

96- and 384-Channel Electronic Pipettes

An affordable way to increase pipetting productivity

Abstract

A new genre of 96- and 384-channel benchtop electronic pipetting systems has become globally popular as the demand for higher sample throughput in laboratories has increased. These benchtop systems fill the gap between standard handheld pipettes and fully automated liquid handling robots in terms of ease of use, productivity and affordability. In this article we discuss key features of 96- and 384 -channel benchtop electronic pipettes and highlight how INTEGRA's VIAFLO 96 system has provided a productive solution to a growing number of life science pipetting applications.

Introduction

For many years the possibility of using high throughput screening (HTS) to conduct a large number of chemical, genetic or pharmacological tests in parallel was limited to specialized facilities in the pharmaceutical and clinical diagnostic industry. In recent years, large numbers of sequencing projects have provided the scientific community with tremendous amounts of genetic information and in consequence with many new biochemical targets to research. Therefore the desire to run hundreds or even thousands of reactions in parallel has become much more widespread in laboratories around the globe.

When handling these increasing numbers of samples, the available pipetting equipment quickly becomes a limiting factor. Standard handheld multichannel pipettes obviously do not offer the necessary throughput. In such a situation, scientists have traditionally been driven to consider an investment in an automated liquid handling system. But because of the high cost of purchase and maintenance, as well as the necessary specialist knowledge to operate such devices, an automated liquid handling system is not the best solution for every laboratory. For many applications a 96- or 384-channel handheld pipette can offer a better choice. They combine the ease of use of handheld pipettes with the productivity and versatility benefits of automated liquid handling systems –beneficially at a price more labs can afford.

The following article briefly describes the experiences of two users to provide you with an idea how a 96-channel bench-top pipette can help to increase the productivity or improve the reproducibility in a typical life science liquid handling application. Further, we take a look at the operational functionality of 96- and 384-channel handheld pipettes, and highlight the key points you should look into when considering to purchase such a device.

Case Studies

Increase the productivity in an ELISA screen

A veterinary diagnostic lab tasked with testing faecal samples for the presence of specific steroids, had a typical workload of screening 150 plates per batch using an enzyme linked immuno assay. Performing the ELISA screen required multiple reagent additions and washing steps until the plates could be analyzed. Since no automation was available in the lab, the work was traditionally done with a manual 12-channel pipette or an 8-channel reagent dispenser, depending on the assay step. Simple coating or washing steps could be performed with the reagent dispenser but steps that included mixing or the stop reaction had to be done with the multichannel pipette. Processing 150 plates using the available technologies typically involved three members of the staff working each 2.5 hours.

Having invested in an INTEGRA VIAFLO 96 handheld pipette the same workload can now be completed in the same time by a single staff member. Using the repeat dispense function enabled the lab to fill eight 96-well plates in a row with only one aspiration step and eight subsequent dispenses with either coating buffer, assay buffer and wash solution. Mixing is performed automatically. Members of the lab enjoy the fact that using the VIAFLO 96, they spend much less time pipetting and less time cleaning the tubing of the reagent dispenser while increasing their screening throughput.

Improving reproducibility in Real-time PCR

A clinical diagnostic lab was tasked with screening patient samples for the presence of disease markers by gene expression analysis. Pretreated patient samples from a 96-well plate source were transferred to the target PCR plate, then the PCR master mix was added and the reaction was subsequently analyzed by real-time PCR. The lab traditionally processed around 100 plates per day and the work was all done using 12-channel pipettes. Manually filling a 96-well plate, including changing of pipette tips after every sample transfer, was acknowledged to be a time consuming task and transferring the samples often proved to be prone to error.

Today an INTEGRA VIAFLO 96 is used to both load the patient samples into the plates and to transfer the PCR master mix to the reaction plate. The work is now done in half the time, but time savings are not the most important aspect for this lab. More important are two other improvements. Transfer mistakes from plate to plate have been eliminated and also the light-sensitive PCR master mix is now exposed to daylight only for a few seconds prior to the reaction, as all wells can be processed at the same time. According to a lab member, the VIAFLO 96 has increased accuracy, robustness and precision of the assay in comparison to the use of manual 12 channel pipette.

Features to consider when specifying a 96-/384-channel pipette

Applications beyond simple plate to plate transfers

96- or 384-channel pipettes are invaluable for applications in which all channels are used simultaneously, such as starting 384 enzymatic reactions in parallel, transferring samples from one plate to another, distribution of buffers or cells from reservoirs into microplates, or reformatting 96-well plates into a 384-well

format or vice versa. On top of this, some 96-/384-channel pipettes also allow partial loading of individual columns and rows of the pipetting heads. This can be a really nice add-on, especially when you need to perform serial dilutions. So make sure the device comes with a solution to index a plate for rows or columns so you can perform dilutions in a portrait or landscape way.

Electronic pipettes offer additional functionality

The advantages of electronic versus manual pipettes with regards to user friendly ergonomics and reproducibility of the pipetting results, are widely acknowledged and offered by most pipette manufacturers. But some electronic 96-/384-channel pipettes offer a set of further features, which manual versions can not provide. Manual 96-channel pipettes are limited to simple neat liquid transfers, whereas electronic devices support functionalities like automatic mixing of serial dilutions, repeat dispense for aliquot dispensing into multiple plates (Fig. 1 and 3) or controlled dispensing speeds for viscous liquid.

The INTEGRA VIAFLO 96/384 goes even further by allowing you to automate more elaborate protocols, like for example the serial dilution of an entire well plate. These protocols can be saved on the unit and recalled anytime.

Filling of ten 96-well Plates

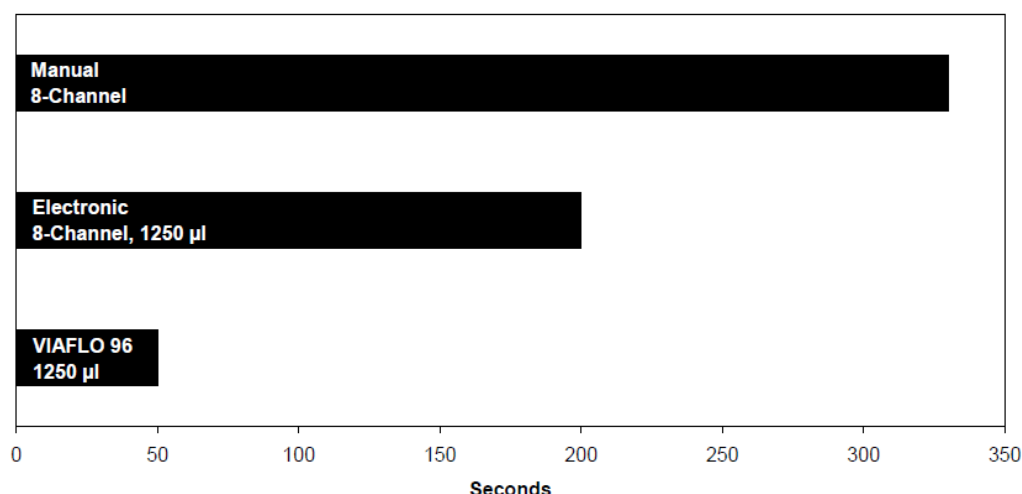


Figure 1: Filling of ten 96-well microplates with 150 µl buffer per well is a typical but time consuming procedure using a multichannel pipette. An electronic 96-channel pipette using repeat dispense mode, allows users to perform this task in less than 50 seconds, which is 75% faster than the electronic multichannel pipette.

Accuracy and precision requirements

Make sure your pipette is not limited to a single volume range. It is a physical fact that the precision of air displacement pipettes is afflicted by large variation when pipetting below 10% of the maximal working volume. What might be good for handling media in cell cultures or when washing cells with buffer, is not optimal for setting up a PCR reaction and running other biochemical assays. The INTEGRA VIAFLO 96/384 allows you to easily exchange the pipetting heads on the same instrument (Fig. 2): a choice of different working volume ranges allow you to pipette from 0.5 – 1250 µl with optimal accuracy and precision.

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96 or 384 channels

The drive for higher sample throughput and the urge to cut cost per reaction looks set to continue. Today your lab might still be working in 96-well formats, but tomorrow you maybe want to switch to 384-well plates. If you see a need to work with 384-well plates down the road, it might be better to buy a pipette which can work with both 96- and 384-channel pipetting heads. If you worry about the higher cost for such a device, at least make sure your 96-channel pipette has a convenient indexing functionality for 384-well plates and provides a way to work precisely with volumes between 0.5 to 50 μ l.



Figure 2: Convenient exchange of a pipetting head.



Figure 3: Repeat Dispensing allows quick filling of multiple plates.



Figure 4: Pipetting in a laminar flow hood.

Easy Handling

A 96-/384-channel electronic pipette should be as easy to use as standard handheld manual pipettes. It should allow you to intuitively control the device by hand-eye coordination and not require any prior programming or special skills of the user. The INTEGRA VIAFLO 96/384 takes this concept a step further, as all movements of the pipette are assisted by servo motors, which results in a completely effortless and ergonomic workflow.

Mobility and Space Requirements

The modern generation of 96- and 384-channel electronic handheld pipettes typically do not occupy more than 50 x 50 cm of bench space, which is a much smaller footprint than most commercial automated liquid handling systems. As a result, using 96-/384-channel electronic pipettes frees up valuable space on your work bench and enables them also to easily fit and be used in a laminar flow hood (Fig. 4). You might not need to work sterile today, but be sure to have the option to do so in the future.

Costs

96- and 384-channel handheld electronic pipettes are a truly cost effective way to increase sample throughput and reduce manual labor without the need to invest into complex laboratory automation. Entry models are available starting from around 15'000 €, which is a fraction of the purchase cost of a fully automated system. Beneficially 96-/384-channel handheld electronic pipettes also lower running costs, as they do not require extensive training of personnel or involve any expensive maintenance contracts.

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Electronic 96-/384-channel pipettes can also be calibrated using a photometric procedure, a method that can be carried out in most labs.

Conclusion

In this article we have sought to introduce to you the many benefits that 96- and 384-channel handheld electronic pipettes have to offer. If you have a liquid handling application where you are looking to improve its reproducibility or enhance the productivity please visit the INTEGRA website for further information on the VIAFLO 96 or VIAFLO 384 handheld electronic pipettes. Alternatively before choosing a 96- or 384-channel pipette you may wish to try it out under your own laboratory conditions – please contact INTEGRA to discuss an evaluation.

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