DeviceNet Router

User Manual

A-DNTR

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aparian

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Revision History

Revision	Date	Comment
1.0	29 April 2016	Initial document
1.1	27 June 2016	Adjusted temperature range
1.2	5 June 2017	Add Scheduled mode to configuration Update certification
1.3	5 October 2017	Added UL Class 1 Division 2
1.4	4 August 2022	Added information required for UL regarding open type device enclosures.
1.5	17 Jan 2023	Update support contact details

1. PREFACE

1.1. INTRODUCTION TO THE DEVICENET ROUTER

This manual describes the installation, operation, and diagnostics of the Aparian DeviceNet Router. The DeviceNet Router provides intelligent data routing between DeviceNet and EtherNet/IP or Ethernet PCCC (CSP). The later allows the module to emulate a PLC5 providing a legacy interface for PanelViews and other devices (as shown below).

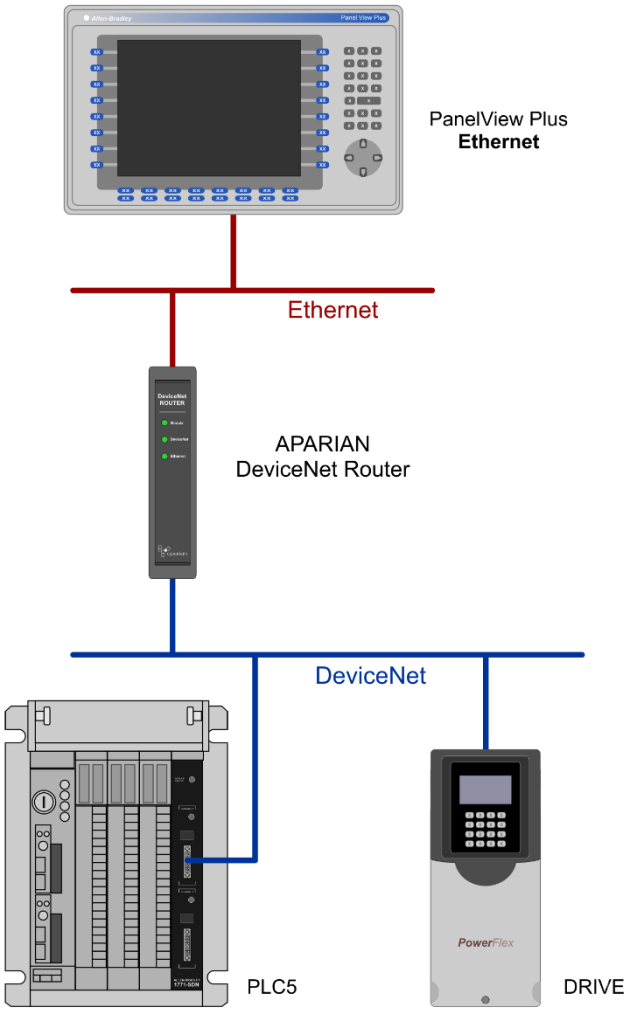


Figure 1.1. – Typical Setup

The DeviceNet Router can also be used in Scheduled Mode allowing the user to extract parameters from various DeviceNet devices and write them directly into Logix tags. The DeviceNet Router will also apply the necessary scaling to the values per EDS file or custom user configuration.

1.2. FEATURES

The DeviceNet Router is able to asynchronously exchange data between a DeviceNet polling master (scanner) and an Ethernet PCCC device. The sizes of the DeviceNet's produced and consumed data are independently configurable from 0 to 128 bytes each.

The consumed (DeviceNet) data can then be mapped to a PLC5 type address file, e.g. N33, and then read by an Ethernet device e.g. a PanelView. Similarly, the produced data (DeviceNet) can also be mapped to a PLC5 type address file, to which an Ethernet device could write.

In addition, the DeviceNet Router can be used to transfer parameters of a DeviceNet device directly to Logix tags. The scaling of the parameter values will either be extracted from the EDS file imported or can be manually updated by the user.

The module also provides a range of statistics and an on-board DeviceNet traffic analyser to assist with fault finding.

A built-in webserver provides detailed diagnostics of system configuration and operation, including the display of DeviceNet operation and communication statistics, without the need for any additional software.

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

1.3. ARCHITECTURE

The figure below provides an example of the typical network setup in PLC Emulation mode, where the DeviceNet Router acts as a DeviceNet slave device.

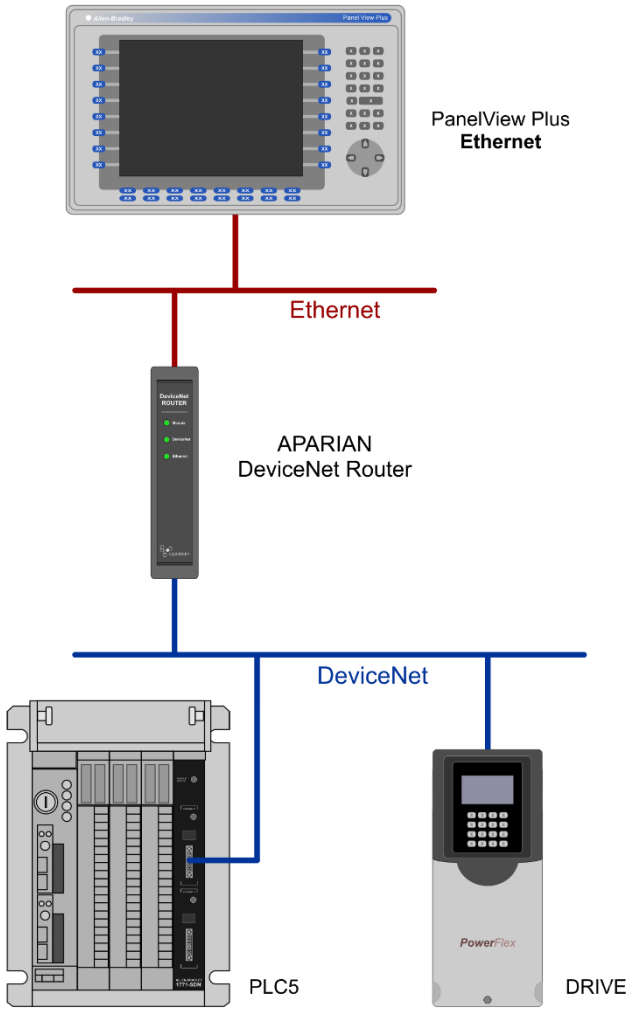


Figure 1.2. - Example of a typical network setup in PLC Emulation mode

In this example, the DeviceNet Router provides the PanelView data access to the PLC5's DeviceNet scanner module (SDN).

In the next example the DeviceNet Router is used to extract parameters from various DeviceNet devices (running in conjunction with the DeviceNet Scanner – e.g. DNB).

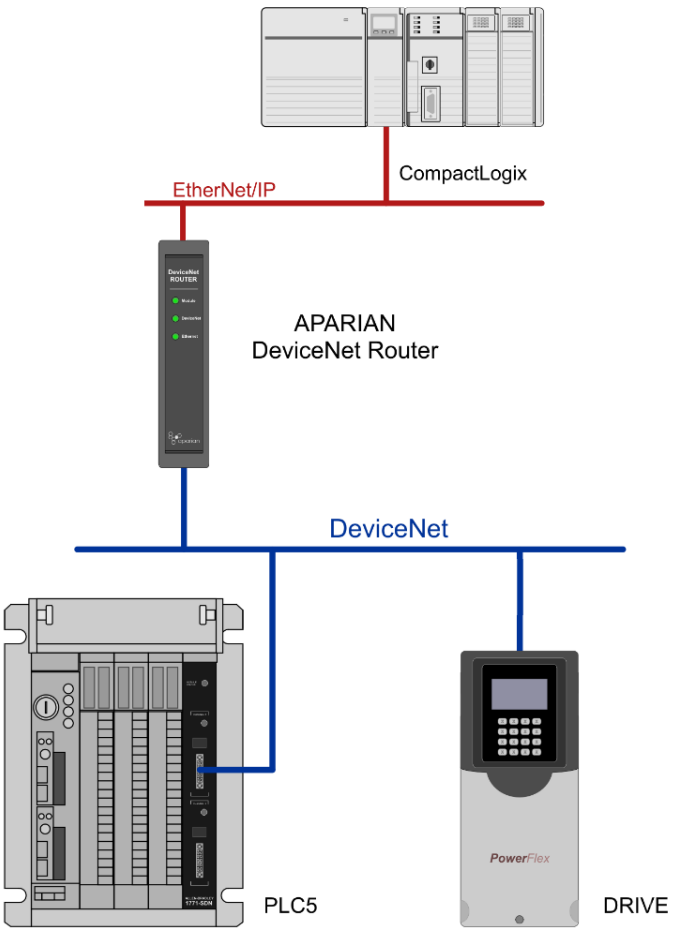


Figure 1.3. - Example of a typical network setup in Scheduled Parameter Mode

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
DeviceNet Router User Manual DeviceNet Router Datasheet Example Code & UDTs	http://www.aparian.com/products/devicenetrouter
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
DeviceNet	http://www.odva.org

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	https://www.prosoft-technology.com/Services-Support/Customer-Support
Support email	support@prosoft-technology.com

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The module has two ports at the bottom of the enclosure as shown in the figure below. The ports are used for Ethernet and DeviceNet. The 5-way DeviceNet connector also provides power to the module. The Ethernet cable must be wired according to industry standards which can be found in the additional information section of this document.

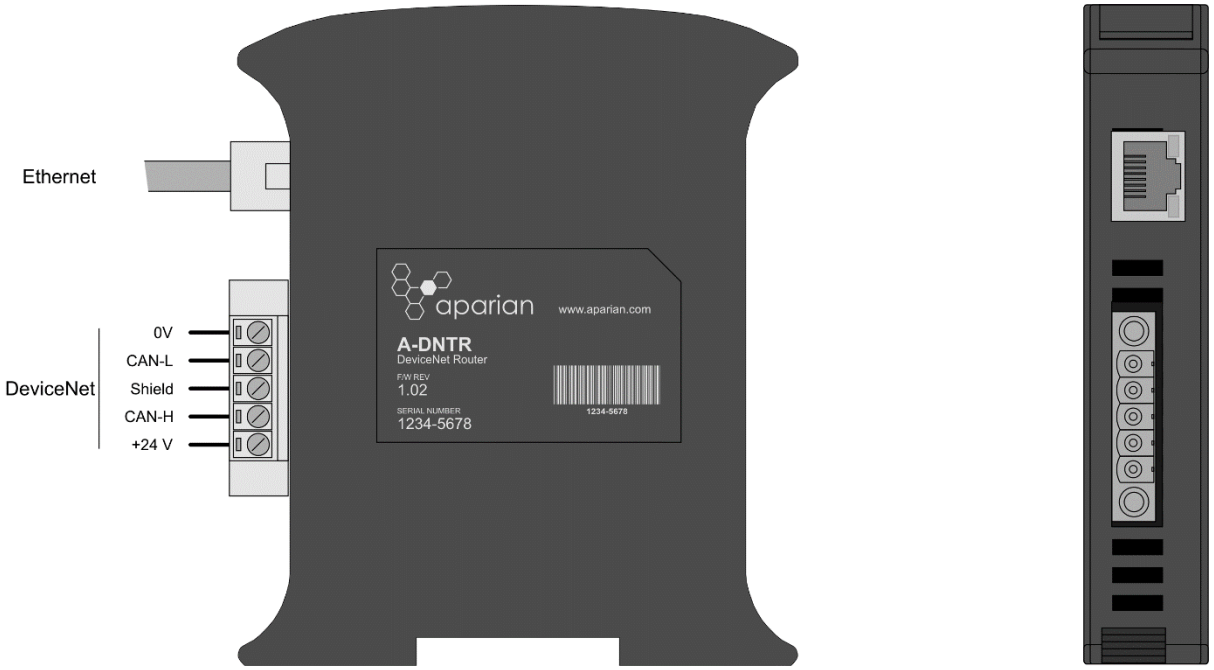


Figure 2.1. – DeviceNet Router side and bottom view

The module provides three diagnostic LEDs as shown in the front view figure below. These LEDs are used to provide information regarding the module system operation, the Ethernet interface, and the DeviceNet interface.

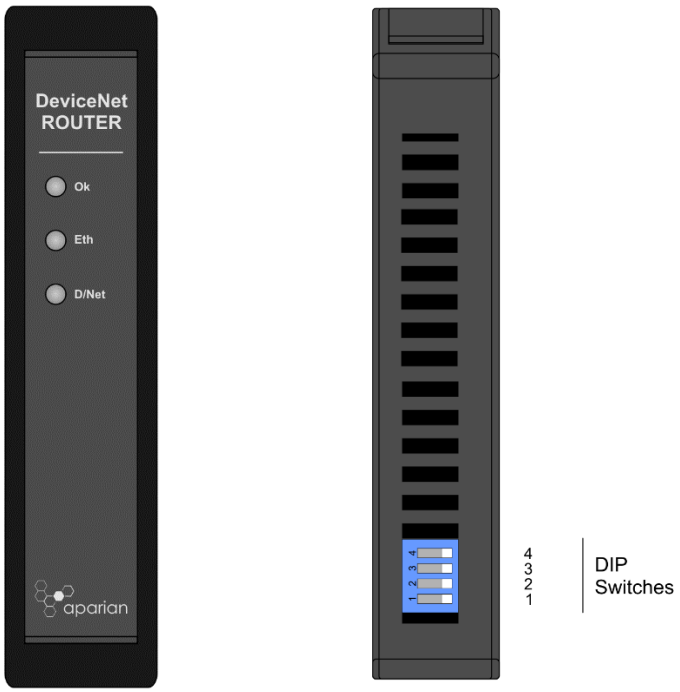


Figure 2.2. – DeviceNet Router front and top view

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	Applies the 120Ω terminating resistor across the DeviceNet network. Switched between Can-H and Can-L.

Table 2.1. - DIP Switch Settings

2.2. MODULE MOUNTING

NOTE: This module is an open-type device and is meant to be installed in an enclosure suitable for the environment such that the equipment is only accessible with the use of a tool.

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

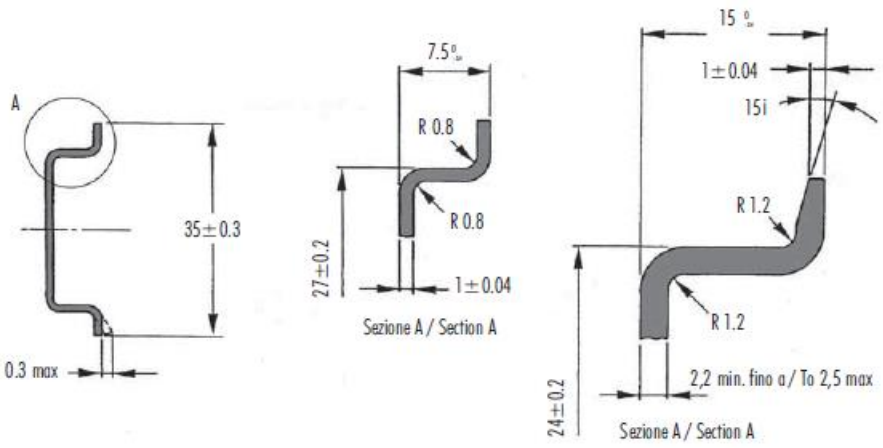


Figure 2.3 - DIN rail specification

The DIN rail clip is mounted on the bottom of the module at the back as shown in the figure below. Use a flat screw driver 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.

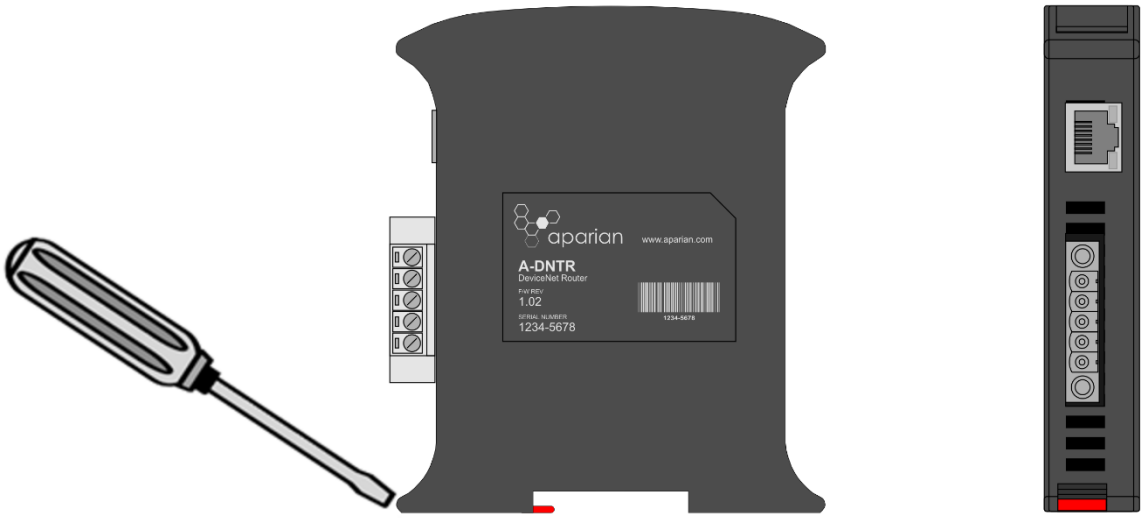


Figure 2.4 - DIN rail mouting

2.3. DEVICENET

A five-way DeviceNet connector is used to connect the DeviceNet CAN interface (Can-L, Can-H), 24Vdc power, and Shield.

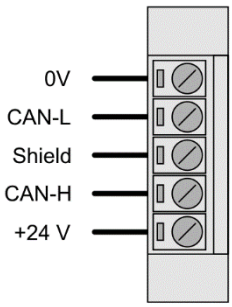


Figure 2.5 - DeviceNet connector

NOTE: It is important that the shield is connected to earth at only one end of the cable to avoid current loops.

2.4. 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.

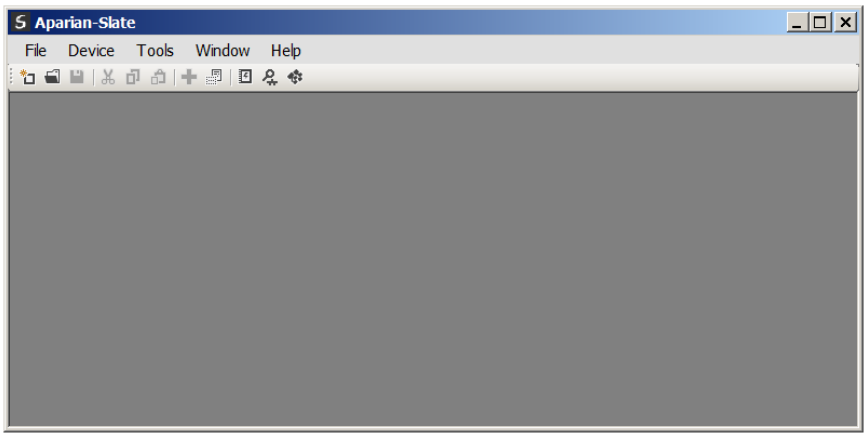


Figure 3.1. - Aparian Slate Environment

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.

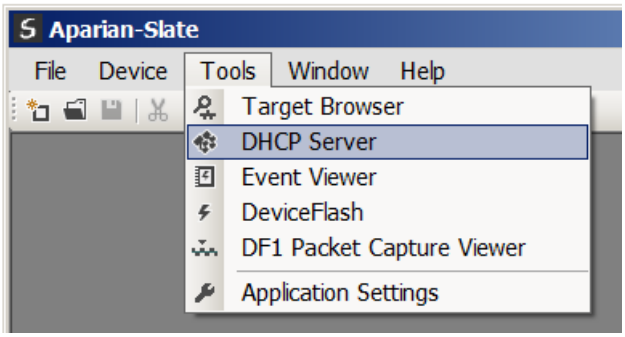


Figure 3.2. - Selecting DHCP Server

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

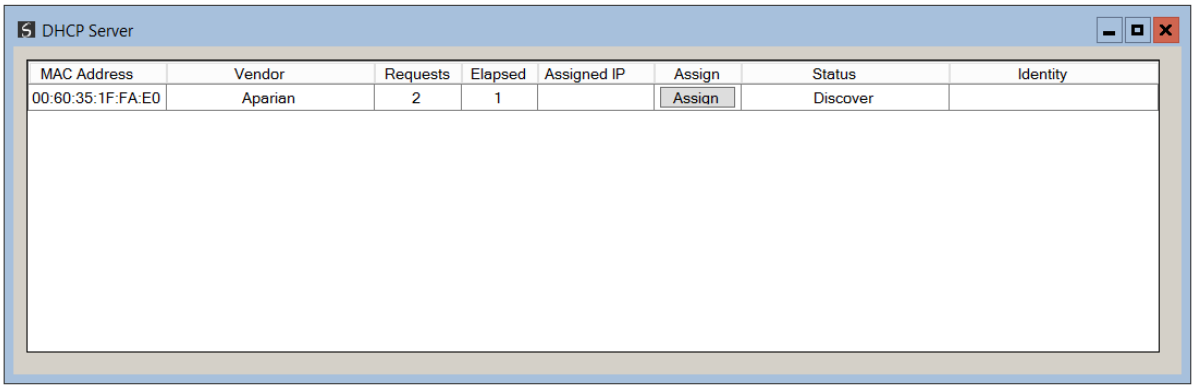


Figure 3.3. - DHCP Server

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.

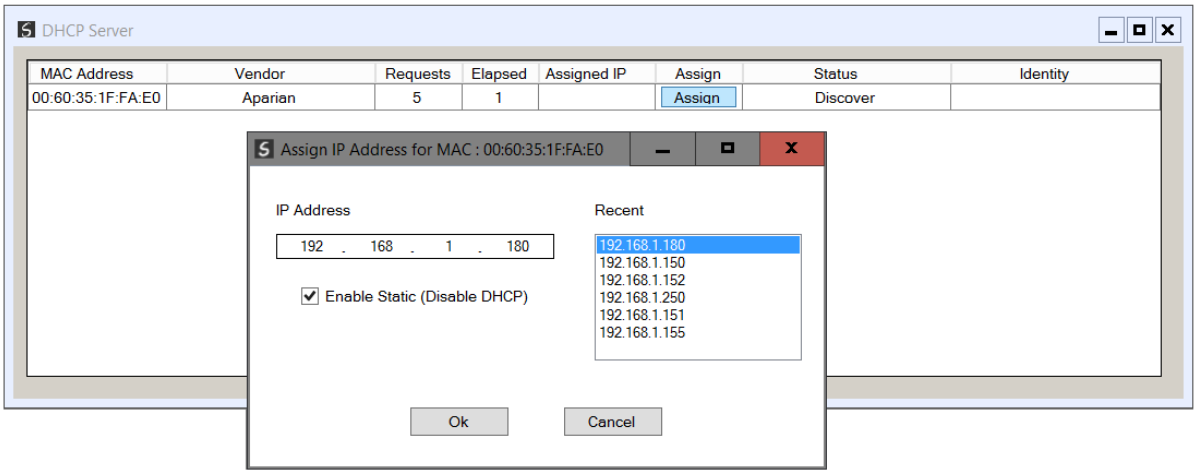


Figure 3.4. - Assigning IP Address

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.

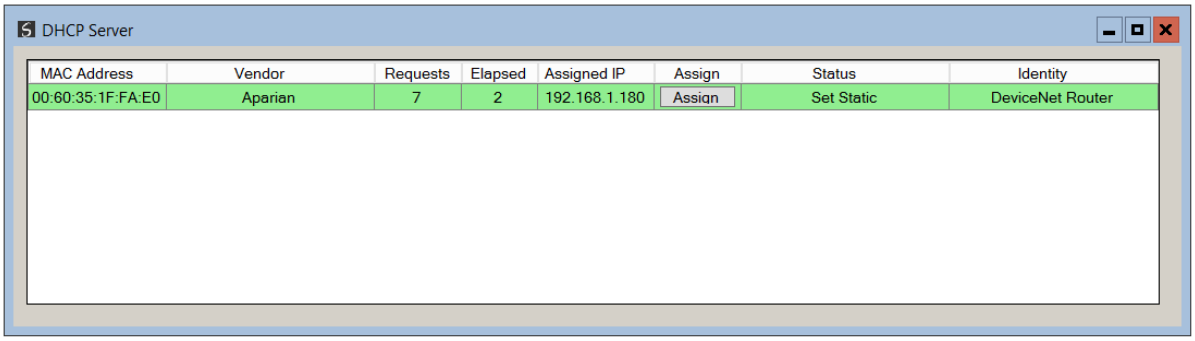


Figure 3.5. - Successful IP address assignment

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.

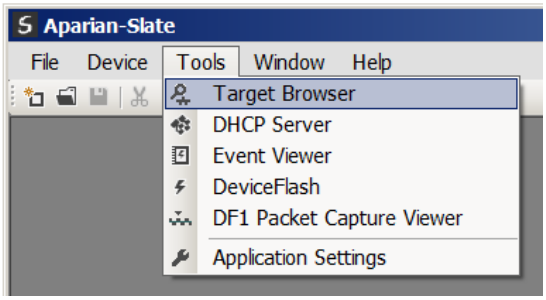


Figure 3.7. - Selecting the Target Browser

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

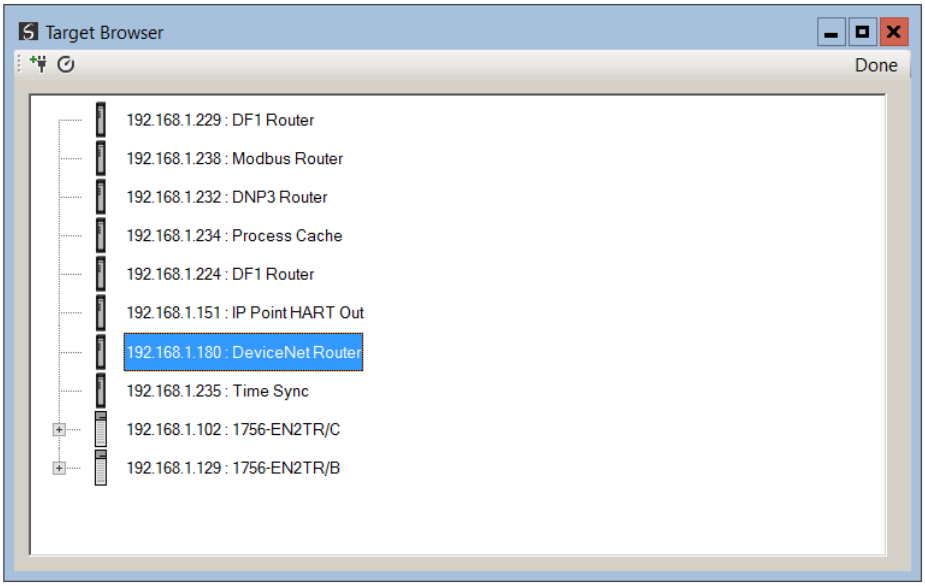


Figure 3.8. - Target Browser

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

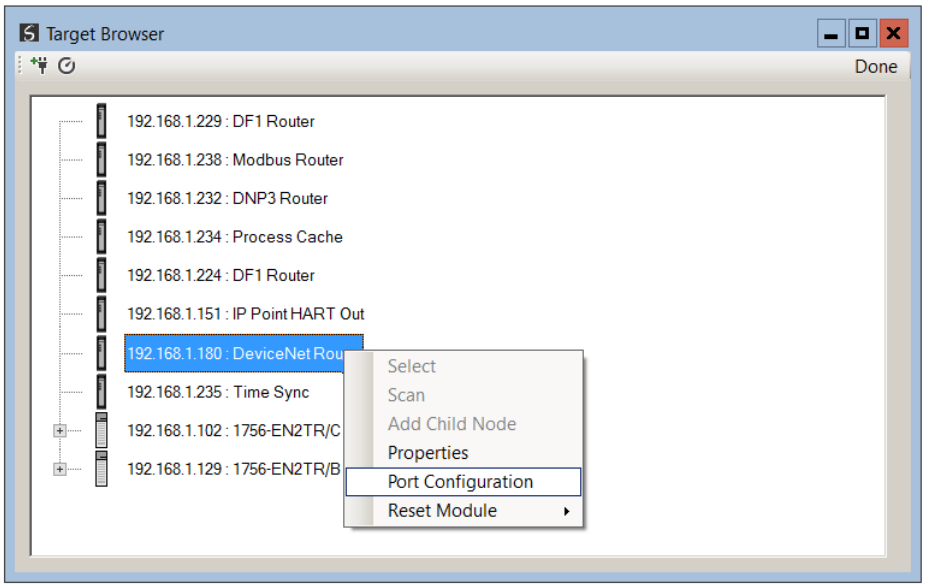


Figure 3.9. - Selecting Port Configuration

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

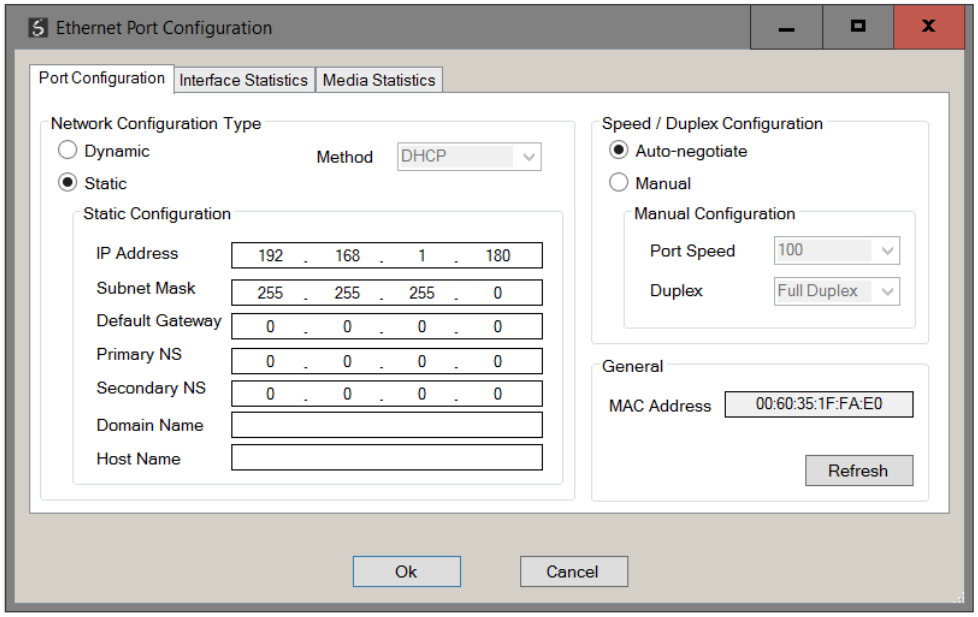


Figure 3.10. - Port Configuration

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.

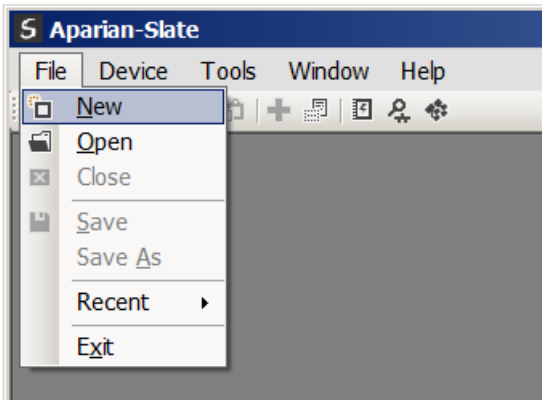


Figure 3.11. - Creating a new project

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 under the Device menu.

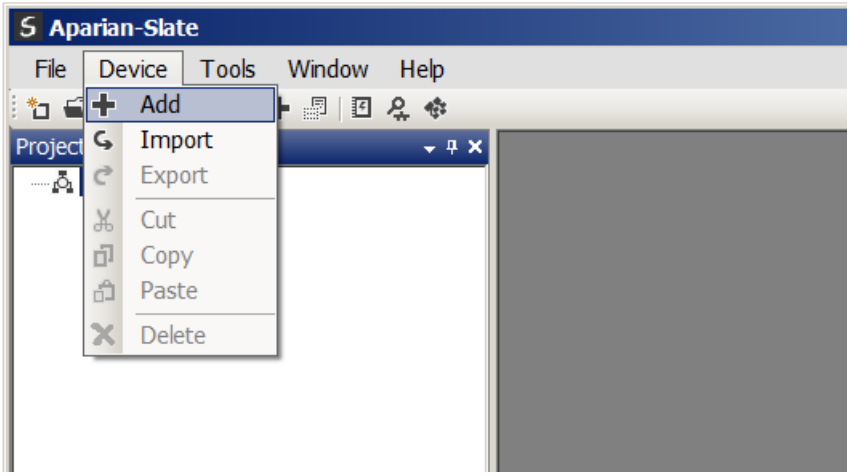


Figure 3.12. - Adding a new device

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

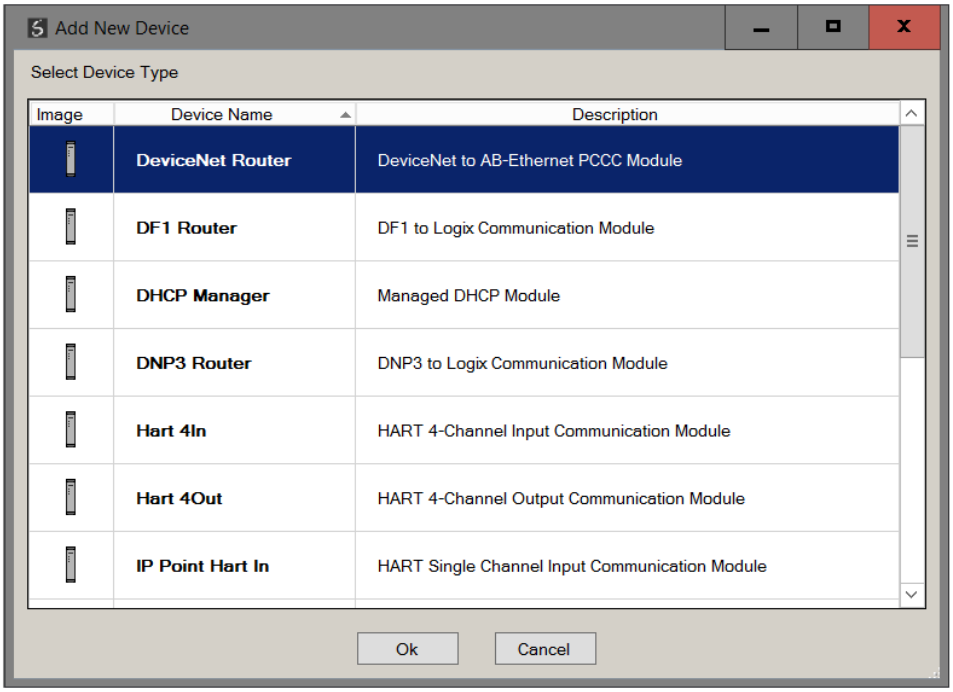


Figure 3.13 – Selecting a new DeviceNet Router

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*.

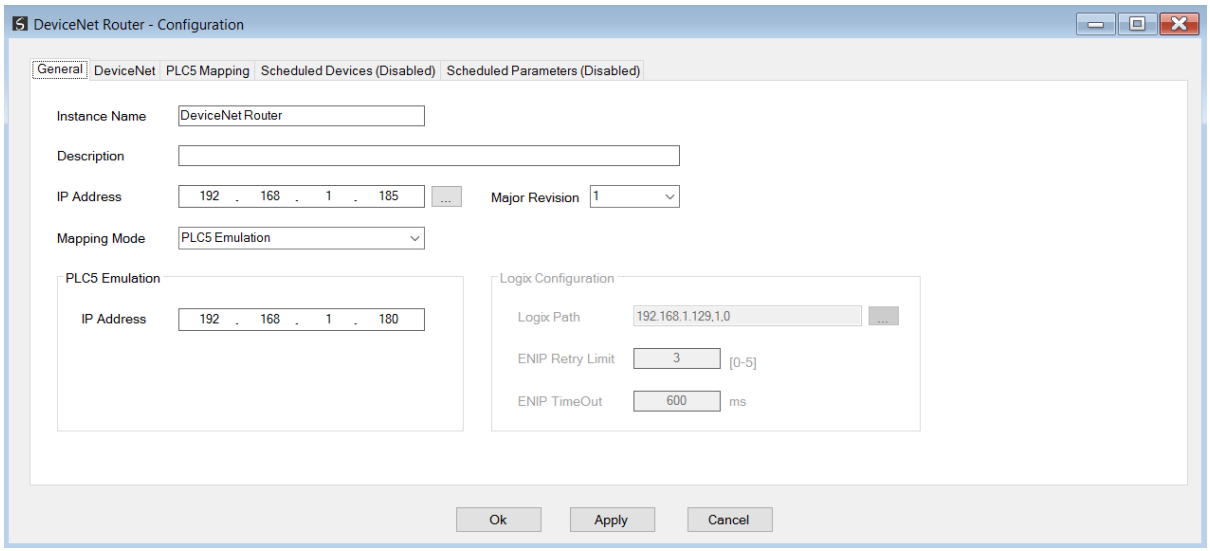


Figure 3.14 - DeviceNet Router configuration

3.4. GENERAL PARAMETERS

The DeviceNet 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 DeviceNet and mapping configuration.

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various DeviceNet Routers.
Description	This parameter is used to provide a more detail 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 DeviceNet Router on the network.
Mapping Mode	There are two mapping modes to choose from: **PLC5 Emulation** When in this mode the DeviceNet Router will produce and consume data on the DeviceNet network and emulate a PLC5 Controller (as a PCCC Ethernet slave) over Ethernet. This will, for example, allow the user to connect a newer "Ethernet only" PanelView to a DeviceNet network. **Scheduled Parameter** When in this mode the DeviceNet Router will request parameters from various DeviceNet nodes, scale them to engineering units and write them into Logix tags. This will allow the user to extract additional parameters from DeviceNet devices without making use of Logix message blocks.
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 DeviceNet 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.
Logix Configuration	**Logix Path:** The Logix path is the CIP path to the Logix controller which will be used to exchange data with the various DeviceNet devices. The user can use the browse button to launch the target browser to the select the Logix controller on the network. **ENIP Retry Limit** The amount of EtherNet/IP retries the module will make once no response was received from the Logix Controller. **ENIP TimeOut** The time in milliseconds after which a retry is sent. Once the first retry is sent the next retry will be sent after the same amount of time. This will repeat until the ENIP Retry Limit is reached.

Table 3.1 - General configuration parameters

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

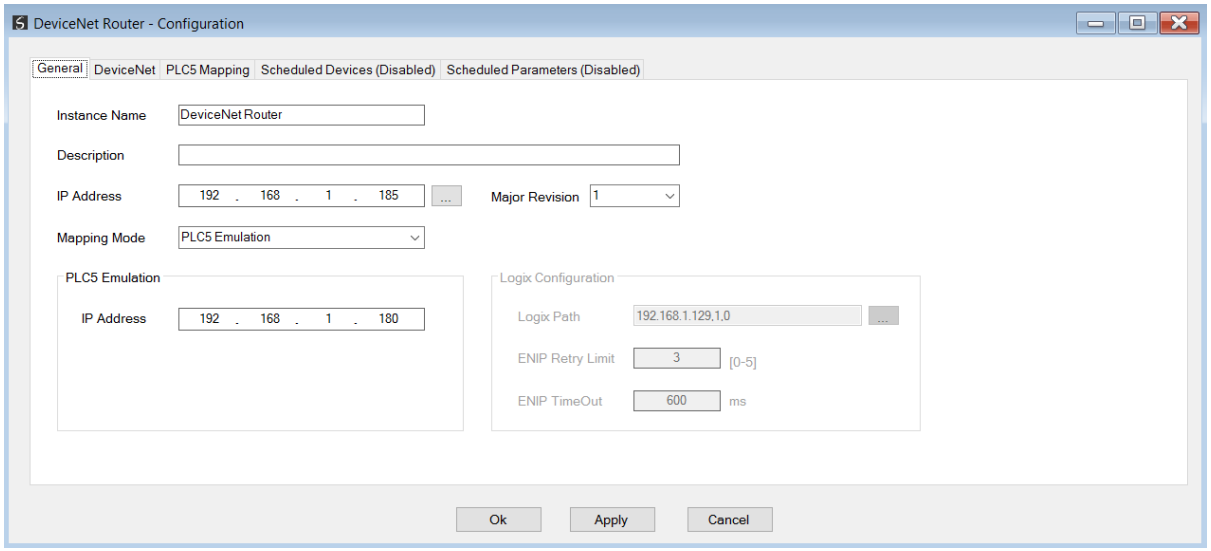


Figure 3.15 - General Configuration

The DeviceNet configuration consists of the following parameters:

Parameter	Description
Node Address	This is the node address of the DeviceNet Router on the DeviceNet network.
BAUD	This is the baud rate at which the CAN bus is operating. The options are: • 125k • 250k • 500k
Message Timeout	This is the DeviceNet message request timeout for Scheduled mode. When no response has been received from a DeviceNet device within this time the response will be seen as a failed no-response.

Table 3.2 - General configuration parameters

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

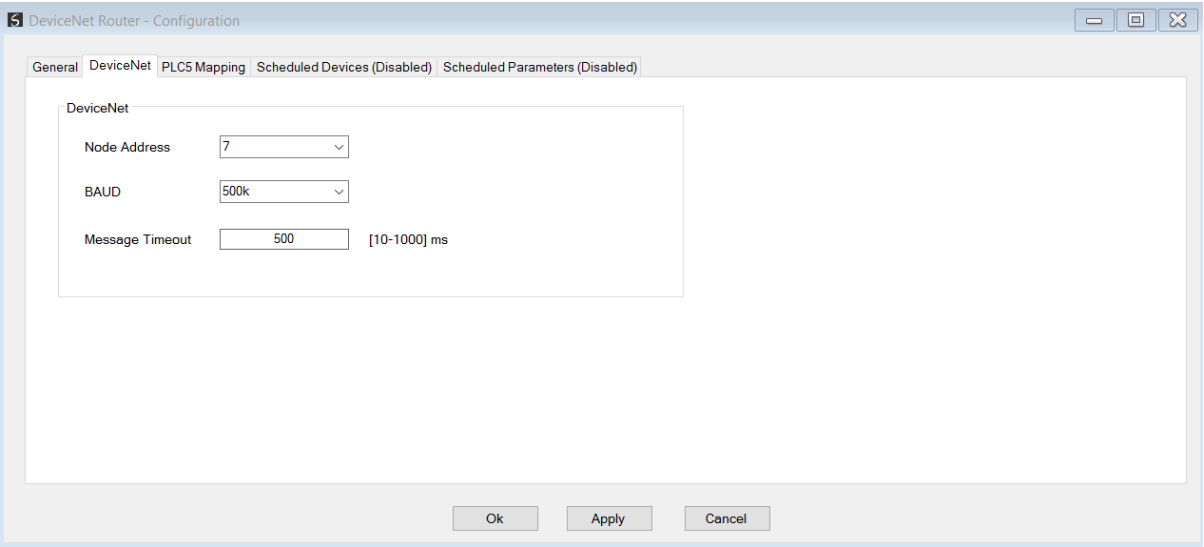


Figure 3.16 - General Configuration

3.5. PLC5 MAPPING

The PLC5 Mapping configuration consists of the following parameters:

Parameter	Description
Produced Size	The size (bytes) of the data to be produced on DeviceNet. The data originates from the Ethernet (PCCC) client.
PLC5 Produced File	The “PLC5” data file emulation to be used for the DeviceNet produced data.
Consumed Size	The size (bytes) of the data to be consumed on DeviceNet. The data is usually read by the Ethernet (PCCC) client.
PLC5 Consumed File	The “PLC5” data file emulation to be used for the DeviceNet consumed data.
Diagnostic File	The “PLC5” data file emulation to be used to expose the module’s diagnostic data.

Table 3.3 – DeviceNet configuration parameters

The PLC5 Mapping configuration is shown in the figure below. The PLC5 Mapping configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration.* Once in the configuration window select the second tab at the top *PLC5 Mapping*.

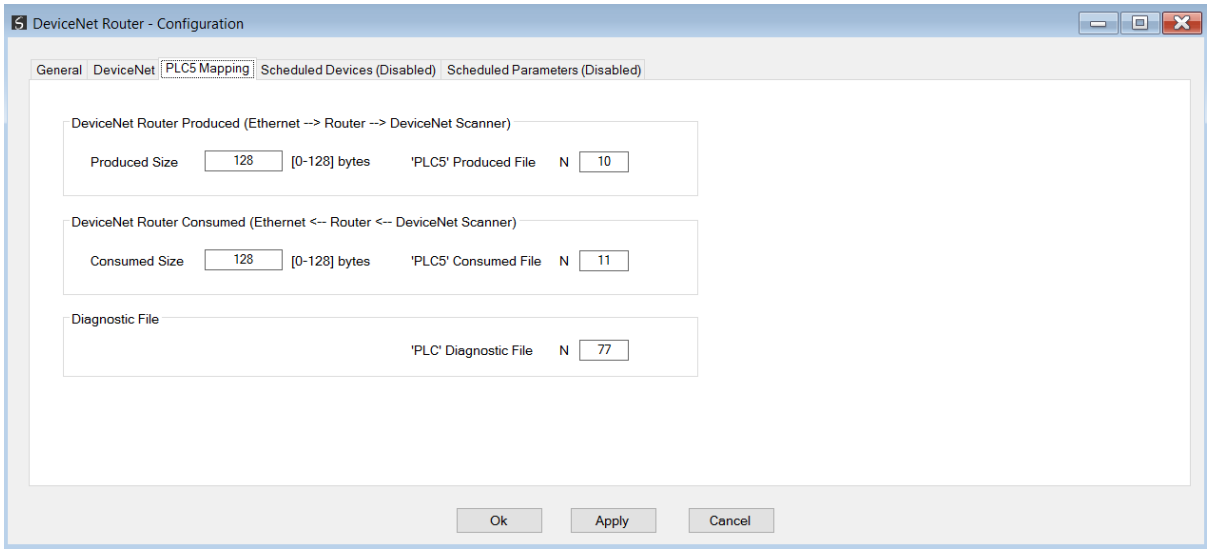


Figure 3.17 – PLC5 Mapping Configuration

3.6. SCHEDULED PARAMETER MAPPING

The scheduled parameter mapping allows the user to extract parameters from various DeviceNet devices and write the data into Logix tags (as shown below).

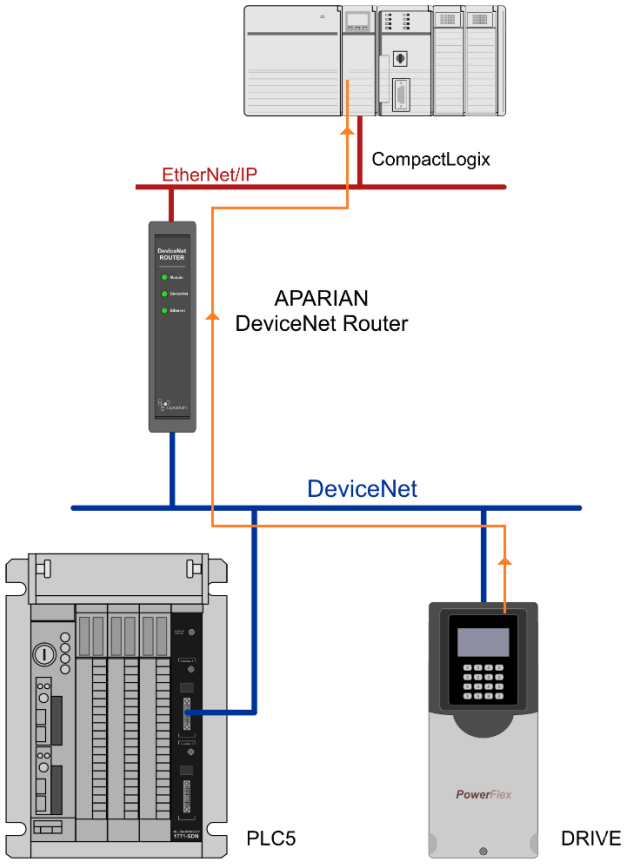


Figure 3.18 - DeviceNet Scheduled Mapping Configuration

There are two configuration steps required; configuring the device followed by configuring the parameters for the device.

NOTE: It is not required for the user to add a Scheduled Device for using the Scheduled Parameter mode. The user can simply add the parameter details directly into the Scheduled Parameter configuration. However, mapping the Scheduled Devices, which links the node to an EDS file, will provide the user the ability to browse for the device parameters and simplify the configuration process.

3.6.1. SCHEDULED DEVICES

First the user will need to select the target DeviceNet device. This is achieved by selecting a node number from the drop-down list followed by selecting the EDS file browse option.

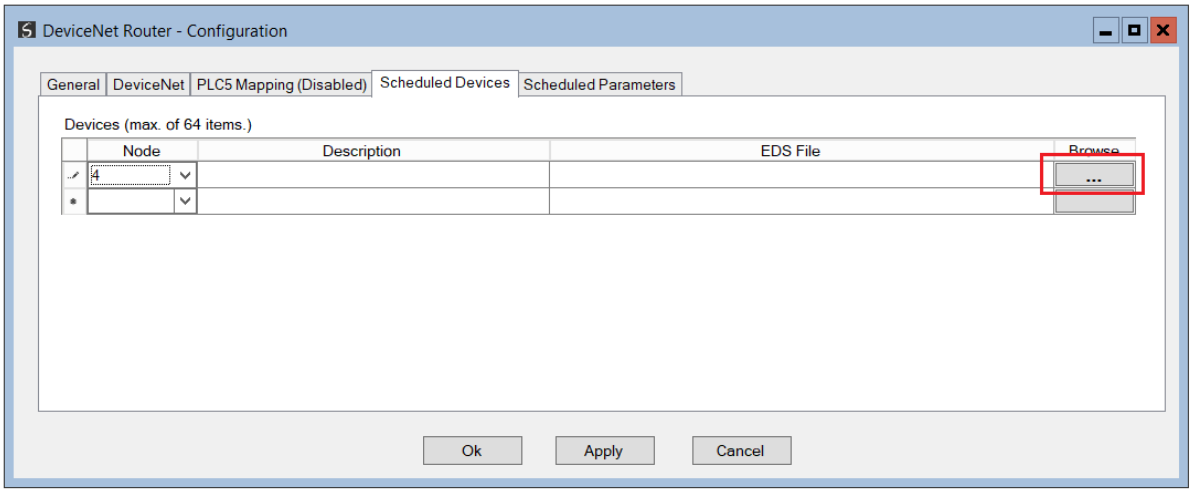


Figure 3.19 - DeviceNet Scheduled Mapping Configuration

NOTE: If the EDS catalog does not yet exist the user will be prompted to build the EDS catalog (as shown below). Alternatively, the user can select *Build EDS Catalog* option from the Tools menu.

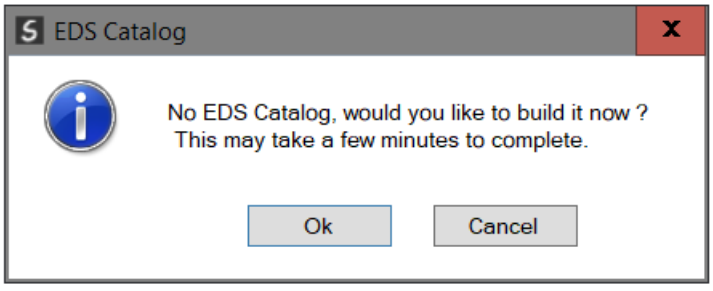


Figure 3.20 – EDS Catalog build request

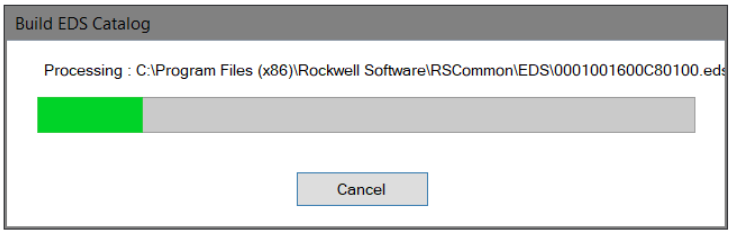


Figure 3.21 – EDS Catalog building

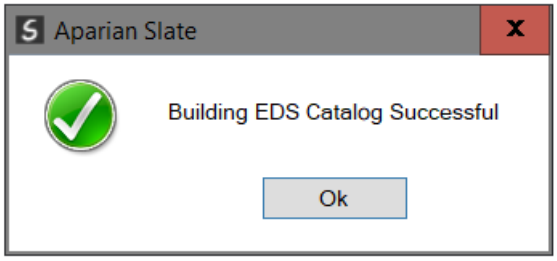


Figure 3.22 – EDS Catalog building finished

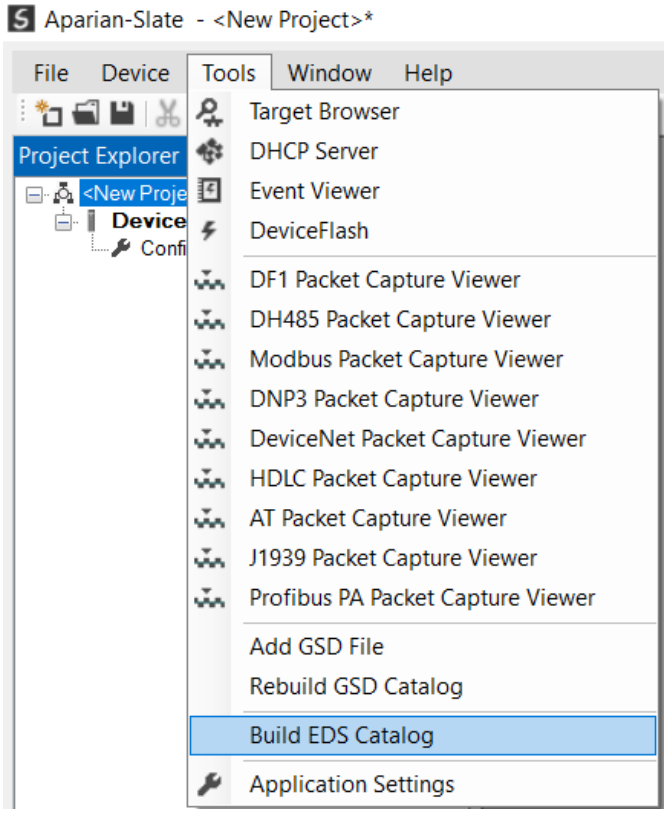


Figure 3.23 - DeviceNet EDS catalog building

Once the EDS catalog has been built the user can select a DeviceNet device from the EDS catalog. This will provide the user with a list of parameters from the device which can be selected in the Scheduled Parameters.

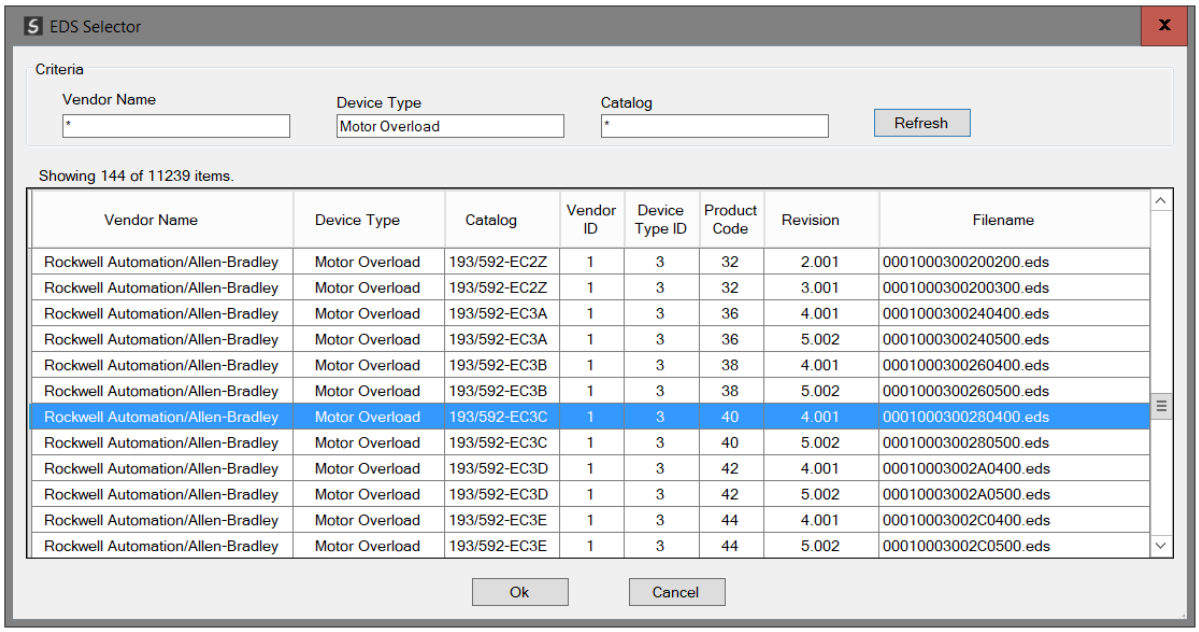


Figure 3.24 – EDS File selection

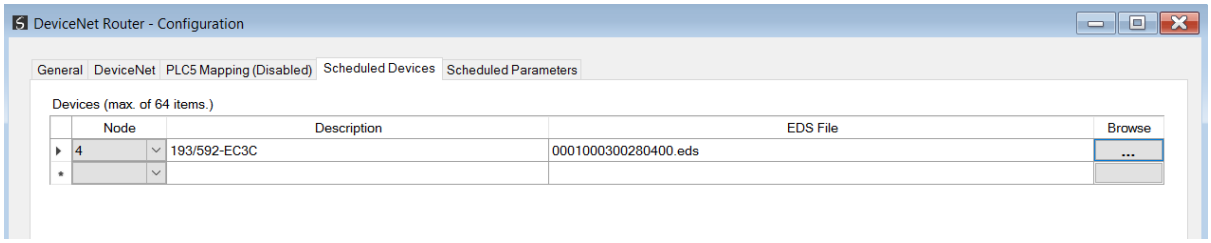


Figure 3.25 – Configured Scheduled Device

Below is an explanation of various fields in the Scheduled Parameter tab.

Parameter	Description
Node	The node address of the device selected
Description	The user description of the device. This will default to the device's catalog number from the EDS file, but can be changed as required.
EDS File	The selected EDS file

Table 3.4 – DeviceNet Scheduled Devices

3.6.2. SCHEDULED PARAMETERS

Once a device has been configured, the user can select the device Node number in the Scheduled Parameter mapping and access the parameters contained within the associated EDS file.

NOTE: It is not required for the user to add a Scheduled Device for using the Scheduled Parameter mode. The user can simply add the parameter details directly into the Scheduled Parameter configuration. However, mapping the Scheduled Devices, which links the node to an EDS file, will provide the user the ability to browse for the device parameters and simplify the configuration process.

If the user has defined a Scheduled device the Parameter browse button can be used to select a parameter from the EDS file.

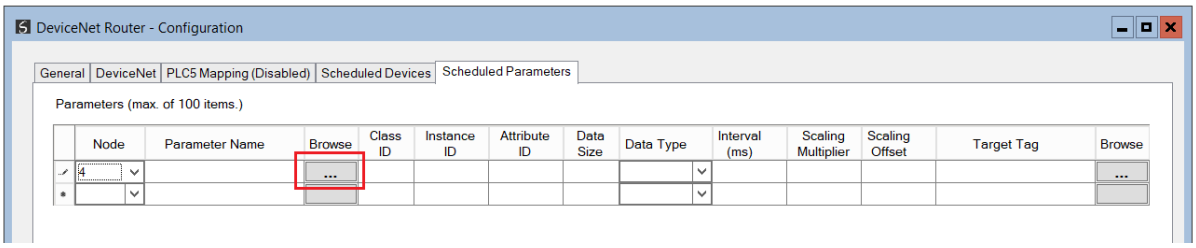


Figure 3.26 – Configured Scheduled Parameter Browse

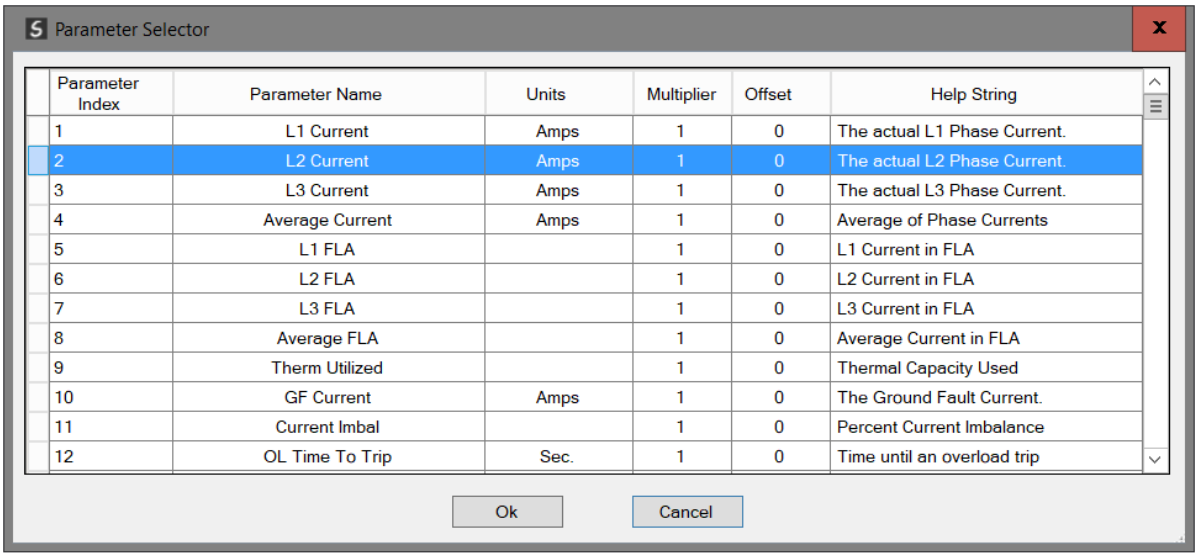


Figure 3.27 – Device Parameter List

Once a parameter has been selected from the parameter list the parameter fields will automatically populated as show below. The user will simply need to select the Target Tag by either typing in the Logix tag name or selecting it from the tag browser.

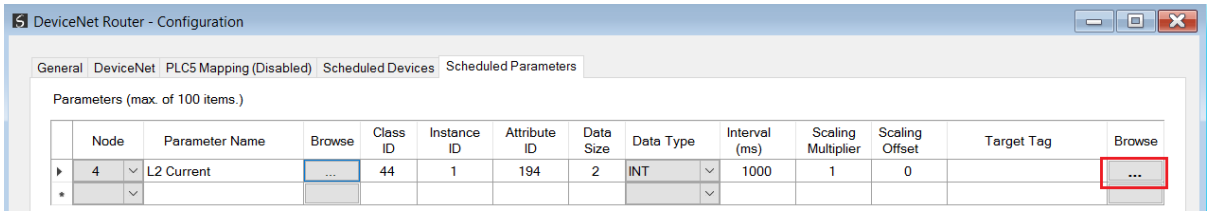


Figure 3.28 – Configured Scheduled Parameter populated

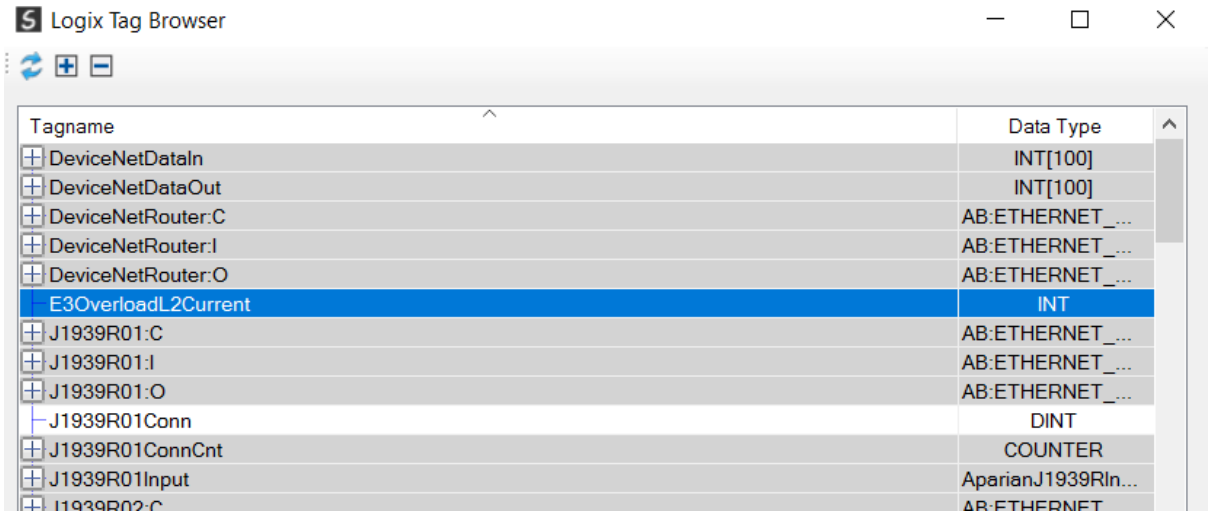


Figure 3.29 – Tag Browser

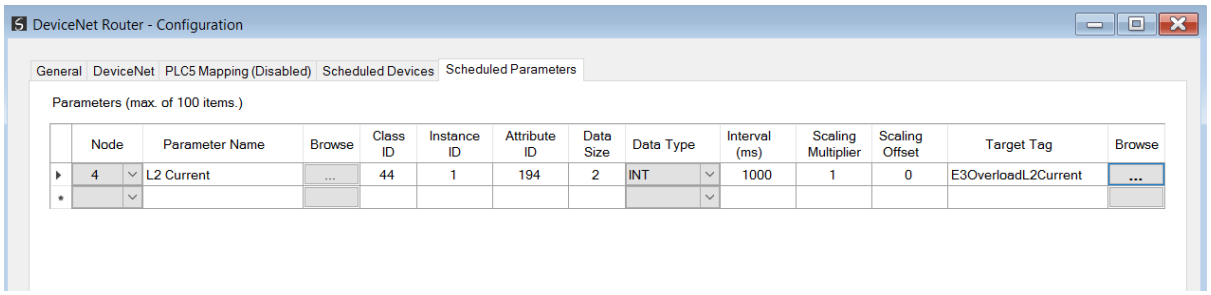


Figure 3.30 – Scheduled Parameter completed

Below is an explanation of various fields in the Scheduled Parameter tab.

Parameter	Description
Node	Node Address of the DeviceNet device from which the data will be requested
Parameter Name	Name of the parameter (extracted from EDS if used)
Class ID	CIP Class ID for the data request
Instance ID	CIP Instance ID for the data request
Attribute ID	CIP Attribute ID for the data request
Data Size	Size (bytes) of the DeviceNet data being received.

Data Type	The data type of the DeviceNet data being received.
Interval	The interval of the request in milliseconds.
Scaling Multiplier	The data scaling multiplier. This is applied before the data is written to the Logix Tag.
Scaling Offset	The data scaling offset. This is applied before the data is written to the Logix Tag.
Target Tag	The Logix Tag to which the data will be written.

Table 3.5 – DeviceNet Scheduled Parameter

3.7. MODULE DOWNLOAD

Once the DeviceNet 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 DeviceNet 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.

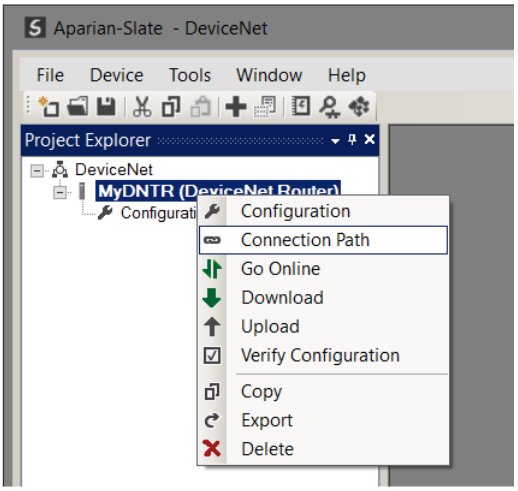


Figure 3.31 - Selecting Connection Path

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

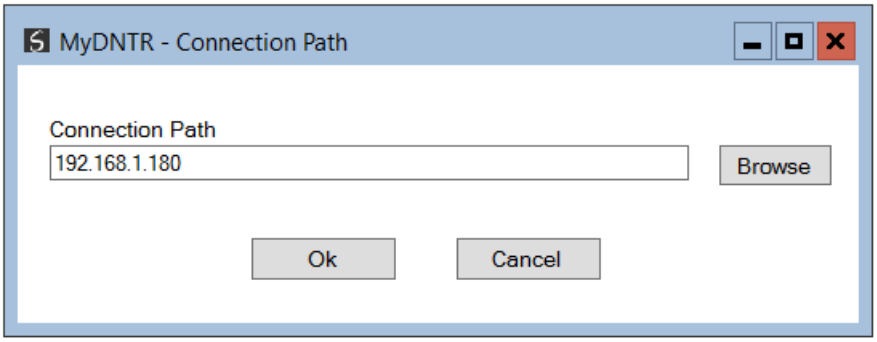


Figure 3.32 - Connection Path

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

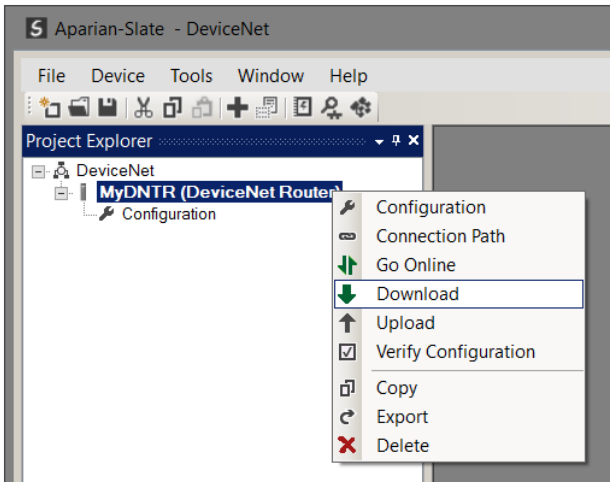


Figure 3.33 - Selecting Download

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

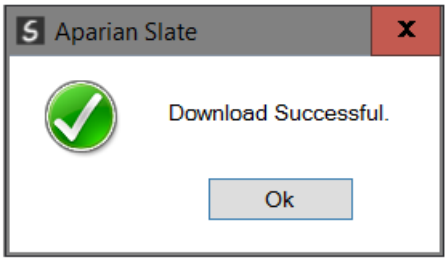


Figure 3.34 - Successful download

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.

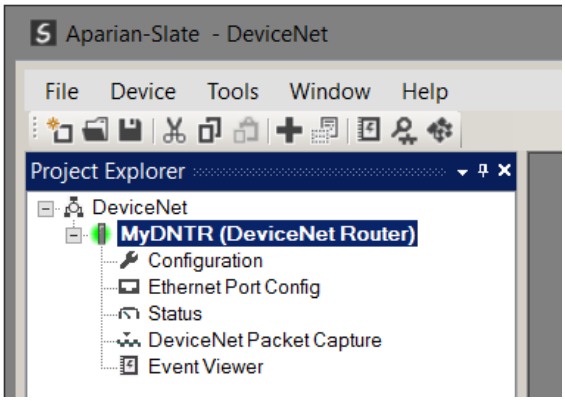


Figure 3.35 - Module online

3.8. LOGIX 5000 CONFIGURATION

3.8.1. ADD MODULE TO I/O CONFIGURATION

When the module operates in a Logix “owned” mode the DeviceNet Router will need to be added to the Logix 5000 I/O tree. 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).

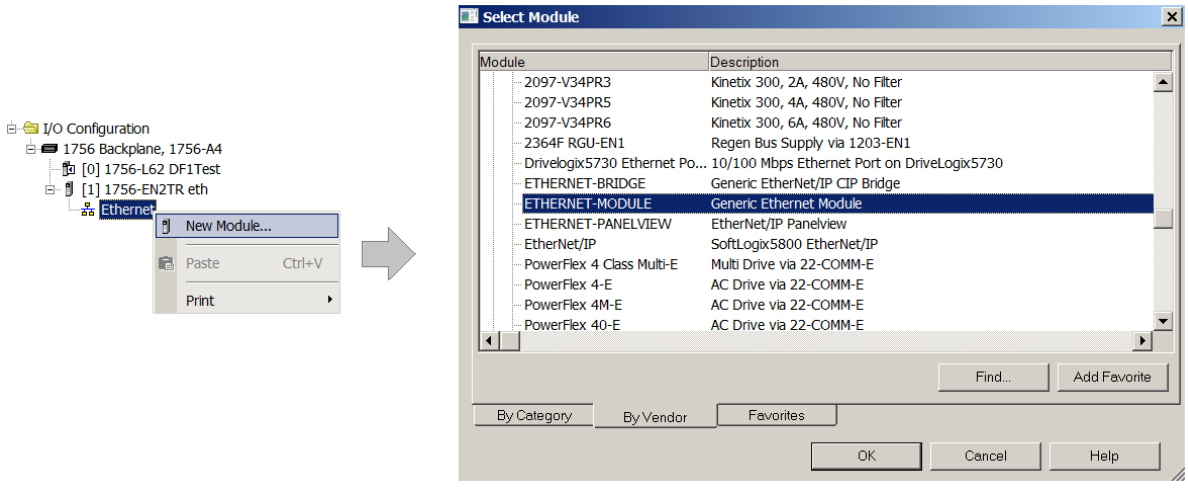


Figure 3.36 - Add a Generic Ethernet Module in Logix 5000

The user must enter the IP address of the DeviceNet 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	117	47 (32-bit)
Output	101	1 (32-bit)
Configuration	102	0 (8-bit)

Table 3.6 - Logix class 1 connection parameters for the DeviceNet Router

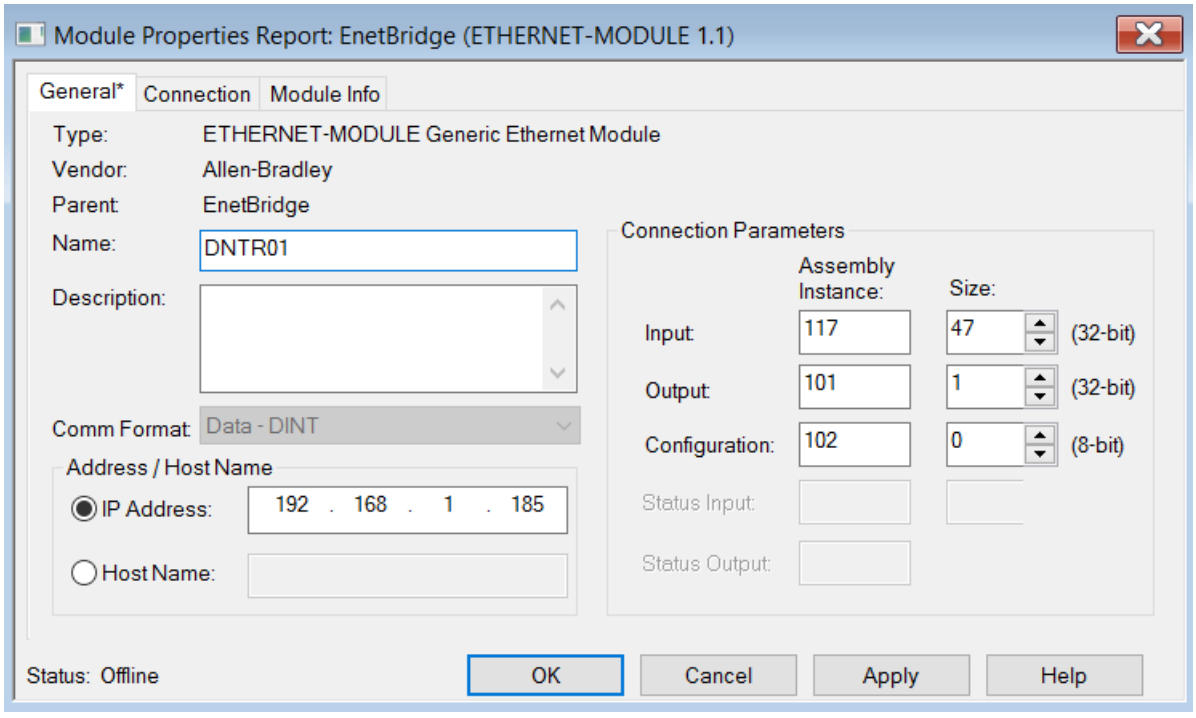


Figure 3.37 - Logix General module properties in Logix 5000

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 add 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.

NOTE: Although the module is capable of running with an RPI of 10ms, it is recommended to set the RPI to 200ms, to avoid unnecessary loading of the module processor.

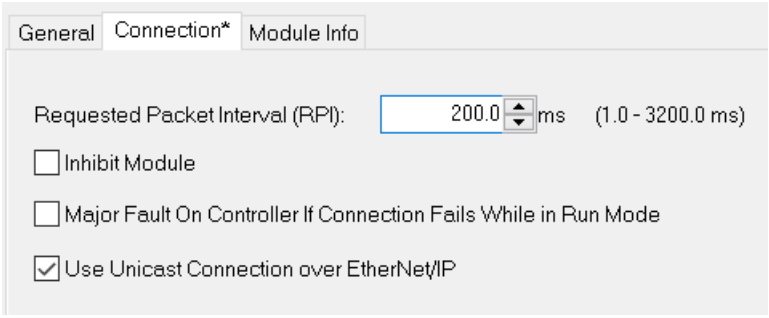


Figure 3.38 - Connection module properties in Logix 5000

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.

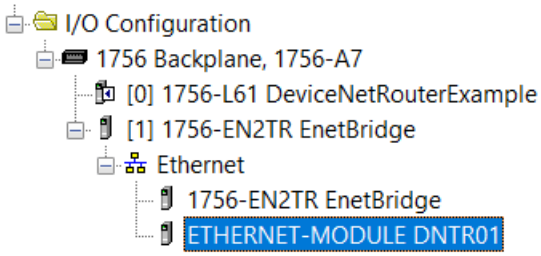


Figure 3.39 – Logix 5000 I/O module tree

3.8.2. 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.

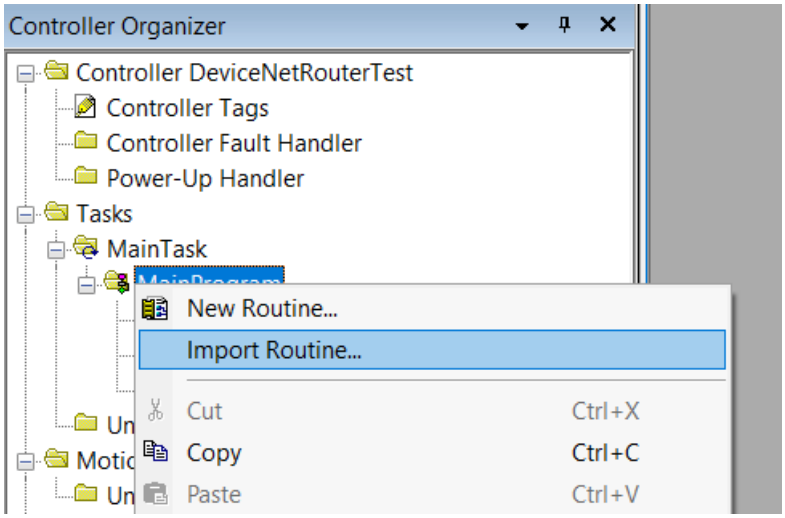


Figure 3.40 – Logix 5000 Importing DeviceNet Router specific routine and UDTs

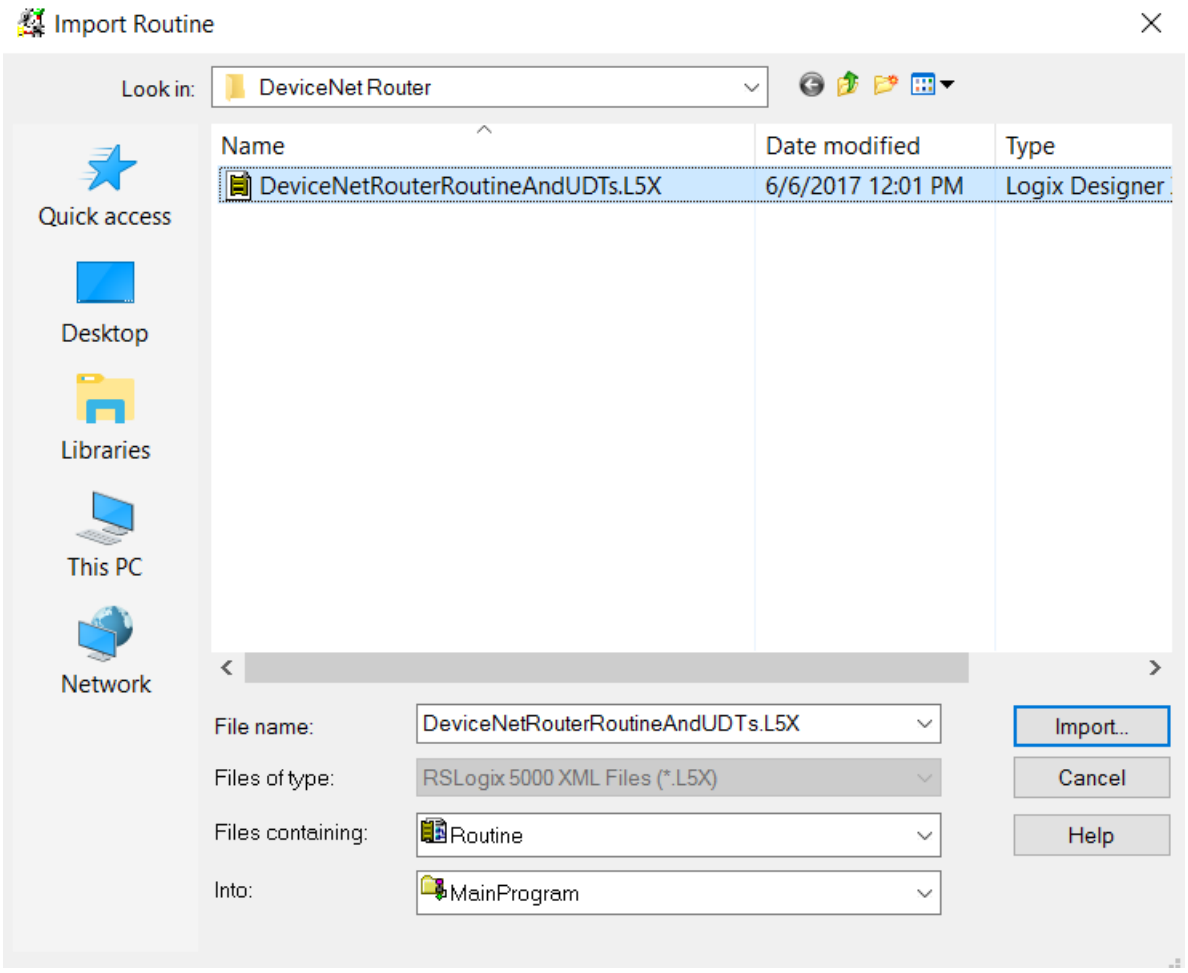


Figure 3.41 - Selecting partial import file

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 DeviceNet Router module to the aforementioned tags.

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

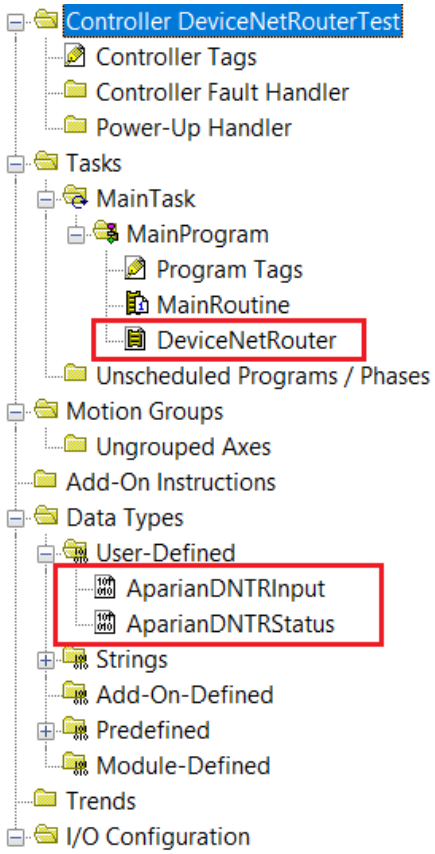


Figure 3.42 - Imported Logix 5000 objects

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

4. DEVICENET CONFIGURATION – RSNETWORX

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

Open RSNetWorx, create a new project and browse to the DeviceNet network. The software will scan the network for all the devices. Additional devices can be added (offline) if required.

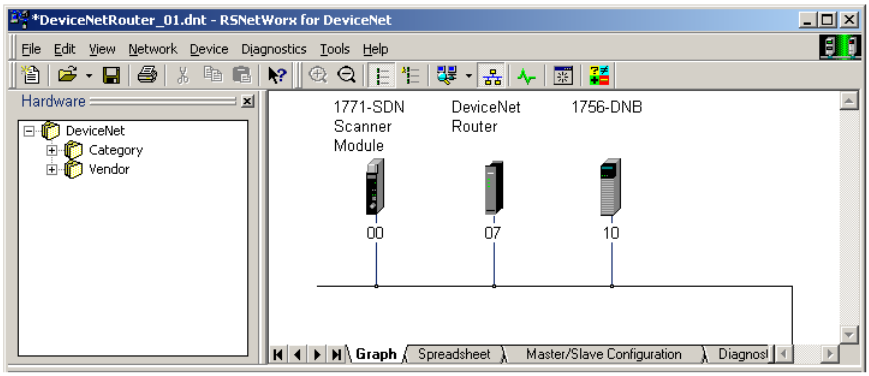


Figure 4.1 – RSNetWorx for DeviceNet

To schedule the master (scanner) module (e.g. 1771-SDN, 1756-DNB) right-click on the scanner module and select ***Properties***.

Select the ***Scanlist*** tab. The DeviceNet Router should be shown in the Available Devices (left) list box. Use the "***>***" (add) button to add it to the Scanlist (right).

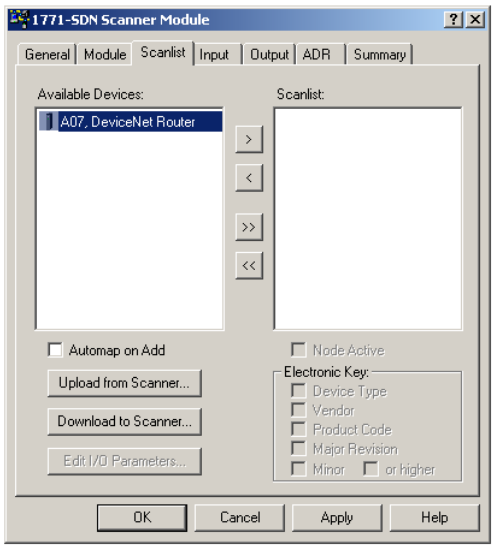


Figure 4.2 – Add device to Scanlist

NOTE: When the DeviceNet Router is added to the Scanlist, a dialog may appear, warning of no I/O Data. This is normal, because the DeviceNet Router's I/O data sizes are dynamically configured, and thus are not fixed in the EDS file.

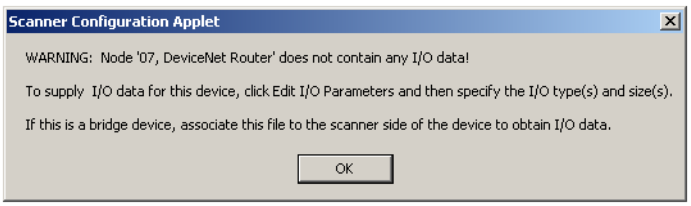


Figure 4.3 – I/O Data Warning

The DeviceNet Router will now appear in the Scanlist.

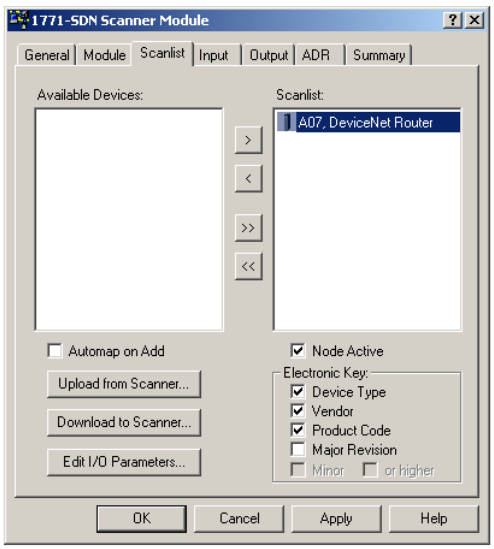


Figure 4.4 – Updated Scanlist

To configure the I/O data sizes, click on the ***Edit I/O Parameters*** button near the bottom of the ***Scanlist*** tab. The ***Edit I/O Parameters*** dialog will appear. The DeviceNet Router supports either ***Polled*** or ***Change of State*** (COS) data exchanges.

NOTE: Only one mode should be selected. Do not select both polled and Change of State.

4.1. POLLED METHOD

To schedule the data transfer using the polling method, select the Polled option.

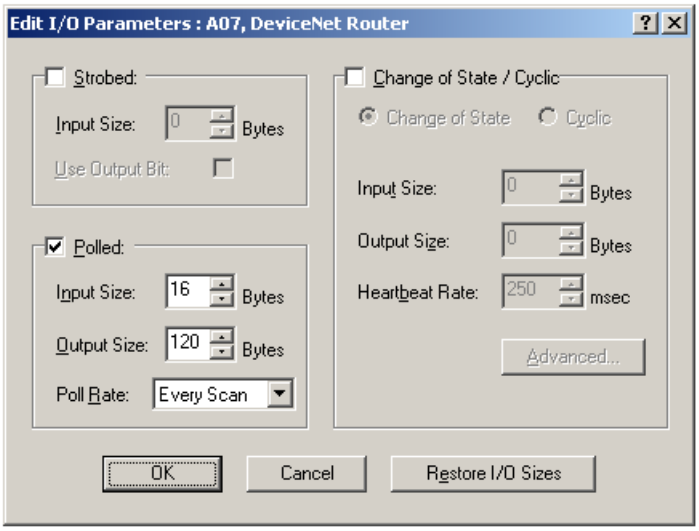


Figure 4.5 – Polled Configuration

The Input and Output sizes are specified in bytes, and should match the DeviceNet Router's configuration, as described the previous chapter.

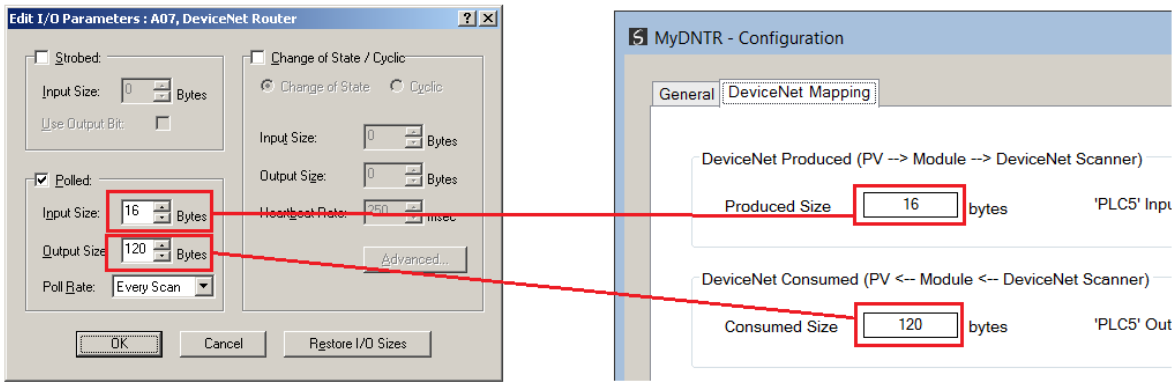


Figure 4.6 – Configuring Polled I/O Sizes

Once configured, click the Ok button.

NOTE: A dialog may again appear, warning that the configured size does not match that of the EDS file. This warning can be ignored.

4.2. CHANGE OF STATE METHOD

To schedule the data transfer using the ***Change of State*** method, select the "***Change of State / Cyclic***" option.

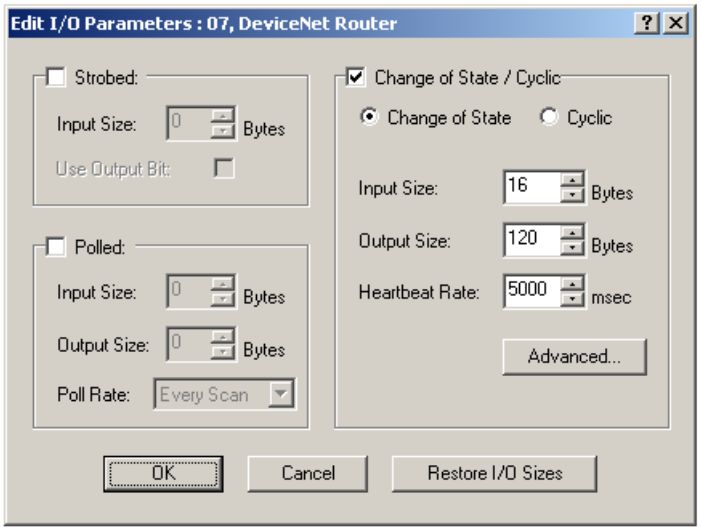


Figure 4.7 – Change of State Configuration

As with the polled configuration, The Input and Output sizes are specified in bytes, and should match the DeviceNet Router's configuration, as described earlier in this chapter.
Once configured, click the Ok button.

NOTE: A dialog may again appear, warning that the configured size does not match that of the EDS file. This warning can be ignored.

4.3. INPUT AND OUTPUT MAPPING

The scanner module typically transfers a large block of data to the host controller (PLC / PAC). The Input and Output mapping allows the user to specify where in this block the DeviceNet Router's data will appear. To map the Input data, select the ***Input*** tab.

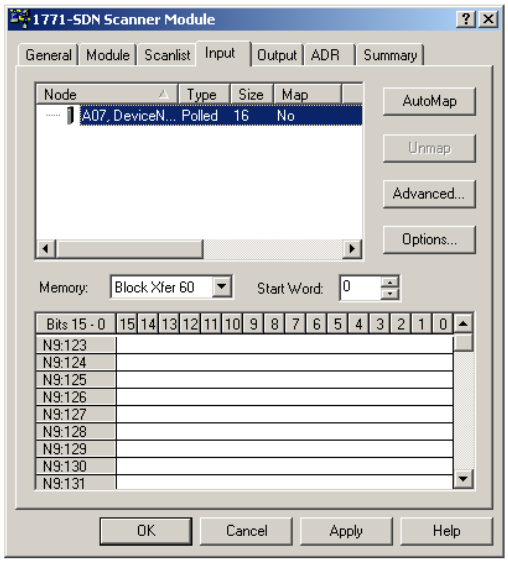


Figure 4.8 – Input Mapping

Select the ***DeviceNet Router*** in the "Node" items and click on the ***Advanced*** button. The ***Advanced Mapping*** dialog will appear.

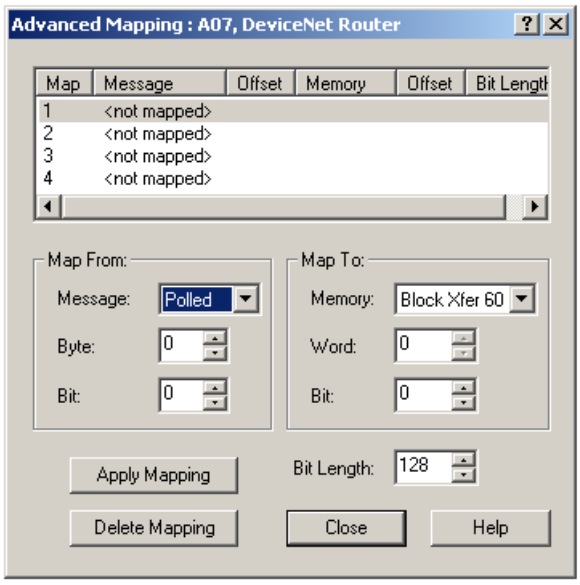


Figure 4.9 – Advanced Mapping – Input

Depending on the previously selected exchange method, the "Map From" Message, will either be ***Polled*** or ***COS***. In the "Map To" group box, enter the appropriate ***Memory*** (Xfer block), ***Word*** and ***Bit*** Offset. Not that the mapping ***Length*** is in bits. In this example, we enter 128 (16 bytes * 8).

Click the ***Apply Mapping*** to accept the configuration. The configured mapping will be illustrated in the lower section of the Input tab.

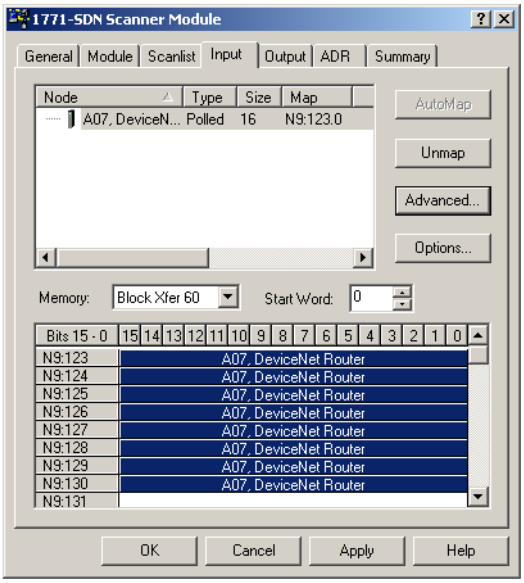


Figure 4.10 – Mapped Input Data

The output data is mapped in a similar method, by selecting the ***Advanced*** button on the ***Output*** tab.

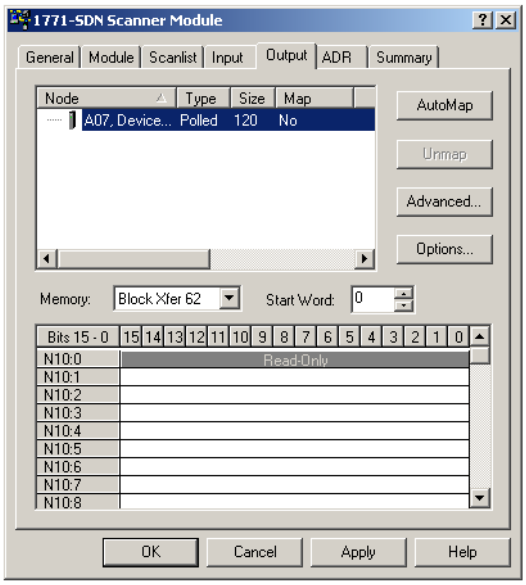


Figure 4.11 – Output Mapping

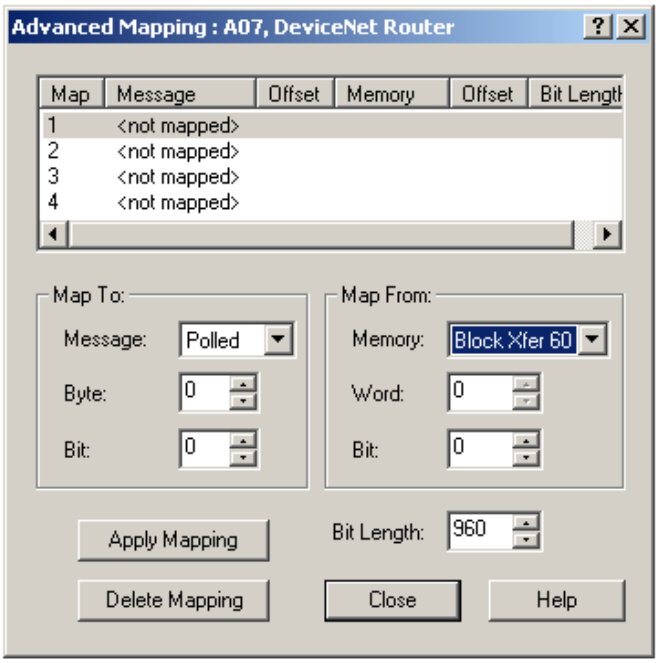


Figure 4.12 – Advanced Mapping – Output

Depending on the previously selected exchange method, the “Map To” Message, will either be ***Polled*** or ***COS***. In the “Map From” group box, enter the appropriate ***Memory*** (Xfer block), ***Word*** and ***Bit*** Offset. Not that the mapping ***Length*** is in bits. In this example we enter 960 (120 bytes * 8).

Click the ***Apply Mapping*** to accept the configuration. The configured mapping will be illustrated in the lower section of the Output tab.

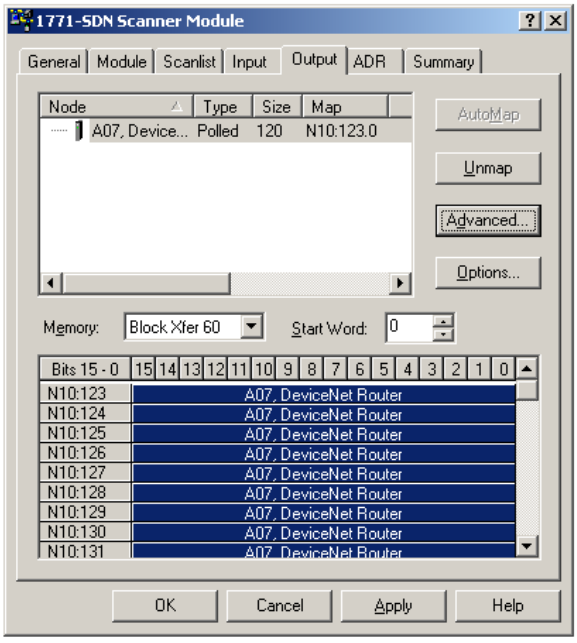


Figure 4.13 – Mapped Output Data

Once the mapping has been configured, select the Ok button on the scanner configuration dialog. The user will then be prompted to download the configuration changes to the scanner. Select the ***Yes*** option.

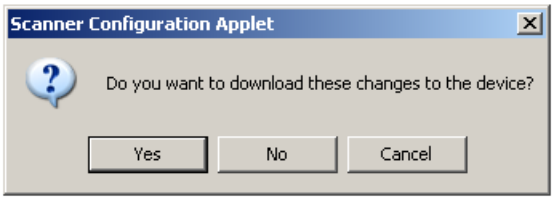


Figure 4.14 – Scanner Configuration Download Prompt

5. FTVIEW CONFIGURATION

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

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

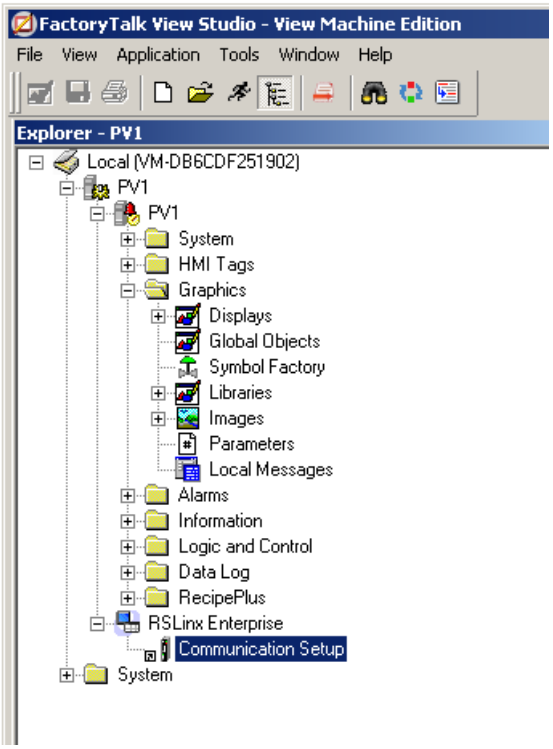


Figure 5.1 - FTView project

5.1. COMMUNICATION

To configure the communication link to the DeviceNet Router, 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***.

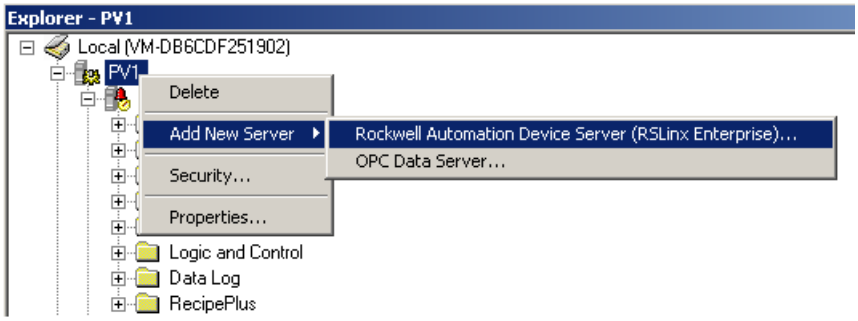


Figure 5.2 – Adding RSLinx Enterprise Server

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 "DNR".

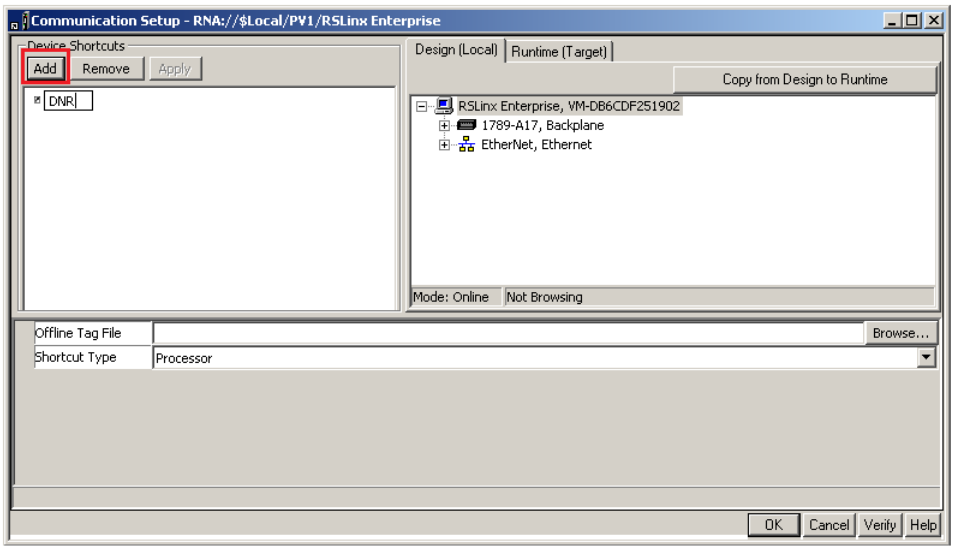


Figure 5.3 – Adding Device Shortcut

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

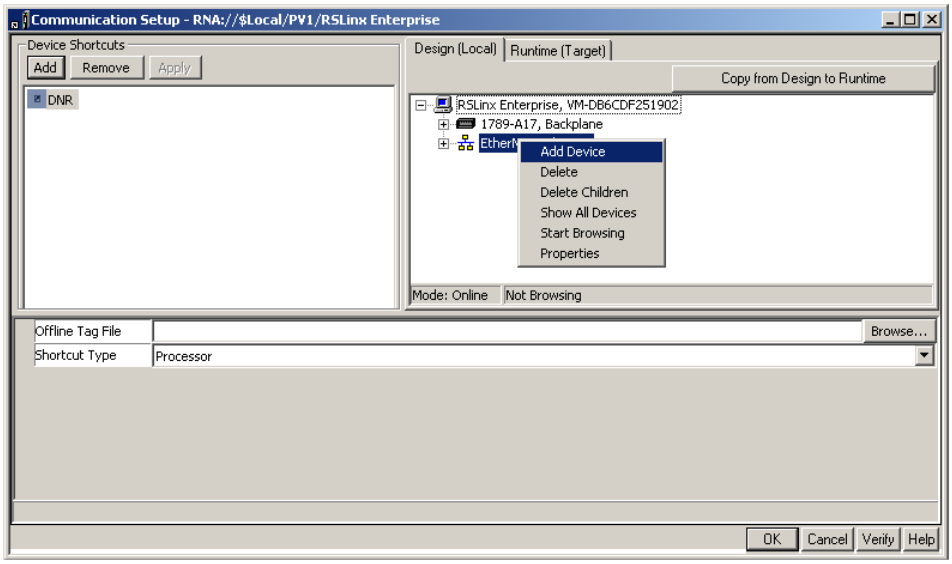


Figure 5.4 – Adding Ethernet Device

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 DeviceNet Router supports a PLC5 emulation mode, allowing it to be accessible by RSLinx Enterprise.

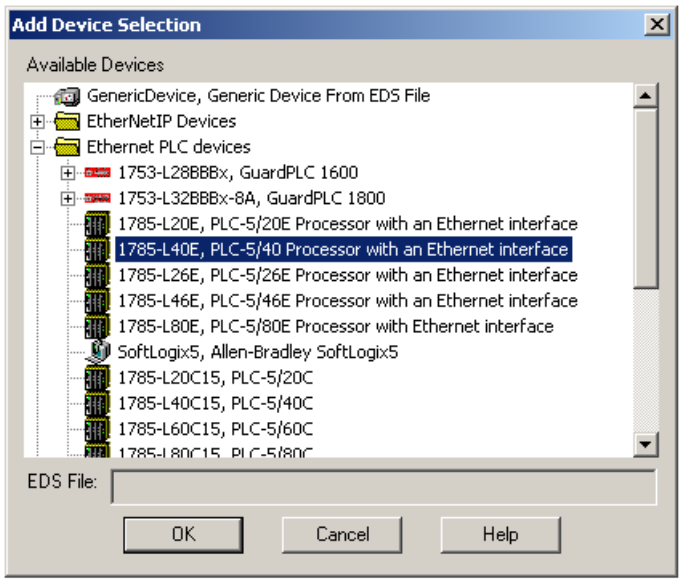


Figure 5.5 – Ethernet Device Selection

In the ***Device Properties*** page, enter the DeviceNet 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 DeviceNet Router's primary (EtherNet/IP) IP

address.

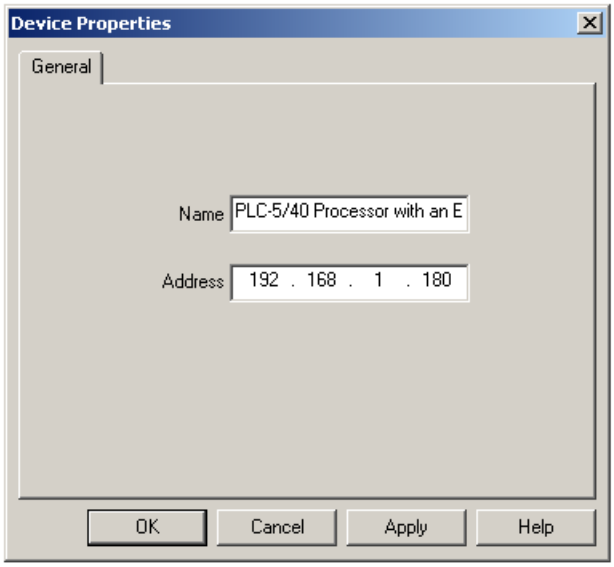


Figure 5.6 –Device Properties

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. ANIMATION

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

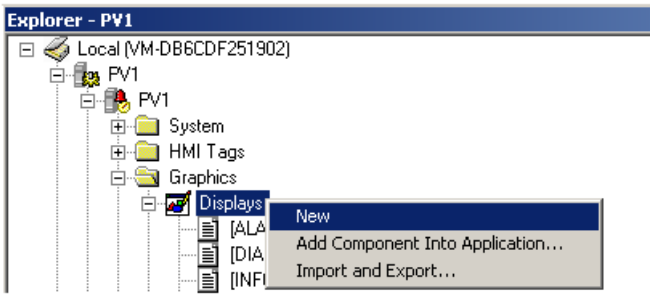


Figure 5.7 – Adding a Graphical Display

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.

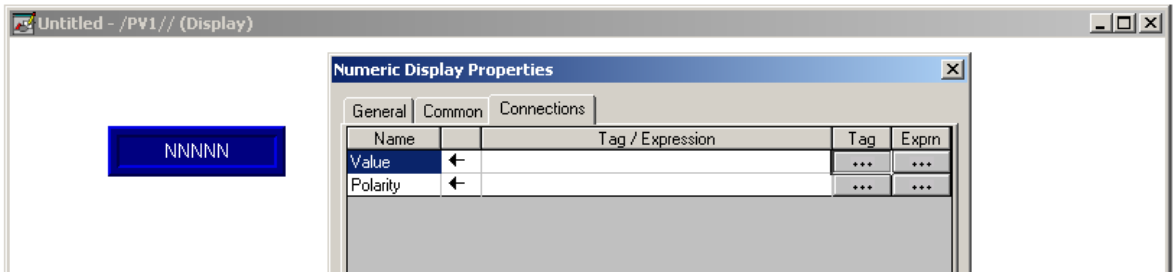


Figure 5.8 – Numeric Display Connections

The Numeric Display can now be linked to a DeviceNet 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 DeviceNet Router must be online for the tag browsing option to work.

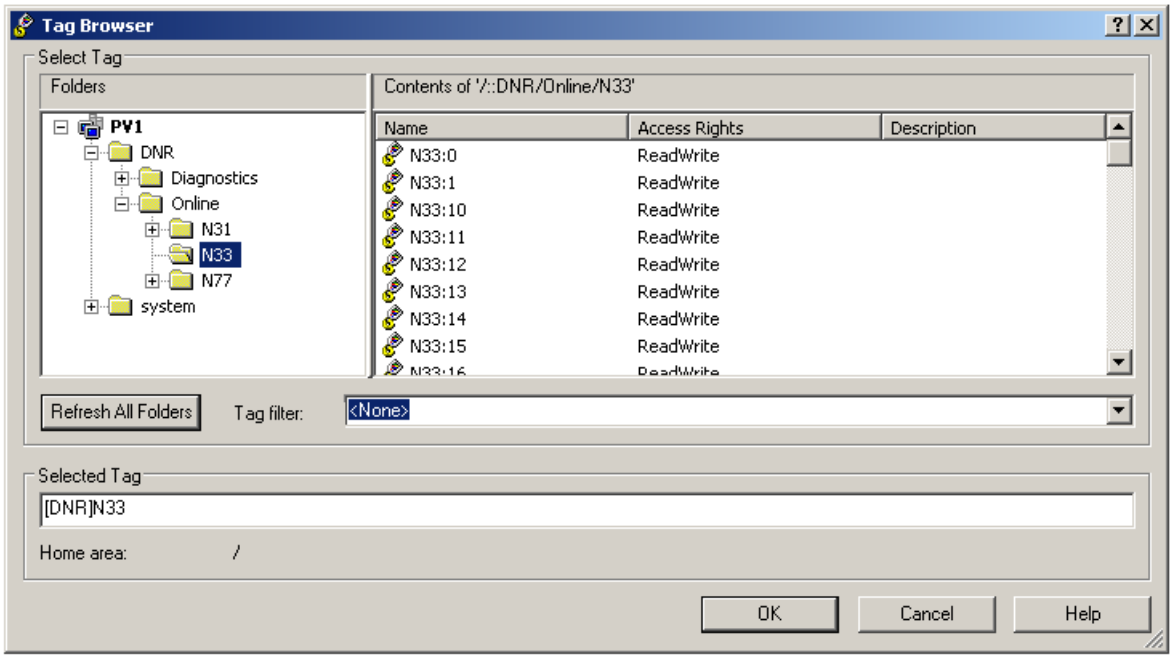


Figure 5.9 – Browsing Data Points

The data files, as configured in the DeviceNet Router, will appear under the ***Online*** section. Select the required data point to be connected to the Numeric Display. In this example, N31 and N33 represent the Input and Output data respectively and N77 represents the diagnostic data.

5.3. DIAGNOSTIC DATA

Various diagnostic items can be displayed in the FTView using the Diagnostic File. The diagnostic file number (e.g. N77) is configured in the DeviceNet Router as shown in chapter 3. The meaning of each diagnostic data point is tabulated below.

Offset	Group	Description
0	DeviceNet	DeviceNet Polling Status Bit 0 – Connection Active - Poll Bit 1 – Connection Standby Bit 2 – Connection Active - COS
1		Rx Can Packet Count
2		Tx Can Packet Count
3		CAN CRC Errors
4		CAN Bit Errors
5		Can Stuff Errors
6		UCCM Connection Open
7		UCCM Connection Close
8		IO Connections
9		Poll Commands
10		Fragment Ack Errors
11		Explicit Fragment Error
12		Poll Fragment Error
13		Explicit Client Not Found
14		Duplicate Node Detected
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
24	Module	DeviceNet Router Internal Temperature

Table 5.1 - Diagnostic File

6. OPERATION

6.1. MESSAGE ROUTING

When the module has been correctly setup the DeviceNet message initiator will send read commands to a certain DeviceNet addresses which will then be routed to a Logix tag. The messages send by the initiator must be completed with the correct data for successful operation. There are various indicators to determine if the mapping is routing the DeviceNet messages correctly. Once a transaction has been successfully completed the ***Transaction Ok*** bit in the mapped items status will be set. Refer to the diagnostics section of this document for a more detailed explanation of the various indicators that can be used to diagnose the module.

6.2. LOGIX 5000 ASSEMBLIES

When the module operates in a Logix "owned" mode the Logix controller will establish a class 1 cyclic communication connection with the DeviceNet 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.

6.2.1. INPUT ASSEMBLY

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

Parameter	Datatype	Description
Instance	STRING	This parameter is the instance name of the module that was configured under the general DeviceNet configuration in Slate.
Status.PLCEmulationMode	BOOL	Set if the module is operating in PLC Emulation Mode.
Status.ScheduledParameterMode	BOOL	Set if the module is operating in Scheduled Parameter mode.
Status.ConfigValid	BOOL	Set if a valid configuration is executing in the module.
MappedItemStatus	BOOL[128]	Each mapped item has a status bit to provide feedback of its operation. ***BOOL – Transaction Ok*** If this bit is set it means that the specific mapped item is successfully communicating between the DeviceNet device and the Logix controller.
TransactionRate	DINT	The transaction rate is the number of DeviceNet messages per second that the module is currently routing.

DeviceTemperature	REAL	The internal temperature of the DeviceNet Router module.
DeviceNetRxCount	DINT	The number of CAN packets received.
DeviceNetTxCount	DINT	The number of CAN packets transmitted.
DeviceNetCrcCount	DINT	The number of detected CAN CRC errors.
DeviceNetBitError	DINT	The number of detected CAN Bit errors.
DeviceNetStuffError	DINT	The number of detected CAN Stuff errors.
DeviceNetUCMMOpenCount	DINT	The number of UCCM (Unconnected Message Manager) Open requests
DeviceNetUCMMCloseCount	DINT	The number of UCCM (Unconnected Message Manager) Close requests
DeviceNetIOConnections	DINT	The number of current IO connections
DeviceNetPollCommandCount	DINT	The number of Poll Commands received.
DeviceNetFragmentAckErrors	DINT	The number of detected Fragment Acknowledge errors.
DeviceNetExplicitFragmentErrors	DINT	The number of detected Explicit Fragment errors.
DeviceNetPollFragmentErrors	DINT	The number of detected Poll fragment errors.
DeviceNetExplicitClientNotFound	DINT	The number of explicit requests received without a matching connection.
DeviceNetDuplicateNode	DINT	The number of duplicate node detections.
TagReads	DINT	The total number of Logix tag reads executed by the module.
TagWrites	DINT	The total number of Logix tag writes executed by the module.
ConnectionFailures	DINT	The number of failed class 3 connection attempts. Note: Logix tag reading and writing requires the module to first establish a class 3 connection with the Logix Controller.
TagErrors	DINT	The number of failed tag access (read/write) requests. These may include privileged violations, non-existing tags, etc.

Table 6.1 - Logix 5000 input assembly parameters

6.2.2. OUTPUT ASSEMBLY

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

Parameter	Datatype	Description
Reserved	DINT	This DINT is reserved for future use.

Table 6.2 - Logix 5000 output assembly parameters

An excerpt of the Input Image is shown in the following figure.

DNTR01Input	{...}	{...}		AparianDNTRInput
DNTR01Input.Instance	'DeviceNet Router'	{...}		STRING
DNTR01Input.Status	{...}	{...}		AparianDNTRStatus
DNTR01Input.Status.PLCEmulationMode	0		Decimal	BOOL
DNTR01Input.Status.ScheduledParameterMode	1		Decimal	BOOL
DNTR01Input.Status.ConfigurationValid	1		Decimal	BOOL
DNTR01Input.MappedItemStatus	{...}	{...}	Decimal	BOOL[128]
DNTR01Input.TransactionRate	0		Decimal	DINT
DNTR01Input.Temperature	68.70213		Float	REAL
DNTR01Input.DeviceNetRxCount	473673		Decimal	DINT
DNTR01Input.DeviceNetTxCount	22706		Decimal	DINT
DNTR01Input.DeviceNetCRCError	0		Decimal	DINT
DNTR01Input.DeviceNetBitError	0		Decimal	DINT
DNTR01Input.DeviceNetStuffError	0		Decimal	DINT
DNTR01Input.DeviceNetUCMMOpenCount	119		Decimal	DINT
DNTR01Input.DeviceNetUCMMCloseCount	0		Decimal	DINT
DNTR01Input.DeviceNetIOConnections	119		Decimal	DINT
DNTR01Input.DeviceNetPollCommandCount	0		Decimal	DINT
DNTR01Input.DeviceNetFragmentAckErrors	0		Decimal	DINT
DNTR01Input.DeviceNetExplicitFragmentErrors	0		Decimal	DINT
DNTR01Input.DeviceNetPollFragmentErrors	0		Decimal	DINT
DNTR01Input.DeviceNetExplicitClientNotFound	0		Decimal	DINT
DNTR01Input.DeviceNetDuplicateNode	0		Decimal	DINT
DNTR01Input.TagReads	0		Decimal	DINT
DNTR01Input.TagWrites	6809		Decimal	DINT
DNTR01Input.TagConnectionErrors	0		Decimal	DINT
DNTR01Input.TagErrors	0		Decimal	DINT

Figure 6.1 – DeviceNet Router Input Assembly

7. DIAGNOSTICS

7.1. 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 7.1 - DevicNetRouter front view

LED	Description
Ok	The module's Ok LED will provide information regarding the system-level operation of the module. Thus 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 then the module has booted and is running correctly.
Eth	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.
DNet	The DNet LED shows the activity on the DeviceNet network. Green indicating valid packets, and red indicating corrupt packets.

Table 7.1 - Module LED operation

7.2. MODULE STATUS MONITORING IN SLATE

The DeviceNet Router can provide a range of 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.

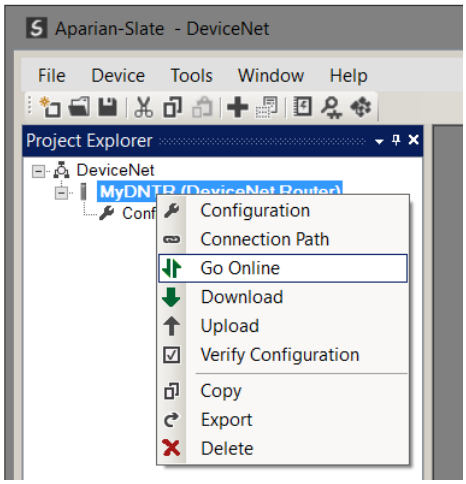


Figure 7.2 - Selecting to Go Online

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

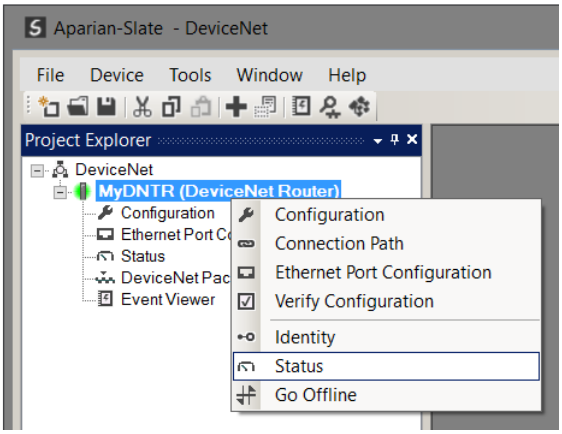


Figure 7.3 - Selecting online Status

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.

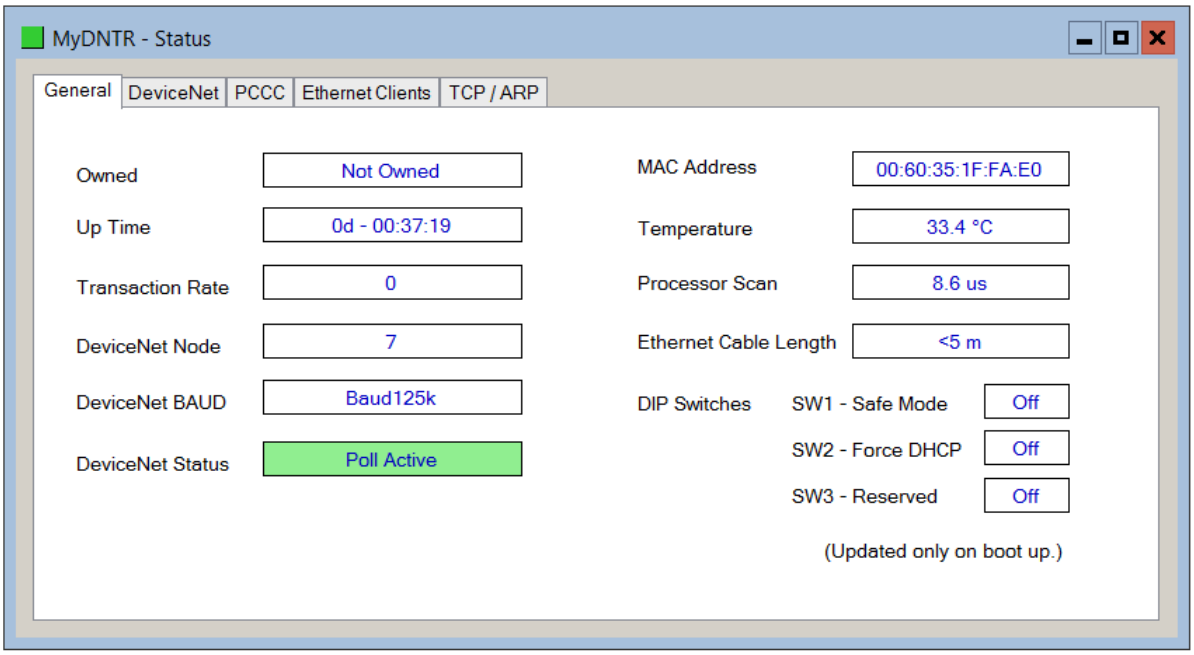


Figure 7.4 - Status monitoring – General

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.
Transaction Rate	The transaction rate is the number of DeviceNet messages per second that the module is currently routing. This parameter is valid only for Logix tag mapping.
DeviceNet Node Number	The current DeviceNet node number, as configured by the rotary DIP switches.
DeviceNet BAUD Rate	The actual DeviceNet BAUD rate.
DeviceNet Status	The current DeviceNet status: Inactive – No valid polling by scanner. Standby – Polling is in standby. (PLC in program mode.) Poll Active – Active polling by scanner. COS Active – Active Change-of-State by scanner.
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 Cable Length	Indicates the estimated length of the Ethernet cable attached to the module. (Accuracy of 5m)

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 7.2 - Parameters displayed in the Status Monitoring – General Tab

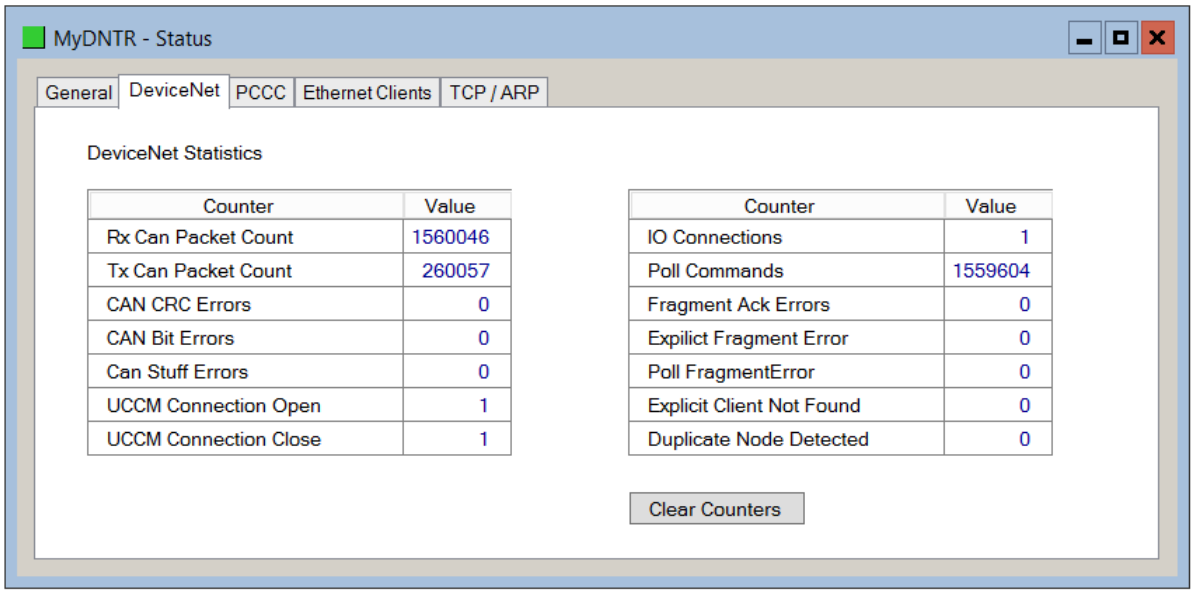


Figure 7.5 - Status monitoring – DeviceNet Statistics

The DeviceNet Statistics tab displays the statistics associated with the DeviceNet communication and mapping.

Statistic	Description
Rx Can Packet Count	The number of CAN packets received.
Tx Can Packet Count	The number of CAN packets transmitted.
CAN CRC Errors	The number of detected CAN CRC errors.
CAN Bit Errors	The number of detected CAN Bit errors.
Can Stuff Errors	The number of detected CAN Stuff errors.
UCCM Connection Open	The number of UCCM (Unconnected Message Manager) Open requests
UCCM Connection Close	The number of UCCM (Unconnected Message Manager) Close requests
IO Connections	The number of current IO connections
Poll Commands	The number of Poll Commands received.
Fragment Ack Errors	The number of detected Fragment Acknowledge errors.
Explicit Fragment Error	The number of detected Explicit Fragment errors.

Poll Fragment Error	The number of detected Poll fragment errors.
Explicit Client Not Found	The number of explicit requests received without a matching connection.
Duplicate Node Detected	The number of duplicate node detections.

Table 7.3 – DeviceNet statistics

The PCCC tab displays the Ethernet PCCC statistics.

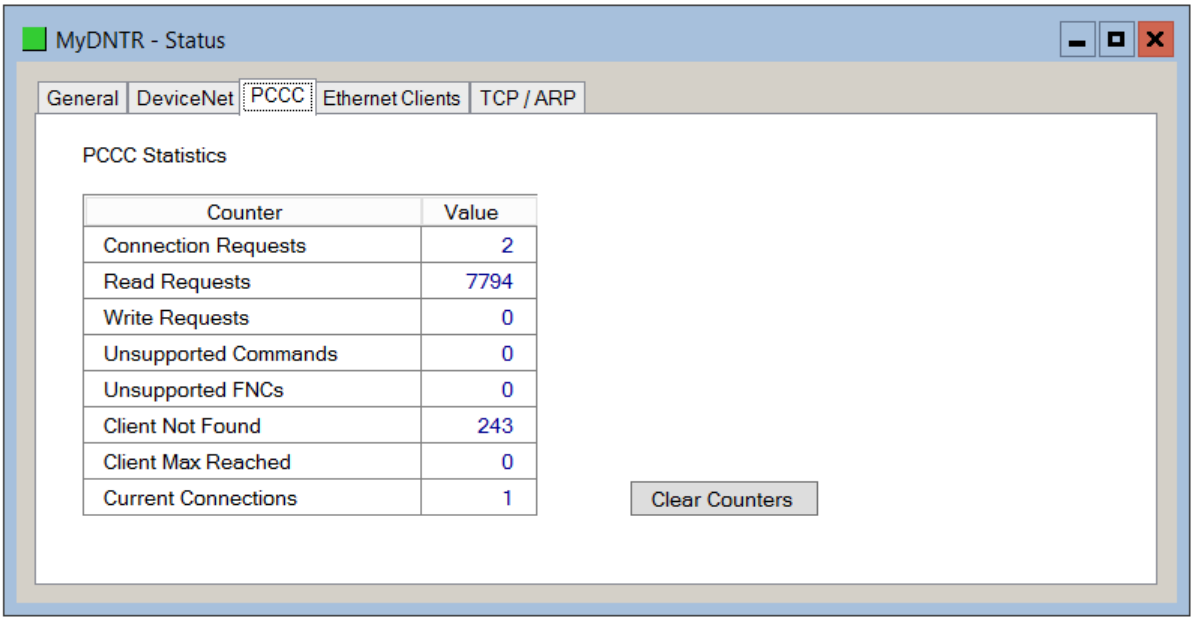


Figure 7.6 - Status monitoring – PCCC Statistics

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

Table 7.4 – PCCC statistics

The Map Item tab displays the Mapped Item statistics.

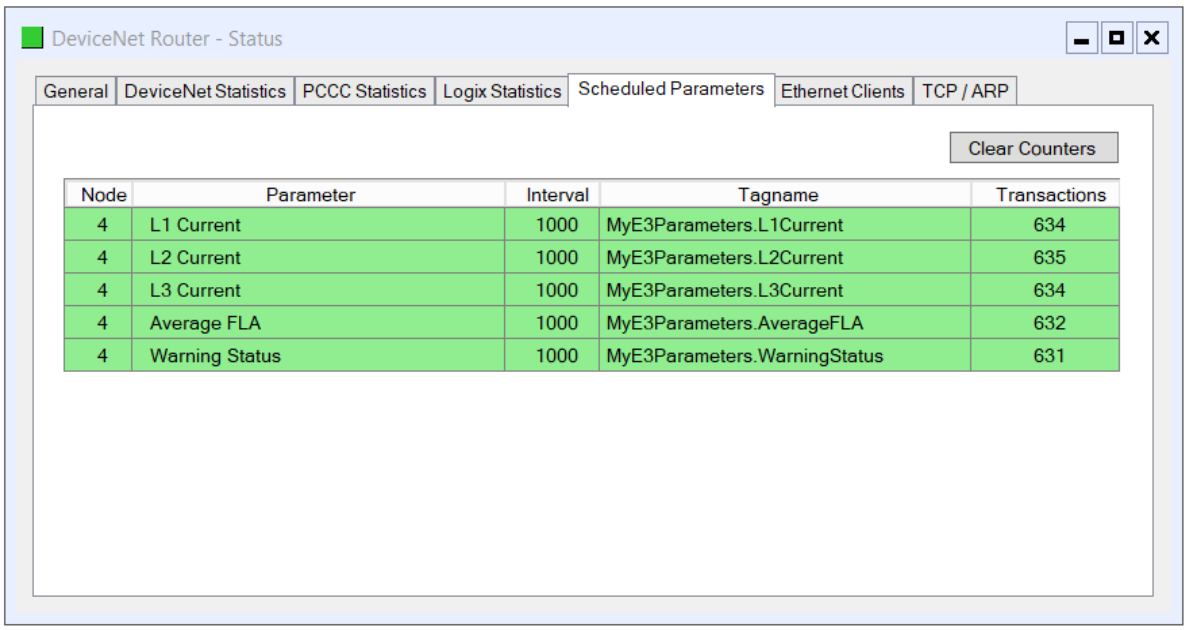


Figure 7.7 - Status monitoring – Mapped Item Statistics

Statistic	Description
Node	Node address of the mapped item
Parameter	Parameter Name of the mapped item.
Interval	Configured interval (ms) to read the parameter.
Tagname	Configured target Logix tagname
Transactions	Succesful transaction count.

Table 7.5 – Mapped Item statistics

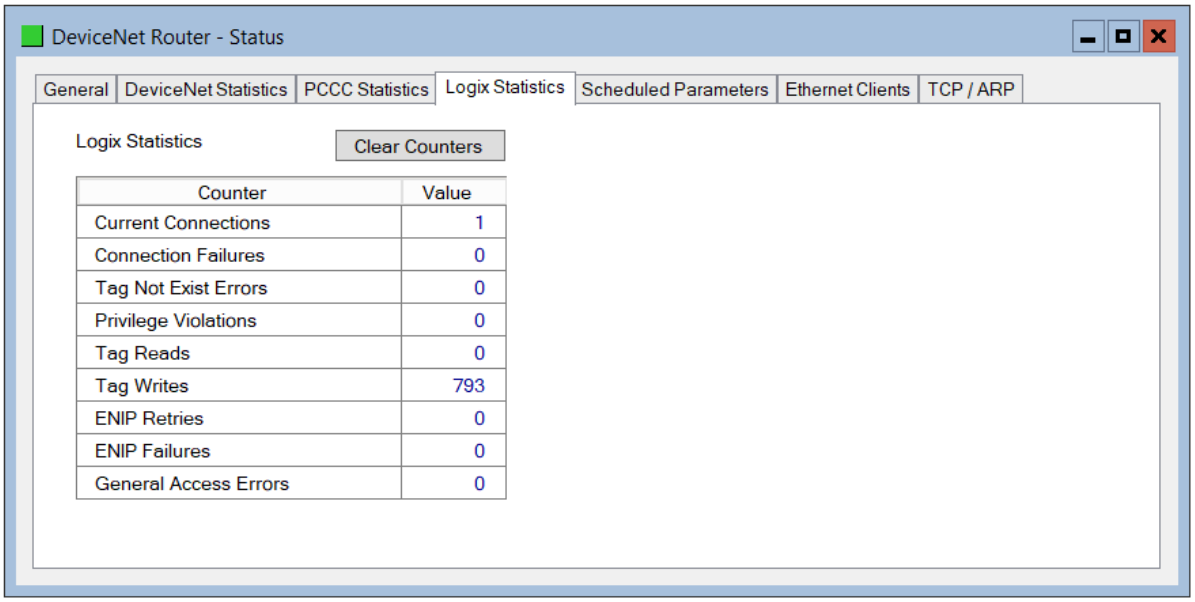


Figure 7.8 - Status monitoring – Logix Statistics

The Logix Statistics tab displays the following general parameters:

Parameter	Description
Current Connections	The number of current open class 3 connections.
Connection Failures	The number of failed attempts at establishing a class 3 connection with a Logix controller.
Tag Not Exist Errors	The number of tag read and tag write transactions that failed due to the destination tag not existing.
Privilege Violations	The number of tag read and tag write transactions that failed due to a privilege violation error. This may be caused by the External Access property of the Logix tag being set to either None or Read Only.
Tag Reads	The number of tag read transactions executed by the DeviceNet Router module.
Tag Writes	The number of tag write transactions executed by the DeviceNet Router module.
ENIP Retries	This count increases when no response was received from the Logix Controller by the time the ENIP timeout is reached.
ENIP Failures	This count increases when the ENIP Retry Limit is reached and no response has been received from the Logix Controller.
Tag Access General Error	This count increases when a tag cannot be accessed for any other reason not reported above.

Table 7.6 - Parameters displayed in the Status Monitoring – Logix Statistics Tab

7.3. DEVICENET PACKET CAPTURE

The module provides the capability to capture the DeviceNet traffic for analysis. The will allow the user and the support team to resolve any possible issues on site. To invoke the capture of the module double-click on the DeviceNet Packet Capture item in the Project Explorer tree.

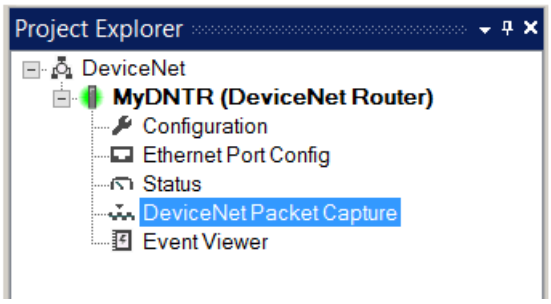


Figure 7.9 - Selecting DeviceNet Packet Capture

The DeviceNet Packet Capture window will open and automatically start capturing all DeviceNet packets.

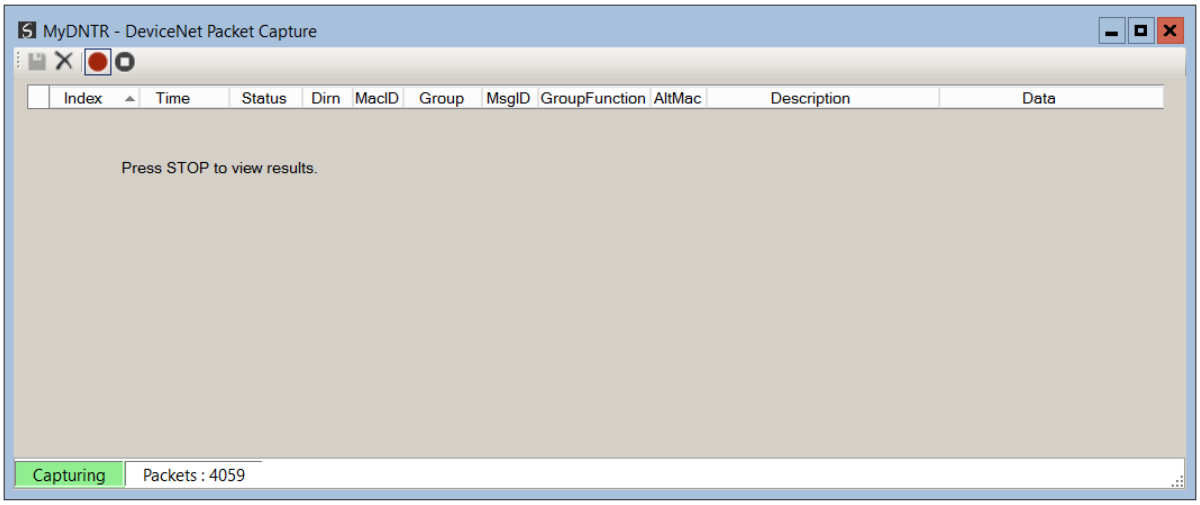
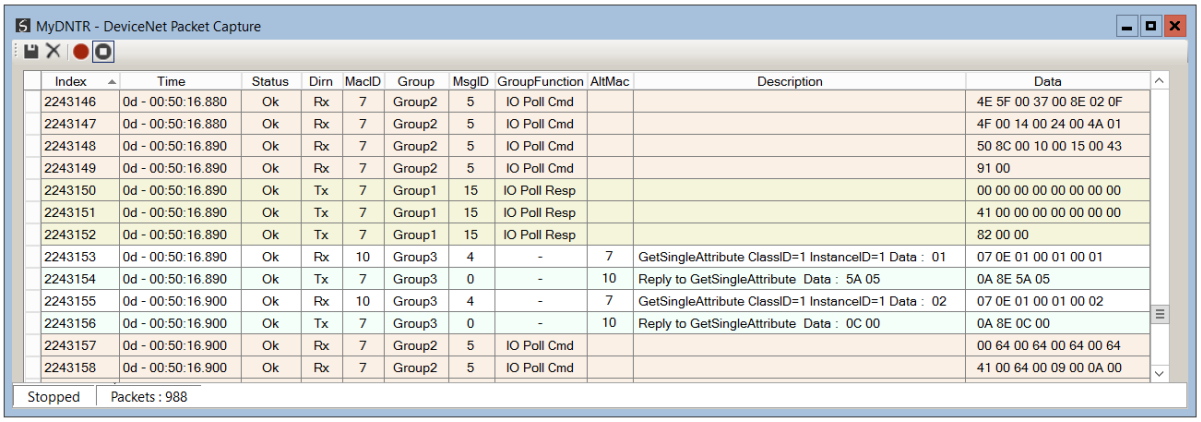


Figure 7.10 - DeviceNet packet capture

To display the captured DeviceNet packets, the capture process must first be stopped, by pressing the Stop button.



Index	Time	Status	Dirn	MacID	Group	MsgID	GroupFunction	AltMac	Description	Data
2243146	0d - 00:50:16.880	Ok	Rx	7	Group2	5	IO Poll Cmd			4E 5F 00 37 00 8E 02 0F
2243147	0d - 00:50:16.880	Ok	Rx	7	Group2	5	IO Poll Cmd			4F 00 14 00 24 00 4A 01
2243148	0d - 00:50:16.890	Ok	Rx	7	Group2	5	IO Poll Cmd			50 8C 00 10 00 15 00 43
2243149	0d - 00:50:16.890	Ok	Rx	7	Group2	5	IO Poll Cmd			91 00
2243150	0d - 00:50:16.890	Ok	Tx	7	Group1	15	IO Poll Resp			00 00 00 00 00 00 00 00
2243151	0d - 00:50:16.890	Ok	Tx	7	Group1	15	IO Poll Resp			41 00 00 00 00 00 00 00
2243152	0d - 00:50:16.890	Ok	Tx	7	Group1	15	IO Poll Resp			82 00 00
2243153	0d - 00:50:16.890	Ok	Rx	10	Group3	4	-	7	GetSingleAttribute ClassID=1 InstanceID=1 Data : 01	07 0E 01 00 01 00 01
2243154	0d - 00:50:16.890	Ok	Tx	7	Group3	0	-	10	Reply to GetSingleAttribute Data : 5A 05	0A 8E 5A 05
2243155	0d - 00:50:16.900	Ok	Rx	10	Group3	4	-	7	GetSingleAttribute ClassID=1 InstanceID=1 Data : 02	07 0E 01 00 01 00 02
2243156	0d - 00:50:16.900	Ok	Tx	7	Group3	0	-	10	Reply to GetSingleAttribute Data : 0C 00	0A 8E 0C 00
2243157	0d - 00:50:16.900	Ok	Rx	7	Group2	5	IO Poll Cmd			00 64 00 64 00 64 00 64
2243158	0d - 00:50:16.900	Ok	Rx	7	Group2	5	IO Poll Cmd			41 00 64 00 09 00 0A 00

Figure 7.11 - DeviceNet Packet Capture complete

The captured DeviceNet packets are tabulated as follows:

Statistic	**Description**
Index	The packet index, incremented for each packet sent or received.
Time	The elapsed time since the module powered up.
Status	The status of the packet. Received packets are checked for valid DeviceNet constructs and valid checksums.
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
MacID	The DeviceNet MAC ID (0-63) of the packet. This is usually the source MAC, but with IO connection data can be the destination MAC.
Group	The message group number. Either Group 1,2,3 or 4.
MsgID	The Message ID is used to identify a message within a particular group. Can be used to indicate specific types of messages, or specific (previously established) connections.
Group Function	The Group Function. Certain Group and Message ID combination have specific meanings which are displayed here.
Alt MAC	The alternate MAC, depending on the type of message. This is usually the destination MAC ID.
Description	A brief description of the packet.
Data	The raw packet data.

Table 7.7 – DeviceNet Packet Capture fields

The packet capture can be saved to a file for further analysis, by selecting the ***Save*** button on the toolbar. Previously saved DeviceNet Packet Capture files can be viewed by selecting the ***DeviceNet Packet Capture Viewer*** option in the tools menu.

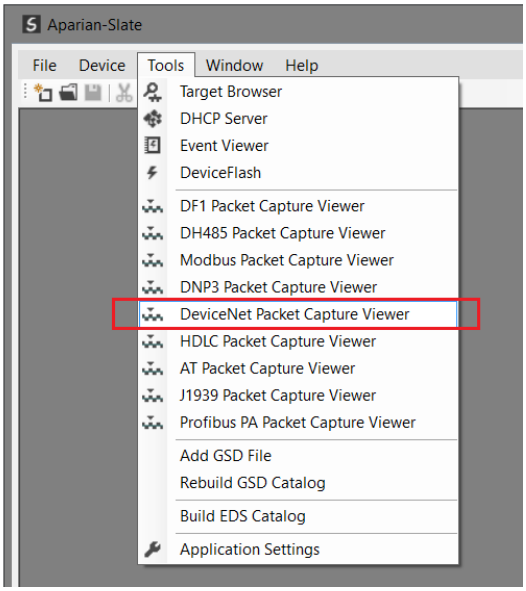


Figure 7.12 - Selecting the DeviceNet Packet Capture Viewer

7.4. MODULE EVENT LOG

The DeviceNet 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.

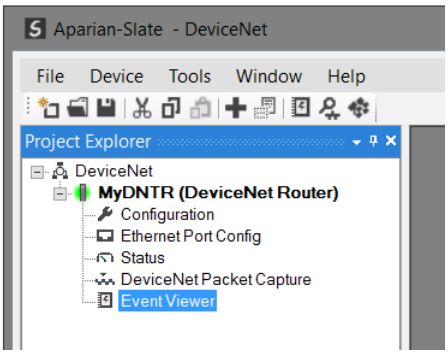


Figure 7.13 - Selecting the module Event Log

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.

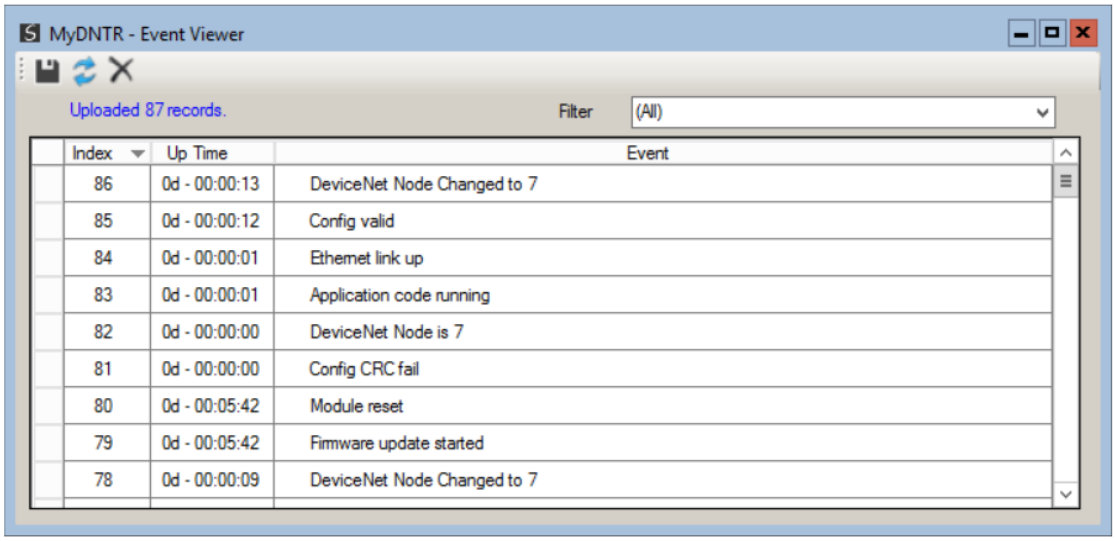


Figure 7.14 - Module Event Log

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.

7.5. WEB SERVER

The DeviceNet 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 (DeviceNet diagnostics).

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

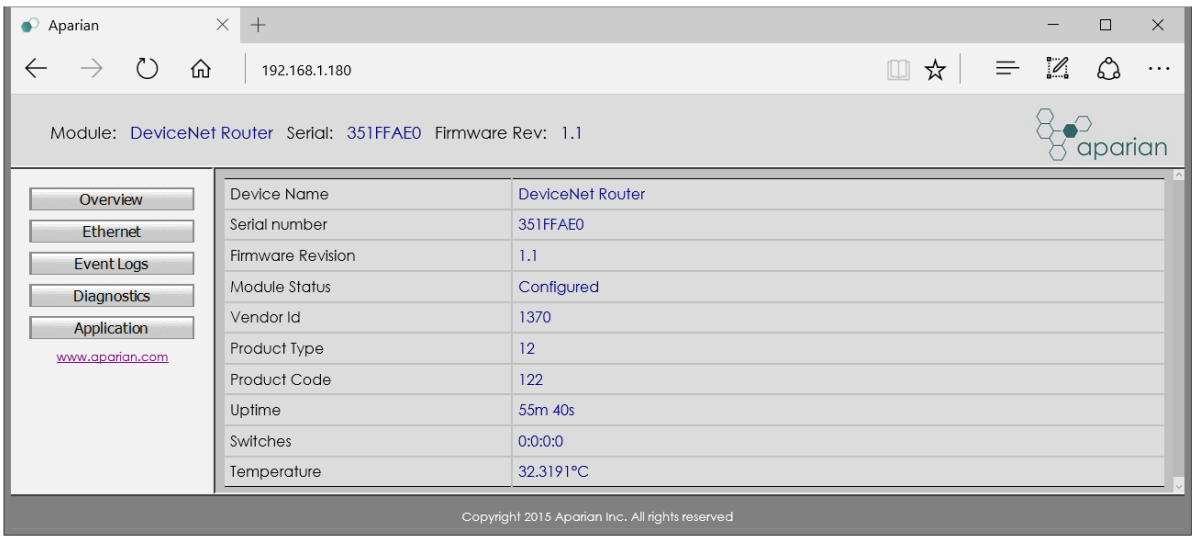


Figure 7.15 – Web interface

8. TECHNICAL SPECIFICATIONS

8.1. DIMENSIONS

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

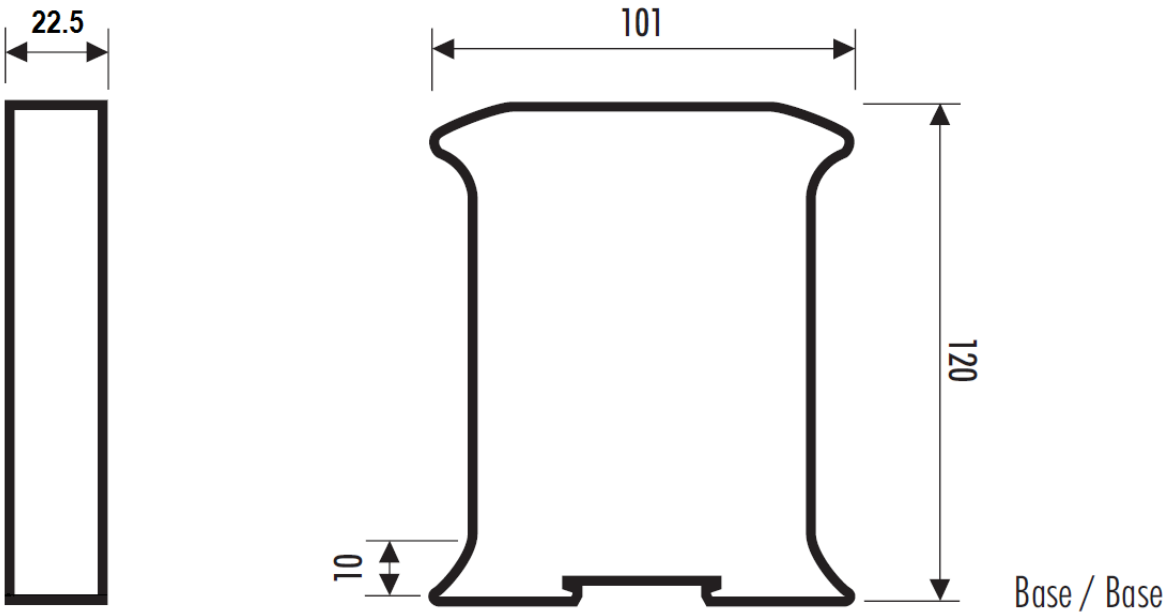


Figure 8.1 – DeviceNet Router enclosure dimensions

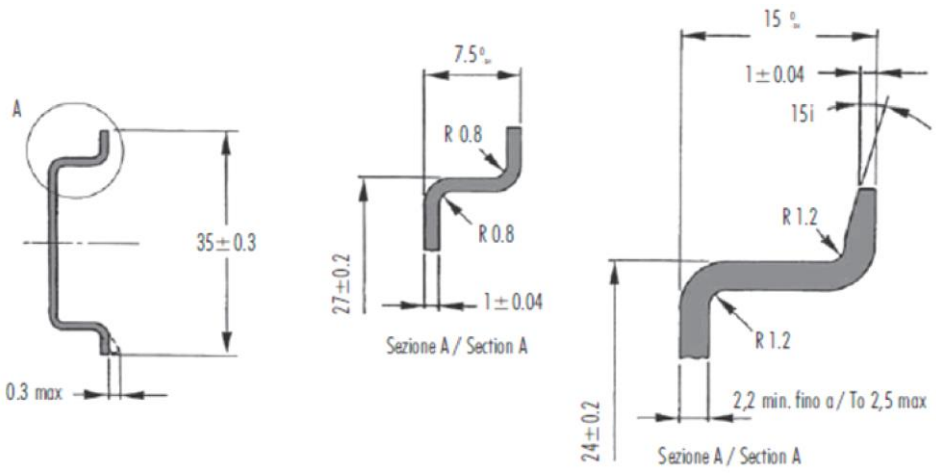


Figure 8.2 - Required DIN dimensions

8.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 28V DC, (70 mA @ 24 VDC)
Power consumption	1.7 W
Connector	5-way terminal, 5.08mm pitch.
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 8.1 - Electrical specification

8.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 20
TCP connections	Max 20
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes

Table 8.2 - Ethernet specification

8.4. DEVICENET

Specification	Rating
Connector	5-way terminal, 5.08mm pitch.
Conductors	12 – 30 AWG
BAUD	125k 250k 500k
IO Messaging	Polled Change of State (COS)
Unconnected Message Manager (UCMM)	Yes
Max Explicit Connections	5

Table 8.3 – DeviceNet specification

8.5. PCCC

Specification	Rating
Max PCCC Connections	10
Max PCCC Payload	1000 bytes

Table 8.4 – PCCC specification

8.6. CERTIFICATIONS

Certification	Mark
CE Mark	CE
RoHS2 Compliant	RoHS2
UL Mark File: E494895	c UL us LISTED CLASS 1, DIV 2, GROUPS A, B, C, D

Table 8.5 – Certifications

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