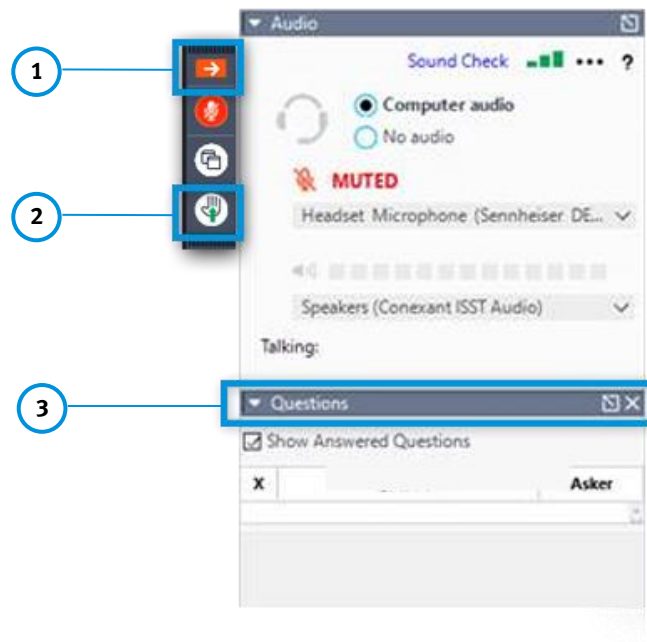


Welcome to the **Life Science Webinar**

Liquid Handling:
Control small volumes of liquid
precisely and efficiently



Notes for your participation in the webinar



- 1 Your control panel**
Click on the red arrow on the right-hand side of the screen to make it visible.
- 2 Show of hands for open discussion at the end of the session**
With a click on the hand signal you will be unmuted, called up and can participate in the open discussion.
- 3 Do you have questions during the session?**
You can ask them at any time under the marked tab "Questions".



Note:

The session is recorded. The recording will include the transmission and the audio of the speaker. Your questions or personal data will not be recorded.

Liquid Handling: control small volumes of liquid precisely and efficiently

Our specialists will discuss the principles and advantages of a pressure over liquid approach and present brand new solutions from Festo that will make your liquid handling more precise, efficient and flexible.

Wednesday 16 June, 3:30 – 4:30 pm CET



Lars Zimmermann

Sales Engineer

LifeTech



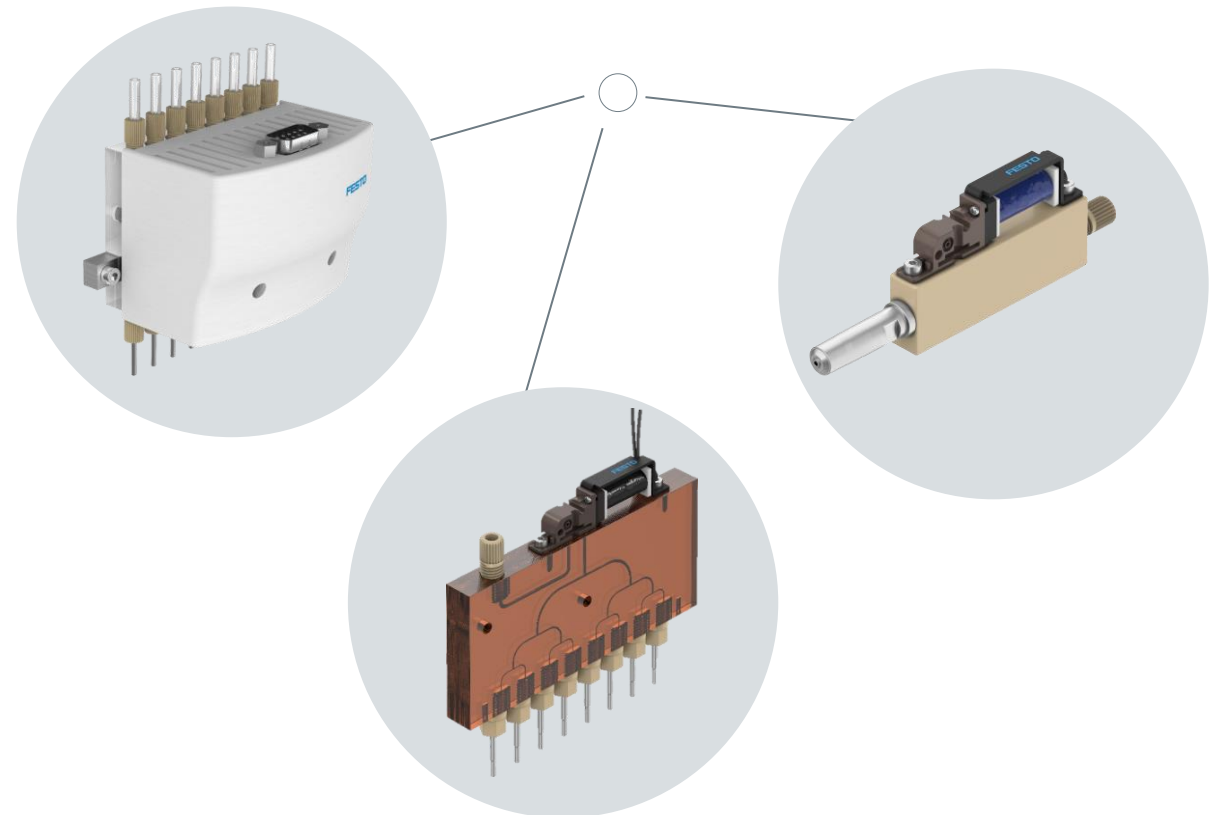
Johannes Lang

Product Manager

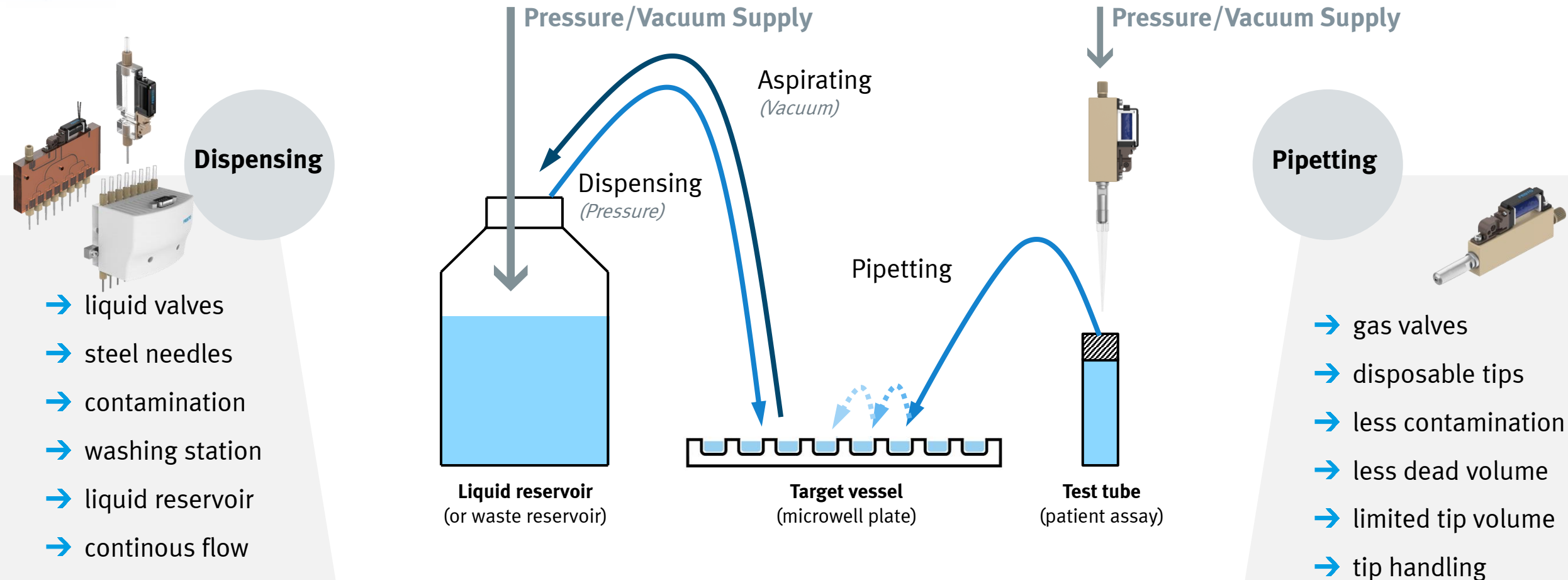
LifeTech

Agenda

- Basics: Dispensing/Aspirating and Pipetting
- Volume, Precision and Accuracy
- Principle of pressure over liquid
- Dispensing and Aspiration Solutions
- Pipetting Solutions
- Handling of samples
- Conclusion



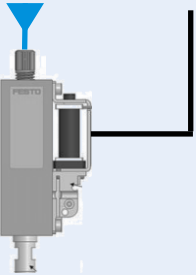
Just a reminder of the basics of liquid handling!



Your needs

Volume (1 µl)

Pressure / Time



Disturbances

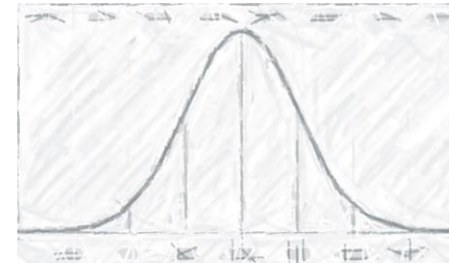
Temperature
Humidity
Evaporation
Viscosity
Length of Tube
Water column
...



Precision (1% CV)

Coefficient of Variation

$$c_v = \frac{\sigma}{\mu}$$



Correlations

Precision
Accuracy
Repeatability

Precision and Accuracy

What is the difference?



Precision

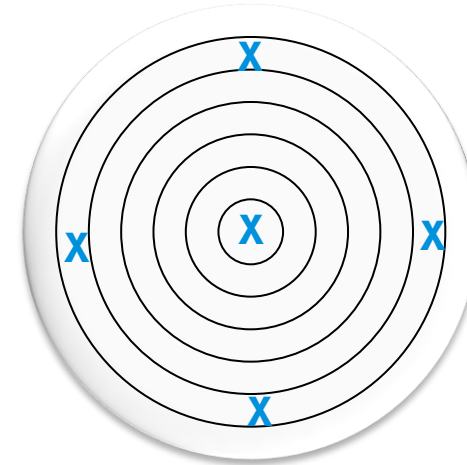
Accuracy

Poll question



Please look at this picture – does this show precision or accuracy?

- Precision
- Accuracy



Precision and Accuracy

What is the difference?



Precision

Accuracy



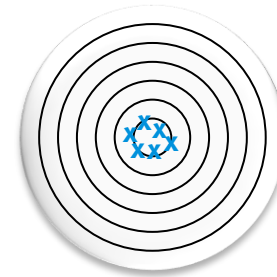
Precision

Accuracy



Precision

Accuracy



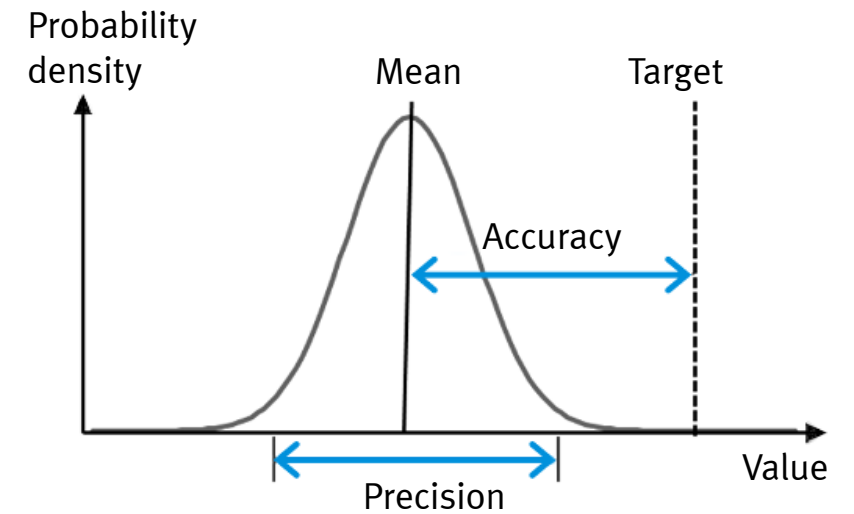
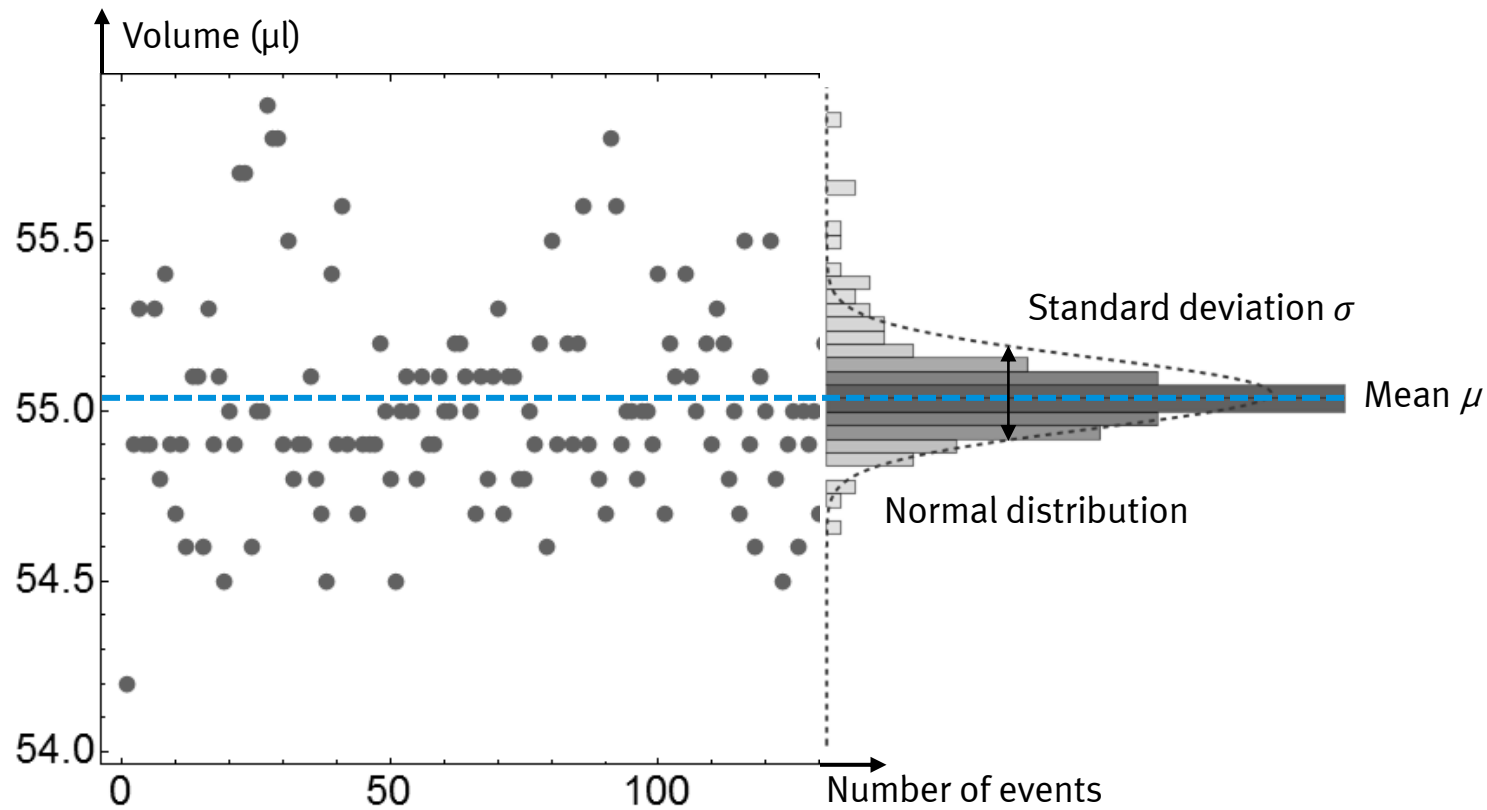
Precision

Accuracy

→ **Precision is more important: The system operates in the same way every time.**

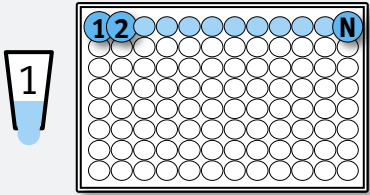
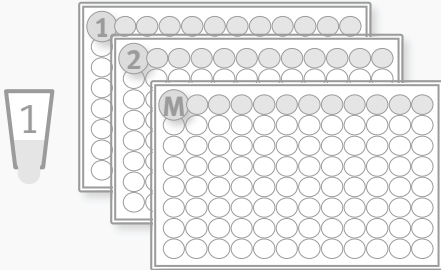
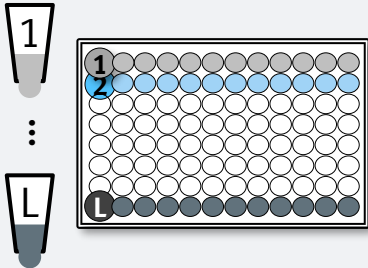
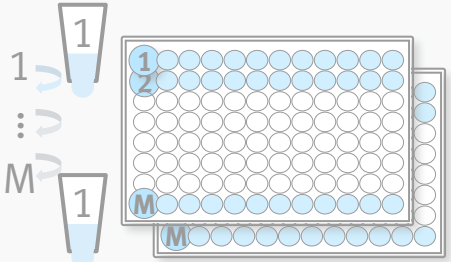
Precision and Accuracy

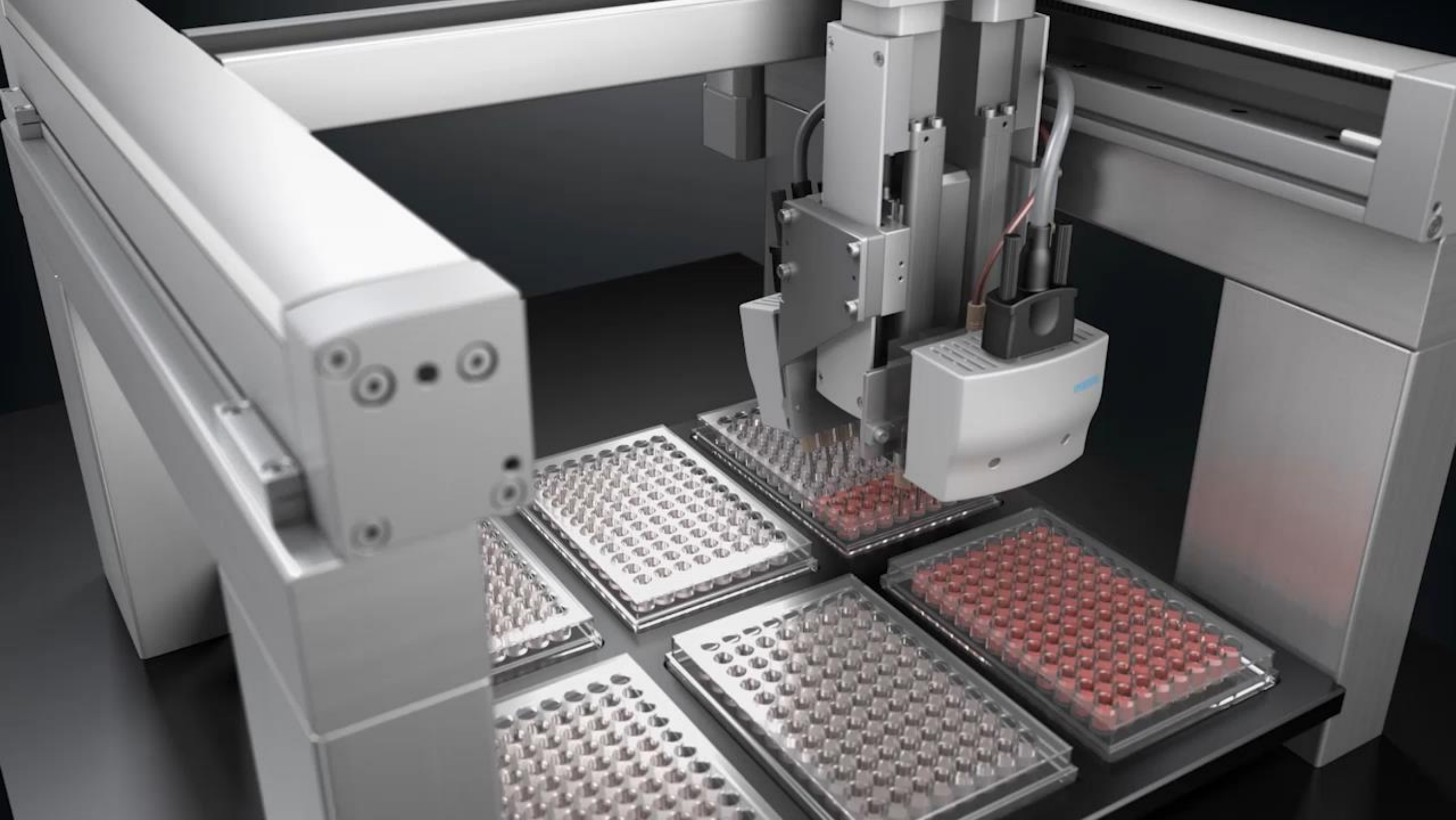
Analysis of measurement results on the gravimetric test stand



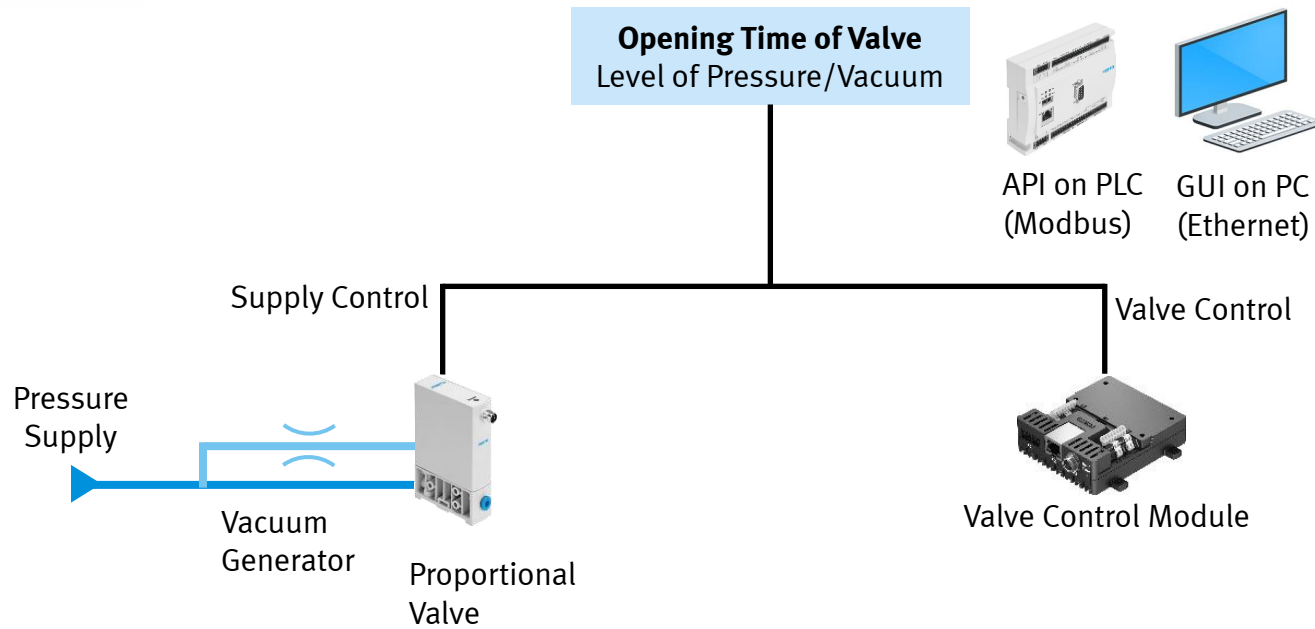
„CV is important!” – But which CV do you mean? And what should be considered?

Different views on CVs (Coefficient of variances)

Intra Run	Inter Run	Tip-to-tip	Load-to-load
 <p>N dispenses</p>	 <p>M runs</p>	 <p>L tips</p>	 <p>M runs, K plates</p>
N	$N \times M$	$N \times L$	$N \times M \times L \times K$
<ul style="list-style-type: none"> • Repeatability • Principle sources of error 	<ul style="list-style-type: none"> • Stability • Reproducibility of runs • Pause time effects 	<ul style="list-style-type: none"> • Errors due to dispensing channel variances • Fabrication tolerances 	<ul style="list-style-type: none"> • Errors due to loading operations • Reproducibility of loading operations • Malfunctioning of loading operations

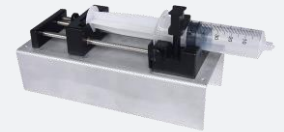


Volume: Pressure-over-Liquid principle for Pipetting – Supply & Control

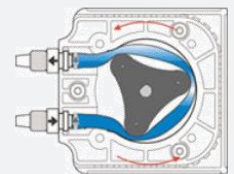


Other common
approaches

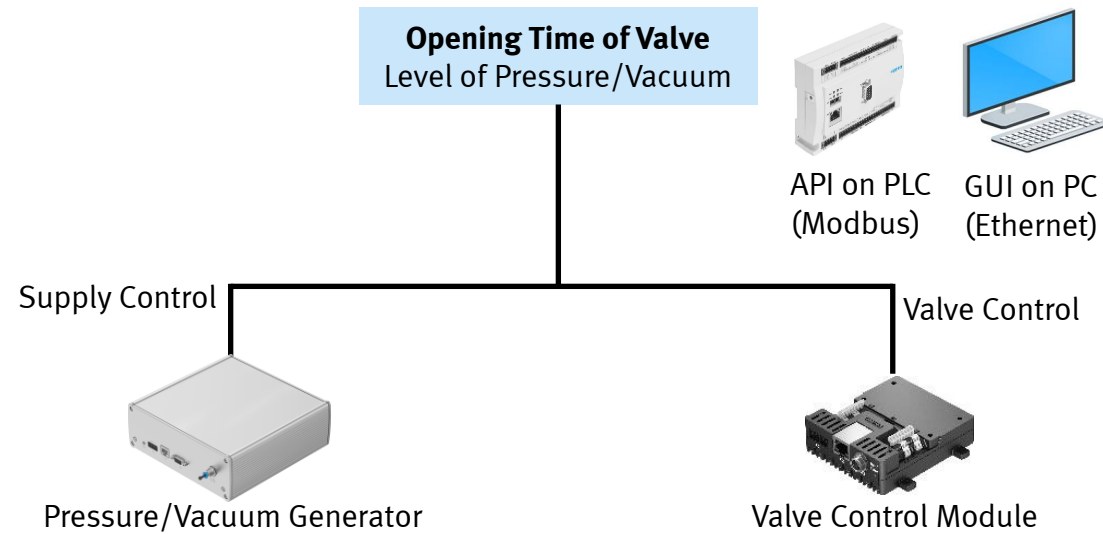
Syringe
pumps



Peristaltic
pumps

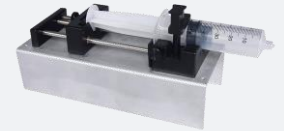


Volume: Pressure-over-Liquid principle for Pipetting – Supply & Control

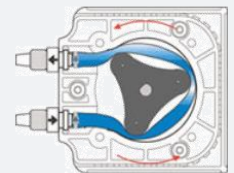


Other common approaches

Syringe pumps



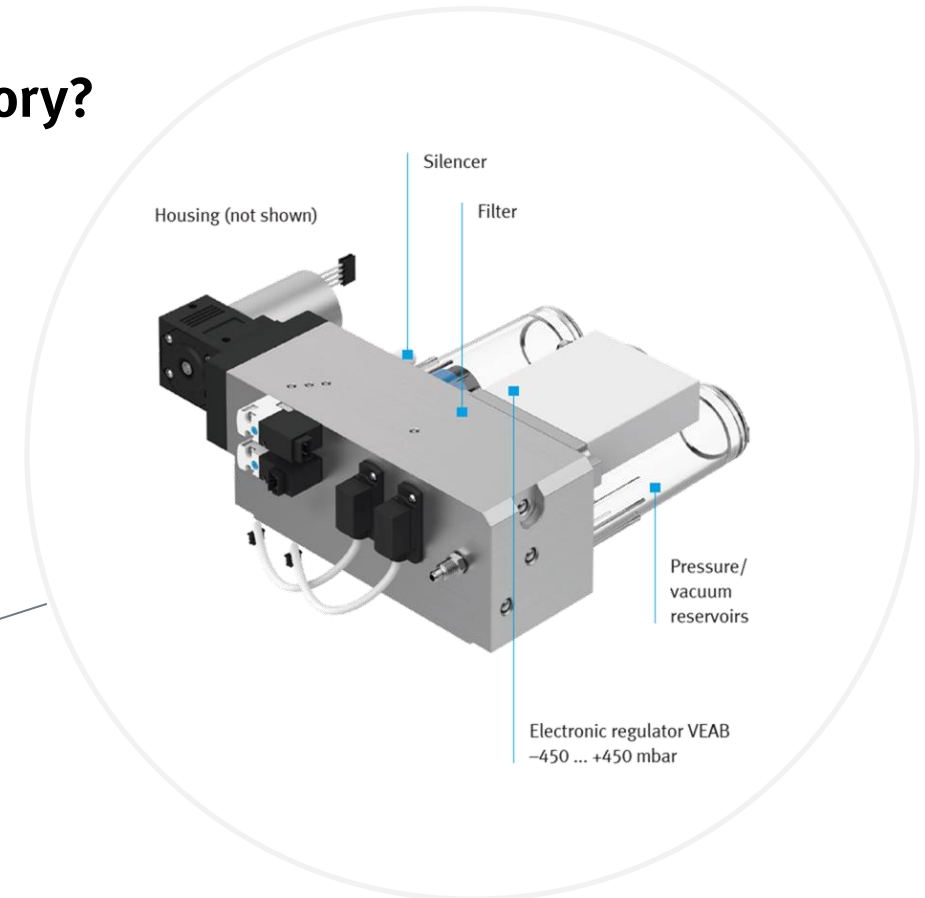
Peristaltic pumps



You don't have a pressure and vacuum supply in your laboratory?

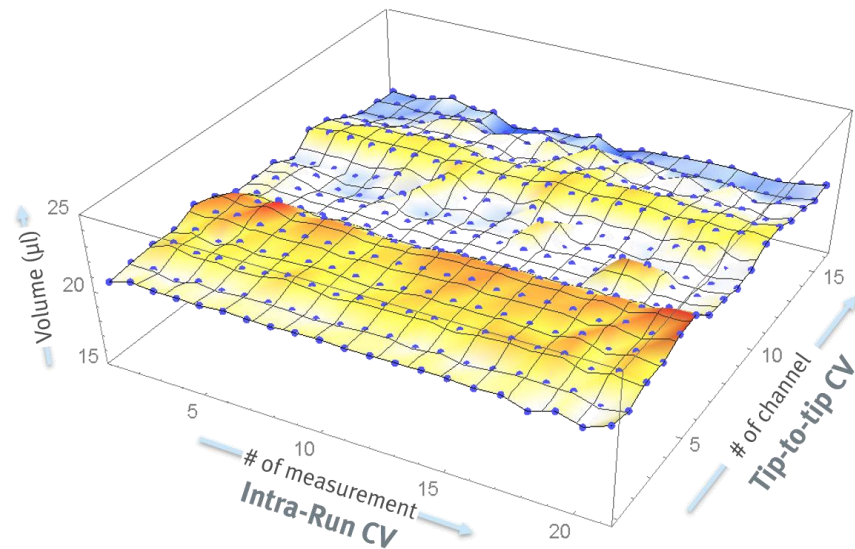
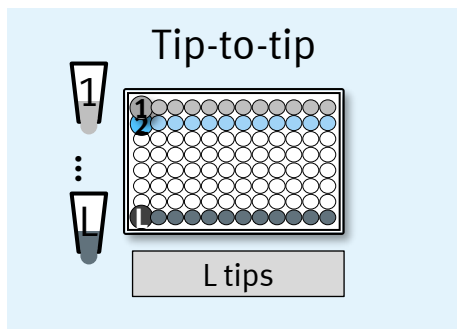
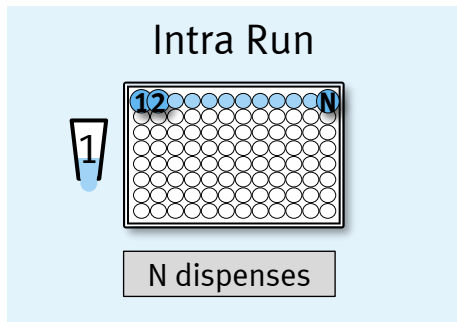
No problem! Just use a mobile pressure/vacuum generator

- air supply from -500 to 500 mbar
- proportional air controller
- 24 V power supply
- integrated digital output
- bus communication
- easy commissioning



Performance

Photometric analysis of multi-channel dispense head VTOE with improved performance by valve control module VAEM

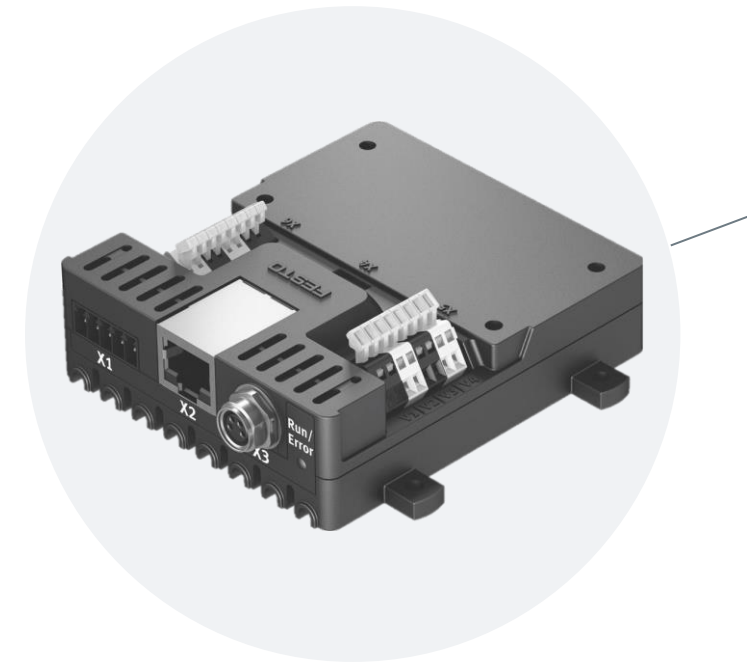
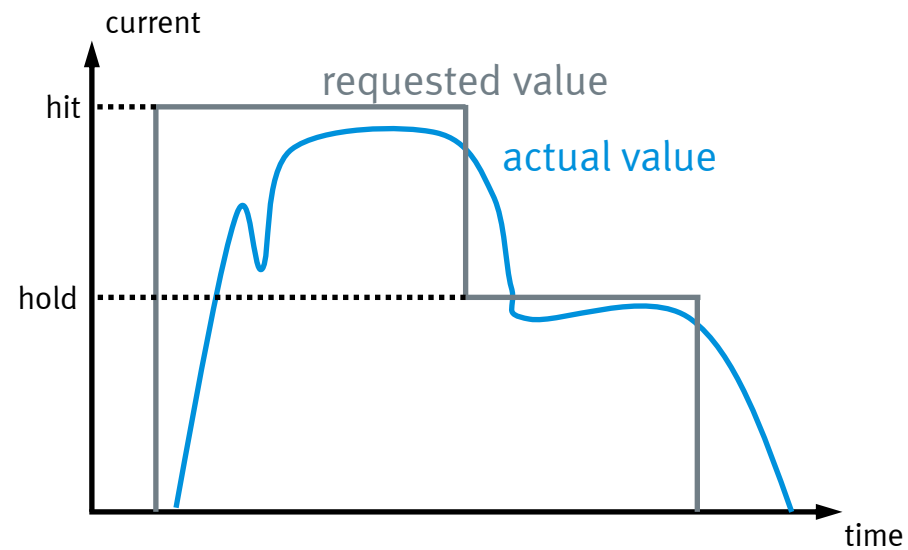


Performance with direct valve control
→ tip-to-tip about 4% CV

Valve Control Module VAEM

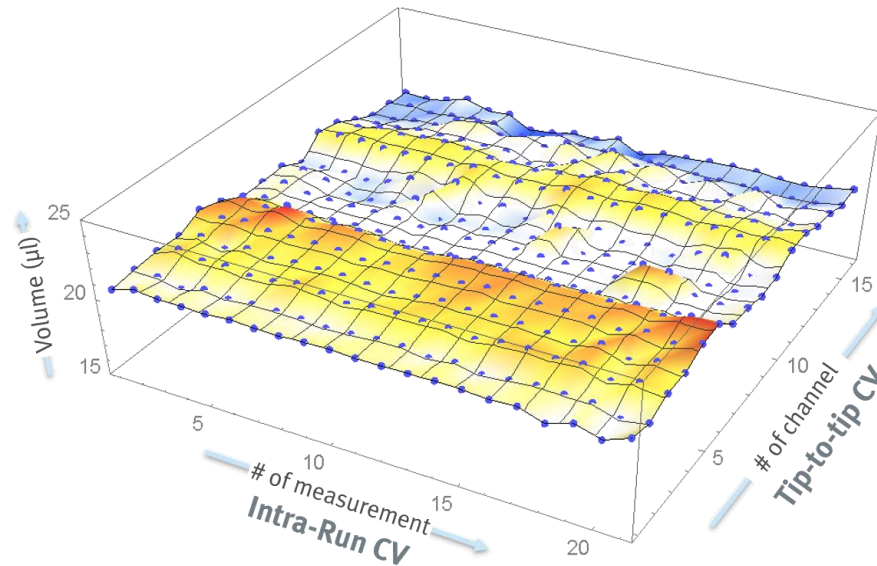
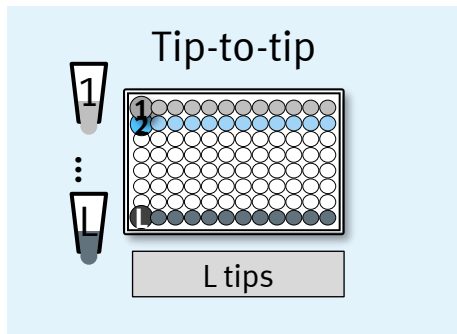
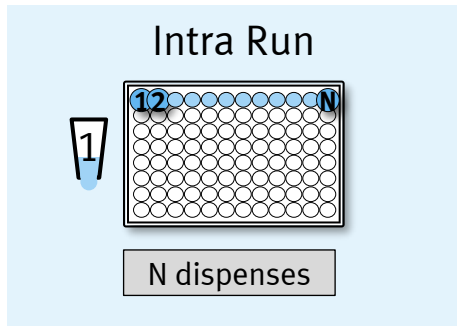
8-channel hit-and-hold actuation for solenoid valves

- short cycle time of 0,2 ms
- individual control of 8 valves
- current control
- hit and hold function
- bus communication
- easy commissioning

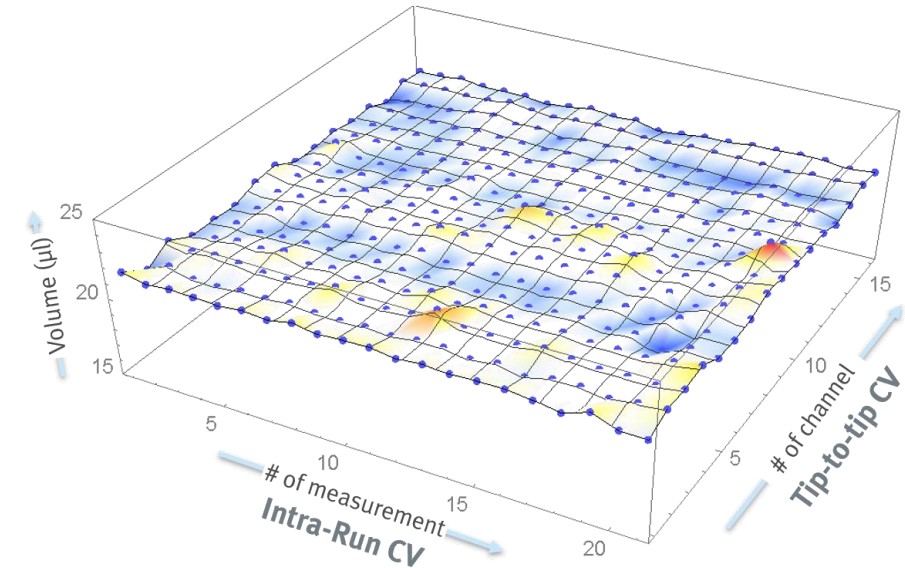


Performance

Photometric analysis of multi-channel dispense head VTOE with improved performance by valve control module VAEM

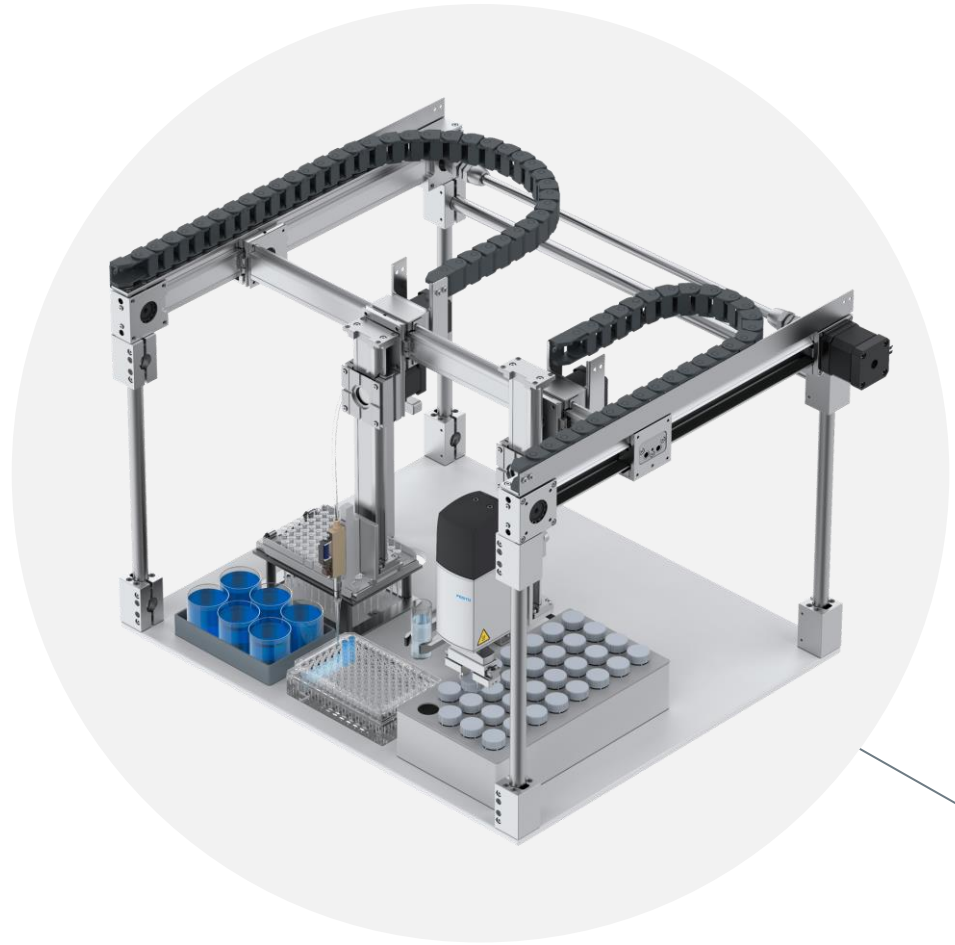
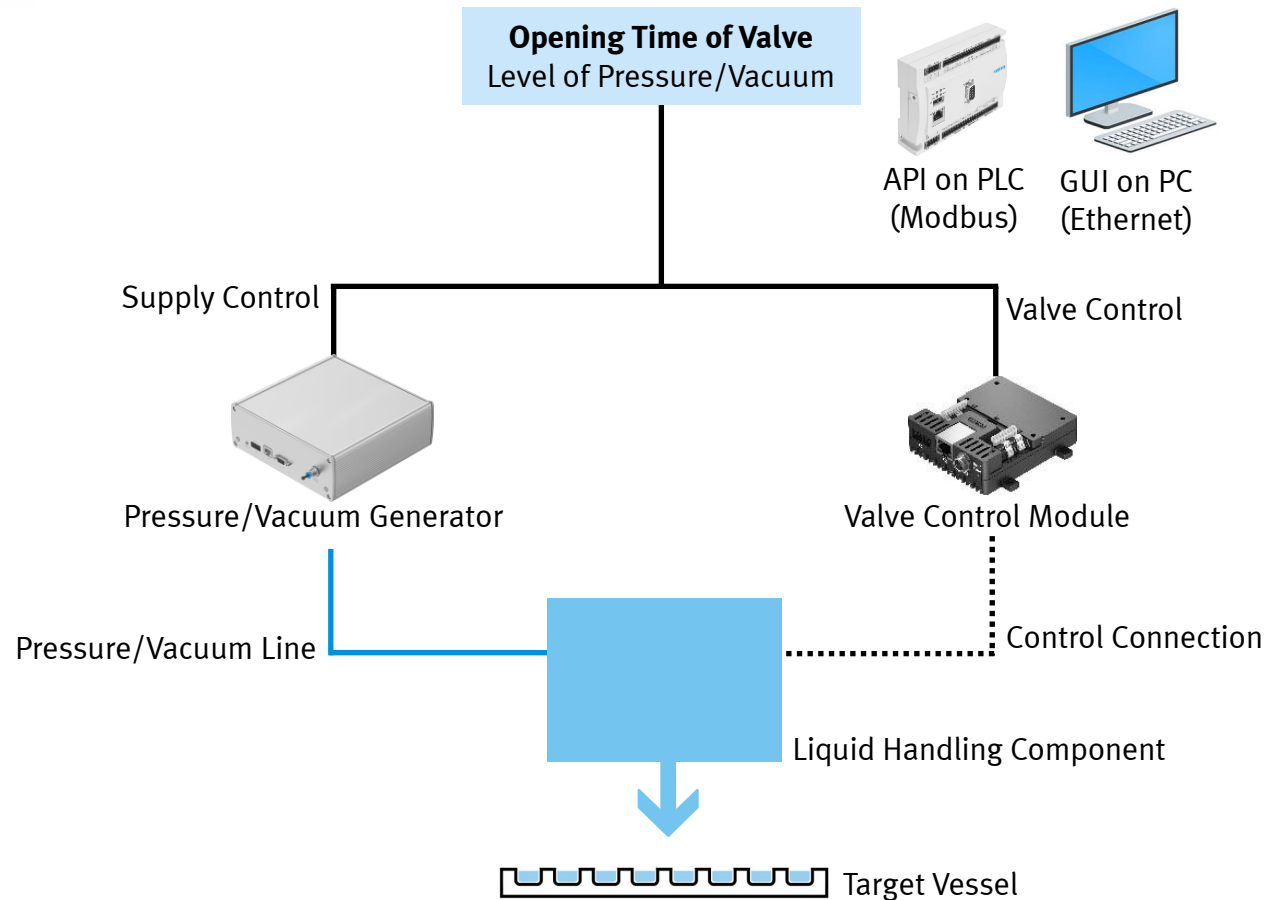


Performance with direct valve control
 ➔ tip-to-tip about 4% CV



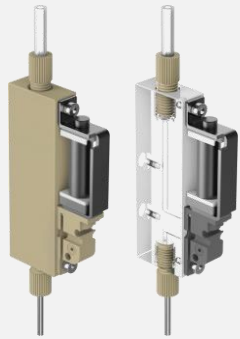
Performance with valve control module
 ➔ tip-to-tip down to 1% CV

Volume: Pressure-over-Liquid principle



Portfolio for Dispensing/Aspirating and Pipetting

Dispensing and Aspirating with VTOx Dispense Heads



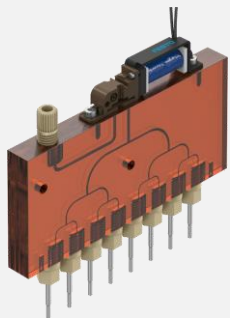
VTOE



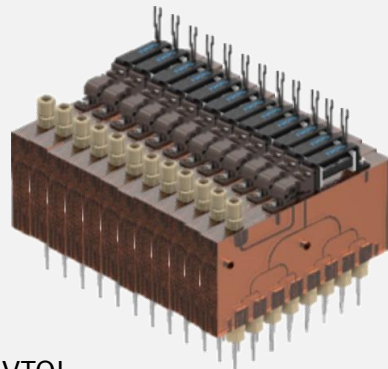
VTOE-8



NLFA + VAVN
Fittings & Needles

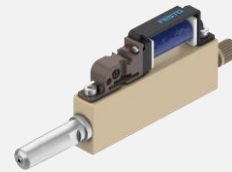


VTOI



VTOI

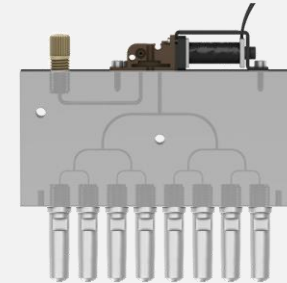
Pipetting with DHOx Pipette Heads



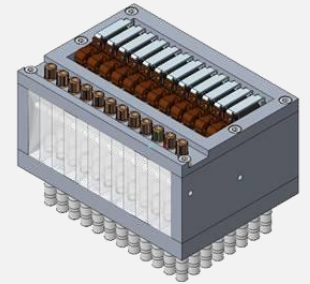
DHOE-1



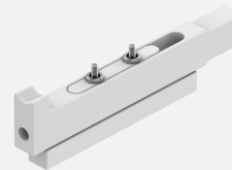
DHOE-8



DHOI



DHOI

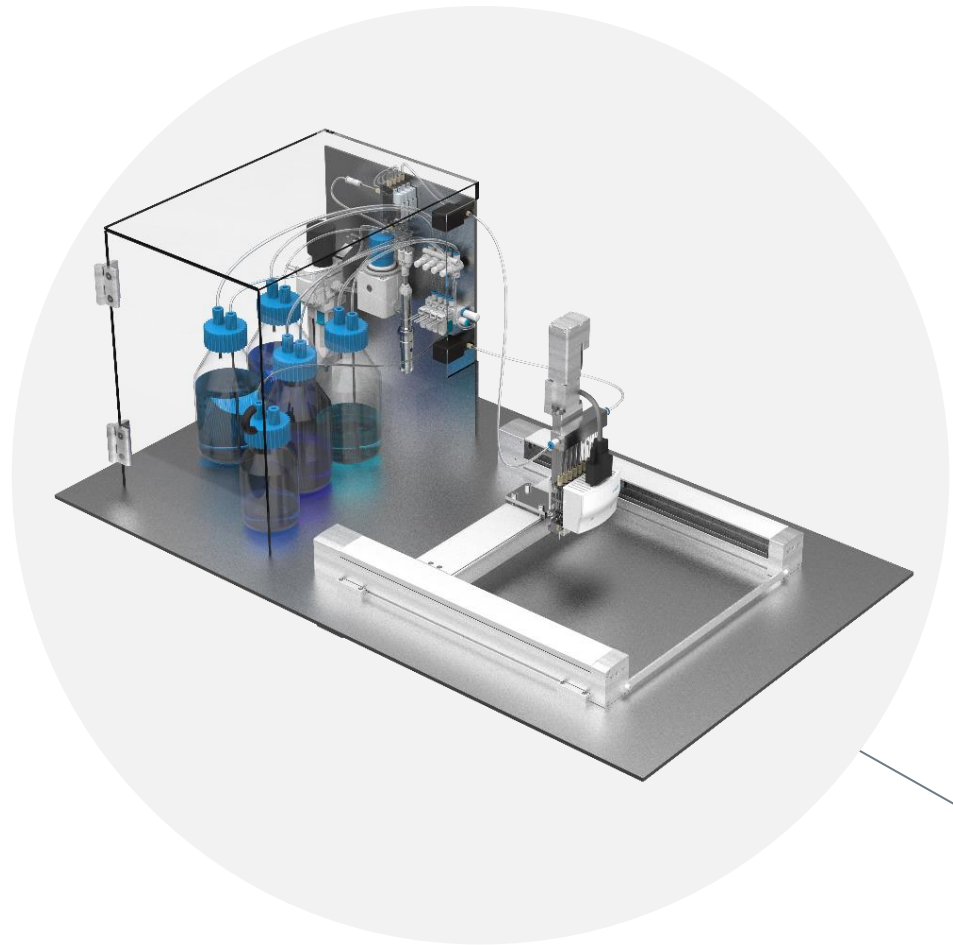
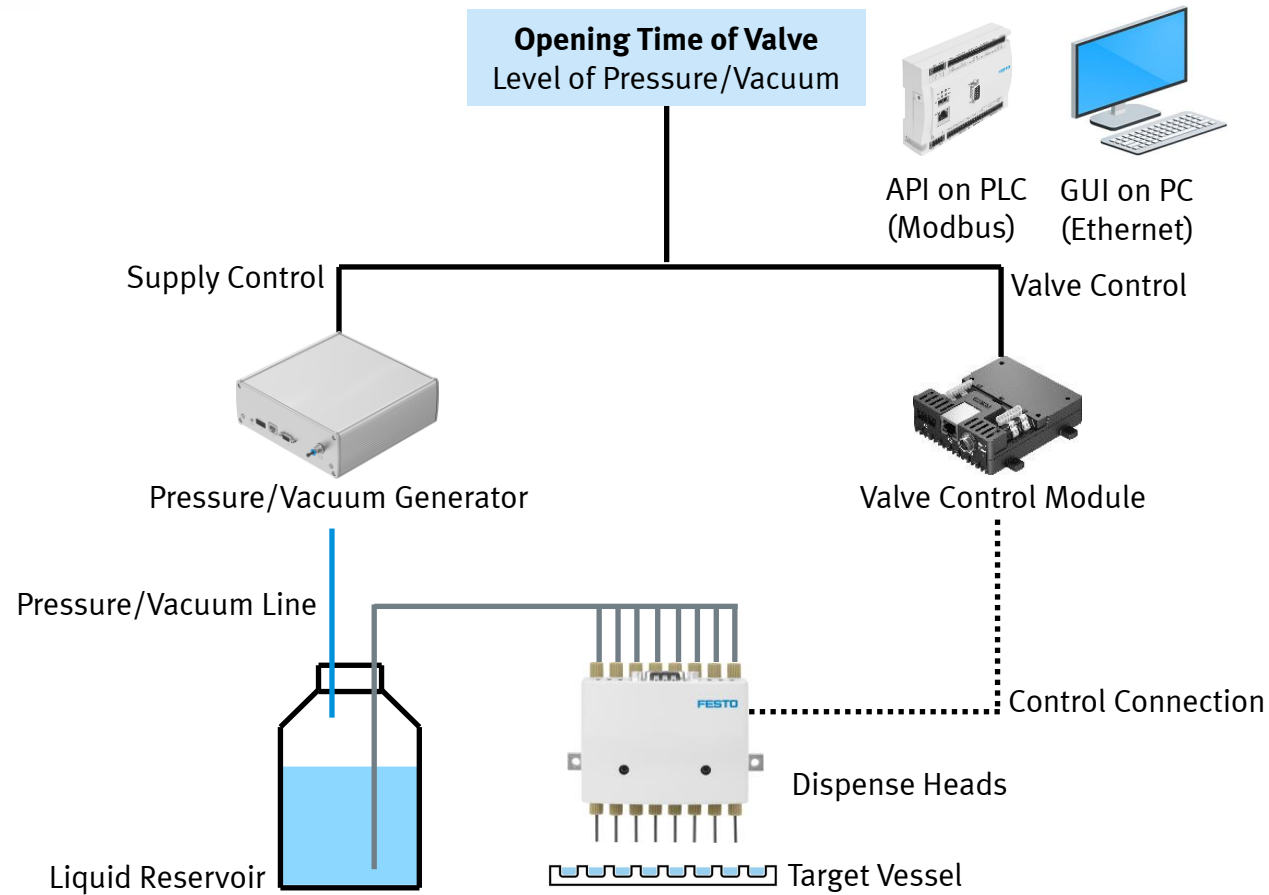


DHAO-EJ
*Disposable Tip
Ejector*



DHAP-DP
Disposable Tips

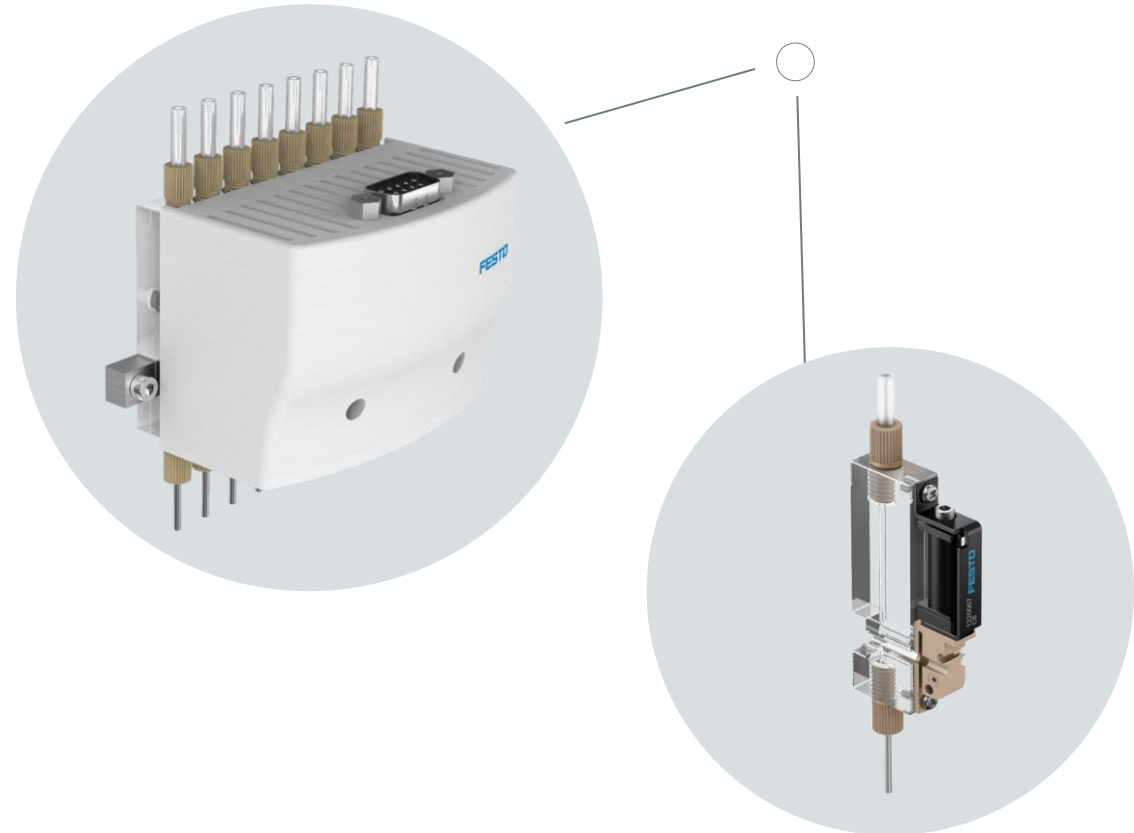
Pressure-over-Liquid principle for Dispensing and Aspirating



You need parallel dispensing of different volumes up to continuous flow?

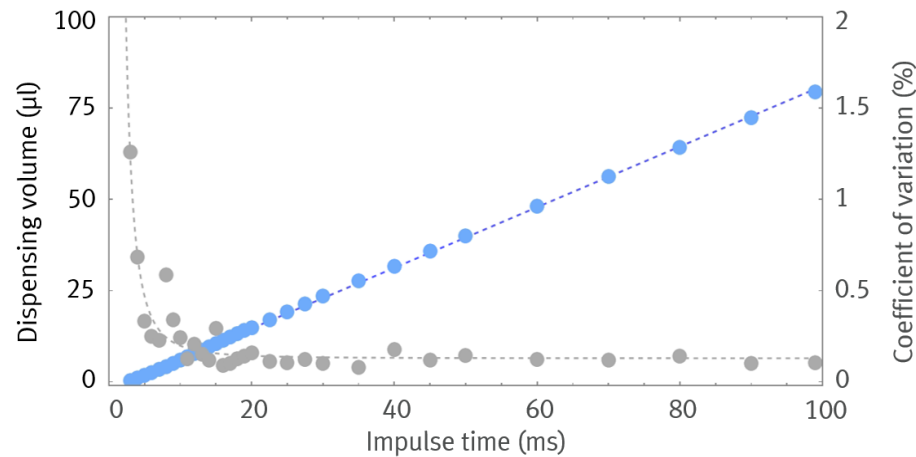
The Dispensing Head supports you!

- independent single channel control
- individual filling quantities from 1 μ l
- max. dispensing speed up to 1,25 ml/s
- highest precision down to 1 % CV
- chemical resistance
- easy integration
- 9 mm pitch



Challenge the results from the gravimetric test bench!

Precision and linearity of individual opening times



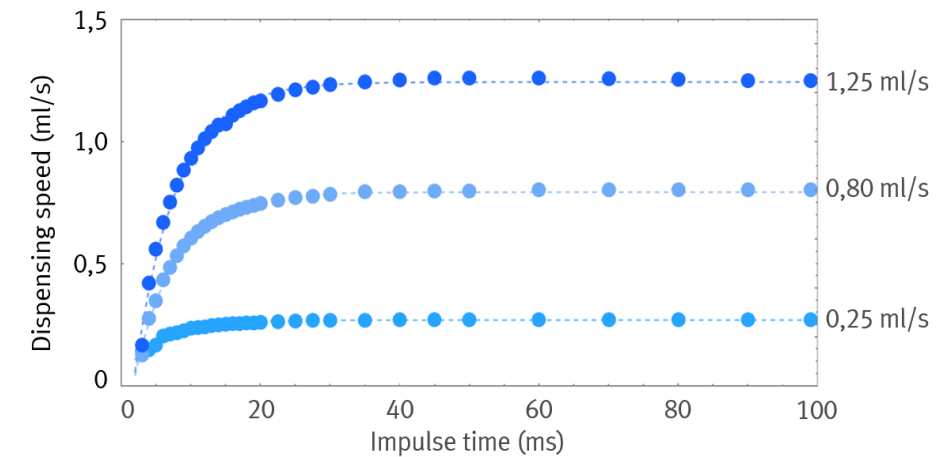
Test Setup

- pressure supply 300 mbar
- room temperature 23 °C
- aqueous solution (water)
- 24 V without hit/hold function

Chart

- Volume in µl
 - Precision in % CV
- (needle inner diameter 0,60 mm)

Different dispensing speeds from various needles

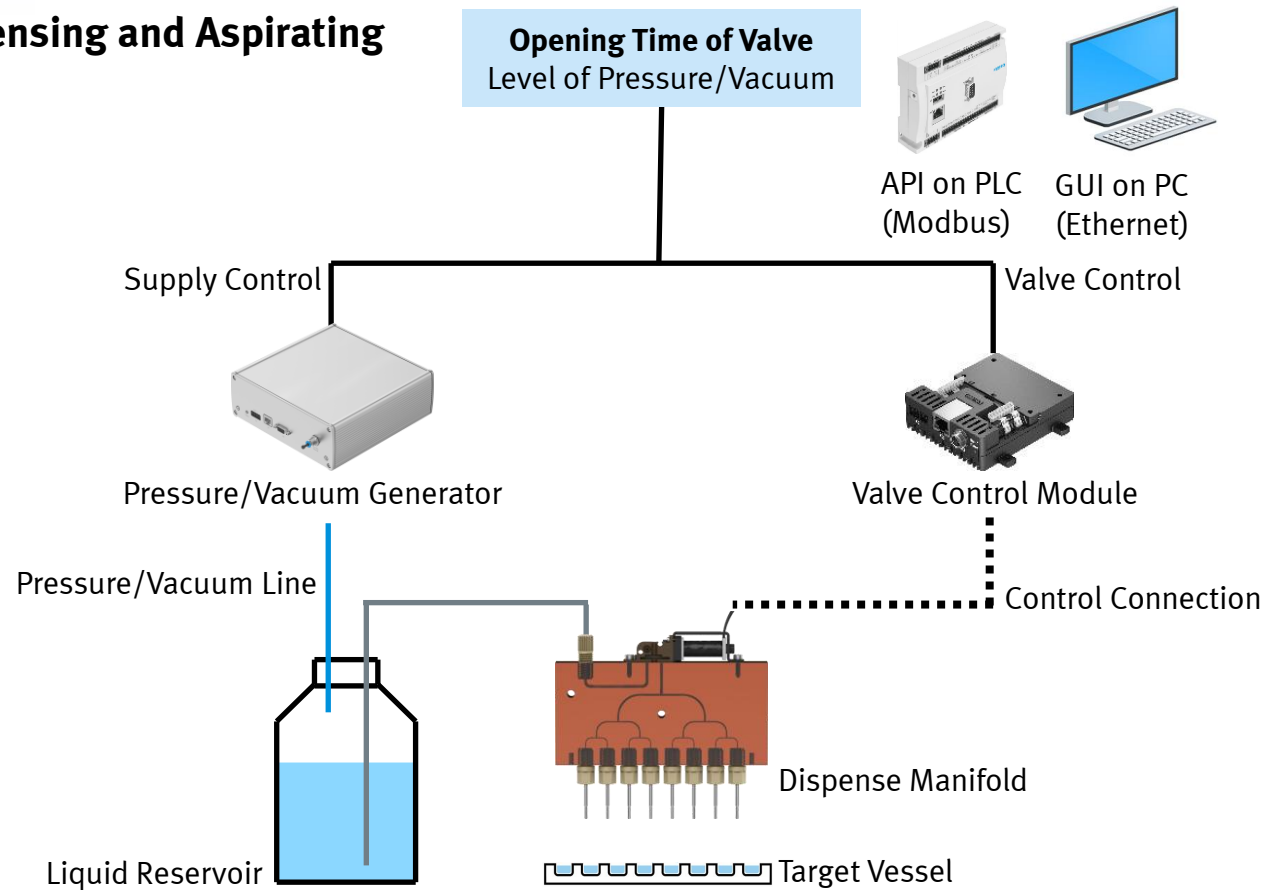


Chart

- needle inner diameter 0,32 mm
- needle inner diameter 0,60 mm
- needle inner diameter 1,00 mm

Pressure over Liquid

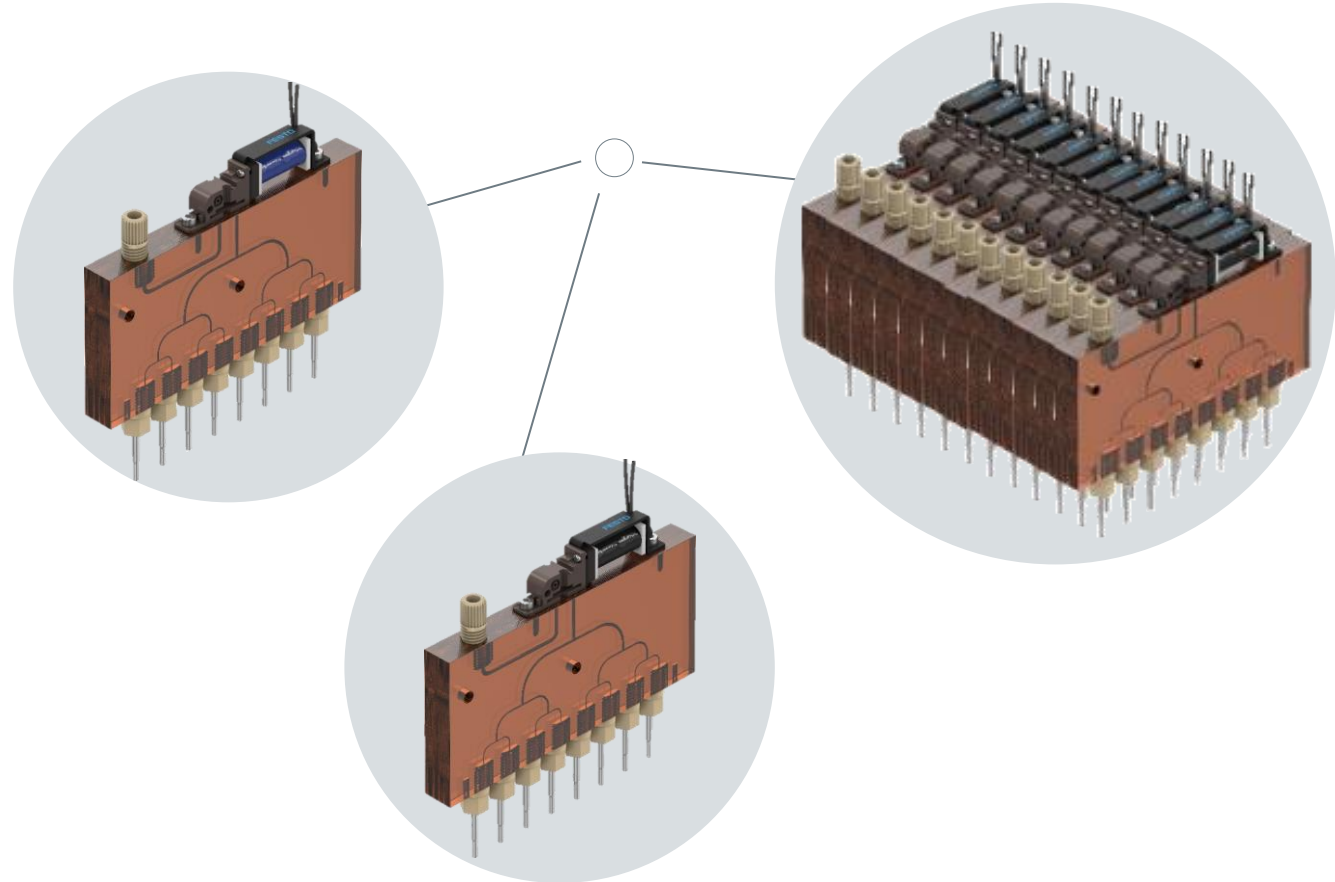
Dispensing and Aspirating



You need increased throughput for equal dispensing volumes?

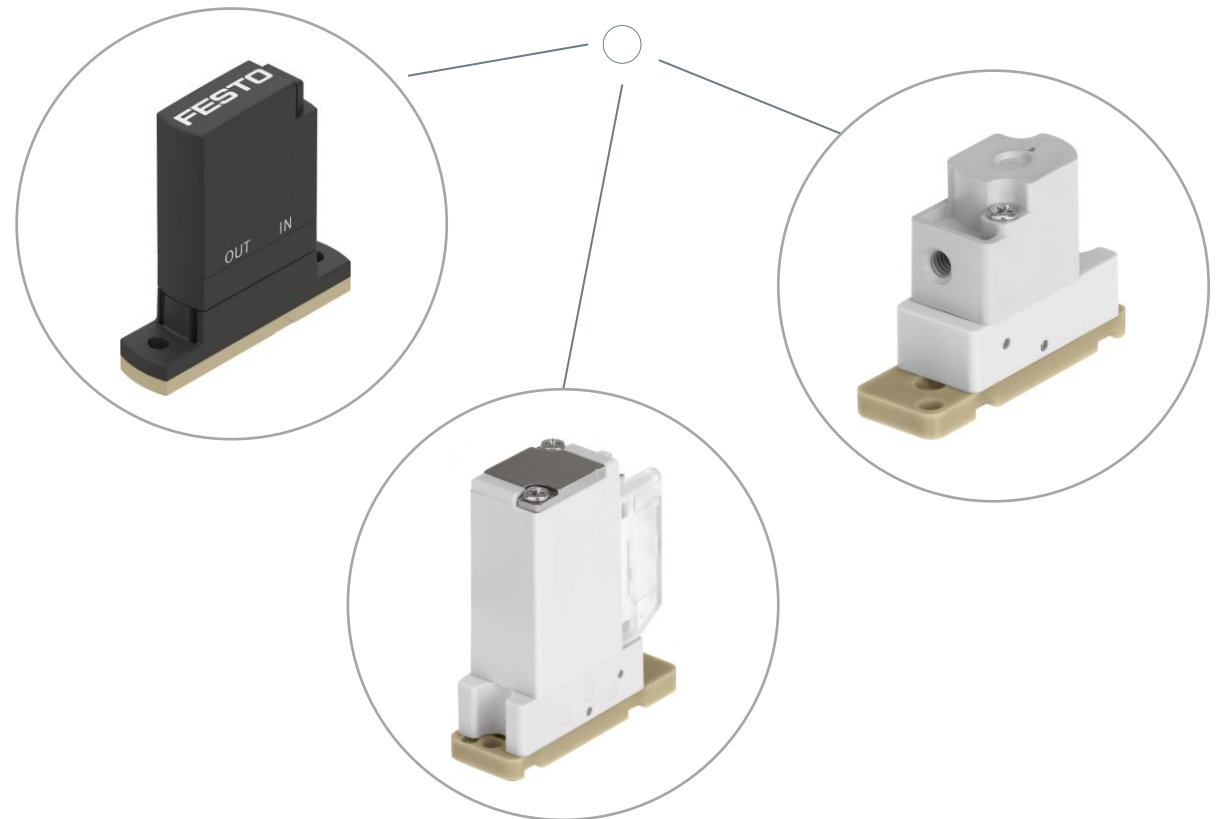
The Dosing Head VTOI can help!

- one valve for 8 channels
- side-by-side mounting
- 9 mm pitch for microplates
- 96 wells with only 12 valves
- tip-to-tip down to 2 % CV



Media-separated solenoid valve VYKA & VYKB and pneumatic valve VZDB

- Media separation
- Small footprint and compact design
- Low internal volume / Good flushability
- FDA listed materials
- Hit-and-hold function / Low heating-up effect
- Pneumatic actuated version

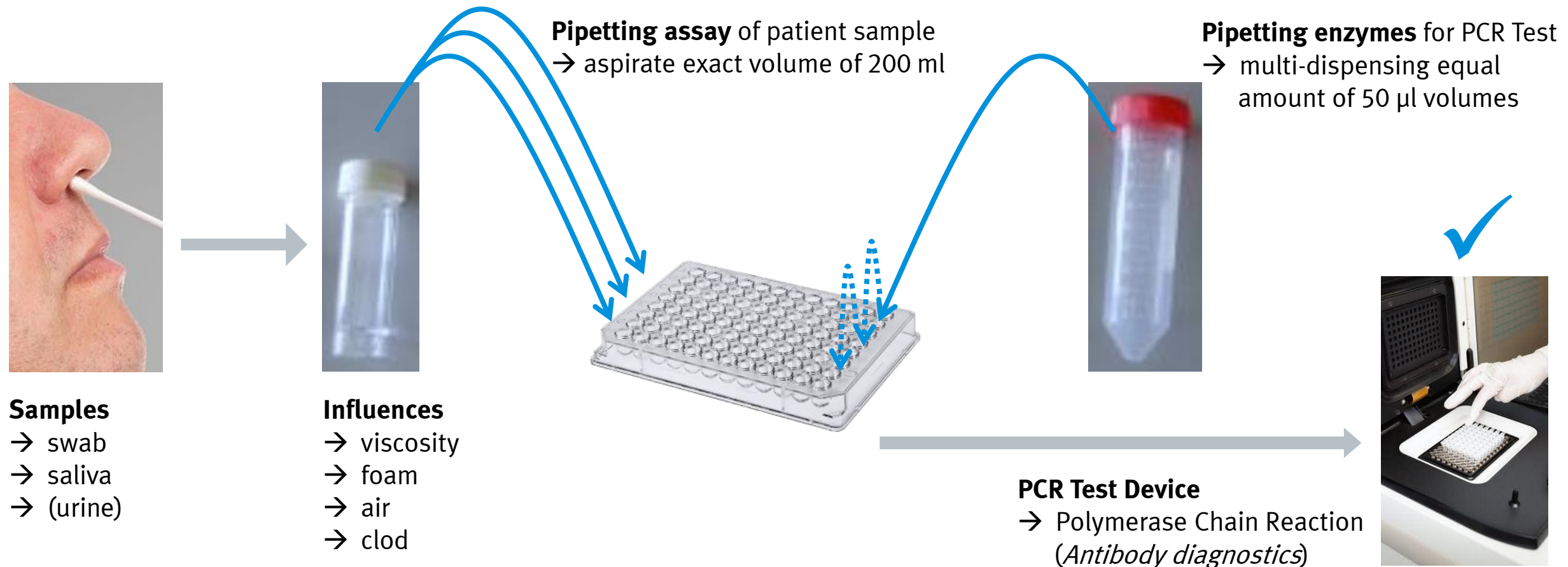


Christian Sampedro

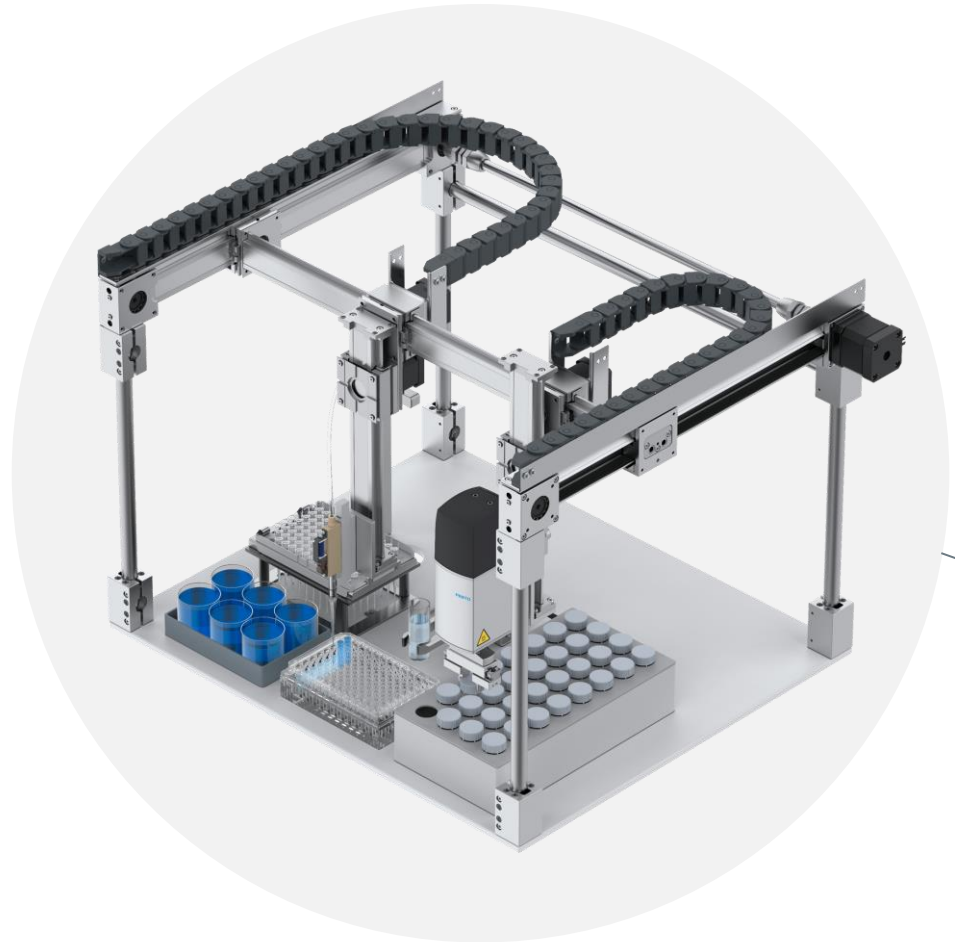
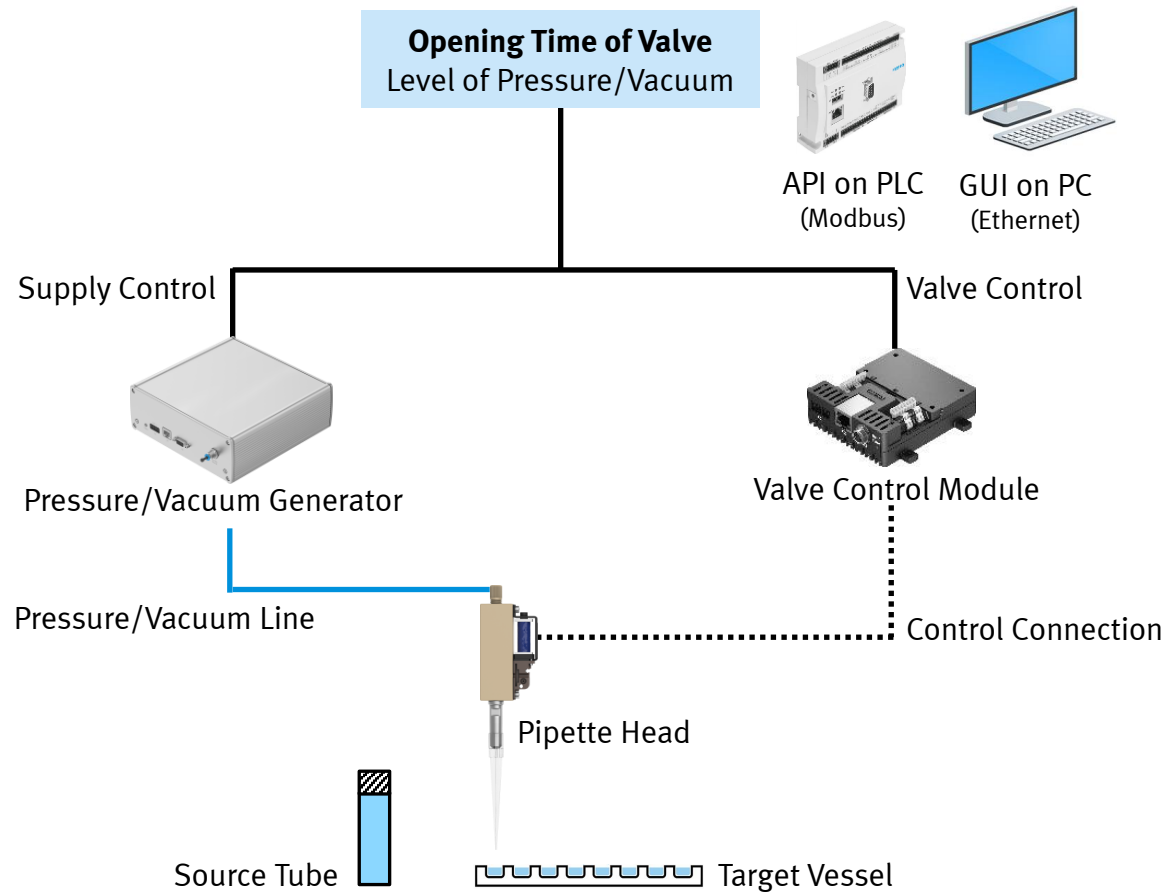
Product Manager
Liquid Handling



How runs the liquid handling process of sample preparation?



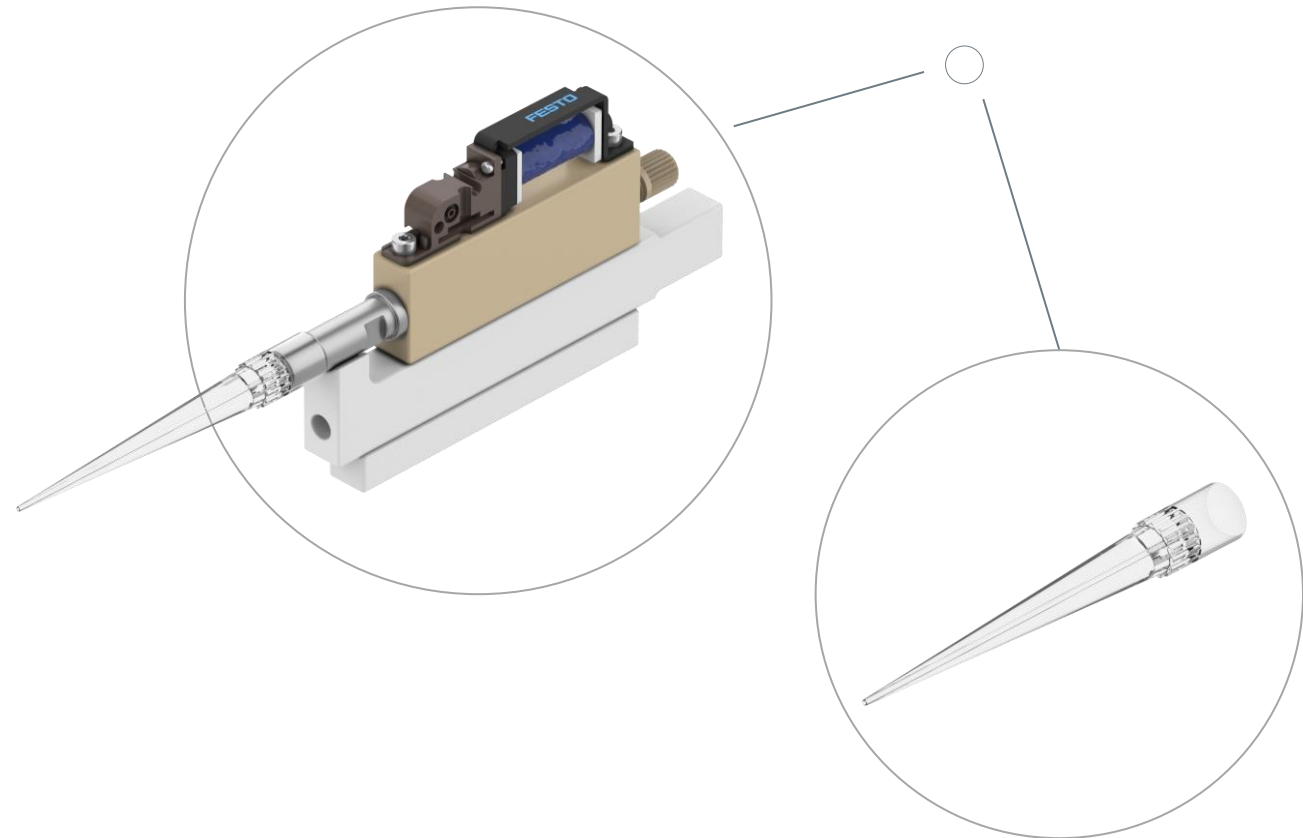
Pressure-over-Liquid principle for Pipetting



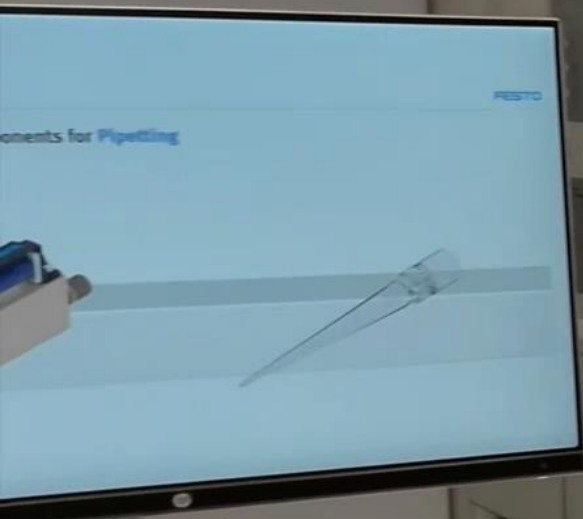
You have unique patient samples and must avoid contamination?

The Pipette Head DHOE supports you!

- high throughput up to 10 ml/s
- minimum pipetting volume of 1 μ l
- highest precision down to 0,5 % CV at 1000 μ l
- prevent contamination
- less air consumption
- multidispensing



FESTO



Laboratory automation
and medical technology

- Liquid Handling
- Sample Handling
- Gas Handling





Poll question

Which are the biggest challenges you see in liquid handling? (multiple answers)



- Contamination
- No pressure supply in my laboratory available
- Highly qualified staff carrying out basic repetitive tasks
- Accuracy / precision
- Flexibility of automated processes

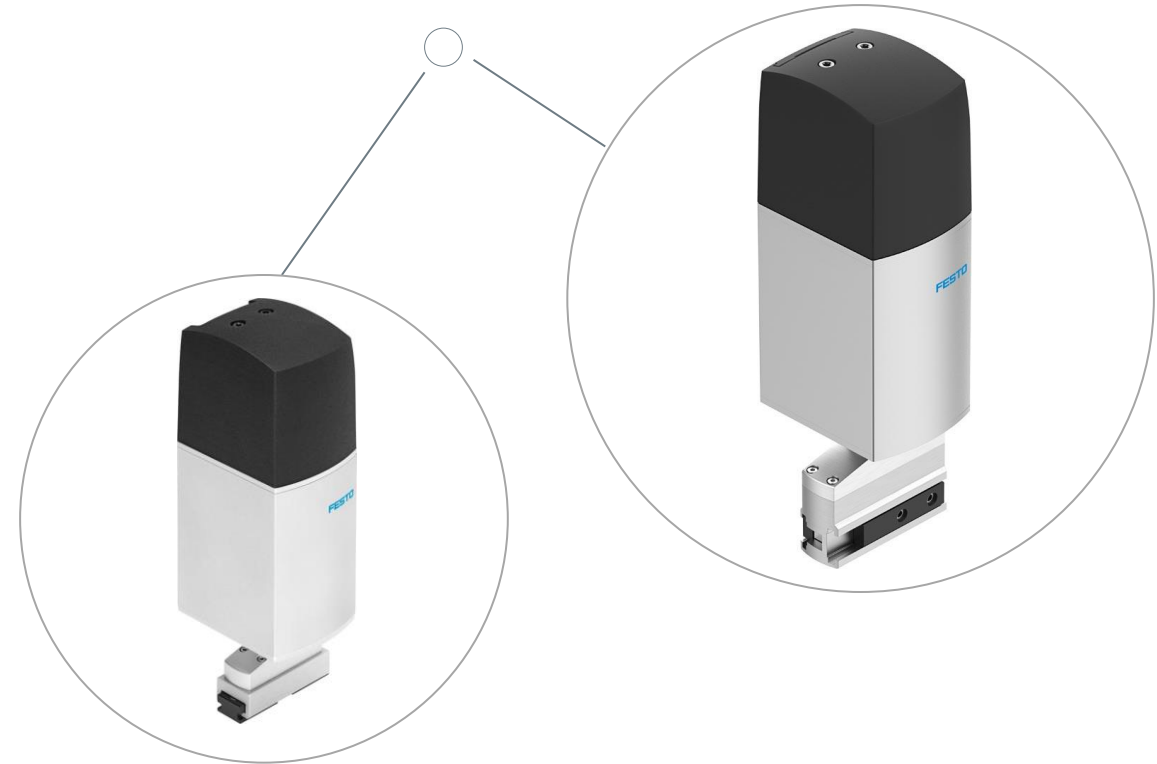
Handling of small vials with the rotary gripper module EHMD

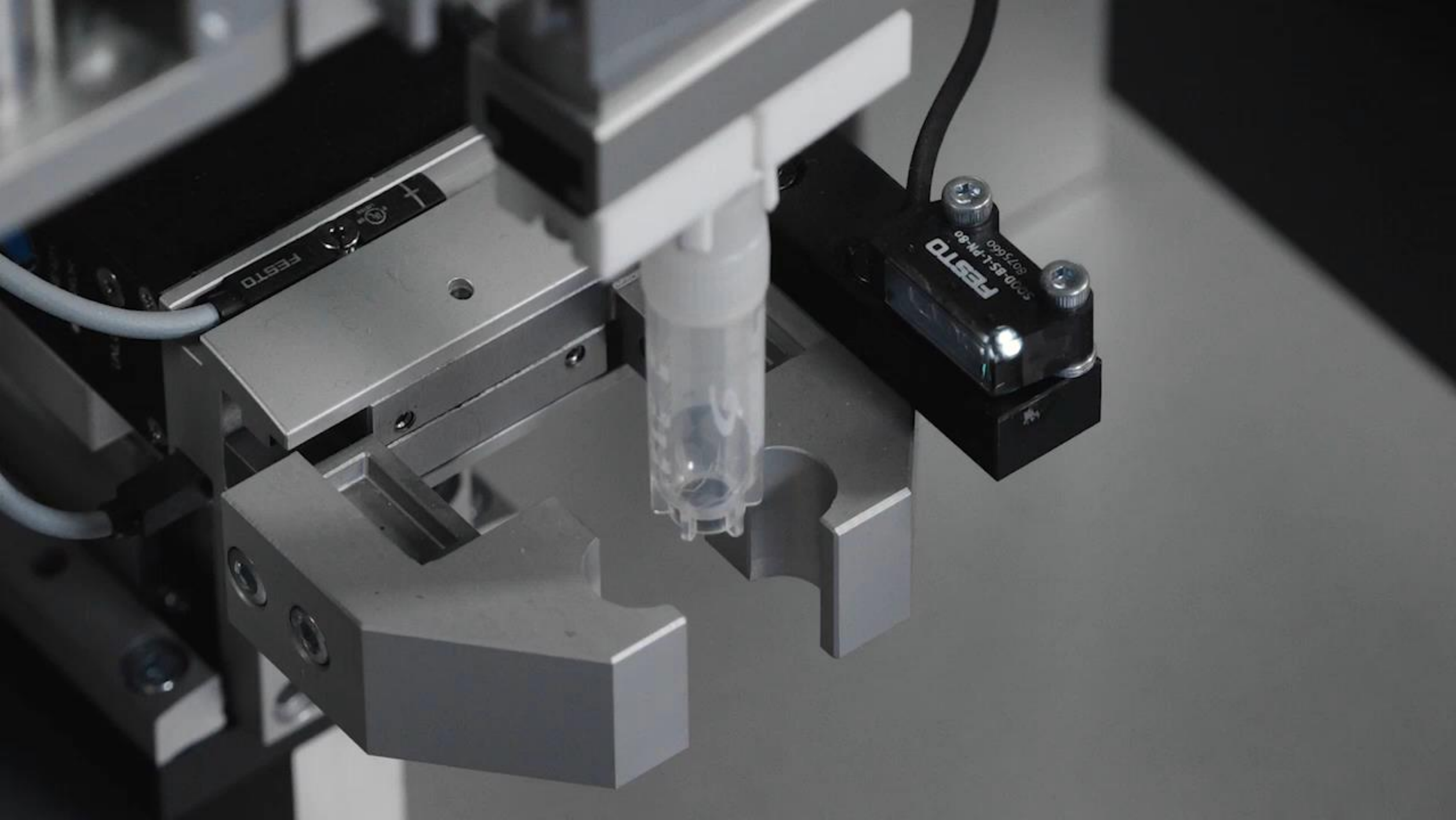
Rotation:

- Endless rotation, simple capping/decapping, with optional compensation of thread pitch of cap
- Torque: max 0.3 Nm, sufficient for opening bottles of up to 15 ml

Gripping:

- Stroke: 2 x 5 mm or 2 x 15 mm
- Max. gripping force: 35 N with 2 x 5 mm, 14 N with 2 x 15 mm
- With Festo motor controllers also Force mode possible, to grip vials/caps of unknown size





From components to a compete ready-to-install subsystem

Control



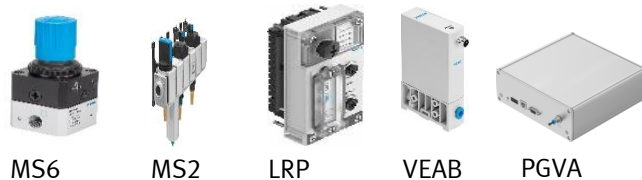
Vision systems and sensors



Connectors, Fitting & Tubings



Air preparation



Positioning



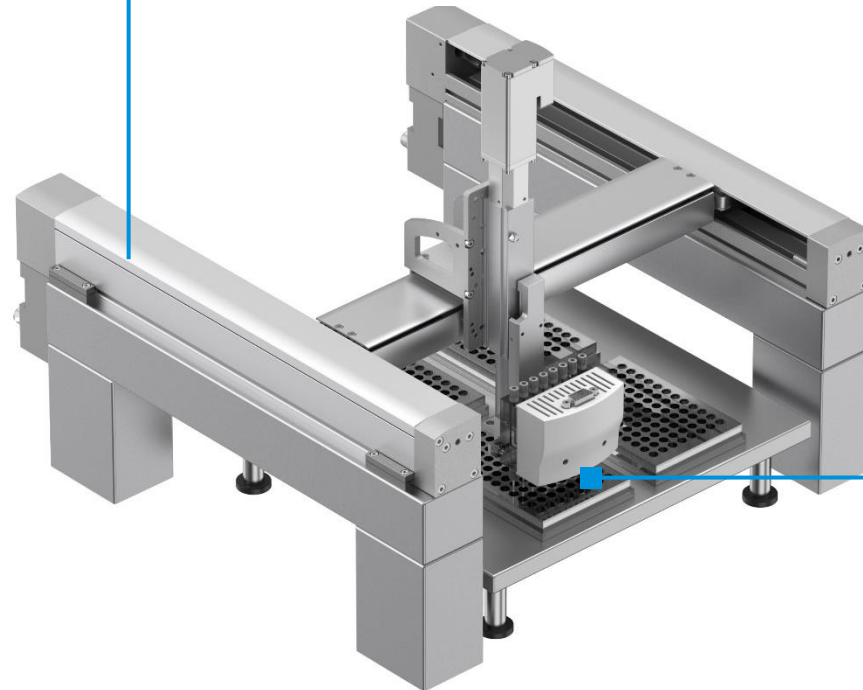
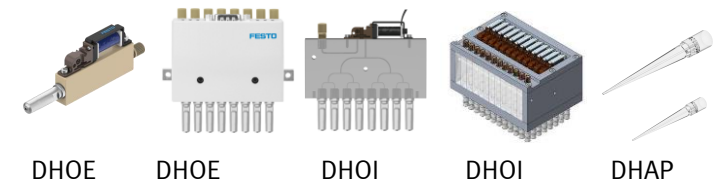
Rotating and gripping



Dispensing



Pipetting



What did you learn today?

Wrap up and key messages of our webinar about liquid handling



You understand the approach of **Pressure over Liquid** and the difference between **Dispensing, Aspirating and Pipetting**



You know the difference between **Precision and Accuracy** and understand the calculation of **Coefficient Variance**



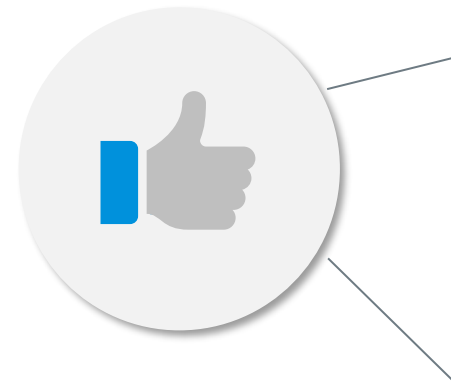
Festo offers the full control platform including **Pressure / Vacuum Generator** and **Valve Control Module**



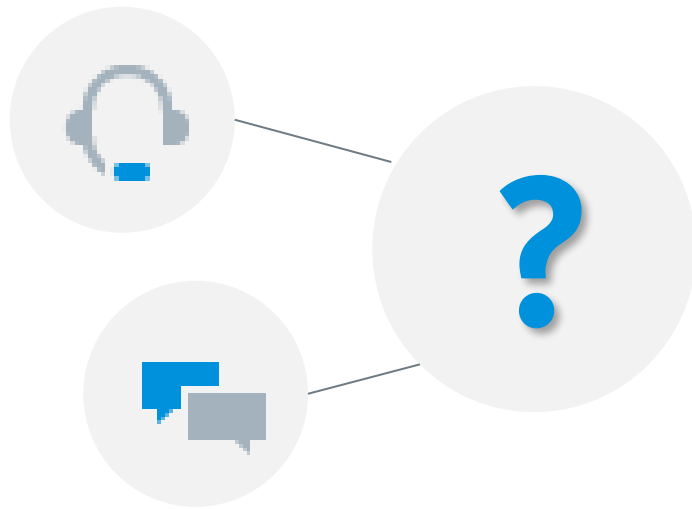
You are aware of the liquid handling solutions like **Dispensing Heads** and **Pipetting Modules**



You know opportunity of **Easy Integration** into the **Handling Systems** from Festo



Thank you for your interest and participation.



Now we have time for your questions

1. With a click on the hand signal you will be unmuted, called up and can participate in the open discussion
2. You can also use the question tab at the control panel

Thank you for your interest and participation!

And now?



You will receive a **newsletter** with the following information:

- PDF-Presentation
- Link to the recording of the Session
- Further relevant information
- Contact

We're glad you joined us for our Life Science Webinar!

Liquid Handling – control small volumes of liquid precisely and efficiently

**We are looking
forward to
further Online
Sessions with
you!**



Our next
Webinar
**Gas handling with
piezo technology**
will take place on
6th of October!