GemLan Router

User Manual

A-GML

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aparian

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Revision History

Revision	Date	Comment
1.0	17 Jan 2017	Initial document
1.1	29 April 2017	Add ODVA Conformance mark
1.2	23 May 2017	Add support for two additional interface modes. Add RCM Conformance mark.
1.3	5 October 2017	Add UL Class 1 Division 2
1.4	9 December 2019	Part number corrected to A-GML
1.5	6 January 2021	Added option for DIP Switch 4 – Fixed IP Address
1.6	8 February 2021	Added Modbus TCP functionality
1.7	20 April 2021	Added GemLan Communication Shutdown/Restart option
1.8	5 September 2022	Fixed Status Information for Modbus Holding Registers

1. PREFACE

1.1. INTRODUCTION TO THE GEMLAN ROUTER

This manual describes the installation, operation, and diagnostics of the Aparian GemLan Router module. The GemLan Router, (hereafter referred to as the **module**,) provides intelligent data routing between either EtherNet/IP, AB Ethernet PCCC (e.g. PLC5 Ethernet communications) or Modbus-TCP and the GEMLAN-D's DecNet (Ethernet) network.

This allows the user to integrate a GEM80 controller into a Rockwell Logix platform (e.g. ControlLogix or CompactLogix) or Rockwell HMI (e.g. FTView / PanelView) with minimal effort.

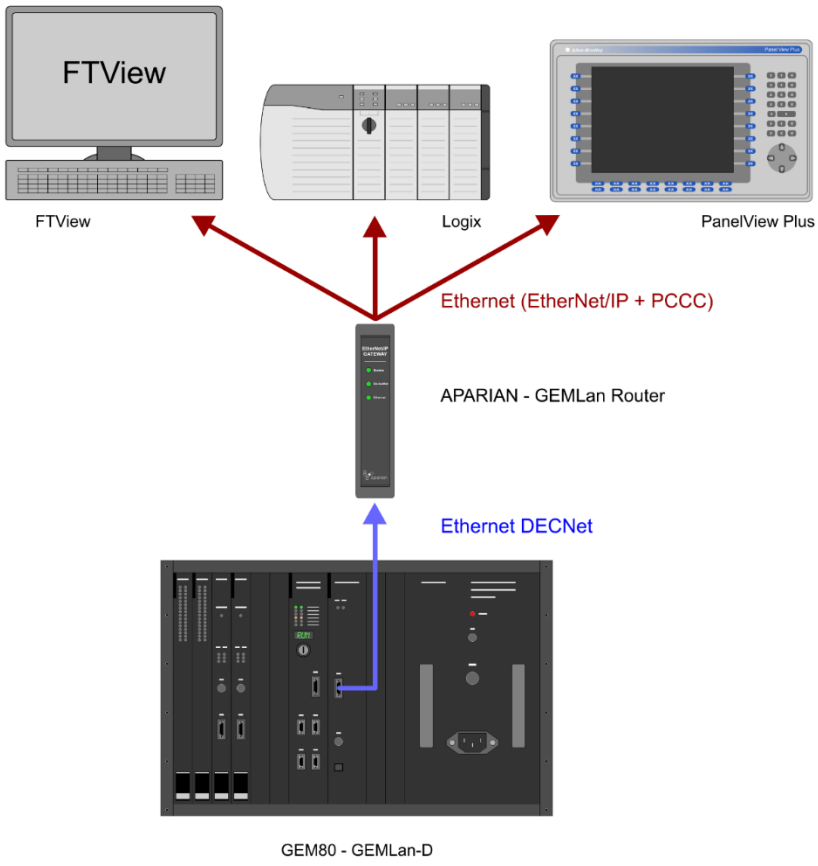


Figure 1.1. – Typical architecture using the GemLan Router

The module can be configured to either exchange data between a Logix controller and a GEM80 controller at a fixed interval, or as an AB Ethernet PCCC slave and DECNet master allowing a Rockwell SCADA to directly communicate with a GEM80 controller.

The GemLan Router also supports Modbus-TCP, allowing a remote Modbus-TCP master to read and write Modbus registers which in turn are mapped to GEM80 registers.

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

The module also provides a range of statistics to help fault find any problem.

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

1.2. ARCHITECTURE

The figure below provides an example of the typical network setup for connecting FTView to a GEM80 controller via the GEMLAN-D card.

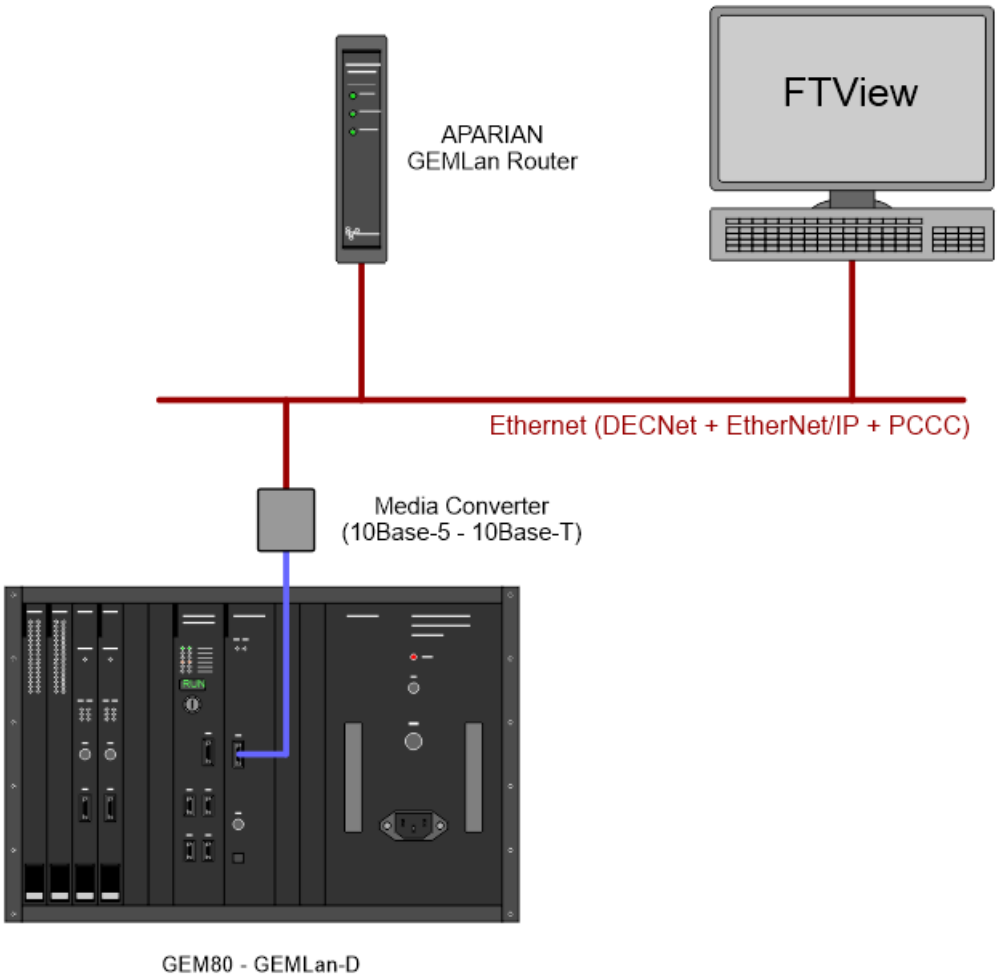


Figure 1.2. - Example of a typical network setup using FTView

The figure below provides an example of the typical network setup for connecting a Logix Controller to a GEM80 controller via the GEMLAN-D card.

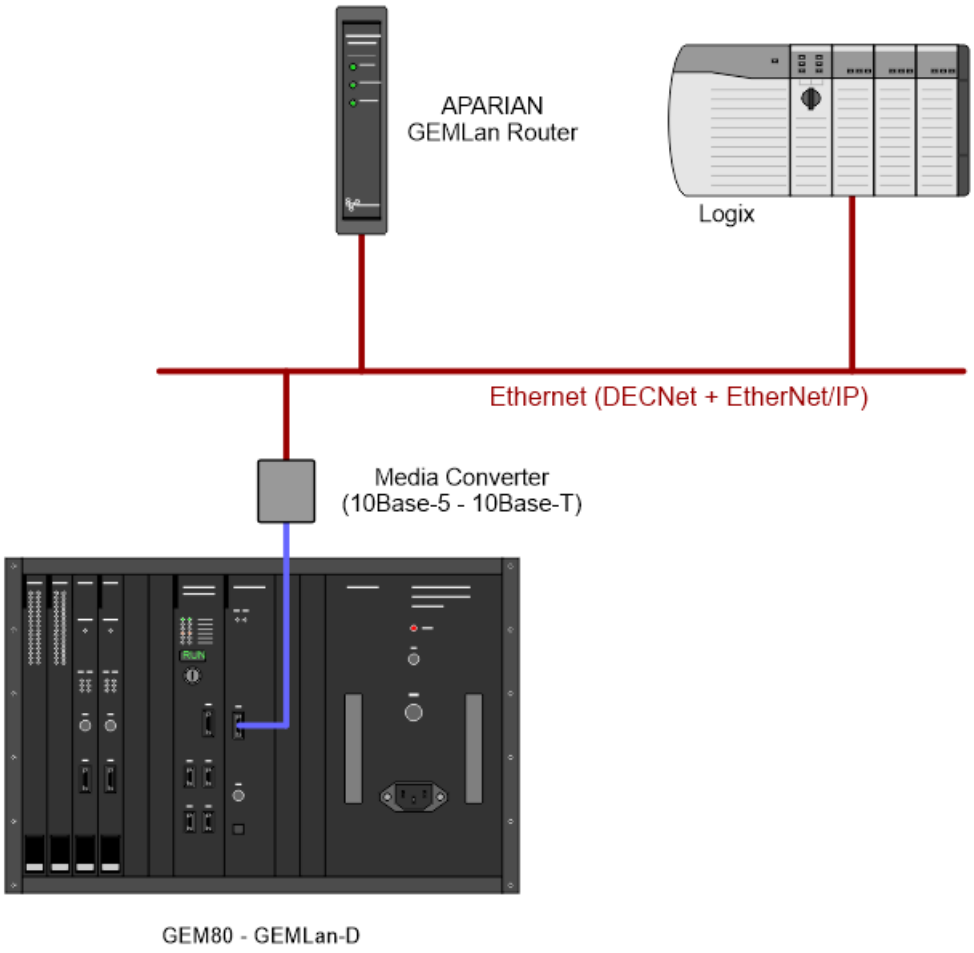


Figure 1.3. - Example of a typical network setup using a Logix Controller

The final example shows a Modbus-TCP master communicating with a GEM80 controller via the GEMLAN-D card.

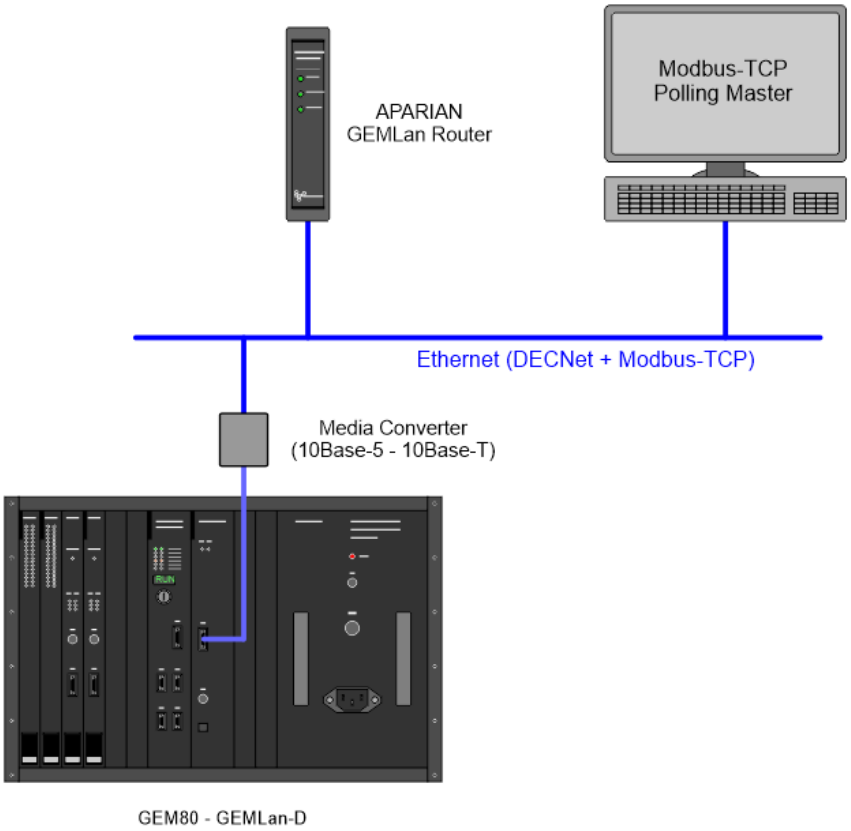


Figure 1.3. – Typical architecture using the GemLan Router and Modbus-TCP

1.3. 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
GemLan Router User Manual GemLan Router Datasheet Example Code & UDTs	http://www.aparian.com/products/gemlanrouter
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

Table 1.1. - Additional Information

1.4. SUPPORT

Technical support is provided via the Web (in the form of user manuals, FAQ, datasheets etc.) to assist with installation, operation, and diagnostics.

For additional support the user can use either of the following:

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

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The module has three ports at the bottom of the enclosure as shown in the figure below. The ports are used for Ethernet, RS232 serial, and power. The power port uses a three-way connector which is used for the DC power supply and the earth connection.

NOTE: The RS232 for this module is reserved and should not be used.

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



Figure 2.1. – GemLan Router side and bottom view

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



Figure 2.2. – GemLan Router front and top view

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

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

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

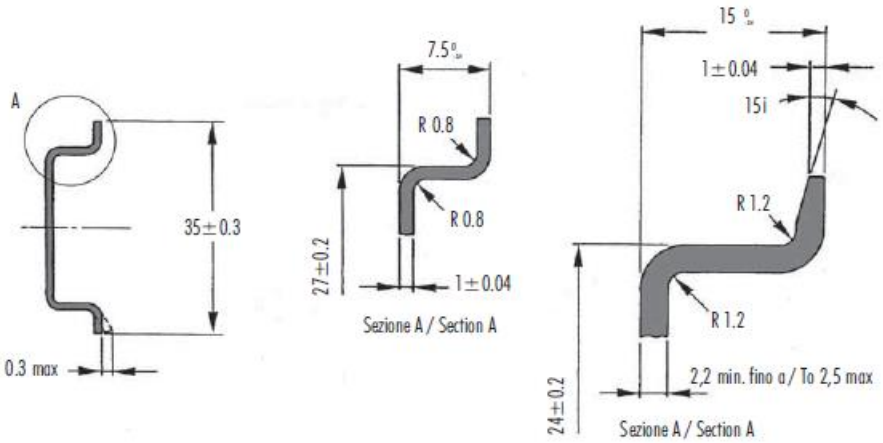


Figure 2.3 - DIN rail specification

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

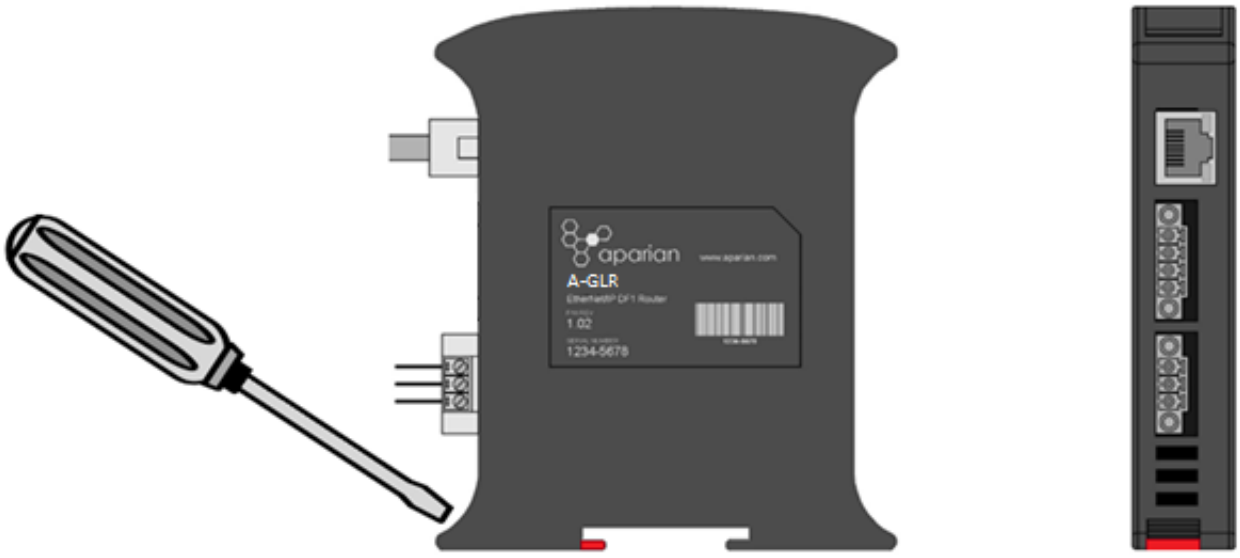


Figure 2.4 - DIN rail mouting

2.3. POWER

A three-way power connector is used to connect Power+, Power– (GND), and earth. The module requires an input voltage of 10 – 28Vdc. **Refer** to the technical specifications section in this document.

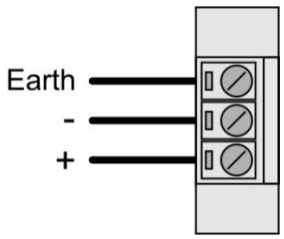


Figure 2.5 - Power connector

2.4. ETHERNET PORT

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

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

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

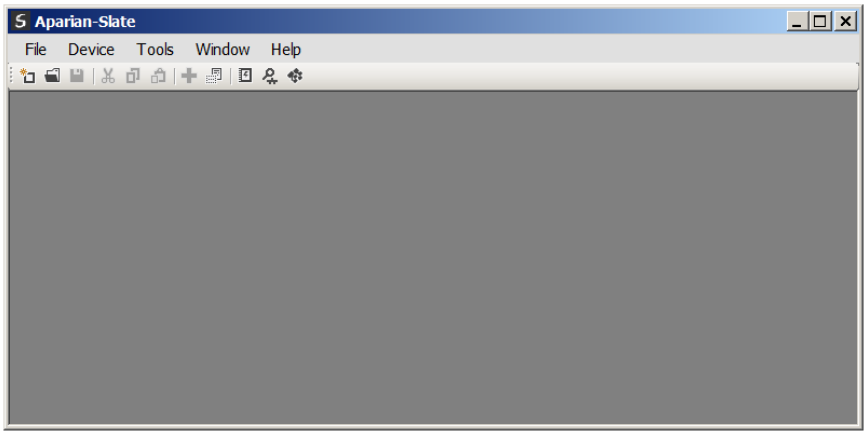


Figure 3.1. - Aparian Slate Environment

3.2. NETWORK PARAMETERS

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

Within the Slate environment, the DHCP server can be found under the Tools menu.

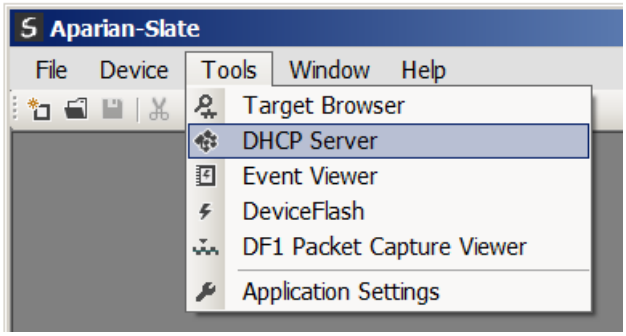


Figure 3.2. - Selecting DHCP Server

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

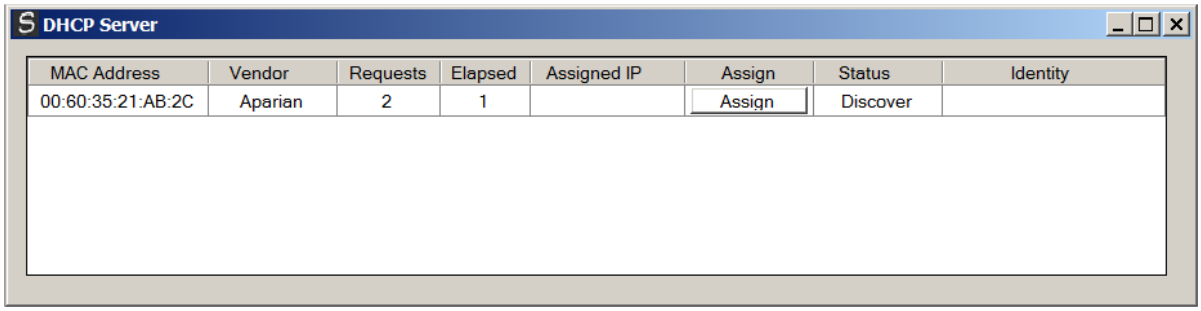


Figure 3.3. - DHCP Server

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

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

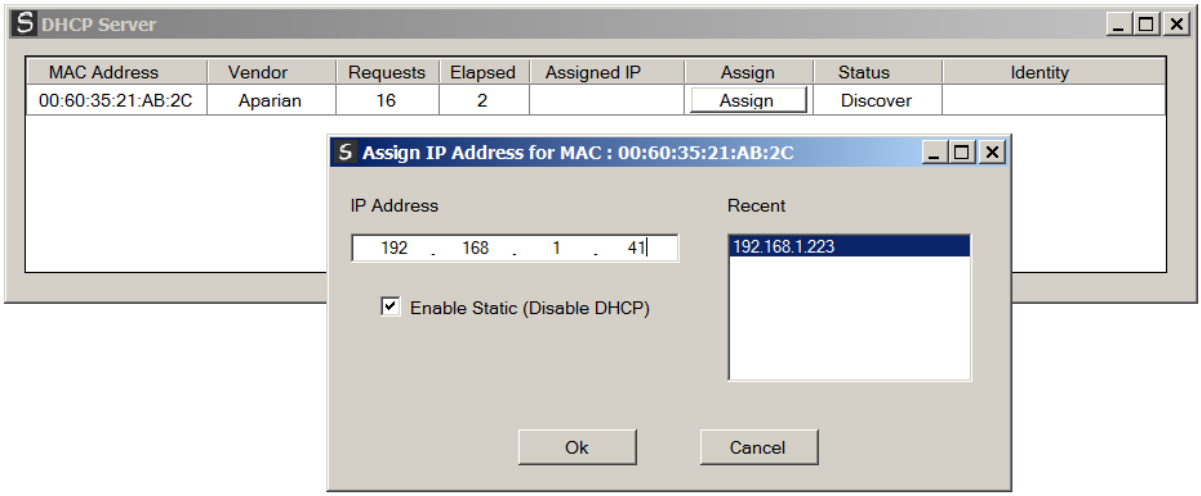


Figure 3.4. - Assigning IP Address

The required IP address can then be either entered, or a recently used IP address can be selected by clicking on an item in the Recent List.

If the "Enable Static" checkbox is checked, then the IP address will be set to static after the IP assignment, thereby disabling future DHCP requests.

Once the IP address window has been accepted, the DHCP server will automatically assign the IP address to the module and then read the Identity object Product name from the device.

The successful assignment of the IP address by the device is indicated by the green background of the associated row.

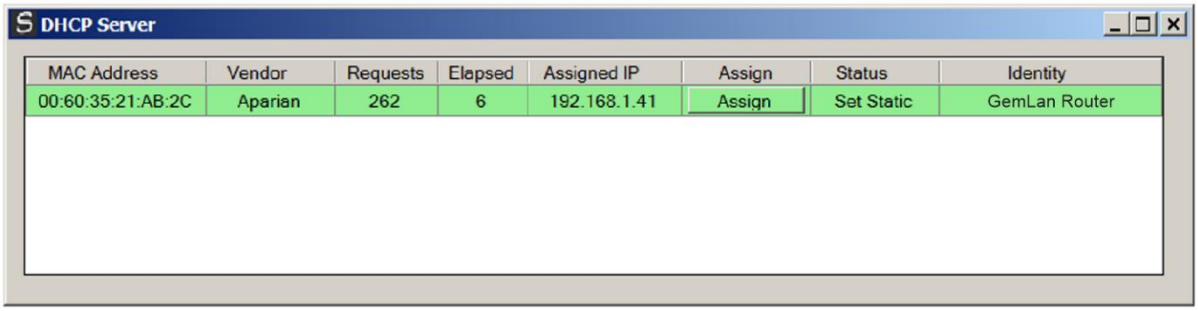


Figure 3.5. - Successful IP address assignment

It is possible to force the module back into DHCP mode by powering up the device with DIP switch 2 set to the On position.

A new IP address can then be assigned by repeating the previous steps.

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

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



Figure 3.6. - Force DHCP warning

In addition to the setting the IP address, a number of other network parameters can be set during the DHCP process. These settings can be viewed and edited in Slate's Application Settings, in the DHCP Server tab.

Once the DHCP process has been completed, the network settings can be set using the Ethernet Port Configuration via the Target Browser.

The Target Browser can be accessed under the Tools menu.

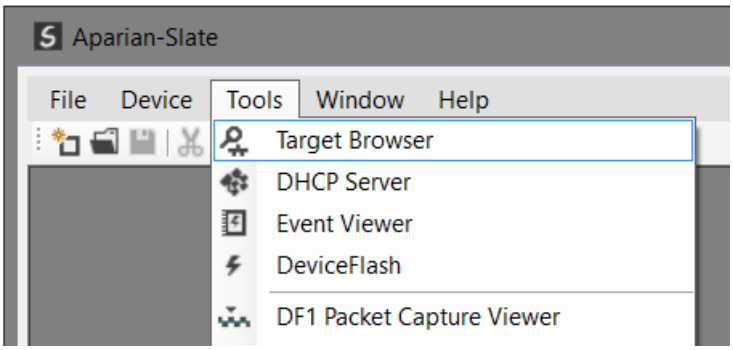


Figure 3.7. - Selecting the Target Browser

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

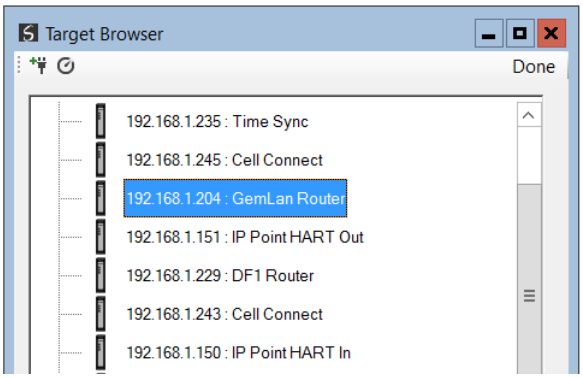


Figure 3.8. - Target Browser

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

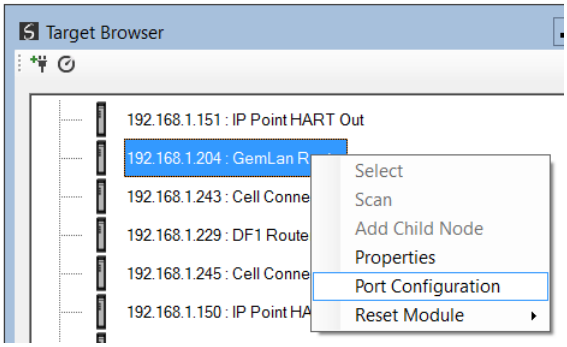


Figure 3.9. - Selecting Port Configuration

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

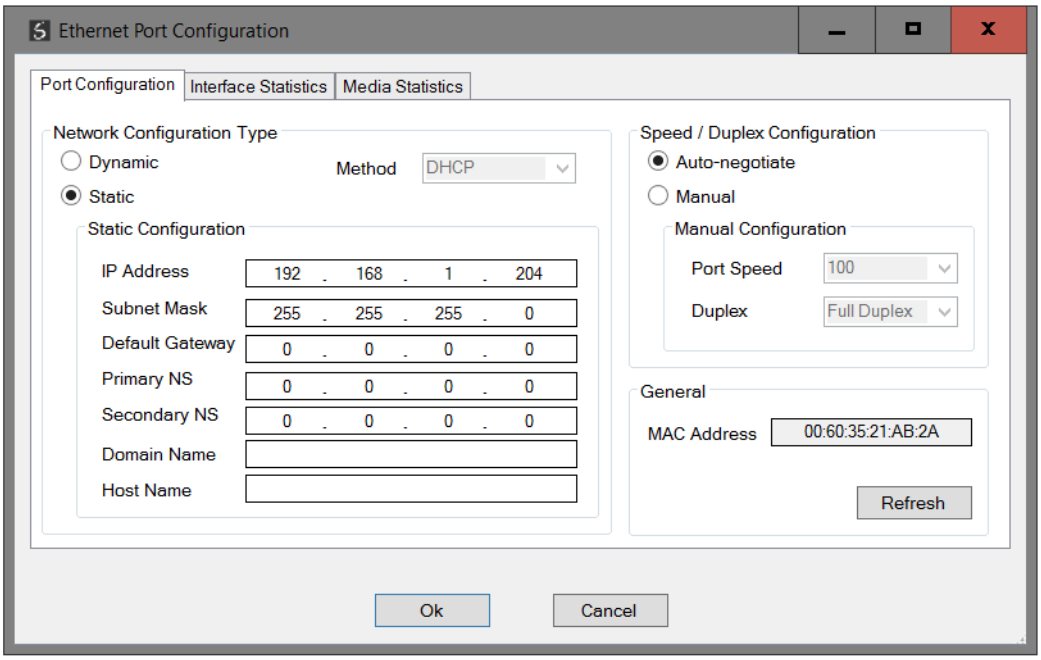


Figure 3.10. - Port Configuration

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

3.3. CREATING A NEW PROJECT

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

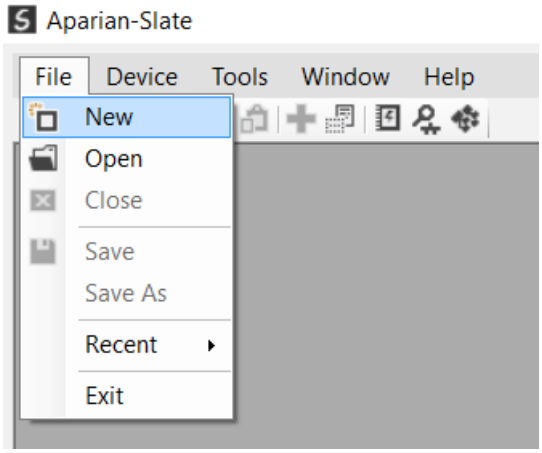


Figure 3.11. - Creating a new project

A Slate project will be created, showing the Project Explorer tree view. To save the project use the Save option under the File menu.

A new device can now be added by selecting Add under the Device menu.

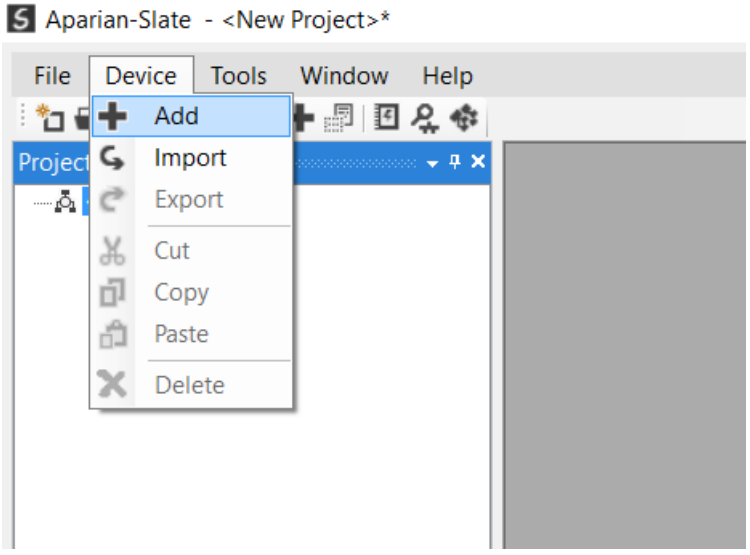


Figure 3.12. - Adding a new device

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

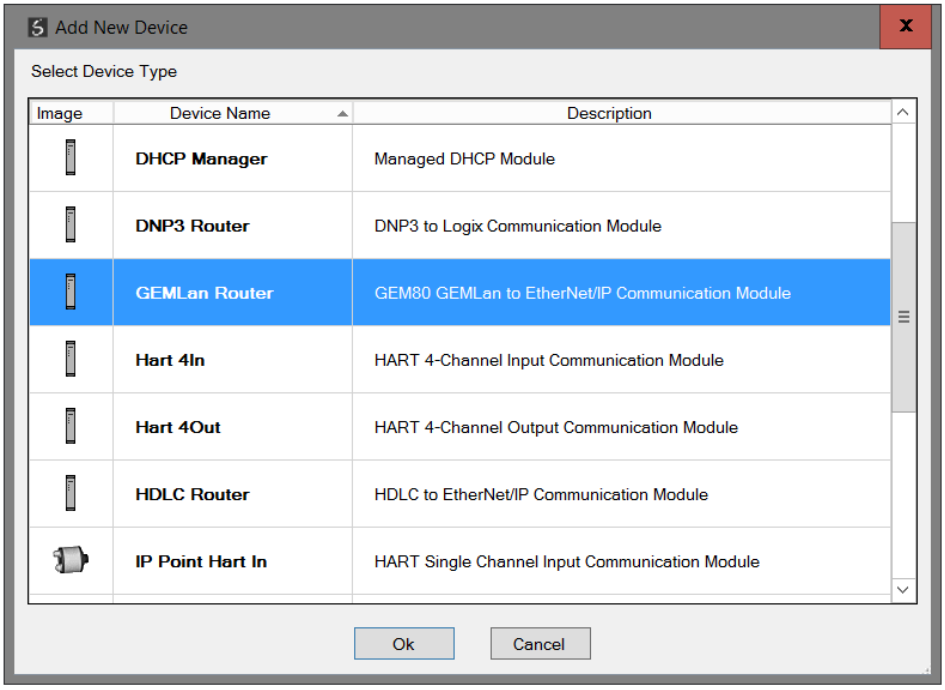


Figure 3.13 – Selecting a new GemLan Router

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*.

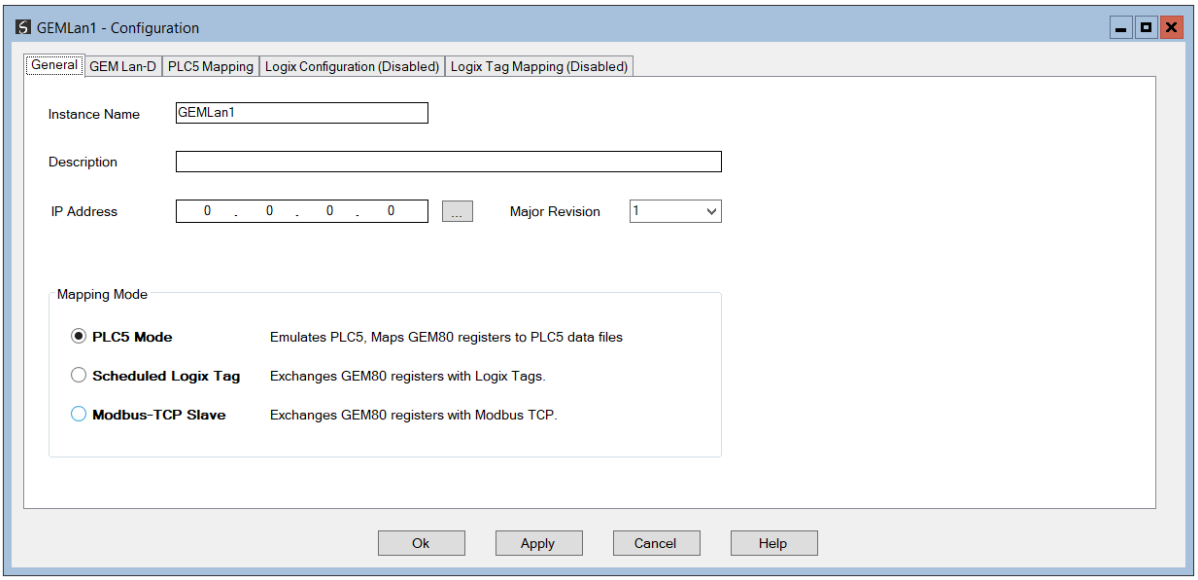


Figure 3.14. – GemLan Router configuration

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

3.4. GEMLAN ROUTER PARAMETERS

The GemLan Router parameters are configured using Slate. **Refer** to the additional information section for documentation and installation links for Aparian Slate. The GemLan Router parameter configuration consists of a general configuration, GEM Lan-D configuration, PLC5 Mapping, Logix Configuration, and Logix Tag Mapping. 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 GemLan Router configuration and routing maps.

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

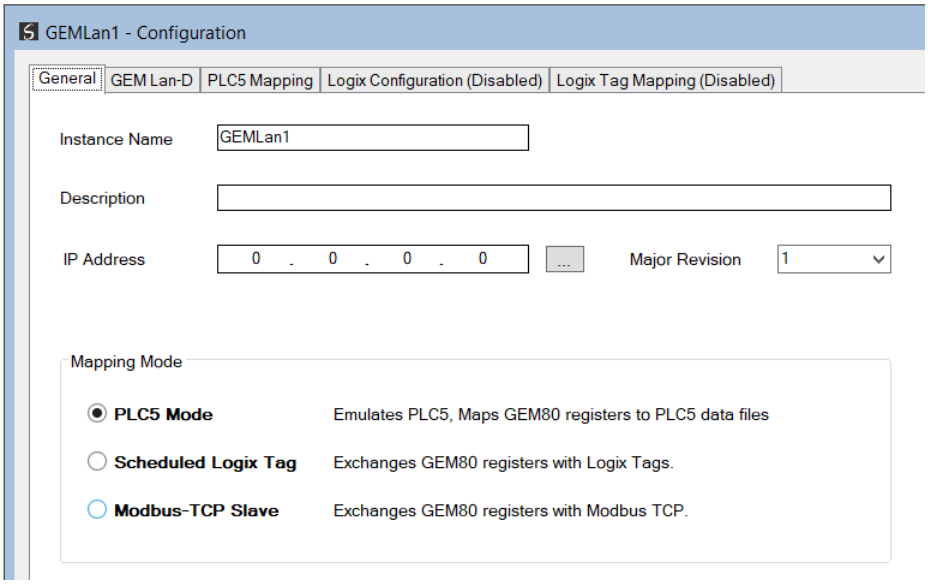


Figure 3.15. - General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various GemLan Router modules.
Description	This parameter is used to provide a more detail description of the application for the module.
IP Address	The IP address of the target module

Major Revision	The major revision of the module
Mapping Mode	The GemLan Router can operate in one of three modes: **PLC5 Mode** In this mode, the GemLan Router will receive AB Ethernet (PCCC) commands from a SCADA or PLC/SLC and read/write the relevant data to/from the GEM80 controller based on the PLC5 mapping that was configured for the module. **Scheduled Logix Tag** In scheduled mode, the GemLan Router will exchange data between a Logix Controller (using EtherNet/IP) and a GEM80 controller (using DECNet) at a configured scan rate. This will allow the user to read preconfigured data from a Logix controller and write it to a GEM80 controller or vice versa. **Modbus-TCP Slave** In Modbus-TCP Slave mode, the GemLan Router will exchange data between a remote Modbus-TCP master and a GEM80 controller (using DECNet) at a configured scan rate. This will allow the Modbus master device to read from, and write to, the GEM80 controller.

Table 3.1 - General configuration parameters

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

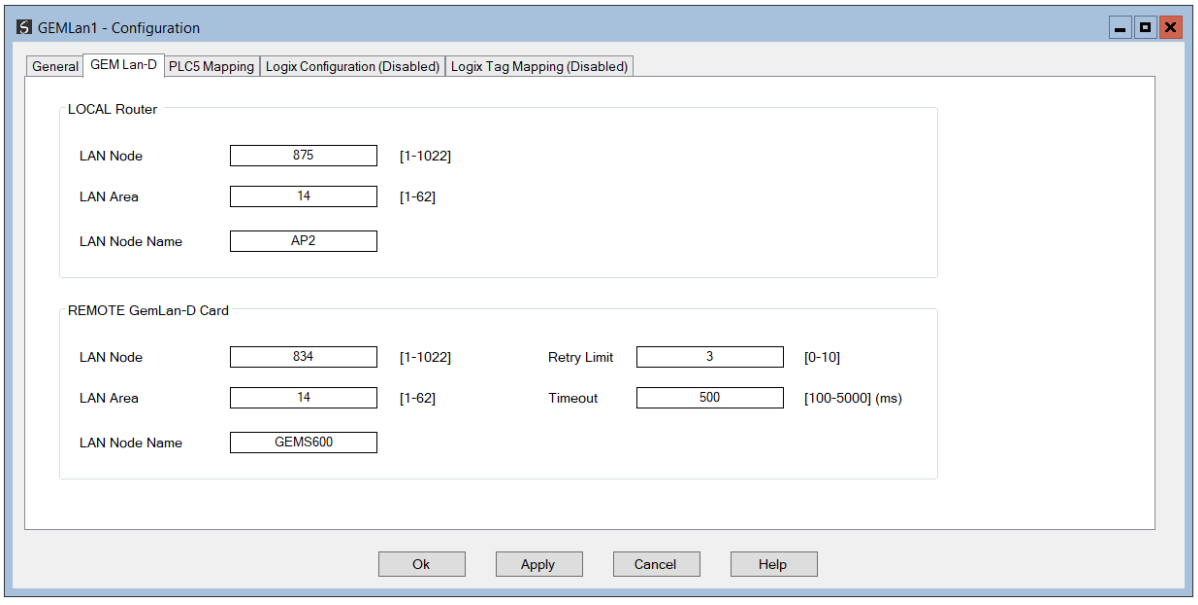


Figure 3.16 – GEM Lan-D Configuration

The GEM Lan-D configuration consists of the following parameters:

Parameter	Description
Local LAN Node	The DECNet LAN Number of the GemLan Router.

Local LAN Area	The DECNet LAN Area of the GemLan Router.
Local LAN Node Name	The DECNet LAN Node Name of the GemLan Router.
Remote LAN Node	The DECNet LAN Number of the remote GemLAN-D card.
Remote LAN Area	The DECNet LAN Area of the remote GemLAN-D card.
Remote LAN Node Name	The DECNet LAN Node Name of the remote GemLAN-D card.
Retry Limit	Retry limit for DECNet communications.
Timeout	Timeout for the DECNet communications.

Table 3.2 – GEM Lan-D configuration parameters

3.5. MESSAGE ROUTING

The module can be configured to operate in one of three modes:

- PLC5 Mode
- Scheduled Logix Tag
- Modbus-TCP Slave

3.5.1. PLC5 MODE

The PLC5 Mode is used to redirect PCCC Ethernet messages to DECNet (Ethernet). This will allow the user to, for example, connect a Rockwell Automation HMI (e.g. PanelView) to a GEM80 controller.

The user will need to configure which GEM Table (e.g. "**E"**), Element Start, and Element Count will exchange data with a specific PLC Data File (e.g. N10). This will enable the GemLan Router to receive PCCC requests from a PLC5 or HMI and retrieve or set the relevant GEM80 table data. To configure the PLC5 mapping the GemLan Router GEM Lan-D configuration window must be opened by either double clicking on the module in the tree or right-clicking the module and selecting *Configuration*.

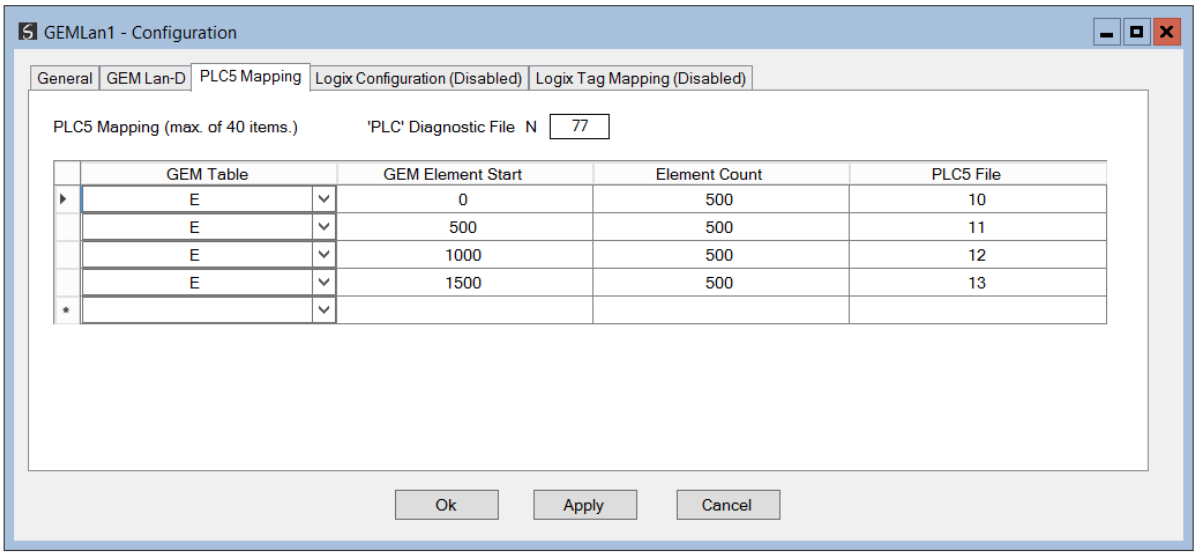


Figure 3.17 – PLC5 Mapping Configuration

The following parameters will need to be updated.

Parameter	Description
GEM Table	Table in the GEM80 controller that must be accessed.
GEM Element Start	The table offset in the GEM80 controller that must be accessed.
Element Count	The number of elements that must be accessed for the specific GEM Table.
PLC5 File	The PLC5 Data File that is used to send/receive data to/from the GEM80 controller.

Table 3.3 – PLC5 Mapping configuration parameters

Below is a graphical representation of the configuration shown above.

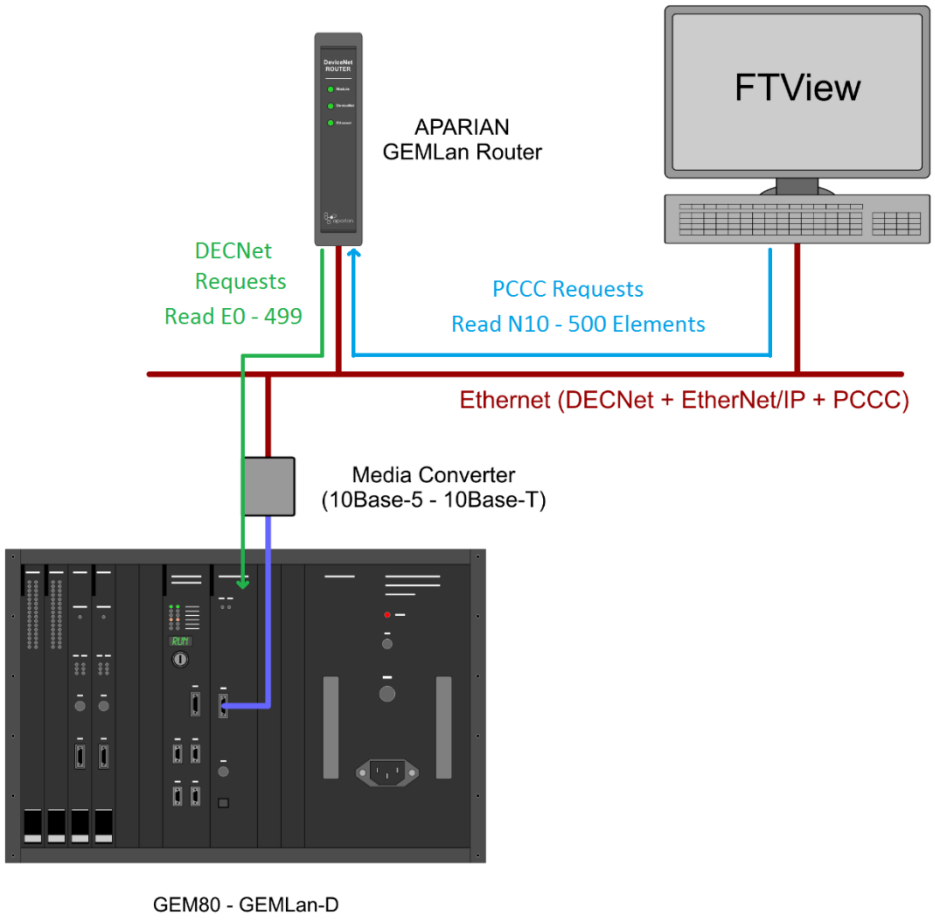


Figure 3.18 – PLC5 Mapping Configuration

3.5.2. Scheduled Logix Tag

The Logix Tag Mapping Mode is used to exchange data between a Logix controller and a GEM80 controller at a configured interval. This will allow the user to, for example, connect a GEM80 controller to a Logix Controller.

The user will need to define the Logix controller that will exchange data with the GEM80 controller. This is done by either using the Target Browser in the Logix Configuration to select a controller (as shown below), or manually typing in the CIP path:

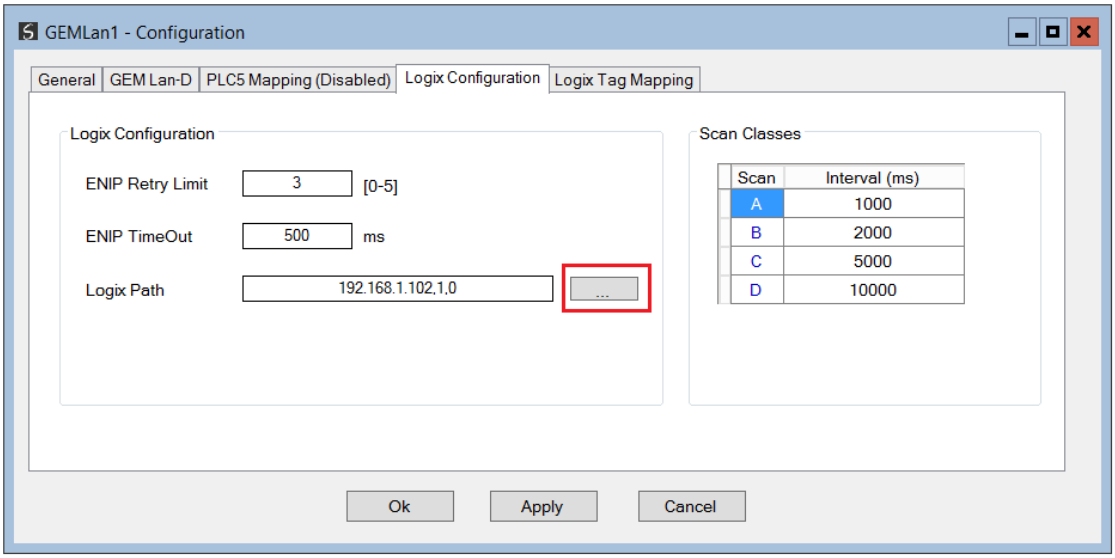


Figure 3.19 - Logix Configuration

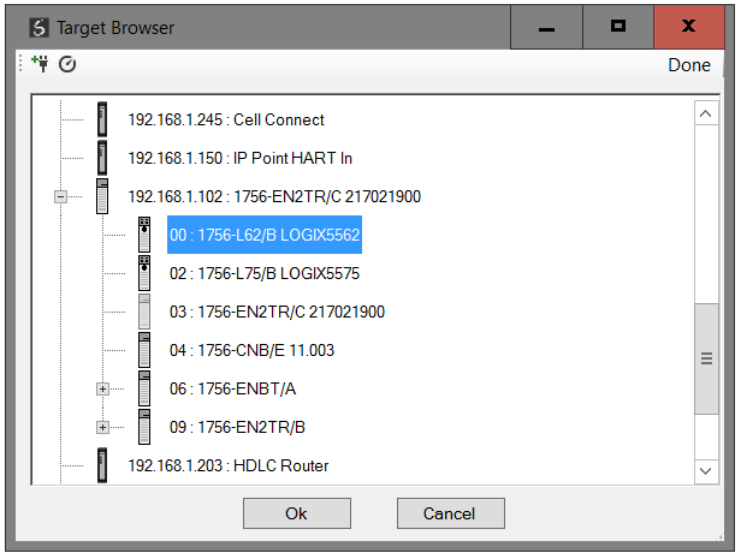


Figure 3.20 – Target Browser used to select the Logix controller

The user will also need to update the Scan Classes if required. The scan classes are used to determine the interval at which the Logix Mapped items are executed.

Once the controller has been selected the user must configure the Logix Tag Mapping as shown below:

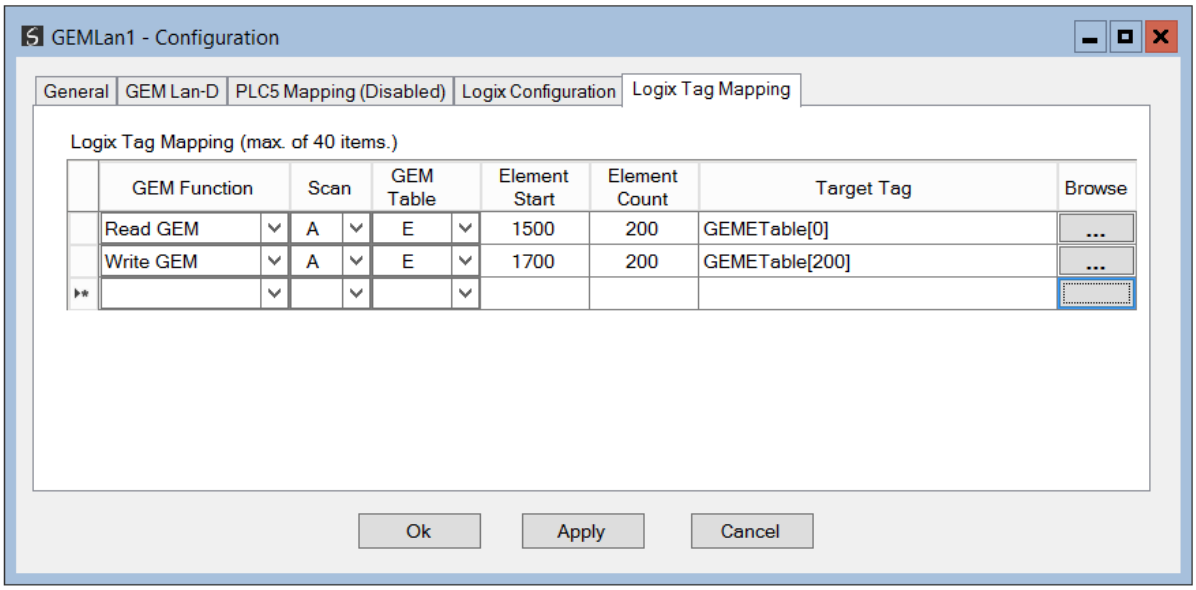


Figure 3.21 – Logix Tag Mapping Configuration

NOTE: Only Logix Tags with a INT data type can be used for the Logix Tag Mapping.

NOTE: In Logix Tag Mapping Mode, a maximum of 240 elements can be used to read/write from/to the GEM80 controller. The GemLan Router supports a maximum of 40 mapped items (each with a maximum of 240 elements) in Logix Tag Mapping Mode.

Parameter	Description
GEM Function	This parameter can either be read or write. **Read GEM** The GemLan Router will read a certain range of GEM Table Elements (in the example above it is E1500 – E1699). The module will then write the received data into the configured Logix Tag. **Write GEM** The Logix Tag configured will be read and the received data will be written into the configured GEM Table Elements (in the above example it is E1700 – E1899)
Scan	The Scan class used for the mapped item.
GEM Table	Table in the GEM80 controller that must be accessed.
Element Start	The table offset in the GEM80 controller that must be accessed.
Element Count	The number of elements that must be accessed for the specific GEM Table.

Target Tag	The Logix Tag array (can also be a single INT) that will be used to exchange data with the specific GEM80 Table (with the specific start and range). The target tag can either be entered manually or if online with the module and the controller the target tag can be updated using the target browser as shown below).

Table 3.4 – Logix Tag Mapping parameters

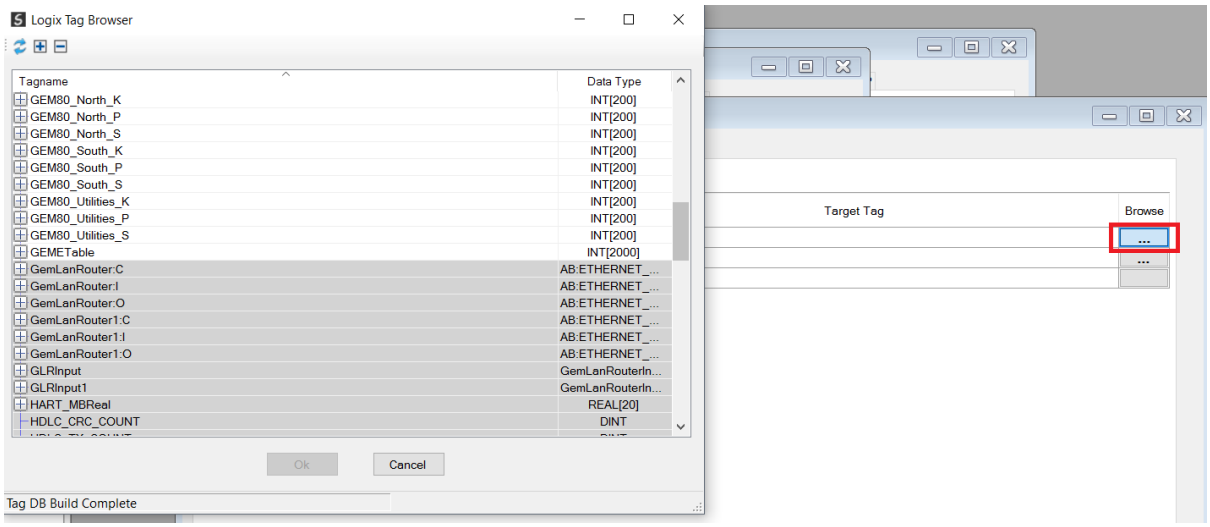


Figure 3.22 – Target Browser

3.5.3. MODBUS-TCP SLAVE

The Modbus-TCP Slave Mode is used to exchange data between a remote Modbus-TCP master and a GEM80 controller at a configured interval.

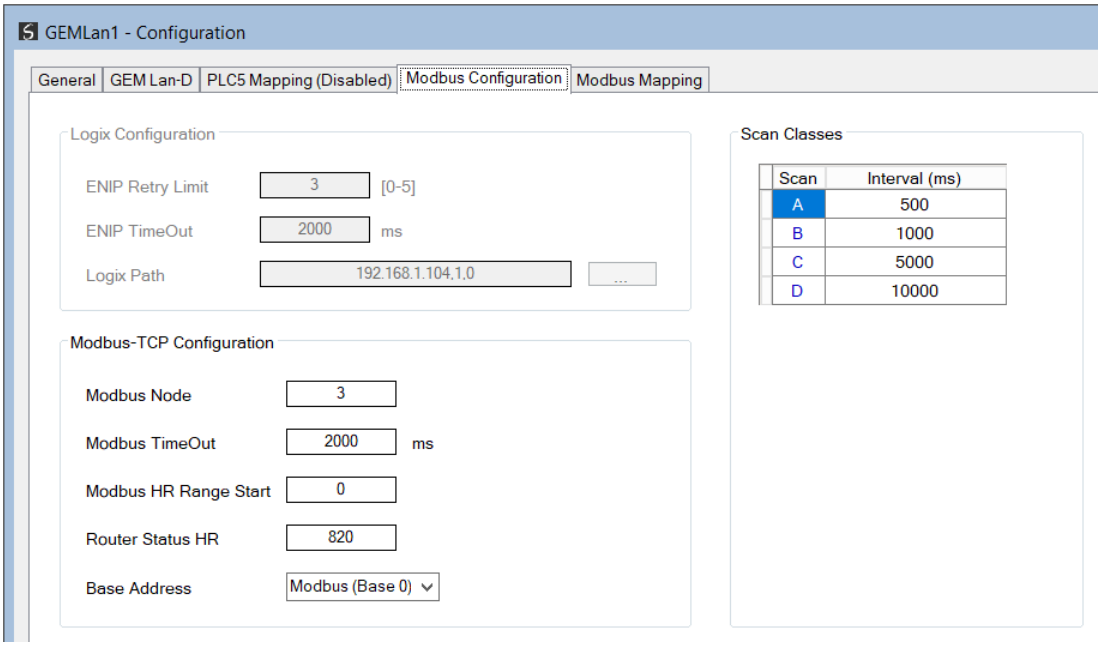


Figure 3.23 - Modbus Configuration

The user will need to configure the following Modbus parameters:

Parameter	Description
Modbus Node	The local Modbus node address of the GemLan Router.
Modbus TimeOut	The timeout is used to determine the interval between retries when a message exchange has failed.
Modbus HR Range Start	Used to specify the supported Holding Register range by specifying the starting register. The GemLan Router support a maximum of 10 000 Holding Registers. For example, if the Modbus HR Range Start is set to 40 000, then configured Holding Registers must be in the range 40 000 to 49 999.
Router Status HR	The Holding Register address where the Module's status information will be available. This allows the remote Modbus master, to read the status and basic statistics of the GemLan Router. The GemLan Router's status information requires 16 registers.
Base Address	The Modbus Router can be configured to operate in one of two Base Address modes; Modbus (Base 0) or PLC (Base 1). For example, when operating in Base 0 mode the first holding register address will be 40000 whilst in Base 1 mode the first holding register address will be 40001. Depending on the system being interfaced to the user will need to select the correct option. Failing to do this will result in the data being misaligned by one register.

Table 3.5 - Modbus configuration parameters

The user will also need to update the Scan Classes as required. The scan classes are used to determine the interval at which the GEMLan (Modbus) mapped items are executed.

The Modbus Mapping is tab is used to configure the GEMLan polling as well as the assignment to internal Modbus registers.

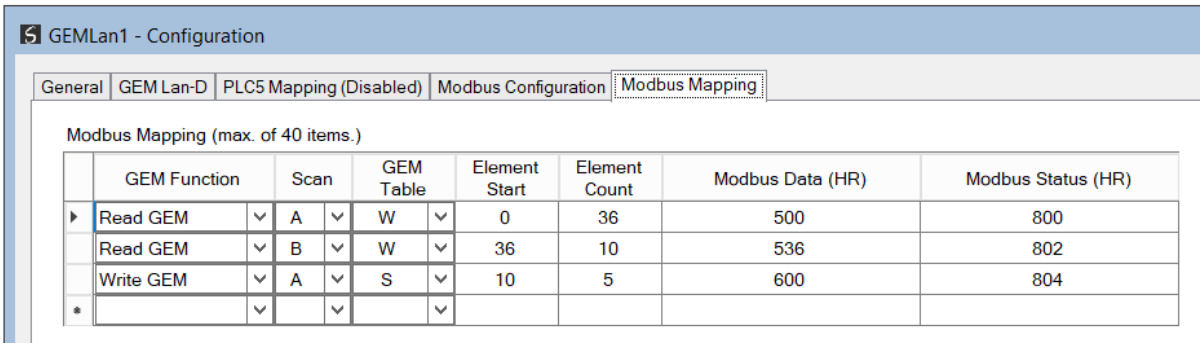


Figure 3.24 - Modbus Mapping configuration

The Modbus Mapping item parameters are as follows:

Parameter	Description
GEM Function	This parameter can either be read or write. **Read GEM** The GemLan Router will read a certain range of GEM Table Elements (in the example above it is W0- W35). The module will then write the received data into the internal Modbus registers HR500 – HR535. **Write GEM** The configured internal Modbus registers will be written into the configured GEM Table Elements (in the above example it is S10 – S14)
Scan	The Scan class used for the mapped item.
GEM Table	Table in the GEM80 controller that must be accessed.
Element Start	The table offset in the GEM80 controller that must be accessed.
Element Count	The number of elements that must be accessed for the specific GEM Table.
Modbus Data (HR)	The starting offset of the internal Modbus Holding Register where the data is mapped. The length of the Modbus data is specified by the above Element Count.
Modbus Status (HR)	The starting offset of the internal Modbus Holding Register where the status of the mapped item will be mapped. The status information occupies 2 Holding Registers. The first register indicates the current status, 0 = Fail, 1 = Success. The seconds register holds the GEMLan success counts for that specific item.

Table 3.6 – Modbus Mapping parameters

NOTE: Both the Modbus Data and Modbus Status Holding Registers must be within the GemLan Router's HR Range. (As configured in the aforementioned Modbus HR Range Start.)

NOTE: The GemLan Router supports a maximum of 40 mapped items (each with a maximum of 240 elements) in Modbus-TCP Slave Mapping Mode.

3.6. FTVIEW CONFIGURATION

The GemLan Router allows an HMI (e.g. FTView) to connect to the GEM80 without the use of a Logix controller. For this, the GemLan Router must be configured in PLC5 mode.

In a new or existing FTView project, add the ***RSLinx Enterprise server***, if it does not already exist, and apply the default settings.

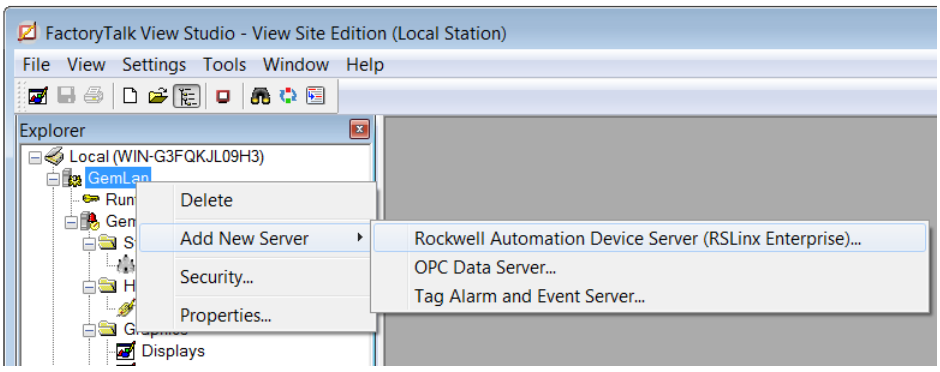


Figure 3.25 - FTView - Adding RSLinx Enterprise Server

The RSLinx Enterprise server will be added to the project tree. Under this new item, right click on the ***Communication Setup*** and select the ***Open***.

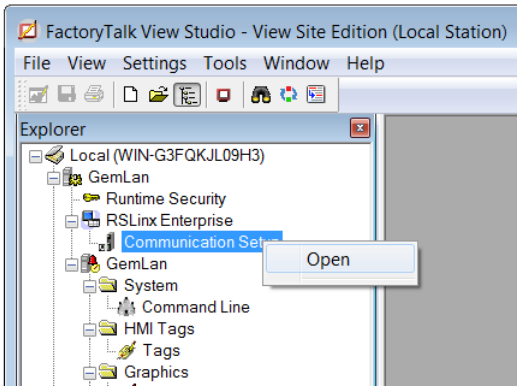


Figure 3.26 - FTView - Open Communication Driver

The Communication Setup window will open. Right click on the ***Ethernet*** driver and select ***Add Device***.

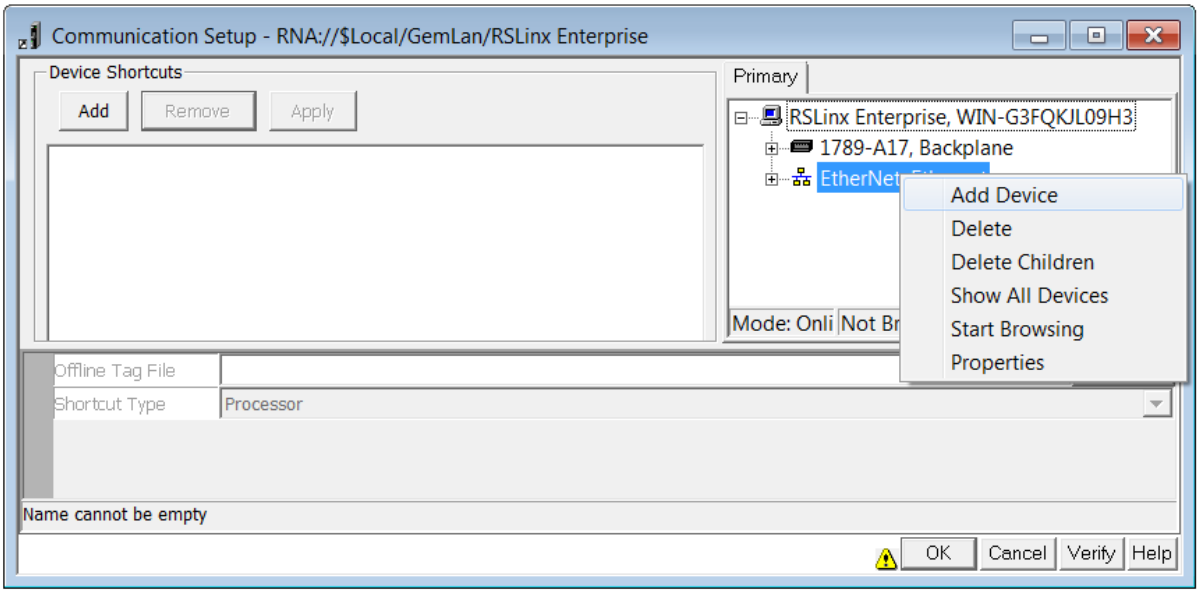


Figure 3.27 - FTView - Communication Setup

The ***Add Device*** window will open, expand the "***Ethernet PLC devices"*** folder and select the ***1785-L40E PLC***.

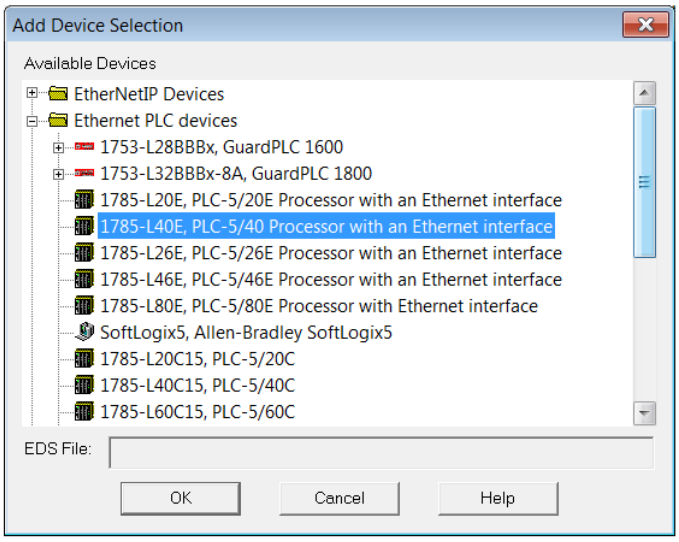


Figure 3.28 - FTView - Add device

In the device properties enter the IP address of the GemLan Router and select the ***Ok*** button.

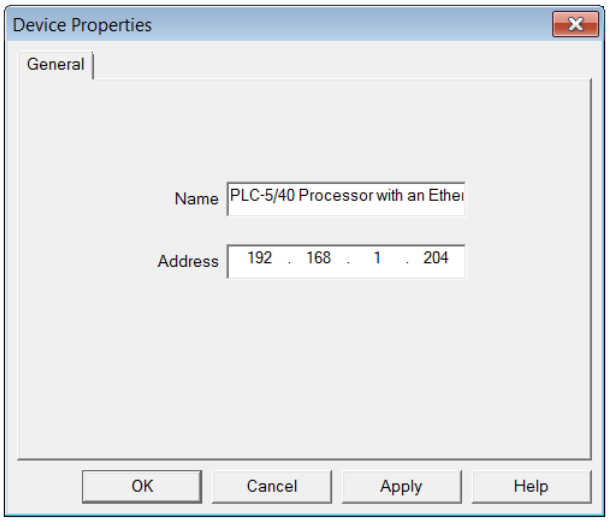


Figure 3.29 - FTView – IP Address configuration

NOTE: The "address already in use" warning may appear if the module is online and RSLinx Enterprise's Auto Browsing function has already added the module as an EtherNet/IP device. To correct this, temporarily disconnect the Gem Lan Router, then delete the Ethernet driver and re-add it.

Once the GemLan Router has been added as a PLC5 device, create a shortcut by selecting the PLC5 device and then clicking the ***Add*** button on the left-hand side. Give the shortcut a suitable name and select the ***Apply*** button.

Then select the ***Ok*** button at the bottom of the ***Communication Setup*** window.

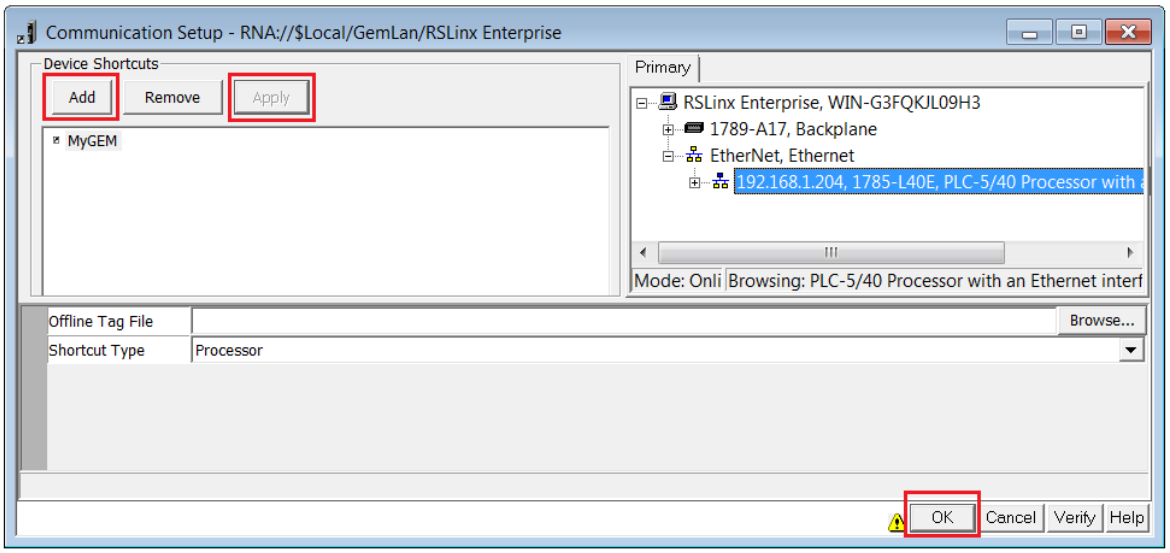


Figure 3.30 - FTView - Adding Device Shortcut

Configuring the FTView application can now continue as normal. When using the Tag Browser for the first time, it may be necessary to right click on the GemLan tag folder and select ***Refresh All Folders***.

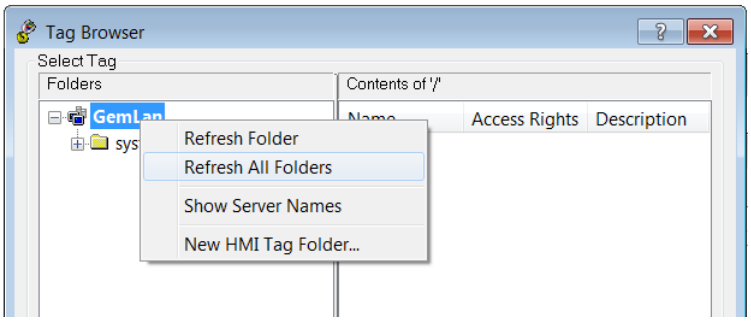


Figure 3.31 - FTView - Refreshing Tags

All the mapped items created in the GemLan Router will now appear as online PLC5-type tags, which can be used in the HMI application.

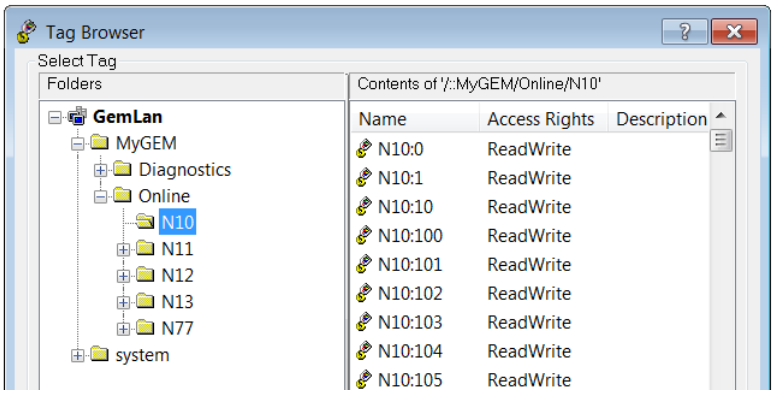


Figure 3.32 - FTView - Online Tags

3.7. MODULE DOWNLOAD

Once the GemLan Router configuration has been completed, it must be downloaded to the module.

Before downloading the Connection Path of the module should be set. This path will automatically default to the IP address of the module, as set in the module configuration. It can however be modified, if the GemLan Router is not on a local network.

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

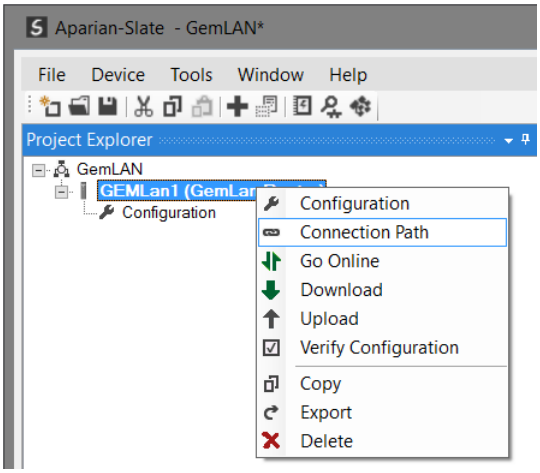


Figure 3.33 - Selecting Connection Path

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

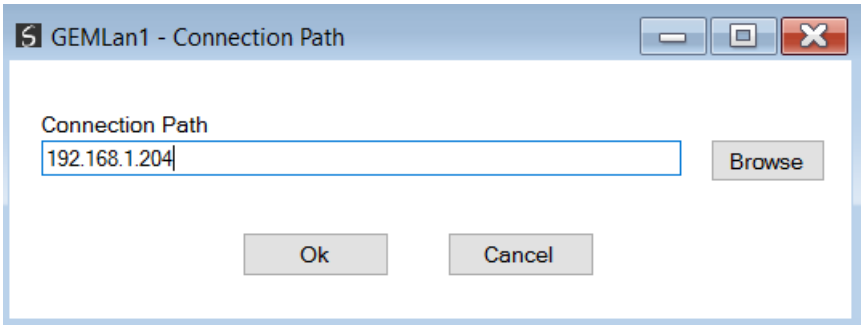


Figure 3.34 - Connection Path

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

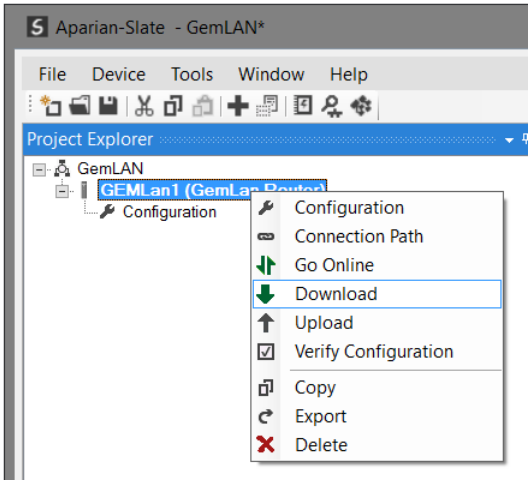


Figure 3.35 - Selecting Download

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

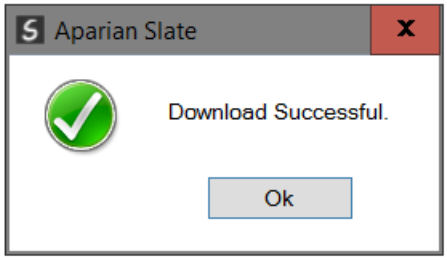


Figure 3.36 - Successful download

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.

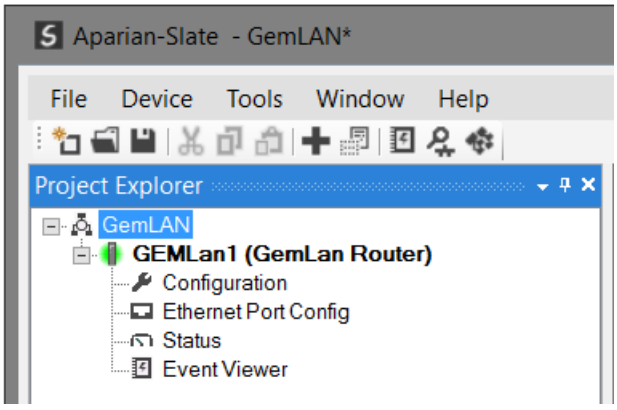


Figure 3.37 - Module online

3.8. LOGIX 5000 CONFIGURATION

3.8.1. ADD MODULE TO I/O CONFIGURATION

When the module operates in a Logix “owned” mode the GemLan Router will need to be added to the Logix 5000 I/O tree. The module will need to be added as a generic Ethernet module. This is done by right clicking on the Ethernet Bridge in the Logix 5000 and selecting *New Module* after which the *ETHERNET-MODULE* is selected to be added as shown in the figure below.

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

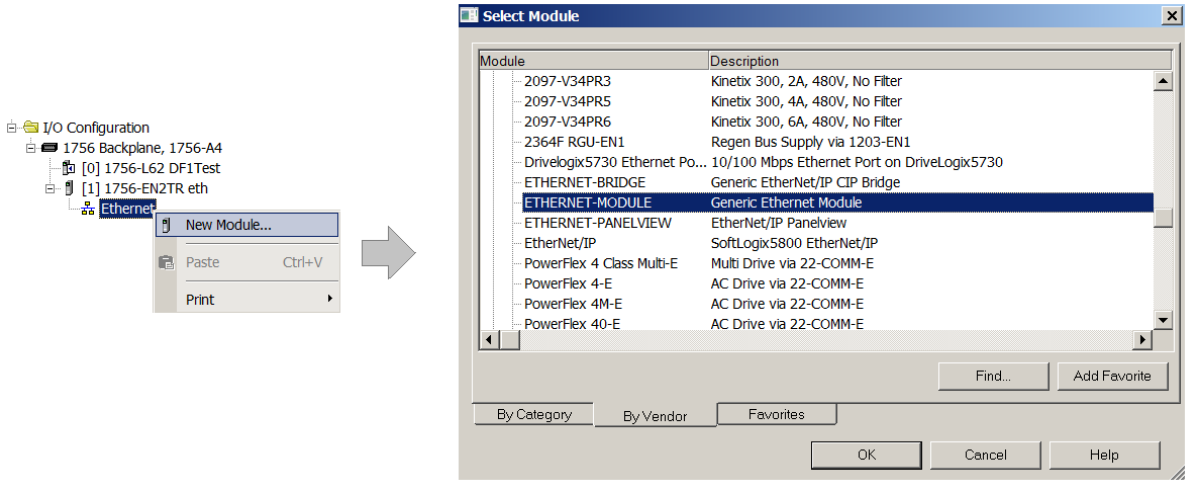


Figure 3.38 - Add a Generic Ethernet Module in Logix 5000

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

Connection Parameter	Assembly Instance	Size
Input	121	20 (32-bit)
Output	101	1 (32-bit)
Configuration	102	0 (8-bit)

Table 3.7 - Logix class 1 connection parameters for the GemLan Router

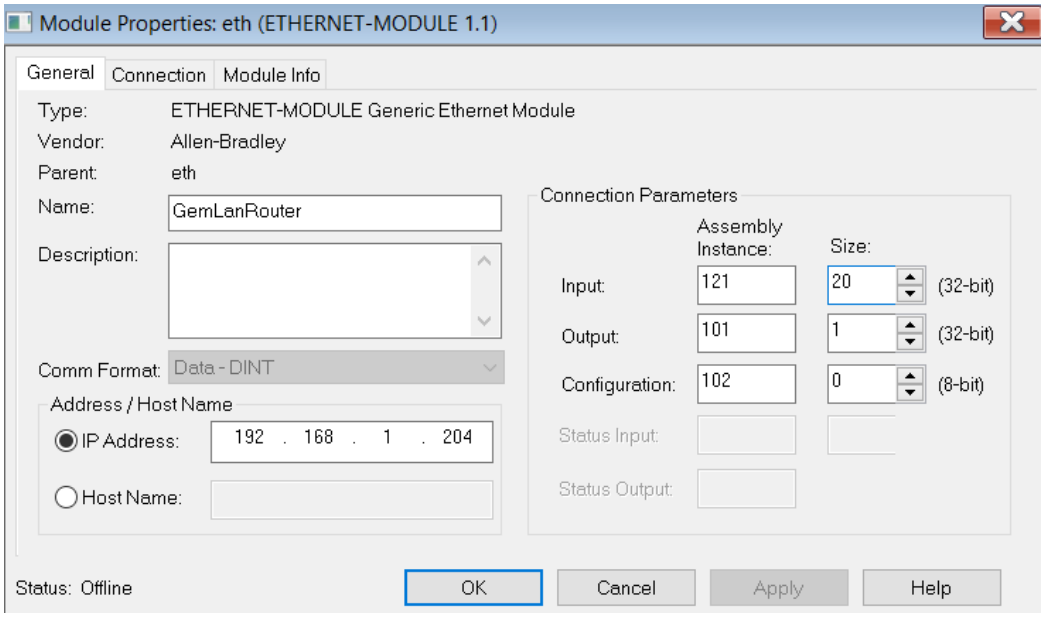


Figure 3.39 - Logix General module properties in Logix 5000

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

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

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

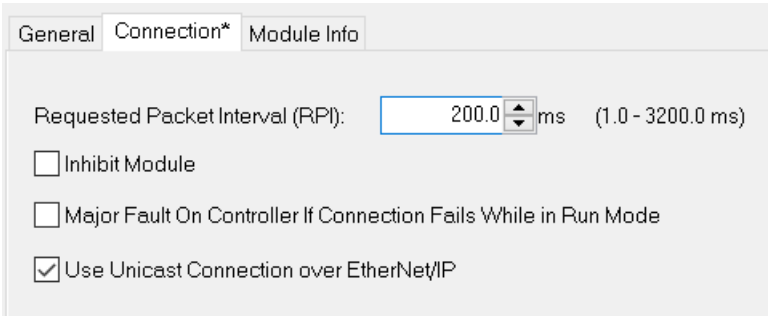


Figure 3.40 - Connection module properties in Logix 5000

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

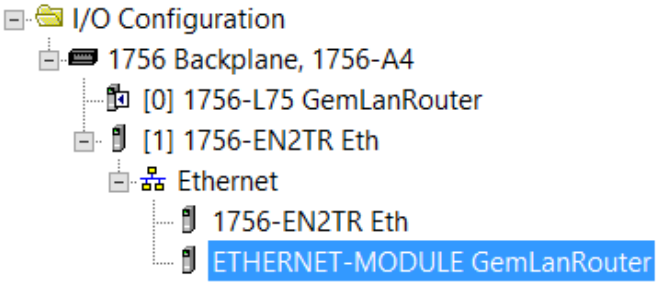


Figure 3.41 - Logix 5000 I/O module tree

3.8.2. Importing UDTs and Mapping Routines

To simplify the mapping of the input image, a Logix 5000 Routine Partial Import (L5X) file is provided.

This file can be imported by right-clicking on the required Program and selecting the Import Routine option.

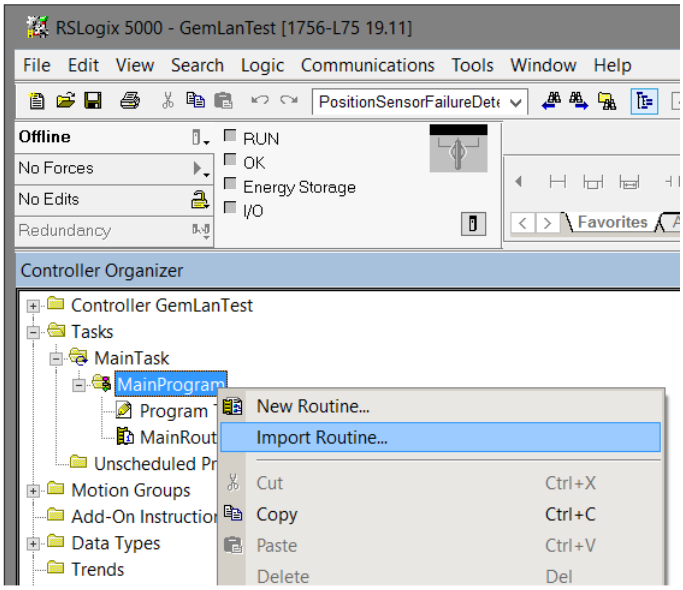


Figure 3.42 - Logix 5000 Importing GemLan Router specific routine and UDTs

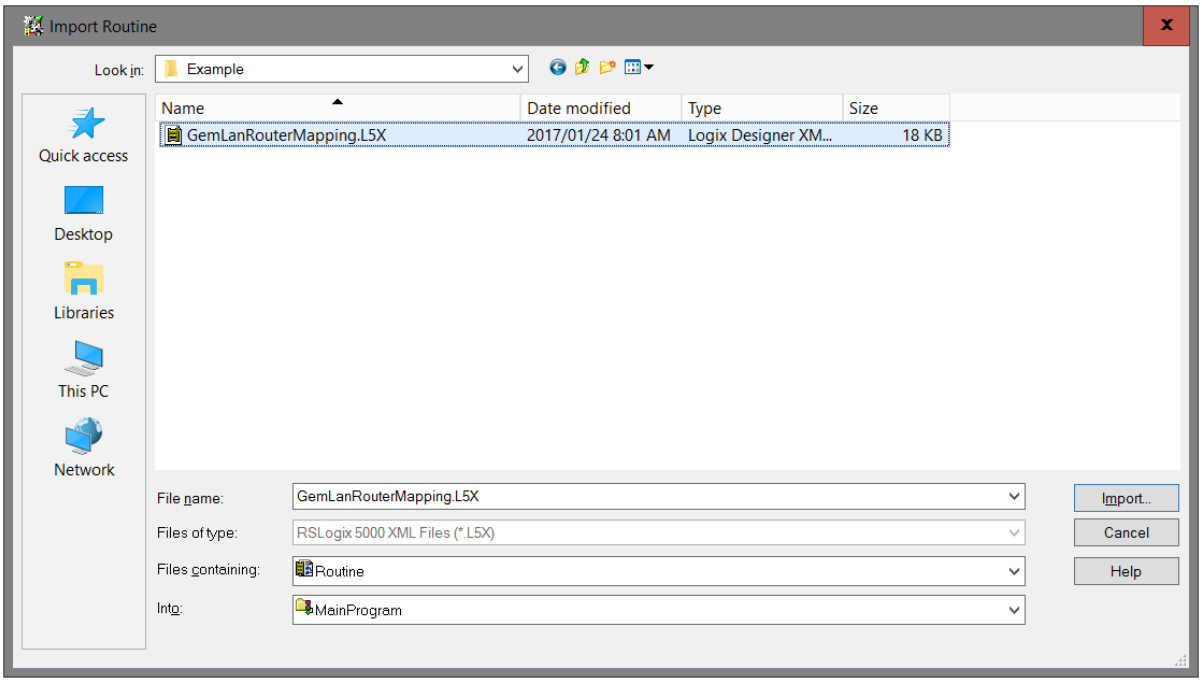


Figure 3.43 - Selecting partial import file

The import will create the following:

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

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

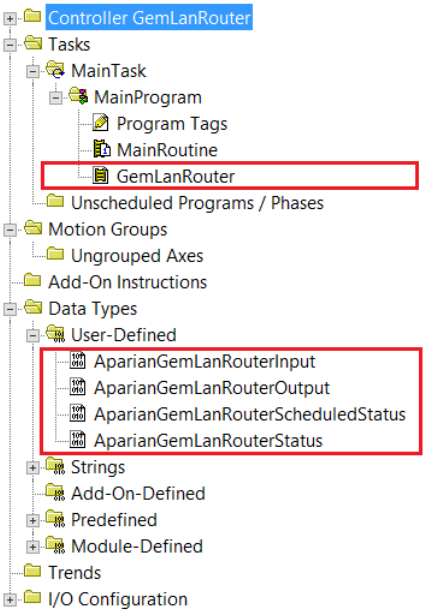


Figure 3.44 - Imported Logix 5000 objects

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

4. OPERATION

4.1. MESSAGE ROUTING

When the module has been correctly setup the PLC5 / Logix message initiator will send a read/write to a certain DECNet address which will then be routed to a Logix tag. The messages send by the initiator must be completed with the correct data for successful operation. There are various indicators to determine if the mapping is routing the DECNet messages correctly. Refer to the diagnostics section of this document for a more detailed explanation of the various indicators that can be used to diagnose the module.

4.2. LOGIX 5000 ASSEMBLIES

When the module operates in a Logix "owned" mode the Logix controller will establish a class 1 cyclic communication connection with the GemLan Router. An input and output assembly is exchanged at a fix interval. The UDTs provided will convert the input and output arrays into tag based assemblies. Refer to the additional information section in this document for the input and output UDTs.

4.2.1. INPUT ASSEMBLY

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

Parameter	Datatype	Description
InstanceNameLen	DINT	This parameter is the instance name length of the module that was configured under the general GemLan Router configuration in Slate.
InstanceName	SINT[16]	This parameter is the instance name of the module that was configured under the general GemLan Router configuration in Slate.
Status.PLC5Mode	BOOL	Set if the module is operating in PLC5 Mode
Status.LogixScheduled	BOOL	Set if the module is operating in Scheduled Logix Mode.
Status.ConfigValid	BOOL	Set if a valid configuration is executing in the module.
Status.RoutingInhibited	BOOL	Set when the module's routing function has been inhibited. Routing can be inhibited by setting a bit in the output assembly of the module.
ScheduledStatus.ScheduledTagStatus0..39	BOOL	Each bit represents the status of the last scheduled transaction for that specific map item. A true value indicates success.

TransactionRate	DINT	The transaction rate is the number of DECNet messages per second that the module is currently routing.
DeviceTemperature	REAL	The internal temperature of the module.
GemLanReadCount	DINT	The total number of DECNet read responses received by the module.
GemLanWriteCount	DINT	The total number of DECNet write responses received by the module.
GemLanErrors	DINT	The total number of DECNet error responses received by the module.
PCCCReadCount	DINT	The total number of PCCC read requests received by the module when operating in PLC5 mode.
PCCCWriteCount	DINT	The total number of PCCC write requests received by the module when operating in PLC5 mode.
PCCCFailureCount	DINT	The total number of PCCC message routing requests that resulted in errors when operating in PLC5 mode.
TagReads	DINT	The total number of tag reads executed by the module when operating in Logix Scheduled mode.
TagWrites	DINT	The total number of tag writes executed by the module when operating in Logix Scheduled mode.
ConnectionFailures	DINT	The number of failed class 3 connection attempts when operating in Logix Scheduled mode. Note: Tag reading and writing requires the module to first establish a class 3 connection with the Logix Controller.
TagErrors	DINT	The number of failed tag access (read/write) requests when operating in Logix Scheduled mode. These may include privileged violations, non-existing tags, etc.

Table 4.1 - Logix 5000 input assembly parameters

4.2.2. OUTPUT ASSEMBLY

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

Parameter	Datatype	Description
RoutingInhibit	BOOL	This bit inhibits the module routing capabilities. When set, no DECNet messages will be routed.

Table 4.2 - Logix 5000 output assembly parameters

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

GLR01Input	{...}		AparianGemLanRouterInput
GLR01Input.InstanceNameLen	8	Decimal	DINT
GLR01Input.InstanceName	{...}	Decimal	SINT[16]
GLR01Input.Status	{...}		AparianGemLanRouterStatus
GLR01Input.Status.PLC5Mode	0	Decimal	BOOL
GLR01Input.Status.LogixScheduled	1	Decimal	BOOL
GLR01Input.Status.ConfigValud	1	Decimal	BOOL
GLR01Input.Status.RoutingInhibited	0	Decimal	BOOL
GLR01Input.ScheduledStatus	{...}		AparianGemLanRouterScheduledStatus
GLR01Input.ScheduledStatus.ScheduledTagStatus0	1	Decimal	BOOL
GLR01Input.ScheduledStatus.ScheduledTagStatus1	1	Decimal	BOOL
GLR01Input.ScheduledStatus.ScheduledTagStatus2	0	Decimal	BOOL
● ● ●			
GLR01Input.ScheduledStatus.ScheduledTagStatus39	0	Decimal	BOOL
GLR01Input.TransactionRate	10	Decimal	DINT
GLR01Input.DeviceTemperature	51.893616	Float	REAL
GLR01Input.GemLanReadCount	334079	Decimal	DINT
GLR01Input.GemLanWriteCount	334078	Decimal	DINT
GLR01Input.GemLanErrors	0	Decimal	DINT
GLR01Input.PCCCReadCount	0	Decimal	DINT
GLR01Input.PCCCWriteCount	0	Decimal	DINT
GLR01Input.PCCCFailureCount	0	Decimal	DINT
GLR01Input.TagReads	334078	Decimal	DINT
GLR01Input.TagWrites	334079	Decimal	DINT
GLR01Input.ConnectionFailures	0	Decimal	DINT
GLR01Input.TagErrors	0	Decimal	DINT
GLR01Output	{...}		AparianGemLanRouterOutput
GLR01Output.RoutingInhibit	0	Decimal	BOOL

Figure 4.1 - Gem Lan Router Input and Output Assembly

4.3. MODBUS MAPPING

The GemLan Router provides additional status information via Modbus.

4.3.1. GENERAL STATUS

The general status of the module can be accessed at the HR Offset specified in the Router Status HR (in the Modbus-TCP Configuration).

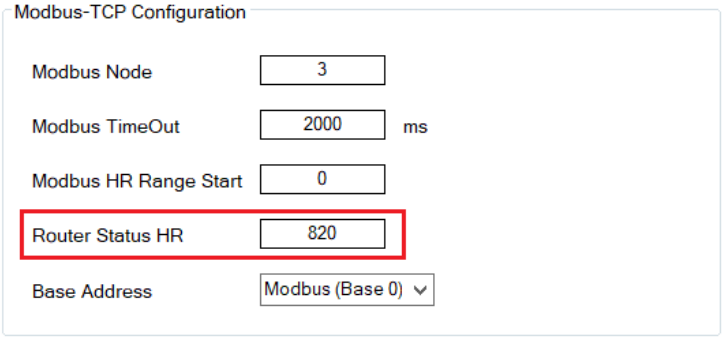


Figure 4.2 - Modbus-TCP Configuration

This status information consumes 16 Modbus Holding Registers and consists of the following parameters:

HR Offset	Parameter	Data Type	Description
0	Config CRC	INT	The configuration checksum.
1	Transaction Rate	INT	The transaction rate is the number of DECNet messages per second that the module is currently routing.
2	Connection Request	DINT	The number of GEM-Lan connection requests sent
4	Reads	DINT	The number of successful GEM-Lan reads
6	Writes	DINT	The number of successful GEM-Lan writes
8	Connection Fails	DINT	The number of GEM-Lan connection requests that failed
10	Read Fails	DINT	The number of unsuccessful GEM-Lan reads
12	Write Fails	DINT	The number of unsuccessful GEM-Lan writes
14	Timeouts	DINT	The number of GEM-Lan connections that have timed out
16	Close Connection	DINT	The number of Close Connection requests that have been sent

Table 4.3 – Modbus General Status parameters

4.3.2. Mapped Item Status

For each Modbus mapped item, a Modbus Status Holding Register must be configured. This status structure occupies 2 Holding Registers and provides information about the GEMLan communication for that specific mapped item.

Modbus Mapping (max. of 40 items.)

	GEM Function	Scan	GEM Table	Element Start	Element Count	Modbus Data (HR)	Modbus Status (HR)
▸	Read GEM	A	W	0	36	500	800
	Read GEM	B	W	36	10	536	802
	Write GEM	A	S	10	5	600	804
*							

Figure 4.3 – Modbus Mapping (Modbus Status HR)

The individual item status structure is as follows:

HR Offset	Parameter	Data Type	Description
0	Current Status	INT	The status of the last GEMLan transaction for this mapped item. **0 = Failed (or not started)** **1 = Success**
1	Success Counts	INT	The number of successful transactions for this mapped item.

Table 4.4 – Modbus Mapped Item Status parameters

5. DIAGNOSTICS

5.1. LEDS

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



Figure 5.1 - GemLan Router front view

LED	Description
Ok	The module Ok LED will provide information regarding the system-level operation of the module. If the LED is red then the module is not operating correctly. For example, if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is green then the module has booted and is running correctly.
Act	The activity LED is used for indicating successful or failed routing transactions.
Eth	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic was detected.

Table 5.1 - Module LED operation

5.2. MODULE STATUS MONITORING IN SLATE

The GemLan Router can provide a range of statistics which can assist with module operation, maintenance, and fault finding. The statistics can be accessed in full by Slate or using the web server in the module.

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

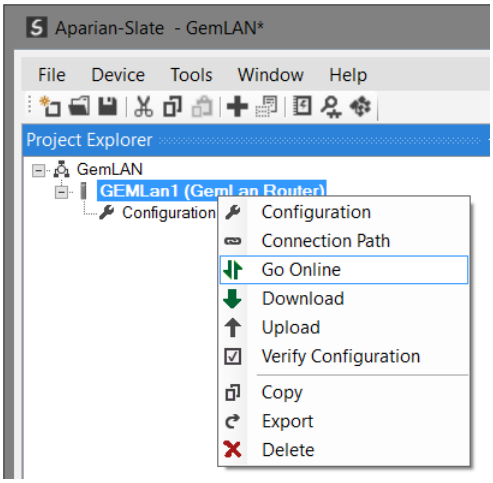


Figure 5.2. - Selecting to Go Online

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

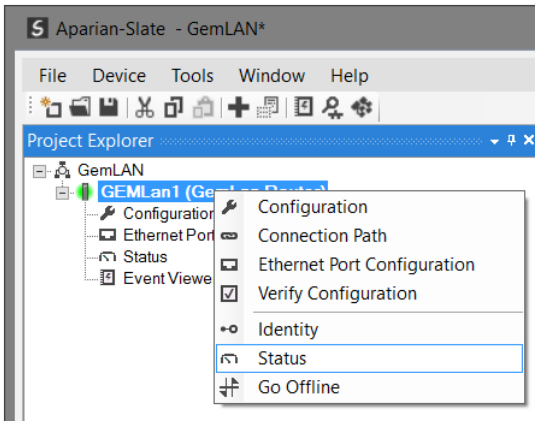


Figure 5.3. - Selecting online Status

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 status of the module. Most of these parameters in the status windows are self-explanatory or have been discussed in previous sections.

5.2.1. General Status

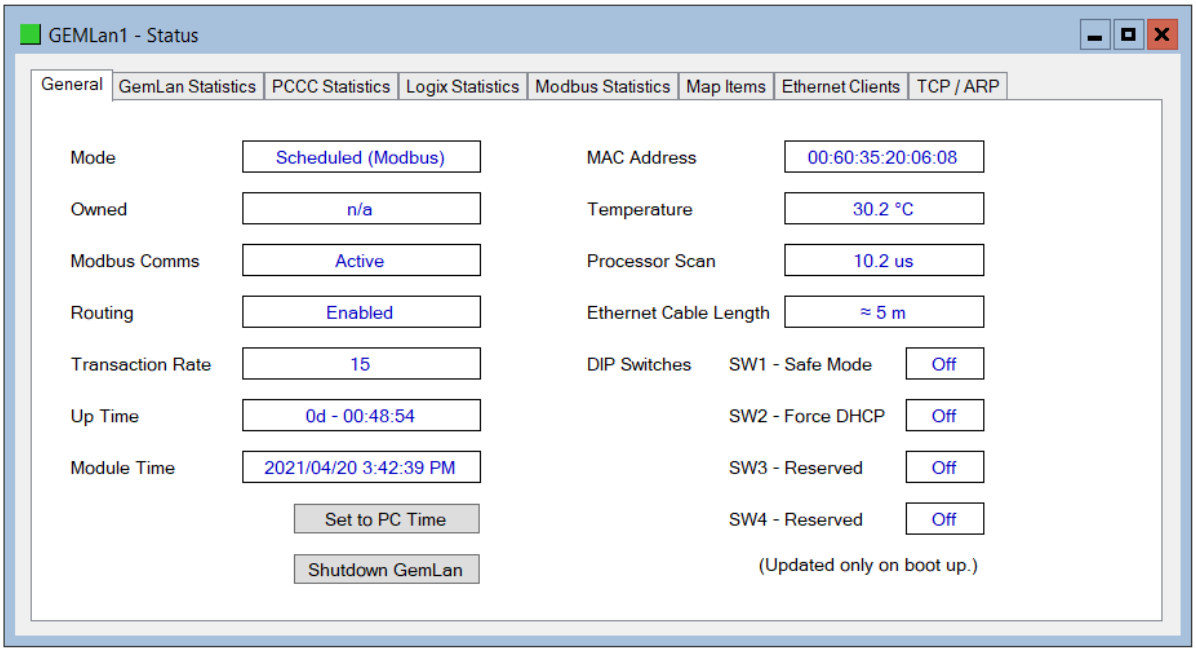


Figure 5.4. - Status monitoring - General

The General tab displays the following general parameters and can also be used to set the module time to the PC time:

Parameter	Description
Mode	Indicates the operating mode of the module. Note: If the Shutdown GemLan option has been selected, then the mode will display ***Disabled***.
Owned	Indicates whether the module is currently owned (Class 1) by a Logix controller.
Modbus Comms	Indicates if the Modbus communications is currently active. Applicable only when in ***Modbus-TCP Slave*** mode.
Routing	Indicates the status of the message routing.
Transaction Rate	The transaction rate is the number of DECNet messages per second that the module is currently routing.
Up Time	Indicates the elapsed time since the module was powered-up.

Module Time	Indicates the module's internal time. The module time is stored in UTC (Universal Coordinate Time) but displayed on this page according to the local PC Time Zone settings.
MAC Address	Displays the module's unique Ethernet MAC address.
Temperature	The internal temperature of the module.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
Ethernet Cable Length	Approximate length of the Ethernet cable (accurate to 5m).
DIP Switch Position	The status of the DIP switches when the module booted. Note that this status will not change if the DIP switches are altered when the module is running.

Table 5.2 - Parameters displayed in the Status Monitoring – General Tab

The GemLan Router's GemLan communication can be temporarily disabled using the ***Shutdown GemLan*** button located at the bottom of the ***General*** tab.

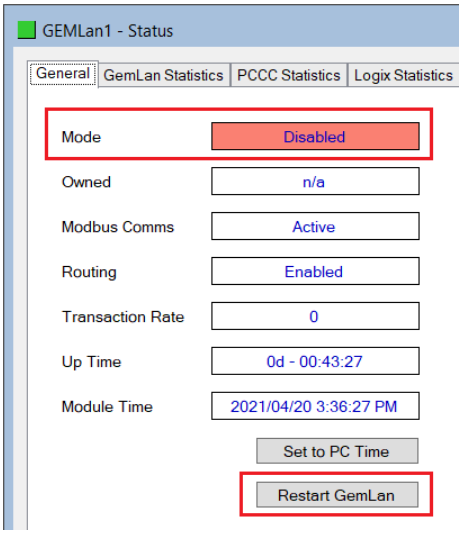


Figure 5.5 - Status monitoring – Shutdown / Restart GemLan Communication

The ***Mode*** will change to ***Disabled***, and the ***Shutdown GemLan*** button will be replaced with the ***Restart GemLan*** button. Clicking the latter restarts the GemLan communication.

NOTE: The ***Shutdown GemLan*** option should be used before powering-down the module or disconnecting the Ethernet cable. The remote GemLan-D card does not time-out connections, and once the maximum number of connections (typically 25) has been reached, then no more connections will be accepted.

5.2.2. GEMLAN STATISTICS

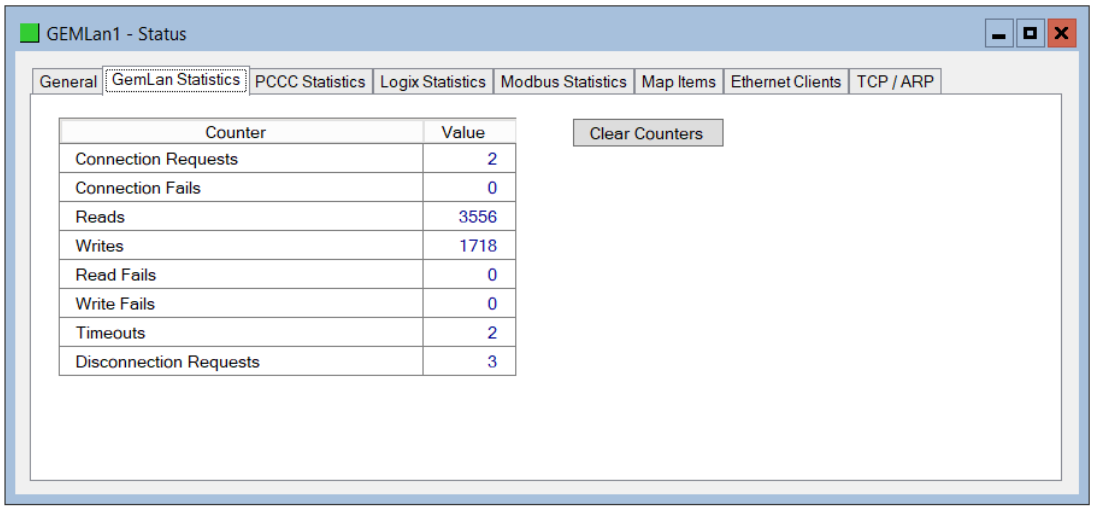


Figure 5.6 - Status monitoring – GemLan Statistics

The GemLan Statistics tab displays the following general parameters:

Parameter	Description
Connection Requests	The number of GEM-Lan connection requests sent
Connection Fails	The number of GEM-Lan connection requests that failed
Reads	The number of successful GEM-Lan reads
Writes	The number of successful GEM-Lan writes
Read Fails	The number of unsuccessful GEM-Lan reads
Write Fails	The number of unsuccessful GEM-Lan writes
Timeouts	The number of GEM-Lan connections that timed out
Disconnection Requests	The number of GEM-Lan disconnection requests sent

Table 5.3 - Parameters displayed in the Status Monitoring – GemLan Statistics Tab

5.2.3. PCCC STATISTICS

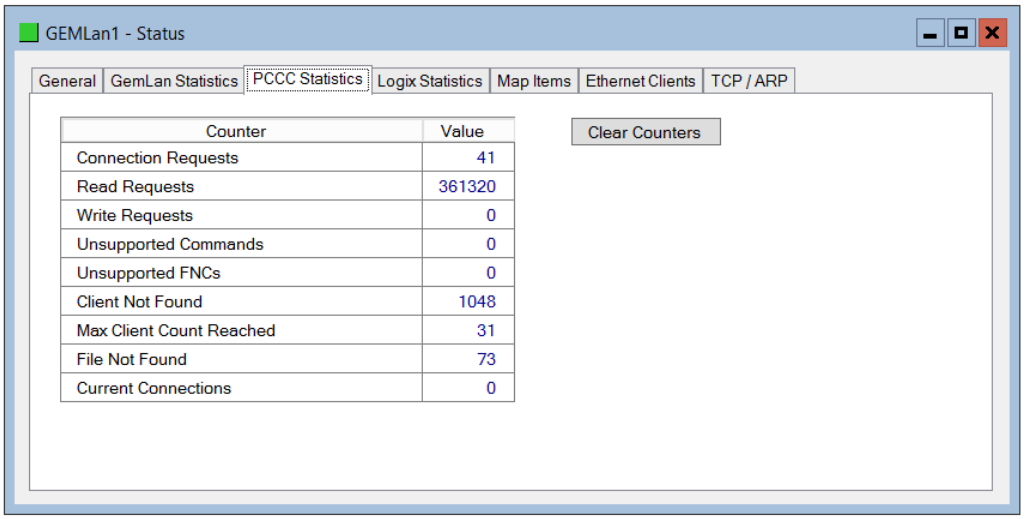


Figure 5.7 - Status monitoring – PCCC Statistics

The PCCC Statistics tab displays the following general parameters:

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

Table 5.4 - Parameters displayed in the Status Monitoring – PCCC Statistics Tab

5.2.4. LOGIX STATISTICS

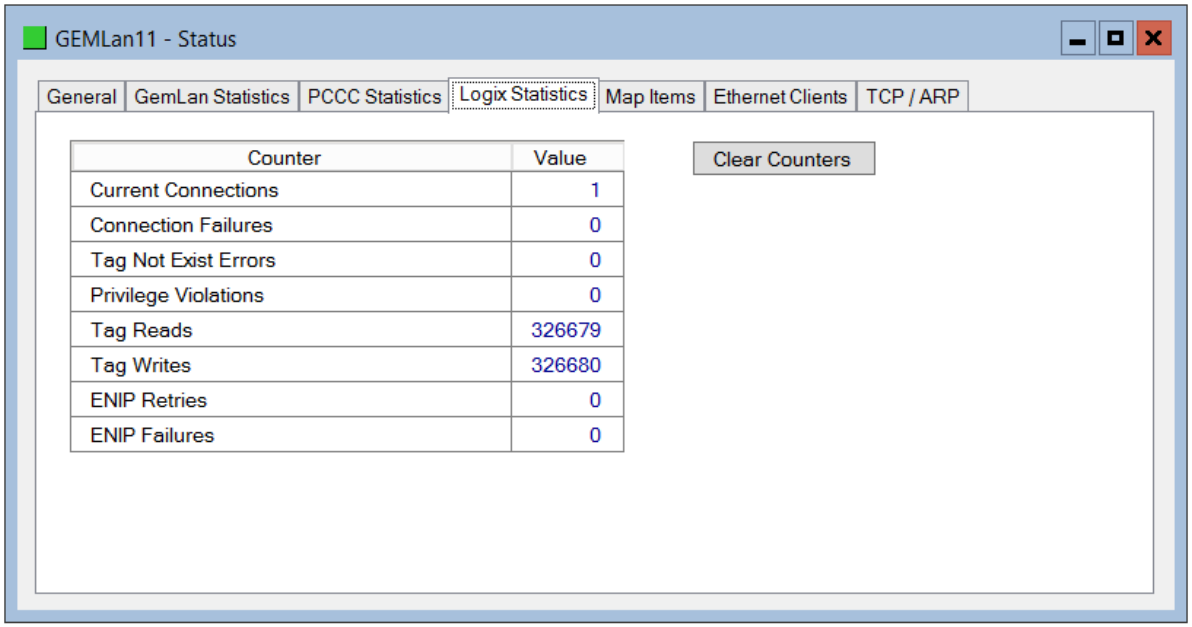


Figure 5.8 - Status monitoring – Logix Statistics

The Logix Statistics tab displays the following general parameters:

Parameter	Description
Current Connections	The number of current open class 3 connections.
Connection Failures	The number of failed attempts at establishing a class 3 connections with a Logix controller.
Tag Not Exist Errors	The number of tag read and tag write transactions that failed due to the destination tag not existing.
Privilege Violations	The number of tag read and tag write transactions that failed due to a privilege violation error. This may be caused by the External Access property of the Logix tag being set to either None or Read Only.
Tag Reads	The number of tag read transactions executed by the DF1 Router module.
Tag Writes	The number of tag write transactions executed by the DF1 Router module.
ENIP Retries	This count increases when no response was received from the Logix Controller by the time the ENIP timeout is reached.
ENIP Failures	This count increases when the ENIP Retry Limit is reached and no response has been received from the Logix Controller.

Table 5.5 - Parameters displayed in the Status Monitoring – Logix Statistics Tab

5.2.5. MODBUS STATISTICS

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

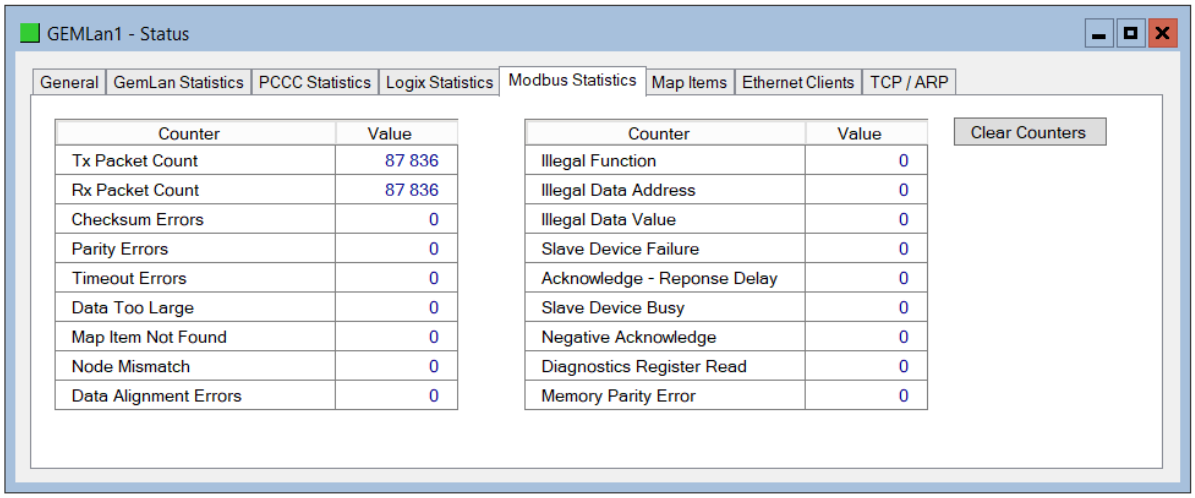


Figure 5.9 - Status Monitoring - Modbus Statistics

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 5.6 - Modbus Statistics

5.2.6. MAPPED ITEM STATUS

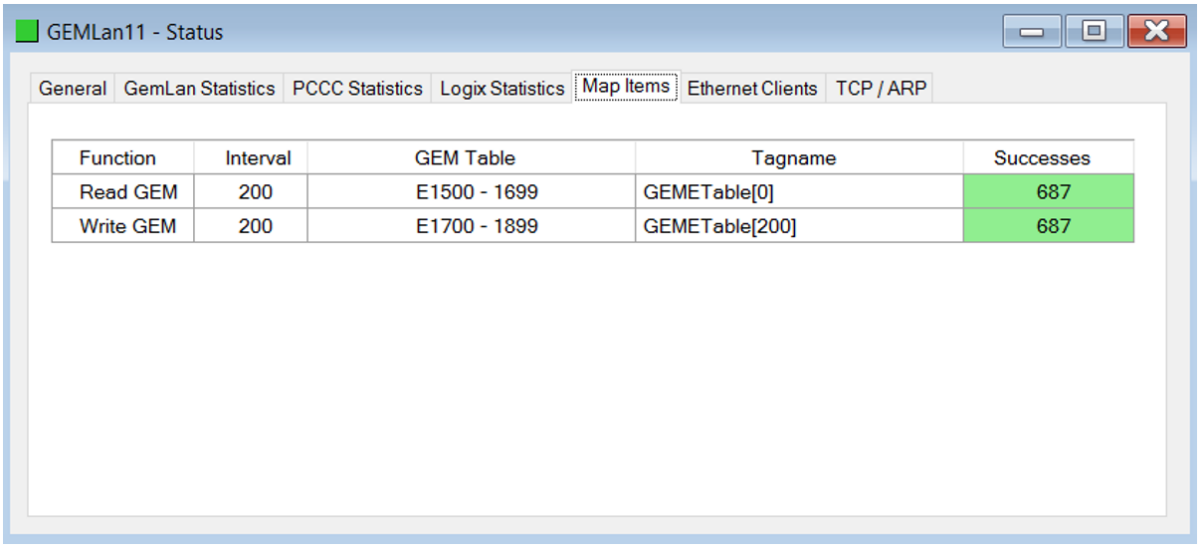


Figure 5.10 - Status monitoring – Map Items

The Mapped Items tab displays the successful transactions per mapped Logix or Modbus item.

5.3. MODULE EVENT LOG

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

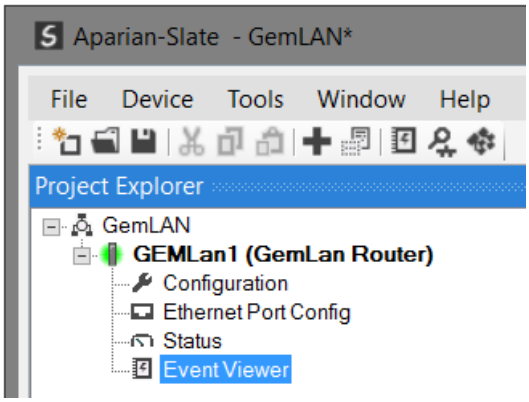
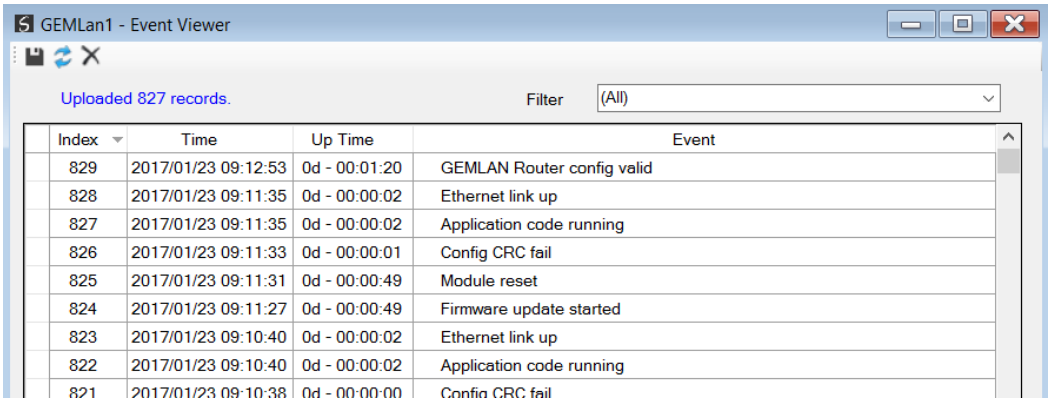


Figure 5.11 - Selecting the module Event Log

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
829	2017/01/23 09:12:53	0d - 00:01:20	GEMLAN Router config valid
828	2017/01/23 09:11:35	0d - 00:00:02	Ethernet link up
827	2017/01/23 09:11:35	0d - 00:00:02	Application code running
826	2017/01/23 09:11:33	0d - 00:00:01	Config CRC fail
825	2017/01/23 09:11:31	0d - 00:00:49	Module reset
824	2017/01/23 09:11:27	0d - 00:00:49	Firmware update started
823	2017/01/23 09:10:40	0d - 00:00:02	Ethernet link up
822	2017/01/23 09:10:40	0d - 00:00:02	Application code running
821	2017/01/23 09:10:38	0d - 00:00:00	Config CRC fail

Figure 5.12 - 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.

5.4. MODBUS PACKET CAPTURE

The module provides the capability to capture the Modbus traffic for analysis. They will allow the user and the support team to resolve any possible issue on site.

To invoke the capture of the module, right-click on the GemLan Router and select the ***Modbus Packet Capture***.

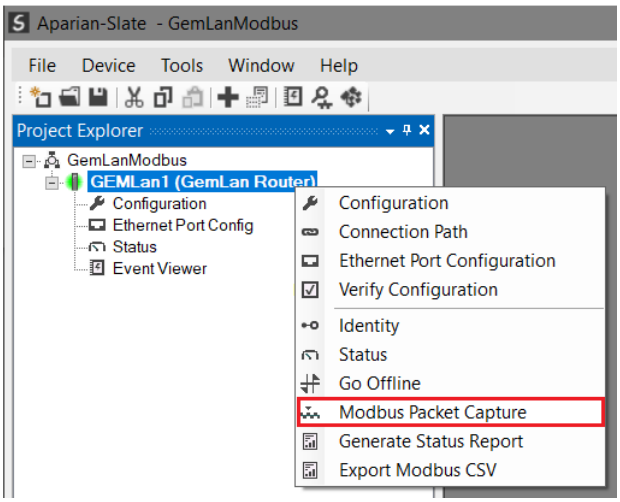


Figure 5.13 - Selecting Modbus Packet Capture

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

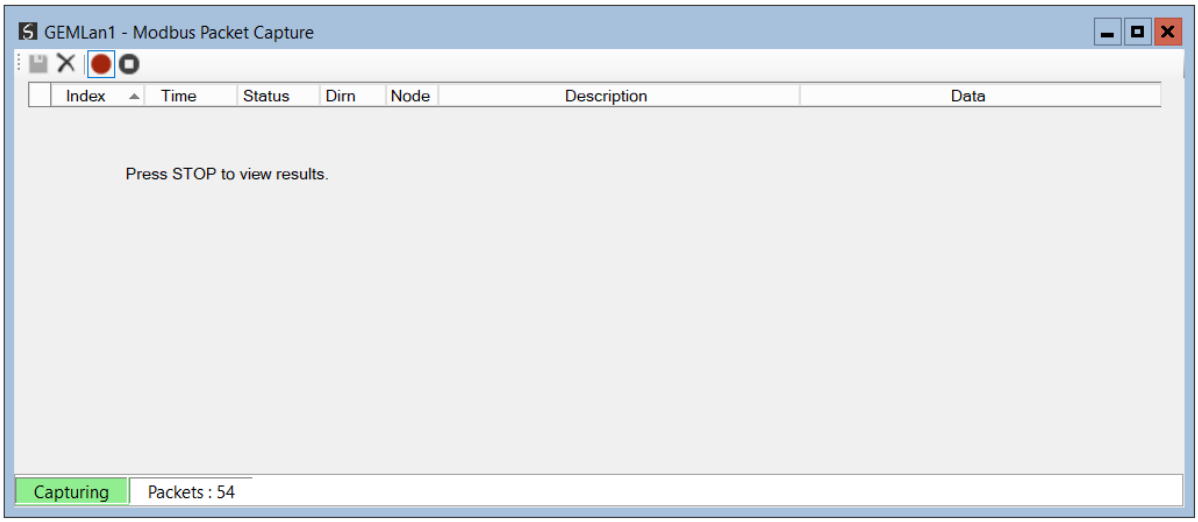


Figure 5.14 – Modbus packet capture

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

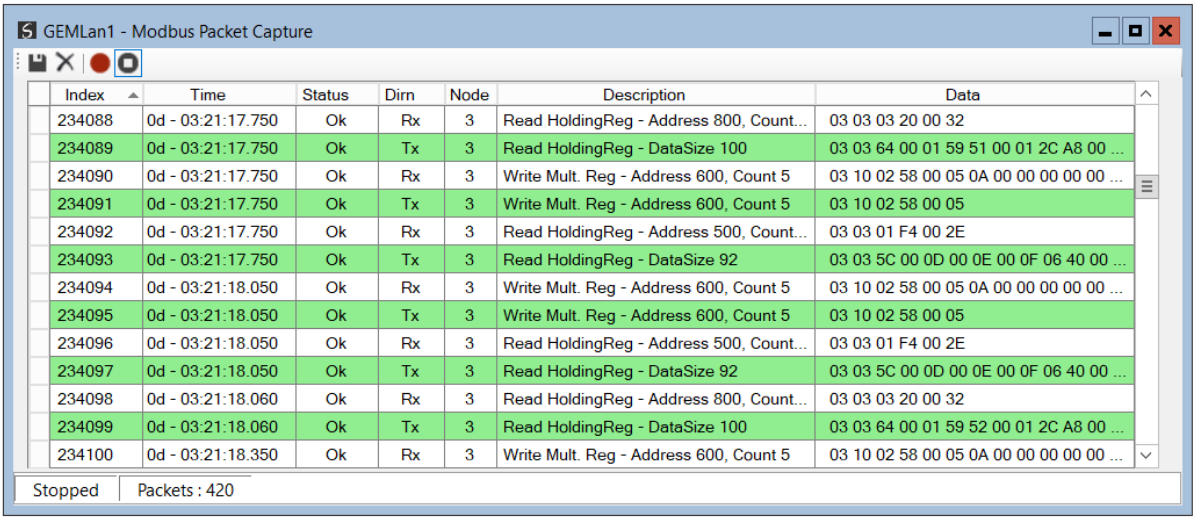


Figure 5.15 – Modbus Packet Capture complete

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.
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).
Node	Modbus node address of the message destination.
Description	A brief description of the packet, showing the function and register range if applicable.
Data	The raw packet data.

Table 5.7 - 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.

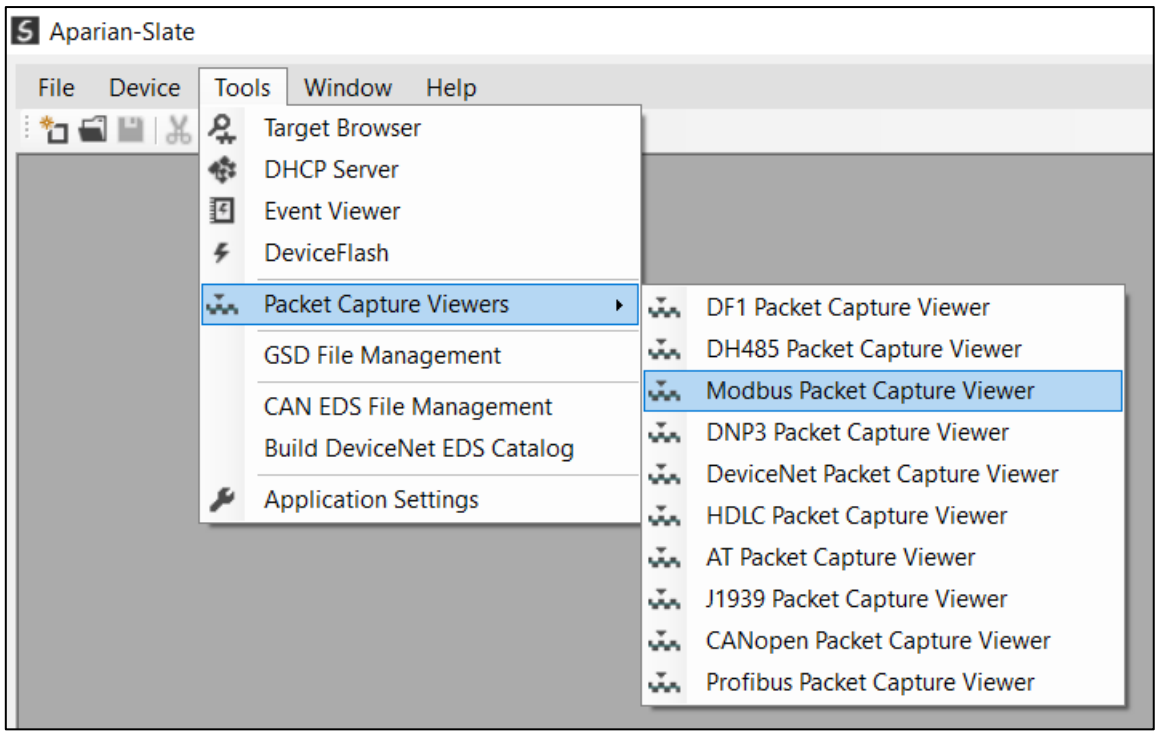


Figure 5.16 - Selecting the Modbus Packet Capture Viewer

5.5. WEB SERVER

The GemLan Router provides a web server allowing a user without Slate or Logix 5000 to view various diagnostics of the module. This includes Ethernet parameters, system event log, advanced diagnostics, and application diagnostics (Gem LAN statistics).

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

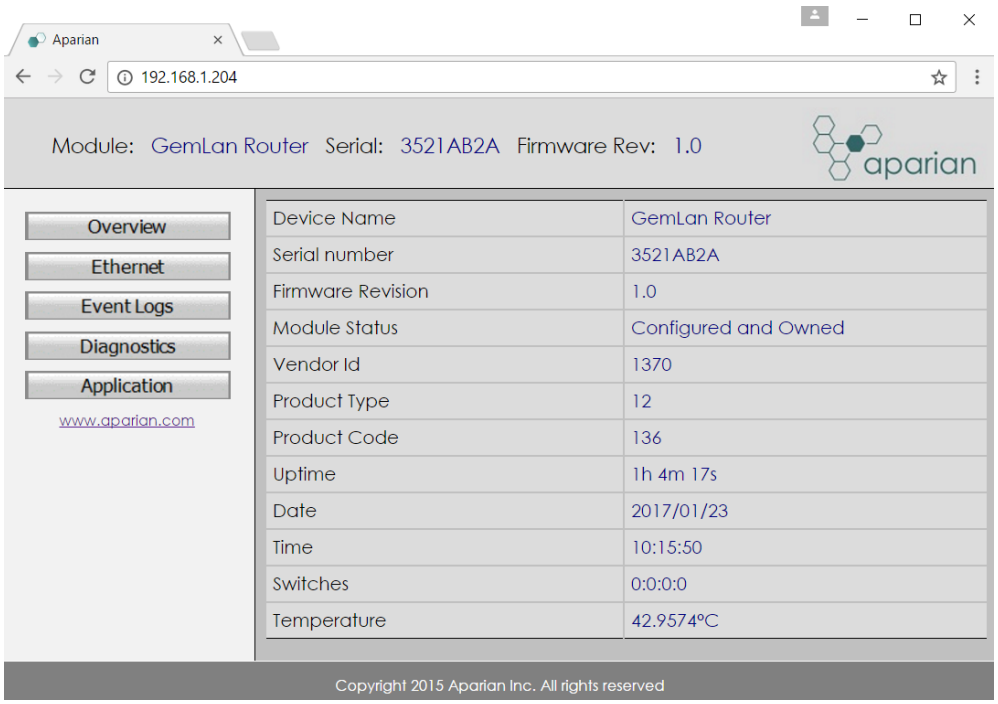


Figure 5.17 - Web interface

6. TECHNICAL SPECIFICATIONS

6.1. DIMENSIONS

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

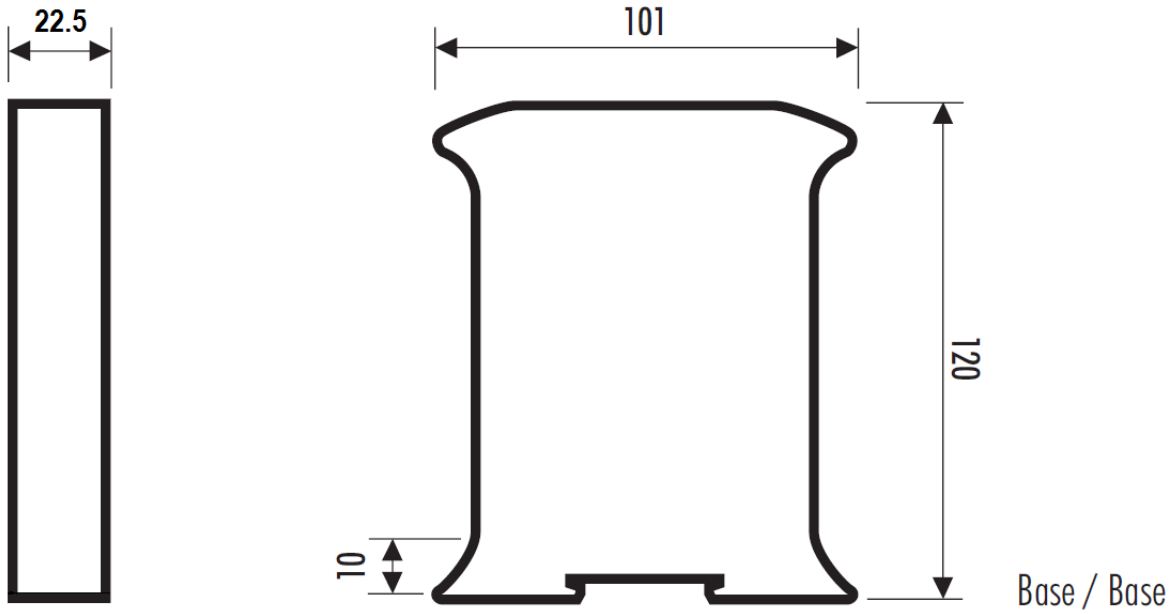


Figure 6.1 – GemLan Router enclosure dimensions

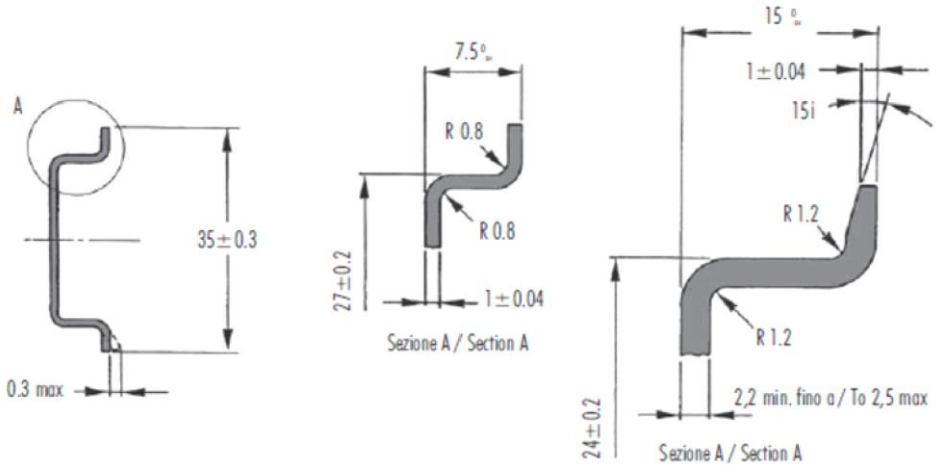


Figure 6.2 - Required DIN dimensions

6.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 28V DC, (70 mA @ 24 VDC)
Power consumption	1.7 W
Connector	3-way terminal
Conductors	24 – 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 6.1 - Electrical specification

6.3. ETHERNET

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

Table 6.2 - Ethernet specification

6.4. PCCC

Specification	Rating
Max PLC Mapping	40
Max element count per item	500 (1000 bytes)
Max PCCC Client count	10

Table 6.3 - PCCC specification

6.5. DECNET

Specification	Rating
Supported GEM Tables	A - Z
Max element count per transaction	500 (1000 bytes)

Table 6.4 – DECNet specification

6.6. LOGIX

Specification	Rating
Max Tag Mapping Count	40
Max Class 3 Connections	10
Max Logix Controllers	1

Table 6.5 – Logix specification

6.7. CERTIFICATIONS

Certification	Mark
CE Mark	CE
RoHS2 Compliant	RoHS2

ODVA Conformance	EtherNet/IP™ * F/W 1.001
RCM	
UL Mark File: E494895	 CLASS 1, DIV 2, GROUPS A, B, C, D

Table 6.6 – Certifications

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