

How Emerson's "I/O on Demand" Is Changing the Automation Infrastructure

By Larry O'Brien

Summary

Many wires are in place today that probably don't need to be. There is tremendous potential associated with reducing this wiring, I/O, and other hardware components and labor costs.

Many factors at work today are radically changing the world of conventional I/O. Fieldbus drastically reduced the need for I/O in process automation. Other technologies, such as wireless, now have a similar impact. Meanwhile, a huge installed base of HART devices not connected to the control system through HART I/O or multiplexers represent untapped potential. While there's still a market for conventional I/O, end users clearly demand more flexible options that can address the requirements of both new capital projects and for migrating the large installed base of automation systems. In many respects, the "old school" of I/O and terminal block wiring is analogous to switched telephone networks. Yes, they get the job done. Yes, the large installed infrastructure continues to work. But newer digital technology reduces the need for such wiring-intensive infrastructure.

A lot of wiring in place today in process plants probably doesn't need to be. The potential for reducing this wiring, I/O, and other hardware components and the labor costs associated with it is tremendous. Emerson has addressed this issue with its "I/O on Demand" concept, released along with Version 11 of the DeltaV process automation system at the most recent Emerson Global Users Exchange. The I/O on Demand concept offers a wide range of I/O options to address any user requirement, from wireless devices to fieldbus systems, electronic marshalling, field-mounted I/O, and conventional I/O. Emerson has also addressed flexible I/O considerations for the company's safety instrumented system, DeltaV SIS, through modular architecture and the ability to utilize HART parameters fully in the safety logic.



What Is I/O on Demand?

Emerson's I/O on Demand concept incorporates bus technologies, conventional I/O schemes, wireless technologies, mounting options, and all the other components that go along with the process automation system wiring, bus, and I/O infrastructure. I/O represents the "last mile" from the automation system to the field device, and users look for any opportunity to reduce the cost of this last mile and provide better diagnostics to avoid failure.

With I/O on Demand, users decide the "what, when, and where" of their I/O. The "what" includes all the different varieties of I/O required in today's process plants. This includes wireless, HART, Foundation Fieldbus,

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AI, AO, DI, DO thermocouple, RTD, and so on. "When," encompasses the point in time that the I/O is added to the system - whether installed as part of a new project, added as part of late term project changes, during startup, during normal plant operations, or even a temporary installation. "Where" includes the location of the I/O, whether

installed in a conventional rack room, in a remote location, hazardous area, harsh environment, or as a part of a safety instrumented system.

Avoid Functional I/O Replacement

Of course, there is also a "how" aspect. End users installing new I/O or replacing existing I/O obviously need to drive down cost as much as possible. At the same time, users should be able to take advantage of the latest diagnostic capabilities that current I/O technology has to offer. This includes the ability to provide diagnostic information about intelligent field devices, network diagnostics, and the health of the I/O itself.

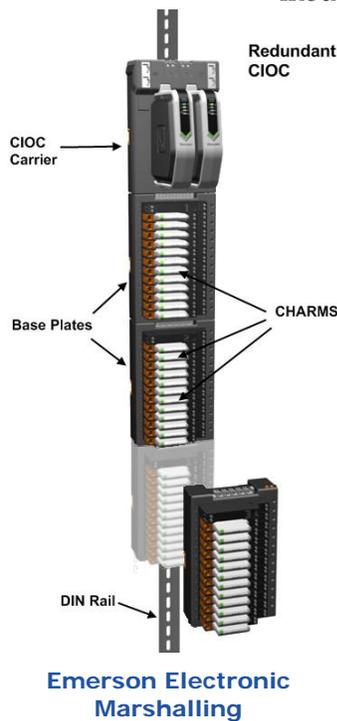
ARC's key recommendation for users undergoing control system migration projects is to avoid doing a "functional replacement," that is, swapping the old technology for the exact same functionality in the new system. Any new technology solution should provide more functionality and a better value proposition. This is just as true for I/O as it is for the entire DCS. In fact, it is becoming next to impossible for end users to justify automation upgrade projects on a functional replacement of I/O.

I/O Options in DeltaV Version 11

I/O options for the new DeltaV automation system Version 11 include DeltaV S-Series I/O, Electronic Marshalling techniques, Foundation Fieldbus, and Wireless HART I/O. In addition, Emerson still supports older DeltaV M Series I/O.

DeltaV S Series I/O

DeltaV S Series I/O represents the next step in the evolution of the original M Series I/O, plus some additional features not initially envisioned. This modular I/O subsystem offers flexibility during installation and Emerson



designed it for extreme environmental conditions of field installations. S-series Traditional I/O is equipped with a snap in retention system and auto-keying of interface slots for quick installation and error-free maintenance. Auto keying ensures that the correct I/O card is always plugged into the corresponding terminal block. The I/O interfaces can be installed in any of the possible 64 slots. All wiring is through the carriers and terminal blocks so that modules can easily be removed without disconnecting any wires. Carriers and interfaces can be added online, without interruption to the existing I/O communication.

Electronic Marshalling

The DeltaV system's new Electronic Marshalling concept, according to Emerson, has the potential to eliminate thousands of hours of landing I/O. Instead, users add I/O as they need it, one point at a time. This is done with CHARacterization Modules, or CHARMS. CHARMS turn the idea of conventional I/O on its head.

Instead of conventional wiring landing at a terminal block, wired to I/O modules, which are then wired to controllers - the wiring is connected directly to a DeltaV electronic marshaling rack. CHARM modules are attached onto this continuous rail. CHARMS can then be characterized however you want them to be and plugged into the rack. CHARMS also have self-diagnostic capabilities.

The uniqueness this solution is that you can put any type of point on the CHARM, and plug it in anywhere in the CHARM module. This also makes it possible for any point in the system to talk to any controller in the system. The CHARM is essentially "free formatting" for the card. This frees users



Emerson Redundant Wireless I/O Card

from having to rewire, significantly reducing the overall level of wiring required for a control system. According to Emerson, this can result in a 50 percent reduction in controller cabinets, a 40 percent reduction in cabinet footprint, and a 90 percent reduction in intra-cabinet wiring.

In ARC's view, the significant cost associated with traditional marshalling methods can limit the changes possible in the engineering and design of the system. The

new I/O on Demand capability of Emerson's DeltaV S-series allows users to add or change I/O types whenever they make project design changes, no matter where the I/O is located. This reduces project costs and, even more importantly, reduces time to startup.

Foundation Fieldbus Cards and I/O

Foundation Fieldbus remains the network of choice for process manufacturers due to its remote diagnostics, control-in-the-field capabilities, and wiring economies. Emerson offers a new Foundation Fieldbus I/O card that includes an integrated power supply. This eliminates the cost and expense of purchasing, engineering, mounting and maintaining separate bulk power supplies and fieldbus power conditioning modules. Users can install S Series Foundation Fieldbus I/O in the field, close to intelligent devices. Function and field-wiring protection keys ensure that the correct I/O card is always plugged into the corresponding terminal block.

The DeltaV system also offers redundant H1 interfaces for increased availability. The two H1 interfaces are connected with a redundant terminal block to provide back-up link active schedule (BLAS) capability that maintains communication with the host system. Transfer to the standby card is automatic and requires no special configuration. Ongoing diagnostics ensure the standby H1 card is available on demand.

The DeltaV system also allows function blocks to run in the Foundation Fieldbus H1 card. Assigned function blocks are included in the fieldbus

macrocycle, with execution fully synchronized with function blocks running in fieldbus devices on the segment. If communication with the DeltaV controller is interrupted, the H1 assigned function blocks continue to execute within the segment macrocycle.

Wireless HART I/O Is Redundant

The DeltaV Wireless I/O Card offers a redundant solution for wireless. Redundant items include DeltaV network communication, 24VDC power, I/O cards, remote links, and the multiple communication paths of the adaptive mesh network itself. The redundant architecture eliminates any single point of failure and provides immediate switchover in case of a fault.

Emerson took the existing 1420 wireless gateway and split it into two pieces – the Smart Wireless Remote Link and DeltaV S-series Wireless I/O. Users can deploy the Smart Wireless Remote Link in hazardous Class 1 Div 1/Zone 0 environments, while the wireless I/O and Remote Links are available in redundant configurations with redundant power and communications. The company also announced a new 4300 Series wireless valve position sensor that can be mounted on existing manual valves.

The Delta V network auto-detects the Wireless I/O Card and automatically senses Wireless HART devices as they are added to the network. This eliminates the need to perform a site survey to determine equipment locations. The self-organizing network automatically determines the optimum communication paths for each device to navigate around structures, making it easy and fast to set up wireless field instrumentation. This saves time and money. The Emerson Process Management layered approach to wireless network security means that network devices implement encryption, authentication, verification, anti-jamming, and key management methods to ensure secure data transmissions.

I/O on Demand as a Migration Path

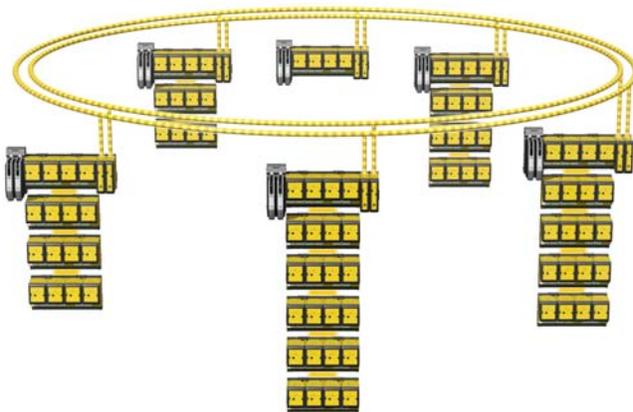
I/O on demand, particularly electronic marshalling, offers considerable advantages for new projects due to the ability to save on wiring and cabinet space. ARC also believes that I/O on Demand offers a migration path for legacy systems that provides users with the option to avoid a functional replacement of their existing I/O. Fieldbus technology, redundant wireless technology, and electronic marshalling can all provide value in a control system migration project. This wider range of options makes it easier to

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articulate a business value proposition to upper management. I/O currently represents a considerable portion of the hardware cost of a process automation system. Today, I/O accounts for almost 30 percent of all DCS hardware sales. The installed cost is even greater. I/O on demand represents an opportunity to reduce these costs.

I/O on Demand Enables Flexibility for Safety

The DeltaV SIS modular, distributed architecture enables users to custom fit the system to their SIS application with the flexibility to locate safety logic and I/O near the process. The DeltaV SIS system scales in size to address requirements for SIL 1, 2, or 3 applications. The modular logic solver hardware scales in size from 16 configurable I/O to up to 30,000 I/O in a single system. With a modular logic solver that has integrated I/O processing, memory and logic solver processing are added every time I/O is added to the system.



DeltaV SIS System

The configurable I/O functionality of the DeltaV SIS system, allows users to design application-specific safety instrumented functions (SIF) without limitations on I/O type per logic solver or the added complexity of I/O card wiring, which simplifies engineering and maintenance. This SIF-based approach isolates safety instrumented functions, eliminates single points of failure, and simplifies change management. The system architecture also enables SIS applications to be geographically distributed across

a plant or facility. This distribution is especially beneficial in large plant complexes, oil & gas applications for distributed wellheads, and long pipelines.

Conclusion

I/O on Demand fits well with Emerson's overall theme of making advanced technologies easily accessible and easier to use for a wide range of industries. ARC believes that I/O on Demand and the concept of electronic marshalling can offer cost savings in new projects, but also offers a good

solution for control system migration projects. Significantly, it avoids a simple functional replacement of conventional I/O, which can be very difficult to justify in today's world of constrained capital and tight operating budgets. I/O on Demand effectively eliminates much of the cost associated with installing conventional I/O.

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