



# Concentrator plus/Vacufuge® plus

Operating manual



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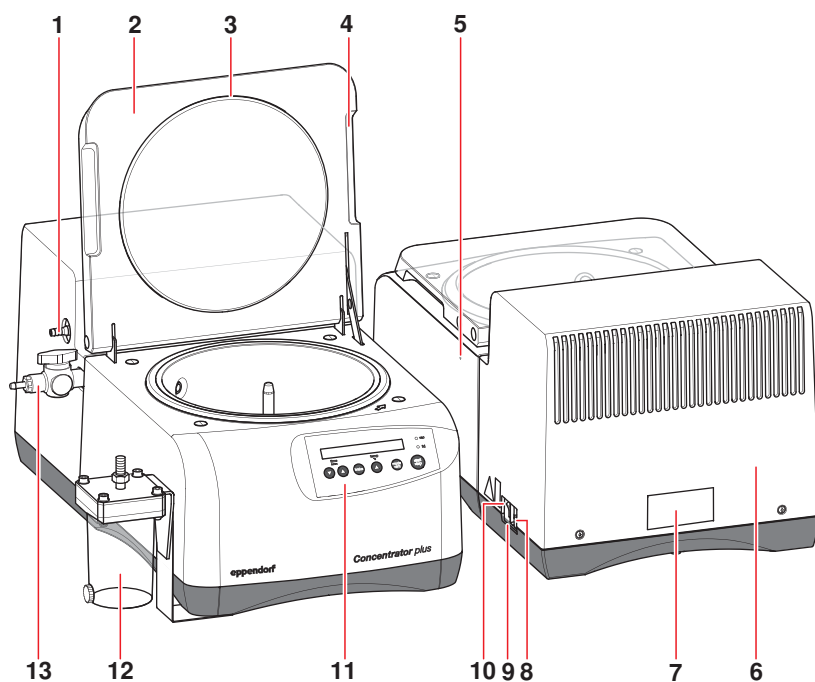


Fig. A: Front and rear view of the complete system with gel dryer connection

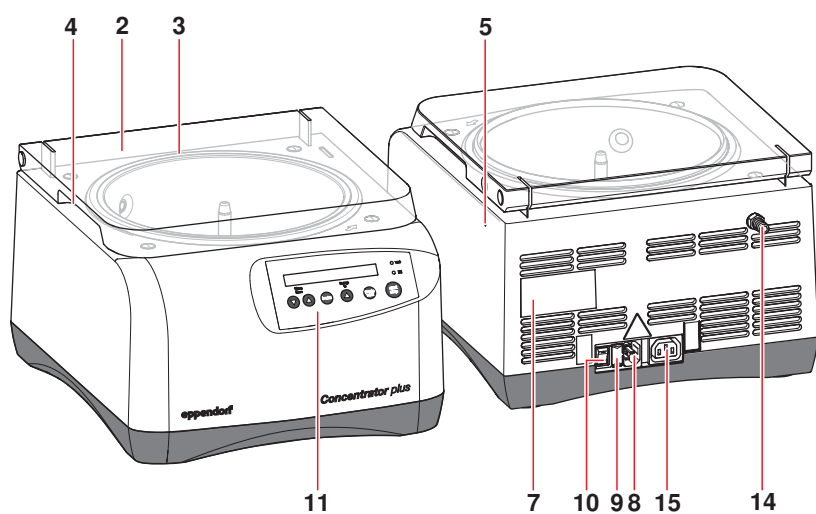


Fig. B: Front and rear view of the basic device

1 Pump outlet (complete system)	2 Lid made from PMMA
3 Sealing ring	4 Grip recess
5 Emergency release	6 Pump housing (complete system)
7 Name plate	8 Mains connection
9 Fuse holder	10 Mains power switch
11 Operating controls and device display	12 Emission condenser (complete system)
13 Gel dryer connection (complete system)	14 Pump connection (basic device)
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## 1 User instructions

### 1.1 Using this manual

- ▶ Read this operating manual completely before using the device for the first time.
- ▶ Consider this operating manual as part of the product and keep it in a place where it can be easily accessed.
- ▶ Include this operating manual with the device when passing the device on to third parties.
- ▶ In case of loss of the operating manual, please request a replacement. The latest version can be found on our website at [www.eppendorf.com](http://www.eppendorf.com).

### 1.2 Warning signs and hazard icons

#### 1.2.1 Hazard symbols


	<b>Biohazard</b>		<b>Explosion</b>
	<b>Electric shock</b>		<b>Hot surface</b>
	<b>Crushing</b>		<b>Toxic substances</b>
	<b>Hazard point</b>		<b>Material damage</b>

#### 1.2.2 Degrees of danger

The degree of danger is a part of a safety note and distinguishes the possible results of non-observance from each other.

<b>DANGER</b>	<i>Will lead to severe injuries or death.</i>
<b>WARNING</b>	<i>May lead to severe injuries or death.</i>
<b>CAUTION</b>	<i>May lead to light to moderate injuries.</i>
<b>NOTICE</b>	<i>May lead to material damage.</i>

### 1.3 Symbols used

Depiction	Meaning
▶	You are requested to perform an action.
1. 2.	Perform these actions in the sequence described.
•	List.
	References useful information.

## 1.4 Abbreviations used

<b>ETFE</b>	Ethylene/Tetrafluorethylene copolymer
<b>FFKM</b>	Perfluoroelastomer
<b>MTP</b>	Micro test plate
<b>NN</b>	Mean sea level (MSL)
<b>PCR</b>	Polymerase Chain Reaction
<b>PMMA</b>	Polymethyl methacrylate
<b>PTFE</b>	Polytetrafluorethylene
<b>rcf</b>	Relative centrifugal force (g value, RZB)
<b>rpm</b>	Revolutions per minute ( $\text{min}^{-1}$ )
<b>RCF</b>	relative centrifugal force (g value)
<b>UV</b>	Ultraviolet radiation



## 2 Product description

### 2.1 Main illustration

The front fold-out page depicts front and rear views of the complete system (see Fig. A) and the basic device (see Fig. B).

<b>1 Pump outlet (complete system)</b> Outlet of the integrated diaphragm vacuum pump, e.g., for tubing connection to the emission condenser.	<b>2 Lid made from PMMA</b>
<b>3 Sealing ring</b>	<b>4 Grip recess</b>
<b>5 Emergency release</b>	<b>6 Pump housing (complete system)</b>
<b>7 Name plate</b>	<b>8 Mains connection</b>
<b>9 Fuse holder</b>	<b>10 Mains power switch</b>
<b>11 Operating controls and device display</b>	<b>12 Emission condenser (complete system)</b>
<b>13 Pump connection (basic device)</b> For tubing connection to external vacuum pump.	<b>14 Mains connection for external vacuum pump (basic device)</b>

### 2.2 Features

Concentrator plus and Vacufuge plus are designed for the evaporation of liquid or wet samples in micro test tubes, round-bottom tubes, Falcon tubes, flat-bottom tubes and different plates.

You can insert the following tubes and plates:

- 1.5 and 2.0 mL micro test tubes in a rotor with 70 places.
- 0.5 mL micro test tubes in a rotor with 72 places.
- 15 mL Falcon tubes in a rotor with 8 places.
- 50 mL Falcon tubes in a rotor with 6 places.
- MTP and PCR plates in a swing-bucket rotor.

A complete list can be found in the following chapter (see *Rotors on p. 11*)

The device is available as a complete system with integrated diaphragm vacuum pump or as a basic device without vacuum pump. The basic device can be connected to an external vacuum system.

Key, practical functions of Concentrator plus or Vacufuge plus have been optimized:

- 3 temperature levels can be set (30, 45, 60 °C). Alternatively, evacuation is carried out without thermoregulation.
- The evaporation of liquids can be carried out optimized in 3 functions. In addition to pure evacuation, aqueous and/or alcoholic solutions can be concentrated extra fast with 2 special functions.
- You can also operate the device as a pure desiccator.
- You can connect a solvent trap to the device behind the pump.

Due to the space-saving design, the device can be situated directly on the workstation. With its clearly laid-out control panel with only a few, clearly marked elements and a display that is easy to read, the device is a pleasant and reliable companion in your daily work.

## 2.3 Delivery package

The delivery package includes one of the following device/rotor combinations and the accessories listed below.

### 2.3.1 Complete system





Quantity	Order No. (International)	Order No. (North America)	Description
1 or or	5305 000.304 5305 000.312 5305 000.347	- 5305000312 -	<b>Concentrator plus/Vacufuge plus complete system</b> with rotor F-45-48-11 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump
or or or	5305 000.509 5305 000.517 5305 000.541	- 5305000517 -	<b>Concentrator plus/Vacufuge plus complete system</b> without rotor 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump
or or or	5305 000.703 5305 000.711 5305 000.746	- 5305000711 -	<b>Concentrator plus/Vacufuge plus complete system</b> with connection, e.g., for a gel dryer, without rotor 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump
1 or	5301 850.249 5417 341.007	022654403 022375831	<b>Fuse</b> 2 x 4.0 A T (230 V) 2 x 6.3 A T UL (120 V / 100 V)
1	-	-	<b>Power cable</b>
1	5305 900.038	-	<b>Operating Manual Concentrator plus/Vacufuge plus</b>
1	5301 330.008	022830309	<b>Emission condenser</b> without hose
1	5301 337.002	022830295	<b>Hose for emission condenser</b> length: 0.7 m
1	5301 110.032	5301110032	<b>Tube connection</b> Plastic


### 2.3.2 Basic device

Quantity	Order No. (International)	Order No. (North America)	Description
1 or or	5305 000.100 5305 000.118 5305 000.142	- 5305000118 -	<b>Concentrator plus/Vacufuge plus basic device</b> with rotor F-45-48-11 230 V/50 - 60 Hz 120 V/50 - 60 Hz 100 V/50 - 60 Hz
1 or	5301 850.249 5417 341.007	022654403 022375831	<b>Fuse</b> 2 x 4.0 A T (230 V) 2 x 6.3 A T UL (120 V / 100 V)
1	-	-	<b>Power cable</b>
1	5305 900.038	-	<b>Operating Manual Concentrator plus/Vacufuge plus</b>

## 2.4 Rotors

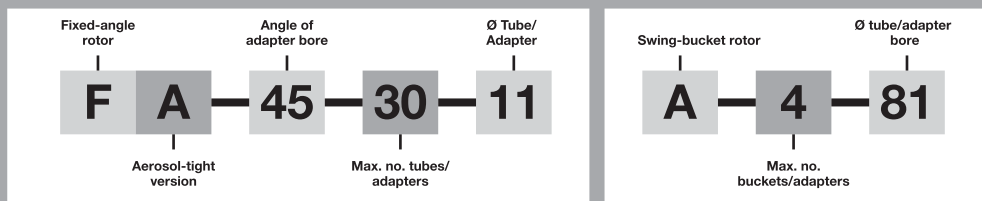
You can operate the device with the following rotors. Before use of sample tubes, please note the manufacturer's specifications with regard to centrifugation resistance (max. rcf).

Rotor	Tube	Max. capacity	Tube dimensions (mm) Ø × L and/or L × W × H	Max. g-force (rcf)/ speed (rpm)	Max. payload per rotor bore <sup>(1)</sup>
F-45-72-8		72 micro test tubes of 0.5 mL each.	8 × 31	inner ring: 202 x g, outer ring: 224 x g/ 1,400 rpm	10 g
F-45-70-11		70 micro test tubes of 1.5/2.0 mL each.	11 × 41/ 11 × 47	inner ring: 153 x g, middle ring: 202 x g, outer ring: 248 x g/ 1,400 rpm	15 g
F-45-48-11		48 micro test tubes of 1.5/2.0 mL each.	11 × 41/ 11 × 47	inner ring: 217 x g, outer ring: 239 x g/ 1,400 rpm	15 g
F-45-24-12		24 round-bottom tubes of 6.0/8.0 mL each.	12 × 67-100	234 x g/ 1,400 rpm	35 g
F-50-8-16		8 round-bottom tubes of 15.0/20.0 mL each.	16 × 105-120	230 x g/ 1,400 rpm	70 g
F-50-8-18		8 round-bottom tubes of 15.0/20.0 mL each.	18 × 105-128	230 x g/ 1,400 rpm	70 g
F-35-6-30		6 Falcon tubes of 15 mL each.	17 × 116-123	232 x g/ 1,400 rpm	25 g
F-45-8-17		8 Falcon tubes of 15 mL each.	17 × 118-123	239 x g/ 1,400 rpm	70 g
F-35-6-30		6 Falcon tubes of 50 mL each.	29.5 × 116-123	232 x g/ 1,400 rpm	75 g



The diagram shows a 16-bit parallel adder. It consists of four 74181 ALU chips and a 74160 counter. The ALUs are connected in a chain to perform a 16-bit addition. The counter is used to generate the carry-in for the least significant bit of the adder.

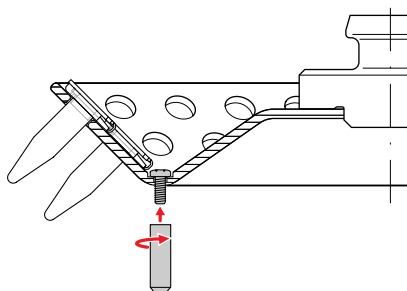
All Eppendorf® rotors are identified using a simple, alphanumeric format that represents the technical specifications in a uniform series of letters and numbers.



## 2.4.1 Special notes on the individual rotors

### Rotor F-45-72-8 and rotor F-45-48-11

- You can place two of these rotors on top of each other in any arrangement by using a spacer (order no. int.: 5301 316.005 / North America: 022822101) and centrifuge them at the same time.
- For this combination, lower upper limits apply to the maximum payload: bottom rotor: 2/3 of the max. payload, top rotor 1/3 of the max. payload.
- **Rotor F-45-72-8 and F-45-48-11:** Included with the accessories are rotor feet which can be screwed into the corresponding bores on the rotor. Their purpose is to prevent the samples from being pushed out of the bores when the rotor is put down on the work bench. The rotors can be centrifuged with the rotor feet. The screws must be checked monthly and re-tightened, if required.



### Rotor F-45-24-12

- Tube length  $\leq 75$  mm: max. capacity 24 tubes.
- Tube length  $> 75$  mm: max. capacity 12 tubes.

### Rotor A-2-VC

- Tubes, PCR strips and plates without frame can only be used with a suitable work plate (see *Adapters* on p. 44).
- Max. loading height: 27 mm.

### Rotor F-35-6-30

- The recommended maximum filling volume for 50 mL Falcon tubes is 44 mL. If the tubes are filled up to the top, the rotational movement may cause the samples to overflow.

## 3 Safety

### 3.1 Intended use

Concentrator plus and Vacufuge plus are intended for sample preparation. The device may only be operated by trained specialist staff.

Concentrator plus and Vacufuge plus are intended for interior use only and mainly intended for the concentration of aqueous solutions of nucleic acids and proteins in approved sample tubes.



#### Poor safety due to incorrect accessories and spare parts.

The use of accessories and spare parts other than those recommended by Eppendorf may impair the safety, function and precision of the device. Eppendorf cannot be held liable or accept any liability for damage resulting from the use of incorrect or non-recommended accessories and spare parts or from the improper use of such equipment.

- ▶ Only use accessories and original spare parts recommended by Eppendorf.

### 3.2 User profile

This device may only be operated by correspondingly trained specialist staff. This staff must have carefully read the operating manual and be familiar with the function of the device.

### 3.3 Application limits



#### Continuous delivery can affect safe operation of the device.

When delivering liquids continuously, membranes and valves of the vacuum pump can be damaged.

- ▶ Only use the device for applications of limited duration.

#### 3.3.1 Declaration concerning the ATEX directive (94/9/EC)



#### Danger of explosion!

- ▶ Do not operate the device in areas where work is completed with explosive substances.
- ▶ Do not use this device to process any explosive or highly reactive substances.
- ▶ Do not use this device to process any substances which could create an explosive atmosphere.

Due to their current design and the environmental conditions on the inside of the device, the Concentrator plus / Vacufuge plus are not suitable for use in a potentially explosive atmosphere. The device must therefore only be used in a safe environment, such as in the open environment of a ventilated laboratory or an extractor hood. The use of substances which may contribute to a potentially explosive atmosphere is not permitted. The final decision with regard to the risks connected with the use of such substances is the responsibility of the user.

#### 3.3.2 Maximum service life for accessories

The maximum service life for plastic adapters is 1 year from first commissioning. Do not use the adapter beyond this period!

For the rotors (see *Rotors on p. 11*) described here there is no limit for their service life, as long as the following conditions are met: proper use, recommended maintenance and undamaged condition.

## 3.4 Information on product liability

In the following cases, the protection provided by the device may be impaired. The liability for the function of the device passes to the operator if:

- The device is not used in accordance with the operating manual.
- The device is used outside of the range of application described in the preceding chapters.
- The device is used with accessories or consumables (e.g., tubes and plates) which are not recommended by Eppendorf.
- The device is maintained or repaired by persons not authorized by Eppendorf.
- The owner has made unauthorized modifications to the device.

## 3.5 Warnings for intended use

Before using the device, read the operating manual and observe the following general safety instructions.

### 3.5.1 Personal injury or damage to the equipment



#### Electric shock from damage to device or mains cable.

- ▶ Only switch on the device if the device and the mains cable are undamaged.
- ▶ Only use devices that have been properly installed or repaired.
- ▶ In case of danger, disconnect the device from the mains.



#### Lethal voltages inside the device.

- ▶ Ensure that the housing is always closed and undamaged so that no parts inside the device can be contacted by accident.
- ▶ Do not remove the housing of the device.
- ▶ Do not allow any liquids to penetrate the inside of the housing.
- ▶ Do not allow the device to be opened by anyone except service personnel who have been specifically authorized by Eppendorf.



#### Risk from incorrect supply voltage.

- ▶ Only connect the device to power sources which correspond with the electrical requirements on the name plate.
- ▶ Only use sockets with a protective earth (PE) conductor and a suitable mains cable.



#### Damage to health due to handling infectious liquids and pathogenic germs.

- ▶ Observe the national regulations for handling these substances, the biological security level of your laboratory, the safety data sheets and the manufacturer's application notes.
- ▶ Wear personal protective equipment (PPE).
- ▶ Follow the instructions regarding hygiene, cleaning and decontamination.
- ▶ For complete instructions regarding the handling of germs or biological material of risk group II or higher, please refer to the "Laboratory Biosafety Manual" (source: World Health Organization, current edition of the Laboratory Biosafety Manual).



#### Burns due to hot sample tubes and device parts.

If the heater is at full power, the wall of the rotor chamber, the rotor and the sample tubes will be heated up to over 60°C.

- ▶ Do not touch the wall of the rotor chamber.
- ▶ Use suitable protective clothing or auxiliary aids to remove the sample tubes.



## Damage to device by spilling liquids in the rotor or rotor chamber.

1. Switch the device off.
2. Disconnect the device from the power supply.
3. Clean the device and the accessories carefully in accordance with the cleaning and disinfection instructions in the operating manual.
4. If a different cleaning and disinfecting method is to be used, contact Eppendorf AG to ensure that the intended method will not damage the device.



## Device damage due to organic solvents.

The use of organic solvents may cause some parts to become damaged, e.g., discolored.

- ▶ If the device becomes contaminated with organic solvents, clean it immediately with a mild cleaning agent.



## Damage to electronic components due to condensation.

After the device has been moved from a cool to a warmer environment, condensation can form inside the device.

- ▶ Wait at least three hours before connecting the device to the power supply.

### 3.5.2 Incorrect handling of the device



## Device lid can crush. Keep hands clear.

- ▶ Do not reach between the device and lid when opening or closing the device lid.



## Damage from knocking against or moving the device during operation.

A rotor banging against the rotor chamber wall can cause considerable damage to the device and rotor.

- ▶ Do not move or knock against the device during operation.

### 3.5.3 Incorrect handling of the rotors



## Risk of injury from improperly attached rotors.

- ▶ Only operate the device if the rotor has been mounted completely.
- ▶ If there are any unusual noises when the device is started up, immediately press the **start/stop** key to stop concentrating.



## Risk of injury from unsymmetric loading of rotors.

- ▶ Load rotors symmetrically with identical tubes and/or buckets and plates.
- ▶ Only load adapters with suitable tubes and/or plates.
- ▶ Always use tubes and/or plates of the same type (weight, material/density and volume).
- ▶ Ensure that tubes that are located opposite each other contain liquids with the same rate of evaporation. Otherwise an imbalance can occur and the concentration may automatically stop.
- ▶ Check for symmetric loading by balancing the adapters and tubes and/or plates used with scales.

The device automatically detects imbalances during operation and stops the run immediately with an error message and a signal tone. Check the load, balance the tubes and restart the run.





## **Risk of injury from overloaded rotor.**

The device is designed for the concentration of substances with a max. density of 1.2 g/mL at maximum speed and filling volume and/or load.

- ▶ Note the maximum payload for each rotor (adapter, tube and content) per rotor bore and/or per bucket and make sure it is not exceeded.



## **Risk of injury from chemically or mechanically damaged accessories.**

Even small scratches and cracks can lead to serious internal material damage.

- ▶ Protect all parts from mechanical damage.
- ▶ Check accessories regularly.
- ▶ Do not use rotors or buckets with signs of corrosion or mechanical damage (e.g. deformations).
- ▶ Do not use accessories whose maximum service life has been exceeded.
- ▶ When inserting the buckets and rotors, ensure that they do not become scratched.



## **Damage to rotors from aggressive chemicals.**

Rotors are high-quality components which withstand extreme stresses. This stability can be impaired by aggressive chemicals.

- ▶ Avoid the use of aggressive chemicals, including strong and weak alkalis, strong acids, solutions with mercury, copper and other heavy metal ions, halogenated hydrocarbons, concentrated saline solutions and phenol.
- ▶ If the rotor is contaminated with aggressive chemicals, clean it immediately using a neutral cleaning agent and then rinse it thoroughly with water. This applies to the base plates of the rotors in particular.

### 3.5.4 Extreme strain on the sample tubes



## **Risk of injury from overloaded tubes.**

- ▶ Note the loading limits specified by the tube manufacturer.
- ▶ Only use tubes which are approved by the manufacturer for the required rcf.



## **Risk from damaged tubes.**

Damaged tubes must not be used, as this could cause further damage to the device and the accessories and loss of the samples.

- ▶ Before use, carry out a visual check of all tubes for any damage.



## **Hazard to plastic tubes from organic solvents.**

When using organic solvents (e.g. phenol, chloroform) the strength of plastic tubes is reduced, i.e., the tubes could get damaged.

- ▶ Follow the manufacturer's information about the chemical resistance of tubes.



## **Sample tubes are subject to strong heat.**

- ▶ Please note the temperature resistance of the sample tubes.

## 3.5.5 Vacuum



### Risk of injury from direct contact with the vacuum.

- ▶ Do not expose any body parts to the vacuum of the device.



### Risk of injury from overpressure.

Overpressure in the exhaust gas lines (e.g., from closed taps or blocked pipes) can cause the pipes to burst.

- ▶ Only use pipes with a sufficiently large cross section.
- ▶ Always keep the exhaust gas line free.
- ▶ Do not place any objects on the exhaust gas lines.
- ▶ Do not bend the exhaust gas lines.
- ▶ Do not fit any hose clamps or valves to the exhaust gas lines.
- ▶ Note the maximum pressures and differential pressures permitted (see p. 41).



### Risk to health from escaping substances.

No vapors from toxic liquids and pathogenic germs must escape.

- ▶ Ensure that there is sufficient condensation and/or separation of the vapors via suitable cold traps or chemical traps.
- ▶ Please note the personal protective equipment (gloves, clothing, goggles, etc.), extraction and safety class required for the laboratory.

## 3.6 Safety instructions on the device

Depiction	Meaning	Location
	<b>General hazard area</b> <ul style="list-style-type: none"> <li>▶ Follow the operating manual.</li> </ul>	Complete system: side of the device next to the mains connection. Basic device: rear next to the mains connection.
	<b>Danger of explosion</b> <ul style="list-style-type: none"> <li>▶ Do not use this device to process any explosive, radioactive or highly reactive substances.</li> <li>▶ Do not use this device to process any substances which could create an explosive atmosphere.</li> </ul>	Top of the device
	<b>Risk of scalding when the device lid is open</b> <p>When the heater is switched on, the surface temperature of the rotor chamber can be &gt; 60 °C.</p> <ul style="list-style-type: none"> <li>▶ Do not touch the wall of the rotor chamber.</li> </ul>	Top of the device
	<b>Risk of injury from overpressure</b> <p>The connection on the top of the emission condenser is intended as an outlet only.</p> <ul style="list-style-type: none"> <li>▶ Make sure that the emission condenser is connected correctly.</li> <li>▶ Never shut this connection off.</li> </ul>	Top of the emission condenser

## 4 Installation

### 4.1 Selecting the location



**If a fault occurs, objects in the immediate vicinity of the device could get damaged.**

- ▶ In accordance with the recommendations of EN 61010-2-020, leave a safety distance of **30 cm** clear around the device during operation.



**Damage from overheating.**

- ▶ Do not place the device close to sources of heat (e.g., radiator, drying cabinet).
- ▶ Do not expose the device to direct sunlight.
- ▶ Ensure free circulation of air by maintaining a distance of at least 30 cm on all sides of the device from adjacent devices or the wall and keep the underside of the device clear.
- ▶ Make sure that the air slots in the device are always free of obstruction.

Select the location for the device according to the following criteria:

- Suitable power connection as per the name plate (230 V/120 V/100 V).
- Stable, horizontal and resonance-free lab bench. Weight of the device: 31/17 kg (complete system/basic device).
- A well ventilated environment which is protected from direct sunlight to prevent the device from heating up more.
- Ambient temperature during operation: 15 to 35 °C.
- At altitudes 1000 m above MSL (risk of insufficient cooling air supply), measures in accordance with DIN EN 60034-1; VDE 0530-1 are required.

### 4.2 Preparing installation



The weight of the device is 31.5 kg (complete system incl. gel dryer) or 16.5 kg (basic device).

- Transport and installation of the device always requires 2 persons.
- Only transport the device in the original packaging.
- Use a transport aid for longer distances (e.g., hand cart).
- Keep the packaging and transport securing devices for later transport or storage. See also the instructions relating to transport (see p. 39).

- ▶ Complete the following steps in the order described:

#### 4.2.1 Open the packaging

1. Cut the adhesive tape.
2. Open up all four tabs of the box.
3. Remove the accessories and rotors.
4. Remove the cover cardboard.
5. Cut the strap retainers.

#### 4.2.2 Lift the device out of the box

1. Lift the device and transport protection pad out of the box.
2. Place the device and transport protection pad on a stable, level and non-resonant lab bench.

## 4.2.3 Complete system: removing the transport protection screw

1. Carefully place the device and transport protection pad on its side.

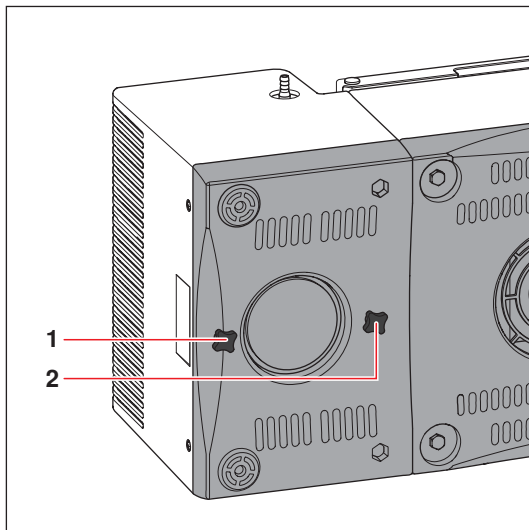


Fig. 1: Transport protection screws on the underside of the Concentrator plus/Vacufuge plus complete system

1 Rear transport protection screw	2 Front transport protection screw
-----------------------------------	------------------------------------

2. Lightly move the rear transport protection pad on the underside of the device towards the back until the rear transport protection screw (1) is visible.
3. Unscrew and remove the two transport protection screws.
4. Push the rear transport protection pad back to its original position.
5. Place the device and transport protection pad upright again.

## 4.2.4 Place the device upright



**WARNING!**

### Operating an incorrectly installed device poses a risk of injury.

The device is not ready for operation after it has been placed upright. Additional components are missing.

- Read the following chapter before operating the device (see *Installing the instrument on p. 21*).

1. Remove the front and rear transport protection pads.
2. Remove the plastic coverings from the device and lid.
3. Place the device upright in a well-ventilated area protected from direct sunlight to prevent it from continuing to heat up.

## 4.2.5 Check the delivery

1. Check that delivery is complete (see *Delivery package on p. 10*).
2. Check all parts for any transport damage. Please contact your distributor if there is any damage.



Proceed in reverse order when packing the Concentrator plus/Vacufuge plus.

## 4.3 Installing the instrument

### 4.3.1 General Installation



#### **Risk from incorrect supply voltage.**

- ▶ Only connect the device to power sources which correspond with the electrical requirements on the name plate.
- ▶ Only use sockets with a protective earth (PE) conductor and a suitable mains cable.



#### **Risk to health from escaping substances.**

No vapors from toxic liquids and pathogenic germs must escape.

- ▶ Ensure that there is sufficient condensation and/or separation of the vapors via suitable cold traps or chemical traps.
- ▶ Please note the personal protective equipment (gloves, clothing, goggles, etc.), extraction and safety class required for the laboratory.



Select a layout for the collection and/or discharge of liquids and gases which corresponds with the current legal requirements and regulations for your application.

On the rear fold-out page of this operating manual you can find schematic representations for possible combinations of the complete system and/or basic devices as well as other components (refer to. Fig. D and Fig. E).

Perform the following steps in the sequence described.

1. Place the device on a suitable lab bench.
2. Allow the device to warm up to ambient temperature for at least 3 hours to prevent damage to electronic components from condensation.
3. Connect the components according to your chosen configuration. Please note the relevant instructions in the following chapters.
  - Complete system: connecting the emission condenser (see p. 22).
  - Complete system: connecting the gel dryer (see p. 23)
  - Basic device: connecting the vacuum pump (see p. 23).
4. Check that the mains voltage and mains frequency comply with the requirements on the name plate for the device.
5. Connect the device to the power supply and switch on with the mains power switch located on the right-hand side of the device (basic device: at the rear of the device) (refer to fold-out page at the front of the manual).
  - Display is active.
  - Lid is released (**lid** indicator lamp lights up).
  - You can now open the lid.

## 4.3.2 Complete system: connecting the emission condenser



### Risk of injury from overpressure.

Overpressure in the exhaust gas lines (e.g., from closed taps or blocked pipes) can cause the pipes to burst.

- ▶ Only use pipes with a sufficiently large cross section.
- ▶ Always keep the exhaust gas line free.
- ▶ Do not place any objects on the exhaust gas lines.
- ▶ Do not bend the exhaust gas lines.
- ▶ Do not fit any hose clamps or valves to the exhaust gas lines.
- ▶ Note the maximum pressures and differential pressures permitted (see p. 41).



Please check whether the use of the emission condenser is sufficient for the intended application. For the evaporation of chemically aggressive or biologically hazardous substances one of the following measures must be taken:

- Replace the emission condenser with a suitable cold trap or chemical trap.
- Place the emission condenser in an ice bath.
- Attach a hose to the upper connection of the emission condenser and connect it to an extraction system.
- Set up a series connection of cold trap or chemical trap and emission condenser.



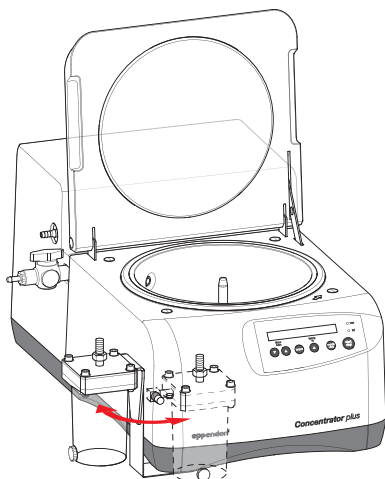
The pump of Concentrator plus and/or Vacufuge plus is fully solvent resistant. Therefore, the emission condenser can be placed behind the pump.

1. Remove packaging from the emission condenser.
2. Remove red cap from the upper connection.
3. Screw the angle connection sideways into the emission condenser.



There must be a fall from the pump outlet to the emission condenser inlet to prevent liquid from collecting in the hose.

4. Connect the pump outlet with the connection on the side of the emission condenser using the hose.
5. Attach the emission condenser from the side or from the front below the front left foot of the device.



6. You can install a filter at the upper connection of the emission condenser. The overpressure at the pump outlet of the complete system must not exceed 1 bar.

## 4.3.3 Complete system: connecting the gel dryer

### Requirement

- 1 connecting hose (length: max. 50 cm, inner diameter: 5 to 7 mm, chemical resistant and suitable for vacuum applications).
1. Screw the hose connection supplied (size: G1/4 ") into the thread of the stop valve on the left-hand side of the device.
  2. Connect the gel dryer to the hose connection, using the connecting hose.

## 4.3.4 Basic device: connecting the vacuum pump



### Danger of explosion from gas mixtures.

When running several devices in parallel on a vacuum pump and/or in combination with a gel dryer, an explosive gas mixture can develop in the vacuum system.

- ▶ Note the solvent properties and only carry out parallel operations with identical solvents or solvents that evaporate in a non-hazardous manner.

You can connect the basic device to an external vacuum pump.

### Requirement

- The vacuum pump is approved according to the standards of your country.
- A separator (e.g., emission condenser, cold trap or chemical trap) between the devices or behind the vacuum pump, depending on the application.
- Pump maintains an ultimate pressure of at least 20 mbar. Its suction capacity is at least 1.8 m<sup>3</sup>/h.



Vacuum pumps that meet these requirements, can, for example, be diaphragm or vane-type rotary pumps. The specifications can be found in the technical data of the vacuum pump or requested from the manufacturer. The manufacturer is also the contact for any further questions regarding the correct handling of the vacuum pump, e.g. operation, use, performance, maintenance, troubleshooting or the specifications and connection of a cold trap.



Please contact Technical Service if problems occur when connecting a vacuum pump. You can find the contact addresses at the end of the operating manual or on the Internet at [www.eppendorf.com](http://www.eppendorf.com).

## Connecting vacuum pumps up to 350 W

### Requirement

- Power consumption of the vacuum pump: max. 350 W or electrical connection value max. 400 VA.
- Special plug for control and power supply of the vacuum pump (see *Accessories on p. 43*)
- 1 connecting hose (length: max. 50 cm, inner diameter: 8 mm, chemical resistant and suitable for vacuum applications).

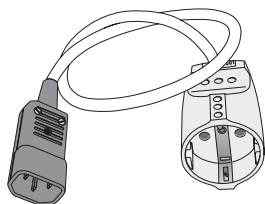


Fig. 2: Special plug for control and power supply of a vacuum pump with a power consumption of **up to 350 W**.

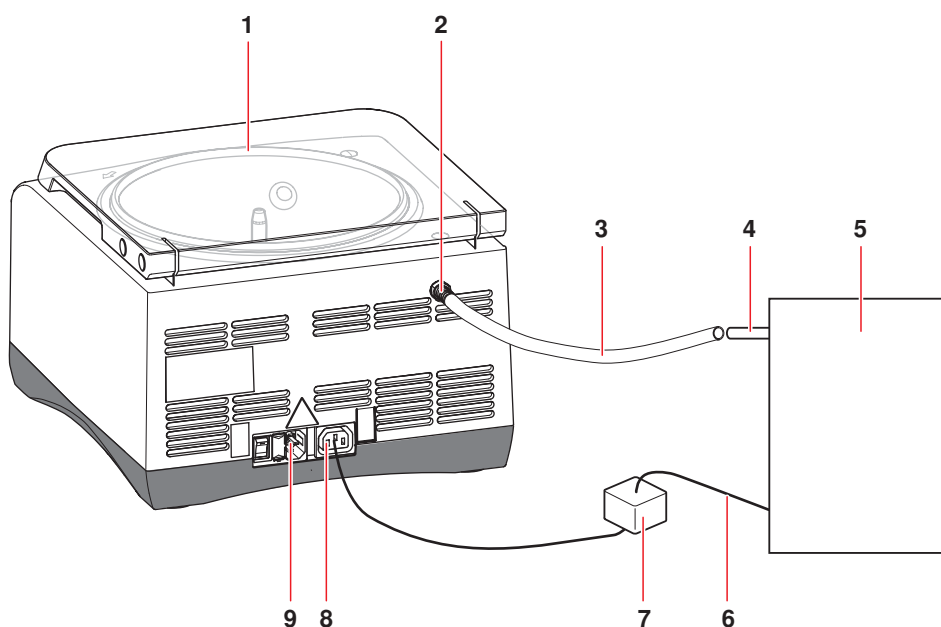


Fig. 3: Connection of the power consumption for a vacuum pump **up to 350 W** to the Concentrator plus basic device.

1. Disconnect the basic device **1** and vacuum pump **5** from the mains power supply.
2. Insert the mains cable of the vacuum pump **6** into the special plug **7**.
3. Insert the special plug into the provided socket **8** at the rear of the basic device (connected mains voltage!).
4. Connect the inlet of the vacuum pump **4** to the pump connection **2** at the rear of the basic device via a connecting hose **3**.
5. Connect the basic device to the mains power supply **9**.



## Connect vacuum pump with external power supply

### Requirement

- Additional power source for the vacuum pump.
- Solenoid valve for controlling the vacuum pump via the basic device (see *Accessories* on p. 43)
- 2 connecting hoses (length: max. 50 cm, inner diameter: 8 mm, chemical resistant and suitable for vacuum applications)

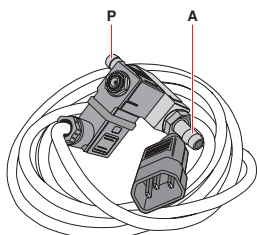


Fig. 4: Solenoid valve for controlling a vacuum pump with external power supply.

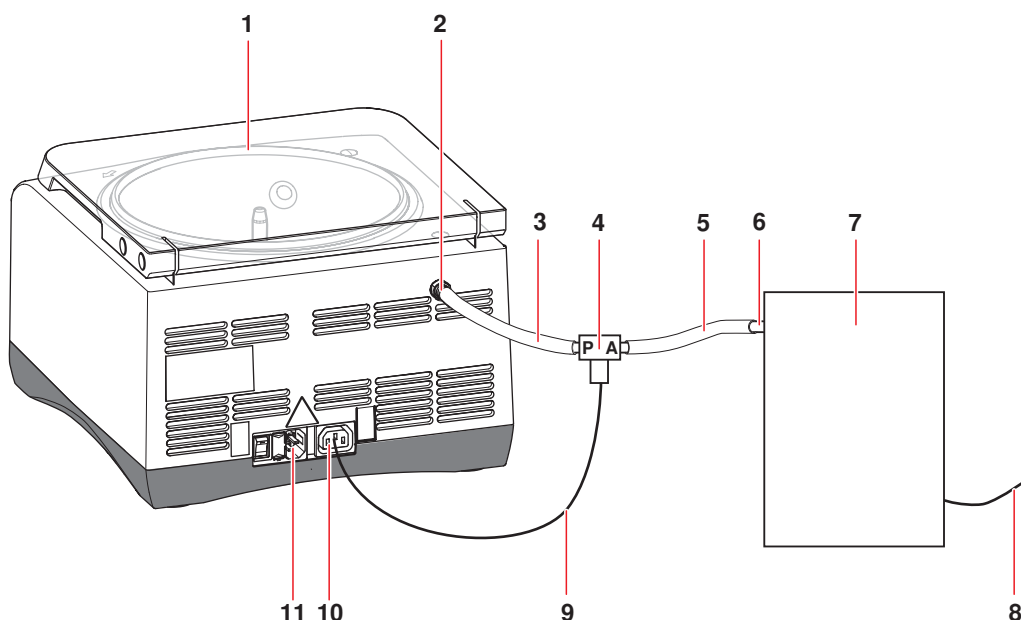


Fig. 5: Connecting a vacuum pump with external power supply to the Concentrator plus basic device.

1. Disconnect the basic device 1 and the vacuum pump 7 from the mains power supply.
2. Connect the hose connection P of the solenoid valve 4 to the pump connection 2 at the rear of the basic device via a connecting hose 3.
3. Connect the hose connection A of the solenoid valve 4 to the inlet of the vacuum pump 6 via a connecting hose 5.
4. Insert the plug of the solenoid valve 9 into the provided socket 10 at the rear of the basic device (connected mains voltage!).
5. Connect the basic device to the mains power supply 11.
6. Connect the vacuum pump 8 to the mains power supply.



The vacuum pump is isolated from the device automatically before concentration is complete by closing the solenoid valve which is piloted by the concentrator. The isolation can also be carried out without a solenoid valve by closing an in-line valve manually (e.g., stop valve with a ground-in stopper).

## 5 Operation

### 5.1 Overview of operating controls

Before using the device for the first time, familiarize yourself with the operating controls and the device display. A depiction of the operating controls and device display can be found on the rear fold-out page (see Fig. C).

<b>1 Concentration run time</b> 1 min to 9:59 h, infinitely (∞), adjustable in 1 min increments.	<b>2 Braking function</b> ON: Braking function on. OFF: Braking function off.
<b>3 Temperature</b> --: Heater off. 30/45/60 °C: Heater on.	<b>4 Mode</b> (see <i>Functions on p. 26</i> )
<b>5 Status of the diaphragm vacuum pump (vac)</b> Off: Pump off. On: Pump running.	<b>6 Status of the device lid (lid)</b> Off: Lid locked. On: Lid unlocked.
<b>7 Starting and/or stopping concentration</b>	<b>8 Setting the mode</b> Manual ventilation of the rotor chamber during a concentrator/desiccator run while the key is pressed and held. Ventilation is displayed.
<b>9 Setting the temperature</b>	<b>10 Setting the braking function</b>
<b>11 Setting the concentrator run time</b>	

### 5.2 Functions

Concentrator plus and Vacufuge plus can be used as a concentrator, a desiccator or a centrifuge. For the concentrator and desiccator functions, there are three different modes available for the quick concentration of different solvents:

Function	Mode	Suitable for
Concentrator	V-AQ (vacuum - aqueous)	aqueous solutions
	V-AL (vacuum - alcoholic)	alcoholic solutions
	V-HV (vacuum - high vapor)	solutions with high vapor pressure
Desiccator	D-AQ (desiccator - aqueous)	aqueous solutions
	D-AL (desiccator - alcoholic)	alcoholic solutions
	D-HV (desiccator - high vapor)	solutions with high vapor pressure and dry substances
Centrifuge	CEFU (centrifuge)	centrifugation at 1,400 min <sup>-1</sup>

► To set the desired function, press the **mode/vent** key before operation of the device.



Use the V-AQ, V-AL, D-AQ or D-AL modes if possible, or press the **mode/vent** key from time to time during the run.



During operation, you cannot change the set function. Instead, holding the **mode/vent** key during the concentrator or desiccator function ventilates the rotor chamber.

## 5.3 Preparation for concentration

### 5.3.1 Switching on the device



Please note before putting the device into service that the ambient temperature during operation must be between 15 and 35 °C.

At altitudes above 1000 m MSL (risk of insufficient cooling air supply), measures in accordance with DIN EN 60034-1; VDE 0530-1 are required.

- ▶ Switch on the device at the mains power switch.
  - Display is active.
  - Lid is released (**lid** indicator lamp lights up).
  - You can now open the lid.
  - The parameter settings of the last run are displayed.

### 5.3.2 Inserting the rotor



#### **Risk of injury from chemically or mechanically damaged accessories.**

Even small scratches and cracks can lead to serious internal material damage.

- ▶ Protect all parts from mechanical damage.
- ▶ Check accessories regularly.
- ▶ Do not use rotors or buckets with signs of corrosion or mechanical damage (e.g. deformations).
- ▶ Do not use accessories whose maximum service life has been exceeded.
- ▶ When inserting the buckets and rotors, ensure that they do not become scratched.



First observe the rotor information (see p. 11) and the special notes on rotors F-35-6-30, F-45-72-8, F-45-48-11, F-45-24-12 and A-2-VC (see p. 13).

Rotor A-2-VC: remove the buckets before inserting the rotor and pick it up at the rotor cross, using both hands.

Proceed as follows when inserting the rotor:

1. Place rotor on the motor shaft.
2. Push rotor down using slight pressure until you encounter resistance.



The rotors do not need to be screwed in.

### 5.3.3 Warm-up phase

The diaphragm vacuum pump reaches the displayed output and the ultimate pressure (see p. 41) only after the device has gone through a 15 minute warm-up phase. The warm-up phase reduces the condensation of liquid in the pump and on the lid of the rotor chamber and therefore prolongs the service life of the pump.



#### **Device lid can crush. Keep hands clear.**

- ▶ Do not reach between the device and lid when opening or closing the device lid.

1. **time** arrow keys: set time to 15 minutes.
2. **brake**: switch brake on or off.
3. **temp**: select temperature.

4. **mode/vent:** select V-AQ, V-AL or V-HV mode.
5. Close the lid of the device.
6. Press **start/stop** to start the warm-up phase.
  - The device lid is locked, and the green **lid** indicator lamp goes out.
  - The rotor starts up.
  - At 1,000 rpm, the vacuum pump switches on, and the **vac** indicator lamp lights up.
  - The vent valve is closed.
  - The rotor accelerates to the end point of 1,400 rpm.
  - On the display, the colon of the time display flashes while the rotor is turning.
  - The remaining run time is displayed in hours and minutes.

## After the warm-up phase is completed

- The device stops automatically.
- During braking the elapsed concentration time is displayed flashing.
- The rotor chamber is ventilated so that the pressure in the chamber increases slowly.
- After two seconds, the vacuum pump is switched off, and the **vac** indicator lamp goes out.
- Then the device brakes.
- When the rotor has come to a standstill, the **lid** indicator lamp lights up.
- The lid can be opened.

### 5.3.4 Loading a fixed-angle rotor

The following notes apply to fixed-angle rotors. Loading the rotor A-2-VC is described in the following chapter (see *Loading a swing-bucket rotor on p. 29*).



#### Risk of injury from unsymmetric loading of rotors.

- ▶ Load rotors symmetrically with identical tubes and/or buckets and plates.
- ▶ Only load adapters with suitable tubes and/or plates.
- ▶ Always use tubes and/or plates of the same type (weight, material/density and volume).
- ▶ Ensure that tubes that are located opposite each other contain liquids with the same rate of evaporation. Otherwise an imbalance can occur and the concentration may automatically stop.
- ▶ Check for symmetric loading by balancing the adapters and tubes and/or plates used with scales.

The device automatically detects imbalances during operation and stops the run immediately with an error message and a signal tone. Check the load, balance the tubes and restart the run.



#### Risk from damaged or overloaded tubes!

- ▶ When loading the rotor, note the safety instructions with regard to risks from overloaded or damaged tubes (see *Warnings for intended use on p. 15*)

Proceed as follows when loading the fixed-angle rotor:

1. Check the maximum payload (tube and content) per rotor bore. Detailed information can be found in this operating manual (see *Rotors on p. 11*).
2. Only load rotors with the tubes intended for this purpose.
3. Insert open tubes opposite each other in pairs into the rotor bores. For symmetrical loading, tubes that are opposite each other must be of the same type and contain the same filling quantity.

In order to minimize weight differences between filled sample tubes, we recommend taring with a scale. This will reduce wear on the drive and cut running noise.

## 5.3.5 Loading a swing-bucket rotor

### Requirement

- A combination of rotor, bucket and adapter, approved by Eppendorf.
- **Two** inserted buckets.
- Matching and tested tubes and plates.
- Adapters and plates with a total height of  $\leq 27$  mm



### Risk of injury from unsymmetric loading of rotors.

- ▶ Load rotors symmetrically with identical tubes and/or buckets and plates.
- ▶ Only load adapters with suitable tubes and/or plates.
- ▶ Always use tubes and/or plates of the same type (weight, material/density and volume).
- ▶ Ensure that tubes that are located opposite each other contain liquids with the same rate of evaporation. Otherwise an imbalance can occur and the concentration may automatically stop.
- ▶ Check for symmetric loading by balancing the adapters and tubes and/or plates used with scales.

The device automatically detects imbalances during operation and stops the run immediately with an error message and a signal tone. Check the load, balance the tubes and restart the run.



### Filling the plates too high can cause overflowing.

During the run the menisci in the tubes along the edges of the plates are at an angle. This is due to the centrifugal forces and cannot be avoided.

- ▶ Fill the wells of the plates to a maximum of 2/3 of the max. filling volume.

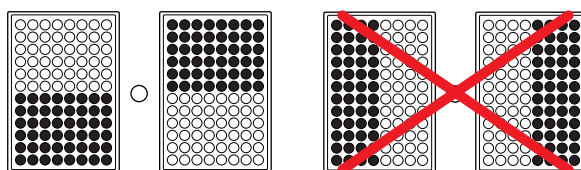
1. Check the bucket grooves for cleanliness and grease lightly with pivot grease (order no. int.: 5810 350.050 / North America: 022634330).

Dirty grooves and pivots prevent buckets from swinging out evenly.

2. Hang the buckets into the rotor.
3. Check that both buckets are hanging properly and can swing freely.
4. When using a plate type for the first time, carry out a manual loading and swing-out test.
5. Check maximum payload (adapter, plate and content) per bucket.

The relevant details can be found on the rotor and in this operating manual (see *Rotors on p. 11*).

6. Load the buckets symmetrically when inserting adapters and plates.



The plate arrangement shown on the right-hand side is incorrect, as the buckets will not swing properly.

The plates have some play in the buckets.

## 5.3.6 Closing the lid of the device



### Device lid can crush. Keep hands clear.

- ▶ Do not reach between the device and lid when opening or closing the device lid.

1. Check that the rotor is correctly positioned.
2. Close the lid of the device.

## 5.4 Concentration

The prerequisite for all applications described here is the previously described preparation (see *Preparation for concentration on p. 27*).



### Risk of injury from improperly attached rotors.

- ▶ Only operate the device if the rotor has been mounted completely.
- ▶ If there are any unusual noises when the device is started up, immediately press the **start/stop** key to stop concentrating.



### Risk from incorrectly loaded rotors and damaged/overloaded tubes!

- ▶ Before commencing concentration, follow the safety instructions relating to risks from unsymmetrically loaded and/or overloaded rotors and from overloaded and/or damaged tubes (see *Warnings for intended use on p. 15*).



### Overflowing of the emission condenser.

The maximum filling volume of the emission condenser is 280 mL.

1. Check before each run whether the volume of the emission condenser is sufficient for your application.
2. Empty the emission condenser, if required (see *Emptying the emission condenser on p. 32*).



Unusual noises may occur when braking heavy rotors. These noises are due to the design and do not indicate problems.

### 5.4.1 Concentration with time setting

Perform the following steps in the sequence described.

1. **time** arrow keys: set run time.
2. **brake**: switch brake on or off.
3. **temp**: select temperature (observe temperature resistance of the samples).
4. **mode/vent**: select V-AQ, V-AL or V-HV mode.
5. **start/stop**: start concentration.
  - The device lid is locked, and the green **lid** indicator lamp goes out.
  - The rotor starts up.
  - At 1,000 rpm, the vacuum pump switches on, and the **vac** indicator lamp lights up.
  - The vent valve is closed.
  - The rotor accelerates to the end point of 1,400 rpm.
  - On the display, the colon of the time display flashes while the rotor is turning.
  - The remaining run time is displayed in hours and minutes.

## 5.4.2 Concentration with continuous run



### Continuous delivery can affect safe operation of the device.

When delivering liquids continuously, membranes and valves of the vacuum pump can be damaged.

- ▶ Only use the device for applications of limited duration.

Use the continuous run function if you do not want to set a fixed run time.

1. Use the **time** arrow keys to set the continuous run function (∞), reachable under 0:01 or over 9:59.
2. Set all other parameters as previously described (see *Concentration with time setting on p. 30*).
3. Press **start/stop** to start concentration.  
Time counting is upwards in minute increments.
4. Press **start/stop** to end the concentration after the desired time.



If the device runs longer than 9:59 h, 9:59 remains on the display.

## 5.4.3 During or after concentration

### During the run you can:

- Time setting: change the total run time. The new parameters are adopted immediately. Note that the shortest new total run time which can be set is the time which has already elapsed plus 2 minutes.
- Adjust the setting of the braking function and the temperature.
- Ventilate the rotor chamber manually by holding the **mode/vent** key. In this way, condensation can be removed from the device lid and the pump and the hose system rinsed.
- Check by means of a stroboscope how far the concentration has progressed.
- Stop concentration before the set run time has elapsed. To do so, press the **start/stop** key.

### When concentration is completed

- The device stops automatically (time setting) or manually (continuous run).
- During braking the elapsed concentration time is displayed flashing.
- The rotor chamber is ventilated so that the pressure in the chamber increases slowly.
- After two seconds, the vacuum pump is switched off, and the **vac** indicator lamp goes out.
- Then the device brakes.
- When the rotor has come to a standstill, the **lid** indicator lamp lights up.
- The lid can be opened and the samples removed.



If a temperature has been set, the rotor chamber is permanently heated, i.e. even when the rotor is at a standstill and the lid is open. Therefore switch the device off after the application or set the temperature to - - (no temperature set), if applicable.

## 5.4.4 Completing an application

1. After the end of the application, leave the device running in **D-AQ** mode for 15 min with an empty rotor.

## 5.4.5 Removing the rotor and switching off the device



**Rotor A-2-VC:** Remove the buckets first before holding the rotor at the rotor cross with both hands to lift it out of the device.

1. If required, switch off the heater.
2. Remove the rotor.
3. Wipe up any liquid that has been spilled in the rotor chamber and on the device lid, using an absorbent cloth.
4. Clean the rotor chamber and device lid, as described separately (see *Cleaning / Disinfection on p. 35*).
5. Leave the device lid open and secure it against falling shut to let any remaining residual liquid evaporate.
6. Switch off the device at the mains power switch.

## 5.4.6 Emptying the emission condenser

1. Depending on the design, there are two options:
  - **The emission condenser is mounted to the side of the device:** detach the tube from the connection and empty the liquid into a collection vessel via the upper connection.
  - **The emission condenser is mounted to the front of the device:** here you can alternatively remove the black plug in the vessel using a screwdriver and fit a special tap before first use. Via this tap, you can then empty the liquid directly into a collection vessel.
2. Dispose of the liquid in accordance with the current legal requirements and regulations for your application.

## 5.5 Notes on using rotors

### 5.5.1 RotorA-2-VC

#### Transferring the rotor



#### Wait for rotor to stop.

When the plates are fully loaded, it can happen during the post-run phase of the A-2-VC rotor that the lid of the device can be opened before the rotor has stopped.

- ▶ Always wait until the rotor has stopped before opening the lid of the device and removing the plates and/or tubes.



#### If handled incorrectly, the rotor can fall over.

The buckets of swing-bucket rotors must not be used as handles.

- ▶ Before moving the rotor, remove the buckets.
- ▶ Always pick up the rotor at the rotor cross, using both hands.



## 5.6 Special function

### 5.6.1 Operation as a desiccator

With the desiccator function the rotor chamber is evacuated. However, the rotor is not turned. You can place the sample tubes directly in the rotor chamber without a rotor or insert them into a rotor.

1. **mode/vent**: select the D-AQ, D-AL or D-HV mode.
2. Then proceed as with the concentrator function (see *Concentration on p. 30*).

### 5.6.2 Operation with gel dryer

On a complete system with a gel dryer connection, a gel dryer can be run in parallel to the operation as a concentrator and/or desiccator or used individually.



#### Danger of explosion from gas mixtures.

When running several devices in parallel on a vacuum pump and/or in combination with a gel dryer, an explosive gas mixture can develop in the vacuum system.

- Note the solvent properties and only carry out parallel operations with identical solvents or solvents that evaporate in a non-hazardous manner.

1. **mode/vent**: select the V-AQ, V-AL, V-HV, D-AQ, D-AL or D-HV mode.

We recommend the V-HV and D-HV modes.

If you use the gel dryer individually, you should use the D-AQ, D-AL or D-HV modes in order to protect the drive.

2. In contrast to the concentrator or desiccator function, open the tap of the gel dryer connection before operation (→ knob points in flow direction) and close it again after operation.

When the gel dryer is operated without concentrator or desiccator function the device lid must also be closed as a vacuum cannot be generated otherwise.

3. Then proceed as with the concentrator function (see *Concentration on p. 30*).

### 5.6.3 Operation as a centrifuge

With the centrifuge function, the rotor is turned. However, the rotor chamber is not evacuated.

1. **mode/vent**: select the CEFU mode.
2. Then proceed as with the concentrator function (see *Concentration on p. 30*).

As no vacuum is applied in this operating mode, the **mode/vent** key does not have any function during operation.

## 6 Maintenance

### 6.1 Maintenance

#### 6.1.1 Device

- ▶ Avoid the drying of saline, aqueous solutions on the material, and avoid long-term exposure of the material (aluminum) to acids and alkalis.
- ▶ Avoid the use of aggressive chemicals, including strong and weak alkalis, strong acids, solutions with mercury, copper and other heavy metal ions, halogenated hydrocarbons, concentrated saline solutions and phenol.
- ▶ For the frequent evaporation of corrosive liquids, apply a thin coat of pivot grease to the rotor and rotor chamber (order no. int.: 5810 350.050 / North America: 022634330).

#### 6.1.2 Pump

The chemical-resistant pump of the complete system does not need to be maintained by the user. However, the valves and diaphragms are subject to natural wear and tear.

- ▶ Regularly remove the condensation from the pump and the hose system. To do so, complete a 15 min run in D-AQ mode without samples.  
This will prolong the service life of the consumables.
- ▶ Observe any changes in the time required for your application. If you notice any deterioration, have the valves and diaphragms checked by the authorized service.

### 6.2 Prepare cleaning / disinfection

- ▶ Clean all accessible surfaces of the device and the accessories at least weekly and when contaminated.
- ▶ Clean the rotor regularly. This way the rotor is protected and the durability is prolonged.
- ▶ Furthermore, observe the notes on decontamination (see *Decontamination before shipping* on p. 36) when the device is sent to the authorized Technical Service for repairs.

The procedure described in the following chapter applies to the cleaning as well as to the disinfection or decontamination. The table below describes the steps required on top of this:

Cleaning	Disinfecting / decontamination
<ol style="list-style-type: none"> <li>1. Use a mild cleaning fluid to clean the accessible surfaces of the device and the accessories.</li> <li>2. Carry out the cleaning as described in the following chapter.</li> </ol>	<ol style="list-style-type: none"> <li>1. Choose the disinfection method which corresponds to the legal regulations and guidelines in place for your range of application. For example, use alcohol (ethanol, isopropanol) or alcohol-based disinfectants.</li> <li>2. Carry out the disinfection or decontamination as described in the following chapter.</li> <li>3. Then clean the device and the accessories.</li> </ol>



If you have any further questions regarding the cleaning and disinfection or decontamination or regarding the cleaning fluid to be used, contact the Eppendorf AG Application Support. The contact details are provided on the back of this manual.

## 6.3 Cleaning / Disinfection



### Electric shock as a result of penetration of liquid.

- ▶ Switch off the device and disconnect it from the power supply before starting cleaning or disinfecting work.
- ▶ Do not allow any liquids to penetrate the inside of the housing.
- ▶ Do not perform spray disinfection on the housing.
- ▶ Only reconnect the device to the power supply once it is completely dry.



### Damage from the use of aggressive chemicals.

- ▶ Do not use any aggressive chemicals on the device or its accessories, such as strong and weak bases, strong acids, acetone, formaldehyde, halogenated hydrocarbons or phenol.
- ▶ If the device becomes contaminated with aggressive chemicals, clean it immediately with a mild cleaning agent.



### Corrosion from aggressive cleaning agents and disinfectants.

- ▶ Do not use corrosive cleaning agents, aggressive solvents or abrasive polishes.
- ▶ Do not incubate the accessories in aggressive cleaning agents or disinfectants for prolonged periods.



### Damage from UV and other high-energy radiation.

- ▶ Do not use UV, beta or gamma radiation or any other type of high-energy radiation for disinfecting.



### Autoclaving

All rotors, buckets and adapters can be autoclaved (121 °C, 20 min).

### 6.3.1 Cleaning / Disinfecting the device

1. Switch off the device at the mains power switch while the lid is open, and disconnect the power plug from the power supply.
2. Remove rotor.
3. Use the agents specified above (see p. 34) to clean and disinfect the device and the rotor chamber.
4. Wipe all accessible surfaces of the device and accessories including the mains cable with a damp cloth.
5. Thoroughly clean the rubber seals of the rotor chamber with water.
6. Rub the dry rubber seal with glycerine or talcum powder to prevent it from becoming brittle. Other components of the device, such as the motor shaft and rotor cone, must not be lubricated.
7. Clean the motor shaft with a soft, dry and lint-free cloth.
8. Check device and accessories for corrosion and damage.

## 6.3.2 Cleaning / Disinfecting the rotor

1. Clean rotors, buckets and adapters with the agents mentioned above and disinfect them (see p. 34).
2. Rinse rotors, buckets and adapters thoroughly with water.
3. Place rotors and accessories onto a cloth to dry.
4. Clean the rotor cone with a soft, dry and lint-free cloth and inspect for damage. Do not lubricate the rotor cone.
5. Place the dry rotor onto the motor shaft.
6. Load the fixed-angle rotor with the cleaned adapters or the swing-bucket rotor with the cleaned buckets and adapters, if necessary.

## 6.4 Glass breakage



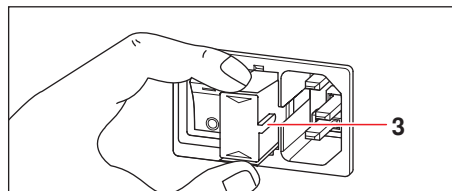
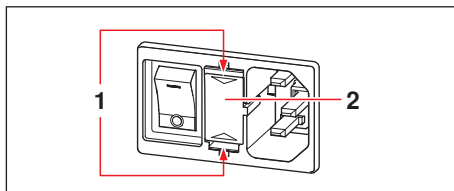
Note when using glass tubes that the danger of breakage of glass increases with an increasing g-force (rcf)/speed (rpm). Please note the manufacturer's information on the recommended centrifugation parameters (load and speed).

Broken glass scratches the surfaces of the rotor chamber and the accessories (rotors, buckets and adapters) so that their chemical resistance is reduced. Therefore, a fine, black metal abrasion develops in the rotor chamber due to the air turbulence which, in addition to causing damage to the rotor chamber and the accessories, can also contaminate the samples.

- ▶ Carefully remove all splinters and glass powder from the rotor chamber and accessories (rotors, buckets and adapters) if breakage of glass occurs.
- ▶ If required, replace the adapters to prevent any further damage.
- ▶ Check the rotor regularly for residues or damage.

## 6.5 Replacing fuses

The fuse holder is located between the mains connection socket and the mains power switch.



1. Disconnect the power plug.
2. Press the upper and lower end of the plastic springs **1** together and pull the fuse holder **2** fully out.
3. Replace faulty fuses and reinsert the fuse holder. Make sure that the guiding rail **3** is positioned correctly.

## 6.6 Decontamination before shipping

If you are shipping the device to the authorized Technical Service for repairs or to your authorized dealer for disposal please note the following:



### Risk to health from contaminated device.

1. Follow the instructions in the decontamination certificate. It is available in PDF format on our homepage ([www.eppendorf.com/decontamination](http://www.eppendorf.com/decontamination)).
2. Decontaminate all the parts you want to dispatch.
3. Enclose the fully-completed decontamination certificate for returned goods (including the serial number of the device) with the dispatch.

## 7 Troubleshooting

If the suggested measures fail repeatedly, please contact Technical Service. You can find the contact addresses at the end of this operating manual or on the Internet under [www.eppendorf.com](http://www.eppendorf.com).


### 7.1 General errors

Symptom / message	Cause	Remedy
No display.	No mains connection.	▶ Check the mains connection.
No display.	Power failure.	▶ Check the mains fuse for the device (see <i>Replacing fuses on p. 36</i> ). ▶ Check the mains fuse for the laboratory.
Lid of the device cannot be opened.	Rotor is still running.	▶ Wait for rotor to stop.
Lid of the device cannot be opened.	Power failure.	1. Check the mains fuse for the device (see <i>Replacing fuses on p. 36</i> ). 2. Check the mains fuse for the laboratory. 3. Activate the emergency lid release (see p. 38).
Device cannot be started.	Lid of the device is not closed.	▶ Close the lid of the device.
Device shakes when it starts up.	Rotor is unsymmetrically loaded.	1. Stop the device and load symmetrically. 2. Restart the device.
No noticeable evaporation.	Damaged sealing ring in the lid of the device.	▶ Insert new sealing ring (see <i>Other accessories on p. 44</i> ).
Pump does not start up.	Pump is overloaded. Thermo switch in the motor winding of the pump triggered.	▶ Let the pump cool down.
Pump does not start up.	Overpressure in the exhaust gas line.	▶ Open the exhaust gas line.
No output.	Long, thin hoses.	▶ Select short hoses with a large cross-section.
No output.	Condensation in the pump.	▶ Let pump run for a few minutes and press the <b>mode/vent</b> key several times.
Temperature value flashes.	Deviation from set value by $\pm 5\text{ °C}$ .	▶ Let the remaining heat from the previous run cool down. ▶ Reduce the excessive ambient temperature, if applicable.
Temperature value flashes fast.	Deviation from set value by $+ 10\text{ °C}$ .	▶ Switch off the external heat radiators (e.g. halogen lamp).
Liquid collects in the hoses.		▶ Activate the ventilation function. ▶ Check the fall of the hoses.

## 7.2 Error messages

If one of the following error messages appears, proceed as follows:

1. Remove fault (see Remedy).
2. Press the **start/stop** key to clear the error message.
3. If required, continue concentration and/or repeat.

Symptom / message	Cause	Remedy
Error 1	Drive fault	► Contact Service.
Error 2	Drive blocked or stiff.	► Move the rotor by hand, remove any obstructions.
Error 3		► Check the max. load of rotor.
Error 4		► Check the rotor mounting.
Error 5	Drive fault	► Contact Service.
Error 7	Error in the lid latch.	► Contact Service.
Error 8	Fault at the temperature sensor	► Contact Service.
Error 9	Electronics fault.	 Caution! The rotor chamber temperature may be > 72 °C. ► Contact Service.
Error 10	Heater defective.	► Contact Service.
Error 12	Electronics fault.	► Contact Service.
Error 14		
Error 16		
IMBAL	Rotor unsymmetrically loaded.	► Load the rotor symmetrically and balance.

## 7.3 Opening the device in case of a power failure

If the device lid cannot be opened during a power failure, you can activate the emergency lid release manually.



### Risk of injury from rotating rotor.

- Wait for the rotor to stop before activating the emergency lid release.



If there is a power failure, the vent valve will open. Before the rotor comes to a full stop, the standard pressure in the rotor chamber will be restored.

1. Disconnect the power plug.
2. Insert a wire (max. 2.5 mm thick, e.g., a paper clip) into the opening on the right-hand side of the housing (see point 5 in Fig. A and Fig. B on the front fold-out page), and push against the noticeable resistance.  
This will release the device lid.
3. Open the device lid slightly.
4. Remove the wire.
5. Open the device lid fully.

## 8 Transport, storage and disposal

### 8.1 Transport

- Only transport the device in the original packaging.

	Air temperature *	Rel. humidity	Atmospheric pressure
General transportation	-25 to 60 °C / -10 to 60 °C	10 to 95%	30 to 106 kPa
Air freight	-40 to 55 °C / -10 to 55 °C	10 to 95%	30 to 106 kPa

\*) Basic device / complete system

### 8.2 Storage

	Air temperature *	Rel. humidity	Atmospheric pressure
Device in transport packaging	-25 to 55 °C / -10 to 55 °C	10 to 95%	70 to 106 kPa
Device without transport packaging	-5 to 45 °C	10 to 95%	70 to 106 kPa

\*) Basic device / complete system

### 8.3 Disposal

Always observe the statutory requirements when disposing of the product.

#### Information on the disposal of electrical and electronic devices in the European Community:

Within the European Community, the disposal of electrical devices is regulated by national regulations based on EU Directive 2002/96/EC pertaining to waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after August 13, 2005, to the business-to-business area this product is assigned to, may no longer be disposed of in municipal or household waste. To document this, they have been marked with the following identification:



Because disposal regulations may differ from one country to another within the EU, please contact your supplier if necessary.

## 9 Technical data

### 9.1 Power supply

	5305 Basic device	5305 Complete system
Mains connection:	230 V, 50 to 60 Hz 120 V, 50 to 60 Hz 100 V, 50 to 60 Hz	230 V, 50 to 60 Hz 120 V, 50 to 60 Hz 100 V, 50 to 60 Hz
Current consumption:	2.1 A (230 V) 6.0 A (120 V) 5.2 A (100 V)	1.7 A (230 V) 5.6 A (120 V) 3.8 A (100 V)
Power consumption:	max. 500 W (230 V) max. 550 W (120 V) max. 520 W (100 V)	max. 350 W (230 V) max. 400 W (120 V) max. 380 W (100 V)
Overvoltage category:	II	
Fuses:	4.0 AT (230 V) 6.3 AT (120 V/100 V)	

### 9.2 Ambient conditions

Environment:	For indoor use only.
Ambient temperature:	15 to 35 °C
Max. relative humidity:	75 %, non-condensing humidity
Atmospheric pressure:	Use at altitudes up to 2000 m above MSL.
Degree of pollution:	2

### 9.3 Weight / dimensions

	5305 Basic device	5305 Complete system incl. gel dryer
Dimensions:	Width: 330 mm (12.6 in.) Depth: 372 mm (14.5 in.) Height: 231 mm (9.1 in.)	Width: 330 mm (12.6 in.) Depth: 579 mm (20.9 in.) Height: 290 mm (11.7 in.)
Weight without rotor:	16.5 kg (37.5 lbs.)	31.5 kg (68.3 lbs.)
Noise level:	≤ 50 dB(A)	≤ 50 dB(A)



## 9.4 Diaphragm vacuum pump for the complete system

Max. current:	1.4/1.6 A (230 V, 50/60 Hz) 3.0 A (120 V, 50 Hz) 3.6/3.8 A (100 V, 50/60 Hz)
Max. power:	180 W (230/120/100 V)
Motor protection:	Thermal winding protection
Protection class according to IEC 529:	IP 54
Suction capacity (in accordance with DIN EN 60529; VDE 0470-1):	1.9/2.1 m <sup>3</sup> /h (50/60 Hz)
Achievable ultimate pressure (absolute):	<20 mbar
Max. permissible pressure at the outlet (absolute):	2 bar
Max. differential pressure between inlet and outlet:	1 bar
Nominal speed at 50/60 Hz:	1.500/1.800 rpm
Radio interference protection class	B

### Materials of surfaces that are in contact with the medium

Inner part of housing cover:	PTFE, with carbon reinforcement
Head cover, diaphragm clamping disc:	ETFE, with carbon reinforcement
Valve:	FFKM
Diaphragm:	PTFE
Inlet:	ETFE
Outlet:	ETFE
Screw connection:	ETFE
Hose:	PTFE

## 9.5 Application parameters

Run time:	1 min to 9:59 h, infinitely (∞), adjustable in 1 min increments.
Speed:	1,400 rpm, not adjustable
Max. relative centrifugal force (rcf):	248 x g, not adjustable
Max. load:	96 micro test tubes of 2.0 mL each or 6 Falcon tubes of 50 mL each.
Permitted density of material for centrifuging (at max. rcf/speed and max. load):	1.2 g/mL
Emission condenser volume:	280 mL

## 10 Ordering Information

### 10.1 Complete system

Order No. (International)	Order No. (North America)	Description
5305 000.304 5305 000.312 5305 000.347	- 5305000312 -	<b>Concentrator plus/Vacufuge plus complete system</b> with rotor F-45-48-11 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump
5305 000.509 5305 000.517 5305 000.541	- 5305000517 -	<b>Concentrator plus/Vacufuge plus complete system</b> without rotor 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump
5305 000.703 5305 000.711 5305 000.746	- 5305000711 -	<b>Concentrator plus/Vacufuge plus complete system</b> with connection, e.g., for a gel dryer, without rotor 230 V/50 - 60 Hz, with integrated diaphragm vacuum pump 120 V/50 - 60 Hz, with integrated diaphragm vacuum pump 100 V/50 - 60 Hz, with integrated diaphragm vacuum pump

### 10.2 Basic device

Order No. (International)	Order No. (North America)	Description
5305 000.100 5305 000.118 5305 000.142	- 5305000118 -	<b>Concentrator plus/Vacufuge plus basic device</b> with rotor F-45-48-11 230 V/50 - 60 Hz 120 V/50 - 60 Hz 100 V/50 - 60 Hz

### 10.3 Fuses

Order No. (International)	Order No. (North America)	Description
5301 850.249 5417 341.007	022654403 022375831	<b>Fuse</b> 2 x 4.0 A T (230 V) 2 x 6.3 A T UL (120 V / 100 V)

## 10.4 Accessories

### 10.4.1 Rotors

Order No. (International)	Order No. (North America)	Description
5490 034.007	022822080	<b>Rotor F-45-72-8</b> 72 positions for 0.5 mL tubes
5490 032.004	022822047	<b>Rotor F-45-70-11</b> 70 positions for 1.5/2.0 mL tubes
5490 030.001	022822004	<b>Rotor F-45-48-11</b> 48 positions for 1.5/2.0 mL tubes
5490 036.000	022822144	<b>Rotor F-45-24-12</b> 24 positions for 6.0/8.0 mL round-bottom tubes (12 x 67-100 mm)
5490 041.003	022822233	<b>Rotor F-50-8-16</b> 8 positions for 15.0/20.0 mL round-bottom tubes (16 x 105-120 mm)
5490 042.000	022822179	<b>Rotor F-50-8-18</b> 8 positions for 15.0/20.0 mL round-bottom tubes (18 x 105-128 mm)
5490 038.002	022822225	<b>Rotor F-45-8-17</b> 8 positions for 15 mL Falcon tubes (17 x 118-123 mm)
5490 040.007	022822209	<b>Rotor F-40-36-12</b> 36 positions for 1.5 mL flat-bottom tubes (12 x 32 mm)
5490 035.003	022822128	<b>Rotor F-45-36-15</b> 36 positions for 3.0/5.0 mL flat-bottom tubes (15 x 48 mm)
5490 043.006	022822136	<b>Rotor F-45-16-20</b> 16 positions for 6.5/10.0 mL flat-bottom tubes (20 x 42-55 mm)
5490 037.006	022822161	<b>Rotor F-40-18-19</b> 18 positions for 10.0 mL flat-bottom tubes (19 x 66 mm)
5490 044.002	022822217	<b>Rotor F-45-12-31</b> 12 positions for 20.0 mL flat-bottom tubes (31 x 55 mm)
5490 039.009	022822187	<b>Rotor F-35-8-24</b> 8 positions for 25.0 mL flat-bottom tubes (24 x 86-90 mm)
5490 047.001	022822231	<b>Rotor F-35-6-30</b> 6 positions for 15 mL Falcon tubes (17 x 116-123 mm) and 50 mL Falcon tubes (29.5 x 116-123 mm)
5490 045.009	022822241	<b>Rotor A-2-VC</b> incl. 2 buckets

## 10.4.2 Adapters

Order No. (International)	Order No. (North America)	Description
0030 124.235	951010031	<b>Work tray</b> for 96 x 0.2 mL PCR tubes, 5-/8-PCR tube strips and plates without border set of 10
0030 124.243	951010049	<b>Frame for work tray</b> set of 5
5825 706.005	022638963	<b>Adapter</b> used in A-2-VC Combislide Adapter, set of 2
5425 715.005 5425 717.008 5425 716.001	022636260 022636243 022636227	<b>Adapter</b> used in F-45-48-11 and F-45-70-11 for 1 PCR tube (0.2 mL, max. Ø 6 mm), set of 6 for 1 sample tube (0.4 mL, max. Ø 6 mm), set of 6 for 1 sample tube (0.5 mL, max. Ø 6 mm) or 1 Microtainer (0.6 mL, max. Ø 8 mm), set of 6

## 10.4.3 Other accessories

Order No. (International)	Order No. (North America)	Description
5301 316.005	022822101	<b>Spacer for simultaneous operation of two rotors</b> for F-45-72-8 and F-45-48-11
5301 330.008	022830309	<b>Emission condenser</b> without hose
5301 337.002	022830295	<b>Hose for emission condenser</b> length: 0.7 m
5301 110.032	5301110032	<b>Tube connection</b> Plastic
5301 010.003 5301 033.003	- 022830110	<b>Special plug for external vacuum pump &lt; 400 W</b> 230 V (Germany), different options upon request 120 V, different options upon request
5301 030.004 5301 036.002	022830104 022830112	<b>Solenoid valve for external vacuum pump</b> Only suitable for aqueous and alcoholic solvents. 230 V, 50 - 60 Hz 120 V
5301 160.005	022830201	<b>Sealing ring</b> for lid
5810 350.050	022634330	<b>Pivot grease</b> Tube 20 mL
5490 030.800	022830520	<b>Rotor feet for F-45-72-8 and F-45-48-11</b> Set of 3

## EG-Konformitätserklärung EC Conformity Declaration

Das bezeichnete Produkt entspricht den einschlägigen grundlegenden Anforderungen der aufgeführten EG-Richtlinien und Normen. Bei einer nicht mit uns abgestimmten Änderung des Produktes oder einer nicht bestimmungsgemäßen Anwendung verliert diese Erklärung ihre Gültigkeit.

The product named below fulfills the relevant fundamental requirements of the EC directives and standards listed. In the case of unauthorized modifications to the product or an unintended use this declaration becomes invalid.

Produktbezeichnung, Product name:

Concentrator plus / Vacufuge® plus basic device

Concentrator plus / Vacufuge® plus complete system

Produkttyp, Product type:

Vakuumkonzentrator / Vacuumconcentrator

einschließlich Zubehör / including accessories

Einschlägige EG-Richtlinien/Normen, Relevant EC directives/standards:

2006/95/EG, EN 61010-1, EN 61010-2-010, EN 61010-2-20

2004/108/EG, EN 61326-1/B, EN 61000-3-2, EN 61000-3-3, EN 61000-4-14



Vorstand, Board of Management:

07.12.2010

Hamburg, Date:



Projektmanagement, Project Management:

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0015 033.509-02

5305.900.305-01

## Certificate of Compliance

Certificate Number 20101104-E215059  
Report Reference E215059-A2-UL, 2010 September 17  
Issue Date 2010 November 4

Page 1 of 1



*Issued to:* **EPPENDORF A G**

BARKHAUSENWEG 1  
22339 HAMBURG GERMANY

*This is to certify that  
representative samples of*

**Laboratory Use Electrical Equipment**  
Centrifuge  
Vacufuge plus and Vacufuge plus System, model 5305

*Have been investigated by Underwriters Laboratories Inc.® (UL) or any authorized  
licensee of UL in accordance with the Standard(s) indicated on this Certificate.*

*Standard(s) for Safety:*

UL 61010-1, Second Edition  
CAN/CSA-C22.2 No. 61010-1, Second Edition  
IEC 61010-2-010 - Edition 2 - Issue Date 2003/06/01  
IEC 61010-2-020 - Edition 2 - Issue Date 2006/05/01

*Additional Information:*

See UL On-Line Certification Directory at [www.UL.com](http://www.UL.com) for additional  
information

Only those products bearing the UL Listing Mark for the US and Canada should be considered as being covered by  
UL's Listing and Follow-Up Service meeting the appropriate requirements for US and Canada.

The UL Listing Mark for the US and Canada generally includes: the UL in a circle symbol with "C" and "US" identifiers:

 the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name  
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William R. Carney Director,

North American Certification Programs

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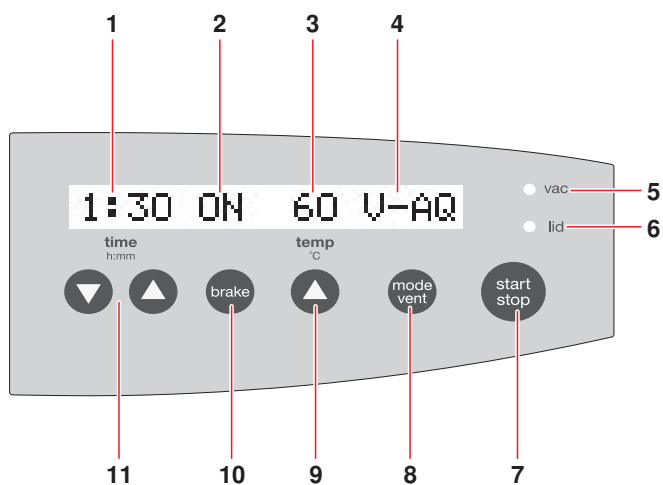


Fig. C: Operating controls and device display for Concentrator plus and Vacufuge plus

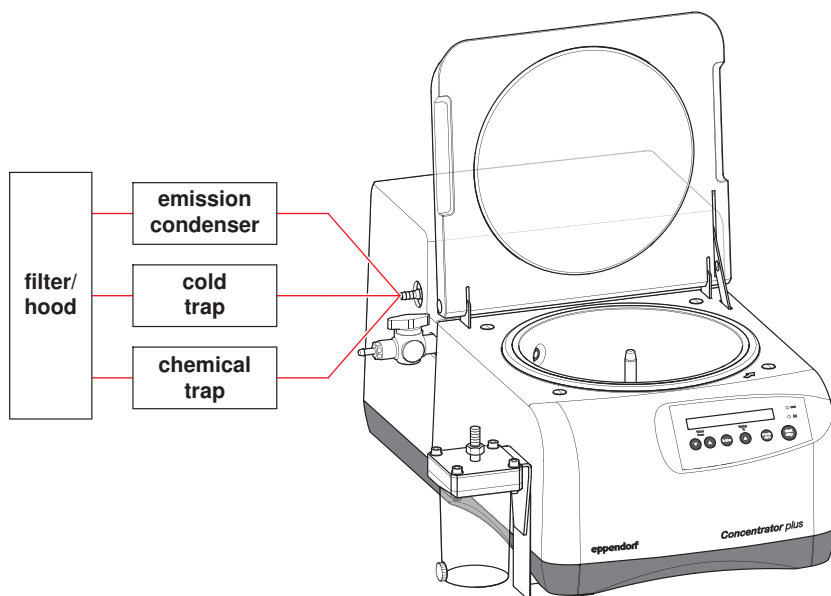


Fig. D: Connection options for the complete system

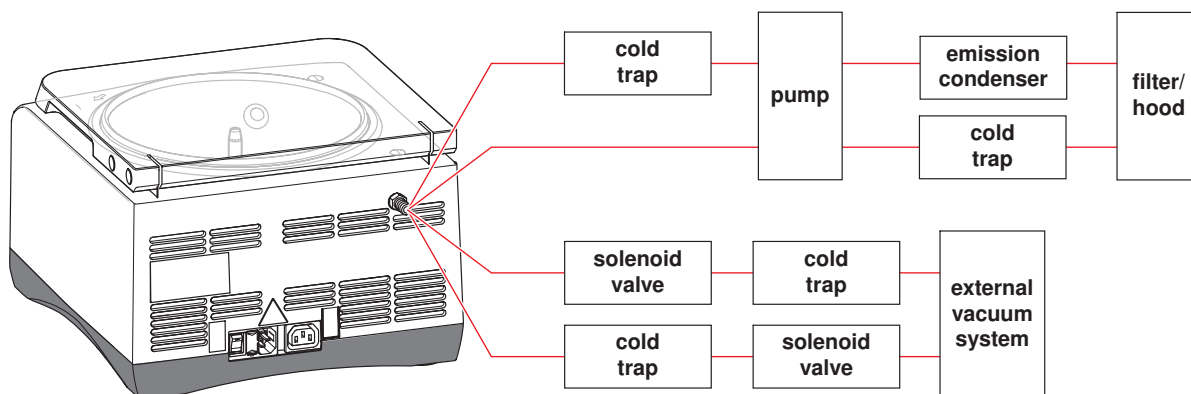


Fig. E: Connection options for the basic device



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