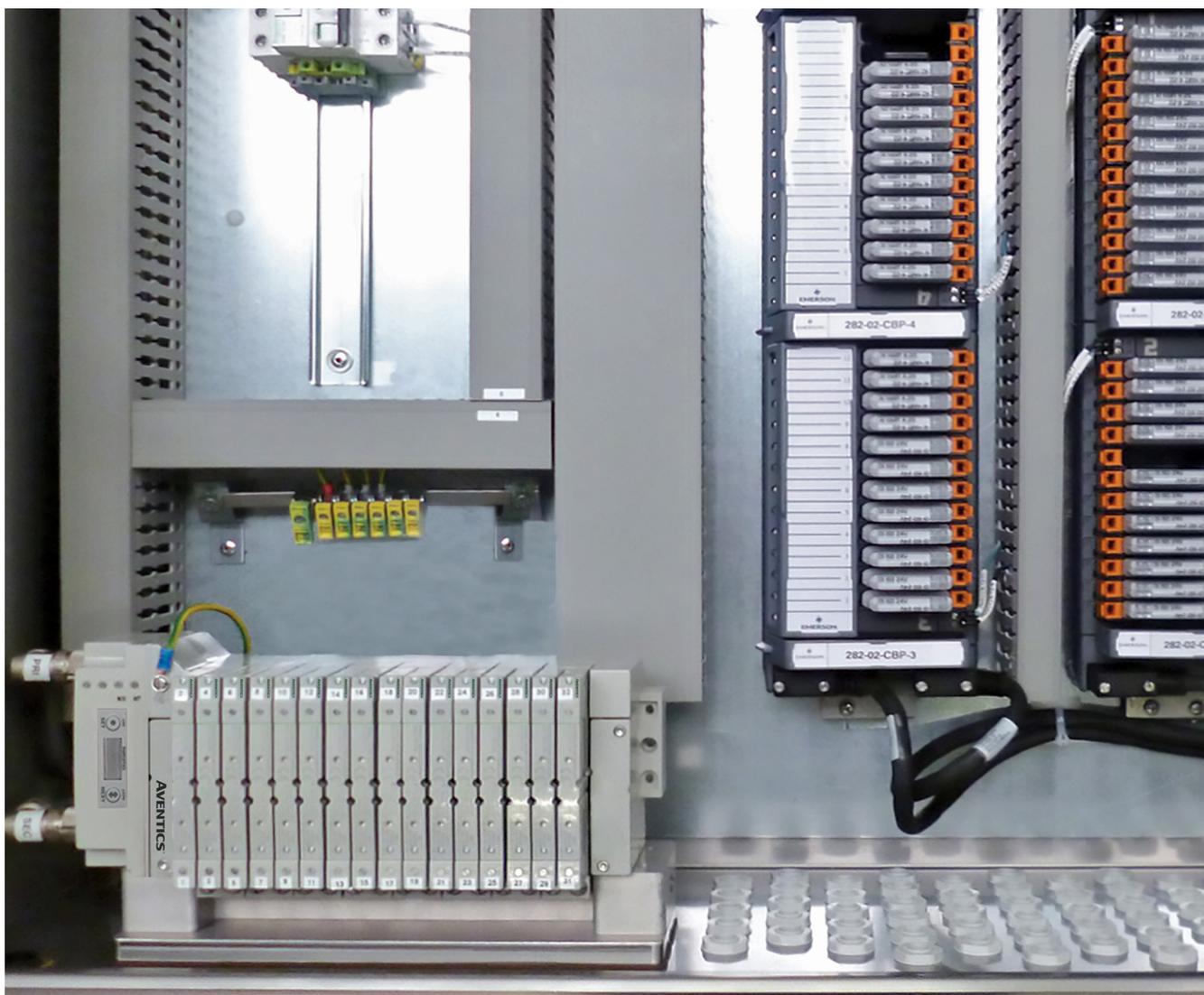


A Revolutionary Approach to Distributed Valve Manifold Control

How the AVENTICS™ 580 CHARM Node saves substantial time and cost when integrating pneumatic valve manifolds into a DeltaV™ distributed control system



Introduction

Traditionally, the chores of I/O mapping and configuring bus networks to valve manifolds in a distributed control system (DCS) have made commissioning time-consuming, expensive, and confusing. Also, users report increasing shortages of the skilled workers needed for all the myriad tasks of system implementation.

In recent years, significant steps toward simplification have become imperative

Fortunately, Emerson's 2009 introduction of Electronic Marshalling technology for DeltaV revolutionized many aspects of plant control, and not coincidentally of system implementation. It gave DeltaV users previously unprecedented flexibility, with the option to add I/O anywhere in the plant at any stage of the project.

Now an exciting new technology from Emerson extends Electronic Marshalling, and for the first time allows integrated control of pneumatic valve manifolds on one network. The AVENTICS 580 CHARM node, attached to an AVENTICS Series 500 valve manifold, can interface directly with the DeltaV CHARacterization Module (CHARM) I/O card from Emerson.

The 580 CHARM node represents a revolutionary approach to distributed valve manifold control. It can benefit DeltaV S-series users in chemicals, pharmaceuticals, life sciences, petrochemicals, and food and beverage manufacturing, as well as control skid assemblers. The 580 CHARM coil capacity can pilot up to 96 process valves.

This paper examines problems with traditional wiring approaches, and explains how this new technology leverages the power of DeltaV and Electronic Marshalling with integrated pilot valve control to save substantial time and provides users with a lower total cost of ownership — while greatly simplifying the control of valve manifolds.

Problems with traditional wired marshalling

In the time-honored way of wiring I/O to a distributed control system, technicians wire field devices to terminal blocks in marshalling panels located within an I/O room. Wires come in from the field through multi-core cables, and are connected to their appropriate I/O cards in controller cabinets. Wiring is cross-marshalled, so that each device gets connected to its appropriate I/O card and channel.

Unfortunately, the process is often frustrating for all concerned: from technicians and integrators to control engineers and project managers. Problems can occur at almost every step.

For instance, during cross-marshalling, it becomes harder and harder to keep track of where each and every wire comes from, and where it should go to. Human errors abound. Wires are connected to the wrong place. Wires are even left out altogether.

And even when cross-marshalling is "all done" — it's actually not.

Almost invariably, every project is subjected to cascades of late I/O changes. These include rework on drawings, control system partitioning, moving wires, building new cabinets, and many other detailed tasks. Every change adds cost, time, and most importantly risk to the job.

Result: delays. And in the field, even a 1-day delay can add millions to the costs of a critical automation project.

Advantages of Emerson's Electronic Marshalling and CHARM technology

An increasing percentage of operations have been moving away from the outdated wired marshalling approaches mentioned above. That includes businesses using DeltaV with Electronic Marshalling for continuous or batch-oriented manufacturing processes with distributed I/O. It also includes facilities that wish to implement modular plant architecture (MPA) for I/O-anywhere distribution.

The newer approach of choice:
Electronic Marshalling.

Electronic Marshalling is an innovative approach developed for the interconnection of field measurement devices to the DeltaV distributed control system. It's part of Emerson's Human Centered Design initiative.

Electronic Marshalling focuses on the areas of commissioning that many users find most complex, labor-intensive, and potentially disruptive. Simply put, Electronic Marshalling eliminates all the design, engineering, and work associated with cross-marshalling. Instead, each individual I/O channel can be electronically marshalled to any controller in the system. So I/O can be bound to specific controllers at any stage in the project without manually rewiring.

Electronic Marshalling's revolutionary advantage: it allows users to make late changes to I/O types, or add new I/O — with no adjustments to existing wiring or cabinets! You just add new I/O to marshalling cabinets, and electronically marshal them to the controllers that need that I/O.

This retains some advantages of bussed I/O networks (reduced wiring and footprint; more diagnostics; device add/change flexibility). Most important, it greatly decreases system complexity and system footprint.

A critical component for this new way of doing things is CHARM technology. A CHARM is a single-channel component with an analog-to-digital (A/D) converter and signal characterizer. You simply click it onto the terminal block — now a smart terminal strip — where field wires are landed. It inserts anywhere onto the strip. No screwdrivers or other tools are needed.

This simple but significant new technology brings unprecedented flexibility to wiring work. It allows field wiring of any signal type to be terminated anywhere.

So using CHARM permits late characterization of any type of I/O signal — analog input, analog output, digital input, digital output, or RTD and thermocouple temperature sensors. For system planners, the ultimate charm of CHARM is simply this: flexibility to add any type of I/O, anywhere, anytime.

CHARM connection with valve manifolds

Adding CHARM functionality to the DeltaV DCS represents a giant step in efficient I/O component implementation. However, problems remain with the connection of valve manifolds.

Some users connect CHARMs with pneumatic valves via hard wiring. But this is expensive, and configuration requires extra time and labor.

Other users improve on valve manifold hard-wiring by adding an additional fieldbus network. This yields some simplification of commissioning, and allows some added diagnostics.

However, this approach requires a second communications card and adds complexity along with additional data mapping. Furthermore, an additional network (usually PROFIBUS-DP, DeviceNet, or EtherNet/IP), requires additional configuration and mapping of data. Lastly, under this approach, the amount of time required to modify a system can increase exponentially with the system's complexity, and may not support communication and power redundancy.

Fortunately, a third approach is now available.

Advantages of AVENTICS 580 CHARM nodes

The latest and best way to integrate valve manifolds into a DeltaV system with Electronic Marshalling utilizes the new AVENTICS 580 CHARM node.

Using Electronic Marshalling technology, the 580 CHARM node provides full integration of AVENTICS Series 500 valves into the DeltaV system. It significantly simplifies commissioning, and empowers the full, native diagnostic capabilities of DeltaV.

The approach requires only one network connection to connect an Electronic Marshalling Cabinet, which includes I/O and a pilot valve manifold, back to the DeltaV system. This single field connection carries control signals for both I/O and the solenoid pilot valve manifold. The pilot valve manifold is connected to the CHARM baseplate via two redundant cables that carry the power and control signals. These connections provide the user with a direct interface of the 580 CHARM node to the DeltaV Control Network — as if the pilot valve manifold was mounted directly on a CHARM baseplate — with no need for CHARM digital output cards to drive each valve coil on the pneumatic valve manifold.

Results: significant reductions in network and programming interfaces, network gateways, wiring, and junction boxes with increased reliability and diagnostics.

All communication between electronically marshalled components, including valve manifolds, and the DeltaV controller takes place on the DeltaV Control Network. No dedicated secondary networks are necessary. With a 580 CHARM node, the valve manifold is electronically marshalled to any controller in the system. Any I/O is available to any controller via one network.

An electronically marshalled cabinet with these new CHARM nodes is 100% functionally equivalent to a traditional wired marshalled cabinet. But it involves fewer wires, much less work, much more flexibility, a lot fewer change order hassles, and better diagnostics. Users gain safe, reliable, and redundant control of pneumatic signals. And they can achieve process efficiency without painful delays in response times.

The 580 CHARM node only connects to AVENTICS Series 500 valves. This family of high performance, “plug-in” directional control valves offers a host of advantages: higher flow rates; the broadest range of components and accessories in its class; and exceptional ease of installation, configuration, and modification.

Applying the 580 CHARM node approach provides users with a complete, integrated Emerson I/O and pneumatic valve manifold solution for DeltaV installations. Interoperability is guaranteed via proven Emerson technology.

This solution offers tight integration to existing Emerson hardware, software, native diagnostics, and redundancy. It eliminates added configuration tools, or the necessity for becoming familiar with multiple networks. It gives the user a single point of responsibility for products, documentation, and support. And it imposes no learning curve on existing CHARM programmers or users.

Cost savings

The 580 CHARM node solution provides substantial savings in network cards, associated I/O, wiring, and commissioning time. But its largest savings for many applications may come from eliminating the need for two different networks. It's no longer necessary to stuff and maintain two networks in each cabinet. For example, this new solution eliminates the need to use PROFIBUS-DP to control pilot valve manifolds. Instead, the job can be done more efficiently solely by the DeltaV Control Network via the CHARM I/O Card, which reads the sensors on process valves.

Of course, integrating 580 CHARM nodes into a DeltaV system using Electronic Marshalling is a new way of doing things — but all the elements add up to make truly impressive reductions in cost and effort:

- Savings of up to 15% on wiring and components alone
- Significant savings in costs for programming and commissioning
- Substantial savings in eliminating or mitigating any need for a secondary industrial control network (e.g., PROFIBUS-DP) and all its associated hardware
- 580 CHARM coil capacity can pilot up to 96 process valves

Ease of use

Integrating 580 CHARM nodes into Electronic Marshalling technology is easy. Solenoid valve outputs are treated like any other electronic outputs by the DeltaV system. There's no need for individual Discrete Output (DO) CHARMS to drive each solenoid valve.

This approach takes advantage of the native capabilities of the DeltaV DCS. Greatly enhanced, higher-level diagnostics are provisioned from the DeltaV system to any authorized workstation — using existing applications, in the same manner as other DeltaV-connected devices.

So using 580 CHARM nodes provides several critical capabilities: It makes it easy to respond to late change orders around I/O requirements (that might otherwise add cost and risk). It supplies increased ease of commissioning. And it furnishes native diagnostic reporting and redundant power and communications to the pilot valve manifold.

Finally, this proven, efficient Emerson solution offers maximum implementation flexibility. Not only can you add any type of I/O, anywhere, at any time, but you can now add any AVENTICS Series 500 valve manifold with that same freedom.

Additional advantages

- Local field solution for modular skid applications — since field junction boxes provide analog and digital inputs wired to DeltaV CHARM; manifold directly connected to CHARM baseplate to drive valve solenoid coils, replacing pilot valve dedicated Discrete Output (DO) CHARM
- Easy-to-use, task-based engineering environment familiar to DeltaV users — configures same as Discrete Output (DO) CHARM
- Connection of CIOC (CHARM I/O Card) redundant communication and power connections to valve manifolds via existing CHARM column extender connections — adds control and reliable communication functionality to valve manifolds; not available with any competitive approaches

Conclusion

Traditional hard-wiring approaches for I/O points in distributed control systems add considerable time and costs. So the availability of Electronic Marshalling and CHARM technologies has been an important advantage of more recent DeltaV system implementation.

Now the full benefits of Electronic Marshalling can be even further improved and extended to the pilot valve level with AVENTICS 580 CHARM technology. Users receive full native DeltaV system diagnostics functionality; full redundancy; full interoperability — and the flexibility to make late changes anywhere, anytime.

This simplifies implementation of systems with integrated valve manifolds, greatly reduces complexity, and eliminates learning curves for DeltaV users. It cuts project risk, and avoids potentially serious delays. Finally, it means substantial cost and time savings in wiring and components; added savings in programming and commissioning; and even more savings from eliminating secondary networks.

Takeaways

- Conventional hard-wiring and dual-network methodologies make for costly, complex, time-consuming control system implementation
- Newer Emerson Electronic Marshalling technology brings substantial simplification and savings
- AVENTICS 580 CHARM nodes help extend these benefits to the valve manifold level, and provide a host of advantages for current DeltaV users
- They promise substantial rewards for businesses that implement the winning combination of Emerson's DeltaV system with Electronic Marshalling, AVENTICS 580 CHARM nodes, and AVENTICS Series 500 valve manifolds