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# 20 Years Automation Experience



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# DeltaV™ Electronic Marshalling

- I/O anywhere you need it
- Single channel granularity
- Reduces installed cost of system
- Fully redundant architecture
- Field-mounted capable hardware
- Plug and play I/O



The DeltaV™ CHARM I/O Card (CIOC) with CHARMs.

## Introduction

DeltaV™ Electronic Marshalling delivers a new level of control system I/O performance with unprecedented flexibility and ease of use. The CHARM I/O card (CIOC) supports up to 96 individually configurable channels and is designed specifically for multi-core home run cables in centrally located marshalling cabinets. It can also be installed in field junction boxes to further reduce system design and installation costs. All communications are completely redundant from the channel (CHARM) to the DeltaV controller.

## Benefits

**I/O anywhere you need it:** DeltaV CIOC provides an unprecedented flexibility in control system I/O topology. Using standard Ethernet infrastructure hardware you can add I/O anywhere you need it. From a local I/O cabinet to remote enclosures miles away, simply install the hardware and connect it to the DeltaV control network. Each I/O card can serve I/O signals to any four controllers in the system with 50-ms updates for fast, reliable control.

**Single channel granularity:** The CHARM I/O architecture allows each individual channel to be characterized for the requirements of the field device. Any instrument signal can be wired to any terminal block. The channel is then electronically marshalled by installing the appropriate CHARM and assigning the channel to one of four controllers. Home run multi-core instrument cables can be landed in order on a series of CHARM terminal blocks without concern for signal types.

**Reduces installed cost of system:** DeltaV Electronic Marshalling helps reduce overall system costs by eliminating internal cabinet cross wiring, reducing overall footprint, simplifying I/O channel assignments, and reducing Factory Authorized Testing activities. Electronic Marshalling provides separation between I&E hardware installation schedules and control strategy development. Wiring can begin earlier knowing any late changes can be done without lifting a wire. Separation of the controller and I/O allows more efficient cabinet designs and accommodates late scope changes you can add I/O anywhere. Adding additional control capacity does not require re-wiring I/O. Simply assign the control modules and their I/O signals to the new controller, without lifting a wire.

**Fully redundant communications:** The CIOC architecture is fully redundant. It starts with the two I/O cards on a carrier. The carrier has redundant communication modules for primary and secondary network connections. There are two 24V DC input power connections. The carrier connects to the CHARMs baseplates and provides redundant power and communication buses to the CHARMs. Everything is redundant down to the individual channel.

**Field-mounted capable hardware:** All components of the CIOC are rated for installation in Class 1/Div 2 or Zone 2 hazardous locations. The extended operating temperature ranges and G3 environment rating allows them to be installed in field-mounted junction boxes. This further reduces the footprint required in central equipment rooms, as well as reduces the overall wiring infrastructure of traditional multi-core instrumentation cable.

**Plug and Play I/O:** The DeltaV CIOC has been designed for ease of use, both in physical installation and its software tools. Components snap together with secure DIN-rail latches and interlocking carrier connectors. Attach a series of 96 I/O channels to a DIN-rail in a matter of minutes. Insert the CHARMs and auto sense the node to create the I/O definition automatically in your DeltaV configuration database. CHARMs use a self keying system to automatically set a channel for a specific CHARM type. Users cannot mistakenly insert a CHARM into the wrong terminal block. Assign all, one or any number of channels to a controller with a simple click or drag and drop.



CHARM and Terminal Block.

Field power is provided through a redundant 24V DC bus to each CHARM, with up to 100 mA per CHARM. Higher current Channels can be powered through integrated power injection bus local to each CHARM Baseplate.

## Product Description

Electronic Marshalling hardware includes:

- CHARM I/O Carrier (DIN rail-mounted and supports redundant pair of CHARM I/O Cards, redundant 24 V DC power connectivity, and redundant Ethernet communication modules).
- CHARM I/O Card (CIOC) provides communication between CHARMs and the Ethernet I/O network to M-series, S-series, and PK Controllers. The CIOC has Achilles Communications Certification Level 1 and the redesigned CIOC2 has more computing power and Achilles Communications Certification Level 2. The CIOC2 is a drop-in replacement for the CIOC (v13.3.1 or later is required).
- CHARM Base plate (DIN rail-mounted with interleaving power and bus connectors. Supports 12 CHARMs and their terminal blocks, as well as connection for injected field power).
- CHARM Terminal Block (removable terminal block providing terminal connections to field wiring and physical latch for CHARM).
- CHARMs (Characterization Module for each field signal. Provides basic analog to digital conversion and signal isolation to the redundant communication bus).
- Cable Extenders that provide flexibility in carrier mounting.
- I/O bus termination (provides bus terminations for redundant I/O bus).
- Labeling features for baseplate and channel identification.



*CHARM I/O Card (CIOC) with CHARMs.*

The CIOC carrier is mounted to the top of a vertical DIN rail and up to eight CHARM Baseplates are mounted below it, snapping easily to the DIN rail as they are connected to each other. The bus termination assembly is attached at the bottom. A standard DIN-rail lock is used to keep the entire assembly in place.

A pair of CIOCs installs on the carrier and communicates over a redundant Ethernet network with up to four controllers, allowing great flexibility and ease of system expansion. Communication modules are available for copper and fiberoptic media.

Each baseplate is ordered with 12 terminal blocks: standard terminal blocks, fused injected power terminal blocks, or relay output terminal blocks.

Electronic Marshalling eliminates the need to partition the I/O wiring to specific channels based on signal type. Simply connect field signal multi-cores in an orderly fashion as desired. Install the appropriate CHARM to complete the field circuit and the signal is ready to be used by any one of four controllers. No cross-wiring required.

Each CHARM acts as a circuit protection device and field wiring disconnect. Signals are inherently current-limited to protect against wiring faults to ground. Each CHARM provides surge protection to meet industry standards in the area of EMC. Under extreme overvoltage conditions due to incorrect field wiring, the CHARM will act as a fuse to protect adjacent channels. Signal faults are thus isolated to the single CHARM.

CHARMs can be partially ejected to a locked position that disconnects the field wiring from the system to perform field maintenance actions or to remove power to a field device. Activating the CHARM latch ejects the CHARM to the detent position. Closing the latch locks the CHARM in place and isolates the field wiring for field work.



*CHARM Latch Mechanism.*

Baseplate extenders and cables provide great flexibility to the CHARM installation in existing cabinets or in custom enclosures. Cables are redundant, each carrying 24V DC field power, 6.3V DC CHARM power, and one of the communication busses.

Bus termination provides added robustness for the communication bus and is installed at the end of the physical bus.

Label features are available to identify channel usage and Baseplate identification to help with maintenance.

CHARMs can be added to any existing baseplate position and autosensed online. Additional CIOCs can be added online.

## CHARM Types

A variety of analog and discrete CHARMs are available to meet your specific requirements. The following CHARMs are available starting with v11.3.1:

- AI 4-20 mA HART
- RTD
- Thermocouple / mV
- AI 0-10V DC Isolated
- AO 4-20 mA HART
- DI NAMUR
- DI 24V DC low-side sense (dry contact)
- DI 24V DC Isolated
- DO 24V DC High Side
- DO 100mA Energy Limited
- DO 24V DC Isolated
- 24V DC Power
- DI 120V AC Isolated
- DI 120V AC Isolated Plus
- DI 230V AC Isolated
- DO V AC Isolated

All CHARMs have a bi-color power/integrity LED that indicates the health of the CHARM. The indications provide clear, actionable instruction to the maintenance personnel.

- Green Solid: Normal Operation
- Green Blink: Normal awaiting configuration
- Red Blink: Fault detected on wiring
- Red Solid: Internal Fault detected

Discrete CHARMs have a yellow LED to indicate the state of the field signal. (On = circuit is energized)

All CHARMs meet ISA 71.04-1985 severity level G3 (harsh) corrosion specifications.

24V DC based discrete input CHARMs support pulse counters with a maximum frequency of 10 KHz.

## I/O Terminal Block Options

- There are six different I/O terminal blocks available to meet the wiring needs of field signals
- Standard Terminal Block
- Fused-Injected-Power Terminal Block
- 3-wire DI Fused Injected-Power Terminal Block
- Relay Output Terminal Block
- Thermocouple / mV Terminal Block
- 3-wire AI Fused Injected Power Terminal Block

**The Standard Terminal block** can be used with all CHARM types. For traditional wiring of field instrumentation, the CHARMs provide loop power through the internally distributed 24V DC field power. Refer to specific CHARM specifications for wiring information.

**The Fused-Injected-Power Terminal block**, the **3-wire DI Fused-Injected-Power Terminal block**, and the **3-wire AI Fused Injected Terminal block** includes a 2A field replaceable fuse. The **3-wire DI Fused-Injected-Power Terminal block** is designed to be used with all isolated discrete Input CHARM types, while the **Fused Injected Power Terminal block** is designed to work with all Isolated discrete Output CHARM types, the **3-wire AI Fused Injected Power Terminal block** is used with AI 4-20mA HART CHARM type creating a system-powered circuit that can deliver up to 1 amp (DC) to the field.

Each baseplate has a local power bus that can be connected to 24V DC or 120/230V AC through the injected power input terminals, located on the Address Plug terminal block. Both, the fused-injected power Terminal Block, the 3-wire DI fused- injected power Terminal Block, and the 3-wire AI Fused Injected Terminal block connect to this power bus to provide system power to the field circuit through the isolated CHARM. You can combine isolated and system powered circuits on the same baseplate, however, all system powered channels on a baseplate share the same power source.

**The Relay Output Terminal Block** is designed for high output current applications and requires the DO 24V DC High-side CHARM to drive the relay coil. The Relay Output Term blocks provide a normally open and normally closed contact with the following ratings:

- 28.8V DC at 5 A switching current
- 48V DC at 0.4 A switching current
- 110V DC at 0.2 A switching current
- 250V AC at 5 A switching current

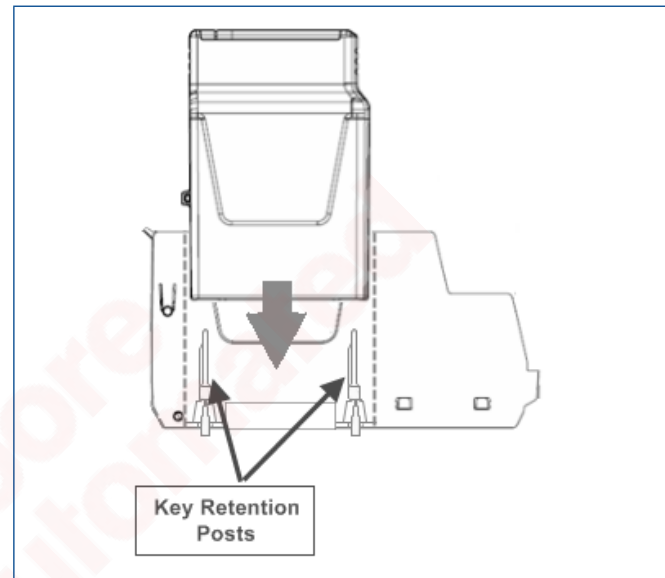
**The Thermocouple / mV Terminal Block** is specially designed for the usage with the Thermocouple / mV CHARM. The Thermocouple / mV Terminal Block has fixed key positions to prevent a mismatch in the field and can only be ordered as an Assembly with the Thermocouple / mV CHARM.

**The 3-wire AI Fused Injected Power Terminal Block** is designed for 3 wire analog transmitters and can be used with the AI 4-20mA HART CHARM. The field power is supplied from the injected power bus on the baseplate, but the power is not removed from the field device when the AI CHARM is removed from the baseplate. There is a Green LED on the terminal block that indicated power is supplied to the field and the 2A fuse also functions as a means to disconnect power from the field device. Although this terminal block was introduced in 2017, it is backwards compatible to any version of DeltaV with Electronic Marshalling.

Although any signal type can be installed in any location on the CHARM baseplates, it is recommended that AC voltage circuits be separated from low voltage signals to comply with safety recommendations and to mitigate induced noise in the signals. Standard Terminal blocks, Fused Injected Power terminal blocks and Relay Output Blocks can be used on the same carrier, typically, to allow the use of DO 24V DC isolated CHARMS on higher wattage and 3-wire devices alongside of standard 24V DC instrumentation signals or relay contacts.

## CHARM Keying Posts

The Terminal Blocks contain keying posts that are automatically set and locked to the unique position of the installed CHARM. The keys prevent the insertion of an incorrect CHARM during maintenance activities. They are shipped in a neutral position and are set when a CHARM is inserted. If needed, the keys can be manually reset to allow a channel to be re-tasks for a different signal type.



*CHARM Standard Terminal block.*

The keying mechanism consists of two keying posts that rotate and lock into the terminal block base. Each CHARM type is assigned a unique key setting.



## ASCO Numatics 580 CHARM Node

The 580 CHARM node enables Easy solenoid valve integration into DeltaV with Electronic Marshalling. The new 580 CHARM node connects directly to the CIOC via redundant CHARM Baseplate extender cables. DeltaV can autosense the I/O as DO Solenoid Valve CHARMS the same way as any other CHARM is autosensed in DeltaV.

Benefits of the new 580 CHARM Node include:

- Redundant communications and power connections to pneumatic valve manifolds.
- Eliminates the need for additional dedicated networks like Profibus-DP and simplifies system I/O mapping.
- Expands the Electronic Marshalling I/O offering to include ASCO Numatics pilot valve manifolds, enhancing the concept of: "I/O Anywhere".
- Reduces programming and commissioning time dramatically.



*ASCO Numatics 580 CHARM Node.*



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