



DeltaV Integration with Rockwell PLCs Using Ethernet/IP

Process DeltaV Integration with Rockwell PLCs is quick and cost-effective using the Ethernet/IP Driver for the DeltaV Virtual IO Module Network Gateway. This solution provides the stability and reliability of DF1 or DH+ integration at the same or similar price. This paper will show the user how to implement this solution by covering:

- Background on the Ethernet/IP protocol
- Implementation of Ethernet/IP for different models of Rockwell PLCs
- Ethernet/IP Integration with DeltaV
- Comparisons of Ethernet/IP to other Rockwell PLC Integration Methods
- How to specify a Virtual IO Module Network Gateway

Ethernet IP Protocol

Ethernet/IP is the implementation of the Common Industrial Protocol (CIP) over TCP/IP. CIP is the common application and data presentation layer that is used for ControlNet and DeviceNet. Originally developed by Rockwell, the protocol is now managed by the Open DeviceNet Vendors Association (www.odva.org). MYNAH Technologies is a registered member of the ODVA. The common physical layer used for Ethernet/IP implementation to most devices is 10/100 Mbaud Ethernet.

The DeltaV Virtual IO Module from MYNAH Technologies has an Ethernet/IP Driver compatible with the Common Industrial Protocol (CIP) as defined in release 1.0 of the Ethernet/IP specification from Open DeviceNet Vendor Assoc. (ODVA) & ControlNet International.

For the purpose of integration of Rockwell PLCs with DeltaV using the Virtual IO Module, two Ethernet/IP communication techniques are supported:

1. Class 3 UCMM (unconnected) messaging – Encapsulated DF1 to PLC5, SLC and ControlLogix devices. These messages are initiated from the VIM, in a command /response format.
2. Class 1 (I/O) connection. The VIM communicates with ControlLogix devices using the generic 1756-ENBT format. Each ENBT corresponds to a VIM dataset. This functionality is available in simplex VIM architecture only.

In some cases, an application may have a mixture of both types within the same network or to the same PLC.



Rockwell PLCs and Ethernet/IP

Most recent Rockwell PLCs support Ethernet/IP communications. Following is a summary of the more common models and their integration devices. A complete list of Ethernet/IP compatible Rockwell devices can be found on the Allen-Bradley web site, www.ab.com.

- ControlLogix 5000 – Requires a 1756-ENBT module. Supports Class 3 and Class 1 messaging.
- FlexLogix – Requires a 1788-ENBT module. Supports Class 3 and Class 1 messaging.
- PLC5 – Requires a 1756-ENET module. Supports Class 3 messaging (encapsulated DF1 commands) only.
- SLC505 – on-board communications port supports Ethernet/IP. Supports Class 3 messaging (encapsulated DF1 commands) only. No other models of SLC controllers support Ethernet/IP communications.

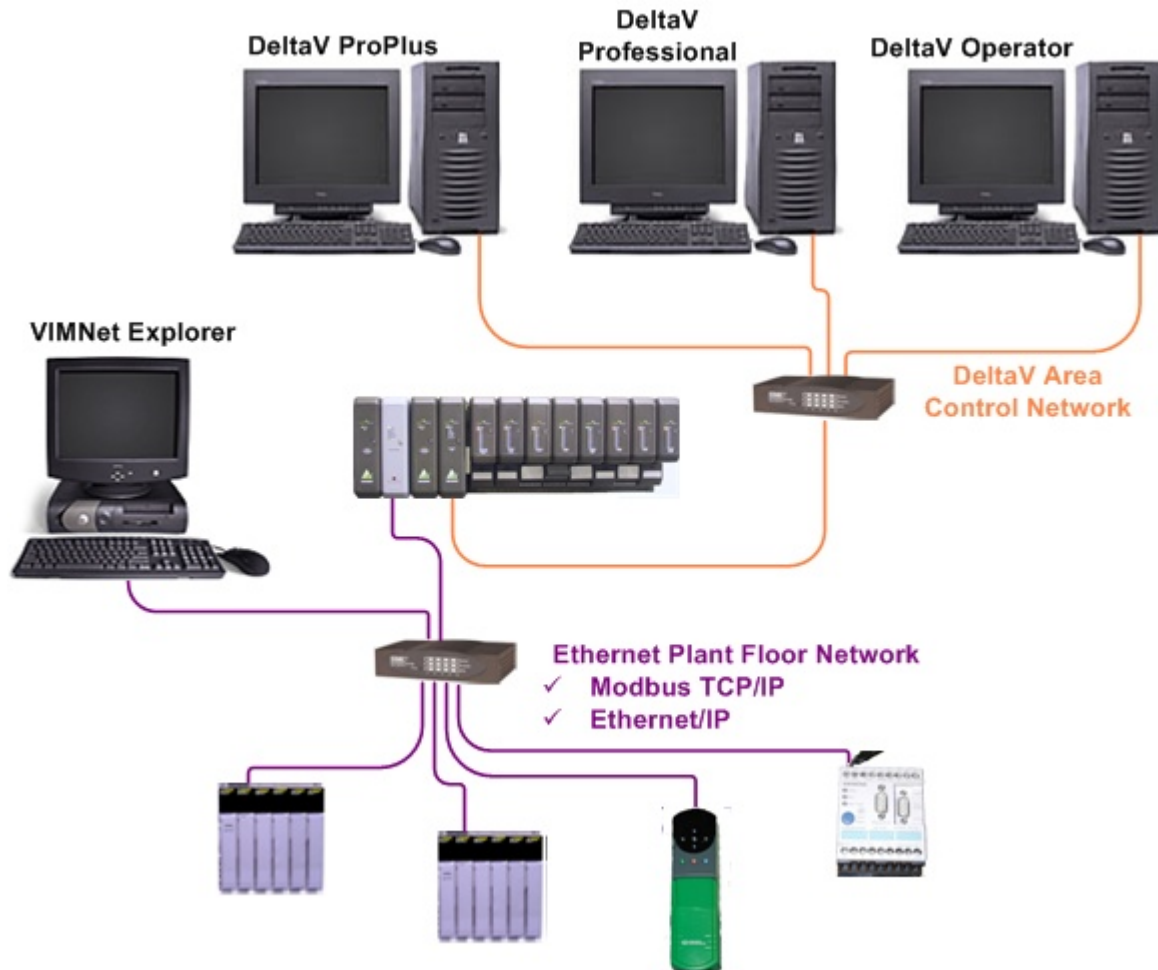
Ethernet/IP and DeltaV

Integration of Ethernet/IP devices with DeltaV is easy and cost-effective using the DeltaV Virtual IO Module from MYNAH Technologies. The DeltaV Virtual I/O Module (VIM), together with its dedicated system power supply is installed on a 2-module carrier on the left-hand side of the DeltaV controller as shown below.

The card is clearly labeled with the interface type as Virtual I/O Module. LEDs, located on the front of the card, show the power, error, and port status of the interface at a glance. This current version of the VIM firmware supports both simplex and redundant communications with field devices.

When commissioned the VIM appears to the controller as a set of four DeltaV serial cards in the last 8-wide carrier slots (user addressable as slots 57-60 or 61-64). Each VIM can support up to 128 datasets of read/write data from the PLCs with each dataset capable of up to 100 16-bit integer words). Each VIM can communicate with up to 32 PLCs in simplex installations.

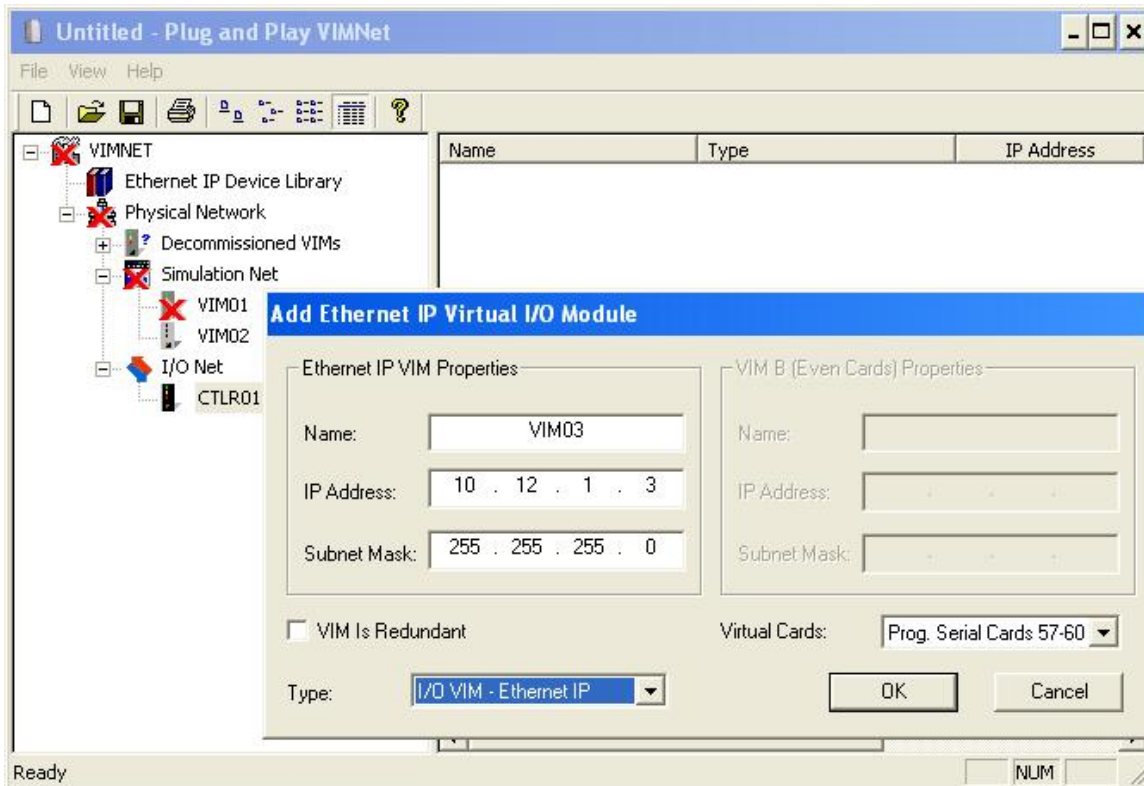
In the following architecture drawing, the VIM is connected by an Ethernet network to a number of PLC using the Ethernet/IP protocol. Data from the PLCs is presented to the controller in read/write datasets in the virtual serial cards.



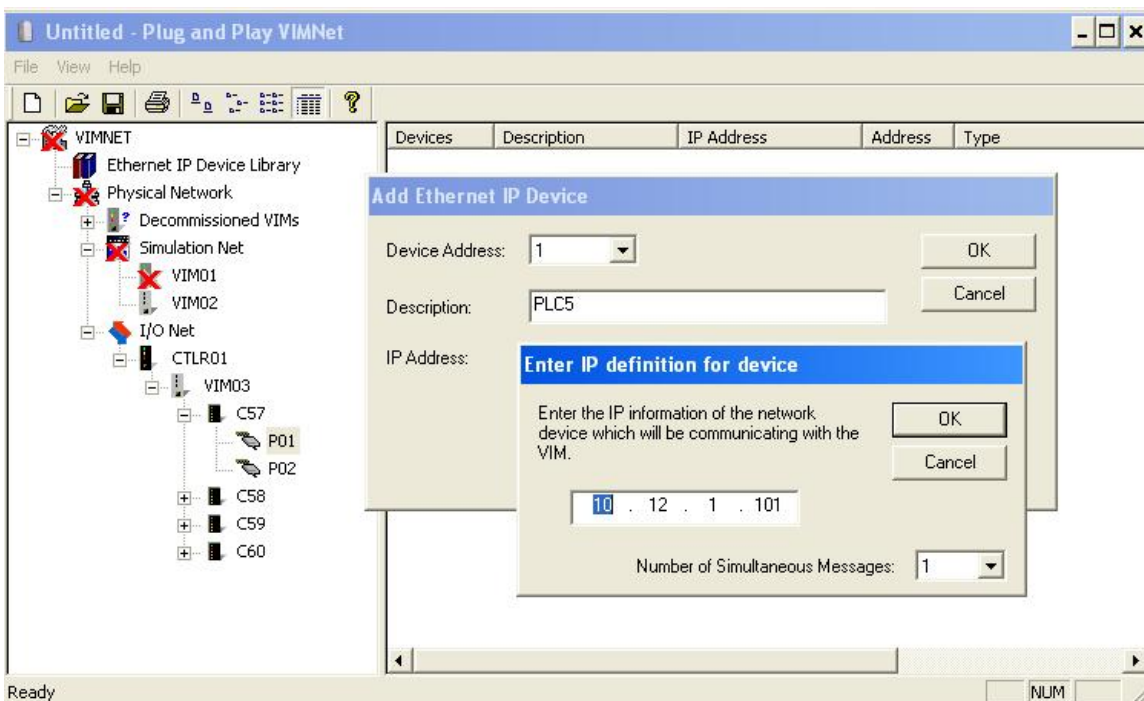
Steps for establishing Ethernet/IP communications in DeltaV

Step 1: Configure the network using the VIMNet Explorer Utility

The VIMNet Explorer is included with the Ethernet/IP driver license. This utility can be loaded on any MS Windows workstation on the same network as the PLCs and the VIM. In the VIMNet Explorer the user would configure a controller placeholder and then a VIM placeholder as shown.



Next, the user would define an Ethernet/IP device such as a Rockwell PLC5 under the first port of the virtual serial card. The Device Address is important; this address is used to identify the device in DeltaV Explorer for defining the data communications.

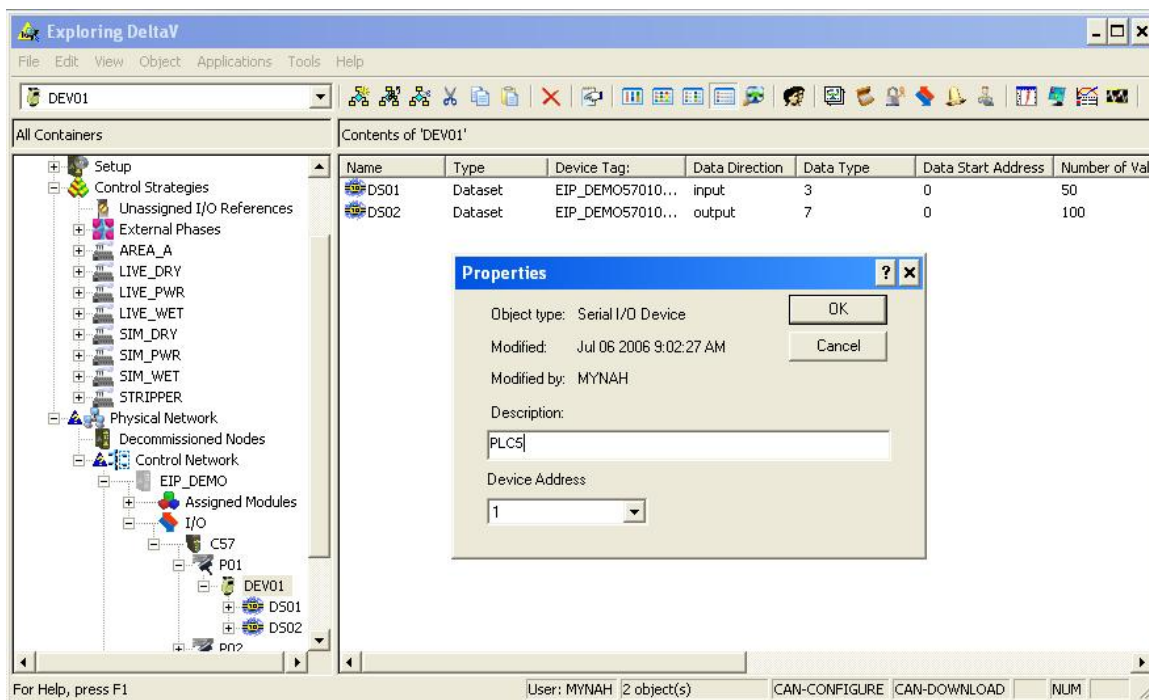


Finally, the user would Commission the VIM by a right-mouse click on the VIM placeholder and selecting the decommissioned VIM from the list. The final step is to upload the VIM configuration by right-mouse clicking on the placeholder and then selecting Upload. The upload executable takes the network configuration and loads it into the VIM.

Step 2: Configure the data communications in DeltaV Explorer

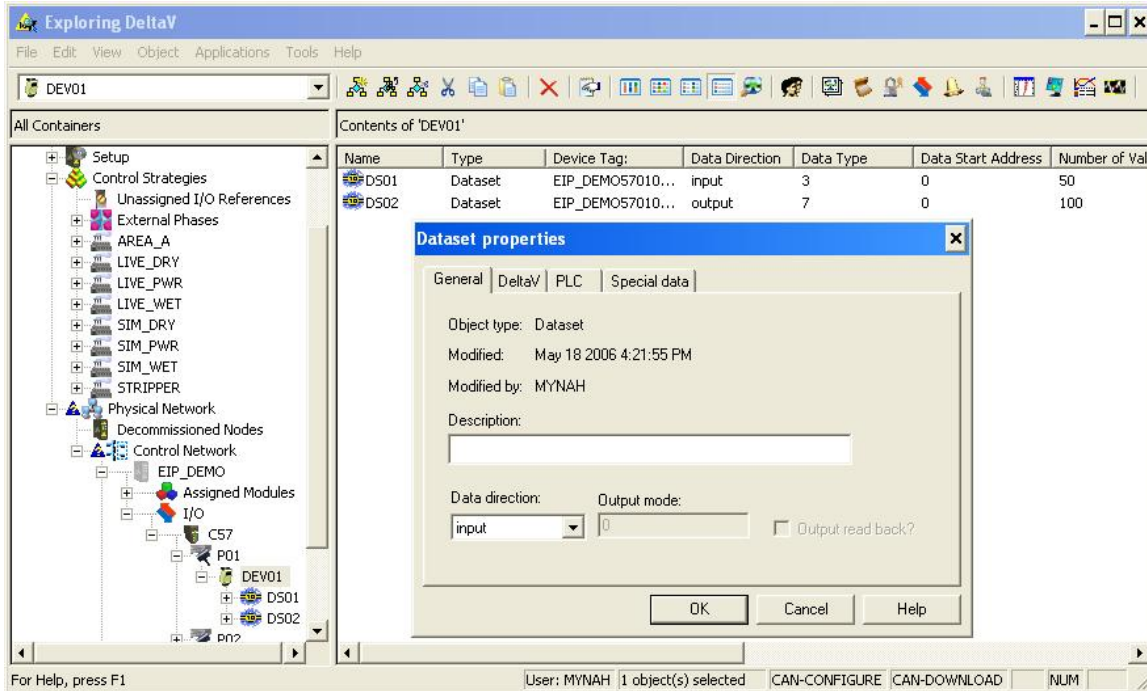
Once the VIM is commissioned, it will appear as a set of four DeltaV Serial Cards under the DeltaV Controller. If the controller is not already commissioned, commission the controller and autosense the IO. The four virtual serial cards should be connected.

Under the same port as defined in the VIMNet Explorer, define a Device. The same Device Address as used for this PLC in VIMNet Explorer.



Next, the user would define datasets for read/write communications with the PLC data tables. The configuration parameters for different Rockwell PLCs are explained in detail in the Ethernet/IP Scanner Driver posted on the MYNAH web site at http://www.mynah.com/vim_network_gateway.asp.

Each dataset allows the user to define data direction (input or output), DeltaV data type, PLC data type, PLC start address, and number of values. In addition, the special data fields are used to define specific file types and locations for PLC data tables.



An example of DeltaV Dataset Properties for reading the first 50 16-bit integer values from a PLC5 N15 table would be as follows:

Data Direction – input

DeltaV Data Type – 16-bit int w/ status

Device data type: 8

Data start address: 0

Number of values: 50

Special data 1: 7 (for integer file type N)

Special data 2: 15

Additional steps for configuring Rockwell Logix processors are explained in detail in the Ethernet/IP Scanner Driver posted on the MYNAH web site at http://www.mynah.com/vim_network_gateway.asp.

Advantages of Integration with Rockwell PLCs Using Ethernet/IP

The following table is a comparison between common methods of integrating Rockwell PLCs with DeltaV using DF1 protocol, Ethernet/IP, and OPC. The table clearly shows that Ethernet/IP integration using the DeltaV Virtual IO Module Network Gateway provides better performance and lower installed cost than OPC integration with the reliability of DF1 integration.

In the comparison below, the stability of the Ethernet/IP approach is listed as medium to high due to the uncertainties of network design and traffic. If the network is physically isolated, it will be as stable as a serial network. For Rockwell PLCs that support Ethernet/IP, it is the best practice for integration with DeltaV.

Integration Method	DF1, Direct Serial or DH+ (requires KF2 module)	Virtual IO Module with Ethernet/IP	OPC Server and Client (RSLinx)
Capacity per Unit	3200 Registers (100 Reg x 32 DataSet)	12,800 Registers (100 Reg x 128 Datasets)	30,000 Parameters
Network Speed	19.2 Kbaud	10 Mbaud	Varies, 100 Mbaud Max
Data Throughput	1000 ms / DataSet	150 ms for 16 Data-Set	5000 parameters / sec
Stability	High	Medium - High	Medium - Low
Redundancy	Yes	Yes	Possible
Ease-of-Use	High	High	Low
Cost	1X	1X	2 - 4X Plus

Specifying a DeltaV Virtual IO Module Network Gateway

The DeltaV Virtual IO Module Network Gateway can be purchased from the local Emerson Sales Office or Business Partner. The model numbers for the Virtual IO Module and Driver licenses are shown below. Virtual IO Module Network Gateway purchases require a software license for each hardware module.

Hardware Module	
MIM-4207	DeltaV Virtual IO Module (Requires a DeltaV Power Supply and 2 Wide Carrier)
Software Licenses	
IOD-4101	Modbus TCP/IP Master Driver for DeltaV VIM
IOD-4102	Ethernet/IP Scanner Driver for DeltaV VIM

DeltaV Software and Hardware Requirements

- DeltaV System Software (Release 6.1 or later) on Windows Workstation configured as a DeltaV ProPlus
- DeltaV Serial Interface Port License, VE4102 (1 per 16 datasets required)
- DeltaV MD or M5 Controller, Power Supply, and 2-Wide Controller Carrier



- Each Virtual IO Modules requires a DeltaV controller mounting carrier. Please refer to the DeltaV Controller Carrier product data sheet for details.
- Each Virtual IO Modules requires a dedicated DeltaV system power supply. Please refer to the DeltaV Power Supplies product data sheet for details.
- Redundant Virtual IO Module installers will require two Virtual IO Modules and two software licenses.

DeltaV Software Licensing Requirements

- In general, DeltaV Module configuration will impact the required DST License more than the serial card driver type and configuration. The following guidelines can be applied:
a DeltaV Serial Module data set can contain up to 100 values (a value can be any boolean, 8-bit or 16-bit number), and up to 16 data sets are supported by each of the 2 ports on the serial card. If the data set registers are configured as floating point or 32-bit values, then the maximum values is 50. However, the serial device, in general, limits the total capacity of the interface.
- Each data set counts as one DST as long as a single module references all values in the data set. If multiple modules reference values in a data set, then the DST count for the data set is equal to the number of modules referencing the data set.
- Values used in modules containing control function blocks will be counted as Control DSTs.
- Values referenced only in graphics or a history collection count as SCADA values, not DSTs.

About the Author

[Martin Berutti](#) is the Director of Business Development at MYNAH Technologies. He helps global customers solve problems in several industries, from refinery to chemical to pharmaceutical plants. His areas of expertise include process simulation, control system and network design, and information integration. Martin has been with MYNAH for over 15 years, holding positions of Systems Engineer, Performance Consultant, Project Manager, and Director of Performance Technology. Previous employers included Fisher Controls, Rosemount, and Applied Automation. He has a B.S. in Chemical Engineering.



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