DYNAMIC PNEUMATICS
REGULATING WITH E/P PRESSURE CONTROL VALVES
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.
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. Electropneumatic 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.
Paint quantity control
The E/P pressure control valve keeps the pressure in the container constant, which allows for even painting.

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

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.

Printing industry
An electropneumatic pressure regulator in a printing press ensures precise roller adjustment and a consistent web tension.
Regulating with E/P pressure control valves | Applications and industries

A wide spectrum of applications

**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.

**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.

**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.

**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.

**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.

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**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.
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.

**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.

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.
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.

Linearity
The ideal behavior between the set point and the output pressure is linear (dashed line). The linearity indicates the maximum deviation between the controlled output pressure and the set point.

Hysteresis
The largest pressure difference for the same set point signal running up and down throughout the full signal range.

Repetitive precision
The span within which the secondary pressure can deviate, if the same set point is repeatedly set.

Dynamic
The course of time of the controlled outlet pressure as the result of a sudden set point change.

Nominal flow
The quantity of air that a control valve can provide at the outlet depends on the primary pressure and the necessary secondary pressure. The stipulated value for AVENTICS control valves is based on a 6 bar set point with a primary pressure of 7 bar and a secondary pressure of $\Delta P = 0.2$ bar.
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.

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.

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.
Regulating with E/P pressure control valves | Product range

User-oriented product concept

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.

<table>
<thead>
<tr>
<th>Series</th>
<th>ED02</th>
<th>ED05</th>
<th>ED07/12</th>
<th>EV03/AV-EP</th>
<th>EV07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamics</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Precision</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Sturdiness</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Protection class</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>O</td>
</tr>
<tr>
<td>Flexibility</td>
<td>+</td>
<td>O</td>
<td>+</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Electric connection</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>O</td>
</tr>
</tbody>
</table>

++ highly recommended  + recommended  O suitable  − less suitable
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.

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

### Pressure regulators

<table>
<thead>
<tr>
<th>Qn</th>
<th>Series</th>
<th>Functions</th>
<th>Principle</th>
<th>Connections</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 l/min</td>
<td>ED02</td>
<td>3/3 (2x 2/2)</td>
<td>Directly controlled</td>
<td>Universal thread G1/8, 1/8–27 NPTF</td>
<td>Pressure range from –1 to 10 bar</td>
</tr>
<tr>
<td>1,000 l/min</td>
<td>ED05</td>
<td>3/3</td>
<td>Directly controlled</td>
<td>Universal thread G1/8, 1/4–27 NPTF</td>
<td>Default position exhausted</td>
</tr>
<tr>
<td>1,300 l/min</td>
<td>ED07</td>
<td>3/3 (2x 2/2)</td>
<td>Highly dynamic</td>
<td>Via base plate G3/8, Ø 12</td>
<td>Pressure range from –1 to 20 bar, external sensor input possible</td>
</tr>
<tr>
<td>2,600 l/min</td>
<td>ED12</td>
<td>3/3 (2x 2/2)</td>
<td>Highly dynamic</td>
<td>Via base plate G3/4</td>
<td>External sensor input possible</td>
</tr>
<tr>
<td>600 l/min</td>
<td>EV03</td>
<td>3/3 (2x 2/2)</td>
<td>Externally piloted</td>
<td>G1/4</td>
<td>Configurable via display</td>
</tr>
<tr>
<td>800 l/min</td>
<td>EV07</td>
<td>3/3 (2x 2/2)</td>
<td>Externally piloted</td>
<td>G1/4</td>
<td></td>
</tr>
<tr>
<td>300 l/min (single pressure) 425 l/min (pressure zone)</td>
<td>AV03-EP</td>
<td>3/3 (2x 2/2)</td>
<td>Externally piloted</td>
<td>Via valve system Ø 6, Ø 8</td>
<td>Configurable via display or fieldbus</td>
</tr>
<tr>
<td>430 l/min (single pressure) 500 l/min (pressure zone)</td>
<td>AV05-EP</td>
<td>3/3 (2x 2/2)</td>
<td>Externally piloted</td>
<td>Via valve system Ø 6, Ø 8</td>
<td>Configurable via display or fieldbus</td>
</tr>
</tbody>
</table>
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°C and +120°C (-40ºF and +248ºF) – 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.
The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.