Pneumatics on the slide?
That's just hot air

VALVE TERMINALS HAVE BEEN THE BIGGEST SUCCESS STORY IN THE PNEUMATICS WORLD FOR OVER A DECADE, BUT IT APPEARS THEY MAY DEVELOP NO FURTHER. HOWEVER, OTHER DEVELOPMENTS NOW LOOK SET TO TAKE THEIR PLACE IN DRIVING PNEUMATICS TECHNOLOGY FORWARD. BOB DOBSON REPORTS.

Pneumatic actuation has been a favourite with machine builders for many years. It is low cost, simple to understand, easy to use and maintain, relatively fast and able to cope with moderately heavy loads. It is ideal for both single and multi-axis applications and can be integrated with other technologies to create reliable, high performance machines.

Pneumatics has evolved steadily over the last couple of decades so that its simplicity hides some very sophisticated design and technology, such as optimised materials and high performance seals that give a working life usually measured in years. But the more astute manufacturers are not resting on their laurels: they are continuing to develop new ideas, reckoning that they could face an onslaught from the East at any time.

The emerging economies of Asia have already proven their ability to clone technologies and make pneumatic equipment that is, on the face of it at least, world class. To date none have tried to export beyond their own region, but it only takes a couple of enterprising young sales engineers to start what could become a flood.

Interestingly, a similar threat arose ten years ago when Eastern European countries opened their manufacturing to world markets. There were several attempts to import Czech, Polish and Hungarian pneumatics to the UK and the EU, but little came of these in the longer term.

Instead, the established European manufacturers outsourced some of their manufacturing to 'New Europe', combining cost advantages with valued brands and their existing distribution channels.

With so much pneumatic equipment built to defined international standards, most major manufacturers have secured their markets by working closely with customers on bespoke and customised design.

Rosy future: *Pneumatics technology is picking up*

In some instances this could be a small variation to a standard pneumatic cylinder, say a change of seal or an elongated piston rod. Going a bit further could involve developing a special mounting bracket or end-effecter. The full service could entail development of a 'macro-solution' or value-engineered subsystem that integrates the pneumatic components with other equipment and technologies.

Design and build

Providing this design and build service makes it much more difficult for competitors to attack and bonds machine builder and pneumatics supplier into a tight partnership from which they can continue to develop subsequent generations of the system and entirely new projects.

Implicit in this approach is the need for pneumatics engineers to be conversant with a number of related technologies, and many of the suppliers have brought these under their own brand umbrella. For instance, some pneumatic companies now offer ranges of electric linear actuators alongside their pneumatic cylinders, the cleverest ones having ensured complete interchangeability between the technologies.

Indeed, the interface between pneumatic and electric linear actuation is becoming increasingly blurred. Pneumatic and electric actuators can often use the same controller, while the mounting methods and mechanical interfaces can be absolutely identical.

Until a few years ago it was correct to say that electric actuators were more controllable than pneumatic but cost more, so selection of the appropriate technology for a given application was relatively easy. But pneumatic control is developing faster and it is now possible to make pneumatics as accurate as electrics. Unfortunately, for this level of control, there is also price parity at present.

However, experts are predicting that within a few years low cost pneumatics will be almost as controllable as electric, providing positional accuracy to 1-2mm at a very attractive price, so the breakpoint between the two technologies will shift dramatically in favour of pneumatics.

Cost has always been a big driver for machine builders buying pneumatics, and to date they have had their way! Pneumatics manufacturers have kept up with this continual demand by automating their production, rationalising their product ranges and optimising designs. As discussed above, they have also sought to add value at the sales interface and to create innovative solutions for users: for instance, one manufacturer has had considerable success with a pneumatic obstruction detection system that is a fraction the price of a light curtain solution.

Valve islands or valve terminals have become the preferred format for pneumatic systems architecture. Most pneumatic devices need a small number of solenoid valves to operate

them and originally these were individually located close to the device.

However, a valve island is a block of say ten or 12 valves that is mounted centrally on the machine or in the control cabinet, and provides plug-and-play capabilities for a number of devices. The time and cost savings they provide for systems building is considerable, while the ease they bring to reconfiguration allows users to remodel their machines virtually at will.

Second and third generation

Valve islands first entered mainstream machine usage perhaps ten years ago, and manufacturers are now typically on their second or third generation of product. Each new generation has been smaller than the last, provided better connectivity, and been easier to install.

However, the embedded technology, direct-acting solenoid coils, is now reaching a fundamental limit and it appears unviable to reduce them in size any further without compromising performance, reliability or both. Instead, the manufacturers have their development teams busy on replacement technologies, mostly focusing on solid-state solutions.

Some technologists are backing piezo-electric switching to be the eventual winner, but for this to be realised significant cost hurdles will have to be overcome, whereas conventional solid state electronics are already at an acceptable price point.

Piezo is a steady state concept based on a tiny ceramic switch that is in either the open position or the closed position. A microscopic electrical impulse will change its position from open to closed or vice versa. By contrast, the conventional solenoid technology is based on a relatively large constant electric supply to charge an electromagnet, which acts against a spring.

Current solenoid switches are say 10mm wide: solid-state equivalents could be half this size. The miniaturising effect will be immediately appreciated by machine builders, who never seem to have enough space in their control cabinets and who do not want relatively large and delicate valves exposed on their machines.

But they could also consider the intrinsic safety of the steady state switch. Instead of having relatively large constant currents in their control systems, they can look forward to instantaneous switching signals of miniscule magnitude which cannot cause sparking even in Zone 1 and 2 explosive atmospheres. Cost savings for hazardous area engineering stand to be immense!

The current generation of valve islands generally boast fieldbus interfaces, with the user having to specify which protocol is to be used. This throws up an interesting three-way anomaly. Most suppliers promote a relatively high level Profibus protocol, while technically a lower level protocol such as ASi or DeviceNet would seem more appropriate. Yet, in the UK at least, many machine builders prefer to hang on to the old hard wiring procedures!

Investigations suggest that German and Italian machine builders are far more enthusiastic about fieldbus – almost to the point where hard wiring has gone the way of the steam engine – than their British counterparts, who are thought to be three years behind the trend.

The reason for this is probably that the Europeans tend to have serial orders for large numbers of identical machines, so production efficiency gains is very much part of the mind set; whereas the British tend to muddle from one unique machine design to the next with most of the intellectual effort going on technicalities of the machines' performance rather than on 'secondary' issues such as wiring.

It is tempting not to worry about this discrepancy, but it is perhaps indicative of the health and future prospects of the machine building sectors in different countries.

Increasing pressure

Pneumatics has a bit of a secret weapon for addressing the future needs of machine users, which is now beginning to be deployed in the automotive sector – often the trend setter for other production sectors.

It does not take a genius to predict that productivity will be required to increase steadily over the coming years. This means that machines have to become faster and more powerful without becoming significantly more costly. Pneumatics can address this requirement simply by increasing the supply pressure of the compressed air systems that drive them. The technology needed to allow this change is far from rocket science, so there is every likelihood that it will prove a winner.

While it may not hold back the tide of servo electric drive solutions completely, it will probably draw a line in the sand that favours low cost, simple adaptable pneumatics over high tech solutions in nine cases out of ten.

Market reports and media coverage could lead one to believe that pneumatics technology has had its day. But we were also told that Prince Charles would never remarry! ■

New range: *Festo's new DGC rodless cylinder design*

FESTO

New range of rodless cylinders offers higher performance

Rodless pneumatic cylinders are a highly-appealing linear actuation technology that can save enormous space on machinery, but compared with conventional rodded cylinders their performance is often regarded as inferior.

However, a new rodless cylinder design from Festo incorporates technology that appears to deliver a step-change improvement in life cycle, load capacity and running costs – along with much simpler system building.

Six diameters of cylinder ranging from 8 to 40mm are available in Festo's new DGC range, offering movement speeds to 3metres/second. Despite compact dimensions, the largest cylinders in the product family will carry loads up to 50kg and accommodate very large forces to 7000N and torques to 380Nm – performance levels that are said to provide a high level of application flexibility. Unbalanced loads are also possible.

Higher running costs because of air leakage from rodless cylinders – which typically have a soft seal between the piston and load – is another common concern. However, Festo says that the new sealing mechanism on the DGC range has virtually zero leakage.

A new aluminium body and piston-to-carriage connection mechanism are at the core of this performance.

These provide improved rigidity and strength to support the increase in load capacity, while substantially reducing manufacturing costs. The highest specification, ball bearing equipped guide is crimped into position during production for instance – eliminating multiple bolts and assembly operations – which Festo says allows it to offer the new rodless cylinders at particularly competitive prices.

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