Changing Direction:
How Improved Directional Control Valves Now Increase Production Efficiency

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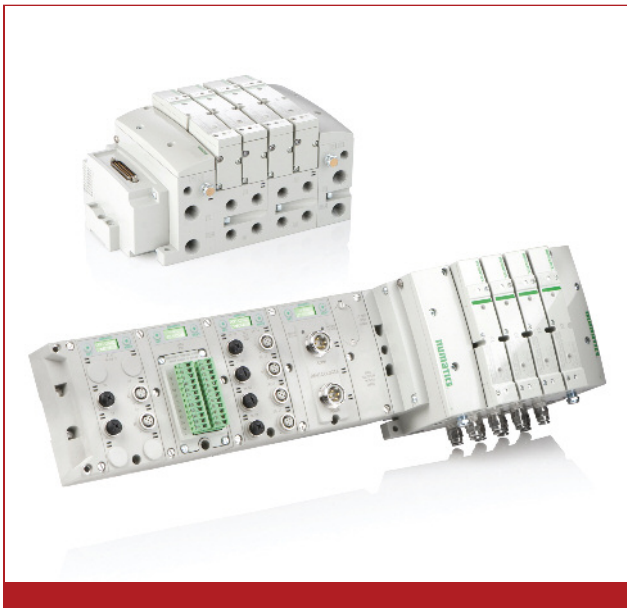

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Introduction

Pneumatic directional control valves have seen notable improvements and refinements in recent times. How can original equipment manufacturers (OEMs) take maximum advantage of these improvements when designing automation and piloting equipment? It may help to adjust their thinking.

First, these valve manifolds are relatively small subsystems in generally much larger assemblages of automation equipment. But the right valve can open up wider degrees of freedom when designing larger automation elements.

Second, automation specialists may conceptualize pneumatic components as if they were simple electrical devices, such as a light switch. You flip the switch (send the signal) and light the bulb (the valve) actuates. That perspective is limiting in important ways.

A pneumatic directional control valve, of course, works with flows of compressed air, not electrons. When you send your signal (activate the valve's solenoid coil), the air inside the valve must be made to change direction. The speed at which it does so, and the amount of air that flows in that new direction, may be substantially affected by quite small changes in the arrangement and construction of the valve internals. These can make significant differences in performance when OEMs design them into machines for applications such as packaging, automotive/tire, food and beverage, pharmaceutical, and general machinery.

Designers who slightly change the direction of their thinking can choose a pneumatic valve that takes advantage of the significant benefits highlighted in this report.

Higher flow rates

Recent technological refinements mean that the latest-model directional control valves are now available with substantially greater air flow rates through the valve.

For example, the 503 series from Numatics Inc. can offer up to a 20% higher flow rate per valve size than previous models! Achieved by rigorous analysis of air flows and comprehensive refinements of the existing valve's internal designs, this is currently the highest such flow rate available in the industry.

Ultra-high flow carries significant benefits. Providing a greater degree of freedom for OEM designers and specifiers, it lets them take their valve use in one of the two following directions:

1. Same work, smaller valve

Most users will take advantage of the design freedom that higher flow delivers to accomplish the same performance as with previous models, but in a smaller valve envelope. This is part of an important, ongoing industry trend.

A decade ago, for instance, many industries applied pneumatic valves with measurements set at ISO standard widths of 50 mm and 38 mm. Today, many of these same operations are moving to 26 mm and even 18 mm products. Decreasing the envelope size of the newer valves has important ripple effects:

- You can purchase smaller, more cost-effective valves
- You can generate (and waste) less expensive air and energy
- You can downsize other components — building smaller, less expensive machines that fit in smaller, less costly cabinets

Estimates show that the cost savings for some users can be truly exceptional.

A number of OEMs report that these benefits are amplified when designs are already near a tipping point. Calculations may reveal that the newest valves make the decisive difference. So designers are finally able to realize their plans of downsizing associated equipment, or dropping a level of magnitude (and cost) in power consumption, or reaching a new plateau of total production throughput.

These kinds of noticeable improvements can help an OEM gain a clear advantage in the most challenging competitive environment.

2. More work, same size valve

In contrast to the above, some users will utilize their new freedom to avoid downsizing directional control valves or other components — instead increasing the amount of work

the system can perform, perhaps by raising production levels. Or they may choose to simply increase the total efficiency of the operation.

For instance, the newest valves can provide greater speed of component motions for higher cycle rates.

OEMs' customers dictate a target cycle rate or other production expectation for a given piece of equipment. OEMs also experience constraints on their equipment's physical dimensions and energy consumption. Choosing a valve with enhanced technology may let the designer meet his or her goals more efficiently than ever — or set and reach new goals not possible before.

Enhanced electronics

Another advantage of some newer directional control valves is integration with the latest fieldbus modules and electronics technology via the valve manifold.

The larger and/or more complex the plant network, the more important this advantage becomes.

Perhaps the best current example would be the Numatics G3 fieldbus electronics system. This kind of platform lets designers take valve and manifold selection in a whole new direction. Critical advantages include configuration ease, distribution flexibility, and diagnostic capabilities.

Configuration. Forget the dreaded DIP switch. New technologies enable configuration of communications protocols, distribution options, I/O mapping, and more — all via small graphic displays and push-buttons embedded on each module. Configuration headaches are relieved, while installation time and commissioning costs go down.

Distribution. The newest fieldbus nodes integrate both valves and I/O capabilities. In addition, I/O and valve manifold functionality can be distributed around the automation machine, so designers can optimize its physical layout using only a few basic multifunctional modules. Users report that productivity rises, while costs for hardware, commissioning, and inventory fall.

Diagnostics. Each of the conventional approaches — remote HMI panels, plug-in handheld devices, and point-of-use LEDs — suffers from well-recognized drawbacks. Fortunately, a solution like the module-integrated graphic display mentioned earlier can provide clear point-of-use diagnostics with plain-language messaging to identify problems. So you get easy identification of any issues, plus simple, intuitive configuration of new manifolds and other new components on the fieldbus network. This level of status monitoring and feedback helps ensure asset availability.

Improved reliability

Look for directional control valve models where the manufacturer has reexamined every aspect of valve design and performance to identify and carry out potential improvements in basic reliability. What's the consequence of inefficiencies within the valve? What specific wear patterns do this produce? How do the seals function, and where do they wear? When and how does any leakage occur, and how can it be eliminated?

Case in point: Numatics 503 Series models have been reengineered from prior designs to improve the reliability of the solenoids that actuate the valve, as well as that of seals and other internal elements.

Result: many users are reporting up to 10% longer service life in a number of applications. Naturally, this leads to other advantages:

- Longer time between overhauls
- Reduced downtime and maintenance costs
- Lower total cost of ownership

These benefits for the valve also can often transfer some reliability effects to associated systems as well.

Increased versatility

Another welcome development of improved valve technologies: more versatility than ever before.

Look for new valves designed with internal construction flexibility that allows them to be optimized for different applications. Of course, different valve sizes are always offered. Also, your operation may benefit from the flexibility of valves now available in both ISO standard and proprietary interfaces to cover virtually any application.

Several manufacturers may supply valves that offer one or the other of these innovative features. Surveying the industry as a whole, users may notice that Numatics directional control valves offer all these advantages, and more.

For example, Numatics 503 Series valves are now available in both spool-and-sleeve and rubber seal versions. Spool-and-sleeve construction lets the valve shift internal air direction faster, making it ideal for tasks demanding high cycle rates. These valves also

deliver the industry's longest service lives. By contrast, versions using rubber seals are sometimes preferred for applications that demand the highest possible flow rates.

Accessories such as pressure regulators, flow controls, and more can also be built into the manifold for greater flexibility. These may be enhanced by tools such as Numatics Numasizing® software, which optimizes the automation system's compressed air flow by precisely calculating proper sizes for pneumatic components, and selecting appropriate pressures. Users say they reap substantial cost returns from resulting air and energy savings.

Even the physical build of these new valves and manifolds helps maximize versatility. Modular plug-and-play components allow easy reconfiguration, even after initial design and assembly. This goes along with external accessibility. Look for manifolds that don't require removal of seven valves in a row to "get at" the eighth valve. Innovative new Numatics models come apart wherever needed.

Result: in a welcome break from past construction difficulties, change orders can be easily accommodated at almost any place on the manifold — or any point in the build.

This flexibility can extend to the valve's ordering and availability. Ask your supplier about quick-shipment programs for the products you may need. Even in the face of a demanding change order late in the process, modular constructions mean the right valve manifolds can be assembled and shipped at the right time.

All these options allow designers to standardize on a valve type they prefer and order variations as needed, simplifying design and inventory issues.

Ultimately, the designer makes fewer compromises in selecting precisely the right valve for the end user's desired application performance.

Conclusion

Directional control valves have recently been the focus of intense refinement and reengineering efforts. These have produced enhancements including ultra-high flow rates, greatly improved electronics, ensured reliability, and expanded versatility. Forward-thinking OEM designers and specifiers are changing direction to take maximum advantage of these developments — thereby realizing significant cost savings and gains in production efficiency.

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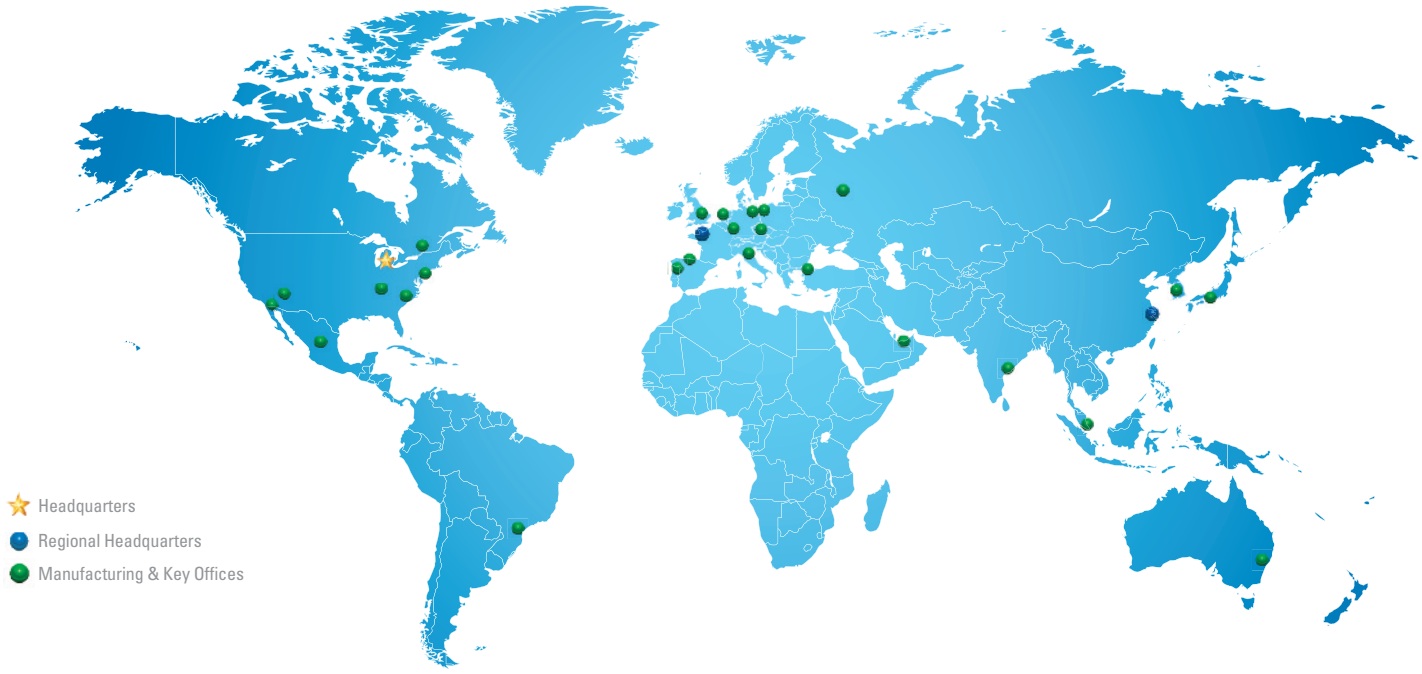

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