ControlNet Router

User Manual

A-CNR

Document No. D138-009
02/2022
Revision 1.6

aparian

CONTENTS

Revision History

Revision	Date	Comment
1.0	14 October 2018	Initial document
1.1	6 February 2019	Added ODVA certification
1.2	3 January 2020	Added ENIP Target and ENIP Map modes
1.3	12 February 2020	Added section for programming a Logix controller
1.4	30 October 2020	Added support for EtherNet/IP Class 1 origination
1.5	7 December 2020	Added UL Class 1 Div 2 certification
1.6	16 February 2022	Fixed catalog numer A-CNR.

1. PREFACE

1.1. INTRODUCTION TO THE CONTROLNET ROUTER

This manual describes the installation, operation, and diagnostics of the Aparian ControlNet Router. The ControlNet Router provides intelligent data routing between ControlNet and EtherNet/IP or Ethernet PCCC (CSP).

This will allow the user to connect new PanelView Plus devices (with no ControlNet interface) to existing ControlNet networks. The support for Ethernet PCCC (CSP) allows the module to emulate a PLC5 providing a legacy interface for PanelViews and other devices over scheduled ControlNet (as shown below).

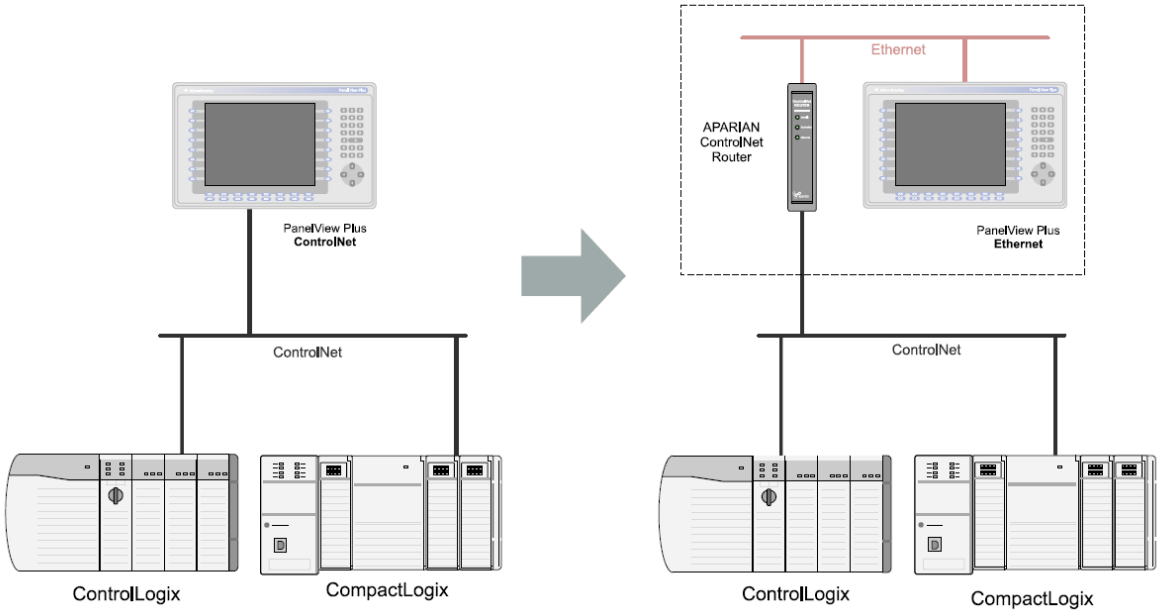


Figure 1.1 – Typical Setup for PanelViews

The user can also interface Logix Controllers (on EtherNet/IP) or EtherNet/IP devices (e.g. PowerFlex Drives) to existing legacy ControlNet networks for various Allen Bradley platforms (e.g. Logix, PLC5, etc.) as shown below. This can be done via unconnected Class 3/UCMM messaging or via cyclic Class 1 data exchange.

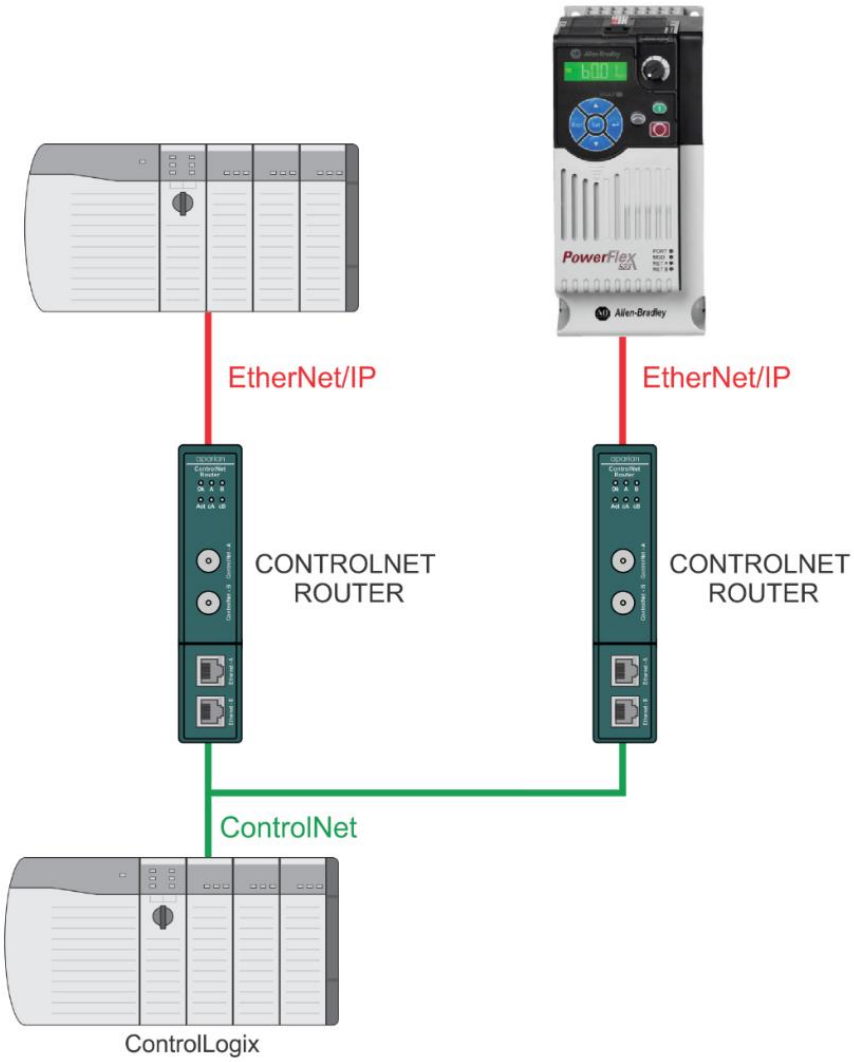


Figure 1.2 – Typical Setup for ControlNet to Logix EtherNet/IP and/or EtherNet/IP Device

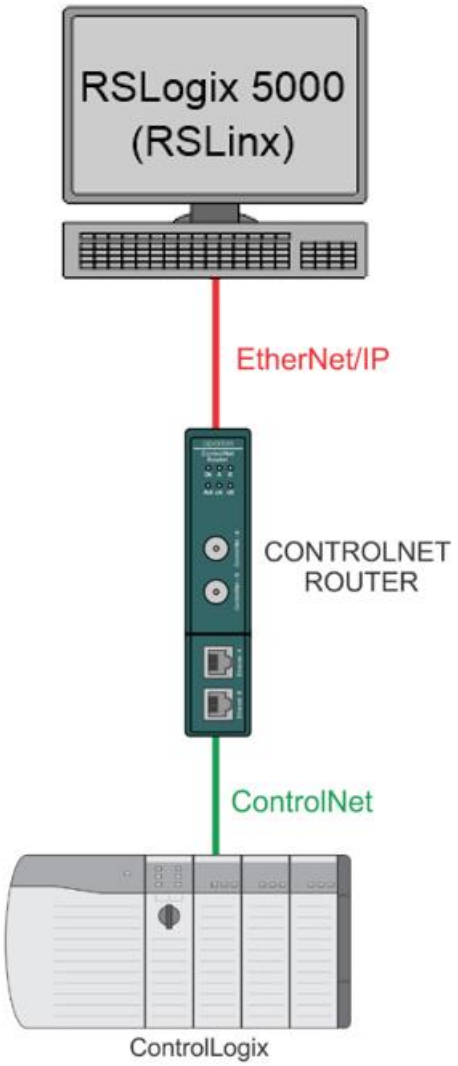


Figure 1.3 – Typical Setup for Programming a Logix controller over ControlNet

1.2. FEATURES

The ControlNet Router supports interfacing ControlNet and EtherNet/IP using various methods described in the sections below (e.g. PanelView interface, Logix to Logix interface, EtherNet/IP to Scheduled ControlNet interface).

The ControlNet Router supports redundant ControlNet.

The module also provides a range of statistics on Ethernet and ControlNet to assist with fault finding. A built-in webserver provides detailed diagnostics of system configuration and operation, including the display of ControlNet operation and communication statistics, without the need for any additional software.

The ControlNet Router is configured using the Aparian Slate application. This program can be downloaded from www.aparian.com free of charge.

1.2.1. PANELVIEW INTERFACE

When set to PCCC Client Mode, the ControlNet Router provides an interface between newer PanelView Plus HMIs (without any ControlNet interface) and existing ControlNet networks using either Unscheduled or Scheduled ControlNet.

When using unscheduled ControlNet, the ControlNet Router can be used as a drop-in replacement for existing legacy PanelView HMI's by simply changing the RSLinx path.

When using scheduled ControlNet, the ControlNet Router can be configured to allow for up to 400 bytes of input data and 400 bytes of output data per PanelView to exchange with the Logix Controller. The ControlNet Router will emulate a PLC5 controller which is used by the PanelView HMI to map PLC5 Files (e.g. N7 or F8) to the Logix input and output assembly over scheduled ControlNet. The consumed (ControlNet) data can be mapped to a PLC5 type address file, N9 and F10, and then read by an Ethernet device e.g. a PanelView. Similarly, the produced (ControlNet) data can also be mapped to a PLC5 type address file, N7 and F8, to which an Ethernet device could write.

1.2.2. LOGIX (ETHERNET/IP) TO LOGIX (SCHEDULED CONTROLNET) INTERFACE

When set to EtherNet/IP Target mode and using a Class 1 EtherNet/IP connection, the data from the EtherNet/IP connection output assembly will be seen in the ControlNet Scheduled connection input assembly and vice versa as shown below.

If the user enters a value in the module ControlNet connection output image (*MappedData* tag*)*, then that data will appear at the same EtherNet/IP connection input image (*MappedData* tag*)*.

If the user enters a value in the module EtherNet/IP connection output image (*MappedData* tag*)*, then that data will appear at the same ControlNet connection input image (*MappedData* tag*)*.

This allows the user to exchange data between a Logix Controller on a legacy ControlNet network and a Logix Controller on a EtherNet/IP network.

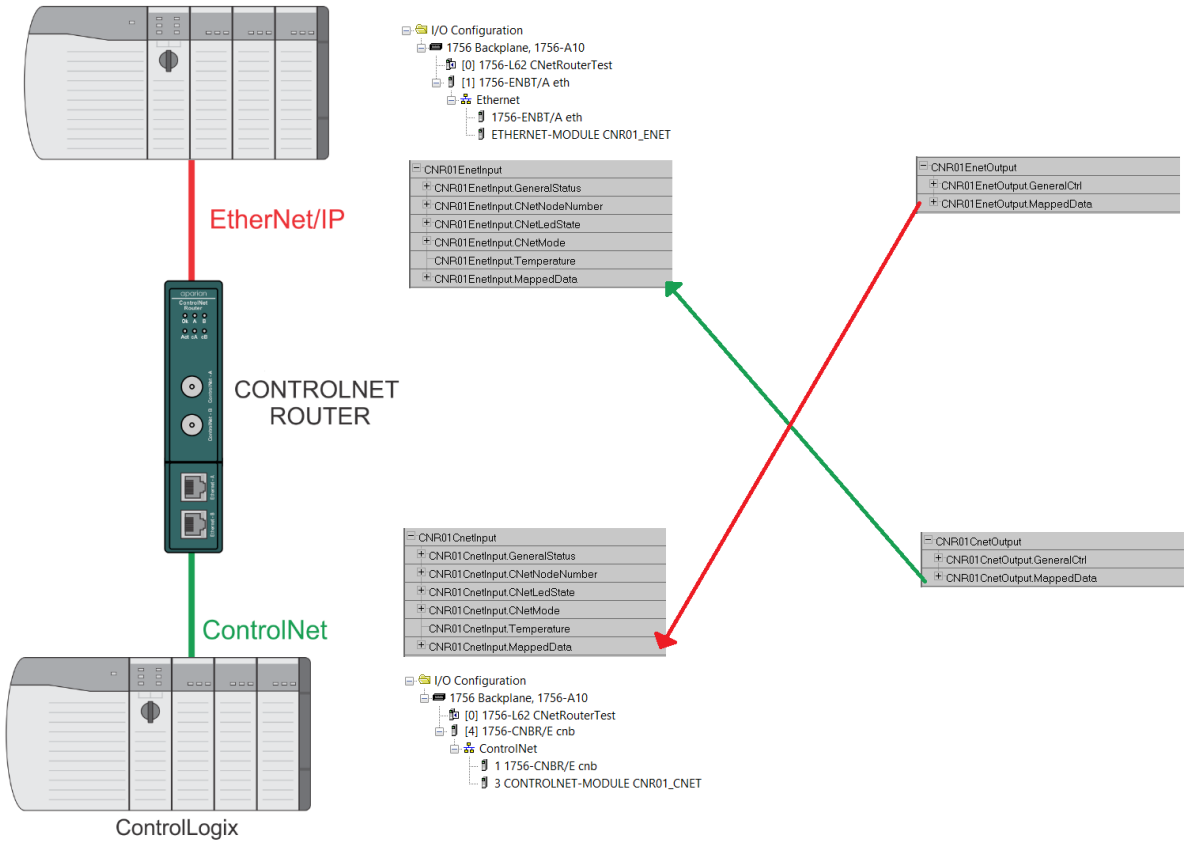


Figure 1.3 – Typical Setup for EtherNet/IP Target Mode

1.2.3. CONTROLNET TO ETHERNET/IP DEVICE

The ControlNet Router supports two ways to connect EtherNet/IP devices to a Logix controller over scheduled ControlNet. The first is using EtherNet/IP Map Mode which allows the user to setup unconnected messaging to extract data from the target device.

The second is using cyclic EtherNet/IP communication (Class 1) to establish a connection to the target EtherNet/IP device and provide the input assembly data from the EtherNet/IP device to the Scheduled ControlNet input assembly and sending the output assembly data from the Scheduled ControlNet to the EtherNet/IP device output assembly.

1.2.3.1. ETHERNET/IP MAP MODE

When set to EtherNet/IP Map Mode, the ControlNet Router will allow the user to Get/Set attributes of EtherNet/IP devices with data from the Scheduled ControlNet connection. In addition to this the module can also use Custom Function CIP requests to send and/or receive data from a target EtherNet/IP device.

The data to be sent to device will be read from the module's scheduled ControlNet *MappedData* tag in the **output** assembly. The data to be read from the device will be written to the module module's scheduled ControlNet *MappedData* tag in the **input** assembly (as

shown below).

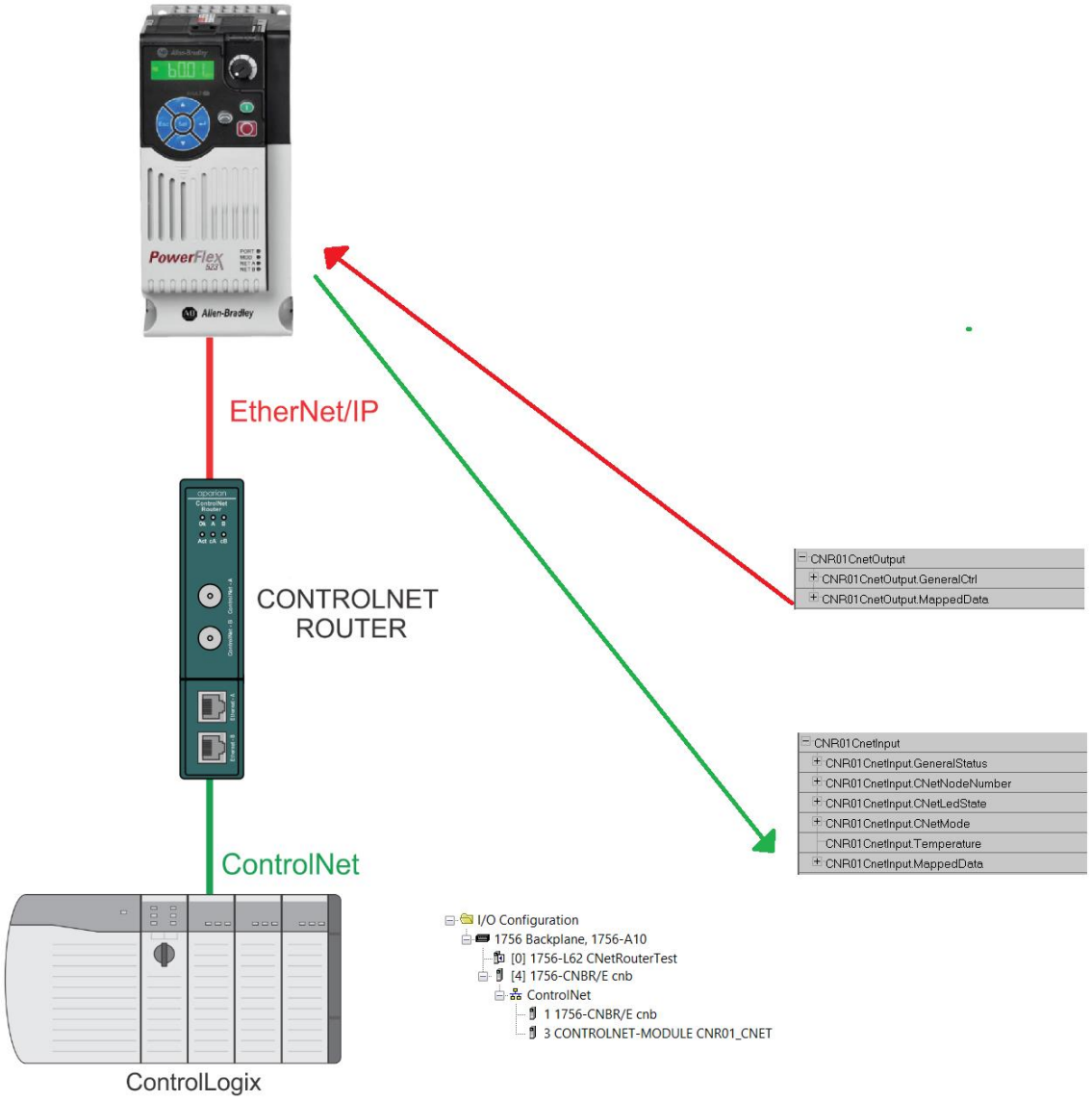


Figure 1.4 – Typical Setup for EtherNet/IP Map Mode

1.2.3.2. ETHERNET/IP ORIGINATOR MODE

When set to EtherNet/IP Originator Mode, the ControlNet Router will allow the user to setup a EtherNet/IP class 1 (cyclic) connection the EtherNet/IP device. The user can enter various Class 1 communication parameters that will allow the ControlNet Router to establish a EtherNet/IP class 1 connection to almost any device supporting this connection.

The data to be sent to device (in the device's class 1 output assembly) will be read from the ControlNet Router's scheduled ControlNet *MappedData* tag in the **output** assembly. The data to be read from the device (in the device's class 1 input assembly) will be written to the ControlNet Router's scheduled ControlNet *MappedData* tag in the **input** assembly (as shown

below).

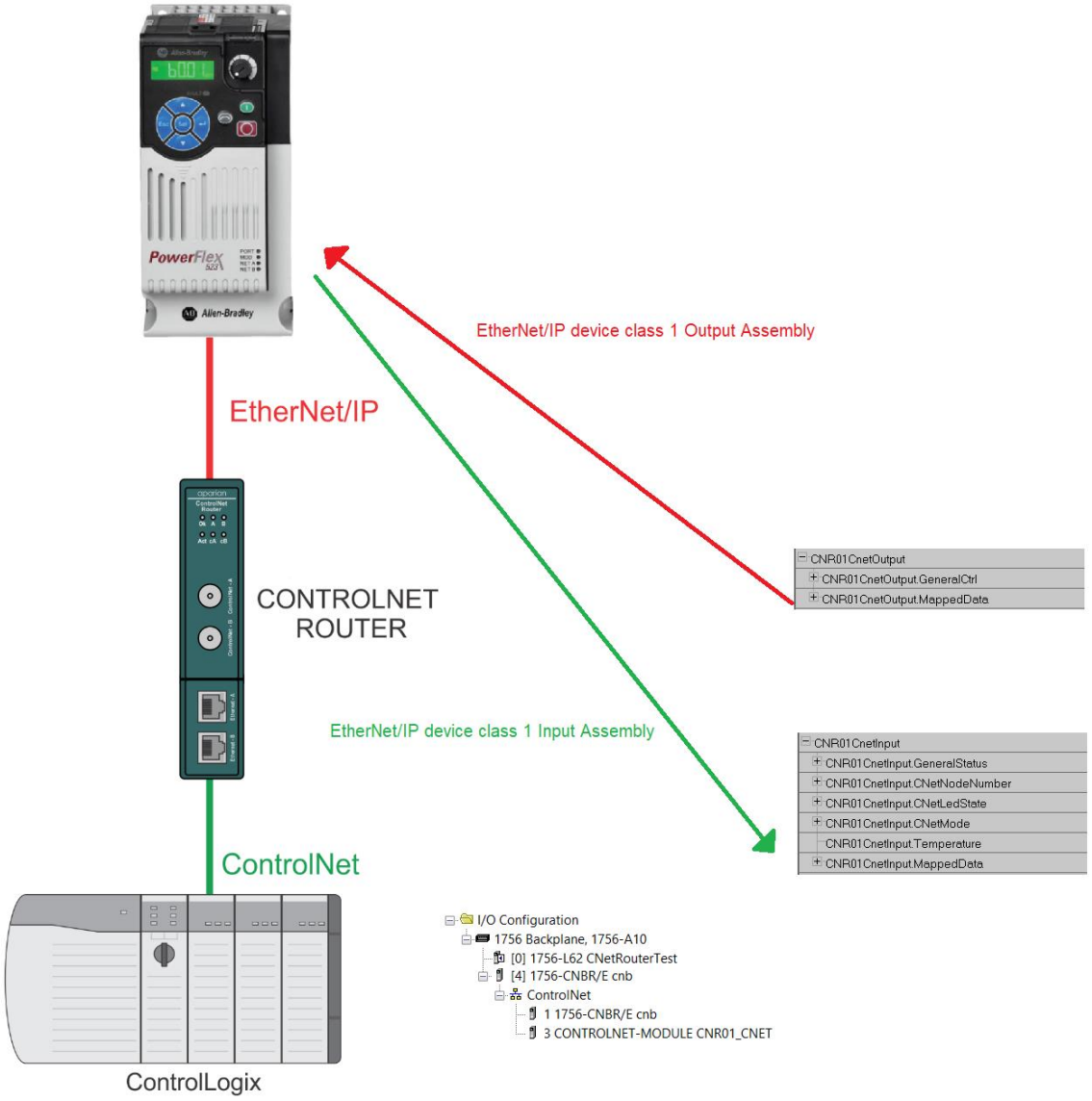


Figure 1.5 – Typical Setup for EtherNet/IP Originator Mode

1.3. ARCHITECTURE

The figure below provides an example of the typical network setup when using unscheduled ControlNet, where the ControlNet Router acts as a target device on the ControlNet network.

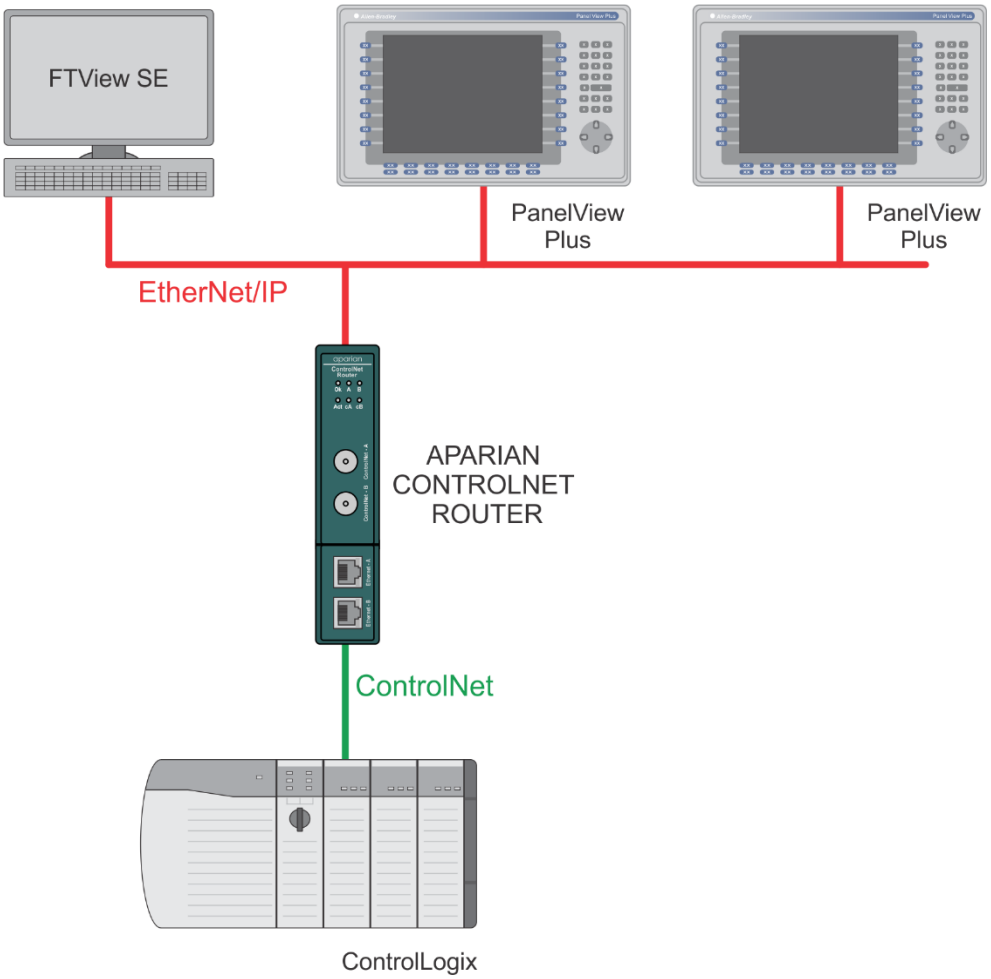


Figure 1.6. - Example of a typical network setup in PLC Emulation mode

In this example, the ControlNet Router will relay requests from the PanelView HMI to the Logix Controller allowing the newer PanelView Plus (with Ethernet only) to access the Logix Controller tags over an existing ControlNet network.

The figure below provides an example of the typical network setup when using scheduled ControlNet and the module exchanges data with devices on EtherNet/IP either through a Class 1 EtherNet/IP connection or Class 3 / UCMM unconnected messages.

When using a Class 1 EtherNet/IP connection the data from the EtherNet/IP connection output assembly will be seen in the ControlNet Scheduled connection input assembly and vice versa.

When using Class 3 / UCMM messages the module will execute a list of preconfigured requests at a configured interval. Data from the Scheduled ControlNet output assembly can be written to a EtherNet/IP device and data from a EtherNet/IP device can be read and written to the Scheduled ControlNet input assembly.

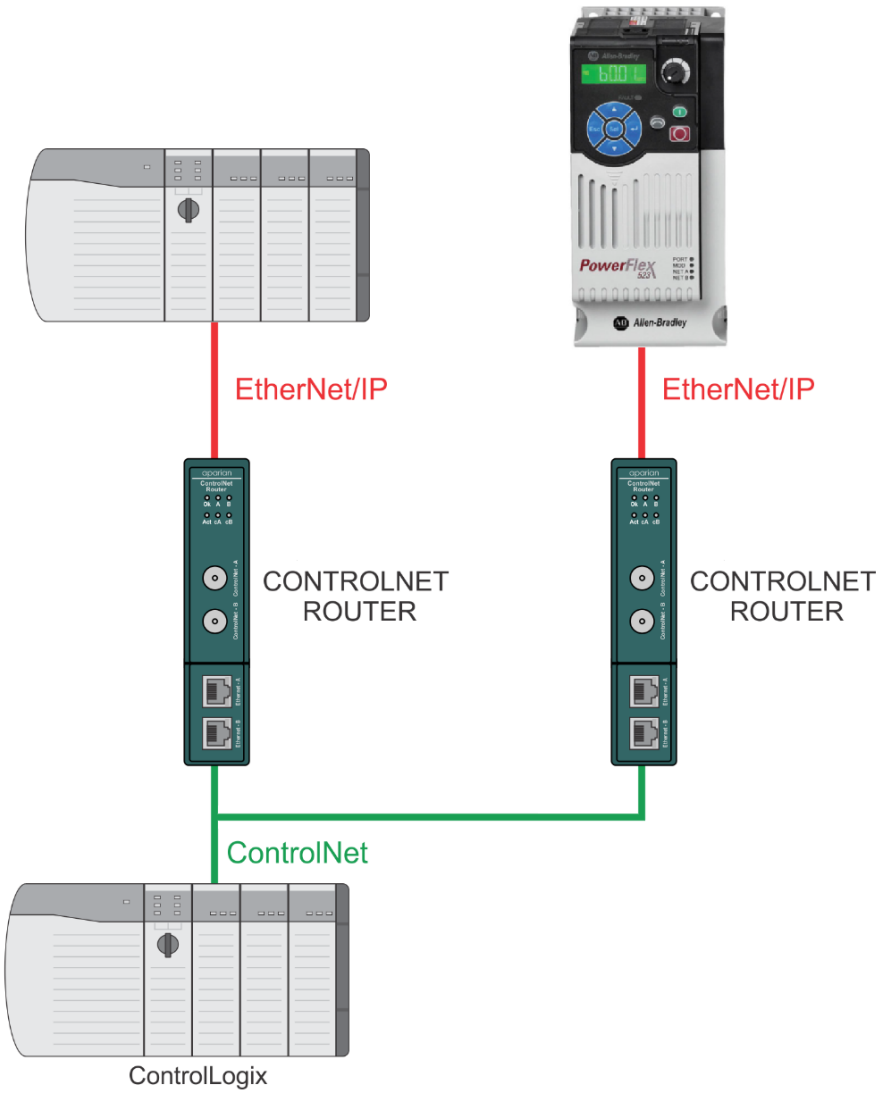


Figure 1.7. - Example of a typical network setup in EtherNet/IP Map, Target, or Originator mode

1.4. ADDITIONAL INFORMATION

The following documents contain additional information that can assist the user with the module installation and operation.

Resource	Link
Slate Installation	http://www.aparian.com/software/slate
ControlNet Router User Manual ControlNet Router Datasheet Example Code & UDTs	http://www.aparian.com/products/controlnetrouter
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html

CIP Routing	The CIP Networks Library, Volume 1, Appendix C:Data Management
ControlNet	http://www.odva.org
ControlNet Cabling	ControlNet Coax Media Planning and Installation Guide https://literature.rockwellautomation.com/idc/groups/literature/documents/in/cnet-in002_-en-p.pdf

Table 1.1. - Additional Information

1.5. SUPPORT

Technical support is provided via the Web (in the form of user manuals, FAQ, datasheets etc.) to assist with installation, operation, and diagnostics.
For additional support the user can use either of the following:

Resource	**Link**
Contact Us web link	www.aparian.com/contact-us
Support email	support@aparian.com

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The module has one 3-way power connector at the bottom of the enclosure as shown in the figure below.

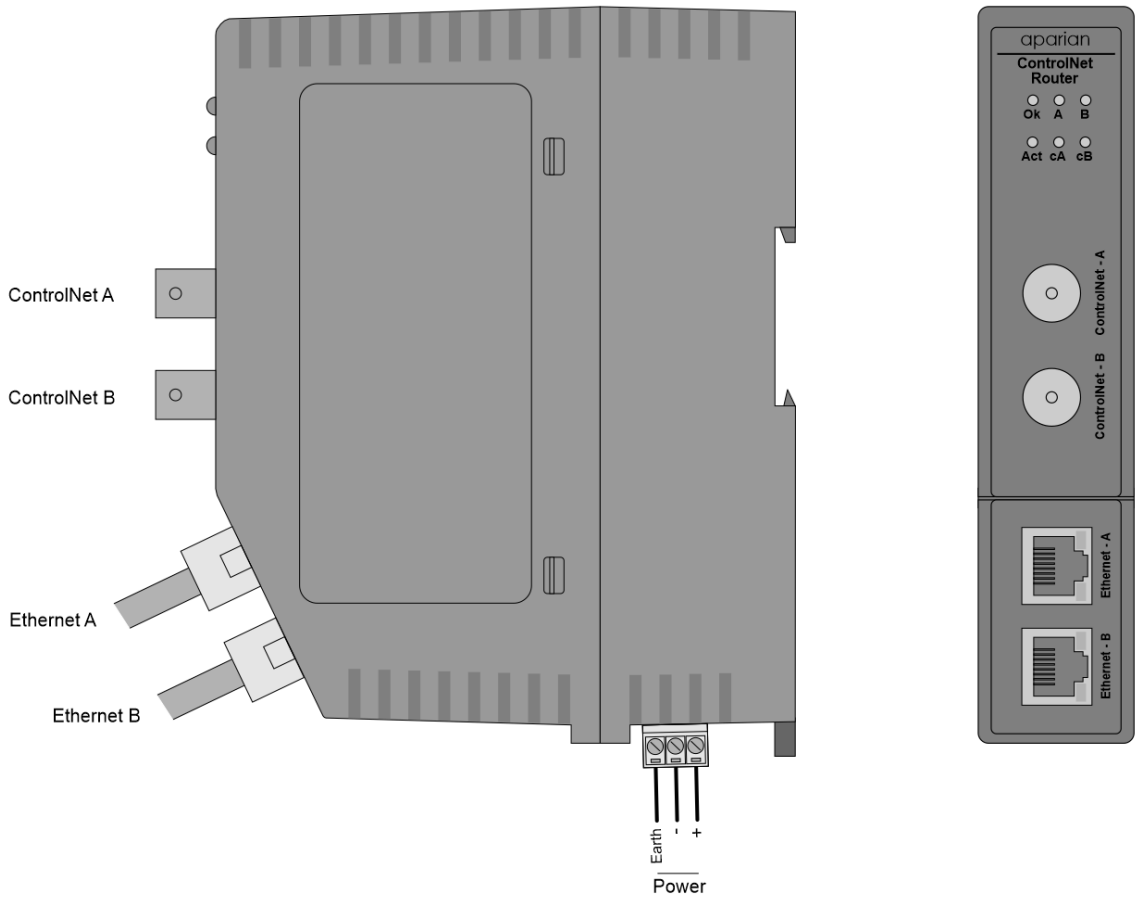


Figure 2.1. – ControlNet Router side and front view

There are two ControlNet BNC connectors in the front of the module for redundant ControlNet. There are two Ethernet RJ45 connectors on the front angle of the module which is used for the Ethernet connection. The Ethernet cable must be wired according to industry standards which can be found in the additional information section of this document.

The module provides six diagnostic LEDs on the front of the module. These LEDs are used to provide information regarding the module system operation, the Ethernet interface, and the ControlNet interface.

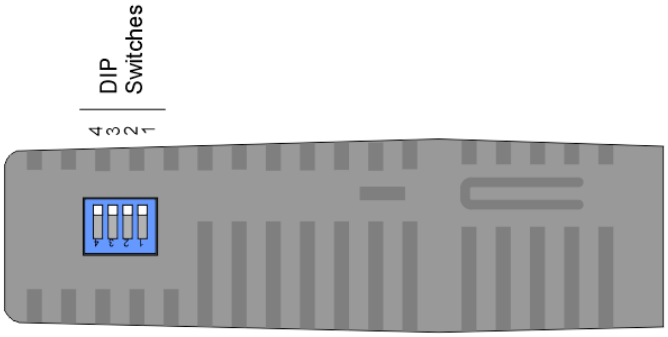


Figure 2.2 – ControlNet Router top view

The module provides four DIP switches at the top of the enclosure as shown in the top view figure above.

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode” the module will not load the application firmware and will wait for new firmware to be downloaded. This should only be used in the rare occasion when a firmware update was interrupted at a critical stage.
DIP Switch 2	This will force the module into DHCP mode which is useful when the user has forgotten the IP address of the module.
DIP Switch 3	Reserved
DIP Switch 4	Reserved

Table 2.1. - DIP Switch Settings

2.2. MODULE MOUNTING

The module provides a DIN rail clip to mount onto a 35mm DIN rail.

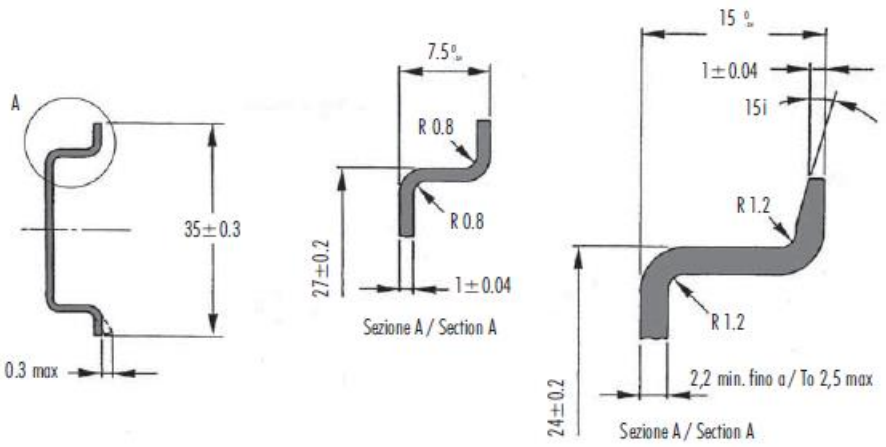


Figure 2.3 - DIN rail specification

The DIN rail clip is mounted on the bottom of the module at the back as shown in the figure below. Use a flat screwdriver to pull the clip downward. This will enable the user to mount the module onto the DIN rail. Once the module is mounted onto the DIN rail the clip must be pushed upwards to lock the module onto the DIN rail.

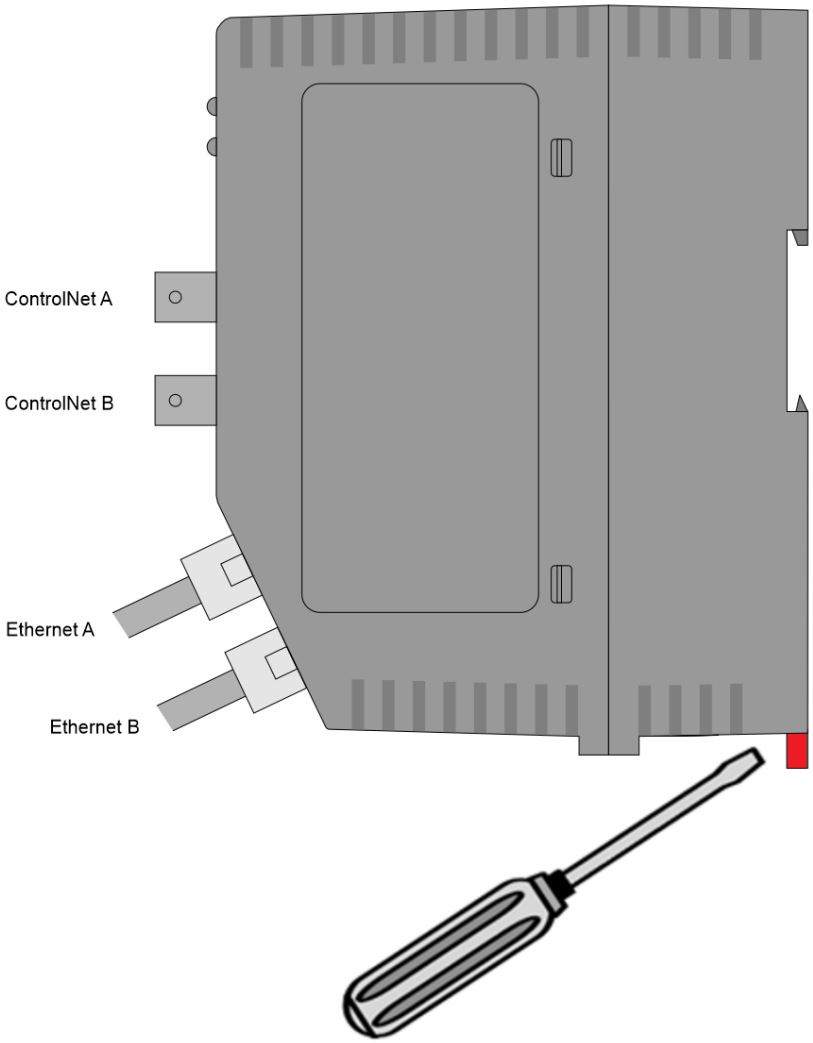


Figure 2.4 - DIN rail mouting

2.3. POWER

A 3-way power connector is used to connect Power+, Power– (GND), and earth. The module requires an input voltage of 10 – 36Vdc. **Refer** to the technical specifications section in this document.

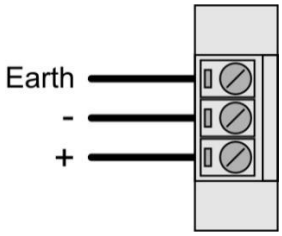


Figure 2.5 - Power connector

2.4. CONTROLNET

ControlNet uses a coax media system. The ControlNet connectors should be wired according to industry standards. **Refer** to the additional information section in this document for further details.

2.5. ETHERNET PORT

The Ethernet connector should be wired according to industry standards. **Refer** to the additional information section in this document for further details.

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

All the network setup and configuration of the module is achieved by means of the Aparian Slate device configuration environment. This software can be downloaded from http://www.aparian.com/software/slate.

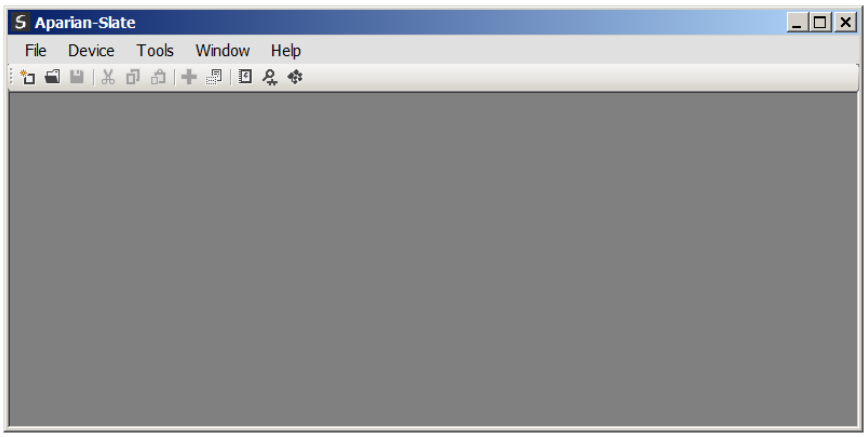


Figure 3.1. - Aparian Slate Environment

3.2. NETWORK PARAMETERS

The module will have DHCP (Dynamic Host Configuration Protocol) enabled as factory default. Thus, a DHCP server must be used to provide the module with the required network parameters (IP address, subnet mask, etc.). There are a number of DHCP utilities available, however it is recommended that the DHCP server in Slate be used. Within the Slate environment, the DHCP server can be found under the Tools menu.

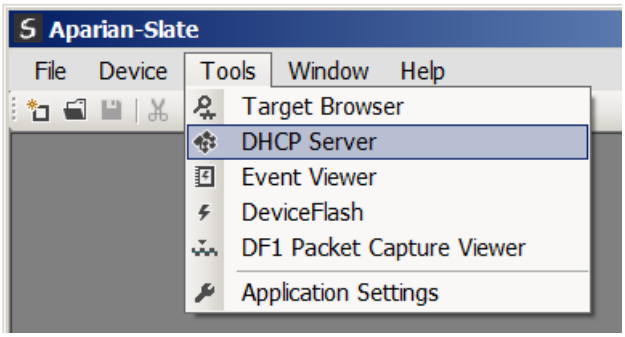


Figure 3.2. - Selecting DHCP Server

Once opened, the DHCP server will listen on all available network adapters for DHCP requests and display their corresponding MAC addresses.

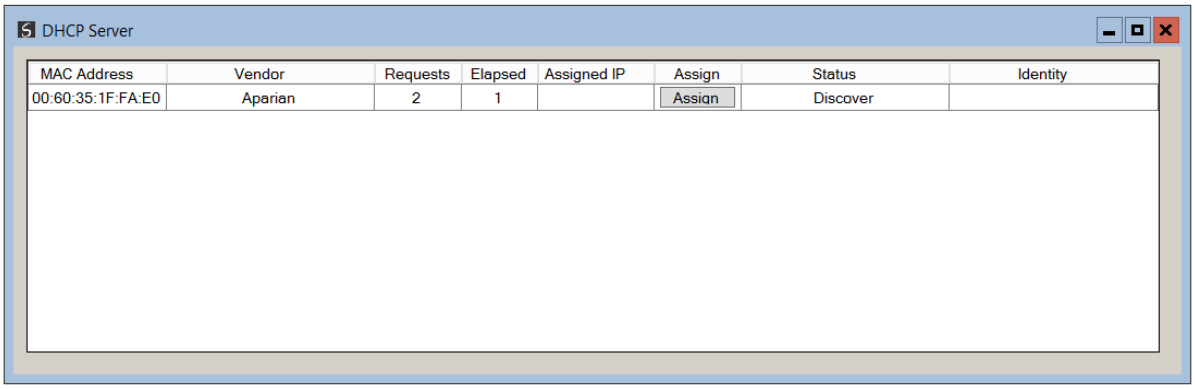


Figure 3.3. - DHCP Server

NOTE: If the DHCP requests are not displayed in the DHCP Server it may be due to the local PC's firewall. During installation the necessary firewall rules are automatically created for the Windows firewall. Another possibility is that another DHCP Server is operational on the network and it has assigned the IP address.

To assign an IP address, click on the corresponding "Assign" button. The IP Address Assignment window will open.

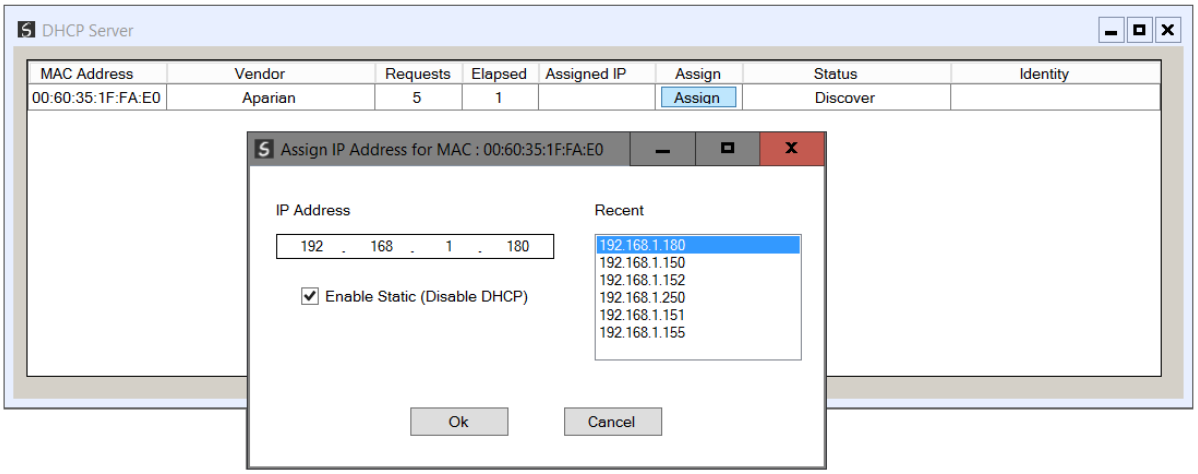


Figure 3.4. - Assigning IP Address

The required IP address can then be either entered, or a recently used IP address can be selected by clicking on an item in the Recent List. If the "Enable Static" checkbox is checked, then the IP address will be set to static after the IP assignment, thereby disabling future DHCP requests.

Once the IP address window has been accepted, the DHCP server will automatically assign the IP address to the module and then read the Identity object Product name from the device.
The successful assignment of the IP address by the device is indicated by the green

background of the associated row.

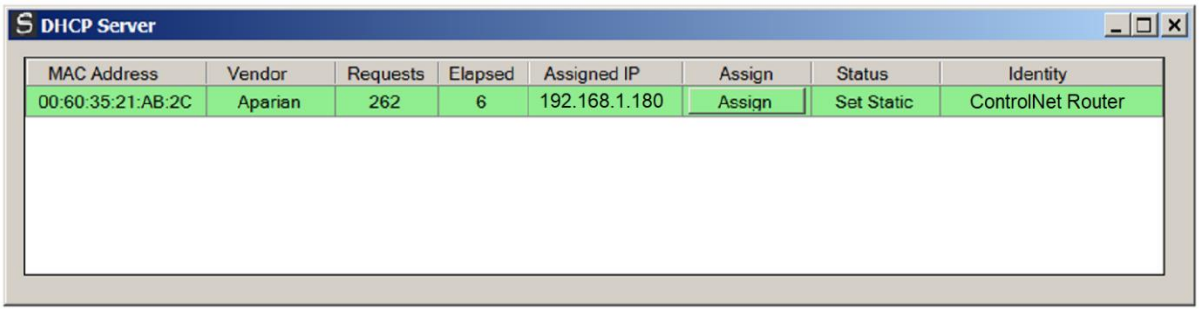


Figure 3.5. - Successful IP address assignment

It is possible to force the module back into DHCP mode by powering up the device with DIP switch 2 set to the On position. A new IP address can then be assigned by repeating the previous steps.

NOTE: It is important to return DIP switch 2 back to Off position, to avoid the module returning to a DHCP mode after the power is cycled again.

If the module's DIP switch 2 is in the On position during the address assignment, the user will be warned by the following message.

Figure 3.6. - Force DHCP warning

In addition to the setting the IP address, a number of other network parameters can be set during the DHCP process. These settings can be viewed and edited in Slate's Application Settings, in the DHCP Server tab. Once the DHCP process has been completed, the network settings can be set using the Ethernet Port Configuration via the Target Browser. The Target Browser can be accessed under the Tools menu.

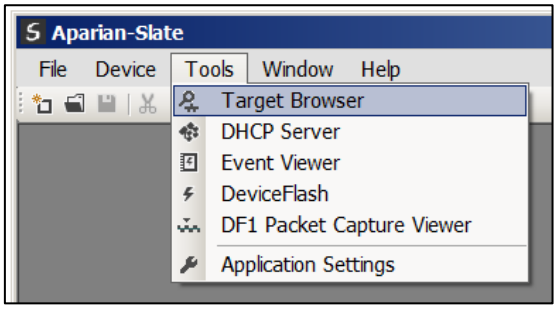


Figure 3.7. - Selecting the Target Browser

The ***Target Browser*** automatically scans the Ethernet network for EtherNet/IP devices.

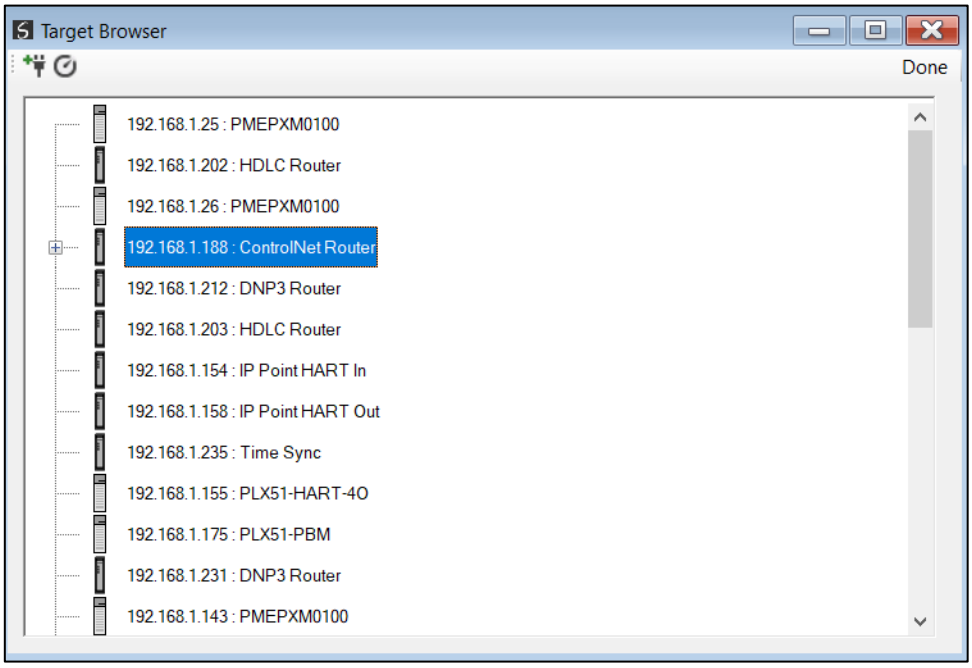


Figure 3.8. - Target Browser

Right-clicking on a device, reveals the context menu, including the ***Port Configuration*** option.

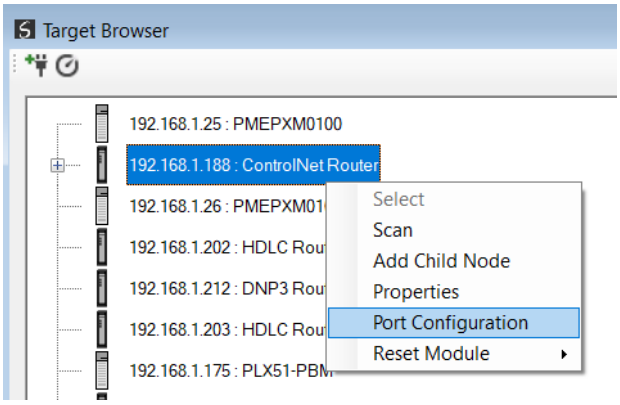


Figure 3.9. - Selecting Port Configuration

All the relevant Ethernet port configuration parameters can be modified using the ***Port Configuration*** window.

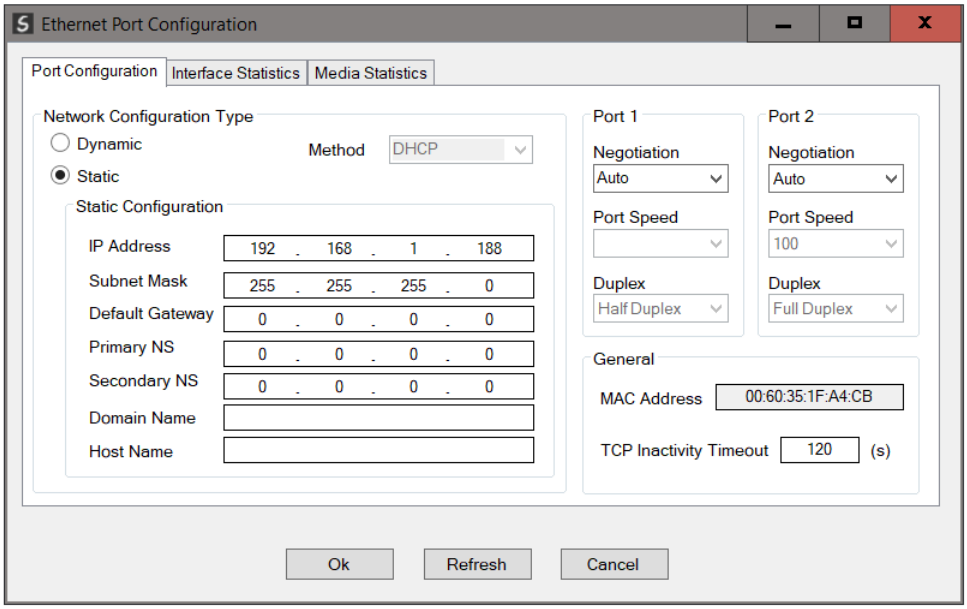


Figure 3.10. - Port Configuration

Alternatively, these parameters can be modified using Rockwell Automation's RSLinx software.

3.3. CREATING A NEW PROJECT

Before the user can configure the module, a new Slate project must be created. Under the ***File*** menu, select ***New***.

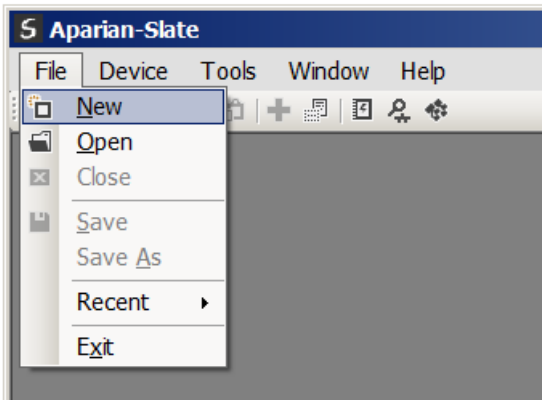


Figure 3.11. - Creating a new project

A Slate project will be created, showing the Project Explorer tree view. To save the project use the ***Save*** option under the ***File*** menu. A new device can now be added by selecting ***Add*** option under the ***Device*** menu.

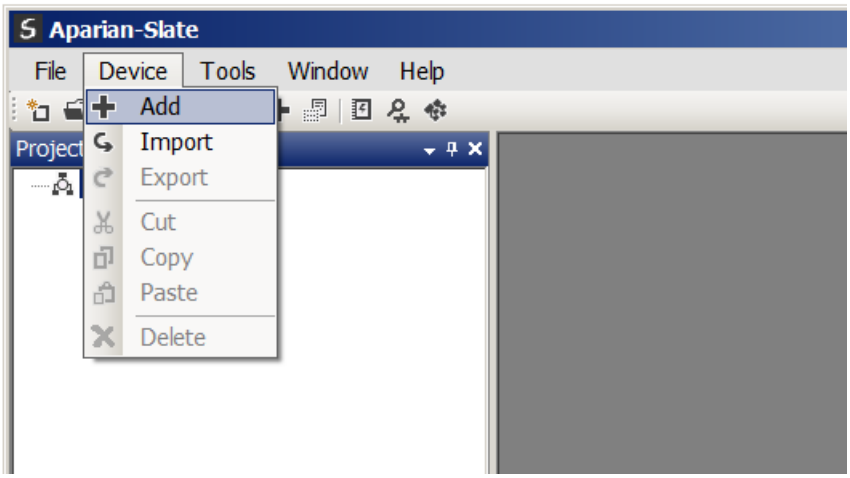


Figure 3.12. - Adding a new device

In the Add New Device window select the ***ControlNet Router***, and click the ***Ok*** button.

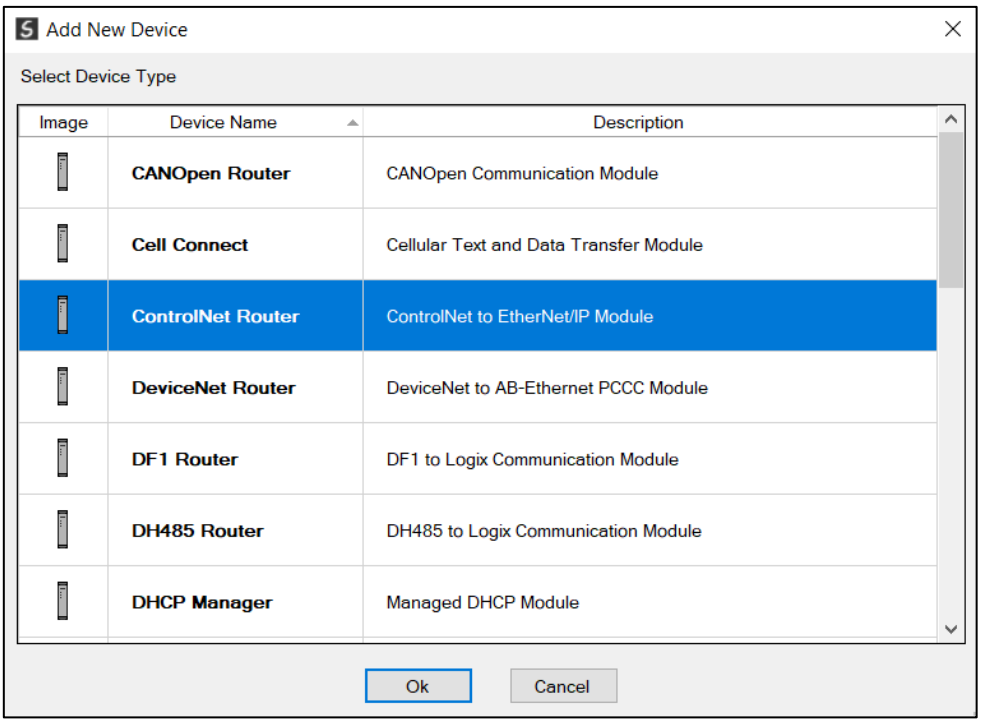


Figure 3.13 – Selecting a new ControlNet Router

The device will appear in the Project Explorer tree as shown below, and its configuration window opened. The device configuration window can be reopened by either double clicking the module in the Project Explorer tree or right clicking the module and selecting ***Configuration***.

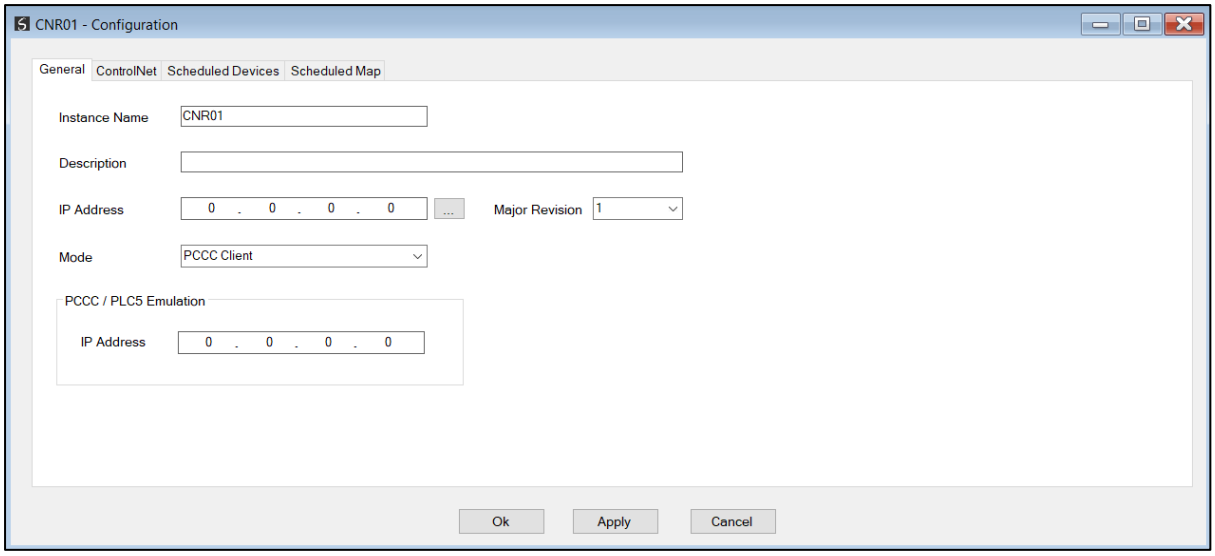


Figure 3.14 - ControlNet Router configuration

3.4. GENERAL PARAMETERS

The ControlNet parameters will be configured by Slate. When downloading this configuration into the module it will be saved in non-volatile memory that persists when the module is powered down.

NOTE: When a firmware upgrade is performed the module will clear all ControlNet and mapping configuration.

The general configuration is shown in the figure below. The ControlNet general configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration***.

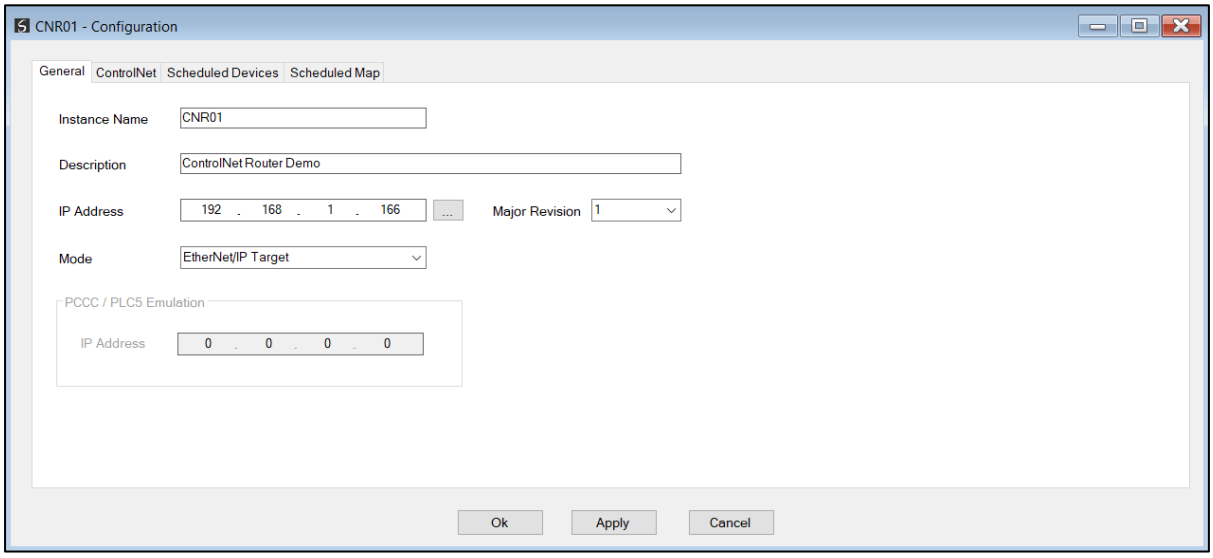


Figure 3.15 - General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various ControlNet Routers.
Description	This parameter is used to provide a more detailed description of the application for the module.
Major Revision	The major revision of the module
IP Address	The IP address of the target module. The user can use the target browse button to launch the target browser to the select the ControlNet Router on the network.
Mode	The user can select one of three modes: **PCCC Client** In this mode the module will allow a device (e.g. PanelView) to exchange data with a Logix controller on ControlNet using File Mapping (e.g. N9). For an example see the section in Scheduled ControlNet for PanelViews read and writing data to a Logix Controller on ControlNet. **EtherNet/IP Target** In this mode the data from the EtherNet/IP class 1 connection output assembly will be mapped in the ControlNet Scheduled connection input assembly and vice versa. **EtherNet/IP Map** In this mode the ControlNet Router will allow the user to Get/Set attributes of EtherNet/IP devices with data from the Scheduled ControlNet connection. In addition to this the module can also use Custom Function CIP requests to send and/or receive data from a target EtherNet/IP device. **EtherNet/IP Originator** In this mode the ControlNet Router will establish a Class 1 connection to an EtherNet/IP device. The input assembly from that device will be available in the ControlNet Router's ControlNet Input assembly, and the ControlNet output assembly of the ControlNet Router will be copied to the EtherNet/IP device's output assembly.
PLC5 Emulation	The IP Address used to emulate a PLC5 controller. This IP address will be seen as the IP address of the PLC5 controller that the ControlNet Router is emulating. Therefore, there will be two IP addresses on the network when in PLC5 Emulation mode. One for the actual target module and one for the emulated PLC5 controller.  **NOTE:** These two IP addresses must **not** be the same.

Table 3.1 - General configuration parameters

The ControlNet configuration is shown in the figure below. The ControlNet configuration window is opened by either double clicking on the module in the tree, or right-clicking the module and selecting ***Configuration***.

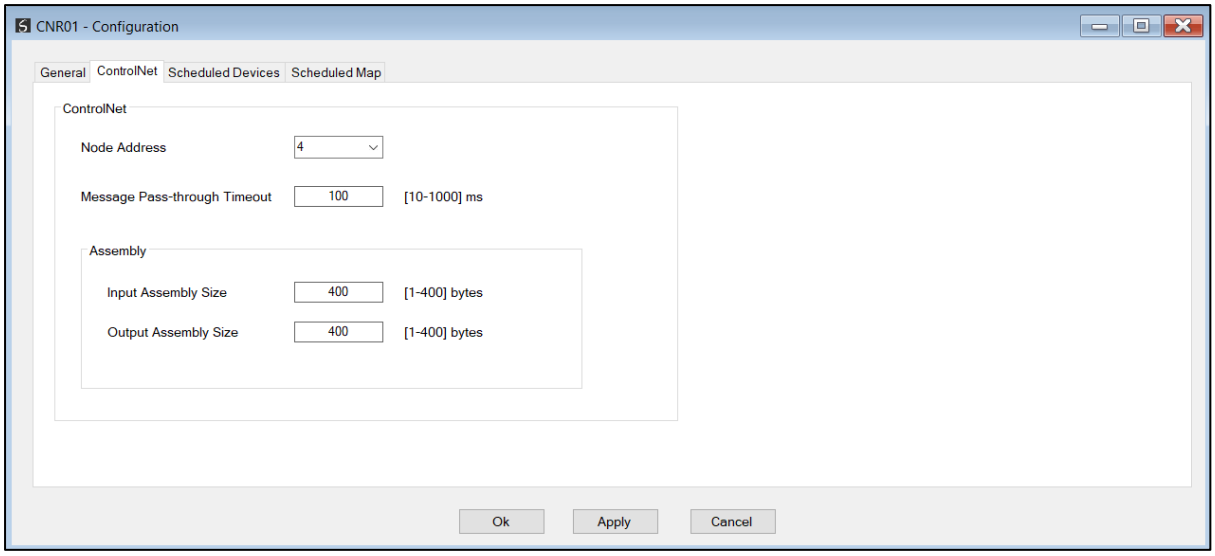


Figure 3.16 - General Configuration

The ControlNet configuration consists of the following parameters:

Parameter	Description
Node Address	This is the node address of the ControlNet Router on the ControlNet network.
Message Pass-Through Timeout	This is the ControlNet message pass-through timeout which specifies how long the ControlNet Router will wait for a response from a ControlNet node before the response will be seen as a failed no-response.
Input Assembly Size	When using Scheduled ControlNet this is the size of the input data (being read from the ControlNet Router) that can be mapped for the PLC5 emulation. See the *Scheduled ControlNet* section.
Output Assembly Size	When using Scheduled ControlNet this is the size of the output data (being sent from the ControlNet Router) that can be mapped for the PLC5 emulation. See the *Scheduled ControlNet* section.

Table 3.2 - General configuration parameters

3.5. SCHEDULED CONTROLNET

3.5.1. LOGIX (CONTROLNET) TO LOGIX (ETHERNET/IP) INTERFACING

When set to *EtherNet/IP Target* mode, the user will have the ControlNet Router connect to a Logix controller via Class 1 EtherNet/IP as well as a Logix controller via Scheduled ControlNet. The data from the EtherNet/IP connection output assembly will be seen in the ControlNet Scheduled connection input assembly and vice versa as shown below.

If the user enters a value in the module ControlNet connection output image (*MappedData* tag), then that data will appear at the same EtherNet/IP connection input image (*MappedData* tag).

If the user enters a value in the module EtherNet/IP connection output image (*MappedData* tag*)*, then that data will appear at the same ControlNet connection input image (*MappedData* tag*)*.

This allows the user to exchange data between a Logix Controller on a legacy ControlNet network and a Logix Controller on an EtherNet/IP network.

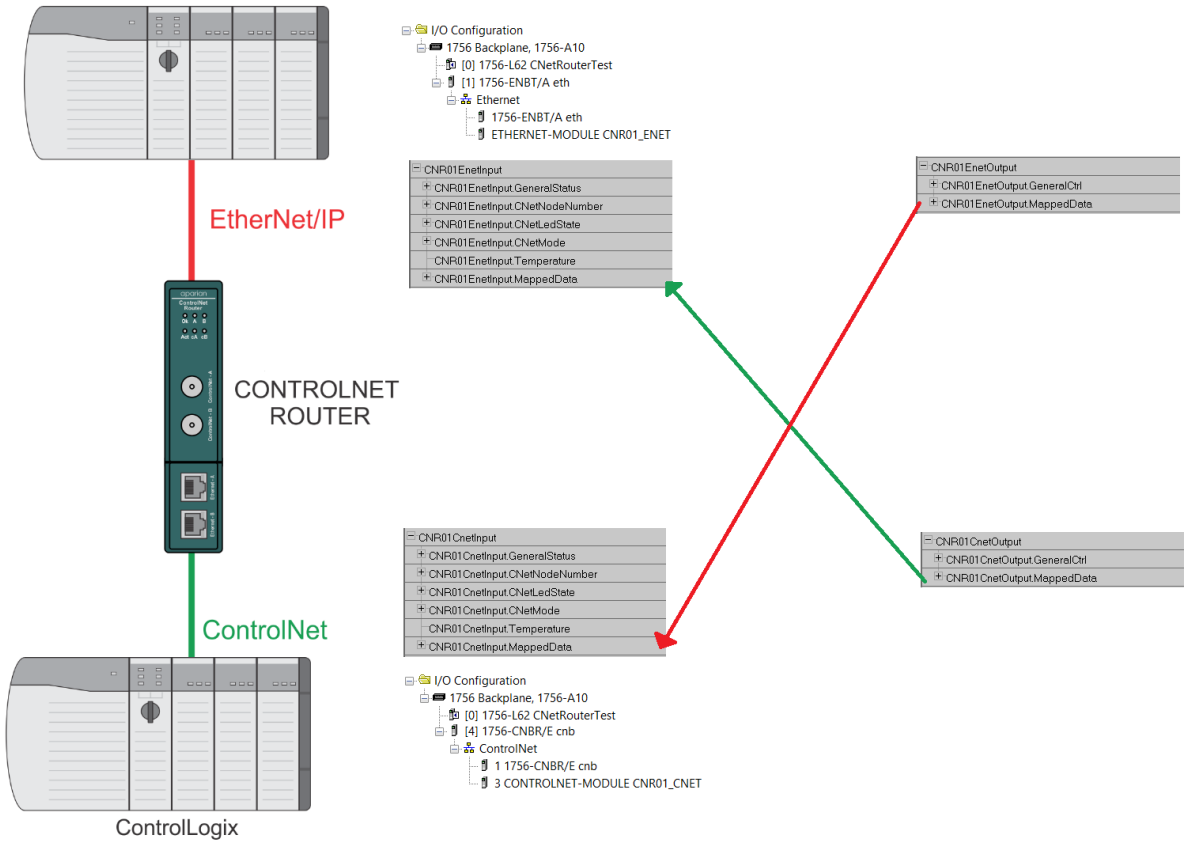


Figure 3.17 – Typical Setup for EtherNet/IP Target Mode

3.5.2. PANELVIEW INTERFACING

The ControlNet Router can exchange data with a PanelView using a Scheduled ControlNet connection. The data being exchanged can then be accessed from a PanelView HMI by using PLC5 emulation.

This ControlNet Router is scheduled using RSNetWorx for ControlNet (see section *ControlNet Configuration – RSNetWorx* for a detailed explanation on how to schedule the ControlNet Router over a ControlNet network).

The data in the *MappedData* tags (see the Logix Operation section) in the Logix input and

output assembly of the ControlNet Router is used by the ControlNet Router to provide PLC5-Type Files that can be accessed from the PanelView by using the PLC5 driver. The sizes configured in Slate for the input and output assemblies will be used to provide the correct size PLC5-Type Files which the PanelView can access (see section *FTView Configuration*).

3.5.2.1. PANELVIEW READING DATA FROM LOGIX

The PanelView will read N9 when accessing integer values from Logix and F10 when accessing floating/real values. The data being written from the Logix Controller to the *MappedData* tag of the Output Assembly UDT will be copied to both file N9 and F10, but in N9 the data is formatted for integers while in F10 the data is formatted for real values. Below is a diagram of the PanelView reading data from the Logix Controller over Scheduled ControlNet using the PLC5 emulation.

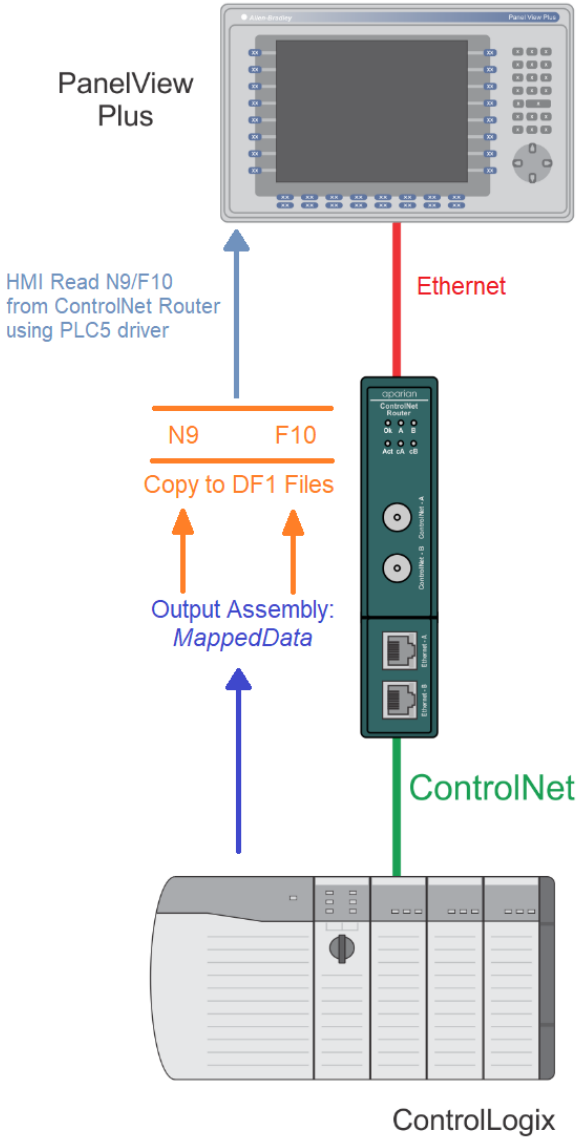


Figure 3.18 – PanelView reading Logix data over Scheduled ControlNet

3.5.2.2. PANELVIEW WRITING DATA TO LOGIX

The PanelView will write to N7 when sending integer values to Logix, and F8 when sending floating/real values. The data being read by the Logix Controller from the *MappedData* tag of the Input Assembly UDT will be copied from both file N7 and F8 respectively, but in N7 the data is formatted for integers, while in F8 the data is formatted for real values. Below is a diagram of the PanelView writing data to the Logix Controller over Scheduled ControlNet using the PLC5 emulation.

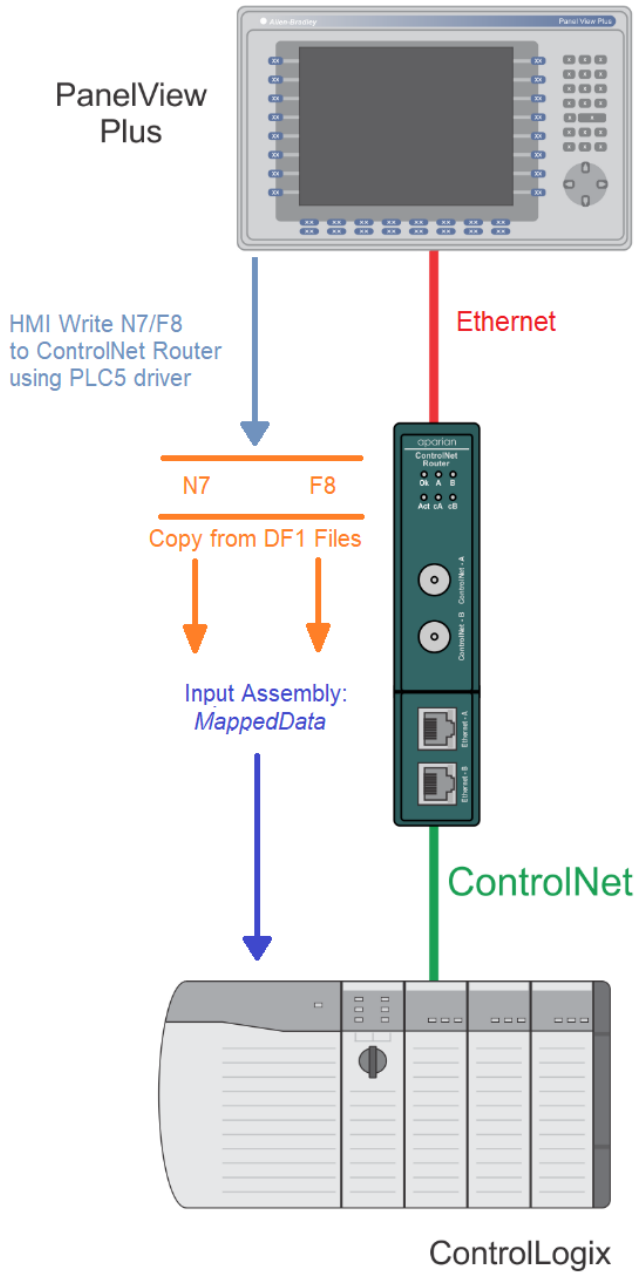


Figure 3.19 – PanelView writing Logix data over Scheduled ControlNet

3.5.2.3. PANELVIEW READING DIAGNOSTIC DATA FROM CONTROLNET ROUTER

The PanelView will read N11 when accessing diagnostics information from the ControlNet Router. See the *Diagnostic Data* section for the format of the diagnostic data. The data will be read similar to the above section where the PanelView will read the Logix data using the PLC5 driver emulation.

3.5.3. SCHEDULED DEVICES

When using *EtherNet/IP Map* mode the user will first need to configure the target EtherNet/IP devices which will be communicated.

A maximum number of 5 EtherNet/IP devices can be added to the device list.

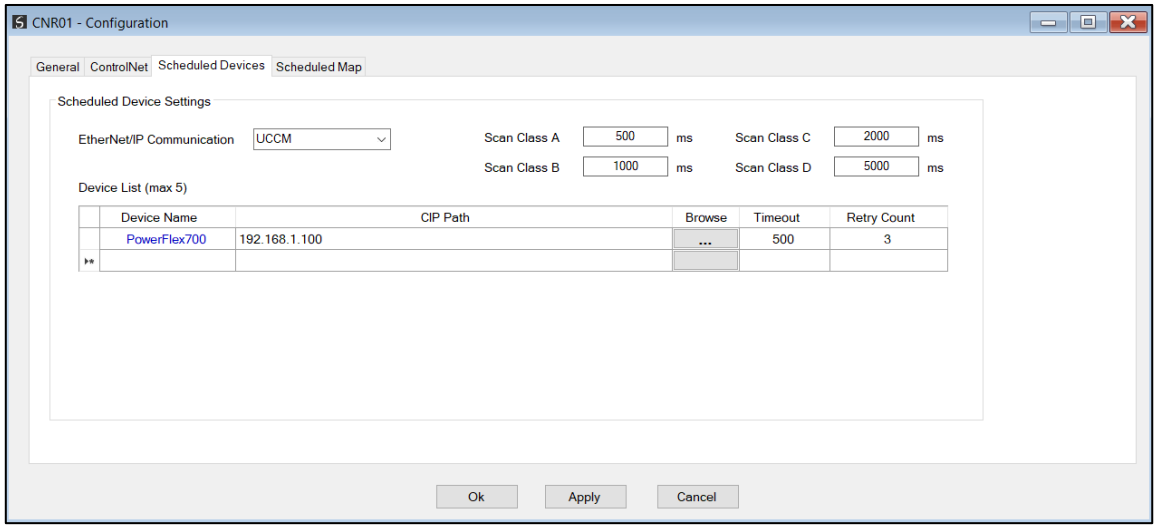


Figure 3.20 – EtherNet/IP devices for EtherNet/IP Map mode

Parameter	Description
EtherNet/IP Communication	The module can use either ***Class 3*** or ***Unconnected Messaging*** when communicating to the target EtherNet/IP device.
Device Name	The user assigned name for the specific device.
CIP Path	The CIP Path to the target device. It can either be entered manually or the user can browse to them by clicking the ***Browse*** button. The Target Browser will open and automatically scan for all available EtherNet/IP devices. If the Ethernet/IP module is a bridge module, it can be expanded by right-clicking on the module and selecting the ***Scan*** option. The required EtherNet/IP device can then be chosen by selecting it and clicking the ***Ok*** button, or by double-clicking on the target module.
Timeout	The amount of time the ControlNet Router module will wait for a response

	from the target EtherNet/IP device.
Retry Count	The number of retires before the target EtherNet/IP device is considered offline.
Scan Class A, B, C, D	The configurable update rates for each mapped item in the Scheduled Map.

Table 3.3 – Scheduled Devices configuration parameters

Next the user will need to configure the mapped items for the EtherNet/IP devices.

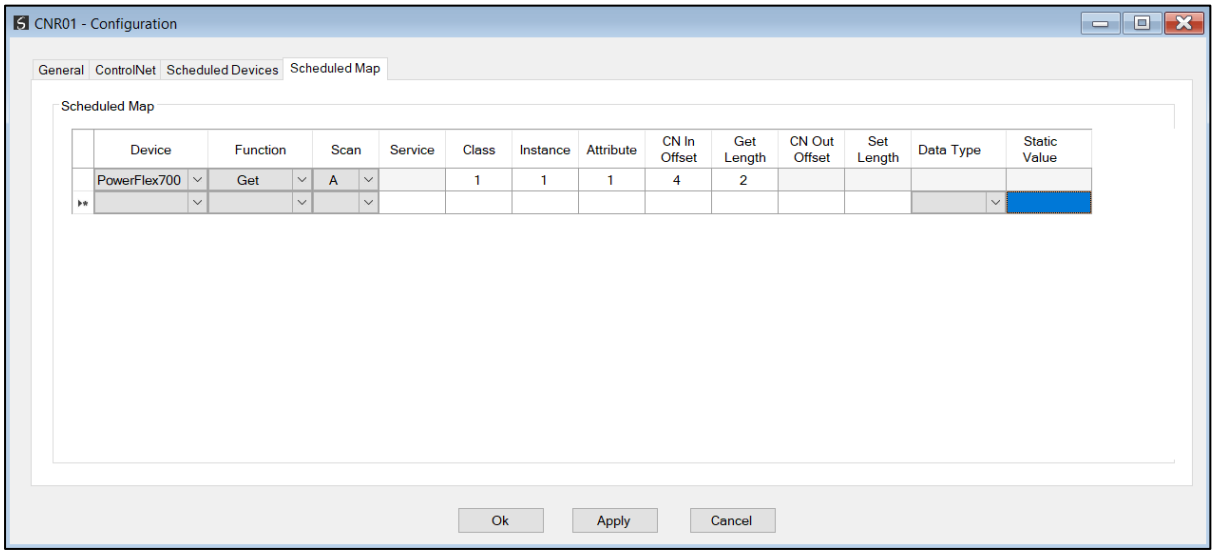


Figure 3.21 – EtherNet/IP mapping items for EtherNet/IP Map mode

Parameter	Description
Device	The device name configured in the previous Scheduled Device Map. The selected device will be used for executing the communication function.
Function	The user can select one of four functions. **Get** The module will read data from the target EtherNet/IP device by using the Get Single Attribute CIP function. The received data will be placed into the Scheduled ControlNet input assembly at the ***CN In Offset*** parameter location in the *MappedData* tag. **Set** The module will write data to the target EtherNet/IP device by using the Set Single Attribute CIP function. The data to be written will be retrieved from the Scheduled ControlNet output assembly at the ***CN Out Offset*** parameter location in the *MappedData* tag. **Set Static** Similar to the Set function above, but the data to be written will be fixed (equal to the *Static Value*) parameter in this configuration window. This function will typically be used with the single Scan class which means the ControlNet Router can be setup to write the fixed value only once when the target device communication has been established.

	Custom This function allows the user to use a custom Service and write and read data in the same transaction. The user will need to see which custom services that target device supports in that device's user manual.
Scan	The user can select Scan Class **A**, **B**, **C** or **D** (which was configured in the Scheduled Devices tab). The specific mapped item will then be executed at that configured scan class rate. The user can also select the **S** class which means that the mapped item will only execute once when communication to the target device is established. If the target device goes offline then the mapped items with this class will be re-armed.
Service	The custom CIP service/function which is only available when the ***Custom*** function has been selected.
Class, Instance, Attribute	The CIP class, instance, and attribute of the request message to be sent.
CN In Offset	The location in the MappedData tag in the Scheduled ControlNet **input** assembly where the received data will be written. This will only be available for ***Get*** and ***Custom*** functions.
Get Length	The length of the data to be received. If the number of bytes received is more than the Get Length, then the data will **not** be written to the **input** assembly. This will only be available for ***Get*** and ***Custom*** functions.
CN Out Offset	The location in the MappedData tag in the Scheduled ControlNet **output** assembly where the data to be written to the target device will be read from. This will only be available for ***Set*** and ***Custom*** functions.
Set Length	The length of the data to be written. This will only be available for ***Set*** and ***Custom*** functions.
Data Type	The data type of the Static Value. This will only be available for ***Set Static*** function.
Static Value	The value to be written to the target device when the ***Set Static*** function has been selected.

Table 3.4 – Scheduled Map configuration parameters

3.5.4. EtherNet/IP Class 1 Device Connections

When using *EtherNet/IP Originator* mode the user will first need to configure the target EtherNet/IP parameters required for the EtherNet/IP class 1 connection.

The data from the EtherNet/IP device's input assembly will be mapped to the *MappedData* tag (see the Logix Operation section) in the Logix input assembly of the ControlNet Router's Scheduled ControlNet connection.

The data from the *MappedData* tag (see the Logix Operation section) in the Logix output assembly of the ControlNet Router's Scheduled ControlNet connection will be send to the EtherNet/IP device's output assembly. Thus, the mapped tags in the ControlNet scheduled connection will have a one to one relationship with that of the EtherNet/IP target device.

NOTE: The user will need to manually enter the connection parameters based on the documentation or information from the EtherNet/IP device manufacturer.

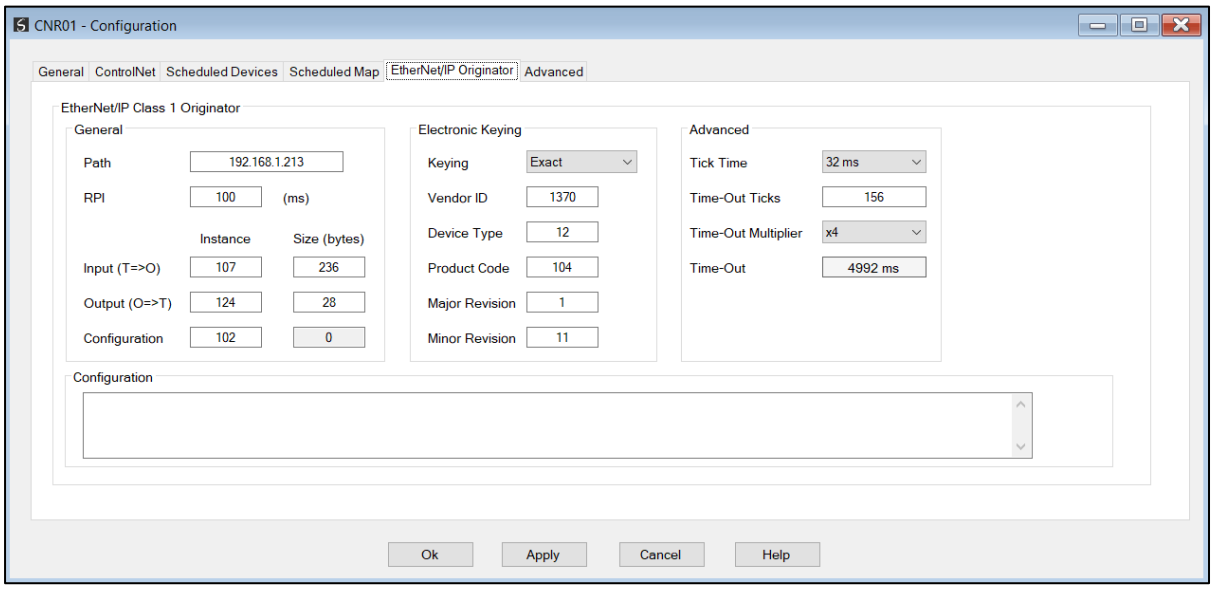


Figure 3.22 – EtherNet/IP Connection parameters for EtherNet/IP Originator mode

Parameter	Description
Path	The user will enter the IP address of the target EtherNet/IP device with which the Class 1 connection must be established.
RPI	The requested packet interval for the cyclic communication between the ControlNet Router and the target EtherNet/IP device.
Input (T -> O)	The parameters for the connection from the EtherNet/IP device to the ControlNet Router (where T -> O is for Target -> Originator). **Instance** The input assembly connection instance. **Size (bytes)** The size of the input connection (i.e. how many bytes are being sent from the EtherNet/IP target device to the ControlNet Router).
Output (O -> T)	The parameters for the connection from the ControlNet Router to the EtherNet/IP device (where O -> T is for Originator -> Target). **Instance** The output assembly connection instance. **Size (bytes)** The size of the output connection (i.e. how many bytes are being sent from the ControlNet Router to the EtherNet/IP target device).
Configuration	The configuration is the data that can be sent to the EtherNet/IP target device as part of the Forward Open connection establishment. **Instance**

	The config data instance. **Size (bytes)** The size of the configuration data is auto generated when the user enters in the config data into the *Configuration* field. The configuration data must be entered as a space separated hex string (e.g. **AB CD ED 00**)
Electronic Keying	The user can enter electronic key for the connection which will allow the target EtherNet/IP device to block the connection if the keying parameter do not match.
Advanced	The advanced settings relate to the time-outs associated with establishing the connection and should not be modified.

Table 3.5 – EtherNet/IP Originator connection parameters

3.6. UNSCHEDULED CONTROLNET

The ControlNet Router can also be used to communicate with a Logix controller over ControlNet using unscheduled communication. This is done by browsing to the target Logix controller in RSLinx Enterprise and selecting it as the target. The user will now have direct access to all the Logix tags via the ControlNet Router (without the need for any PLC5 emulation). See the *FTView Configuration* section for more details regarding the communication path setup.

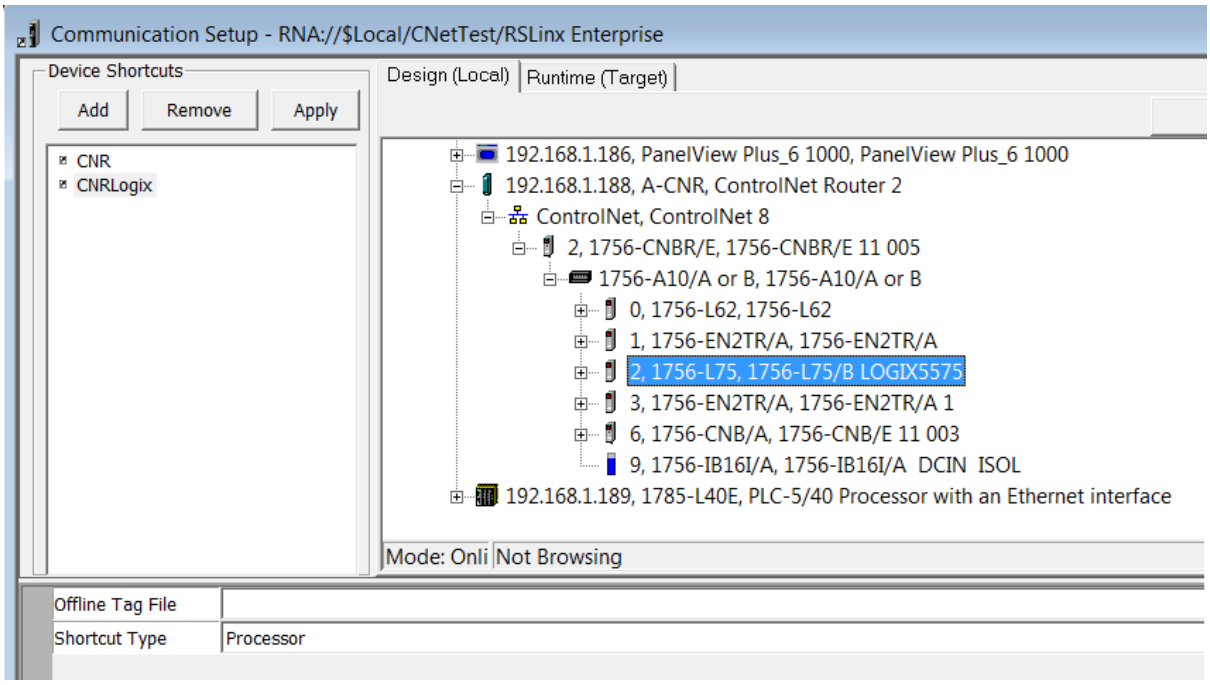


Figure 3.23 - Selecting Connection Path in RSLinx Enterprise

3.7. MODULE DOWNLOAD

Once the ControlNet Router configuration has been completed, it must be downloaded to the module. Before downloading the ***Connection Path*** of the module should be set. This path will automatically default to the IP address of the module, as set in the module configuration. It can however be modified, if the ControlNet Router is not on a local network.

The connection path can be set by right-clicking on the module and selecting the ***Connection Path*** option.

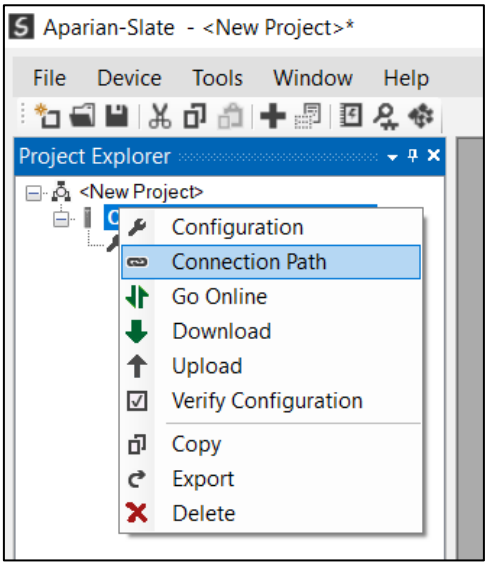


Figure 3.24 - Selecting Connection Path

The new connection path can then be either entered manually or selected by means of the ***Target Browser***.

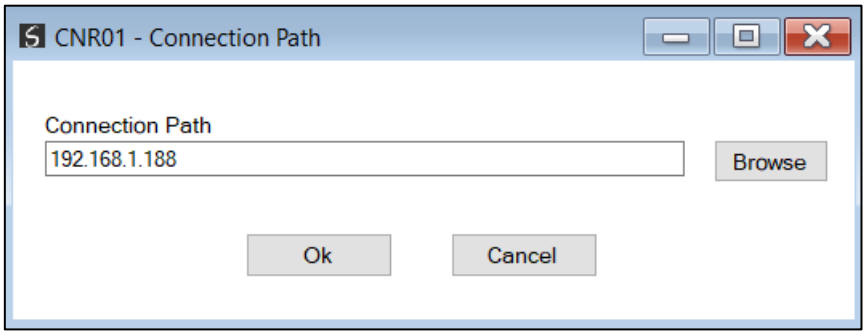


Figure 3.25 - Connection Path

To initiate the download, right-click on the module and select the ***Download*** option.

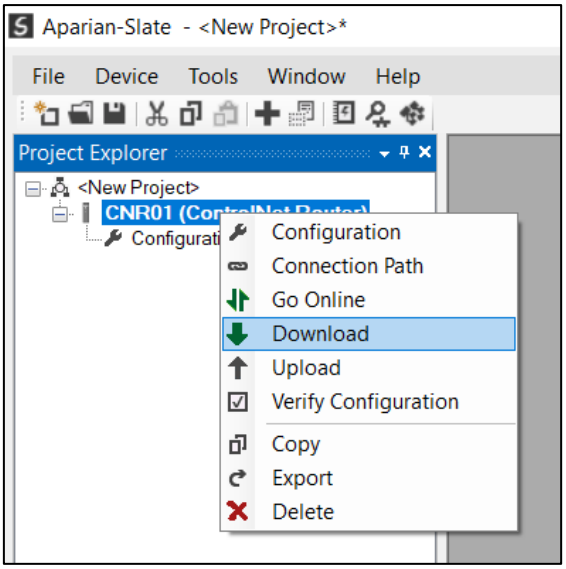


Figure 3.26 - Selecting Download

Once complete, the user will be notified that the download was successful.

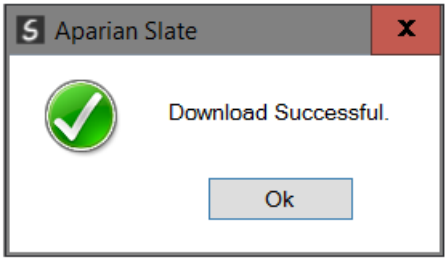


Figure 3.27 - Successful download

Within the Slate environment the module will be in the Online state, indicated by the green circle around the module. The module is now configured and will start operating immediately.

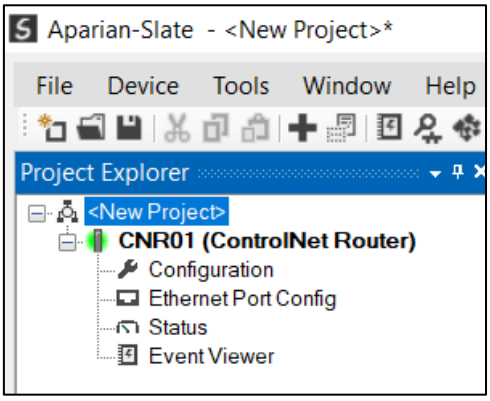


Figure 3.28 - Module online

3.8. LOGIX 5000 CONFIGURATION

3.8.1. ADD MODULE TO CONTROLNET I/O CONFIGURATION (USING SCHEDULED CONTROLNET)

The ControlNet Router can be added to the Logix 5000 I/O tree under a ControlNet bridge (e.g. CN2TR). The module will need to be added as a generic ControlNet module. This is done by right clicking on the ControlNet Bridge in the Logix 5000 and selecting *New Module* after which the *CONTROLNET-MODULE* is selected to be added as shown in the figure below.

NOTE: See the next section for importing the configuration (L5X).

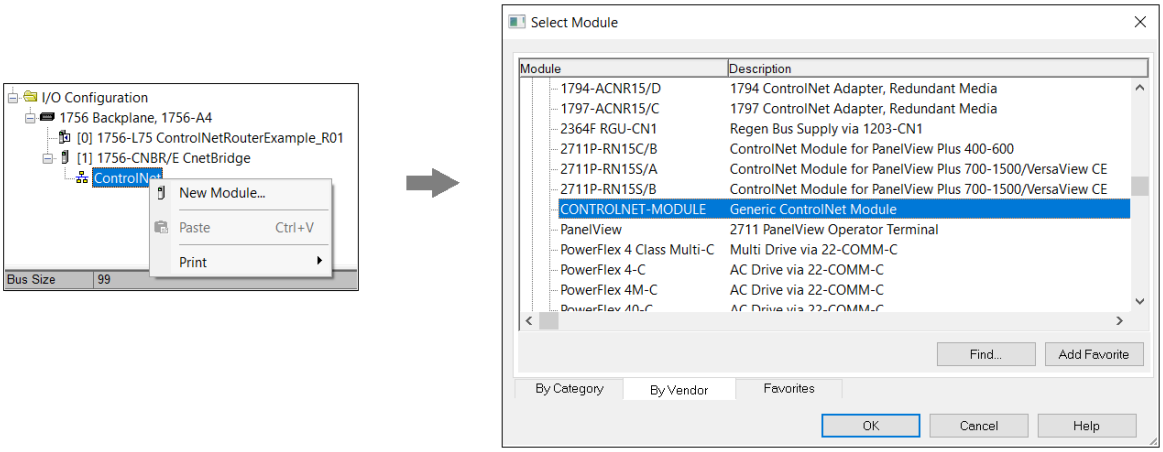


Figure 3.29 - Add a Generic ControlNet Module in Logix 5000

The user must enter the ControlNet node number of the ControlNet Router that will be used. The assembly instance and size must also be added for the input, output, and configuration in the connection parameters section. Below are the required connection parameters.

NOTE: The input and output assembly connection sizes will be dynamic and based on the sizes of the MappedData for the input and output (as shown below).

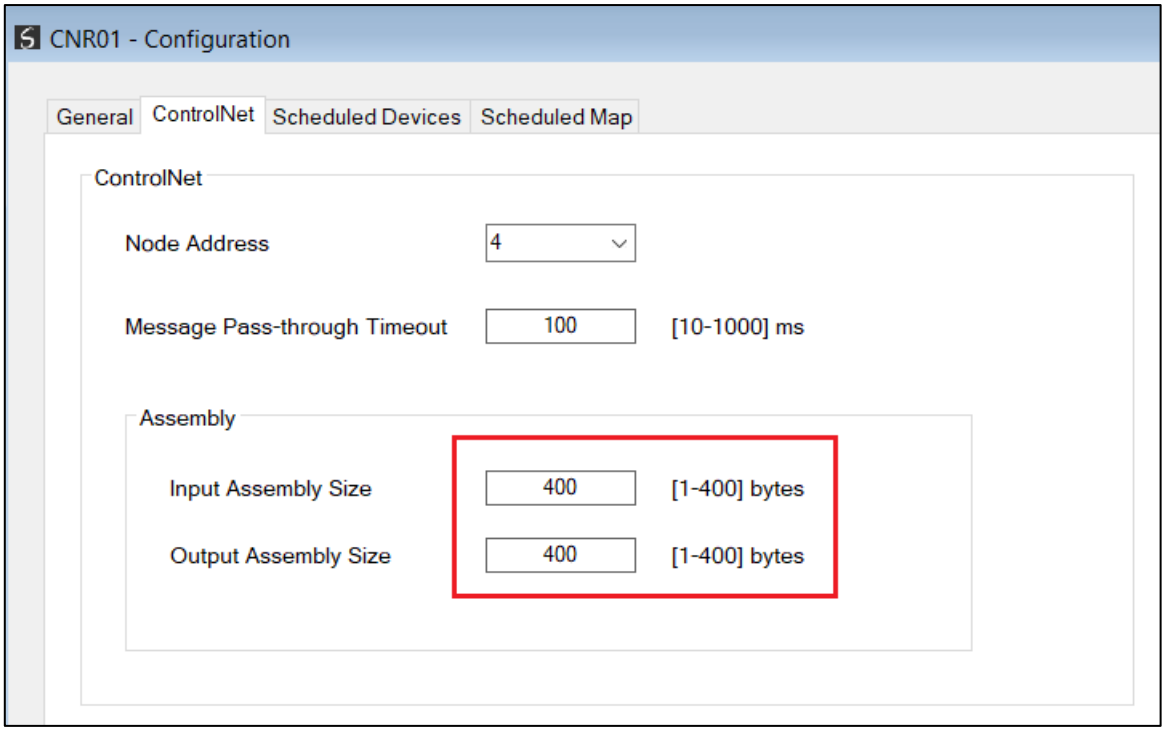


Figure 3.30 – Mapped data for input and output

Connection Parameter	Assembly Instance	Size
Input	130	8 + Input MappedData Size (8-bit) *For example: if the input mapped data is 400 then the input assembly size will be 408.*
Output	131	4 + Output MappedData Size (8-bit) *For example: if the output mapped data is 400 then the output assembly size will be 404.*
Configuration	102	0 (8-bit)

Table 3.6 – ControlNet Logix class 1 connection parameters for the ControlNet Router

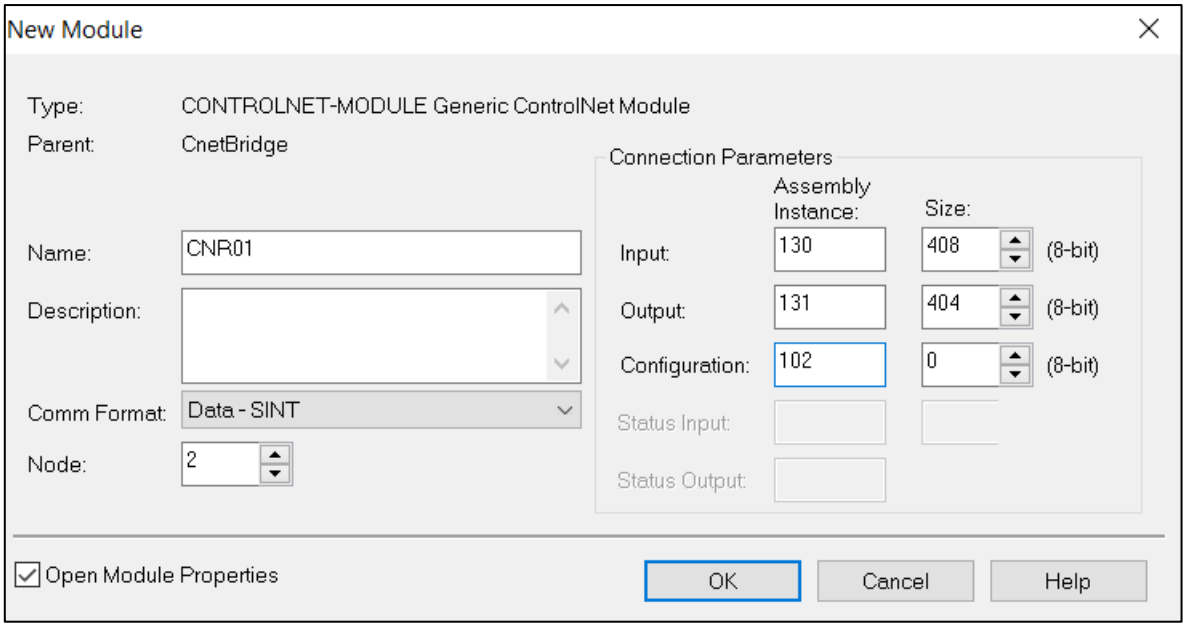


Figure 3.31 - Logix General module properties in Logix 5000

NOTE: The user will need to enter the exact connection parameters before the module will establish a class 1 connection with the Logix controller.

Next the user needs to configure the connection requested packet interval (RPI). This is the rate at which the input and output assemblies are exchanged. The recommended value is 200ms. Refer to the technical specification section in this document for further details on the limits of the RPI.

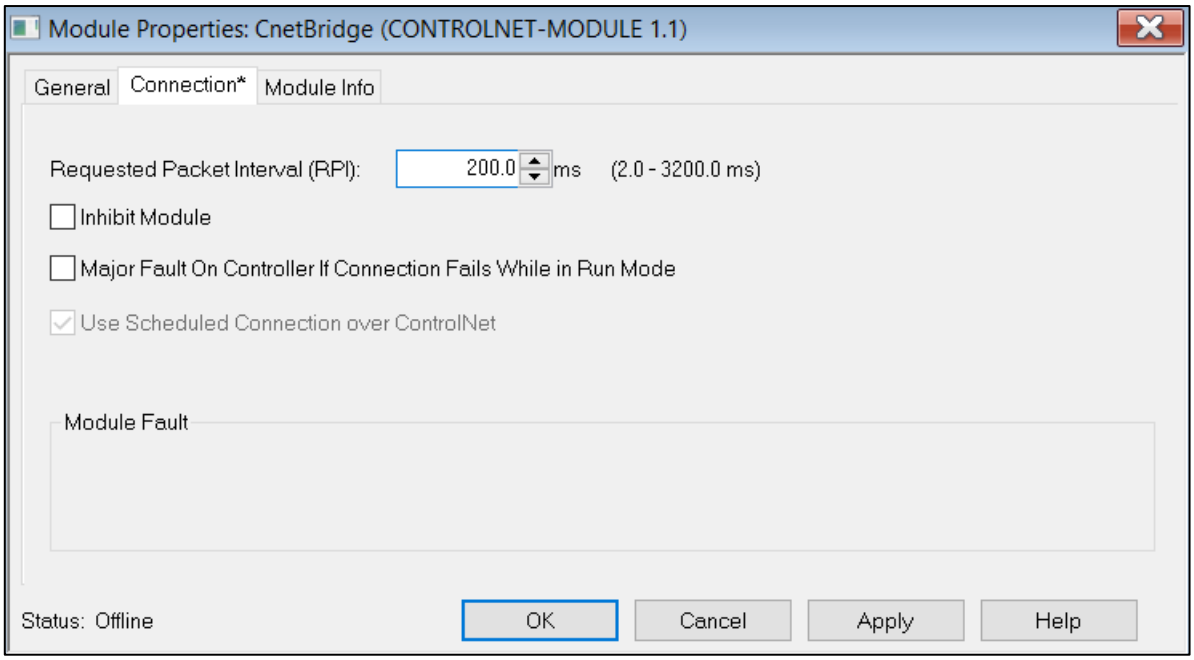


Figure 3.32 - Connection module properties in Logix 5000

Once the module has been added to the Logix 5000 I/O tree the user must assign the User Defined Types (UDTs) to the input and output assemblies. The user can import the required UDTs by right-clicking on *User-Defined* sub-folder in the *Data Types* folder of the IO tree and selecting *Import Data Type*. The assemblies are then assigned to the UDTs with a ladder copy instruction (COP) as shown in the figure below.

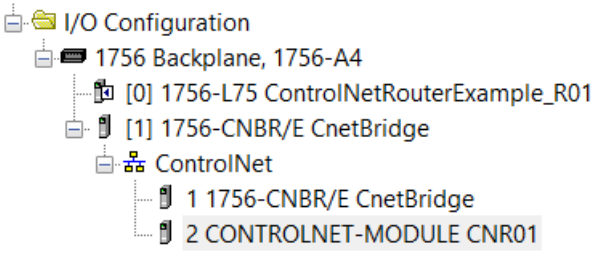


Figure 3.33 – Logix 5000 I/O module tree

NOTE: At this stage the module will not connect to the Logix controller because the connection has not been scheduled. See the *ControlNet Configuration – RSNetworx* section for more details on how to schedule the network.

3.8.2. Add Module to EtherNet/IP I/O Configuration

When operating in *EtherNet/IP Target* mode, the ControlNet Router can be added to the Logix 5000 I/O tree under an Ethernet bridge (e.g. EN2TR). The module will need to be added as a generic Ethernet module. This is done by right clicking on the Ethernet Bridge in the Logix 5000 and selecting *New Module* after which the *ETHERNET-MODULE* is selected to be added as shown in the figure below.

NOTE: See the next section for importing the configuration (L5X).

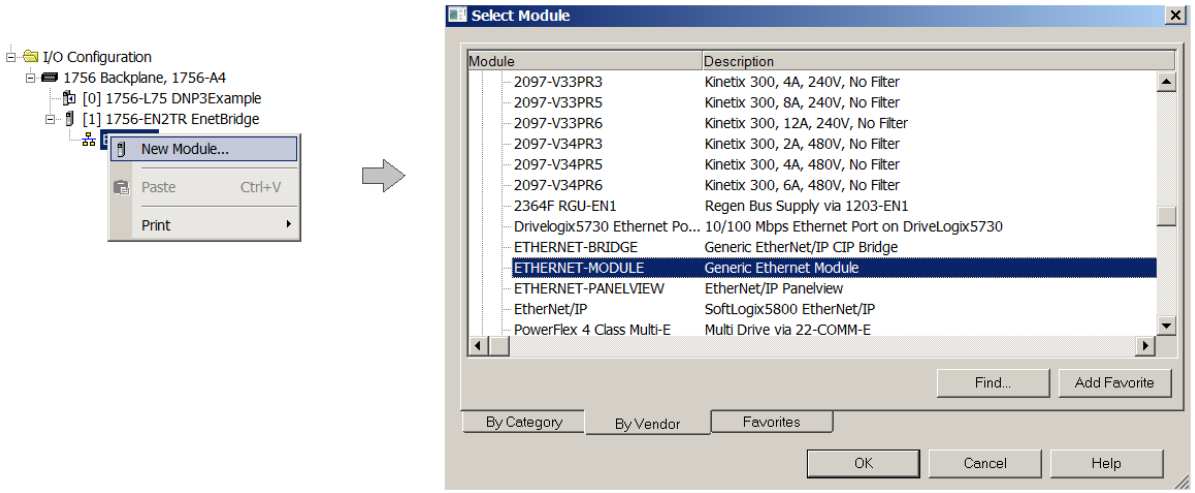


Figure 3.34 - Add a Generic Ethernet Module in Logix 5000

The user must enter the ***IP Address*** of the ControlNet Router that will be used. The assembly instance and size must also be added for the input, output, and configuration in the connection parameters section. Below are the required connection parameters.

Connection Parameter	Assembly Instance	Size
Input	166	408
Output	167	404
Configuration	102	0 (8-bit)

Table 3.7 – EtherNet/IP Logix class 1 connection parameters for the ControlNet Router

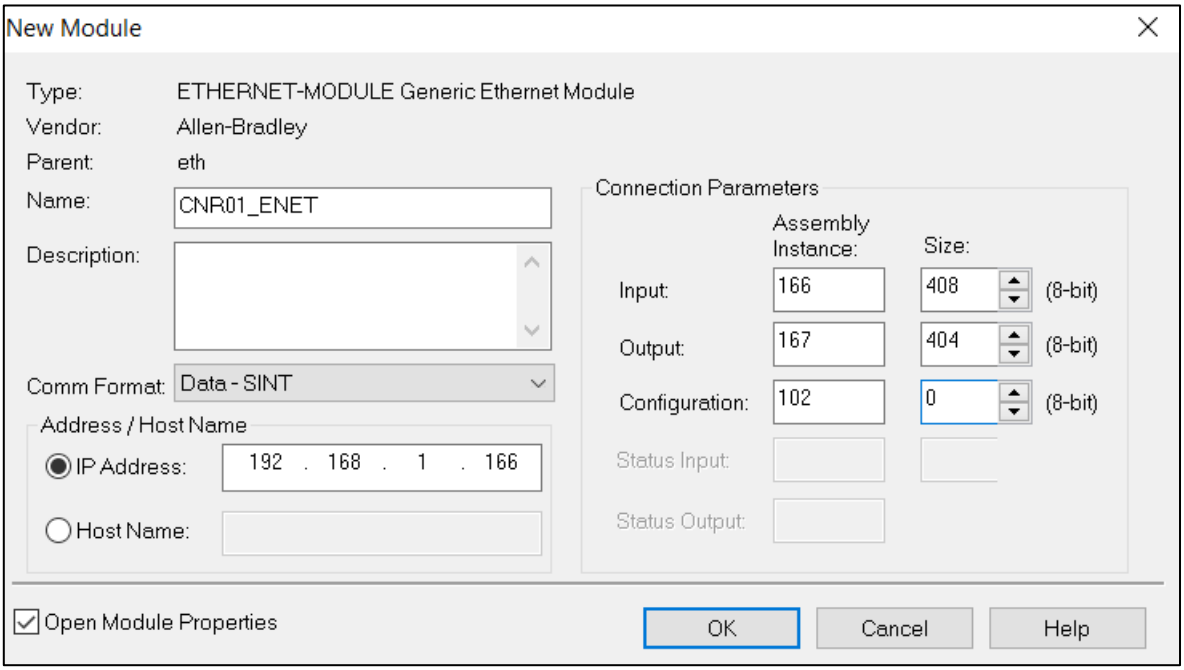


Figure 3.35 - Logix General module properties in Logix 5000

NOTE: The user will need to enter the exact connection parameters before the module will establish a class 1 connection with the Logix controller.

Next the user needs to configure the connection requested packet interval (RPI). This is the rate at which the input and output assemblies are exchanged. The recommended value is 200ms. Refer to the technical specification section in this document for further details on the limits of the RPI.

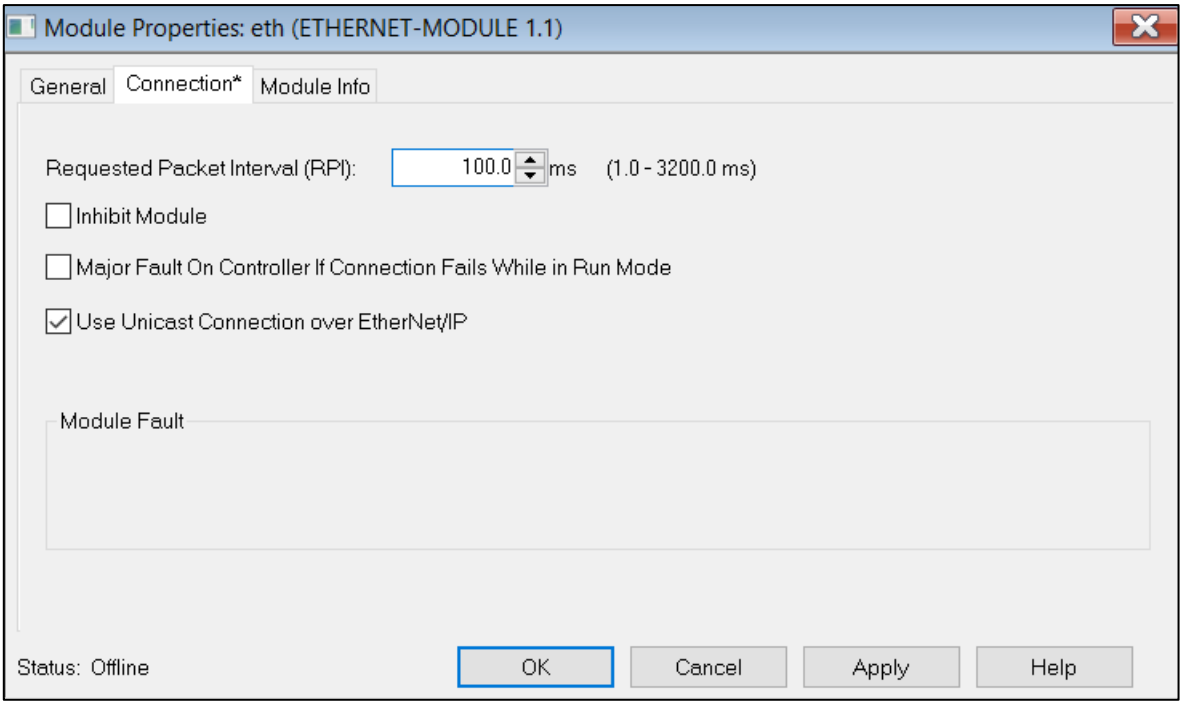


Figure 3.36 - Connection module properties in Logix 5000

Once the module has been added to the Logix 5000 I/O tree the user must assign the User Defined Types (UDTs) to the input and output assemblies. The user can import the required UDTs by right-clicking on ***User-Defined*** sub-folder in the ***Data Types*** folder of the IO tree and selecting ***Import Data Type***. The assemblies are then assigned to the UDTs with a ladder copy instruction (COP) as shown in the figure below.

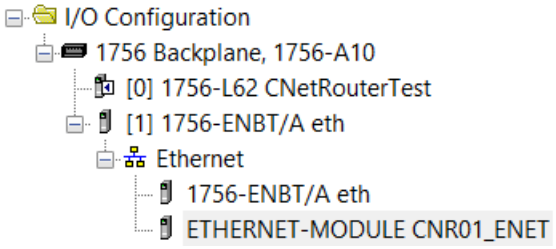


Figure 3.37 – Logix 5000 I/O module tree

3.8.3. Importing UDTs and Mapping Routines

To simplify the mapping of the input image, a Logix 5000 Routine Partial Import (L5X) file is provided. This file can be imported by right-clicking on the required Program and selecting the Import Routine option.

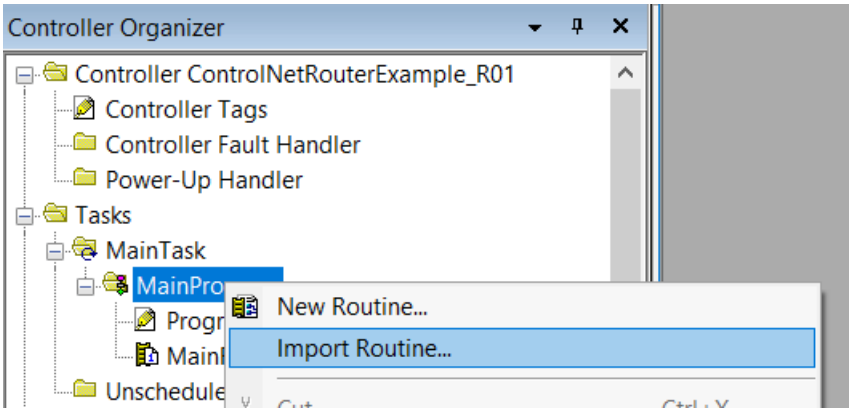


Figure 3.38 – Logix 5000 Importing ControlNet Router specific routine and UDTs

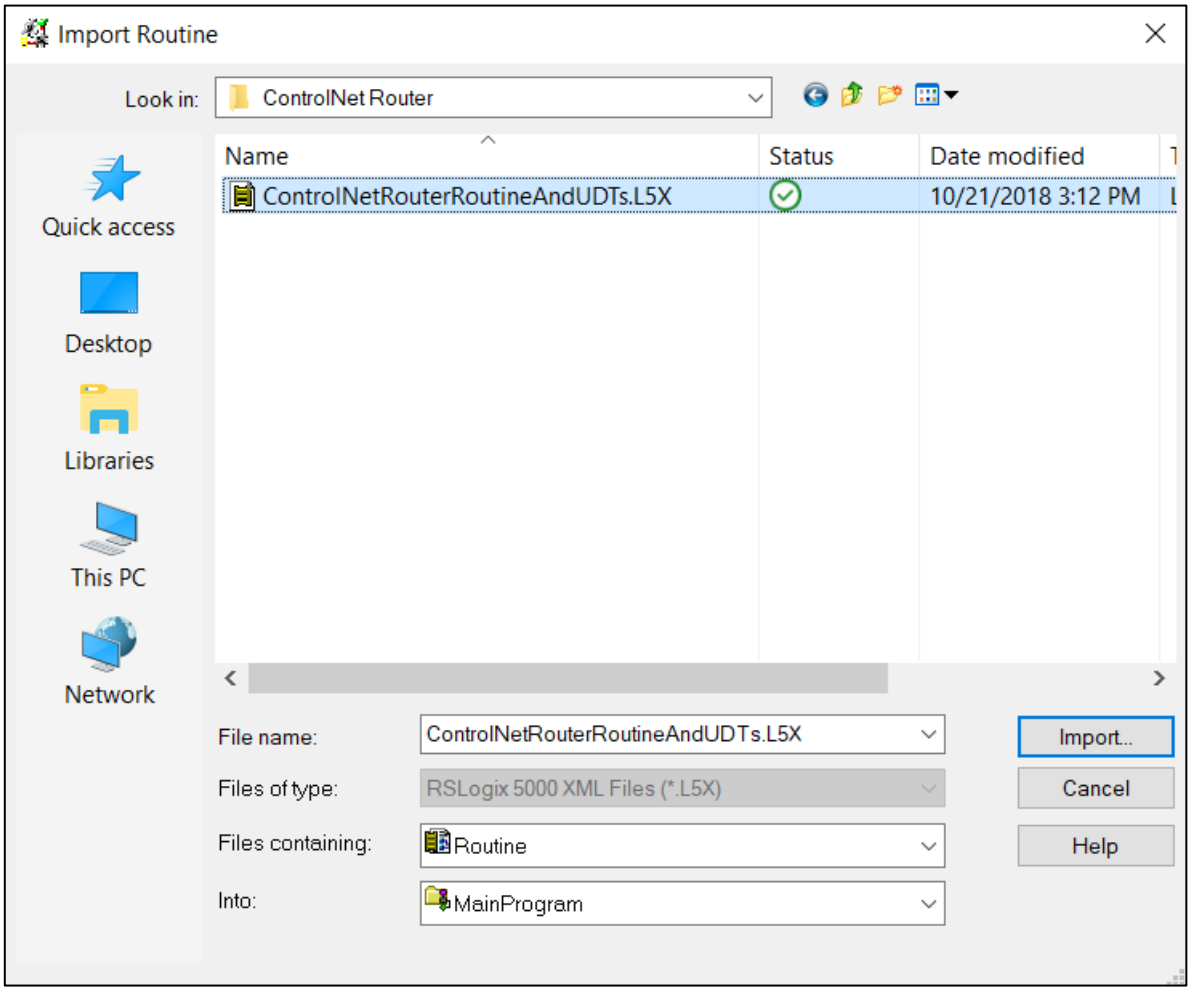


Figure 3.39 - Selecting partial import file

The import will create the following:

- The required UDTs (user defined data types)
- Two controller tags representing the Input and Output assemblies.
- A routine mapping the ControlNet Router module to the aforementioned tags.

The user may need to change the routine to map to the correct ControlNet Router module instance name, and make sure that the mapping routine is called by the Program's Main Routine.

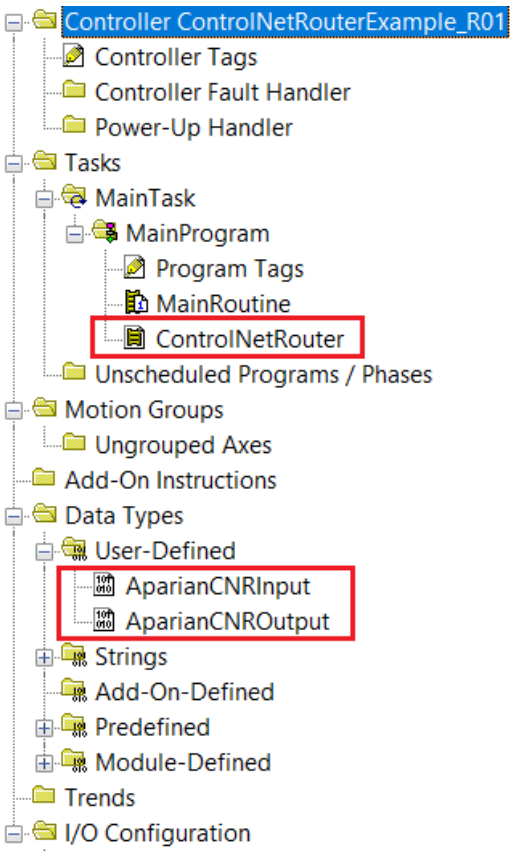


Figure 3.40 - Imported Logix 5000 objects

Refer to the additional information section of this document for an example Logix 5000 project as well as the required UDTs.

4. CONTROLNET CONFIGURATION – RSNETWORX

The ControlNet IO messaging scheduling is typically configured using ***RSNetworx for ControlNet*** and is required when using the PLC5 Emulation mode.

Open RSNetWorx, create a new project and browse to the ControlNet network.

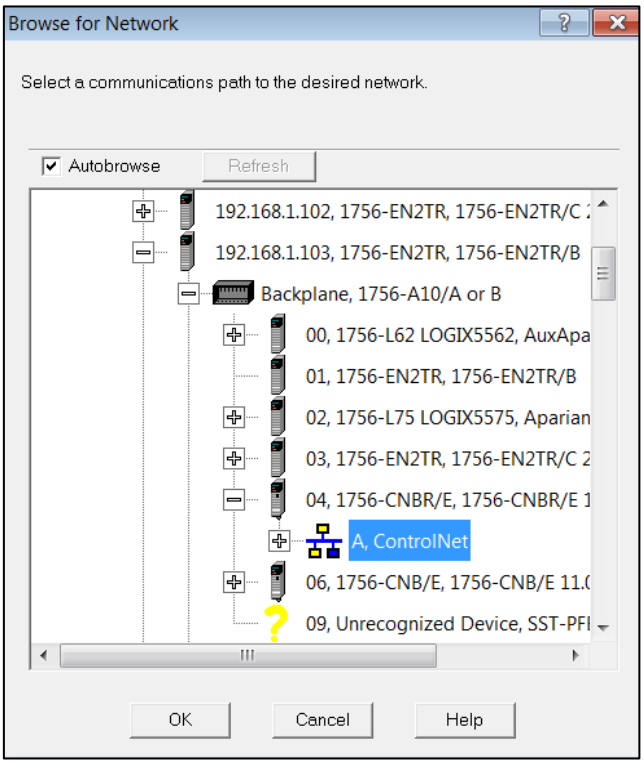


Figure 4.1 – RSNetWorx browse for ControlNet network

Click the online button and the software will scan the network for all the devices. Additional devices can be added (offline) if required.

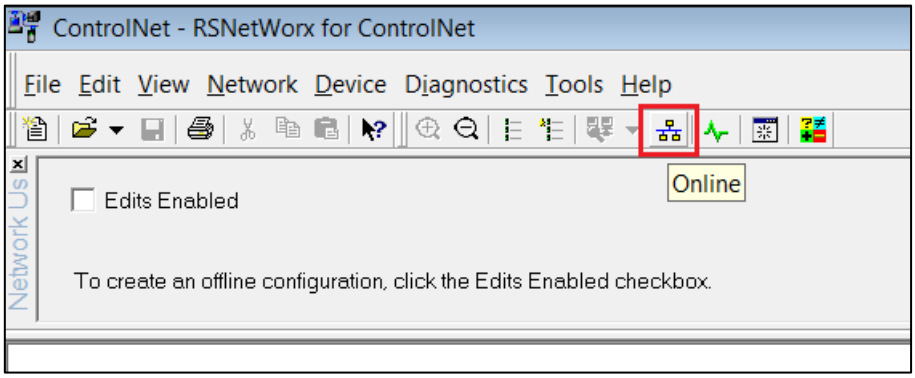


Figure 4.2 – RSNetWorx for ControlNet Online

NOTE: The EDS file of the ControlNet Router will need to be installed to schedule the ControlNet network. The EDS file can be either manually installed or uploaded from the module in RSLinx (as shown below).

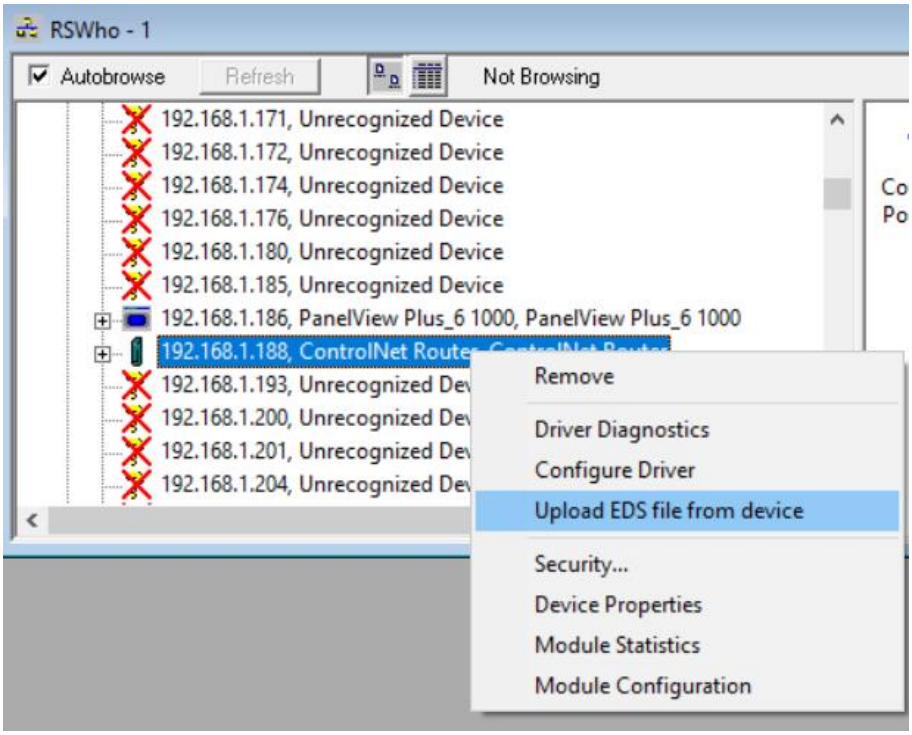


Figure 4.3 – RSLinx EDS upload

Once the scan is completed the online devices will be displayed.

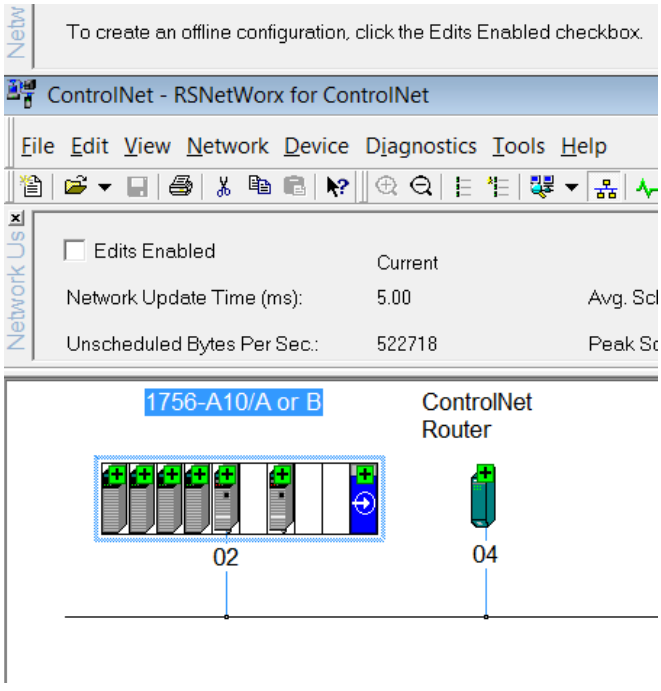


Figure 4.4 – RSNetWorx found devices on the ControlNet network

The user can then make changes (e.g. Redundant ControlNet selected, Max scan address, etc.) to the ControlNet network by pressing the edit button.

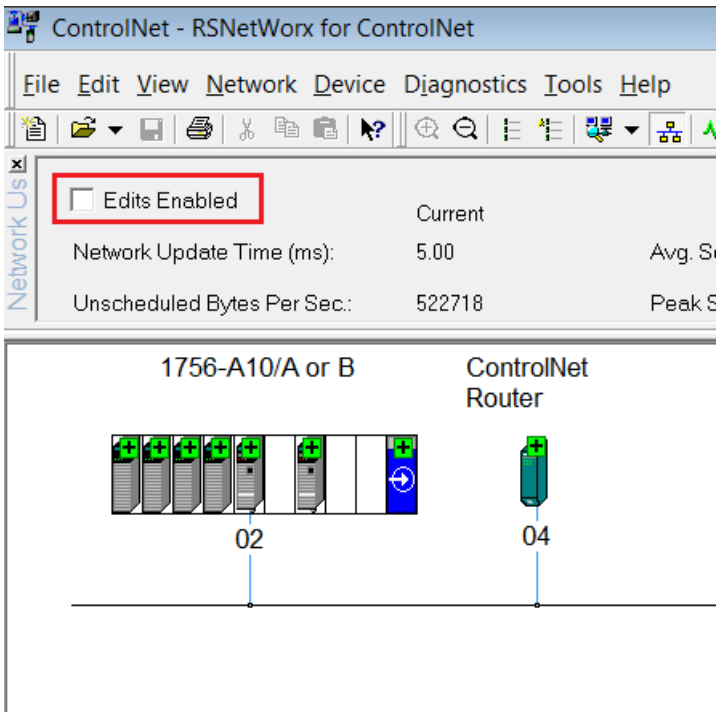


Figure 4.5 – RSNetWorx network edits.

Once done the user must download the ControlNet network configuration to the network by right-clicking on the background and selecting *Download to Network*.

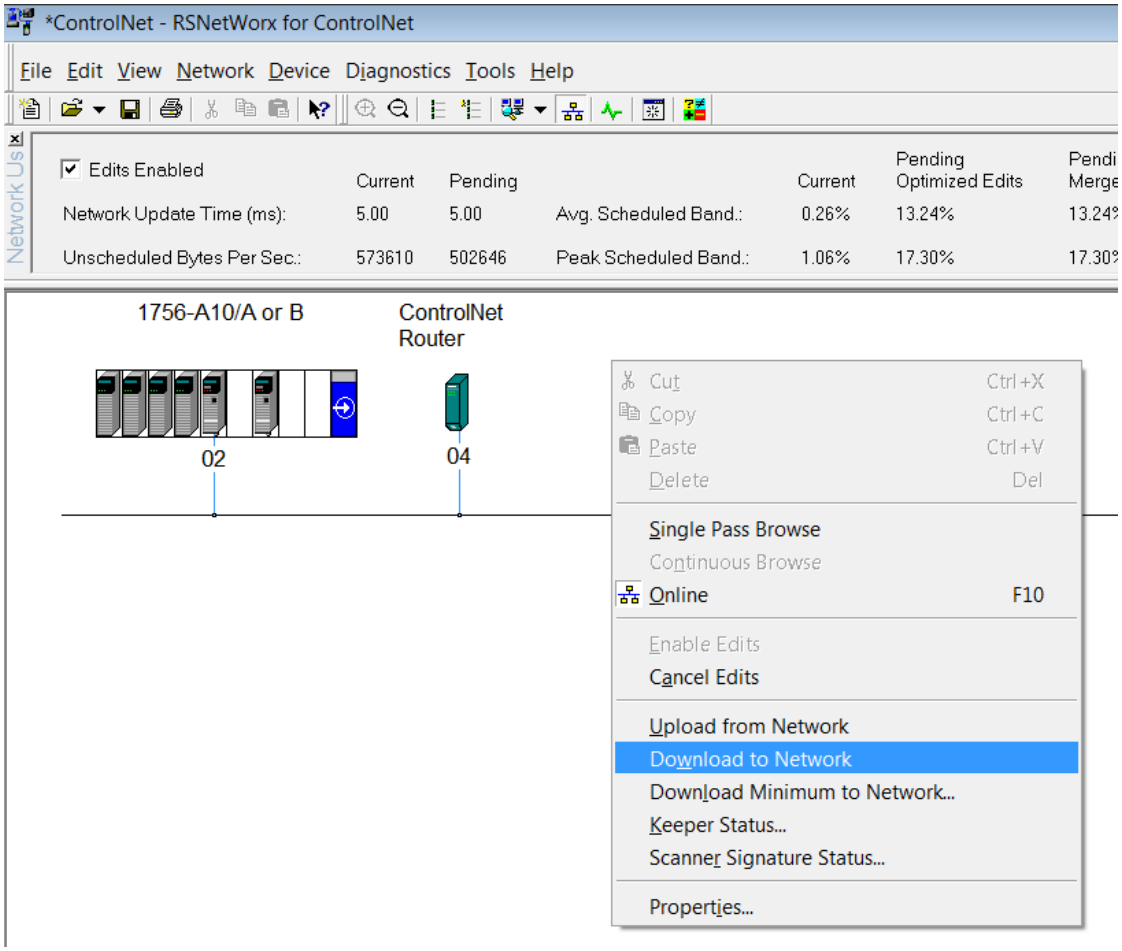


Figure 4.6 – RSNetWorx download

Once this is done the ControlNet Router will connect to the Logix controller over the scheduled ControlNet network (see below):

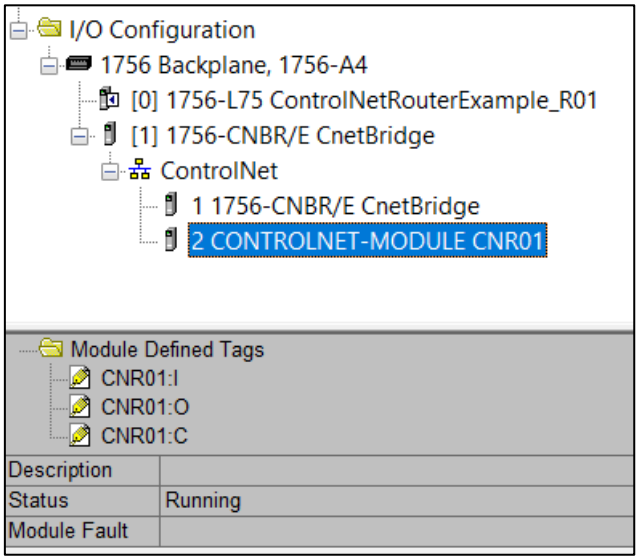


Figure 4.7 – ControlNet Router connected over Scheduled ControlNet

5. FTVIEW CONFIGURATION

The ControlNet Router can be interfaced directly to FTView using PCCC (PLC5 Ethernet emulation) or Unscheduled ControlNet. This is illustrated in the following examples where a PanelView is configured to read data from the ControlNet Router.

Using FTView Studio (Machine Edition) create a new project.

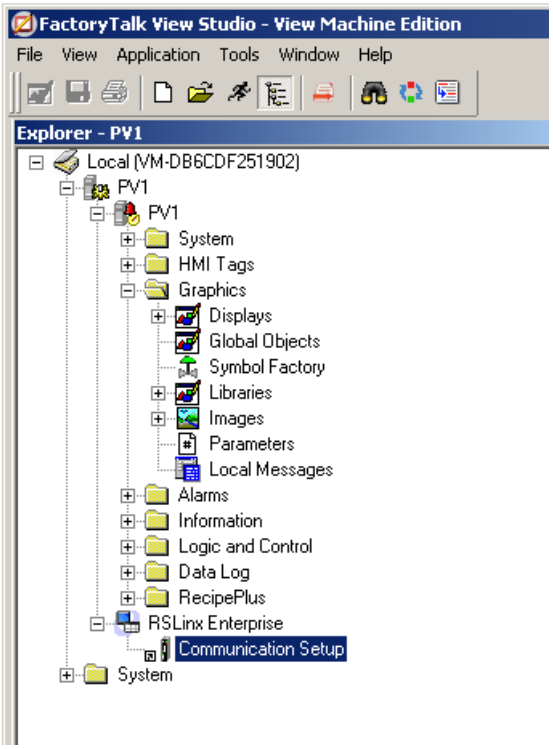


Figure 5.1 - FTView project

5.1. COMMUNICATION – SCHEDULED CONTROLNET

To configure the communication link to the ControlNet Router (when using Scheduled ControlNet), select the ***Communication Setup*** under the ***RSLinx Enterprise*** section. If the RSLinx Enterprise heading does not appear, then it should be added by right-clicking on the project and selecting ***Add New Server***.

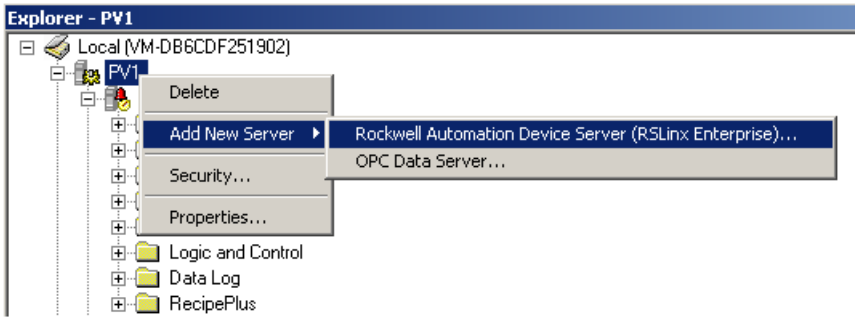


Figure 5.2 – Adding RSLinx Enterprise Server

The ***Communication Setup*** dialog will open. Under the ***Device Shortcuts*** group box, click on the ***Add*** button to create a new shortcut. Rename the shortcut as required. In this example the shortcut is renamed to "CNR".

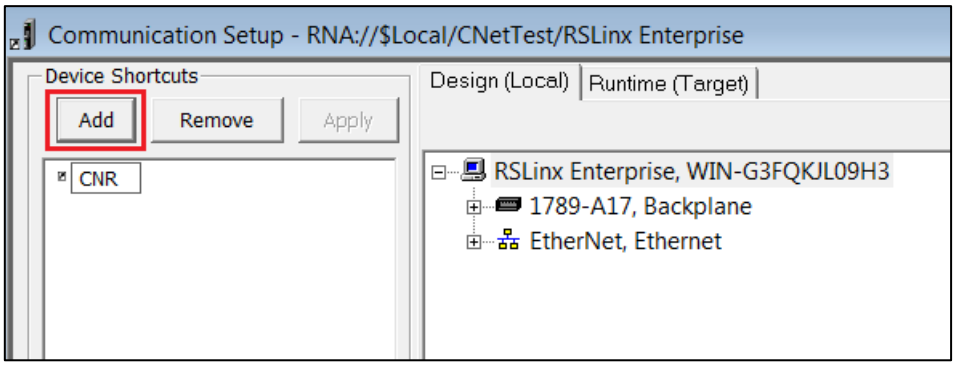


Figure 5.3 – Adding Device Shortcut

With the newly created device shortcut selected, right-click on the ***Ethernet*** network and select the ***Add Device*** option.

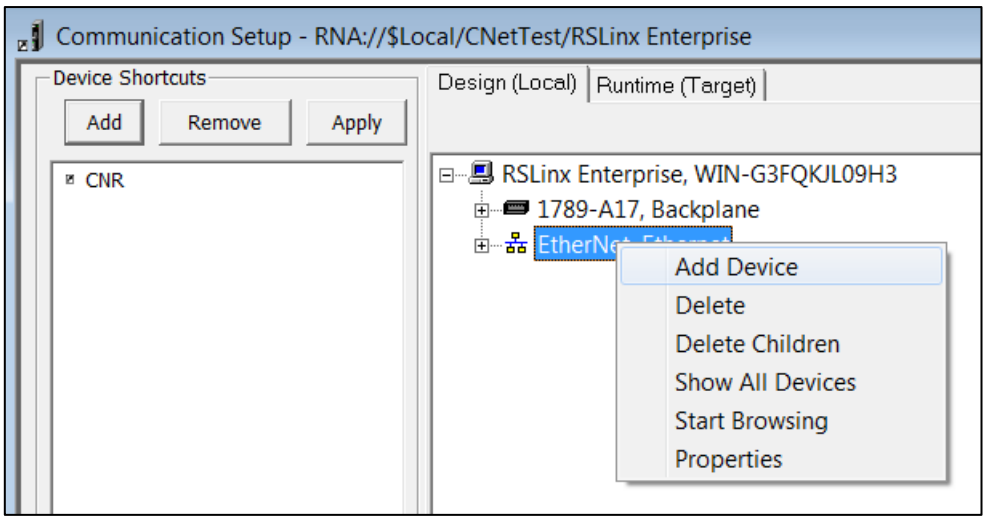


Figure 5.4 – Adding Ethernet Device

The ***Add Device*** dialog will open. Under the ***Ethernet PLC devices*** section, select the ***1785-L40E PLC-5/40 Processor with an Ethernet interface*** option.

NOTE: The ControlNet Router supports a PLC5 emulation mode, allowing it to be accessible by RSLinx Enterprise.

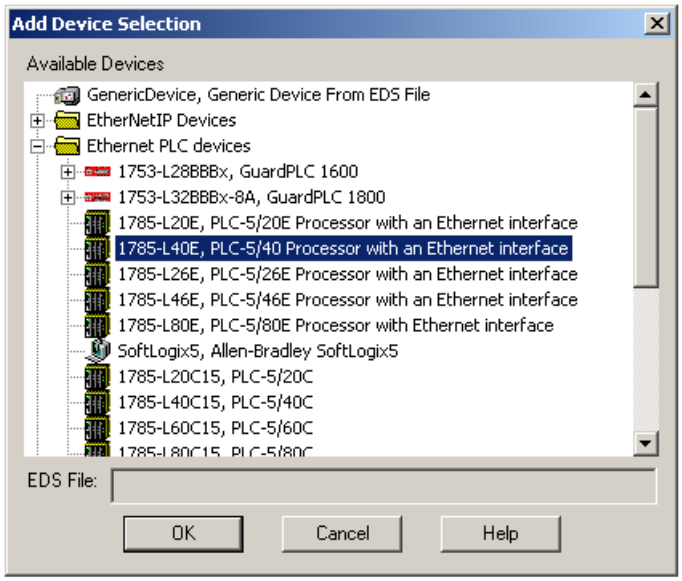


Figure 5.5 – Ethernet Device Selection

In the ***Device Properties*** page, enter the ControlNet Router's IP address, and then click on the Ok button.

NOTE: The user will need to enter the PLC5 emulation IP address for the PLC5 shown below, and **not** the ControlNet Router's primary (EtherNet/IP) IP address.

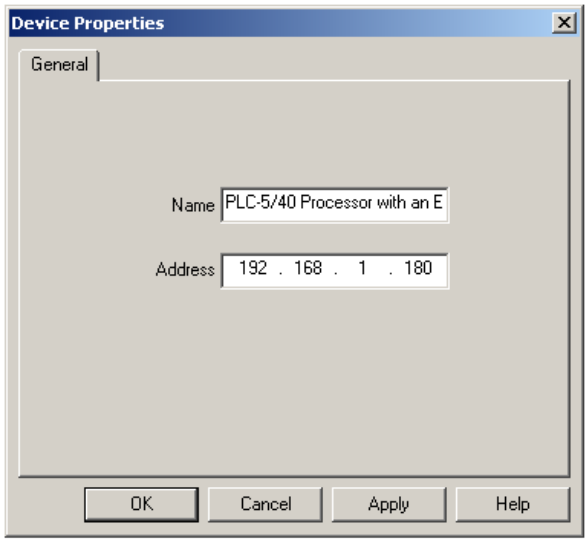


Figure 5.6 – Device Properties

At the top of the ***Communication Setup*** dialog, select the ***Copy from Design to Runtime*** button. As the name implies, this copies the configuration to be used by the PanelView at runtime. Select the ***Ok*** button to close the ***Communication Setup*** dialog.

5.2. COMMUNICATION – UNSCHEDULED CONTROLNET

To configure the communication link to the ControlNet Router (when using Unscheduled ControlNet), select the ***Communication Setup*** under the ***RSLinx Enterprise*** section. If the RSLinx Enterprise heading does not appear, then it should be added by right-clicking on the project and selecting ***Add New Server***.

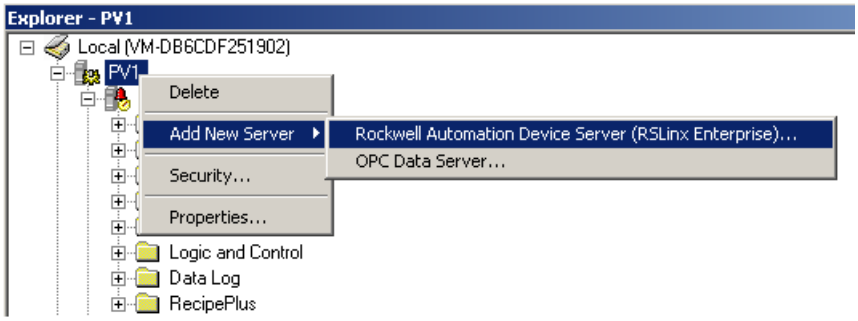


Figure 5.7 – Adding RSLinx Enterprise Server

The ***Communication Setup*** dialog will open. Under the ***Device Shortcuts*** group box, click on the ***Add*** button to create a new shortcut. Rename the shortcut as required. In this example the shortcut is renamed to "CNRLogix". Next browse to the Logix Controller using the ControlNet Router and select it.

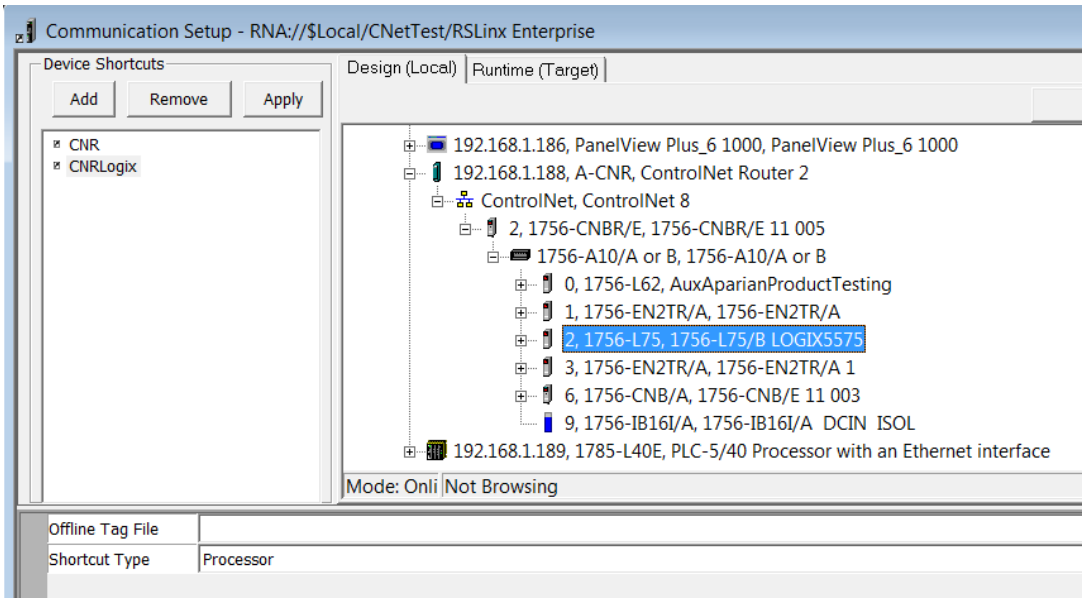


Figure 5.8 – Adding RSLinx Enterprise Server

5.3. ANIMATION

Once the communication has been correctly configured, objects can be linked to the ControlNet Router data points. Create a new graphic Display by right-clicking on the ***Display*** item, under the ***Graphics*** section.

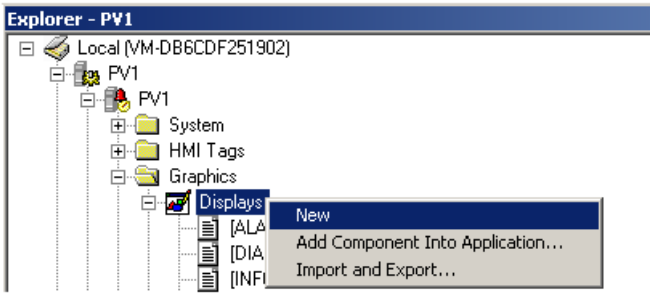


Figure 5.9 – Adding a Graphical Display

A blank Display dialog will be created. To display a number, select the ***Numeric Display*** object, from either the toolbar or from the ***Numeric and String*** menu, located under in ***Objects*** menu.

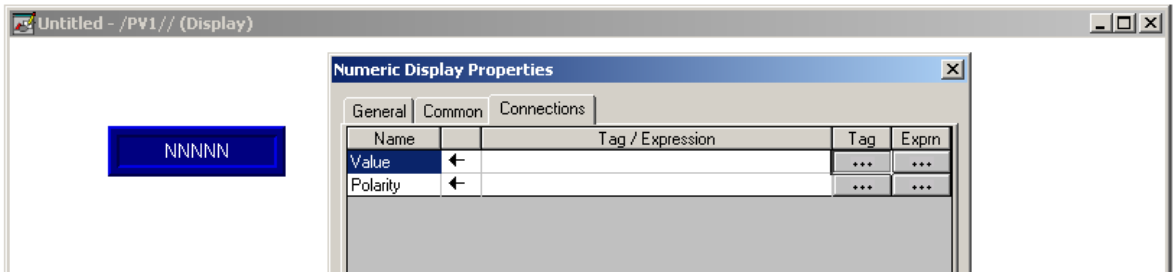


Figure 5.10 – Numeric Display Connections

The Numeric Display can now be linked to a ControlNet Router data point using the ***Connections*** tab. Select the ***Tag*** (…) button adjacent to the ***Value*** item. The FTView Tag Browser dialog will open. To view all the available data points, select the ***Refresh All Folders*** button.

NOTE: The ControlNet Router must be online for the tag browsing option to work.

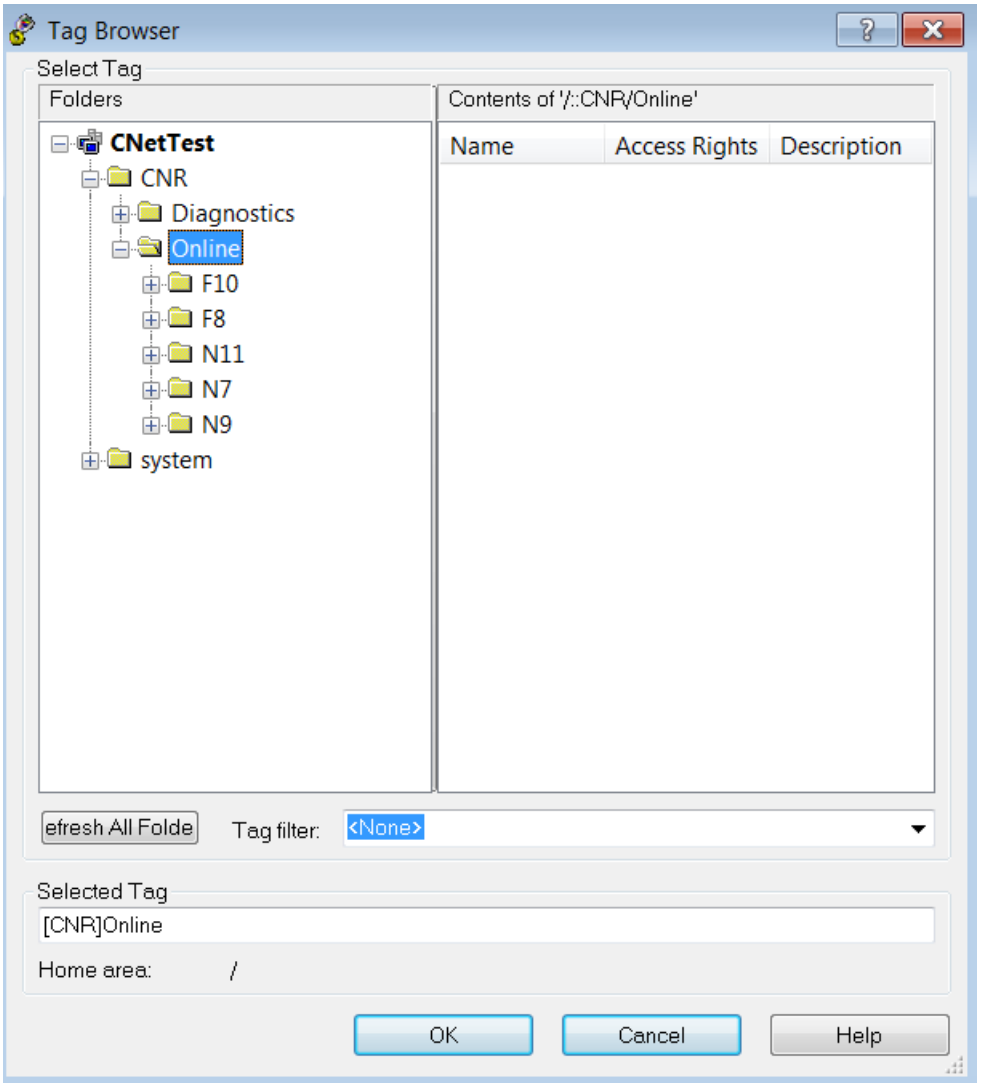


Figure 5.11 – Browsing Data Points

The data files, as configured in the ControlNet Router, will appear under the ***Online*** section. Select the required data point to be connected to the Numeric Display.

In this example, N9 and F10 represent the Input data, N7 and F8 represent the Output data, and N11 represents the diagnostic data.

5.4. DIAGNOSTIC DATA

Various diagnostic items can be displayed in the FTView using the Diagnostic File. The diagnostic file number is N11. The description of each diagnostic data point is tabulated below.

Offset	Group	Description
0	General Status	ControlNet Router Status Bit 0 – Config Valid Bit 1 – Routing Inhibited
1		ControlNet Node Number
2		ControlNet LED State
3		ControlNet Net Mode
4		ControlNet Router Internal Temperature
5	ControlNet Stats	Rx Packet Count
6		Tx Packet Count
7		Scheduled Tx Packet Count
8		Scheduled Rx Packet Count
9		Unscheduled Tx Packet Count
10		Unscheduled Rx Packet Count
11		Routed Class 3 Forward Open
12		Routed Class 3 Forward Close
13		Routed Class 3 Message
14		Routed UCMM Message
15	PCCC - Ethernet	PCCC Connection Requests
16		PCCC Read Requests
17		PCCC Write Requests
18		PCCC Unsupported Command
19		PCCC Unsupported FNC Code
20		PCCC Client Not Found
21		PCCC Client Max Reached
22		PCCC File Not Found
23		Current Connections

Table 5.1 - Diagnostic File

6. LOGIX CONTROLLER PROGRAMMING

The ControlNet Router can be used to Program or Go-Online with a Logix Controller on a legacy ControlNet network from an EtherNet/IP network via the ControlNet Router. The ControlNet Router will use the unscheduled ControlNet bandwidth to access the other nodes on the ControlNet network (e.g. programming a Logix controller).

Figure 6.1 – Programming a Logix Controller over ControlNet via the ControlNet Router

6.1. RSLINX SETUP

The user will need to setup the path to the Logix Controller to access the Logix controller in RSLogix 5000 / Studio 5000. The ControlNet Router's EDS file must be registered on the programming PC. This can be achieved in two ways:

- Uploading the EDS file from the ControlNet Router online, or
- Downloading the EDS file from the Aparian website and manually registering it.

NOTE: Older revision of RSLinx may not support the uploading of the EDS file option, in which case, the second (manual) option should be used.

6.1.1. Uploading EDS File from Module

First add the ControlNet Router module in RSLinx. Under the Communications menu select the Configure Drivers menu item.

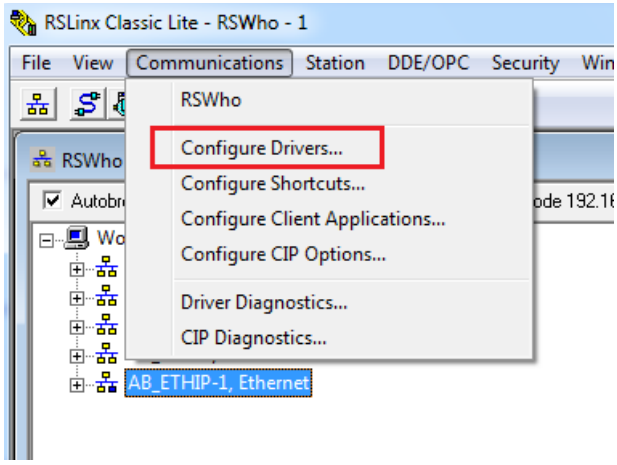


Figure 6.2 – RSLinx Driver Configuration

In the driver selection window, add the ***EtherNet/IP Driver***.

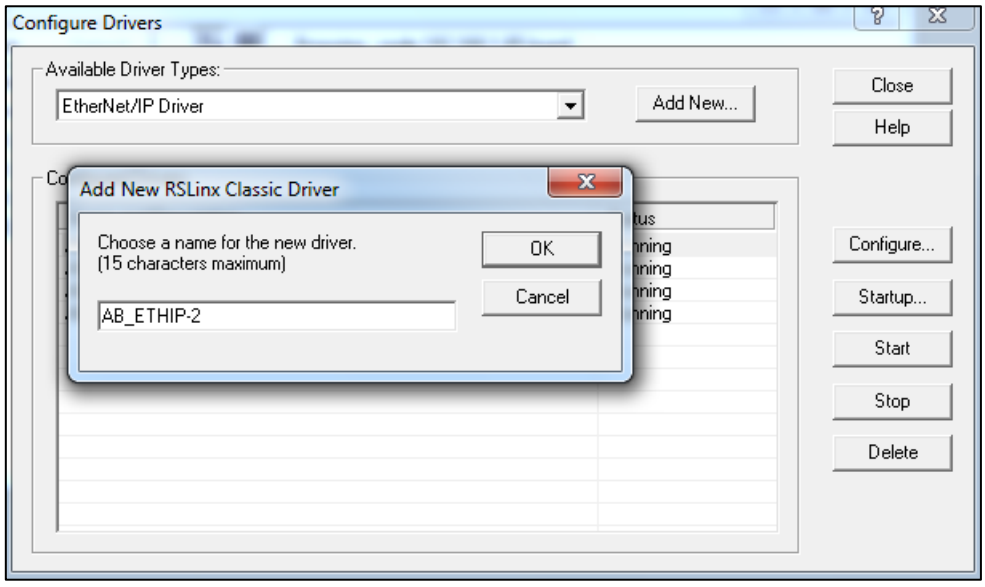


Figure 6.3 – RSLinx EtherNet/IP Driver

If the ControlNet Router is powered and connected on the network, it will appear in the RSLinx's RSWho browse window. Note that the device icon will be a yellow question mark, as the EDS file has not yet been registered.

Right-click on the ControlNet Router in the RSWho browser and select the "***Upload EDS file from device***" option.

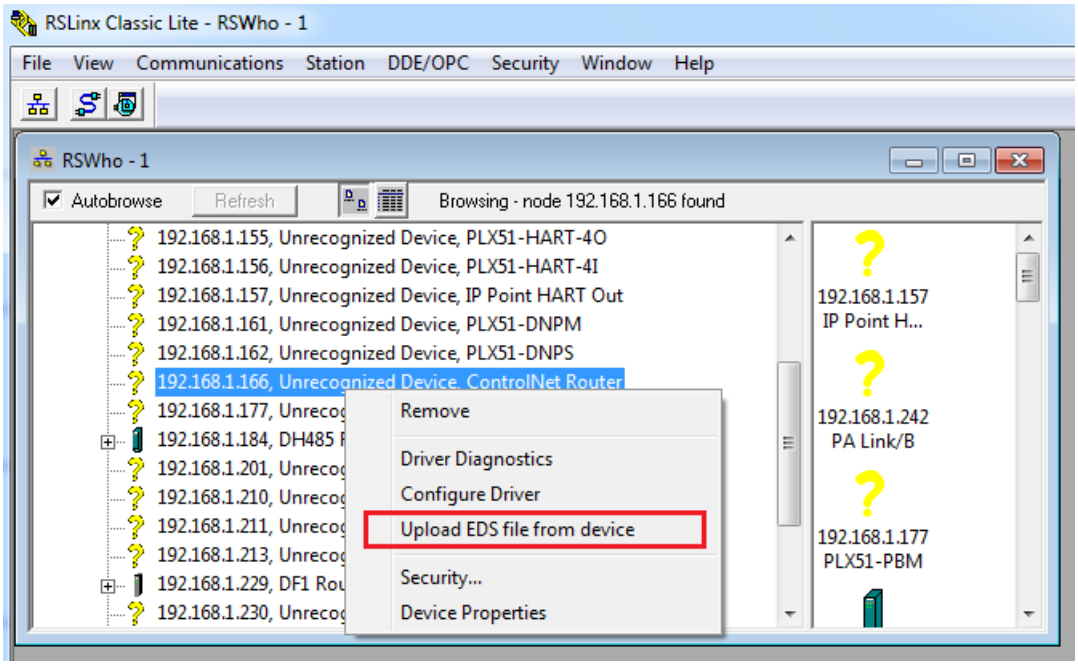


Figure 6.4 – RSLinx Upload EDS File from Device

The Rockwell Automation EDS Wizard will then launch. Follow the multiple steps by pressing the ***Next*** button and complete the EDS file registration.

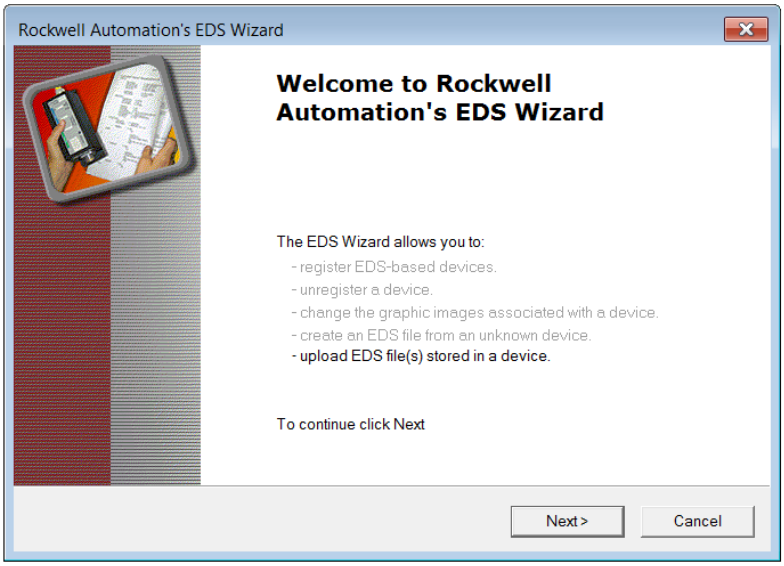


Figure 6.5 – EDS Wizard

NOTE: Depending on the RSLinx revision, RSLinx may need to be **shut-down and re-started**. If RSLinx is running as a service, make sure the service is shut down completely before re-starting.

After restarting RSLinx, the ControlNet Router will correctly appear in the RSWho browser. It will also show the underlying ControlNet Port, which, when expanded, will show the underlying ControlNet network nodes (and further down Logix Controller).

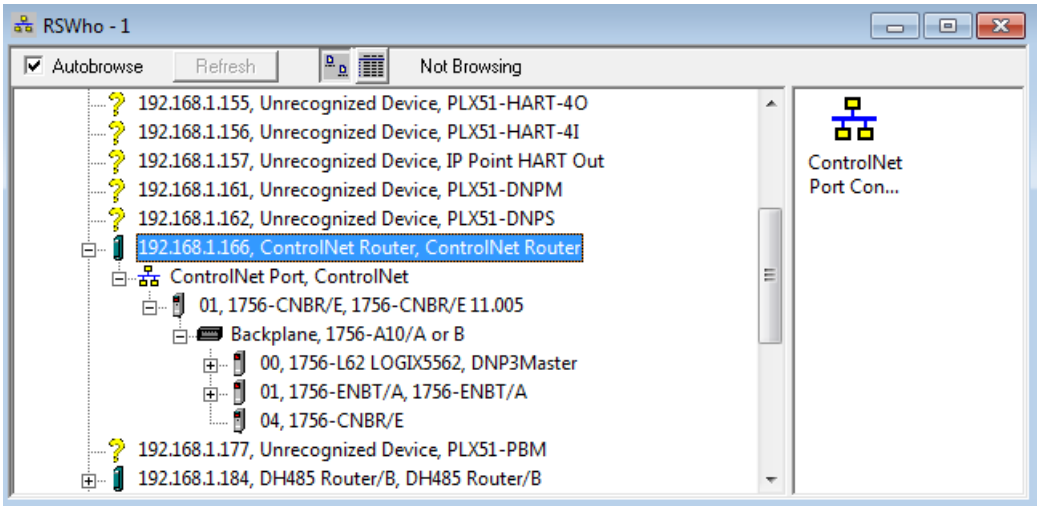


Figure 6.6 – Browsing the Logix Controller via ControlNet Router

6.1.2. Manually Installing the EDS File Option

To install the ControlNet Router's EDS file manually, it must first be downloaded from the Aparian website: https://www.aparian.com/products/controlnetrouter#downloads

The EDS file and associated icon are zipped in a single file. Save the file to local hard drive and unzip the file.

Using the Windows start button launch the Rockwell Software's ***EDS Hardware Installation Tool***.

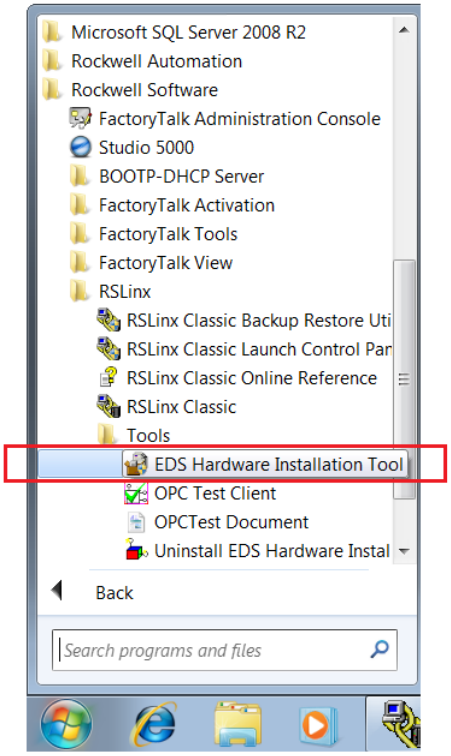


Figure 6.7 – Launch EDS Hardware Installation Tool

In the ***Hardware Installation Tool***, select the ***Add*** option.

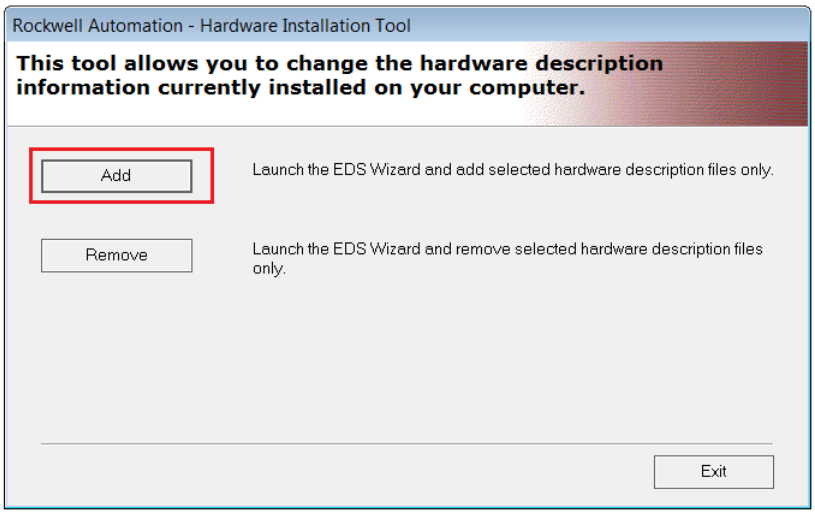


Figure 6.8 – Hardware Installation Tool - ADD

Use the ***Browse*** button to navigate to the folder where the EDS file was unzipped and select the EDS file.

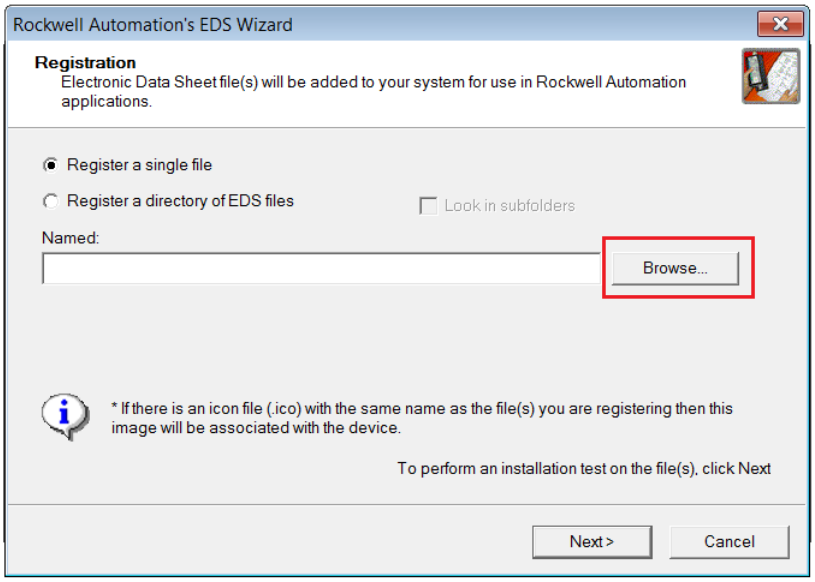


Figure 6.9 – EDS Registration

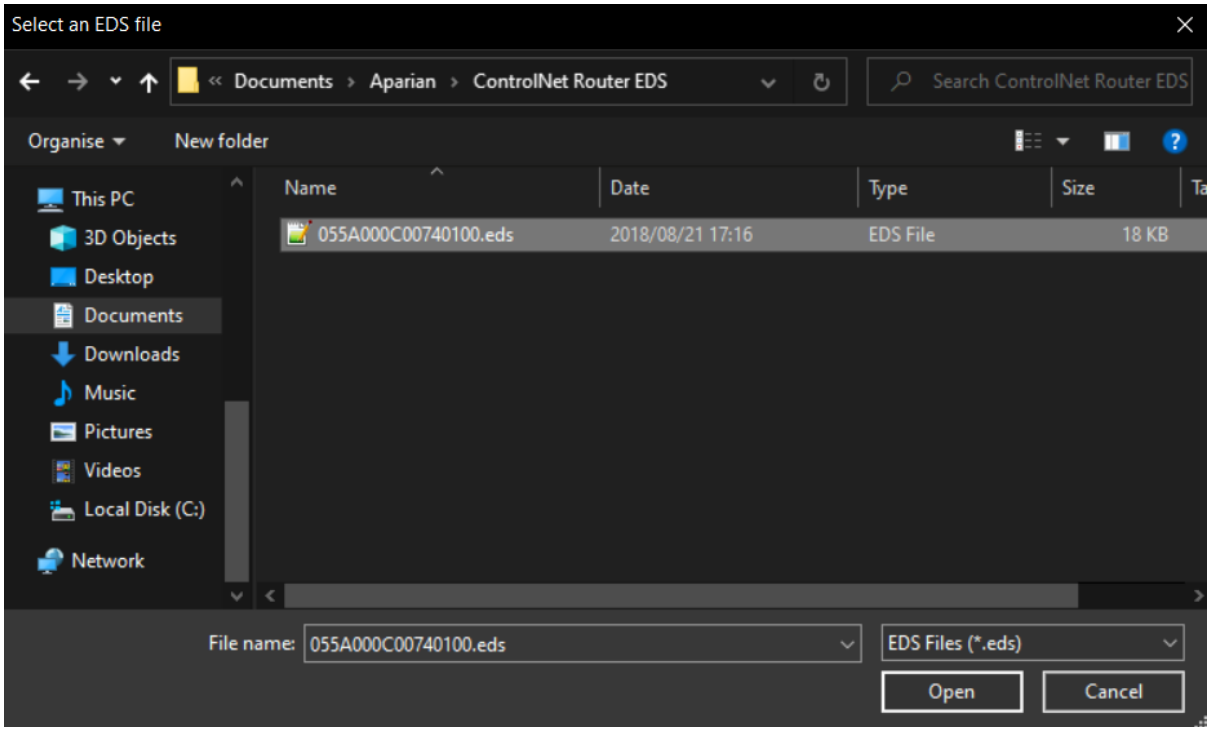


Figure 6.10 – EDS File Select

Follow the prompts and select the Next button to complete the EDS file registration.

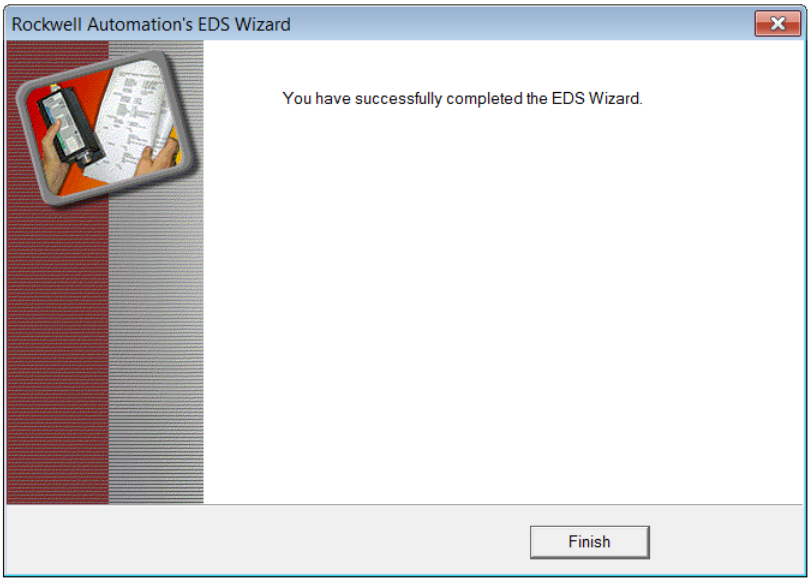


Figure 6.11 – EDS Registration Complete

NOTE: Depending on the RSLinx revision, RSLinx may need to be **shut-down and re-started**. If RSLinx is running as a service, make sure the service is shut down completely before re-starting.

6.2. RSLOGIX 5000

Programming using RSLogix 5000 can then continue as normal. Inside RSLogix5000 under the ***Communications*** menu, select the ***Who Active*** item.

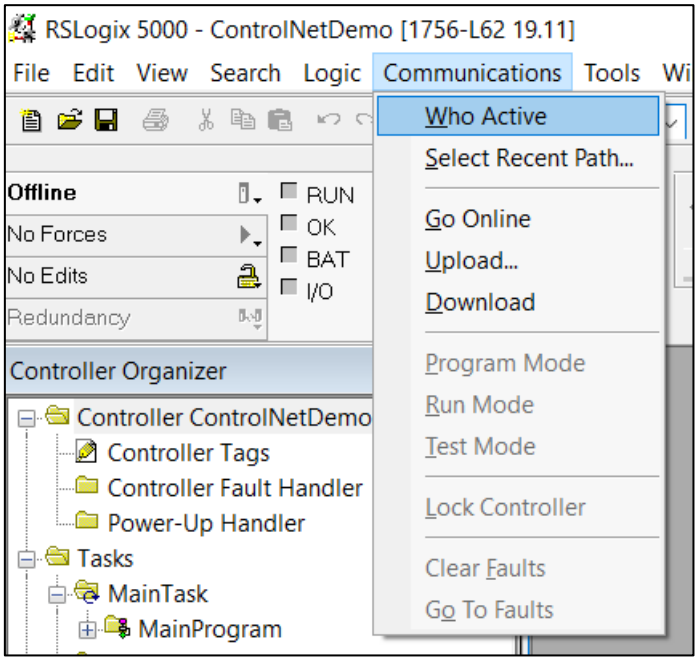


Figure 6.12 – System Communication

In the Communications window, browse to the Logix controller under the ControlNet Router, and select Online, Upload or Download as required.

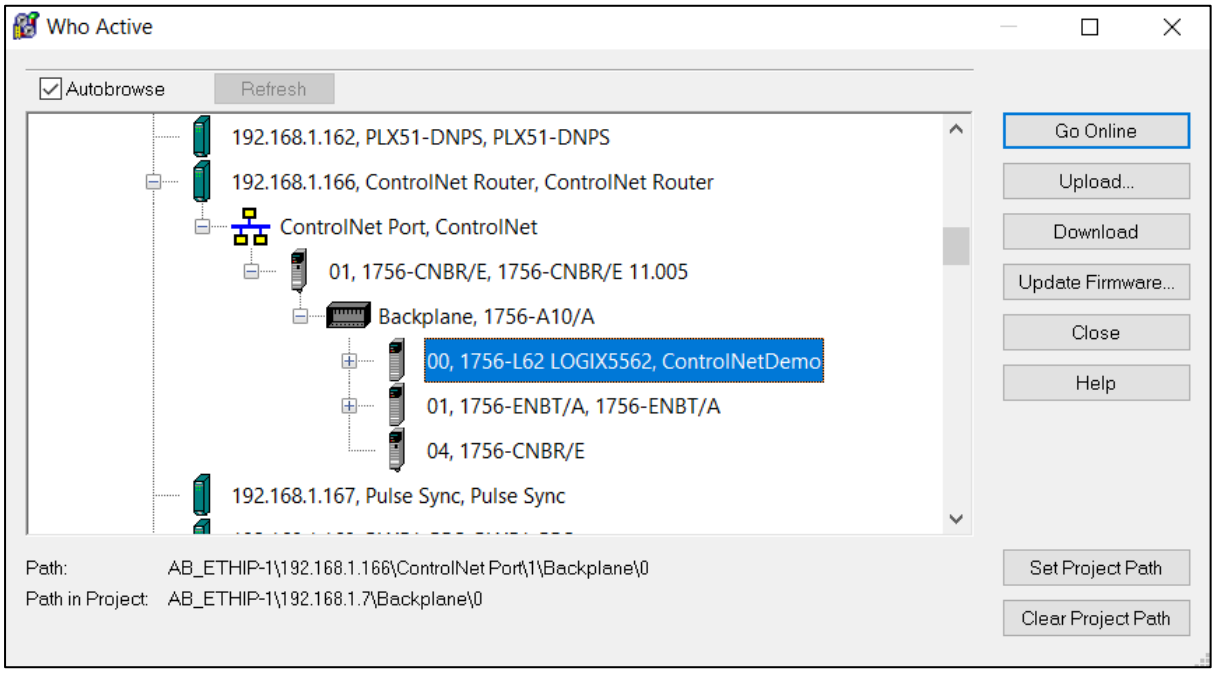


Figure 6.13 – Select Device

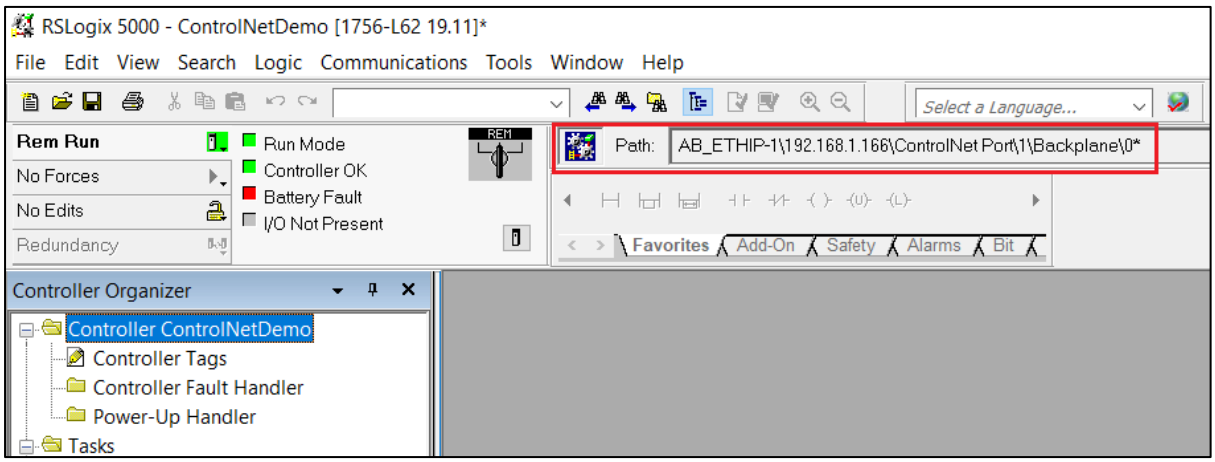


Figure 6.14 – Online with Controller

7. OPERATION

7.1. MESSAGE ROUTING

When the module has been correctly configured for unscheduled messaging, the ControlNet Router will route messages received on EtherNet/IP to a Logix Controller via a ControlNet network.

7.2. LOGIX 5000 ASSEMBLIES

When the module uses Scheduled ControlNet the Logix controller will establish a class 1 cyclic communication connection with the ControlNet Router. An input and output assembly is exchanged at a fix interval (RPI). The UDTs provided will convert the input and output arrays into tag-based assemblies. Refer to the additional information section in this document for the input and output UDTs.

7.2.1. INPUT ASSEMBLY

The following parameters are used in the input assembly of the module.

Parameter	Datatype	Description
GeneralStatus	SINT	Bit 0 – Configuration Valid Bit 1 – Routing Inhibited
CNetNodeNumber	SINT	The Node Number of the ControlNet Router on the network.
CNetLedState	SINT	The current status of the ControlNet LEDs. ControlNet A LED – Bit 0 to 3 ControlNet B Led – Bit 4 to 7 See the appendix for an explanation of the LED States.
CNetNetMode	SINT	The current Net Mode of the ControlNet network.
DeviceTemperature	REAL	The internal temperature of the ControlNet Router module.
MappedData	SINT[]	The data that is mapped to PLC5 file N7 and F8. Can be up to 400 bytes.

Table 7.1 - Logix 5000 input assembly parameters

7.2.2. OUTPUT ASSEMBLY

The following parameters are used in the output assembly of the module.

Parameter	Datatype	Description
General Control	DINT	Bit 0 - Inhibit Routing
MappedData	SINT[]	The data that is mapped to PLC5 file N9 and F10. Can be up to 400 bytes.

Table 7.2 - Logix 5000 output assembly parameters

8. DIAGNOSTICS

8.1. LEDS

The module provides three LEDs for diagnostics purposes as shown in the front view figure below. A description of each LED is given in the table below.

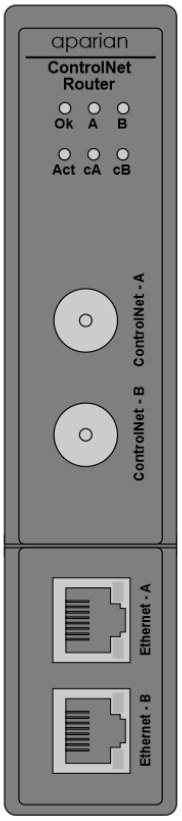


Figure 8.1 – ControlNet Router front view

LED	Description
Ok	The module LED will provide information regarding the system-level operation of the module. If the LED is **red**, then the module is not operating correctly. For example, if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is **green (flashing)**, then the module has booted and is running correctly **without** any application configuration loaded. If the LED is **green (solid)**, then the module has booted and is running correctly **with** application configuration loaded.
A / B	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in

	a connected Ethernet cable). The LED will flash every time traffic was detected. This module has two Ethernet ports A and B. Each LEDs represents each specific port.
Act	The Act LED shows the routing activity on the ControlNet network. Every time there is a routed message request or a PCCC request for the PLC5 emulation the LED will flash green.
cA / cB	The status of the ControlNet link. See the appendix for details on the ControlNet LED status.

Table 8.1 - Module LED operation

8.2. MODULE STATUS MONITORING IN SLATE

The ControlNet Router provides various statistics which can assist with module operation, maintenance, and fault finding. The statistics can be accessed in full by Slate or using the web server in the module.

To view the module's status in the Aparian-Slate environment, the module must be online. If the module is not already Online (following a recent configuration download), then right-click on the module and select the ***Go Online*** option.

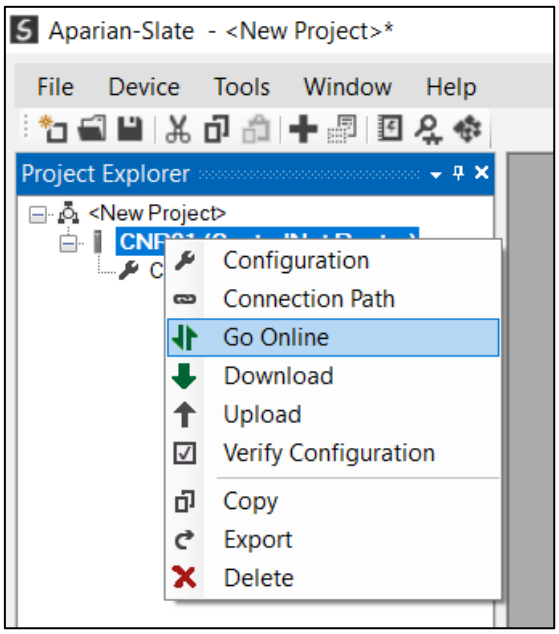


Figure 8.2 - Selecting to Go Online

The Online mode is indicated by the green circle behind the module in the Project Explorer tree.

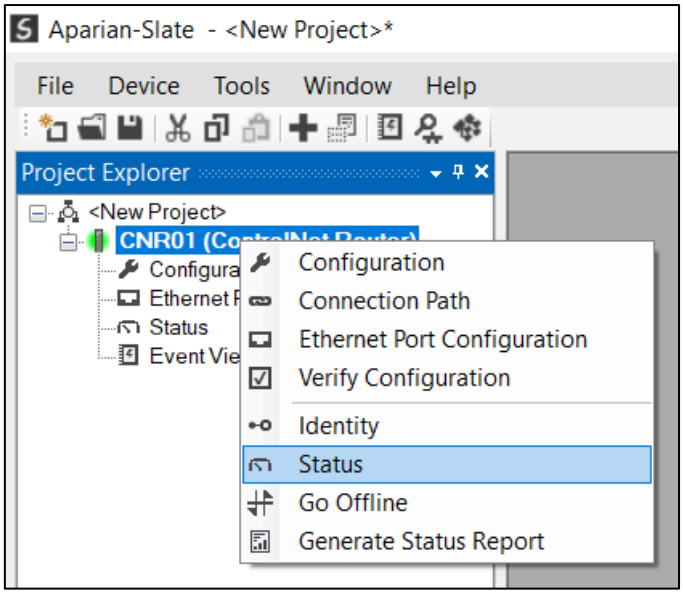


Figure 8.3 - Selecting online Status

The Status monitoring window can be opened by either double-clicking on the ***Status*** item in the Project Explorer tree, or by right-clicking on the module and selecting ***Status***. The status window contains multiple tabs to display the current status of the module.

8.2.1. GENERAL

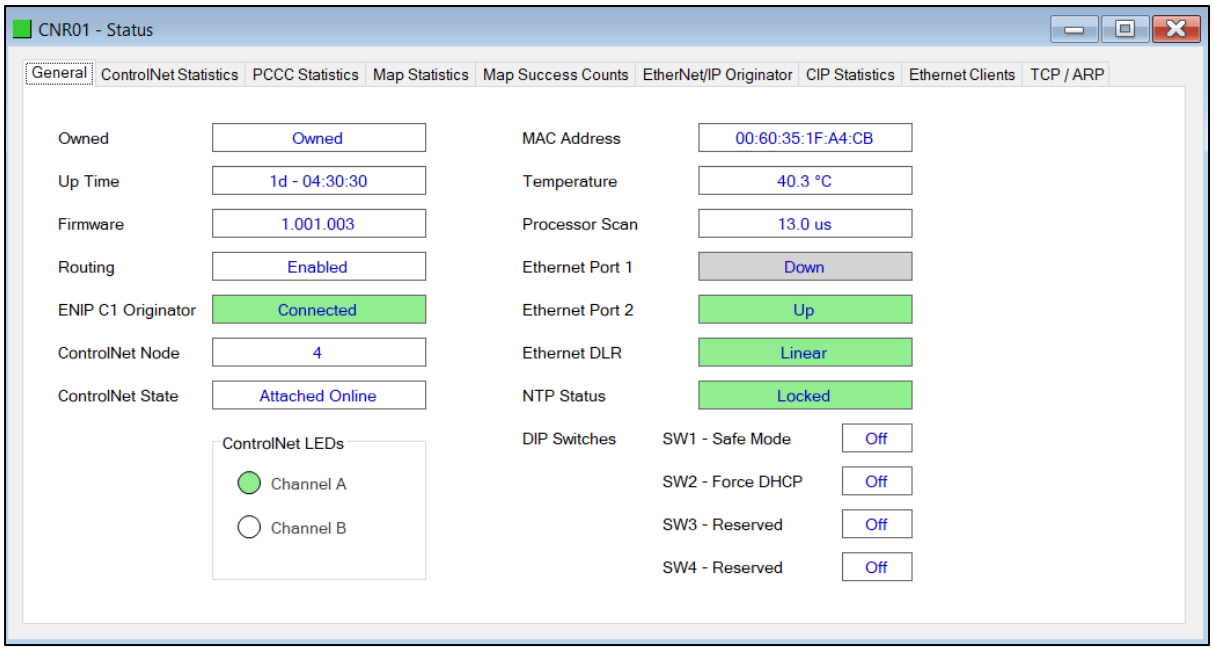


Figure 8.4 - Status monitoring – General

The General tab displays the following general parameters:

Parameter	Description
Owned	Indicates whether or not the module is currently owned (Class 1) by a Logix controller.
Up Time	Indicates the elapsed time since the module was powered-up.
Firmware	The version of the module's firmware.
Routing	Indicates if routing of EtherNet/IP messages to ControlNet is enabled or inhibited (from the output assembly).
ENIP C1 Originator	When the module is configured for EtherNet/IP Originator then this will indicate the status of the class 1 connection to the target EtherNet/IP device. **Online** The target device is connected and exchanging data. **Offline** The target device is not connected.
ControlNet Node Number	The current ControlNet node number.
ControlNet State	This is the Net Mode of the ControlNet network. See the appendix for more details.
ControlNet LEDs	The current status of the ControlNet LEDs. See the appendix for more details.
MAC Address	Displays the module's unique Ethernet MAC address.
Temperature	The internal temperature of the module.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
Ethernet Port 1/2	This is the status of each Ethernet port. **Down** The Ethernet connector has **not been** successfully connected to an Ethernet network. **Up** The Ethernet connector has successfully connected to an Ethernet network. **Mirror Enabled** The Ethernet port is mirroring the traffic on the other Ethernet port.
Ethernet DLR (Device Level Ring)	The status of the Ethernet DLR. **Disabled** Device Level Ring functionality has been disabled.

	Linear The DLR functionality has been enabled and the Ethernet network architecture is linear. **Ring – Fault** The DLR functionality has been enabled and the Ethernet network architecture is ring, but there is a fault with the network. **Ring – Ok** The DLR functionality has been enabled and the Ethernet network architecture is ring and is operating as expected.
NTP Status	The status of the local NTP Client. **Disabled** The NTP time synchronization has been disabled. **Locked** NTP time synchronization has been enabled and the PLX51-PBx has locked onto the target time server. **Not Locked** NTP time synchronization has been enabled and the PLX51-PBx has not locked onto the target time server.
DIP Switch Position	The status of the DIP switches when the module booted. Note that this status will not change if the DIP switches are altered when the module is running.

Table 8.2 - Parameters displayed in the Status Monitoring – General Tab

8.2.2. CONTROLNET STATISTICS

The ControlNet Statistics tab displays the statistics associated with the ControlNet communication network

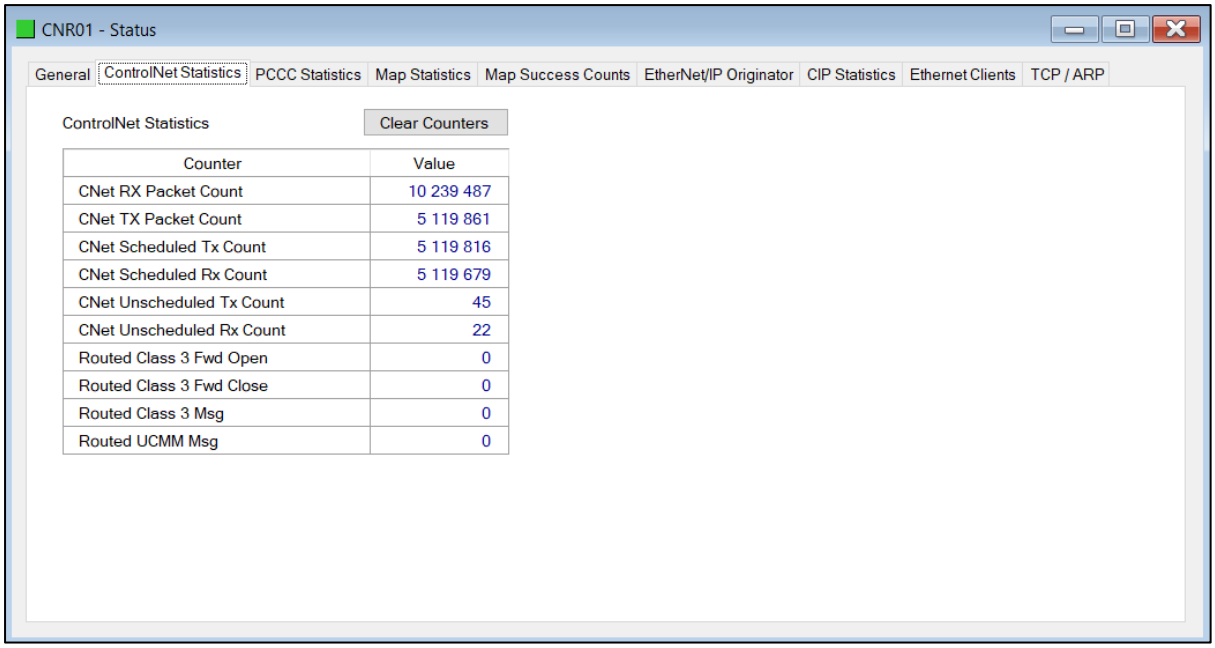


Figure 8.5 - Status monitoring – ControlNet Statistics

Statistic	Description
CNet Rx Packet Count	Number of ControlNet packets received.
CNet Tx Packet Count	Number of ControlNet packets sent.
CNet Scheduled Tx Count	Number of Scheduled ControlNet packets received.
CNet Scheduled Rx Count	Number of Scheduled ControlNet packets sent.
CNet Unscheduled Tx Count	Number of Unscheduled ControlNet packets received.
CNet Unscheduled Rx Count	Number of Unscheduled ControlNet packets sent.
Routed Class 3 Forward Open	Number of Class 3 Forward Opens received for routed messaging.
Routed Class 3 Forward Close	Number of Class 3 Forward Closes received for routed messaging.
Routed Class 3 Message	Number of Routed Class 3 Messages received.
Routed UCMM Message	Number of Routed UCMM Messages received.

Table 8.3 – ControlNet statistics

8.2.3. PCCC STATISTICS

The PCCC tab displays the Ethernet PCCC statistics.

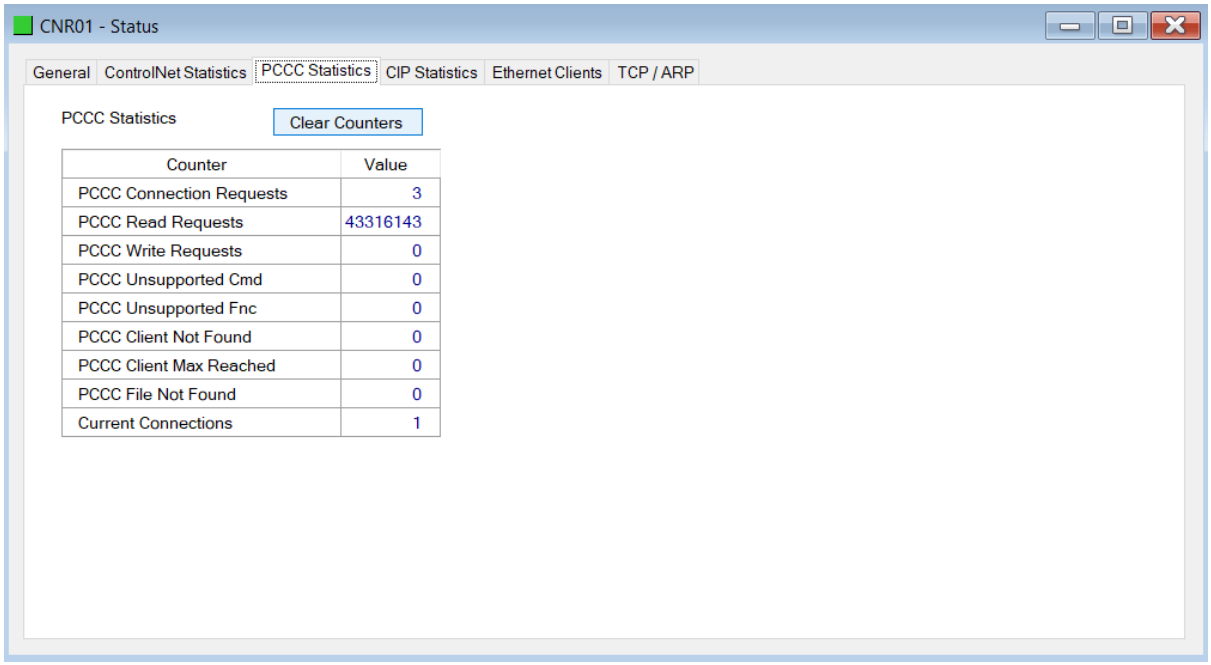


Figure 8.6 - Status monitoring – PCCC Statistics

Statistic	Description
PCCC Connection Requests	The number of PCCC connection establishment requests received.
PCCC Read Requests	The number of Read requests received.
PCCC Write Requests	The number of Write requests received.
PCCC Unsupported Cmd	The number of requests rejected due to an unsupported command.
PCCC Unsupported Fnc	The number of requests rejected due to an unsupported function code.
PCCC Client Not Found	The number of requests rejected due to no matching connection.
PCCC Client Max Reached	The number of connection request rejections due to maximum connection count reached.
PCCC File Not Found	The number of requests rejected due to an unsupported PLC file number.
Current Connections	The current number of active connections.

Table 8.4 – PCCC statistics

8.2.4. MAP STATISTICS

The Map Statistics tab displays the statistics associated with Scheduled Device mapping.

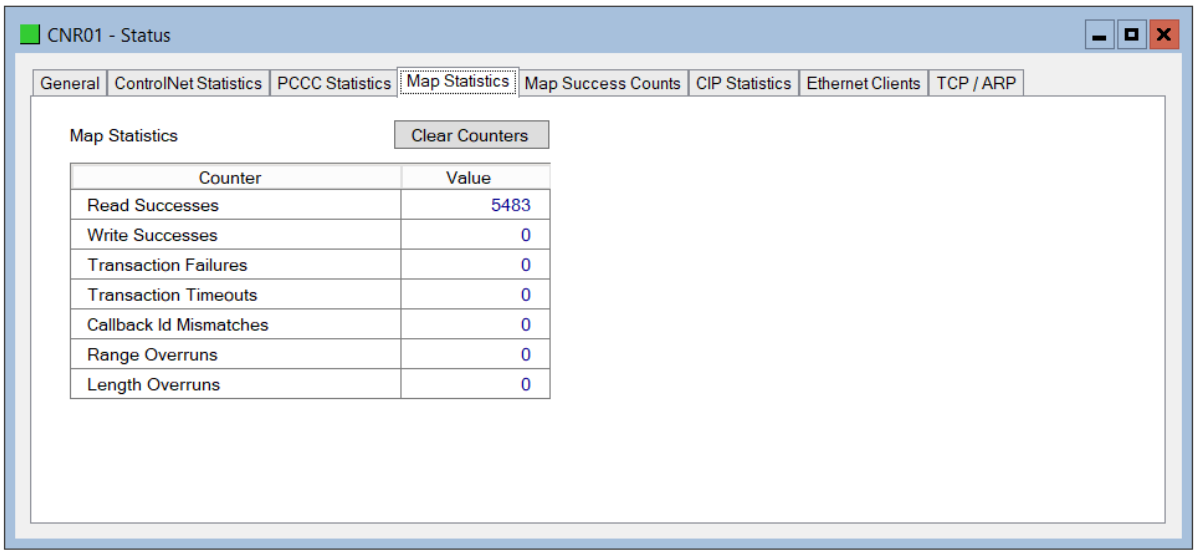


Figure 8.7 - Status monitoring – Map Statistics

Statistic	Description
Read Successes	The number of successful reads from the target EtherNet/IP device.
Write Successes	The number of successful write to the target EtherNet/IP device.
Transaction Failures	The number of failed reads/writes to the target EtherNet/IP device (e.g. error response).
Transaction Timeouts	The number of times the target EtherNet/IP device failed to respond.
Callback Id Mismatches	The EtherNet/IP Class 3 or UCMM response does not match the request.
Range Overruns	The number of times the returned data length + the input assembly location is greater than the *MappedData* tag area.
Length Overruns	The number of times the returned data is greater than the configured get length.

Table 8.5 – Map Statistics

8.2.5. Map Success Counts

The Map Success Counts tab displays the success counts for each scheduled device mapped item.

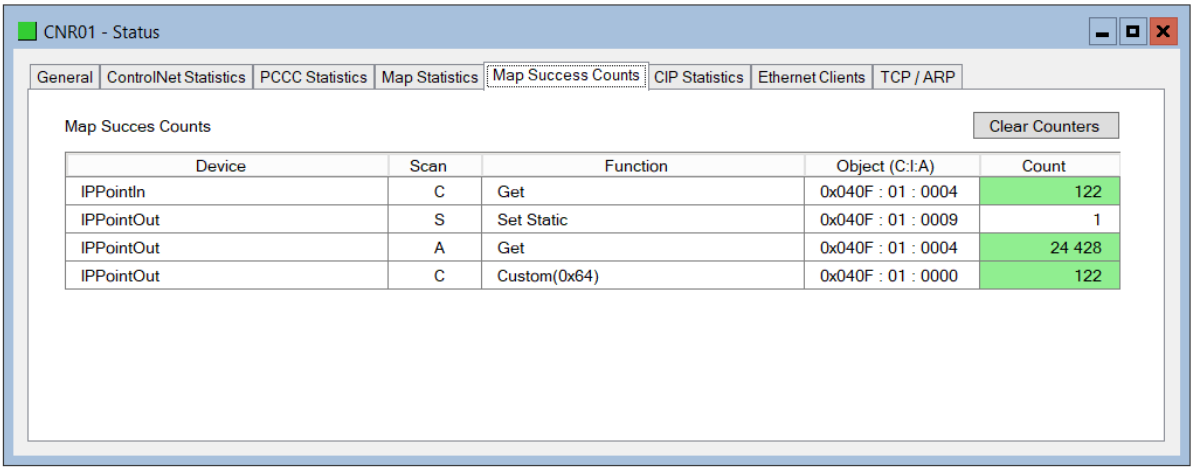


Figure 8.8 - Status monitoring – Map Success Counts

Each time a mapped item is executed successfully its associated count will increase. The count cell will momentarily be highlighted green following a successful transaction.

8.2.6. EtherNet/IP Originator

The EtherNet/IP Originator tab displays the EtherNet/IP Class 1 connection status and statistics.

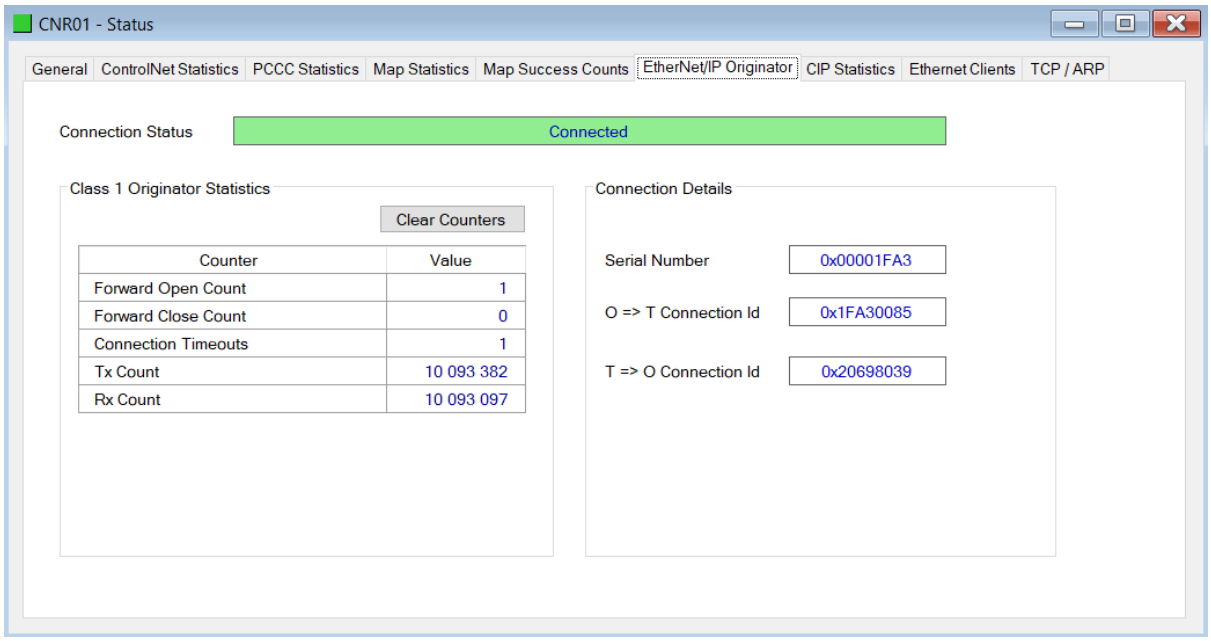


Figure 8.9 - Status monitoring – EtherNet/IP Originator

Statistic	Description
Connection Status	The current connection status of the module. **Connected** The device is connected and exchanging data using Class 1 cyclic communication. **Offline** The device it offline and not connected **Various response faults** If the connection parameters entered are not correct, then generally the target device will reply with the specific reason for the connection reject (as shown in the example below): 
Class 1 Originator Statistics	
Forward Open Count	The number of Class 1 Forward Open (connection establishment) messages sent to this device.
Forward Close Count	The number of Class 1 Forward Close (connection termination) messages sent or received from this device.
Connection Timeouts	The number of this connection was closed due to timeouts.
Tx Count	Number of Class 1 messages sent to the specific target device.
Rx Count	Number of Class 1 messages received from the specific target device.
Connection Details	
Serial Number	The active connection's serial number.
O -> T Connection Id	The active connection O->T Connection Id.
T -> O Connection Id	The active connection T->O Connection Id.

Table 8.6 – EtherNet/IP Class 1 status and statistics

8.2.7. CIP STATISTICS

The CIP tab displays the Ethernet CIP statistics.

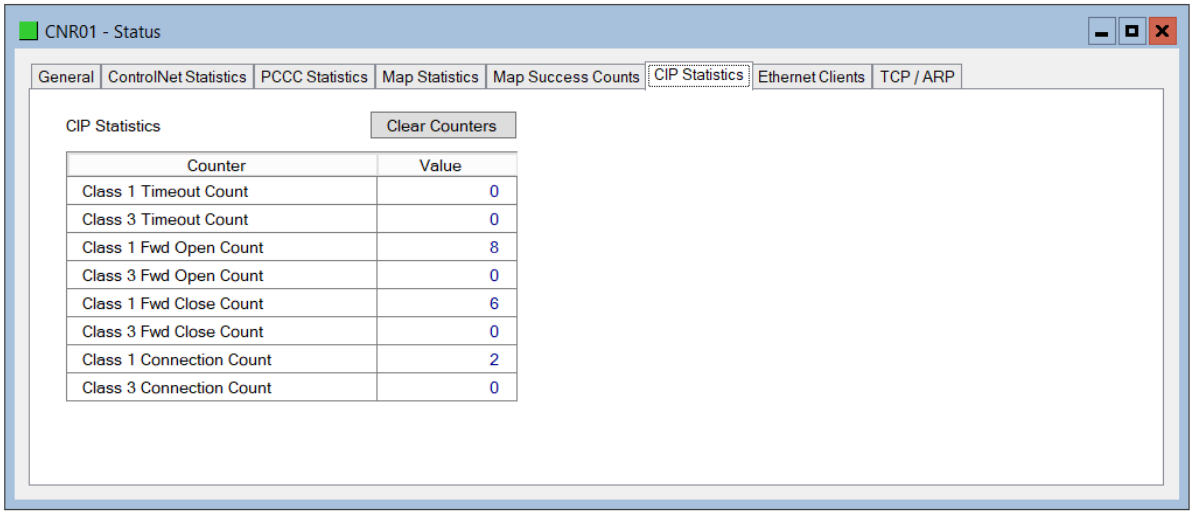


Figure 8.10 - Status monitoring – CIP Statistics

Statistic	Description
Class 1 Timeout Count	The number of Class 1 connections closed due to Timeouts.
Class 3 Timeout Count	The number of Class 3 connections closed due to Timeouts.
Class 1 Forward Open Count	The number of Class 1 Forward Open (connection establishment) messages sent.
Class 3 Forward Open Count	The number of Class 3 Forward Open (connection establishment) messages sent.
Class 1 Forward Close Count	The number of Class 1 Forward Close (connection termination) messages sent.
Class 3 Forward Close Count	The number of Class 3 Forward Close (connection termination) messages sent.
Class 1 Connection Count	The current number of active Class 1 connections.
Class 3 Connection Count	The current number of active Class 3 connections.

Table 8.7 – Mapped Item statistics

8.2.8. Ethernet Clients

The Ethernet Clients tab displays details of the Ethernet and EtherNet/IP clients connected to the ControlNet Router.

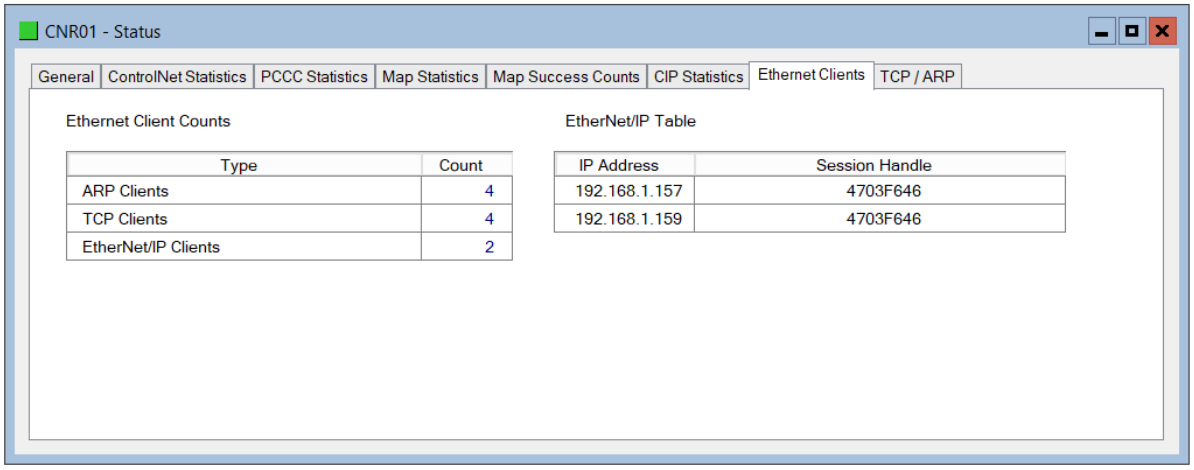


Figure 8.11 –Status monitoring – Ethernet Client Statistics

8.2.9. TCP/ARP

The TCP/ARP tab displays details of the internal Ethernet ARP and TCP lists of the ControlNet Router.

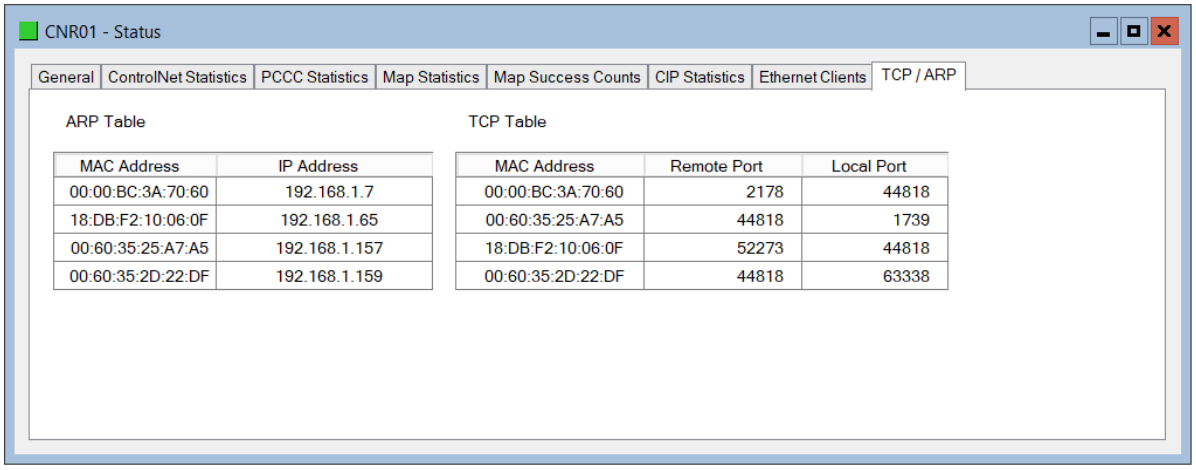


Figure 8.12 – Status monitoring – Ethernet TCP / ARP Statistics

8.3. MODULE EVENT LOG

The ControlNet Router module logs various diagnostic records to an internal event log. These logs are stored in non-volatile memory and can be displayed using Slate or via the web interface. To view them in Slate, select the ***Event Viewer*** option in the Project Explorer tree.

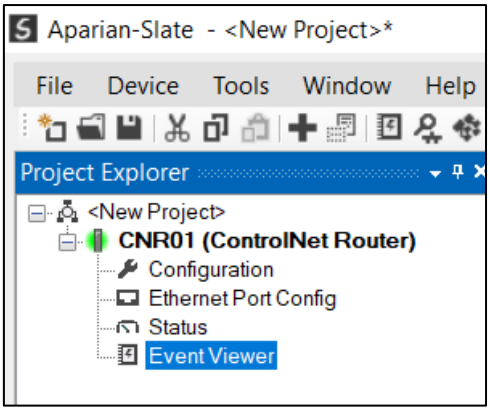
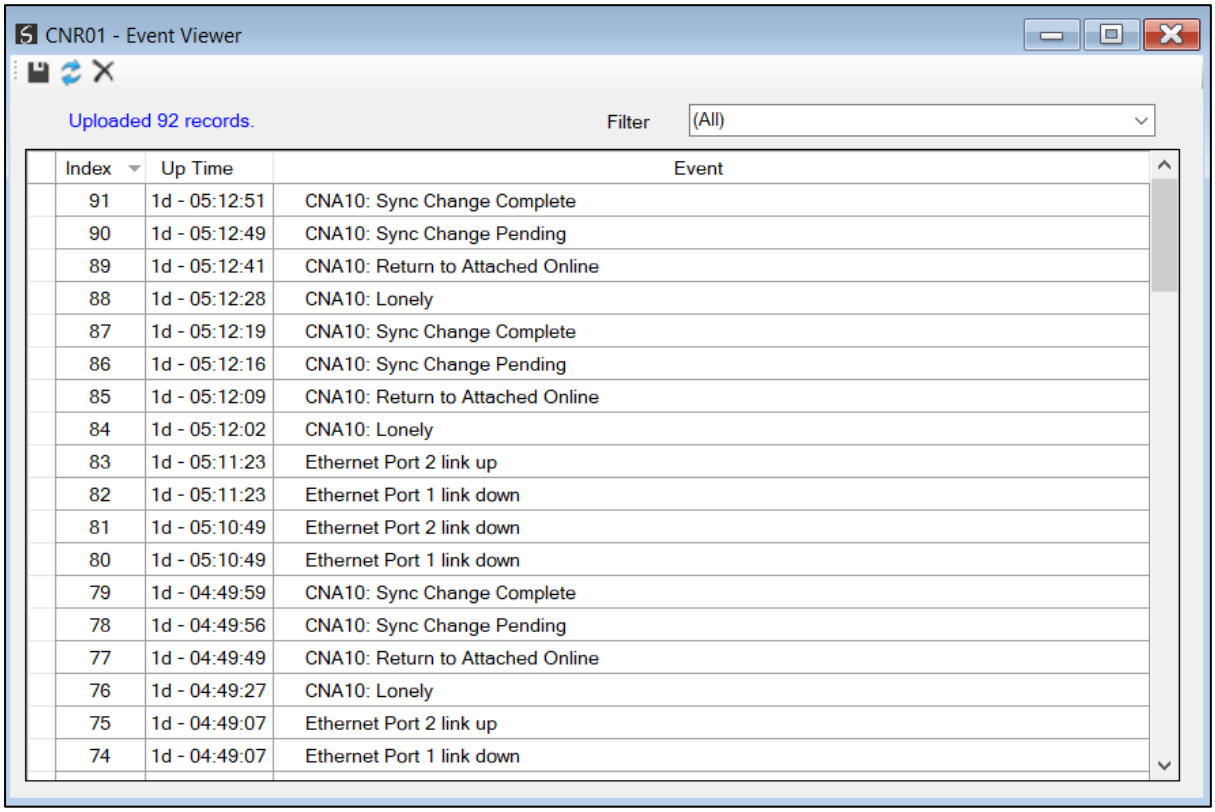


Figure 8.13 - Selecting the module Event Log

The Event Log window will open and automatically read all the events from the module. The log entries are sorted so as to have the latest record at the top. Custom sorting is achieved by double-clicking on the column headings.



Index	Up Time	Event
91	1d - 05:12:51	CNA10: Sync Change Complete
90	1d - 05:12:49	CNA10: Sync Change Pending
89	1d - 05:12:41	CNA10: Return to Attached Online
88	1d - 05:12:28	CNA10: Lonely
87	1d - 05:12:19	CNA10: Sync Change Complete
86	1d - 05:12:16	CNA10: Sync Change Pending
85	1d - 05:12:09	CNA10: Return to Attached Online
84	1d - 05:12:02	CNA10: Lonely
83	1d - 05:11:23	Ethernet Port 2 link up
82	1d - 05:11:23	Ethernet Port 1 link down
81	1d - 05:10:49	Ethernet Port 2 link down
80	1d - 05:10:49	Ethernet Port 1 link down
79	1d - 04:49:59	CNA10: Sync Change Complete
78	1d - 04:49:56	CNA10: Sync Change Pending
77	1d - 04:49:49	CNA10: Return to Attached Online
76	1d - 04:49:27	CNA10: Lonely
75	1d - 04:49:07	Ethernet Port 2 link up
74	1d - 04:49:07	Ethernet Port 1 link down

Figure 8.14 - Module Event Log

The log can also be stored to a file for future analysis, by selecting the Save button in the tool menu. To view previously saved files, use the Event Log Viewer option under the Tools menu.

8.4. WEB SERVER

The ControlNet Router provides a web server allowing a user without Slate to view various diagnostics of the module. This includes Ethernet parameters, system event log, advanced diagnostics, and application diagnostics (ControlNet diagnostics).

NOTE: The web server is view **only** and therefor no parameters or configuration can be altered from the web interface.

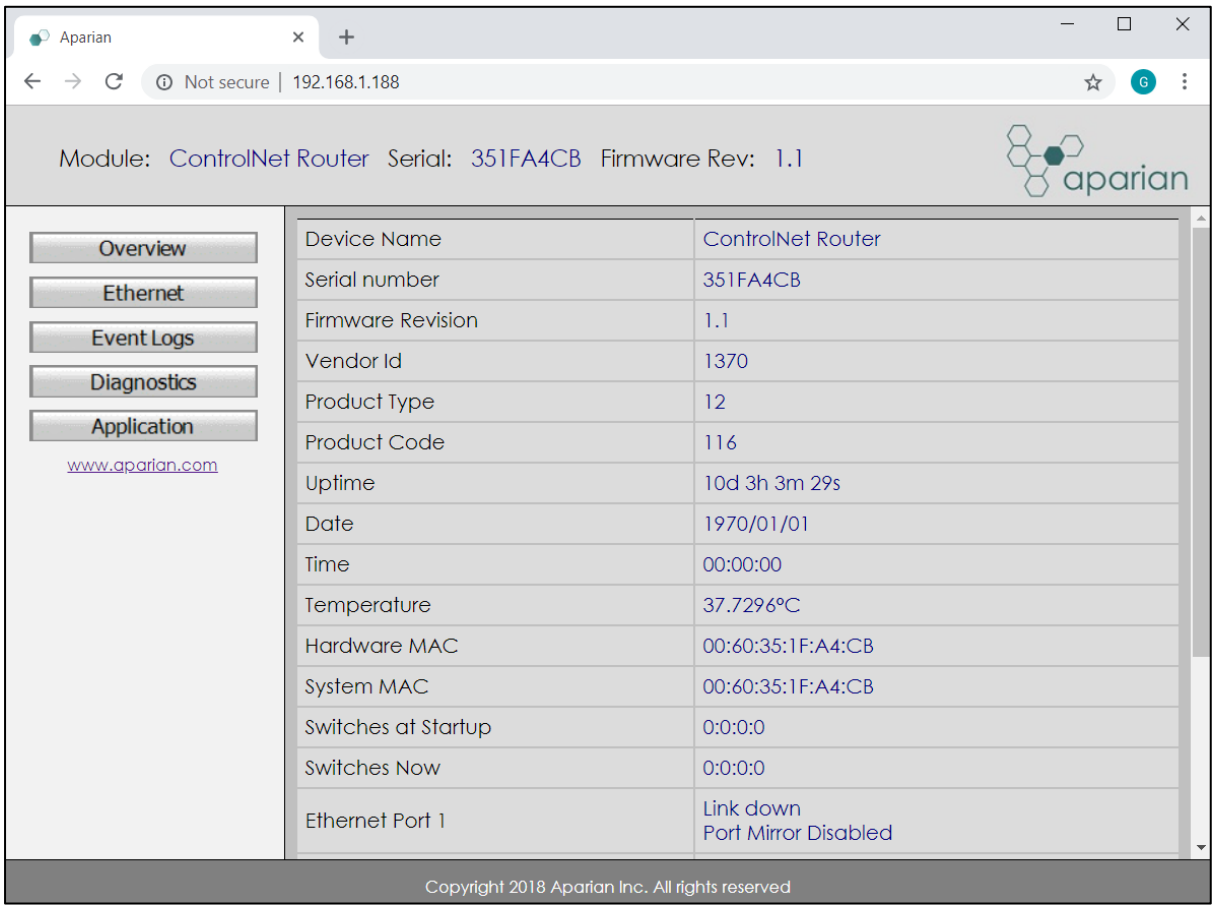


Figure 8.15 – Web interface

9. TECHNICAL SPECIFICATIONS

9.1. DIMENSIONS

Below are the enclosure dimensions as well as the required DIN rail dimensions. All dimensions are in millimetres.

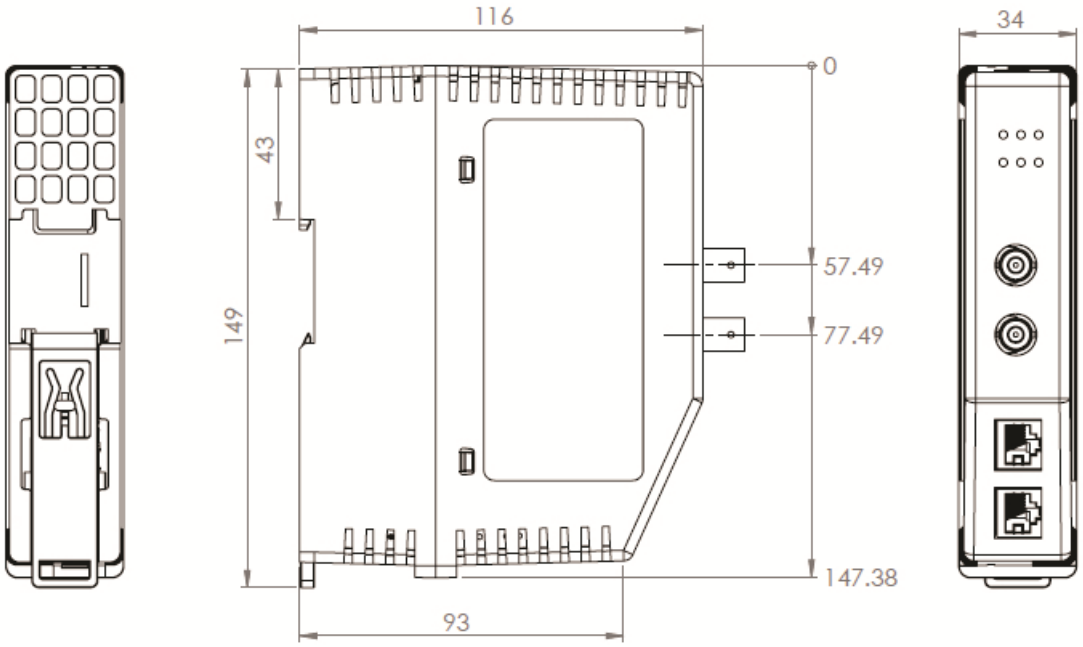


Figure 9.1 – ControlNet Router enclosure dimensions

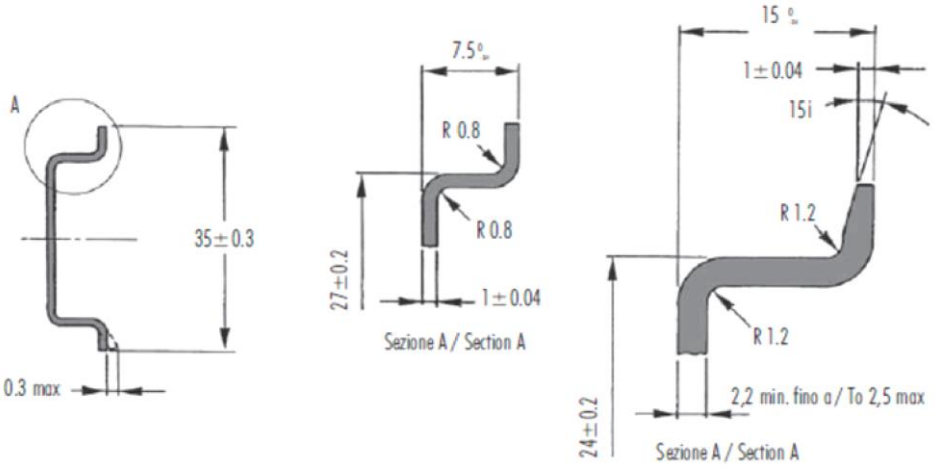


Figure 9.2 - Required DIN Rail dimensions

9.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 36V DC, (85 mA @ 24 VDC)
Power consumption	2 W
Connector	3-way terminal
Conductors	24 – 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 9.1 - Electrical specification

9.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 40
TCP connections	Max 40
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes
Embedded switch	Yes, 2 x Ethernet ports

Table 9.2 - Ethernet specification

9.4. CONTROLNET

Specification	Rating
Connectors	2 x BNC connectors (ControlNet A and B).
Conductors	Quad shield RG-6 coaxial cable
Unscheduled Routed Client Max	40
Scheduled Connection	Max Input Size – 408 bytes (400 bytes mapped data) Max Output Size – 404 bytes (400 bytes mapped data)

Table 9.3 – ControlNet specification

9.5. PCCC

Specification	Rating
Max PCCC Connections	10
Max PCCC Payload	1000 bytes

Table 9.4 – PCCC specification

9.6. CERTIFICATIONS

Certification	Mark
CE Mark	CE
RoHS2 Compliant	RoHS2
ODVA Conformance	EtherNet/IP™ * F/W 1.001
UL Mark File: E494895	c UL us LISTED CLASS 1, DIV 2, GROUPS A, B, C, D

Table 9.5 – Certifications

10. APPENDIX

		Channel A		Channel B	
Value	**LED State**	**Flash Phase 0**	**Flash Phase 1**	**Flash Phase 0**	**Flash Phase 1**
000	Off	off	off	off	off
001	Green	green	green	green	green
010	Flashing	green	off	green	off
011	Flashing	red	off	red	off
100	Flashing	red	green	red	green
101	Railroad	red	off	off	red
110	Railroad	red	green	green	red
111	Red	red	red	red	red

Figure 10.1 – ControlNet LED State

Mode: mod3 – mod0	Description
0x0	Invalid
0x1	Power–up
0x2	Check for Cable
0x3	Waiting to Rogue
0x4	Check for Moderator Listen–Only
0x5	I'm Alive
0x6	Attached On–Line
0x7	Forced Listen–Only
0x8	Duplicate Listen–Only

Figure 10.2 – ControlNet Net Mode

11. INDEX