

## The Electronic Pipette Eppendorf Xplorer<sup>®</sup> – Intuitive Handling

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### Abstract

Electronic pipettes are designed to make work easier. They allow liquid aspiration and dispensing operations to be achieved at the press of a button, saving both time and energy. The multifunctionality offered by the different dispensing techniques (dispensing, mixing, manual pipetting) also ensures increased efficiency. This user guide explains the intuitive operating concept of the new electronic pipette Eppendorf Xplorer in more detail.

### Introduction

For users it is extremely important that new products should, among other things, feature ease of operation. This requires that the special needs and characteristics of the user groups within a specific application field are recognized and implemented in the development of the new product.

To ensure user acceptance, the instrument must be optimally adapted to human needs. In the case of the new electronic pipette Eppendorf Xplorer, this was ensured, among other things, by an operating study which was conducted during the development phase in conjunction with the Institute of Human Factors Engineering at the Darmstadt University of Technology (IAD), Germany.

## Ease of operation

Intuitive pipette operation is a basic requirement for clear and easy handling. Each element of an electronic pipette must be designed to enable new users to master operation within a very short time.

The new electronic pipette Eppendorf Xplorer meets user requirements and provides optimal support during pipetting tasks.

The intuitive operating concept (Fig. 1) is setting new standards in terms of simplicity to ensure that no more time is wasted with complicated programming or instrument control is lost.



Fig. 1: Intuitive operation of the main operating elements

The Eppendorf Xplorer pipette features a unique multifunctional rocker, which has been developed to enable precise control of liquid aspiration and dispensing operations. The size of the rocker allows for comfortable operation regardless of the size of the user's hand and for both left and right-handed use.

The rocker is based on the straightforward "up is up and down is down" principle. This ensures that users always retain complete control over piston motion. The rocker is pressed up in order to aspirate liquid and down to dispense liquid. The identical operating philosophy between the rocker of the Eppendorf Xplorer pipette and the control button of a conventional manual pipette (slide control button up = aspiration, press control button down = dispensing) facilitates the changeover between a manual and an electronic pipetting system.

The different operating modes available in Xplorer are selected with the selection wheel. This enables you to understand and select all the functions offered by the electronic pipette at a glance. The desired function is simply set by turning the dial accordingly. This means no more getting lost in submenus! Two softkeys and the rocker are available for adjusting the desired parameters. A help function which provides editing tips can also be called up at any time.

The clear color display always shows all the adjustable parameters. The following operating modes can be selected:

- Ads** – Automatic dispensing
- Dis** – Dispensing
- Pip** – Pipetting
- P/M** – Pipetting and Mixing
- Man** – Manual pipetting
- Opt** – Options
- Off** – Power off

The dispensing function is suitable for, e.g., an ELISA for filling a micro titer plate. This requires many repetitive steps. A more efficient approach to completing the application is to use the "Automatic dispensing" function. In this case, the liquid is dispensed "automatically", with the rocker pressed down, in a preselected interval.

To achieve greater dispensing precision of liquids which have a tendency to foam, or highly viscous solutions, the "Pipetting" function offers the possibility of performing additional blow-outs.

The "Pipetting and Mixing" function is recommended, for example, for pipetting very small volumes. For dispensing volumes < 10 µL, it is recommended to rinse it into the respective reaction liquid. This can be accomplished by automatically starting a mixing movement after the liquid has been dispensed. Both the mixing volume and the mixing cycles are defined before. An application for this would be, e.g., the addition of DNA to a PCR master mix.

“Manual pipetting” is suitable for the pipetting of supernatants, for measuring an unknown amount of liquid, for titration or for loading gels. The display will then show the volume contained in the pipette tip.

The loading of gels demands an extremely high level of concentration while working. Even the slightest irregular thumb movement when you dispense the sample with manual pipettes will mean that the sample will partly flow out of the gel pocket. The excellent synchronization of the Xplorer motor as well as the dispensing speed, which can be adjusted in 8 levels, ensure precise sample dispensing. The blow-out can be deactivated if required in order to prevent liquid from being accidentally blown out of the gel pocket.

The “Options” function can be used to make general settings, such as the sound level, the display brightness, adjustments to a specific medium, and for making further settings. The “Off” function switches off the pipette. This helps to greatly reduce the discharging of the rechargeable battery.

During the development of the electronic Eppendorf Xplorer pipette, the Institute of Ergonomics at the Darmstadt University of Technology (IAD) conducted a study on how easy it is to learn how to use the pipette.

This study included, e.g., the time required to learn how to operate the Xplorer in comparison with different competitor pipettes. Results showed that inexperienced users were able to master Xplorer operation in less than 3 minutes.

The test subjects performed the task described below:  
 Step 1: 1000 µL bromophenol blue solution was placed into a container

Step 2: 90 µL glycerol solution was added

Step 3: The solutions were mixed until the blue solution had turned into a clear yellow solution.

At the end of the mixing process the pipette tip should be clear and free of any glycerol residue.

Explanation: This experimental design is comparable to tasks where a small volume of a “critical” liquid is to be dispensed carefully into a larger volume. At the same time, the liquids are to be mixed thoroughly following dispensing.

Since its higher density forces glycerol to the bottom, where it remains, the mixing of both solutions needs to be achieved via a separate mixing process. During the mixing process, residues from the tip are completely rinsed into solution.

Apart from the volumes used here, this experiment may be compared to the adding of a DNA sample to a PCR master mix.

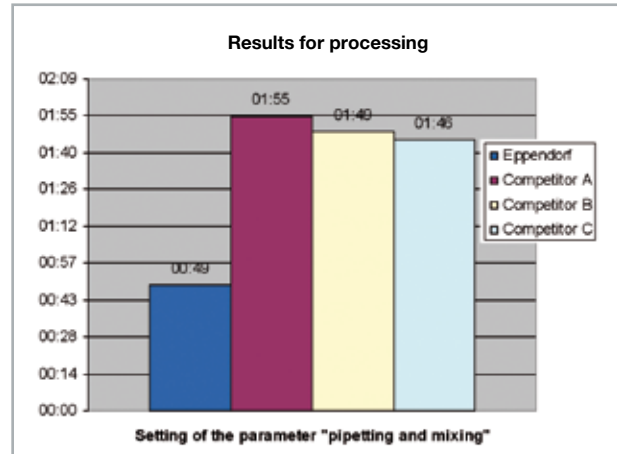


Fig. 2: Time required to set the parameters for pipetting and mixing

The advantages of the Xplorer, especially during the complex task of “Mixing”, are clearly visible in figure 2. The function “Mixing” was difficult or impossible to find when using competitors’ pipettes, as the menu structures are unclear.

Figure 3 shows how many of the participants were able to perform the task correctly.

In figure 4, handling of the function “Mixing” is evaluated by the participants.

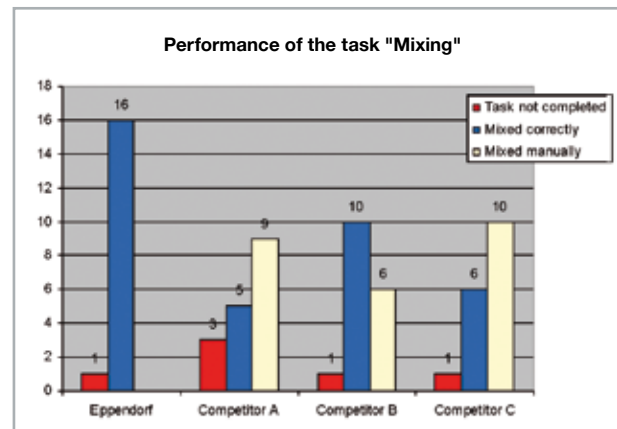


Fig. 3: Performance of the task "Mixing". 17 participants were asked to use each pipette to complete the task "Mixing".

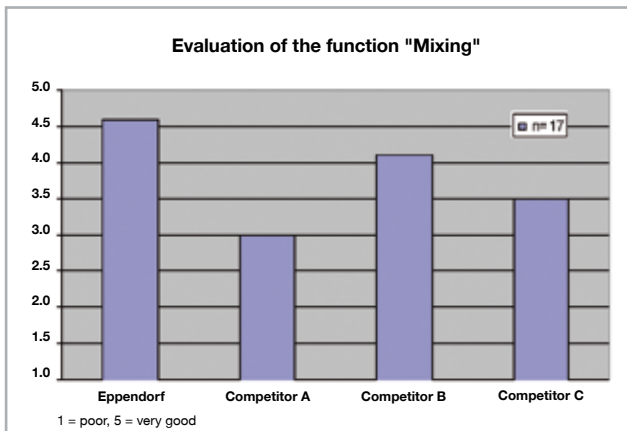


Fig. 4: Subjective evaluation of the function "Mixing" by the participants.

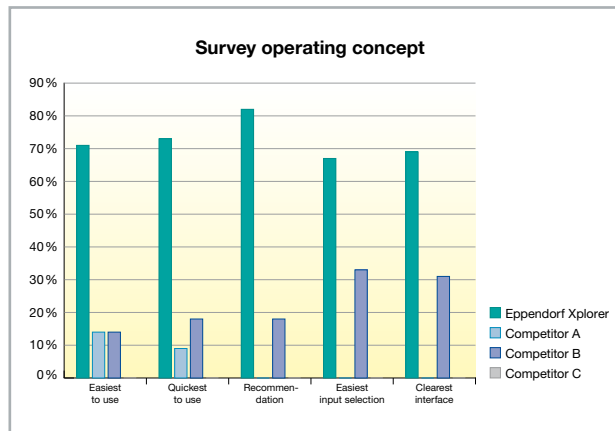


Fig. 5: Results of the study regarding the operating concept of the electronic pipettes

The study rated as extremely positive both the programming of the individual parameters and the clear presentation of these parameters in the display. From among the tested pipettes, the Xplorer was found to be the pipette which was the easiest and quickest to operate as well as the pipette offering the best input options and the top clarity (Fig. 5).

This is an important factor when using electronic pipettes compared to manual pipettes in the performance of daily routine tasks.

## Outlook

Pipetting results are dependent on the user, the environment and the pipette used. Therefore, user working conditions in the lab regarding the features and the operation of pipettes should be optimum. The intuitive operating concept of the electronic pipette Eppendorf Xplorer ensures optimum ease of use and supports users to complete their numerous sample processing tasks quickly and efficiently and to achieve improved results.

## Single-channel Eppendorf Xplorer® (incl. charger)

Volume range	Volume	Systematic deviation		Random deviation		Order no.
<b>Medium gray multi-function rocker for 20 µL epT.I.P.S.® pipette tips</b>						
0.5–10 µL	1 µL	±2.5 %	±0.025 µL	±1.8 %	±0.018 µL	4861 000.015
	5 µL	±1.5 %	±0.075 µL	±0.8 %	±0.04 µL	
	10 µL	±1.0 %	±0.1 µL	±0.4 %	±0.04 µL	
<b>Yellow multi-function rocker for 200 µL epT.I.P.S.® pipette tips</b>						
5–100 µL	10 µL	±2.0 %	±0.2 µL	±1.0 %	±0.1 µL	4861 000.023
	50 µL	±1.0 %	±0.5 µL	±0.3 %	±0.15 µL	
	100 µL	±0.8 %	±0.8 µL	±0.2 %	±0.2 µL	
<b>Orange multi-function rocker for 300 µL epT.I.P.S.® pipette tips</b>						
15–300 µL	30 µL	±2.5 %	±0.75 µL	±0.7 %	±0.21 µL	4861 000.031
	150 µL	±1.0 %	±1.5 µL	±0.3 %	±0.45 µL	
	300 µL	±0.6 %	±1.8 µL	±0.2 %	±0.6 µL	
<b>Blue multi-function rocker for 1,000 µL epT.I.P.S.® pipette tips</b>						
50–1,000 µL	100 µL	±3.0 %	±3 µL	±0.6 %	±0.6 µL	4861 000.040
	500 µL	±1.0 %	±5 µL	±0.2 %	±1 µL	
	1,000 µL	±0.6 %	±6 µL	±0.2 %	±2 µL	
<b>Violet multi-function rocker for 5 mL epT.I.P.S.® pipette tips</b>						
0.25–5 mL	500 µL	±3.0 %	±15 µL	±0.6 %	±3 µL	4861 000.058
	2,500 µL	±1.2 %	±30 µL	±0.3 %	±6.25 µL	
	5,000 µL	±0.6 %	±30 µL	±0.15 %	±7.5 µL	
<b>Turquoise multi-function rocker for 10 mL epT.I.P.S.® pipette tips</b>						
0.5–10 mL	1,000 µL	±3.0 %	±30 µL	±0.6 %	±6 µL	4861 000.066
	5,000 µL	±0.8 %	±40 µL	±0.2 %	±10 µL	
	10,000 µL	±0.6 %	±60 µL	±0.15 %	±15 µL	

## Multi-channel Eppendorf Xplorer® (incl. charger)

Volume range	Volume	Systematic deviation	Random deviation	Order no. 8-channel	Order no. 12-channel		
<b>Medium gray multi-function rocker for 20 µL epT.I.P.S.® pipette tips</b>							
0.5–10 µL	1 µL	±5.0 %	±0.05 µL	±3.0 %	±0.03 µL	4861 000.104	4861 000.112
	5 µL	±3.0 %	±0.15 µL	±1.5 %	±0.075 µL		
	10 µL	±2.0 %	±0.2 µL	±0.8 %	±0.08 µL		
<b>Yellow multi-function rocker for 200 µL epT.I.P.S.® pipette tips</b>							
5–100 µL	10 µL	±2.0 %	±0.2 µL	±2.0 %	±0.2 µL	4861 000.120	4861 000.139
	50 µL	±1.0 %	±0.5 µL	±0.8 %	±0.4 µL		
	100 µL	±0.8 %	±0.8 µL	±0.25 %	±0.25 µL		
<b>Orange multi-function rocker for 300 µL epT.I.P.S.® pipette tips</b>							
15–300 µL	30 µL	±2.5 %	±0.75 µL	±1.0 %	±0.3 µL	4861 000.147	4861 000.155
	150 µL	±1.0 %	±1.5 µL	±0.5 %	±0.75 µL		
	300 µL	±0.6 %	±1.8 µL	±0.25 %	±0.75 µL		
<b>Green multi-function rocker for 1,200 µL epT.I.P.S.® pipette tips</b>							
50–1,200 µL	120 µL	±6.0 %	±7.2 µL	±0.9 %	±1.08 µL	4861 000.163	—
	600 µL	±2.7 %	±16.2 µL	±0.4 %	±2.4 µL		
	1,200 µL	±1.2 %	±14.4 µL	±0.3 %	±3.6 µL		

Charging stand	Order no.	Order no.
for 1 pipette	4880 000.000	for 4 pipettes (incl. charging adapter) 4880 000.026

The data for systematic and random deviations only applies when using Eppendorf epT.I.P.S. pipette tips.

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