unit.
  ✓ AOX or AOF adsorption starts.



- At the end of adsorption, fill the syringe with rinse solution.
- Enter the volume of the rinse solution as sample volume, because the rinse solution will be pumped through the system via the syringes. The rinse volume remains at the value "0 ml".
  ✓ The rinse step takes place.

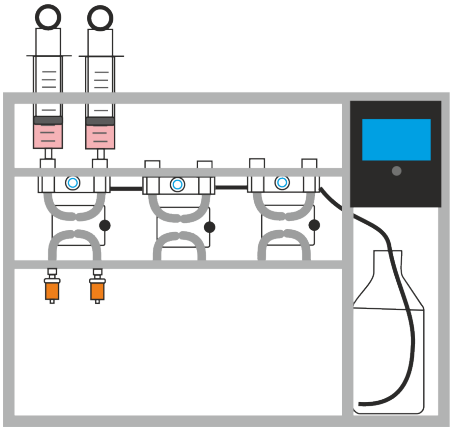
When using a pre-column, the filter material loaded with particles contains part of the sample. If necessary, the filter column can be analyzed separately or together with the activated carbon columns.

4.5 SPE-AOX and SPE-AOF sample preparation

The SPE-AOX and SPE-AOF methods are used for the enrichment of organically bound halogens in aqueous solutions with a high content of inorganic halides (fluoride > 1 mg/l, chloride > 5000 mg/l, bromide > 10 mg/l, iodide > 1 mg/l) according to DIN 38409-59 and DIN EN ISO 9562, if prior dilution of the sample cannot be performed. Highly saline waters can be, for example, industrial wastewater. Wastewater in municipal wastewater treatment plants can also be heavily contaminated with chlorides, for example due to road salt in winter.

The SPE method separates organic compounds from the highly saline matrix in a first step by solid phase extraction. After elution with methanol, AOX or AOF enrichment takes place on activated carbon.

Insoluble inorganic and organic halogen compounds and halogens adsorbed on solids are not detected by this method. Samples containing particles must be filtered through a 0.45 µm membrane filter prior to adsorption.

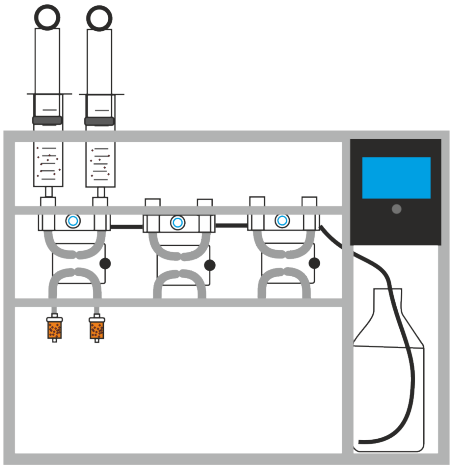


Condition the SPE cartridge

- Empty the waste container. Insert the waste tube into the canister.
- Provide sodium nitrate solution as a rinsing solution.
- If necessary, rinse syringes with ultrapure water to remove sample residue.
- Fill the syringes with 11 ml methanol, making sure that there are no air bubbles in the syringe. Insert the syringes into the device.

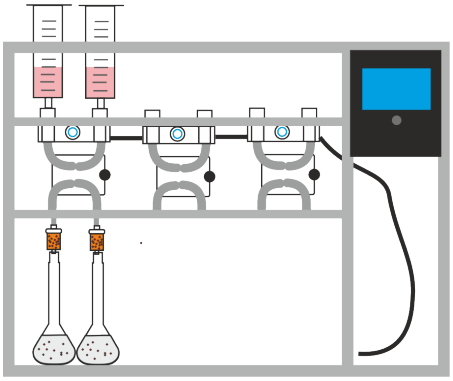
NOTICE! For volumes less than 100 ml, 10% more sample volume is pumped by default to empty the syringes. Instead of 10 ml, you must therefore draw a little more (11 ml) methanol onto the syringe to prevent air from entering the SPE cartridge.

- Attach the SPE cartridges to the Luer lock.
- Set 10 ml as the sample volume and 10 ... 50 ml as the rinse volume in the dosing program and start the pump.
  - ✓ The SPE cartridges are conditioned.



Solid phase extraction

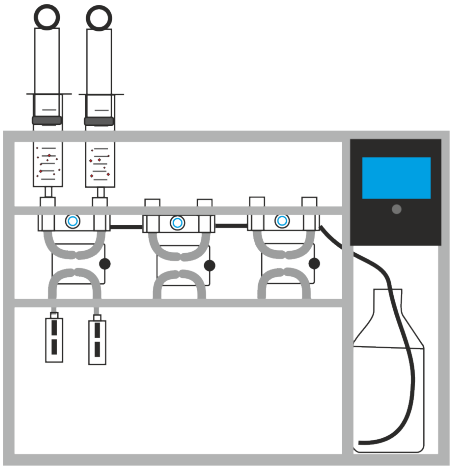
- Draw the filtered samples onto the syringes.
- Set the exact sample volume in the dosing program. Enter 25 ml as the rinse volume.
- Start the pump unit.
  - ✓ AOX/AOF is adsorbed on the SPE cartridge. The rest of the sample drains into the waste canister via the drainage channel. Interfering matrix components are washed out with the rinse solution.



Elution

Elution is performed manually, i.e., you dose the solutions into the open syringes.

- Place 100 ml volumetric flasks under the columns to collect all of the eluate.
- Elute AOX/AOF compounds with 5 ml methanol from the SPE cartridges:
  - Pour 5 ml methanol into the syringes. Do not attach the plungers.
  - Set 5 ml as the sample volume and 0 ml as the rinse volume in the program.
  - Start the pump unit.
- Then wash the SPE cartridge with 5 ml distilled water (procedure analogous to methanol). Catch the eluates in the volumetric flask.
- Top up the eluted samples in the volumetric flask with distilled water to 100 ml and add nitrate stock solution.



Adsorption on activated carbon

Adsorption on activated carbon is carried out in the same way as for automatic AOX and AOF preparation.

- Dispose of the SPE cartridges. Attach filled duplex columns.
- Add the eluted samples to the syringes and attach the plungers. Tilt the plungers back and forth so that the air can escape from the seals and no air cushion forms.
- Configure the sample volume, rinse volume and dosing rate in the control software. The defined sample volume must be identical to the volume added to the syringe.
- Start the pump unit.
  - ✓ The loaded active carbon can be analyzed.

See also

Automatic AOX and AOF sample preparation [▷ 14]

4.6 EOF sample preparation with SPE method

During the SPE method (solid-phase extraction), organic fluorine compounds are bound to a solid phase, e.g., octadecyl-modified silica gel, and eluted with methanol at the end of the process. At the same time, inorganic compounds remain in the water sample and are thus removed. This achieves two objectives: Enrichment of the organically bound fluorine and separation of interfering inorganic matrix components.

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

Use deionized water acidified with HNO_3 (pH < 2) as rinse solution.

The method consists of the following 4 steps:

1. Condition the SPE cartridges
2. Sample extraction
3. Rinse
4. Elution of the analytes

NOTICE

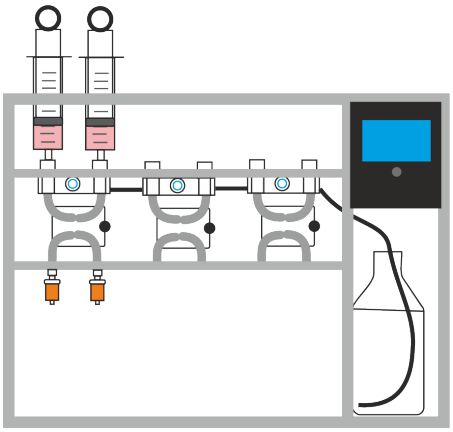
The SPE cartridge must not dry before sample extraction

The EOF compounds only bind optimally to moistened, conditioned resins. Air bubbles in the sample path could dry the cartridge.

- Therefore, make sure that no air bubbles form during sample extraction.

Sample volume greater than 100 ml

Perform EOF sample preparation manually. Have the samples dispensed via transfer tubes.

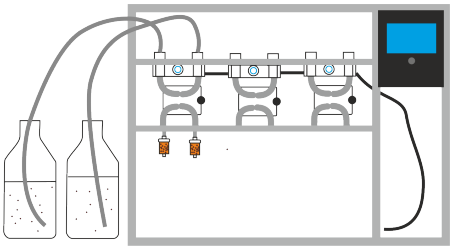


Condition the SPE cartridge

- Empty the waste container. Insert the waste tube into the canister.
- Provide distilled water acidified with nitric acid (pH < 2) as a rinse solution.
- If necessary, rinse syringes with ultrapure water to remove sample residue.
- Fill the syringes with 11 ml methanol, making sure that there are no air bubbles in the syringe. Insert the syringes into the device.

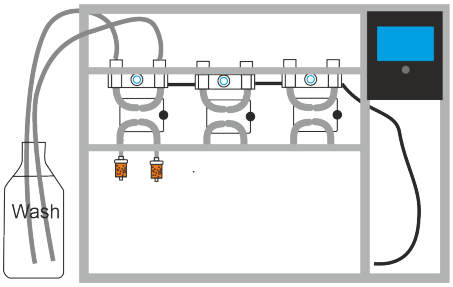
NOTICE! For volumes less than 100 ml, 10% more sample volume is pumped by default to empty the syringes. Instead of 10 ml, you must therefore draw a little more (11 ml) methanol onto the syringe to prevent air from entering the SPE cartridge.

- Attach the SPE cartridges to the Luer lock.
- Set 10 ml as the sample volume and 10 ... 50 ml as the rinse volume in the dosing program and start the pump.
  - ✓ The SPE cartridges are conditioned.



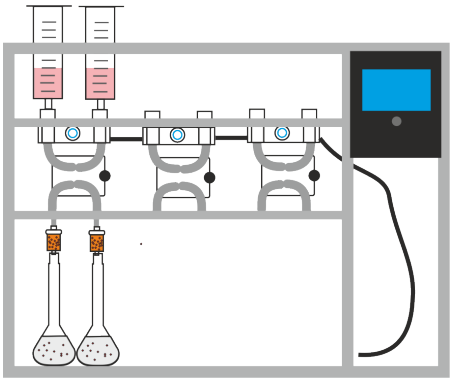
Extract samples

- Remove the sample syringes and install the transfer tubes. Hold the end of the tubing by the bracket and push it into the pump connection. You will feel slight resistance until the pump-tube connection is properly sealed.
- Immerse the other end of the tube into the sample vessel.
- Pull off the SPE cartridges at the pump outlets.
- Pump the sample through the system until there are no more air bubbles in the transfer and pump tubes.
- Reattach the SPE cartridges.
- Set the sample volume precisely. The volume can be 100 ... 5000 ml. Set the rinse volume to 0 ml. The pump speed can be increased to 5 ml/min to save time.
- Start the pump unit.
  - ✓ EOF is extracted and bound in the SPE cartridge. The sample residues run off via the drainage channel.



Rinse cartridge

- Immerse the transfer tubes in the rinse solution.
- Rinse SPE cartridges with 50 ... 100 ml rinse solution to remove interfering matrix components. Set the volume as the sample volume. The rinse volume remains at the value "0 ml".
- Allow the SPE cartridge to dry for 20 min.

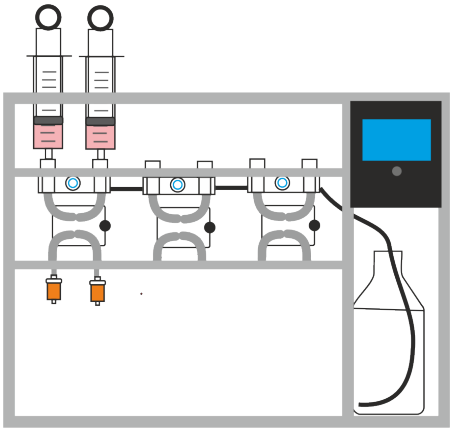


Elute the sample

- Install the sample syringes in the device. The syringes remain open during this step.
- Install the volumetric flask under the SPE cartridges.
- Pour 5 ml methanol into the syringe. Set the sample volume to 10 ml. Start the pump. Collect the eluate in the volumetric flask.
- When the sample syringe becomes empty, pour 5 ml of distilled water into the syringe to rinse the syringe. Collect the rinse solution in the same volumetric flask.
- If necessary, top up the eluate volume to 10 ml with distilled water.
  - ✓ The EOF sample preparation is complete. The eluate can now be analyzed.

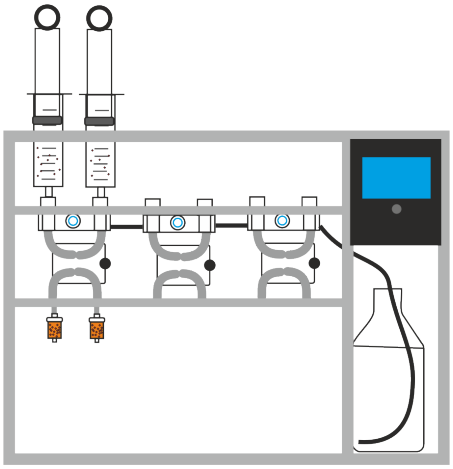
Sample volume up to 100 ml

For samples with a volume of up to 100 ml, the "Condition SPE cartridge" and "Extract sample" steps can be processed automatically.



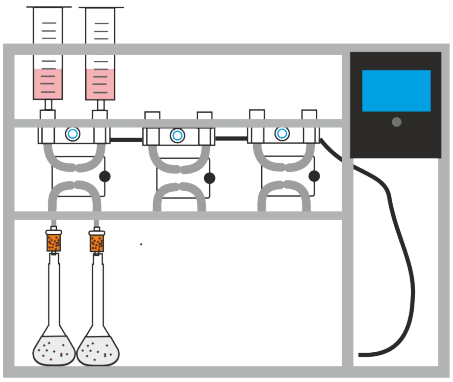
Condition the SPE cartridge

- Empty the waste container. Insert the waste tube into the canister.
- Install sample syringes in the device.
- Fill the rinse bottle with distilled water acidified with nitric acid (pH < 2), install in the mount on the device and insert hose 1 into the rinse bottle.
- Connect the SPE cartridges to the Luer connection on the pump outlets.
- Fill the sample syringes with 10 ml methanol. Attach the syringe plunger and press down to the surface of the liquid. Tilt the plunger slightly back and forth so that the air can escape past the plunger seal. There must be no air cushion between the plunger and the surface of the liquid.
- Set the following parameters in the program: 10 ml sample volume, 10 ... 50 ml rinse volume, 3.0 ml/min pump speed.
- Start the pumps.
  - ✓ The SPE cartridges are conditioned.



Extract sample

- Pour the filtered samples into the sample syringes.
- Attach the syringe plunger and press down to the surface of the liquid.
- Set the following parameters in the program: Exact sample volume, 10 ... 50 ml rinse volume, 3.0 ml/min pump speed.
- Start the pump.
  - ✓ The EOF compounds are adsorbed in the SPE cartridge. Sample residues flow out via the drainage channel. The SPE cartridge is then rinsed and interfering matrix components are removed.
- Allow the SPE cartridge to dry for 20 min.



Elute the sample

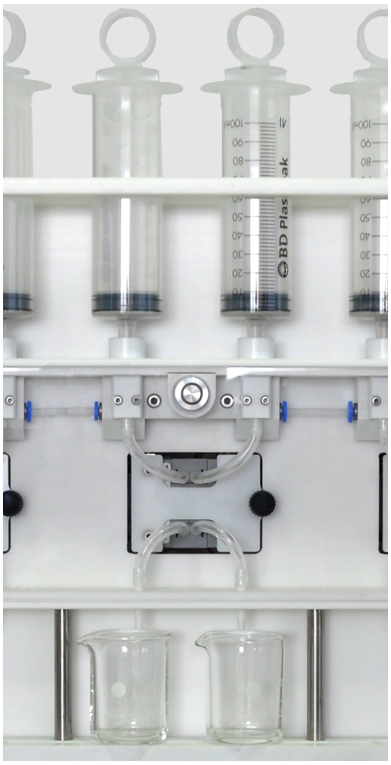
- Install the sample syringes in the device. The syringes remain open during this step.
- Install the volumetric flask under the SPE cartridges.
- Pour 5 ml methanol into the syringe. Set the sample volume to 10 ml. Start the pump. Collect the eluate in the volumetric flask.
- When the sample syringe becomes empty, pour 5 ml of distilled water into the syringe to rinse the syringe. Collect the rinse solution in the same volumetric flask.
- If necessary, top up the eluate volume to 10 ml with distilled water.
  - ✓ The EOF sample preparation is complete. The eluate can now be analyzed.

4.7 Calibration of the pump unit

You can calibrate the pump units. Calibration is required in the following cases:

- After replacing the tube system
- If the syringe is not fully emptied during the processing time
- In case of deviations from the standard conditions (dosing rate ≠ 3 ml/min)

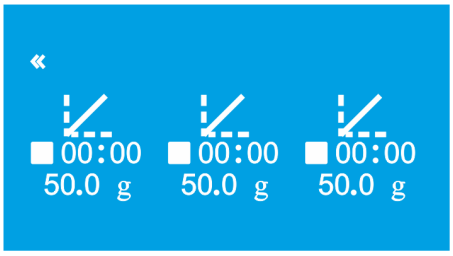
You can calibrate each pump unit individually. You must calibrate both channels of a unit together. 50 g distilled water is pumped through the system at a time. The amount of water collected is weighed to the nearest 0.1 g and the mean of the two channels of a pump unit is calculated.



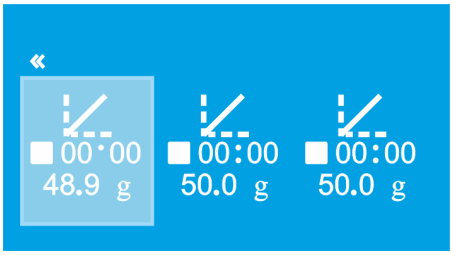
- Fill the pump tubes with distilled water through the syringe.
- Fill the syringe with min. 70 ml distilled water.
- Weigh 2 beakers (50 or 100 ml) with a precision of 0.1 g and note the masses.
- Place the beakers under the tube outlets. Position the drainage channel under the pump unit so that the water is completely collected in the beakers.

- Configure the pump speed in the program window as for 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.



- Select the calibration window by rotating the control knob.
- Start the calibration by pressing the start button on the pump unit and let it run to the end.
  - ✓ A signal tone sounds at the end of the calibration.
- Weigh the two beakers with the collected water. Determine the mass of the water. Calculate the average of both measurements of a pump unit.



- Enable the pump unit by pressing the control knob.
  - ✓ The pump unit is highlighted in light blue.
- Set the mean of the water masses to an accuracy of 0.1 g by turning the control knob.
- 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. Sample preparation cannot be carried out at the same time as a calibration is running.

5 Maintenance and care

5.1 Maintenance overview

Maintenance item	Task	Frequency
Basic device	Clean	Daily During decommissioning
	Remove liquid from the drainage channel	In case of residue in the drainage channel
Pump tubes and connecting tubes	Rinse with ultrapure water	Daily During decommissioning
	Replace complete tube system	Annually
Sealing rings in the syringe holders	Replace	Annually If the connection is leaking and bubbles are forming in the pump tubes
O-rings for activated carbon columns	Replace	Annually
Rinsing solution	Replace	Daily
Supply bottle for washing solution	Clean	Monthly

5.2 Rinse the pump tubes

Rinse the pump tubes daily at the end of work.

- Rinse the syringes to remove sample residues.
- Draw 50 ml ultrapure water onto the syringes.
- Insert syringes into the device.
- Set the following program parameters: Sample volume 50 ml, rinse volume 0 ml, pump speed 5 ml/min.
- Push the drainage channel upward so that the water is collected and does not splash onto the laboratory bench.
- Press the start button on the pump units.
  - ✓ The ultrapure water is pumped through the system.

The device can now be switched off at the device switch.

5.3 Replacing pump hoses

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.

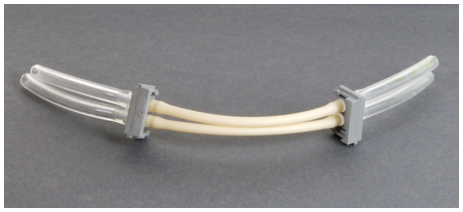


Fig. 4 Tube set with pump tubes and connecting tubes

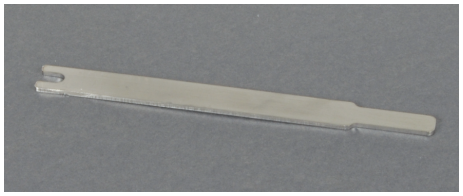
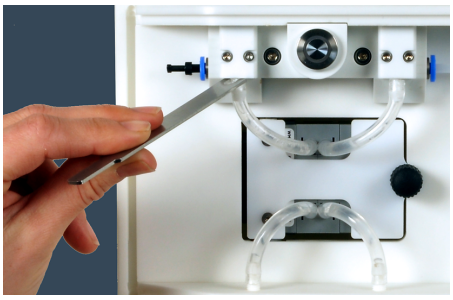
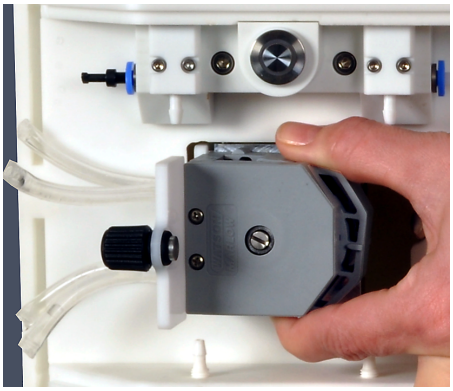


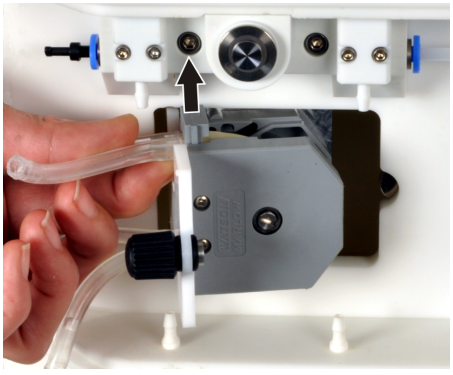
Fig. 5 Tube lifter



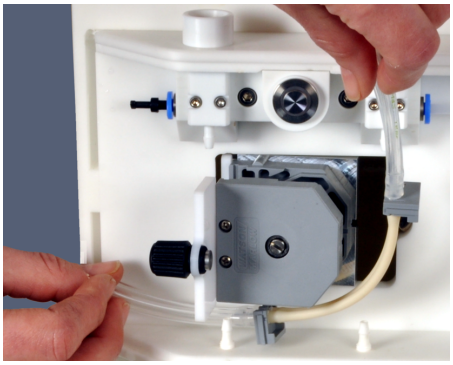
- Detach the connection tubes with the tube lifter from the top and bottom connections. To this end, slightly lift the tube with the tube lifter and pull it off with the other hand.



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



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



- Close the pump with the tension clamp.
  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.
- To align the pump tubes allow the open pump to run briefly, then stop manually.
- Close the service flap.
- Attach the connecting tubes to the connections.
  ✓ The system is operational.

After replacing the tube system, a calibration must be performed.

See also

Calibration of the pump unit [▸ 21]

5.4 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.

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

6 Fault removal

Error	Cause	Remedy
Sample is not being pumped through the system	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
Air bubbles in the tube system	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
Drainage channel overflows	The waste tube has kinked or does not enter the waste container with a constant incline	Remove kink in waste tube Shorten waste tube if necessary
	Waste container overflows	Empty the waste container
Poor recovery, reproducibility	Plastic syringes leaking	Replace plastic syringes
	System contaminated	Replace plastic syringes Rinse system with ultrapure water
	System leaking	Check the tube connection Replace tube system

7 Transport and storage

WARNING

Risk of damage to health due to improper decontamination

- Decontaminate the device professionally and document the cleaning measures before returning the device to Analytik Jena.
- The customer service department will send you the decontamination declaration when you register the return.

NOTICE

Risk of device damage due to unsuitable packaging material

- Only transport the device and its components in the original packaging.
- Empty the device completely and attach all transport locks before transporting the device.
- Add a suitable desiccant to the packaging to prevent damage from moisture.

Ambient conditions for transport and storage

Observe the environmental conditions listed in the specifications.

Preparing the device for transport

- ▶ Rinse the hose system through the plastic syringes with ultrapure water.
- ▶ Pull the tube out of the storage bottles. Wipe off the tube with a clean paper towel.
  ⚠ CAUTION! The tube contains residues of rinse solution.
- ▶ Empty and clean the storage bottles.
- ▶ Pump the tube system empty.
- ▶ Switch off the device via the power switch. Disconnect power supply from device.
- ▶ Remove plastic syringes and duplex/triplex columns.
- ▶ Rinse drainage channel with ultrapure water. Move the drainage channel into the lowest position and remove.
  NOTICE! The drainage channel can only be removed in the lowest position.
- ▶ Empty and clean the waste container.
- ▶ Clean the device housing with a damp, non-dripping cloth and allow to dry.
- ▶ Pack the device and accessories in their original packaging. Use a desiccant.

Moving the device in the laboratory

Observe the following when moving the device within the laboratory:

- Insufficiently secured components pose a risk of injury!
  Before moving the device, remove all loose parts and disconnect all connections from the device.
- For safety reasons, two persons are required to transport the device, one person on each side of the device.
- As the device does not have carrying handles, grip the device firmly with both hands at the lower end. Lift the device simultaneously.
- Observe the guide values and adhere to the legally mandated limits for lifting and carrying loads without auxiliary means.
- Observe the installation conditions at the new location.

8 Disposal

Waste water is produced during operation. Depending on the sample preparation, the waste water contains methanol (SPE-AOX, SPE-AOF and EOF), sodium nitrate, nitric acid and sample. Dispose of the neutralized waste in accordance with the legal requirements.

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

9 Specifications

General characteristics

Designation/type	APU sim
Basic device dimensions (W x H x D)	450 mm x 600 mm x 205 mm
Mass	Approx. 20 kg

Methods data

Number of samples	6
Sample volume	5 ... 100 ml with plastic syringes 100 ... 5000 ml with transfer tube set
Rinsing volume	0 ... 100 ml, increment 1 ml
Dosing rate	1 ... 6 ml/min, increment 0.5 ml/min
Particle handling capacity	< 1 mm
Operation	Internal control module
Syringe volume	100 ml maximum

Electrical variables

Operating voltage	24 V via external power supply
Power consumption	50 W max.
Current consumption	2.1 A maximum
Mains voltage of internal power supply	100 ... 240 V
Interference suppression (electromagnetic compatibility)	In accordance with the provisions of EN 55022 class A

Ambient conditions

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

The ambient conditions for the device are identical for operation and storage. Use a desiccant when storing the device to prevent damage from condensate forming.

List of figures