

## DYNAMIC PNEUMATICS REGULATING WITH E/P PRESSURE CONTROL VALVES

Pneumatics  
It's that easy





**It's all about exact metering**

Sophisticated systems with E/P pressure control valves frequently replace other pneumatic solutions or simply take over due to their clear advantages over non-pneumatic control technology. Classical applications include precise positioning of parts and components, variable control of welding tips, weight-independent balancer technology in assembly, and exact controlling and metering in cutting-edge painting systems.

# Sensitive and highly dynamic – electropneumatic pressure regulation

Speed and precision are crucial to controlling dynamic processes reliably. State-of-the-art AVENTICS regulators meet these requirements, no matter the application – our E/P technology offers control with the utmost precision.

## **We'll take control: precisely and energy-efficiently**

The optimal pressure for every application, ultra-precise and highly dynamic: Precisely set, dynamically adjusted pressure forms the basis for optimized, energy-efficient processes. Our product range includes the entire spectrum of E/P pressure control valves with all useful control principles: pilot control, direct control or high-dynamic control. So you can always apply the best technology for the specific task.

## **Precise energy use with intelligent pressure control – Energy on demand**

Situational pressure control ensures that only as much energy is accessed as is currently required by the respective process. In addition, decreased pressure can be used to actuate cylinder return strokes; the required pressure is only provided when the application demands full performance.

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# The perfect solution for a wide variety of applications

## Electropneumatic pressure control technology in all industries

The examples shown offer a general idea of the range of applications for solutions with controlled air. These are solutions that have been fulfilling their tasks for years and illustrate our extensive competence in many industries.

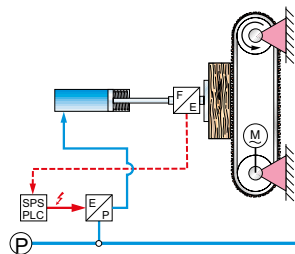
Our systems with electropneumatic pressure control are used today in nearly all industries in a wide variety of applications.

- Contact pressure control, speed, or RPM
- Compensating roller control
- Paint quantity control
- Welding tips control
- Counter-balancing control
- Fluid flow and air quantity control
- Blowing air control in bottle production
- Fluid metering in filling systems
- Force control for material tests in testing facilities
- Brake force control in machines and systems
- Fill level control with metering valves



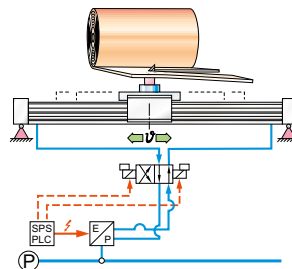
## Automation

Dynamic movements, precise timing, and always the right force are all musts in handling and automation technology. Electro-pneumatic control valves are an essential interface between the controller and process. They are used to individually control pressures and forces for each process step, both reliably and precisely.



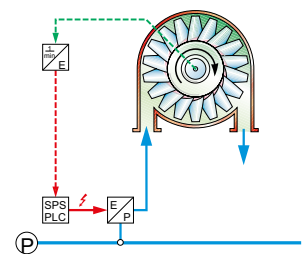
### Contact pressure control

Keeping the surface pressure of the tool constant provides uniform results for surface processing.



### Speed control

By controlling the pressure in the cylinder chamber, defined movement of the piston with various speed profiles is possible.



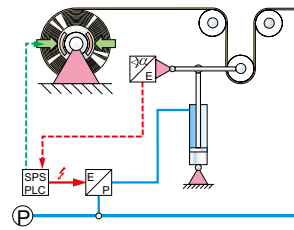
### Rpm control

Controlled air flow pressure provides an even and easily adjustable rpm for pneumatic motors/turbines. An extremely precise control can be achieved using an rpm sensor.



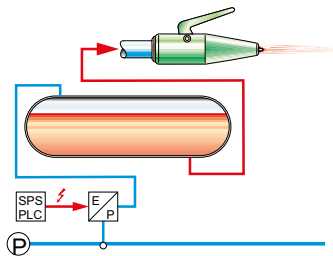
### Printing industry

An electropneumatic pressure regulator in a printing press ensures precise roller adjustment and a consistent web tension.



### Compensating roller control

Pressure-controlled tensioning devices prevent lengths of fabric from tearing or getting tangled and provide an optimal material flow.



### Paint quantity control

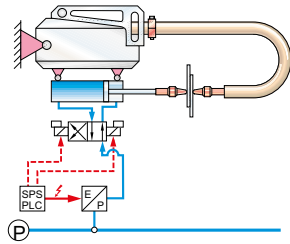
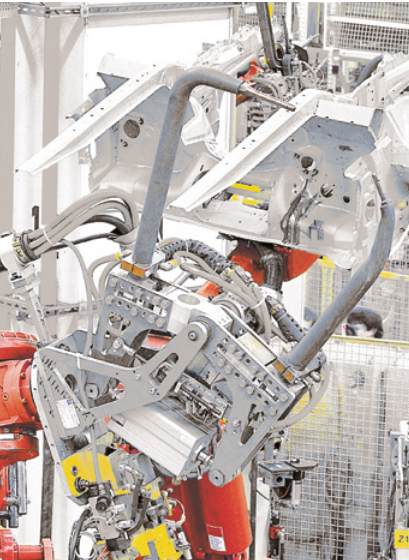
The E/P pressure control valve keeps the pressure in the container constant, which allows for even painting.



### Painting technology

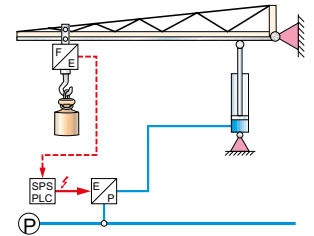
In painting technology, electropneumatic valves ensure exact turbine speeds and precise air and paint quantities for even layers of paint. They also take over important functions when changing colors and cleaning sprayers.

# A wide spectrum of applications



## Welding tips control

Electropneumatic pressure control in welding tips makes it possible to quickly and gently close the tips and enable welding forces with repetitive precision.



## Counter-balancing control

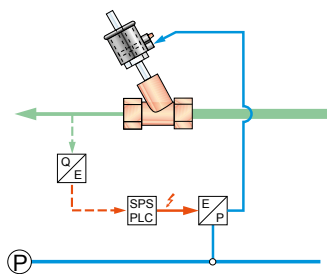
A cylinder with applied pressure helps to handle heavy loads. Using an E/P control, the supporting force can always be adapted optimally to the load to be moved.

## Welding technology

Precise control of welding tip opening with electropneumatic-based pneumatic systems is particularly important in welding robots in the automotive industry. E/P pressure regulators ensure exact welding plier opening and precise contact pressure for the welding head.

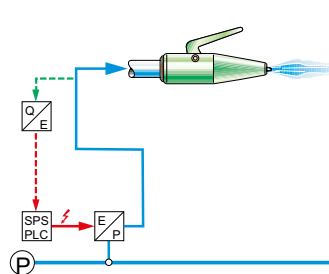
## Assembly technology

Pneumatic systems play an important role in assembly technology. Electronically controlled weight-independent balancers deal with heavy loads, parts, and components and make handling easier.



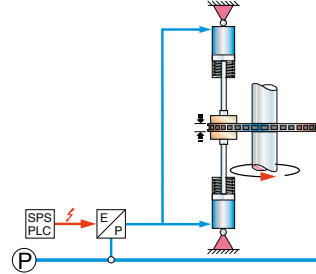
## Flow control

E/P pressure regulators change the cross-section opening on a flow valve, controlling fluid flow quantities. Continuous measurement enables infinitely variable flow control.



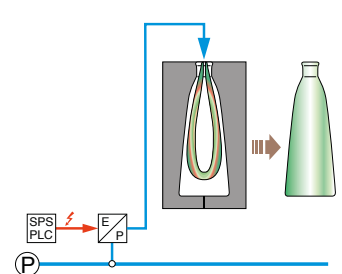
## Air quantity control

The air flow through a nozzle can be adjusted exactly using controlled pressure. Precision can be optimized by installing a flow rate sensor and an overriding rate control.



## Brake force control

With the E/P pressure regulator, individual brake forces are applied to a brake disk in accordance with the respective set point signal. The rotating mass can be decelerated and braked in line with the programmed speed profile.



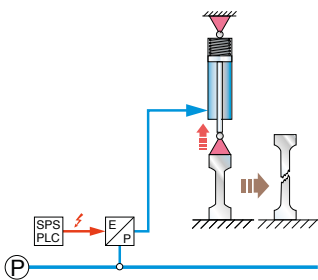
## Bottle production

By maintaining the correct air flow and air pressure with E/P pressure regulators, the bottle blank in the mold is blown up and perfectly shaped.

# Theoretically possible and useful in practice

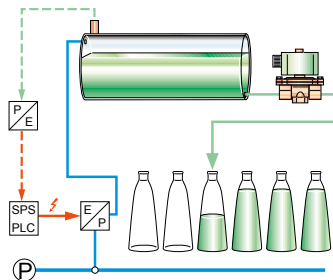


The possibilities for new applications have not been exhausted by any means. AVENTICS constantly works to perfect existing solutions, as well as to open up new fields of application. Innovative and professional. Contact us! We would be happy to find a pneumatic solution tailored to your specific application.



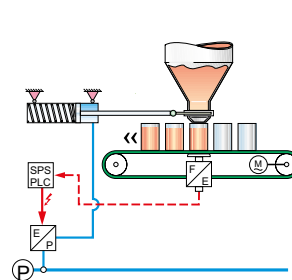
## Material test

The force exerted on the test object is precisely measured and continuously increased by the E/P pressure regulator until the test object is destroyed.



## Metering of fluids

The E/P pressure regulator ensures continuous pressure in the supply tank. The fluid flows to the filling valve with a uniform pressure, regardless of the fill level in the supply tank. The fill quantity is thus always metered identically.



## Capacity control

Electropneumatically controlled metering valves allow containers to be filled precisely down to the gram with high cycle time and repetitive precision.

# A permanent comparison of set and actual values ensures needs-based control

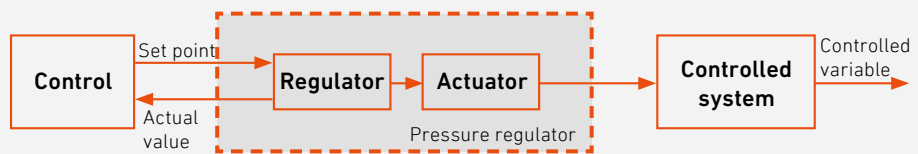
## Dynamic with ultimate precision

The tasks for pressure regulators are varied and cover everything from extremely fast changes to set points that must be immediately implemented (sometimes with a brief overpressure), to smooth transitions with exact movements. Electro-pneumatic pressure control valves provide sensitive pressure control by combining digital control electronics with innovative proportional technology.

The complexity of a system, external influencing variables, or the desired precision determine whether a control requires special feedback to meet requirements. For this reason, a differentiation is made between open and closed control loops.

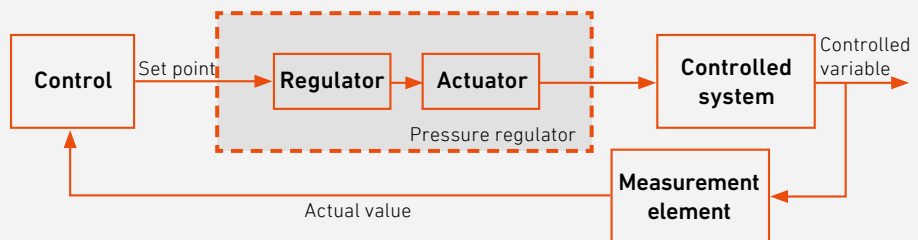
### Open control loop

For many simple applications, a clear mechanical interrelation between the controlled pressure and a surface is enough to regulate the output quantity with sufficient precision.



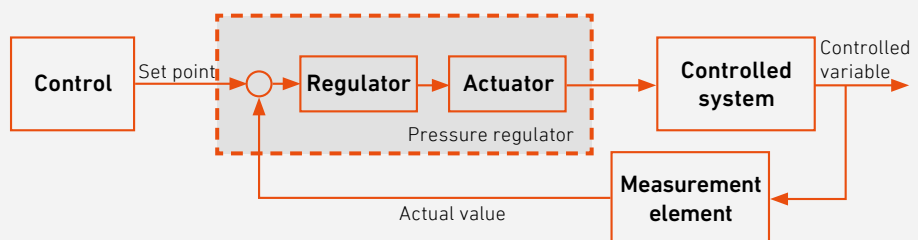
### Closed control loop

For very precise control tasks, however, it is necessary to directly record the controlled variable and override the pressure control with a force controller, for example.



### Closed control loop with input for external sensor signal

E/P pressure regulators with a direct connection for external sensors are the ideal solution for special requirements. AVENTICS also offers tailored solutions for these applications.





# Important parameters

## Correct consideration of all parameters determines the quality of the solution

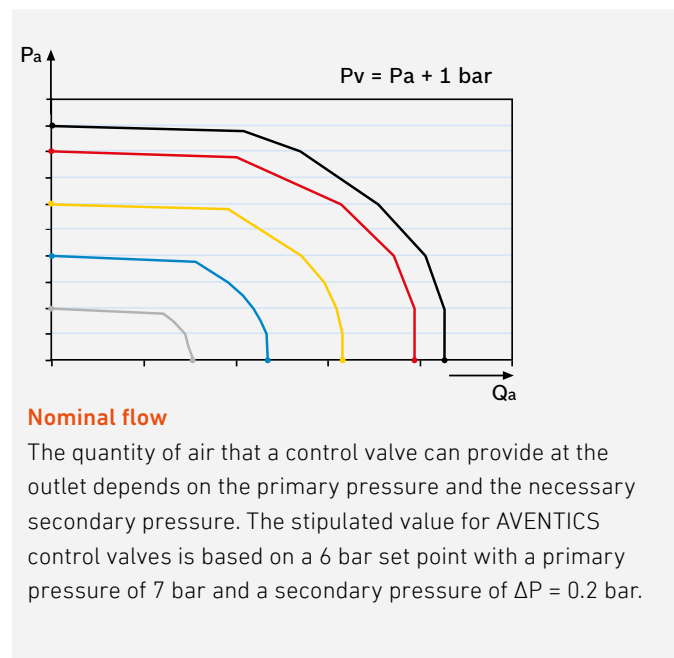
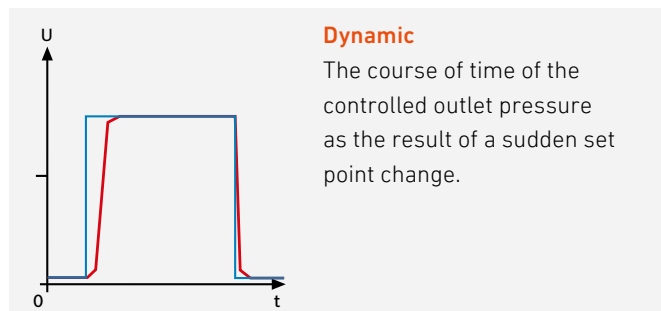
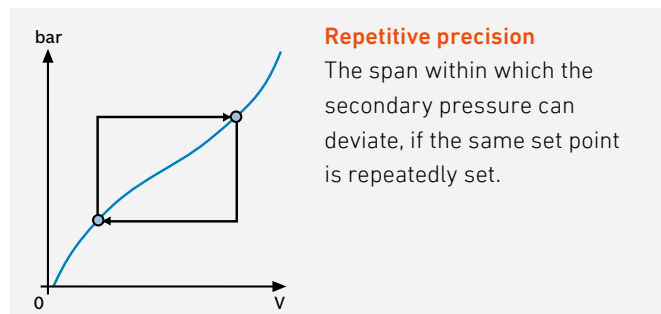
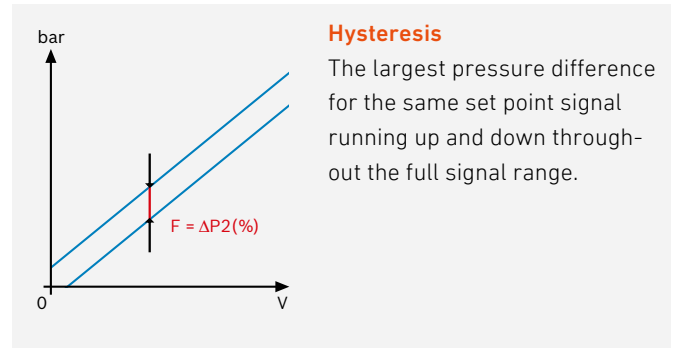
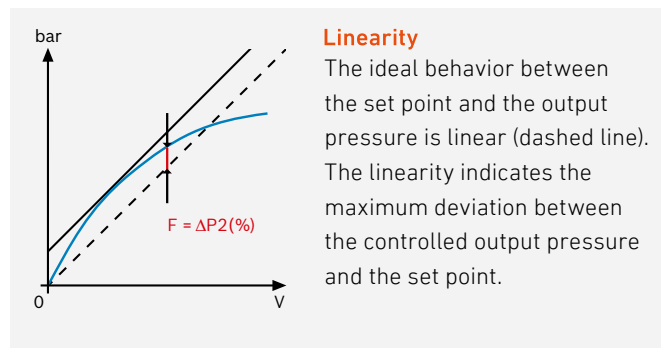
Linearity, hysteresis and nominal flow, repetitive precision and dynamics – the specific relevance of these important parameters depends on the respective task and application. Only specialist know-how and many years of practical experience can lead to the right results that optimally meet the varying demands.

## Actual value

The actual value of a physical quantity (pressure, force, temperature, flow, etc.)

## Set point

The stipulated value for the controlled variable, which must be maintained by the controller.



# Infinite control of compressed air and air flow

## The technical principles behind the different variants

In electropneumatic pressure control technology, three different control principles have developed over time.

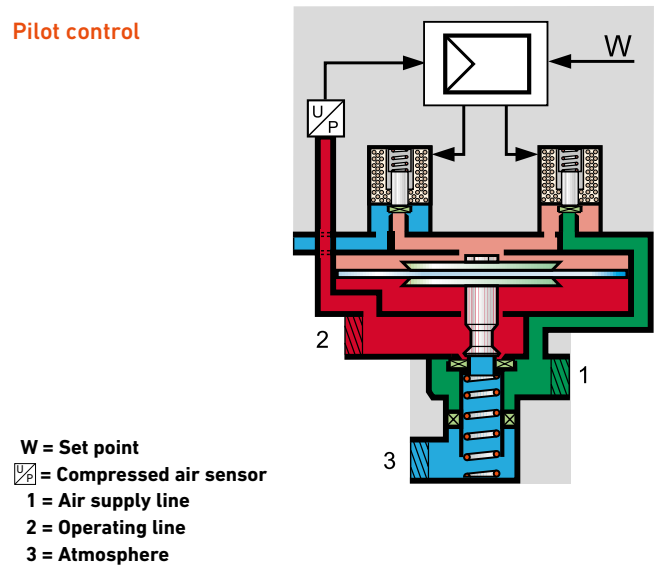
- Pilot control
- Direct control
- High-dynamic control

## Poppet valve and suitable media

The poppet valve is the basis of E/P pressure control technology from AVENTICS. The valve is impervious to contamination due to a relatively large cross-section of the opening and the use of a soft-sealing poppet valve.

Pressure regulators are suitable for dry compressed air and inert gases. If the devices are operated with lubricated air, lubrication must be used afterwards, since the lubricant may have washed away the original valve lubrication. A suitable media converter (relay valve) must be used to control reactive, aggressive, or liquid materials.

## Pilot control

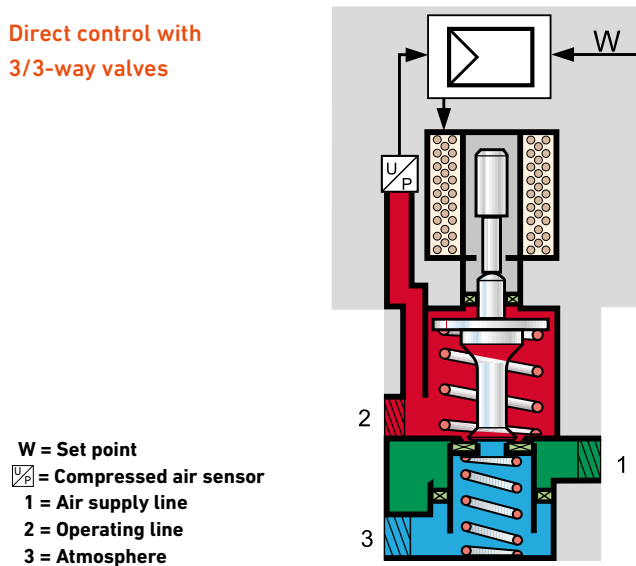


## Indirect control with pilot valves

With this type of control, pressure is applied to a volume using pilot valves. The pressure in these pilot volumes operates the valve until a balance between the pilot pressure and the outlet pressure is achieved through the dynamic effect of the pressures on the membrane. In control valves from AVENTICS that work according to this principle, the outlet pressure is always measured, thus electronically compensating for interference from the valve mechanics. An important feature of controlling with pilot valves is that, in case of a power loss and thus a failure of the electrical control, mechanical pressure control is maintained by the pressure in the pilot volumes, even if air escapes from the main valve. If the pilot is controlled with pilot valves, the device is optimally suited for static conditions. Since the pilot valves must switch several times for each control process, continually changing set pressure points would result in a high number of operations and a high level of wear. This effect is mostly eliminated if proportional valves are used for pilot control.

# Control principles: basic valve and suitable media

## Direct control with 3/3-way valves

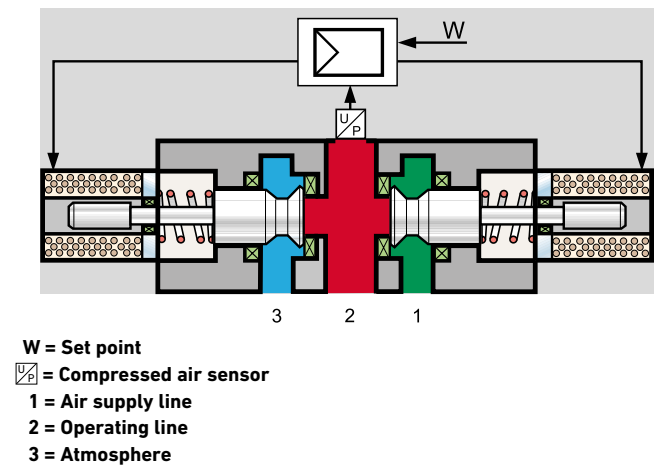


### Direct control with a proportional magnet

With the direct control principle, the force to adjust the valve seat is directly provided by a proportional magnet. Pressure is measured at the outlet and sent to the electronics, making it possible to control the current strength, and, as a result, the opening of the valve. With a direct drive, inertia and hysteresis can be avoided in mechanical transfer elements. Control precision is basically only dependent upon the quality of the pressure sensor used.

Thus, much higher dynamics can be achieved with the smallest control deviations. Also, a nearly wear-free adjustment of the valve seat offers the best prerequisite for a final control element in constantly changing processes. The pressure regulators with direct control bleed the operation line if there is a power loss.

## Direct control – high-dynamic control with two 2/2-way valves



### High-dynamic control

Two 2/2-way valves are used instead of a 3/2-way valve in this type of control. Besides the possibility for a higher air volume with a larger valve, another advantage of this type of control is its dynamic characteristics. Ventilation and exhaust valves can be controlled directly and independently of each other. This drive principle is ideal for dynamic processes.

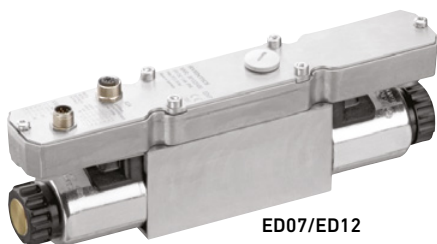
# User-oriented product concept



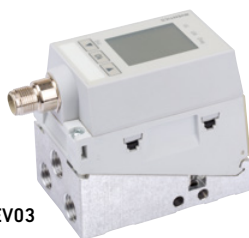
ED02



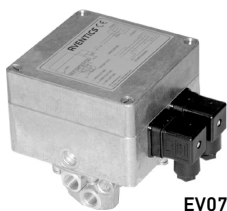
ED05



ED07/ED12



EV03



EV07

## Different models for different tasks

Making the best use of any E/P-type valve depends on the kind of application and the actual tasks involved. AVENTICS is the technological leader in every aspect of electropneumatic pressure control and offers a range of products for all required nominal widths. AVENTICS control valves are not only suited to a wide range of applications; they can also be connected with universal ports threads. Besides standard analog current and voltage interfaces, AVENTICS offers many field bus options that can be combined with the control valves.

### ED02 – the smallest

The extremely compact yet powerful ED02 offers perfect control solutions in a variety of applications. Reliable, dynamic, and cost-effective. On top of that, it is easy to stack.

### ED05 – the all-rounder

The principle of direct control with a proportional solenoid enables highly precise control while remaining extremely dynamic. This also minimizes inertia and hysteresis in mechanical transfer elements.

### ED07/ED12 – highly dynamic

ED07 and ED12 are E/P valves for highly dynamic control. They can realize high air flow rates and offer particularly dynamic control characteristics thanks to proportional valves for pressurization and exhaust that can be controlled separately.

### Serie EV03/EV07 – externally piloted

EV03 and EV07 work according to the indirect control principle and are perfect for static requirements. A key feature of the series is its extremely low energy consumption – yet it still guarantees pressure control during a power loss.

Series	ED02	ED05	ED 07/12	EV03/AV-EP	EV07
Dynamics	++	+	++	+	○
Precision	+	+	++	+	++
Sturdiness	++	++	++	+	+
Protection class	++	++	++	++	○
Flexibility	+	○	+	++	–
Electric connection	+	++	++	++	○

++ highly recommended + recommended ○ suitable – less suitable

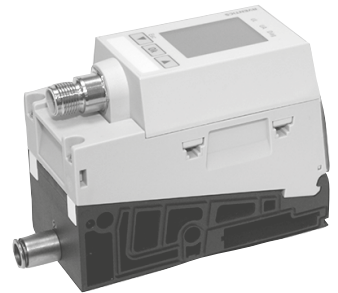





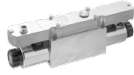






◀ Adjustment, diagnosis, or monitoring: The clearly visible and easy-to-operate system display offers a wide range of functions.

### AV-EP series

AV-EP series electropneumatic control valves are the ideal solution for the AV03/AV05 valve system. They can be fully integrated with all functions and provide the desired working pressure directly at the regulator via fittings or supply pressure to the switching valves adjacent to the regulator. The pressure can be set and controlled via the membrane keyboard and display or via multipole or fieldbus.



Pressure regulators						
Qn		Series	Functions	Principle	Connections	Comments
120 l/min		ED02	3/3 (2x 2/2)	Directly controlled	Universal thread G1/8, 1/8–27 NPTF	Pressure range from –1 to 10 bar
1,000 l/min		ED05	3/3	Directly controlled	Universal thread G1/8, 1/4–27 NPTF	Default position exhausted
1,300 l/min		ED07	3/3 (2x 2/2)	Highly dynamic	Via base plate G3/8, Ø 12	Pressure range from –1 to 20 bar, external sensor input possible
2,600 l/min		ED12	3/3 (2x 2/2)	Highly dynamic	Via base plate G3/4	External sensor input possible
600 l/min		EV03	3/3 (2x 2/2)	Externally piloted	G1/4	Configurable via display
800 l/min		EV07	3/3 (2x 2/2)	Externally piloted	G1/4	
300 l/min (single pressure) 425 l/min (pressure zone)		AV03-EP	3/3 (2x 2/2)	Externally piloted	Via valve system Ø 6, Ø 8	Configurable via display or fieldbus
430 l/min (single pressure) 500 l/min (pressure zone)		AV05-EP	3/3 (2x 2/2)	Externally piloted	Via valve system Ø 6, Ø 8	Configurable via display or fieldbus

# Technological leadership and international market transparency



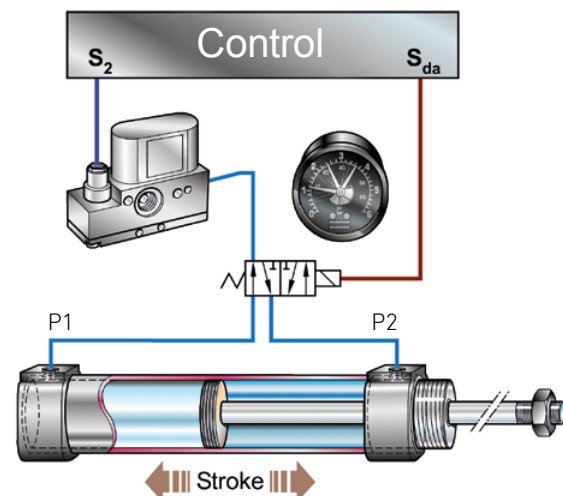
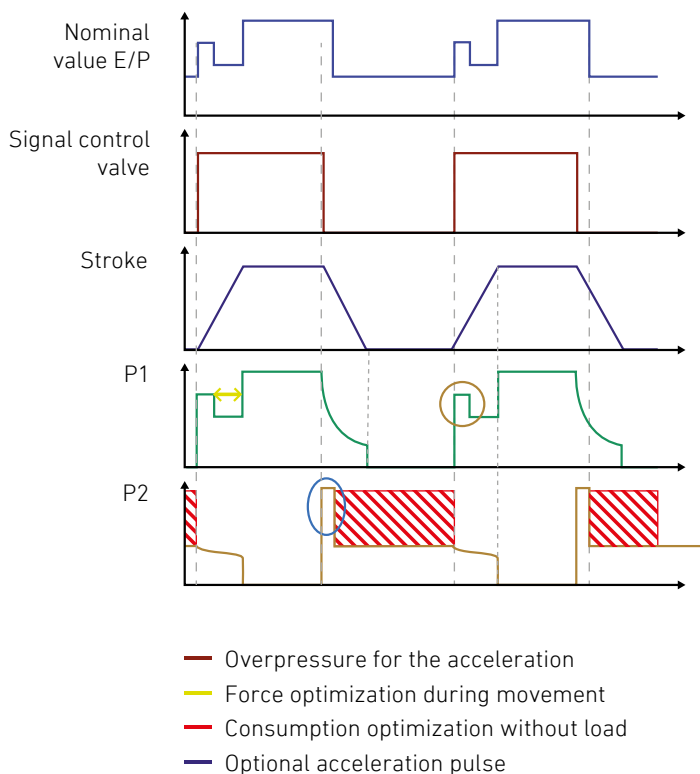
With its well-established E/P product range, AVENTICS stands for perfection in electropneumatic pressure regulator technology. Our latest example is the AV03/AV05-EP EP valves, which are the perfect addition to the AV family.

## E/P for Advanced Valves

Flexible system integration, compact design, and maximum functionality – the electropneumatic pressure regulators in the AV family offer a wide variety of options and are a future-proof pneumatic solution based on an innovative product strategy. Compared with existing products, AV-EP are up to **70% lighter** thanks to the consistent use of polymers and **cut current consumption by 80%** thanks to the use of pilot valve technology.

## E/P for maximum energy efficiency

Electropneumatic pressure regulation is not only more precise, dynamic, and easier to meter, but also extremely energy-efficient. Energy is provided exactly on demand, no more and no less, preventing energy losses right from the start. The graphic shows the influencing factors when using on-demand pressure regulation technology including force optimization for movements and consumption optimization for load-free movements. Less energy – more efficiency.



# Consulting and service

## **AVENTICS experience not only shows in every detail – it is the basis of our whole agenda**

Our control valves are used worldwide to control air flows, rpm, forces, positions, speeds, etc. They are used as pressure control components, for example, but can also integrate the complete control process and communication with external sensors.

Pneumatic functions must be conducted exactly, also under extreme ambient conditions on occasion. The robust poppet valve technology can handle it, even at temperatures between  $-40^{\circ}\text{C}$  and  $+120^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  and  $+248^{\circ}\text{F}$ ) – and under water if need be. Talk to us today!

We do not just offer products, but also the right customer service, so that you get the best solution for your application with our control valves.



## **Around-the-clock information**

The AVENTICS Internet Portal never sleeps. In the online catalog, you can find additional information covering the entire product range, including all technical details, as well as the use of user-friendly Engineering Tools.



### **Online catalog**

The fastest point of entry is via our online catalog. Here you can start your search directly by entering a part number or keyword.



### **CAD**

Your desired object can be issued here directly as a CAD file in various formats, as a PDF file, or for further configuration in your software.



### **Configurators**

The configurator can be reached by clicking the selected product. After selecting your product, you can begin to adapt it to your own specifications.



### **Calculation programs**

Here you can specify the dimensions or loadbearing capacity of your components with a wide variety of calculation options. We also provide an air consumption calculator as a special feature.



### **Circuit diagram software**

With the D&C Scheme Editor, you can quickly and easily create circuit diagrams that are based on your component layout and linked to your catalog selection.



### **eShop**

The eShop is our online shop that answers your price requests and monitors the whole order process up to delivery.

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