

The Eppendorf Xplorer® Electronic Pipette Family

Kornelia Ewald, Maren Rudolph, Eppendorf SE, Hamburg, Germany

Abstract

Electronic pipettes are designed to make work more ergonomic, reproducible, efficient and easy. They allow liquid aspiration and dispensing operations to be achieved at the press of a button, saving both time and energy while ensuring user-to-user reproducibility. The multifunctionality offered by the different dispensing techniques,

including automatic dispensing, pipetting and mixing as well as reverse pipetting, as well as reverse pipetting, also ensures increased efficiency. This user guide explains the intuitive operating concept of the Eppendorf Xplorer electronic pipette family* in more detail.

* includes Eppendorf Xplorer, Xplorer plus and Xplorer plus Move It® adjustable tip spacing pipettes

Introduction

Users find it extremely important that new products are easy to operate. This means that the special requirements and characteristics of the user groups within a specific application field are must be identified and taken into account 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 Eppendorf Xplorer electronic pipette, this was ensured by an operating study conducted during the development phase in conjunction with the Institute of Ergonomics and Human Factors (IAD) at the Technical University of Darmstadt, 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 its operation within a very short time.

The Eppendorf Xplorer electronic pipette meets user requirements and provides optimal support during pipetting tasks. The intuitive operating concept (fig. 1) sets new standards in terms of simplicity to ensure that no users no longer waste time on complicated programming and maintain complete control over the device.

The Xplorer pipette features a unique multifunctional rocker developed to enable precise control of liquid aspiration and dispensing operations. The size of the rocker allows for comfortable operation regardless of hand size or whether the user is left- or right-handed.

The rocker is based on the straightforward "up is up and down is down" principle, i.e., it is pressed up to aspirate liquid and down to dispense liquid. This ensures that users always retain complete control over piston motion. The identical operating philosophy between the rocker of the Xplorer pipette family and the control button of a conventional mechanical pipette (slide control button up = aspiration, press control button down = dispensing) enables an easy transition from a mechanical to an electronic pipetting system.

The different operating modes available in Xplorer (plus) pipettes are controlled via a selection dial. Users are able to see all the functions of the electronic pipette at a glance and simply select the function they need by turning the dial. No more getting lost in submenus. Two softkeys and the rocker are available to adjust the desired parameters. A help function that 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 (see table 1):



Figure 1: Intuitive operation of the main operating elements

Mode of operation	Eppendorf Xplorer	Eppendorf Xplorer plus
Pipetting (Pip): Aspiration and dispensing of liquids	■	■
Manual pipetting (Man): Aspiration of liquid can be manually stopped prior to reaching the maximum set volume; used for volume determination.	■	■
Pipetting and mixing (P/M): Automatic aspiration and dispensing of samples followed by an adjustable number of mixing cycles	■	■
Dispensing (Dis): Dispensing of liquid in equal partial volumes at user-defined time intervals	■	■
Automatic dispensing (Ads): Automatic dispensing of liquid in equal partial volumes at user-defined time intervals	■	■
Special mode (Spc) – multi aspiration: Consecutive aspiration for pooling into one pipette tip		■
Special mode (Spc) – sequential dispensing: Aspiration of liquid followed by dispensing in up to 10 user-defined volume steps		■
Special mode (Spc) – reverse pipetting: Over-aspiration of liquid followed by a regular dispensing step. Ideal for non-aqueous solutions.		■
Special mode (Spc) – diluting: Aspiration of a diluent and a sample separated by an air bubble		■
Special mode (Spc) – sequential pipetting: Pipetting of up to ten user-defined volumes in sequential order		■
Fix volume (Fix): Save up to ten of your most frequently used volumes including aspiration and dispensing speed for ease of operation		■
Programming (Prg): Save up to ten of your most common methods with up to four different pipetting steps each.		■
Options (Opt): Save favorite settings, set service intervals, activate key lock and more	■	■

Table 1: Selection of operating modes

The "Dispensing" mode is suitable to quickly fill a microplate as needed, for example, for an ELISA, PCR preparation or other assays that require many repetitive steps. Efficiency can be further increased with the "Automatic dispensing" mode, in which the liquid is dispensed automatically, at preselected intervals, with the rocker pressed down.

To standardize the concentration of different stocks, the "Sequential pipetting" mode of the Xplorer plus, can be used to pipette up to ten different volumes in sequential order.

A useful tool for setting up a standard curve is the "Sequential dispensing" mode of the Xplorer plus, allowing up to ten user-defined volumes of the same liquid to be dispensed.

To achieve greater dispensing precision when dealing with highly viscous solutions or liquids that tend to foam, the "Pipetting" mode of the Xplorer pipettes can be used to perform additional blow-outs. In addition, the Xplorer plus offers a "Reverse pipetting" mode in which the liquid is over-aspirated followed by a regular dispensing step.

Sample mixing efficiency can be further optimized by using the "Diluting" mode offered by the Xplorer plus, which allows the diluent and sample to be aspirated in a single tip, separated by an air bubble, and dispensed in the same vessel.

The "Pipetting and mixing" mode is recommended, for example, for pipetting very small volumes. When dispensing volumes $< 10 \mu\text{L}$, it is recommended to rinse the sample into the respective reaction liquid. This is easily accomplished, since the mode automatically starts a mixing movement after the liquid has been dispensed. Both the mixing volume and the mixing cycles are defined in advance. An application for this would be, for example the addition of DNA to a PCR master mix.

"Manual pipetting" is suitable for aspirating supernatants, for measuring an unknown amount of liquid, for titration or for loading gels. The display will indicate 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 while dispensing the sample with mechanical pipettes can result in parts of the sample floating out of the gel pocket. The excellent synchronization of the Xplorer motor as well as the dispensing speed, which can be adjusted in eight 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 "Multiple aspiration" mode of the Xplorer plus allows the consecutive aspiration to pool liquid in one pipette tip. This can be useful for pooling samples from various vessels, removing supernatants after centrifugation or exchanging nutrients.

The additional "Programming" mode of the Xplorer plus offers the option to store up to ten of the most frequently used methods with up to four different pipetting steps.

The "Options" function can be used to manipulate general settings, such as the sound level, the display brightness, adjustments to a specific medium, and for adjusting further settings.

However, ease of use is not limited to numerous modes or intuitive buttons. The Xplorer family offers a comprehensive set of pipette versions with a variety of volumes and channels to fit every pipetting need. In addition, the Eppendorf Xplorer Move It is a multichannel pipette that comes with adjustable tip spacing, allowing the cones to be adjusted precisely to the specific vessel. Source and destination formats can be adjusted and locked with the format limiter, which quickly switches forward and backward within the set formats. The format adjustment itself is carried out manually with an adjustment knob.

Intuitive handling

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

This study included 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 operation of Xplorer pipettes in less than three minutes.

The test subjects performed the task described below:

Step 1: 1,000 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 mixing process, the pipette tip was supposed to 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 remain at the bottom, a separate mixing process is needed to mix the two solutions. During the mixing process, residues from the tip are completely rinsed into the solution.

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

The advantages of the Xplorer, especially during the complex task of mixing, are clearly visible in figure 2.

The "Mixing" function was difficult or impossible to find when using competitors' pipettes, since the menu structures are unclear.

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

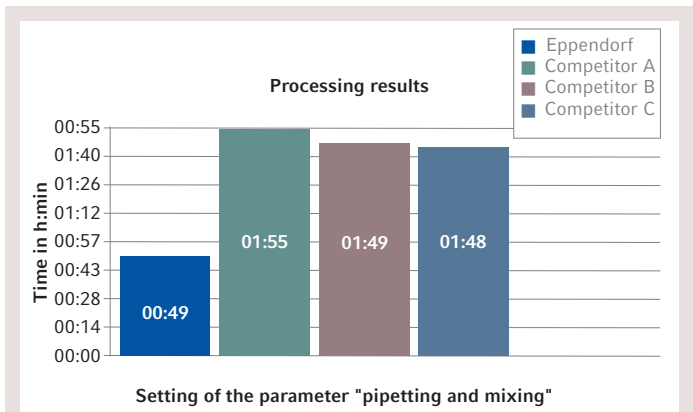


Fig. 2: Time required to set the parameters for pipetting and mixing

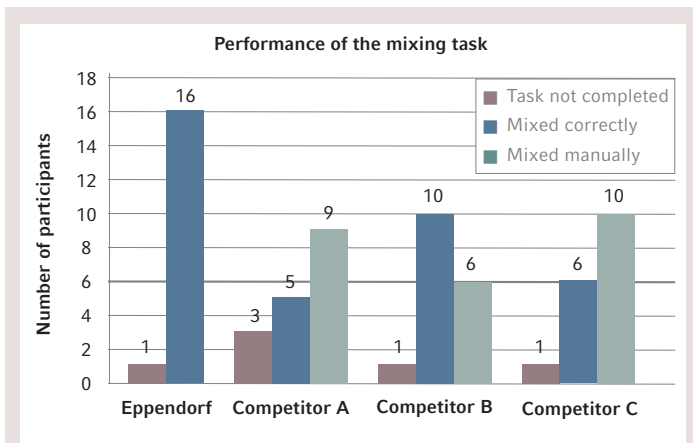


Fig. 3: Performance of the mixing task. 17 participants were asked to perform the task of mixing.

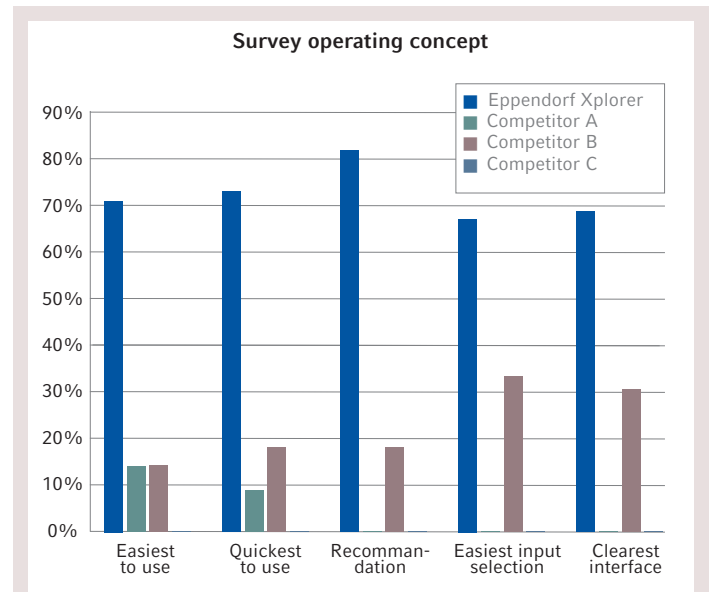


Figure 4: Evaluation of operating concepts of different electronic pipettes

Source: Independent survey, Institute of Ergonomics and Human Factors (IAD) at the Technical University of Darmstadt, February 2010

The study rated both the programming of the individual parameters and the clear presentation of these parameters in the display as extremely positive.

Among the pipettes tested, the Xplorer was found to be the easiest and quickest to operate while also offering good input options and the clearest interface (fig. 4).

Summary

Pipetting results are dependent on the user, the environment and the pipette used. Electronic pipettes not only need to be accurate, precise and well-balanced but also intuitive and easy to use. All features should be quickly accessible. The intuitive operating concept of the Eppendorf Xplorer electronic pipette family ensures optimum ease of use and helps users complete their numerous sample processing tasks quickly and efficiently.

Even more ease of use and quicker access to all operating modes and settings can be achieved by connecting Xplorer pipettes to the VisioNize® pipette manager (sold separately). The VisioNize pipette manager is a standalone touch server that interacts in real-time with Xplorer pipettes via WiFi technology, and allowing for remote feature setting while giving guidance for ideal settings when working with challenging liquids.

For more information, technical specifications and ordering information for Eppendorf Xplorer electronic pipettes, visit www.eppendorf.com/xplorer.

Software updates for Eppendorf Xplorer electronic pipettes are available at www.eppendorf.com/software-downloads.

Your local distributor: www.eppendorf.com/contact
Eppendorf SE · Barkhausenweg 1 · 22339 Hamburg · Germany
eppendorf@eppendorf.com · www.eppendorf.com

www.eppendorf.com



Learn more about the VisioNize pipette manager at:

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