

Pneumatics Extend Reach into Packaging Applications

New technologies deliver intelligent control, networking and inexpensive sensing solutions
Al Presher, Contributing Editor -- Design News, October 12, 2009

Keeping in step with their electromechanical counterparts, pneumatics technology is developing at a rapid pace, now delivering modular designs, safety solutions, diagnostic capabilities, and sensing and control functions that reach beyond traditional packaging applications.

Modular Design and Efficiency

A key trend in packaging equipment design today is the use of modular concepts and components. KHS Flexible Packaging uses that approach in its new Innopouch K-Series modular pouch machines, which feature both pneumatic and servo controls. "We are taking a modular approach to the design of our machines, so what we need now are modular components that fit into that strategy," says Randy Uebler, general manager for KHS.

In the design process, KHS engineers analyze the type of move that needs to be made and make the decision whether to use either electronics or pneumatics based on cost and performance.

KHS designed both servo and pneumatic controls from Bosch Rexroth in its pouching machines.

Engineers selected pneumatics where air control is critical for achieving accurate positioning, including a modular HF03-LG pneumatic valve manifold system and a CL03 valve bank with the added bonus of providing washdown, IP69K-rated protection.

Valve banks can be mounted and connected using either PROFIBUS or SERCOS, which makes it possible to pre-build the modules and plumb the air lines to the components without waiting until final assembly. In fact, complete modular subassemblies are now built up separately and integrated at the end of the assembly process.

"Pneumatics really helped us bridge the gap to modularity," says Uebler. "Instead of valves mounted all over the machine, we have one valve bank that distributes air throughout, which reduces wiring and makes it cleaner. It is expandable to add valves if we want a bigger machine."

Safety and Diagnostics

According to John Holmes, packaging industry segment manager for FESTO Corp., a supplier of pneumatic and electrical automation, pneumatics are making advances in safety, valve diagnostics and networking.

In fact, new Category 4 safety valves designed for pneumatically operated automation are helping OEMs and system integrators comply with new safety legislation.

EN ISO 13849-1 replaces the existing EN 954-1 safety standard on Nov. 30, 2009 and forms part of the Machinery Directive 2006/42/EC, which becomes mandatory at the end of 2009. New safety valves can help OEMs address issues in the directive including mean time to failure, self diagnostics, common cause failure protection, and external validation and certification.

The MS6-SV redundant safety valve from FESTO, for example, offers an exhaust flow rate of 6,000 ÜP/min, or 1.5 times its standard maximum operational flow rate for implementing emergency stop functions in safety-critical system areas. Built-in safety redundancy and parallel valves insure fail-safe exhaust of the system if one valve develops a fault. Integrated sensors continuously monitor the physical position of the valve components to confirm the valve's condition and status.

"Advances in diagnostics and networking also are providing higher levels of intelligence at the valve terminal," Holmes says. "Ethernet networks using true peer-to-peer communications are creating more I/O density on valves and the ability to address higher numbers of analog and digital I/O on the manifold." He adds that by reporting switching and voltage irregularities over the network, intelligent feedback from the valve can be used to help set preventative maintenance schedules.

Sensing and Control

"Two areas where pneumatics are making a significant impact in packaging machinery are sequence valve control and sensing applications," says Paul Gant, sales manager with **Clippard Instrument Lab. Inc.** Clippard manufactures electronic and pneumatic valves, cylinders and fittings.

A traditional strength of pneumatics in packaging has been repetitive motion sequences that are controlled pneumatically without requiring a PLC or controller. Sequence valves now are offering more options for inexpensive sensing.

Interruptible air jet sensors typically support gaps from 4 inches down to 0.1 inch, providing a jet of air to detect objects and shift the valve to reject a product or create motion. Touch sensors use a very small amount of air escape to initiate an action. They can be used in parallel to assure that the product is in the proper position for the X, Y and Z axes.

A whisker valve, which is a low-force contact sensor that operates similar to a limit valve, provides sensing in a very small area. The valve is only 0.5 inches tall and can be placed 4 to 5 inches from the valve. It senses when an object touches it and works by exhausting air to atmosphere to initiate a function within the control valving.

Gant says pneumatics can also offer economical brake control in long conveyor lines, which often require a series of solenoid valves or some type of a mechanical brake.

Washdown Operation

Pneumatics and inexpensive sensing are also making their way into applications that require washdown operation. Many of these machines are in dirty, washdown environments and may be affected by condensation in the air lines, which can degrade performance.

When a bottling equipment manufacturer wanted to speed up the cycle time on its filling machinery, Bimba Mfg. helped develop a dynamic nozzle that can follow a filling profile, starting out with a rapid fill and slowing as the bottle reaches capacity, to eliminate spillage. A precise filling profile maximizes speed and maintains process control.

Bimba engineers designed a custom position feedback cylinder with a sensor shrouded in a hollow piston rod. Every sensor is individually calibrated at Bimba for a 0–10V feedback signal output, a requirement because up to 40 units are installed per machine and individual calibration is not possible in production.

"The feedback voltage is proportional to how far the cylinder's magnetic piston moves along the sensor tip, which is inside the cylinder rod," says Bob Kral, a product manager for Bimba. "The magnet produces a constriction in conductors inside the sensor tip, and the time delay of the reflected signal is converted to a proportional voltage. Most importantly, the sensor doesn't wear out and is immune to wear from rapid cycling, moisture and air line contamination."