Ethernet I/O Card (EIOC)

- Powerful solution that communicates directly to external Ethernet Device Networks
- Easy connection to devices using Modbus TCP, EtherNet/IP, IEC61850 MMS, OPC UA client or EtherNet/IP Control Tag Integration protocols
- Proven S-series packaging
- Modular with easy to add redundancy
- Communication to any M- and S-series Controller

The Ethernet I/O Card provides direct connection to Ethernet Device Networks.

Introduction

The Ethernet I/O Card (EIOC) provides a platform for accessing data from Ethernet devices in the DeltaV™ system. Ethernet Devices capable of talking Modbus TCP, EtherNet/IP, IEC 61850 MMS (Manufacturing Message Specification), OPC UA client and EtherNet/IP Control Tag Integration protocols are supported.

The EIOC provides monitoring and control of Ethernet Devices on the Ethernet Device Network via control modules assigned to and executed in the EIOC. Ethernet Devices like PLCs, Motor Control Centers, drives, switchgear and others can be controlled directly by the EIOC, independent of a controller.

Benefits

- **Ability to Communicate Directly to Ethernet Device Networks.** Use the EIOC to monitor and control Ethernet Devices.
- **Powerful and Scalable.** The EIOC allows a huge amount of data coming from Ethernet Devices to be accessed in DeltaV. It is scalable to fit your needs with licensing based on the number of connected devices. The EIOC supports:
  - Up to 32,000 signals from 256 Ethernet Devices when using Modbus TCP, EtherNet/IP, or IEC61850 MMS.
  - Up to 30,000 signals from 64 Ethernet Devices when using OPC UA client protocol.
  - Up to 2,000 tags (10 signals per tag) from 256 Ethernet Devices when using EtherNet/IP Control Tag Integration Protocol.

- **Monitoring.** Data values integrated into the EIOC can be used in Control Modules running inside the EIOC. These control modules enable alarm generation, history collection, and visualization by the operator, just like control modules running in a Controller using traditional DeltaV native I/O.
- **Supports Control Functionality.** Function blocks for discrete control and limited PID control are supported for the EIOC. No assignment to a controller is required. Motors, switchgear, variable frequency drives, or any device that communicates via Ethernet protocols can be controlled directly from the EIOC.
- **Easy to Connect to Ethernet Devices.** The EIOC supports Modbus TCP, EtherNet/IP, IEC61850 MMS, OPC UA Client and EtherNet/ IP Control Tag Integration Protocols. Use the EIOC Ethernet protocols to connect your DeltaV system to your Ethernet Device Networks.
- **Huge Processing Capacity.** Each EIOC is capable of handling a huge amount of data across up to 2,000 Control Modules.
- **EIOC is part of the DeltaV Control Network.** Up to 60 EIOCs can be added directly to the DeltaV Control Network, providing maximum freedom in segregating your networks.
- **Flexible Networking.** User configurable IP addressing for the Ethernet Device Network allows the EIOC to be deployed in almost any plant environment regardless of the networking scheme. When designing a simplex Ethernet Device Network, consider that the EIOC and the Ethernet Devices must be on the same IP subnet to communicate. Also, when designing a redundant Ethernet Device Network without PRP, consider that the primary and secondary ports in the EIOC must be in different subnets to follow best engineering practices.
- **Easy to Use.** The EIOC is easy to use as it provides a native way to bring Ethernet protocol data into the DeltaV system. Specific ease of use features include:
  - Five different Ethernet Protocols supported in the EIOC. Only one protocol is supported at a time and requires the proper licensing.
  - Updates for the EIOC and drivers are included within DeltaV.
  - Configuration in DeltaV Explorer. All needed configuration for the Ethernet Devices is done in DeltaV Explorer and DeltaV Control Studio, just like Traditional I/O signals. The data can be configured in DeltaV Control Modules, displayed on DeltaV Live and DeltaV Operate graphics, and stored in the DeltaV Continuous Historian.
- **Modular and Easy to add Redundancy.** The dual horizontal carrier hosts all the components needed for a redundant setup (redundant Power input Terminals and redundant Ethernet Isolation ports). Redundancy is achieved just by adding a second EIOC on the dual horizontal carrier. The configuration will change automatically, confirming that the two EIOCs are now working as a redundant pair. Manual switchovers can be controlled in DeltaV Diagnostics. The redundant Ethernet ports provide isolation between DeltaV Control Network communication and the redundant Ethernet Device Network. The EIOC also supports Parallel Redundant Protocol (PRP) for an added layer of robustness, providing a seamless switchover between primary and secondary networks.

Product Description

The EIOC is a big pipe for the integration of process data from 3rd party Ethernet Devices, including PLCs and smart field devices such as Intelligent Field Devices (IFDs) and Intelligent Electronic Devices (IEDs). A network of these Ethernet Devices can be directly connected to the EIOC. Communication between the Ethernet devices and the EIOC is supported through five protocols: Modbus TCP, EtherNet/IP, IEC61850 MMS, OPC UA client and EtherNet/IP Control Tag Integration. The EIOC connects directly into the DeltaV Control Network and can be placed remotely in an enclosure in the field.

The EIOC is an independent embedded data server. This means that there is no need for a separate controller to process the data being integrated into the EIOC. Control Modules needed to process the data from the Ethernet Devices are assigned and executed in the EIOC, enabling fast and direct communication with these devices. Any parameters from the modules running in the EIOC can be read by M-series, S-series, and PK Controllers using External References when needed in control strategies at the controller level.

When configuring Control Modules in the EIOC, all typical Function blocks needed for continuous operation are available. However, the usage of the following Function blocks is limited in the EIOC:

- 256 DCs, EDCs and DCCs – used for such applications as motor control in MCCs.
- 26 PIDs – analog control where all or most of the signals are coming from Ethernet Devices.
- 16 SEQs – Sequence function block used for sequencing motor control states.
- 16 STDs – State Transition Diagram used in sequencing and can be used with the SEQ function blocks.
- Batch control, SFCs, PLMs, and Equipment Modules are not supported in the EIOC.

To maintain the capacity of the EIOC, control modules should be kept as lean as possible. Heavy configuration in the modules will reduce the EIOC's capacity of 2,000 modules.

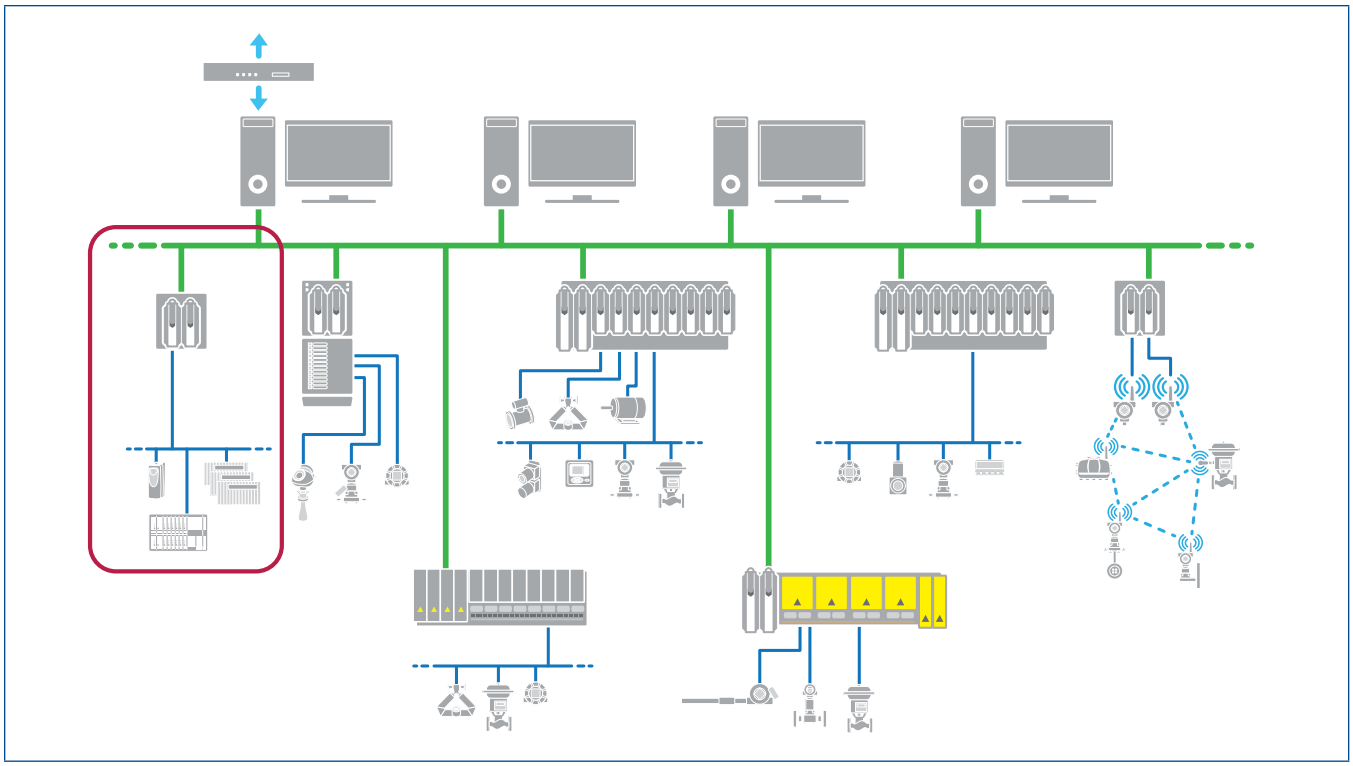
Below is a categorized list of all function blocks available for use within the EIOC:

- **Advanced Control –** None
- **Advanced Functions –** State Transition, Step Sequencer
- **Analog Control –** Analog Tracking, Calc/Logic, Filter, Input Selector, Scaler, Signal Characterizer, Signal Generator, Signal Selector, Bias/Gain, Manual Loader, PID, Rate Limit, Ramp, Enhanced Ramp, Splitter, Limit
- **Energy Metering –** None
- **IO –** Alarm Detection, AI, AO, DI, DO
- **Tag I/O –** DI, DO, AI, AO
- **Logical –** All
- **Math –** All
- **Special Items –** All
- **Timer Counter –** All

Simplex EIOC (Protection cover installed in the redundant EIOC slot in the dual horizontal carrier).

Access to DeltaV Live graphics, DeltaV Operate graphics, as well as alarms and history collection from EIOC control modules follows the same rules and mechanisms as control modules running in the controllers in a DeltaV System.

The EIOC mounts on the dual horizontal carrier, which includes redundant Power input Terminals as well as redundant Ethernet Isolation ports. The Ethernet Isolation ports isolate the redundant DeltaV Control Network communication from the redundant Ethernet Device Networks. An Industrial Network Firewall is recommended to provide added security based on deep packet inspection to restrict communications at the Ethernet device and Ethernet protocol level. In this way, Robustness and Security is ensured.



The DeltaV™ system with a redundant Ethernet I/O Card and simplex connection to the Ethernet Device Network.

Supported Industrial Ethernet Protocols

Modbus TCP Interface

The Modbus TCP interface supports Modbus data sources such as PLCs, MCCs, analyzers and similar devices communicating Modbus TCP. The Modbus TCP interface is a Modbus Client reading from and writing to Modbus Server devices. The Modbus server devices can be Modbus TCP devices or Modbus serial devices using a Modbus TCP gateway.

The Modbus TCP interface supports the following types of data access:

- Reading input data from Modbus Coils, Discrete Input, Holding Registers, and Input Registers.
- Writing output data to Coils and Holding registers.

All reads will be performed periodically and outputs will be sent when they are written.

EtherNet/IP

The EtherNet/IP protocol enables direct integration of data sources such as PLCs, Intelligent Field Devices (IFDs), variable-speed drives, MCCs, and analyzers, and other EtherNet/IP compatible devices into DeltaV via the EIOC.

The EtherNet/IP interface supports both implicit and explicit messaging, allowing access to both Class 1 and Class 3 EtherNet/IP I/O adapters. Redundancy with EtherNet/IP Class 1 Implicit and Class 3 Explicit messaging for control (sending outputs to the devices) requires special considerations due to exclusive owner communications defined by the protocol. Please refer to the DeltaV System Planning Guide for more information. Class 3 PCCC and UCMM with Logix tags message classes are also supported.

IEC 61850 (MMS)

The IEC 61850 MMS interface enables data from Intelligent Electronic Devices (IEDs) such as motor protection relays, motor starters, motor control centers, switchgear, and similar MMS-based devices to be integrated into DeltaV. The MMS interface will be a client reading and writing data from/to the Intelligent Electronic Device which acts as the server.

The EIOC only supports reading and writing of real time signals using this protocol. Reading historical data or Goose applications are not supported.

OPC UA Client

The OPC UA Client in the EIOC provides native client implementation of a Data Access profile (real time data) compliant with OPC UA version 1.02. The OPC UA client will read and write up to 30,000 real time signals coming from up to 64 OPC UA servers.

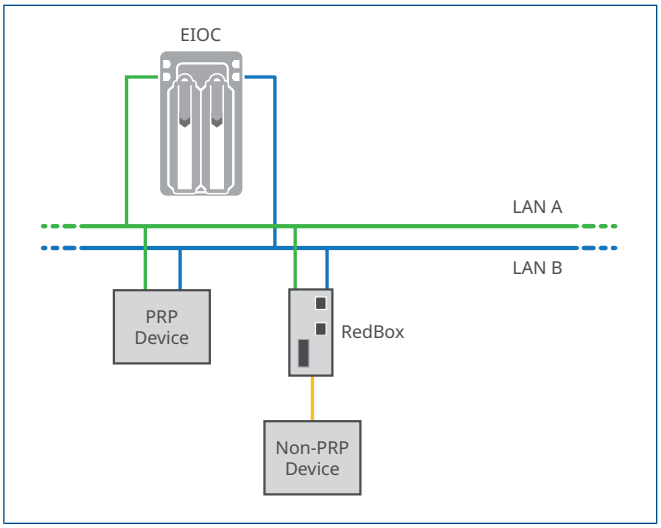
EtherNet/IP Control Tag Integration Protocol

The EtherNet/IP Control Tag Integration protocol uses EtherNet/IP Class 3 messaging to provide integration with tag-based PLC data sources. Referencing data by tag name eliminates the need for register mapping. Read or write up to 10 signals per tag, and up to 2,000 tags per EIOC for a total of 20,000 signals. The EtherNet/IP Control Tag Integration protocol supports reading string type signals and read/write of arrays up to 64 elements each (max 100 arrays per EIOC).

The EtherNet/IP Control Tag Integration protocol supports integration with ControlLogix and CompactLogix PLCs utilizing tags.

Parallel Redundant Protocol (PRP)

PRP is a network protocol standard for Ethernet that provides seamless failover against failure of any network component. Therefore, it is a great solution when high availability and short switchover time is required (e.g. electrical monitoring using IEC 61850 MMS). PRP allows for simultaneous communication through both Primary and Secondary ports of the Ethernet Device Network in the EIOC. This means that a device connected to the Ethernet Device Network is getting the same information at the same time through different network paths. In case one of the networks fails, PRP provides zero-time to recovery and eliminates any single point of failure in a redundant Ethernet Device Network.



EIOC with Parallel Redundant Protocol (PRP) enabled in a redundant Ethernet Device Network, talking directly with native PRP devices and using a RedBox to talk to Non-native PRP devices.

PRP is independent of the application-protocol and can be used by most Industrial Ethernet protocols. In the EIOC, PRP is an optional feature that can be enabled at the port level and is available for all the protocols supported in the EIOC. When enabled, PRP runs on top of the protocol that is selected at that time.

For PRP to work properly, the Ethernet Devices connected to the redundant network must also support PRP natively. If a device does not support PRP natively, then a RedBox must be used to connect it to the PRP network without having bad status in diagnostics.

EIOC Configuration

The EIOC is configured in the I/O network level within DeltaV Explorer and does not count towards the controller node count limit (up to 60 EIOCs per system). The hierarchy of the EIOC in DeltaV Explorer consist of:

- **EIOC**
  - **Assigned Modules –** Control Modules configured and running inside the EIOC.
  - **Hardware Alarms –** Hardware alarms associated with the EIOC.
  - **P01 –** The EIOC port where the Ethernet Device Network and protocol are setup.
  - **PDT –** Ethernet Devices are added and configured under the EIOC port, P01, as Physical Devices (PDTs). The number of PDTs that can be configured depends on the selected protocol and the number of device licenses assigned. PDTs can be renamed.
  - **LDT –** Logical Devices (LDTs) are added under PDTs to configure signals or control tags, depending on the protocol selected at the port level. DST licenses are applied at this level.

EIOC Licensing

Licensing for the EIOC is easy and scalable. Just buy the hardware assembly for the EIOC, simplex or redundant. No additional license is required for redundancy. Then decide which protocol you need (one per EIOC is permitted), and pick the appropriate license. Next, determine the number of Ethernet Devices you need to connect, and pick the license that covers the required number. Once the EIOC is configured, one DST license will be consumed per LDT, with the license type being determined based on the highest value configured in the LDT (except for the EtherNet/IP Control Tag Integration Protocol). For the EtherNet/IP Control Tag Integration protocol, one DST license is consumed per Control Tag. The DST license is consumed based on the type of Control Tag that is configured.

PRP does not require a license, as it is included as part of the EIOC functionality.

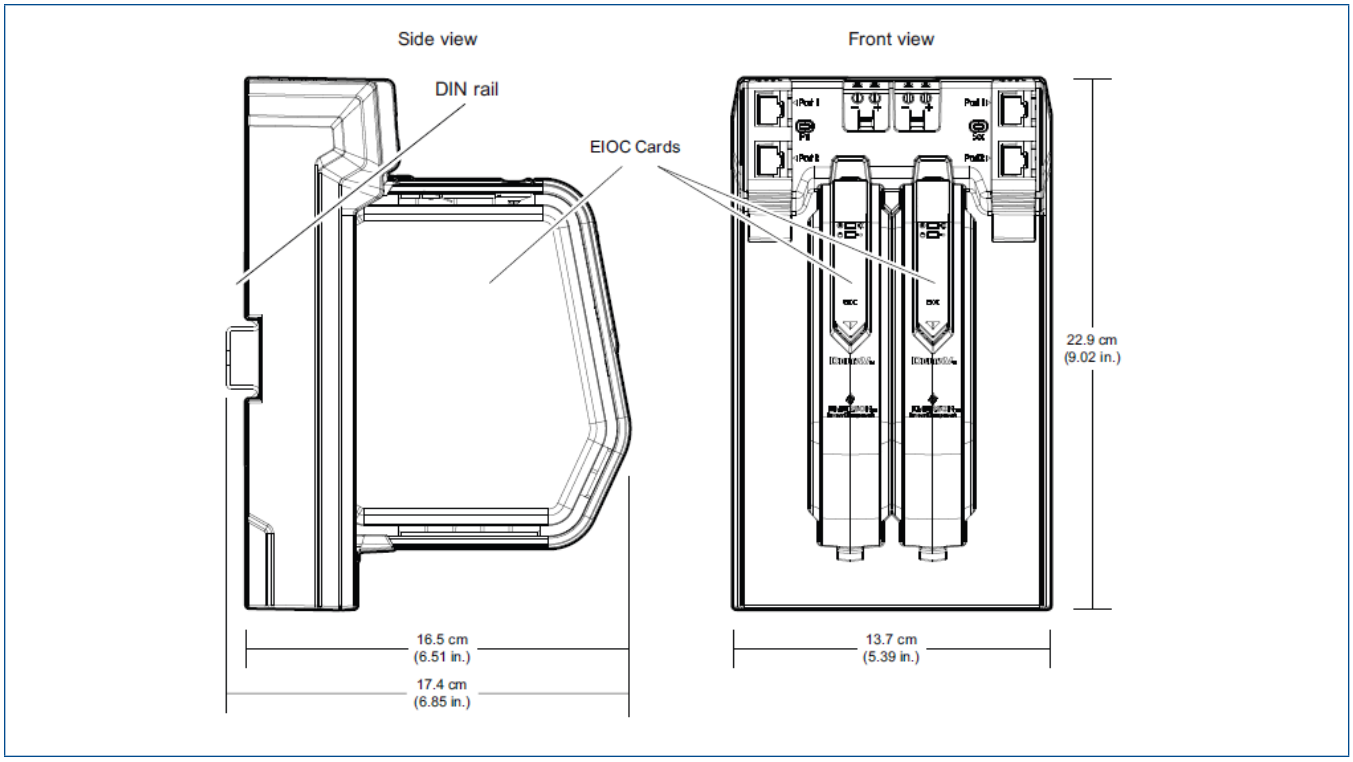
Summary

The EIOC supports communications with Ethernet Devices using Modbus TCP, EtherNet/IP, IEC61850 MMS, OPC UA client and Ethernet/IP Control Tag Integration protocols. The EIOC supports a huge capacity of data for monitoring or control. Its capacity, polling rate, and switchover times vary based on the selected protocol, device type, and system load. Refer to the DeltaV System Planning Guide for more information.

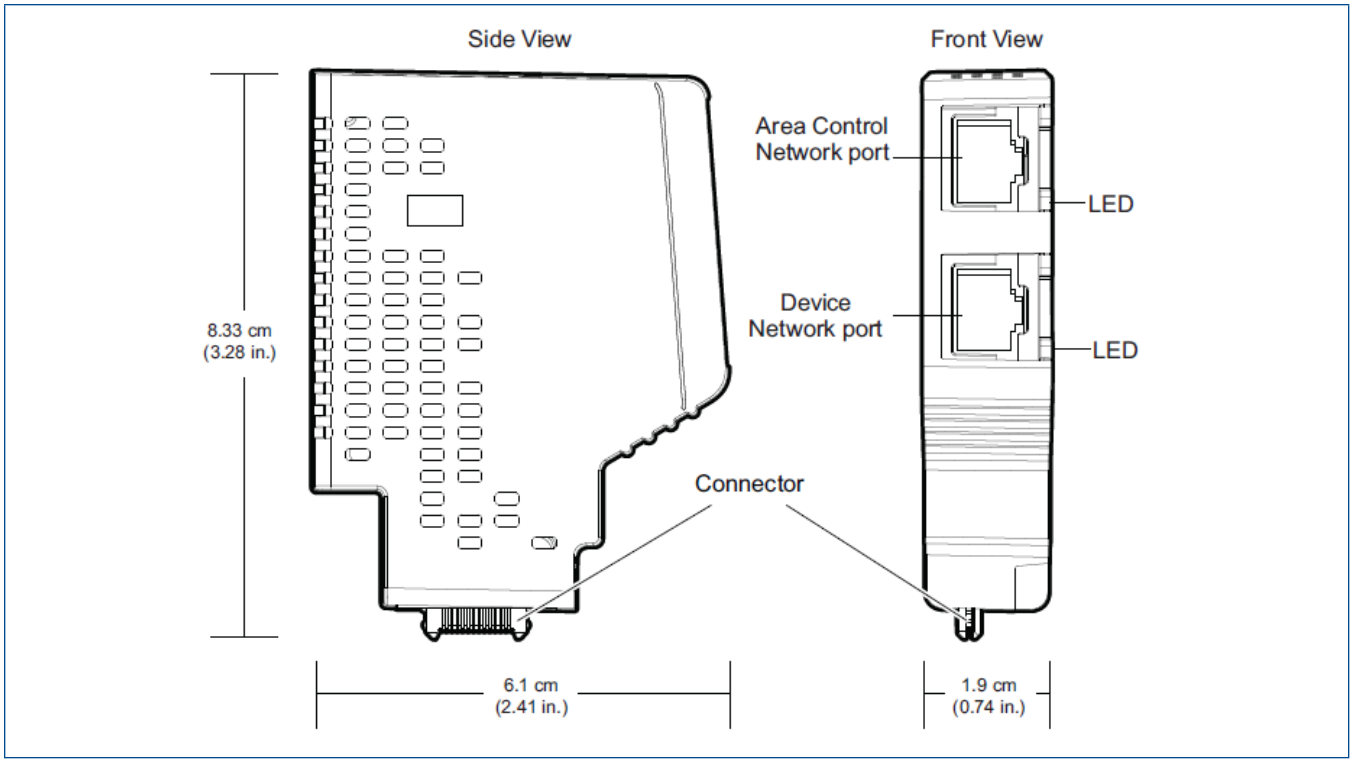
The EIOC is ideal for large-scale integration projects with limited control needs. For applications that require batch or sequence control (EIOC does not support class-based units, PLMs, SFCs, and Equipment Modules), or more complex control functionality, such as traditional I/O, bus I/O, or Electronic Marshalling, a PK Controller or a VIM2 card combined with a DeltaV controller may be a more suitable solution. Please consult your local Emerson office for more details.

Protocol Specifications of the EIOC	
Modbus TCP	■ Modbus TCP protocol as specified by **www.modbus.org** ■ For non-extended address ranges, register addresses fall within the following ranges: ● Coils: 1 – 9999 ● Discrete Inputs: 10001 – 19999 ● Input Registers: 30001 – 39999 ● Holding Registers: 40001 – 49999 ■ In v15.FP2 or later, the Full Modbus Addressing range can be enabled, in which case register addresses will fall within the following ranges: ● Coils: 1 – 65536 ● Discrete Inputs: 100001 – 165536 ● Input Registers: 300001 – 365536 ● Holding Registers: 400001 – 465536 ■ Uses MODICON (PLC) based addressing (Modbus absolute addressing is not supported) ■ EIOC is always the Modbus Client that reads and writes data from and to Modbus Server devices **Please review the VIM2 product data sheet as an alternative to provide added Modbus TCP functionality*
EtherNet/IP Interface	■ EtherNet/IP interface in the EIOC is a Scanner Device that reads and writes data from EtherNet/IP Adapter devices ■ Ethernet/IP interface supports the following types of messaging connections: ● Implicit messages (Class 1) ● Explicit messages (Class 3) ● Class 3 with PCCC ● UCMM with Logix Tags ■ Configuration of this messages connections is only supported via manual configuration on the DeltaV™ Explorer at the LDT level or bulk edit configuration. EDS files are not supported **Please review the VIM2 product data sheet as an alternative to provide added EtherNet/IP functionality (e.g. EDS file support)*
EtherNet/IP Control Tag Integration	■ EtherNet/IP Control Tag integration is based on EtherNet/IP Class 3 messaging to provide integration with tag-based PLC data sources ■ EIOC is a Scanner Device that reads and writes data from PLCs configured as adapters ■ Supports integration with ControlLogix and CompactLogix PLCs utilizing tags based on add on instructions and structures ■ Support browsing of add on instructions via the Rockwell Logix 5000 L5X file ■ Only supports read/write of ControlLogix controller scoped tags, and not program tags ■ Implicit Class1, Explicit Class 3, Class 3 with PCC and UCMM messages are not supported in combination with this protocol

Protocol Specifications of the EIOC	
OPC UA Client	■ EIOC is a Client that reads and writes data from OPC UA servers ■ Supports only the DA profile (real time data) ■ Is based on OPC UA standard version 1.02 that supports the following: ● OPC Binary Transportation ● 128 or 256-bit encryption levels ● Message Signing ● Digital Certificates – Self Signed and Certificate Authority (CA) ● Support browsing of configuration online and offline via a NodeSet file **Please review the DeltaV OPC UA product data sheet for more information regarding other OPC UA clients and servers available in DeltaV*
IEC 61850 MMS	■ IEC 61850 Manufacturing Message Specification (MMS) interface is a client that reads and writes real time data from and to Intelligent Electronic Device servers ■ Reading or writing historical data is not supported



EIOC and Dual Horizontal Carrier.



EIOC Ethernet Isolation Port.

Hardware Specifications

Common Environmental Specifications (all components)	
Operating Temperature*	-40 to 70°C (-40 to 158°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5 to 95%, non-condensing
Protection Rating	IP 20
Airborne Contaminants	ISA-S71.04-1985 Airborne Contaminants Class G3 Conformal coating
Shock	10 g ½-sine wave for 11 ms
Vibration	1mm Peak-to-Peak from 2 to 13.2 Hz; 0.7g from 13.2 to 150 Hz

*Operating any electronics at the higher end of its temperature range for long periods of time will shorten its expected lifetime, see **Effects of Heat and Airflow Inside an Enclosure White Paper** for more information.

Carrier Specifications

Specifications for Dual Horizontal Carrier	
Capacity	One (simplex) or two (redundant) EIOC
Input Power	+24 VDC ±10% at 1 A maximum
Redundant Ethernet connections via replaceable Ethernet Isolation Ports (EIPs)	Copper twisted pair: 10/100BASE-TX with RJ45 connectors; Full duplex operation – 100 m distance
Mounting	DIN rail latch to horizontally orientated T-type rail

EIOC Hardware Specifications

Specifications for the Ethernet I/O Card	
Number of EIOCs Per System	60
Input Power	+24 VDC ± 10% at 325 mA maximum for simplex; 575 mA maximum for redundant
Heat Dissipation (Redundant)	7 Watts maximum for simplex; 13 Watts maximum for redundant
Fuse Protection (Internal)	Internal Non-replaceable Fuse
Mounting	One or two slots on the Dual Horizontal Carrier
Communication	Redundant Ethernet connections via Dual Horizontal Carrier to the: a) Ethernet Device Network b) Area Control Network (ACN)
ACN Network Addressing	Auto Assigned during commissioning
Device Network Addressing	Manual, Client only
Control Module Limit	2000
Max Data Values Sent	4000/second
Max Data Values Received	500/second
Max I/O Network Nodes	300*
Module Execution Rates	100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 30s, 60s
LED Indicators	
Green – Power	Indicates DC power is applied
Red – Error	Indicates an error condition
Green – Active/Standby	Indicates operating mode of each EIOC
Yellow flashing – Pri./Sec. CN	Indicates valid control network communication

*Combined number of Remote I/O nodes, CHARM I/O cards (CIOCs), Wireless I/O cards (WIOCs), and Ethernet I/O Cards (EIOCs) in a DeltaV™ system.

Certifications

The following certifications are available for the EIOC (see actual certificates for exact certifications for each product):

- **CE**

  EMC – EN 61326-1

- **FM**

  FM 3600

  FM 3611

- **CSA**

  CSA C22.2 No. 213-M1987

  CSA C22.2 No. 1010-1

- **ATEX**

  ATEX 94/9/EC

  EN60079-0

  EN60079-15

- **IEC-Ex**

  IEC60079-0

  IEC60079-15

- **Marine Certifications:** IACS E10

  ABS Certificate of Design Assessment

  DNV-GL Marine Certificate

- **Security Certifications**

  Achilles Level 2*

Hazardous Area/Location

The EIOC can be installed and used based on the following Standards (see actual certificates for exact product markings for each product):

- **FM (USA)**

  Class I, Division 2, Groups A, B, C, D, T4

- **cFM (Canada)**

  Class I, Division 2, Groups A, B, C, D, T4

- **ATEX**

  II 3G Ex nA IIC T4 Gc

- **IEC Ex**

  II 3G Ex nA IIC T4 Gc

Regarding the Installation instructions please refer to the following Documents:

Class 1 Division 2 Installation Instructions DeltaV S-series	*12P5402*
Zone 2 Installation Instructions DeltaV S-series	*12P5404*

*PRP communications are not included in the certification

Ordering Information

Description	Model Number
Simplex Ethernet I/O Card (EIOC) Assembly, (Includes EIOC, Dual Horizontal Carrier, Universal Carrier Protection Cover, 2 Ethernet Isolation Ports for twisted copper, 2 Power Plugs)	SE4100
Redundant Ethernet I/O Card (EIOC) Assembly, (Includes 2 EIOC, Dual Horizontal Carrier, 2 Ethernet Isolation Ports for twisted copper, 2 Power Plugs)	SE4101
MODBUS TCP Interface for Ethernet connected I/O (EIOC)	VE4103
EtherNet/IP Control Tag Integration for Ethernet connected I/O (EIOC)	VE4104
EtherNet/IP Interface for Ethernet connected I/O (EIOC)	VE4105
OPC-UA client for Ethernet connected I/O (EIOC)	VE4106
IEC 61850 MMS Interface for Ethernet connected I/O (EIOC)	VE4107
Ethernet connected I/O (EIOC and PK): nn Physical Devices	VE4109Sxxx

Where xxx and nn is the number of Physical Devices that you want to license in the EIOC. VE4109Sxxx licenses are system wide and can be assigned either to the EIOC or PK Controller. Also, VE4109Sxxx license is additive in the system and therefore you just need to buy more licenses if you want to increase the number of physical devices in the system (there is no scale up license).

EIOC Spare Part Ordering Information

EIOC Spare Parts	
Description	**Model Number**
Ethernet I/O Card	KL2001X1-BD1
Ethernet Isolation Port for Twisted Copper	KL1604X1-BA1
Dual Horizontal Carrier	KL4104X1-BA1
Universal Carrier Protection Cover	SE6106

Related Products

- **PK Controller –** DeltaV controller with native Ethernet ports to connect to Ethernet Devices, allowing full control functionality in combination with all DeltaV I/O.
- **VIM2 Card –** M- and S-series card that in combination with a DeltaV controller can provide an interface to Ethernet Devices for full control functionality in combination with all DeltaV I/O.
- **OPC UA –** The different OPC UA servers and clients in the DeltaV system allow data reads and writes to and from 3rd party application in an easy, reliable and secure way.
- **DeltaV Simulate –** Use of Ethernet I/O cards in a DeltaV Simulate system is limited to Virtual Ethernet I/O cards (vEIOC). The physical EIOC is not supported in DeltaV Simulate.

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