

**FESTO**

LifeTech – technology for the life sciences

Components for medical technology and laboratory automation

LifeTech  
Technology for the life sciences  
Components for medical technology  
and laboratory automation

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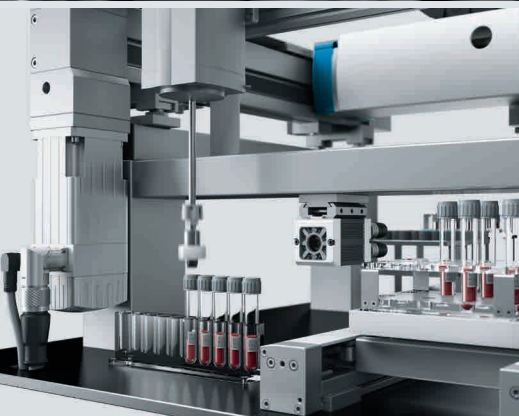


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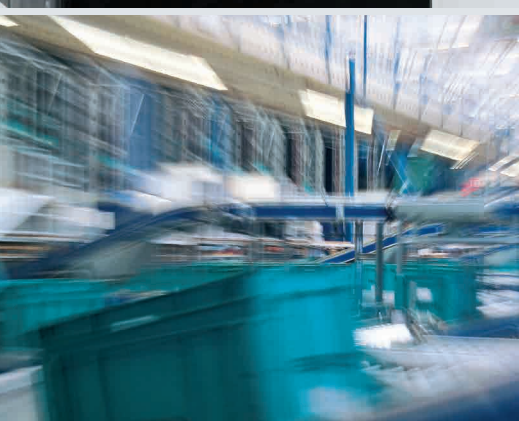
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# Life Sciences – smart solutions for medical technology and laboratory automation



You develop top-quality medical technology.  
You want highly efficient laboratory processes.  
We are your partner for individual solutions.

→ **WE ARE THE ENGINEERS  
OF PRODUCTIVITY.**

The healthcare sector worldwide is facing ever greater challenges – challenges that can also be solved by industrial automation. The LifeTech division at Festo provides forward-looking answers – with innovative solutions for medical technology and laboratory automation. Festo supports systems and equipment manufacturers with components and customised solutions that combine top quality with maximum efficiency.

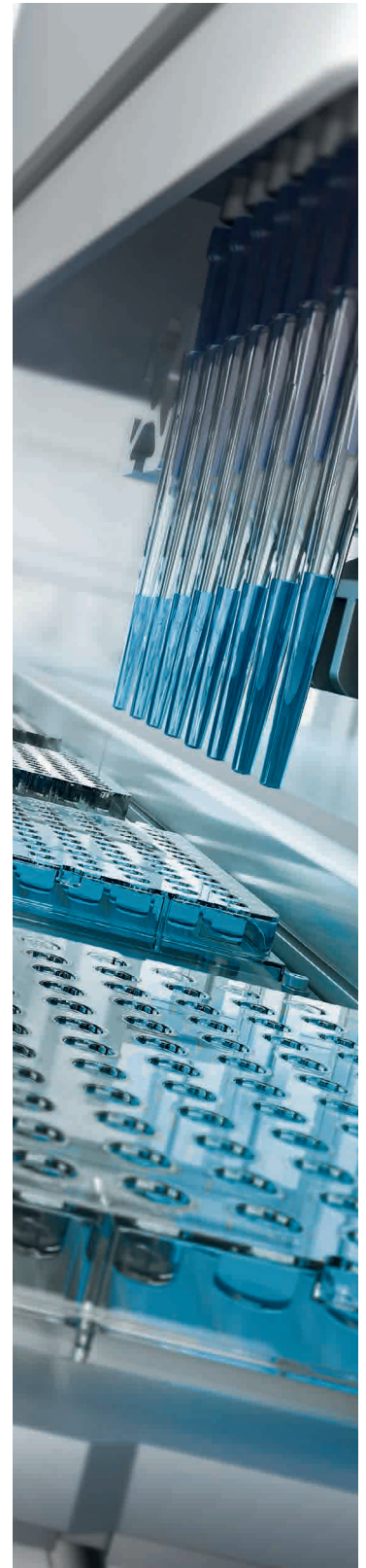
Growing and ageing populations, increasing risk of illness and global mobility call for cost-effective healthcare solutions. The demand for suitable preventative healthcare and diagnostic procedures is also on the rise.

Technical developments such as miniaturisation, integration or dispensing ever smaller volumes of liquid are opening up new opportunities. Festo is supporting these trends with increasingly compact components, highly integrated modules and a focus on micro-fluid products for regulating gases and liquids. For the medical technology and laboratory automation segments, Festo offers standardised

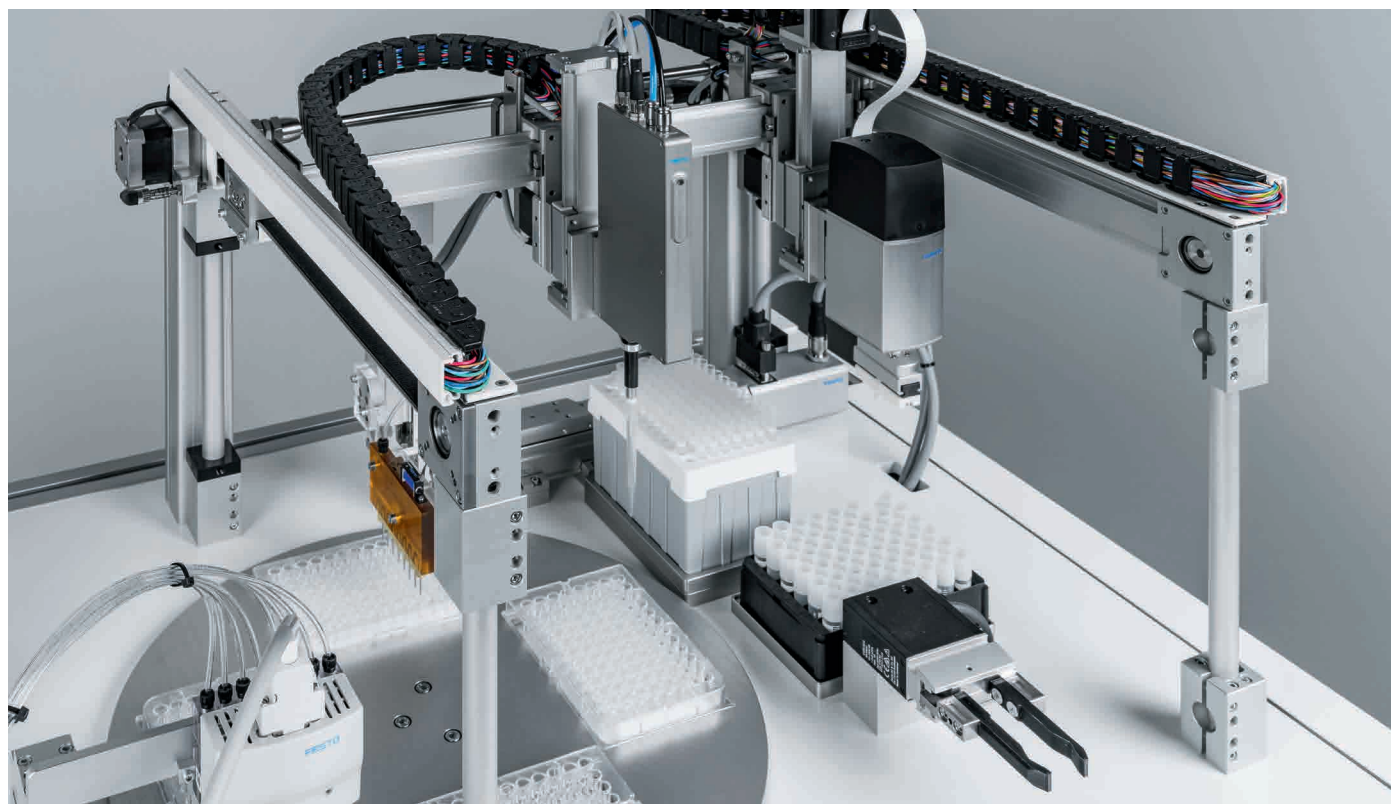
components and develops customised automation solutions together with you to meet your requirements – cost-effectively, to fit the smallest possible space and in the best possible quality.

**The benefits at a glance**

- + Everything from a single source, from standard products to ready-to-install, customised subsystems
- + Collaborative engineering right from the initial planning stage
- + Transforming individual, validated process steps into automated process sequences
- + Easy to integrate into your overall system
- + Perfect interaction between liquid handling and kinematics



# Laboratory automation: modular solutions for every task



From identifying and checking the sample carriers to opening and closing sample vials and dispensing liquids in microwell plates, with Festo you can implement customised applications for sample preparation in the smallest of spaces.

The modular system solutions work quickly, precisely, consistently and efficiently, while the results of the automated processes are always reproducible and verifiable. The degree of automation can be flexibly adapted to your individual requirements, and thus everything from single process steps to linking complex individual processes can be automated. Festo provides you with everything from a single source, from conceptualisation and joint development to delivery of sub-systems.



“By automating these process steps, we can use our highly qualified laboratory staff much more effectively for more demanding tasks, such as analysing test results.”

Niels Kruize, CEO, MolGen



**Precision and reliability in automated liquid handling**

The demand from laboratories for a high throughput of samples is constantly growing. The new handling device PurePrep TTR from the Dutch company MolGen prepares 320 patient samples per hour for molecular processing – at a speed that cannot be matched by a single individual person. The first robot arm of the PurePrep TTR, which is equipped with two SCARA robots, uses an electric gripper to pick up a sample vial by

the cap and places it in a position where the cap can be removed. Once it's been opened, the second robot arm uses pipette head DHOE to transport the liquid from the sample vial to the microwell plate.



**The benefits at a glance**

- + The level of automation can be adapted flexibly
- + Clear interfaces for rapid integration
- + Pre-assembled, tested modules via a single order number
- + Perfectly matched components
- + Specially developed components with technical highlights

“Thanks to the close cooperation between Fast MDx and Festo, we were able to build the first prototypes quickly and efficiently despite the extremely high complexity.”

Richard Lewis, CEO, Fast MDx



**High-throughput testing for many upper respiratory tract pathogens**

Fast MDx shows how many pathogens can be detected with unrivalled speed without the need for expensive biosafe laboratories. This London-based com-

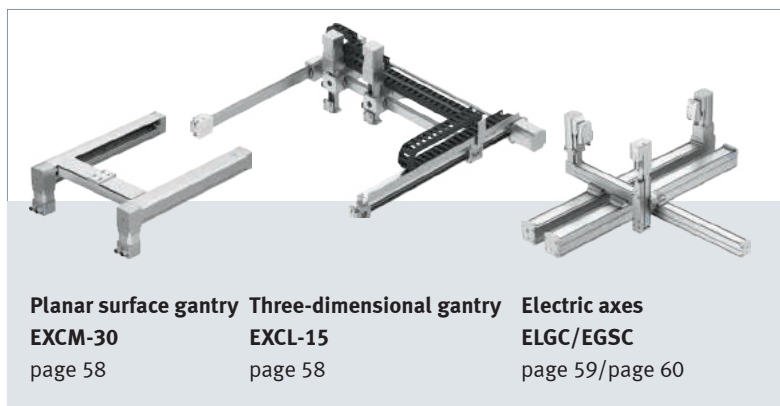
pany developed a point-of-care testing system that cuts the typical waiting time for test results from 24 to 48 hours to just one to two hours. The Fast MDx platform automates the pipetting and dispensing processes. The fully integrated system includes

everything needed for the test, from the sample tubes and swabs to the electronic transmission of results to the hospital, clinic or doctor's practice.

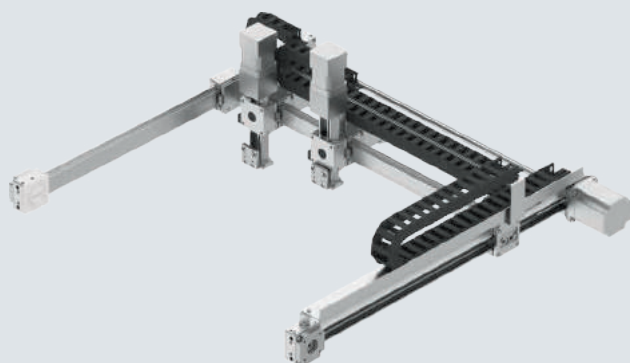


# Sample preparation – complete process

Laboratory automation 01



## Three-dimensional gantry EXCL



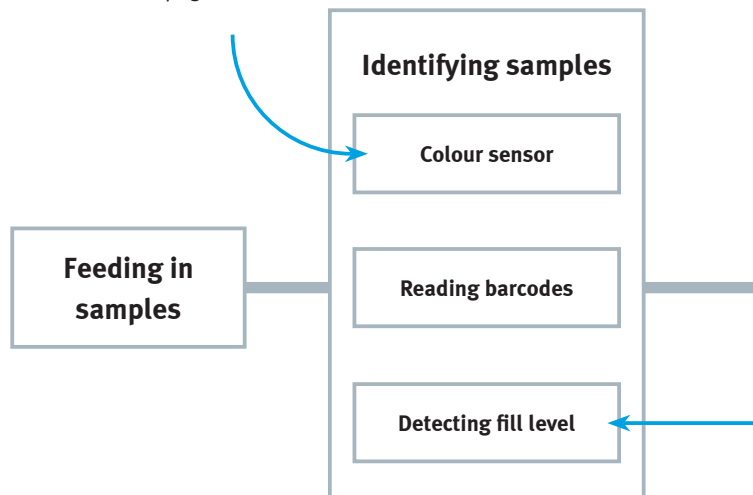
### Optimised for life sciences

Miniaturisation is an important trend in many laboratory applications. The multi-axis gantry EXCL has a small footprint and PCB-based motion controls and was developed to save valuable space when designing systems and devices. The functionality of the system can be further extended with two independently moving Z-axes.

- Ideal for analytical processes where sample vials are to be opened and liquid samples are pipetted in the same three-dimensional gantry
- Ready to install for plug & play
- Sized for minimum TCO
- The working area (X,Y) can be configured in 1 mm steps up to 1000 mm x 700 mm in line with your requirements. The stroke of the Z-axes can be selected for 50, 100, 150 and 200 mm.



**Colour sensor**  
**SOEC**  
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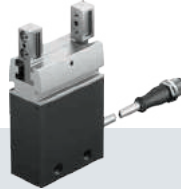




**Stepper motor**  
**EMMS-ST**  
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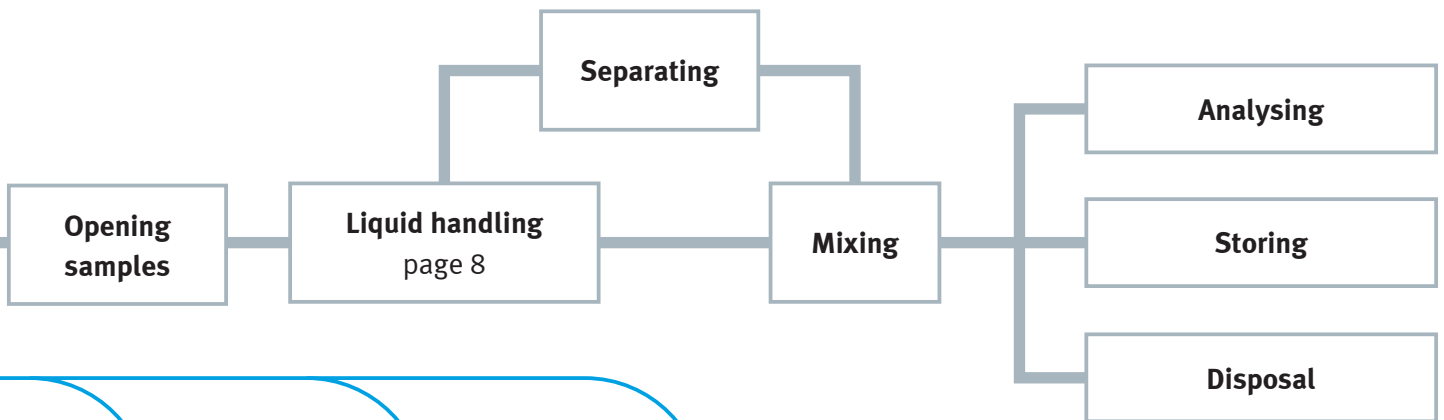
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**Parallel gripper**  
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**Rotary gripper module**  
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**Colour sensor**  
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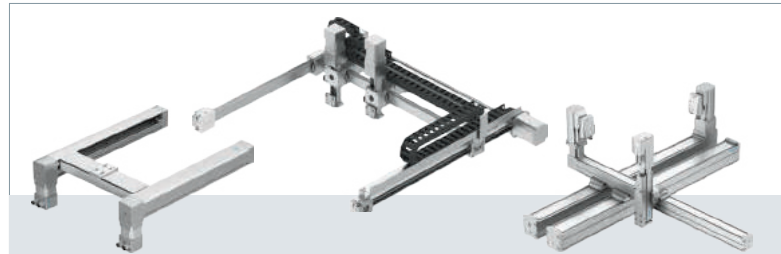
**Light guide**  
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**Fork light barrier**  
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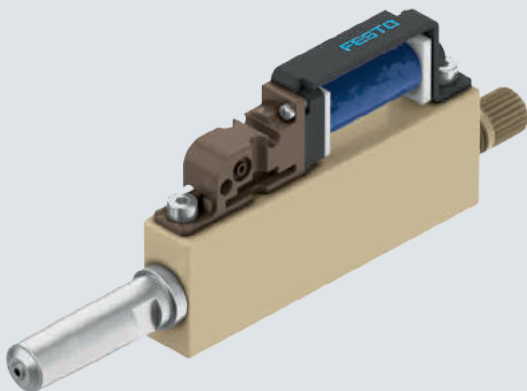
# Sample preparation – liquid handling

Laboratory automation



**Planar surface gantry** EXCM-30 page 58  
**Three-dimensional gantry** EXCL-15 page 58  
**Electric axes** ELGC/EGSC page 59/page 60

## Pipette head DHOE



### Precise and powerful pipetting system

The open pipetting system for the easy transport of liquids enables you to configure the most important pipetting functions in line with your needs and to expand them flexibly – the system is compatible even with the largest pipette tips. And thanks to its outstanding chemical resistance, it can be used for a wide range of liquids with different viscosities. Even minute volumes as small as 5 µl can be pipetted with the greatest precision.

- Media-resistant pipette head
- With pipette tips
- Easy integration
- Complete subsystem from a single source



**Proportional pressure regulator** VEAB page 43



**Pressure vacuum generator** PGVA page 31



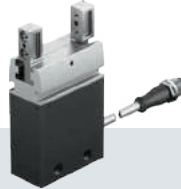
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**Media separated valves** VYKA/VYKB/VYKC/VZDB page 36  
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**Controller  
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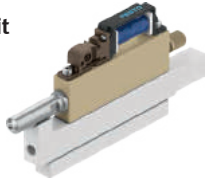


**Parallel gripper  
EHPS**  
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**Rotary gripper module  
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**Pipetting unit  
DHOE**  
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**Disposable tip  
DHAP**  
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**Disposable tip ejector  
DHAO-EJ**  
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**Pipetting**

**Dispensing**

**Process monitoring**

Pressure

Flow rate

Volume

Filling level

**Flow transmitter  
SFTE**  
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**Flow sensor  
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**Pressure sensor  
SPAN**  
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**Pressure transmitter  
SPTW**  
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**Analysing**

**Storing**

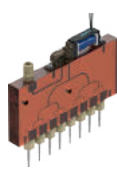
**Disposal**



**Dispense head  
VTOE**  
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**Dispense head  
VTOI**  
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**Colour sensor  
SOEC**  
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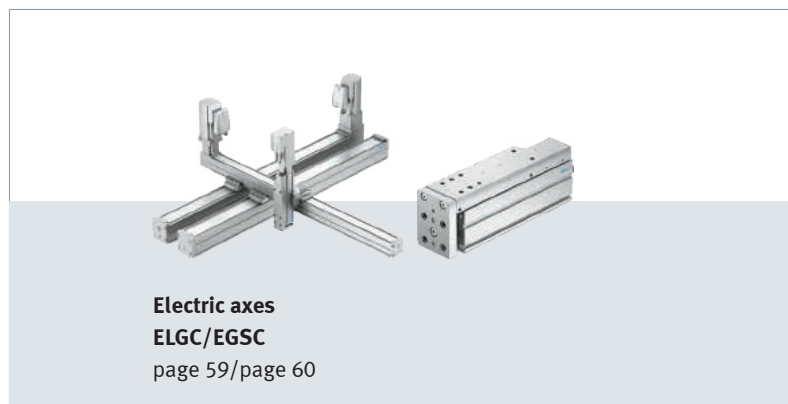
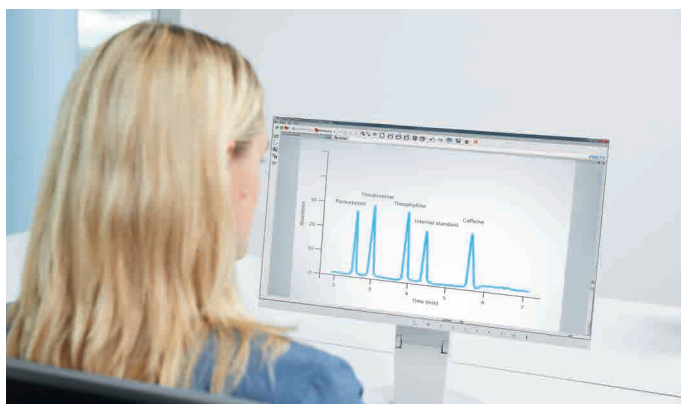
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SOOC**  
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**Fork light barrier  
SOOF**  
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# Flow cytometry

Laboratory automation 01



**Electric axes**  
**ELGC/EGSC**  
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## Media separated valves VYKA/VYKB/VYKC/VZDB



### Maximum performance density and precision

With the media separated valves VYKA, VYKB, VYKC and VZDB, all three operating modes of dosing, aspirating or continuous flow are possible. These compact, powerful valves dose and aspirate any quantity, right from the very smallest, with great precision. Their uniquely impressive pressure and nominal width specifications also make them perfect for flow control, for example in manifold duct plates.

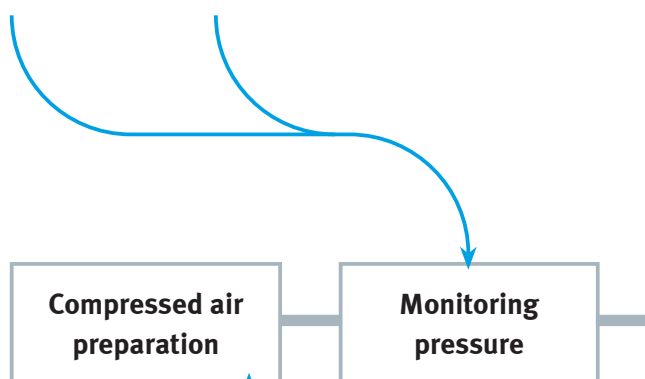
- Reliable media separation:
  - Including for aggressive liquids
  - Very easy to clean
- Flexible in use thanks to 3/2 and 2/2 (NC/NO)
- Various nominal widths for dosing, aspirating and for continuous flow applications



**Proportional pressure regulator**  
**VEAB**  
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**Pressure vacuum generator**  
**PGVA**  
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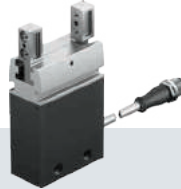
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**Parallel gripper  
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**Rotary gripper module  
EHMD**  
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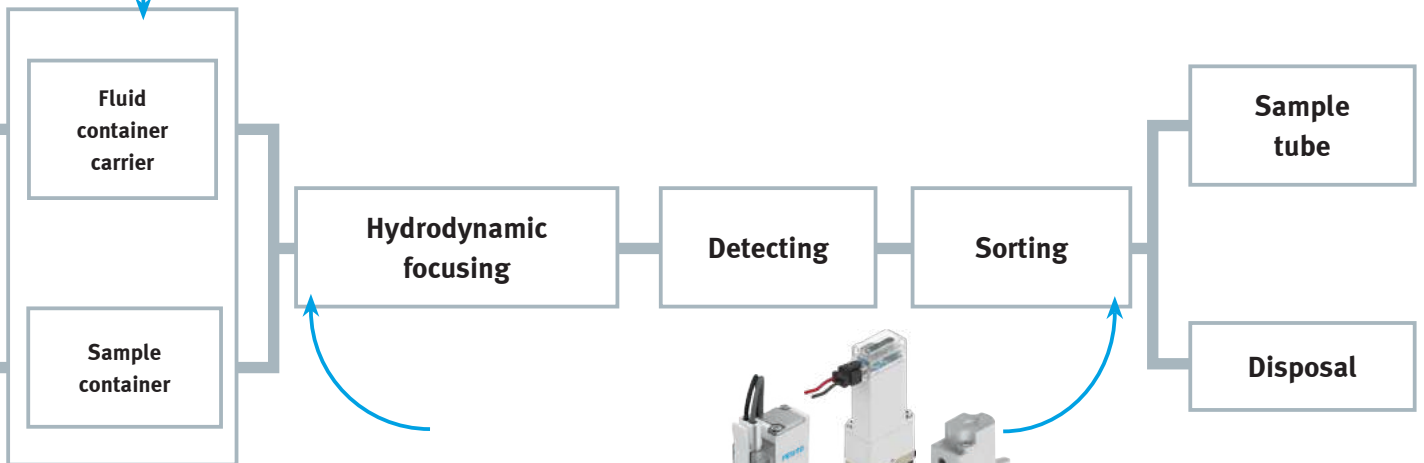
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**Colour sensor  
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**Fitting  
NLFA**  
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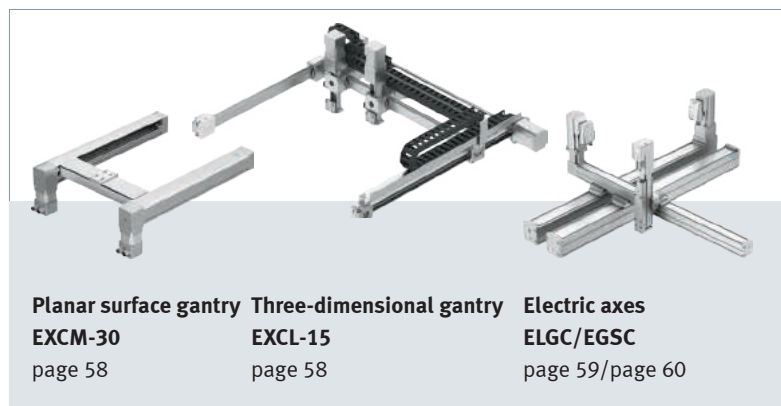


**Electrical interface  
VAEM**  
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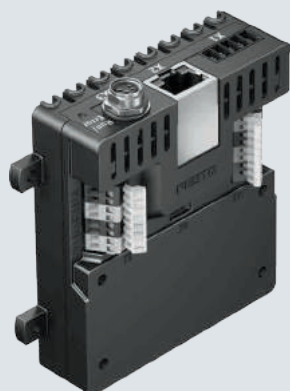


**Media separated valves  
VYKA/VYKB/VYKC/VZDB**  
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# Analytical chromatography



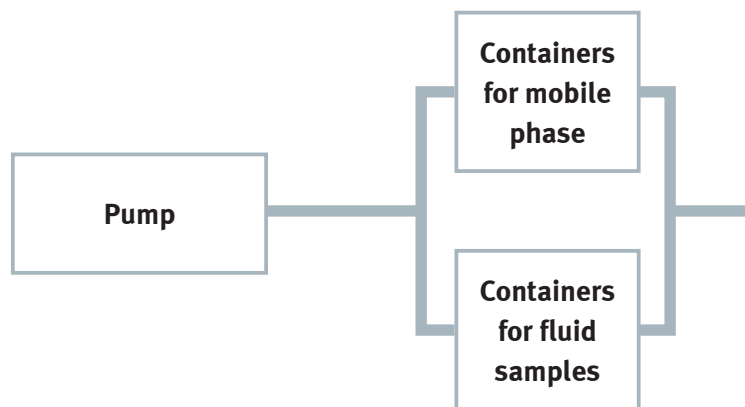
## Valve control module VAEM



### Easy actuation of valves with holding current reduction

The VAEM is ideal for high-precision dispensing applications. The digital interface simplifies the configuration and control of solenoid valves: the calibration factor between the individual channels, the opening time per valve and the pickup and holding current. The module improves the precision of the switching behaviour of the valves. It is a perfect fit for the media separated valve VYKA. The dispensing process is controlled via an external trigger signal or the communication interface.

- Very precise valve control with 0.2 ms time resolution
- For 1 to 8 valves, independently controllable
- Freely adjustable holding current reduction
- Interface for controlling and programming the parameters as well as for reading out the values or errors
- Graphical user interface (GUI) as the operator environment
- Communication interface: ASCII via RS232, Modbus® TCP via Ethernet

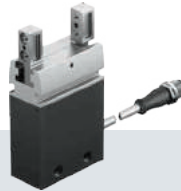




**Stepper motor**  
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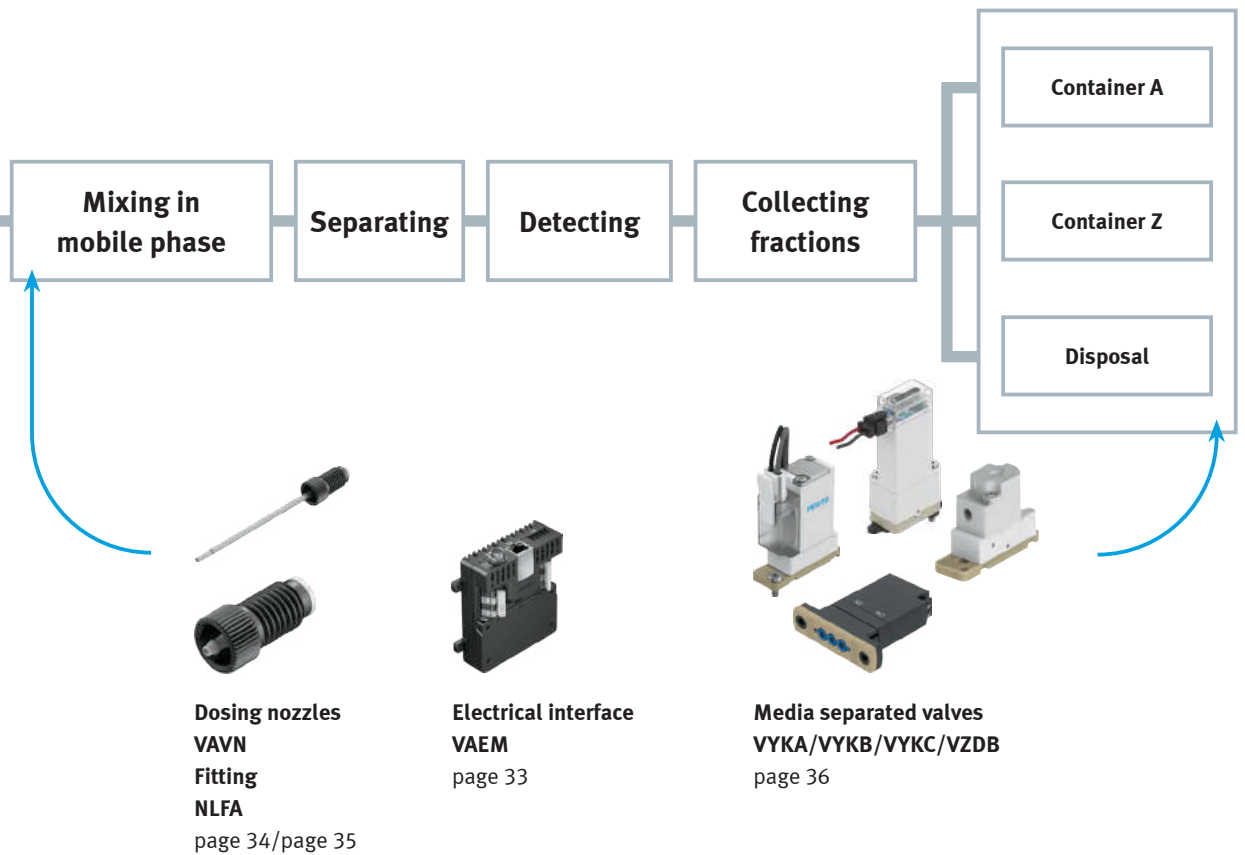
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**Parallel gripper**  
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**Rotary gripper module**  
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# Bioreactors – gas supply to cell cultures



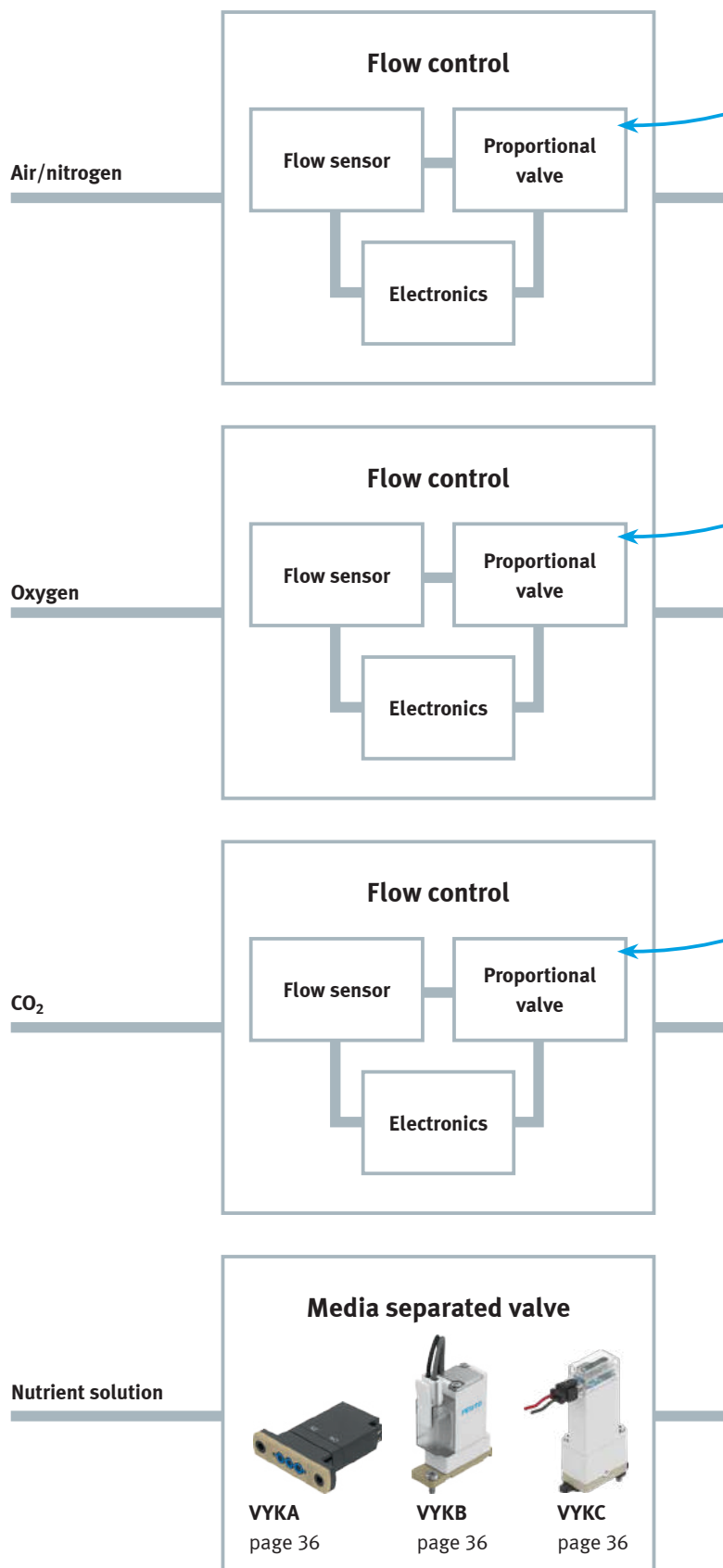
## Proportional flow control valve VEMD



### For air, oxygen and inert gases

The flow rate of air or other gases needs to be regulated in many applications. Oxygen is becoming increasingly important, not just in the life sciences sector, but also in the food and biotech industries. The gas must always be precisely dosed, whether it is used for regulating protective gases in production or for respiratory air in medical devices. And meeting the high standards for reliability and performance is just as important as cost efficiency. The new VEMD offers both: a high dynamic response at an extremely attractive price.

- Many flow rate ranges: 10, 20, 50, 100 and 200 l/min
- Analogue and digital interfaces built in
- Best-in-class price
- Best-in-class dynamic response
- Linear control response
- Sturdy and durable



VYKA  
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VYKB  
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VYKC  
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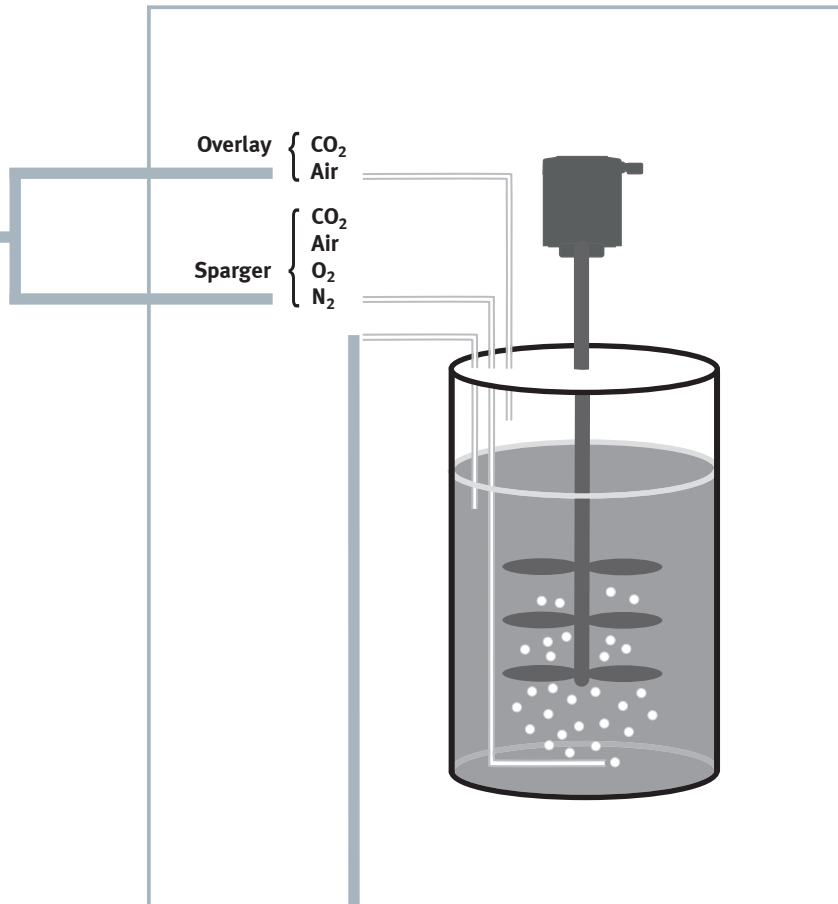
Proportional flow control valve  
VEMD  
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Proportional flow control valve  
VEMD  
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Proportional flow control valve  
VEMD  
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# In-vitro diagnostics – point of care



## Miniature solenoid valve VOVK



### Extremely narrow for many valves in a small space

With a width of only 5.9 mm, the VOVK is ideal for applications where many valves have to be fitted into a very small space and where flow rates of up to 6 l/min are sufficient.

For example, for small devices where the miniature valves actuate many diaphragms on a lab-on-a-chip (IVD PoC) cartridge.

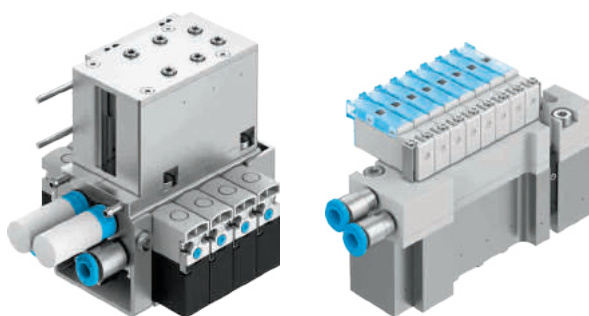
- Compact 3/2-way miniature solenoid valve with a width of just 5.9 mm (valve MHA1 = 10 mm)
- Pressure range vacuum -0.9 ... 7 bar gauge pressure
- Flow rate up to 6 l/min
- For air and inert gases



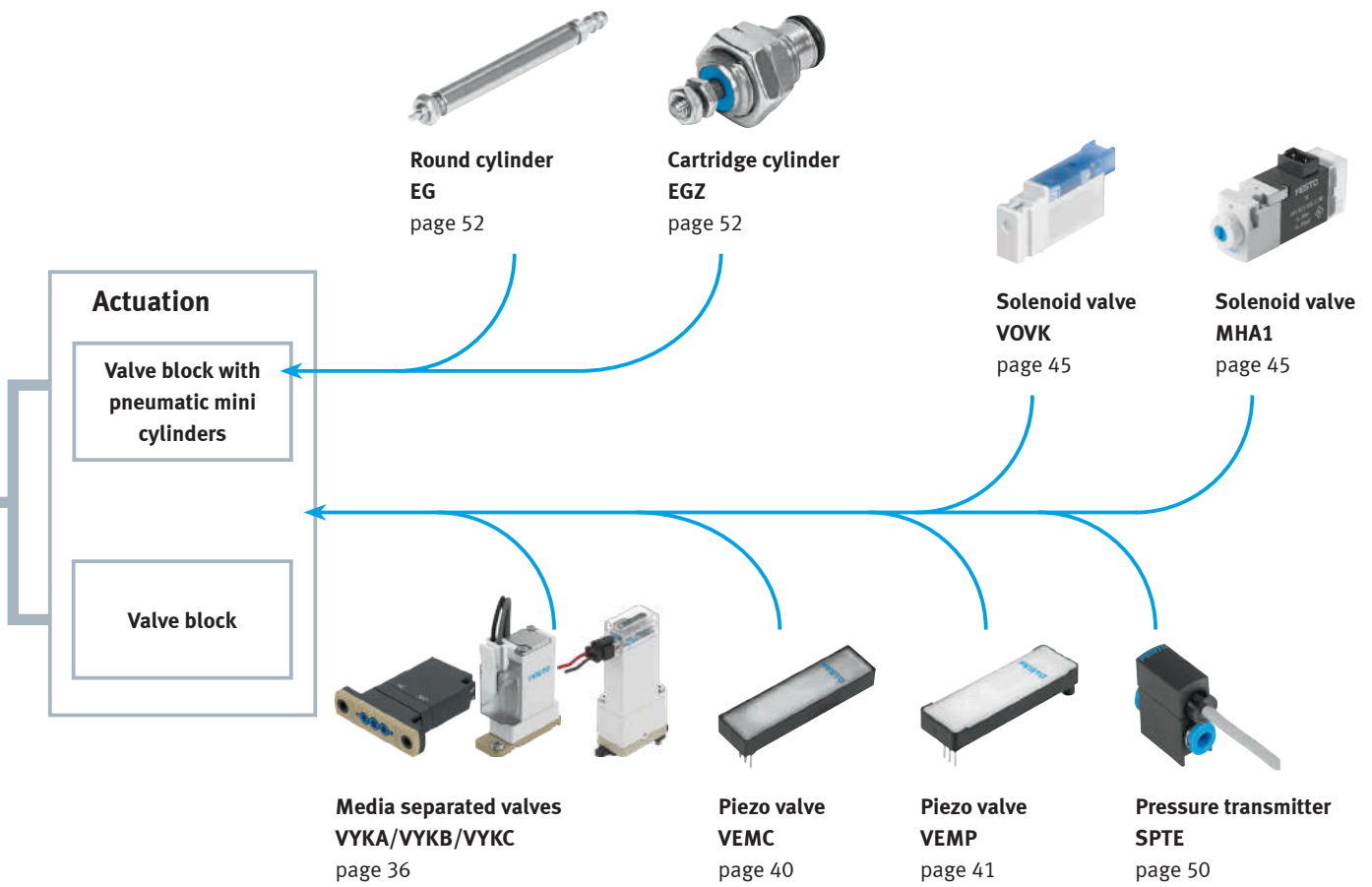
**Filter regulator MS2-LFR-B**  
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**Proportional pressure regulator VEAB**  
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**Examples of a customised valve block**



# Medical technology – customised safety



In medical technology safety comes first, for you as an equipment manufacturer and for Festo as your ISO-certified partner. Close and trusting cooperation simplifies the processes and defines the responsibilities for both parties.

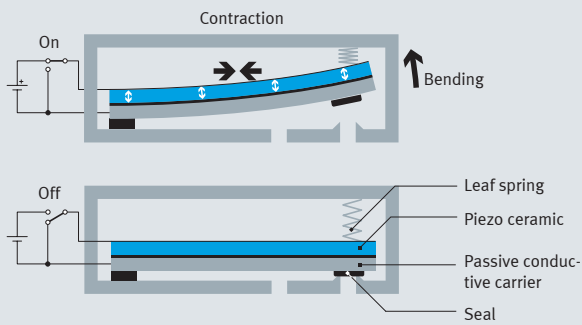
You can rest assured that with Festo the ISO 9001 standard is always complied with. Festo combines the world of industrial automation with medical technology by implementing medical risk management processes in product development in accordance with the standards ISO 13485 and ISO 14971.

Festo develops components as well as subsystems for medical devices. Solenoid valves as well as proportional valves with piezo technology are often used for regulating the pressure levels and flow rates of medical gases in

mobile applications and in applications close to the patient. These are especially compact, silent and energy-saving. Thanks to the material properties of piezo ceramics, no energy is needed to maintain a steady flow, but only to change the state of the flow. The generation of heat is thus avoided and the valves are highly energy-efficient.



**Proportional valves with piezo technology:  
Mode of operation**



Festo uses the piezoelectric characteristics of certain ceramics which are mechanically deformed when a voltage is applied.

**2/2-way proportional valves**



They control the flow rate, e.g. in mobile oxygen therapy devices, thus ensuring precise oxygen supply and dosing during inhalation.

**3/3-way proportional valves**



They are used to regulate the flow or pressure in oxygen therapy, ophthalmology and other therapies.

**The benefits of piezo valves at a glance**

- + Low energy consumption: ideal for portable devices
- + No operating noise: for use close to the patient
- + Proportional characteristics
- + Safe by maintaining the current status in case of power failure
- + Lightweight
- + Compatible with oxygen
- + Sturdy and durable

“The piezo valves from Festo have played a significant role in enabling us to make our portable oxygen therapy devices lighter, smaller, quieter and more efficient.”

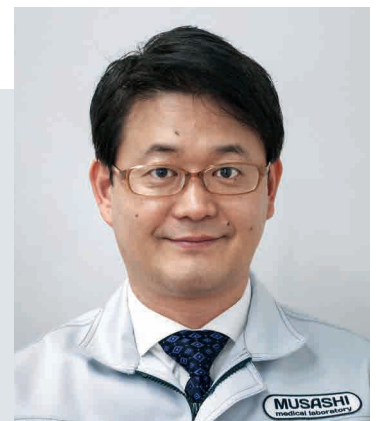
Satoru Tokuyama, President of Musashi Medical Laboratory, Japan

**Greater comfort and efficiency for long-term oxygen therapy**

Around 600 million people worldwide suffer from chronic obstructive pulmonary disease (COPD) and depend on a portable oxygen therapy device. Musashi Medical Laboratory has

developed the convenient oxygen conserver IVY with its control block in smartphone format. The conserver works with a compact, lightweight piezo valve from Festo. The switching operations of the proportional valve VEMR are completely silent. It is

sensor-controlled and only opens during inhalation. Less oxygen is consumed as a result, and the patient’s radius of activity is significantly increased.



# Oxygen therapy

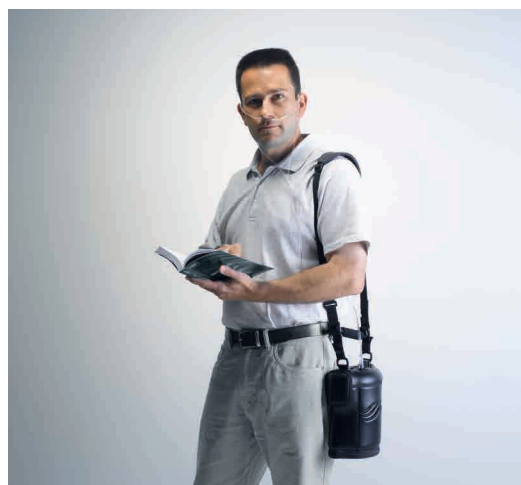
## Proportional flow control valve VEMD



### Quiet, precise and energy-saving – ideal for mobile devices

The lightweight and compact mass flow controller (MFC), which is designed specifically for medical applications, is very quiet and, thanks to its short response times, very precise. The module with 2/2-way piezo valve, flow sensor and control electronics doses and regulates inert gases such as oxygen or nitrogen proportionally. The integrated control circuit with sensor detects and regulates the current flow rate and forwards it to the master controller as an analogue signal. The volumetric flow rate at the system's output can be adjusted very simply by entering a setpoint between 0.2 and 10 V.

- Compact module with integrated control electronics
- Minimal energy consumption thanks to piezo technology
- Silent: ideal for mobile applications and those close to the patient



**Portable oxygen concentrator**  
(oxygen concentrator)

**Air compressor**

**Valve for feed waste dump**

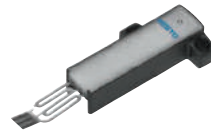
**Oxygen storage tank**

**Portable oxygen conserver**  
(oxygen conserver)

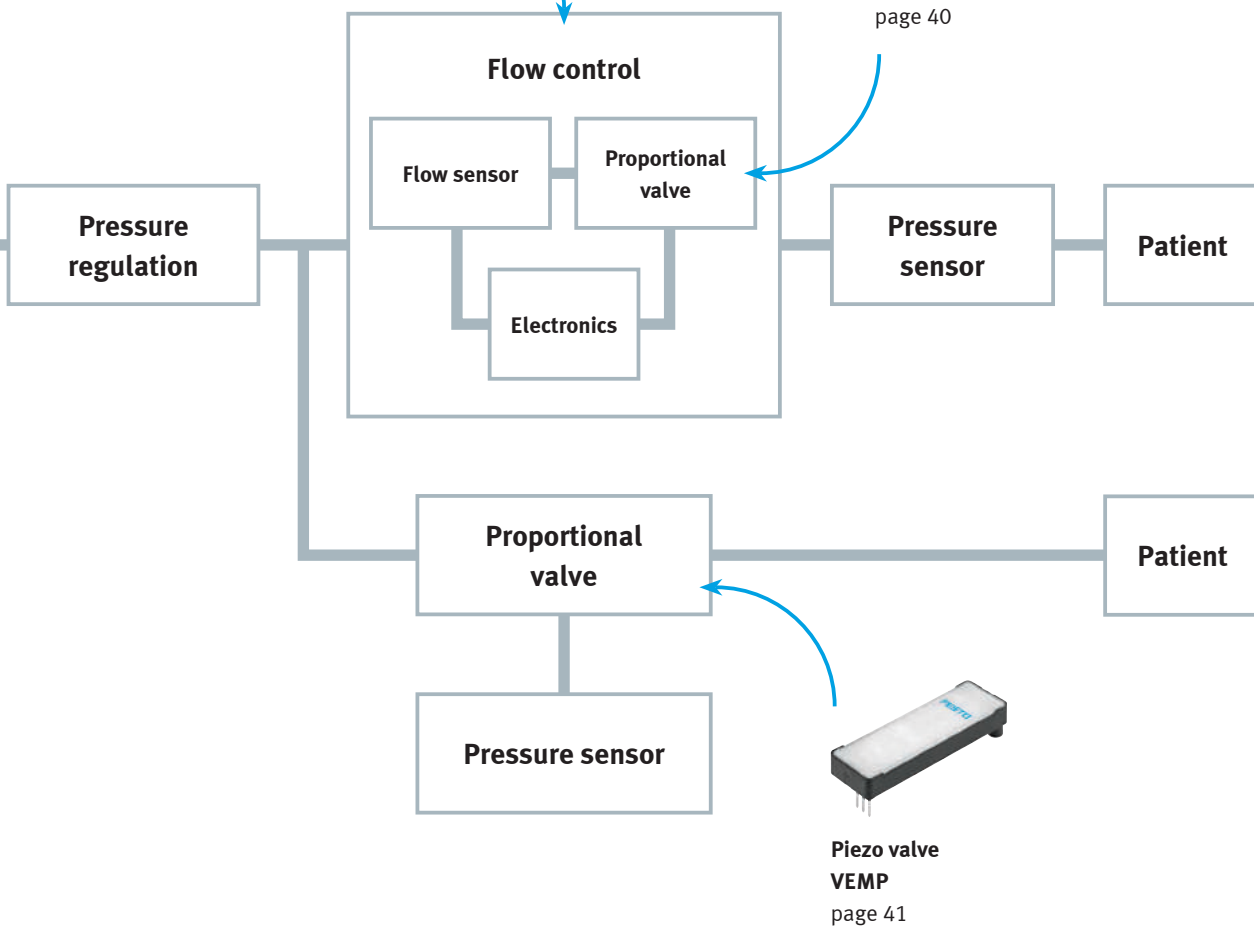




**Proportional flow control valve  
VEMD**  
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**Piezo valve  
VEMR**  
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# Ventilator breathing devices



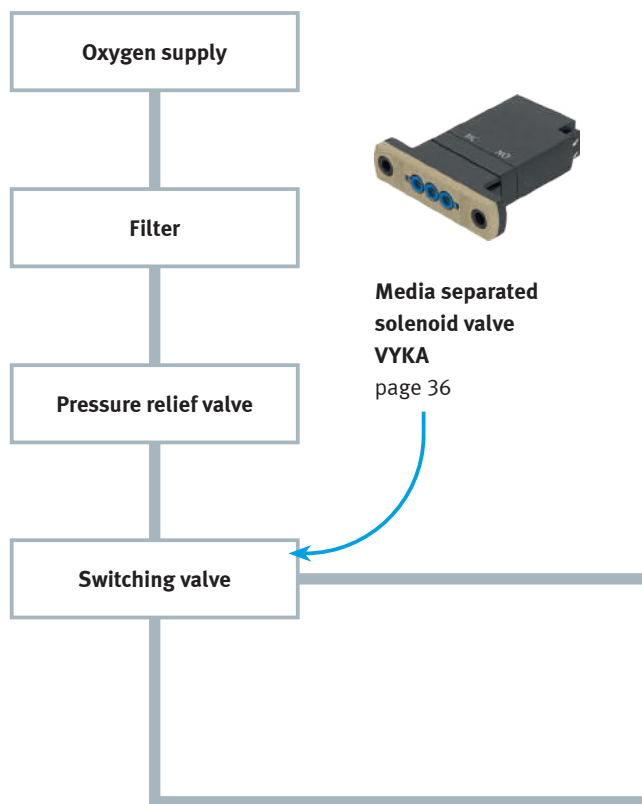
## 2/2-way proportional valve VEAЕ



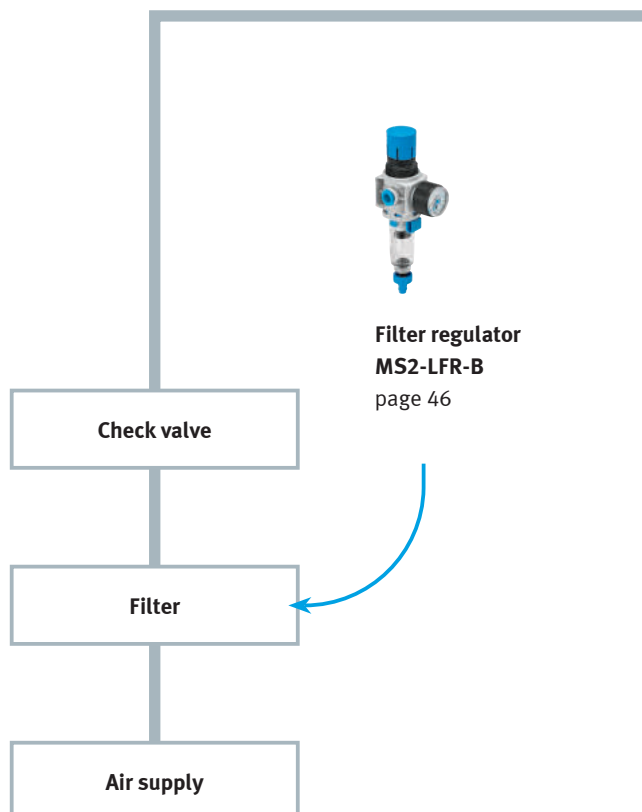
### Suitable for oxygen – small and quiet with high flow rate

The VEAЕ regulates gas flows, whether oxygen, air, nitrogen or inert gases, safely and precisely. Since the piezo ceramics also maintain their current status in case of a power failure, the valves offer outstanding process reliability. The high flow rate of up to 100 l/min makes the VEAЕ ideal for portable or stationary ventilator breathing devices. The compact valve is ideally suited for regulating the flow of air, and thus the speed of compressed air drills used in dentistry and surgery.

- Piezo proportional valve with high flow rate and for high pressure ranges
- Energy consumption < 10 mW
- No self-heating
- Compatible with oxygen
- Small and lightweight
- Ideal for battery-powered, mobile applications



Media separated solenoid valve VYKA page 36



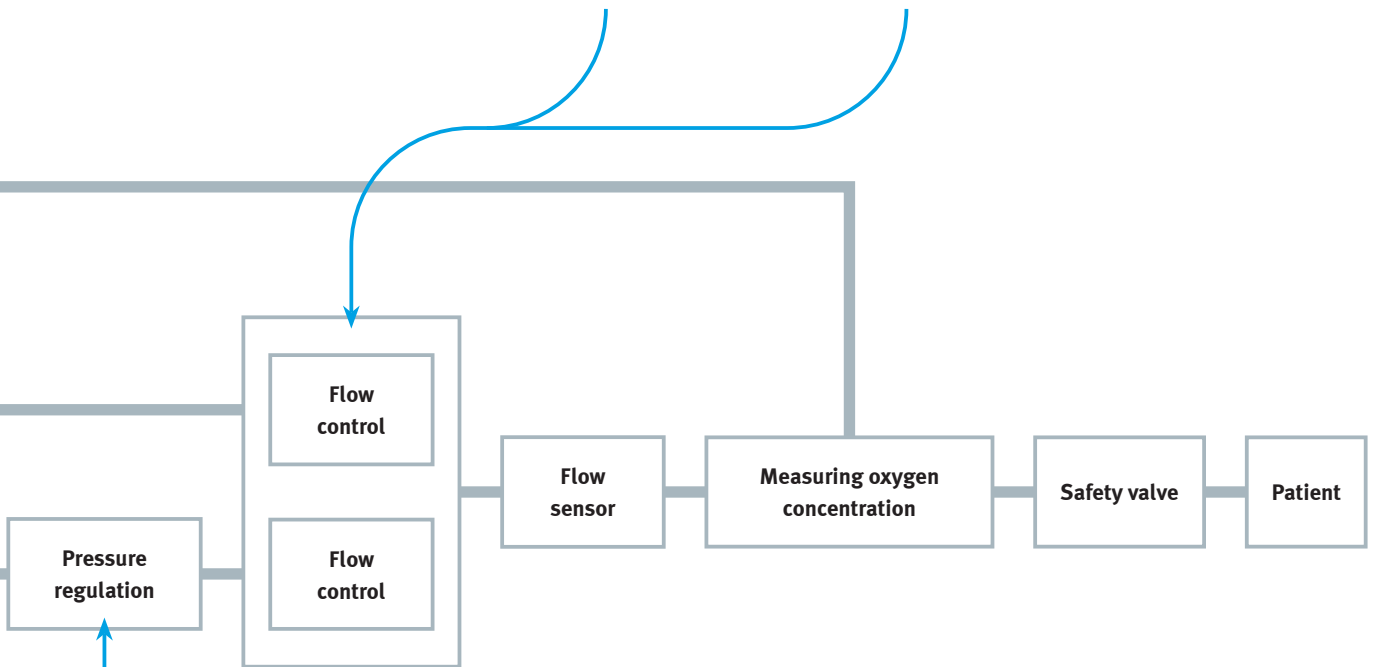
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**Piezo valve  
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**Proportional directional control valve  
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**Proportional pressure  
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**Proportional pressure  
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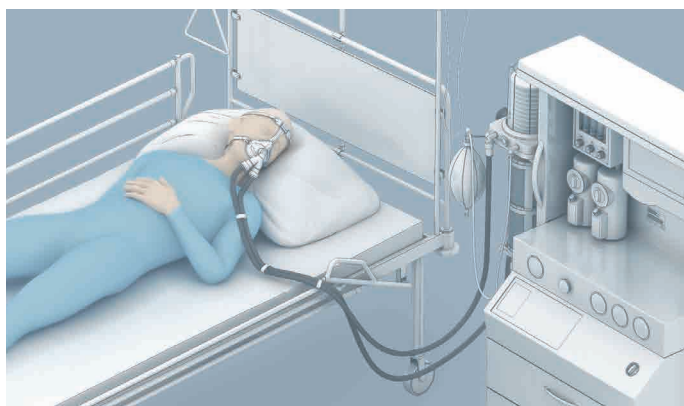


**Proportional pressure  
regulator  
VPPE**  
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**Precision pressure  
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# Anaesthesia



**Piezo valve VEA E**  
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**Proportional directional control valve VPWS**  
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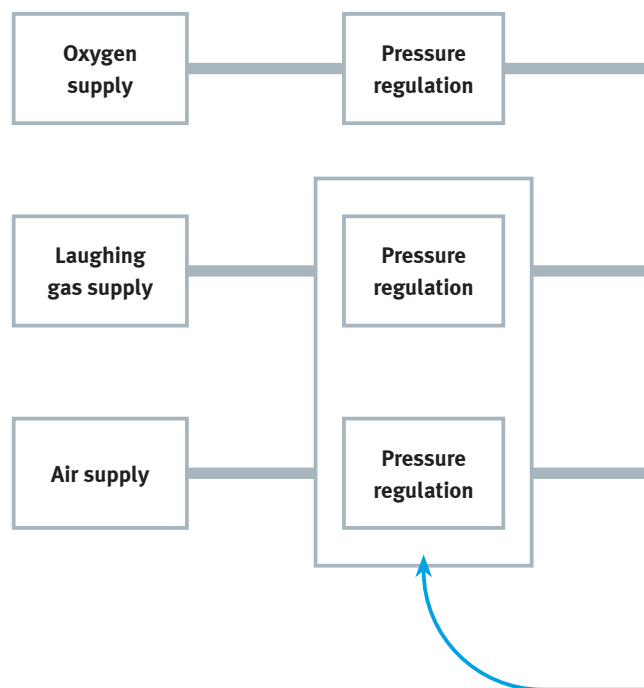
## 2/2-way proportional valve VPWS



### Extremely compact with high flow rate

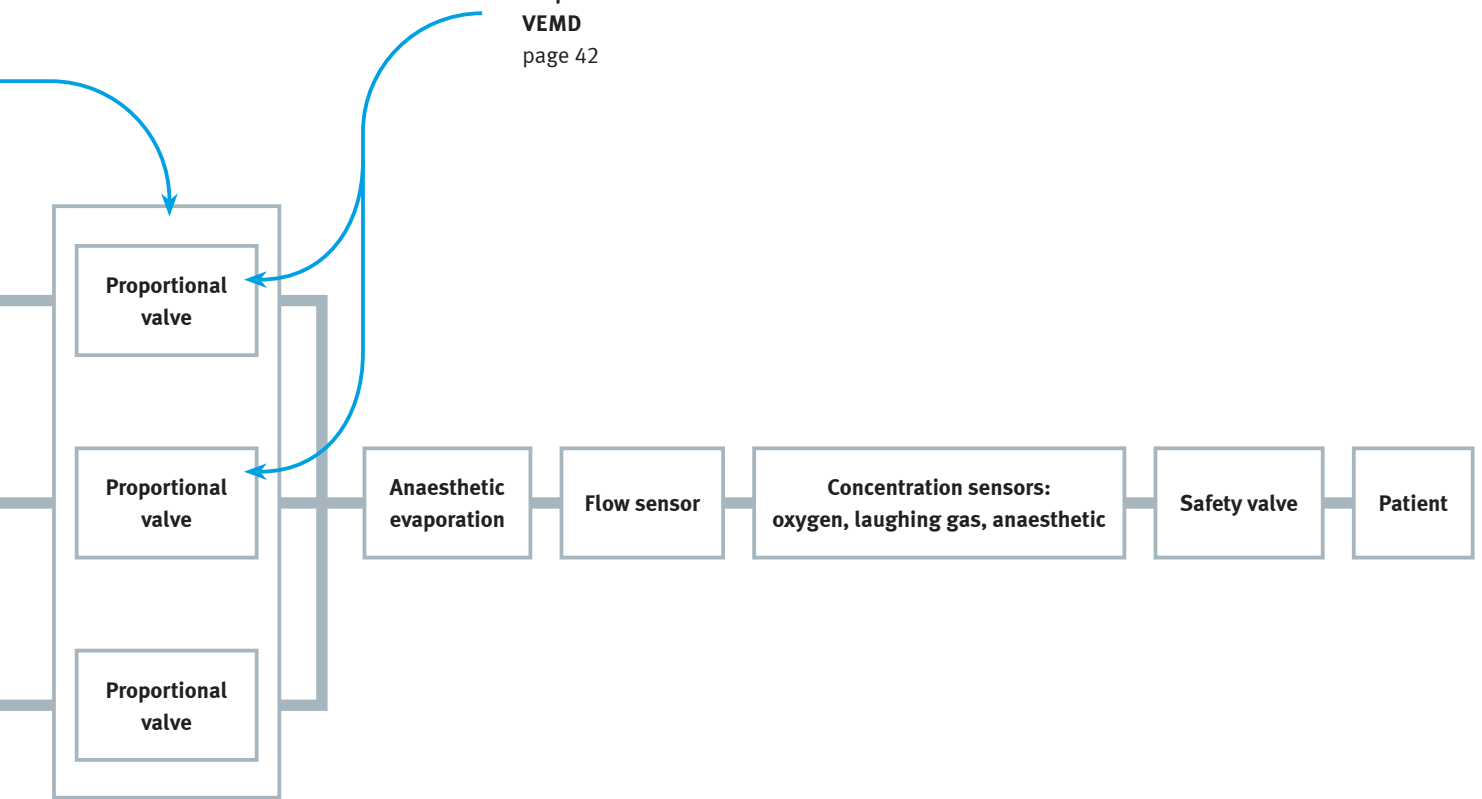
The VPWS is a lightweight, compact 15 mm cartridge valve with high flow rate. The proportional solenoid valve safely and accurately regulates the flow of gases, whether oxygen, carbon dioxide, air, nitrous oxide or inert gases. It is perfect for use in ventilator breathing and anaesthetic systems, for example where respiratory gases need to be mixed with oxygen. But it is also suitable for laparoscopes and colonoscopes, as well as other surgical instruments which are operated with compressed air.

- Extremely small cartridge valve: 15 mm diameter, 30 mm long
- Different variants with flow rates of 40 l/min at 2 bar, 90 l/min at 8 bar and 200 l/min at 2 bar
- Ideal for applications with minimal installation space





**Proportional flow control valve  
VEMD**  
page 42



**Proportional pressure  
regulator  
VEAB**  
page 43



**Proportional pressure  
regulator  
VPPI**  
page 44



**Proportional pressure  
regulator  
VPPE**  
page 43



**Precision pressure  
regulator  
LRP**  
page 47



**Filter regulator  
MS2-LFR-B**  
page 46

# Dental drills and media handling



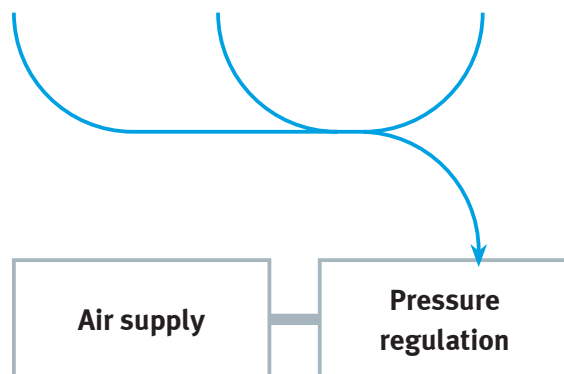
**Filter regulator MS2-LFR-B**  
page 46



**Precision pressure regulator LRP**  
page 47



**Proportional pressure regulator VEAB**  
page 43



## Proportional pressure regulators VEAA/VEAB



### Highly precise and quiet – with a large pressure range

The extremely compact valves deliver top performance for the regulation of pressure and are highly economic for flow rates of up to 20 l/min. They also boast an extremely long service life. The VEAA and VEAB combine innovative piezo technology with digital closed-loop control technology. This makes the pressure regulators with their outstanding features interesting for laboratory automation applications where regulated pressure or vacuum is required for pressure-supported dosing and pipetting of fluids.

- Compact module with 3/3-way valve, pressure sensor and integrated control electronics
- Excellent control precision
- High repetition accuracy
- Completely silent: ideal for use in laboratories and in medical technology
- Wide pressure range: -1 to 10 bar



**Vacuum generator OVEM**  
page 49



**Vacuum generator VN**  
page 49





**Proportional flow control valve  
VEMD**  
page 42

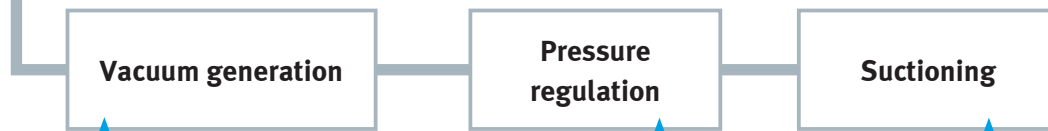
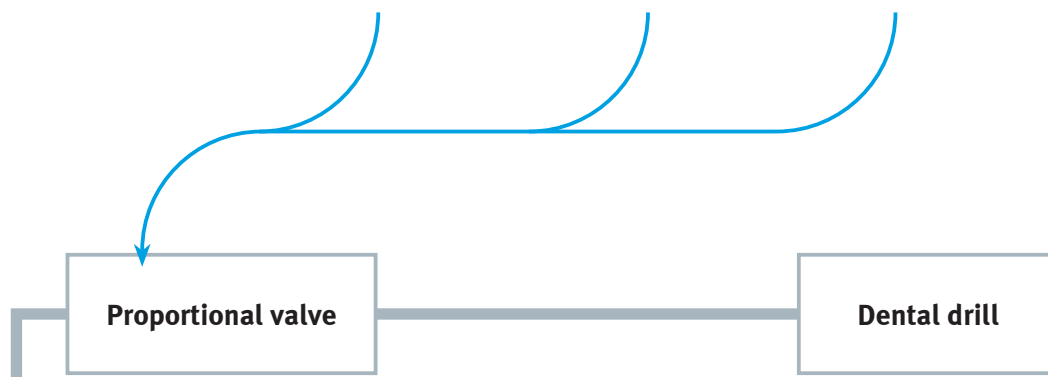


**Piezo valve  
VEAE**  
page 41



**Proportional directional control valve  
VPWS**  
page 42

Gas handling



**Dosing needle  
VAVN**  
**Fitting  
NLFA**  
page 34, page 35



**Electrical interface  
VAEM**  
page 33



**Proportional  
pressure regulator  
VEAB**  
page 43



**Media separated valves  
VYKA/VYKB/VZDB**  
page 36

Media handling



# Compression therapy/medical mattresses

## Piezo valve VEMP



### Small, lightweight, affordable and energy-saving

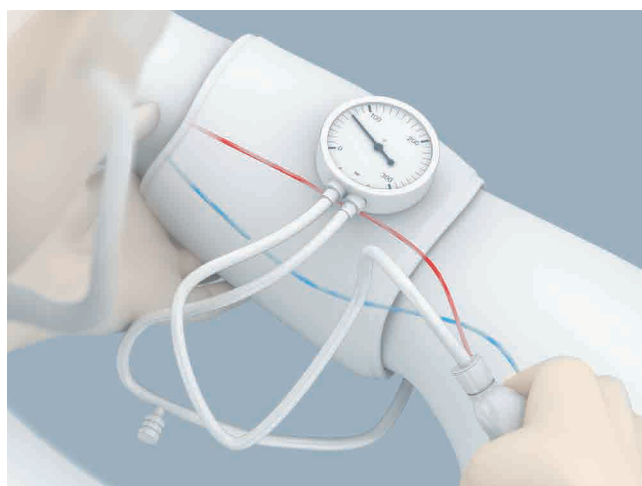
The extremely compact proportional valve VEMP with piezo technology requires only minimal energy of just 1 mW. At 20 g it is lightweight, making it ideal for use in mobile devices such as portable oxygen therapy devices. The VEMP enables extremely precise proportional control of gas flow rates from 0 to 30 l/min, as well as pressure. With a switching speed of 15 ms, it can react very quickly to setpoint changes. It is ideal for medical compression therapy, oxygen/ventilation therapy, ophthalmology and dialysis.

- Proportional air supply and exhaust
- Very precise
- Very low energy consumption
- Extremely compact design
- Minimal weight
- Minimal leakages
- No heat generation
- Long service life



### Anti-decubitus mattress

### Sleeve





**Piezo valve  
VEMR**  
page 40



**Piezo valve  
VEMP**  
page 41



**Solenoid valve  
MHA1, MHA2/3/4**  
page 45



**Proportional pressure regulator  
VEAB**  
page 43

# Liquid handling



We develop ready-to-install complete solutions with dosing technology and the matching kinematics in line with your requirements – for dosing and pipetting liquids, e.g. for dilutions, adding nutrient solutions or for dispensing reagents into microwell plates.

**Extremely precise**

## Dispense and pipette heads >

### Pipette heads





**Pipetting units  
DHOE**

<b>Pipetting volume</b>	5 ... 1000 µl (depending on the pipette tip, larger volumes on request)
<b>Max. pipetting throughput</b>	3000 µl/s
<b>Pipetting accuracy</b>	1 ... 5% CV
<b>Input pressure</b>	-0.2 ... 0.65 bar
<b>Power supply</b>	24 V DC
<b>Electrical connection</b>	2 pins, open end
<b>Liquid connection</b>	¼-28 UNF female thread
<b>Dimensions (W x L x H)</b>	8.1 mm x 76.2 mm x 30 mm
<b>Grid dimension</b>	9 mm
<b>Pipette tip</b>	<b>Volume</b> 20 µl, 300 µl, 1000 µl
	<b>Key features</b> Filter, sterile
	<b>Packaging unit</b> 960 tips (10 racks x 96 tips)
<b>Description</b>	<ul style="list-style-type: none"> <li>• Pipetting system with pipette head</li> <li>• Open pipetting system</li> <li>• Freely configurable</li> <li>• Flexible extension options</li> <li>• Media-resistant pipette head</li> <li>• With pipette tips</li> <li>• Easy integration</li> <li>• Complete solution from a single source</li> </ul>
<b>online:</b> →	<a href="#">dhoe</a>



Dispense and pipette heads >

## Accessories for pipetting units

		
	<b>Pipette tip ejectors</b> <b>DHAO-EJ</b>	<b>Disposable tips</b> <b>DHAP</b>
<b>Description</b>	<ul style="list-style-type: none"> <li>Once the pipetting process is complete, the used pipette tips can be removed and disposed of completely mechanically using the pipette tip ejector DHAO-EJ</li> </ul>	<ul style="list-style-type: none"> <li>Volume: 20, 300, 1000 µl</li> <li>Disposable tip material: polypropylene (clear, not coloured)</li> <li>Filter material: polyethylene (white)</li> <li>Optional: sterile packaging</li> <li>Delivered stacked or in racks</li> <li>Packaging unit: 960 pieces</li> </ul>
<b>online:</b> →	<a href="#">dhao-ej</a>	<a href="#">dhap</a>

Dispense and pipette heads >

## Compressed air generators

		
	<b>Pressure vacuum generators</b> <b>PGVA-1</b>	<b>Pressure vacuum generator</b> <b>PGVA-2</b>
<b>Pressure regulation range</b>	-450 ... +450 mbar	-620 mbar, +800 mbar
<b>Standard flow rate</b>	< 1 l/min	< 1.2 l/min
<b>Absolute accuracy</b>	1% (FS)	1% (FS)
<b>Max. grade of filtration</b>	0.01 µm	0.01 µm
<b>Pneumatic connection</b>	QS-4	QS-4
<b>Power supply</b>	24 V DC	24 V DC
<b>Digital output design</b>	For integrated individual valve actuation	
<b>Electrical connection, connection technology</b>	RJ45 Ethernet port for Modbus TCP RS232 serial port for ASCII	
<b>Dimensions (W x L x H)</b>	210 mm x 208 mm x 76 mm	170 mm x 210 mm x 55 mm
<b>Description</b>	<ul style="list-style-type: none"> <li>Regulated pressure/vacuum generation</li> <li>Proportional pressure/vacuum control</li> <li>Integrated compressor</li> <li>Mobile, can therefore be used flexibly</li> <li>Easy to integrate</li> <li>Dynamic and precise</li> <li>Easy to operate and configure with the GUI configuration tool, see <a href="http://www.festo.com/software/PGVA">www.festo.com/software/PGVA</a></li> </ul>	<ul style="list-style-type: none"> <li>Constant pressure/vacuum generation</li> <li>Integrated compressor</li> <li>Mobile, can therefore be used flexibly</li> <li>Easy to integrate</li> <li>Dynamic and precise</li> </ul>
<b>online:</b> →	<a href="#">pgva</a>	<a href="#">pgva</a>

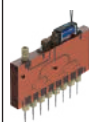
# Liquid handling

## Dispense and pipette heads >

### Dispense heads



**Dispense heads  
VTOE**



**Dispense heads  
VTOI**

<b>Basic function</b>	Dosing	Dosing and aspirating
<b>Valve function</b>	2/2-way, single solenoid, closed	2/2-way, single solenoid, closed
<b>Grid dimension</b>	9 mm	9 mm
<b>Operating pressure</b>	0 ... 0.5 bar	0 ... 1 bar, -0.2 ... 0.65 bar
<b>Internal volume</b>	113 µl valve with fluid connections	10 µl fluid chamber valve, 178 µl distributor block with valve, needle and fittings
<b>Fluid connection</b>	8x UNF1/4-28, UNF1/4-28	Female thread 1/4-28 UNF-2B
<b>Medium</b>	Liquid media	Liquid media, gaseous media
<b>Materials in contact with the media</b>	ETFE, FPM, FPM, PC, PEEK, PPS, high-alloy stainless steel	ETFE, FPM, PEI, PPS, high-alloy stainless steel
<b>Water flow rate at max. operating pressure</b>	370 µl/s, 2000 µl/s, 1300 µl/s	
<b>Nominal width of dosing needle</b>	0.32 mm, 0.6 mm, 1 mm	0.3 mm
<b>Length of dosing needle</b>	30 mm	30 mm
<b>Min. dosing volume</b>	1 µl	1 µl
<b>Note on dosing volume</b>	Depending on the configuration, environment and application	Depending on the configuration, environment and application
<b>Typical dosing precision</b>	<1% CV for volumes >5 µl, <2.5% CV for volumes between 1-5 µl	≤ 5% tip-to-tip CV, ≤ 3% intra-run CV
<b>Note on dosing precision</b>	Depending on the configuration, environment and application	Depending on the configuration, environment and application
<b>Nominal operating voltage DC</b>	24 V	24 V
<b>Duty cycle</b>	100% with individual mounting, 50% (max. switch-on time 1 s), 50% with block mounting (max. switch-on time 1 s)	100%
<b>Degree of protection</b>	IP30	IP30
<b>Ambient temperature</b>	5 ... 40°C	5 ... 40°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Ready-to-install dosing solution saves time and costs</li> <li>• Compact 9 mm grid dimension</li> <li>• Suitable for sensitive and aggressive liquids</li> <li>• Ideally suited for contactless dispensing of liquid media</li> <li>• Maximum dosing precision down to the microlitre range</li> <li>• Small internal volume makes it easy to rinse</li> <li>• 1- or 8-channel dispense head</li> <li>• Typical coefficient variation (CV): &lt; 1% at 10 to 1000 µl</li> </ul>	<ul style="list-style-type: none"> <li>• Extremely precise</li> <li>• Compact 9 mm grid dimension</li> <li>• Ideal for microwell plates</li> <li>• 8-channel dispense head</li> <li>• Simple design with side-by-side mounting for increased throughput</li> <li>• High-quality materials, therefore also suitable for aggressive media</li> <li>• The complete dispensing system can be designed with just a few components</li> <li>• A 96-channel dispense head can be realised using just 12 valves</li> </ul>
<b>online: →</b>	<a href="#">vtoe</a>	<a href="#">vtoi</a>

Dispense and pipette heads > Accessories >

## Control system for dispense heads




**Valve control modules  
VAEM**

<b>Dimensions (W x L x H)</b>	92 mm x 100 mm x 28 mm
<b>Parameterisation</b>	Parameter setting per output
<b>Max. number of outputs</b>	8
<b>Pickup current, per output</b>	20 ... 1000 mA
<b>Holding current, per output</b>	20 ... 400 mA
<b>Pickup current, total</b>	4 A
<b>Holding current, total</b>	1.8 A
<b>Trigger level</b>	Level 14 ... 24 V
<b>Time resolution</b>	0.2 ms
<b>Communication interface, protocol</b>	ASCII via RS232
<b>Ethernet interface, protocol</b>	Modbus TCP
<b>Description</b>	<ul style="list-style-type: none"> <li>• Electronic control system with integrated, adjustable holding current reduction for controlling up to eight solenoid valves</li> <li>• Parameterisation, diagnostics and control via graphical user interface (GUI), Ethernet and RS232 interface as well as external 24 V trigger input</li> <li>• Graphical user interface (GUI) for extremely easy operation and clear visualisation</li> <li>• Very fast valve actuation with a time resolution of 0.2 ms</li> <li>• Easy to set the calibration factor between the individual channels (opening times per valve)</li> </ul>
<b>online:</b> →	<a href="#">vaem</a>

# Liquid handling

Dispense and pipette heads › Accessories ›

## Dosing elements

	 <p><b>Dosing needle sets VAVN</b></p>
<b>Design of dosing needle</b>	With chamfer, with taper
<b>Nominal width of dosing needle</b>	0.3 mm, 0.6 mm, 1.2 mm
<b>Outside diameter of dosing needle</b>	1.6 mm
<b>Length of dosing needle</b>	30 mm, 60 mm
<b>Operating pressure [MPa]</b>	0 ... 0.4 MPa
<b>Flow rate Kv</b>	0.003 ... 0.039 m <sup>3</sup> /h
<b>Medium</b>	Liquid media, gaseous media
<b>Materials in contact with the media</b>	High-alloy stainless steel
<b>Ambient temperature</b>	5 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• For dosing applications with extremely high precision</li> <li>• Length of dosing needle 30 mm or 60 mm</li> <li>• Outside diameter 1.6 mm</li> <li>• Nominal width 0.3 mm, 0.6 mm or 1.2 mm</li> <li>• High corrosion resistance (corrosion resistance class CRC 3 to Festo standard 940 070) and chemical resistance</li> <li>• Design with chamfer and/or with taper</li> <li>• Pack of 10</li> </ul>
<b>online:</b> →	<a href="#">vavn</a>

Individual valves › Accessories ›

## Fittings






**Fittings  
NLFA**

<b>Design</b>	Tubing mounted via clamped connection, tubing mounted via barbed connector
<b>Design</b>	Straight design
<b>Fluid connection</b>	UNF1/4-28
<b>Fluid connection 2</b>	For tubing O.D. 3 mm, for tubing I.D. 1.2 mm, for tubing I.D. 2.1 mm, for tubing O.D. 1.6 mm (1/16"), for tubing O.D. 3.2 mm (1/8")
<b>Operating pressure for full temperature range</b>	-0.75 bar, 4 bar, 6 bar
<b>Operating pressure [MPa] for full temperature range</b>	-0.075 MPa, 0.4 MPa, 0.6 MPa
<b>Operating pressure [psi] for full temperature range</b>	-10.875 psi, 58 psi, 87 psi
<b>Medium</b>	Liquid media, gaseous media
<b>Materials in contact with the media</b>	PP
<b>Ambient temperature</b>	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• For mounting in laboratory devices</li> <li>• Excellent rinsability thanks to connector without dead space</li> <li>• For liquid and gaseous media</li> <li>• Including for aggressive liquids</li> <li>• Materials in contact with the media: PP</li> <li>• For securing tubing and dosing needles</li> <li>• Straight design</li> </ul>
<b>online: →</b>	<a href="#">nlfa</a>

# Liquid handling


Individual valves >

## Media separated valves

	 <b>Media separated solenoid valves VYKA</b>	 <b>Media separated solenoid valves VYKB</b>	 <b>Media separated solenoid valves VYKC</b>
<b>Size</b>	7	10, 12	16
<b>Valve function</b>	2/2-way, single solenoid, closed, 2/2-way, single solenoid, open, 3/2-way, single solenoid, open/closed	2/2-way, single solenoid, closed, 3/2-way, single solenoid, open/closed	2/2-way, single solenoid, closed, 2/2-way, single solenoid, open, 3/2-way, single solenoid, open/closed
<b>Actuation type</b>	Electrical	Electrical	Electrical
<b>Operating voltage range DC</b>	12 ... 24 V	12 V, 24 V	12 ... 24 V
<b>Note on operating voltage range DC</b>	With E-box VAVE-K1-..., tolerance: +/- 10%		Nominal operating voltage: 24 V Tolerance: +/- 10% Maximum residual ripple: +/- 15%
<b>Characteristic coil data</b>	12 ... 26 V DC: low-current phase 0.06 W, high-current phase 2.2 W	12 V DC: low-current phase 1 W, high-current phase 3.7 W 12 V DC: low-current phase 1 W, high-current phase 5.2 W 24 V DC: low-current phase 1 W, high-current phase 5.2 W 24 V DC: low-current phase 1 W, high-current phase 3.7 W	With integrated holding current reduction at 24 V DC: low-current phase 1 W, high-current phase 5.8 W Maximum duty cycle: 100% Without holding current reduction: inrush phase: 630 mA for 100 ms Holding phase: 180 mA (+/- 2%)
<b>Fluid connection</b>	Flange	Flange	Flange
<b>Nominal width</b>	1.2 mm	1.6 mm, 2 mm	1.2 mm, 1.6 mm, 2 mm
<b>Flow rate Kv</b>	0.013 m <sup>3</sup> /h, 0.021 m <sup>3</sup> /h	0.034 m <sup>3</sup> /h, 0.056 m <sup>3</sup> /h	0.033 m <sup>3</sup> /h, 0.052 m <sup>3</sup> /h, 0.078 m <sup>3</sup> /h
<b>Medium</b>	Liquid media, gaseous media	Liquid media, gaseous media	Liquid media, gaseous media
<b>Medium pressure [MPa]</b>	0 MPa, 0.2 MPa	-0.075 MPa, 0.1 MPa, 0.3 MPa	-0.075 - 0.2 Mpa, -0.075 ... 0.3 MPa
<b>Materials in contact with the media</b>	FFPM, FPM, PEEK	EPDM, FFPM, FPM, PEEK	EPDM, FKM, FFKM, PEEK
<b>Ambient temperature</b>	0 ... 50°C	0 ... 50°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact width of 7 mm</li> <li>• Maximum performance and precision in the smallest of spaces</li> <li>• High flow rate with small size</li> <li>• Very easy to clean thanks to media separation</li> <li>• Low media consumption thanks to small internal volume</li> <li>• FDA-listed materials</li> <li>• High-quality materials, therefore also suitable for aggressive media</li> <li>• High repetition accuracy, switching frequency and precision, therefore also suitable for extremely small volumes and dispensing tasks</li> <li>• Very flexible to use thanks to 3/2-way and 2/2-way variants (NC/NO) as well as 12 ... 26 V DC actuation</li> <li>• Optionally with slide-on E-box VAVE-K1 with holding current reduction as accessory</li> <li>• Developed to ISO 13485</li> <li>• Pressure and temperature ranges vary depending on the configuration</li> </ul>	<ul style="list-style-type: none"> <li>• Compact width of 10 mm or 12 mm</li> <li>• Very easy to clean thanks to media separation</li> <li>• High-quality materials, therefore also suitable for aggressive media</li> <li>• Very flexible to use thanks to 3/2-way or 2/2-way variants as well as 12 or 24 V DC actuation</li> <li>• For dosing, aspirating and for continuous flow applications</li> <li>• Developed to ISO 13485</li> </ul>	<ul style="list-style-type: none"> <li>• Compact width of 16 mm</li> <li>• Very flexible to use thanks to 3/2-way and 2/2-way variants</li> <li>• NC/NO, various nominal sizes as well as 12 ... 26 V DC actuation</li> <li>• Very easy to clean thanks to media separation</li> <li>• FDA-listed materials</li> <li>• Use of high-performance materials (EPDM, FKM, FFKM, PEEK), therefore also suitable for aggressive media</li> <li>• Easy commissioning and maintenance, thanks to second status LED display</li> <li>• Optionally with integrated, smart holding current reduction (minimal self-heating)</li> <li>• Developed according to ISO 13485</li> </ul>
<b>online: →</b>	<a href="#">vyka</a>	<a href="#">vykb</a>	<a href="#">vykc</a>



Individual valves › Accessories ›

## Electrical connection components

	 <p><b>E-boxes VAVE-K1</b></p>
<b>Electrical connection</b>	2-pin, twin wire, open end
<b>Operating voltage range DC</b>	12 ... 26 V
<b>Cable composition</b>	2 x 0.08 mm <sup>2</sup>
<b>Cable length</b>	0.5 m
<b>Signal status indication</b>	LED
<b>Additional functions</b>	Holding current reduction
<b>Description</b>	<ul style="list-style-type: none"> <li>• For media separated solenoid valve VYKA</li> <li>• With holding current reduction</li> </ul>
<b>online:</b> →	<a href="#">vave-k1</a>

Individual valves › Accessories ›

## Sub-bases

	 <p><b>Sub-bases VABS-K1</b></p>	 <p><b>Sub-bases VABS-K2</b></p>
<b>Fluid connection</b>	Female thread 1/4-28 UNF-2B, female thread M5	Female thread 1/4-28 UNF-2B, female thread M6
<b>Nominal width</b>	1.2 mm	1.6 mm, 2 mm
<b>Operating medium</b>	Liquid media, gaseous media	Liquid media, gaseous media
<b>Note on the operating/pilot medium</b>	Note resistance of materials in contact with the media	Note resistance of materials in contact with the media
<b>Description</b>	<ul style="list-style-type: none"> <li>• For media separated solenoid valve VYKA</li> <li>• Connections underneath</li> </ul>	<ul style="list-style-type: none"> <li>• For media separated solenoid valve VYKB and media separated pneumatic valve VZDB</li> <li>• Variants with connections underneath or on the side</li> </ul>
<b>online:</b> →	<a href="#">vabs-k1</a>	<a href="#">vabs-k2</a>

# Liquid handling

Individual valves > Accessories >

## Connecting cables for valves



**Connecting cables  
NEBV-Q7G2**



**Connecting cables  
NEBV-HPG2**

<b>Electrical connection 1, connection type</b>	Socket	Cable with socket
<b>Electrical connection 1, cable outlet</b>	Straight	Straight
<b>Electrical connection 1, number of pins/wires</b>	2	2
<b>Electrical connection 1, design</b>	Rectangular	Rectangular
<b>Electrical connection 2, connection type</b>	Twin wire	2x single wires
<b>Electrical connection 2, connection technology</b>	Open end	Open end
<b>Operating voltage range DC</b>	0 ... 30 V	0 ... 24 V
<b>Cable length</b>	0.1 m, 0.5 m	0.3 m
<b>Description</b>	<ul style="list-style-type: none"> <li>For media separated solenoid valve VYKA</li> </ul>	<ul style="list-style-type: none"> <li>For media separated solenoid valve VYKB</li> </ul>
<b>online: →</b>	<a href="#">nebv-q7g2</a>	<a href="#">nebv-hpg2</a>

Individual valves >

## Media separated valves



**Media separated pneumatic valves  
VZDB**

<b>Size</b>	10
<b>Valve function</b>	2/2-way, single solenoid, closed, 3/2-way, single solenoid, open/closed
<b>Actuation type</b>	Pneumatic
<b>Operating medium</b>	Liquid media, gaseous media
<b>Note on the operating/ pilot medium</b>	Note resistance of materials in contact with the medium, maximum particle size 5 µm
<b>Operating pressure [MPa]</b>	-0.075 MPa, 0.1 MPa
<b>Fluid connection</b>	Flange
<b>Nominal width</b>	1.6 mm
<b>Flow rate Kv</b>	0.034 m <sup>3</sup> /h
<b>Ambient temperature</b>	0°C, 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact width of 10 mm</li> <li>• Very easy to clean thanks to media separation</li> <li>• High-quality materials, therefore also suitable for aggressive media</li> <li>• For dosing, aspirating and for continuous flow applications</li> <li>• Developed according to ISO 13485</li> </ul>
<b>online: →</b>	<a href="#">vzdb</a>

# Gas handling


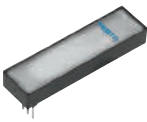


Festo, in close cooperation with you, develops products and sub-systems for medical devices for the efficient regulation and control of medical gases – dosing with piezo valves, pressure regulation or pneumatic integration solutions.

**Maximum efficiency**

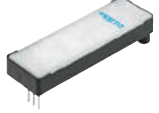

Individual valves >

## Proportional valves, piezo valves

	 <b>Piezo valves VEMR</b>	 <b>Piezo valves VEMC</b>
<b>Valve function</b>	2/2-way, single solenoid, closed	3/3-way, single solenoid, closed
<b>Standard nominal flow rate</b>	0 ... 17 l/min	0 ... 16 l/min at 2 bar
<b>Nominal width</b>	0.7 mm, 1.2 mm, 1.3 mm, 1.4 mm	0.9 mm
<b>Operating pressure</b>	0 ... 1.7 bar, 0 ... 2 bar, 0 ... 3.8 bar, 0 ... 6 bar	0 ... 2 bar
<b>Pneumatic connection 1</b>	Flange	Flange
<b>Medium</b>	Air, oxygen, nitrogen, inert gases	Air, oxygen, nitrogen, inert gases
<b>Ambient temperature</b>	5 ... 40 °C (41 ... 104 °F), 0 ... 60 °C (32 ... 140 °F)	5 ... 40 °C (41 ... 104 °F)
<b>Description</b>	<ul style="list-style-type: none"> <li>• Small, lightweight and energy-efficient</li> <li>• Controlling the flow rates of gas and oxygen</li> <li>• Proportional characteristics thanks to piezo technology</li> <li>• Very low energy consumption</li> <li>• Extremely compact design</li> <li>• Minimal weight</li> </ul>	<ul style="list-style-type: none"> <li>• Silent pressure regulation</li> <li>• Very low energy consumption</li> <li>• Compact design, minimal weight</li> <li>• No heat generation</li> <li>• Long service life</li> </ul>
<b>online:</b> →	<a href="#">vemr</a>	<a href="#">vemc</a>




Individual valves >

Proportional valves, piezo valves

		
	<b>Piezo valves VEMP</b>	<b>Piezo valves VEAE</b>
<b>Valve function</b>	2/2-way, single solenoid, closed, 3/3-way, single solenoid, closed	2/2-way, single solenoid, closed
<b>Standard nominal flow rate</b>	18 l/min, 19 l/min, 27 l/min, 28 l/min	50 l/min, 53 l/min, 60 l/min, 61 l/min, 64 l/min, 81 l/min
<b>Nominal width</b>	1.3 mm, 1.6 mm	1.2 mm, 1.5 mm, 1.7 mm
<b>Operating pressure</b>	0 ... 1.7 bar, 0 ... 0.7 bar, 0 ... 1.1 bar	0 ... 6 bar, 0 ... 3 bar
<b>Pneumatic connection 1</b>	Flange	Flange
<b>Medium</b>	Air, oxygen (oxygen applications to IEC 60601-1 only on request), nitrogen, inert gases	Compressed air to ISO 8573-1:2010 [5:3:1], inert gases, oxygen (oxygen applications to IEC 60601-1 only on request)
<b>Ambient temperature</b>	-20 ... 70°C	-10 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Very low energy consumption</li> <li>• No self-heating</li> <li>• Minimal leakages</li> <li>• Extremely precise</li> <li>• Operating medium: air, oxygen, inert gases, nitrogen</li> <li>• Integrated piezo technology</li> <li>• Long service life</li> <li>• Lightweight</li> <li>• Mounting: on sub-base, on manifold rail</li> </ul>	<ul style="list-style-type: none"> <li>• Silent operation</li> <li>• Very low energy consumption</li> <li>• No self-heating</li> <li>• Integrated piezo technology</li> <li>• Extremely long service life</li> <li>• Operating medium: air, oxygen, inert gases</li> <li>• Small and lightweight</li> <li>• High flow rates</li> <li>• Mounting via through-holes</li> </ul>
<b>online:</b> →	<a href="#">vemp</a>	<a href="#">veae</a>

Individual valves >

Accessories for piezo valves

			
	<b>Electronics modules VAVE-P12</b>	<b>Electronics modules VAVE-P17</b>	<b>Electrical plug-in base, adapter NEFV</b>
<b>Operating voltage range DC</b>	12 ... 24 V	12 ... 24 V	0 ... 310 V
<b>Adjustable output voltage</b>	0 ... 310 V	0 ... 310 V	
<b>Voltage of external setpoint input</b>	0 ... 10 V	0 ... 10 V	
<b>Max. output current</b>	5 mA	5 mA	
<b>Ambient temperature</b>	-10 ... 60°C	-10 ... 60°C	-25 ... 80°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• 2-channel open-loop piezo driver</li> <li>• For the electrical actuation of the piezo valve VEMP</li> <li>• For the electrical actuation of the piezo valves VEMR and VEAE via an adapter of type NEFV-V13/NEFV-V14</li> <li>• With protective circuit</li> </ul>	<ul style="list-style-type: none"> <li>• 2-channel open-loop piezo driver</li> <li>• For the electrical actuation of the piezo valve VEMC</li> <li>• With protective circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Adapter for connecting the piezo valves to the electronics module VAVE-P12</li> </ul>
<b>online:</b> →	<a href="#">vave</a>	<a href="#">vave</a>	<a href="#">nefv</a>

# Gas handling

## Individual valves >

### Proportional valves, solenoid valves



**Proportional directional control valves  
VPWS**

<b>Design</b>	Directly actuated poppet valve
<b>Valve function</b>	2/2-way proportional directional control valve, closed
<b>Actuation type</b>	Electrical
<b>Operating pressure</b>	0 ... 3 bar, 0 ... 7 bar, 0 ... 8 bar, 0 ... 10 bar
<b>Standard flow rate pmax -&gt; 0 bar</b>	5 l/min, 46 l/min, 56 l/min, 82 l/min, 98 l/min, 200 l/min, 220 l/min
<b>Nominal width</b>	1 mm, 1.5 mm, 2.2 mm, 6 mm
<b>Current regulating range</b>	0 ... 225 mA
<b>Medium</b>	Inert gases, air, oxygen
<b>Ambient temperature</b>	5 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Directly actuated poppet valve</li> <li>• Operating medium: air, oxygen, inert gases</li> <li>• Extremely small and lightweight</li> <li>• Compact and cost-effective</li> <li>• Mounting: on sub-base</li> </ul>
<b>online: →</b>	<a href="#">vpws</a>

## Control valves >

### Flow control valves



**Proportional flow control valves  
VEMD**






**Proportional flow control valves  
VEMD**

<b>Valve function</b>	2-way proportional flow control valve	2/2-way proportional flow control valve
<b>Operating pressure</b>	0 ... 2.5 bar	6 bar, 0.6 MPa
<b>Flow rate control range</b>	0 ... 20 l/min	0 ... 200 l/min
<b>Nominal width</b>	1.4 mm	6 mm
<b>Nominal operating voltage DC</b>	12 V, 24 V	12 ... 24 V
<b>Reference value</b>	0.2 - 10 V	Analogue 0 - 10 V, 1 - 5 V or 4 - 20 mA, digital via Ethernet (Modbus TCP) or RS232/RS485 (ModBus RTU)
<b>Medium</b>	Compressed air to ISO 8573-1:2010 [5:4:1], inert gases, oxygen (oxygen applications to IEC 60601-1 only on request), nitrogen	Air, oxygen, inert gases (nitrogen, argon, CO <sub>2</sub> ), calibrated for air
<b>Ambient temperature</b>	0 ... 50°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact module with integrated control electronics</li> <li>• Dynamic regulation with short response time</li> <li>• Mass flow controller (MFC)</li> <li>• Operating medium: air, oxygen, inert gases, nitrogen</li> <li>• Minimal energy consumption thanks to piezo technology</li> <li>• Silent: ideal for mobile applications and those close to the patient</li> <li>• Direct mounting via thread</li> <li>• Ideal for life sciences applications</li> </ul>	<ul style="list-style-type: none"> <li>• Digital mass flow controller (MFC) with integrated thermal flow sensor</li> <li>• Many flow rate ranges: 10, 20, 50, 100 and 200 l/min</li> <li>• Analogue and digital interfaces built in</li> <li>• With or without display</li> <li>• Best-in-class dynamic response</li> <li>• Linear control response</li> <li>• Sturdy and durable</li> </ul>
<b>online: →</b>	<a href="#">vemd</a>	<a href="#">vemd</a>

Control valves ›



Pressure regulators

	 Proportional pressure regulators <b>VEAA</b>	 Proportional pressure regulators <b>VEAB</b>	 Proportional pressure regulators <b>VPPE</b>
<b>Valve function</b>	3-way proportional pressure regulator	3-way proportional pressure regulator	3-way proportional pressure regulator, 3-way proportional pressure regulator, closed
<b>Standard nominal flow rate</b>	7 l/min, 10 l/min, 13 l/min	4.5 l/min, 5 l/min, 13 l/min, 13.5 l/min, 16 l/min, 17 l/min, 20 l/min, 21 l/min	310 l/min, 800 l/min, 850 l/min, 1250 l/min
<b>Operating pressure</b>			8 bar
<b>Pressure regulation range</b>	0.01 ... 2 bar, 0.03 ... 6 bar, 0.05 ... 10 bar	-1 ... -0.005 bar, -1 ... 1 bar, -0.5 ... 0.5 bar, -1 ... 5 bar, 0.001 ... 0.2 bar, 0.005 ... 1 bar, 0.01 ... 2 bar, 0.025 ... 5 bar, 0.03 ... 6 bar	0.15 ... 6 bar, 0.1 ... 10 bar, 0.02 ... 2 bar, 0.06 ... 6 bar
<b>Operating medium</b>	Inert gases, compressed air to ISO 8573-1:2010 [7:4:4]	Inert gases, compressed air to ISO 8573-1:2010 [7:4:4]	Inert gases, compressed air to ISO 8573-1:2010 [7:4:4]
<b>Nominal operating voltage DC</b>	24 V	24 V	
<b>Reference value</b>	4 - 20 mA, 0 - 5 V, 0 - 10 V	4 - 20 mA, 0 - 5 V, 0 - 10 V	
<b>Ambient temperature</b>	0 ... 50°C	0 ... 50°C	0 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Silent operation</li> <li>• Very low energy consumption</li> <li>• Extremely precise</li> <li>• Integrated piezo technology</li> <li>• Long service life</li> <li>• Mounting: via through-holes, H-rail mounting, on mounting plate or sub-base</li> </ul>	<ul style="list-style-type: none"> <li>• Silent operation</li> <li>• Very low energy consumption</li> <li>• Extremely precise</li> <li>• Integrated piezo technology</li> <li>• Short switching times</li> <li>• Mounting: via through-holes, H-rail mounting</li> </ul>	<ul style="list-style-type: none"> <li>• Piloted pressure regulator</li> <li>• Setpoint input as analogue voltage signal (0 ... 10 V)</li> <li>• Electrical connection via M12x1 plug, 4- or 5-pin</li> <li>• Optionally with setpoint module</li> <li>• Variant with display with three retrievable presets and digital controller electronics</li> <li>• For simple control tasks</li> </ul>
<b>online: →</b>	<a href="#">veaa</a>	<a href="#">veab</a>	<a href="#">vppe</a>

# Gas handling




Control valves >

## Pressure regulators

	 <b>Proportional pressure regulators</b> <b>VPPX</b>	 <b>Proportional pressure regulators</b> <b>VPPI</b>
<b>Valve function</b>	3-way proportional pressure regulator	3-way proportional pressure regulator
<b>Standard nominal flow rate</b>	1400 l/min, 1650 l/min, 2750 l/min, 7000 l/min	150 l/min, 900 l/min, 1400 l/min, 1630 l/min
<b>Operating pressure</b>		0 bar, 1 bar, 2 bar, 6 bar, 8 bar, 10 bar, 12 bar, 13 bar
<b>Pressure regulation range</b>	0.1 ... 10 bar	-1 ... 12 bar, 0 ... 10 bar, 0 ... 12 bar, 0 ... 2 bar, 0 ... 6 bar, -1 ... 0 bar, -1 ... 1 bar, 0 ... 10 bar, 0 ... 6 bar
<b>Operating medium</b>	Inert gases, compressed air to ISO 8573-1:2010 [7:4:4]	Inert gases, compressed air to ISO 8573-1:2010 [7:4:4]
<b>Nominal operating voltage DC</b>		24 V
<b>Reference value</b>		
<b>Ambient temperature</b>	0 ... 60°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Pressure regulator with additional sensor input</li> <li>• Programmable, freely adjustable PID controller</li> <li>• Multi-sensor control (cascade control)</li> <li>• Control characteristic adjustable via FCT (Festo Configuration Tool) software</li> <li>• Integrated pressure sensor with separate output</li> <li>• Pressure is maintained if the controller fails</li> </ul>	<ul style="list-style-type: none"> <li>• Select between three predefined and one customer-specific controller preset</li> <li>• With or without display</li> <li>• Low-noise, flexible and highly dynamic</li> <li>• Precise and stable changeover, rapid switching of the setpoint by high-performance moving coil actuator</li> <li>• Control via analogue current or voltage signal, digital pattern for adjustable setpoint values or pulse-width modulation signal</li> </ul>
<b>online:</b> →	<a href="#">vppx</a>	<a href="#">vpqi</a>

Individual valves >

Switching valves

	 <b>Solenoid valves VOVK</b>	 <b>Solenoid valves MH1</b>	 <b>Solenoid valves MHE2, MHP2, MHA2, MHE3, MHP3, MHA3, MHE4, MHP4, MHA4</b>
<b>Design</b>	Connection direction underneath, connection direction at the front, poppet valve with spring return	Poppet valve with spring return	Pressure relief poppet valve
<b>Width</b>	5.9 mm	10 mm	10 mm, 14 mm, 18 mm
<b>Valve function</b>	3/2-way, single solenoid, closed	2/2-way, single solenoid, closed, 3/2-way, single solenoid, closed, 3/2-way, single solenoid, open	3/2-way, single solenoid, closed, 3/2-way, single solenoid, open, 5/2-way, single solenoid
<b>Actuation type</b>	Electrical	Electrical	Electrical
<b>Standard nominal flow rate</b>	5.5 l/min	10 l/min, 14 l/min	90 l/min, 100 l/min, 200 l/min, 400 l/min
<b>Nominal width</b>	0.36 mm	0.9 mm	2 mm, 3 mm, 4 mm
<b>Operating pressure</b>	-1 bar, 7 bar	-0.9 bar, 8 bar	-0.9 bar, 8 bar
<b>Operating pressure [MPa]</b>	-0.1 MPa, 0.7 MPa		-0.09 MPa, 0.8 MPa
<b>Operating medium</b>	Compressed air to ISO 8573-1:2010 [6:4:1]	Compressed air to ISO 8573-1:2010 [7:4:4]	Compressed air to ISO 8573-1:2010 [7:4:4]
<b>Nominal operating voltage DC</b>	12 V, 24 V	5 V, 12 V, 24 V	
<b>Ambient temperature</b>	5 ... 50°C	-5 ... 40°C	-5 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Very narrow: 5.9 mm grid dimension</li> <li>• Extremely small and lightweight</li> <li>• Very low energy consumption</li> <li>• Variable connection concepts: flanged connection underneath or at the front, barbed fitting connection at the front</li> <li>• Ideal for controlling small air flows</li> </ul>	<ul style="list-style-type: none"> <li>• Miniaturised poppet valves</li> <li>• Multi-pin or individual electrical connection</li> </ul>	<ul style="list-style-type: none"> <li>• Directly actuated poppet valve</li> <li>• Fast-switching valve: switching times down to 2 ms</li> <li>• Direct mounting, individual sub-base, manifold assembly</li> <li>• Manifold block for 2 ... 10 valves</li> </ul>
<b>online:</b> →	<a href="#">vovk</a>	<a href="#">mh1</a>	<a href="#">mh2</a>

# Gas handling

Compressed air preparation >

## Filter regulators, MS Basic series



**Filter regulators**  
**MS2-LFR-B, MS4-LFR-B, MS6-LFR-B**

<b>Pneumatic connection 1</b>	G1/2, G1/4, M5, QS-6
<b>Standard nominal flow rate</b>	140 ... 5300 l/min
<b>Pressure regulation range</b>	0.3 ... 7 bar
<b>Operating pressure</b>	1 ... 10 bar
<b>Grade of filtration</b>	5 µm, 40 µm
<b>Ambient temperature</b>	-5 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Directly actuated diaphragm control valve</li> </ul>
<b>online: →</b>	<a href="#">ms2-lfr</a>

Compressed air preparation >

## Pressure regulators, MS Basic series



**Pressure regulators**  
**MS2-LR-B, MS4-LR-B, MS6-LR-B**

<b>Pneumatic connection 1</b>	G1/2, G1/4, M5, QS-6
<b>Standard nominal flow rate</b>	170 ... 6000 l/min
<b>Pressure regulation range</b>	0.3 ... 7 bar
<b>Operating pressure</b>	1 ... 10 bar
<b>Ambient temperature</b>	-5 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Attractively priced basic component focused on the most important technical functions</li> <li>• Lightweight and sturdy thanks to modern polymer materials</li> <li>• Compatible with the MS series for the perfect combination of low-cost basic functionality and high-end functional requirements</li> <li>• Stable control response</li> <li>• With integrated secondary exhausting and primary exhausting with return flow function</li> <li>• Rotary knob with latch</li> <li>• Grid dimension 25, 40, 62 mm (sizes 2, 4, 6)</li> </ul>
<b>online: →</b>	<a href="#">ms-lr-b</a>

Compressed air preparation >

Pressure regulators, individual devices



**Precision pressure regulators**  
**LRP, LRPS**

<b>Pneumatic connection 1</b>	For sub-base Ø 7 mm, G1/4, G1/8
<b>Standard nominal flow rate</b>	240 ... 2300 l/min
<b>Pressure regulation range</b>	0.05 ... 10 bar
<b>Operating pressure</b>	1 ... 12 bar
<b>Ambient temperature</b>	-10 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Lockable design</li> <li>• Good regulation characteristics with minimal pressure hysteresis and primary pressure compensation</li> <li>• High secondary exhausting</li> </ul>
<b>online: →</b>	<a href="#">lrp</a>

Individual valves >

Pressure regulators






**Mini pressure regulators**  
**LR**

<b>Design</b>	Diaphragm regulator, with secondary exhausting
<b>Operating pressure</b>	10 bar
<b>Standard nominal flow rate</b>	150 l/min
<b>Ambient temperature</b>	-10 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Regulates the operating pressure independently of the fluctuating input pressure</li> <li>• Directly actuated diaphragm regulator</li> <li>• With secondary exhaust</li> <li>• Mounting on sub-base or for front panel mounting</li> </ul>
<b>online: →</b>	<a href="#">lr</a>

# Gas handling



Individual valves > Accessories >

## Silencers

	 <b>Silencers U</b>	 <b>Silencers UC</b>	 <b>Silencers AMTE</b>
<b>Information on silencer insert materials</b>	PE, bronze	PE	Bronze
<b>Pneumatic connection</b>	3/4 NPT, G1, G1/2, G1/4, G1/8, G3/4, G3/8, PK-3, PK-4	G1/4, G1/8, G3/8, M5, M7, QS-10, QS-3, QS-4, QS-6, QS-8	10-32 UNF-2A, 1/8 NPT, 1/4 NPT, 3/8 NPT, 1/2 NPT, G1, G1/2, G1/4, G1/8, G3/4, G3/8, M3, M5
<b>Noise level</b>	70 ... 90 dB(A)	58 ... 68 dB(A)	55 ... 95 dB(A)
<b>Ambient temperature</b>	-10 ... 70°C	-10 ... 70°C	-40 ... 80°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact design, polymer or die-cast</li> <li>• Barbed connector or threaded connection</li> <li>• Operating medium compressed air</li> </ul>	<ul style="list-style-type: none"> <li>• To reduce noise and prevent contamination at the exhaust ports of pneumatic components</li> <li>• Polymer design</li> <li>• Operating medium: compressed air</li> <li>• For solenoid valves CPE</li> <li>• Threaded connection or push-in sleeve for push-in fitting QS</li> </ul>	<ul style="list-style-type: none"> <li>• Long or short design</li> <li>• Metal design</li> <li>• Operating medium: compressed air</li> <li>• High temperature resistance up to 80 °C</li> <li>• Slim overall width</li> <li>• Many different variants</li> <li>• Can be used universally</li> </ul>
<b>online:</b> →	<a href="#">u</a>	<a href="#">uc</a>	<a href="#">amte</a>

Vacuum technology ›




## Vacuum generators

	 <b>Vacuum generators OVEM</b>	 <b>Vacuum generators, pneumatic VN</b>
<b>Nominal width of Laval nozzle</b>	0.45 ... 3 mm	0.45 ... 3 mm
<b>Ejector characteristics</b>	High suction rate, high vacuum, standard	High suction rate, high vacuum, standard, inline, high vacuum, high suction rate
<b>Integrated function</b>	Electric ejector pulse valve, flow control valve, electric on/off valve, filter, electric air saving function, check valve, open silencer, vacuum switch	Pneumatic ejector pulse valve, open silencer, vacuum switch
<b>Max. vacuum</b>	93%	86 ... 93%
<b>Max. suction rate with respect to atmosphere</b>	6 ... 348 l/min	6.1 ... 339 l/min
<b>Ambient temperature</b>	0 ... 50°C	0 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Monitoring with vacuum sensor with IO-Link®</li> <li>• Central electrical connection via an M12 plug</li> <li>• Maintenance-free operation and reduced noise level through an integrated, open silencer</li> <li>• Integrated filter with inspection window</li> <li>• Optionally with air-saving function and LCD display</li> <li>• Short switching times with integrated solenoid valves</li> <li>• Adjustable ejector pulse: precise and safe depositing of the workpiece</li> </ul>	<ul style="list-style-type: none"> <li>• Can be used directly in the work space</li> <li>• Available as a straight type (inline: vacuum port in line with the supply port) or T-shape (standard: vacuum port at 90° to the supply port)</li> <li>• Compact and cost-effective</li> <li>• Maintenance-free operation and reduced noise level through an integrated, open silencer</li> </ul>
<b>online:</b> →	<a href="#">ovem</a>	<a href="#">vn</a>

# Gas handling

Sensors ›

## Pressure and vacuum sensors

	 <b>Pressure transmitters SPTW</b>	 <b>Pressure transmitters SPTE</b>	 <b>Pressure sensors SPAN</b>
<b>Pressure measuring range start value</b>			-0.1 MPa, 0 MPa
<b>Pressure measuring range end value</b>	1 bar, 2 bar, 6 bar, 10 bar, 16 bar, 25 bar, 50 bar, 100 bar	-1 bar, 1 bar, 10 bar	-1 bar, 1 bar, 10 bar, 16 bar
<b>Switching element function</b>			N/C or N/O contact, switchable
<b>Switching output</b>			2 x PNP or 2 x NPN switchable, PNP/NPN switchable
<b>Pneumatic connection</b>	G1/4	Flange, cartridge 10, push-in sleeve QS-4, QS-6, QS-3, QS-4	Male thread 1/8 NPT, male thread G1/8, R1/8, female thread G1/8, M5, for tubing O.D. 4
<b>Electrical connection</b>	4-pin, plug, to EN 60947-5-2, round design, M12x1	3-core, cable, open end	
<b>Display type</b>			Illuminated LCD
<b>Ambient temperature</b>	0 ... 80°C	0 ... 50°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Sensor versions: piezoresistive pressure sensor or metal thin-film pressure sensor</li> <li>• Measured variable: relative pressure</li> <li>• Operating medium: liquid media and gaseous media</li> <li>• Seal-free: pressure measuring cell and interfaces in stainless steel</li> <li>• Degree of protection IP67</li> </ul>	<ul style="list-style-type: none"> <li>• Piezoresistive pressure sensor</li> <li>• Measured variable: relative pressure</li> <li>• Cable length 2.5 m</li> <li>• Compact: 8-bracket wall mount for manifold assembly</li> </ul>	<ul style="list-style-type: none"> <li>• For monitoring compressed air and non-corrosive gases</li> <li>• For network monitoring, regulator monitoring, leak testing, object detection</li> <li>• Relative measurement method based on a piezoresistive measuring cell</li> <li>• Serial communication integrated using IO-Link® 1.1</li> <li>• Compact design 30 x 30 mm</li> <li>• High-contrast, blue backlit display</li> </ul>
<b>online: →</b>	<a href="#">sptw</a>	<a href="#">spte</a>	<a href="#">span</a>

Sensors >

Flow sensors



**Flow sensors**  
**SFAH**





**Flow transmitters**  
**SFTE**

<b>Flow measuring range end value</b>	0.1 l/min, 0.5 l/min, 1 l/min, 5 l/min, 10 l/min, 50 l/min, 100 l/min, 200 l/min	1 l/min, 5 l/min, 10 l/min
<b>Operating medium</b>	Argon, nitrogen, compressed air to ISO 8573-1:2010 [6:4:4]	Nitrogen, compressed air to ISO 8573-1:2010 [6:4:4]
<b>Operating pressure</b>	-0.9 bar, 10 bar	-0.9 bar, 10 bar
<b>Pneumatic connection</b>	Female thread G1/4, G1/8, for tubing O.D. 4, 6, 8	Female thread M5, for push-in connector O.D. 3, 4
<b>Switching output</b>	2 x PNP or 2 x NPN switchable	
<b>Electrical connection, connection type</b>	Plug	Cable, cable with plug
<b>Electrical connection, connection technology</b>	Plug pattern L1J, M8x1 A-coded to EN 61076-2-104	M8x1 A-coded to EN 61076-2-104, open end
<b>Ambient temperature</b>	0 ... 50°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Process, compressed air, forming gas and pneumatic object monitoring, handling ultra-small parts, leak test</li> <li>• Compact design 20 x 58 mm</li> <li>• Clear 2-line display</li> <li>• Mounting: H-rail mounting, wall or surface mounting, front panel mounting</li> <li>• Serial communication integrated using IO-Link® 1.1</li> </ul>	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Universal flow detection</li> <li>• Easy installation</li> <li>• Reliable pick &amp; place application for extremely small workpieces</li> </ul>
<b>online: →</b>	<a href="#">sfah</a>	<a href="#">sfte</a>

# Gas handling





Drives >

## Piston rod cylinders

	 <b>Round cylinders</b> <b>EG-PK</b>	 <b>Cartridge cylinders</b> <b>EGZ</b>
<b>Mode of operation</b>	Single-acting, pushing	Single-acting, pushing
<b>Piston diameter</b>	2.5 mm, 4 mm, 6 mm	6 mm, 10 mm, 16 mm
<b>Theoretical force at 6 bar, advancing</b>	1.9 ... 11.8 N	13.9 ... 109 N
<b>Stroke</b>	5 ... 25 mm	5 ... 15 mm
<b>Cushioning</b>	At one end, non-adjustable, no cushioning	No cushioning
<b>Description</b>	<ul style="list-style-type: none"> <li>• Micro cylinder</li> <li>• Barbed fitting for plastic tubing with standard I.D.</li> <li>• Without position sensing</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal installation space</li> <li>• Installation optionally via mounting components</li> <li>• Piston rod with male thread</li> </ul>
<b>online:</b> →	<a href="#">eg-pk</a>	<a href="#">egz</a>

Connection technology >




Standard O.D. tubing

	 Plastic tubing PFAN	 Plastic tubing PTFEN	 Plastic tubing PLN	 Plastic tubing PUN-H, PUN-H-DUO
<b>Outside diameter</b>	3 ... 12 mm	4 ... 16 mm	4 ... 16 mm	2 ... 16 mm
<b>Inside diameter</b>	2.3 ... 8.4 mm	2.9 ... 11 mm	2.9 ... 12 mm	1.2 ... 11 mm
<b>Temperature-dependent operating pressure</b>	-0.95 ... 16 bar	-0.95 ... 15 bar	-0.95 ... 14 bar	-0.95 ... 10 bar
<b>Ambient temperature</b>	-20 ... 150°C	-20 ... 150°C	-30 ... 80°C	-35 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Perfluoroalkoxy alkane</li> <li>• Pneumatic tubing with resistance to high temperatures and chemicals</li> <li>• Food-safe, see <a href="http://www.festo.com/sp/pfan">www.festo.com/sp/pfan</a> -&gt; "Certificates" tab</li> <li>• High resistance to chemicals, microbes, UV radiation, hydrolysis and stress cracks</li> <li>• Operating medium: compressed air, vacuum, water</li> </ul>	<ul style="list-style-type: none"> <li>• Polytetrafluoroethylene</li> <li>• Food-safe, see <a href="http://www.festo.com/sp/ptfen">www.festo.com/sp/ptfen</a> -&gt; "Certificates" tab</li> <li>• High resistance to chemicals</li> <li>• High temperature resistance</li> <li>• Operating medium: compressed air, vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Polyethylene</li> <li>• High resistance to chemicals, microbes and hydrolysis</li> <li>• Food-safe, see <a href="http://www.festo.com/sp/pln">www.festo.com/sp/pln</a> -&gt; "Certificates" tab</li> <li>• Resistant to most cleaning agents and lubricants</li> <li>• Operating medium: compressed air, vacuum, water</li> </ul>	<ul style="list-style-type: none"> <li>• Polyurethane</li> <li>• High resistance to microbes and hydrolysis</li> <li>• Food-safe, see <a href="http://www.festo.com/sp/pun-h">www.festo.com/sp/pun-h</a> -&gt; "Certificates" tab</li> <li>• Suitable for energy chains</li> <li>• Also available as DUO tubing</li> <li>• Operating medium: compressed air, vacuum, water, oxygen (only applies to NT variants, colour: natural)</li> </ul>
<b>online:</b> →	<a href="#">pfan</a>	<a href="#">ptfen</a>	<a href="#">pln</a>	<a href="#">pun-h</a>

# Gas handling

Connection technology >

## Push-in fittings

	 <b>Push-in fittings/connectors, media resistant NPQP</b>	 <b>Push-in fittings/connectors, standard series QS, QSC, QSF, QSH, QSL, QSS, QST, QSW, QSX, QSY</b>	 <b>Push-in fittings NPQR</b>
<b>Pneumatic connection 1</b>	Push-in sleeve QS-10, QS-12, QS-4, QS-6, QS-8, for tubing O.D. 10 mm, 12 mm, 4 mm, 6 mm, 8 mm, R1/2, R1/4, R1/8, R3/8	Male thread G1/2, G1/4, G1/8, G3/4, G3/8, M5, R1/2, R1/4, R1/8, R3/8, female thread G1/2, G1/4, G1/8, G3/8, push-in sleeve QS-10, QS-12, QS-16, QS-4, QS-6, QS-8, for tubing O.D. 10 mm, 12 mm, 16 mm, 4 mm, 6 mm, 8 mm	Male thread G1/2, G1/4, G1/8, G3/8, M5, M7, for tubing O.D. 10 mm, 12 mm, 4 mm, 6 mm, 8 mm
<b>Pneumatic connection 2</b>	For tubing O.D. 10 mm, 12 mm, 4 mm, 6 mm, 8 mm	Female thread G1/2, G1/4, G1/8, G3/8, push-in sleeve QS-10, QS-12, QS-16, QS-4, QS-6, QS-8, for tubing O.D. 10 mm, 12 mm, 16 mm, 22 mm, 4 mm, 6 mm, 8 mm	For tubing O.D. 10 mm, 12 mm, 4 mm, 6 mm, 8 mm
<b>Operating pressure for full temperature range</b>	-0.95 ... 10	-0.95 ... 14 bar	-0.95 ... 16 bar
<b>Ambient temperature</b>	-20 ... 60°C	-20 ... 80°C	-20 ... 150°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Polypropylene</li> <li>• Low-cost alternative to stainless steel: resistant to most cleaning agents in combination with tubing PLN</li> <li>• For use with extreme media influences</li> <li>• Food-safe, see <a href="http://www.festo.com/sp/npqp">www.festo.com/sp/npqp</a> -&gt; "Certificates" tab</li> <li>• Operating medium: compressed air, vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Standard series</li> <li>• Wide range of variants: large selection for maximum flexibility in standard applications</li> <li>• PBT and nickel-plated brass</li> <li>• Operating medium: compressed air, vacuum, (water)</li> </ul>	<ul style="list-style-type: none"> <li>• Very easy to clean thanks to chamfered O-ring and fewer edges where dirt can accumulate</li> <li>• Optimal price/performance ratio ideal for applications from a single source</li> <li>• Maximum corrosion resistance (corrosion resistance class CRC 4 to Festo standard 940 070) and chemical resistance</li> <li>• High temperature resistance</li> <li>• Stainless steel</li> <li>• Operating medium: compressed air, vacuum, (water)</li> </ul>
<b>online:</b> →	<a href="#">npqp</a>	<a href="#">qs</a>	<a href="#">npqr</a>

Connection technology >

Threaded fittings



**Threaded fittings**  
**NPFC**

<b>Pneumatic connection 1</b>	G1, G1/2, G1/4, G1/8, G3/4, G3/8, M3, M5, M7, R1, R1/2, R1/4, R1/8, R3/4, R3/8
<b>Pneumatic connection 2</b>	G1, G1/2, G1/4, G1/8, G3/4, G3/8, M3, M5, R1, R1/2, R1/4, R1/8, R3/4, R3/8
<b>Operating pressure</b>	-0.95 ... 50 bar
<b>Ambient temperature</b>	-20 ... 150°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Nickel-plated brass</li> <li>• Sleeve</li> <li>• Extension</li> <li>• Double nipple</li> <li>• Reducing nipple</li> <li>• L-, T-, Y- or X-fitting</li> <li>• Operating medium: compressed air, vacuum</li> </ul>
<b>online:</b> →	<a href="#">npfc</a>

# Kinematics





Compact handling systems from Festo enable you to implement analysis applications in very small spaces, from automated sample preparation to handling samples in medical diagnostics.

Everything from a single source


Drives >

## Handling systems

	 <b>Rotary gripper modules</b> <b>EHMD-40</b>	 <b>Rotary gripper modules</b> <b>EHMD-50</b>
<b>Design</b>	Electric rotary drive, electric gripper, pneumatic gripper	Electric rotary drive, electric parallel gripper
<b>Size</b>	40	50
<b>Stroke per gripper jaw</b>	5 mm, 15 mm	15 mm
<b>Max. output torque</b>	0.3 Nm	1.0 Nm
<b>Gripping force per gripper jaw</b>	3 ... 35 N	10 ... 70 N
<b>Rotation angle</b>	Infinite	Infinite
<b>Motor type</b>	Stepper motor	Stepper motor
<b>Nominal voltage DC</b>	24 V	24 V
<b>Ambient temperature</b>	0 ... 40°C	0 ... 40°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Ideal for small objects in laboratory automation</li> <li>• Infinite electrical rotation and electric or pneumatic gripping</li> <li>• Gripping and turning to open and close covers on vials</li> <li>• Optional: mounting with Z compensation compensates for the thread pitch of covers on vials during opening and closing</li> </ul>	<ul style="list-style-type: none"> <li>• Ideal for small objects in laboratory automation</li> <li>• Infinite electrical rotation and electric gripping</li> <li>• Gripping and turning to open and close covers on vials</li> <li>• Optional: mounting with Z compensation compensates for the thread pitch of covers on vials during opening and closing</li> </ul>
<b>online:</b> →	<a href="#">ehmd</a>	<a href="#">ehmd</a>



Drives >

## Electric grippers

	 <p><b>Parallel grippers, electric EHPS</b></p>
<b>Design</b>	Worm gear, T-shape, gear rack/pinion, electric gripper
<b>Size</b>	16, 20, 25
<b>Stroke per gripper jaw</b>	10 ... 16 mm
<b>Max. force on gripper jaw F<sub>z</sub>, static</b>	200 ... 450 N
<b>Gripper repetition accuracy</b>	≤0.03 mm
<b>Motor type</b>	DC servo motor
<b>Electrical connection</b>	5-pin, cable with plug, M12x1
<b>Nominal operating voltage DC</b>	24 V
<b>Protocol</b>	IO-Link
<b>Ambient temperature</b>	5 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Electric version of the pneumatically actuated parallel gripper DHPS</li> <li>• Ideal for use as a front-end actuator thanks to its low dead weight</li> <li>• Controller-free actuation using digital signals</li> <li>• Gripping force (4 settings) adjustable via ratchet switch or via IO-Link® interface</li> <li>• RA1 version with robot connection, enables fast integration in lightweight robot environments</li> </ul>
<b>online:</b> →	<a href="#">ehps</a>

Drives >

## Accessories for grippers

	 <p><b>Gripper jaws DHAS-GG</b></p>	 <p><b>Gripper jaw mountings EHAA-G1</b></p>
<b>Size</b>	16	16
<b>Type of mounting</b>	Via female thread M3	
<b>Ambient temperature</b>	0 ... 40°C	0 ... 40°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Reliable gripping, e.g. for microwell plate in the life sciences sector</li> <li>• Easy to mount</li> </ul>	<ul style="list-style-type: none"> <li>• Gripper jaws for horizontal or vertical mounting on parallel gripper EHPS-16</li> <li>• For gripper jaws DHAS-GG</li> <li>• Stainless steel design</li> </ul>
<b>online:</b> →	<a href="#">dhas</a>	<a href="#">ehaa-g1</a>

# Kinematics

Drives > Handling systems >

## Planar surface gantries



**2D planar surface gantries**  
**EXCM**

<b>Description</b>	<ul style="list-style-type: none"> <li>• Excellent functionality in confined spaces</li> <li>• Low moving dead weight</li> <li>• Actuation via two stepper motors with an integrated optical encoder and a two-axis controller</li> <li>• With recirculating ball bearing guide</li> </ul>
<b>online:</b> →	<a href="#">excm</a>

Drives > Handling systems >

## Three-dimensional gantries






**Three-dimensional gantries**  
**EXCL**

<b>Design</b>	Three-dimensional gantry with electromechanical axes (X: toothed belt, Y: gear rack, Z: spindle)
<b>Size</b>	15
<b>Working stroke (X, Y)</b>	Configurable from 200 x 200 to 1000 x 700 mm
<b>Working stroke Z</b>	50, 100, 150 or 200 mm, self-locking spindle
<b>Max. payload at Z-axis</b>	Max. 1.5 kg (with 2 Z-axes together max. 2 kg)
<b>Motor controller</b>	6-axis motion controller
<b>Motor type</b>	Stepper motor
<b>Nominal voltage DC</b>	24 V
<b>Homing</b>	Against integrated microswitch
<b>Repetition accuracy</b>	± 0.1 mm
<b>Description</b>	<ul style="list-style-type: none"> <li>• 2D planar surface gantry or 3D gantry, for integration in desktop devices</li> <li>• Can be used, for example, for sample preparation in in-vitro diagnostics/laboratory automation with 2 Z-axes (e.g. for decapping using EHMD and for transferring liquid using pipettes) in the same handling system</li> <li>• Max. stroke: X/Y-axis: 1000 x 700 mm, Z-axis: 50, 100, 150 or 200 mm with 1 or 2 Z-axes</li> <li>• Max. payload: 1.5 kg (with 2 Z-axes together max. 2 kg)</li> <li>• Optionally with 6-axis motion controller</li> <li>• Programmable via G-code</li> </ul>
<b>online:</b> →	<a href="#">excm</a>

Drives >

Electric drives

	 <b>Toothed belt axes</b> <b>EGC-TB-KF</b>	 <b>Spindle axes</b> <b>EGC-BS-KF</b>	 <b>Spindle axes</b> <b>ELGC-BS-KF</b>
<b>Design</b>	Electromechanical linear axis, with toothed belt	Electromechanical linear axis, with recirculating ball spindle	Electromechanical linear axis, with recirculating ball spindle
<b>Size</b>	50, 70, 80, 120, 185	70, 80, 120, 185	32, 45, 60, 80
<b>Working stroke</b>	50 ... 8500 mm	50 ... 3000 mm	100 ... 1000 mm
<b>Max. acceleration</b>	50 m/s <sup>2</sup>	15 m/s <sup>2</sup>	15 m/s <sup>2</sup>
<b>Max. speed</b>	3 ... 5 m/s	0.5 ... 2 m/s	0.6 ... 1 m/s
<b>Max. feed force Fx</b>	50 ... 2500 N	400 ... 3000 N	40 ... 350 N
<b>Max. force Fy</b>	50 ... 2500 N	400 ... 3000 N	40 ... 350 N
<b>Max. force Fz</b>	650 ... 15200 N	1850 ... 15200 N	300 ... 2700 N
<b>Motor type</b>	Stepper motor, servo motor	Stepper motor, servo motor	Stepper motor, servo motor
<b>Ambient temperature</b>	-10 ... 60°C	-10 ... 60°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Axis for high speeds and acceleration</li> <li>• Recirculating ball bearing guide for high loads and torques</li> <li>• Optionally with clamping unit, at one or both ends</li> <li>• Profile with optimised rigidity</li> <li>• 22 types in stock with short delivery times and modular products for custom variants</li> </ul>	<ul style="list-style-type: none"> <li>• Axis for high repetition accuracy</li> <li>• Recirculating ball bearing guide for high loads and torques</li> <li>• Optionally with clamping unit, at one or both ends</li> <li>• Profile with optimised rigidity</li> <li>• Various spindle pitches</li> <li>• The optional spindle support enables maximum travel speed</li> <li>• Axial or parallel motor mounting</li> </ul>	<ul style="list-style-type: none"> <li>• Internal guide and ball screw</li> <li>• Space-saving position sensing</li> <li>• Flexible motor connection</li> <li>• The toothed belt axes, spindle axes ELGC and mini slides EGSC form a scalable modular system for compact automation</li> <li>• Variants with less than 1% copper and zinc content – recommended for production facilities for manufacturing lithium-ion batteries</li> </ul>
<b>online:</b> →	<a href="#">egc</a>	<a href="#">egc</a>	<a href="#">elgc-bs</a>

# Kinematics

Drives >

## Accessories for electric drives



**Guide axes  
EGC-FA**

<b>Design</b>	Guide
<b>Size</b>	70, 80, 120, 185
<b>Working stroke</b>	50 ... 8500 mm
<b>Max. acceleration</b>	50 m/s <sup>2</sup>
<b>Max. speed</b>	5 m/s
<b>Max. force F<sub>y</sub></b>	1850 ... 15200 N
<b>Max. force F<sub>z</sub></b>	1850 ... 15200 N
<b>Pneumatic connection on clamping unit</b>	M5
<b>Ambient temperature</b>	-10 ... 60°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• For spindle/toothed belt axes ELGA (drive axes)</li> <li>• To absorb forces and torques in multi-axis applications</li> <li>• Increased torsional resistance</li> </ul>
<b>online: →</b>	<a href="#">egc</a>

Drives >

## Electric drives



**Electric slides  
EGSK**



**Mini slides  
EGSL-BS**



**Mini slides  
EGSC-BS-KF**

<b>Design</b>	Electromechanical linear axis, with ball screw	Electric mini slide, guide, with ball screw	Electric mini slide, with ball screw
<b>Size</b>	15, 20, 26, 33, 46	35, 45, 55, 75	25, 32, 45, 60
<b>Working stroke</b>	25 ... 840 mm	50 ... 300 mm	25 ... 200 mm
<b>Max. acceleration</b>	10 m/s <sup>2</sup> , 20 m/s <sup>2</sup>	25 m/s <sup>2</sup>	15 m/s <sup>2</sup>
<b>Max. speed</b>	0.16 ... 1.48 m/s	0.3 ... 1.3 m/s	0.4 ... 0.6 m/s
<b>Max. feed force F<sub>x</sub></b>	19 ... 392 N	75 ... 450 N	20 ... 250 N
<b>Max. force F<sub>y</sub></b>	19 ... 392 N	75 ... 450 N	20 ... 250 N
<b>Max. force F<sub>z</sub></b>	764 ... 4919 N	291 ... 1539 N	669 ... 4937 N
<b>Motor type</b>		Stepper motor, servo motor	Stepper motor, servo motor
<b>Ambient temperature</b>	0 ... 40°C	0 ... 60°C	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Electromechanical linear axis with ball screw</li> <li>• Recirculating ball bearing guide and ball screw without caged ball bearings</li> <li>• Standardised mounting interfaces</li> <li>• Compact design</li> <li>• High rigidity</li> <li>• 22 types in stock with short delivery times and modular products for custom variants</li> </ul>	<ul style="list-style-type: none"> <li>• Very high rated slide load, ideal for vertical applications such as press-fitting or joining</li> <li>• Reliable: the completely closed spindle stops dirt or stray small parts getting into the guide area</li> <li>• Axial or parallel motor mounting</li> </ul>	<ul style="list-style-type: none"> <li>• Precision guide and ball screw</li> <li>• Compact dimensions</li> <li>• Flexible motor mounting</li> <li>• The toothed belt axes, spindle axes ELGC and mini slides EGSC form a scalable modular system for compact automation</li> <li>• Variants with less than 1% copper and zinc content – recommended for production facilities for manufacturing lithium-ion batteries</li> </ul>
<b>online: →</b>	<a href="#">egsk</a>	<a href="#">egsl</a>	<a href="#">egsc-bs</a>

Motors and servo drives >

## Stepper motors



**Stepper motors**  
**EMMS-ST**

<b>Nominal motor current</b>	1.4 ... 9.5 A
<b>Maximum speed</b>	430 ... 6000 1/min
<b>Motor holding torque</b>	0.09 ... 9.3 Nm
<b>Ambient temperature</b>	-10 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Small increment and high driving torques thanks to 2-phase hybrid technology</li> <li>• Optimised connection technology</li> <li>• Four sizes with flange sizes 28, 42, 57 and 87</li> <li>• 28 types in stock</li> <li>• With incremental encoder for closed-loop operation</li> <li>• Degree of protection IP40 (motor shaft), IP54 (sizes 42, 27, 87: motor housing and plug connection), IP65 (size 28: motor housing and plug connection)</li> <li>• Optionally with holding brake</li> </ul>
<b>online:</b> →	<a href="#">emms</a>

Motors and servo drives >

## Electronic controllers



**Controllers**  
**CECC-D, CECC-LK, CECC-S**

<b>Operating voltage</b>	19.2 - 30 V DC, 20.4 - 30 V DC
<b>CPU data</b>	400 MHz processor
<b>Ambient temperature</b>	0 ... 55°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Compact programmable logic controller</li> <li>• Programming with CODESYS to IEC 61131-3</li> <li>• 12 digital inputs, 8 digital outputs, additionally 2 high-speed counters up to 250 kHz</li> <li>• Ethernet 10/100 Mbit/s</li> <li>• USB interface for data transfer</li> <li>• CECC-LK with CANopen, IO-Link®, I-Port and Modbus TCP protocol</li> </ul>
<b>online:</b> →	<a href="#">cecc</a>

# Kinematics

Motors and servo drives ›

## Stepper motor controllers







Servo drives  
CMMT-ST

<b>Nominal current, load supply</b>	8 A
<b>Nominal voltage, load supply DC</b>	24 V, 48 V
<b>Fieldbus coupling</b>	EtherCAT, Ethernet, Modbus/TCP, PROFINET
<b>Performance level (PL)</b>	STO/Cat. 3, PLd (EC motor without diagnostics), STO/Cat. 3, PLe (stepper motor/EC motor with diagnostics)
<b>Ambient temperature</b>	0 ... 50°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Very efficient for tasks with low power requirements</li> <li>• Ideal for positioning tasks and point-to-point and interpolating motion solutions</li> <li>• 50% more compact than the smallest servo drive CMMT-AS</li> <li>• 150 W at 24 V DC, 300 W at 48 V DC</li> <li>• Optimised for use with stepper motors like the tried-and-tested EMMS-ST</li> </ul>
<b>online: →</b>	<a href="#">cmmt-st</a>

Sensors >

Opto-electrical sensors

	 <b>Colour sensors SOEC</b>	 <b>Retro-reflective sensors, diffuse sensors, distance sensor, light barriers SOOE</b>	 <b>Fork light barriers SOOF</b>	 <b>Light guide SOEZ, SOOC</b>
<b>Measurement method</b>	Colour sensor	Retro-reflective sensor, distance sensor, through-beam sensor, transmitter, receiver, diffuse sensor with background suppression, laser contrast sensor, retro-reflective sensor for transparent objects, diffuse sensor	Fork light barrier	Through-beam sensor, fixed focus, fork light barrier, fibre-optic cable, diffuse sensor
<b>Working range</b>	12 ... 32 mm	0 ... 20000 mm		2 ... 650 mm
<b>Size</b>	50x50x17 mm		Fork 120x60 mm, 30x35 mm, 50x55 mm, 80x55 mm	M4, M6
<b>Setting options</b>	Teach-in, teach-in via electrical connection	IO-Link®, potentiometer, teach-in	IO-Link®, potentiometer, teach-in	
<b>Type of light</b>	White	Laser, red, LED	Red	
<b>Switching output</b>	PNP	Push-pull	Push-pull, NPN, PNP	
<b>Ambient temperature</b>	-10 ... 55°C	-40 ... 60°C	-25 ... 60°C	-55 ... 160°C
<b>Description</b>	<ul style="list-style-type: none"> <li>• Diffuse sensor</li> <li>• Block design</li> <li>• Electrical connection via M12x1 plug, 8-pin</li> <li>• Display via 7 LEDs</li> </ul>	<ul style="list-style-type: none"> <li>• Easy to operate</li> <li>• Quick to commission</li> <li>• Reliable and stable sensing</li> <li>• Attractive price/performance ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Through-beam sensor with minimal installation effort</li> <li>• Design: polymer or metal</li> <li>• Sturdy housing: high shock and vibration resistance</li> <li>• Degree of protection IP67</li> <li>• Electrical connection via M8x1 plug, 3-pin</li> <li>• LED displays</li> </ul>	<ul style="list-style-type: none"> <li>• Cable connection, push-in connector</li> </ul>
<b>online:</b> →	<a href="#">soec</a>	<a href="#">sooe</a>	<a href="#">soof</a>	<a href="#">soez</a>

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Take the ambient conditions at the place of use into consideration.

Corrosive, abrasive and dusty environments (e.g. water, ozone, grinding dust) will reduce the service life of the product.

Check the resistance of the materials of Festo products to the media used and surrounding media.

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