J1939 Router/B

User Manual

A-J1939R/B

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aparian

CONTENTS

1. Preface 7
1.1. Introduction to the J1939 Router 7
1.2. Features 10
1.3. Architecture 11
1.4. Additional Information 15
1.5. Support 16
2. Installation 17
2.1. Module Layout 17
2.2. Module Mounting 19
2.3. Bottom Power 20
2.4. RS232/RS485 Port 21
2.5. RS485 Termination 21
2.6. Ethernet Ports 22
2.7. CAN and Front Power 22
2.8. North American Hazardous Location Approval 22
3. Setup 24
3.1. Install Configuration Software 24
3.2. Network Parameters 24
3.3. Creating a New Project 29
3.4. General parameters 31
3.5. J1939 Configuration 32
3.5.1. Communication 32
3.5.2. Identity 34
3.5.3. PGN Map 35
3.5.3.1. Consume 36
3.5.3.2. Produce 37
3.5.3.3. Internal Data Space Mapping 38
3.5.3.4. Custom versus Standard PGN 40
3.6. Primary Interface 42
3.6.1. EtherNet/IP Target 42
3.6.1.1. Studio / Logix 5000 Configuration 42

3.6.1.2. Internal Data Space Mapping 51
3.6.2. Modbus Server 53
3.6.2.1. Internal Data Space Mapping 54
3.6.3. Modbus Client 56
3.6.3.1. Modbus Auxiliary Map 58
3.6.3.2. Internal Data Space Mapping 59
3.6.4. EtherNet/IP Originator 61
3.6.4.1. EtherNet/IP Class 1 Device Connections 61
3.6.4.2. EtherNet/IP Explicit Message Device Connections 71
3.6.4.3. Internal Data Space Mapping 75
3.7. Internal Data Space Map 77
3.7.1. Copy From 78
3.7.1.1. Internal 78
3.7.1.2. EIP Target 79
3.7.1.3. EIP Originator 79
3.7.1.4. Modbus Register 80
3.7.1.5. PGN 81
3.7.1.6. J1939 Device 82
3.7.1.7. System 85
3.7.2. Copy To 87
3.7.2.1. Internal 87
3.7.2.2. EIP Target 87
3.7.2.3. EIP Originator 88
3.7.2.4. Modbus Register 89
3.7.2.5. PGN 89
3.7.2.1. J1939 Device 90
3.8. Advanced 91
3.9. Module Download 92
4. SD Card 94
4.1. Firmware 94
4.2. Network Parameters 95
4.3. Configuration 96
4.3.1. Manual Copy 97

4.3.2. Slate Triggered Upload 98
5. Device Firmware Update 100
6. Operation 103
6.1. J1939 PGN 103
6.1.1. Produce 103
6.1.2. Consume 103
6.1.3. Explicit Messaging 104
6.2. EtherNet/IP Target 107
6.2.1. Class 1 Assembly Mapping 108
6.2.2. Explicit Messaging 109
6.2.2.1. J1939 Passthrough 109
6.2.2.2. Explicit J1939 / CAN Message 110
6.2.2.3. Set CAN Baud Rate 113
6.2.2.1. J1939 Node Live List Message 113
6.3. EtherNet/IP Originator 114
6.3.1. EtherNet/IP Class 1 Connections 114
6.3.1.1. Connection Status 116
6.3.2. Explicit Messaging 117
6.4. Modbus Client 119
6.5. Modbus Server 121
6.6. Internal Map Data Formats 122
6.6.1. System Status 122
6.6.2. J1939 Device - Status 124
6.6.3. J1939 Device – Device ID 127
6.6.4. J1939 Device – Control 128
6.6.5. J1939 PGN - Status 129
6.6.6. J1939 PGN - Statistics 129
6.6.7. J1939 PGN - Control 130
6.6.8. EtherNet/IP IO Device Status 130
6.6.9. PGN – Encoded/Decoded 131
7. Diagnostics 133
7.1. LEDs 133
7.2. Module Status Monitoring in Slate 134

7.2.1. General 136
7.2.2. J1939 Statistics 138
7.2.3. CAN Statistics 139
7.2.4. EtherNet/IP Explicit 140
7.2.5. EtherNet/IP Map 142
7.2.6. EtherNet/IP Originator 142
7.2.7. Logix 143
7.2.8. Modbus 144
7.2.9. Serial Statistics 146
7.2.10. CIP Statistics 147
7.2.11. Ethernet Clients 148
7.2.12. TCP/ARP 148
7.3. PGN Map Status 149
7.4. J1939 Node Monitoring 149
7.5. PGN Live List 151
7.6. Target Device Status Monitoring In Slate 152
7.6.1. EtherNet/IP 152
7.6.1.1. General 152
7.6.1.2. Input Data 154
7.6.1.3. Output Data 154
7.7. Module Event Log 155
7.8. Web Server 156
7.9. J1939 Packet Capture 157
7.10. Modbus Packet Capture 160
7.11. Module Status Report 164
7.12. Modbus Summary CSV 165
7.13. Modbus Expanded CSV 167
7.14. Internal Register Viewer 169
8. Technical Specifications 171
8.1. Dimensions 171
8.2. Electrical 172
8.3. Ethernet 172
8.4. Serial Port (RS232) 173

8.5. Serial Port (RS485) 173
8.6. J1939 174
8.7. EtherNet/IP Target 174
8.8. EtherNet/IP Originator 175
8.9. Modbus Client 175
8.10. Modbus Server 176
8.11. Certifications 176
9. Index 178

Revision History

Revision	Date	Comment
1.0	23 January 2023	Initial document
1.1	11 September 2023	Added option to disable duplicate node detect
1.2	13 November 2023	Added ATEX and ODVA Conformance Mark
1.3	28 November 2023	Updated EtherNet/IP Class 1 connection import options
1.4	29 April 2024	Added Explicit Messaging Tool for J1939 messages Added Node Address Change utility
1.5	10 May 2024	Updated Explicit Message Tool with 11-bit CAN ID option
1.6	16 May 2024	Updated Explicit Message Tool with Transaction option
1.7	7 June 2024	Add setting of CAN Baud Rate dynamically Add indication of the current CAN Baud Rate in the status Add node online status CIP message
1.8	20 May 2025	Add duplicate IP address indication to LEDs in the Diagnostics section.
1.9	9 October 2025	Add new structures for internal mapping Add PGN interface trigger option
1.10	20 January 2026	Added support for 125K CAN Baud Rate.
1.11	28 January 2026	Added support for SD Card Added section for Internal Register Viewer
1.12	2 March 2026	Add new RS232 and RS485 statistics.
1.13	16 April 2026	Added UL North American Hazardous Location Approval.

1. PREFACE

1.1. INTRODUCTION TO THE J1939 ROUTER

This manual describes the installation, operation, and diagnostics of the Aparian J1939 Router Series B module. The J1939 Router/B, (hereafter referred to as the **module**) provides intelligent data routing between either EtherNet/IP or Modbus TCP/RTU and a J1939 network. This allows the user to integrate J1939 devices into a Rockwell Automation Logix platform (e.g., ControlLogix or CompactLogix) or any Modbus Client or Server device with minimal effort.

The SAE J1939 protocol is primarily used in the heavy/industrial vehicle industry. It is used for communication and diagnostics between various components and/or sensors used in the vehicle system (e.g. Engine Controller). Due to is widespread popularity it is also used in diesel-power applications, marine propulsion, power generation, and industrial pumping. J1939 provides the user with Parameter Group Numbers (PGNs) which consists of various Suspect Parameter Numbers (SPNs). Numerous PGNs and SPNs are defined by the SAE group and are used to define the data received, scaling, ranges, etc. *[Source: www.sae.org]*

The module can be configured to produce and consume PGNs allowing the user to not only integrate J1939 devices into a Logix or Modbus system, but to also allow the user to use EtherNet/IP or Modbus devices in an existing J1939 network.

Primary Interface:
The module can use one of four Primary Interface modes:

EtherNet/IP Target

Here a remote EtherNet/IP device (e.g. a Logix controller) establishes a number of Class 1 connections to the module. J1939 data can be mapped into two separate input and output class 1 cyclic connections to the Logix controller (allowing up to 2KB input and 2KB output to be exchanged at the requested packet interval – RPI).

EtherNet/IP Originator
As an EtherNet/IP originator, the module can use one of two methods to read and write data to and from the J1939 network:

- **EtherNet/IP Explicit Messaging**

  This allows J1939 devices to exchange data with up to 10 EtherNet/IP devices. The module can use either Class 3 or Unconnected Messaging (UCMM) to Get and Set data in the remote EtherNet/IP devices.

- **Direct-To-Tag technology**

  This allows the J1939 devices to exchange data with a Logix controller without the need to write any application code (e.g. ladder) in Studio 5000. The J1939 data is directly read from, or written to, Logix tags.

- **EtherNet/IP Class 1 connection**

  J1939 data can be mapped to a maximum of 10 EtherNet/IP devices using input and output class 1 cyclic connections. This will allow the J1939 Router/B to "own" the EtherNet/IP target device and exchange J1939 data using the EtherNet/IP device's input and output assemblies.

Modbus Server
The diagnostics and J1939 data will be written to, or read from, the module's internal Modbus Registers (Holding or Input Registers). These registers can be accessed by a remote Modbus Client using either Modbus TCP, Modbus RTU232, or Modbus RTU485.

Modbus Client
The diagnostics and J1939 data will be written to, or read from, the module's internal Modbus Registers (Holding or Input Registers). The Modbus Auxiliary Map can then be used to configure the Modbus data exchange between multiple remote Modbus Server devices and the module's internal Modbus registers. The Modbus communication can be via Modbus TCP, Modbus RTU232, or Modbus RTU485.

The J1939 Router provides auto extraction and scaling of SPNs for standard SAE defined PGNs. These SPNs can then be mapped to Logix UDTs Tags which can also be automatically generated by the Slate software. This allows the user to create a J1939 Router project with all the required PGNs and then export a Logix L5X file which contains all the required Tags and UDTs for that specific J1939 Router project. This L5X file can be imported into Logix removing the hassle of creating UDTs for the numerous PGNs.

The J1939 Router/B is configured using the Aparian Slate application. This program can be downloaded from www.aparian.com free of charge.

The J1939 Router allows the user to select standard specification defined PGNs (e.g. PGN 61444 – Electronic Engine Controller 1) from a list in the Slate software. This will automatically build the mapping and scaling for each SPN which can be downloaded to the module. The user can then export a Logix UDT from the Slate software which maps the PGN selected. This can be imported into a Logix application and used as a destination tag for the configured PGN (greatly simplifying the application setup).

Slate also allows the user to map custom and/or propriety PGNs to a SINT array allowing the user to format the response data in the Logix environment. The module can be configured to either consume data from J1939 devices or produce data for other J1939 devices.

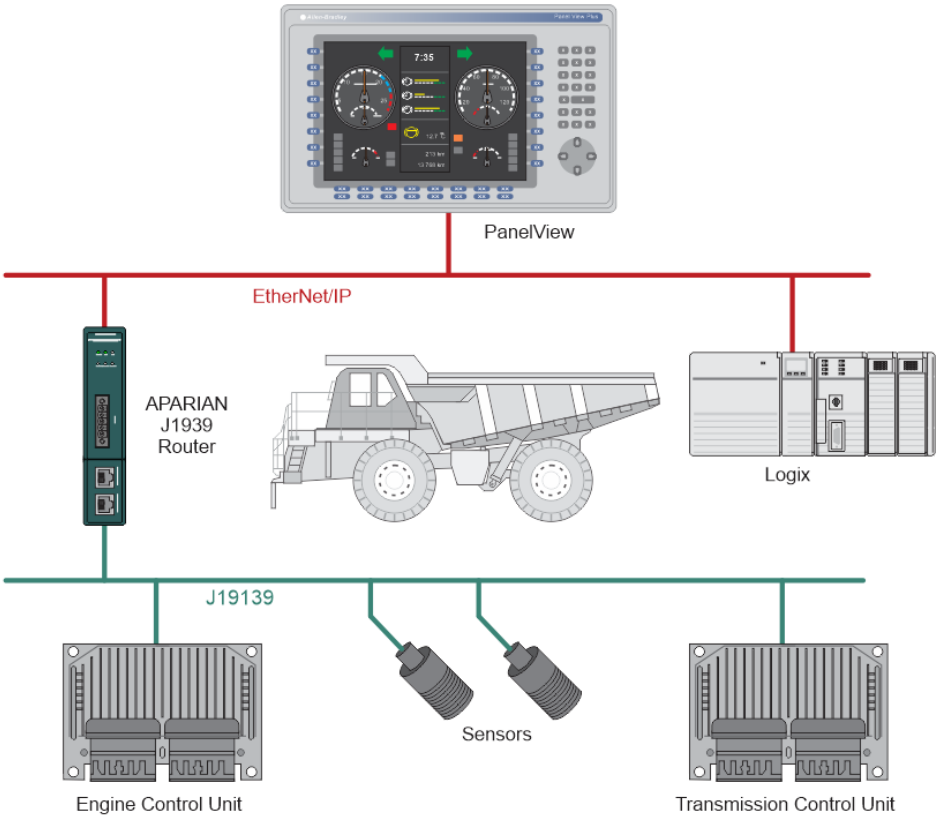


Figure 1.1. – Example of a typical network setup for connecting J1939 device to Logix

The module also provides a range of statistics, J1939 and Modbus packet capture functions, and internal Modbus and Data table reads to simplify the diagnostic process for remote diagnosis.

The module has two Ethernet ports and supports Device-Level-Ring (DLR) architectures.

A built-in webserver provides detailed diagnostics of system configuration and operation, including the display of J1939 operation and communication statistics, without the need for any additional software.

1.2. FEATURES

- Module can consume and produce up to 100 x J1939 PGNs.
- Auto SPN extraction and scaling for standard SAE defined PGNs
- Logix L5X generation - Ready for import
- Supports PGN Request Passthrough Messaging from Logix
- Module has various Primary Interfaces:
    - EtherNet/IP Target (Class 1 connection)
    - Modbus Server (TCP, RTU232, and RTU485)
    - Modbus Client (TCP, RTU232, and RTU485)
    - EtherNet/IP Originator (Class 1 connection with up to 10 EtherNet/IP devices and Explicit Messaging, including Direct-To-Tag Logix tag access, with up to 10 EtherNet/IP devices).
- Slate software provides a J1939 and Modbus packet capture utility for better diagnosis of issues.
- Supports J1939 PGN live list.
- Supports all J1939 Baud Rates (125k, 250k, 500k).
- Dual Ethernet ports which support Device-Level-Ring (DLR).
- Network Time Protocol (NTP) supported for external time synchronization.
- Small form factor – DIN rail mounted.

1.3. ARCHITECTURE

The figures below provide an example of the typical network setup for connecting J1939 devices to either EtherNet/IP or Modbus TCP/RTU232/RTU485.

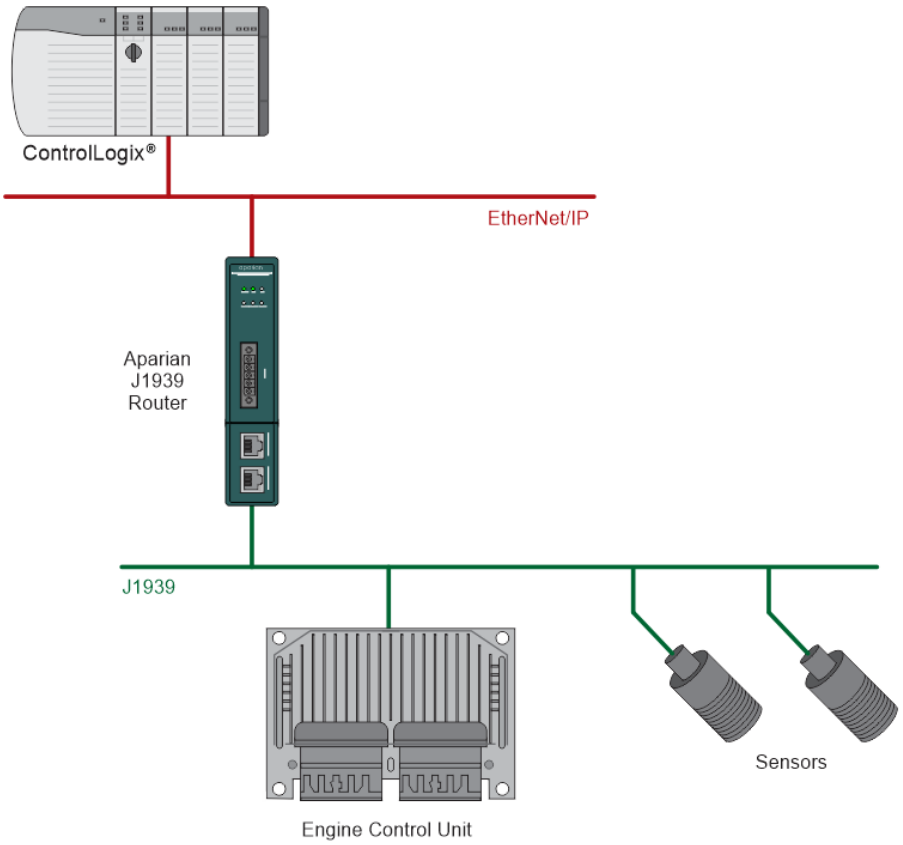


Figure 1.2. – Example of connecting J1939 Devices to a Logix Controller

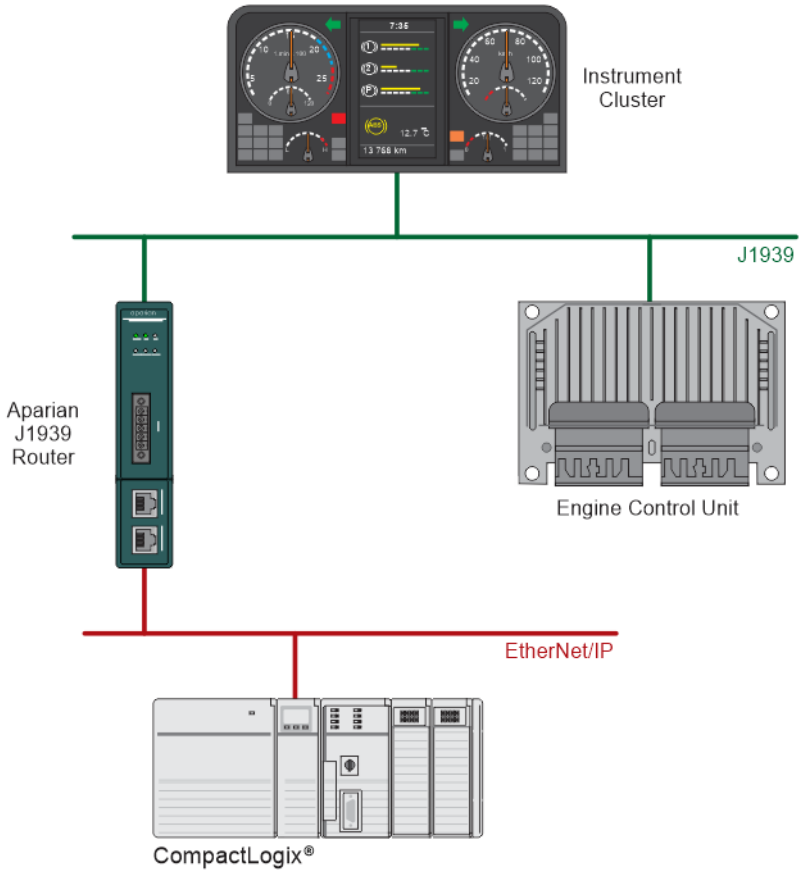


Figure 1.3. – Example of connecting a Logix Controller to and existing J1939 network

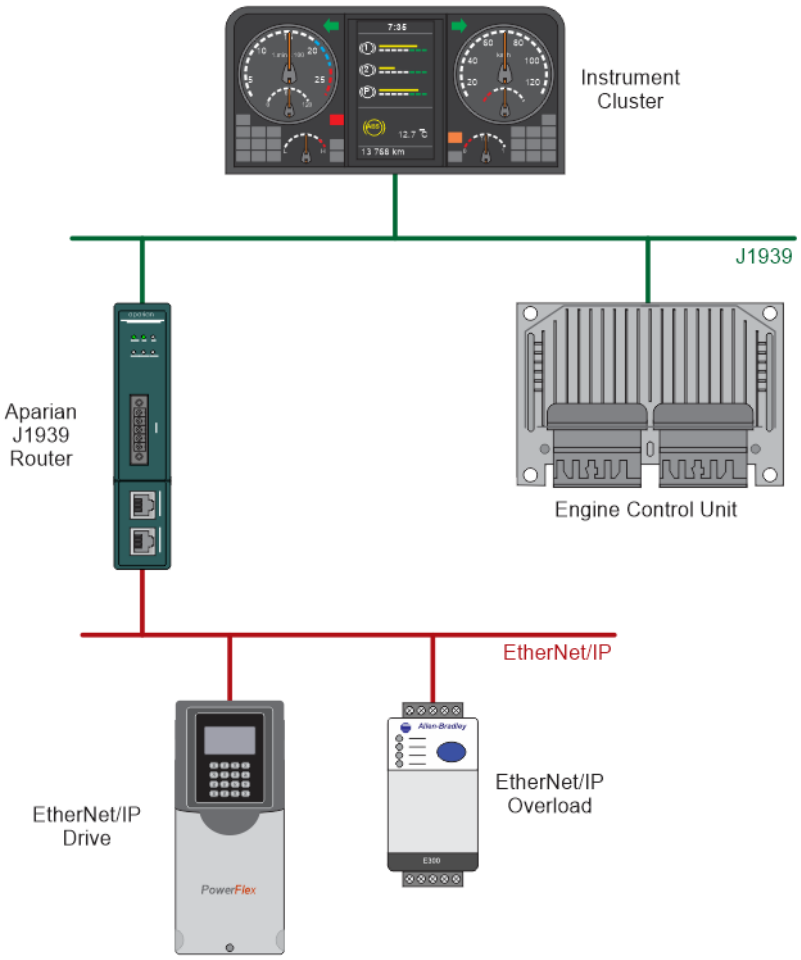


Figure 1.4. – Example of connecting EtherNet/IP IO to and existing J1939 network

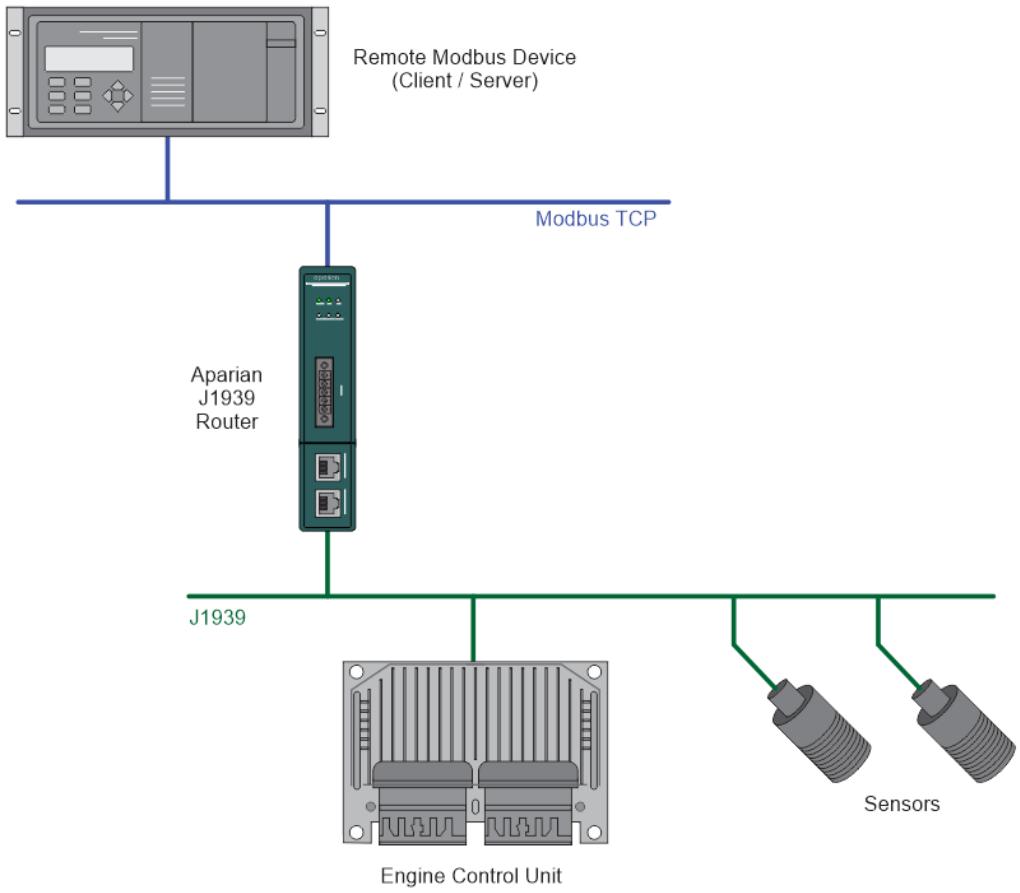


Figure 1.5. - Example of connecting J1939 Devices to a Modbus TCP Client or Server

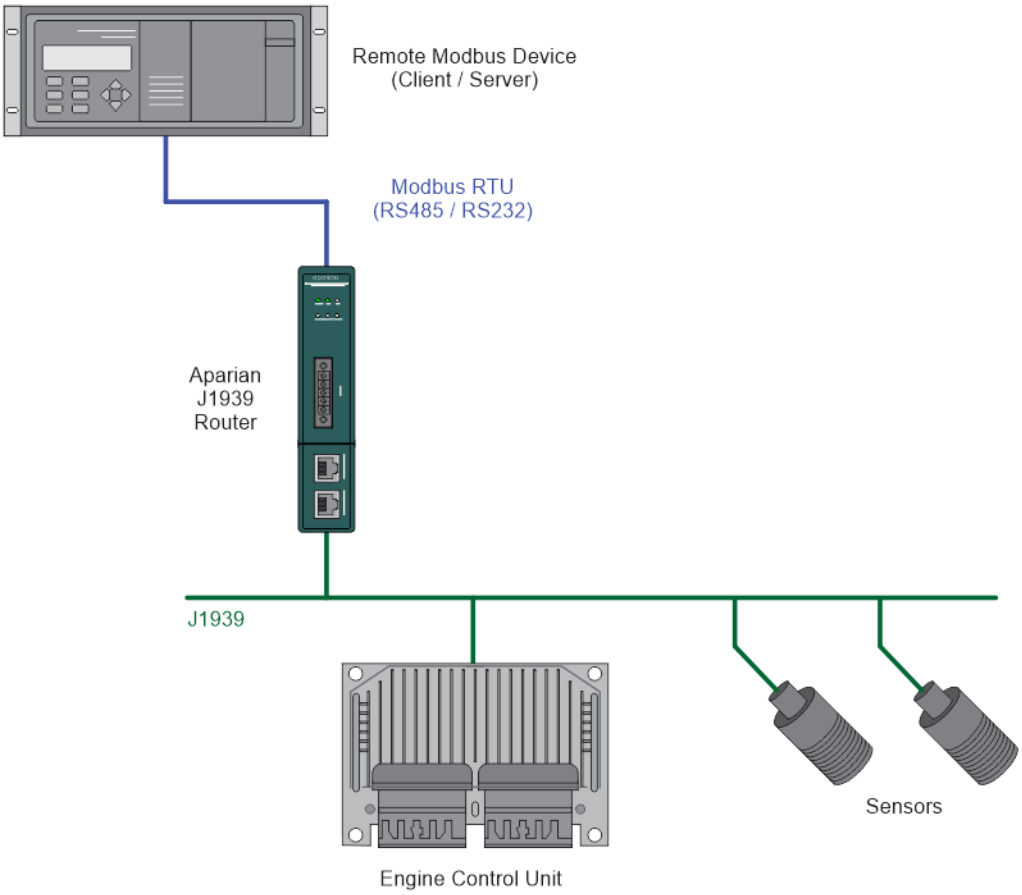


Figure 1.6. - Example of connecting J1939 Devices to a Modbus RTU Client or Server

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
J1939 Router User Manual J1939 Router Datasheet Example Code & UDTs	https://www.aparian.com/products/j1939Routerb
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
SAE J1939 Standards	http://www.sae.org/standardsdev/groundvehicle/j1939a.htm

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, two Ethernet ports on the angled front, and one port at the front as shown in the figure below. The ports at the bottom are used for RS232 and RS485 serial communication, and power. The power port uses a three-way connector which is used for the DC power supply positive and negative (ground) voltage as well as the earth connection.

The port on the front of the module is the CAN port and can also be used to power the module.

NOTE: The module allows the user to provide power on both bottom and front power connectors and can be used for power supply redundancy.

The Ethernet cable used for the Ethernet ports must be wired according to industry standards which can be found in the additional information section of this document.

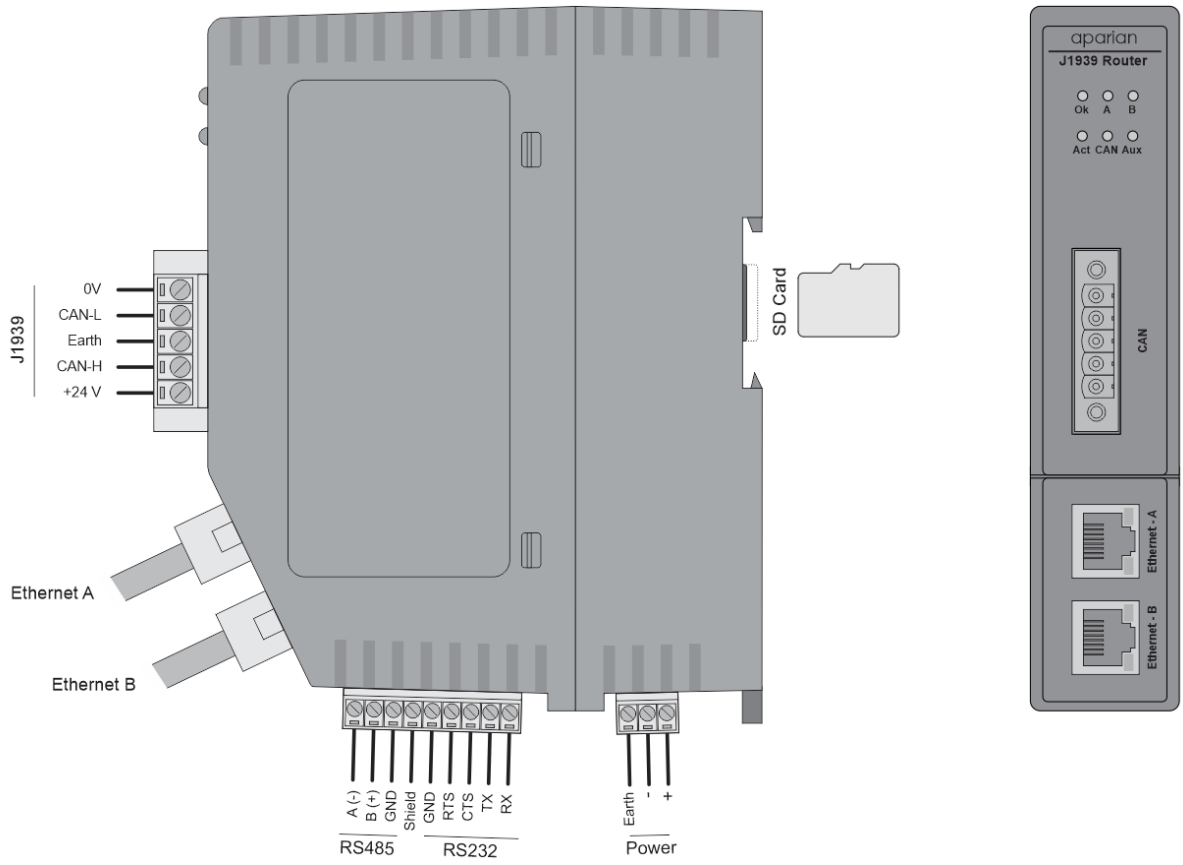


Figure 2.1 – J1939 Router/B side and front view

The module also supports an SD Card for disaster recovery which can be used to automatically update the configuration and/or firmware of a new module.

The module provides six diagnostic LEDs as shown in the front view figure above. These LEDs are used to provide information regarding the module system operation, the Ethernet interface, and the auxiliary communication interface (RS232 or RS485).

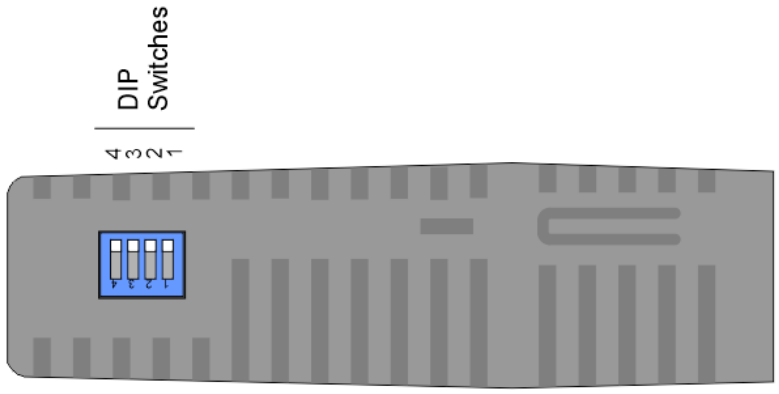


Figure 2.2 – J1939 Router/B top view

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 an earlier 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	This DIP Switch is used to lock the configuration from being overwritten by the Slate. When set Slate will not be able to download to the module.
DIP Switch 4	When this DIP Switch is set at bootup it will force the module Ethernet IP address to **192.168.1.100** and network mask 255.255.255.0. The user can then switch the DIP switch off and assign the module a static IP address if needed.

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.

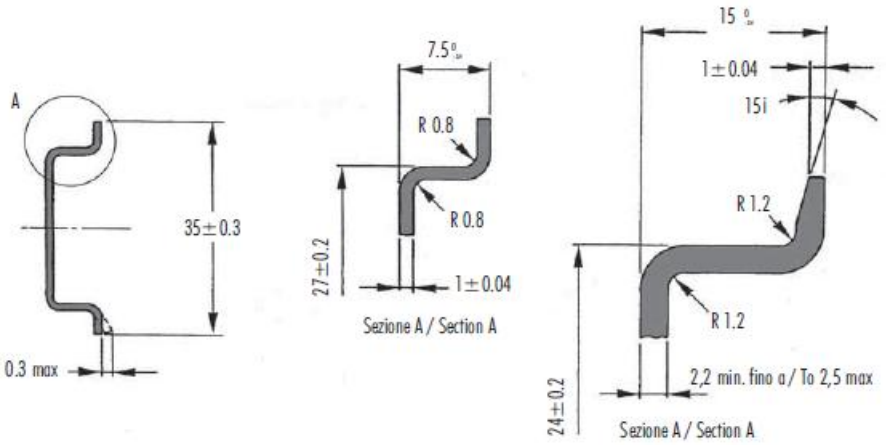


Figure 2.3 - DIN rail specification

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

A three-way power connector is used to connect Power+, Power– (GND), and earth. The module requires an input voltage of 10 – 32Vdc. **Refer** to the technical specifications section in this document.

NOTE: The module allows the user to provide power on both bottom and front power connectors and can be used for power supply redundancy.

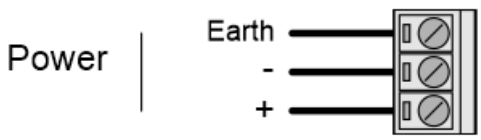


Figure 2.5 - Power connector

2.4. RS232/RS485 PORT

The nine-way connector is used to connect the RS232 and RS485 conductors for serial communication. The shield terminal can be used for shielded cable in high noise environments.

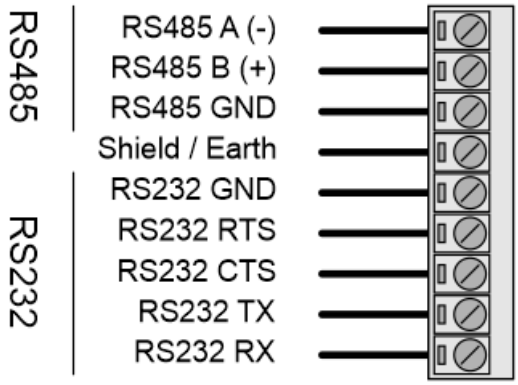


Figure 2.6 - RS232/RS485 connector

The RS485 port provides the standard A and B conductors. The RS232 port provides the standard communication conductors (RX, TX, and GND) as well as hardware handshaking lines for legacy systems (RTS – Request to Send, CTS – Clear to Send).

NOTE: The shield of the RS232/RS485 port is internally connected to the power connector earth. Thus, when using a shield, it is important to connect the Earth terminal on the power connector to a clean earth. Failing to do this can lower the signal quality of the RS232/RS485 communication.

NOTE: When using a shielded cable, it is important that only one end of the shield is connected to earth to avoid current loops. It is recommended to connect the shield to the J1939 Router module, and not to the other J1939 device.

2.5. RS485 TERMINATION

All RS485 networks need to be terminated at the extremities (start and end point) of the communication conductor. The termination for the RS485 network can be enabled/disabled via the module configuration. Enabling the termination will connect an internal 125 Ohm resistor between the positive (B+) and negative (A-) conductors of the RS485 network.

2.6. ETHERNET PORTS

The Ethernet connectors should be wired according to industry standards. **Refer** to the additional information section in this document for further details. The module has an embedded switch connecting the two Ethernet ports.

2.7. CAN AND FRONT POWER

A five-way CAN connector is used to connect the J1939 CAN bus network as well as the Power+, Power– (GND), and earth. The module requires an input voltage of 10 – 32Vdc. **Refer** to the technical specifications section in this document.

NOTE: The module allows the user to provide power on both bottom and front power connectors and can be used for power redundancy.

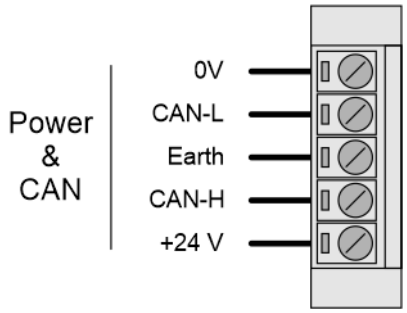


Figure 2.7 – CAN and Power connector

2.8. NORTH AMERICAN HAZARDOUS LOCATION APPROVAL

The following information applies when operating the product in hazardous locations:

SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS LOCATIONS, OR NONHAZARDOUS LOCATIONS ONLY.

-20°C to +70°C, T5A
Class 1, Div 2 Gps A, B, C, D

THIS EQUIPMENT IS 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.

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOW TO BE FREE OF IGNITABLE CONCENTRATIONS.

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF ANY COMPONENT MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

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.

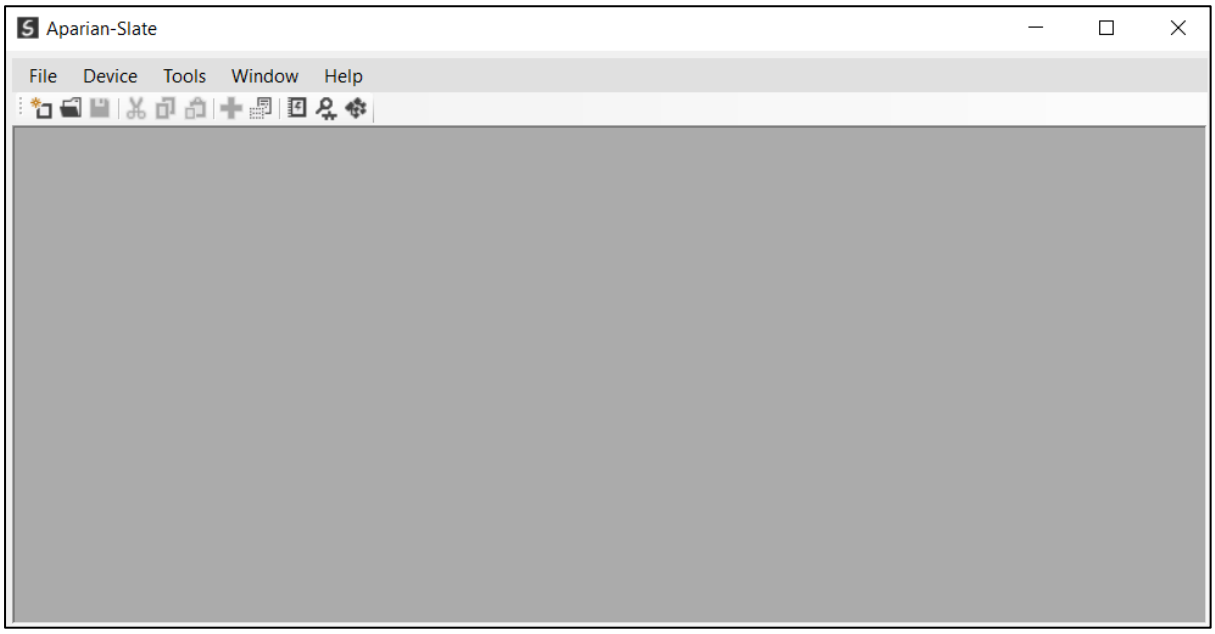


Figure 3.1. - Aparian Slate Environment

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.

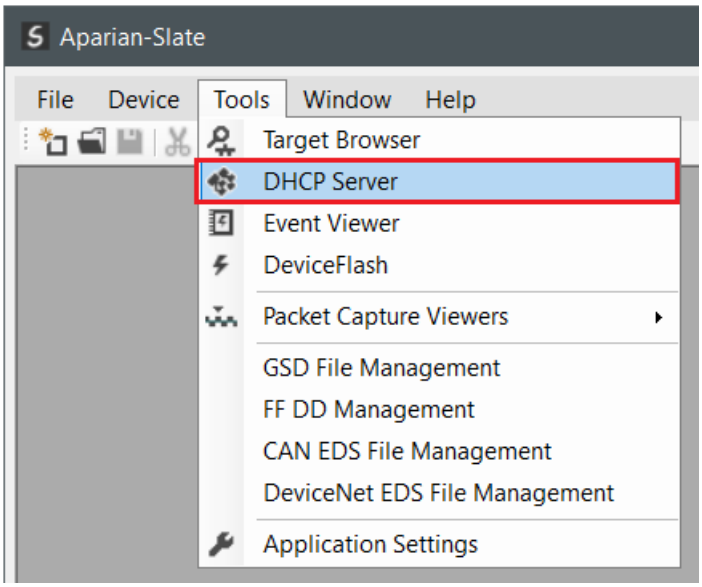


Figure 3.2. - Selecting DHCP Server

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

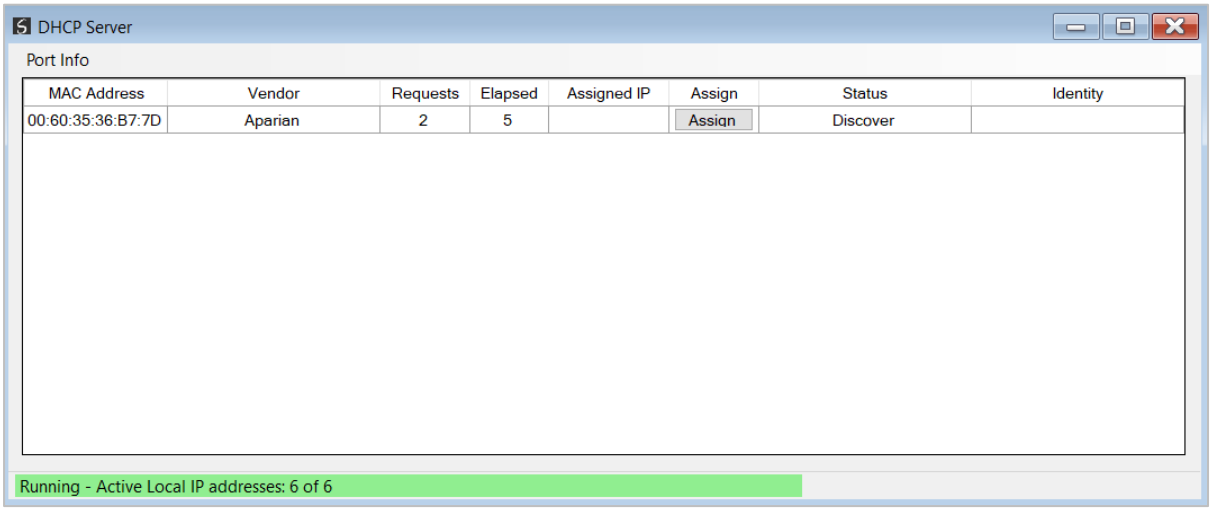


Figure 3.3. - DHCP Server

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.

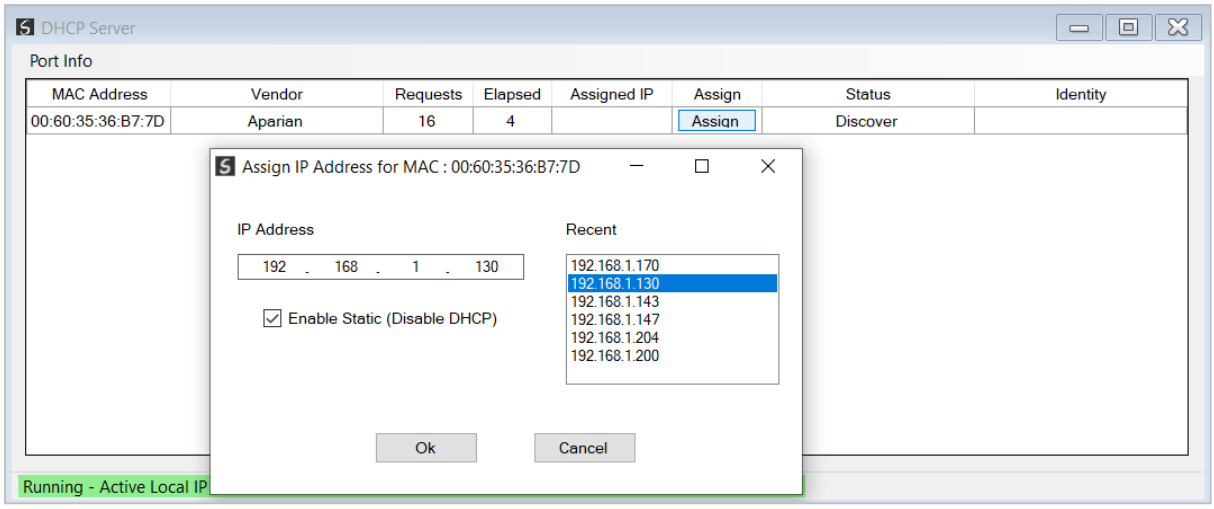


Figure 3.4. - Assigning IP Address

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.

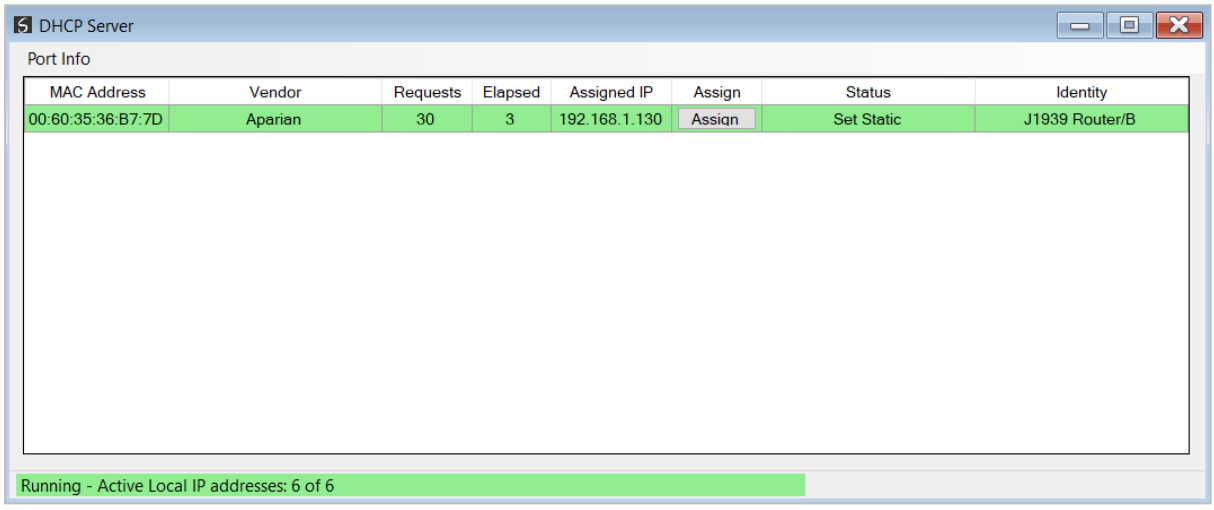


Figure 3.5. - Successful IP address assignment

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.

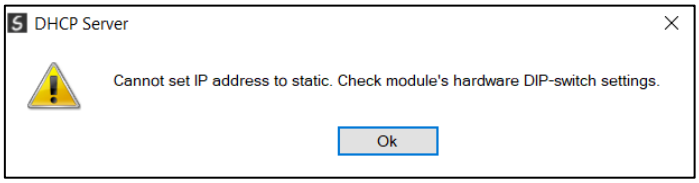


Figure 3.6. - Force DHCP warning

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.

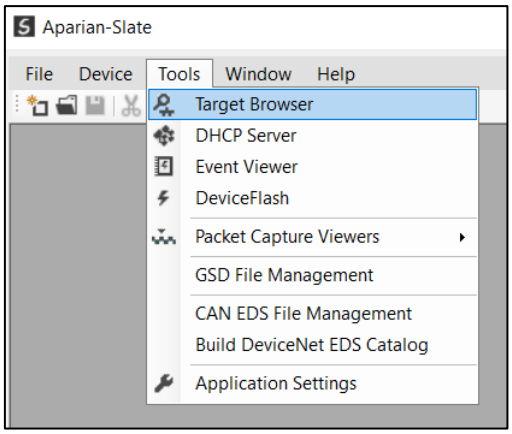


Figure 3.7. - Selecting the Target Browser

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.

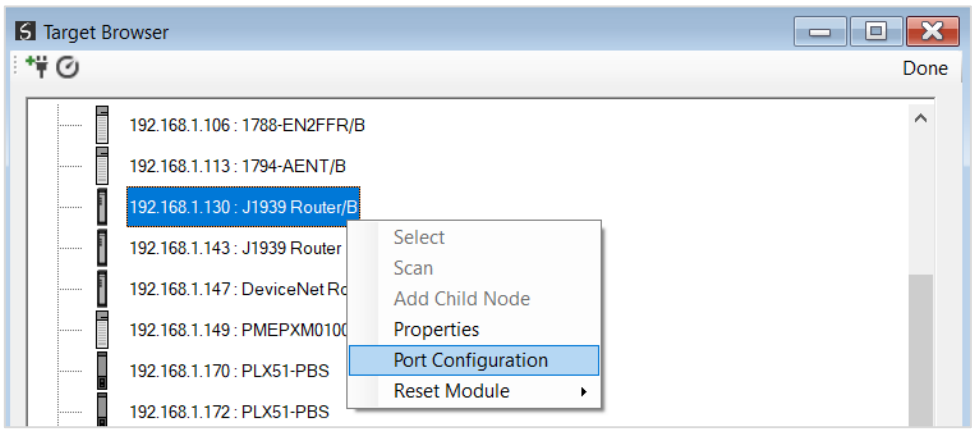


Figure 3.9. - Selecting Port Configuration

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

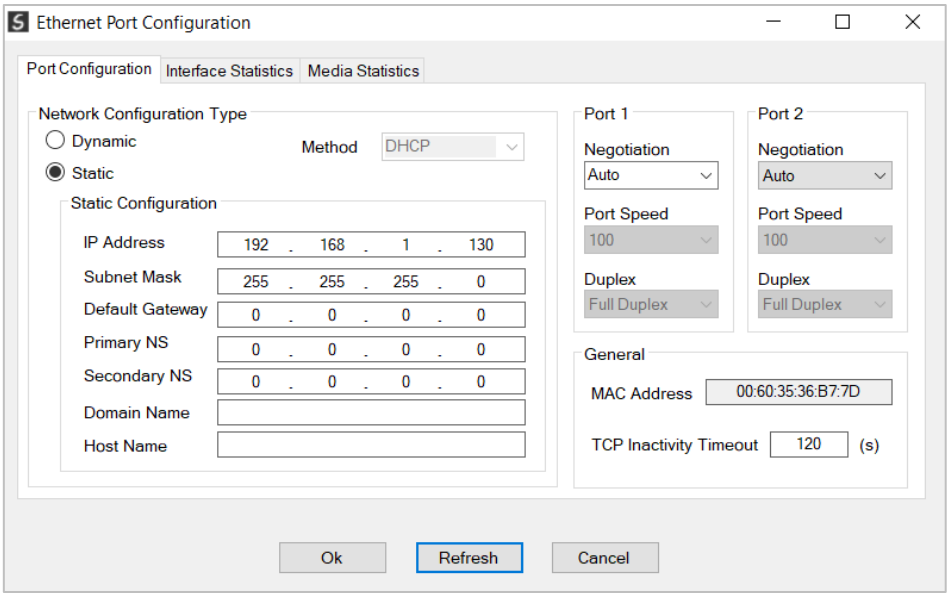


Figure 3.10. - Port Configuration

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.

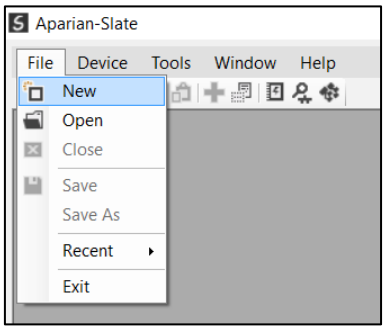


Figure 3.11. - Creating a new project

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.

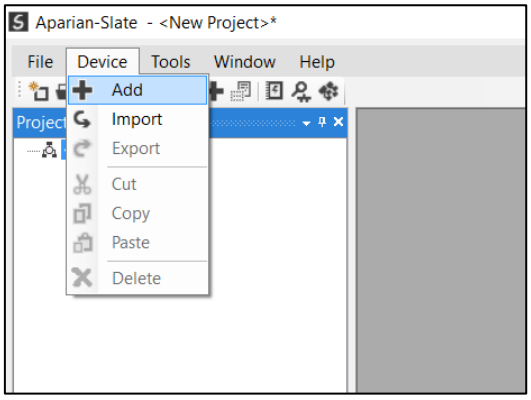


Figure 3.12. - Adding a new device

In the Add New Device window select the J1939 Router/B and click the Ok button.

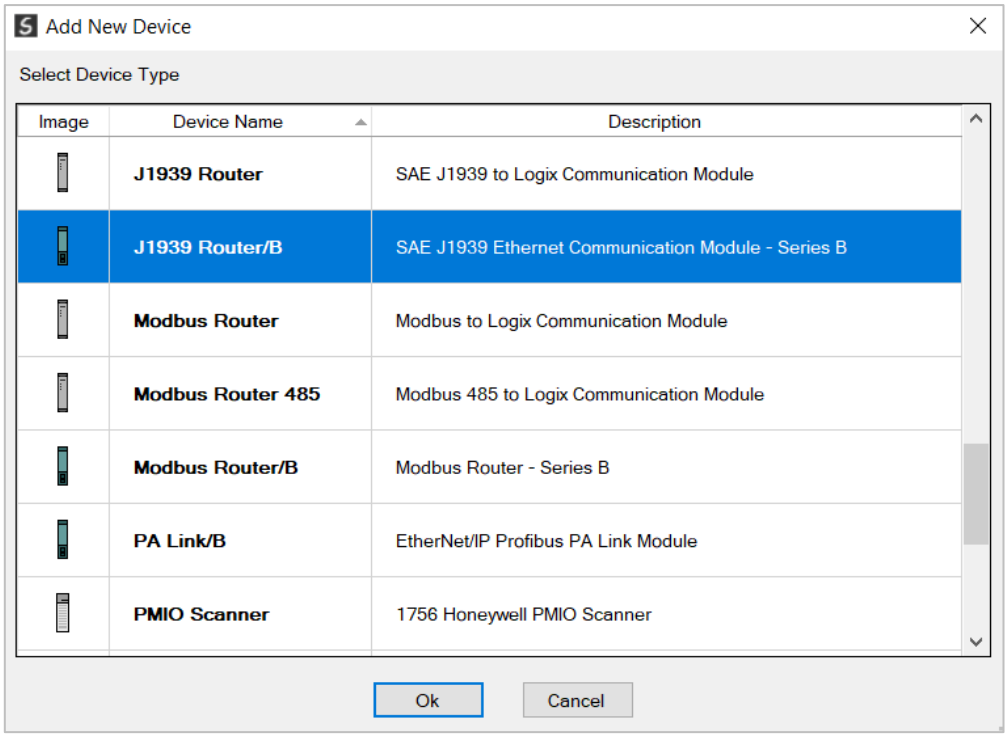


Figure 3.13 – Selecting a new J1939 Router

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***.

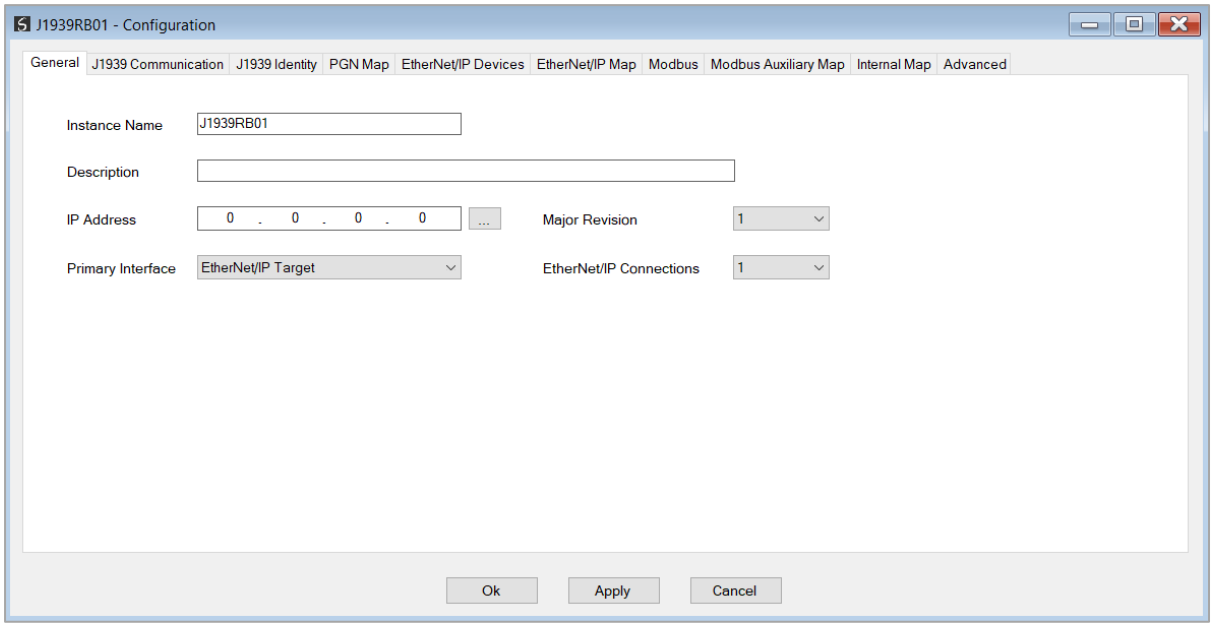


Figure 3.14. – J1939 Router/B configuration

Refer to the additional information section in this document for Slate's installation and operation documentation.

3.4. GENERAL PARAMETERS

The J1939 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 the module configuration stored in non-volatile storage.

The general configuration is shown in the figure below. The J1939 Router/B general configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration***.

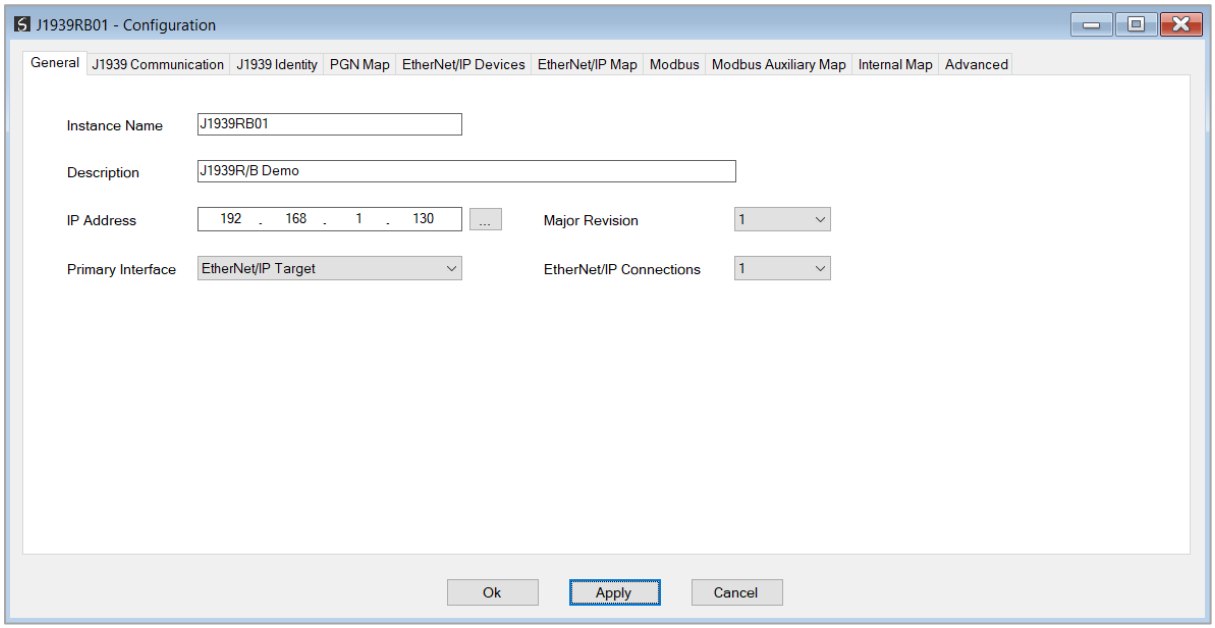


Figure 3.15 - General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various J1939 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

EtherNet/IP Connections	The number of connections the module will use when operating as an EtherNet/IP target.
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 J1939 Router/B on the network.
Primary Interface	**EtherNet/IP Target** A Logix controller can own the J1939 Router/B over EtherNet/IP using up to 4 class 1 connections. **Modbus Server** A Modbus Client can read and write data to the module which can then be mapped to one or more J1939 devices. The module can operate as a Modbus Server on Ethernet TCP, RTU232, and RTU485 **Modbus Client** A module can read and write data from various Modbus devices which can then be mapped to one or more J1939 devices. The module can operate as a Modbus Client on Ethernet TCP, RTU232, and RTU485 **EtherNet/IP Originator** As an EtherNet/IP originator, the module can use two methods to read and write data to and from an EtherNet/IP device (IO): *EtherNet/IP Class 1 Connection* The J1939 Router/B can own EtherNet/IP IO by using the Slate software to configure the IO connections. *EtherNet/IP Explicit Messaging* The J1939 Router/B can exchange data with up to 10 EtherNet/IP devices using explicit messaging.

Table 3.1 - General configuration parameters

3.5. J1939 CONFIGURATION

The J1939 configuration is setup as explained below.

3.5.1. COMMUNICATION

The J1939 Communication configuration window is opened by either double clicking on the module in the tree, or right-clicking the module and selecting ***Configuration*** and then selecting the ***J1939 Communication*** tab.

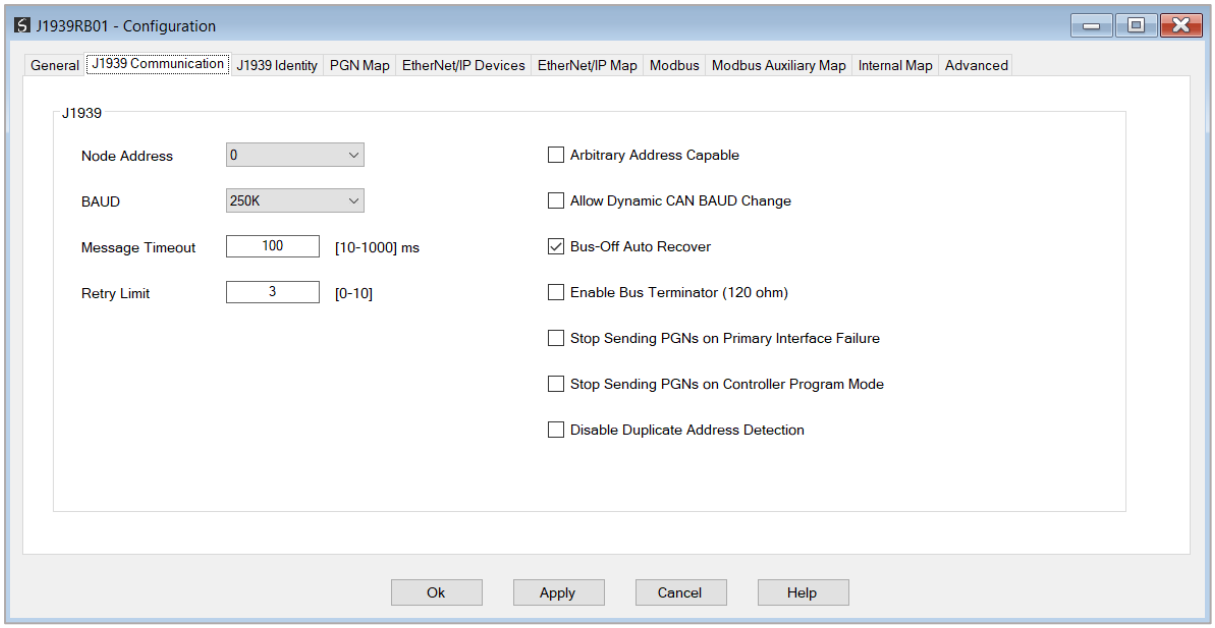


Figure 3.16 – J1939 Communication Configuration

The **J1939 Communication** configuration consists of the following parameters:

Parameter	Description
Node Address	This is the node address of the J1939 Router/B on the J1939 network.
BAUD Rate	The J1939 bus BAUD rate. The following options are available: • 125k • 250k • 500k
Message Timeout	This is the J1939 message timeout which specifies how long the J1939 Router/B will wait for a response from a J1939 node before the response will be seen as a failed no-response.
Retry Limit	The number of retries that will be attempted before indicating a transaction has failed.
Arbitrary Address Capable	When this is set the J1939 Router/B module will start with the configured node address, but if there is a conflict and the J1939 Router/B has a lower priority it will change its Node address to an open slot and continue operation. **NOTE:** When this is **not** set the J1939 Router/B module will start with the configured node address, but if there is a conflict and the J1939 Router/B has a lower priority it will stop communicating until a new address has been configured and downloaded.
Bus Off Auto Recover	Enables automatic J1939 network recovery when the module has detected that the CAN bus network is off.

Enable Bus Terminator	Enables the internal 120 Ohm terminator on the CAN bus network. The CAN bus network must be terminated at the two extremities of the network (i.e., the start and end of the network).
Allow Dynamic CAN BAUD Change	Once this parameter is set, it will allow the user to dynamically change the J1939 Router/B CAN Baud Rate using a specific CIP message. See the Operation section for more details regarding the message. **NOTE:** When the J1939 Router/B module is power cycled, the CAN Baud Rate will return to the Baud Rate configured in the Slate configuration and the Baud Rate set dynamically will **not** persist.
Stop Sending PGNs on Primary Interface Failure	When this option is selected, the J1939 Router/B will stop producing PGNs when the primary interface communication has failed.
Stop Sending PGNs on Controller Program Mode	When this option is selected and the primary interface has been set to EtherNet/IP Target, the J1939 Router/B will stop producing PGNs when the controller (which is the EtherNet/IP communication originator) is in Program mode.
Disable Duplicate Address Detection	When this option is selected, it will disable the duplicate node detection on the J1939 network.

Table 3.2 - J1939 Communication configuration parameters

3.5.2. IDENTITY

The J1939 Identity configuration window is opened by either double clicking on the module in the tree, or right-clicking the module and selecting ***Configuration*** and then selecting the ***J1939 Identity*** tab.

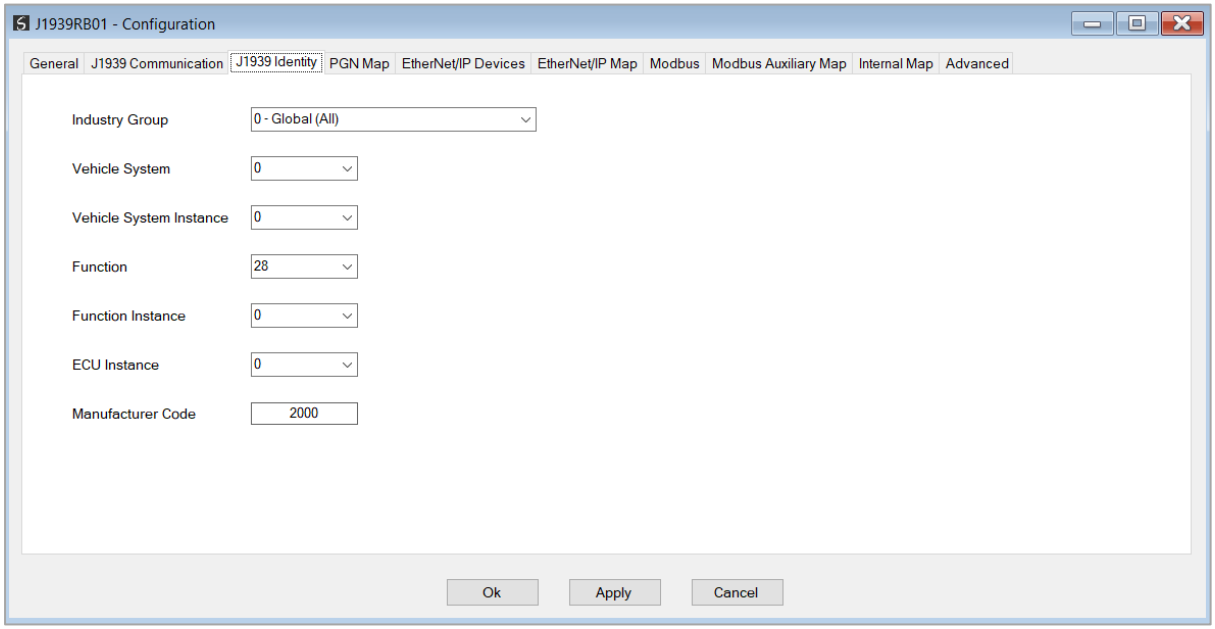


Figure 3.17 – J1939 Identity Configuration

The **J1939 Identity** configuration consists of the following parameters:

Parameter	Description
Industry Group	The J1939 Name consists of the following elements. These can be configured to provide the J1939 Router with a specific name. Refer to the J1939 specification (see section 1.3 for additional information).
Vehicle System	
Vehicle System Instance	
Function	
Function Instance	
ECU Instance	
Manufacturer Code	

Table 3.3 – J1939 Identity parameters

3.5.3. PGN MAP

The J1939 PGN Map configuration window is opened by either double clicking on the module in the tree, or right-clicking the module and selecting ***Configuration*** and then selecting the ***PGN Map*** tab.

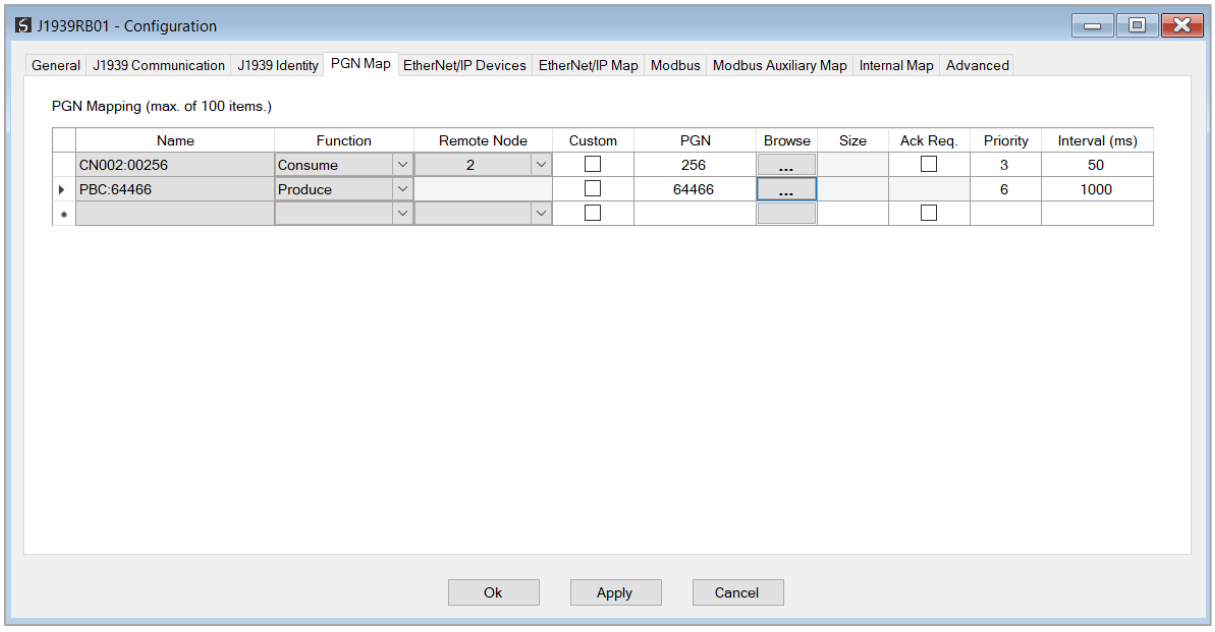


Figure 3.18 – PGN Map Configuration

The **PGN Map** configuration consists of the following parameters:

Parameter	Description
Name	The name that is automatically assigned to the PGN mapping item. This name is to be used in the internal mapping when exchanging data between the J1939 network and the primary interface.
Function	The operation of the mapped item. **Consume** The J1939 Router will receive J1939 PGNs from the J1939 network. **Produce** The J1939 Router will transmit PGNs on the J1939 network. Refer to the *Consume Function* and *Produce Function* sections for more detail.
Remote Node	The destination node that the PGN is mapped to. **NOTE:** Node 255 is a broadcast address.
Custom	The user can select this option to either use a standard SAE defined PGN or a custom manufacturer defined PGN. When selecting the Custom PGN option the PGN data will be copied as is to the target destination in the internal mapping. When selecting a standard SAE defined PGN, the J1939 Router/B will decode and scale the data as per the SAE defined PGN. Refer to the *Custom vs Standard PGN* section for more detail.
PGN	The PGN number for the specific mapped item.
Size	When using Custom PGNs, this is the size (in bytes) of the PGN data that will be produced or consumed.
Ack Req.	Each Peer to Peer PGN mapping item to be selected to either send a J1939 ACK (Consume) or wait for an ACK (Produce).
Priority	The priority of the PGN that will be transmitted.
Interval	This is update interval for the specific PGN in milliseconds. **NOTE:** If the Interval is set to zero when the function is *Consume*, then the module will never request the PGN if not received not will the *Timeout* statistic ever increase. If the Interval is set to zero when the function is *Produce*, then the PGN will never transmit until it is triggered by the primary interface. In the internal mapping the PGN will have a Control destination sub-tag.

Table 3.4 – J1939 Identity parameters

3.5.3.1. CONSUME

When the user has selected the Consume function for a mapped item the J1939 Router/B will receive the specific PGN and save the data to mapped in the internal mapping.

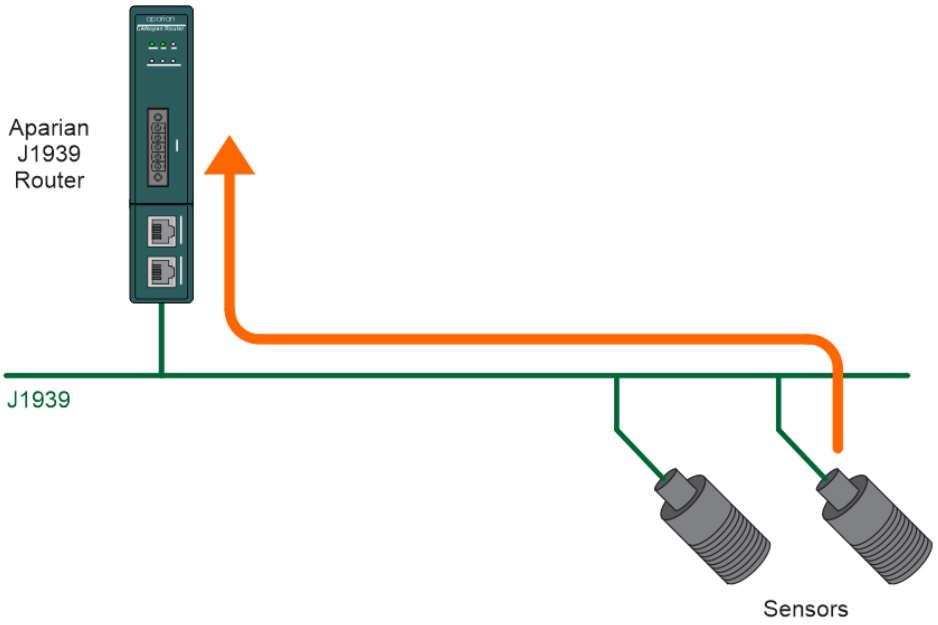


Figure 3.20 – Consume Function data flow

The J1939 Router/B will request the mapped PGN from the configured node address, if no PGN is received from the specified node within **three** update intervals.

NOTE: PGNs are made up of various SPNs, but many devices only support certain SPNs which means only certain parts of the PGN returned is valid. The industry norm is to make the SPNs not supported all 1s (e.g. a byte SPN that is not supported will be returned as 0xFF).

3.5.3.2. PRODUCE

When the user has selected the Produced function for a mapped item, the J1939 Router/B will transmit the specific PGN on the J1939 network at the configured rate.

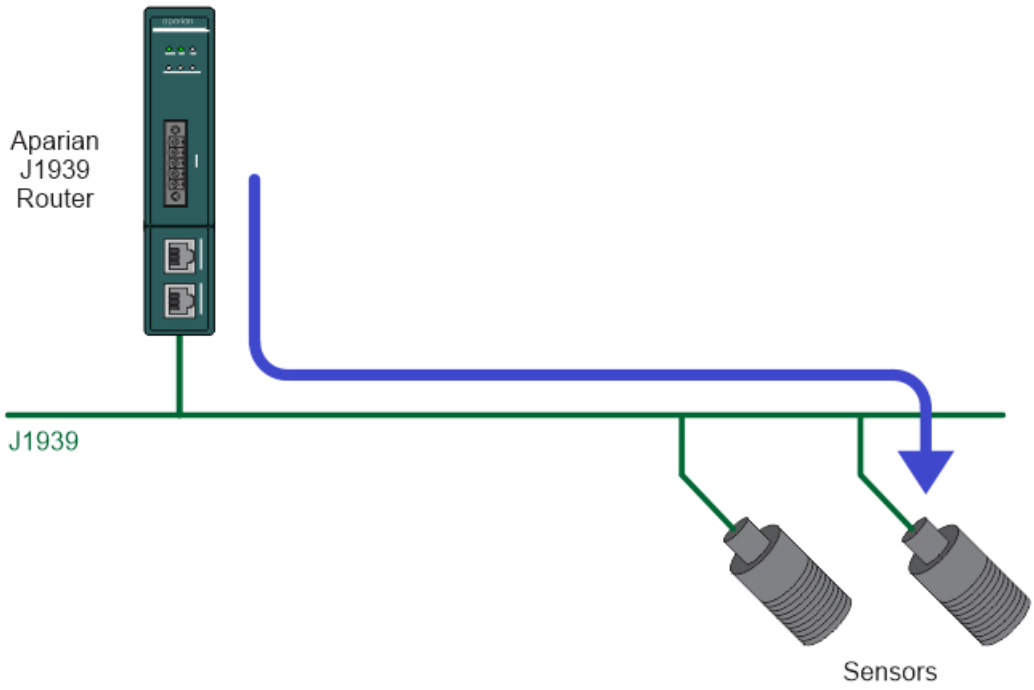


Figure 3.21 – Produce Function data flow

The mapped PGN will be transmitted on the J1939 network at the configured update interval.

3.5.3.3. INTERNAL DATA SPACE MAPPING

The data from the J1939 (produced or consumed) can be mapped to the Ethernet interface using the Internal Map. The Internal Map configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration*** and selecting the ***Internal Map*** tab.

A. IDS COPY – PGN CONSUME SOURCE

When copying data from a consume PGN to the Ethernet interface, the source type needs to be *PGN*.

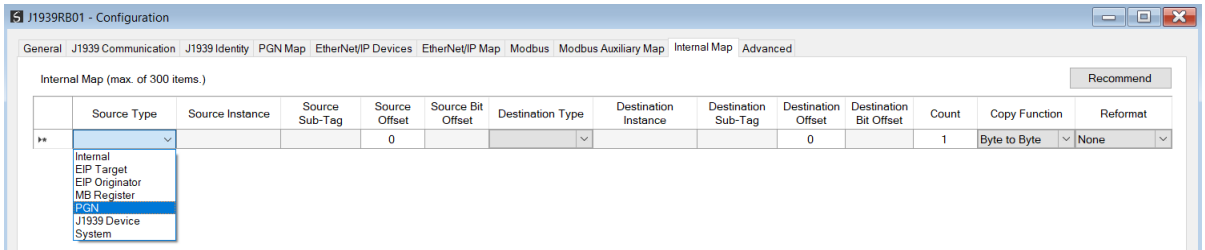


Figure 3.19 – IDS Copy – PGN Source Type

The source instance will be the PGN name in the PGN Map configuration. The Source Sub-Tag can either be the PGN data or the PGN status which indicates if the PGN mapping is ok and data is being consumed.

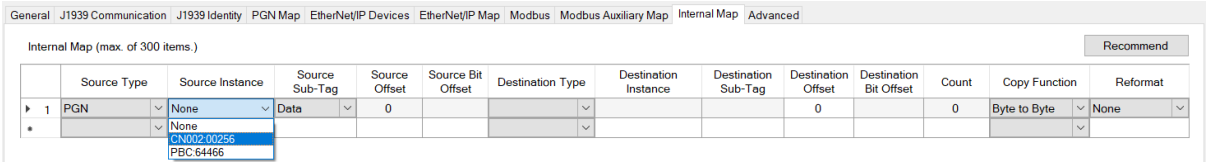


Figure 3.20 – IDS Copy – PGN Source Instance and Sub-Tag

Source Sub-Tag	Description
PGN Status	Status of the mapped PGN. Bit 0 – Mapped PGN Ok. Bit 1 to 15 – Reserved

Table 3.4 – IDS Copy - PGN Status

NOTE: PGN data being copied from non-custom PGNs will be in the decoded format. The format for each mapped PGN can be seen in the PGN details. This can be found by right-clicking on the module in Slate and selecting *Export PGN Details*.

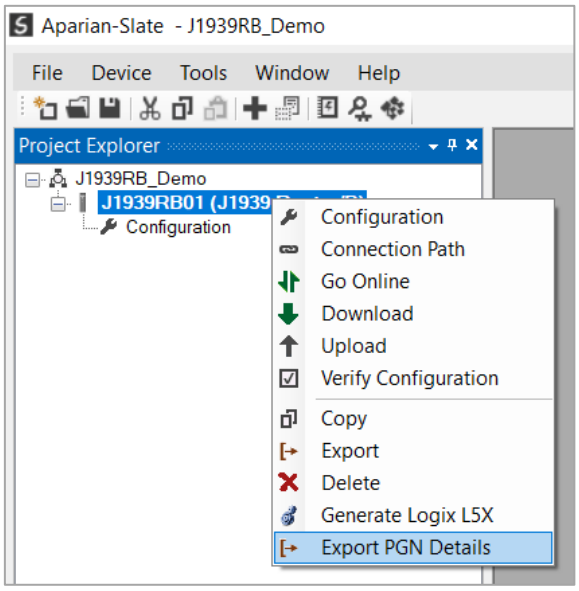


Figure 3.21 – Export PGN Details.

The Source Offset is the offset of the PGN data from where the data must be copied. The Count is the number of **bytes** that will be copied.

See the Internal Data Space Mapping section for more information regarding the operation.

B. IDS COPY – PGN PRODUCE DESTINATION

When copying data from the Ethernet interface to a produce PGN, the destination type needs to be PGN.

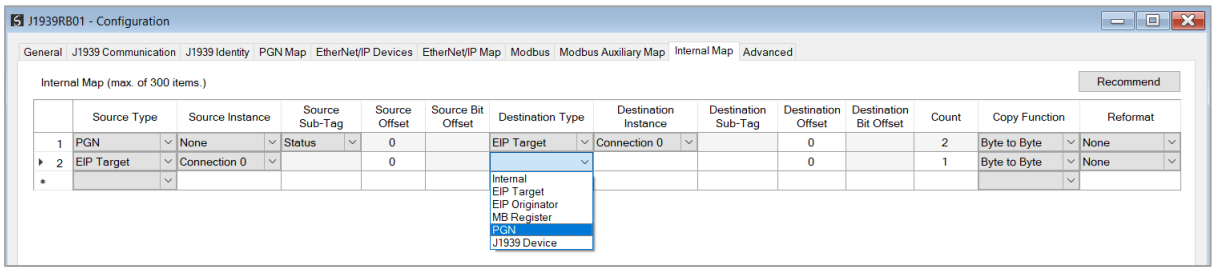


Figure 3.22 – IDS Copy – PGN Destination Type

The destination instance will be the PGN name in the PGN Map configuration. The Destination Offset is the offset of the PGN data to where the data must be copied. The Count is the number of **bytes** that will be copied.

See the Internal Data Space Mapping section for more information regarding the operation.

3.5.3.4. CUSTOM VERSUS STANDARD PGN

For each mapped item the user can select to either use a standard SAE defined PGN or a custom manufacturer defined PGN. When using a standard PGN the user can use the PGN browse button to select from the list of SAE defined PGNs as shown below.

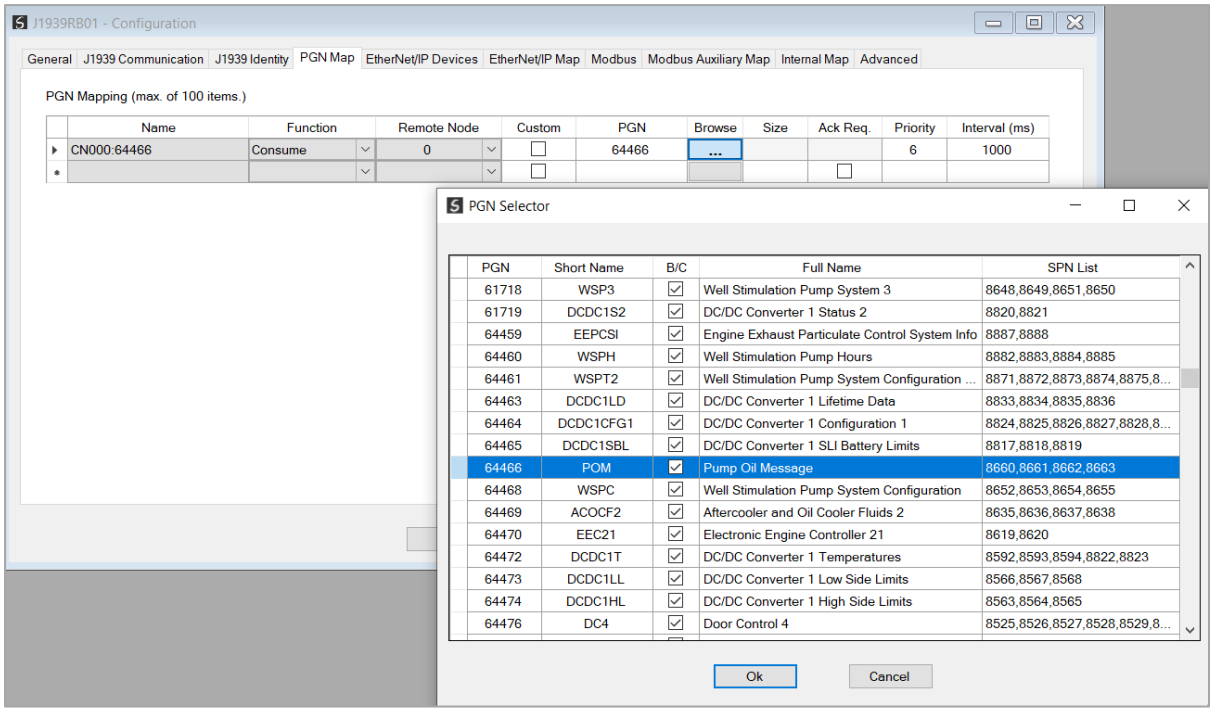


Figure 3.22 – PGN selection list

The PGN data will automatically be reformatted and scaled as per the SAE PGN standards and definitions when selecting a standard SAE defined PGN.

A Logix L5X file can be generated from Slate when the J1939 Router/B is operating as a EtherNet/IP Target. This will contain the mapping routines as well as the UDTs for the specific reformatted SAE PGNs in the PGN Map configuration.

See the *Generating Logix L5X* section for more information regarding this feature.

NOTE: When using Standard SAE defined PGNs it is strongly recommended that the automatic UDT and Tag generation function is used to ensure the correct data structure mapping.

NOTE: Using an incorrectly formed UDT for J1939 data exchange can cause unexpected and dangerous results.

When selecting a custom PGN the Logix Data Type used is a SINT array. The user will need to extract, scale, and reformat the required data in the Logix environment as required.

NOTE: The L5X generation will also create the Tag (of data type SINT array) for custom PGNs.

3.6. PRIMARY INTERFACE

The J1939 Router/B module supports four different modes for the Primary Interface.

3.6.1. ETHERNET/IP TARGET

A controller (e.g. Logix controller) can own the J1939 Router/B over EtherNet/IP using up to 4 Class 1 EtherNet/IP connections when the Primary Interface is set to EtherNet/IP target. This will allow the J1939 Router/B to exchange data with the controller using the input and output assembly of the Class 1 EtherNet/IP connections. Data from J1939 devices, in the form of PGNs, can be mapped to the Logix controller over EtherNet/IP.

The user will need to add the J1939 Router/B to the Logix IO tree under a EtherNet/IP bridge (e.g. 1756-EN2TR) or Ethernet Logix controller (e.g. 1756-L85E).

3.6.1.1. STUDIO / LOGIX 5000 CONFIGURATION

A. ADD MODULE TO ETHERNET/IP I/O CONFIGURATION

The J1939 Router/B can be easily integrated with Allen-Bradley Logix family of controllers. Integration with the Logix family in Studio5000 makes use of the EDS Add-On-Profile (AOP).

NOTE: Logix version 21 and newer supports EDS AOPs.

Before the module can be added to the tree the module's EDS file must be registered.

Using RSLinx, the EDS file can be uploaded from the device after which the ***EDS Hardware Installation*** tool will be invoked to complete the registration.

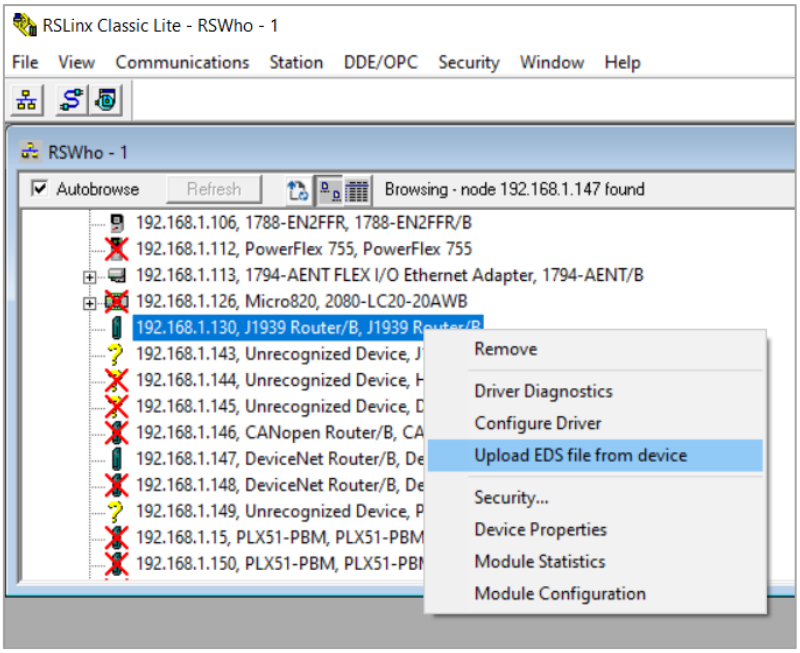


Figure 3.23 – EDS file upload from J1939 Router/B

Alternatively, the EDS file can be downloaded from the product web page at www.aparian.com and registered manually using the ***EDS Hardware Installation Tool*** shortcut under the ***Tools*** menu in Studio 5000.

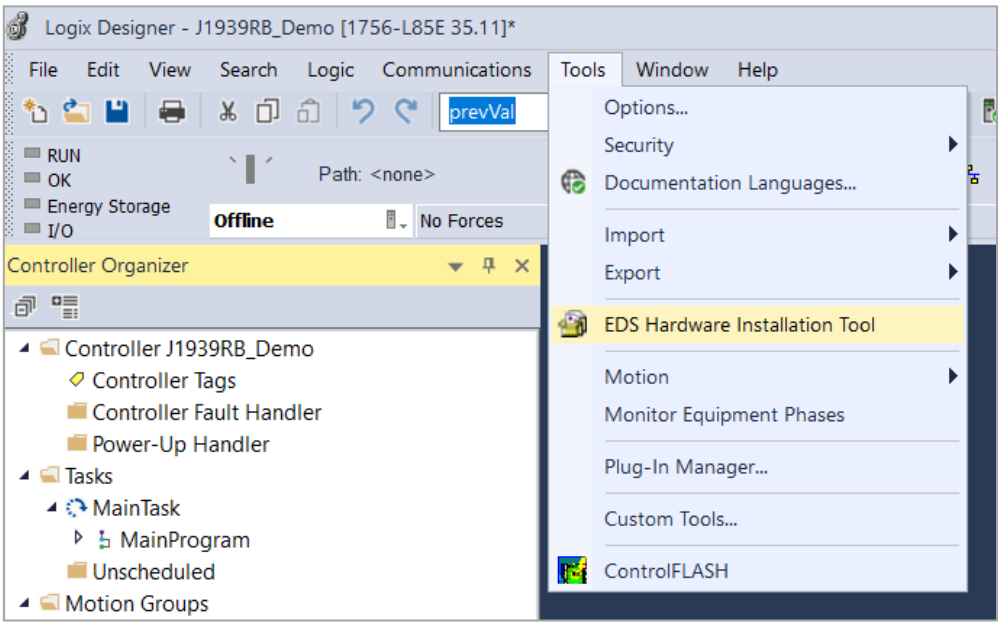


Figure 3.24 - EDS Hardware Installation Utility

After the EDS file has been registered, the module can be added to the Logix IO tree in Studio 5000. Under a suitable Ethernet bridge module in the tree, select the Ethernet network, right-click and select the ***New Module*** option.

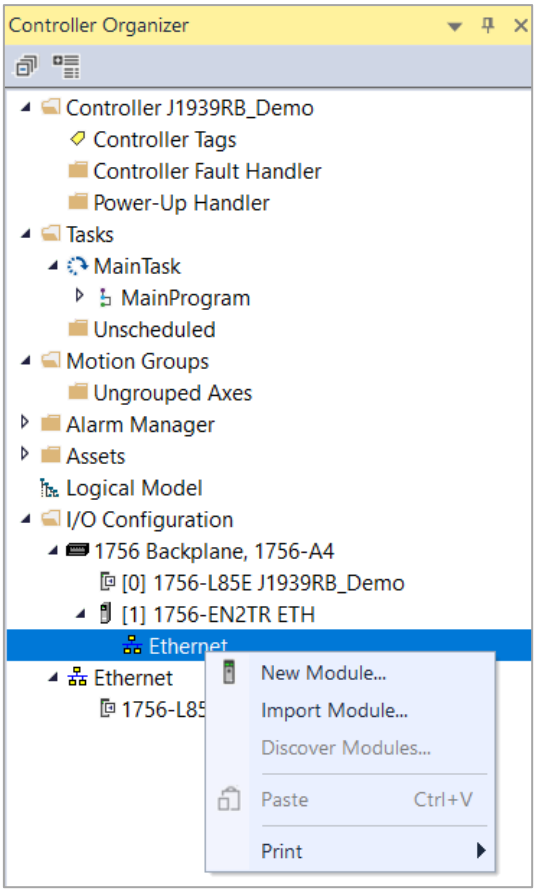


Figure 3.25 – Adding a module

The module selection dialog will open. To find the module more easily, use the Vendor filter to select only the Aparian modules as shown in the figure below.

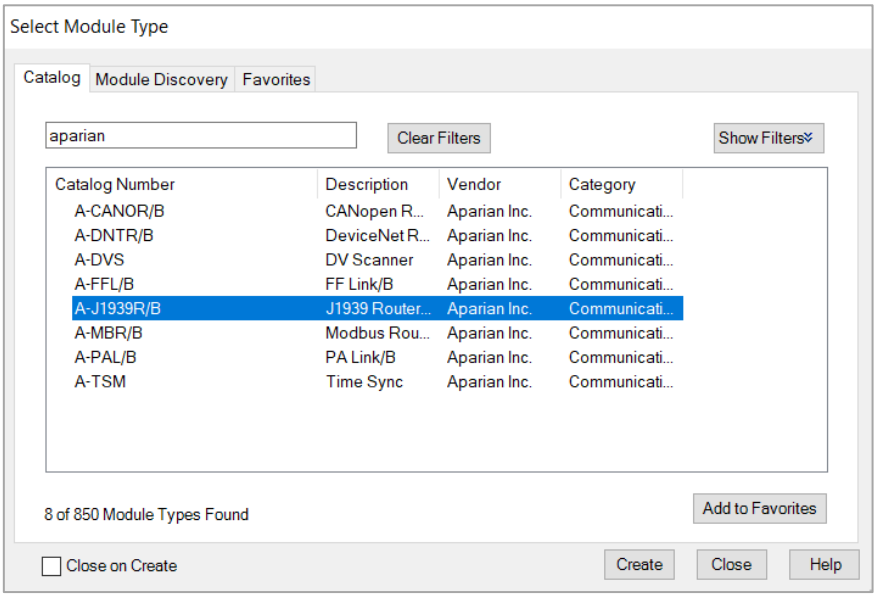


Figure 3.26 – Selecting the module

Locate and select the J1939 Router/B module and select the ***Create*** option. The module configuration dialog will open, where the user must specify the Name and IP address as a minimum to complete the instantiation.

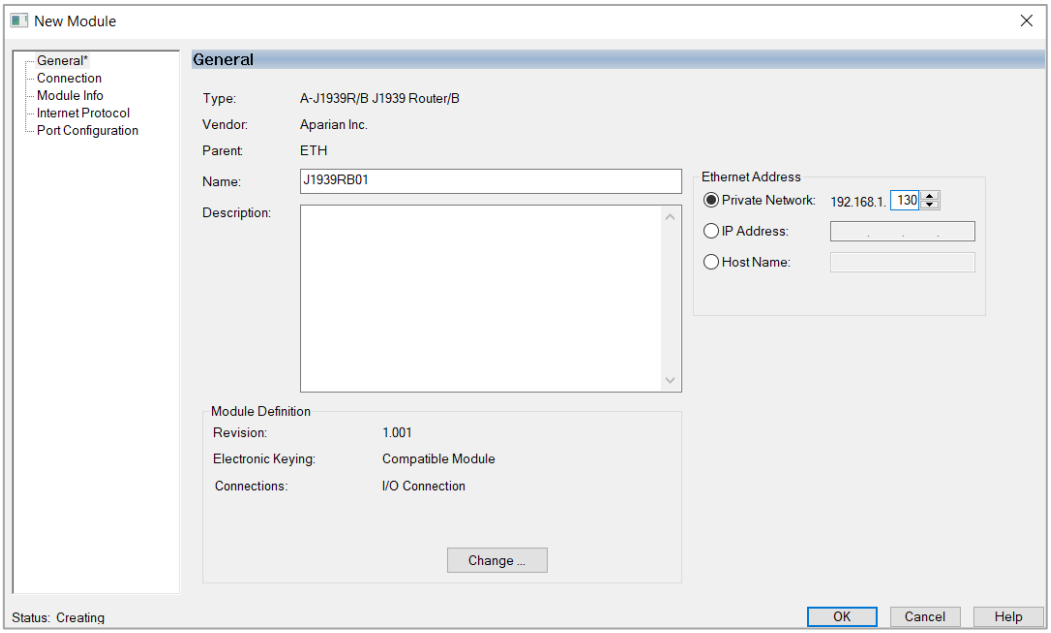


Figure 3.27 – Module instantiation

The J1939 Router/B supports up to 4 class 1 EtherNet/IP connections. The user will need to **ensure that the number of connections configured in the General tab of the module configuration (Slate) matches the selected connection count in Logix (Studio 5000)**.

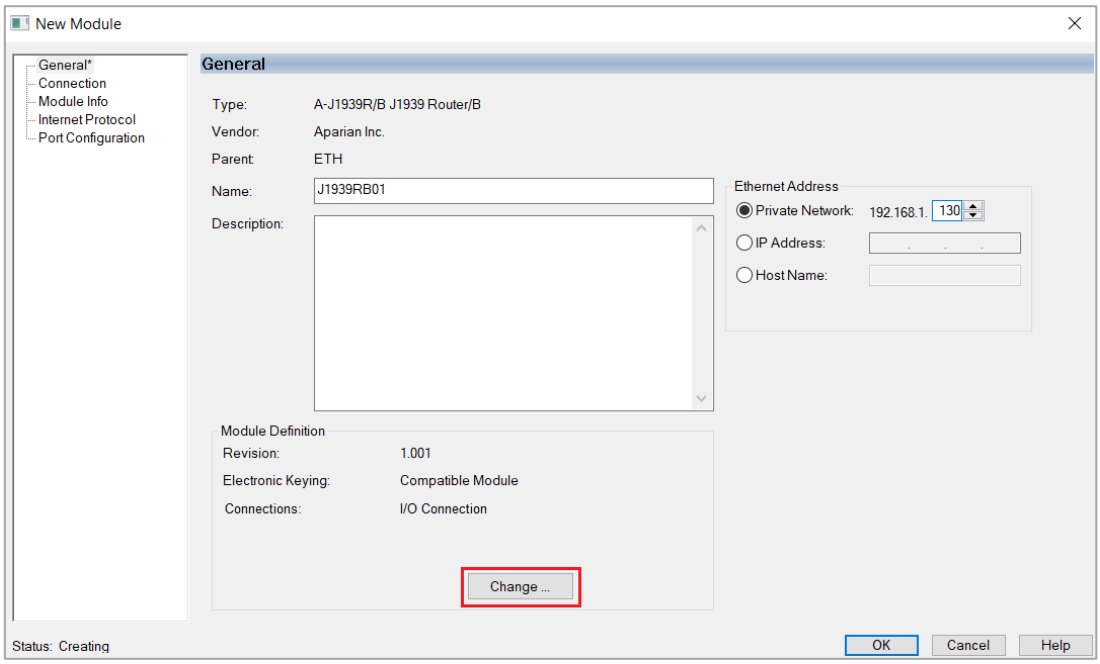


Figure 3.28 – Change number of IO Connections

Next the user will need to select the number of connections required.

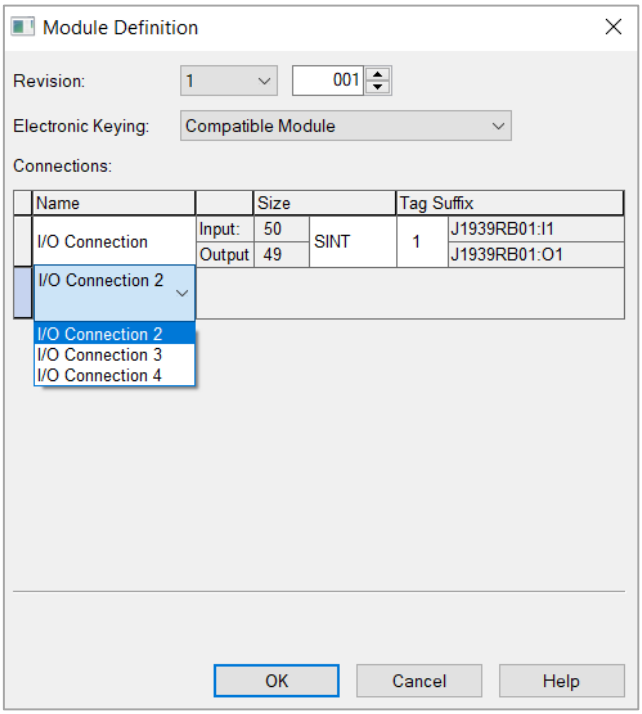


Figure 3.29 – Selection of IO Connections

Now the J1939 Router/B module will be in the Logix IO tree.

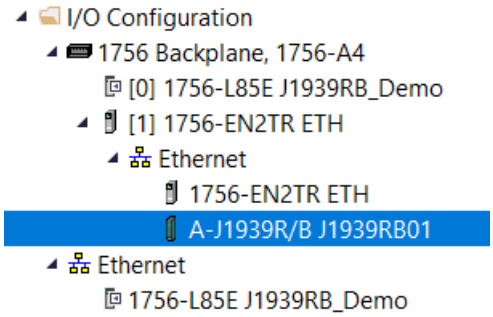


Figure 3.30 – Logix IO tree

The Module Defined Data Types will automatically be created during the instantiation process. These module defined tags will need to be copied to and from meaningful structures.

B. LOGIX MAPPING

Slate will generate the required UDTs and Routines (based on the Internal Map) to map the required J1939 produce and consume PGNs. The user will need to select the ***Recommend***

button in the Internal Mapping to auto populate the Internal Mapping which can then be used to generate the L5X file for Logix mapping, routines, and UDTs

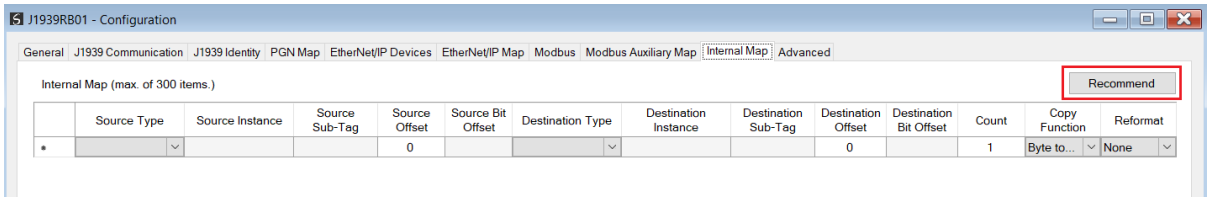


Figure 3.31 – Internal Mapping Recommend

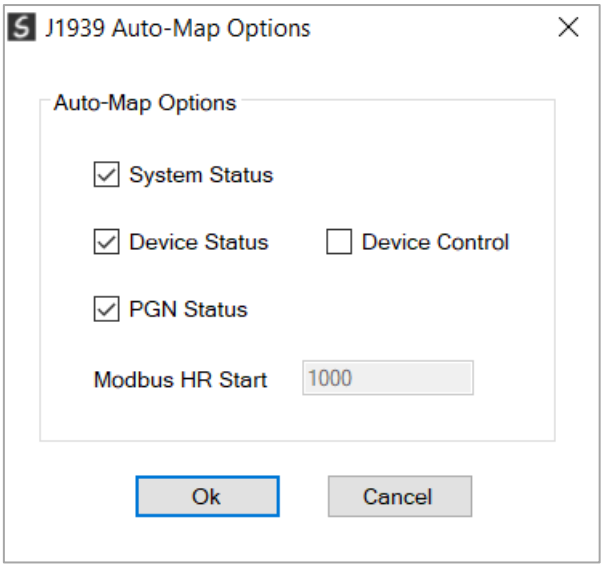


Figure 3.32 – Auto-Map Options popup

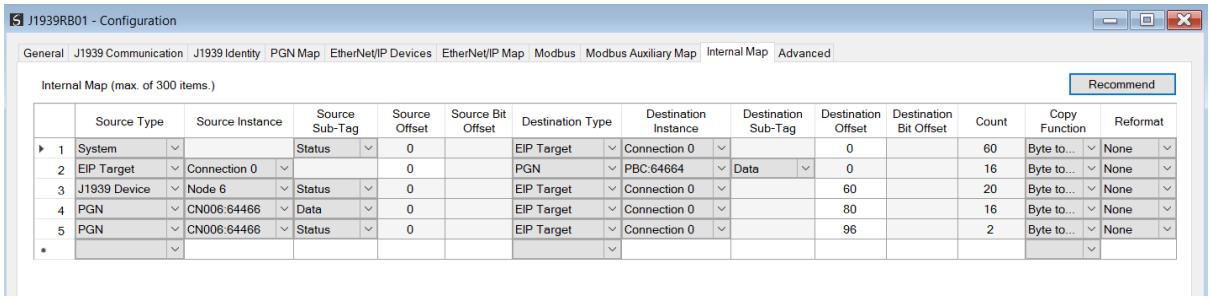


Figure 3.33 – Internal Mapping Auto Populated

The user can then generate the required Logix and UDTs by right-clicking on the module in Slate and selecting the ***Generate Logix L5X*** option.

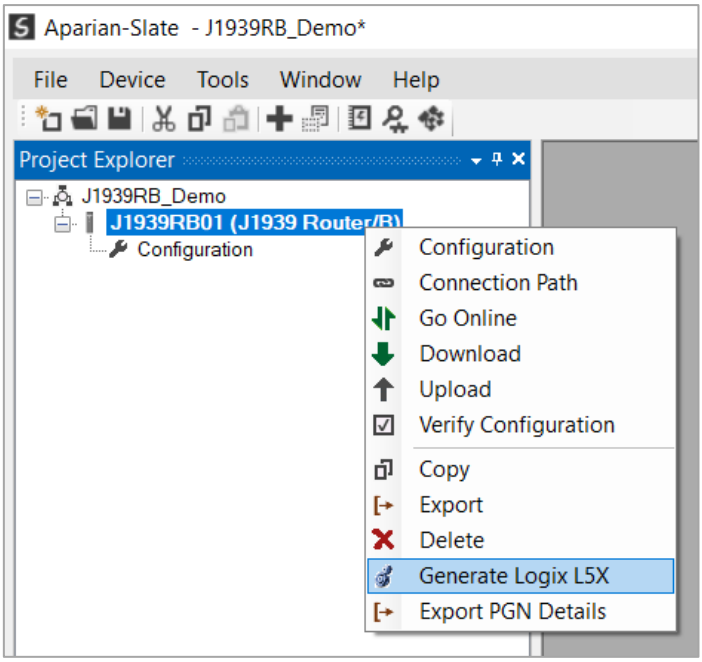


Figure 3.34 – Selecting Generate Logix L5X

The user will then be prompted to select a suitable file name and path for the L5X file.

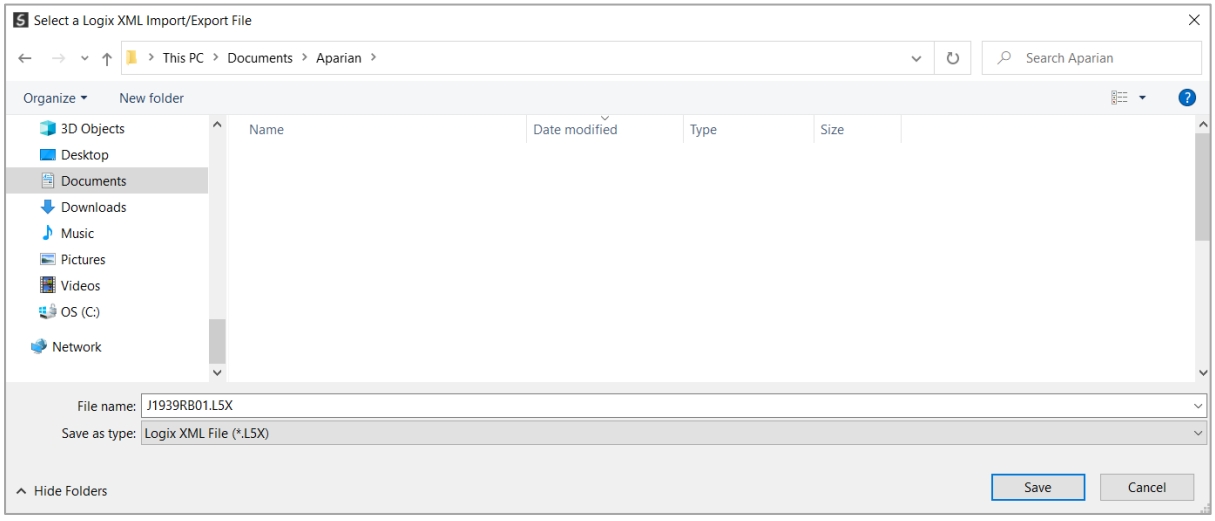


Figure 3.35 – Selecting the Logix L5X file name

This L5X file can now be imported into the Studio 5000 project by right-clicking on a suitable ***Program*** and selecting ***Add***, and then ***Import Routine***.

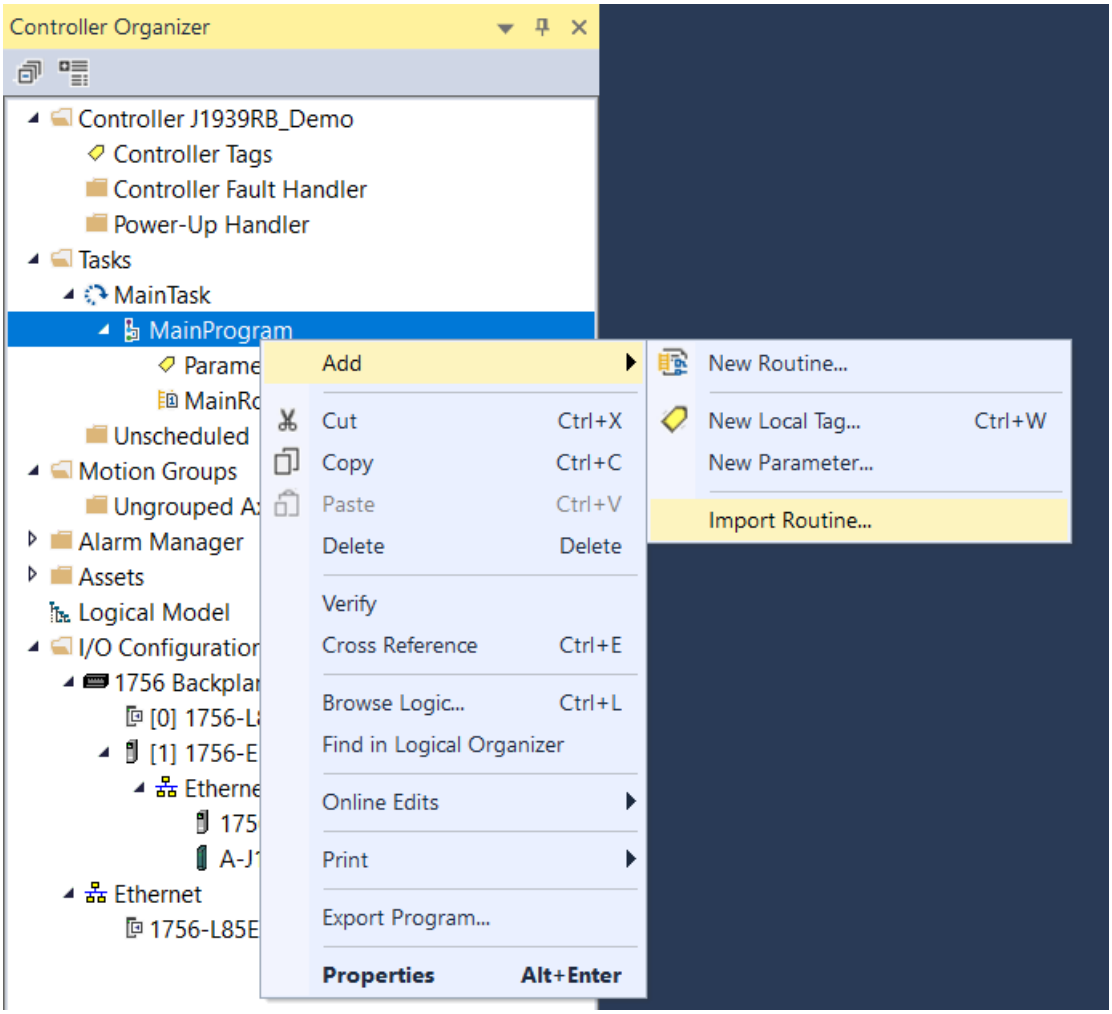


Figure 3.36 – Importing the L5X file into Studio 5000

In the file open dialog select the previously created L5X file and accept the import by pressing ***Ok***.

The import will create the following:

- Mapping Routine
- Multiple UDT (User-Defined Data Types)
- Multiple Controller Tags

Since the imported mapping routine is not a Main Routine, it will need to be called from the current Main Routine.

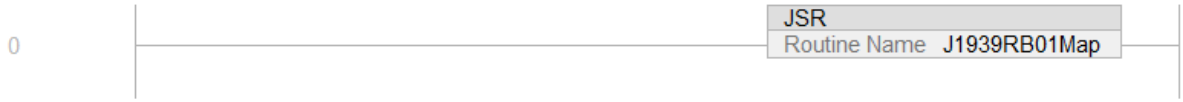


Figure 3.37 – Calling the mapping routine

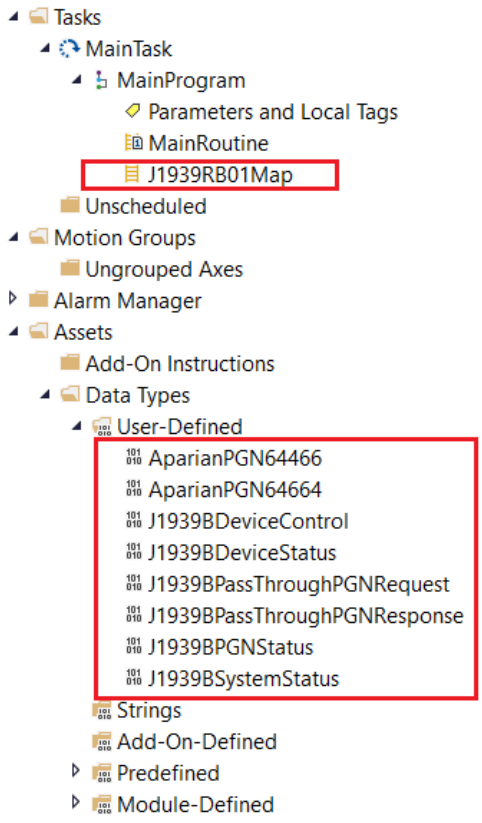


Figure 3.38 – Imported Logix Objects

A number of J1939 Router/B specific (UDT) tags are created. The System tag displays the status and diagnostics information of the J1939 Router/B.

Name	Value	Force	Style	Data Type	Description
J1939RB01System	{...}	{...}		J1939BSystemStatus	
J1939RB01System.ConfigValid	0		Decimal	BOOL	Configuration Valid
J1939RB01System.EIPOriginatorCommsOk	0		Decimal	BOOL	EtherNet/IP Originator 0=Fail, 1=Ok
J1939RB01System.ModbusOnline	0		Decimal	BOOL	0=Offline, 1=Online
J1939RB01System.EIPOwned	0		Decimal	BOOL	EtherNet/IP Target: 0=Not-Owned, 1=Owned
J1939RB01System.AllPGNStatus	0		Decimal	BOOL	All PGNs Status: 0=Fault, 1=Ok
J1939RB01System.PowerMainConnector	0		Decimal	BOOL	Main Power: 0=Off 1=On
J1939RB01System.PowerCANConnector	0		Decimal	BOOL	CAN Power: 0=Off 1=On
J1939RB01System.DuplicateNodeNumber	0		Decimal	BOOL	0=Ok, 1=Duplicate Node Detected
J1939RB01System.NTPOk	0		Decimal	BOOL	NTP Status: 0=Fail, 1=Ok
J1939RB01System.ControllerRun	0		Decimal	BOOL	Controller Mode: 0=Program, 1=Run
J1939RB01System.TransactionRate	0		Decimal	DINT	Transactions per second
J1939RB01System.Temperature	0.0		Float	REAL	Module Temperature (deg C)
J1939RB01System.RxCanPacketCount	0		Decimal	DINT	Rx Can Packet Count
J1939RB01System.TxCanPacketCount	0		Decimal	DINT	Tx Can Packet Count
J1939RB01System.CRCErrors	0		Decimal	DINT	CAN CRC Errors
J1939RB01System.BitErrors	0		Decimal	DINT	CAN Bit Errors
J1939RB01System.StuffErrors	0		Decimal	DINT	CAN Stuff Errors
J1939RB01System.BussOffCount	0		Decimal	DINT	Bus Off Events
J1939RB01System.AckErrors	0		Decimal	DINT	CAN Acknowledgment Errors
J1939RB01System.FormatErrors	0		Decimal	DINT	CAN Format Errors
J1939RB01System.PGNItemStatus	{...}	{...}	Decimal	BOOL[256]	PGN Status (0=Error, 1=Ok)

Figure 3.39 – System Status tag

There is also a tag created for each configured J1939 device on the J1939 network. The structure of which comprises the status of the specific J1939 device.

◢ J1939RB01Node006Status	{...}	{...}		J1939BDeviceStatus	
J1939RB01Node006Status.Online	0		Decimal	BOOL	Device Online (0=Offline, 1=Online)
▸ J1939RB01Node006Status.Node	0		Decimal	INT	Node Address
▸ J1939RB01Node006Status.ProtectLamp	0		Decimal	SINT	Protect Lamp Status
▸ J1939RB01Node006Status.AmberLamp	0		Decimal	SINT	Amber-Warning Lamp Status
▸ J1939RB01Node006Status.RedLamp	0		Decimal	SINT	Red-Stop Lamp Status
▸ J1939RB01Node006Status.MalfunctionLamp	0		Decimal	SINT	Malfunction Lamp Status
▸ J1939RB01Node006Status.ProtectLampFlash	0		Decimal	SINT	Protect Lamp Flash Status
▸ J1939RB01Node006Status.AmberLampFlash	0		Decimal	SINT	Amber-Warning Lamp Flash Status
▸ J1939RB01Node006Status.RedLampFlash	0		Decimal	SINT	Red-Stop Lamp Flash Status
▸ J1939RB01Node006Status.MalfunctionLampFlash	0		Decimal	SINT	Malfunction Lamp Flash Status
▸ J1939RB01Node006Status.ProblemSPN	0		Decimal	DINT	Problem SPN
▸ J1939RB01Node006Status.FailureModeIndicator	0		Decimal	SINT	Failure Mode Indicator
▸ J1939RB01Node006Status.ConversionMethod	0		Decimal	SINT	Conversion Method
▸ J1939RB01Node006Status.OccuranceCount	0		Decimal	SINT	Number of fault occurances

Figure 3.40 – J1939 Device-Specific tags

There is also a tag created for each configured PGN in the PGN Map. The structure of which comprises the data and status of the specific PGN. When using a Custom PGN the data structure will be a SINT array of 8 bytes. The Status structure for the PGN is a BOOL that indicates if the mapped PGN is ok.

◢ J1939RB01CN006_64466Data	{...}	{...}		AparianPGN64466	
J1939RB01CN006_64466Data.WellStimulationPumpOilViscosity	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilDensity	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilRelativeDielectric	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilTemperature	0.0		Float	REAL	
◢ J1939RB01CN006_64466Status	{...}	{...}		J1939BPGNStatus	
J1939RB01CN006_64466Status.Online	0		Decimal	BOOL	Device Online (0=Offline, 1=Online)

Figure 3.41 – J1939 PGN Specific tags

3.6.1.2. INTERNAL DATA SPACE MAPPING

When the module is operating as an EtherNet/IP Target, the data from the originator device (e.g. Logix Controller) can be mapped to the J1939 interface using the Internal Map. The Internal Map configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration* and selecting the *Internal Map* tab.

A. IDS COPY – ETHERNET/IP TARGET SOURCE

When copying data from a connection originator (e.g. the output assembly from the Logix Controller) to the J1939 interface, the source type needs to be EIP Target.

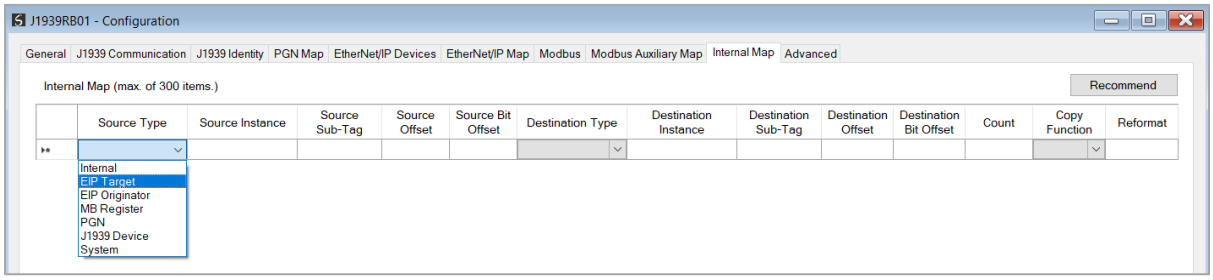


Figure 3.42 – IDS Copy – EtherNet/IP Target Source Type

The source instance will be the connection number, which can be connection 0 to 3, based on the number of connections configured. The Source Offset is the offset in the EtherNet/IP output assembly from where the data must be copied. The Count is the number of **bytes** that will be copied.

See the Internal Data Space Mapping section for more information regarding the operation.

B. IDS COPY – ETHERNET/IP TARGET DESTINATION

When copying data from the J1939 interface to the EtherNet/IP Target input assembly, the destination type needs to be EIP Target.

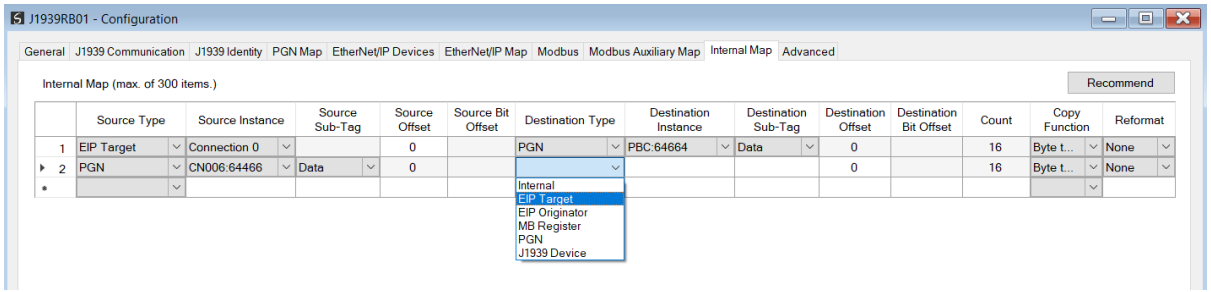


Figure 3.43 – IDS Copy – EtherNet/IP Target Destination Type

The destination instance will be the connection number, which can be connection 0 to 3, based on the number of connections configured. The Destination Offset is the offset of the EtherNet/IP input assembly from where the data must be copied. The Count is the number of **bytes** that will be copied.

3.6.2. MODBUS SERVER

The J1939 Router/B can operate as a Modbus Server for Modbus TCP, RTU232, and RTU485. A Modbus Client can read and write to the full Modbus Register range in the J1939 Router/B. The J1939 Router/B can operate as a Modbus Server for Modbus TCP, Modbus RTU232, and Modbus RTU485 simultaneously. The user will need to configure the relevant Modbus Parameters as shown below.

The Modbus configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration* and selecting the ***Modbus*** tab.

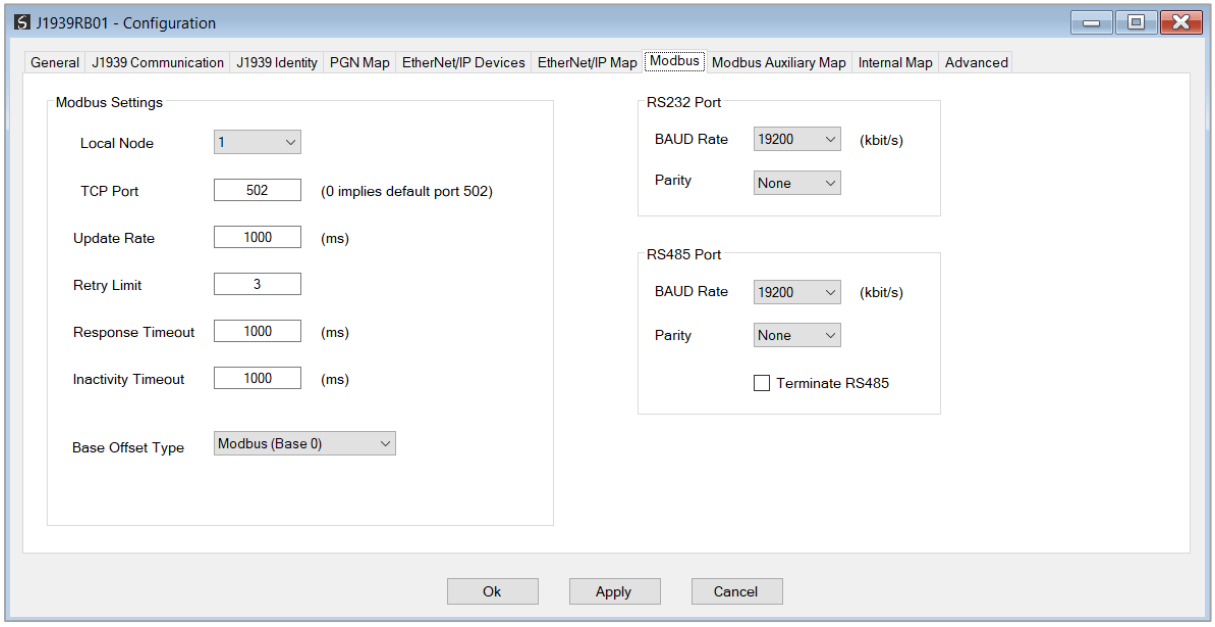


Figure 3.44 – Modbus Configuration

The Modbus Communication configuration consists of the following parameters:

Parameter	Description
Local Node	The Modbus Node address assigned to the J1939 Router/B.
TCP Port	The TCP port to be used for the Modbus communication. By default, the module will use the standard TCP port 502.
Update Rate	The period (in milliseconds) between Client requests to the target Modbus device. **(Modbus Client mode only)**
Retry Limit	The number of successive Modbus request retries before the request is set to have failed. **(Modbus Client mode only)**
Response Timeout	The time (in milliseconds) the module will wait for a valid Modbus response.

	(Modbus Client mode only)
Inactivity Timeout	The amount of time during which no Modbus requests have been received before the J1939 Router/B indicates that the connection to the Modbus Client is no longer active. **(Modbus Server mode only)**
Base Offset Type	**Modbus (Base 0)** Conventional Modbus addressing where the first address is 0. **PLC (Base 1)** PLC addressing, where the first address is 1.
RS232 Port	
BAUD Rate	The RS232 serial port's BAUD rate. (Modbus RTU232)
Parity	The RS232 serial port's Parity configuration. (Modbus RTU232)
RS485 Port	
BAUD Rate	The RS485 serial port's BAUD rate. (Modbus RTU485)
Parity	The RS485 serial port's Parity configuration. (Modbus RTU485)
Terminate RS485	Enables the on-board 125Ω RS485 terminating resistor.

Table 3.3 – Modbus parameters

The Modbus Node Number will need to be configured in the parameters above to allow a Modbus Client to access the J1939 Router/B as a Modbus Server device.

3.6.2.1. INTERNAL DATA SPACE MAPPING

When the module is operating as a Modbus Server, the data from the Modbus Registers (used to exchange data with the Modbus Client) can be mapped to the J1939 interface using the Internal Map. The Internal Map configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration* and selecting the *Internal Map* tab.

NOTE: The user can select the *Recommend* button in the Internal Map to auto map the J1939 status and data to recommended Modbus Registers.

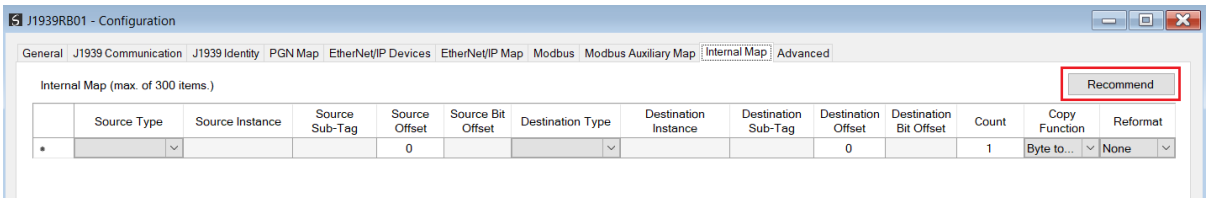


Figure 3.45 – Modbus Server – Internal Mapping Recommend

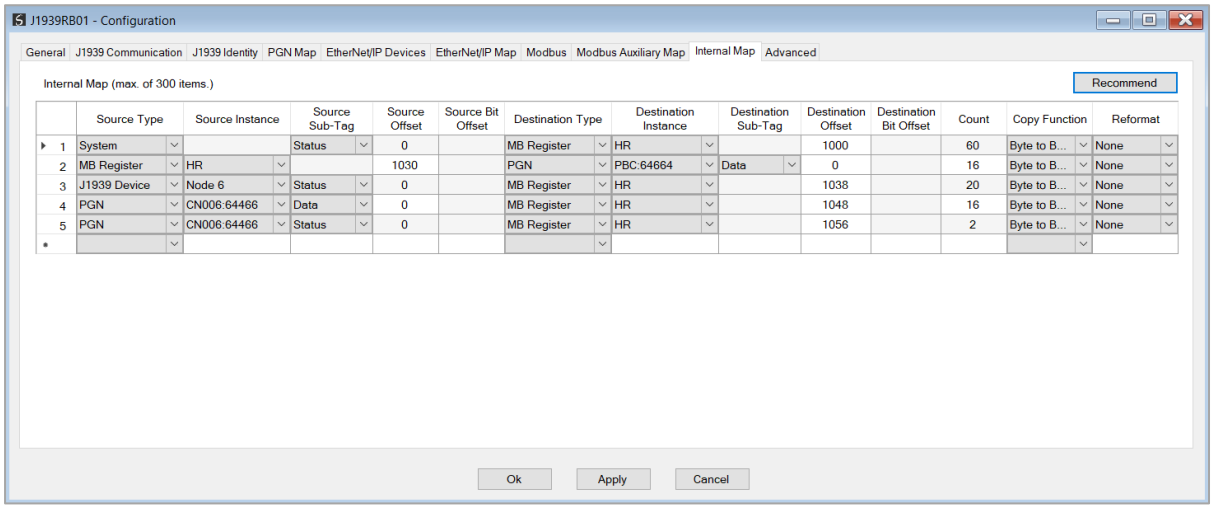


Figure 3.46 – Modbus Server – Internal Mapping Updated

A. IDS COPY – MODBUS SOURCE

When copying Modbus data to the J1939 interface, the source type needs to be MB Register.

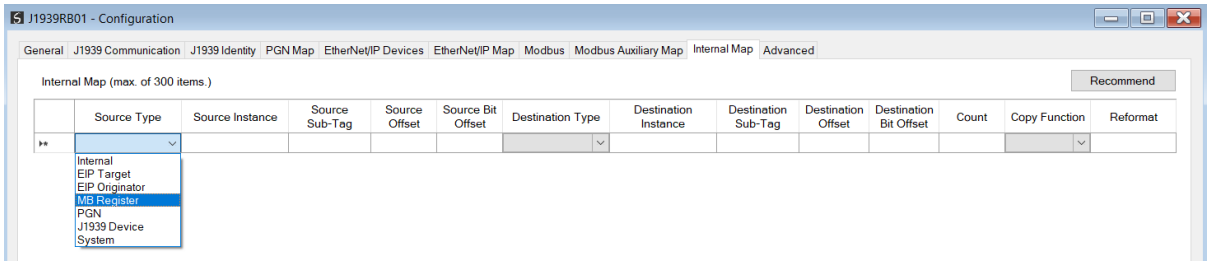


Figure 3.47 – IDS Copy - Modbus Source Type

The source instance will be the Modbus register type required.

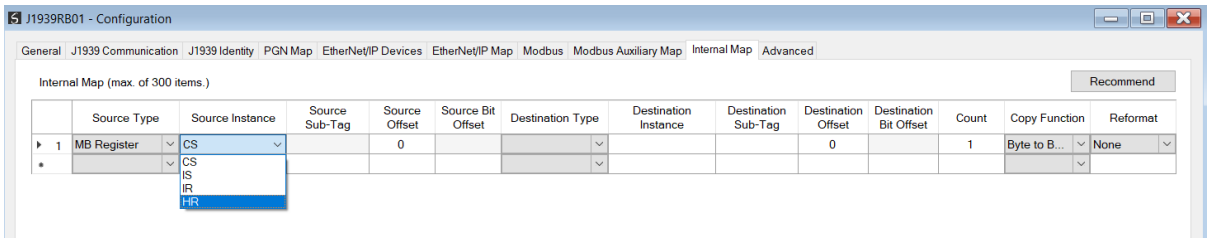


Figure 3.48 – IDS Copy - Modbus Source Instance

The Source Offset is the Modbus Register offset from where the data must be copied. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

B. IDS COPY – MODBUS DESTINATION

When copying data from the J1939 interface to a Modbus Register, the destination type needs to be MB Register.

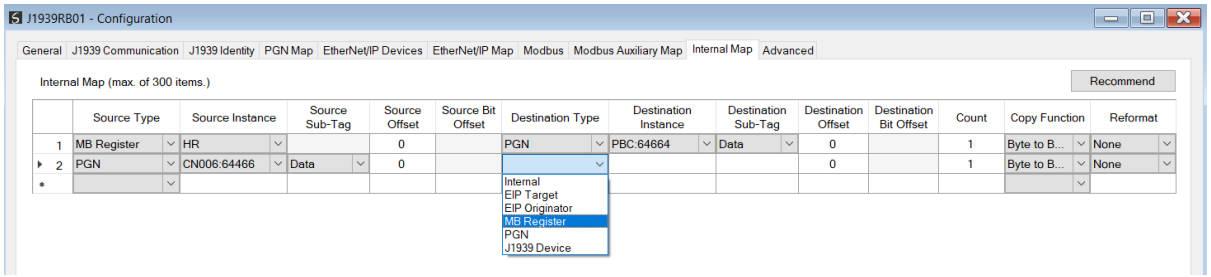


Figure 3.49 – IDS Copy - Modbus Destination Type

The destination instance will be the Modbus register type required.

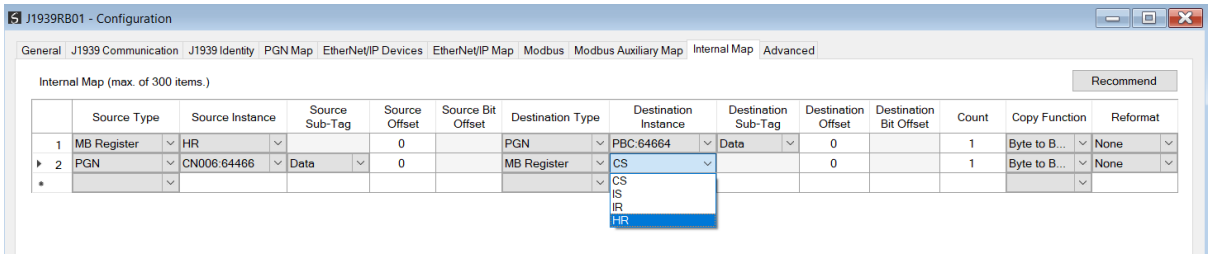


Figure 3.50 – IDS Copy - Modbus Destination Instance

The Destination Offset is the Modbus Register offset to where the data must be copied. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

3.6.3. MODBUS CLIENT

The J1939 Router/B can operate as a Modbus Client for Modbus TCP, RTU232, and RTU485. The user will need to configure the relevant Modbus Parameters as shown below followed by the configuration of the Modbus Auxiliary Map. This map will allow the user to configure various read and write functions to external Modbus Registers, to and from the internal Modbus registers.

The Modbus configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration* and selecting the *Modbus* tab.

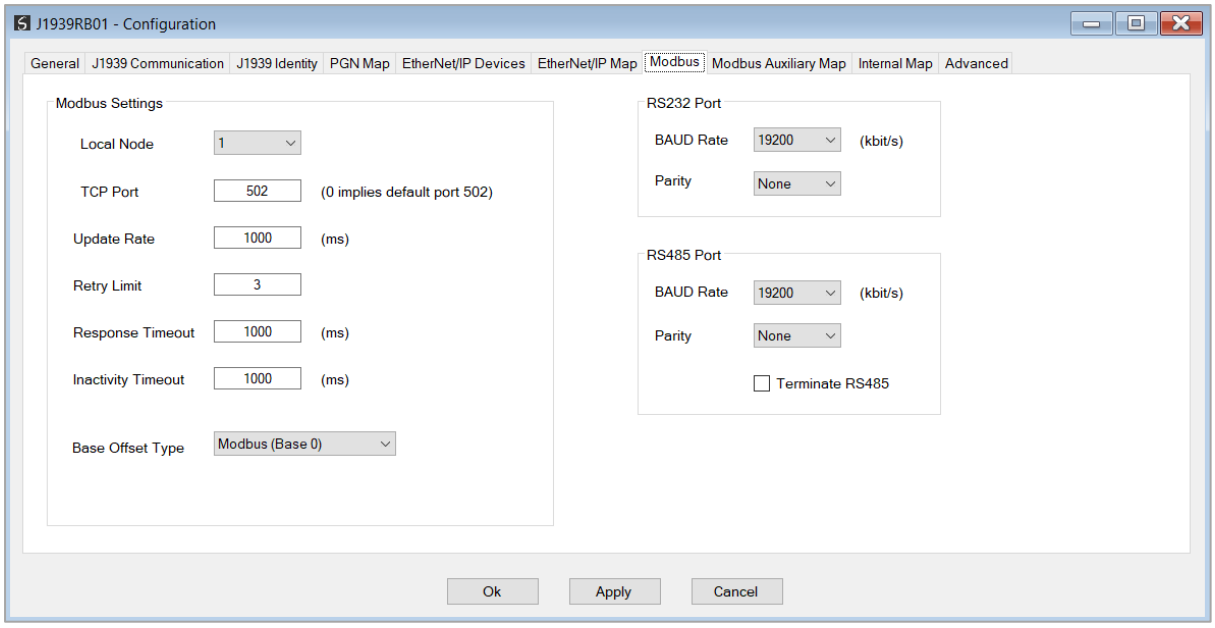


Figure 3.51 – Modbus Configuration

The Modbus Communication configuration consists of the following parameters:

Parameter	Description
Local Node	The Modbus Node address assigned to the J1939 Router/B.
TCP Port	The TCP port to be used for the Modbus communication. By default, the module will use the standard TCP port 502.
Update Rate	The period (in milliseconds) between Client requests to the target Modbus device. **(Modbus Client mode only)**
Retry Limit	The number of successive Modbus request retries before the request is set to have failed. **(Modbus Client mode only)**
Response Timeout	The time (in milliseconds) the module will wait for a valid Modbus response. **(Modbus Client mode only)**
Inactivity Timeout	The amount of time during which no Modbus requests have been received before the J1939 Router/B indicates that the connection to the Modbus Client is no longer active. **(Modbus Server mode only)**
Base Offset Type	**Modbus (Base 0)** Conventional Modbus addressing where the first address is 0. **PLC (Base 1)** PLC addressing, where the first address is 1.
RS232 Port	

BAUD Rate	The RS232 serial port's BAUD rate. (Modbus RTU232)
Parity	The RS232 serial port's Parity configuration. (Modbus RTU232)
RS485 Port	
BAUD Rate	The RS485 serial port's BAUD rate. (Modbus RTU485)
Parity	The RS485 serial port's Parity configuration. (Modbus RTU485)
Terminate RS485	Enables the on-board 125Ω RS485 terminating resistor.

Table 3.4 – Modbus parameters

3.6.3.1. MODBUS AUXILIARY MAP

The Modbus Auxiliary Map configuration is shown in the figure below. The Modbus configuration is only applicable when the module has a Modbus Client operating interface. Up to 100 mapping items can be configured. Within the 100 mapping items, a maximum of 20 Modbus TCP Server devices can be configured.

The Modbus Aux Map will be executed in a sequential manner and a mapped item will be executed at the *Update Rate* in the Modbus parameters. That is, the *Update Rate* is the time between two successive mapped item executions.

The Modbus Auxiliary Map configuration window is opened by either double clicking on the module in the tree or by right-clicking the module and selecting ***Configuration***.

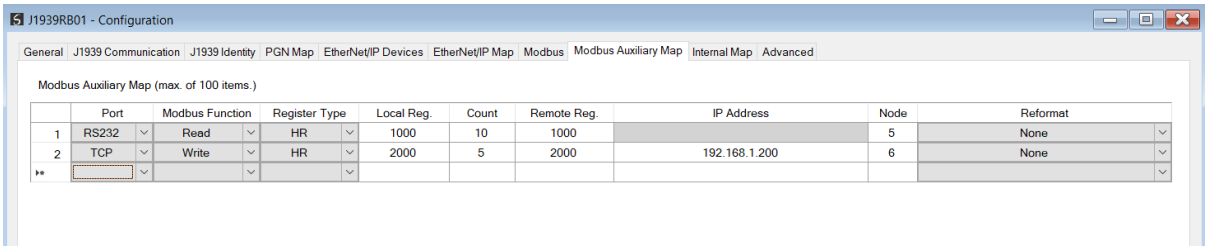


Figure 3.52 – Modbus Auxiliary Map Configuration

The Modbus Auxiliary Map configuration consists of the following parameters:

Parameter	**Description**
Port	The external port to be used: **TCP** – Modbus TCP (Ethernet) **RS232** – Modbus RTU232 **RS485** – Modbus RTU485
Modbus Function	This is the Modbus function that is sent to the Modbus Server.

	Read – Read a Modbus Register (e.g. HR, IR, CS, or IS) from a Modbus Server. **Write** – Write a Modbus Register (e.g. HR or CS) to a Modbus Server.
Register Type	Modbus Register Type: **CS** – Coil Status **IS** – Input Status **IR** – Input Register **HR** – Holding Register
Local Reg.	The local (internal) J1939 Router/B Modbus register address.
Count	The number of Modbus elements to read or write.
Remote Reg.	The remote Server Modbus address register.
IP Address	The IP address of the remote Modbus Server.
Node	The Modbus Node address of the remote Modbus Server.
Reformat	Used to specify how the data is formatted before writing to, or after reading from, the Modbus Server. **None** – No reformatting applied. (AA BB CC DD). **BB AA** – 16bit Byte swap **BB AA DD CC** – 32bit Byte Pair Swap **CC DD AA BB** – Word Swap **DD CC BB AA** – Word and Byte Pair Swap

Table 3.5 – Modbus Auxiliary Map parameters

3.6.3.2. INTERNAL DATA SPACE MAPPING

When the module is operating as a Modbus Client, the data from the Modbus Registers (used to exchange data with various Modbus Servers) can be mapped to the J1939 interface using the Internal Map. The Internal Map configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration*** and selecting the ***Internal Map*** tab.

NOTE: The user can select the *Recommend* button in the Internal Map to auto map the J1939 status and data to recommended Modbus Registers.

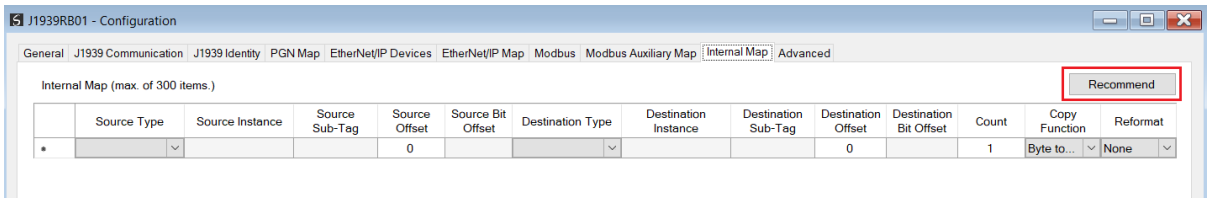


Figure 3.53 – Modbus Server – Internal Mapping Recommend

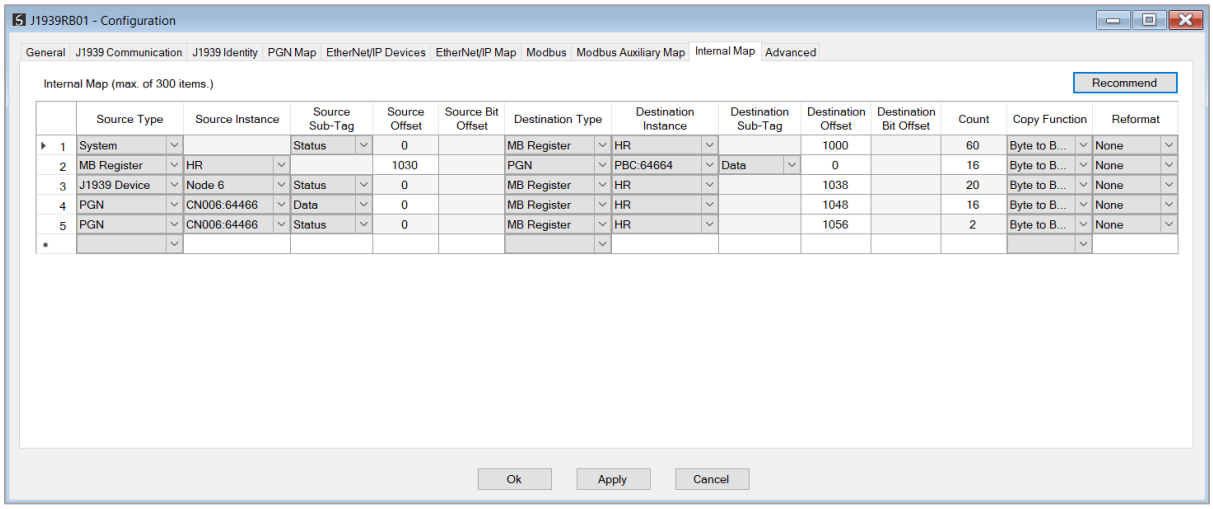


Figure 3.54 – Modbus Server – Internal Mapping Updated

A. IDS COPY – MODBUS SOURCE

When copying Modbus data to the J1939 interface, the source type needs to be MB Register.

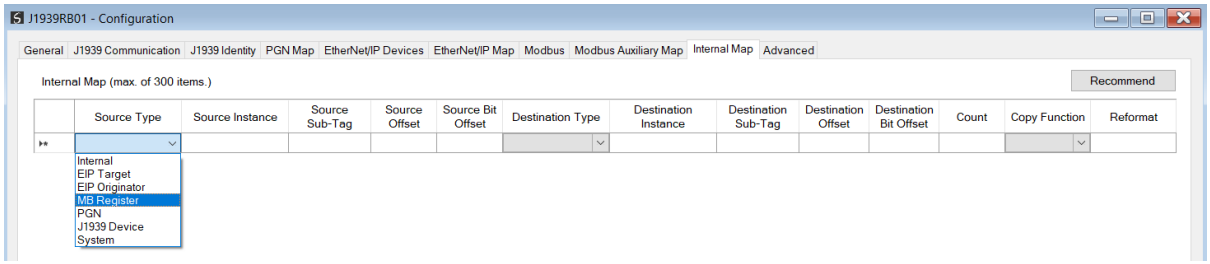


Figure 3.55 – IDS Copy - Modbus Source Type

The source instance will be the Modbus register type required.

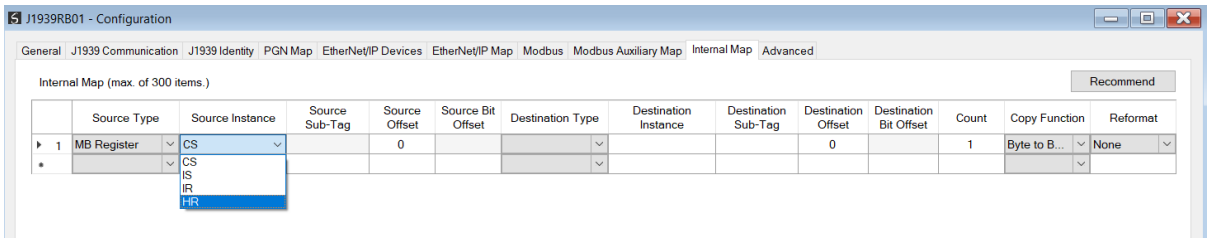


Figure 3.56 – IDS Copy - Modbus Source Instance

The Source Offset is the Modbus Register offset from where the data must be copied. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

B. IDS COPY – MODBUS DESTINATION

When copying data from the J1939 interface to a Modbus Register, the destination type needs to be MB Register.

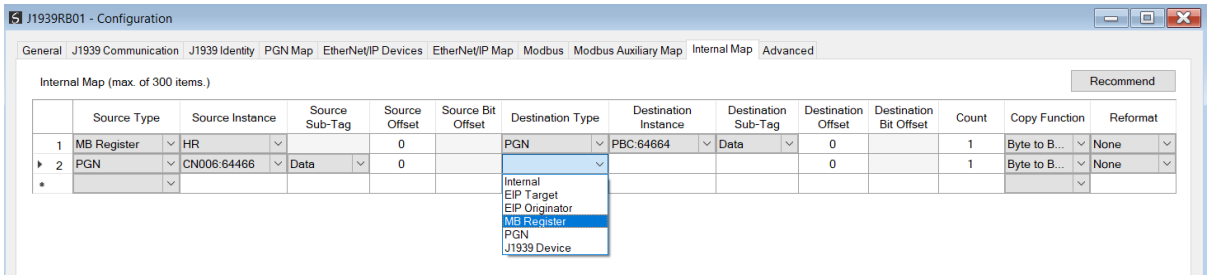


Figure 3.57 – IDS Copy - Modbus Destination Type

The destination instance will be the Modbus register type required.

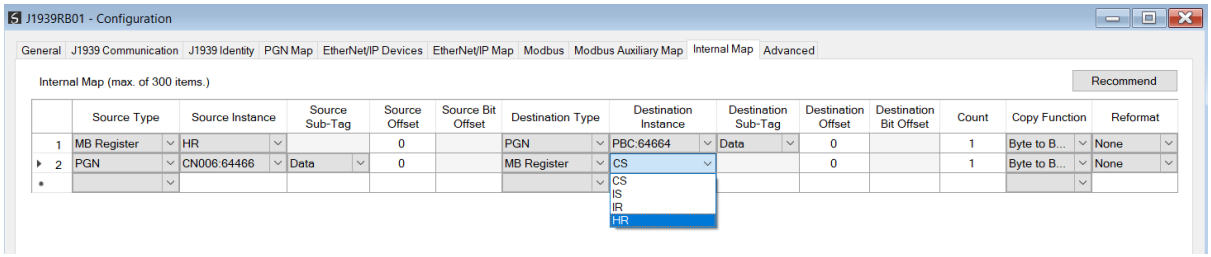


Figure 3.58 – IDS Copy - Modbus Destination Instance

The Destination Offset is the Modbus Register offset to where the data must be copied. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

3.6.4. ETHERNET/IP ORIGINATOR

The J1939 Router/B can operate as a EtherNet/IP connection originator for cyclic (Class 1) or explicit (Class 3 or UCMM) data exchange. The explicit messaging can be setup in the *EtherNet/IP Devices* and *EtherNet/IP Map* in the Master configuration while the cyclic class 1 connections are added to the *EtherNet/IP Connections* node under the module in the Slate project tree.

3.6.4.1. ETHERNET/IP CLASS 1 DEVICE CONNECTIONS

The J1939 Router/B can establish up to 10 cyclic Class 1 EtherNet/IP connections to EtherNet/IP devices. This can be done by either manually entering the connection data into the Connection Parameter window, or by importing the configuration from one or more of the following sources:

- Online Logix Controller
- Logix Controller L5X
- EDS File
- Connection Library

A. MANUAL CONFIGURATION

A class 1 connection can be added to the *EtherNet/IP Connections* tree by right-clicking on the tree in Slate and selecting ***Add EtherNet/IP Connection***.

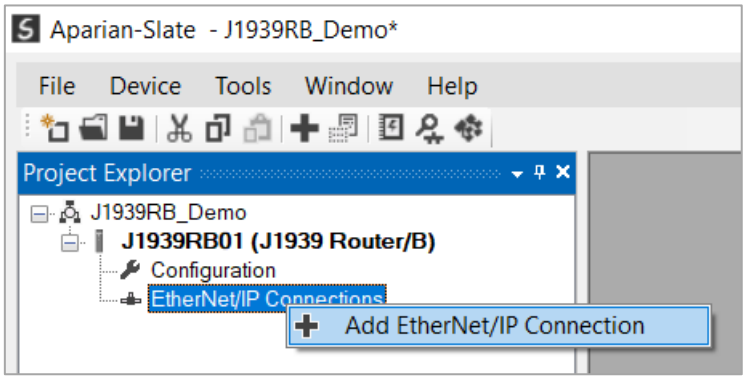


Figure 3.59 – Adding EtherNet/IP Class 1 Connection

Next the user will need to enter the connection parameters for the Class 1 connection.

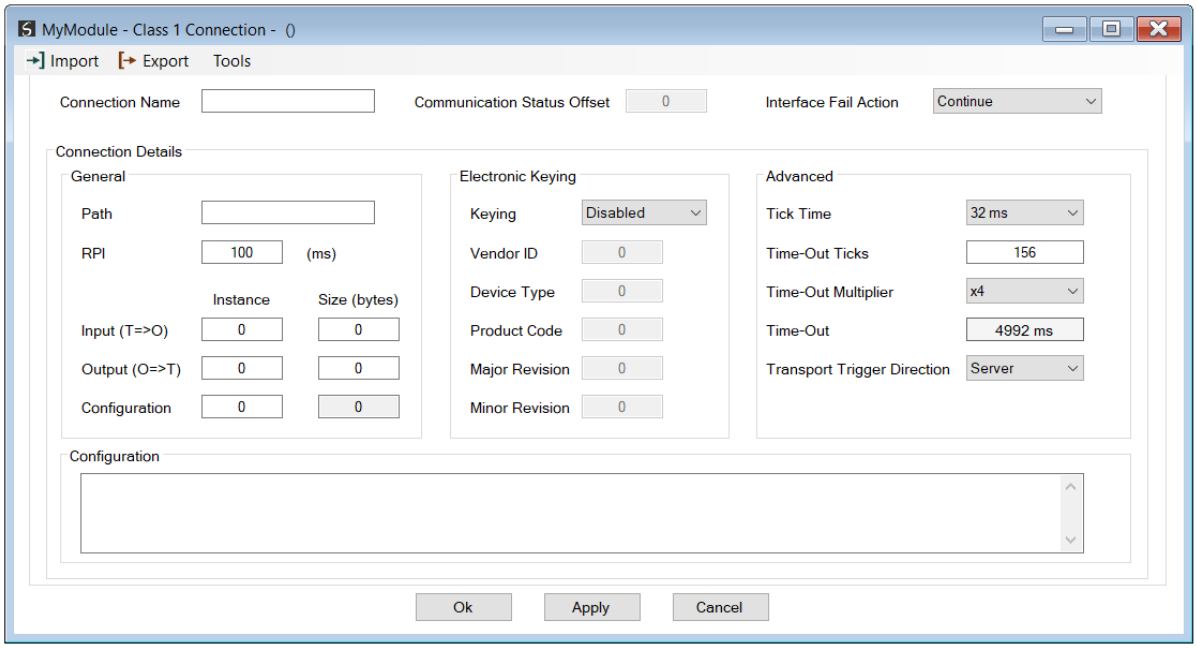


Figure 3.60 – EtherNet/IP Class 1 Connection Parameters



NOTE: It is recommended that the user not change the values in the *Advanced* frame of the connection parameters.

Parameter	Description
Connection Name	The instance name given to the Class 1 Connection.
Interface Fail Action	When the J1939 communication has failed, the EtherNet/IP IO can be configured to either keep the connection running as is, change the connection status to program mode, or force the connection offline. This will allow the EtherNet/IP device to go into a pre-determined state when the J1939 communication fails.
General	
Path	The path to the target device. If the device is an Ethernet device, then this will just be the IP address of the module. If the device is, for example, a module in a backplane or via an adapter, then the user will need to enter the IP address of the bridge or adapter followed by the backplane port (for example 1) and the slot number of the device. Each item is separated by a comma. As an example, to connect to an Allen-Bradley Flex module (via the Flex Adapter at IP address 192.168.1.100) that is in slot 2 of the Flex backplane, the user will need to enter the following path: 192.168.1.100,1,2 (IP address, port (backplane), slot).
RPI	The requested packet interval (RPI) is the rate in milliseconds at which the data will be sent from the originator to the target and vice versa.
Input (T=>O) – Instance	The instance of the input assembly.
Input (T=>O) – Size (bytes)	The size in bytes of the input assembly.
Output (O=>T) – Instance	The instance of the output assembly.
Output (O=>T) – Size (bytes)	The size in bytes of the output assembly.
Configuration – Instance	The instance of the configuration assembly.
Configuration – Size (bytes)	The size in bytes of the configuration assembly. **NOTE:** This is a read-only value and will be equal to the number of bytes entered into the configuration window below.
Electronic Keying	
Keying	Electronic Keying can be used to ensure that the target device is the correct device type. **Disabled** Keying is not enabled, and no key information will be sent in the connection establishment. **Compatible**

	Keying has been enabled with compatibility enabled. This will allow devices with older firmware to also establish a connection. **Exact** Keying has been enabled and the exact device with specific firmware revision will allow the establishment of the connection.
Vendor ID	The Vendor ID of the target device.
Device Type	The Device Type of the target device.
Product Code	The Product Code of the target device.
Major Revision	The Major Revision of the target device.
Minor Revision	The Minor Revision of the target device.
Advanced (Note: Changing these values is not recommended)	
Tick Time	For unconnected messages, this is the time for each tick to calculate the unconnected Time-Out time.
Time-Out Ticks	The number of ticks before the unconnected message is set for timeout.
Time-Out Multiplier	This is the multiplier of the RPI to define the connection timeout time.
Time-Out	The unconnected message timeout time (read-only)
Transport Trigger Direction	The Transport Trigger direction; **Server** or **Client**.
Configuration	
Data	The configuration data that is sent with the forward open connection establishment. The data will need to be entered as a space-delimited, hexadecimal string. For example: 0A 0D 12 EE The configuration size will increase by one each time a byte is added to the configuration.

Table 3.6 – EtherNet/IP Class 1 Connection Parameters

B. IMPORT FROM ONLINE CONTROLLER

Here the EtherNet/IP connection parameters are imported directly from an online Logix controller.

PREPARATION

Before the connection information can be imported, some preparation is required using Studio5000 and a Logix controller:

1. In Studio5000 create a new project and add the required EtherNet/IP device in the IO tree. If the device's profile supports configuration, then configure the device as required.
2. Download the project to a Logix controller.

NOTE: When instantiating modules in Studio5000 do not make use of the "Rack Optimization" communication format.

NOTE: Some versions Logix (V32+) do not support the reading of the module's configuration. Where possible use an earlier version (e.g. V24).

NOTE: It is possible that not all the connection information will be imported as it may not be available due to the type of device and Logix version.

IMPORT CONNECTION PARAMETERS

The connection parameters can be imported from the Logix controller by selecting the ***Import from Online Controller*** option located under the ***Import*** menu of the Class 1 Connection form.

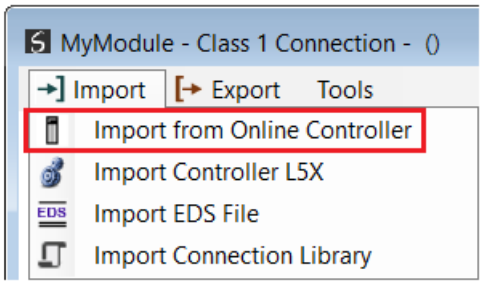


Figure 3.61 – Import from Online Controller

The Import Connection Parameters form will open.

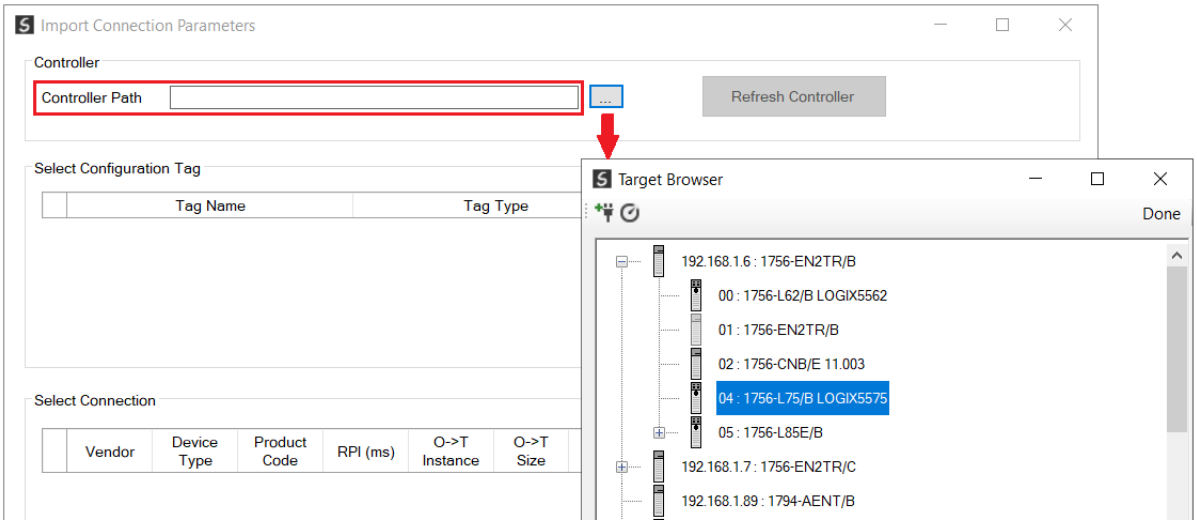


Figure 3.62 – Import Connection Parameters – Controller Path

Enter the path to the Logix controller. This can be either entered manually, or the Browse button "…", can be selected to launch the Target Browser, where the Logix controller can be selected.

Once the Logix controller path has been selected, all the device configuration tags and device connections will be read from the controller and displayed in the Configuration Tag grid and Connection grid respectively.

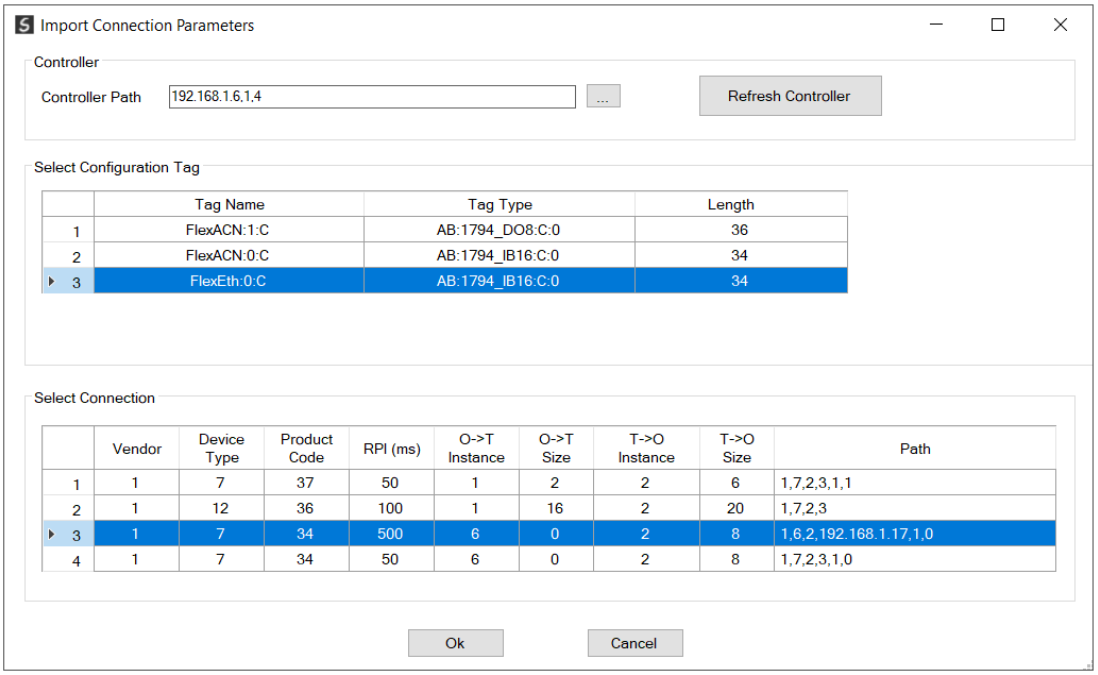


Figure 3.63 – Import Connection Parameters – Select Connection

In order to import all the necessary connection information, the user will need to select both the appropriate ***Configuration Tag***, and the matching ***Connection***.

The new connection's configuration data is derived from the selected ***Configuration Tag***, when the new connection's parameters are derived from the selected ***Connection***.

Once the appropriate selections have been made, press ***Ok***. The imported data will be populated into the Connection form.

The user can then modify the ***Connection Name***, ***Path*** and ***RPI*** as required.

C. IMPORT FROM CONTROLLER L5X FILE

Here the EtherNet/IP connection parameters are imported from a Logix controller's L5X file.

PREPARATION

Before the connection information can be imported some preparation is required using Studio5000:

1. In Studio5000 create a new project and add the required EtherNet/IP device in the IO tree. If the device's profile supports configuration, then configure the device as required.
2. Save the Studio5000 project as an L5X file.

NOTE: When instantiating modules in Studio5000 do not make use of the "Rack Optimization" communication format.

NOTE: It is possible that not all the connection information will be imported as it may not be available in the L5X file due to the type of device and Logix version.

IMPORT L5X FILE

The connection parameters can be imported from the L5X file by selecting the ***Import Controller L5X*** option located under the ***Import*** menu of the Class 1 Connection form.

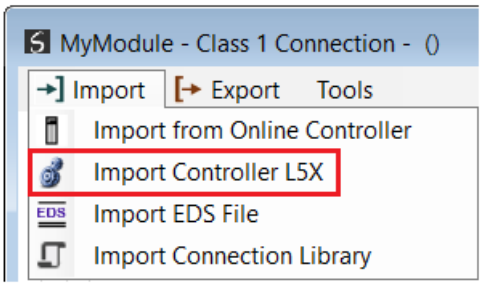


Figure 3.64 – Import from Controller L5X

The Import Connection Parameters form will open.

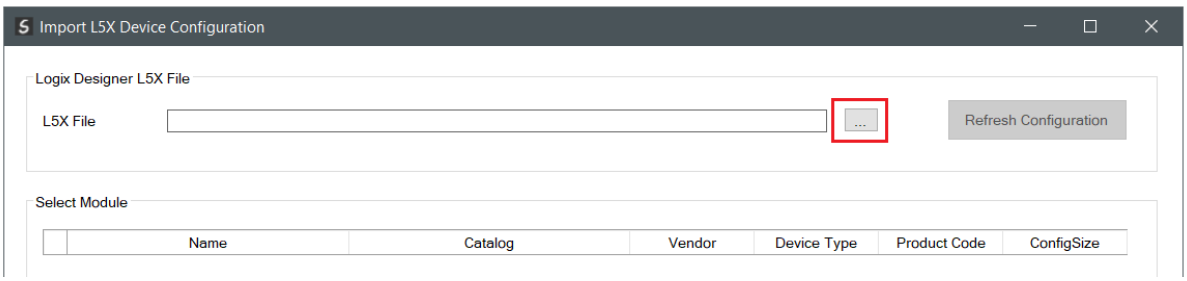


Figure 3.65 – Import L5X Device Configuration – Select L5X

Click on the Browse ("…") button to select the previously generated L5X file.

The modules found in the selected L5X file will then be displayed in the Module List.

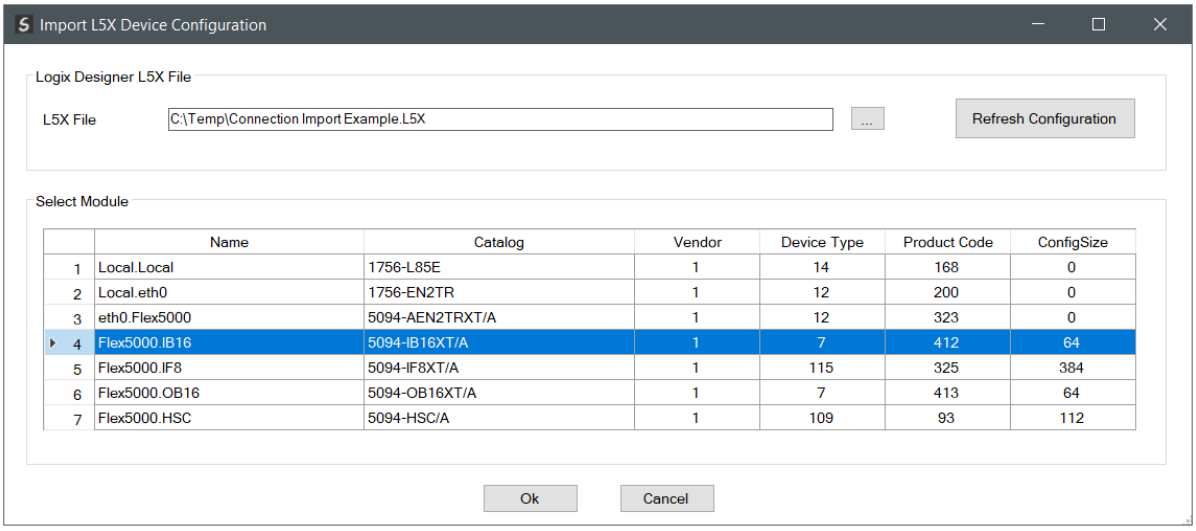


Figure 3.66 – Import L5X Device Configuration

Select the required module and click ***Ok***. The imported data will be populated into the Connection form.

The user can then modify the ***Connection Name***, ***Path*** and ***RPI*** as required.

D. IMPORT EDS FILE

The connection parameters can be imported from a suitable EDS file. Typically, this approach is preferred for devices that do not require configuration data.

To import the connection parameters from a device EDS file, select the ***Import EDS File*** option located under the ***Import*** menu of the Class 1 Connection form.

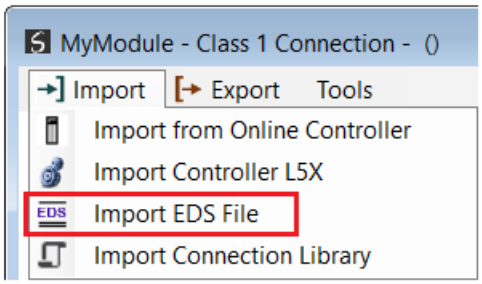


Figure 3.67 – Import EDS File

A File Open dialog will open allowing the user to select the EDS file.

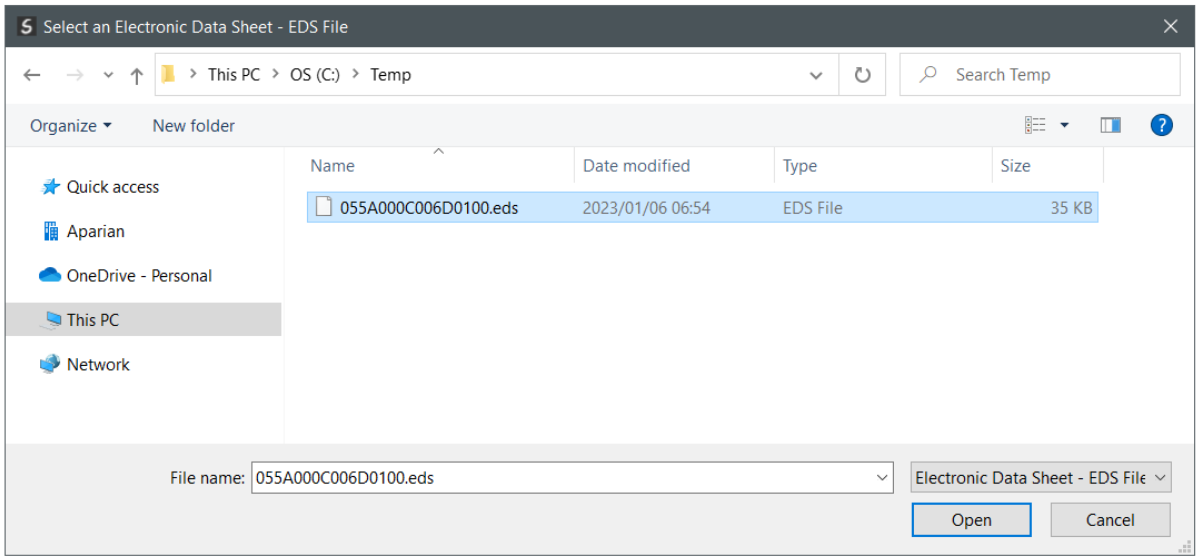


Figure 3.68 – Browse to EDS File

The selected EDS file will be imported, and a summary of the connections displayed. The user will need to select one of the IO connections.

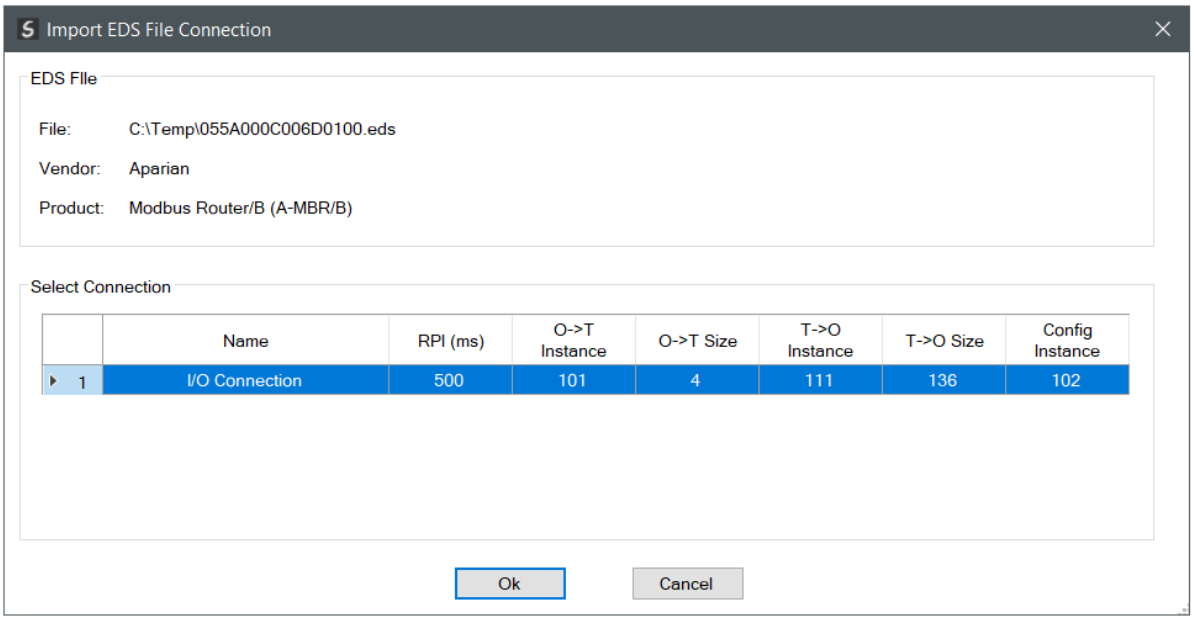


Figure 3.69 – Select Connection

The selected connection within the EDS file will be used to populate the Connection parameters.

The user can then modify the ***Connection Name***, ***Path*** and ***RPI*** as required.

E. IMPORT CONNECTION LIBRARY

The connection parameters can be imported from a previously created Connection Library (.EIPCNX) file.

NOTE: Please contact support to receive a pack of the latest Connection Library files, for commonly used devices.

To import the connection parameters from a Library file, select the ***Import Connection Library File*** option located under the ***Import*** menu of the Class 1 Connection form.

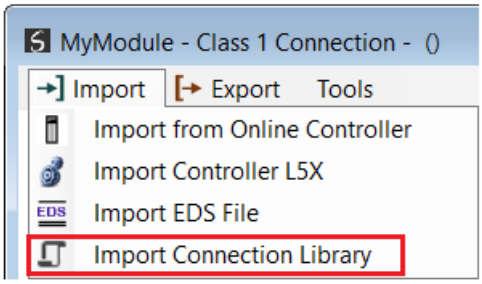


Figure 3.70 – Import Connection Library File

A File Open dialog will open allowing the user to select the Library (.EIPCNX) file.
The selected Library file will be used to populate the Connection parameters.

The user can then modify the ***Connection Name***, ***Path*** and ***RPI*** as required.

EXPORT LIBRARY FILE

In order to create a Library file for future use, select the ***Export Connection Library*** option located under the ***Export*** menu.

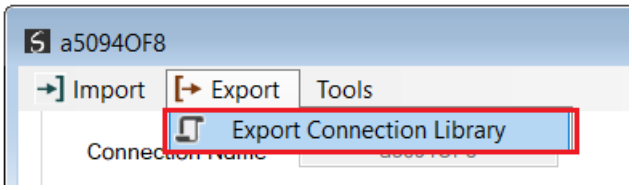


Figure 3.71 – Export Connection Library File

3.6.4.2. ETHERNET/IP EXPLICIT MESSAGE DEVICE CONNECTIONS

Up to 10 EtherNet/IP devices can be added for explicit messaging. The user will need to add each device as explained in the EtherNet/IP Devices section below. Once the EtherNet/IP devices have been added the user can then configure the required mapping for the EtherNet/IP Explicit messaging as shown in EtherNet/IP Map section below.

A. ETHERNET/IP DEVICES

This tab is enabled when the Primary Interface is set to *EtherNet/IP Originator*.

The EtherNet/IP Devices configuration is shown in the figure below. Up to 10 EtherNet/IP devices can be configured with up to 50 EtherNet/IP mapped items allowing for either explicit EtherNet/IP Class 3 or Unconnected Messaging (UCMM) to any of the 10 configured devices. The data from each EtherNet/IP device is written to, or read from, an Internal Data Space with a size of 100Kbytes. See the *Explicit EtherNet/IP Messaging* section for more details.

The EtherNet/IP Devices configuration window is opened by either double clicking on the module in the tree, or by right-clicking the module and selecting *Configuration*.

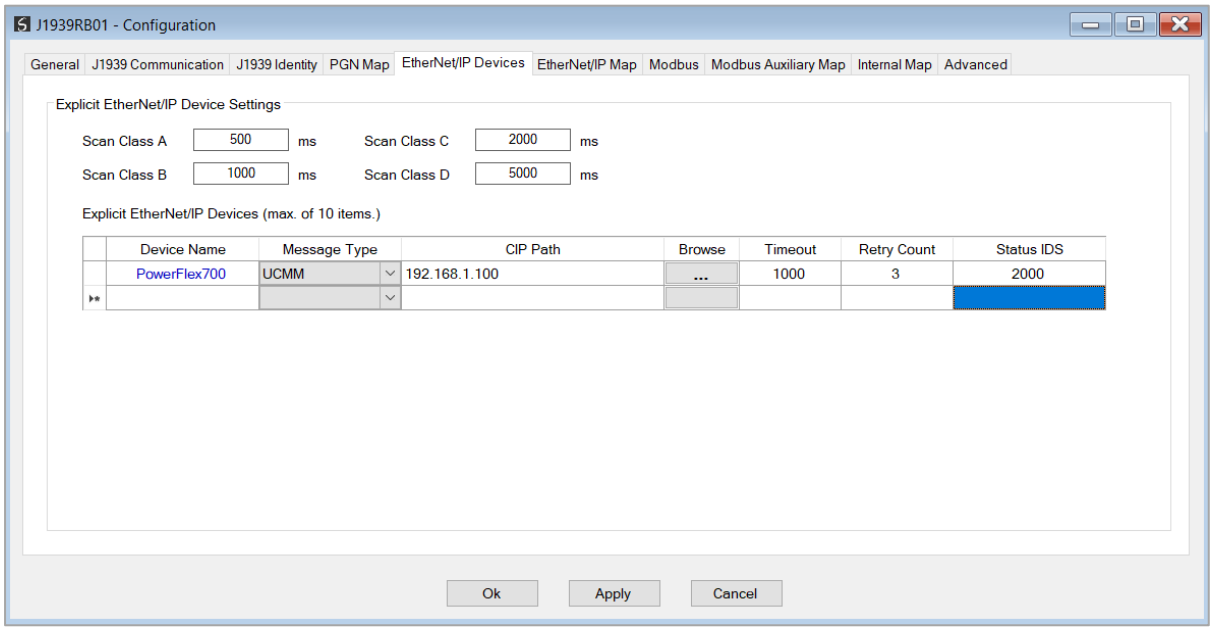


Figure 3.72 – EtherNet/IP Devices - Configuration

The EtherNet/IP Devices configuration consists of the following parameters:

Parameter	Description
Scan Class A, B, C, D	The configurable update rates (in milliseconds) for each scan class in the EtherNet/IP Map.
Device List (per device)	
Device Name	The user assigned instance name for the specific device.
Message Type	The module can use either ***Class 3*** or ***Unconnected Messaging*** when communicating to the target EtherNet/IP device.
CIP Path	The CIP Path to the target device. This 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 (in milliseconds) the module will wait for a response from the target EtherNet/IP device.
Retry Count	The number of message retries before the target EtherNet/IP device is considered offline.
Comm Status Offset	This is the offset in the Internal Data Space (used to map EtherNet/IP device data) which provides the communication status of each EtherNet/IP device. The Communication Status is as shown below: Bit 0 - (1:Device Online , 0:Device Offline) Bit 1 to 7 – Reserved.

Table 3.7 – EtherNet/IP Devices configuration parameters

B. ETHERNET/IP MAP

This tab is enabled when the Primary Interface is set to *EtherNet/IP Originator*.

The EtherNet/IP Map configuration is shown in the figure below. Up to 50 EtherNet/IP mapped items, either explicit EtherNet/IP Class 3 or Unconnected Messaging (UCMM) to any of the 10 pre-configured devices can be configured. The data from each EtherNet/IP device is written to or read from Internal Data Space with a size of 100Kbytes. See the *Explicit EtherNet/IP Messaging* section for more details.

The EtherNet/IP Map configuration window is opened by either double clicking on the module in the tree, or by right-clicking the module and selecting *Configuration*.

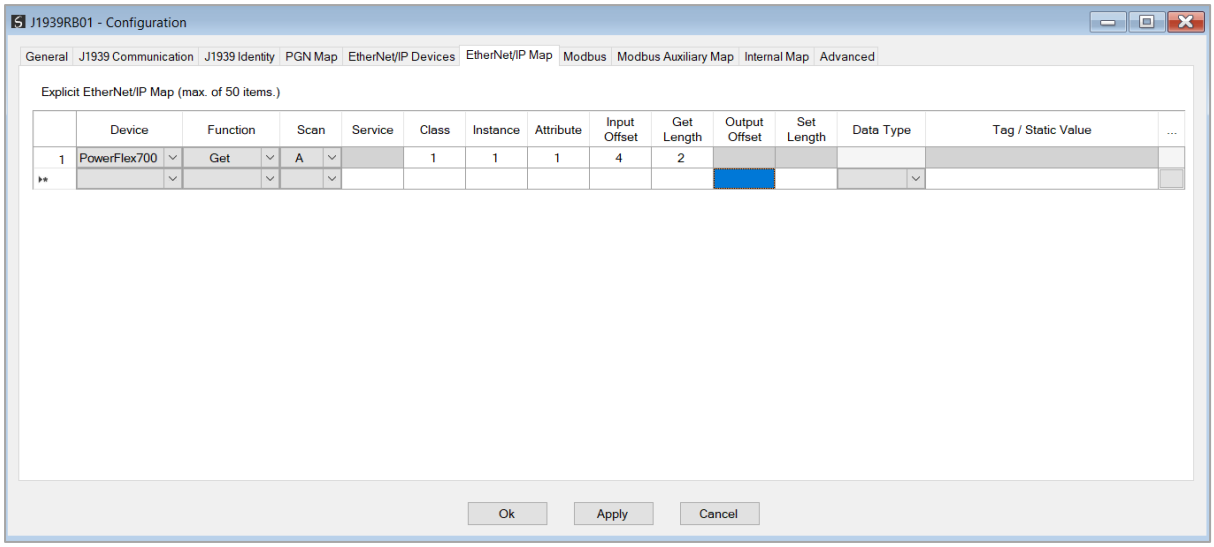


Figure 3.73 – EtherNet/IP Map configuration

The EtherNet/IP Map configuration consists of the following parameters:

Parameter	Description
Device	The device instance name configured in the previous EtherNet/IP Devices tab. 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 Internal Data Space at the ***Input Offset*** location configured in this tab. **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 Internal Data Space at the ***Output Offset*** location configured in this tab. **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 (**S**) Scan class which means the J1939 Router/B module 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 to 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.

	Read Tag When using a Logix controller as a EtherNet/IP Device, the J1939 Router/B module can read a Logix tag from the target Logix controller using Class 3 or UCMM messaging. The value from the tag will be saved at the configured Input Offset. **Write Tag** When using a Logix controller as a EtherNet/IP Device, the J1939 Router/B module can write to Logix tag from the target Logix controller using Class 3 or UCMM messaging. The value from the tag will be read from the configured Output Offset.
Scan	The user can select Scan Class **A**, **B**, **C** or **D** (which was configured in the EtherNet/IP 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, and resent when communication is re-established.
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.
Input Offset	The location in the Internal Data Space 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 Internal Data Space.  **NOTE:** When the function is Logix Read, then the Get Length will be the number of elements of the configured data type and **not** the byte count. This will only be available for ***Get*** and ***Custom*** functions.
Output Offset	The location in the Internal Data Space from where the data to be written to the target device will be read. This will only be available for ***Set*** and ***Custom*** functions.
Set Length	The length of the data to be written.  **NOTE:** When the function is Logix Write, then the Set Length will be the number of elements of the configured data type and **not** the byte count. 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.
Tag / Static Value	The value to be written to the target device when the ***Set Static*** function has been selected. **Note**: When using the SINT Array data type, the values must be entered as space-delimited hex values. For example: 05 34 2E A1

Table 3.8 – EtherNet/IP Map configuration parameters

3.6.4.3. INTERNAL DATA SPACE MAPPING

When the module is operating as a EtherNet/IP Originator, the data from the EtherNet/IP IO devices can be mapped to the J1939 interface using the Internal Map. The Internal Map configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration* and selecting the *Internal Map* tab.

A. IDS COPY – ETHERNET/IP ORIGINATOR SOURCE

When copying data from a EtherNet/IP IO to the J1939 interface, the source type needs to be EIP Originator.

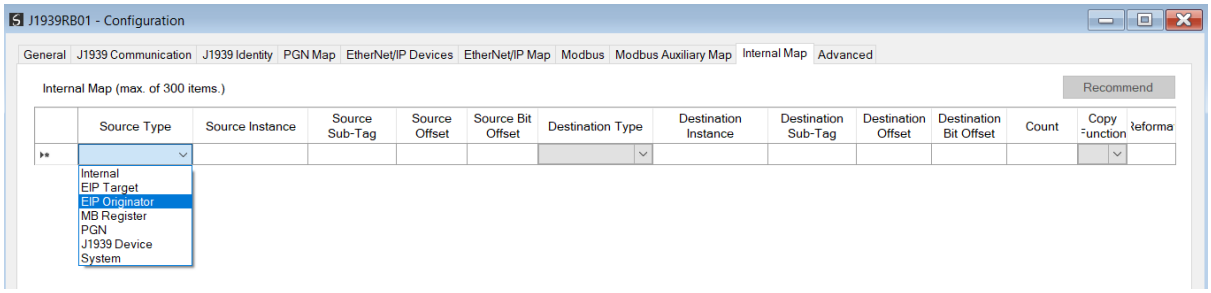


Figure 3.74 – IDS Copy – EtherNet/IP Originator Source Type

The source instance will be one of the EtherNet/IP IO devices added to the EtherNet/IP IO tree in Slate.

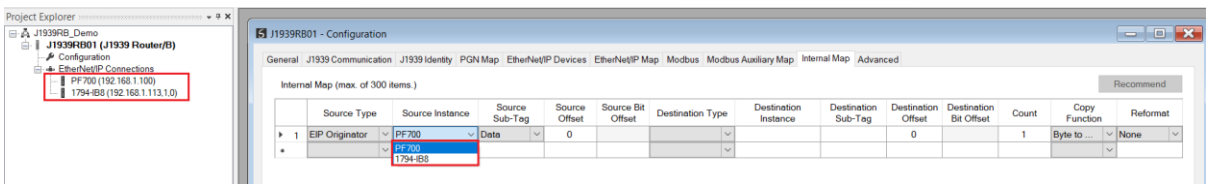


Figure 3.75 – IDS Copy – EtherNet/IP Originator Source Instance

The Source Offset is the offset in the selected EtherNet/IP device Class 1 **Input** Assembly. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

The user can select to copy either the Data, or Status, from the EtherNet/IP connection.

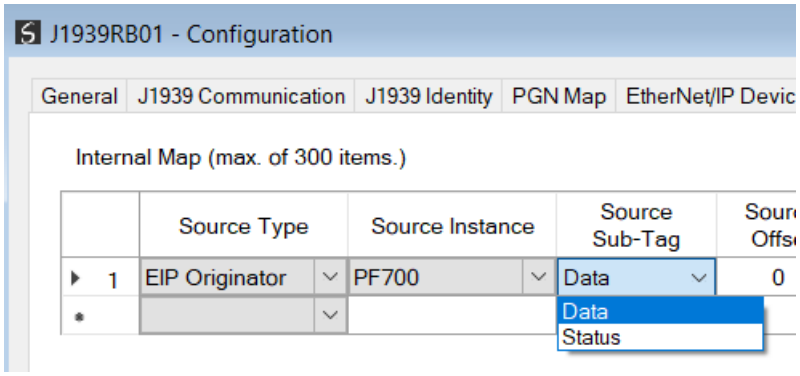


Figure 3.76 – IDS Copy – EtherNet/IP Originator Status

When selecting the Status, the format of the Status information is shown below:

Parameter	Data Type	Description
EtherNet/IP Originator Connection Status	DINT	Bit 0 – Connection Ok

Table 3.9 – EtherNet/IP Originator Connection Status

B. IDS COPY – ETHERNET/IP TARGET DESTINATION

When copying data from the J1939 interface to a EtherNet/IP IO device **Output** Assembly, the destination type needs to be EIP Originator.

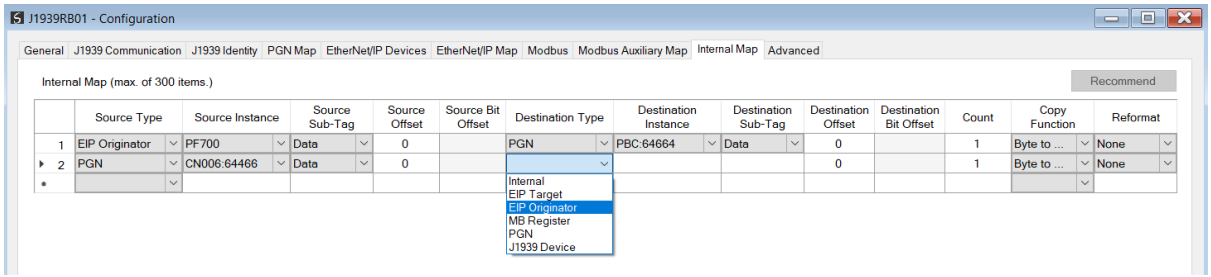


Figure 3.77 – IDS Copy – EtherNet/IP Originator Destination Type

The destination instance will be one of the EtherNet/IP IO devices added to the EtherNet/IP IO tree in Slate.

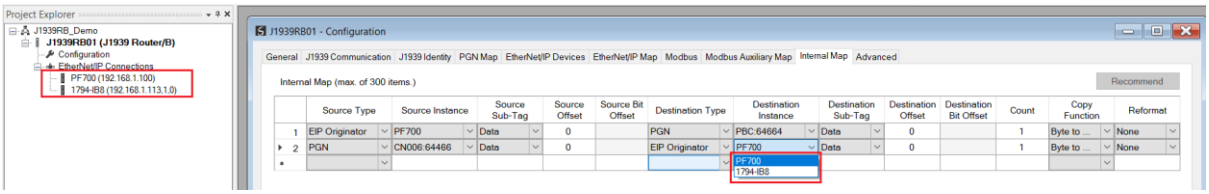


Figure 3.78 – IDS Copy – EtherNet/IP Originator Destination Instance

The Destination Offset is the offset in the selected EtherNet/IP device Class 1 **Output** Assembly. The Count is the number of **bytes** that will be copied. See the Internal Data Space Mapping section for more information regarding the operation.

3.7. INTERNAL DATA SPACE MAP

The internal data map is used to exchange data from the Ethernet interface to the J1939 interface and vice versa. Up to 300 items can be mapped. The Internal Map configuration window is opened by either double clicking on the module in the tree, or right-clicking the module and selecting ***Configuration*** and then selecting the ***Internal Map*** tab.

The ***Count*** is the number of bytes that will be copied from the source to the destination. There are four different ***Copy Functions*** that can be used.

Function	Description
Byte to Byte	Each **byte** from the source will be directly copied to each **byte** in the destination.
Byte to Bit	Each byte from the source will be copied to each bit in the destination. If a value greater than zero is read from the **source byte** then a 1 will be written to the **destination bit** address. If a value of zero is read from the **source byte** then a 0 will be written to the **destination bit** address. The destination offset will be the bit offset and the destination address will be incremented by one bit each time.
Bit to Bit	Each **bit** from the source will be directly copied to each **bit** in the destination.
Bit to Byte	Each bit from the source will be copied to each byte in the destination. If a value of one is read from the **source bit** then a 1 will be written to the **destination byte** address. If a value of zero is read from the **source bit** then a 0 will be written to the **destination byte** address. The source offset will be the bit offset and the source address will be incremented by one bit each time.

Table 3.10 – Internal Map Copy functions

The data in the destination source can also be reformatted. The reformat option provides five different reformat options.

NOTE: The reformat option is only available for ***Byte to Byte*** Copy Functions.

Function	Description
None	No reformatting applied (AA BB CC DD)
BB AA	16-bit Byte swap
BB AA DD CC	32-bit Byte Pair Swap
CC DD AA BB	Word Swap
DD CC BB AA	Word and Byte Pair Swap

Table 3.11 – Internal Map Reformat Options

3.7.1. COPY FROM

One of seven sources can be selected to copy from:
Internal, EIP Target, EIP Originator, MB Register, PGN, J1939 Device, and System.

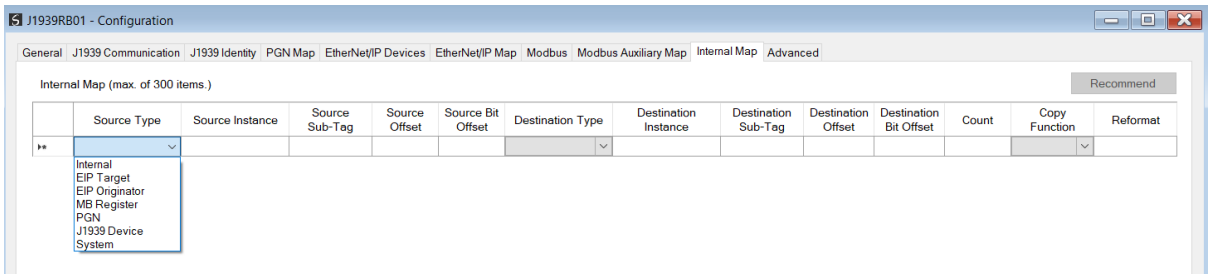


Figure 3.79 – Internal Map – Source Type

3.7.1.1. INTERNAL

When copying data from the internal data space (IDS), the source type needs to be Internal.

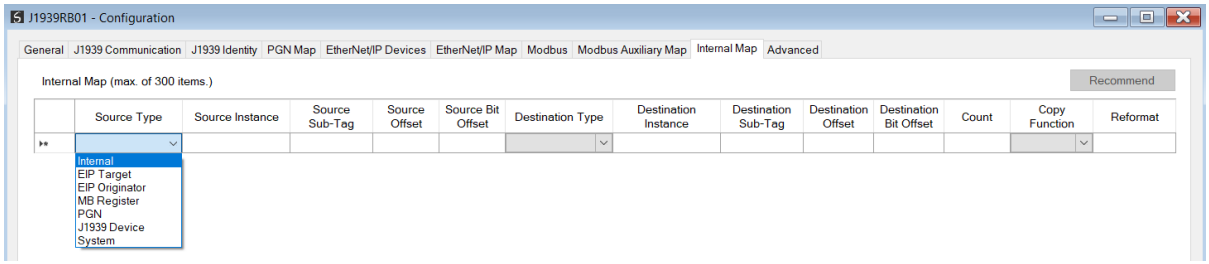


Figure 3.80 – IDS Copy – Internal Source Type

The source instance is Not Applicable for the internal data space. The Source Offset is the offset in the *Internal Data Space (IDS)* which has a max of 100,000 bytes. The Count is the number of **bytes** that will be copied.

3.7.1.2. EIP TARGET

When copying data from a connection originator (e.g. the output assembly from the Logix Controller) to the J1939 interface, the source type needs to be EIP Target.

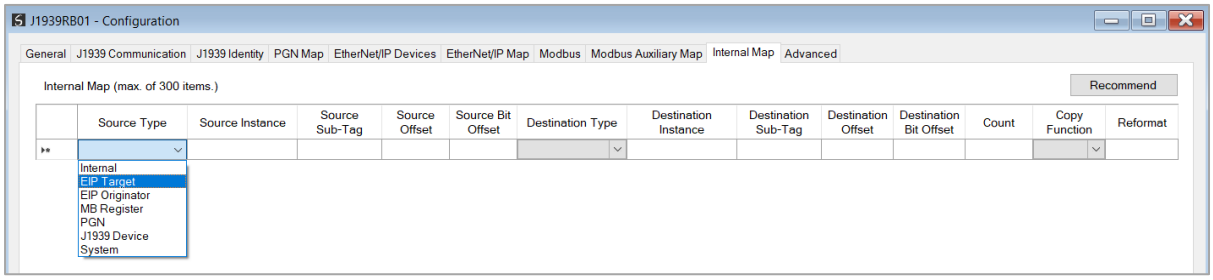


Figure 3.81 – IDS Copy – EtherNet/IP Target Source Type

The source instance will be the connection number, which can be connection 0 to 3, based on the number of connections configured. The Source Offset is the offset in the EtherNet/IP output assembly from where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.1.3. EIP ORIGINATOR

When copying data from a EtherNet/IP IO to the J1939 interface, the source type needs to be EIP Originator.

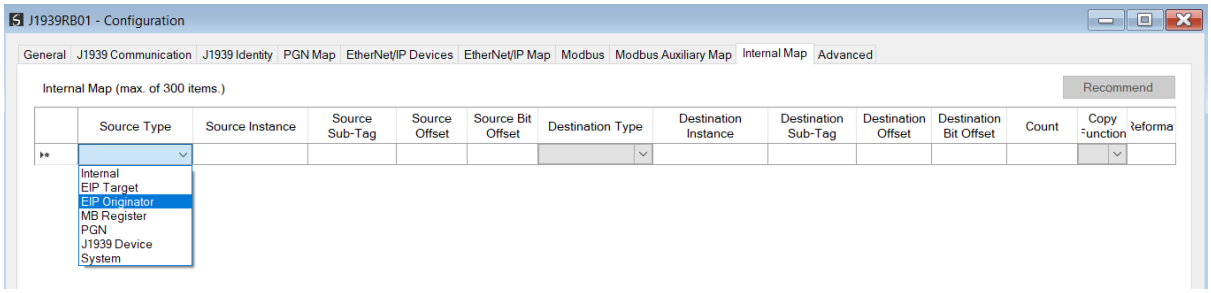


Figure 3.82 – IDS Copy – EtherNet/IP Originator Source Type

The source instance will be one of the EtherNet/IP IO devices added to the EtherNet/IP IO tree in Slate.

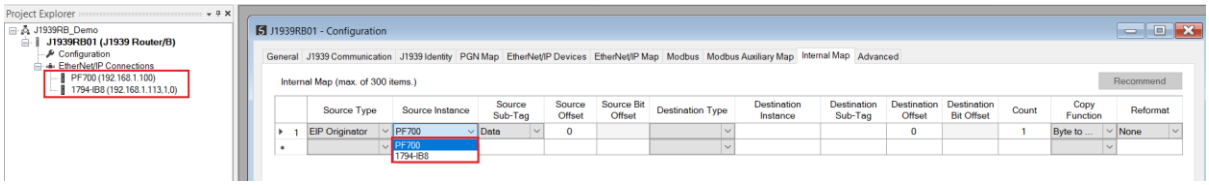


Figure 3.83 – IDS Copy – EtherNet/IP Originator Source Instance

The Source Offset is the offset in the selected EtherNet/IP device Class 1 **Input** Assembly. The Count is the number of **bytes** that will be copied.

The user can select to copy the data from the EtherNet/IP connection or the status.

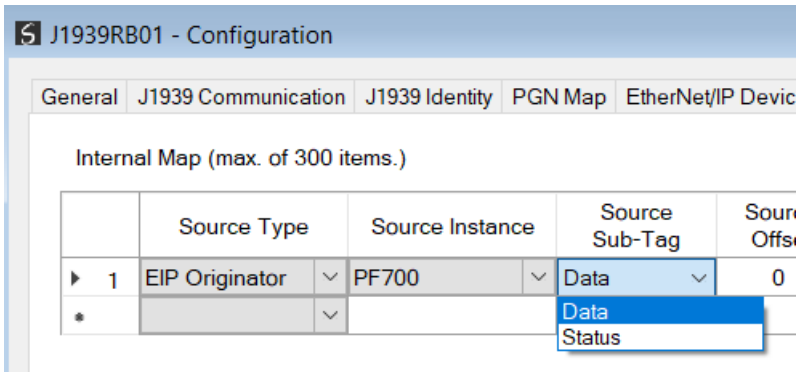


Figure 3.84 – IDS Copy – EtherNet/IP Originator Status

When selecting the status the format of the Status information is shown below:

Parameter	Data Type	Description
EtherNet/IP Originator Connection Status	DINT	Bit 0 – Connection Ok

Table 3.12 – EtherNet/IP Originator Connection Status

3.7.1.4. MODBUS REGISTER

When copying Modbus data to the J1939 interface, the source type needs to be MB Register.

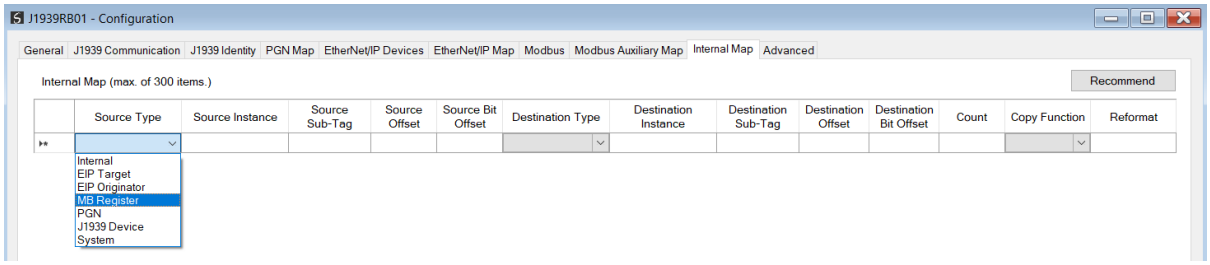


Figure 3.85 – IDS Copy - Modbus Source Type

The source instance will be the Modbus register type required.

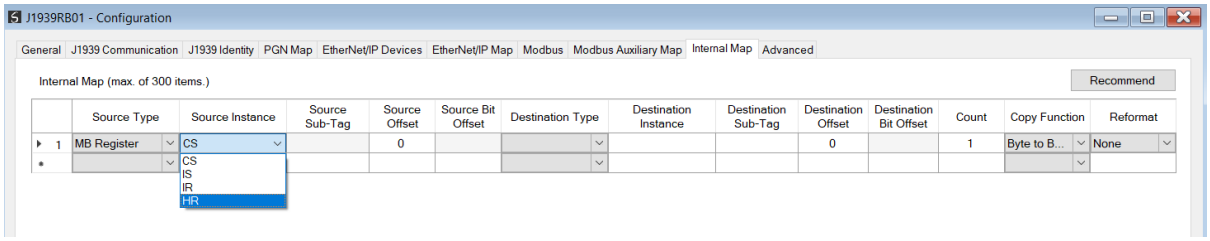


Figure 3.86 – IDS Copy - Modbus Source Instance

The Source Offset is the Modbus Register offset from where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.1.5. PGN

When copying data from a consume PGN to the Ethernet interface, the source type needs to be *PGN*.

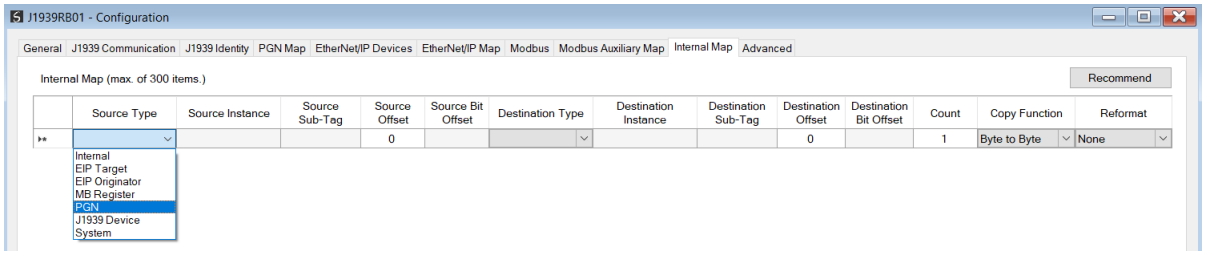


Figure 3.87 – IDS Copy – PGN Source Type

The source instance will be the PGN name in the PGN Map configuration. The Source Sub-Tag can either be the PGN data or the PGN status which indicates if the PGN mapping is ok and data is being consumed.

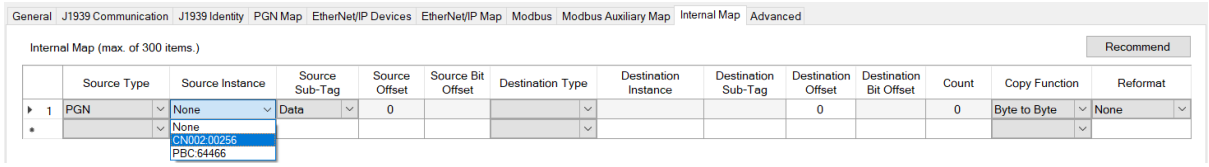


Figure 3.88 – IDS Copy – PGN Source Instance and Sub-Tag

Source Sub-Tag	Description
PGN Status	Status of the mapped PGN. Bit 0 – Mapped PGN Ok. Bit 1 to 15 – Reserved

Table 3.4 – IDS Copy - PGN Status

NOTE: PGN data being copied from non-custom PGNs will be in the decoded format. The format for each mapped PGN can be seen in the PGN details. This can be found by right-clicking on the module in Slate and selecting *Export PGN Details*.

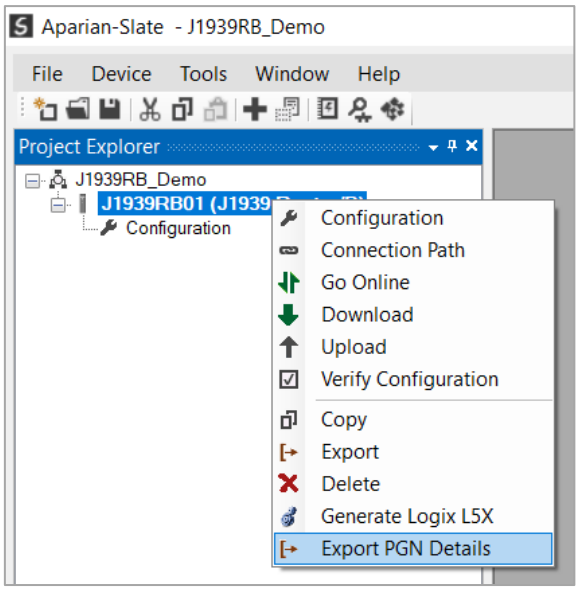


Figure 3.89 – Export PGN Details.

The Source Offset is the offset of the PGN data from where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.1.6. J1939 DEVICE

When J1939 Device status information, the source type needs to be J1939 Device.

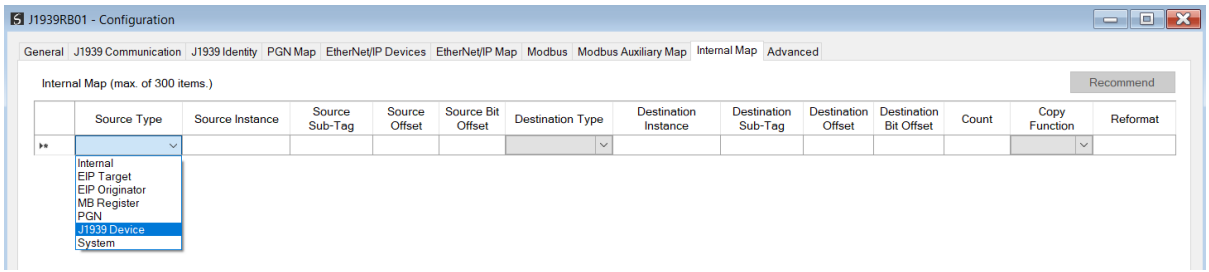


Figure 3.90 – IDS Copy – J1939 Device Source Type

The source instance is the J1939 device node address for which the status must be copied.

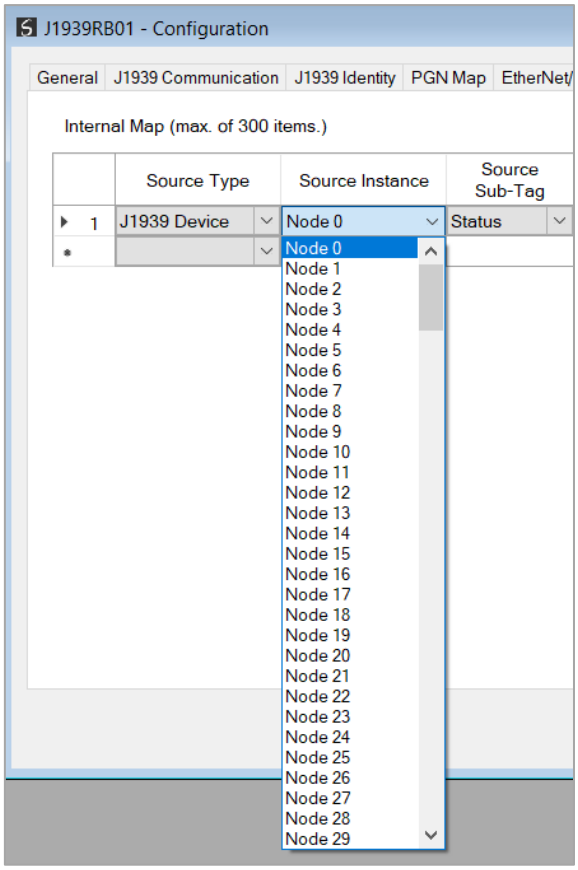


Figure 3.91 – IDS Copy – J1939 Device Source Instance

The format of the J1939 Device Status to be copied is shown below and can also be found in the *Internal Map Data Formats* section.

Parameter	Data Type	Description
Flags	SINT	**Indicates if the J1939 Device is online or offline.** Bit 0 - Online Bit 1 to 7 - Reserved
Reserved (Pad)	SINT	Reserved
Node	INT	The node number of the J1939 device.
Lamp Status - Protect	SINT	**The Protect Lamp Status.** 0 – Off 1 – On
Lamp Status - Amber Warning	SINT	**The Amber Warning Lamp Status.** 0 – Off 1 – On
Lamp Status - Red Stop	SINT	**The Red Stop Lamp Status.** 0 – Off 1 – On
Lamp Status - Malfunction	SINT	**The Malfunction Lamp Status.** 0 – Off 1 – On
Lamp Flash - Protect	SINT	**The Protect Lamp Flash indication.**

		0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Amber Warning	SINT	**The Amber Warning Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Red Stop	SINT	**The Red Stop Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Malfunction	SINT	**The Malfunction Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Problem SPN	DINT	The SPN number that has the error.
Failure Mode Indicator	SINT	**The code to indicate the reason for the fault.** 0 - Data Valid, but above normal operating range (most severe level) 1 - Data Valid, but below normal operating range (most severe level) 2 - Data Erratic, Intermittent, or Incorrect 3 - Voltage Above Normal or shorted to High Source 4 - Voltage Below Normal or shorted to Low Source 5 - Current Below Normal or Open Circuit 6 - Current Above Normal or Ground Circuit 7 - Mechanical System not Responding or Out of Adjustment 8 - Abnormal Frequency or Pulse Width or Period 9 - Abnormal Update Rate 10 - Abnormal Rate of Change 11 - Root Cause Unknown 12 - Bad Intelligent Device Or Component 13 - Out of Calibration 14 - Special Instructions 15 - Data Valid, but above normal operating range (least severe level) 16 - Data Valid, but above normal operating range (moderately severe level) 17 - Data Valid, but below normal operating range (least severe level) 18 - Data Valid, but below normal operating range (moderately severe level) 19 - Received Network Data In Error 20 - Data Drifted High 21 - Data Drifted Low 22 to 30 - Reserved 31 - Condition Exists
Conversion Method	SINT	Indicates the SPN conversion format standard being used.

Occurrence Count	SINT	The 7-bit occurrence count field contains the number of times a fault has been independently detected.
Reserved (Pad)	SINT	Reserved

Table 3.13 – J1939 Device Status Format

3.7.1.7. SYSTEM

When copying system information, the source type needs to be System.

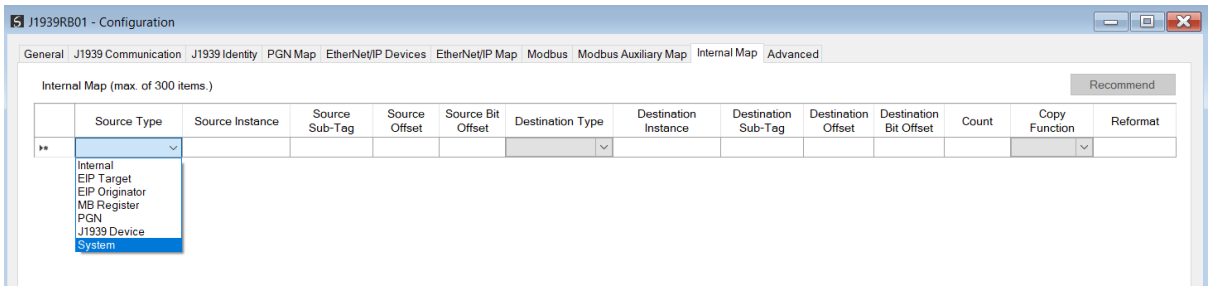


Figure 3.92 – IDS Copy – System Information

The module's System information has the following format.

Parameter	Data Type	Description
Status	INT	Module Status. Bit 0 – Module Config Valid Bit 1 – EtherNet/IP Originator Comms Ok Bit 2 – Modbus Comms Ok Bit 3 – EtherNet/IP Target Comms Ok Bit 4 – J1939 All PGN Ok Bit 5 – Power is applied to the bottom connector. Bit 6 – Power is applied to the front connector. Bit 7 – Duplicate Node Number Bit 8 – NTP Ok Bit 9 – Controller in Run Mode.
Reserved	INT	Reserved
Transaction Rate	DINT	Number of J1939 transactions executed every second.
Temperature	REAL	The internal temperature of the module.
Rx CAN Packet Count	DINT	The number of J1939 packets received.
Tx CAN Packet Count	DINT	The number of J1939 packets sent.

CAN CRC Errors	DINT	The number of received packets where the packet checksum does not match the calculated packet checksum. This implies one or more bits in the frame have been corrupted. May indicate an intermittent CAN cable connection or induced electrical noise.
CAN Bit Errors	DINT	The number of transmitted bits where the transmitted bit state does not match the instantaneous read-back state. This may indicate that another device is transmitting at the same time, or one of the CAN lines shorted to power, shorted together, or incorrectly termination.
CAN Stuff Errors	DINT	The number of frames received where the required inserted (opposite) bit was not received after 5 identical bits. This may be an indication of bus noise, bad physical cable connection, or a faulty device.
Bus Off	DINT	The number of Bus-Off Events. A node will enter the Bus-Off state when the transmit Error Count exceeds a certain threshold (typically 125). This may indicate a cable break or loss of power causing the Scanner to enter the Bus-Off state.
Ack Error	DINT	The number of transmitted bits that are not read-back and acknowledged by at least one other node. Typically seen when the device is alone on the bus, and there is no other node to acknowledge the frame.
Format Error	DINT	The number of received frames where the fixed format part of a received frame is invalid, or the Frame structure is non-standard. (Frame size/type start delimiter etc.) May indicate an intermittent CAN cable connection, induced electrical noise or a node present with an incorrect BAUD rate.
Mapped Item Status	SINT[16]	This is a 16-byte bit array where each bit represents a mapped PGN item (up to 100 mapped item). 1 – PGN mapped item ok. 0 – PGN mapped item failed. Bit 0 – PGN Mapped item 0 Bit 1 – PGN Mapped item 1 Bit 2 – PGN Mapped item 2 … Bit 98 – PGN Mapped item 99 Bit 99 – PGN Mapped item 100

Table 3.14 – System Information Format

3.7.2. COPY TO

One of six destinations can be selected to copy to:
Internal, EIP Target, EIP Originator, MB Register, PGN, and J1939 Device.

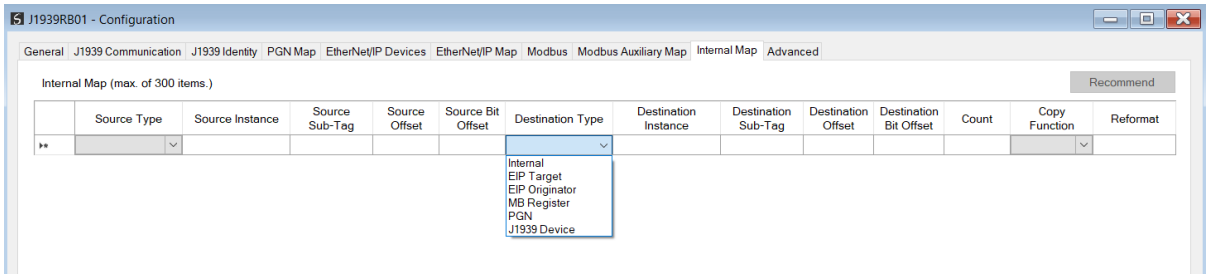


Figure 3.93 – Internal Map – Destination Type

3.7.2.1. INTERNAL

When copying data to the internal data space (IDS), the destination type needs to be Internal.

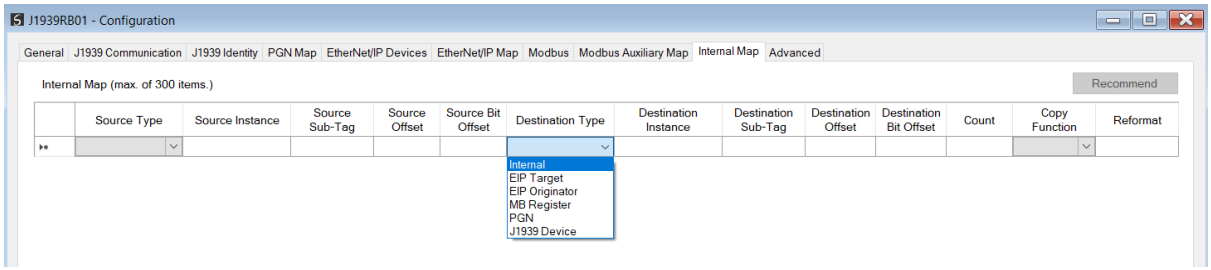


Figure 3.94 – IDS Copy – Internal Source Type

The destination instance is Not Applicable for the internal data space. The Destination Offset is the offset in the *Internal Data Space (IDS)* which has a max of 100,000 bytes. The Count is the number of **bytes** that will be copied.

3.7.2.2. EIP TARGET

When copying data from the J1939 interface to the EtherNet/IP Target input assembly, the destination type needs to be EIP Target.

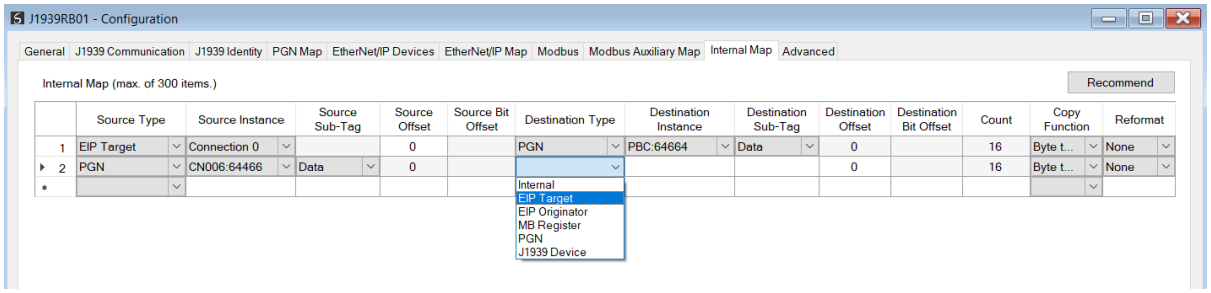


Figure 3.95 – IDS Copy – EtherNet/IP Target Destination Type

The destination instance will be the connection number, which can be connection 0 to 3, based on the number of connections configured. The Destination Offset is the offset of the EtherNet/IP input assembly from where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.2.3. EIP ORIGINATOR

When copying data from the J1939 interface to a EtherNet/IP IO device **Output** Assembly, the destination type needs to be EIP Originator.

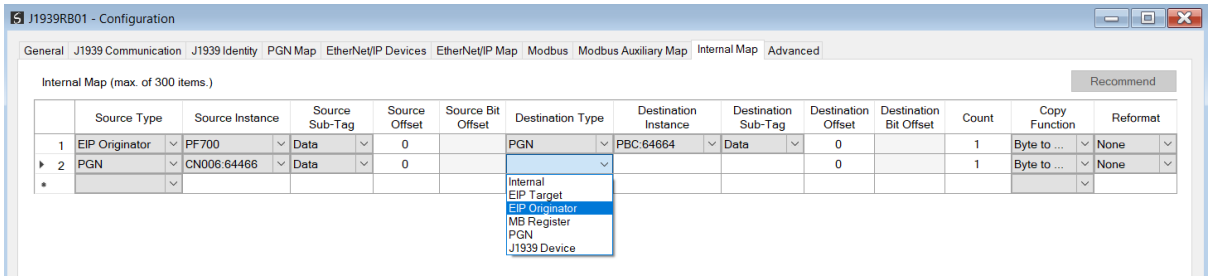


Figure 3.96 – IDS Copy – EtherNet/IP Originator Destination Type

The destination instance will be one of the EtherNet/IP IO devices added to the EtherNet/IP IO tree in Slate.

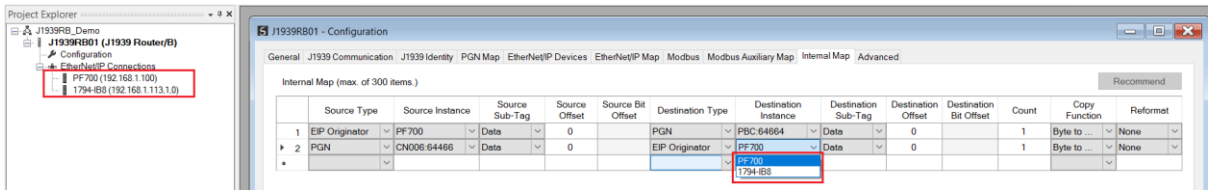


Figure 3.97 – IDS Copy – EtherNet/IP Originator Destination Instance

The Destination Offset is the offset in the selected EtherNet/IP device Class 1 **Output** Assembly. The Count is the number of **bytes** that will be copied.

3.7.2.4. MODBUS REGISTER

When copying data from the J1939 interface to a Modbus Register, the destination type needs to be MB Register.

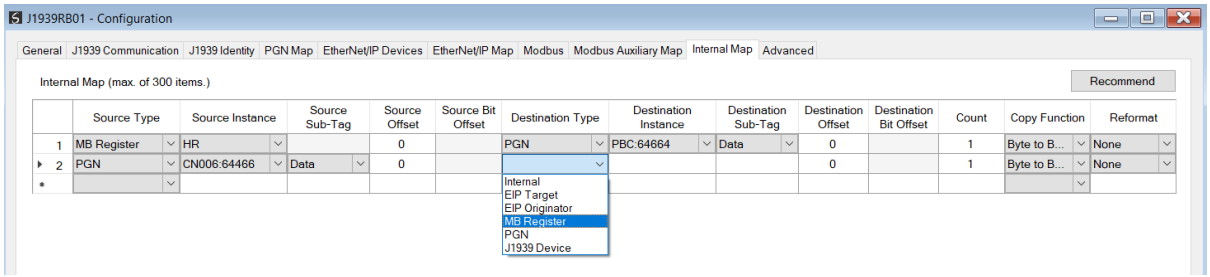


Figure 3.98 – IDS Copy - Modbus Destination Type

The destination instance will be the Modbus register type required.

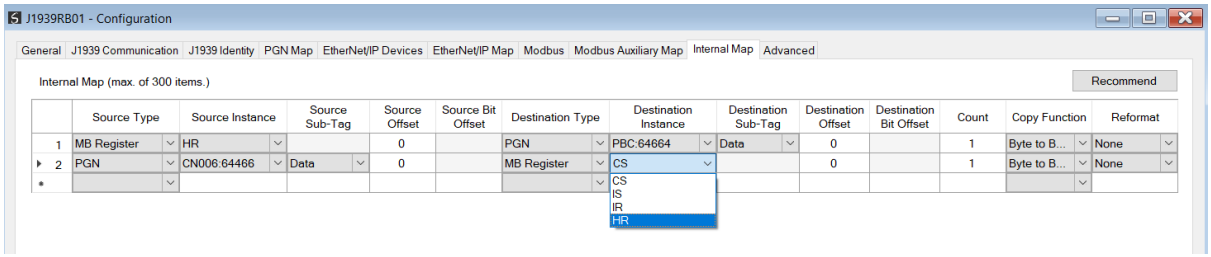


Figure 3.99 – IDS Copy - Modbus Destination Instance

The Destination Offset is the Modbus Register offset to where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.2.5. PGN

When copying data from the Ethernet interface to a produce PGN, the destination type needs to be PGN.

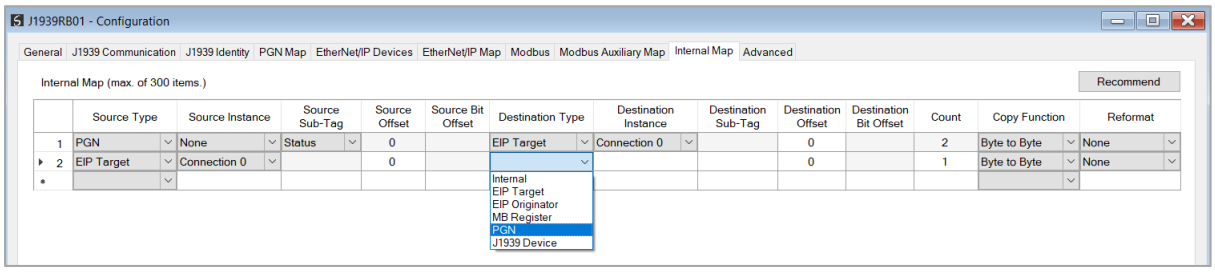


Figure 3.100 – IDS Copy – PGN Destination Type

The destination instance will be the PGN name in the PGN Map configuration. The Destination Offset is the offset of the PGN data to where the data must be copied. The Count is the number of **bytes** that will be copied.

3.7.2.1. J1939 DEVICE

When J1939 Device Control information, the destination type needs to be J1939 Device.

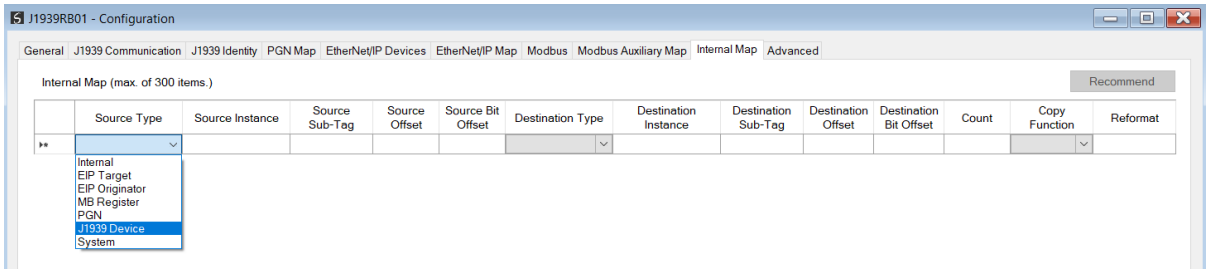


Figure 3.101 – IDS Copy – J1939 Device Destination Type

The destination instance is the J1939 device node address for which the status must be copied.

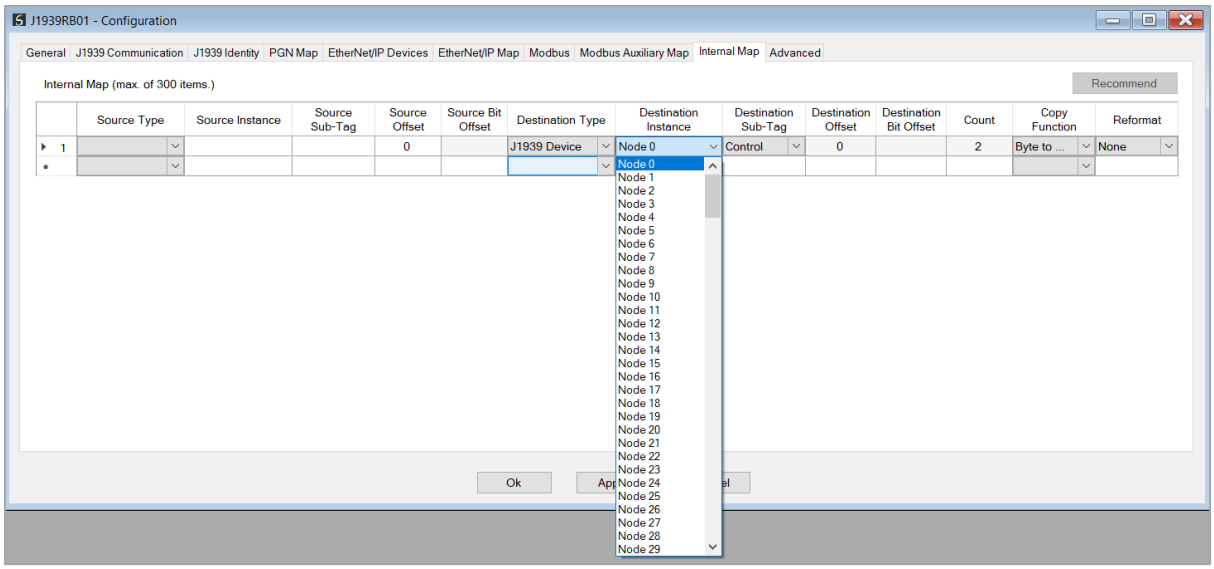


Figure 3.102 – IDS Copy – J1939 Device Destination Instance

The format of the J1939 Device Control to copy to is shown below and can also be found in the *Internal Map Data Formats* section.

Parameter	Data Type	Description
Flags	INT	**Provides a command for the J1939 Router/B** Bit 0 – Clear Active Diagnostics. Bit 1 to 15 - Reserved

Table 3.15 – J1939 Device Status Format

NOTE: For more information regarding the specific Internal Map operation for specific interfaces, see the setup and configuration sections for the various J1939 and Primary Interfaces.

3.8. ADVANCED

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

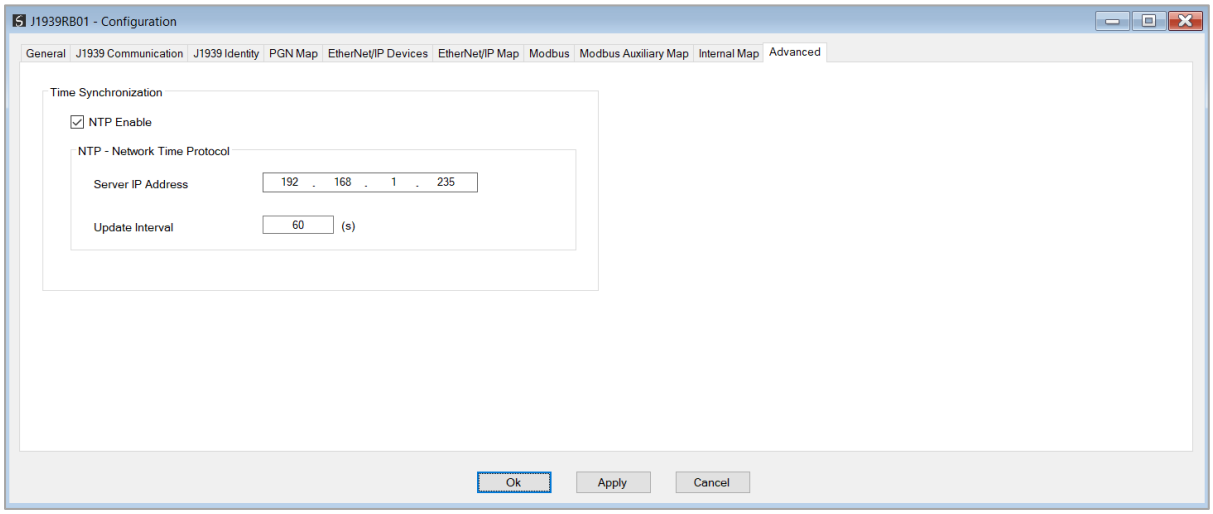


Figure 3.103 – Advanced configuration

The Advanced configuration consists of the following parameters:

Parameter	Description
NTP Enable	The J1939 Router/B can synchronize its onboard clock to an NTP Server by enabling NTP.
NTP – Server IP Address	This setting is the IP address of the NTP Server which will be used as a time source.
NTP – Update Interval	This setting is the updated interval (in seconds) that the J1939 Router/B will request time from the NTP Server.

Table 3.16 – Advanced configuration parameters

3.9. MODULE DOWNLOAD

Once the J1939 Router/B 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 J1939 Router/B is not on a local network.

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

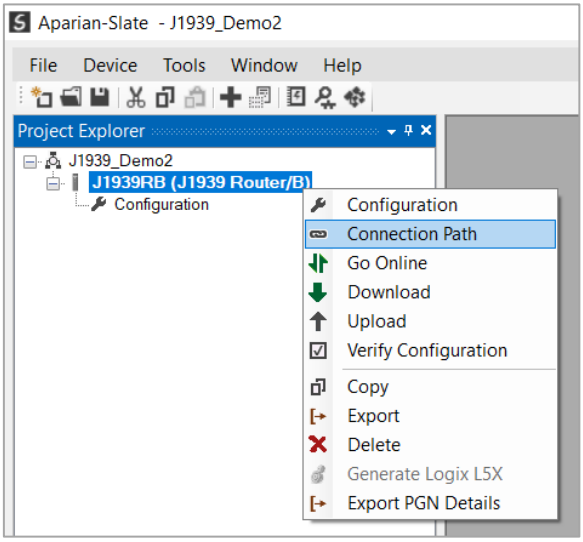


Figure 3.104 - Selecting Connection Path

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

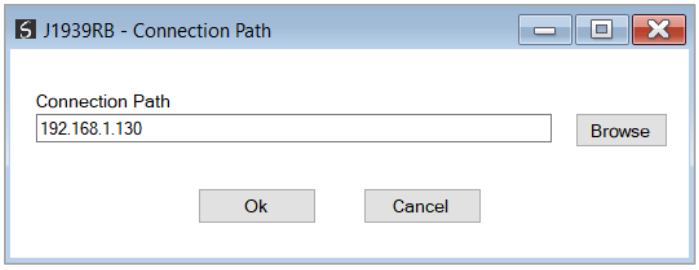


Figure 3.105 - Connection Path

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

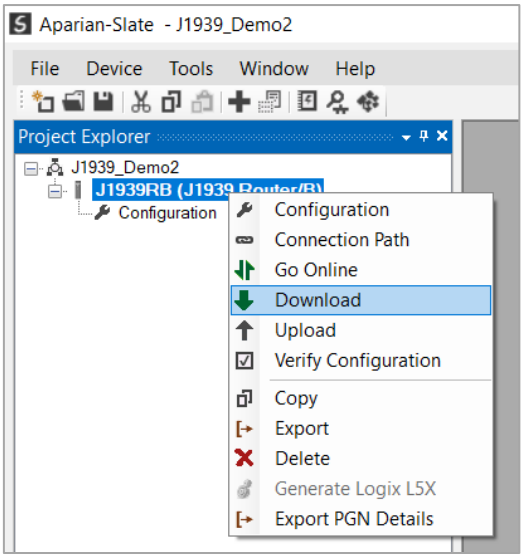


Figure 3.106 - Selecting Download

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

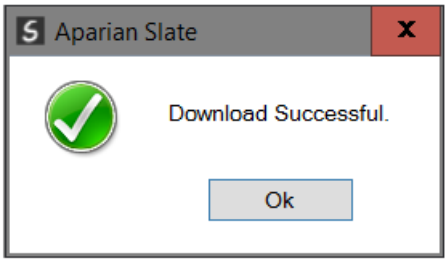


Figure 3.107 - Successful download

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.

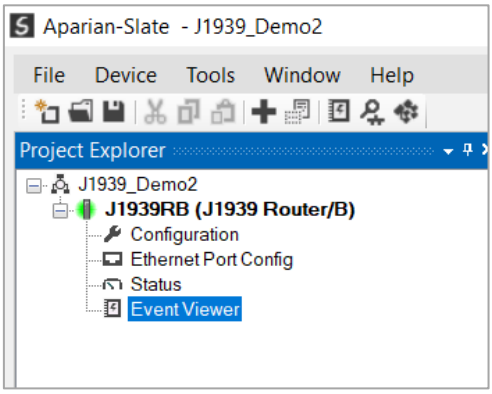


Figure 3.108 - Module online

4. SD CARD

The J1939 Router/B supports an SD Card (see below) which can be used for disaster recovery. The SD Card can be pre-loaded with the required firmware and/or application configuration.

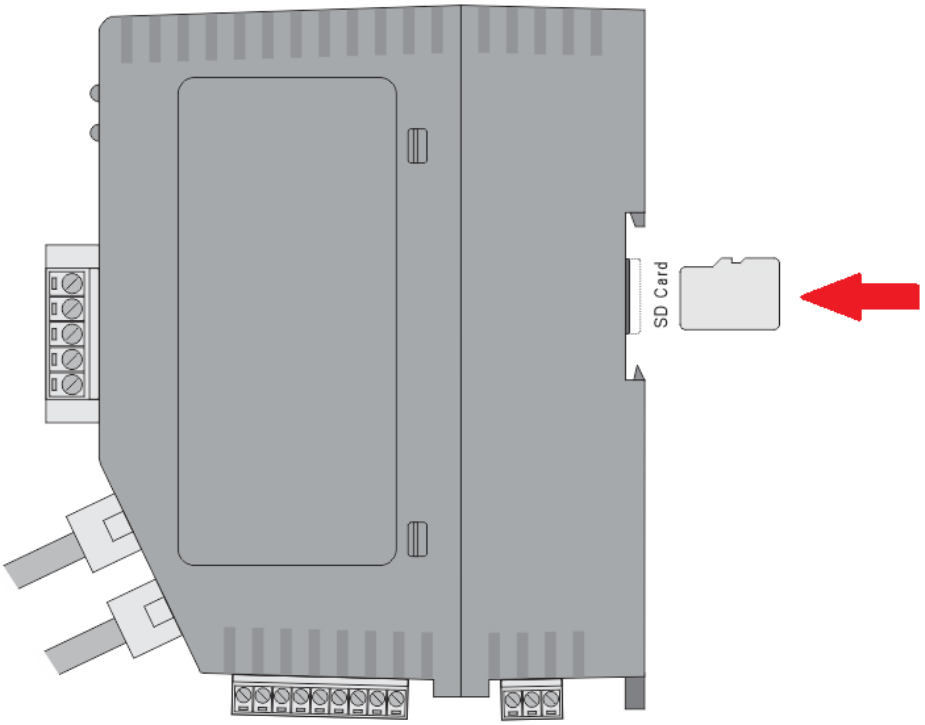


Figure 4.1 – Module Side View – SD Card Slot

NOTE: The user will need to ensure that the SD Card has been formatted for FAT32.

NOTE: All needed files must be copied into the root directory of the SD Card. The module will not use files which are located in folders.

4.1. FIRMWARE

The user can copy the required firmware (which can be downloaded from the Aparian website) onto the root directory of the SD Card.

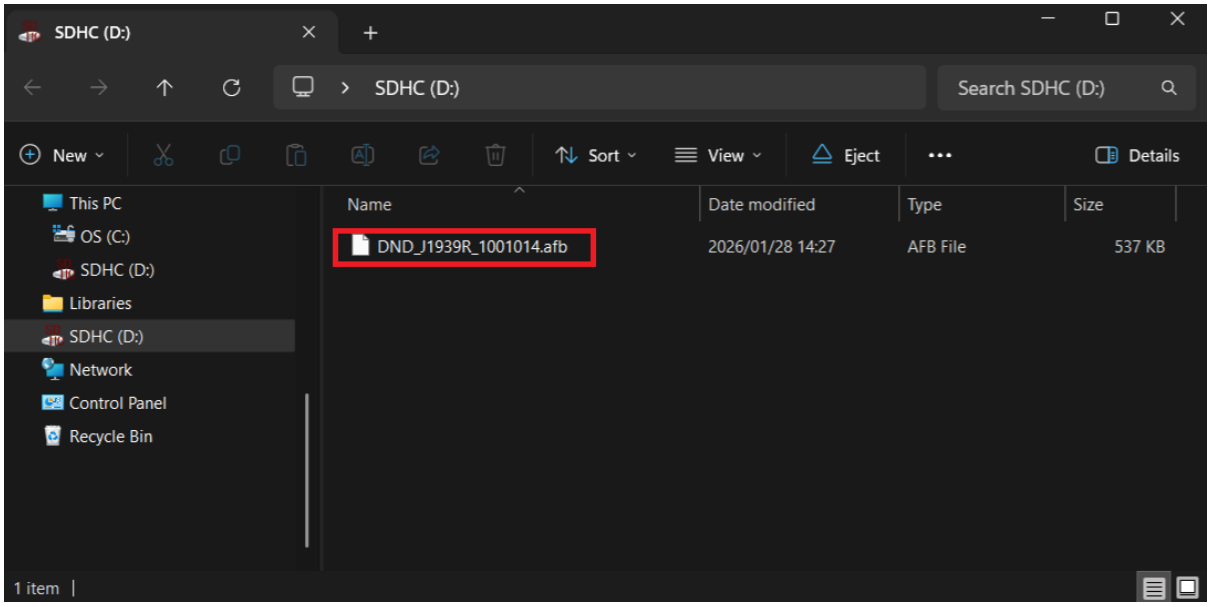


Figure 4.2 – SD Card – Firmware file

NOTE: The filename of the firmware file must not be changed. The specific module will use only the firmware that is valid (e.g. the J1939 Router/B will only use the DND_ J1939R firmware file).

NOTE: If more than one firmware file, with different firmware revisions, of the same product is on the SD Card it can cause the module to constantly firmware upgrade the module.

If a faulty module is replaced the user can insert the SD Card with the firmware file on into the new module. While the module is booting it will detect if the firmware on the new module is different from that on the SD Card. If yes, the firmware will either be upgraded or downgraded to the firmware revision on the SD Card.

4.2. NETWORK PARAMETERS

When the SD Card has been inserted into the module and the user is online with the module in Slate, then the user has the option to directly upload the network parameters (e.g., IP Address, Subnet Mask, etc.) on to the SD Card using the *Save Network Parameters to SD Card* option. This will copy the network parameters that has been downloaded to the module directly to the SD Card.

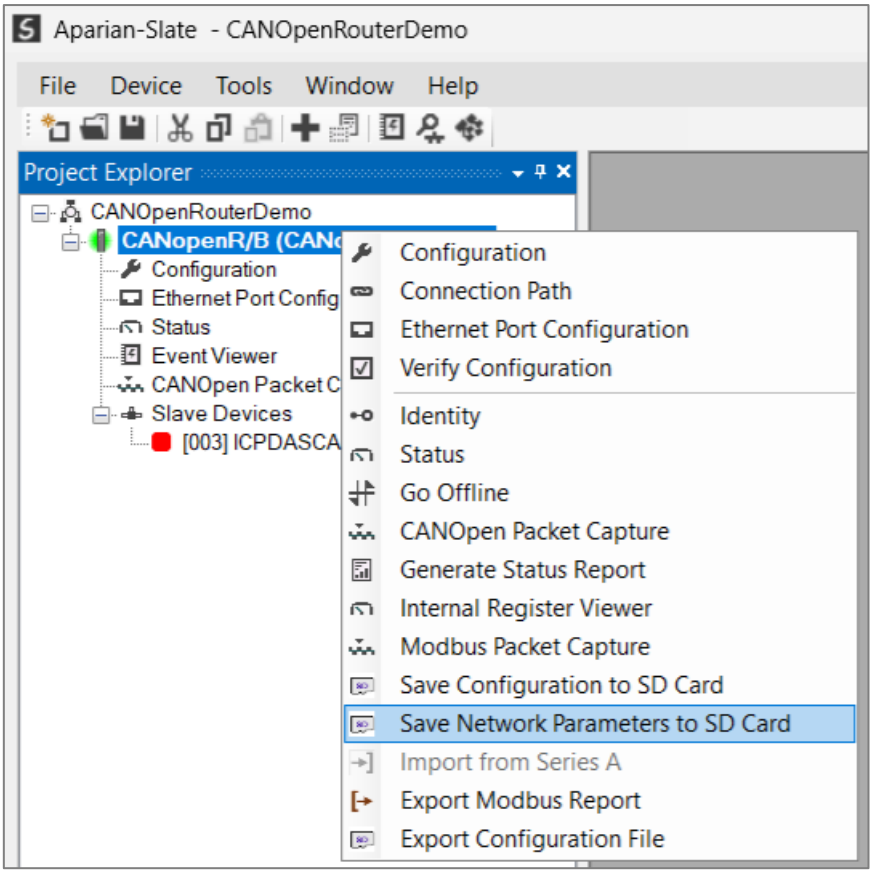


Figure 4.3 – SD Card – Network Parameters

When the module powers up with the SD Card inserted and there are network parameters saved onto the SD Card, it will update the existing network parameters if they are different.

4.3. CONFIGURATION

If a faulty module is replaced the user can insert the SD Card with the configuration file on into the new module. The new module will determine if the configuration on the SD Card is different than the currently loaded configuration (even when there is no configuration on the module). If different, the configuration on the SD Card will be downloaded into the module's NV memory before the module starts executing.

The user can add the Slate configuration file to the SD Card root directory in one of two ways.

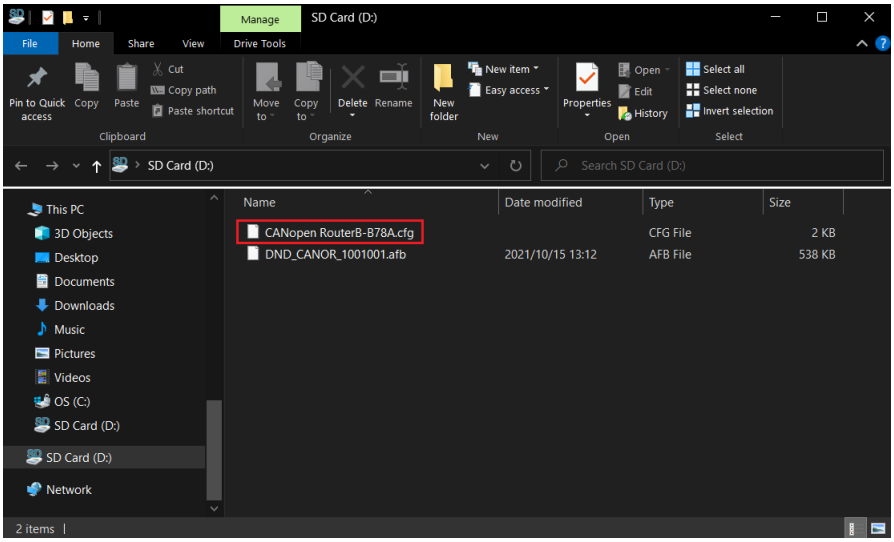


Figure 4.4 – SD Card – Configuration file

4.3.1. Manual Copy

Once the user has created the needed application configuration in the Slate the configuration can be exported to a file that can be used on the SD Card. Once the file has been created the user can copy this file into the root directory of the SD Card.

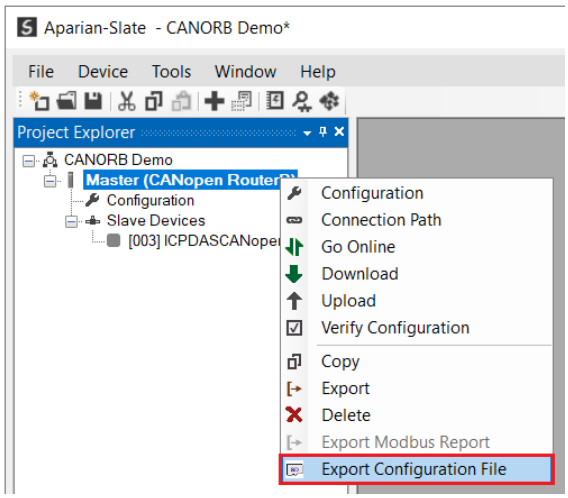


Figure 4.5 – Configuration Export for SD Card

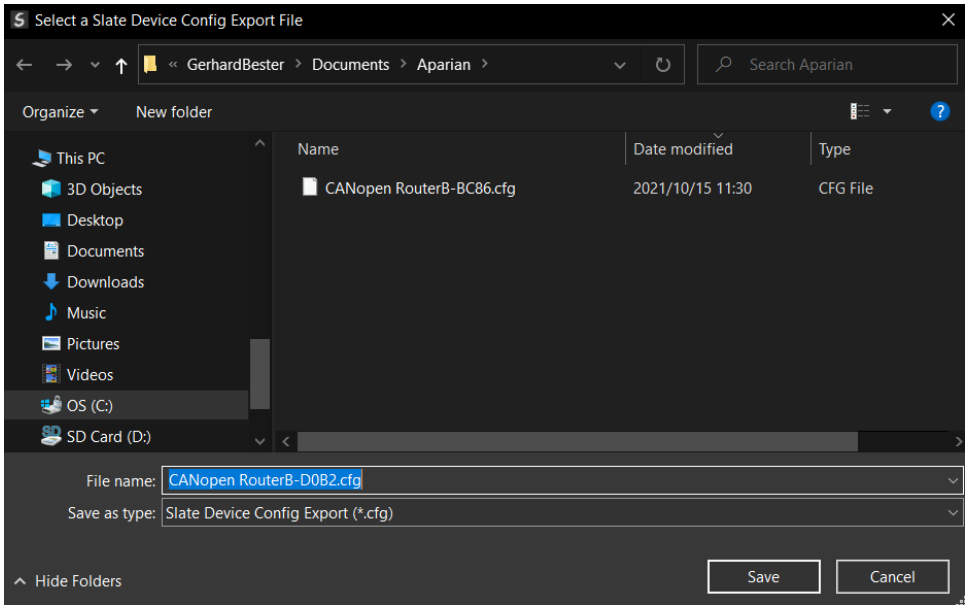


Figure 4.6 – Configuration Export for SD Card

NOTE: The filename of the configuration file must **not** be changed. The specific module will use only the configuration that is valid (e.g. the J1939 Router/B will only use the J1939 configuration file).

NOTE: If more than one configuration file, with different configuration signatures, of the same product is on the SD Card then only the last configuration will be used.

4.3.2. SLATE TRIGGERED UPLOAD

When the SD Card has been inserted into the module and the user is online with the module in Slate, then the user has the option to directly upload the configuration on to the SD Card using the *Save Configuration to SD Card* option. This will copy the configuration that has been downloaded to the module directly to the SD Card without the need to remove it from the module and inserted into a PC.

NOTE: All other configuration files in the SD Card root directory will be deleted when the upload is done.

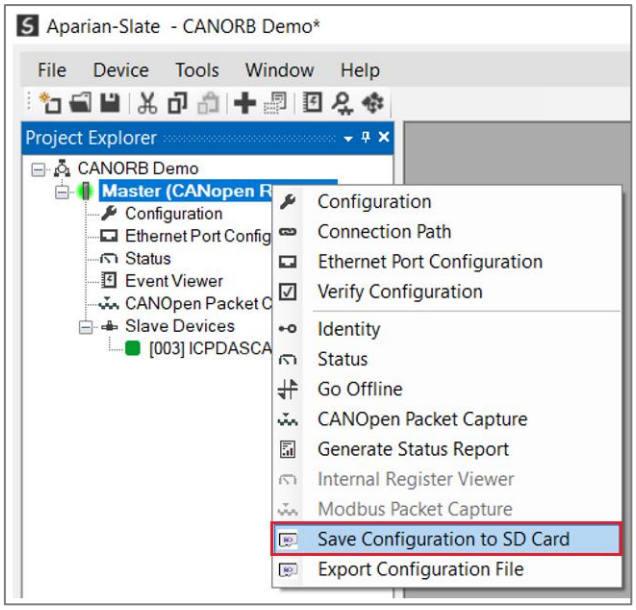


Figure 4.7 – Save Configuration to SD Card

5. DEVICE FIRMWARE UPDATE

The J1939 Router/B module supports in-field firmware upgrading. The latest firmware for the module can be downloaded from the Aparian website ***www.aparian.com***. The firmware is digitally signed, so only the correct firmware can be used.

To firmware upgrade the module, follow the steps below:

- From the ***Tools*** menu in Slate, select the ***DeviceFlash*** utility.

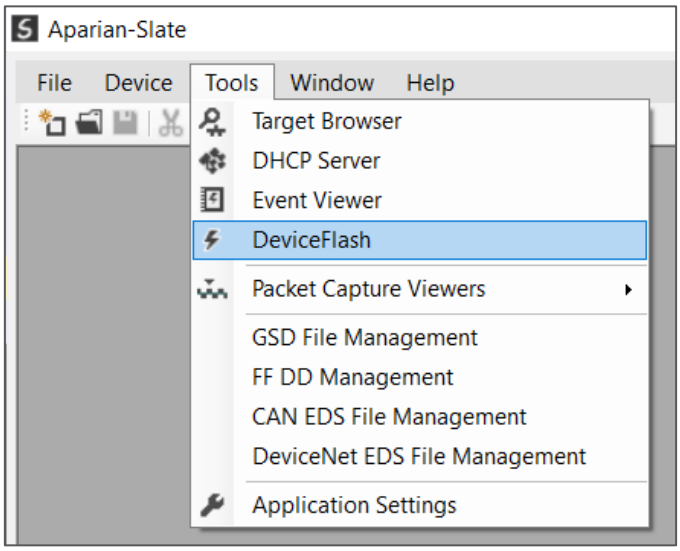


Figure 5.1 – Select DeviceFlash utility from Slate

- When the utility opens, the user will be prompted to select the binary file to be used to firmware upgrade the module.

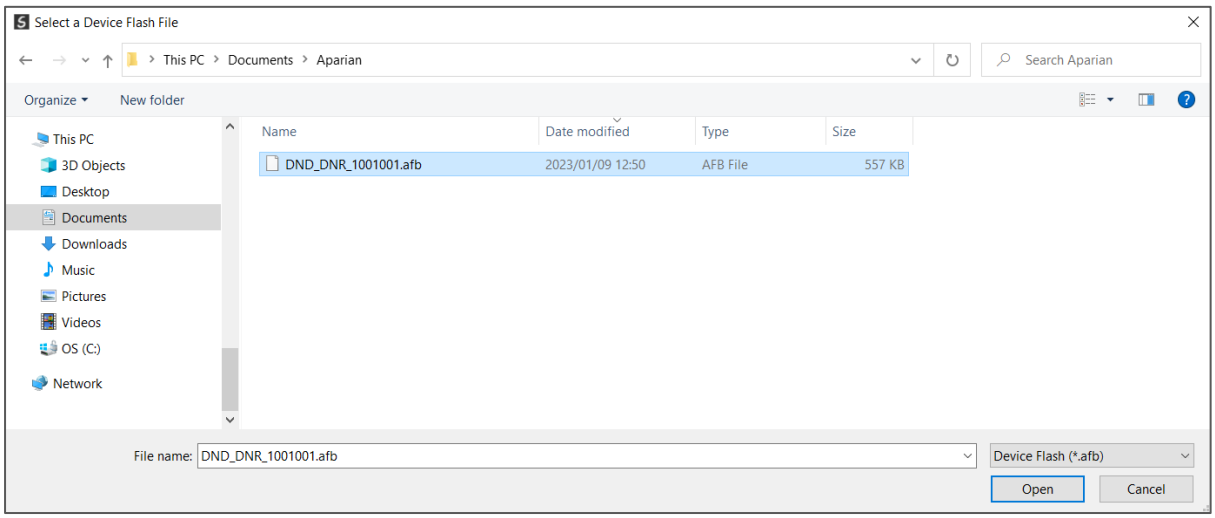


Figure 5.2 – Select the binary file

- After selecting the file, the user will be prompted to select the device to firmware upgrade on the local network.

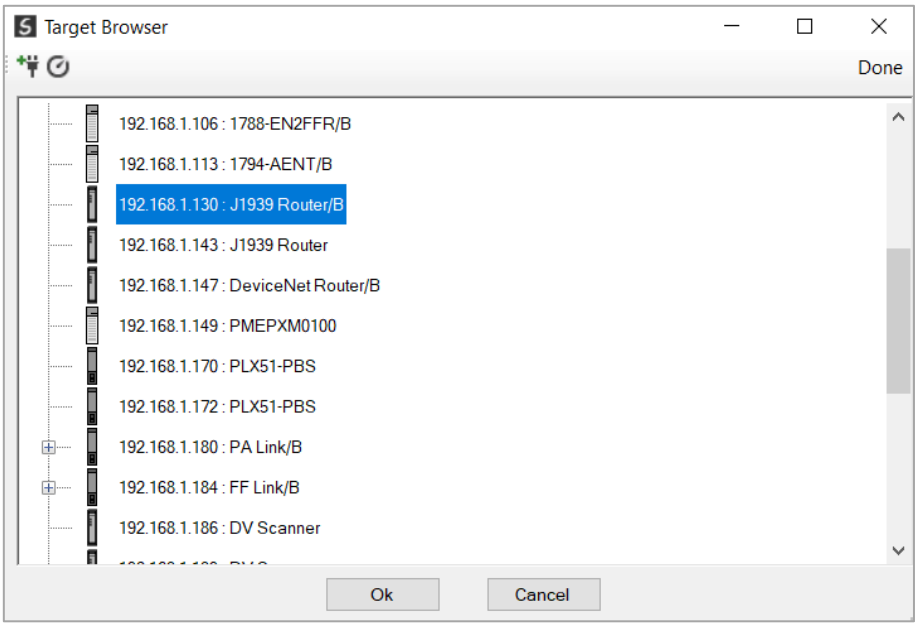


Figure 5.3 – Select the device to be updated

- After the device selection the user will be prompted if the device flash must start. The firmware update will take less than 2 minutes to complete.

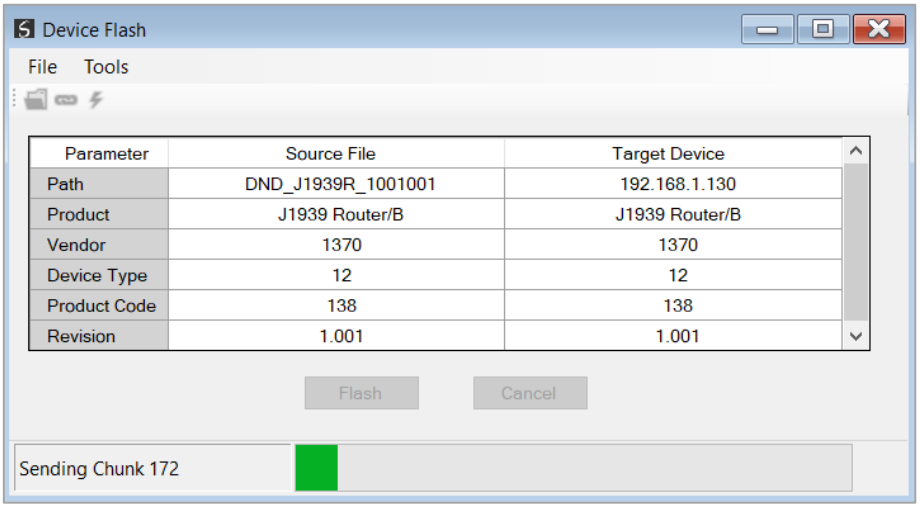


Figure 5.4 – Firmware update busy

- Once the firmware update has successfully completed, the Target Device textboxes will display green.

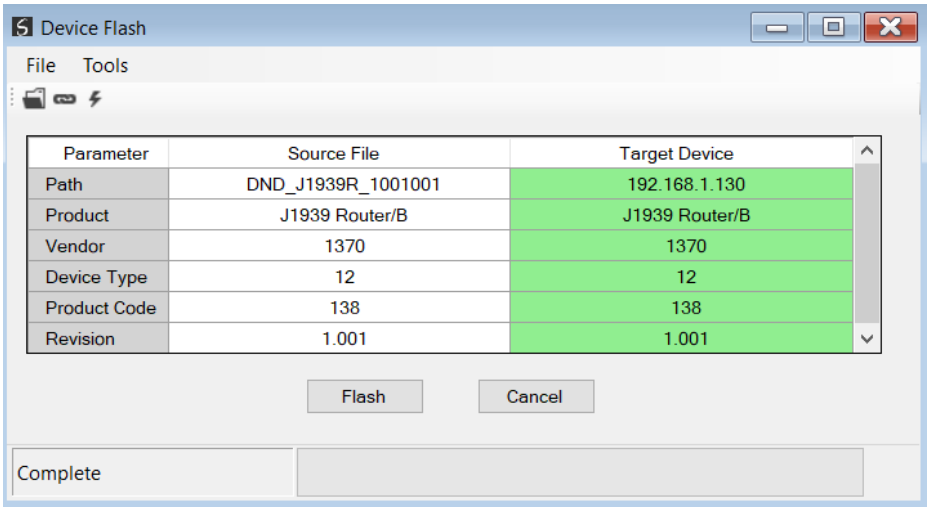


Figure 5.5 – Firmware update successfully completed.

NOTE: If for any reason the firmware update failed (e.g. power down during the update), then the module will revert back to the bootloader. The user can then simply reflash the module again to update it to the latest application firmware.

6. OPERATION

6.1. J1939 PGN

The J1939 Router/B can produce or consume J1939 PGNs on the J1939 CAN network. When producing, the PGNs are being sent from the J1939 Router/B to devices on the J1939 network. When consuming, the PGNs are being received by the J1939 Router/B from devices on the J1939 network.

6.1.1. PRODUCE

PGNs are sent from the J1939 Router/B using the PGN Map and selecting the function *Produce*. PGNs can be produced peer-to-peer or as a broadcast. Data from the primary interface (e.g, EtherNet/IP or Modbus) can be copied to the produce PGN using the internal mapping.

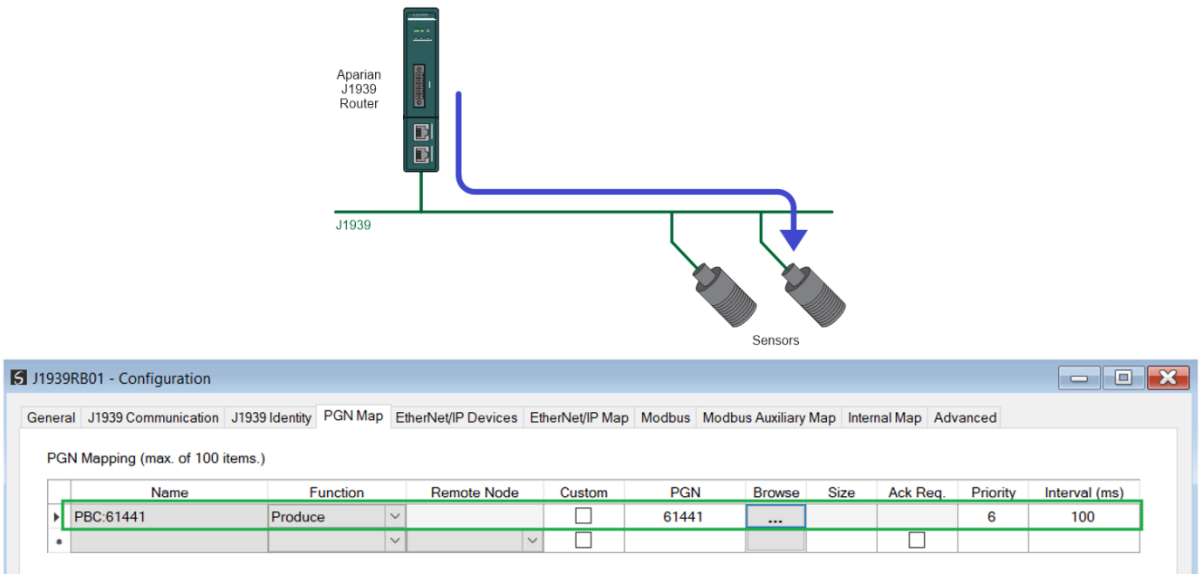


Figure 6.1 – J1939 PGN Produce

6.1.2. CONSUME

PGNs are received by the J1939 Router/B using the PGN Map and selecting the function *Consume*. PGNs from devices on the J1939 network can be consumed as peer-to-peer or as a broadcast. Data from the consumed PGNs can be copied to the primary interface (e.g, EtherNet/IP or Modbus) using the internal mapping.

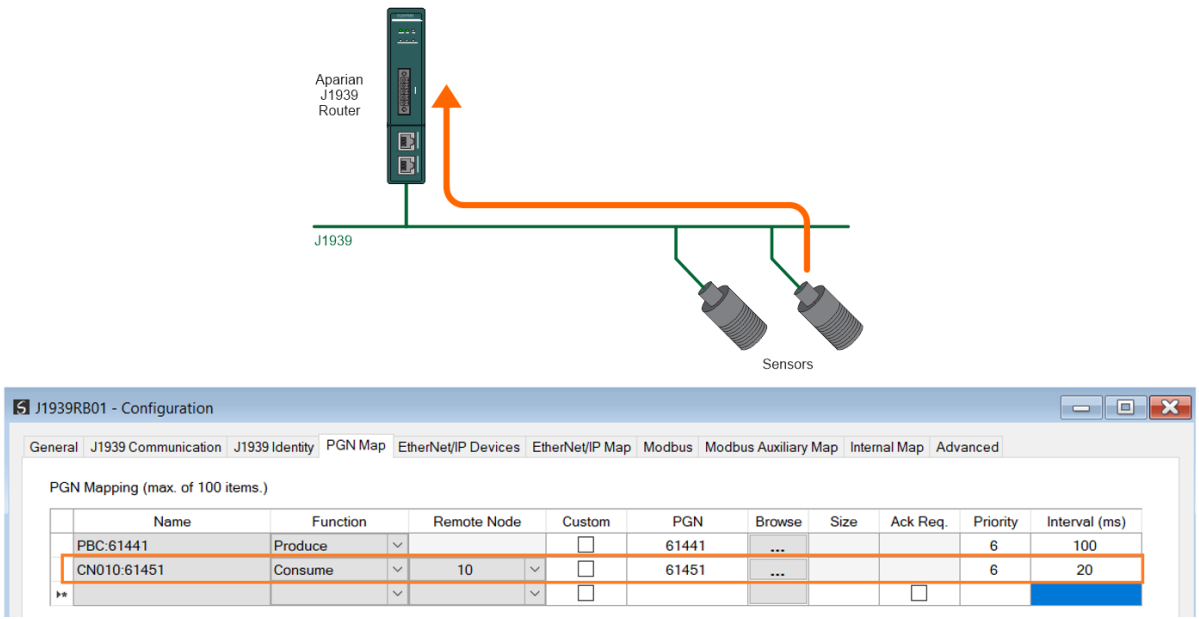


Figure 6.2 – J1939 PGN Consume

6.1.3. EXPLICIT MESSAGING

The J1939 Router/B supports the sending of explicit J1939 / CAN messages from the *Explicit Message Utility* in Slate. This is launched by right-clicking on the module, when online in Slate, and selecting *Explicit Message Utility*.

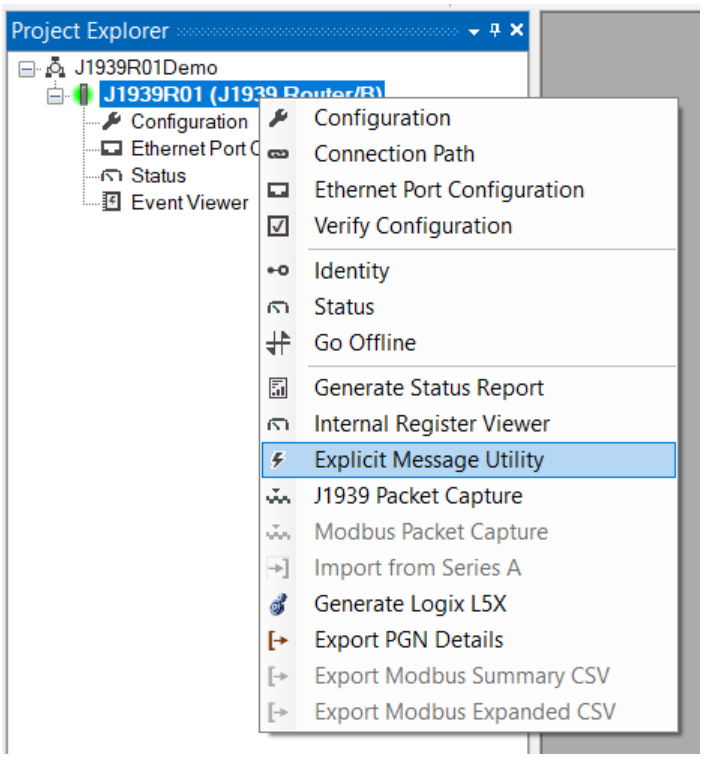


Figure 6.3 – Launching J1939 Explicit Messaging Utility

Once the utility is launched the user will be able to Read or Write PGNs on the J1939 network. The supports reading or writing of J1939 PGNs that span over multiple CAN packets (e.g., BAM messages). The Explicit Message Utility also supports the sending of raw CAN ID messages.

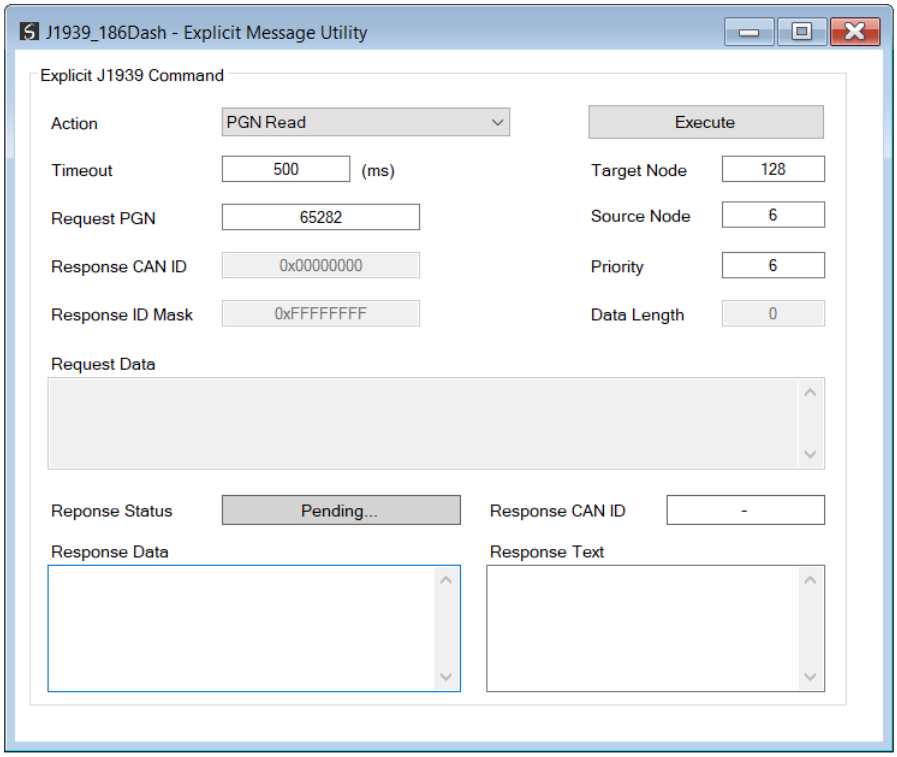


Figure 6.4 –J1939 Explicit Messaging Utility

Parameter	Description
Action	**PGN Read** A specific PGN will be requested from a specific J1939 node or network (using a broadcast). The CAN ID will be compiled from the PGN, Source Node, Target Node, and Priority. **PGN Write** Data will be written to a specific J1939 node or the network (using a broadcast). The CAN ID will be compiled from the PGN, Source Node, Target Node, and Priority. **Raw ID Send (29-bit)** A CAN message (with or without data) will be sent to the J1939 network with the (extended 29-bit) CAN ID entered into the ***Request CAN ID*** textbox. **Raw ID Send (11-bit)** A CAN message (with or without data) will be sent to the J1939 network with the (standard 11-bit) CAN ID entered into the ***Request CAN ID*** textbox. **Raw ID Transaction (29-bit)** A CAN request message (with or without data) will be sent to the J1939 network with the (extended 29-bit) CAN ID entered into the ***Request CAN ID*** textbox.

	The module will then wait for a reply on the network that matches the ***Response CAN ID*** masked by the ***Response ID Mask*** and return the data. **Raw ID Transaction (11-bit)** A CAN request message (with or without data) will be sent to the J1939 network with the (standard 11-bit) CAN ID entered into the ***Request CAN ID*** textbox. The module will then wait for a reply on the network that matches the ***Response CAN ID*** masked by the ***Response ID Mask*** and return the data.
Timeout	The number of milliseconds before the message times out.
PGN / Request CAN ID	When the selected ***Action*** is ***PGN Read/Write***, then this will specify the PGN. When the selected ***Action*** is ***Raw ID Send*** *(11-bit or 29-bit) or* ***Raw ID Transaction*** *(11-bit or 29-bit)* then this will specify the (raw) CAN ID. **NOTE**: The value can be entered as a decimal or hexadecimal. When using hexadecimal, in must start with **0x** (for example 0xA5).
Response CAN ID	The CAN ID required in a received message to be matched with this transaction. The received CAN ID, and ***Response CAN ID*** are both masked (bitwise-AND) with the ***Response ID Mask***, before making the match comparison. This allows a range of CAN IDs to be accepted as a valid response. Only available when the selected ***Action*** is ***Raw ID Transaction*** (11-bit or 29-bit).
Response ID Mask	The CAN ID Mask to be used (bitwise-AND) when matching a received message. Each bit in the mask corresponds to the same bit location in the response, where: Mask Bit = 0: the bit in received message CAN-ID is ignored. Mask Bit = 1: the bit in the received message CAN-ID must equal the corresponding bit in the ***Response CAN ID***. For example, if: ***Response CAN ID*** = 0x354 ***Response ID Mask*** = 0xFFC Then, any message with a CAN ID of either: 0x354, 0x355, 0x356 or 0x357 will be a match. Only available when the selected ***Action*** is ***Raw ID Transaction*** (11-bit or 29-bit).
Target Node	The J1939 target node. If 255 is selected, then this will be a broadcast message.
Source Node	The J1939 source node. If 255 is selected, then this will be a broadcast message.
Priority	The priority of the J1939 message compiled into the CAN ID.
Data Length	The number of bytes to send. **NOTE:** This is read-only and will automatically update as data is entered into the Request Data window.
Request Data	This is the data that must be sent with the CAN message. This will be disabled when the ***Action*** selected is ***PGN Read*.** **NOTE:** The data must be entered in hexadecimal and delimited by spaces (as shown below): 10 AB E5 33

Table 6.1 - General configuration parameters

Once the relevant parameters and data have been setup and populated, then the user can press the *Execute* button to send the CAN request onto the J1939 network via the J1939 Router/B.

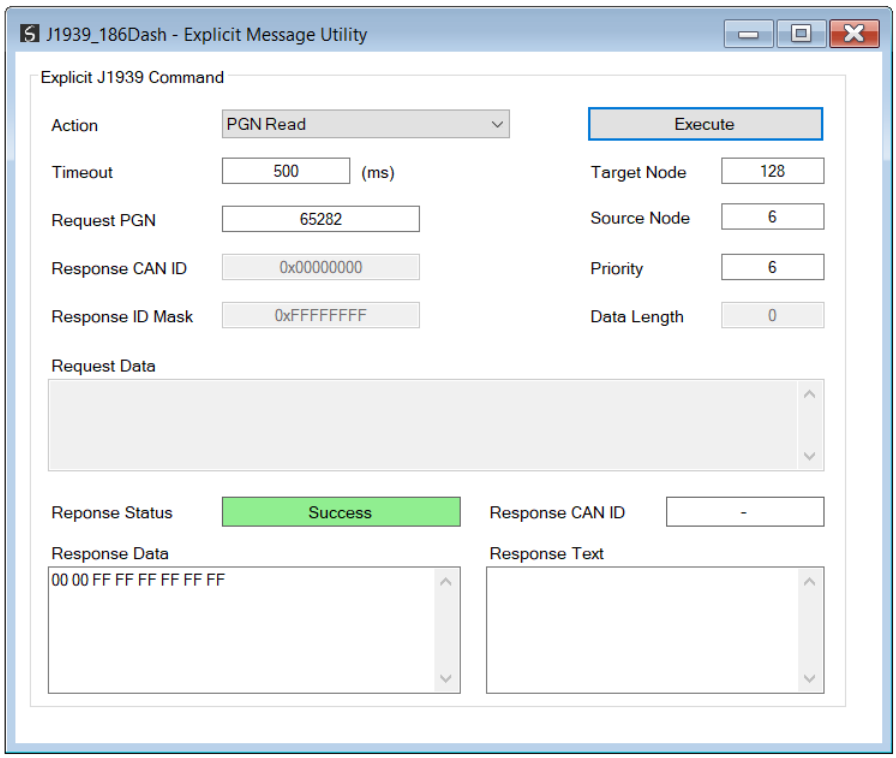


Figure 6.5 –J1939 Explicit Messaging Utility Executed

6.2. ETHERNET/IP TARGET

A controller (e.g. Logix controller) can own the J1939 Router/B over EtherNet/IP using up to 4 Class 1 EtherNet/IP connections when the J1939 Router/B is operating as an EtherNet/IP target. This will allow the J1939 Router/B to exchange data with the controller using the input and output assembly of the Class 1 EtherNet/IP connection.

NOTE: When using EtherNet/IP Target, it is recommended to use the ***Recommend*** button in the Internal Map configuration. This will automatically map and reformat all the required data in the Internal Map.

6.2.1. CLASS 1 ASSEMBLY MAPPING

When the module operates in a Logix “owned” mode the Logix controller will establish a class 1 cyclic communication connection to the J1939 Router/B. Up to four input and output assemblies are exchanged at a fix interval (RPI).



NOTE: The module input and output assembly of each connection will be an undecorated array of bytes. The imported Logix routine (generated by Slate) will copy this data to the input and output assemblies.

Once the generate L5X file has been imported (which will match the Internal Mapping in the configuration), the user will be able to use the tags generated for the specific J1939 Router/B. The data of the various tags (System Status, Device Status, etc.) will be in the format as shown in section 6.6.

◢ J1939RB01System	{...}		J1939BSystemStatus	
J1939RB01System.ConfigValid	0	Decimal	BOOL	Configuration Valid
J1939RB01System.EIPOriginatorCommsOk	0	Decimal	BOOL	EtherNet/IP Originator 0=Fail, 1=Ok
J1939RB01System.ModbusOnline	0	Decimal	BOOL	0=Offline, 1=Online
J1939RB01System.EIPOwned	0	Decimal	BOOL	EtherNet/IP Target: 0=Not-Owned, 1=Owned
J1939RB01System.AllPGNStatus	0	Decimal	BOOL	All PGNs Status: 0=Fault, 1=Ok
J1939RB01System.PowerMainConnector	0	Decimal	BOOL	Main Power: 0=Off 1=On
J1939RB01System.PowerCANConnector	0	Decimal	BOOL	CAN Power: 0=Off 1=On
J1939RB01System.DuplicateNodeNumber	0	Decimal	BOOL	0=Ok, 1=Duplicate Node Detected
J1939RB01System.NTPOk	0	Decimal	BOOL	NTP Status: 0=Fail, 1=Ok
J1939RB01System.ControllerRun	0	Decimal	BOOL	Controller Mode: 0=Program, 1=Run
J1939RB01System.CANBAUDIs250k	0	Decimal	BOOL	CAN BAUD is currently 250k
J1939RB01System.CANBAUDIs500k	0	Decimal	BOOL	CAN BAUD is currently 500k
▸ J1939RB01System.TransactionRate	0	Decimal	DINT	Transactions per second
J1939RB01System.Temperature	0.0	Float	REAL	Module Temperature (deg C)
▸ J1939RB01System.RxCanPacketCount	0	Decimal	DINT	Rx Can Packet Count
▸ J1939RB01System.TxCanPacketCount	0	Decimal	DINT	Tx Can Packet Count
▸ J1939RB01System.CRCErrors	0	Decimal	DINT	CAN CRC Errors
▸ J1939RB01System.BitErrors	0	Decimal	DINT	CAN Bit Errors
▸ J1939RB01System.StuffErrors	0	Decimal	DINT	CAN Stuff Errors
▸ J1939RB01System.BussOffCount	0	Decimal	DINT	Bus Off Events
▸ J1939RB01System.AckErrors	0	Decimal	DINT	CAN Acknowledgment Errors
▸ J1939RB01System.FormatErrors	0	Decimal	DINT	CAN Format Errors
▸ J1939RB01System.PGNItemStatus	{...}	Decimal	BOOL[256]	PGN Status (0=Error, 1=Ok)

Figure 6.6 – Logix System Status Tag

J1939RB01Node006Status	{...}	{...}		J1939BDeviceStatus	
J1939RB01Node006Status.Online	0		Decimal	BOOL	Device Online (0=Offline, 1=Online)
J1939RB01Node006Status.Node	0		Decimal	INT	Node Address
J1939RB01Node006Status.ProtectLamp	0		Decimal	SINT	Protect Lamp Status
J1939RB01Node006Status.AmberLamp	0		Decimal	SINT	Amber-Warning Lamp Status
J1939RB01Node006Status.RedLamp	0		Decimal	SINT	Red-Stop Lamp Status
J1939RB01Node006Status.MalfunctionLamp	0		Decimal	SINT	Malfunction Lamp Status
J1939RB01Node006Status.ProtectLampFlash	0		Decimal	SINT	Protect Lamp Flash Status
J1939RB01Node006Status.AmberLampFlash	0		Decimal	SINT	Amber-Warning Lamp Flash Status
J1939RB01Node006Status.RedLampFlash	0		Decimal	SINT	Red-Stop Lamp Flash Status
J1939RB01Node006Status.MalfunctionLampFlash	0		Decimal	SINT	Malfunction Lamp Flash Status
J1939RB01Node006Status.ProblemSPN	0		Decimal	DINT	Problem SPN
J1939RB01Node006Status.FailureModeIndicator	0		Decimal	SINT	Failure Mode Indicator
J1939RB01Node006Status.ConversionMethod	0		Decimal	SINT	Conversion Method
J1939RB01Node006Status.OccuranceCount	0		Decimal	SINT	Number of fault occurances

Figure 6.7 – J1939 Device Specific tags

There is also a tag created for each configured PGN in the PGN Map. The structure of which comprises the data and status of the specific PGN. When using a Custom PGN the data structure will be a SINT array of 8 bytes. The Status structure for the PGN is a BOOL that indicates if the mapped PGN is ok.

J1939RB01CN006_64466Data	{...}	{...}		AparianPGN64466	
J1939RB01CN006_64466Data.WellStimulationPumpOilViscosity	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilDensity	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilRelativeDielectric	0.0		Float	REAL	
J1939RB01CN006_64466Data.WellStimulationPumpOilTemperature	0.0		Float	REAL	
J1939RB01CN006_64466Status	{...}	{...}		J1939BPGNStatus	
J1939RB01CN006_64466Status.Online	0		Decimal	BOOL	Device Online (0=Offline, 1=Online)

Figure 6.8 – J1939 PGN Specific tags

6.2.2. EXPLICIT MESSAGING

The J1939 Router/B allows the user to read PGN data from a J1939 IO devices using explicit EtherNet/IP CIP messages. The required parameters for J1939 PGN extraction from a J1939 IO device are listed below.

6.2.2.1. J1939 PASSTHROUGH

A. CIP MESSAGE

Parameter	**Description**
Service Code	0x6B (Hex)
Class	0x437 (Hex)
Instance	1

Attribute	N/A
Request Data Length	8

Table 6.2 – J1939 Passthrough Message

B. REQUEST DATA

Parameter	Data Type	Description
Node	INT	The Node Address of the target J1939 device
Timeout	INT	Time before the message transaction is marked as failed in milliseconds. Default 100ms.
PGN	DINT	The number of the requested PGN.

Table 6.3 – J1939 Passthrough Request

C. RESPONSE DATA

Parameter	Data Type	Description
Response Status	INT	This is the status of the request. 0 – Success 1 – Timeout
Data Length	INT	The size of the PGN response data to follow.
Data	SINT[]	The PGN response data from the target J1939 device.

Table 6.4 – J1939 Passthrough Response

6.2.2.2. EXPLICIT J1939 / CAN MESSAGE

A. CIP MESSAGE

Parameter	Description
Service Code	0x6D (Hex)
Class	0x437 (Hex)
Instance	1
Attribute	N/A
Request Data Length	24 - 256

Table 6.5 – Explicit J1939 / CAN Message

NOTE: The Explicit J1939 / CAN Message Request and Response UDTs are included in the L5X file, when selecting the ***Generate Logix L5X*** option.

B. REQUEST DATA

Parameter	Data Type	Description
Command	SINT	**0 – PGN Read** A specific PGN will be requested from a specific J1939 node or network (using a broadcast). The CAN ID will be compiled from the ***PGN***, ***Source Node***, ***Target Node***, and ***Priority***. **1 – PGN Write** Data will be written to a specific J1939 node or the network (using a broadcast). The CAN ID will be compiled from the ***PGN***, ***Source Node***, ***Target Node***, and ***Priority***. **2 – Raw ID Send (29-bit CAN ID)** A CAN message (with or without data) will be sent to the J1939 network using the (extended 29-bit) ***Request CAN ID***. **3 – Raw ID Send (11-bit CAN ID)** A CAN message (with or without data) will be sent to the J1939 network using the (standard 11-bit) ***Request CAN ID***. **4 – Raw ID Transaction (29-bit)** A CAN request message (with or without data) will be sent to the J1939 network with the (extended 29-bit) ***Request CAN ID***. The module will then wait for a reply on the network that matches the ***Response CAN ID*** masked by the ***Response ID Mask*** and return the data. **5 – Raw ID Transaction (11-bit)** A CAN request message (with or without data) will be sent to the J1939 network using the (standard 11-bit) ***Request CAN ID***. The module will then wait for a reply on the network that matches the ***Response CAN ID*** masked by the ***Response ID Mask*** and return the data.
Priority	SINT	3-bit J1939 message priority
Source Node	INT	The source Node Address being used in the J1939 request
Target Node	INT	The Node Address of the target J1939 device
Reserved	INT	-
PGN / Request CAN ID	DINT	When the selected ***Command*** is PGN Read/Write, then this will specify the PGN. When the selected **Command** is Raw ID Send (11-bit or 29-bit) or Raw ID Transaction (11-bit or 29-bit) then this will specify the (raw) CAN ID.

Response CAN ID	DINT	The CAN ID required in a received message to be matched with this transaction. The received CAN ID, and ***Response CAN ID*** are both masked (bitwise-AND) with the ***Response ID Mask***, before making the comparison. This allows a range of CAN IDs to be accepted as a valid response. Only applicable when the ***Command*** is Raw ID Transaction (11-bit or 29-bit).
Response ID Mask	DINT	The CAN ID Mask to be used (bitwise-AND) when matching a received message. Each bit in the mask corresponds to the same bit location in the response, where: Mask Bit = 0: the bit in received message CAN-ID is ignored. Mask Bit = 1: the bit in the received message CAN-ID must equal the corresponding bit in the ***Response CAN ID***. For example, if: ***Response CAN ID*** = 0x354 ***Response ID Mask*** = 0xFFC Then, any message with a CAN ID of either: 0x354, 0x355, 0x356 or 0x357 will be a match.
Timeout	INT	Time before the message transaction is marked as failed in milliseconds. Default 500ms.
Data Length	INT	The size of the data to be sent.
Data	SINT[]	The data to be sent.

Table 6.6 – Explicit J1939 / CAN Message Request

C. RESPONSE DATA

Parameter	Data Type	Description
Response Status	INT	This is the status of the request. 0 – Success 1 – Timeout
Data Length	INT	The size of the response data to follow.
Response ID	DINT	The CAN ID of the message that was matched as a suitable reply. Available only for Raw ID Transaction (11-bit or 29-bit) commands.
Data	SINT[]	The response data from the target J1939 device.

Table 6.7 – Explicit J1939 / CAN Message Response

6.2.2.3. SET CAN BAUD RATE

A. CIP MESSAGE

Parameter	Description
Service Code	0x10 (Hex) – Set Single Attribute
Class	0x437 (Hex)
Instance	1
Attribute	16
Request Data Length	1

Table 6.8 – Set CAN Baud Rate Message

B. REQUEST DATA

Parameter	Data Type	Description
Baud Rate Option	SINT	0 – 250k 1 – 500k 2 – 125k

Table 6.9 – Set CAN Baud Rate Request

C. RESPONSE DATA

No data is returned for a Set Single Attribute message.

6.2.2.1. J1939 NODE LIVE LIST MESSAGE

A. CIP MESSAGE

Parameter	Description
Service Code	0x0E (Hex) – Get Single Attribute
Class	0x437 (Hex)
Instance	1
Attribute	15
Request Data Length	0

Table 6.10 – J1939 Node Live List Message

B. REQUEST DATA

No request data is sent for a Get Single Attribute message.

C. RESPONSE DATA

Parameter	Data Type	Description
Response Status	SINT[255]	The response has one byte for each available node address on the J1939 network where the index of the array is the same as the node on the network. For example, index 5 will be the live list data for node 5. Bit 0 – Online Bit 1 – Protect Lamp Enable Bit 2 – Amber Lamp Enable Bit 3 – Red Stop Lamp Enable Bit 4 – Malfunction Lamp Enable Bit 5 – Reserved Bit 6 – Reserved Bit 7 - Reserved

Table 6.11 – J1939 Node Live List Response

6.3. ETHERNET/IP ORIGINATOR

The J1939 Router/B module can operate as an EtherNet/IP originator. In this mode the module can exchange data from the J1939 network with EtherNet/IP devices using either the input and output assemblies of the Class 1 EtherNet/IP connection to the device or using explicit (Class 3 or UCMM) EtherNet/IP messages.

6.3.1. ETHERNET/IP CLASS 1 CONNECTIONS

In the example below, the J1939 Router/B is consuming and producing J1939 PGN data while the J1939 Router/B is owning some EtherNet/IP IO. The data from the PGNs are exchanged with those of the EtherNet/IP IO.

Once the EtherNet/IP Class 1 connections are setup and established then any Internal Map copying to an EtherNet/IP device will be written to the output assembly of the selected EtherNet/IP device (Originator to Target). In the Internal Map the user will specify which device instance is the target and at what offset the data must be written in the output assembly.

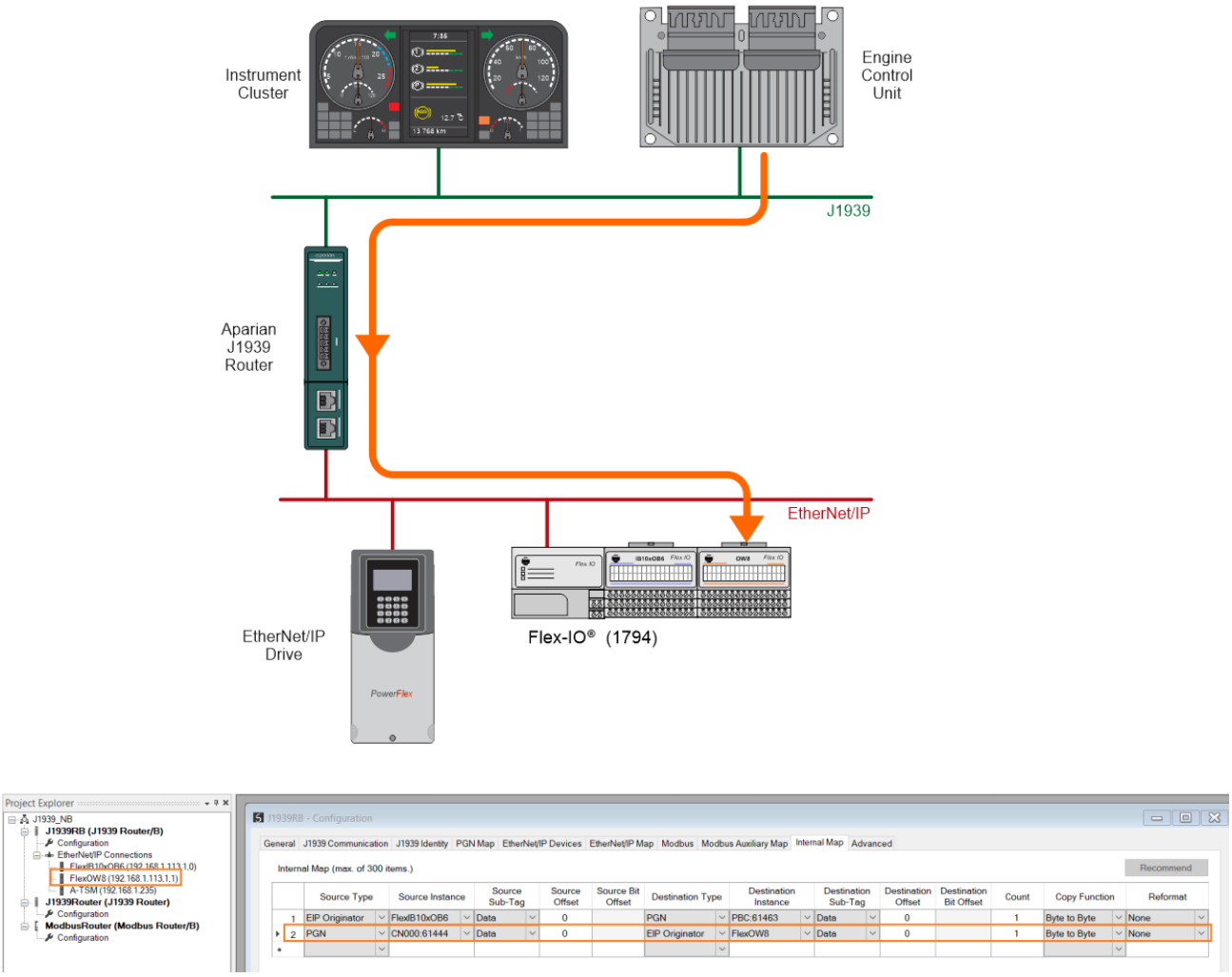


Figure 6.9 – Internal Mapping from J1939 to EtherNet/IP Originator

Any Internal Map copying from an EtherNet/IP device will be read from the input assembly of selected EtherNet/IP device (Target to Originator). In the Internal Map the user will specify which device instance is the target and at what offset the data must be read from the input assembly.

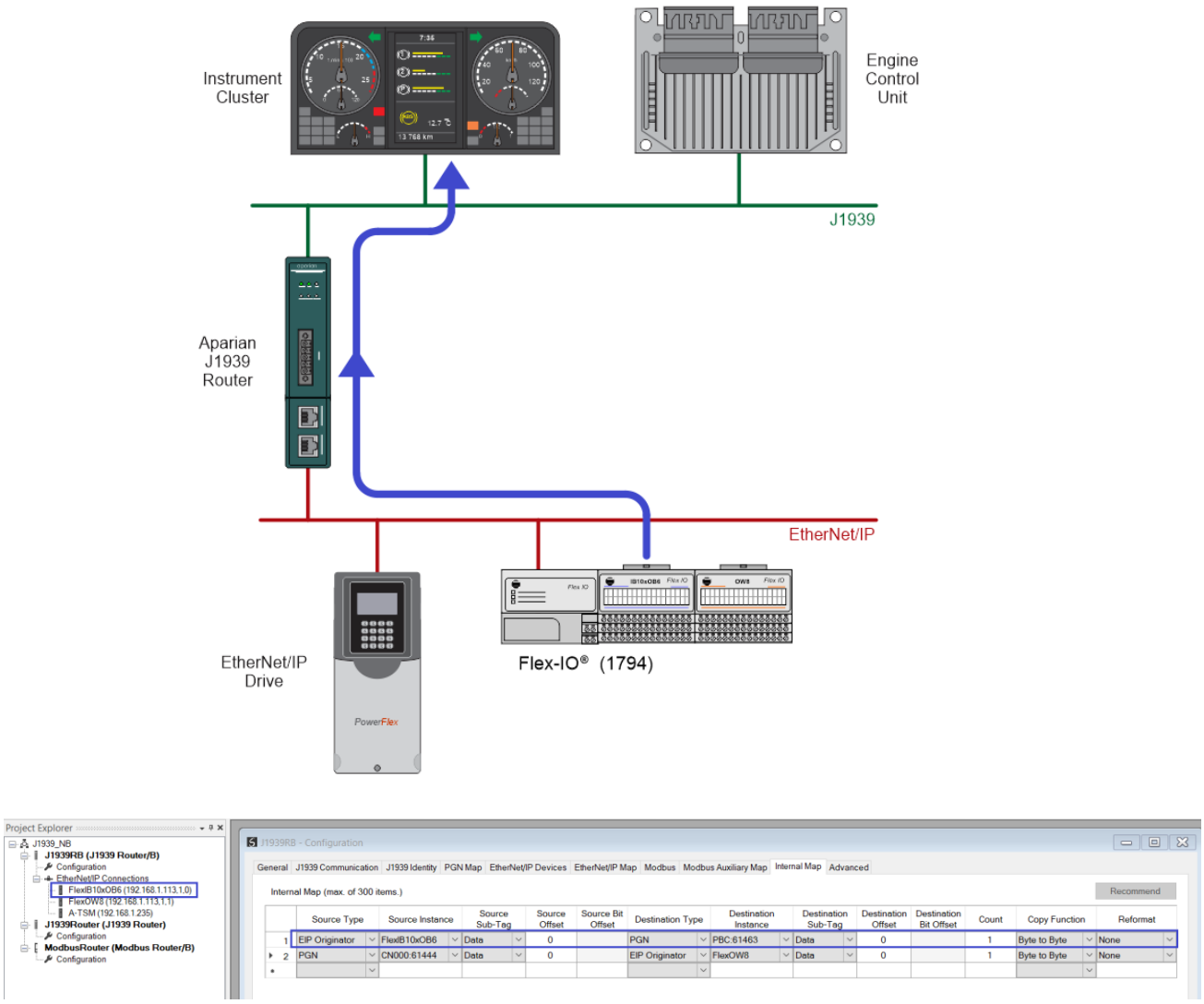


Figure 6.10 – Internal Mapping from EtherNet/IP Originator to J1939

6.3.1.1. CONNECTION STATUS

The user can select to copy the data from the EtherNet/IP connection or the status.

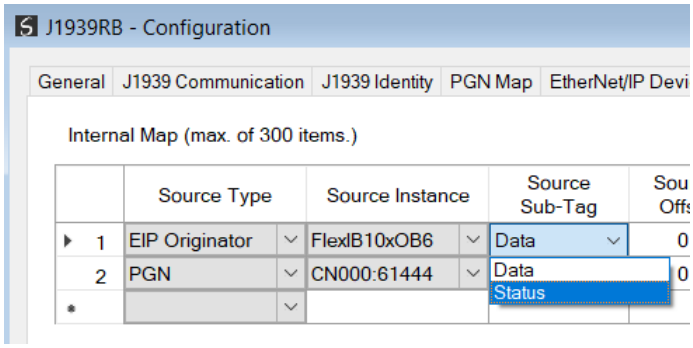


Figure 6.11 – IDS Copy – EtherNet/IP Originator Status

When selecting the status, the format of the Status information is shown below:

Parameter	Data Type	Description
EtherNet/IP Originator Connection Status	DINT	Bit 0 – Connection Ok

Table 6.12 – EtherNet/IP Originator Connection Status

6.3.2. EXPLICIT MESSAGING

When using the EtherNet/IP Explicit Messaging, the user can configure up to 10 EtherNet/IP devices which will be used for the Explicit Messaging. This configuration is accessed in the *EtherNet/IP Devices* tab. Following this, the EtherNet/IP Map of explicit messages needs to be configured. The Explicit Messaging uses the internal data space (IDS) where data can be stored for exchanges between the explicit EtherNet/IP devices and the J1939 network.

The Input and Output IDS Offset is where the Explicit EtherNet/IP device data will be read from, or written to. The data in the IDS can then, in turn, be copied to or from the J1939 network using the Internal Map in the configuration.

In the below example, the J1939 Router/B is receiving data from a PGN 61444 on J1939 and copying the Engine Speed (4 bytes) from the decoded PGN to the Internal Data Space at address 4080.

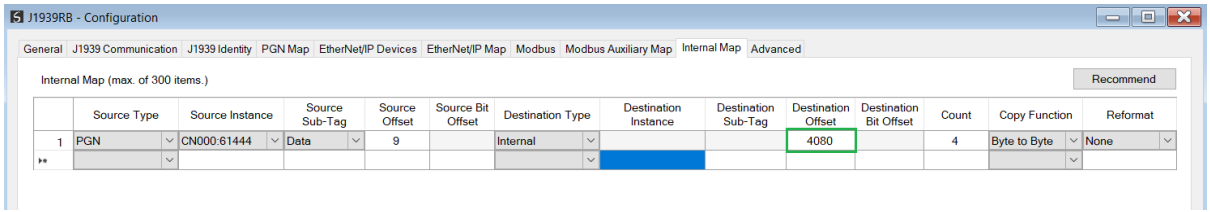


Figure 6.12 – Internal Mapping from J1939 to IDS

NOTE: In the above example the PGN being used is an SAE standard PGN which means the J1939 Router/B will automatically decode and scale the values received in the raw PGN packet. To view the structure of the decoded PGN, the user can right-click on the module in Slate and select *Export PGN Details*.

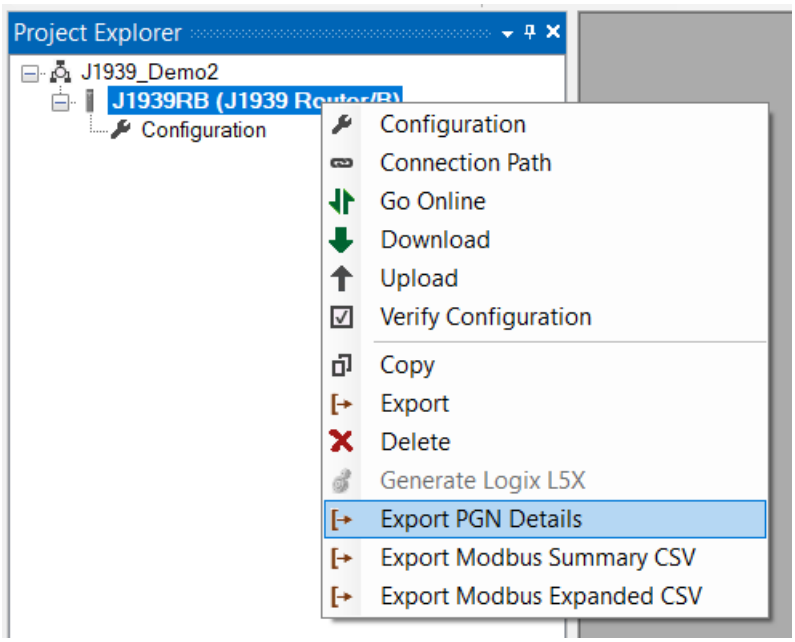


Figure 6.13 – Standard SAE PGN Decoded Structure

PGN Id	PGN Name	Node	Total Size	SPN Index	Byte Offse	SPN Name	Data Type	Scale Gain	Scale Offs	Raw Bit Length	Raw Bit Offset
61444	CN000:61444	0	22	0	0	EngineTorqueMode	SINT	1	0	0	4
61444	CN000:61444	0	22	1	4	ActualEnginePercentTorqueFractional	REAL	0.125	0	4	4
61444	CN000:61444	0	22	2	8	DriversDemandEnginePercentTorque	INT	1	-125	8	8
61444	CN000:61444	0	22	3	10	ActualEnginePercentTorque	INT	1	-125	16	8
61444	CN000:61444	0	22	4	12	EngineSpeed	REAL	0.125	0	24	16
61444	CN000:61444	0	22	5	16	SourceAddressofControllingDeviceforEngin	INT	1	0	40	8
61444	CN000:61444	0	22	6	18	EngineStarterMode	SINT	1	0	48	4
61444	CN000:61444	0	22	7	20	EngineDemandPercentTorque	INT	1	-125	56	8

Figure 6.14 – CSV Export PGN Details – Example PGN 61444

The J1939 Router/B then uses the Engine Speed data from the consumed PGN (which was copied to IDS offset 4080) to execute a Set Single Attribute to a target EtherNet/IP device using explicit messaging.

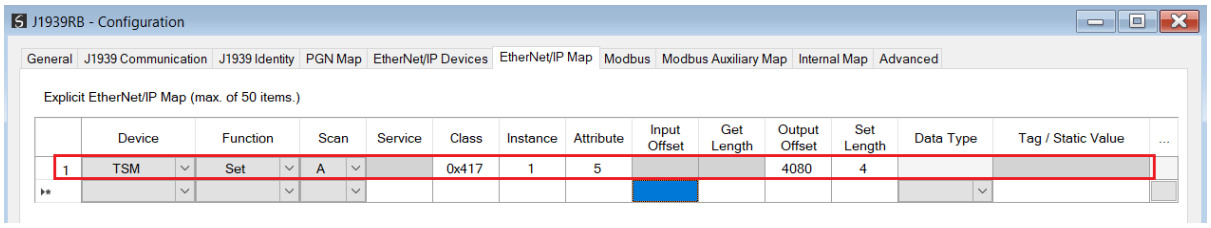


Figure 6.15 – Explicit Messaging – Set Function from IDS to EtherNet/IP device

In the next example below, the J1939 Router/B is receiving data from an EtherNet/IP device using a ***Get*** Explicit EtherNet/IP message and saving the data at IDS offset 4040.

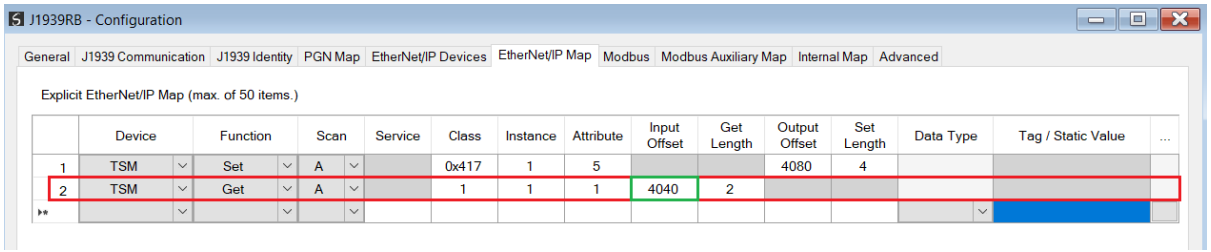


Figure 6.16 – Explicit Messaging – Get Function from EtherNet/IP device to IDS

The J1939 Router/B will then map the received data at IDS offset 4040 to the broadcast produce PGN61463.

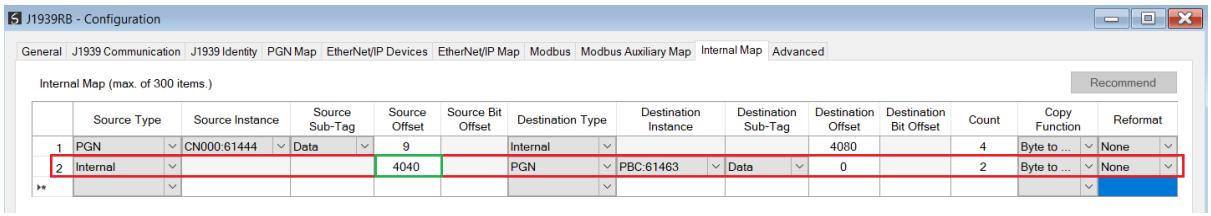


Figure 6.17 – Explicit Messaging – Internal Mapping from IDS to broadcast PGN

6.4. MODBUS CLIENT

When the J1939 Router/B has the Primary Interface set to Modbus Client, then the J1939 PGN data can be mapped to and from configurable internal Modbus Registers using the Internal Map.

The internal Modbus Registers are then asynchronously exchanged with Modbus devices as configured in the Modbus Auxiliary Map. In this mapping the user can exchange (read or write) data between the internal Modbus Registers and a remote Modbus device on Modbus TCP, RTU232, or RTU485.

In the example below the J1939 Router/B with the Primary Interface set to Modbus Client will read multiple Modbus Holding Registers from a Modbus Server device and then map the received data to a J1939 produce PGN.

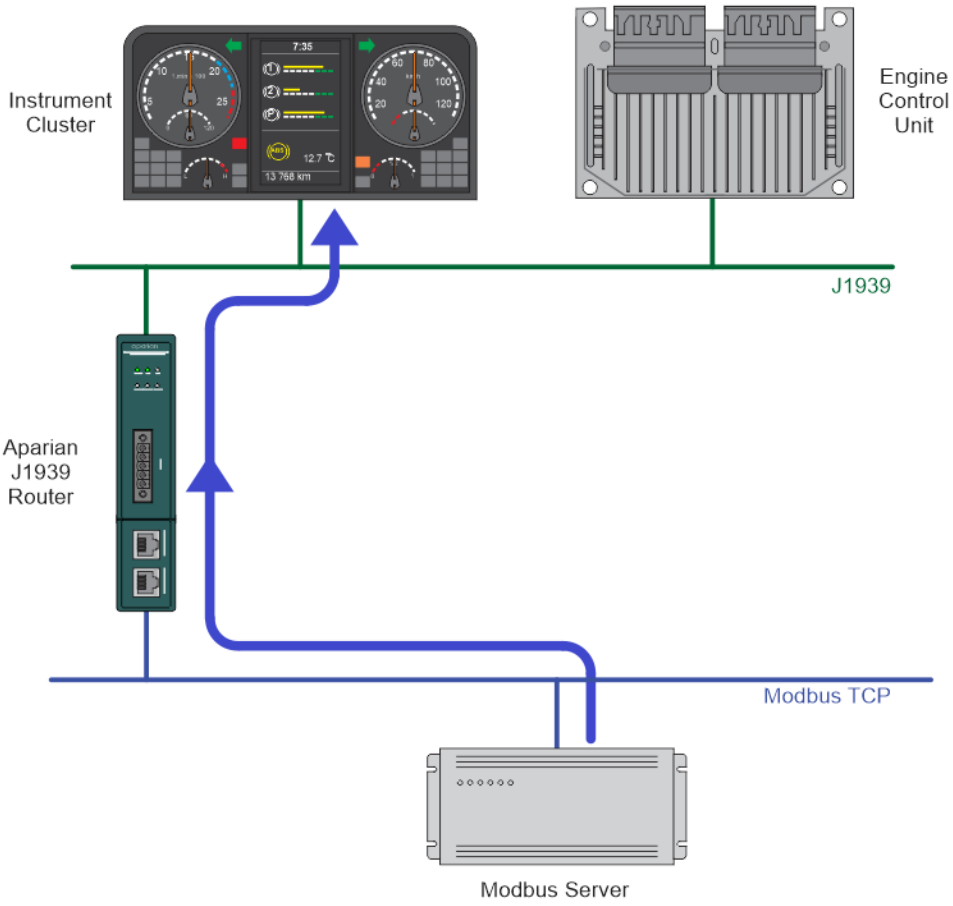


Figure 6.18 – Modbus Client to J1939 operation

For this example the user will configure the Modbus Auxiliary Map to read data from a Modbus Server device on Ethernet. The J1939 Router/B will request data from Modbus Holding Register 4000 (from the external Modbus Server) and write it to the module's internal Modbus Holding Register 3000.

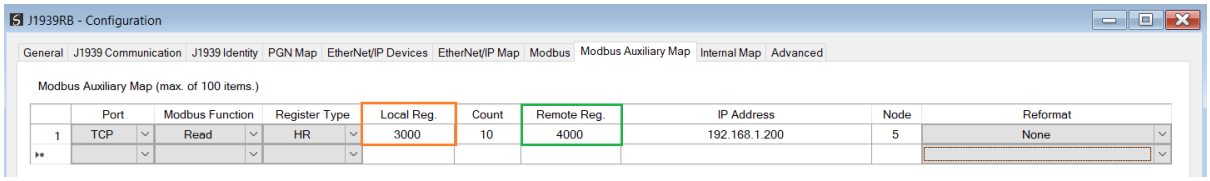


Figure 6.19 – Modbus Client Aux Mapping

Next the data saved in the internal Modbus Register at MB Holding Register 3000 is mapped to a peer-to-peer produce PGN7680.

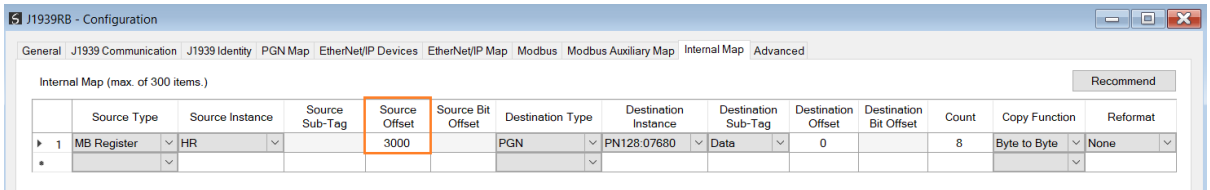


Figure 6.20 – Internal Mapping from Modbus Register to J1939 PGN

NOTE: The user will need to ensure that when writing to the J1939 Router/B Modbus Holding Registers that the registers holding data from the device are not inadvertently overwritten.

6.5. MODBUS SERVER

When the J1939 Router/B has the Primary Interface set to Modbus Server, then the J1939 PGN data can be mapped to and from configurable internal Modbus Registers and offsets using the Internal Map.

The internal Modbus Registers can then be asynchronously exchanged with a remote Modbus Client on Modbus TCP, RTU232, or RTU485. The remote Modbus Client can read or write to the configured Modbus addresses to access the J1939 PGN data that has been mapped to the Modbus Registers.

In the example below the J1939 Router/B, with the Primary Interface set to Modbus Server, will have multiple Modbus Holding Registers read from a Modbus TCP Client. The read Modbus registers will have data mapped from received J1939 PGNs.

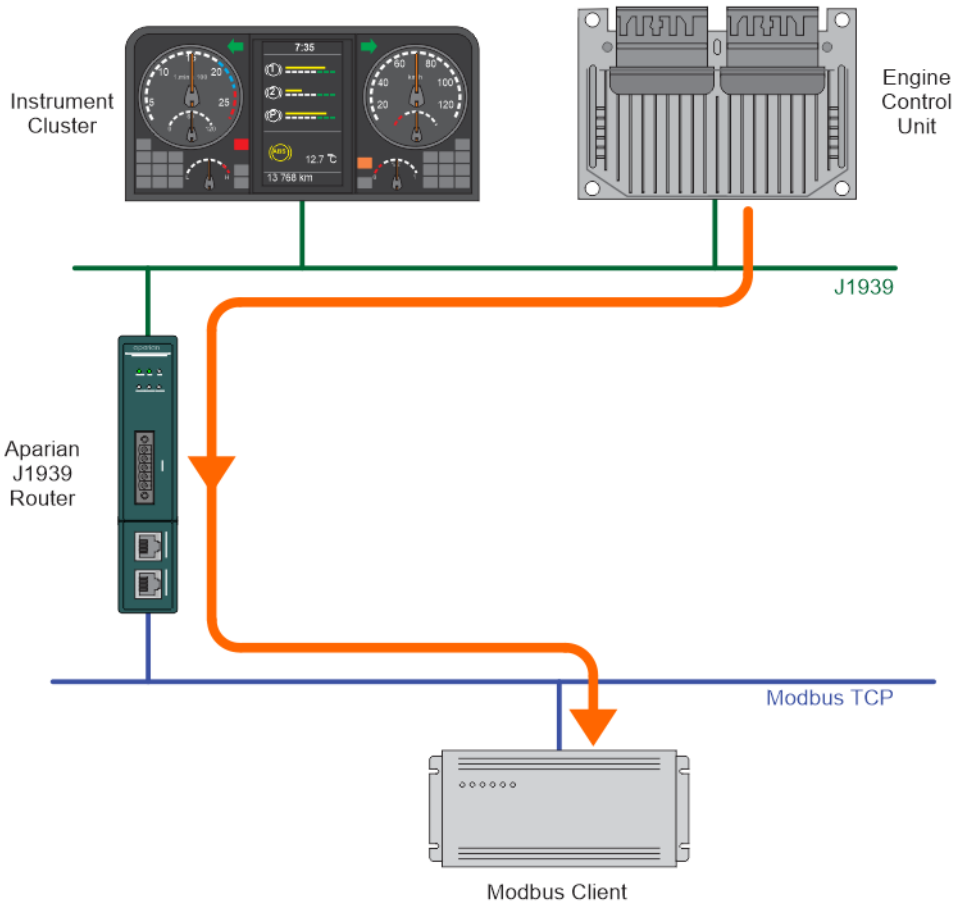


Figure 6.21 – J1939 PGN to Modbus TCP Client

For this example the remote Modbus TCP Client will read data from Modbus Holding Register 4000 in the J1939 Router/B. The J1939 Router/B will map received J1939 PGNs to the internal Modbus Holding registers (at Holding Register 4000).

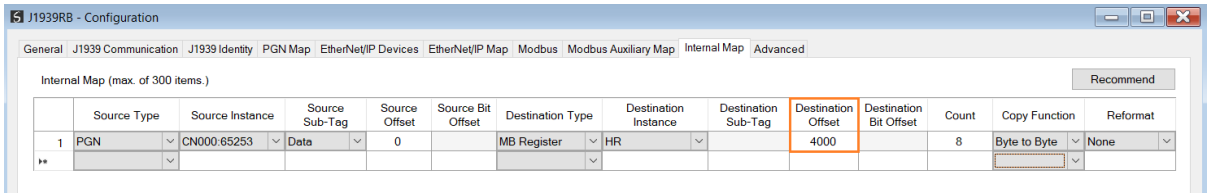


Figure 6.22 – Internal Mapping from J1939 PGN to Modbus Register

NOTE: The user will need to ensure that when writing to the J1939 Router/B Modbus Holding Registers that the registers holding data from the device are not inadvertently overwritten.

6.6. INTERNAL MAP DATA FORMATS

The following tables describe the raw format of the data structures that can be mapped in the Internal Map table configuration.

NOTE: When using EtherNet/IP Target, Modbus Server, or Modbus Client, it is recommended to use the Recommended Mapping feature in the internal mapping. This will automatically map all the required data in the Internal Map.

6.6.1. SYSTEM STATUS

When copying system information, the source type needs to be System.

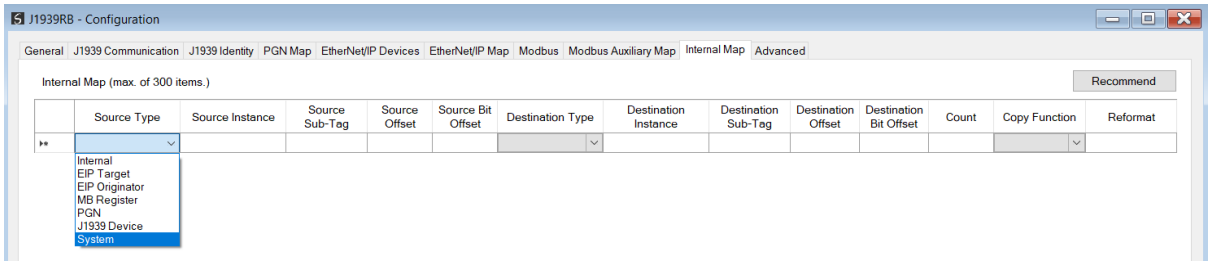


Figure 6.23 – IDS Copy – System Information

The module's system information has the following format.

Parameter	Data Type	Description
Status	INT	Module Status. Bit 0 – Module Config Valid Bit 1 – EtherNet/IP Originator Comms Ok Bit 2 – Modbus Comms Ok Bit 3 – EtherNet/IP Target Comms Ok Bit 4 – J1939 All PGN Ok Bit 5 – Power is applied to the bottom connector. Bit 6 – Power is applied to the front connector. Bit 7 – Duplicate Node Number Bit 8 – NTP Ok Bit 9 – Controller in Run Mode.
Reserved	INT	Reserved
Transaction Rate	DINT	Number of J1939 transactions executed every second.
Temperature	REAL	The internal temperature of the module.
Rx CAN Packet Count	DINT	The number of J1939 packets received.
Tx CAN Packet Count	DINT	The number of J1939 packets sent.
CAN CRC Errors	DINT	The number of received packets where the packet checksum does not match the calculated packet checksum. This implies one or more bits in the frame have been corrupted. May indicate an intermittent CAN cable connection or induced electrical noise.
CAN Bit Errors	DINT	The number of transmitted bits where the transmitted bit state does not match the instantaneous read-back state. This may indicate that another device is transmitting at the same time, or one of the CAN lines shorted to power, shorted together, or incorrectly termination.
CAN Stuff Errors	DINT	The number of frames received where the required inserted (opposite) bit was not received after 5 identical bits. This may be an indication of bus noise, bad physical cable connection, or a faulty device.
Bus Off	DINT	The number of Bus-Off Events. A node will enter the Bus-Off state when the transmit Error Count exceeds a certain threshold (typically 125). This may indicate a cable break or loss of power causing the Scanner to enter the Bus-Off state.
Ack Error	DINT	The number of transmitted bits that are not read-back and acknowledged by at least one other node. Typically seen when the device is alone on the bus, and there is no other node to acknowledge the frame.

Format Error	DINT	The number of received frames where the fixed format part of a received frame is invalid, or the Frame structure is non-standard. (Frame size/type start delimiter etc.) May indicate an intermittent CAN cable connection, induced electrical noise or a node present with an incorrect BAUD rate.
Mapped Item Status	SINT[16]	This is a 16-byte bit array where each bit represents a mapped PGN item (up to 100 mapped item). 1 – PGN mapped item ok. 0 – PGN mapped item failed. Bit 0 – PGN Mapped item 0 Bit 1 – PGN Mapped item 1 Bit 2 – PGN Mapped item 2 … Bit 98 – PGN Mapped item 99 Bit 99 – PGN Mapped item 100

Table 6.13 – System Information Format

6.6.2. J1939 Device - Status

For J1939 Device status information, the source type needs to be J1939 Device.

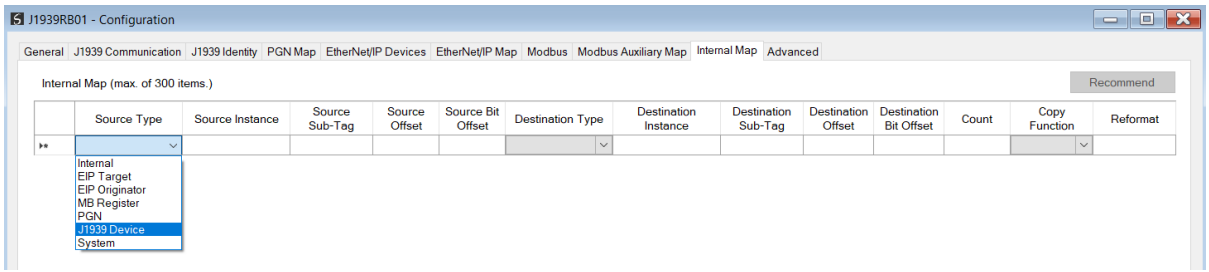


Figure 6.24 – IDS Copy – J1939 Device Source Type

The source instance is the J1939 device node address from which the status must be copied.

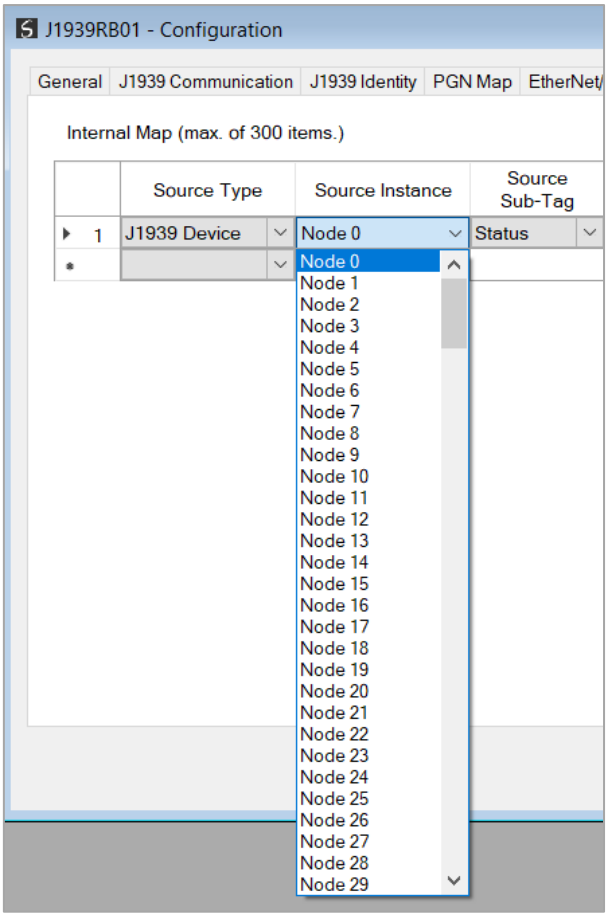


Figure 6.25 – IDS Copy – J1939 Device Source Instance

The format of the J1939 Device Status to be copied is shown below and can also be found in the *Internal Map Data Formats* section.

Parameter	Data Type	Description
Flags	SINT	**Indicates if the J1939 Device is online or offline.** Bit 0 - Online Bit 1 to 7 - Reserved
Reserved (Pad)	SINT	Reserved
Node	INT	The node number of the J1939 device.
Lamp Status - Protect	SINT	**The Protect Lamp Status.** 0 – Off 1 – On
Lamp Status - Amber Warning	SINT	**The Amber Warning Lamp Status.** 0 – Off 1 – On
Lamp Status - Red Stop	SINT	**The Red Stop Lamp Status.** 0 – Off 1 – On
Lamp Status - Malfunction	SINT	**The Malfunction Lamp Status.** 0 – Off 1 – On

Lamp Flash - Protect	SINT	**The Protect Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Amber Warning	SINT	**The Amber Warning Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Red Stop	SINT	**The Red Stop Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Lamp Flash - Malfunction	SINT	**The Malfunction Lamp Flash indication.** 0 - Slow Flash 1 - Fast Flash 2 – Reserved 3 - Solid
Problem SPN	DINT	The SPN number that has the error.
Failure Mode Indicator	SINT	**The code to indicate the reason for the fault.** 0 - Data Valid, but above normal operating range (most severe level) 1 - Data Valid, but below normal operating range (most severe level) 2 - Data Erratic, Intermittent, or Incorrect 3 - Voltage Above Normal or shorted to High Source 4 - Voltage Below Normal or shorted to Low Source 5 - Current Below Normal or Open Circuit 6 - Current Above Normal or Ground Circuit 7 - Mechanical System not Responding or Out of Adjustment 8 - Abnormal Frequency or Pulse Width or Period 9 - Abnormal Update Rate 10 - Abnormal Rate of Change 11 - Root Cause Unknown 12 - Bad Intelligent Device Or Component 13 - Out of Calibration 14 - Special Instructions 15 - Data Valid, but above normal operating range (least severe level) 16 - Data Valid, but above normal operating range (moderately severe level) 17 - Data Valid, but below normal operating range (least severe level) 18 - Data Valid, but below normal operating range (moderately severe level) 19 - Received Network Data In Error 20 - Data Drifted High 21 - Data Drifted Low 22 to 30 - Reserved 31 - Condition Exists

Conversion Method	SINT	Indicates the SPN conversion format standard being used.
Occurrence Count	SINT	The 7-bit occurrence count field contains the number of times a fault has been independently detected.
Reserved (Pad)	SINT	Reserved

Table 6.14 – J1939 Device Status Format

6.6.3. J1939 Device – Device ID

For J1939 Device ID information, the source type needs to be J1939 Device.

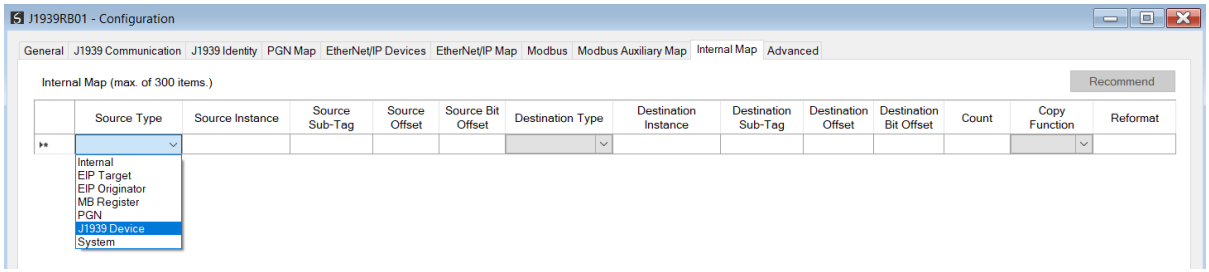


Figure 6.26 – IDS Copy – J1939 Device Source Type

The source instance is the J1939 device node address from which the status must be copied.

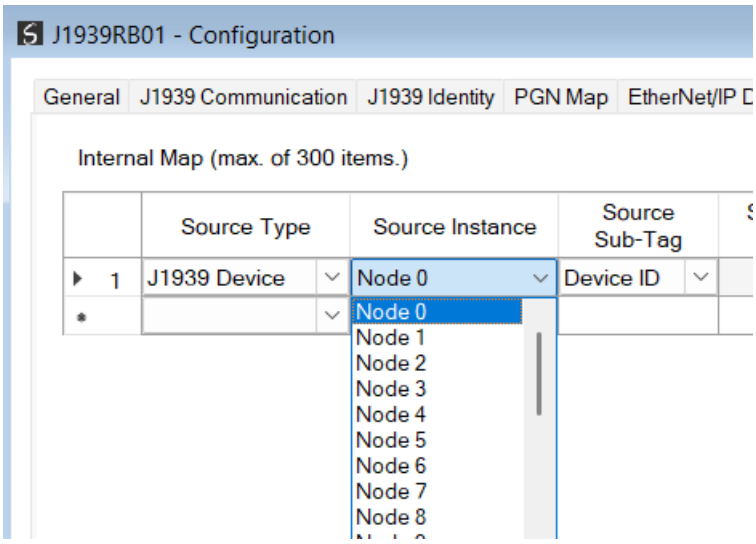


Figure 6.27 – IDS Copy – J1939 Device Source Instance

The format of the J1939 Device ID to be copied is shown below and can also be found in the *Internal Map Data Formats* section.

Parameter	**Data Type**	**Description**
Arbitrary Address Capable	INT	

Industry Group	INT	The J1939 Name consists of the following elements. Refer to the J1939 specification (see section 1.3 for additional information).
Vehicle System Instance	INT	
Vehicle System	INT	
Function	INT	
Function Instance	INT	
ECU Instance	INT	
Manufacturer Code	INT	
Identity Number	DINT	

Table 6.15 – J1939 Device ID Format

6.6.4. J1939 Device – Control

For J1939 Device control, the destination type needs to be J1939 Device.

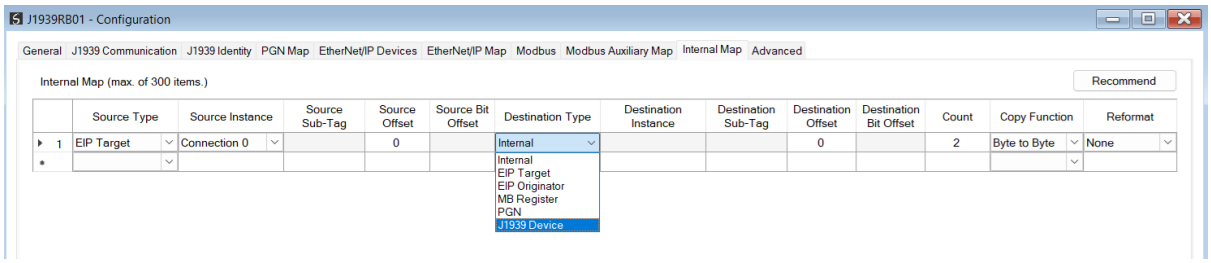


Figure 6.28 – IDS Copy – J1939 Device Destination Type

The destination instance is the J1939 device node address to which the control data must be copied.

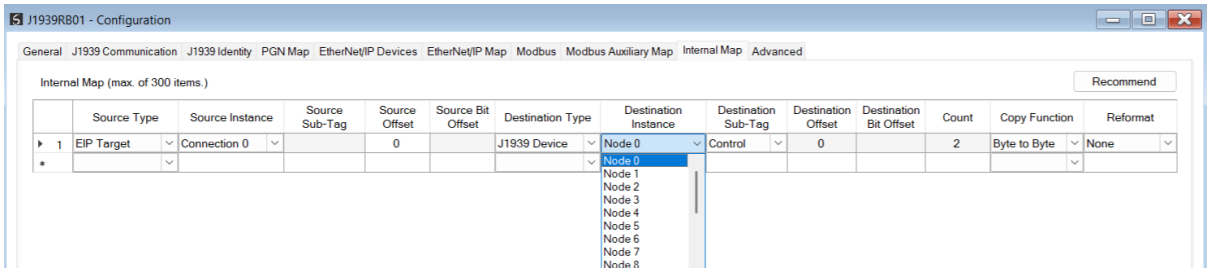


Figure 6.29 – IDS Copy – J1939 Device Destination Instance

The format of the J1939 Device Control is shown below and can also be found in the *Internal Map Data Formats* section.

Parameter	Data Type	Description
Clear Diagnostics	BOOL	When this bit is set, the J1939 Router/B will send a PGN Diagnostics Clear to the specific device, which will clear the active Diagnostic.

Table 6.16 – J1939 Device Control Format

6.6.5. J1939 PGN - STATUS

The source instance will be the PGN name in the PGN Map configuration. The Source Sub-Tag can either be the PGN data, PGN Statistics, or the PGN status which indicates if the PGN mapping is ok and data is being consumed.

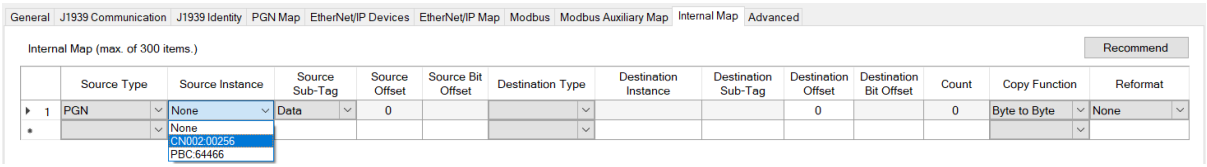


Figure 6.30 – IDS Copy – PGN Source Instance and Sub-Tag

When selecting the Status, the format of the Status information is shown below:

Source Sub-Tag	Description
PGN Status	Status of the mapped PGN. Bit 0 – Mapped PGN Ok. Bit 1 to 15 – Reserved

Table 6.4 – IDS Copy - PGN Status

6.6.6. J1939 PGN - STATISTICS

The source instance will be the PGN name in the PGN Map configuration. The Source Sub-Tag can either be the PGN data, PGN Statistics, or PGN status. The PGN Statistics provides the Transmit (Tx) and Receive (Rx) counts for the specific PGN.

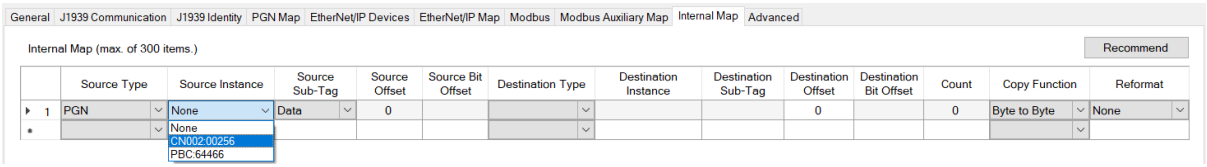


Figure 6.31 – IDS Copy – PGN Source Instance and Sub-Tag

When selecting the Status, the format of the Status information is shown below:

Parameter	Data Type	Description
Rx Statistic	INT	Will increase each time the PGN is received.
Tx Statistic	INT	Will increase each time the PGN is sent or requested.

Table 6.4 – IDS Copy - PGN Statistics

6.6.7. J1939 PGN - CONTROL

The destination instance will be the PGN name in the PGN Map configuration. The Destination Sub-Tag can either be the PGN data or the PGN Control which is used to trigger PGNs that do not have an update interval.

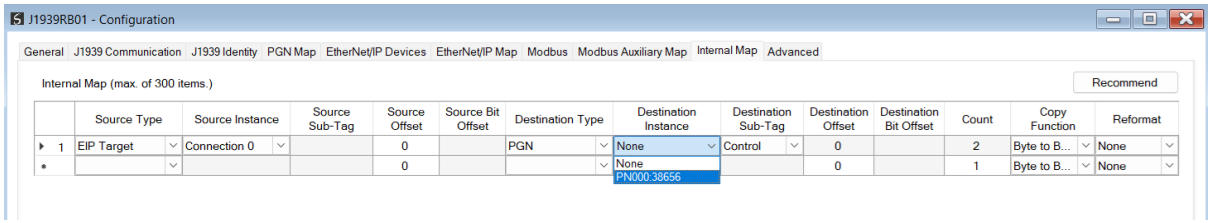


Figure 6.32 – IDS Copy – PGN Destination Instance and Sub-Tag

When selecting the Control, the format of the Control word is shown below:

Source Sub-Tag	Description
PGN Control	Control of the mapped PGN. Bit 0 – Trigger PGN transmit. Bit 1 to 15 – Reserved

Table 6.4 – IDS Copy - PGN Control

6.6.8. ETHERNET/IP IO DEVICE STATUS

The user can select to copy the Data, or Status, from the EtherNet/IP connection.

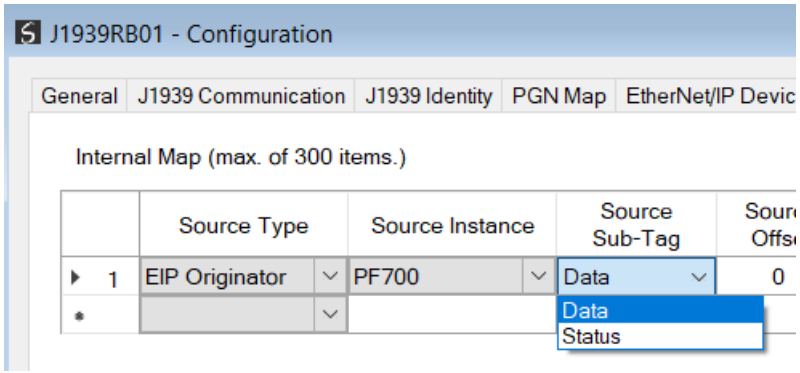


Figure 6.33 – IDS Copy – EtherNet/IP Originator Status

When selecting the Status, the format of the Status information is shown below:

Parameter	Data Type	Description
EtherNet/IP Originator Connection Status	DINT	Bit 0 – Connection Ok

Table 6.17 – EtherNet/IP Originator Connection Status

6.6.9. PGN – Encoded/Decoded

The J1939 Router will encode/decode and scale the raw PGNs to specific formats when using standard SAE PGNs.

When the module is operating as an EtherNet/IP target, the user must use the Recommend button in the *Internal Map* in the module configuration. Then when generating the L5X import file for Logix, Slate will automatically apply the required formatting such that the user does not require to know how the raw standard PGN is formatted because the tag structure will already be in that format.

When using Modbus or EtherNet/IP Originator, the user will need to know what the format is of the decoded/encoded standard PGN such to ensure that the data can be accessed in the correct format and offset.

To view the structure of the decoded PGN, the user can right-click on the module in Slate and select *Export PGN Details*.

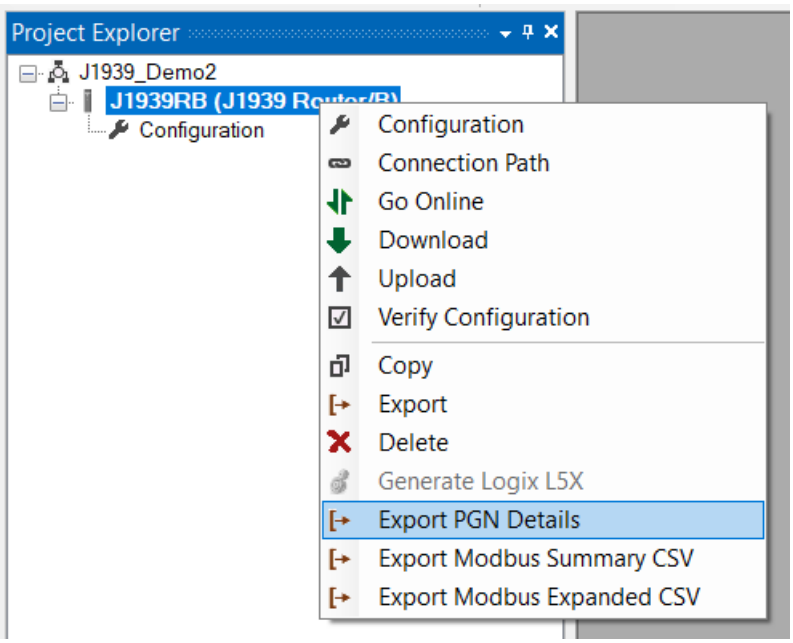


Figure 6.34 – Standard SAE PGN Decoded Structure

The structure and scaling for each PGN will be in the exported CSV file. Below is an example where the raw PGN61444 is received and decoded and scaled to the format below. When accessing the PGN in the internal mapping, the user will need to user the decoded format below and **not** the raw 8-byte format.

PGN Id	PGN Name	Node	Total Size	SPN Index	Byte Offse	SPN Name	Data Type	Scale Gain	Scale Offs	Raw Bit Length	Raw Bit Offset
61444	CN000:61444	0	22	0	0	EngineTorqueMode	SINT	1	0	0	4
61444	CN000:61444	0	22	1	4	ActualEnginePercentTorqueFractional	REAL	0.125	0	4	4
61444	CN000:61444	0	22	2	8	DriversDemandEnginePercentTorque	INT	1	-125	8	8
61444	CN000:61444	0	22	3	10	ActualEnginePercentTorque	INT	1	-125	16	8
61444	CN000:61444	0	22	4	12	EngineSpeed	REAL	0.125	0	24	16
61444	CN000:61444	0	22	5	16	SourceAddressofControllingDeviceforEngin	INT	1	0	40	8
61444	CN000:61444	0	22	6	18	EngineStarterMode	SINT	1	0	48	4
61444	CN000:61444	0	22	7	20	EngineDemandPercentTorque	INT	1	-125	56	8

Figure 6.35 – CSV Export PGN Details – Example PGN 61444

When using a custom PGN (where the custom box has been ticked in the PGN Map), then the data will not be decoded, and the raw data will be used.

7. DIAGNOSTICS

7.1. LEDS

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

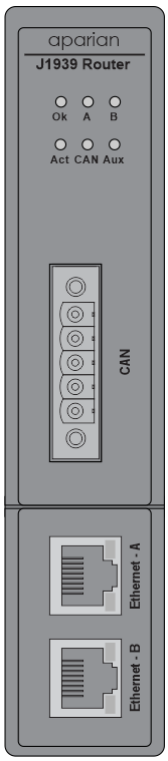


Figure 7.1 – J1939 Router/B front view

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 briefly **flashing red**, and then returning to either flashing green or solid green, then there is a duplicate IP address on the Ethernet network similar to that of the local module. 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 indicates if the module is currently in an active state where the primary interface is operational. Solid Green – The local J1939 Router/B is in an operating state. Off - The local J1939 Router/B is **not** in an operating state.
CAN	The CAN LED indicates the activity on the J1939 network. Flashing Red – A corrupted or incorrect J1939 packet was received. Flashing Green – A valid J1939 packet was received or sent. Off – No J1939 packets are being received or sent.
Aux	The Aux LED will flash each time there was activity on any of the primary interfaces. Flashing Red – A corrupted or incorrect packet was received on one of the Primary Interfaces (EtherNet/IP, Modbus TCP/RTU232/RTU485). Flashing Green – A valid packet was received on one of the Primary Interfaces (EtherNet/IP, Modbus TCP/RTU232/RTU485). Off – No activity.

Table 7.1 - Module LED operation

7.2. MODULE STATUS MONITORING IN SLATE

The J1939 Router/B 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.

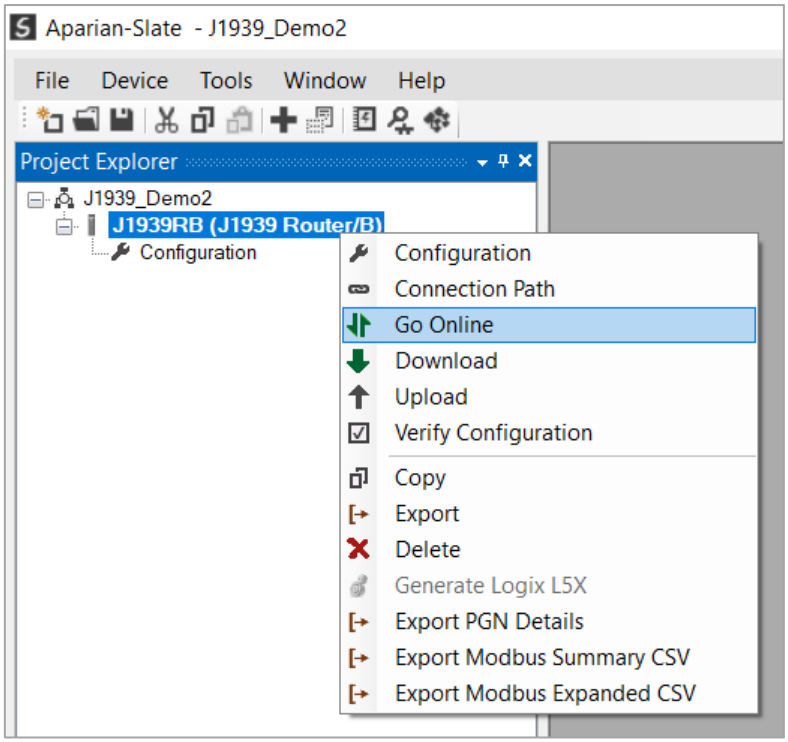


Figure 7.2 - Selecting to Go Online

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

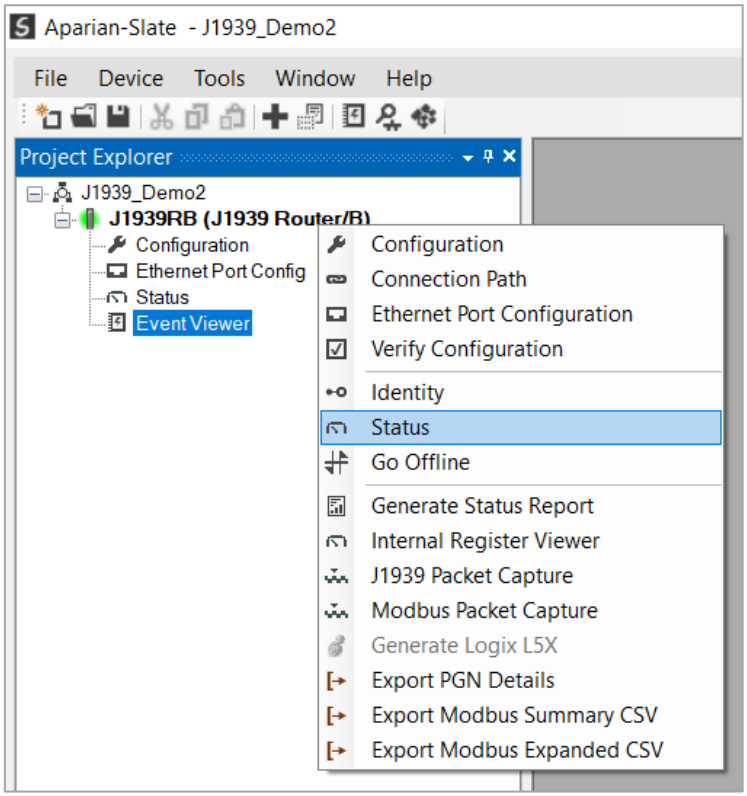


Figure 7.3 - Selecting online Status

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.

7.2.1. GENERAL

The General tab displays the general status for the local J1939 Router/B module.

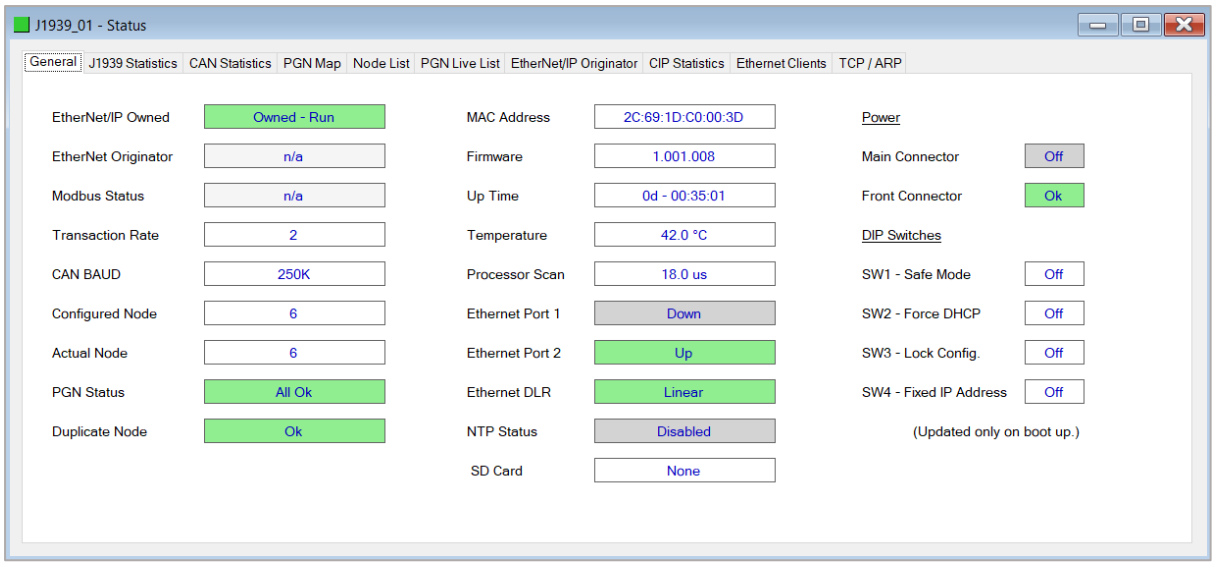


Figure 7.4 - Status monitoring – General

The General tab displays the following general parameters:

Parameter	Description
EtherNet/IP Owned	When the module is configured as an EtherNet/IP Target, this will indicate if the module is owned by an EtherNet/IP connection originator, as well as the Run/Program state of the controller.
EtherNet/IP Originator	When the module is configured as an EtherNet/IP Originator, this will show if all the Class 1 and Explicit Message connections to EtherNet/IP target devices are established and returning valid data.
Modbus Status	When the module is operating as a **Modbus Server**, this parameter will indicate that the module has received a valid Modbus request within the Modbus inactivity time. When the module is operating as a **Modbus Client**, this parameter will indicate that all the mapping items in the Modbus Auxiliary Map are executing correctly.
Transaction Rate	Number of J1939 transactions executed per second.
CAN BAUD	Current Baud Rate of the CAN Bus.

Configured Node	The configured PGN node number.
Actual Node	The current PGN node number.
PGN Status	Indication of the status of the produce and consume PGNs. If all the PGNs are being sent and received successfully, then the status will indicate *All Ok.*
Duplicate Node	Indicates if there is a duplicate node on the network. This is only relevant if the *Arbitrary Address Capable* option has not been selected.
MAC Address	Displays the module's unique Ethernet MAC address.
Firmware	The version of the module's firmware.
Up Time	Indicates the elapsed time since the module was powered-up.
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 module has locked onto the target time server. **Not Locked** NTP time synchronization has been enabled and the module has not locked onto the target time server.
SD Card	Indicates if a SD Card is present or not.
Power	Indication from which port the module is receiving power. **Main Connector** The power is present at the bottom connector. **CAN Connector** The power is present at the CAN connector.
DIP Switch Position	The status of the DIP switches when the module booted. **NOTE**: 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

7.2.2. J1939 STATISTICS

The J1939 Statistics tab displays the statistics associated with the J1939 communication network.

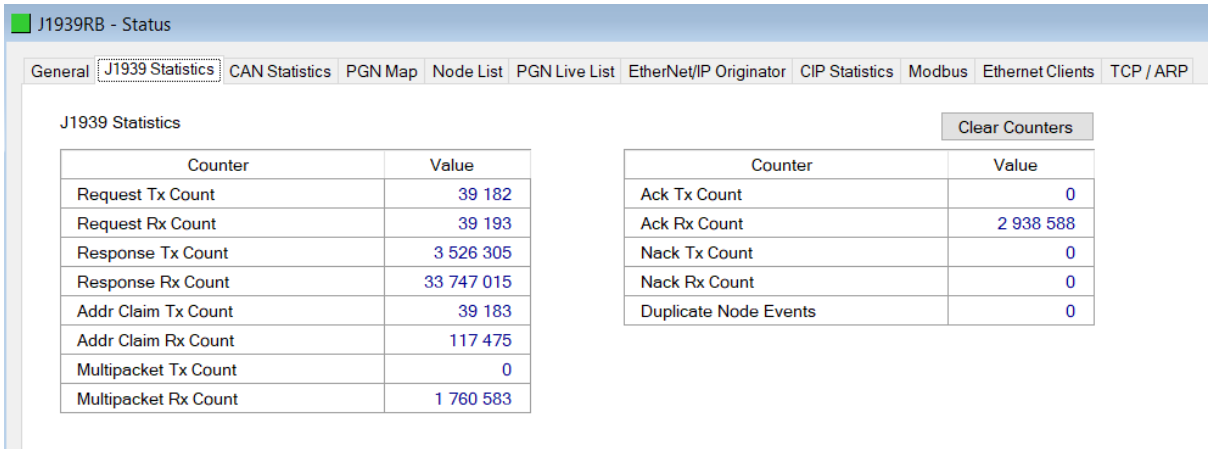


Figure 7.5 - Status monitoring – J1939 Statistics

Statistic	Description
Request Tx Count	J1939 PGN Request Transmitted count.
Request Rx Count	J1939 PGN Request Received count.
Response Tx Count	J1939 PGN Response Transmitted count.
Response Rx Count	J1939 PGN Response Received count.
Addr Claim Tx Count	J1939 Address Claim messages sent.
Addr Claim Rx Count	J1939 Address Claim messages received.
Multipacket Tx Count	J1939 Connection Management packets sent.
Multipacket Rx Count	J1939 Connection Management packets received.
Ack Tx Count	J1939 Acknowledge messages sent.
Ack Rx Count	J1939 Acknowledge messages received.
Nack Tx Count	J1939 Negative Acknowledge messages sent.
Nack Rx Count	J1939 Negative Acknowledge messages received.
Duplicate Node Events	The number of times a duplicate node has been found on the J1939 network.

Table 7.3 – J1939 statistics

7.2.3. CAN STATISTICS

The CAN Statistics tab displays the statistics associated with the J1939 communication network.

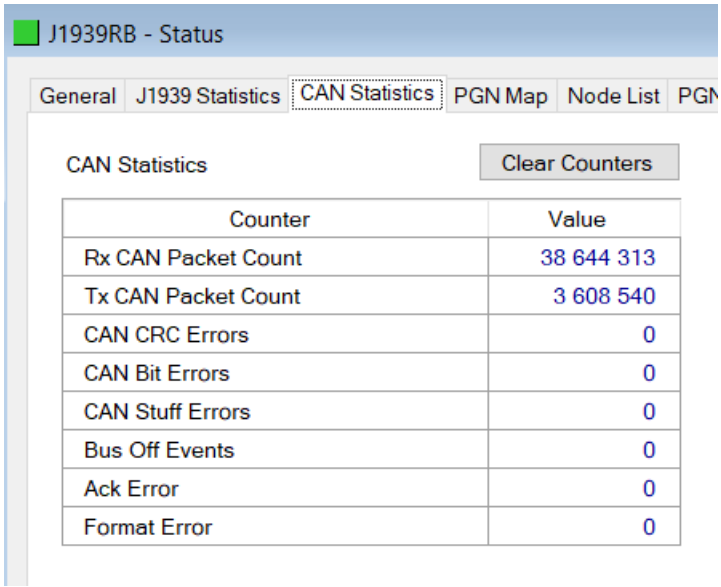


Figure 7.6 - Status monitoring – J1939 Statistics

Statistic	Description
Rx CAN Packet Count	The number of CAN packets received.
Tx CAN Packet Count	The number of CAN packets sent.
CAN CRC Errors	The number of received packets where the packet checksum does not match the calculated packet checksum. This implies one or more bits in the frame have been corrupted. May indicate an intermittent CAN cable connection or induced electrical noise.
CAN Bit Errors	The number of transmitted bits where the transmitted bit state does not match the instantaneous read-back state. This may indicate that another device is transmitting at the same time, or one of the CAN lines shorted to power, shorted together, or incorrectly termination.
CAN Stuff Errors	The number of frames received where the required inserted (opposite) bit was not received after 5 identical bits. This may be an indication of bus noise, bad physical cable connection, or a faulty device.
Bus Off	The number of Bus-Off Events. A node will enter the Bus-Off state when the transmit Error Count exceeds a certain threshold (typically 125). This may indicate a cable break or loss of power causing the Scanner to enter the Bus-Off state.
Ack Error	The number of transmitted bits that are not read-back and acknowledged by at least one other node. Typically seen when the device is alone on the bus, and there is no other node to acknowledge the frame.
Format Error	The number of received frames where the fixed format part of a received frame is invalid, or the Frame structure is non-standard. (Frame size/type start delimiter etc.) May indicate an intermittent CAN cable connection, induced electrical noise or a node present with an incorrect BAUD rate.

Table 7.4 – CAN statistics

7.2.4. EtherNet/IP Explicit

The EtherNet/IP Explicit Statistics tab displays the statistics associated with EtherNet/IP Device explicit mapping.



NOTE: This tab is only applicable when the module has the Primary Interface set to EtherNet/IP Originator.

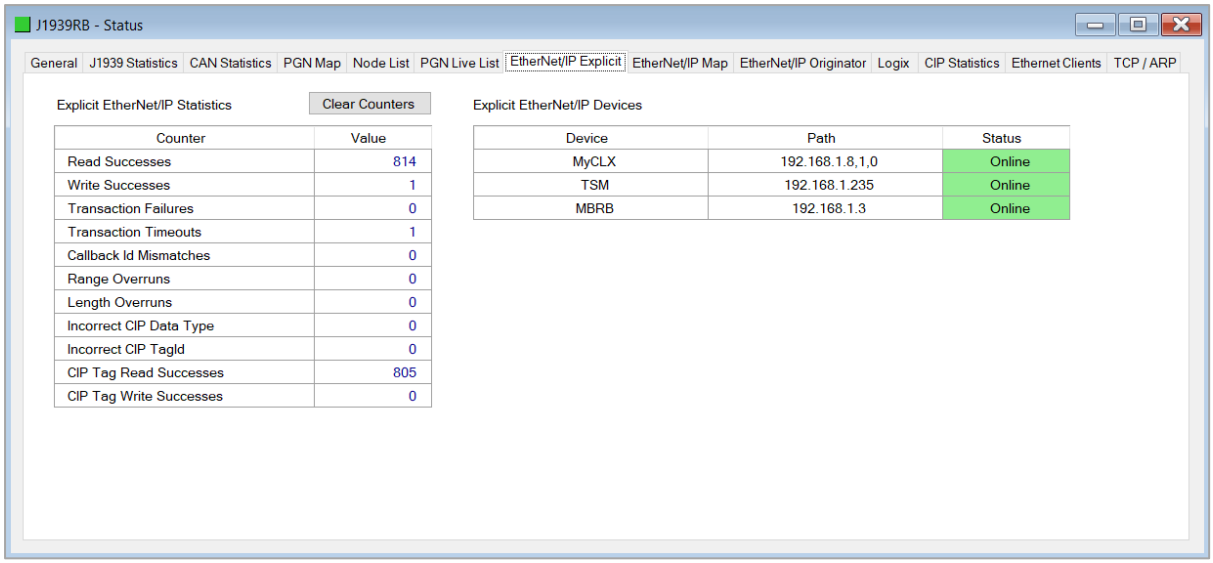


Figure 7.7 - Status monitoring – EtherNet/IP Explicit

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 UCMM or Class 3 response does not match the request.
Range Overruns	The number of times the returned data amount runs over the max Internal Data Space.
Length Overruns	The number of times the returned data is greater than the configured get length.
Incorrect CIP Data Type	When the Explicit Message Function is a Tag Read/Write, this statistic will increase when the incorrect CIP data type was returned in the response.
Incorrect CIP Tag Id	When the Explicit Message Function is a Tag Read/Write, this statistic will increase when the incorrect CIP UDT tag ID was returned in the response.
CIP Tag Read Successes	When the Explicit Message Function is a Tag Read, this statistic will increase when there was a successful Logix Tag Read.
CIP Tag Write Successes	When the Explicit Message Function is a Tag Write, this statistic will increase when there was a successful Logix Tag Write.

Table 7.5 – EtherNet/IP Explicit Statistics

7.2.5. ETHERNET/IP MAP

The EtherNet/IP Map tab displays the success counts for each EtherNet/IP device mapped item.

NOTE: This tab is only applicable when the module has the Primary Interface set to EtherNet/IP Originator.

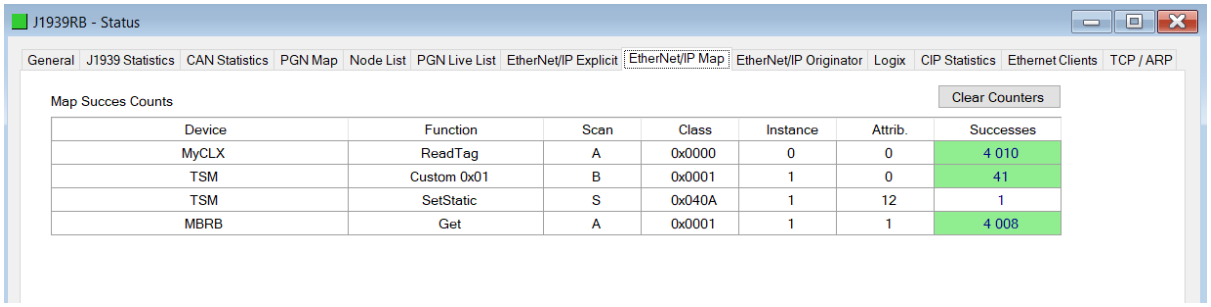


Figure 7.8 - Status monitoring – EtherNet/IP Map

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.

7.2.6. ETHERNET/IP ORIGINATOR

The EtherNet/IP Originator tab displays the EtherNet/IP Class 1 connection status and statistics for each configured EtherNet/IP device.

NOTE: This tab is only applicable when the module has the Primary Interface set to EtherNet/IP Originator.

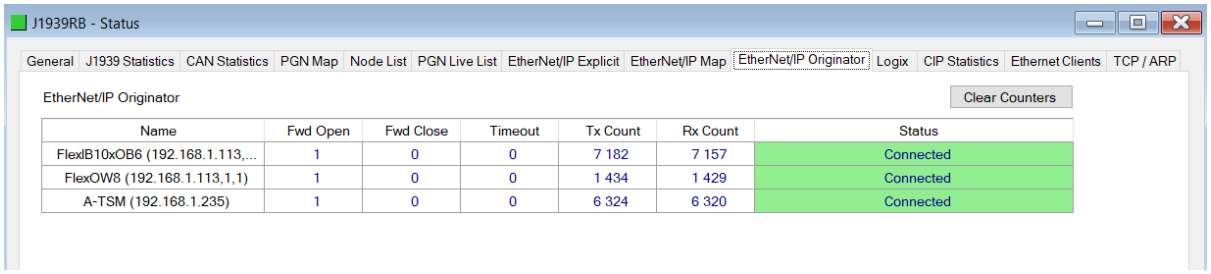


Figure 7.9 - Status monitoring – EtherNet/IP Originator

Statistic	Description
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, for example: Ownership Conflict Connection In Use Or Duplicate Forward Open
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.

Table 7.6 – EtherNet/IP Class 1 status and statistics

7.2.7. LOGIX

The Logix tab displays the Logix statistics for the explicit EtherNet/IP Tag Read/Write message instructions.

NOTE: This tab is only relevant when the module has the Primary Interface set to EtherNet/IP Originator and Logix Tag Read/Write functions are being used in the EtherNet/IP Explicit Message Map.

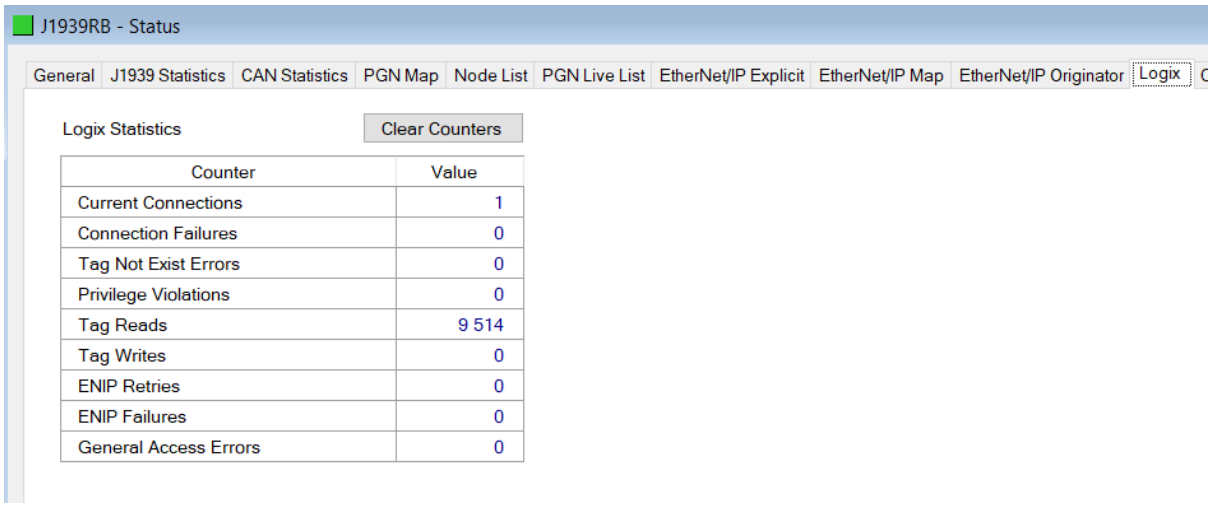


Figure 7.10 - Status monitoring – Logix Statistics

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. Note: 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 J1939 Router/B module.
Tag Writes	The number of tag write transactions executed by the J1939 Router/B module.
ENIP Retries	This count increases when no response is received from the Logix Controller within the ENIP timeout.
ENIP Failures	This count increases when the ENIP Retry Limit is reached and no response has been received from the Logix Controller.
Access General Error	This count increases when a tag cannot be accessed for any other reason not reported above.

Table 7.7 – Logix Statistics Tab

7.2.8. MODBUS

The Modbus tab displays the Modbus statistics for the Modbus Read and Write Message Exchanges when the module is a Modbus TCP Server or Modbus TCP Client.

NOTE: The Modbus statistics tab is only displayed if the module has the primary interface set to Modbus TCP Client or Modbus TCP Server.

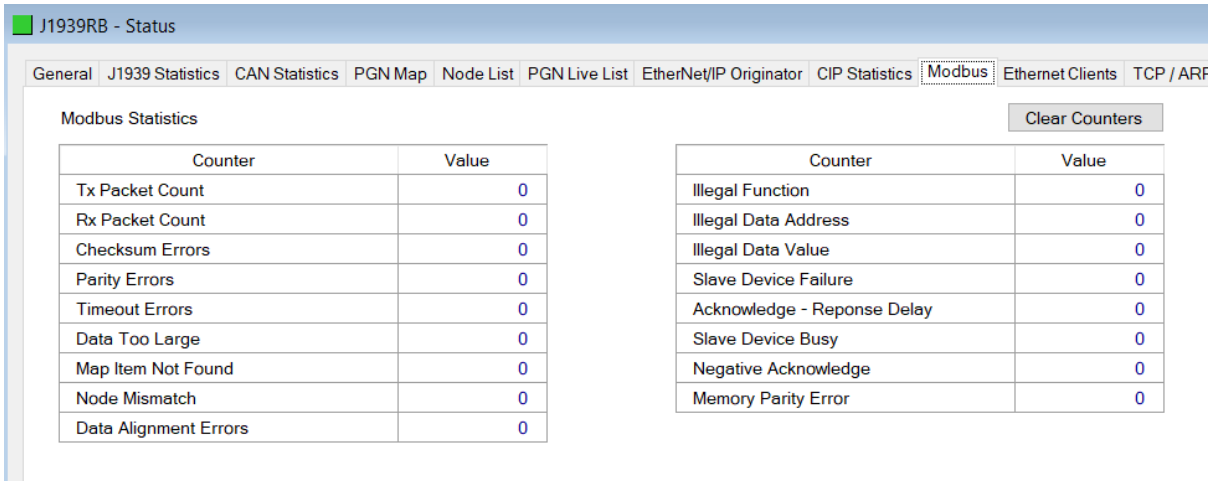


Figure 7.11. - Status monitoring – Modbus Statistics

The Modbus tab displays the following parameters:

Statistic	Description
Tx Packet Count	The number of Modbus packets sent by the module.
Rx Packet Count	The number of Modbus packets received by the module.
Checksum errors	The number of corrupted Modbus packets received by the module.
Parity errors	The number of bytes with parity errors received by the module.
Timeout Errors	The number of message response timeouts the module has encountered.
Data Too Large	The number of Modbus requests or responses where the data was too large to process.
Map Item Not Found	The number of Modbus requests did not match any mapped items.
Node Mismatch	The received Modbus request did not match the module's Modbus node address.
Data Alignment Errors	The Modbus request and associated mapped item is not byte aligned with the destination Logix tag.
Illegal Function	The number of times the Modbus device responded with an Illegal Function exception.
Illegal Data Address	The number of times the Modbus device responded with an Illegal Data Address exception.
Illegal Data Value	The number of times the Modbus device responded with an Illegal Data Value exception.
Slave Device Failure	The number of times the Modbus device responded with a Device Failure exception.
Acknowledge –Response Delay	The number of times the Modbus device responded with an Acknowledge exception.

Slave Device Busy	The number of times the Modbus device responded with a Slave Busy exception.
Negative Acknowledge	The number of times the Modbus device responded with a Negative Acknowledge exception.
Memory Parity Error	The number of times the Modbus device responded with a Memory Parity exception.

Table 7.8 - Modbus Statistics Tab

7.2.9. SERIAL STATISTICS

The Serial Statistics tab displays the Serial statistics for the Modbus Read and Write Message Exchanges when the module is a Modbus Server or Modbus Client.

NOTE: The Serial statistics tab is only displayed if the module has the primary interface set to Modbus Client or Modbus Server.

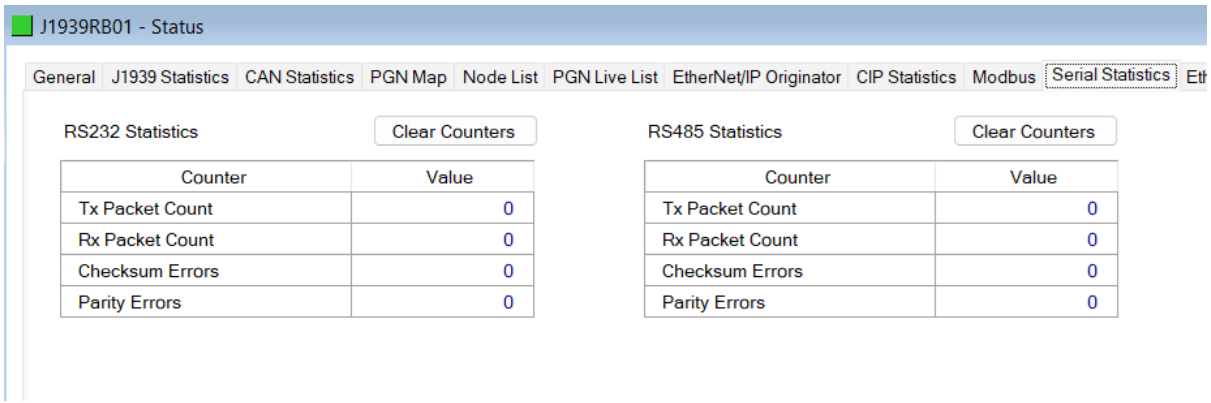


Figure 7.12. - Status monitoring – Serial Statistics

The Serial Statistics tab displays the following parameters:

Statistic	Description
RS232	
Tx Packet Count	The number of RS232 packets sent by the module.
Rx Packet Count	The number of RS232 packets received by the module.
Checksum errors	The number of corrupted RS232 packets received by the module.
Parity errors	The number of RS232 bytes with parity errors received by the module.
RS485	
Tx Packet Count	The number of RS485 packets sent by the module.

Rx Packet Count	The number of RS485 packets received by the module.
Checksum errors	The number of corrupted RS485 packets received by the module.
Parity errors	The number of RS485 bytes with parity errors received by the module.

Table 7.9 - Serial Statistics Tab

7.2.10. CIP STATISTICS

The CIP tab displays the Ethernet CIP statistics.

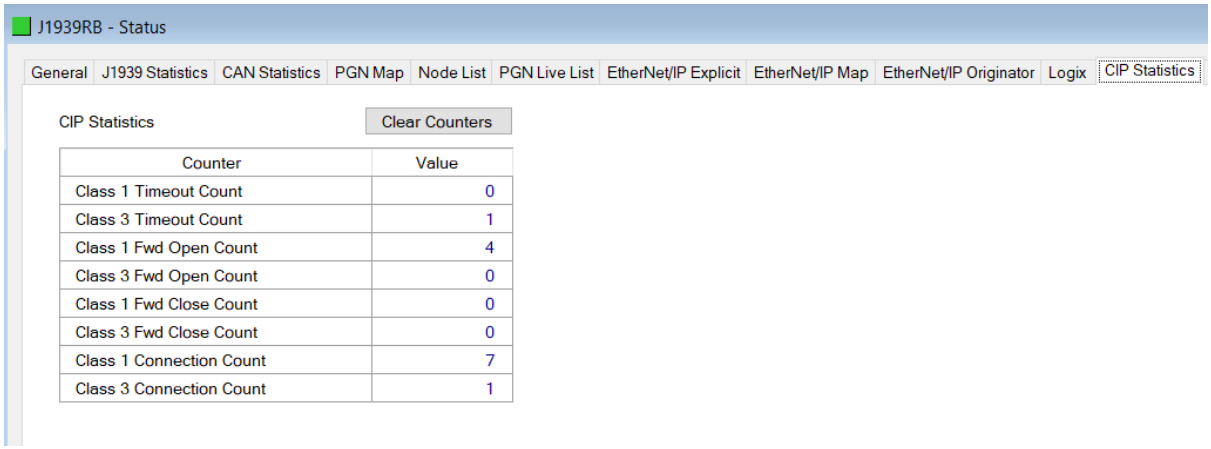


Figure 7.13 - Status monitoring – CIP Statistics

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 7.10 – Mapped Item statistics

7.2.11. ETHERNET CLIENTS

The Ethernet Clients tab displays details of the Ethernet and EtherNet/IP clients connected to the J1939 Router/B.

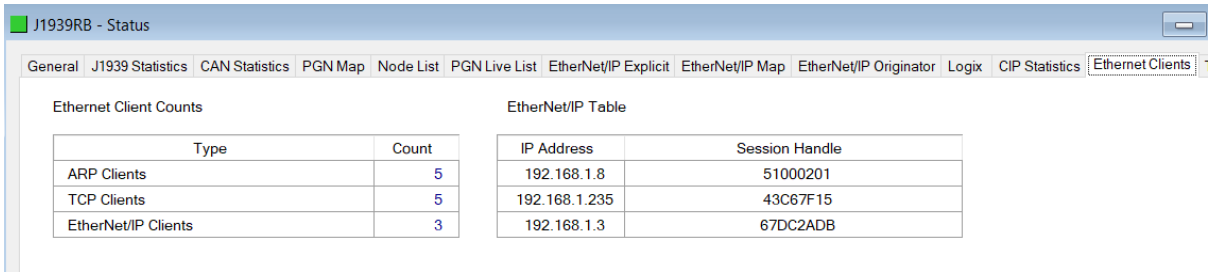


Figure 7.14 –Status monitoring – Ethernet Client Statistics

7.2.12. TCP/ARP

The TCP/ARP tab displays details of the internal Ethernet ARP and TCP lists of the J1939 Router/B.

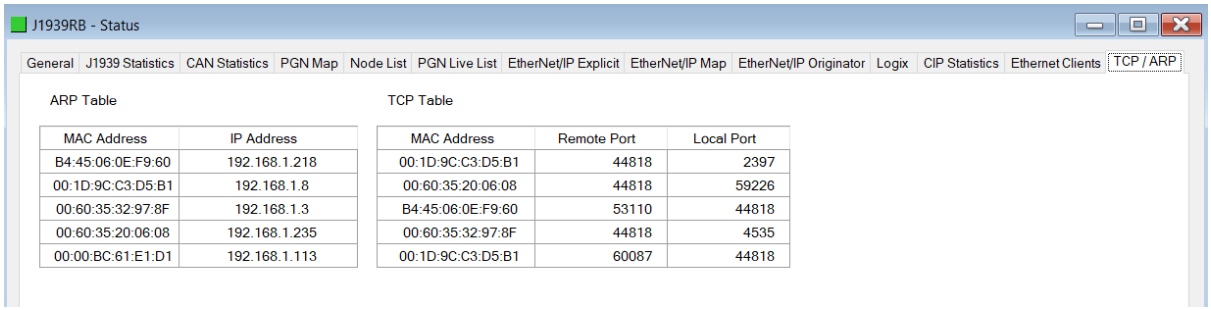
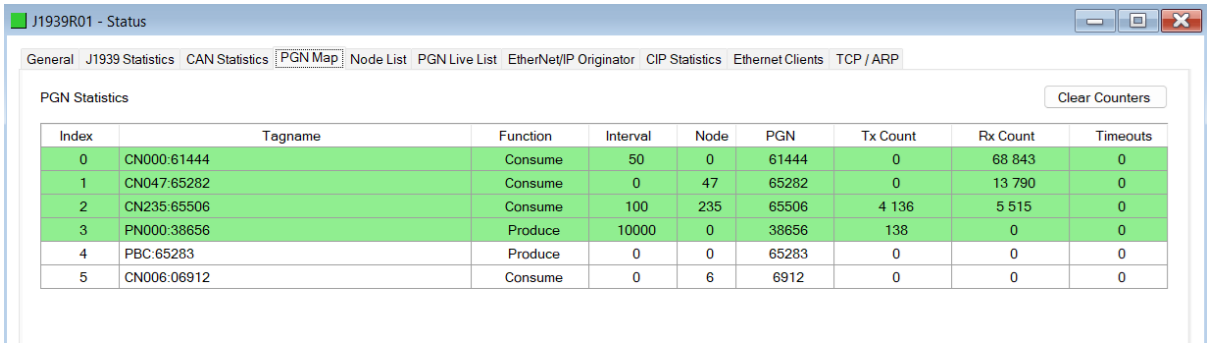


Figure 7.15 – Status monitoring – Ethernet TCP / ARP Statistics

7.3. PGN MAP STATUS

The PGN Map status provides the status and statistics for each item in the configured PGN Map.



Index	Tagname	Function	Interval	Node	PGN	Tx Count	Rx Count	Timeouts
0	CN000:61444	Consume	50	0	61444	0	68 843	0
1	CN047:65282	Consume	0	47	65282	0	13 790	0
2	CN235:65506	Consume	100	235	65506	4 136	5 515	0
3	PN000:38656	Produce	10000	0	38656	138	0	0
4	PBC:65283	Produce	0	0	65283	0	0	0
5	CN006:06912	Consume	0	6	6912	0	0	0

Figure 7.16 – Status monitoring – PGN Map

Statistic	Description
Tagname	The name automatically assigned to the specific PGN in the Tag Map
Function	**The function of the PGN** Consume – PGN is received from the J1939 network. Produce – PGN is sent to the J1939 network.
Interval	How often the PGN is expected to be received or how often the PGN will be sent.
Node	If the PGN is peer-to-peer when producing or consuming, this is the node address of the remote J1939 device.
PGN	The PGN Number.
Tx Count	The number of times the PGN was sent when set to produce or the number of times the PGN was requested when set to consume.
Rx Count	The number of times the PGN was received when consuming or requested when set to produce.
Timeouts	The number of times a PGN was not received within the allocated time when set to consume.

Table 7.11 – PGN Map Item statistics

7.4. J1939 NODE MONITORING

The Node List status window provides the identity as well as the lamp status of the J1939 node. This will indicate if the J1939 device has an error, if the J1939 device is online, and the identity of the J1939 device.

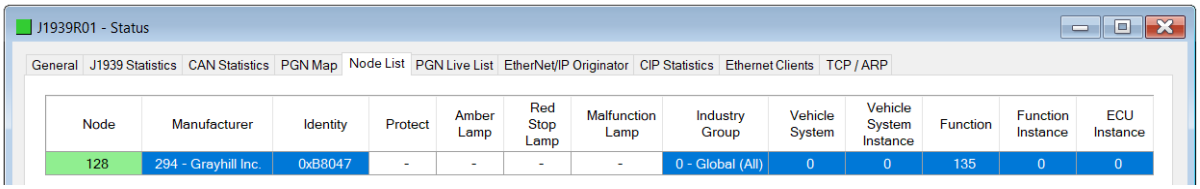


Figure 7.17 – Status monitoring – Node List

Additional information can be viewed by either double-clicking on a node, or by right-clicking and selecting the ***Show Detail*** option.

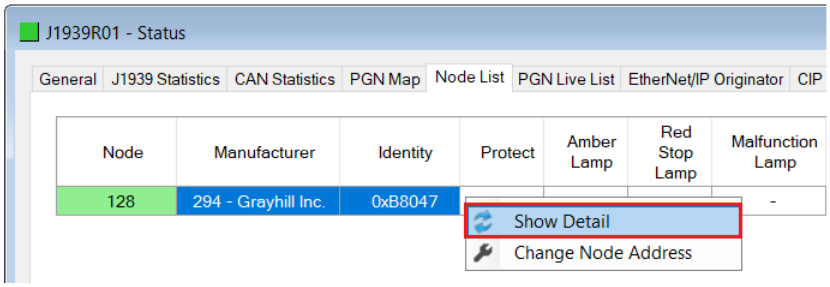


Figure 7.18 – Status monitoring – Node List – Show Detail

The Node Status Detail window will open.

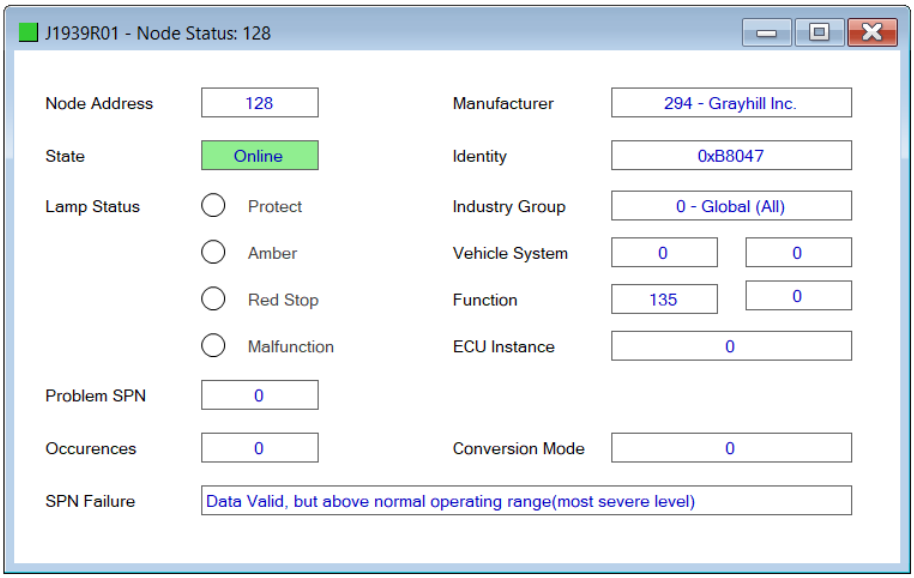


Figure 7.19 – Status monitoring – Node Detail

To change the node number, right-click on the node, and select the ***Change Node Address*** option.

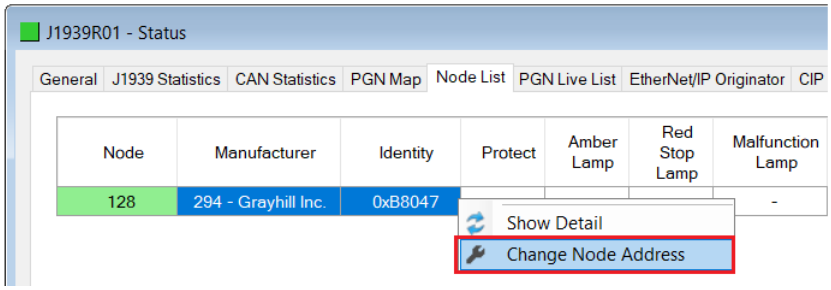


Figure 7.20 – Status monitoring – Node List – Change Node Address option

In the Address Management form, enter the new ***Node Address*** and click the ***Ok*** button.

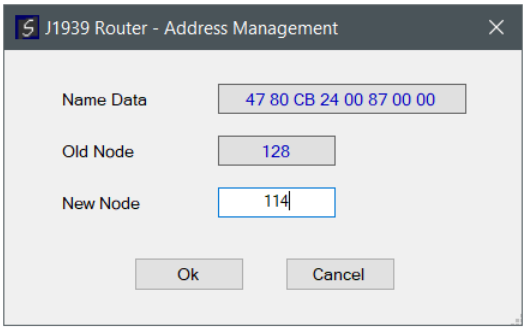


Figure 7.21 – Status monitoring – Address Management

7.5. PGN LIVE LIST

The PGN Live List provides the user with the PGNs being sent from each node on the network. Note that only the first 100 PGNs are displayed. PGN and Node combinations that are included in the mapped configuration are displayed with a blue background.

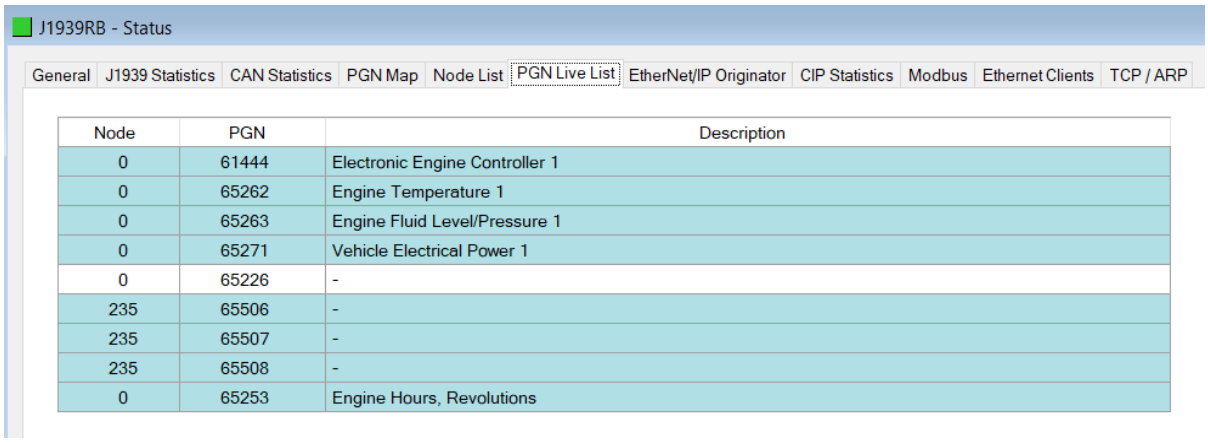


Figure 7.22 – Status monitoring – Node List

7.6. TARGET DEVICE STATUS MONITORING IN SLATE

The J1939 Router/B can also provide individual statistics and status for each for each of the EtherNet/IP Class 1 or J1939 Cyclic IO devices when the Primary Interface is *EtherNet/IP Originator.*

7.6.1. ETHERNET/IP

When online with the module in Slate, right-click on the desired EtherNet/IP device under the *EtherNet/IP Connections* tree in Slate and select *Status*.

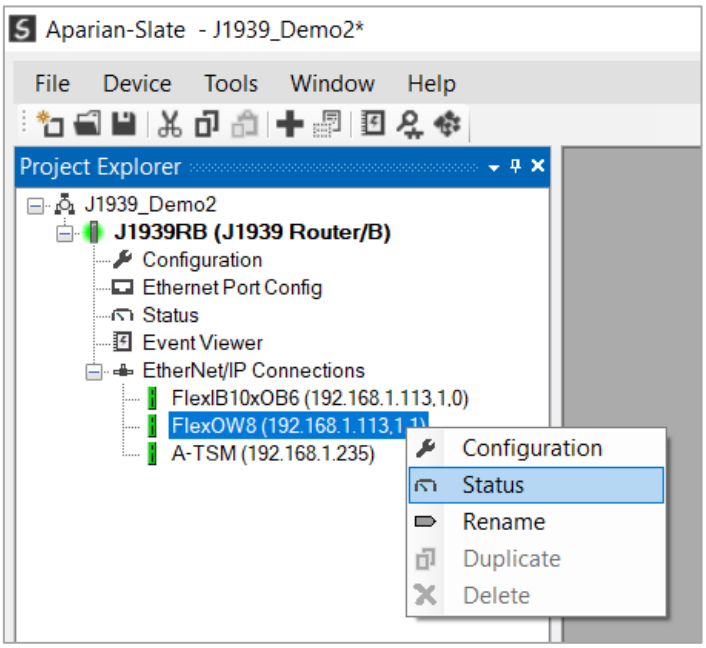


Figure 7.23 – EtherNet/IP Device Status – Status selection

7.6.1.1. GENERAL

The General Status for the EtherNet/IP device shows the connection statistics and parameters associated with the EtherNet/IP Class 1 connection.

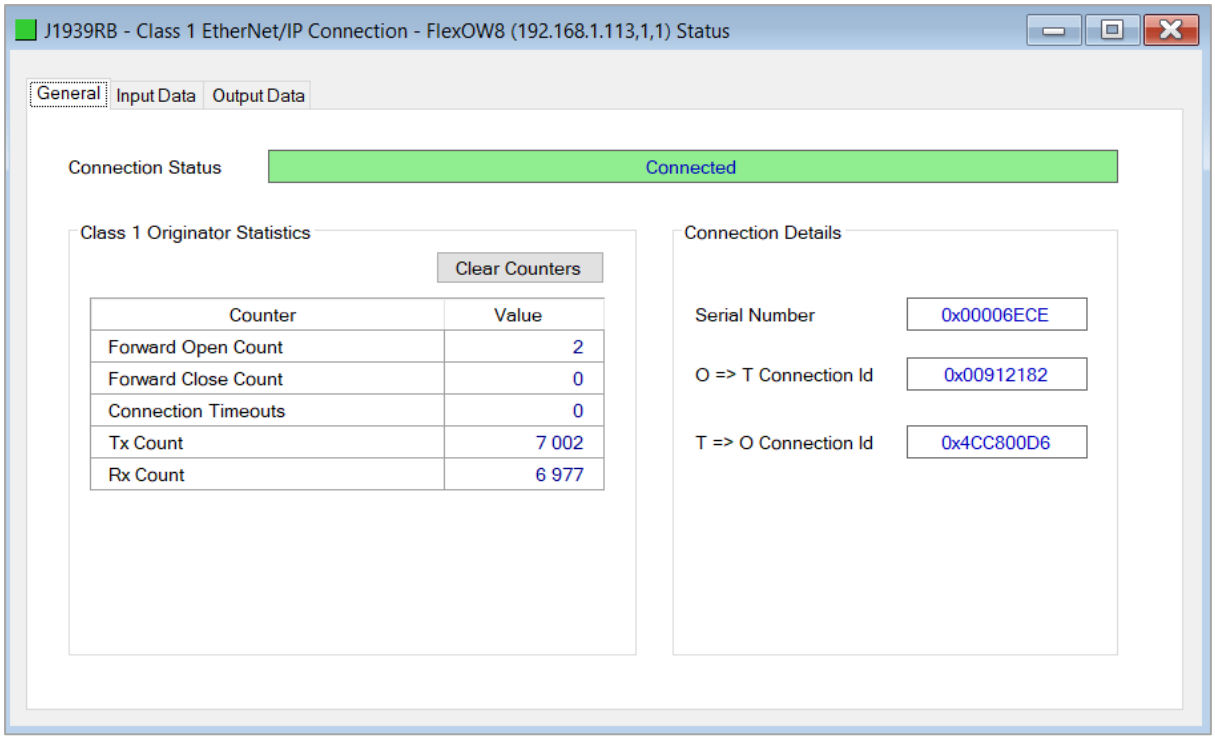


Figure 7.24 – EtherNet/IP Device Status – General Status

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, for example: Connection Status: Invalid Originator To Target Size
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 Originator to Target Connection Id.
T -> O Connection Id	The active connection Target to Originator Connection Id.

Table 7.12 – EtherNet/IP Class 1 Device status and statistics

7.6.1.2. INPUT DATA

The Input Data for the EtherNet/IP device shows the Input Assembly associated with the EtherNet/IP Class 1 connection.

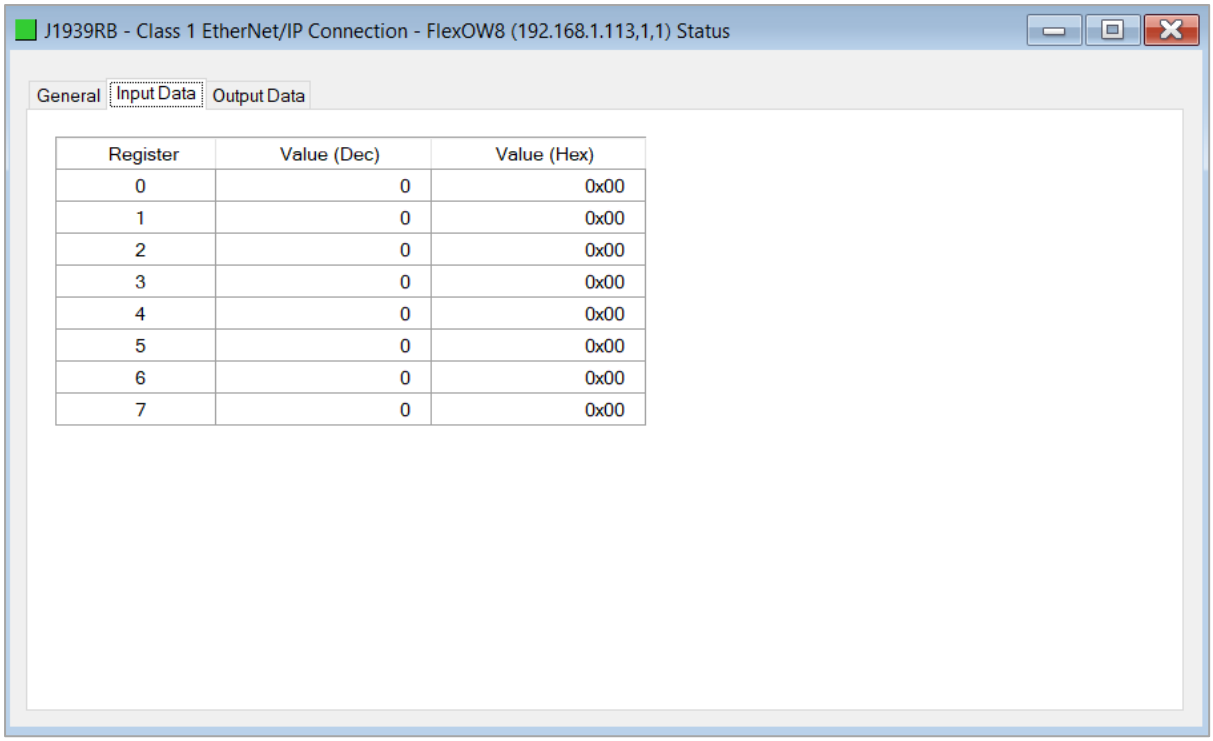


Figure 7.25 – EtherNet/IP Device Status – Input Data

7.6.1.3. OUTPUT DATA

The Output Data for the EtherNet/IP device shows the Output Assembly associated with the EtherNet/IP Class 1 connection.

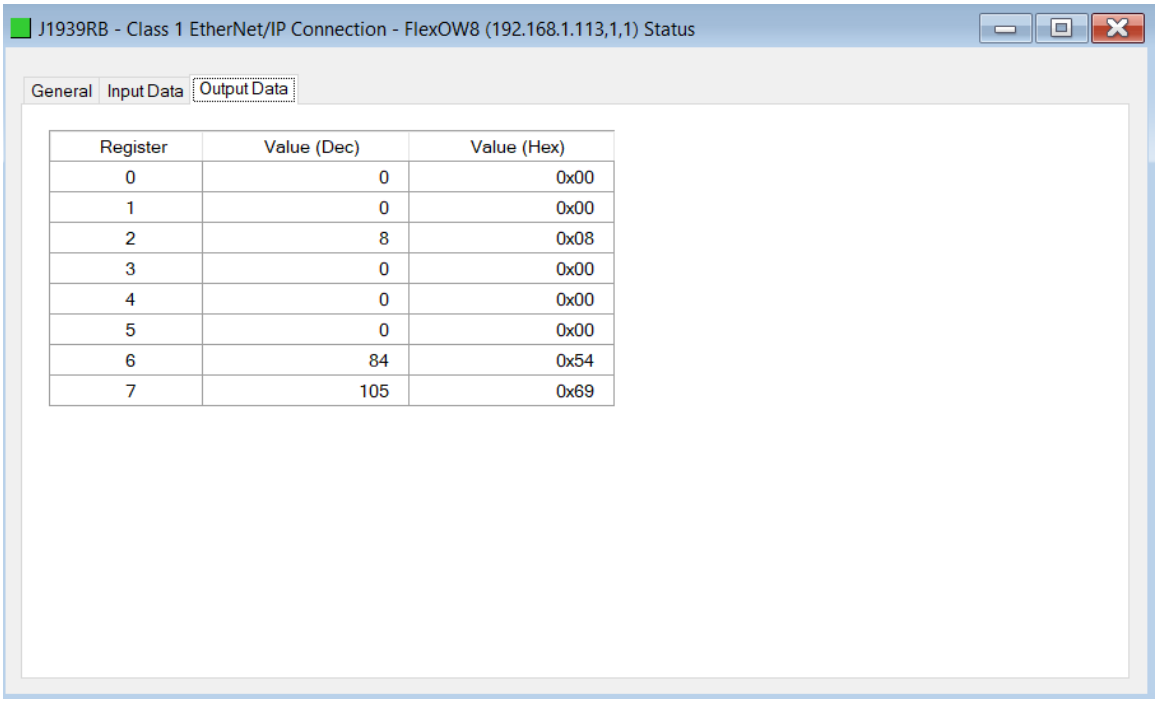


Figure 7.26 – EtherNet/IP Device Status – Output Data

7.7. MODULE EVENT LOG

The J1939 Router/B 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.

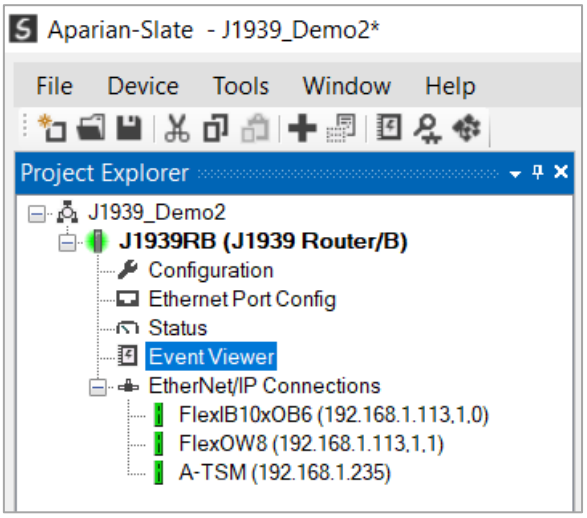
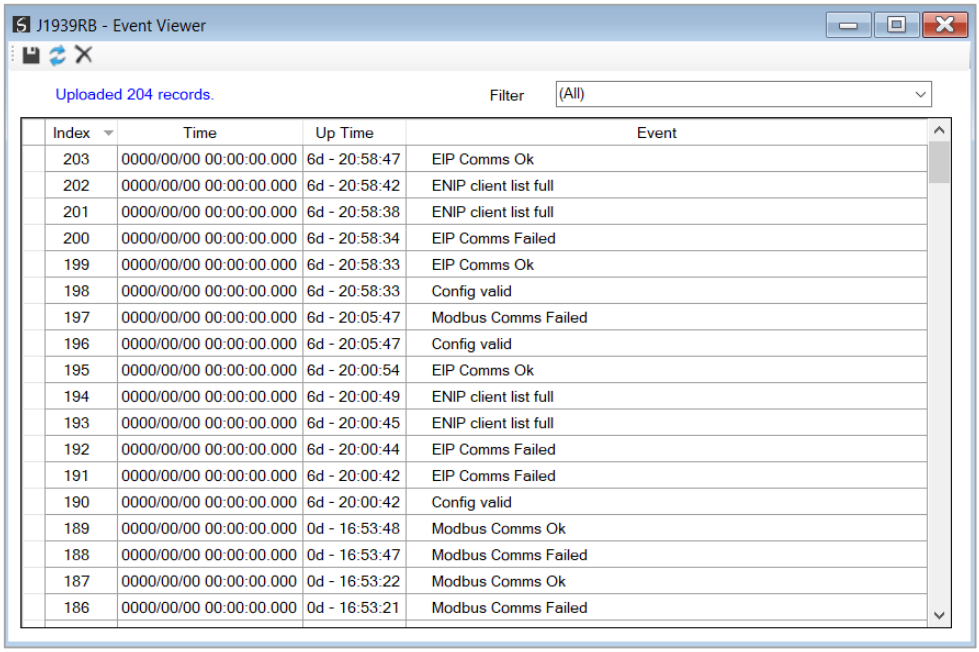


Figure 7.27 - Selecting the module Event Log

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	Time	Up Time	Event
203	0000/00/00 00:00:00.000	6d - 20:58:47	EIP Comms Ok
202	0000/00/00 00:00:00.000	6d - 20:58:42	ENIP client list full
201	0000/00/00 00:00:00.000	6d - 20:58:38	ENIP client list full
200	0000/00/00 00:00:00.000	6d - 20:58:34	EIP Comms Failed
199	0000/00/00 00:00:00.000	6d - 20:58:33	EIP Comms Ok
198	0000/00/00 00:00:00.000	6d - 20:58:33	Config valid
197	0000/00/00 00:00:00.000	6d - 20:05:47	Modbus Comms Failed
196	0000/00/00 00:00:00.000	6d - 20:05:47	Config valid
195	0000/00/00 00:00:00.000	6d - 20:00:54	EIP Comms Ok
194	0000/00/00 00:00:00.000	6d - 20:00:49	ENIP client list full
193	0000/00/00 00:00:00.000	6d - 20:00:45	ENIP client list full
192	0000/00/00 00:00:00.000	6d - 20:00:44	EIP Comms Failed
191	0000/00/00 00:00:00.000	6d - 20:00:42	EIP Comms Failed
190	0000/00/00 00:00:00.000	6d - 20:00:42	Config valid
189	0000/00/00 00:00:00.000	0d - 16:53:48	Modbus Comms Ok
188	0000/00/00 00:00:00.000	0d - 16:53:47	Modbus Comms Failed
187	0000/00/00 00:00:00.000	0d - 16:53:22	Modbus Comms Ok
186	0000/00/00 00:00:00.000	0d - 16:53:21	Modbus Comms Failed

Figure 7.28 - 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.

7.8. WEB SERVER

The J1939 Router/B 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 (J1939 diagnostics).

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

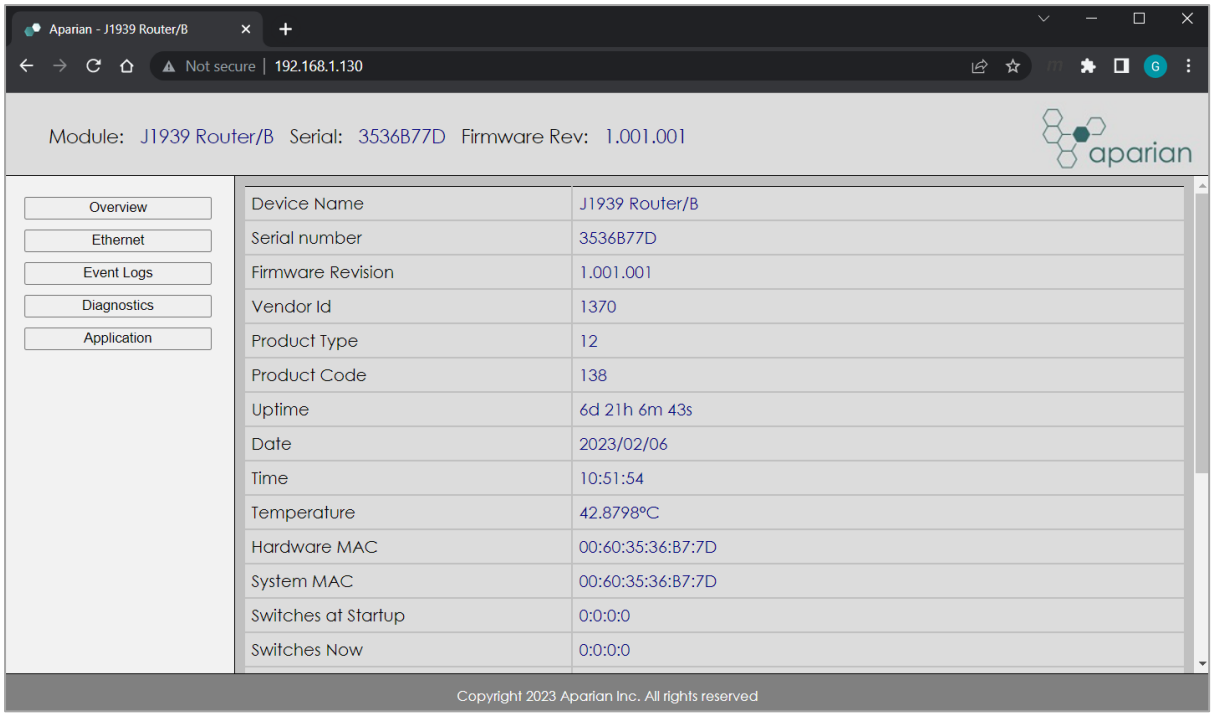


Figure 7.29 – Web interface

7.9. J1939 PACKET CAPTURE

The module provides the capability to capture the J1939 traffic for analysis. This will allow the user and a remote support team to resolve any possible issues on site. To invoke the capture of the module, double-click on the J1939 Packet Capture item in the Project Explorer tree.

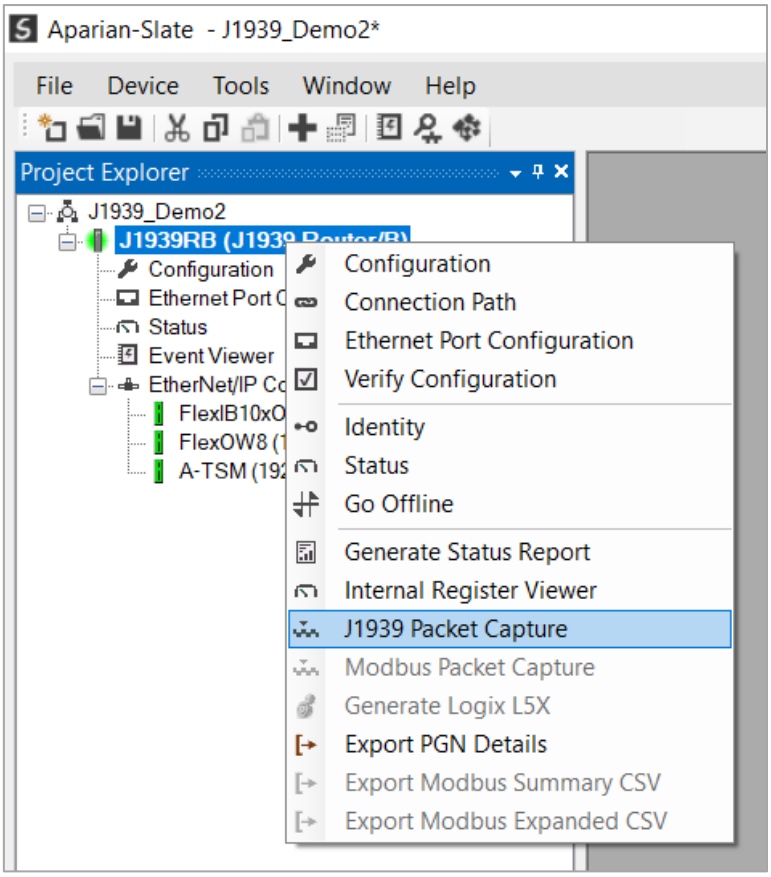


Figure 7.30 - Selecting J1939 Packet Capture

The J1939 Packet Capture window will open and automatically start capturing all J1939 packets.

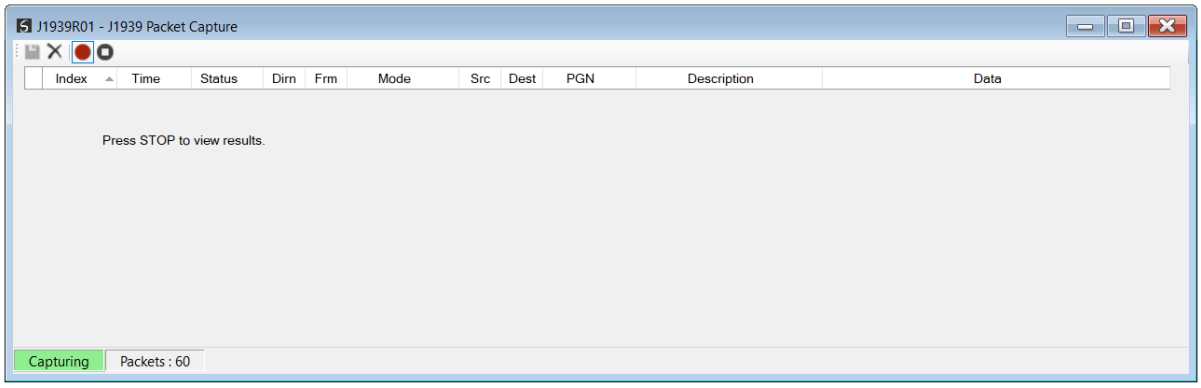


Figure 7.31 – J1939 packet capture

To display the captured J1939 packets, the capture process must first be stopped, by pressing the Stop button.

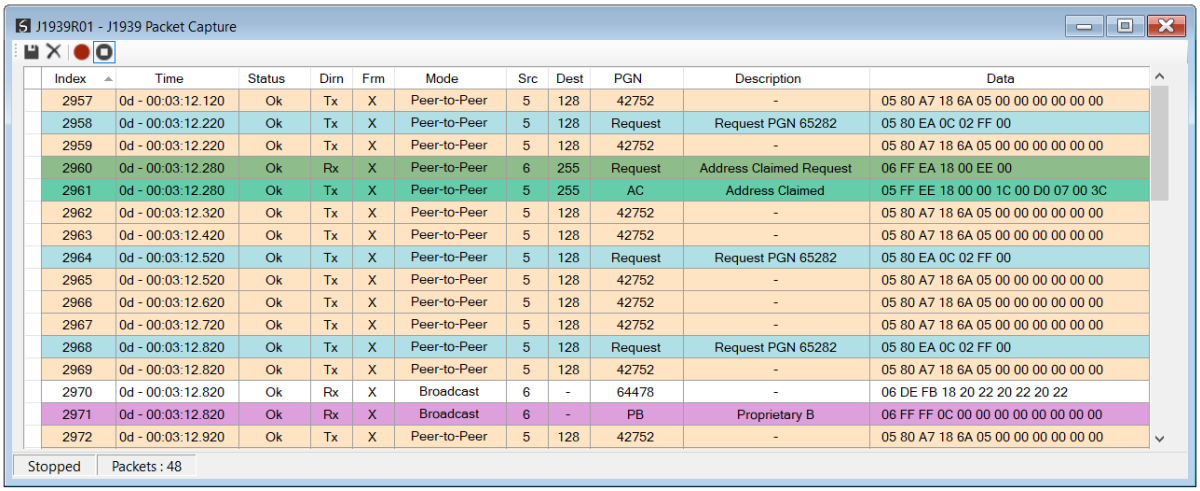


Figure 7.32 – J1939 Packet Capture complete

The captured J1939 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 J1939 constructs and valid checksums.
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
Frm	The format of the CAN header either Standard (S) or Extended (X).
Mode	The message can be either a Peer to Peer or Broadcast message.
Src	J1939 Source Address
Dest	J1939 Destination Address
PGN	The PGN Number used in the Message ID
Description	Description of the packet that was received.
Data	The raw packet data.

Table 7.13 – J1939 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 J1939 Packet Capture files can be viewed by selecting the ***J1939 Packet Capture Viewer*** option in the ***Tools*** menu.

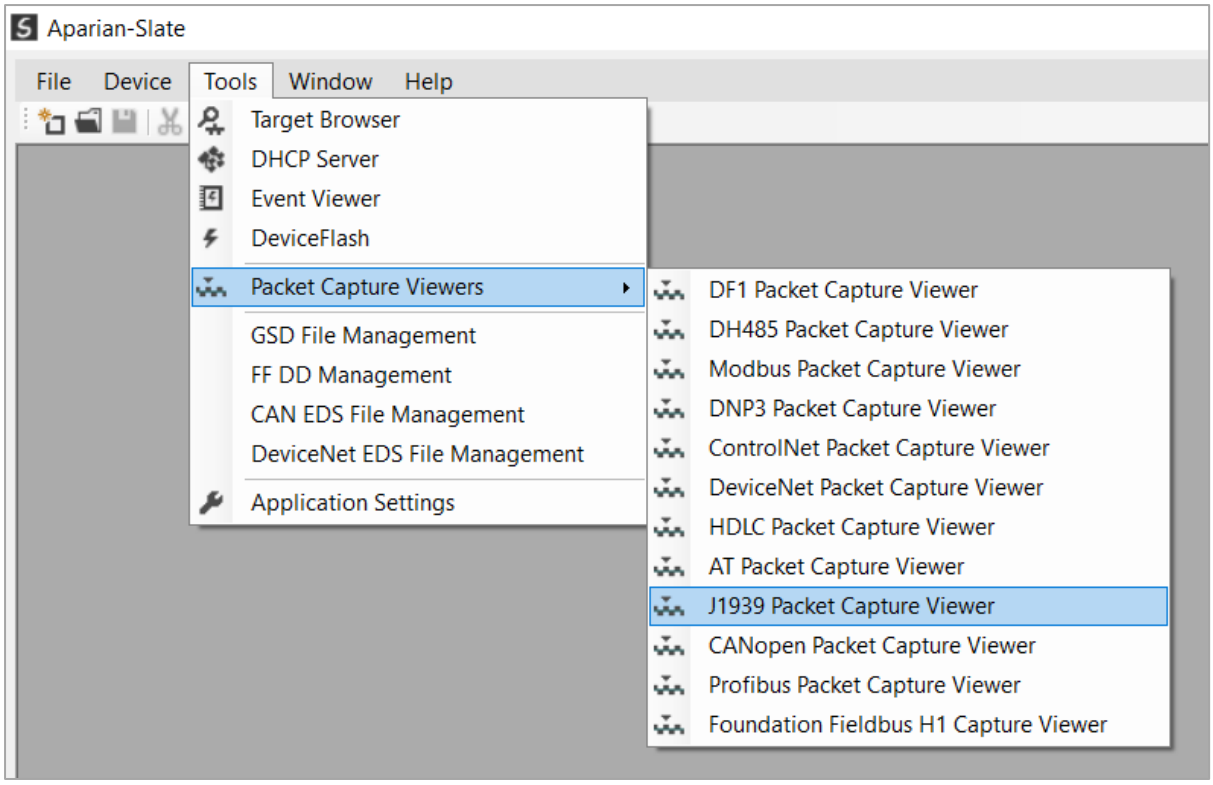


Figure 7.33 - Selecting the J1939 Packet Capture Viewer

7.10. MODBUS PACKET CAPTURE

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

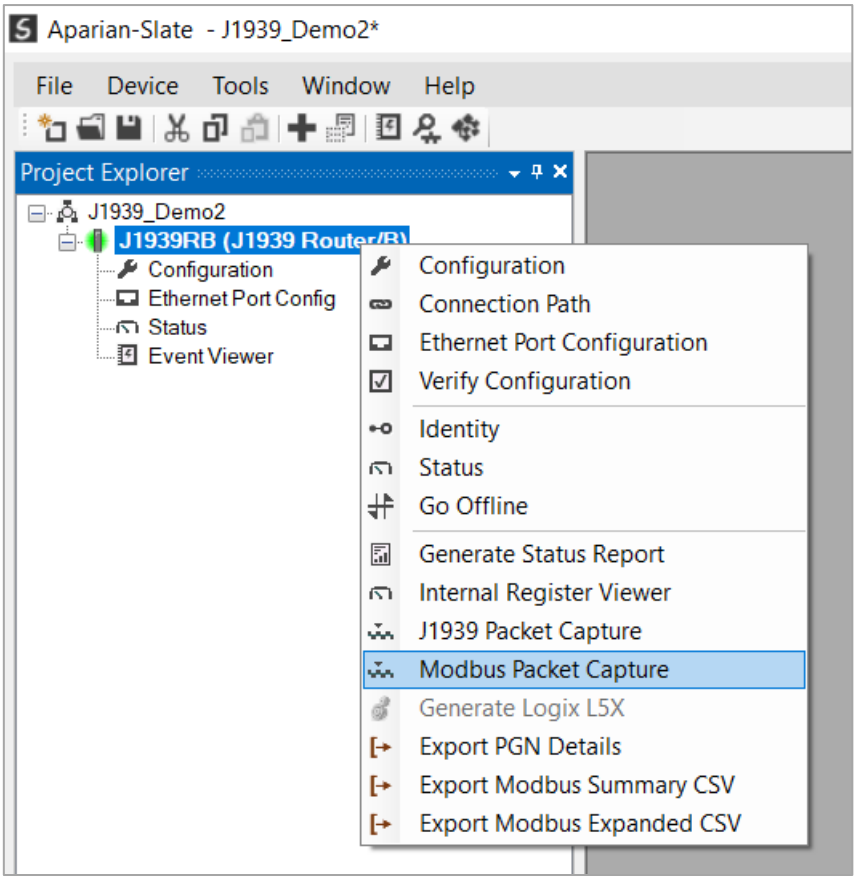


Figure 7.34 - Selecting Modbus Packet Capture

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

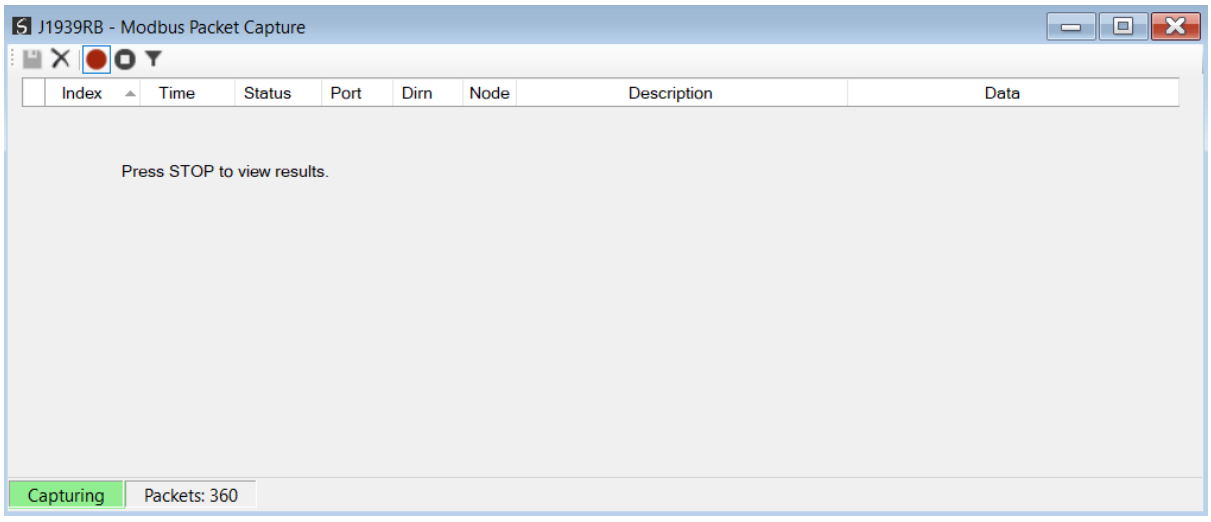


Figure 7.35 – Modbus packet capture

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

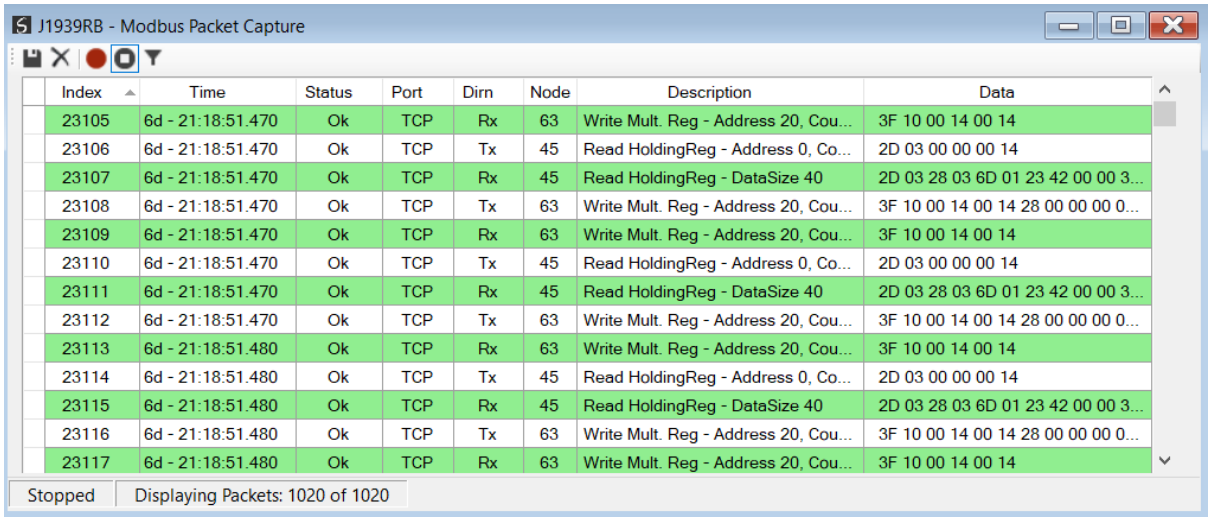


Figure 7.36 – Modbus Packet Capture complete

The captured Modbus 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 Modbus constructs and valid checksums.
Port	Port on where the data was sent or received (TCP, RTU232, RTU485)
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
Node	The Source Node address for the packet
Description	Description of the packet that was received.
Data	The raw packet data.

Table 7.14 – Modbus 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 Modbus Packet Capture files can be viewed by selecting the ***Modbus Packet Capture Viewer*** option in the ***Tools*** menu.

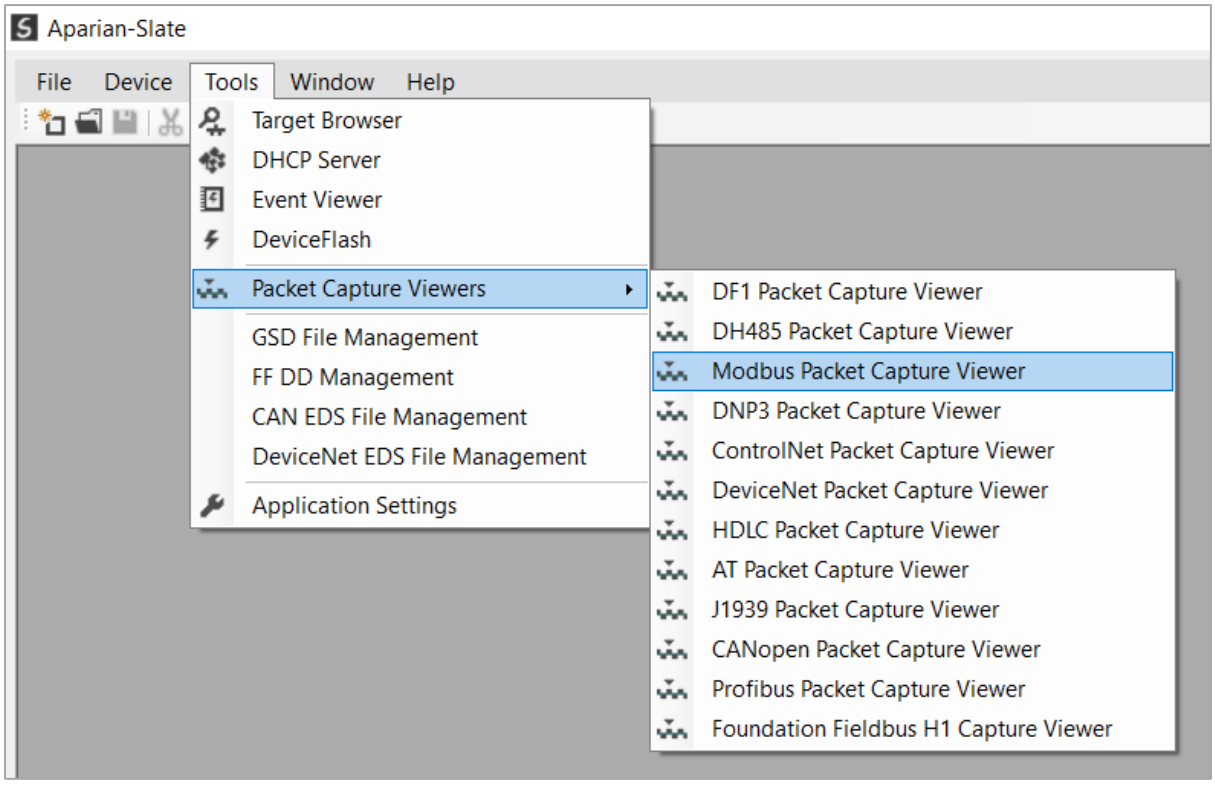


Figure 7.37 - Selecting the Modbus Packet Capture Viewer

7.11. MODULE STATUS REPORT

For assisting with support Slate can generate a status report for the module which is a Microsoft Word compatible document that can be emailed to support. To generate this report the user can right-click on the module (when online in Slate) and select *Generate Status Report*.

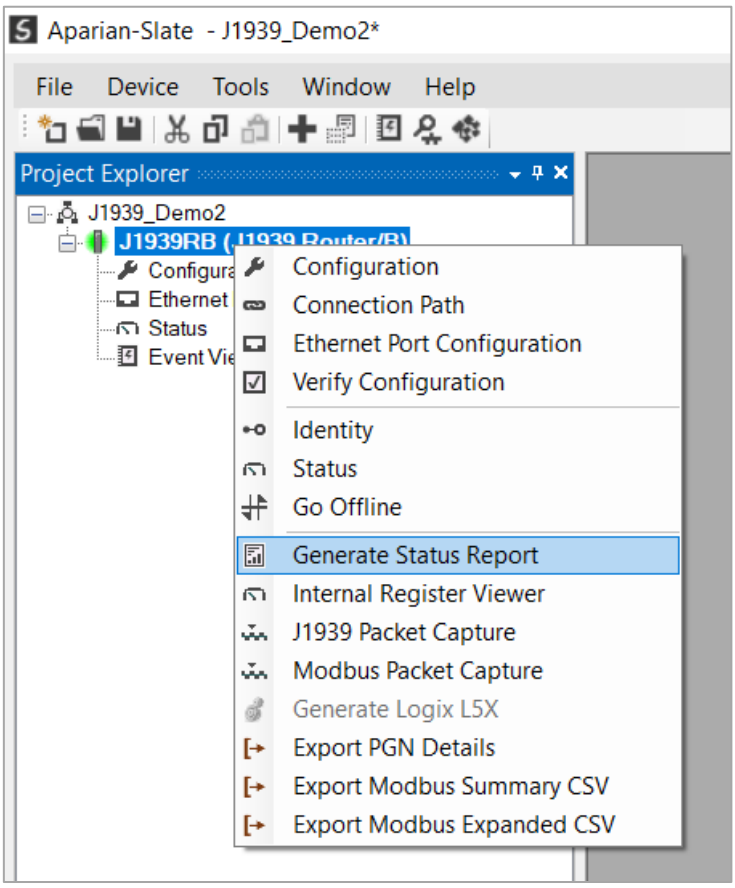


Figure 7.38 – Module Status Report

7.12. MODBUS SUMMARY CSV

Slate can provide a summary of the Modbus registers being used in the form of a CSV file. This will assist the user to better understand where what data is being mapped (based on the J1939 Router/B module configuration). To generate the Modbus Summary CSV, right-click on the module (when online in Slate), and select *Export Modbus Summary CSV*.

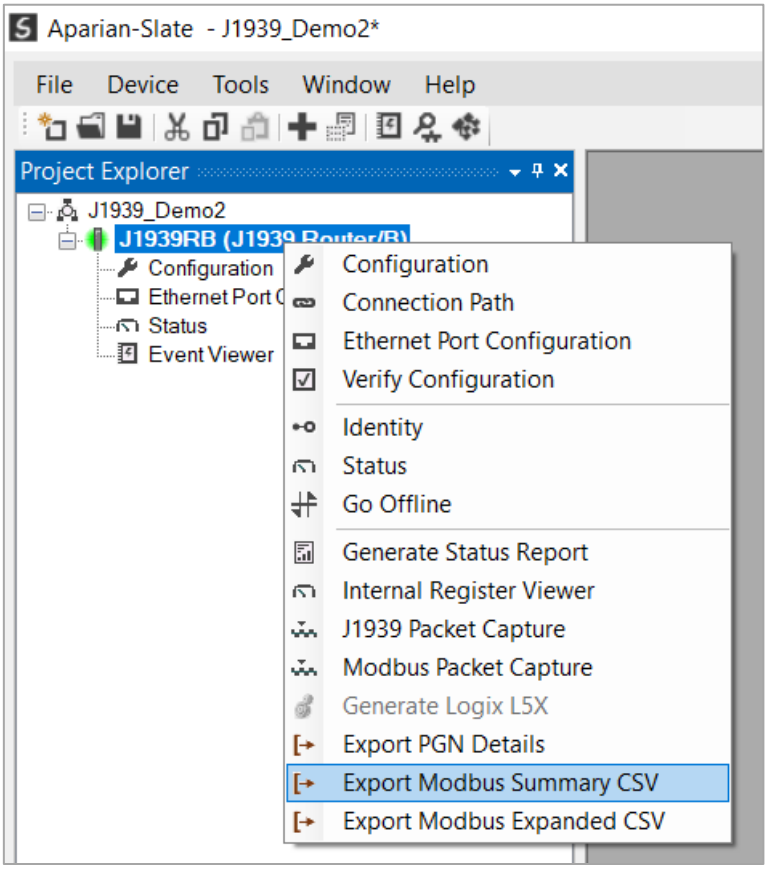


Figure 7.39 – Modbus Summary Report Generation

	A	B	C	D	E	F
1	Reg Type	Modbus Function	Start Address	End Address	Element Count	Description
2	HR	Read	1000	1029	30	System.Status
3	HR	Write	1030	1037	8	PGN.PBC:61463.Data
4	HR	Read	1038	1047	10	J1939 Device.Node 0.Status
5	HR	Read	1048	1058	11	PGN.CN000:61444.Data
6	HR	Read	1059	1059	1	PGN.CN000:61444.Status
7	HR	Read	1060	1073	14	PGN.CN000:65263.Data
8	HR	Read	1074	1074	1	PGN.CN000:65263.Status
9	HR	Read	1075	1084	10	PGN.CN000:65262.Data
10	HR	Read	1085	1085	1	PGN.CN000:65262.Status
11	HR	Read	1086	1093	8	PGN.CN000:65271.Data
12	HR	Read	1094	1094	1	PGN.CN000:65271.Status
13	HR	Read	1095	1098	4	PGN.CN000:65253.Data
14	HR	Read	1099	1099	1	PGN.CN000:65253.Status
15	HR	Read	1100	1109	10	J1939 Device.Node 128.Status
16	HR	Write	1110	1117	8	PGN.PN128:07680.Data
17	HR	Read	1118	1127	10	J1939 Device.Node 235.Status
18	HR	Read	1128	1131	4	PGN.CN235:65506.Data
19	HR	Read	1132	1132	1	PGN.CN235:65506.Status
20	HR	Read	1133	1136	4	PGN.CN235:65507.Data
21	HR	Read	1137	1137	1	PGN.CN235:65507.Status
22	HR	Read	1138	1141	4	PGN.CN235:65508.Data
23	HR	Read	1142	1142	1	PGN.CN235:65508.Status
24	(End)					

Figure 7.40 – Modbus Summary CSV

7.13. MODBUS EXPANDED CSV

Slate can provide a detailed version of the Modbus registers being used in the form of a CSV file. This will assist the user to better understand where what data is being mapped (based on the J1939 Router/B module configuration). To generate the Modbus Expanded CSV, right-click on the module (when online in Slate), and select *Export Modbus Expanded CSV*.

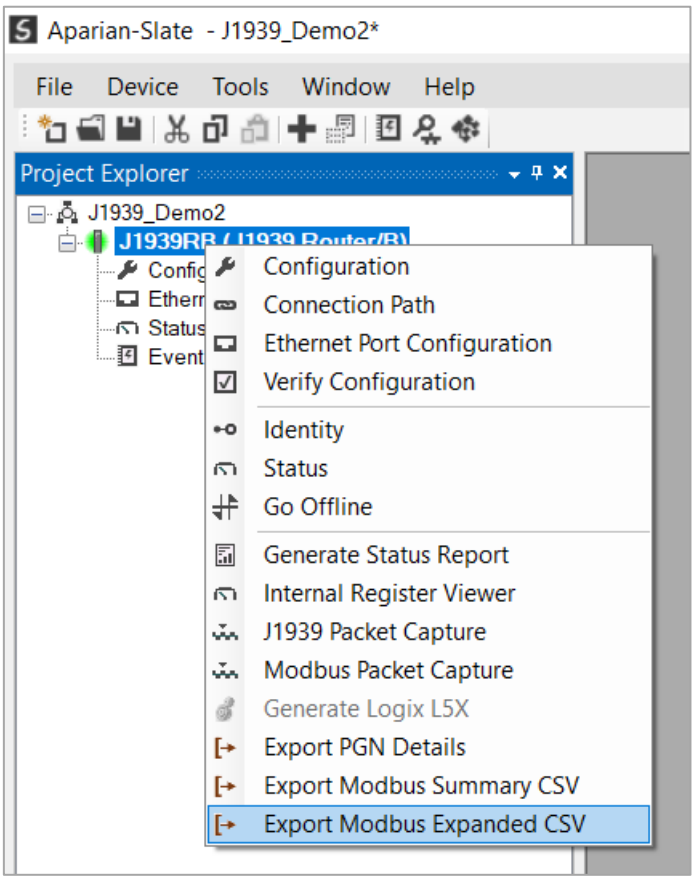


Figure 7.41 – Modbus Expanded Report Generation

	A	B	C	D	E	F
1	Reg Type	Modbus Function	Start Address	End Address	Element Count	Description
2	HR	Read	1000	1000	1	Master.MasterStatus.General
3	HR	Read	1002	1003	2	Master.MasterStatus.TransactionRate
4	HR	Read	1004	1005	2	Master.MasterStatus.Temperature
5	HR	Read	1006	1007	2	Master.MasterStatus.RxCANPacketCount
6	HR	Read	1008	1009	2	Master.MasterStatus.TxCANPacketCount
7	HR	Read	1010	1011	2	Master.MasterStatus.CANCRCErrors
8	HR	Read	1012	1013	2	Master.MasterStatus.CANBitErrors
9	HR	Read	1014	1015	2	Master.MasterStatus.CANStuffErrors
10	HR	Read	1016	1017	2	Master.MasterStatus.CANBusOffCount
11	HR	Read	1018	1019	2	Master.MasterStatus.CANAckErrors
12	HR	Read	1020	1021	2	Master.MasterStatus.CANFormatErrors
13	HR	Read	1022	1029	8	Master.MasterStatus.MappedItemStatus
14	HR	Write	1030	1030	1	AparianPGN61463.Data.EngineCylinder1KnockLevel
15	HR	Write	1031	1031	1	AparianPGN61463.Data.EngineCylinder2KnockLevel
16	HR	Write	1032	1032	1	AparianPGN61463.Data.EngineCylinder3KnockLevel
17	HR	Write	1033	1033	1	AparianPGN61463.Data.EngineCylinder4KnockLevel
18	HR	Write	1034	1034	1	AparianPGN61463.Data.EngineCylinder5KnockLevel
19	HR	Write	1035	1035	1	AparianPGN61463.Data.EngineCylinder6KnockLevel
20	HR	Write	1036	1036	1	AparianPGN61463.Data.EngineCylinder7KnockLevel
21	HR	Write	1037	1037	1	AparianPGN61463.Data.EngineCylinder8KnockLevel
22	HR	Read	1038	1038	1	Node 0.StatusFlags
23	HR	Read	1039	1039	1	Node 0.Node
24	HR	Read	1040	1040	1	Node 0.LampStatus:Protect+Amber
25	HR	Read	1041	1041	1	Node 0.LampStatus:Red+Malfunction

Figure 7.42 – Modbus Expanded CSV

7.14. INTERNAL REGISTER VIEWER

The module provides an Internal Register Viewer that allows the user to view the data registers in the Internal Data Space (IDS) and Modbus Registers.

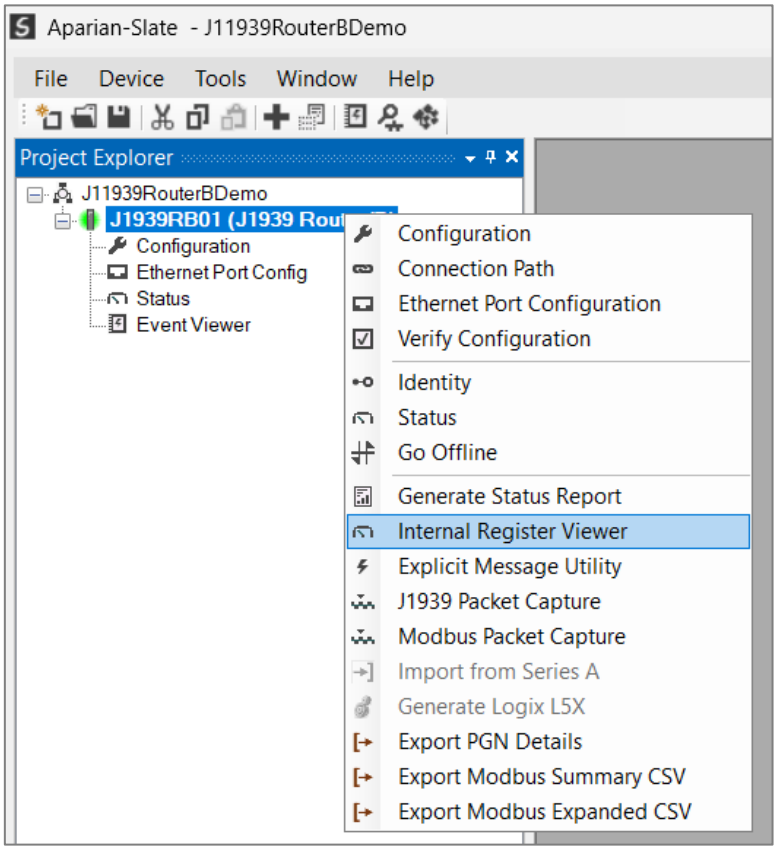


Figure 7.43 – Internal Register Viewer - Select

Once opened, the register type can be selected. Note that the Modbus Registers will only be available if the Primary Interface configured is for Modbus Server or Modbus Client.

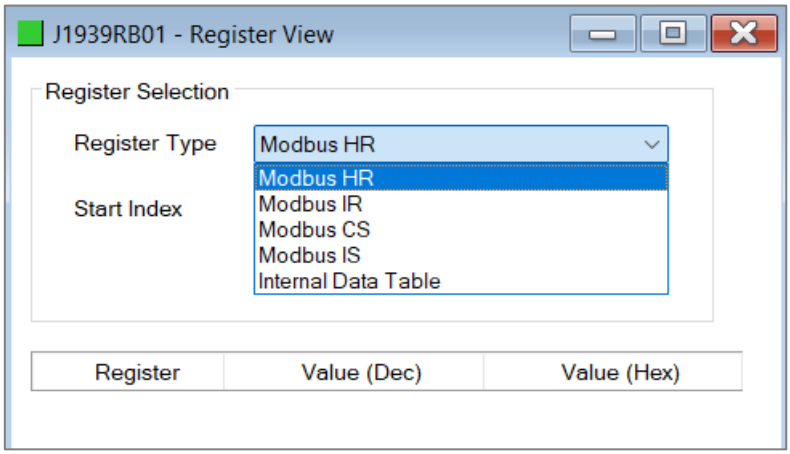


Figure 7.44 – Internal Register Viewer – Register Type

The Start and Stop Index can then be selected to determine how much data to display and refresh.

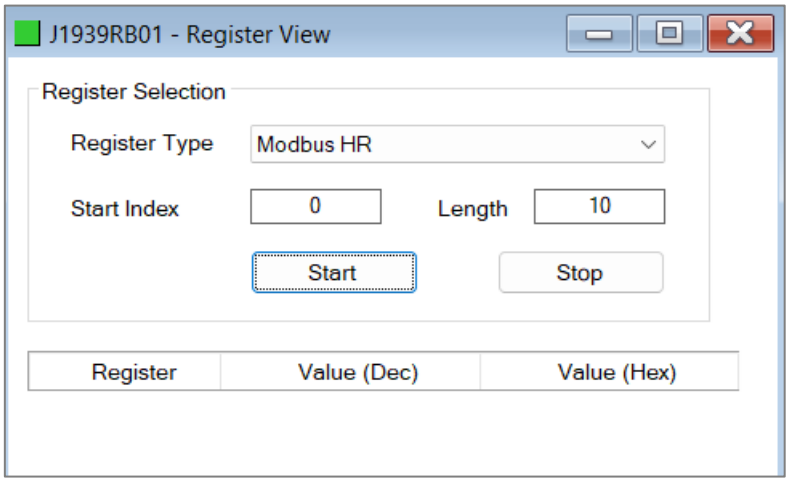


Figure 7.45 – Internal Register Viewer – Indexes

The data will appear and start refreshing by pressing the *Start* button.

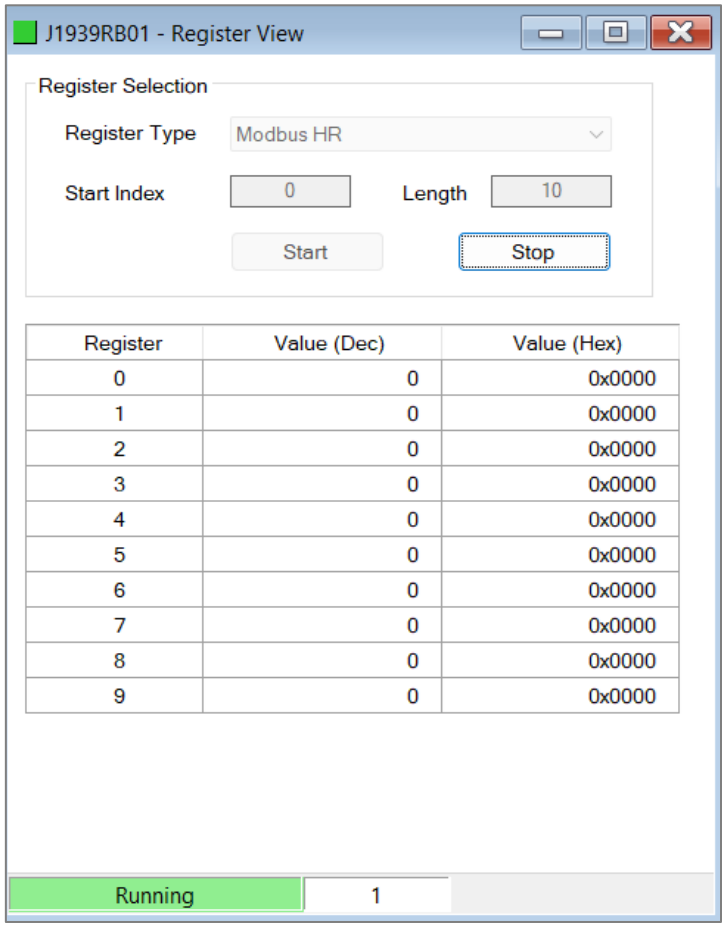


Figure 7.46 – Internal Register Viewer – Running

8. TECHNICAL SPECIFICATIONS

8.1. DIMENSIONS

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

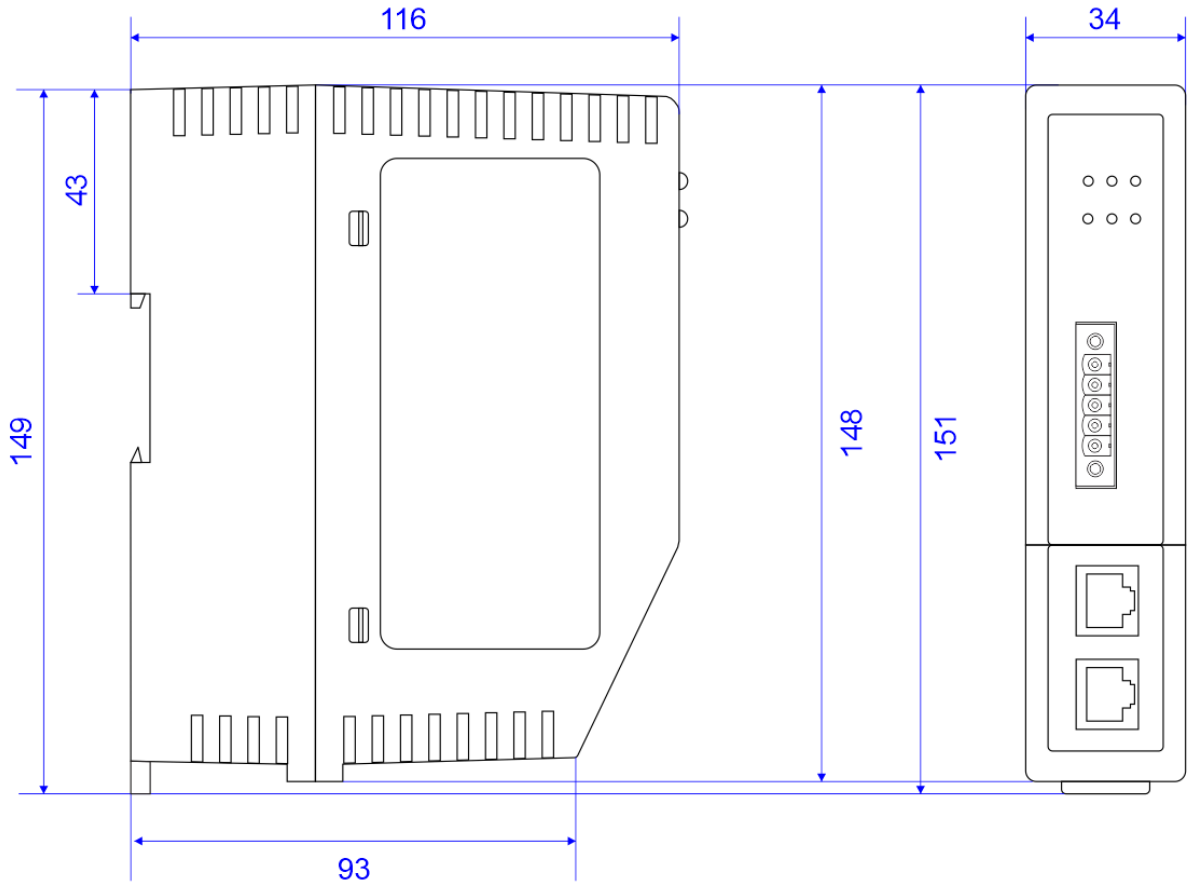


Figure 8.1 – J1939 Router/B enclosure dimensions

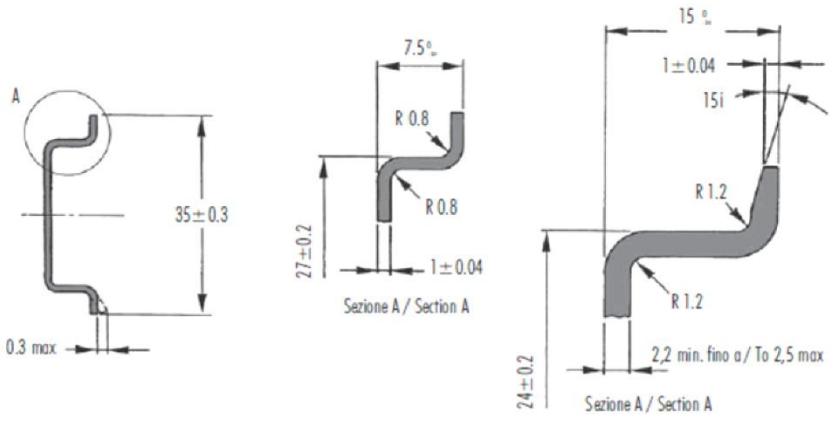


Figure 8.2 - Required DIN dimensions

8.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 32V DC
Power consumption	2.2 W (Max.) Current: 180 mA @ 10 V Current: 85 mA @ 24 V
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 8.1 - Electrical specification

8.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 100
TCP connections	Max 100
CIP connections	Max 15
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes

Embedded switch	Yes, 2 x Ethernet ports
Device Level Ring (DLR)	Supported
Network Time Protocol (NTP)	Supported

Table 8.2 - Ethernet specification

8.4. SERIAL PORT (RS232)

Specification	Rating
RS232 Connector	9-way terminal (shared with RS485)
RS232 Conductor	24 – 18 AWG
Electrical Isolation	1000 Vdc
BAUD	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	None, Even, Odd
Data bits	8
Stop bits	1

Table 8.3 – RS232 Serial Port specification

8.5. SERIAL PORT (RS485)

Specification	Rating
RS485 Connector	9-way terminal (shared with RS485)
RS485 Conductor	24 – 18 AWG
Electrical Isolation	1500 Vrms for 1 minute.
BAUD	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	None, Even, Odd
Data bits	8
Stop bits	1

Table 8.4 – RS485 Serial Port specification

8.6. J1939

Specification	Rating
Connector	5-way terminal, 5.08mm pitch.
Functions	Produce Consume
Max PGN Mapping	100 (produce and consume)
Passthrough Messaging	Supported
Supported Baud Rates	125k 250k 500k
CAN Terminator	120 Ω - Software Enabled
Arbitrary Address Capable	Yes
Support for multi-packets	Yes
Configurable J1939 Name	Yes
PGN Live List	Supported

Table 8.5 – J1939 specification

8.7. ETHERNET/IP TARGET

Specification	Rating
Class 1 Cyclic connection count	4
Logix Direct-to-Tag Supported	Yes

Table 8.6 – EtherNet/IP Target specification

8.8. ETHERNET/IP ORIGINATOR

Specification	Rating
Class 1 Cyclic Connections Supported	Yes
Class 3 / UCMM Connections Supported	Yes
Class 1 Connection Count	10
Class 3 / UCMM Target Device Count	10
Class 3 / UCMM Mapping Count	50

Table 8.7 – EtherNet/IP Originator specification

8.9. MODBUS CLIENT

Specification	Rating
Modes Supported	Modbus TCP, Modbus RTU232, Modbus RTU485
Modbus RTU485 Termination	125 Ω - Software Enabled
Max. Modbus Server Devices	20
Max. Modbus Mapping	100
Mapping Ranges	Holding Register 0 – 65535 Input Register 0 – 65535 Input Status 0 – 65535 Coil Status 0 – 65535
Base Offset	Modbus (Base 0) PLC (Base 1)
Configurable Modbus TCP Port	Yes
Data Reformatting Supported	BB AA BB AA DD CC CC DD AA BB DD CC BB AA

Table 8.8 – Modbus Client specification

8.10. MODBUS SERVER

Specification	Rating
Modes Supported	Modbus TCP, Modbus RTU232, Modbus RTU485 (simultaneous)
Modbus RTU485 Termination	Software set
Mapping Ranges	Holding Register 0 – 65535 Input Register 0 – 65535 Input Status 0 – 65535 Coil Status 0 – 65535
Base Offset	Modbus (Base 0) PLC (Base 1)
Configurable Modbus TCP Port	Yes

Table 8.9 – Modbus Server specification

8.11. 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
UKCA	UK CA
ATEX	Ex II 3 G Ex ec IIC T5 -25°C ≤ Ta ≤ 70 °C

ODVA Conformance	EtherNet/IP™

Table 8.10 – Certifications

9. INDEX

A

Adanced, 71, 72

C

Connection path, 92
Contact Us, 16

D

DC power, 17
DHCP, 18, 24, 25, 26, 27
dimensions, 171
DIN rail, 19, 20, 171
DIP, 18

E

Ethernet connector, 22
Ethernet/IP, 72
EtherNet/IP, 7, 72
EtherNet/IP Devices configuration, 71
EtherNet/IP Map configuration, 72, 73, 91

F

firmware upgrade, 31

I

Input assembly, 139
input voltage, 20, 22
IP Address, 25, 26

J

J1939, 159
J1939 general configuration, 31, 32, 34, 35
J1939 parameters, 31
J1939 Router, 7, 17, 18, 21, 30, 108, 144
J1939 Router, 7
J1939 Router, 92
J1939 Router, 134
J1939 Router, 144
J1939 Router, 155
J1939 Router, 156
J1939 Router general configuration, 38, 51, 53, 54, 56, 58, 59, 75, 77

L

LED, 133, 134

M

MODBUS, 145

O

output assembly, 108, 122

R

Rockwell Automation, 29
RS232, 17, 18, 21
RS232/RS485, 21
RSLinx, 29

S

Safe Mode, 18
Serial, 173
Slate, 30, 31, 93, 134, 149, 151, 152, 155, 156
statistics, 142, 143, 144, 147, 149, 154, 159, 162
Statistics, 134
Support email, 16

T

Target Browser, 27, 28, 72, 92

W

web server, 134, 156