Welcome to the
Life Science Webinar

Gas Handling:
Controlling flow and pressure with piezo technology

Gas Handling: Controlling flow and pressure with piezo technology

Thomas Kunert
Product Manager
LifeTech

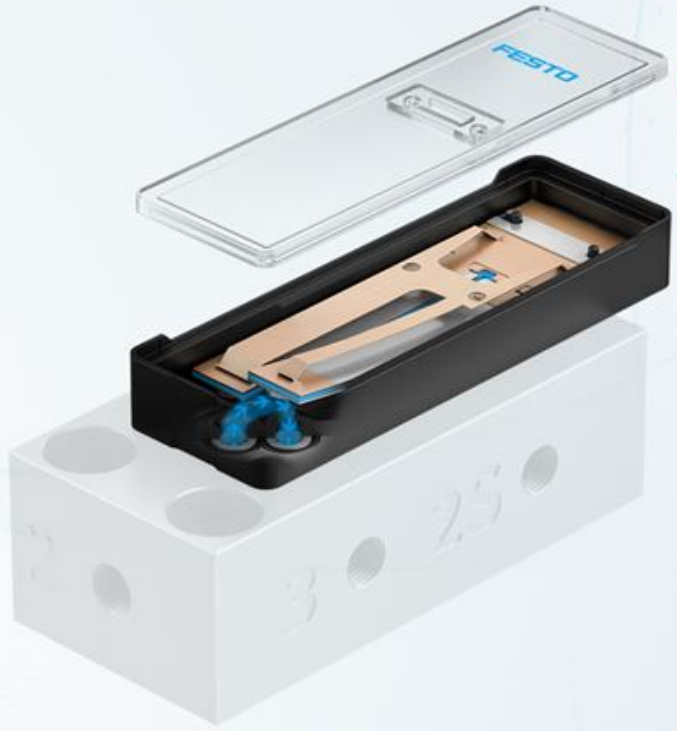
Wednesday 6 October, 3:30 – 4:30 pm CET

Extremely energy-saving, silent, fast and precise: piezo technology offers many advantages for safe gas handling in medical technology and laboratory automation.

In this webinar, you will find out what the differences with conventional solenoid valves are and how you can easily integrate piezo components into your systems and devices.

Agenda

- Basics: Principle and advantages of piezo technology
- Flow and pressure control with piezo valves
- Replace proportional solenoid valves easily
- Products for higher flow rates
- Complete solutions with integrated sensors and electronics
- Applications in life sciences and other industries
- Summary
- Open Q&A session



Poll question

Are you already using piezo technologies in your existing machines and systems?

- ➔ Yes
- ➔ No
- ➔ I don’t know if we’re using piezo

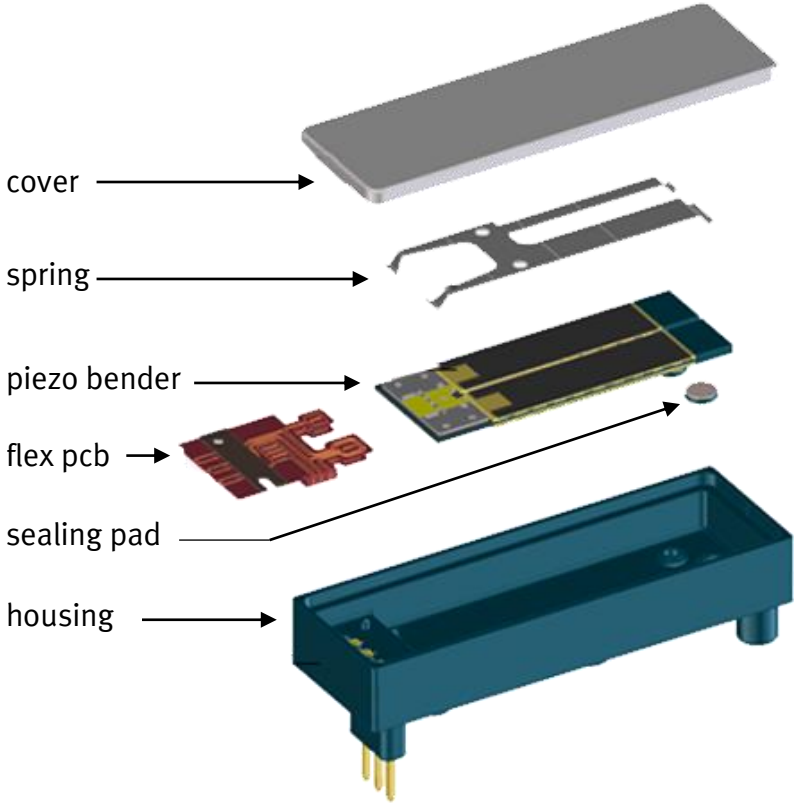
Basics | Proportional gas valves using piezo ceramic actuators

Capacitive principle

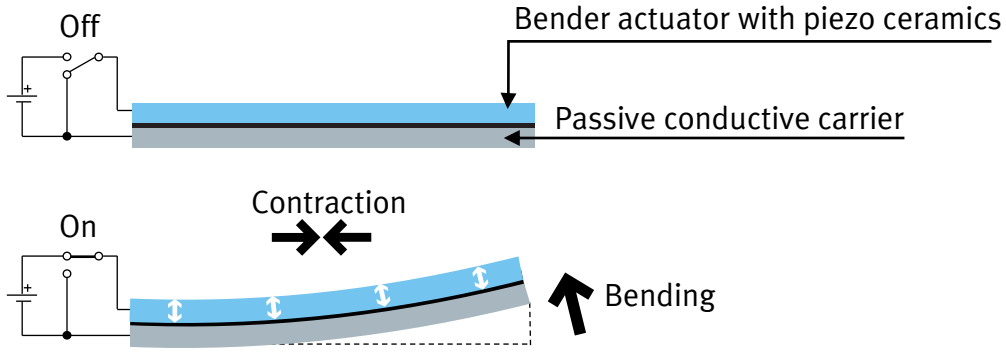
Piezo ceramics only needs current at the start

No further energy is needed to hold its state: no heat generation

Piezo valves consume up to 95% less energy than solenoid valves: low energy consumption



Basics | Proportional gas valves using piezo ceramic actuators



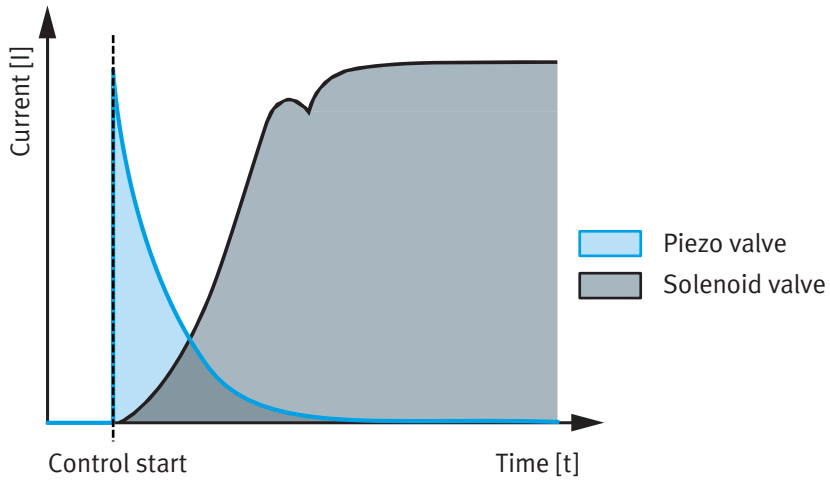
Function of the bender actuator in piezo valves

Capacitive principle

Piezo ceramics only needs current at the start

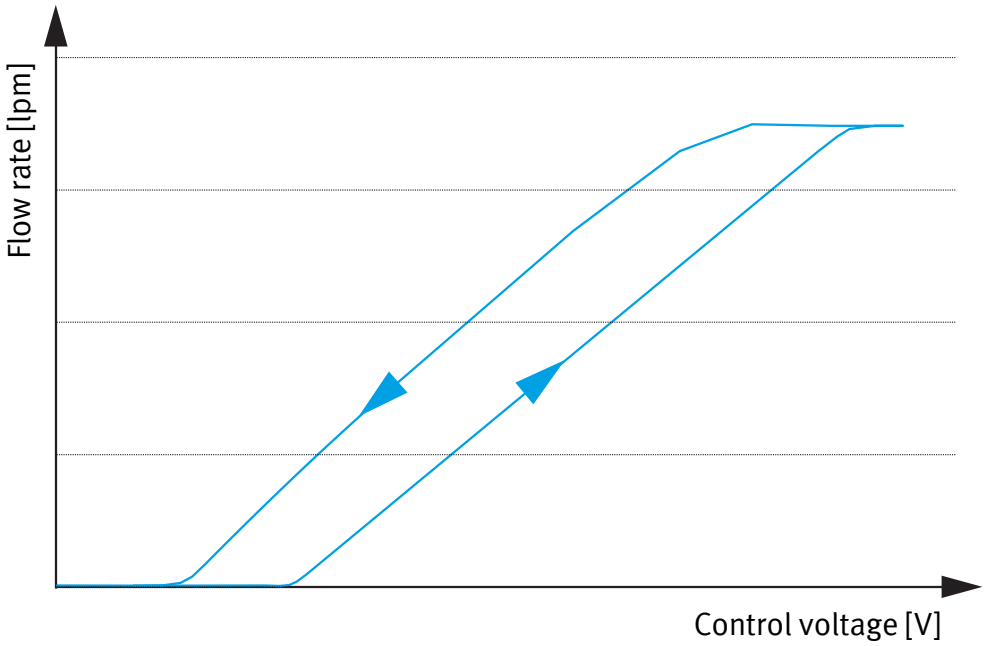
No further energy is needed to hold its state: no heat generation

Piezo valves consume up to 95% less energy than solenoid valves: low energy consumption



Proportional gas valves using piezo ceramic actuators

Flow in relation to the control voltage (sample curve)



The piezo is like a capacitor!
Current only needed for a short time – when charging the ceramics to change the flow.

Note:

Not suitable for liquid or condensing humidity – will short-cut the piezo ceramics

We need special electronics to control a piezo valve

0 ... 310V for the proportional behaviour

But low current – max 5mA, very low power consumption

Benefits of piezo technology compared to solenoid valves


size


weight


heating of media


silent


energy consumption


lifetime


price

Proportional solenoid valve

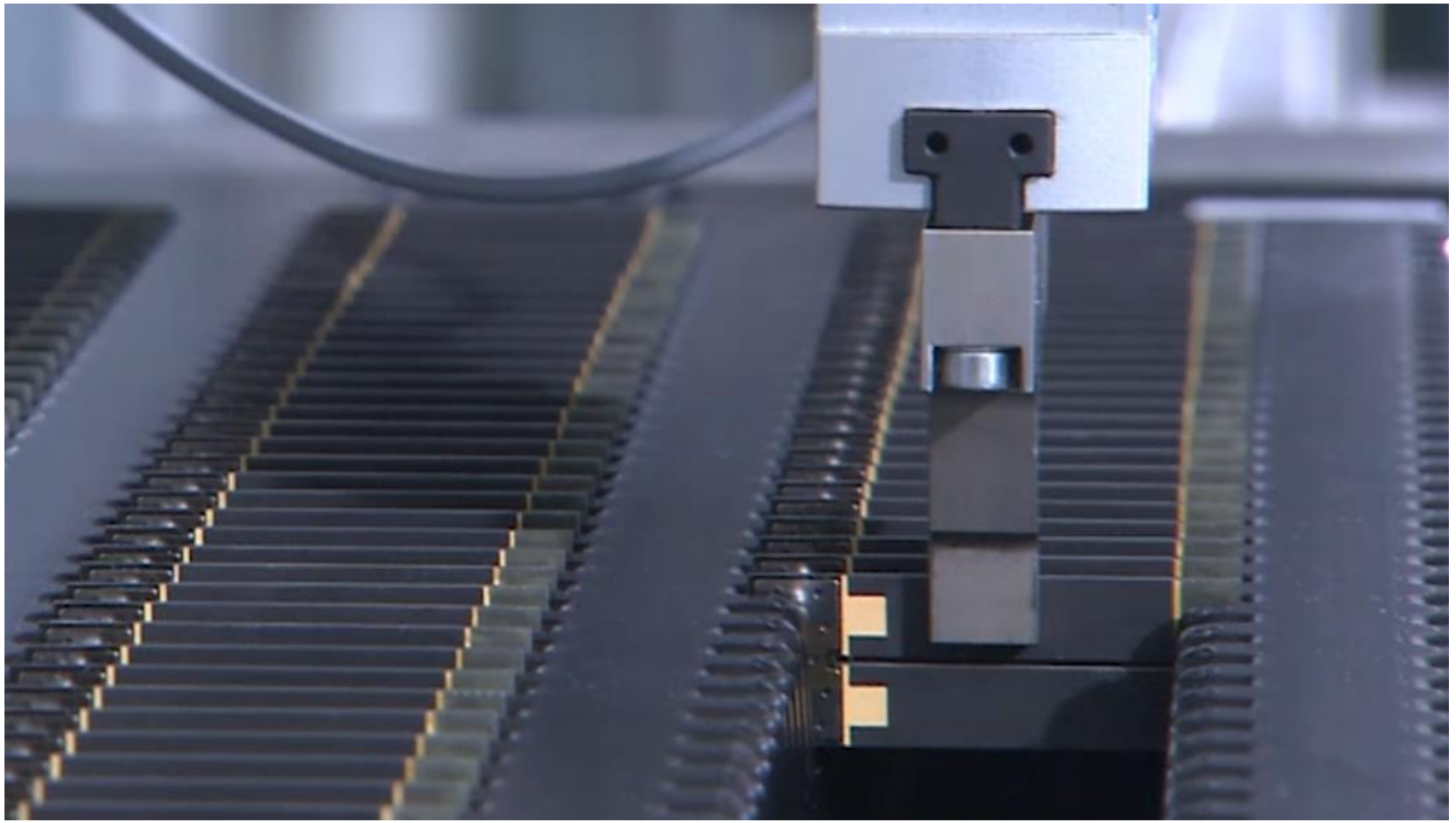
Proportional piezo valve

Proportional behaviour
Very low energy consumption
No heat creation
No operating noises
Lightweight and small
Short response time
Very long lifetime
For air, inert gas and oxygen applications

Production of piezo valves

Our piezo valves are produced in Scharnhausen, Germany.

Enjoy the film!



Speaker: Thomas Kunert

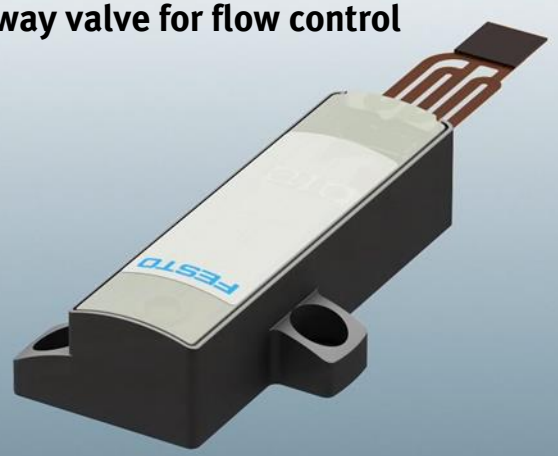
Poll question

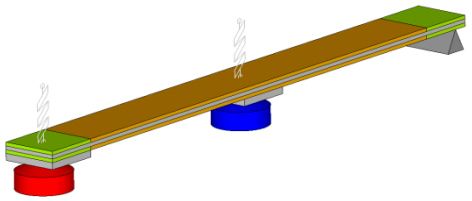
What are your negative perceptions of piezo as a technology?

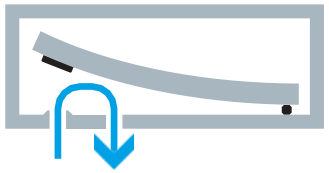
- 300 V DC control difficult to implement
- Poor stability
- Only suitable for low pressure
- Problematic in the case of power loss
- Limited media compatibility

Piezo technology: operating mode

2/2-way valve for flow control

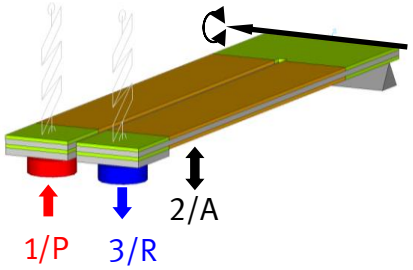


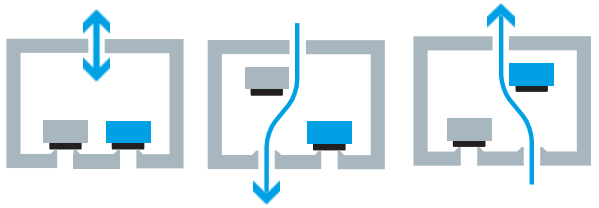




standard piezo bender

3/3-way valve for pressure control





gap piezo bender

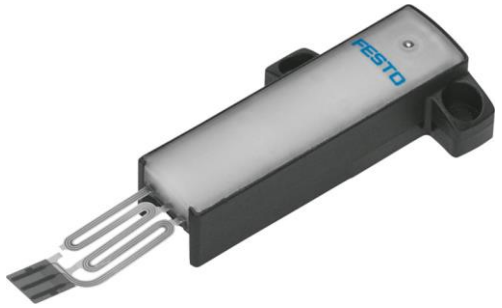
Portfolio: different types for different flows or pressures

3/3-way valve NC
for pressure control

VEMP

1.3 mm or 1.6 mm orifice
Supply pressure up to 0.7, 1.1, 1.7 bar (10, 16, 25 psi)
Flow rate 28 lpm at 20 psi (1.5 bar)
Response time <10 ms
Product size 52 x 12 x 12 mm

2/2-way valve NC
for flow control



VEMR

0.7, 1.0 mm or 1.2 mm orifice
Supply pressure up to 1.7, 2, 3.5 bar (24, 30, 50 psi)
Flow rate 17 ... 25 lpm at 30 psi (2 bar)
Response time <10 ms
Product size 42.9 x 10.7 x 12.2 mm

2/2-way valve NC
for flow control

VEAE

1.2 mm, 1.5 mm or 1.7 mm orifice
Supply pressure up to 3 bar or 6 bar
Max flows: 60 lpm or 81 lpm at 6 bar or 55 lpm at 3 bar
Response time <10 ms
Product size 64 x 24 x 12 mm

Piezo driver electronics VAVE-P

Suitable for all Festo piezo valves VEMR, VEMC, VEMP, VEAE

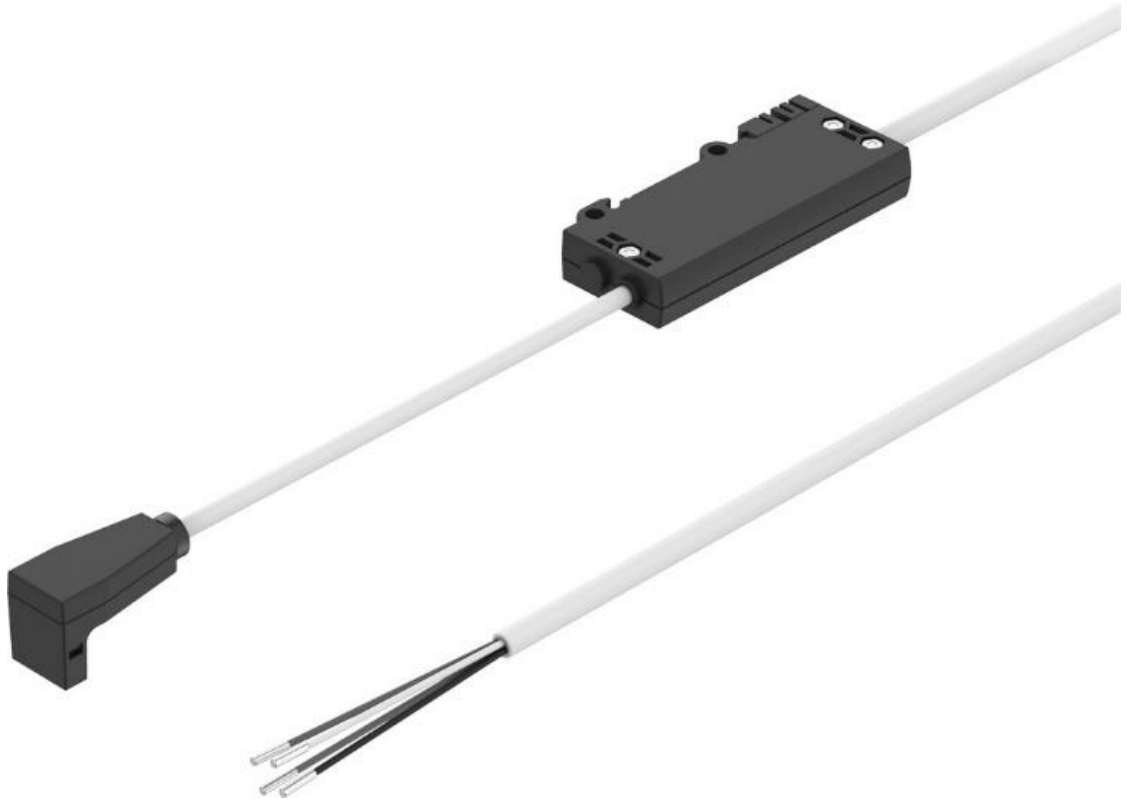
1 VEMC or 1 VEMP
Direct connector

2x VEMR
With adapters NEFV
to flex connectors

2x VEAE
With adapters NEFV
to flex connectors

Piezo driver electronics VAVE-P

Open-loop driver electronics to replace proportional solenoid with piezo valve



- Simple open-loop control, 2-channel, with the necessary electronics for controlling piezo valves
- Offers all the benefits of piezo technology and is easy to use
- Wide range of applications
- Suitable for piezo valves from Festo
- Compact
- Dual channel, open loop, with integrated 310V generation
- Flexible power supply
- With current limitation, **electrically safe** according to ISO 61010

Proportional gas valve VPWS for flows up to 270 l/min

When you need more flow than piezo valves can provide

Compact proportional solenoid valve

2/2 NC for flow control

Stainless steel, no grease, FKM seal

Cartridge with 15 mm diameter, 33 mm long

Different types for 50 – 270 lpm at max 2 ... 8 bar

Media: air, **oxygen**, nitrogen, inert gases, ...

Current control: 0 ... 230 mA, max 3 W

Agenda

Basics: Principle and advantages of piezo technology

Flow and pressure control with piezo valves

Replace proportional solenoid valves easily

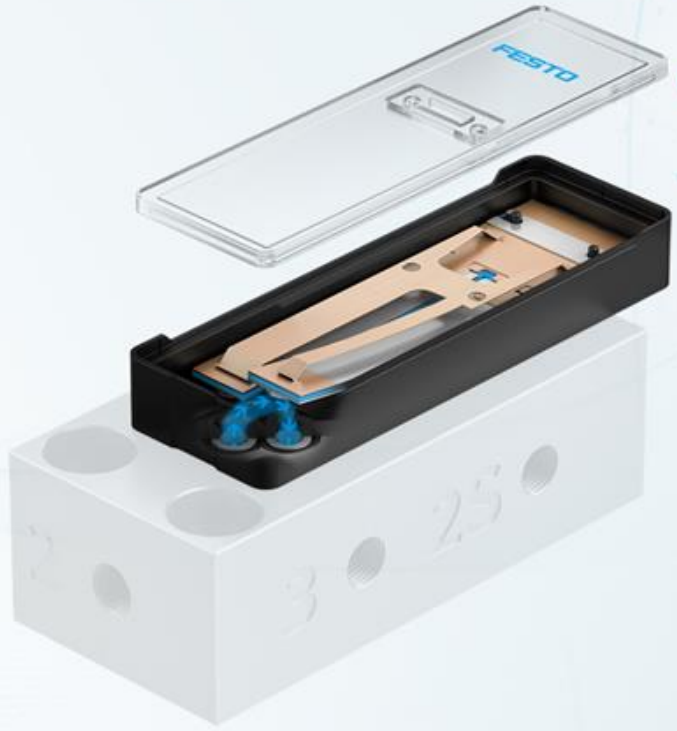
Products for higher flow rates

Complete solutions with integrated sensors and electronics

Applications in life sciences and other industries

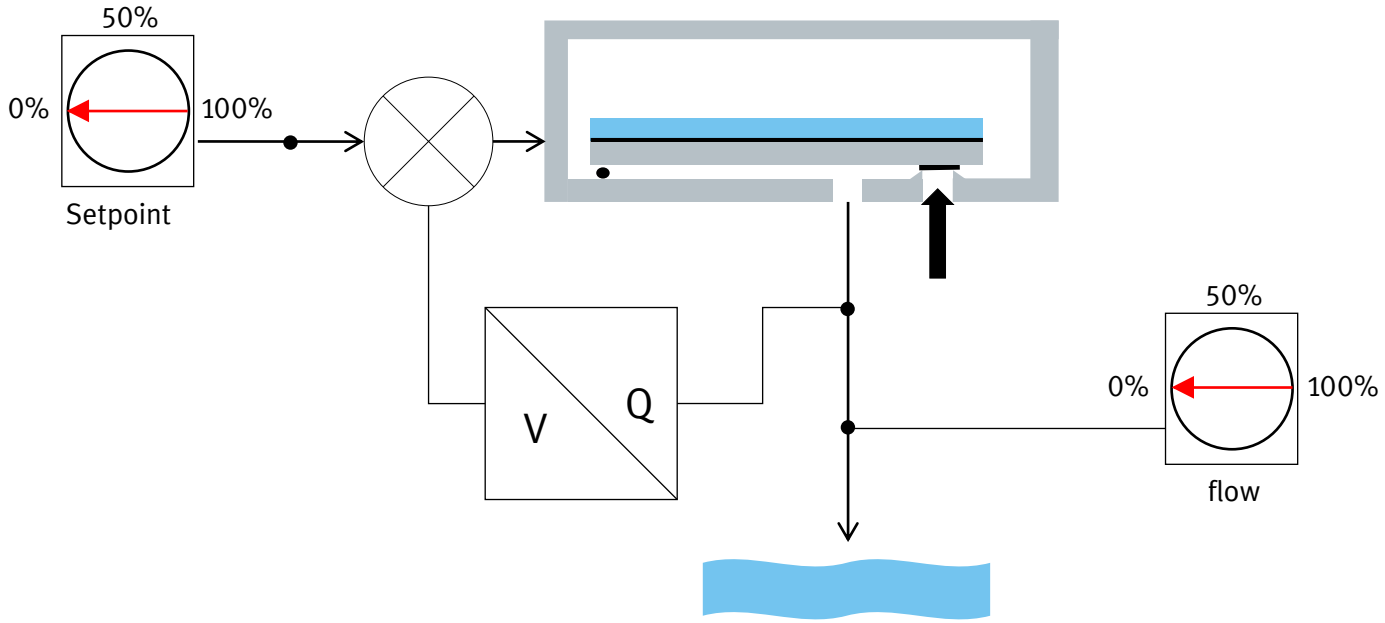
Summary

Open Q&A session



Piezo valves: functionality and technical details

2/2-way valve function with integrated flow sensor → Proportional flow control valve
Constant flow control proportional to setpoint



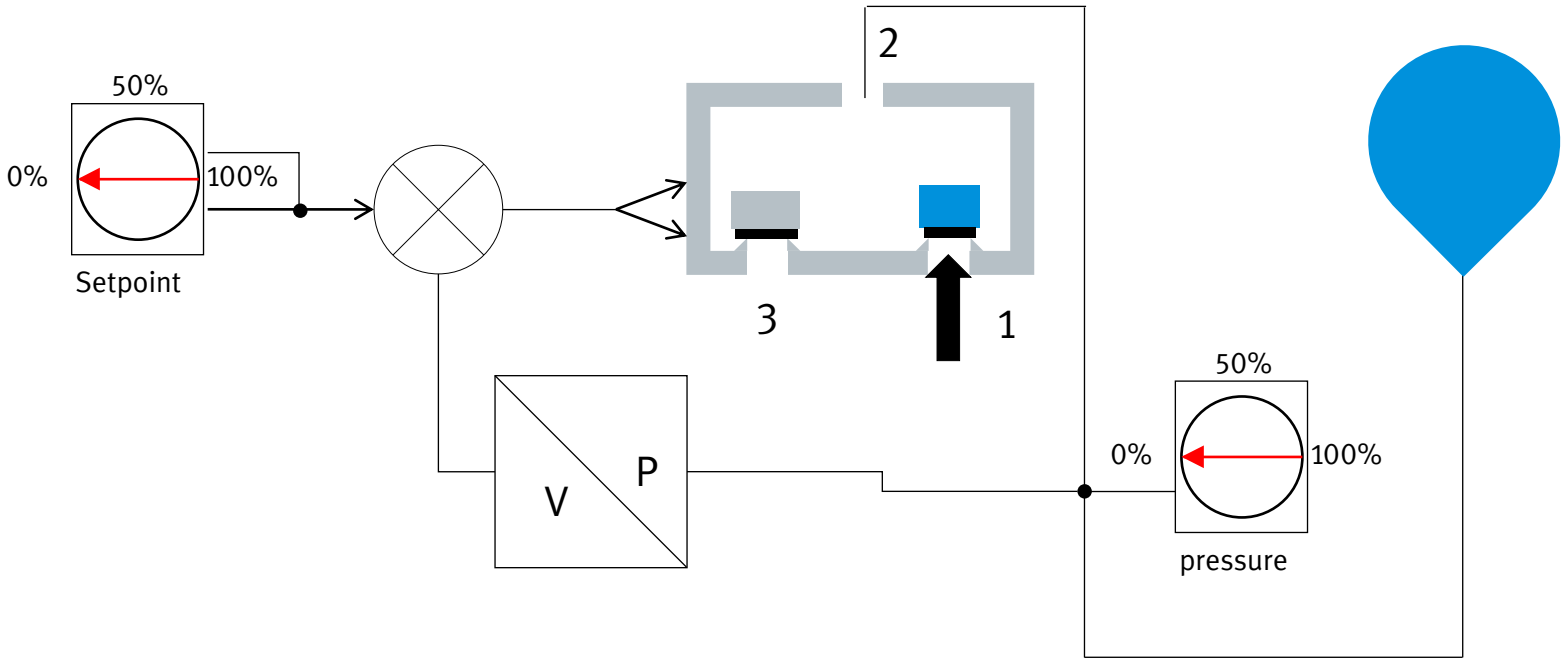
2/2-way valve (NC)

VEMR: 17 lpm @ 2 bar

VEAE: 80 lpm @ 6 bar

Piezo valves: functionality and technical details

3/3-way valve function with integrated pressure sensor → Proportional pressure control valve
Constant pressure control proportional to setpoint



3/3-way valve (NC)

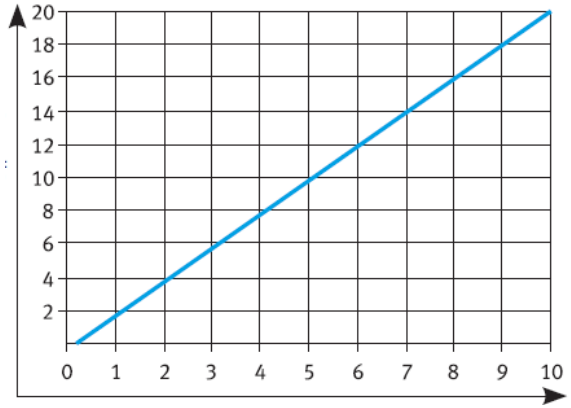
VEMC: 11 lpm @ 1 bar

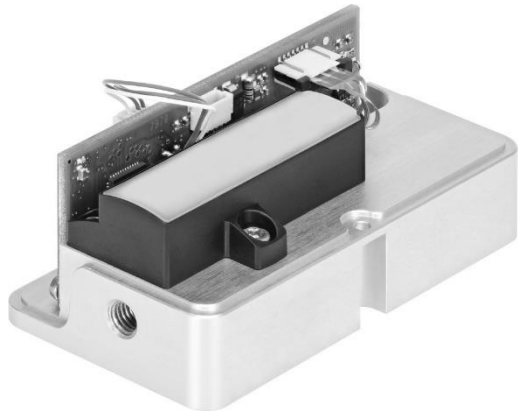
VEMP: 35 lpm @ 1.7bar

And if you need a flow controller? Proportional flow control valve VEMD

With sensor and electronics to create a linear relationship between input voltage and output pressure or flow (closed-loop control)

- Compact module with integrated control electronics
- Dynamic regulation with short response time
- Minimal energy consumption thanks to piezo technology
- Silent: ideal for mobile and patient-facing applications
- Direct mounting via thread
- Ideal for life sciences applications





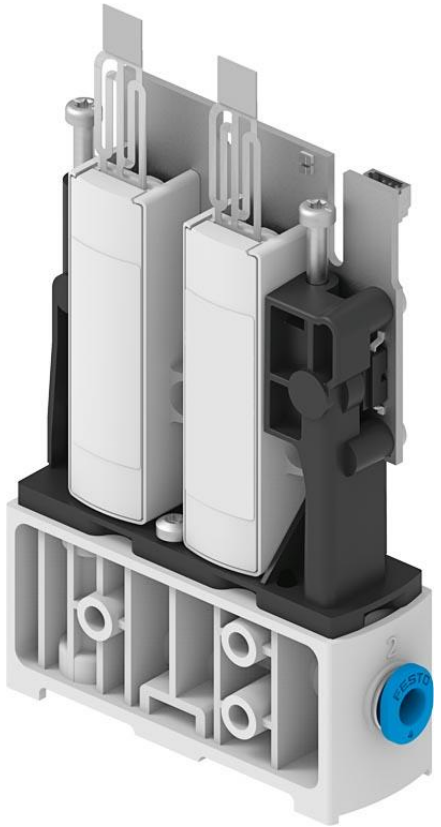
Proportional pressure regulators VEAB

Technical data

- Silent
- Durable
- Very low energy consumption
- High precision
- Wide pressure range: –1 ... 10 bar
- Simple electrical and pneumatic interfaces

Applications

- Pressure regulation
- Checking
- Aspiration and dispensing
- Pressing
- Press-fitting



Portable oxygen therapy

- Low energy consumption
- Silent operation
- Portability
- Proportional behaviour
- Very small
- Long service life

Dosing of oxygen gas in portable oxygen concentrators and conservers for the patient

Mobile oxygen therapy for greater quality of life

The mass flow controller ensures the oxygen is precisely dosed.

Medical mattresses

For pressure regulation / lower pressures

Anti-decubitus mattress

Prevention of bed sores

Teaching robot with piezo technology

- Silent operation
- Highly responsive
- Compact

Humanoid robot that realistically simulates the behaviour of young children during dental treatments.

Proportional pressure piezo regulators

Mixing and dosing gases – especially protective gases

Clean

Precise

Repeatability

Inert gas for safe infusion bags

Infusion bags are flooded with nitrogen when they are being filled

Build-up welding with argon is faster

Dosing of argon: The metal or plastic powder is transported using argon.

Applications: very diverse

Piezo-based flow or pressure control can be used in many industry segments!

Life Sciences

- Respiratory: medical ventilators, anaesthesia
- Oxygen therapy: portable and stationary oxygen concentrators
- Leakage tests on infusion bags
- Gas blending applications: blending gases into blood (renal perfusion)
- Operating equipment for ophthalmology and dental drills
- Controlling drying air when gluing disposable medical products
- Climatic chamber for tissue cultures
- Inert gas for manufacturing
- Stressing of cells with process gases for biological experiments

Semicon/Electronics

- Controlling protective gases or oxygen for burning waste gases

Applications: very diverse

Piezo-based flow or pressure control can be used in many industry segments!

Process automation

Food and packaging: quality inspection, protective gas applications in production

Pharma research: bioreactors and fermenters

Textile industry

Inspecting the quality of fabrics

Machine building

Protective gas applications in production machines

Inert gas welding

Mixing of air into test stands for gear pumps

Controlling humidity when testing aviation fuel

Digitised pneumatics: the new Motion Terminal VTEM

Intelligent technology consisting of pneumatics, sensors, electronics and software

Functions controlled by apps

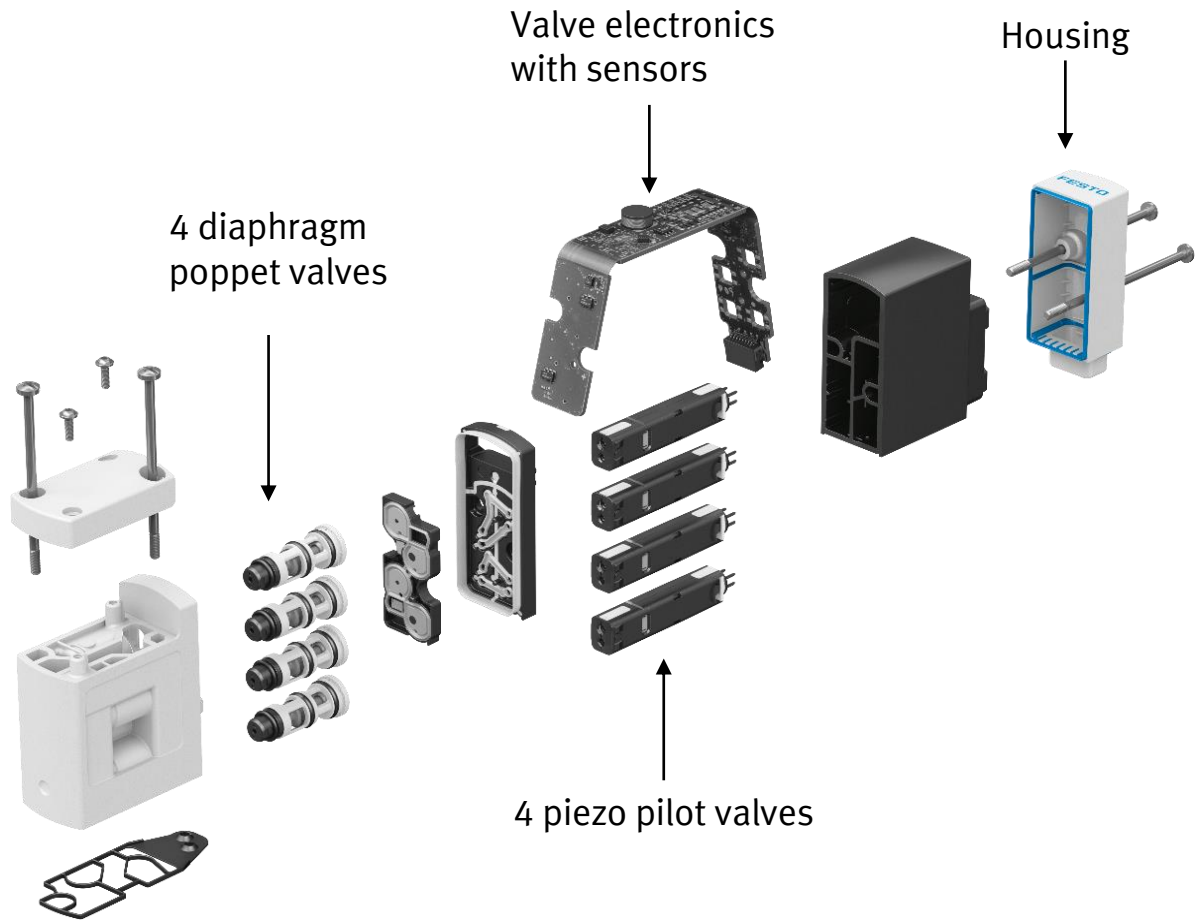
Ideal for many motion and monitoring tasks

Pneumatic regulation of motion, pressure and flow rate

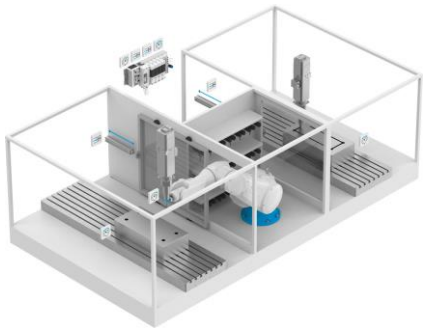
Digitised pneumatics: the new Motion Terminal VTEM

The intelligent valve slice
For a multitude of functions that currently require you to order and install more than 50 separate components.

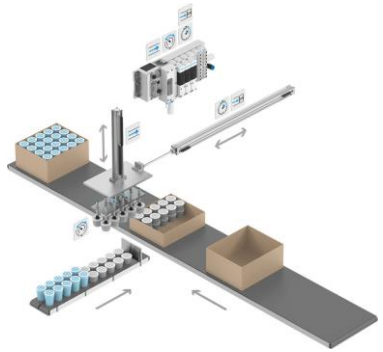
Software controlled,
piezo-piloted industrial valve



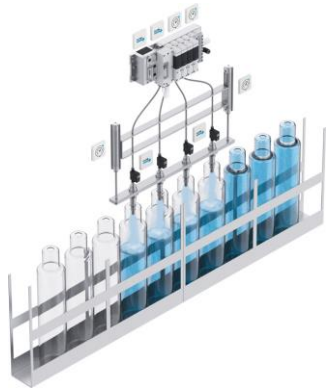
Industrial applications



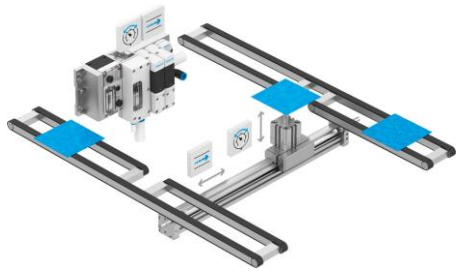
Reliable machine tooling operations



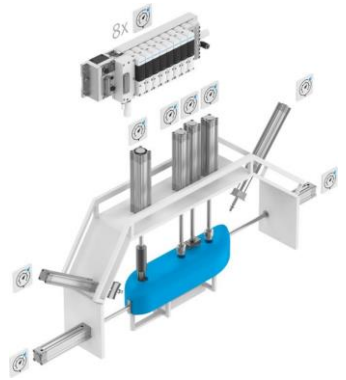
Highly flexible pick & place



Control more flow rates simultaneously



Safe, gentle, and fast handling of delicate components



Simultaneously run multiple complex machining processes

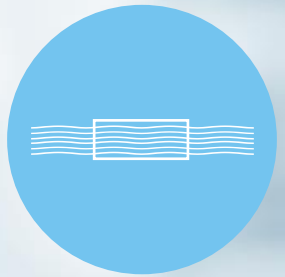
Summary Slide

You now understand the **principle of piezo valves**, which function differently from proportional solenoid valves.

You know the most important advantages of piezo technology: **extremely energy-saving, no heat generation, noiseless and durable**.

You know **how you can easily replace** proportional solenoid valves with piezo valves using the new piezo E-box VAVE-P.

You know compact **closed-loop solutions** for precise flow and pressure control – complete with piezo valves, electronics and sensors.



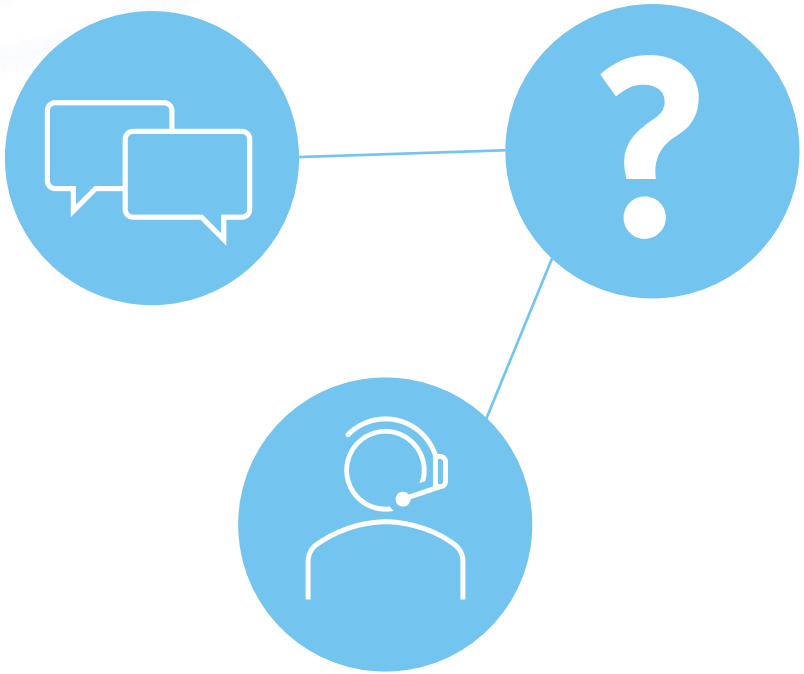
You have learned that there are alternatives for large flow rates – such as the **proportional solenoid valve VPWS** and the **Motion Terminal** with piezo valves as pilot valves.

Poll question

Which of the potential benefits do you think would be most important to you?

- Low energy consumption
- Precise control
- Silent operation
- No heat generation
- Integration into your product

Thank you for your interest and participation.



Now we have time for your questions

- By clicking on the hand signal you will be unmuted, called up and can participate in the open discussion
- You can also use the question tab at the control panel

Thank you for your interest and participation!

And now?

You will receive an **e-mail** 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!

Gas Handling: Controlling flow and pressure with piezo technology

We are looking forward to further online sessions with you!

Thank you for your interest and participation!