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Eppendorf Research[®] plus

Operating manual

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1 Safety

1.1 Intended use

The Research plus pipette is designed and constructed for low-contamination transfer of liquids. It is intended exclusively for use in research. This pipette is intended exclusively for indoor use, and for operation by trained and skilled personnel.

1.2 Warnings for intended use



WARNING! Damage to health due to infectious liquids and pathogenic germs.

- ▶ When handling infectious liquids and pathogenic germs, observe the national regulations, the biological security level of your laboratory, the material safety data sheets, and the manufacturer's application notes.
- ▶ Wear your personal protective equipment.
- ▶ For comprehensive regulations about handling germs or biological material of risk group II or higher, please refer to the "Laboratory Biosafety Manual" (source: World Health Organization, Laboratory Biosafety Manual, in its respectively current valid version).



WARNING! Damage to health due to toxic, radioactive, or aggressive chemicals.

- ▶ Wear your personal protective equipment.
- ▶ Observe the national regulations for handling these substances.
- ▶ Observe the material safety data sheets and manufacturer's application notes.



CAUTION! Danger to individuals due to careless use

- ▶ Never point the opening of the device toward yourself or others.
- ▶ Only initiate liquid dispensing if it is safe to do so.
- ▶ With any dispensing task please ensure that you do not endanger yourself and other persons.



CAUTION! 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, functioning, 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.



NOTICE! Damage to device from missing pipette tips.

- ▶ Use the pipette with fitted pipette tips only.



NOTICE! Carry-over, contamination and incorrect dispensing results due to the incorrect use of pipette tips.

The pipette tips are for single use only. Prolonged use can have a negative impact on dispensing tasks.

- ▶ Only use the pipette tips once.
- ▶ Do not use autoclaved ep Dualfilter T.I.P.S. for dispensing.



NOTICE! Incorrect dispensing volume with special liquids and due to temperature differences.

Solutions with physical data very different than water or differences in temperature between pipette, pipette tip and liquid can result in faulty dispensing volumes.

- ▶ Avoid temperature differences between the pipette, pipette tip and liquid.



NOTICE! Damage to the device due to penetration of liquids.

- ▶ Do not set the pipette aside when the pipette tip is filled.
 - ▶ Do not allow any liquids to penetrate the inside of the housing.
-

2 Operating instructions






2.1 Using this manual

- ▶ Read this operating manual completely before using the device for the first time. Also observe the instructions for use of the accessories.
- ▶ This operating manual is part of the product. Thus, it must always be easily accessible.
- ▶ Enclose this operating manual when transferring the device to third parties.
- ▶ You will find the current version of the operating manual for all available languages on our website under www.eppendorf.com/manuals.

2.2 Danger symbols and danger levels

2.2.1 Danger symbols


The safety instructions in this manual have the following danger symbols and danger levels:

	Biohazard		Explosive substances
	Toxic substances		Material damage
	Hazard point		

2.2.2 Danger levels

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

2.3 Symbols used

Depiction	Meaning
1. 2.	Actions in the specified order
▶	Actions without a specified order
•	List:
<i>Text</i>	Display or software texts
	Additional information

3 Product description

3.1 Delivery package

Quantity	Description
1	Operating manual
1	Certificate
1	Adjustment tool (Allen key with a blue handle)
1	Black locking ring for single-channel pipettes ≤ 1000 µL
5	Red adjustment seal
5	Protection filter for 5 mL and 10 mL pipettes
1	Pipette key for opening the lower part (5 mL and 10 mL)
1	Multi-channel tool for cutting the O-rings (for 100 µL and 300 µL multi-channel pipettes only)
1	Safety plug tool
1	Pin for loosening the safety plug

3.2 Features

The Research plus pipettes are piston-stroke pipettes that operate according to the air-cushion principle.

When the control button is pressed, the piston in the pipette moves in the same direction. If the control button and the piston are moved upwards, the liquid can be aspirated into the pipette tip. With the downward movement of the piston, the liquid is dispensed (measuring stroke).

Blow-out occurs if the downward piston stroke exceeds the first stop.

Depending on the Research plus pipette it is possible to dispense volumes from 0.1 µL to 10 mL.

The Research plus family consists of single-channel and multi-channel pipettes (8 and 12-channels) with variable volume settings, as well as single-channel fixed-volume pipettes. You can find a list of all available models of the Research plus in the "Technical Data" section.

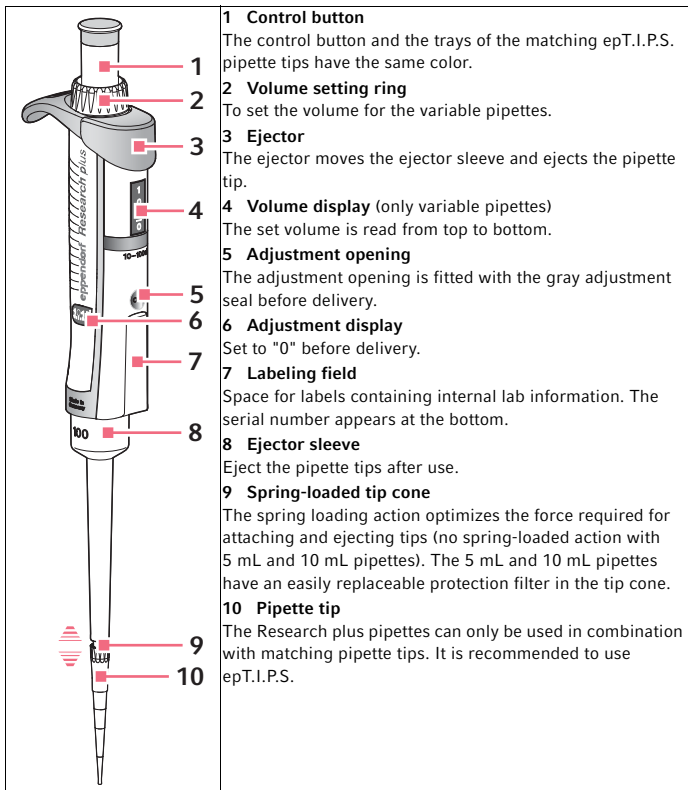
All Research plus pipettes are fully autoclavable.

You can adjust the Research plus pipettes. The side viewing window displays the change in the adjustment.

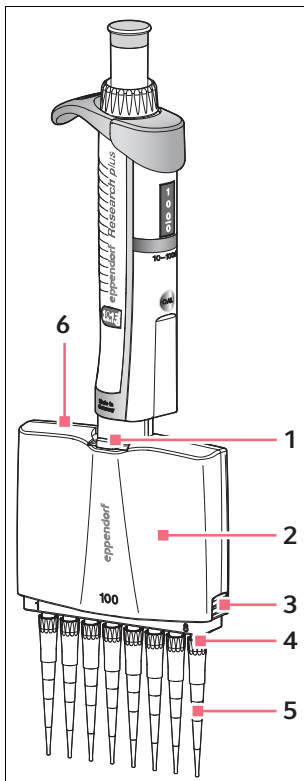
When attaching a pipette tip, the spring-loading action of the tip cone is activated (exceptions 5 mL and 10 mL pipettes).

3.3 Main illustration

3.3.1 Research plus single-channel



3.3.2 Research plus Multi-channel



For an explanation of the upper part of the pipette, refer to the main illustration of the single-channel pipette (see p. 9).

1 Lever

To loosen the multi-channel lower part.

2 Multi-channel lower part

The multi-channel lower part is freely rotatable. The lower part does not detach when it is rotated. The outer channels are labeled with the numbers 1 and 8 (or 12).

The multi-channel version has a piston for each channel allowing it to be equipped with less than 8 or 12 tips.

The lower part can be converted from an 8 to a 12-channel version with the same volume range. The multi-channel lower part can be opened, enabling you to replace or remove individual channels.

3 Latches on the right and left

To release the cover plate with the interior ejector rail.

4 Spring-loaded tip cones

The spring loading action optimizes the force required for attaching and ejecting tips.

5 Pipette tips

It is recommended to use epT.I.P.S.

6 Cover plate

Detachable cover plate with an interior ejector rail. The cover plate is opposite the side with the lever (1).

3.4 Materials



NOTICE! Aggressive substances may damage the pipette, pipette tip and accessories.

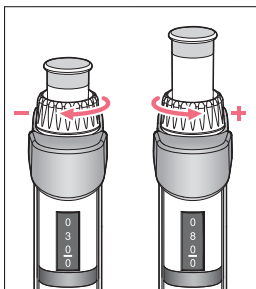
- ▶ Check the resistance to chemicals before using organic solvents or aggressive chemicals.
- ▶ Only use liquids whose vapors do not corrode the used materials.
- ▶ Observe the cleaning instructions.

The components of the pipette which can be accessed by the user are made of the following materials:

Assembly	Material
External surfaces of the upper part	<ul style="list-style-type: none"> • Improved polypropylene (PP) • Polycarbonate (PC) • Polyetherimide (PEI) • Foil
Viewing window	<ul style="list-style-type: none"> • Polycarbonate (PC)
Exterior and interior of lower parts	<ul style="list-style-type: none"> • Improved polypropylene (PP) • Polyvinylidene fluoride (PVDF) • Polyetherimide (PEI) • Polyphenylene sulfide (PPS) • Polyetheretherketone (PEEK) • Polytetrafluoroethylene (PTFE) • Ethylene propylene diene rubber (EPDM) • Silicone • Steel (stainless steel and spring steel)

4 Operation

4.1 Setting the volume (only Research plus variable)



► Turn the volume adjustment ring as depicted to adjust the volume.

The height of the control button changes as the volume is adjusted.

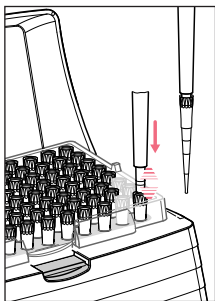
The numbers on the volume display are to be read from the top to the bottom. The decimal places are below the hyphen.

The volume is displayed up to 1000 µL in µL. For the 5 mL and 10 mL sizes, the volume is displayed in mL. We recommend to adjust the volume setting from a higher value to a lower value. If required, turn beyond the required value and then back again.

4.2 Using pipette tips

The liquid to be dispensed is aspirated into pipette tips. We recommend using epT.I.P.S. pipette tips, which are available with various degrees of purity, with and without filters, and as special tips. We recommend using special epT.I.P.S. LoRetention tips with liquids that have a surface tension that is lower than water (e.g., due to wetting agent in the liquid).

Pipette tips are for single use only.



The pipette can only be used if a pipette tip has been attached. You can either attach the pipette tip by hand or directly insert the end of the pipette into a tip that is held in the tip storage box. If you attach a pipette tip by hand, it must be handled in a way that prevents both the contamination and heating of the pipette tip.

The color of the control button of the Research plus matches the color of the epT.I.P.S. tray.

- ▶ If you are using pipette tips without a filter, insert the protection filter in the 5 mL and 10 mL pipettes.
- ▶ Remove the protection filter from the pipette if you are using the 5 mL or 10 mL ep Dualfilter T.I.P.S. This also applies to 5 mL/10 mL filter tips of other manufacturers. The filters can interfere with each other. The backpressure of the two filters makes it difficult to exactly identify the first stop (see p. 13).
- ▶ Apply light pressure to fit the suitable pipette tip(s) on the tip cone.

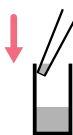
When it responds with spring-loaded action, the pipette tip is securely fitted to the tip cone (exceptions: no spring loading for 5 mL and 10 mL single-channel pipettes.)

4.3 Aspirating liquid

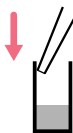


1. The liquid to be aspirated must be taken from a suitable vessel. For multi-channel pipettes, we recommend the reagent reservoir "Tip-Tub".
2. Press down the dispensing button to the first stop (measuring stroke).
3. Vertically immerse the pipette tip(s) approx. 4 mm into the liquid.
4. To aspirate liquid, allow the dispensing button to slide back slowly. Maintain the immersion depth to ensure no air is aspirated.
5. For large volumes: wait approx. 3 seconds before removing the pipette tip from the liquid. To ensure maximum precision and accuracy, we recommend initially wetting each new tip by aspirating and dispensing the liquid one to three times. Only then should pipetting begin.
6. Remove the tip(s) slowly from the liquid.
7. Wipe the tip(s) slowly against the tube wall to ensure that no outer wetting remains on the tip.

4.4 Dispensing liquid



1. Place the tip on the tube inner wall at an angle.
2. Press the dispensing button slowly until the first stop (measuring stroke) and wait until the flow of liquid stops.



3. To empty the tip, press the dispensing button until the second stop (blow-out).
4. Hold down the dispensing button and wipe the tip on the tube inner wall.
5. Let the dispensing button slide back slowly outside of the tube.
6. To eject the tips, press the ejector.

5 Troubleshooting

5.1 Error search

Problem	Cause	Solution
Liquid is dripping from the tip and/or the dispensed volume is incorrect.	Pipette tip is loose.	<ul style="list-style-type: none"> ▶ Attach the pipette tip firmly ▶ Deactivate the spring load. ▶ Use epT.I.P.S. pipette tips. ▶ For 5 mL and 10 mL ep Dualfilter T.I.P.S. pipette tips, work without a protection filter in the pipette.
	Liquid with high vapor pressure and/or different density.	▶ Wet the tip several times and adjust the pipette for the liquid used.
	Pipetting was too quick.	▶ Move the dispensing button slowly.
	The tip is withdrawn from the liquid too quickly.	▶ Withdraw the tip slowly from the liquid with a time delay (approx. 3 seconds).
	Liquid aspirated with blow out and dispensed with blow out.	▶ Repeat dispensing correctly.
	The piston is contaminated.	▶ Clean and grease the piston.
	The tip cone is damaged.	▶ Replace the lower part or channel.
	The O-rings of the tip cones are damaged.	▶ Replace the O-rings (only 100 µL, 300 µL multi-channel).

Problem	Cause	Solution
The dispensing button jams and does not move smoothly.	<ul style="list-style-type: none">• The piston is dirty.• The seal is dirty.• Seal defective.• The pipette is blocked.	<ul style="list-style-type: none">▶ Clean the lower part.▶ 5 mL and 10 mL sizes: replace the protection filter.
The adjustment seal has been removed; the adjustment display has been changed.	The pipette has been adjusted for a different liquid.	<ul style="list-style-type: none">▶ Adjust the pipette for the liquid used.
No spring-loaded action of tip cone.	The spring-loaded action is blocked (single-channel).	<ul style="list-style-type: none">▶ Remove locking ring.
	Use of a 5 mL or 10 mL pipette.	The tip cone of these sizes does not have spring-loaded action.

Regularly check the precision and accuracy of the Research plus to prevent dispensing errors. You can use the "PICASO" software (version 2.3 or higher) to determine the maximum permissible systematic and random errors. If the pipette is used at an extremely high altitude, it must be adjusted to the ambient air pressure. An SOP (Standard Operation Procedure) for the inspection is available on our website www.eppendorf.com/manuals.

6 Maintenance



NOTICE! Aggressive substances may damage the pipette, pipette tip and accessories.

- ▶ Check the resistance to chemicals before using organic solvents or aggressive chemicals.
 - ▶ Only use liquids whose vapors do not corrode the used materials.
 - ▶ Observe the cleaning instructions.
-
- All single and multi-channel lower parts are wear parts. Clean them after contamination, use of aggressive chemicals and/or heavy stress. If the lower parts are worn or damaged, replace these parts.
 - Faulty dispensing results are sometimes due to lack of maintenance.

6.1 Cleaning



NOTICE! Damage to device from unsuitable cleaning fluids or sharp or pointed objects.

Unsuitable cleaning agents can damage the device.

- ▶ Never use corrosive cleaning agents, strong solvents or abrasive polishes.
- ▶ Check the compatibility with the materials used.
- ▶ Please note the information on chemical resistance.
- ▶ Do **not** clean the device with acetone or organic solvents with a similar effect.
- ▶ Do **not** clean the device with sharp objects.



NOTICE! Damage to the device due to penetration of liquids.

- ▶ Do not set the pipette aside when the pipette tip is filled.
 - ▶ Do not allow any liquids to penetrate the inside of the housing.
-

6.1.1 Cleaning and disinfecting the pipette

All single and multi-channel lower parts are wear parts. Clean them after contamination, use of aggressive chemicals and/or heavy stress. If the lower parts are worn or damaged, replace these parts.

1. Moisten a cloth with a cleaning agent and a decontamination agent.
2. Remove external contamination.
3. Moisten a new cloth with water.
4. Wipe down the housing.

6.1.2 Cleaning and disinfecting the lower part

Prerequisites

- Heavy contamination caused by ingress of liquid must be removed.
- Lower part has been removed and disassembled.

1. Remove piston grease.
2. Rinse the lower part with cleaning agent or decontamination agent or let it soak.



Observe the contact time recommended by the manufacturer.

3. Thoroughly rinse the lower part with demineralized water.
4. Let it dry.
5. Lubricate the piston or cylinder.



See instructions for use "Grease for pipettes".

6. Assemble the lower part.

6.1.3 Sterilizing the pipette with UV light

The pipette can be sterilized with UV light at 254 nm.

6.2 Sterilizing or disinfecting the pipette



NOTICE! Damage to device from incorrect handling.

- ▶ Do not use any additional disinfectants, decontamination agents or sodium hypochlorite during autoclaving or UV irradiation.
-

6.2.1 Autoclaving

All Research plus pipettes are completely steam autoclavable.

6.2.1.1 Before autoclaving

1. Remove any contamination from the exterior and the lower part (see *Disassembling and assembling the pipette lower part on p. 19*).
2. If you remove grease, only relubricate the piston seal slightly with the grease specified in the ordering information.

6.2.1.2 Execution

Follow the operating manual of the autoclave manufacturer.

1. Autoclave at: 121 °C; 20 minutes; 1 bar pressure
2. When placing the Research plus into the autoclave, make sure that the temperature at the pipette does not exceed 121 °C.
3. You can put the Research plus into the autoclave as a complete unit or with the lower part removed. Do not disassemble the lower part.
4. 5 mL- and 10 mL pipettes: Remove the old protection filter. Add a new protection filter and install it after autoclaving. Only autoclave the protection filter once.
5. If lower parts have been removed, make sure that no lower parts are confused during reassembly (Tip: Use one beaker per pipette).

6.2.1.3 After autoclaving

- ▶ Cool the pipette to room temperature and let it dry.
- ▶ 5 mL- and 10 mL pipettes: The protection filter swells during autoclaving. Slightly squeeze the protection filter when installing it into the cone tip. The piston does not need to be relubricated after autoclaving. If autoclaving is carried out as described above, no gravimetric testing or adjustment is necessary.

6.2.2 Disinfection

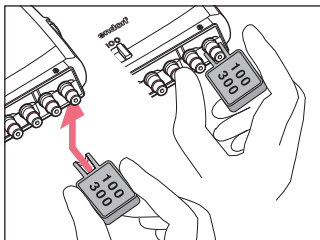
- ▶ Carefully wipe off the outer surfaces with disinfectant, DNA/RNA decontamination agents or 70 % isopropanol.
- ▶ You can wipe the outside of the tip cone and the ejector sleeve using a sodium hypochlorite solution of 4 %.
- ▶ After the exposure time of the sodium hypochlorite solution has elapsed, thoroughly remove it using demineralized water.

The Research plus pipettes may be temporarily subjected to the UV light of a sterile bench (≥ 254 nm).

6.3 Replacing O-rings

The 100 μ L and 300 μ L multi-channel lower parts are equipped with O-rings. They are wear parts. Replace old, worn or damaged O-rings. Defective O-rings cause the incorrect positioning of the tips and dispensing errors.

6.3.1 Removing the O-ring



1. Push the opening of the multi-channel tool (included in the delivery package) against the tip cone from the side so that the sharp edge in the opening of the multi-channel tool is on top of the O-ring. Do not slide the multi-channel tool onto the cone!
2. Push the opening of the multi-channel tool (included in the delivery package) against the tip cone from the side so that the sharp edge in the opening of the multi-channel tool is on top of the O-ring. Do not slide the multi-channel tool onto the cone!
3. Supporting the multi-channel tool with your thumb, push it firmly against the tip cone.
The O-ring is cut at one location.
4. Remove the multi-channel tool and the O-ring from the tip cone.

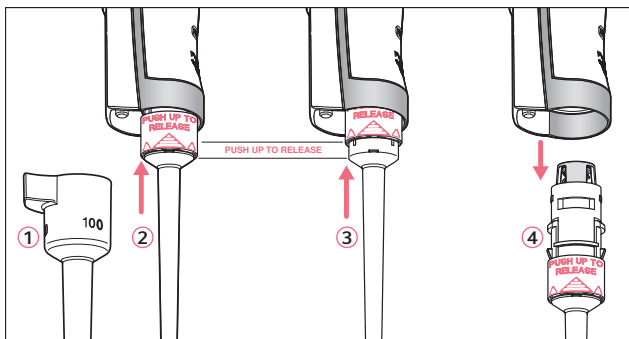
6.3.2 Mounting a new O-ring

1. Fit the installation aid (shortened pipette tip, included in the O-ring delivery package) on the tip cone.
2. Push the new O-ring over the tip and onto the tip cone.
3. Check that the pipette tips are correctly positioned. Ensure that the tips are tightly sealed and properly aligned.

6.4 Disassembling and assembling the pipette lower part

6.4.1 Single-channel lower part up to 1000 µL

6.4.1.1 Removing the lower part



1. Keep the ejector pressed and remove the ejector sleeve ①.
2. ② and ③ : On the lower part, slide the ring "PUSH UP TO RELEASE" up by about 5 mm until the lower part comes off.
3. ④ : Remove the lower part from the upper part.

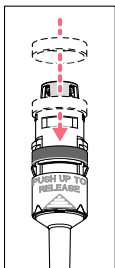
6.4.1.2 Deactivating spring loading

For the following dispensing tasks, it may be helpful to deactivate the spring-loading action of the tip cone.

- A pipette tip is to be used over a long period of time.
- The pipette tip is slightly bent during dispensing.

Deactivating this action may also be helpful for pipette tips which are not designed for the Eppendorf pipette tip cone.

Single-channel pipettes



The spring-loading action of the tip cone can be deactivated by installing the locking ring. The locking ring is included in the delivery package.

1. Push the black locking ring onto the lower part from the top by slightly squeezing the clamps on the lower part.
2. Insert the lower part into the upper part until it audibly engages.
3. Keep the ejector pressed. The ejector rod protrudes from the upper part.
4. Place the ejector sleeve on the ejector rod. If correctly fitted, it will engage slightly.

Unlock the locking ring to reactivate the spring-loading action.

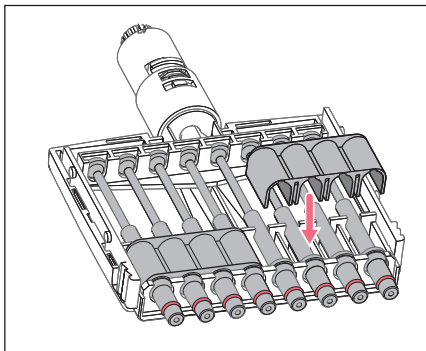
Multi-channel pipettes

The spring loading of the tip cones can be deactivated in the 10 μ L, 100 μ L and 300 μ L multi-channel lower parts by installing 2-3 locking clips. The locking clips are part of the delivery package.

Prerequisites

- Multi-channel lower part is open and has been removed from the upper part (see p. 26)
- Channels removed (see p. 26)

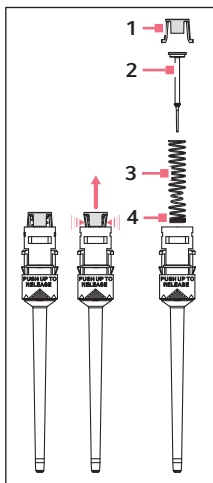
1. Remove the spring from the channels.
2. Insert the channels without springs.



3. Firmly press the locking clips onto the channels.
4. Assemble the pipette (see p. 26).

6.4.1.3 Opening and assembling the lower part ($\leq 1000 \mu\text{L}$)

- i** To avoid confusing the parts, only disassemble and assemble one pipette at a time.



Opening the lower part:

1. Slightly push the stop pins together on the piston mount (1).
2. Remove the piston mount.
3. Remove the piston (2) and the piston spring (3). The piston is under spring tension. The appearance of pistons and piston springs varies according to the individual volume versions.

Assembling the lower part:

1. Carefully guide the piston and the piston spring into the cylinder. Make sure that the piston is guided correctly in the piston spring and the cylinder. There must not be any perceptible resistance. **Stop pushing as soon as any resistance is felt.** This may indicate that the piston is not positioned correctly in the cylinder. There is a risk of bending the piston if too much force is applied. Carefully pull out the piston and repeat the process correctly. For piston springs with double windings (4), these windings must point downward.
2. Keep the piston and the piston spring pressed.
3. Keep the stop pins on the piston mount pressed with the other hand.
4. Mount the piston mount so that the two stop pins engage in their retainers.
5. Gently press a pipette tip against the inserted piston. The piston must move down in the cylinder without any noticeable resistance.

Installation of the lower part and ejector sleeve:

1. Insert the lower part into the upper part until it audibly engages.
2. Set the maximum volume and press the dispensing button several times. It must run smoothly and resistance-free.
3. Keep the ejector pressed. The ejector rod protrudes from the upper part.
4. Place the ejector sleeve on the ejector rod. If correctly fitted, it will engage slightly.
5. Carry out a gravimetric test of the systematic and random errors.

This test ensures that no parts were confused during assembly and that the pipette has been assembled correctly.

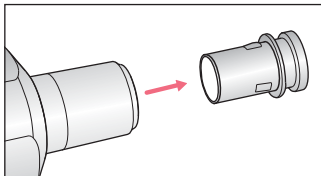
6.4.2 Single-channel lower part

Applies to the following single-channel pipettes:

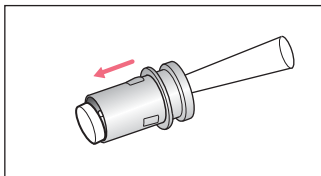
- 5 mL
- 10 mL

Replace the protection filter in the tip cone after each contact with liquid or if it is frayed.

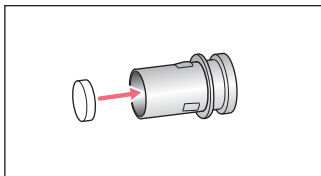
6.4.2.1 Exchanging the filter



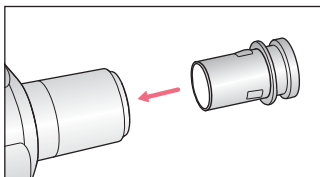
1. Remove the filter sleeve.



2. Use a pipette tip to push out the old filter.

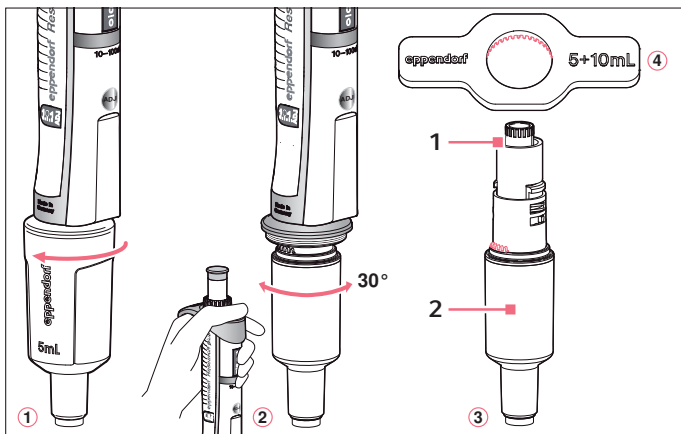


3. Insert a new filter into the filter sleeve.



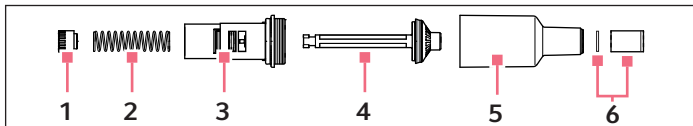
4. Insert the filter sleeve.

6.4.2.2 Opening and assembling the lower part (2 mL or larger)



1. ① Unscrew the ejector sleeve.
2. ② : Keep the ejector pressed and turn the lower part approximately 30° to the left or right.
The lower part is automatically released from the upper part.
3. ③ : Open the lower part: Fit the pipette wrench ④ (included in the delivery package) onto the lower part. Hold the cylinder and unscrew it from the lower part. See the next figure.
4. Hold the piston (4) which is now partly visible in the lower part.
5. Push the piston mount (1) slightly downward (3 mm) and turn it by 45°.
The piston spring pushes the piston mount upward. The lower part opens.

The lower part consists of the following:



1 5 mL/10 mL piston mount

4 Piston (with seal)

2 Piston spring

5 Cylinder and tip cone

3 Upper part of the lower part

6 Protection filter in the tip cone

Before assembling the pipette, install the piston mount, piston spring, and piston in the upper part of the lower part. Further assembly is as shown in the figures. Carry out the procedure in reverse order.

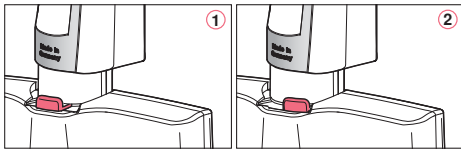
► Carry out a gravimetric test of the systematic and random errors.

This test ensures that no parts were confused during assembly and that the pipette has been assembled correctly.

- i** For replacing an ejector sleeve, the 5 mL and 10 mL sizes are delivered with an ejector sleeve and ejection carrier. The lower part must be removed in order to install a new ejection carrier.

6.4.3 Multi-channel lower part

6.4.3.1 Loosen and open the 10 μ L, 100 μ L and 300 μ L multi-channel lower part



1. ① and ② : Slide the lever on the lower part to the left or right.

This separates the lower part from the upper part so that it can be removed.

2. Put down the lower part with the lever facing downward.

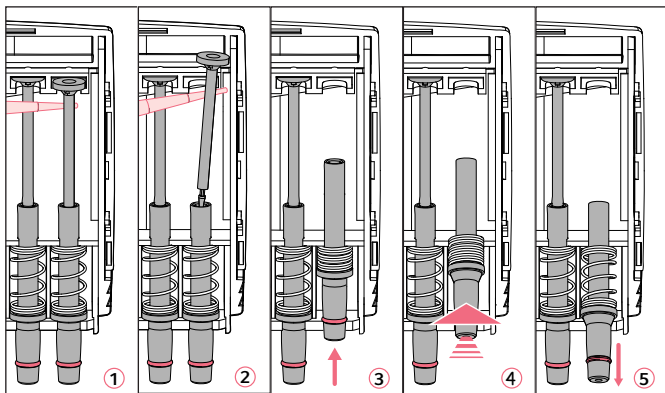
3. ③ : Slide the two latches (right and left at the side) down.

The lower part is still lying on the table with the lever facing downward.

4. Remove the cover plate facing upward and the integrated ejector rail.

Do **not** remove the ejector rail from the cover plate. The spring for the ejector rail may accidentally come off and get lost during this step.

6.4.3.2 Removing and installing channels



1. ① and ② : Position a pipette tip under the piston and carefully remove the piston from the upper rail.
2. Carefully pull the piston out in an upward direction. **Do not bend the piston.**
3. Hold the tip cone at the lower end and push it upward slightly ③.
This compresses the spring.
4. ④ : Lightly lift the tip cone and release it from the lower rail.
5. ⑤ : Relax the spring by letting the tip cone slide back above the lower rail.
6. Remove the tip cone, along with the cylinder and spring, from the upper rail.
Before installation, slide the piston into the cylinder. Install the channels in reverse order.

6.4.3.3 Assembling the 10 - 300 μ L multi-channel pipette

1. Fit the cover plate with the integrated ejector.
2. Push the latches downward.
3. For mounting, push the lower part into the upper part until it audibly engages.
4. Carry out a gravimetric test of the systematic and random errors (see p. 31).
This test ensures that no parts were confused during assembly and that the pipette has been assembled correctly.

6.5 Adjusting the pipette



NOTICE! Incorrect dispensing volume with special liquids and due to temperature differences.

Solutions with physical data very different than water or differences in temperature between pipette, pipette tip and liquid can result in faulty dispensing volumes.

- ▶ Avoid temperature differences between the pipette, pipette tip and liquid.



The random and systematic errors recorded on delivery can be found in the *Eppendorf Certificate*. This certificate is included in delivery. Changes to the factory adjustment will render the certificate void.

6.5.1 General instructions on user adjustment and factory adjustment

The Research plus was adjusted, tested and fitted with a gray adjustment seal with the abbreviation "ADJ" before delivery. The adjustment display on the side reads "0".

Changing the adjustment of the Research plus is sometimes recommended for solutions which are very different from water with regard to their density, viscosity, surface tension and/or vapor pressure etc. If the density of an aqueous solution changes by approximately $\pm 10\%$, for example, because of the salt concentration, the volume will change by approximately $\pm 0.2\%$. This statement does not apply if other relevant properties of the liquid also change.

If the pipette is used at extremely high altitudes, it must be calibrated to the ambient air pressure. At 1000 m above sea level, the volume error of a 100 μL pipette is about -0.3% .

When using special tips, i.e. tips with a geometry that is very different from standard tips, changing the adjustment can improve the dispensing accuracy (systematic error).

Follow the adjustment tips for epT.I.P.S. Long provided in the *User adjustment* document.

Adjustment changes can be reset in simple steps.

In addition to changing the user adjustment, a Research plus with variable volume setting can be permanently changed by altering the factory adjustment.

Changes to the user adjustment or factory adjustment will not affect the dispensing precision (random error). Precision can be improved by exchanging worn parts. Precision is also significantly affected by handling.

The existing dispensing volume must be checked before changing the factory calibration or adjustment.

The actual volume can be checked by weighing:

$$\text{Actual volume} = \frac{\text{Mean value of the weighings}}{\text{Density liquids at weighing temperature}}$$

The density of distilled water is approx. 0.9982 mg/μL at 20 °C and 0.9965 mg/μL at 27 °C.

If the set volume corresponds to the actual volume, no correction is necessary.

If there is a difference between the actual volume and the set volume of distilled water, please check the following:

- Is there any liquid dripping from the tip?
- Is the pipette tip fitted leak-proof?
- Is the tip cone undamaged?
- Are the piston and the cylinder leak-proof?
Adequate leak tightness is ensured when no drop is formed at the pipette tip after aspiration of the nominal volume with distilled water and a waiting time of approx. 15 s. Hold the pipette vertically, making sure not to touch the pipette tip. Pre-wet the tip several times in the case of nominal volumes $\leq 20 \mu\text{L}$.
- Does the temperature of the pipetted liquid correspond to:
 - the temperature of the device?
 - the ambient air temperature?
- Is the weighing location free from drafts?
- Does the work method and pipetting speed permit complete aspiration and dispensing of the liquid?
- Has the correct numerical value for "Density liquids at weighing temperature" been used for the calculation of the actual volume?
- Is the set volume correct?
- For very small volumes ($<10 \mu\text{L}$): Is the analytical balance sufficiently sensitive (balance resolution: 0.001 mg)?
- Were original epT.I.P.S pipette tips used for testing?
Information on which pipette tip was used as the test tip can be found in the "Technical data (see p. 31).

No adjustment changes are allowed unless you can answer all the questions with "yes". In all other cases, the problems associated with the questions answered with "no" must be eliminated. If the problem is remedied by exchanging a complete lower part or other parts that have an effect on the volume, proper assembly must be verified by carrying out a gravimetric test. Information on the systematic and random errors to be met can be found in the "Technical data" chapter.

6.6 Decontamination before shipment



CAUTION! Use of a contaminated device may result in personal injuries and damage to the device.

- ▶ Clean and decontaminate the device in accordance with the cleaning instructions before shipping or storage.
-

Hazardous substances are:

- solutions presenting a hazard to health
- potentially infectious agents
- organic solvents and reagents
- radioactive substances
- proteins presenting a hazard to health
- DNA

1. Please note the information in the document "Decontamination certificate for product returns".

It is available as PDF document on our website www.eppendorf.com/manuals.

2. Enter the serial number of the device in the decontamination certificate.
3. Enclose the completed decontamination certificate for returned goods with the device.
4. Send the device to Eppendorf AG or an authorized service center.

7 Technical data

7.1 Ambient conditions

	Temperature range	Relative humidity
Storage without transport package	-5 °C — 45 °C	10 % — 95 %
Operating conditions	5 °C — 40 °C	10 % — 95 %

7.2 Increments of the single-channel and multi-channel pipettes

Model	Increment
0.1 µL – 2.5 µL	0.002 µL
0,5 µL – 10 µL	0.01 µL
2 µL – 20 µL	0.02 µL
2 µL – 20 µL	0.02 µL
10 µL – 100 µL	0.1 µL
20 µL – 200 µL	0.2 µL
30 µL – 300 µL	0.2 µL
100 µL – 1000 µL	1 µL
0.5 mL – 5 mL	0.005 mL
1 mL – 10 mL	0.01 mL

8 Measurement deviations according to Eppendorf AG

8.1 Single-channel pipette with fixed volume

Model	Testing tip epT.I.P.S.	Error of measurement			
		Systematic error		Random error	
		± %	± µL	± %	± µL
10 µL	0.1 µL – 20 µL medium gray 40 mm	1.2	0.12	0.6	0.06
20 µL	0.5 µL – 20 µL L light gray 46 mm	0.8	0.16	0.3	0.06
10 µL	2 µL – 200 µL yellow 53 mm	1.2	0.12	0.6	0.06
20 µL		1.0	0.2	0.3	0.06
25 µL		1.0	0.25	0.3	0.08
50 µL		0.7	0.35	0.3	0.15
100 µL		0.6	0.6	0.2	0.2
200 µL		0.6	1.2	0.2	0.4
200 µL	50 µL – 1000 µL blue 71 mm	0.6	1.2	0.2	0.4
250 µL		0.6	1.5	0.2	0.5
500 µL		0.6	3.0	0.2	1.0
1000 µL		0.6	6.0	0.2	2.0

8.2 Variable volume single-channel pipette

Model	Testing tip epT.I.P.S.	Testing volume	Error of measurement			
			Systematic error		Random error	
			± %	± µL	± %	± µL
0.1 µL – 2.5 µL	0.1 µL – 10 µL dark gray 34 mm	0.1 µL	48	0.048	12	0.012
		0.25 µL	12	0.03	6.0	0.015
		1.25 µL	2.5	0.031	1.5	0.019
		2.5 µL	1.4	0.035	0.7	0.018
0.5 µL – 10 µL	0.1 µL – 20 µL medium gray 40 mm	0.5 µL	8.0	0.04	5.0	0.025
		1 µL	2.5	0.025	1.8	0.018
		5 µL	1.5	0.075	0.8	0.04
		10 µL	1.0	0.1	0.4	0.04
2 µL – 20 µL	0.5 µL – 20 µL L light gray 46 mm	2 µL	5.0	0.1	1.5	0.03
		10 µL	1.2	0.12	0.6	0.06
		20 µL	1.0	0.2	0.3	0.06
2 µL – 20 µL	2 µL – 200 µL yellow 53 mm	2 µL	5.0	0.1	1.5	0.03
		10 µL	1.2	0.12	0.6	0.06
		20 µL	1.0	0.2	0.3	0.06
10 µL – 100 µL	2 µL – 200 µL yellow 53 mm	10 µL	3.0	0.3	1.0	0.1
		50 µL	1.0	0.5	0.3	0.15
		100 µL	0.8	0.8	0.2	0.2
20 µL – 200 µL	2 µL – 200 µL yellow 53 mm	20 µL	2.5	0.5	0.7	0.14
		100 µL	1.0	1.0	0.3	0.3
		200 µL	0.6	1.2	0.2	0.4
30 µL – 300 µL	20 µL – 300 µL orange 55 mm	30 µL	2.5	0.75	0.7	0.21
		150 µL	1.0	1.5	0.3	0.45
		300 µL	0.6	1.8	0.2	0.6
100 µL – 1000 µL	50 µL – 1000 µL blue 71 mm	100 µL	3.0	3.0	0.6	0.6
		500 µL	1.0	5.0	0.2	1.0
		1000 µL	0.6	6.0	0.2	2.0
0.5 mL – 5 mL	0.1 mL – 5 mL violet 120 mm	0.5 mL	2.4	12	0.6	3
		2.5 mL	1.2	30	0.25	6.25
		5.0 mL	0.6	30	0.15	7.5
0.5 mL – 5 mL	0.1 mL – 5 mL L violet 175 mm	0.5 mL	5.0	25	1.0	5
		2.5 mL	3.0	75	0.9	22.5
		5.0 mL	2.0	100	0.8	40

Model	Testing tip epT.I.P.S.	Testing volume	Error of measurement			
			Systematic error		Random error	
			± %	± µL	± %	± µL
1 mL – 10 mL	1 mL – 10 mL turquoise 165 mm	1.0 mL	3.0	30	0.6	6
		5.0 mL	0.8	40	0.2	10
		10.0 mL	0.6	60	0.15	15
1 mL – 10 mL	1 mL – 10 mL L turquoise 243 mm	1.0 mL	6.0	60	1.0	10
		5.0 mL	3.0	150	0.9	45
		10.0 mL	2.0	200	0.7	70

8.3 Variable multi-channel pipette

Model	Testing tip epT.I.P.S.	Testing volume	Error of measurement			
			Systematic error		Random error	
			± %	± µL	± %	± µL
0.5 µL – 10 µL	0.1 µL – 20 µL medium gray 40 mm	0.5 µL	12	0.06	8.0	0.04
		1 µL	8.0	0.08	5.0	0.05
		5 µL	4.0	0.2	2.0	0.1
		10 µL	2.0	0.2	1.0	0.1
10 µL – 100 µL	2 µL – 200 µL yellow 53 mm	10 µL	3.0	0.3	2.0	0.2
		50 µL	1.0	0.5	0.8	0.4
		100 µL	0.8	0.8	0.3	0.3
30 µL – 300 µL	20 µL – 300 µL orange 55 mm	30 µL	3.0	0.9	1.0	0.3
		150 µL	1.0	1.5	0.5	0.75
		300 µL	0.6	1.8	0.3	0.9

8.4 Test conditions

Test conditions and test analysis in accordance with the standard ISO 8655, Part 6. The inspections are performed with a calibrated analytical balance with evaporation protection.

- Number of determinations per volume: 10
- Water according to ISO 3696
- Inspection at 20 °C – 27 °C ±0.5 °C
- Dispensing onto the tube inner wall

9 Ordering information

9.1 Single-channel, fixed volume

Order no. (International)	Order no. (North America)	Description
		Eppendorf Research plus, fixed single-channel
3124 000.016	3124000016	medium gray, 10 µL
3124 000.024	3124000024	yellow, 10 µL
3124 000.032	3124000032	light gray, 20 µL
3124 000.040	3124000040	yellow, 20 µL
3124 000.059	3124000059	yellow, 25 µL
3124 000.067	3124000067	yellow, 50 µL
3124 000.075	3124000075	yellow, 100 µL
3124 000.083	3124000083	yellow, 200 µL
3124 000.091	3124000091	blue, 200 µL
3124 000.105	3124000105	blue, 250 µL
3124 000.113	3124000113	blue, 500 µL
3124 000.121	3124000121	blue, 1000 µL

9.2 Single-channel pipette with variable volume

Order no. (International)	Order no. (North America)	Description
		Eppendorf Research plus, variable single-channel
3123 000.012	3123000012	dark gray, 0.1 - 2.5 µL
3123 000.020	3123000020	medium gray, 0.5 - 10 µL
3123 000.098	3123000098	light gray, 2 - 20 µL
3123 000.039	3123000039	yellow, 2 - 20 µL
3123 000.047	3123000047	yellow, 10 - 100 µL
3123 000.055	3123000055	yellow, 20 - 200 µL
3123 000.101	3123000101	orange, 30 - 300 µL
3123 000.063	3123000063	blue, 100 - 1000 µL
3123 000.071	3123000071	violet, 0.5 - 5 mL
3123 000.080	3123000080	turquoise, 1 - 10 mL

9.3 Multi-channel

Order no. (International)	Order no. (North America)	Description
		Eppendorf Research plus, variable 8-channel
3125 000.010	3125000010	medium gray, 0.5 - 10 µL
3125 000.036	3125000036	yellow, 10 - 100 µL
3125 000.052	3125000052	orange, 30 - 300 µL
		Eppendorf Research plus, variable 12-channel
3125 000.028	3125000028	medium gray, 0.5 - 10 µL
3125 000.044	3125000044	yellow, 10 - 100 µL
3125 000.060	3125000060	orange, 30 - 300 µL



The ordering information can be found on our website
www.eppendorf.com/manuals.

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