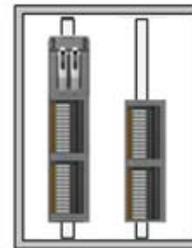
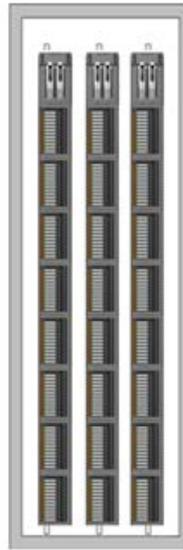


DeltaV™ Enclosures

This document describes the types of DeltaV™ Enclosures available from Emerson Process Management, since the version 11 release of DeltaV. The details of the Enclosures, as well as the benefits of using these Enclosures, are described in this paper.



Design-to-Order Enclosures

Configure-to-Order Enclosures

Table of Contents

Introduction..... 3

Current Project Challenges 3

 Timelines..... 3

 Cabinet Design and Installation..... 3

 Late Changes..... 4

DeltaV Enclosure Overview 5

 CTO CHARMs Cabinets..... 6

 CTO CHARMs Field Enclosures 7

Design-to-Order Enclosures..... 8

Assembly, Quality Assurance and Shipping..... 8

Benefits of DeltaV Enclosures..... 9

 It’s Easy!..... 9

 Project Timelines..... 10

 Additional Benefits..... 11

Summary 11

Literature Cited..... 12

Introduction

Reducing project cost and risk has become increasingly more important in all industries. In addition, facilities are not always being built in world areas with a labor force that has the needed skills to install technically advanced control systems. Emerson Process Management is focused on helping customers with these challenges by eliminating unnecessary work at the job site, reducing the complexity of tasks that must be done and embedding knowledge into new technologies.

Current Project Challenges

Timelines

Tight schedules for projects are all too familiar. Project timelines are short to keep costs down, while trying to eliminate the overall project risk.

Project events are generally sequential because one area is waiting on information from another area to get started. For example, the number and type of I/O must be known before the cabinet design can be started or control configuration can be started. Time can be wasted when each team is rushed through tasks, only to have to wait on another team to continue their work.

Cabinet Design and Installation

Having a 'custom' design for process automation system cabinets sounds great on the surface— the specifications are wide-open and customization goes as far as desired. However, when analyzing the true work involved in the customization there are certain drawbacks to custom cabinets, which in many cases can outweigh the benefits.

With any custom panel or junction box, upfront time and planning, along with panel configuration and design by engineers and designers is required. Of course, all of this costs time and money. The project schedule must include the time it takes to design control panels and field junction boxes, along with the Factory Acceptance Test (FAT) that usually is required.

Cabinet layout for a small application (<200 I/O), with no modifications to initial scope, can take upwards of two or three weeks. Then the project must include a couple of weeks for detail design, as well as time for project administration and management over this duration. Taking all of those things into consideration, cabinet design alone will take over a month, possibly up to six weeks. So if everything goes smoothly, cabinet design alone will take about 30% of the total time for custom cabinets to be delivered to site. Cabinet fabrication can take six to ten weeks, with the fabricator needing to order materials, put the panels together and then wiring the panel.

Once the cabinets are designed and built, project (and possibly plant) engineers have days to weeks of testing at the factory. After FAT, the cabinets are delivered to the plant site and field wiring is installed. Finally, the cabinets undergo Site Acceptance Testing (SAT). The following figure shows a timeline and relative time that is required for custom cabinets.

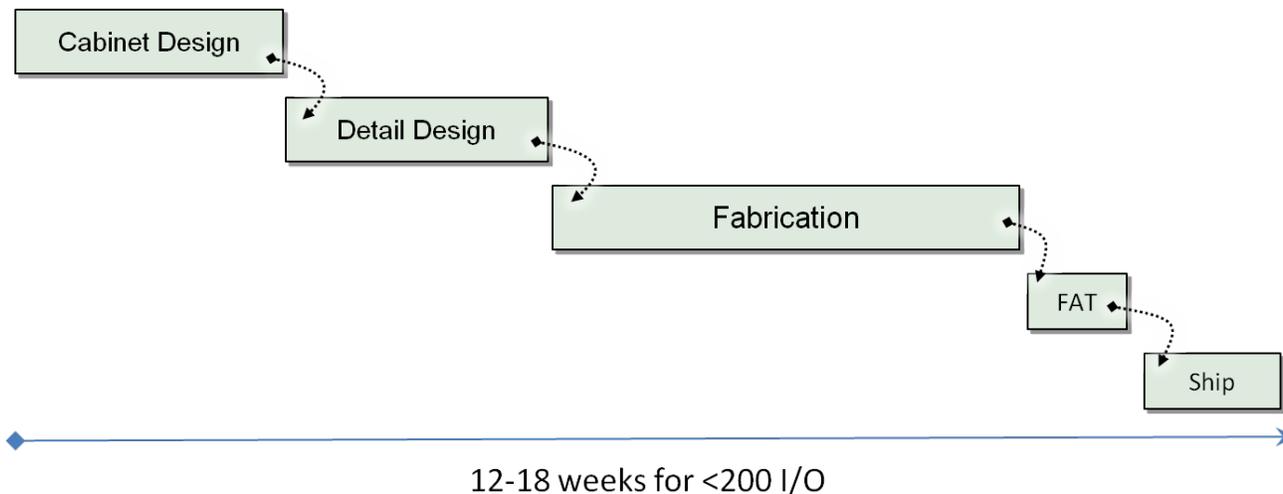


Figure 1 – General Timeline for Custom Cabinets

Additional time and cost is incurred with larger projects, as well as with traditionally wired I/O cabinets. Obviously, as the size of a project increases, there will be a significant increase in the amount of time needed for design, fabrication and testing of custom cabinets. Furthermore, there is extra design, fabrication, installation and checkout of marshalling cabinets with traditionally wired I/O cabinets, compared with Electronic Marshalling cabinets. Finally, schedule and costs can be affected by mistakes made during fabrication and wiring of custom cabinets. While many errors with wiring are generally found during FAT, fixing those errors takes time, which can push out the entire project timeline.

Late Changes

Using custom cabinets may also increase risk to the project timeline or work flow. Any late changes made to I/O will affect just about every aspect of the cabinets. While cabinets may not need to be re-fabricated, they may need to be modified extensively or even re-designed if the I/O change impacts their layout in anyway. Changes to I/O will certainly affect engineering drawings and very likely affect wiring. Controllers and power supplies may also need to be moved and/or added. All of these changes or additions are very expensive. Late changes can even happen after the cabinets are on site. In this case, several project teams have found it cheaper and faster to ship the cabinet back to the panel fabricator instead of modifying the cabinet in the field due to the local work force and lack of experience. In each case, the costs and schedules take big hits (weeks and months for large projects), which impacts the most important factor of all—start up.

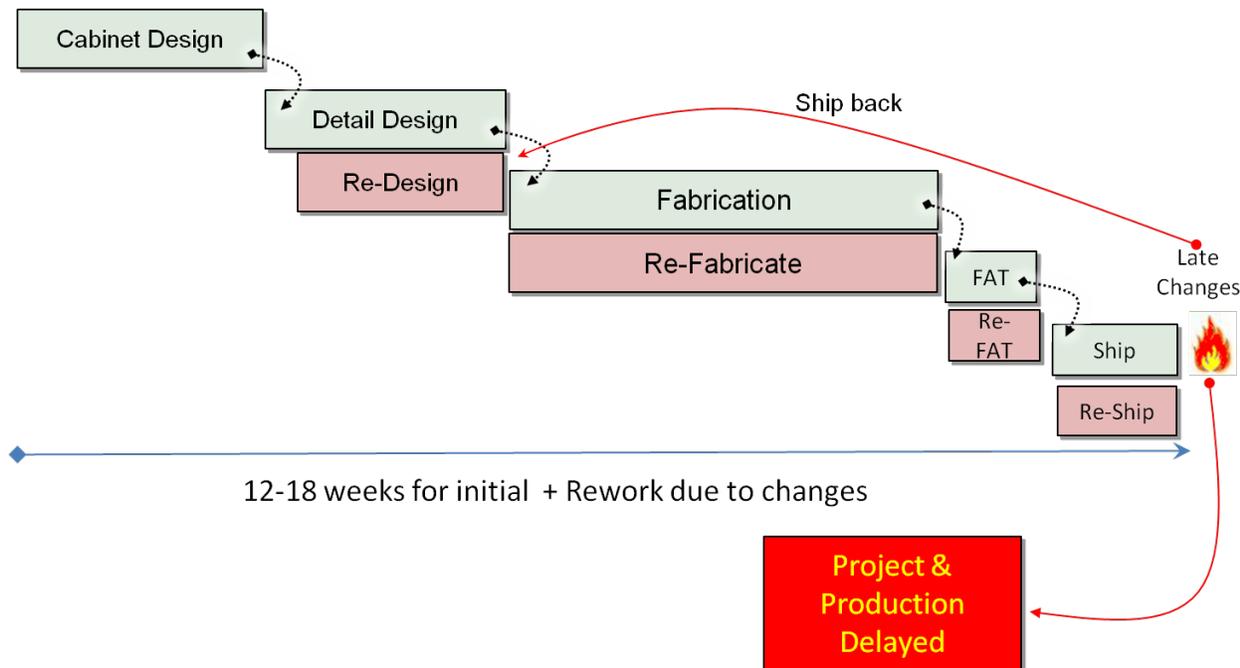


Figure 2 – Late Changes and Wiring Mistakes Are Costly

DeltaV Enclosure Overview

Starting with DeltaV v11, Emerson is providing Enclosure solutions to meet all customer needs, by providing varying levels of customization. Emerson is widely known for its best cost manufacturing capabilities (Porter 1998:36). With DeltaV Enclosures, users can take advantage of Emerson’s world renowned best cost manufacturing capability and supply chain organization. Also, since the many of the enclosures are based on a standard design, they are easily assembled; therefore, available on a much shorter lead-time compared to customized cabinets.

There are two types of DeltaV Enclosures, each serving a specific purpose.

- Configure-to-Order Enclosures
- Design-to-Order Enclosures

All DeltaV Enclosures are designed to seamlessly integrate into the overall DeltaV hardware solution for any project. Configure-to-Order (CTO) Enclosures are available for Electronic Marshalling equipment. They are easily ordered, with no engineering or design work needed. CTO Enclosures will typically house components such as CHARMs or Controller, power supplies and traditional I/O cards. They are configured to project needs, but require little engineering and design work. Design-to-Order Enclosures are fully customized to house any components or subsystems.

With the introduction of Electronic Marshalling capabilities, the need for additional space for cross wiring is eliminated. Using Electronic Marshalling provides initial reductions in project time, cost and risk. (Please see the [Electronic Marshalling Overview Whitepaper](#) for more details on Electronic Marshalling and its benefits.) CTO Enclosures, which are Factory tested, provide additional reductions to project time, cost and risk.

There are two main types of CTO Enclosures – CHARM cabinets for use in 'I/O rooms' and field-mounted CHARM Field Enclosures. Both types of CTO Enclosures maximize the use of space, while still following the installation recommendations of the Electronic Marshalling subsystem. The CTO Enclosures come with pre-mounted CHARM I/O equipment (CHARM I/O carriers, base plates, I/O bus termination, address plugs and terminals), wire ducts, grounding bars and name plates.

Industry best practices have been taken into consideration in the design. Furthermore, all CTO Enclosures are fully tested, which **eliminates the need for a FAT**. This is just like ordering a DeltaV controller, I/O card, or any type of standard part – no need to perform FATs.

CTO CHARMs Cabinets

The cabinet version of CTO Enclosures are stand-alone, to be floor mounted and designed to be installed in rooms with HVAC conditions appropriate for computer/electronic equipment. They come with three rows of DIN rails with the pre-mounted CHARM I/O equipment. These cabinets can accommodate either single pair, multi-core or armored cables from field devices, with 'basket type' wire ducts being used. Depending on the site installation practices, the multi-core cables can be routed in the wire duct or the overall shield can be stripped at the bottom of the cabinet. Likewise, with using armored cable, the armor is stripped at the bottom and fixed in the cable clamp rail.

Each CTO CHARM cabinet comes with full documentation showing internal lay-out, bill of materials and internal wiring, which will allow proper maintenance and changes throughout the system life time. Once ordered, this Electronic Marshalling Cabinet can be delivered directly on-site, ready to be connected to field I/O, receive 24 VDC power and communications cabling. CHARM I/O Cards (CIOCs) and CHARMs are ordered separately, because the number and type of I/O will vary. Those components can be delivered to the end-user site to be installed during commissioning stage.

CTO CHARM cabinets are available with front access only or front and rear access in the cabinet. Each of the three DIN rails can have up to 96 CHARM I/O channels. So, cabinets with front access only will hold up to 288 CHARM I/O channels, and cabinets with front and rear access will hold up to 576 CHARM I/O channels.

CTO CHARM cabinets can now also have 24VDC bulk power supplies. The sizing of the power supplies will depend on I/O types and quantity. But 24VDC bulk power supplies are typically assumed to be in a nearby cabinet (or dedicated power supply cabinet). In either way, the cabinets do include 24VDC power distribution for the CIOCs and for bussed field power. The power distribution consists of fully redundant power with two separate feeds of 24VDC for primary and secondary power.

Example – CTO CHARMs Cabinets

What would a cabinet look like if you had selected to use Electronic Marshalling to add 258 I/O, using CTO CHARM cabinet? You would have one CTO CHARM cabinet, with three rows. Two of the rows would be completely full ($96+96 = 192$ I/O channels), and one of the rows would have 66 channels used. There would be 30 Terminal blocks left open on the base plates, as spares for *any* type of I/O.

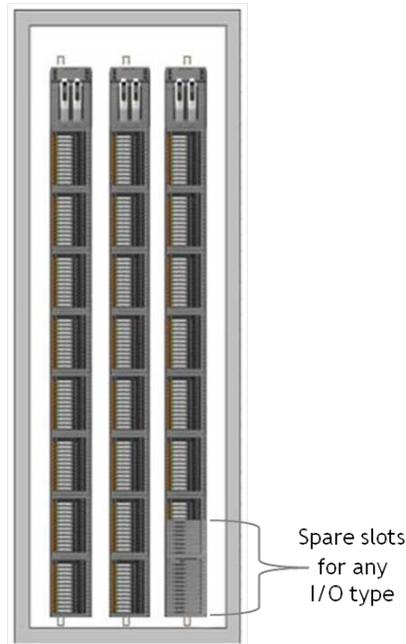


Figure 3 – Example CTO CHARM Cabinet for 258 I/O

With Electronic Marshalling, a decision doesn't have to be made during initial project design on how many spares of each type of I/O will be made available. Because of the late-binding enabled by Electronic Marshalling and the use of CHARMs, the spare capacity is extremely flexible – spares can be designated as any I/O type whenever they are needed.

For more details on this type of cabinet, please see the [CTO CHARMs Cabinets - Solution Data Sheet](#).

CTO CHARMs Field Enclosures

CTO CHARMs Field Enclosures provide users with another option for further reducing I/O footprint and project cost with Electronic Marshalling in the field. These field enclosures are great for users that are adding I/O to existing facilities without the need for adding cabinet space. These industry standard enclosures replace traditional field junction boxes, with wiring coming directly from field devices.

So there are additional project savings gained because materials and labor for "home run" wiring from a junction box to I/O cabinets is eliminated (replaced by one redundant Fiber Optic Ethernet connection). There is also significant savings when and I/O expansion is large enough in a project that these enclosures can save the project the cost of a Remote Instrumented Enclosure (RIE) building. Instead of putting the I/O in the RIE, the I/O can be moved to the field.

Each CTO CHARM Field Enclosure can have up to 48 or 96 CHARM I/O channels. Because Electronic Marshalling is being used, all of the CHARM I/O Cards can be used for any mix of I/O signals. Any changes to field devices are easily accommodated by simply changing the CHARM.

Environmental and Power

Because CTO CHARM Field Enclosures are installed outside, there are considerations and options for the environment and for power distribution. Field enclosures are designed to be installed in a shaded area with outside temperature limits of -40°C to +55°C.

CTO CHARM Field Enclosures can be ordered as either permitted for safe area or hazardous area. The hazardous area Field Enclosure is classified for European Zone 2 and USA/Canada Class1, Div2. Primary and secondary 24VDC power can be supplied from outside the field enclosure with this classification. If AC power needs to be used, optional redundant 5 or 10 Amp, 24VDC bulk power supplies are available.

For more details on the Field Enclosures, please see the [CTO CHARMS Field Enclosures - Solution Data Sheet](#).

CTO CHARM Field Enclosures provide fully functional enclosures in a standard, cost-effective way. The man-hours for cabinet design and engineering are eliminated, which saves money on the overall project as well as reduces the risk of the process automation system delaying the project schedule.

CTO CHARM Field Enclosures still maximize the use of the enclosure space, follow the installation recommendations for DeltaV, and use embedded knowledge and best practices for the enclosure design. However, there is a little more flexibility with what will go into each enclosure. There are a number of items to select from, which can be used to configure each enclosure.

One way to think of how this works is to think of building something with LEGOs®. You have a bucket of LEGOs – pieces of different colors and sizes that will be used for different things in your project. You may have a LEGO ‘foundation’ on which to build your project. Similarly, CTO CHARM Field Enclosures have a list of components (“LEGOs”) to choose from for use in your project.

Items that are available in the library of “LEGOs” include power supplies, network options, or CIOCs and CHARM Options. These components will be assembled in a designated position every time for each enclosure.

Design-to-Order Enclosures

The name really says it all – Emerson will work with project teams to design enclosures to meet the project specifications exactly. Cost of these enclosures will be higher than with CTO Enclosures because of engineering, design work and testing that will be necessary. However, projects will still have the benefit of Emerson’s best cost manufacturing and continuous improvement practices.

Assembly, Quality Assurance and Shipping

Emerson’s global, best cost supply chain and organization will be used to optimize the delivery and costs associated with fabricating enclosures. Using materials that are readily available in the world areas where the enclosures are assembled will reduce the lead time required on enclosure orders. There are benefits to having the enclosures assembled in the same places every time.

For CTO Enclosures, there will be repetitive manufacturing. Enclosures will not be reinvented every time there is an order. The same enclosures are assembled over and over at the same place, which increases the quality and reduces the time it takes to assemble. Just as with other DeltaV products, CTO Enclosures are ‘plug-and-play’. They are ready to be used upon arrival.

Once the cabinets are assembled and checked for quality, they are directly shipped from the world area assembly location to the designated location for the project. Certainly, with CTO Cabinets, this could be directly to the end-user facility. However, there may be reasons to send it to a project integration site first. The delivery site is chosen by the end-user.

All three of these steps – assembly, quality assurance and shipping – can be done with CTO Enclosures in much less time than custom cabinets, or cabinets with traditional wiring and cross marshalling. The amount of time and money that will be reduced by these enclosures will be significant in any project.

Benefits of DeltaV Enclosures

Using standardized DeltaV Enclosures will not eliminate all process automation system project challenges, but it can greatly reduce the complexity of the task. With this simplification come savings – savings in cost and savings in time. DeltaV Enclosures that are pre-design and repeatedly manufactured in the same, few locations also dramatically reduce project risk.

DeltaV Enclosures have been developed to perfectly match with the DeltaV product installation specifications, such as power supply, distribution and grounding. The overall solution is approved by Emerson as the best practice DeltaV solution.

It's Easy!

With DeltaV Enclosures, you can give us your I/O count, and we'll build your system with the correct number of controllers, CHARM I/O Cards, CHARMS and cabinets. This can happen fairly early in the project timeline, because the exact number and type of I/O does not need to be known. Let's look at an example project, with an estimated 1000 I/O points using Electronic Marshalling Enclosures. One CTO CHARM Field Enclosure holds either 48 I/O or 96 I/O points.

So, we can easily figure that at least 11 field enclosures are needed. However, to account for approximately 10% spare I/O points, we can figure that at least 12 Field Enclosures should be ordered. Need 20% spare? No problem – add at least one more field enclosure.

CTO CHARM Field Enclosure 'design' in less than a minute. Easy. Once the number of CTO Enclosures that are needed is known, they can be ordered. Six weeks later, they arrive, ready for field wiring.

~ 1000 I/O

1 field enclosure = 48 I/O

$1000/48 = 20.83$
= 21 field enclosures

+ 2 field enclosures for spare

Need: 23 Field Enclosures

~ 1000 I/O

1 field enclosure = 96 I/O

$1000/96 = 10.41$
= 11 field enclosures

+ 1 field enclosures for spare

Need: 12 Field Enclosures

Project Timelines

CTO Enclosures can significantly reduce the amount of project time required to get process automation enclosures ordered, delivered and tested. Having the cabinet design and installation time shortened can shorten the overall project timeline, which could generate revenue faster.

Cabinet Design and Installation

The amount of time that is saved with both design and installation is considerable. Once the CTO Enclosures are ordered, assembly and delivery will take six weeks. Since no FAT is needed, the enclosures can be shipped directly to the end-user’s facility, where installation and SAT will take place. Figure 4 shows the general timeline when ordering CTO Enclosures, compared with the timeline for custom cabinets shown in a shadow. By eliminating the time required to complete cabinet layout, detailed design and FAT, the CTO Enclosures become available and useful much sooner than custom cabinets.

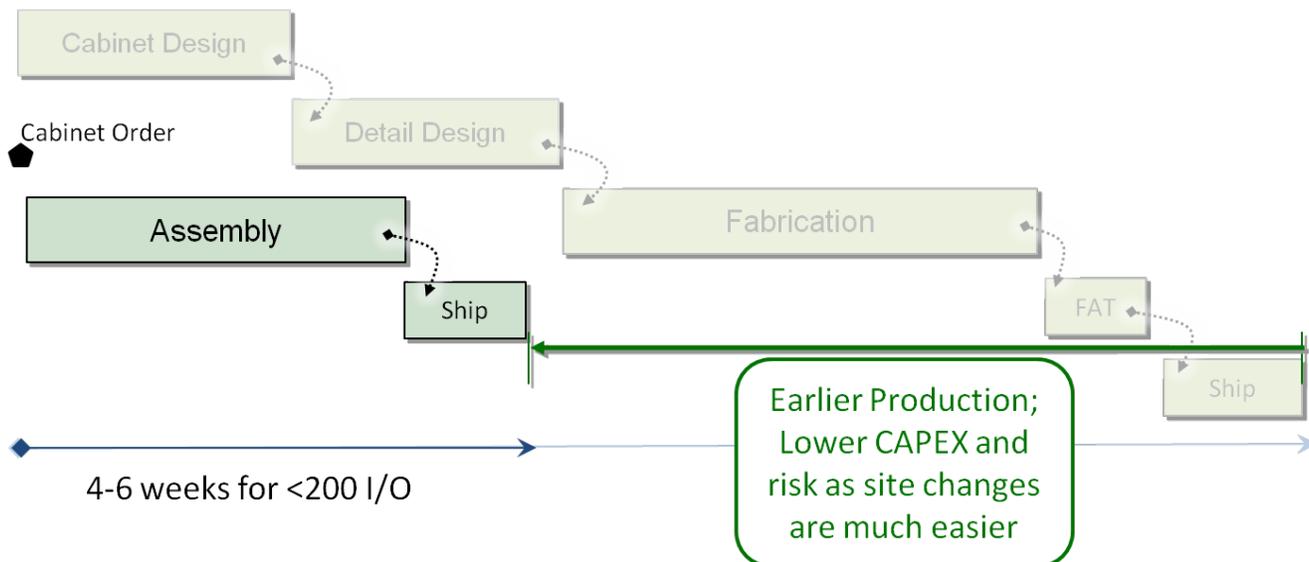


Figure 4 – General Timeline for CTO Enclosures vs. Custom Cabinets

Individual channel assignments do not need to be done until after the field wiring is complete. At that point, the CHARMs can be installed to make the assignments.

Late Changes

Unlike with traditional marshalling cabinets, late changes with Electronic Marshalling are easily accommodated with minimal re-engineering and no rewiring. I/O changes are easily accommodated by replacing one type of CHARM for another. I/O additions are easily accommodated because spare capacity can be assigned to any type of signal. Cabinets are not on the critical path, because changes with I/O will not alter work that is already completed.

Even if the late changes are dramatic such that a lot of I/O was missed or added to the project, these enclosures are readily available and can significantly reduce the change in schedule. Where changes to custom cabinets can take several months, DeltaV Enclosures will be much quicker, especially for CTO Enclosures. Now, if you are talking large scale projects, the time and money saved can be even more considerable with CTO Enclosures.

Additional Benefits

In addition to addressing challenges that come with using custom cabinets in a project, there are other benefits to using Electronic Marshalling and DeltaV Enclosures. For example, in times of rising costs, Emerson’s supply chain can help mitigate higher prices on enclosures and components.

Emerson’s global reach with best cost engineering centers provides a local enclosure, which are built and shipped quickly. This is done with Emerson best practices and procedures around the world. That reduces the number of potential errors, which, in turn, reduces risk. Furthermore, the DeltaV Enclosures will continuously be evaluated and enhanced based on feedback from Emerson project organizations, customer applications and DeltaV product updates.

If and when the time comes, expansions are easy with DeltaV I/O on Demand. Users can choose to continue to use Electronic Marshalling, or choose a digital bus or wireless device, if one of those options is suitable for the application. Whatever the choice, they will work with the existing DeltaV System and Enclosure offerings.

Summary

DeltaV Enclosures provide several options to meet project needs and budgets. The picture below gives an overview of the differences in required time, money and testing that must be done with each type of enclosure.

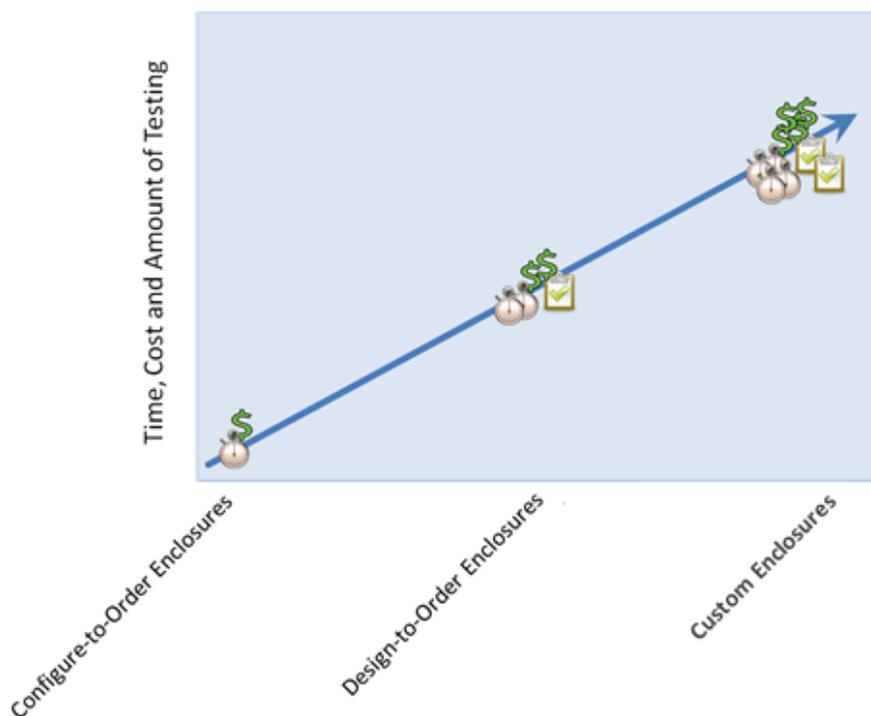


Figure 5 – Comparison of Investment in Time, Cost and Testing for Enclosures

Configure-to-Order (CTO) Enclosures provide low cost, low risk enclosures that are specifically designed to meet DeltaV Electronic Marshalling requirements. Much of the work involved with system cabinets is eliminated, because they are pre-designed. Design-to-Order Enclosures are still cost effective, because the enclosures are still based on a standard design. And with Custom Enclosures, the cost will vary because each enclosure will be fully made-to-order from the beginning to meet the exact specifications of the project. As seen in Figure 5, the amount of time needed, the cost and the amount of testing that must be completed increases as the enclosures become more customized.

Literature Cited

Porter, Michael E. 1998. Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York: Free Press. 397 p.

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