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Proportional regulators optimise the use of compressed air in the glass industry

Precise and reliable dosage of compressed air is needed in the manufacture of container glass to ensure an optimal distribution of the molten glass within the mould. The objective was to develop a valve with an electronic proportional regulator for this specific purpose. It is characterised by its ultra-high precision, functional reliability and great flexibility. Additional user benefits of this tailor-made solution are low maintenance and significant cost savings.

ASCO NUMATICS, a member of the global Emerson group, offers over 60,000 products for fluid control technology.

Compressed air dosing valves are most often placed close to the mould. At ambient temperatures of 70°C and higher, they are exposed to high stress which may cause problems, especially with soft-sealing valves with elastomers. Excessive wear and faulty air supply often result in cost-intensive production stoppages and increased reject rates.

ASCO Numatics has developed a valve with integrated electronic proportional regulator (Servotronic Digital) without any moving soft sealing elements. After two years of development and a successful test phase, the valve was launched in mid-2010.

As regards the valve's function, the name says everything! The input voltage varies in proportion to the intensity of an air flow between 0 and 10 bar at a nominal diameter of 14 mm and a maximal flow of up to 4,000 l/min (ANR).
Other pressure ranges are also available.

Long service life

What are the valve's technical details in terms of service life and temperature stability?

The spool & sleeve technology, a Numatics patent which has proven itself over and over again, is used. The assembly is composed of a tubular metal sleeve with radial bores into which a metal spool is precisely fit. This design has no moving sealing elements as metal rests directly on metal. The air flow is controlled by the axial shift of the spool. This movement creates an air cushion between both components which minimises friction due to the air bearing principle and guarantees trouble-free service of over 200 million cycles. The simple but ingenious construction requires only few components and ensures best functional reliability. The valves are of the "hard-sealing" type.

Electronics integrated into the valve control the precisely defined air pressure. The electronics communicate with an integral pressure sensor to query the actual value. A microprocessor then

compares the value against the programmed setpoint values and adjusts it within milliseconds, if necessary. If the pressure is too low, the electronics increase the input voltage at the proportional solenoid. The proportional solenoid moves the core out which causes a proportional shift of the steel spool in the spool & sleeve assembly. The higher the voltage, the more the valve position changes and consequently the pressure increases. A spring at the other end of the spool ensures, via counterforce, just the right relation between voltage and pressure.

Interplay for a precise distribution of air pressure

Above description only relates to cases where pressure is too low and needs to be adjusted.

The pressure sensor immediately detects when pressure is too high and transmits it to the electronics. The electronics control a second spool over which the overpressure is relieved. All functions occur continually within milliseconds in an interplay between both spools. In this way, the complex system ensures the desired pressure at all times.

Microprocessor-based electronics developed in-house at ASCO are used for control. They evaluate the difference between the setpoint and actual value, calculate the control output (current) for both proportional solenoids and balance any deviations. Along with the valve's robust mechanics, the control electronics form a high-performance unit. In addition, all control parameters can be quickly and easily adjusted via a PC connection, even during operation. At the same time, this network is needed to evaluate and optimise the pressure curve. With larger systems, the network enables remote adjustment from the control centre.

Digital electronics for quick and easy parameter setting

DaS is the free software for Servotronic Digital proportional valves which considerably simplifies all monitoring and control functions and increases manufacturing reliability. At the same time, the software supports routine maintenance work and fault diagnosis in changing environmental conditions. The software can be used with standards PCs and a serial interface. Functions of the *DaS* software include:

- Proportional valve control
- Visualisation of output pressure and regulator status
- Diagnosis
- Parameter setting and optimisation of the regulator, e.g. for different volumes.

The control functions allow, amongst other things, the simulation of different pressure steps or ramps. As with an oscilloscope, the transient response can be watched in real time with the visualisation software. Since high-dynamic, pneumatic control valves sometimes tend to oscillate when not well set up, the zoom function which allows any post-oscillation to be monitored is a valuable diagnostic tool. If the factory settings of the PID controller are not yet optimally adapted to the specific application, the user can either select the parameters offered for another controller or define a set of user parameters. A display of all controller parameter variables allows the user to quickly see which parameter must be adjusted to obtain a good result. The wide adjustment range of each parameter provides good results, even in difficult control tasks. All new controller parameters can be transmitted by the user to the pressure regulator. Saved in a project file, these data can be used e.g. as a reference for servicing or preventive maintenance. The project file can be sent via e-mail to deliver remote support for diagnosis or parameter setting. The user can adjust

the different controller settings required for different systems, thereby reducing the number of valve types needed for each system.

Visualisation software

Besides the pressure curve at the control valve's output, the visualisation software *DaS* also displays all the controller's input and output signals, such as pressure switch functions, auto-safe activation, ramp setting etc. Extras, such as the ramp or pressure switch function etc., are already a standard in the controller. If the output pressure is not reached after a preset time has elapsed, the valve's integrated auto-safe function reduces the current to the solenoid in order to prevent the valve from overheating. The solenoid's current is switched to 100 per cent at regular intervals to check whether the pressure setpoint can be reached.

One valve – many applications

With its individual parameter setting options, the Servotronic Digital proportional valve can be programmed for different tasks. Besides PID controller parameter setting, the type of setpoint can be switched, e.g. from 0-10 V to 4-20 mA. The pressure range can also be limited via the software without the need to apply pressure. The time and expense consuming set-up with measuring equipment that was required to adjust analog proportional valves is no longer necessary.


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Picture 1: The precise and reliable dosage of compressed air is an important parameter for the error-free forming of container glass, especially of thin-wall container glass in light-glass technology. Image: TP/Archives/AscoNumatics
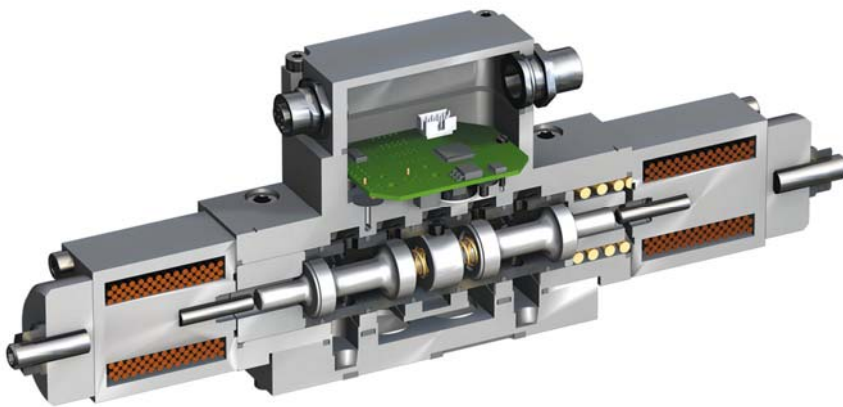
Picture 2: Spool & sleeve valve technology: The construction is based on an air bearing principle and ensures reliable, wear-free operation. Image: AscoNumatics
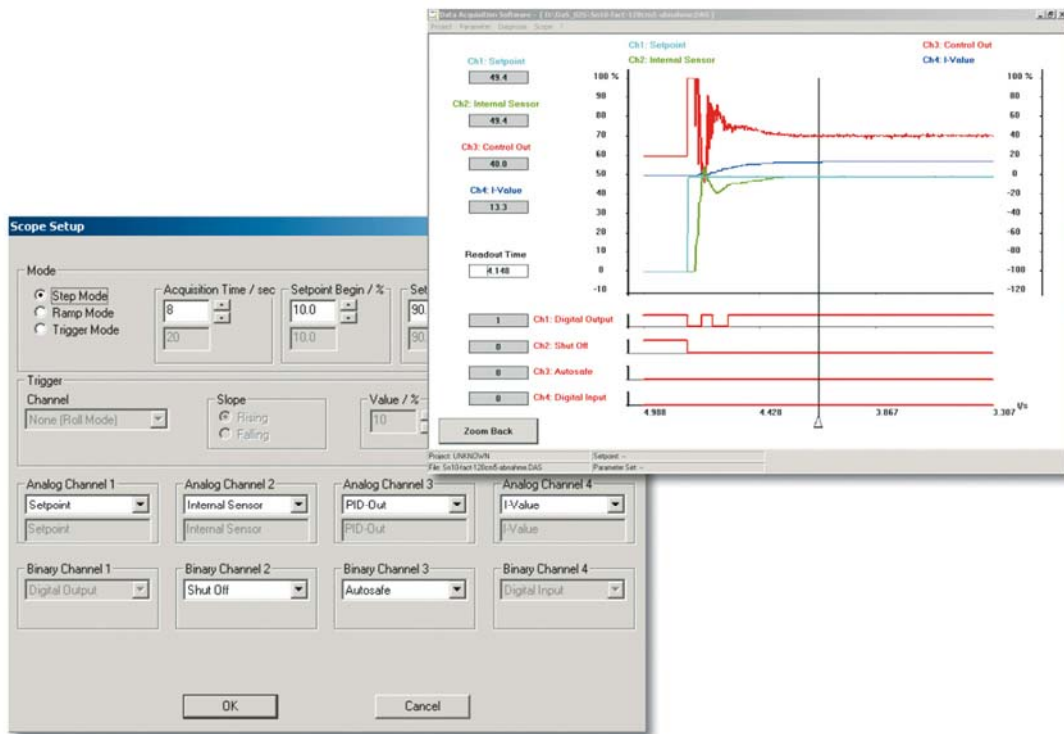
Picture 3: Easy and quick parameter setting. Monitoring and control functions are considerably simplified.
Image: AscoNumatics