High Speed Counter

User Manual

A-HSC

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aparian

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Revision History

Revision	Date	Comment
1.0	24 April 2026	Initial document
1.1	21 August 2026	Updated certification information
1.2	25 August 2026	Updated serial connector information
1.3	17 September 2026	Updated certification information

1. PREFACE

1.1. INTRODUCTION TO THE HIGH SPEED COUNTER

This manual describes the installation, operation, and diagnostics of the Aparian High Speed Counter (A-HSC) module. The High Speed Counter, (hereafter referred to as the **module**) provides 8 high speed digital inputs for counter and frequency measurements and sequence-of-events (SOE) applications, as well as 4 digital outputs, 4 analog inputs and 1 analog output.

The module can be configured to be either an EtherNet/IP target, a Modbus (TCP/RTU) client or a Modbus (TCP/RTU) server.

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

EtherNet/IP Target
Here a remote EtherNet/IP device (e.g. a Logix controller) establishes a Class 1 connection to the module. Direct I/O data, diagnostics and counter values are exchanged using the input and output data assembly.

Modbus Server
Direct I/O data, diagnostics and counter values 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 Modbus TCP or Modbus RTU (RS232 or RS485).

Modbus Client
Direct I/O data, diagnostics and counter values 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 via Modbus TCP or Modbus RTU (RS232 or RS485).

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

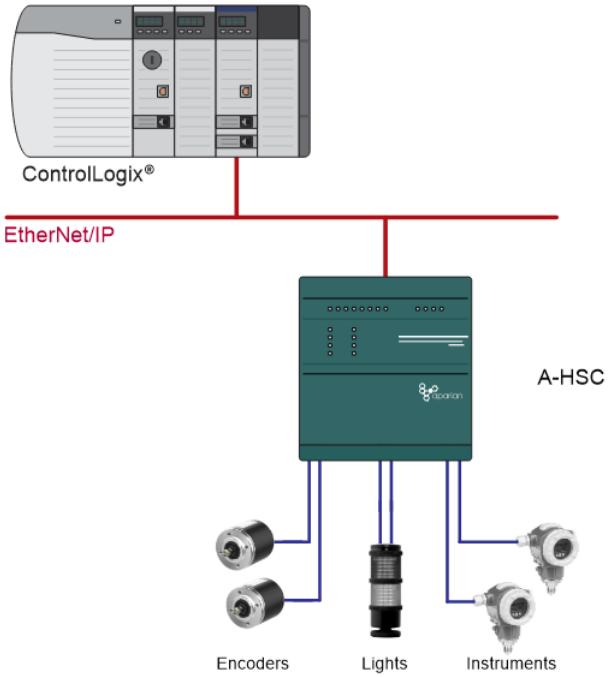


Figure 1.1. – Example of A-HSC owned by Logix via EtherNet/IP

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

The module has two Ethernet ports and supports Device-Level-Ring (DLR) architectures as well as 1588 Precision Time Protocol (PTP) for accurate time synchronization used in Sequence-of-Event (SOE) applications.

1.2. FEATURES

- Module has various Primary Interfaces:
    - EtherNet/IP Target (Class 1 connection)
    - Modbus Server (TCP, RTU232, RTU485)
    - Modbus Client (TCP, RTU232, RTU485)
- 8 Isolated Digital Inputs (24V / 5V) capable of 1 MHz.
- 4 Isolated Digital Solid-State Relay Outputs capable of 100Hz.
- 4 Analog Inputs (Current / Voltage)
- 1 Analog Current Output (Current)
- Multiple Encoder options
    - Count / Direction
    - Count Up, Count Down
    - Quadrature X1, X2, X4 (ABZ)
- Slate software provides a Modbus packet capture utility for better diagnosis of issues.
- Dual Ethernet ports which support Device-Level-Ring (DLR).
- Digital Input Sequence of Events time stamping accurate to 200us.
- Time Synchronization using either Simple Network Time Protocol (SNTP) or 1588 Precision Time Protocol (PTP).
- SD Card backup is supported for disaster recovery (firmware, application and security configuration, and network parameters).

The security services provide the following features:

- Configurable level of security
- Encrypted EtherNet/IP communication
- Fixed User Roles and Custom Users
- Configurable Password rules
- Login Expiry
- Failed Login Cool-off and Account Disable options
- Configurable Global Services and Custom Ports
- Optional IP Address Access Control List
- Optional MAC Access Control List
- Restrictions on Reset commands
- Restrictions on Device Flash options
- Security Audit trail in Event Log

1.3. ARCHITECTURE

The figures below provide an example of the typical network setup for connecting via either EtherNet/IP or Modbus.

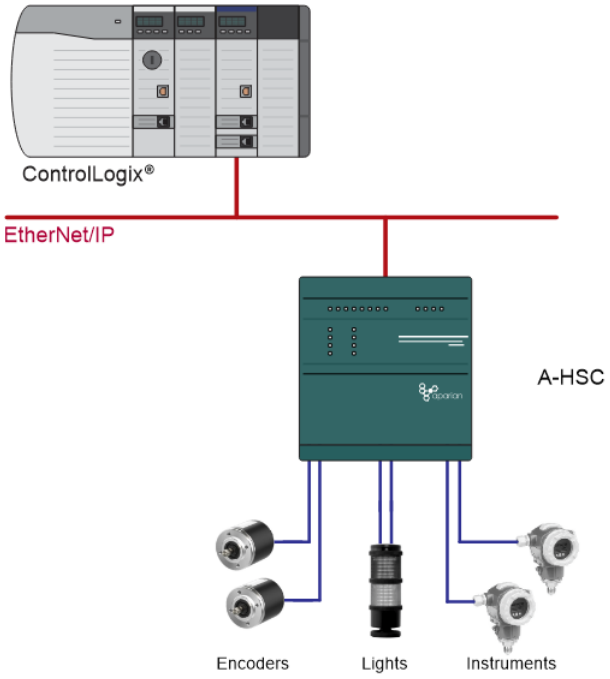


Figure 1.2. – Example of connecting to a Logix Controller

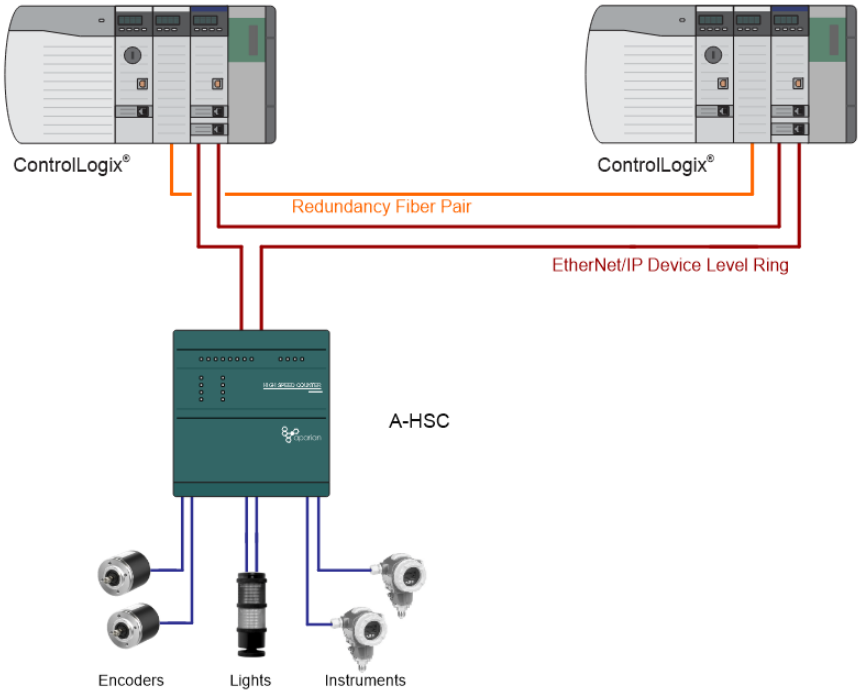


Figure 1.3. – Example of connecting to a Redundant Logix Controller pair

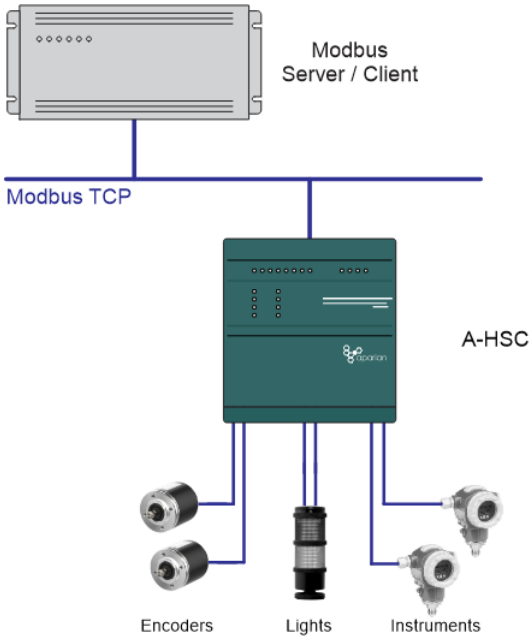


Figure 1.4. - Example of connecting to a Modbus TCP Client or Server

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
High Speed Counter User Manual High Speed Counter Datasheet Example Code & UDTs	https://www.aparian.com/products/HSC
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
Modbus	http://www.modbus.org

Table 1.1. - Additional Information

1.5. SUPPORT

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

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

Resource	Link
Contact Us web link	https://www.aparian.com
Support email	support@aparian.com

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

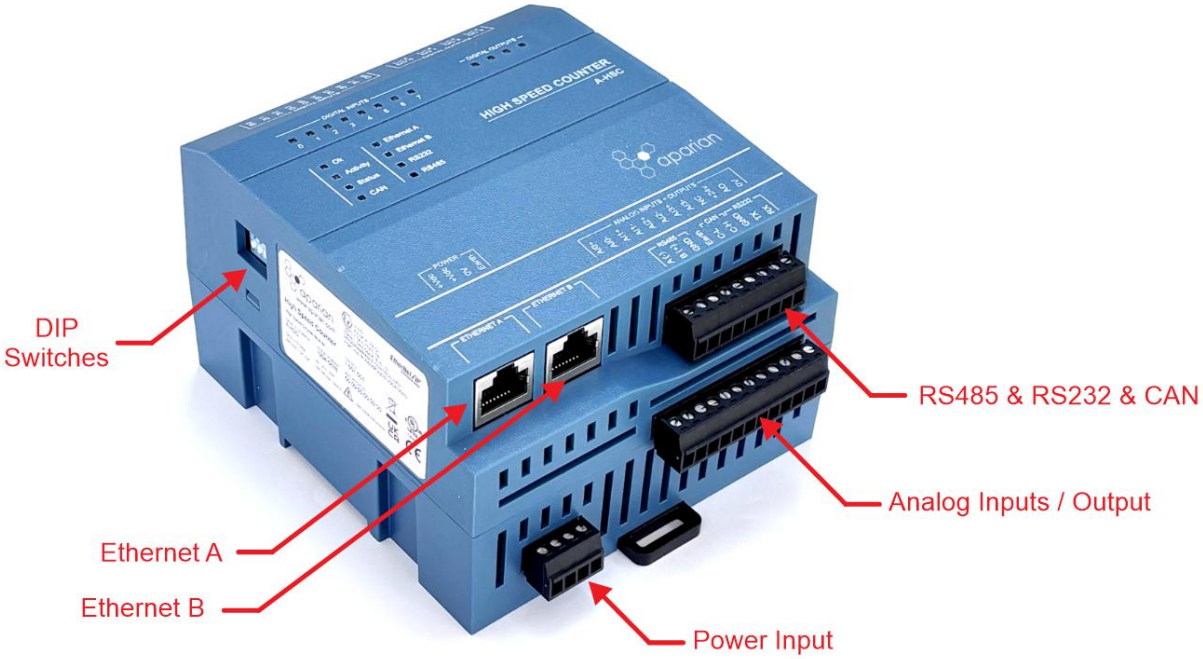


Figure 2.1 – Module top/front view

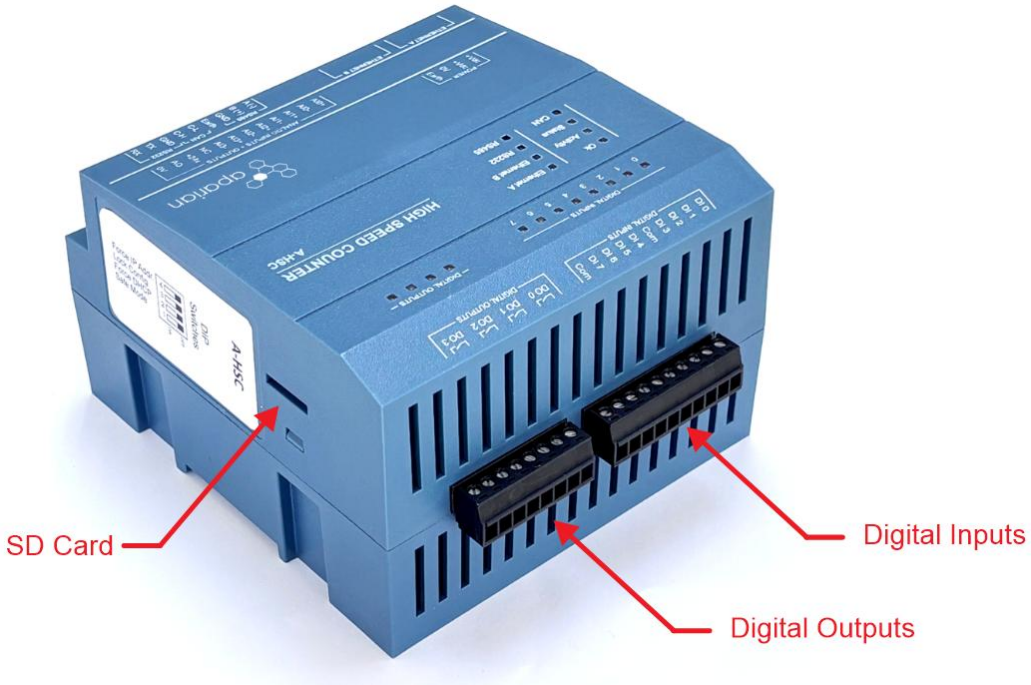


Figure 2.2 – Module top/back view

The module has three layers of connectors on the front.

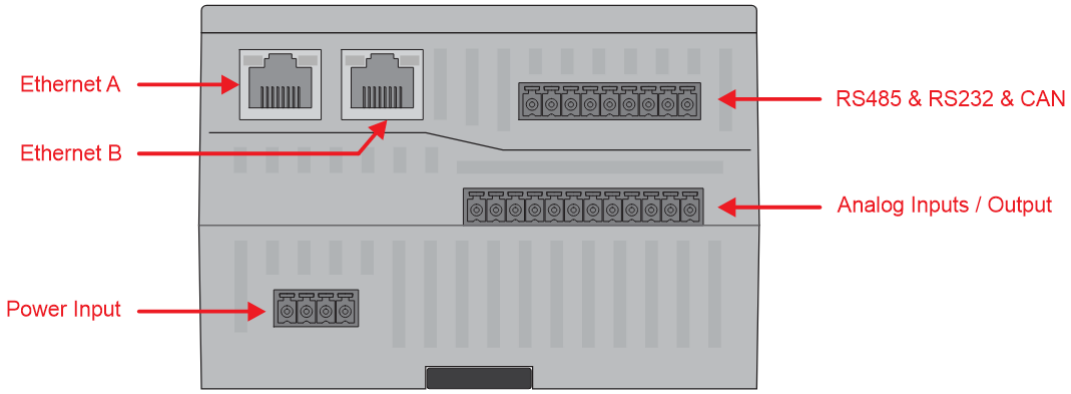


Figure 2.3 – Module front view

The bottom layer contains a 4-way power connector that supports redundant DC power inputs to the module.

The middle layer contains one 12-way connector at the bottom providing four analog inputs (mA or voltage) and one analog output (mA).

The top layer contains two RJ45 connectors for Ethernet and one 9-way connector for RS232, RS485, and CAN communications (note that the CAN communication has not been enabled on this module). The Ethernet cable must be wired according to industry standards, for more information see section 1.4.

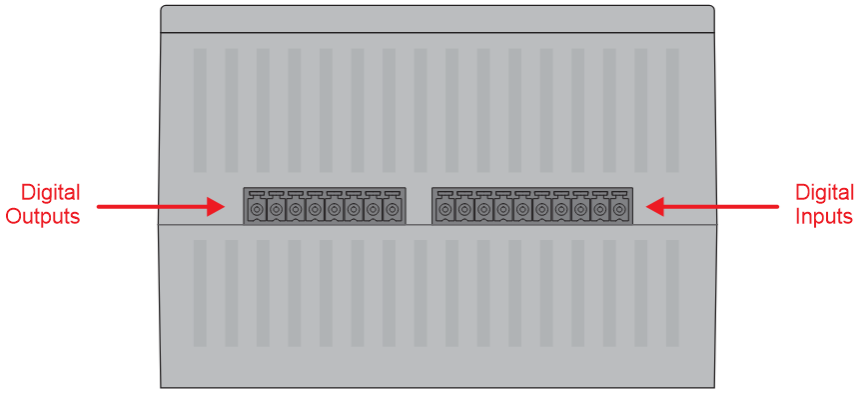


Figure 2.4 – Module back view

At the back of the module, the middle layer also contains one 10-way connector for Digital Inputs (5/24Vdc) and one 8-way connector for the four digital solid-state relay outputs.

The module provides four DIP switches on the left-hand side of the enclosure.

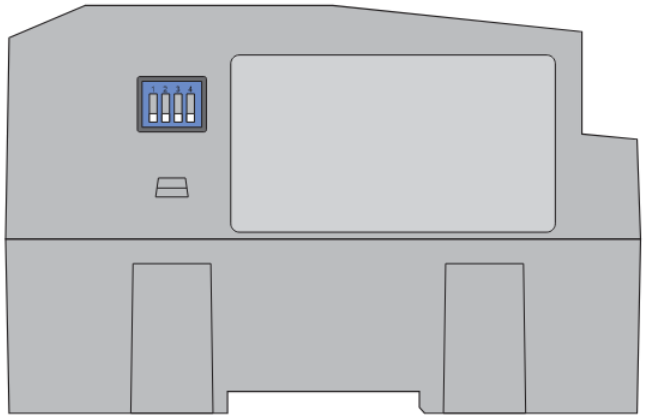


Figure 2.5 – Module side view

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 be used only 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	This DIP Switch is used to lock the configuration from being overwritten by 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.

The module provides eight communication and diagnostic LEDs as well as eight Digital Input and four Digital Output status LEDs. These LEDs are used to provide status of the module system operation, the Ethernet interface, and the status of each Digital Input and Output.

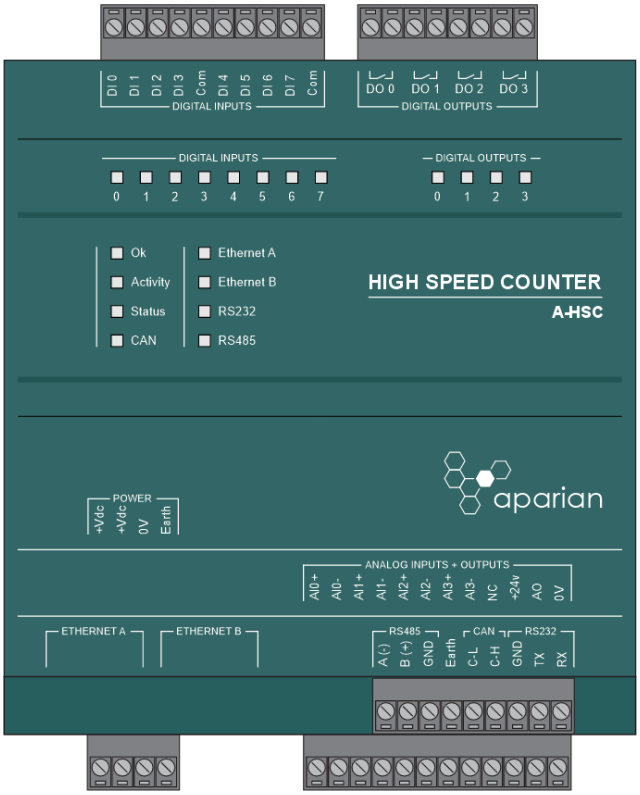


Figure 2.6 – Module top view

2.2. MODULE MOUNTING

NOTE: The equipment shall be installed in an enclosure that provides minimum ingress protection of IP 54 in accordance with EN/IEC 60079-0 and shall only be used in an area of at least pollution degree 2 as defined in IEC 60664-1.

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

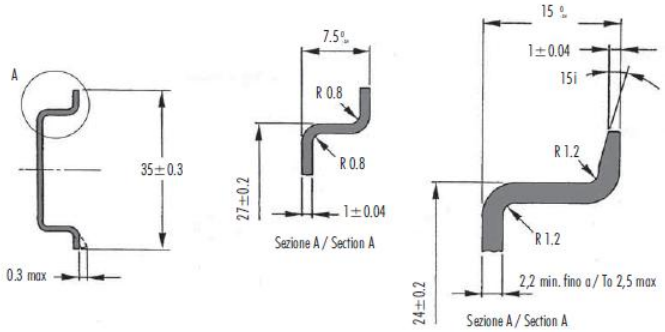


Figure 2.7 - DIN rail specification

The DIN rail clip is mounted on the bottom of the module. 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.

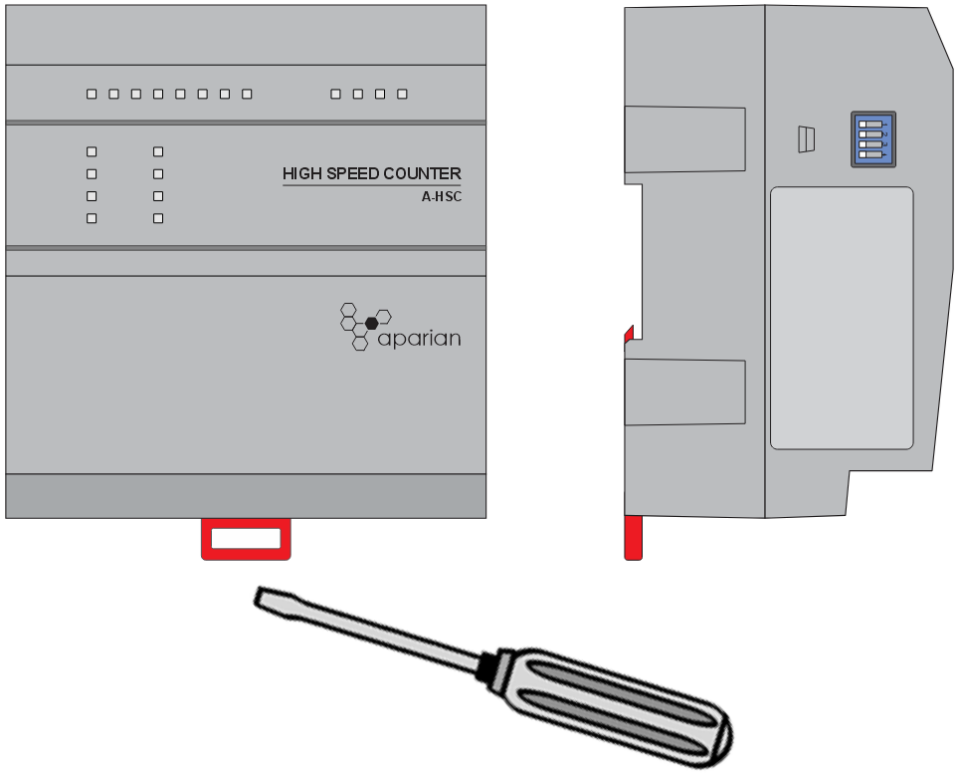


Figure 2.8 - DIN rail mouting

2.3. POWER

A 4-way power connector is used to connect Power 1 +, Power 2 +, Power - (0V), and Earth. The module requires an input voltage of 10 – 32Vdc. Refer to the Technical Specifications section 9.

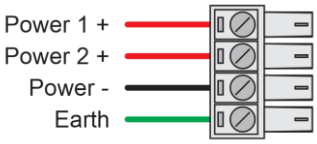


Figure 2.9 - Power connector

NOTE: The DC power supply or DC power source used by the module must be classified as Limited-Energy Circuits and Safety Extra Low Voltage (SELV).

NOTE: Provision shall be made to prevent the rated voltage being exceeded by the transient disturbances of more than 140% of the peak rated voltage.

2.4. ETHERNET PORTS

The Ethernet connector should be wired according to industry standards. Refer to section 1.4 for more details.

2.5. RS232 / RS485 / CAN PORT

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

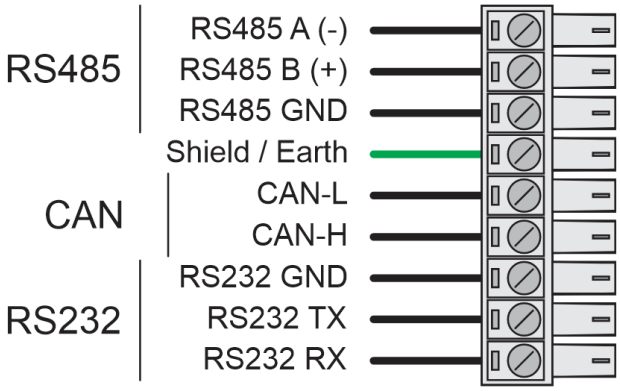


Figure 2.10 – Serial communication connector

2.6. DIGITAL INPUT

The Digital Inputs are connected using a 10-way connector for eight digital inputs. The digital inputs can be configured for either 24Vdc or 5Vdc inputs.

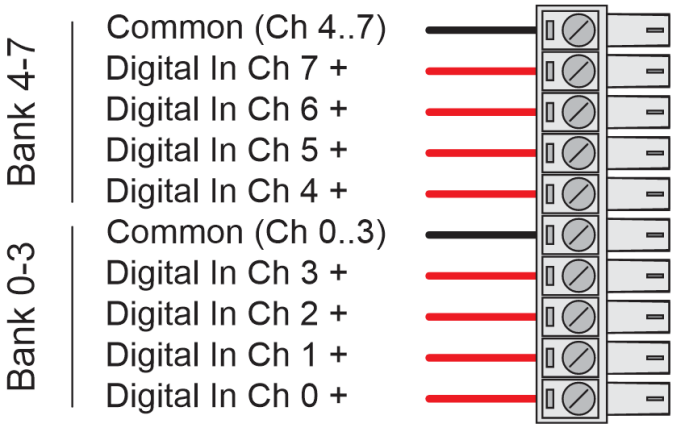


Figure 2.11 – Digital Input connector

Each digital input channel can be represented by the following equivalent circuit:

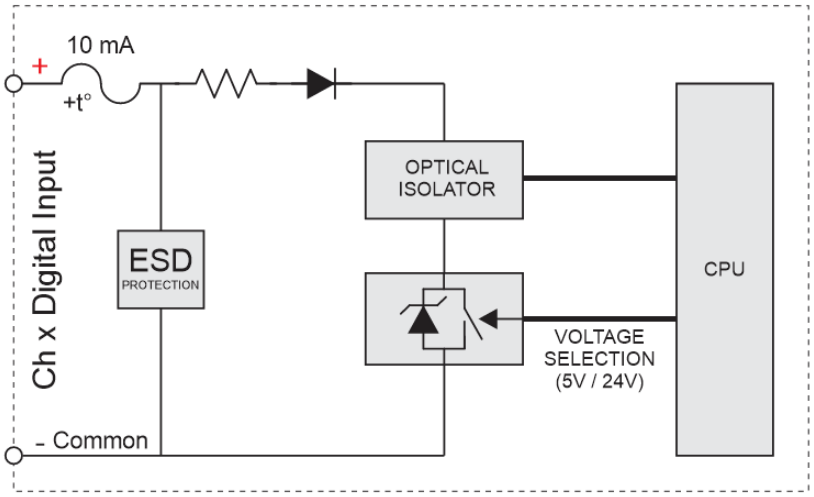


Figure 2.12 – Digital Input equivalent circuit

NOTE: Each digital input bank is galvanically isolated from the rest of the module.

2.7. DIGITAL RELAY OUTPUT

The Digital Relay Outputs are connected using an 8-way connector for four digital solid-state relay outputs.

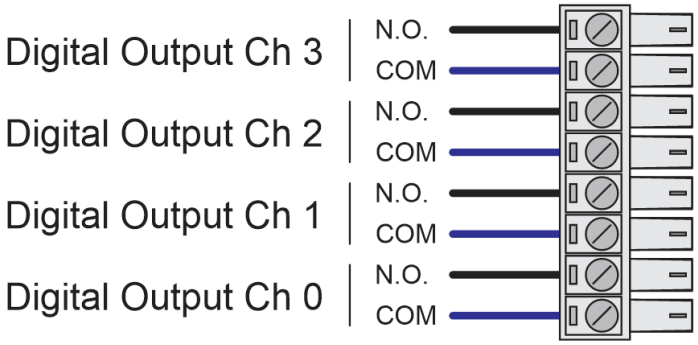


Figure 2.13 – Digital Relay Output connector

Each digital output channel can be represented by the following equivalent circuit:

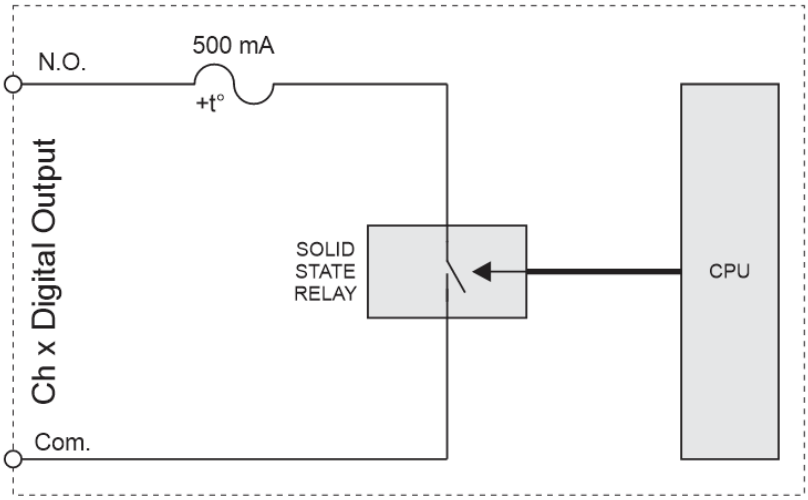


Figure 2.14 – Digital Output equivalent circuit

NOTE: Each digital output is galvanically isolated from the rest of the module.

2.8. ANALOG INPUT

The Analog Input channels are connected using a 12-way connector for four analog inputs.

NOTE: The analog inputs and analog output share the 12-way connector.

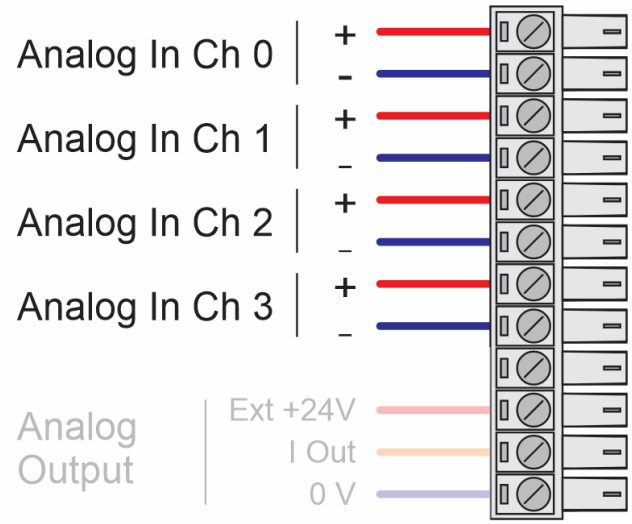


Figure 2.15 – Analog Input connector

Each analog input channel can be represented by the following equivalent circuit:

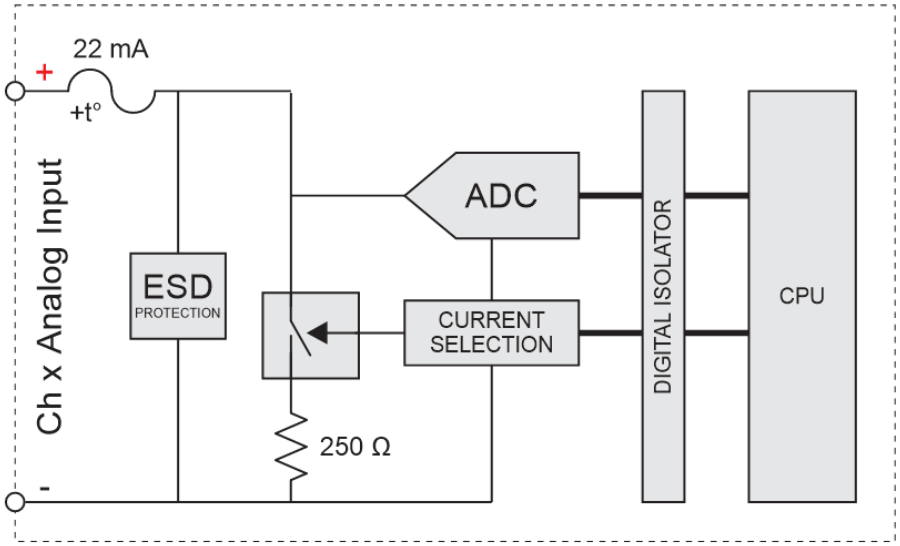


Figure 2.16 – Analog Input equivalent circuit

NOTE: The analog input and output channels are galvanically isolated from the rest of the module, but not from each other.

Each analog input channel can be configured for either voltage or current input.

2.8.1. VOLTAGE INPUT

When configured for a Voltage input (0-10V), the wiring to the terminal must be as follows:

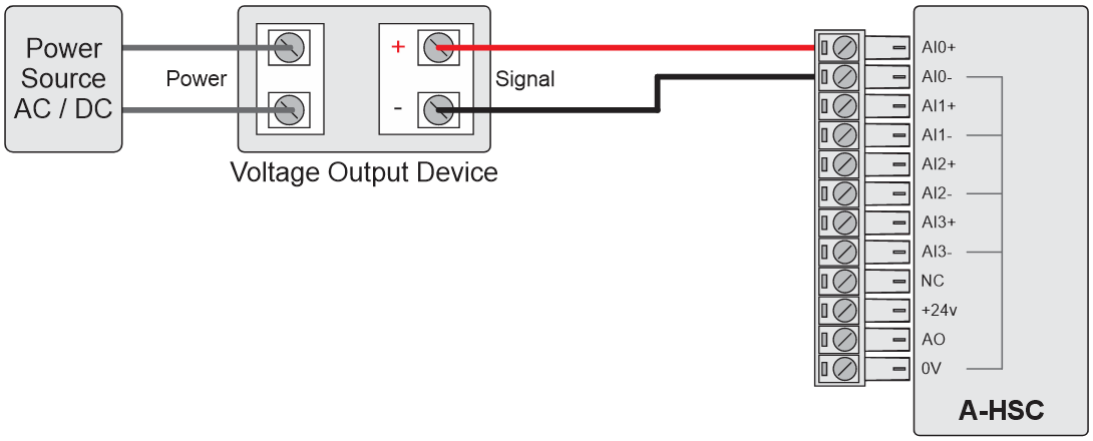


Figure 2.17 – Typical Voltage input

NOTE: Voltages more than 11V must **not** be applied to the analog inputs when configured for Voltage Mode.

2.8.2. CURRENT INPUT

When configured for current input types (0-20mA or 4-20mA), the wiring of 2-wire devices should be such that it is loop-powered with the device (as shown below).

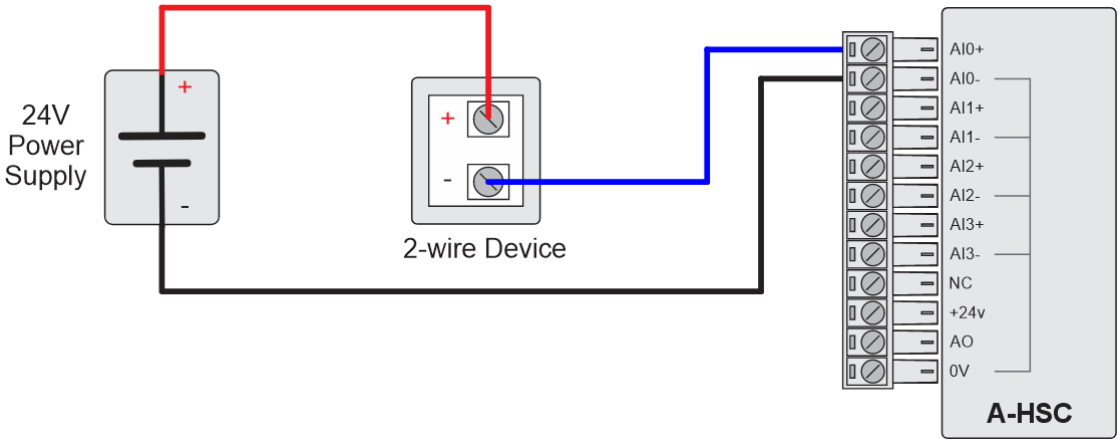


Figure 2.18 – Current Input – Loop-Powered (2-wire) device

Non-loop powered (4-wire) devices should be wired as follows:

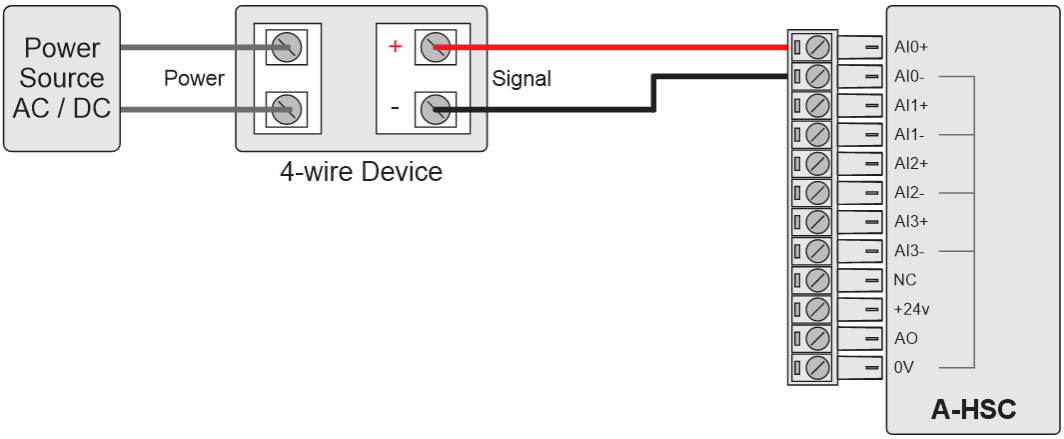


Figure 2.19 – Current Input – Non-Loop-Powered (4-wire) device

NOTE: Voltages more than 24V must **not** be applied to the analog inputs when configured in Current Mode.

2.9. ANALOG OUTPUT

The Analog Output channel is connected using a 12-way connector for one analog output.

NOTE: The analog inputs and analog output share the 12-way connector.

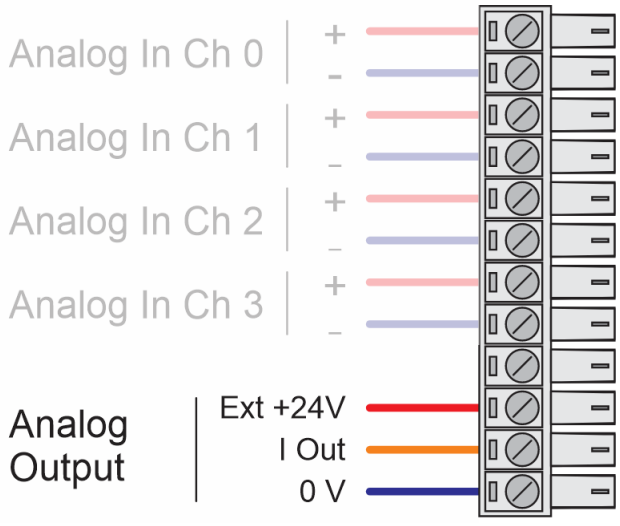


Figure 2.20 – Analog Output connector

The analog output channel can be represented by the following equivalent circuit:

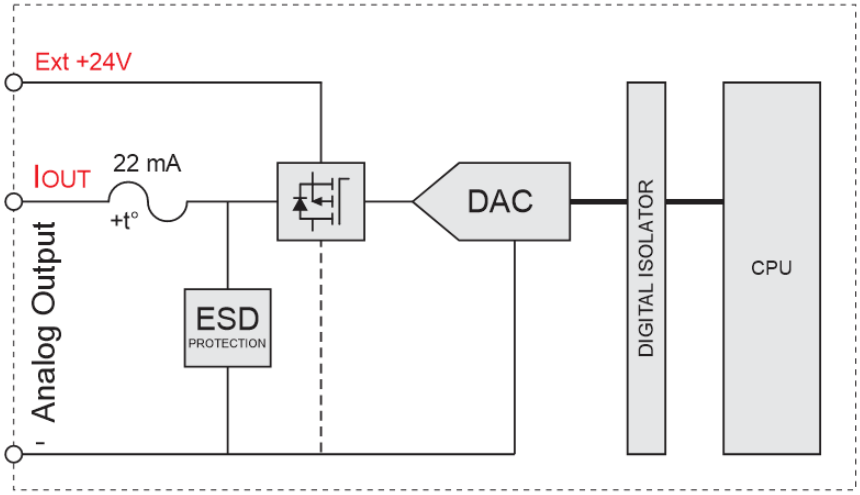


Figure 2.21 – Analog Output equivalent circuit

NOTE: The analog input and output channels are galvanically isolated from the rest of the module, but not from each other.

The analog output channel can be configured for current output.

2.9.1. Analog (Current) Output

The analog output provides a current source for controlling external devices. The output requires an external 24V power source connected as follows:

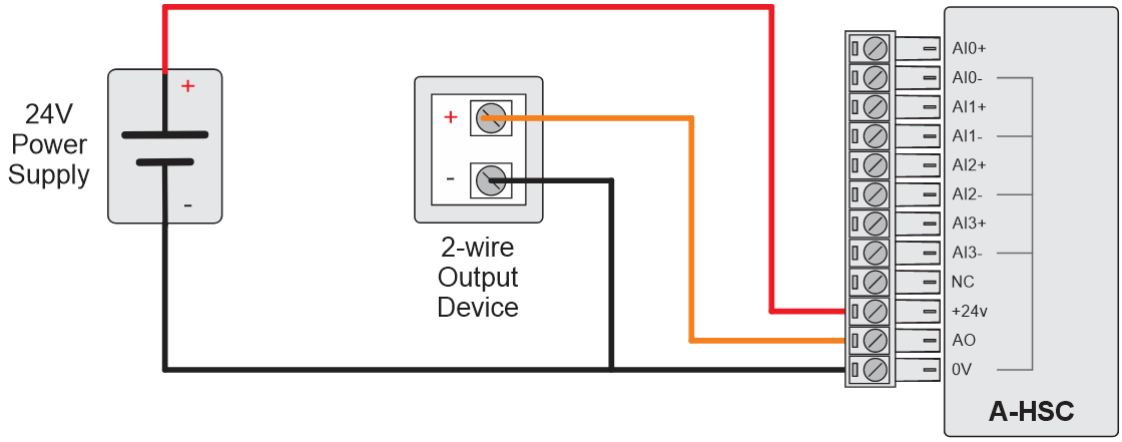


Figure 2.22 – Current Output device

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.

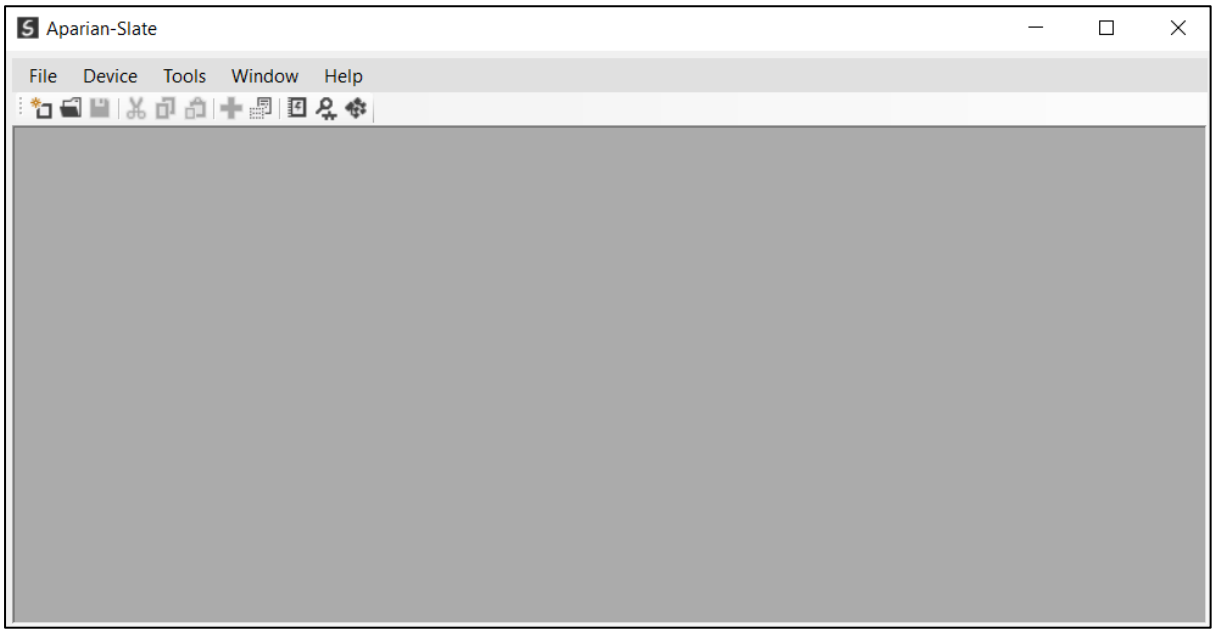


Figure 3.1. - Aparian Slate Environment

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.

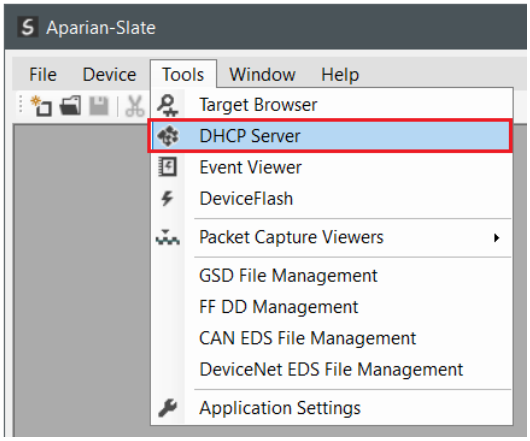


Figure 3.2. - Selecting DHCP Server

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

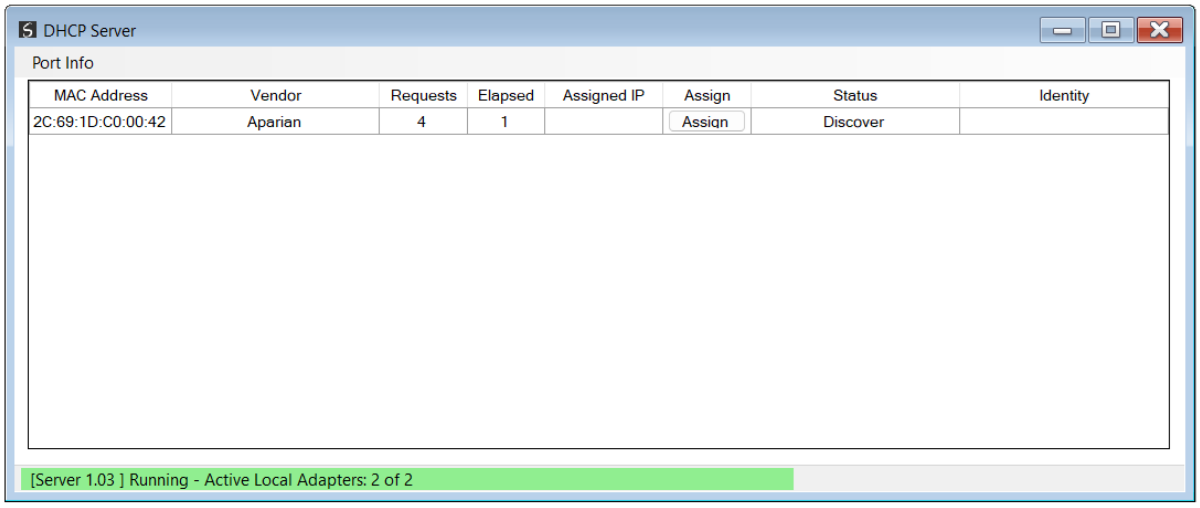


Figure 3.3. - DHCP Server

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.

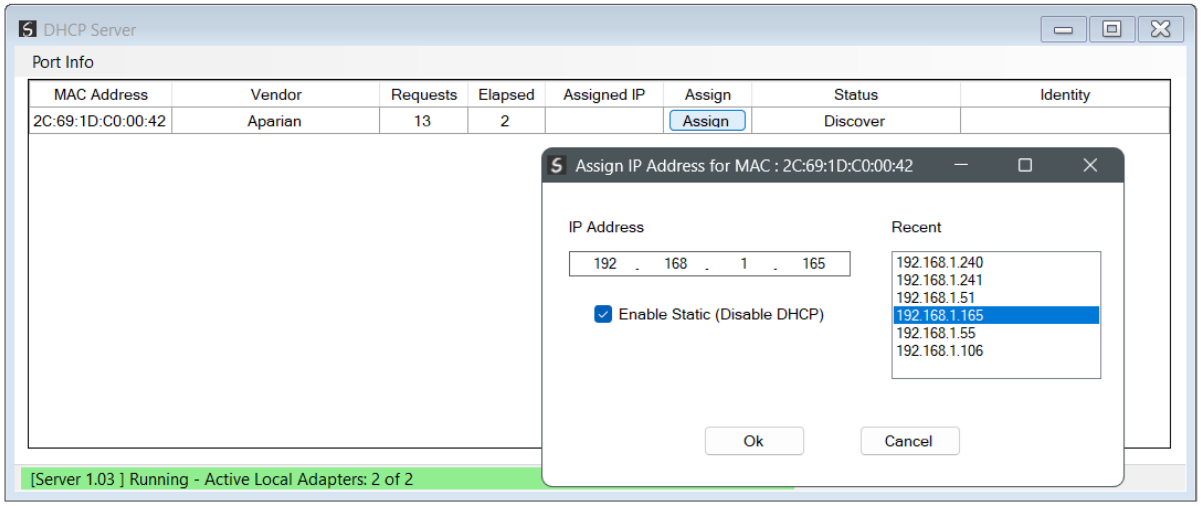


Figure 3.4. - Assigning IP Address

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.

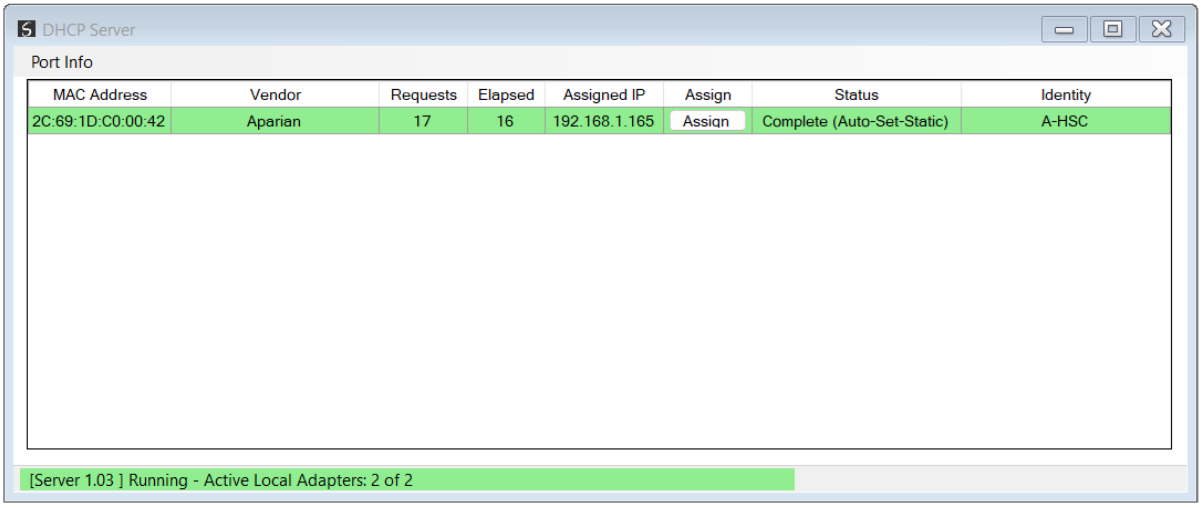


Figure 3.5. - Successful IP address assignment

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.

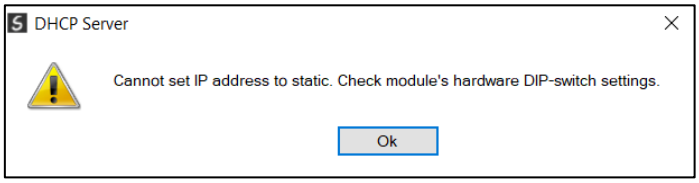


Figure 3.6. - Force DHCP warning

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.

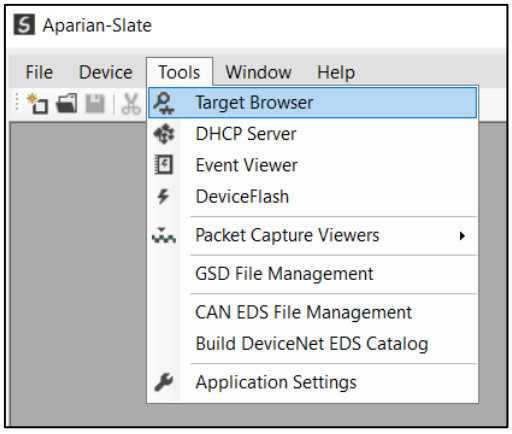


Figure 3.7. - Selecting the Target Browser

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

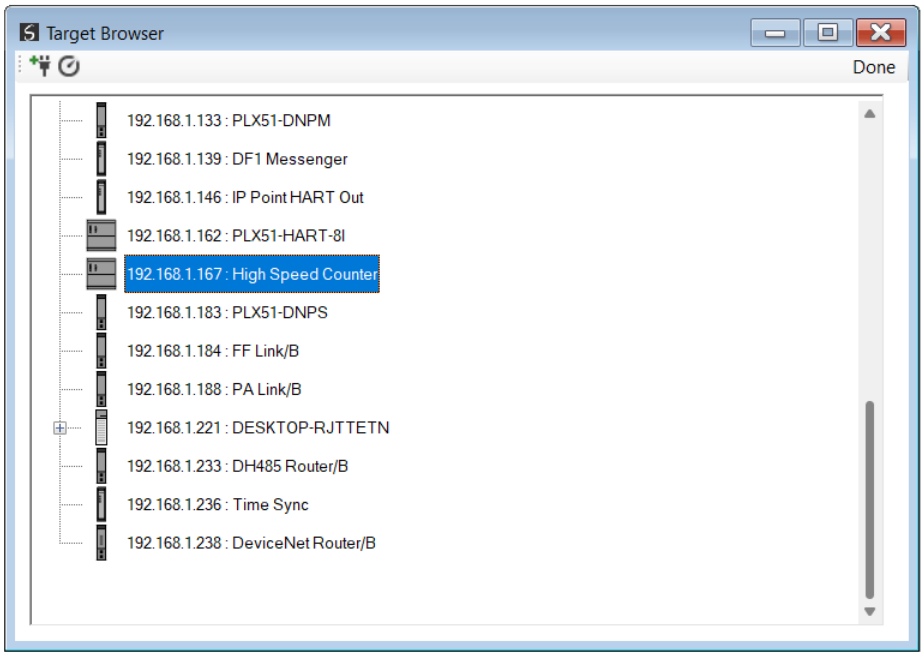


Figure 3.8. - Target Browser

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

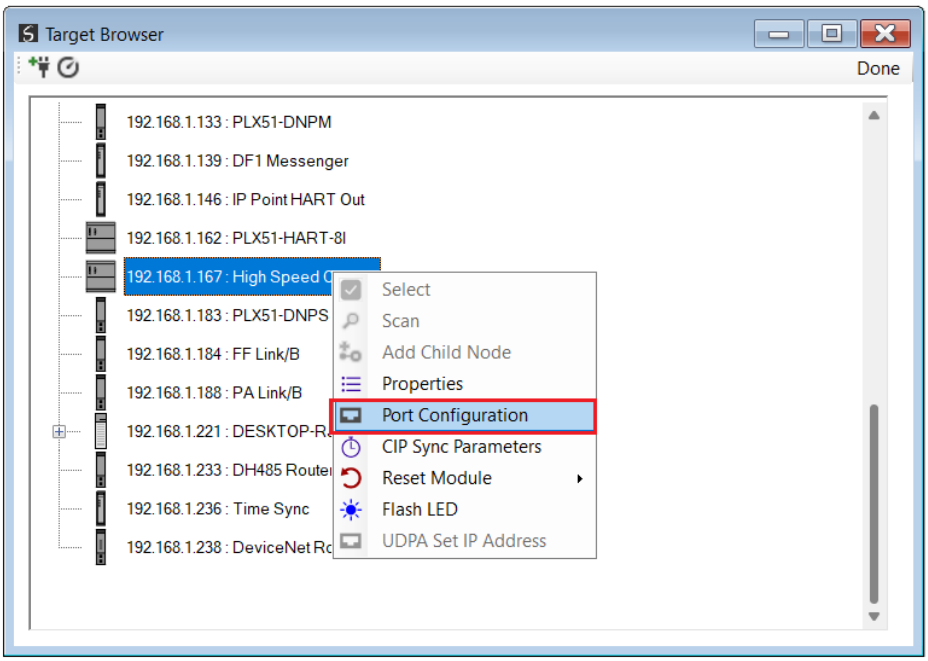


Figure 3.9. - Selecting Port Configuration

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

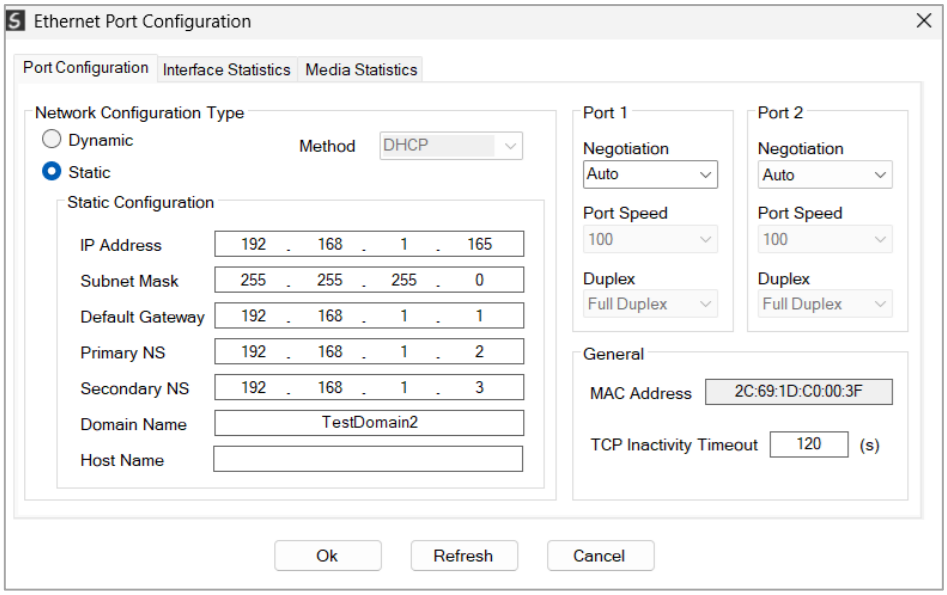


Figure 3.10. - Port Configuration

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.

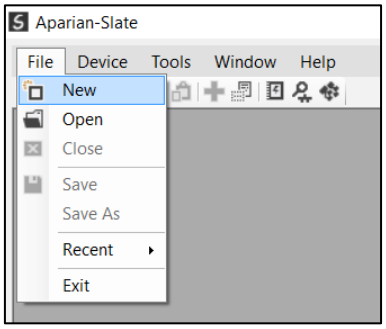


Figure 3.11. - Creating a new project

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.

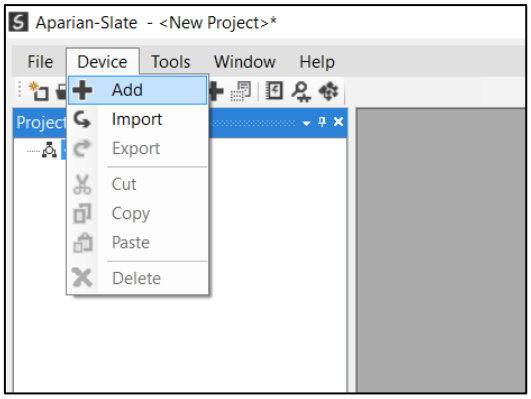


Figure 3.12. - Adding a new device

In the Add New Device window select the High Speed Counter and click the Ok button.

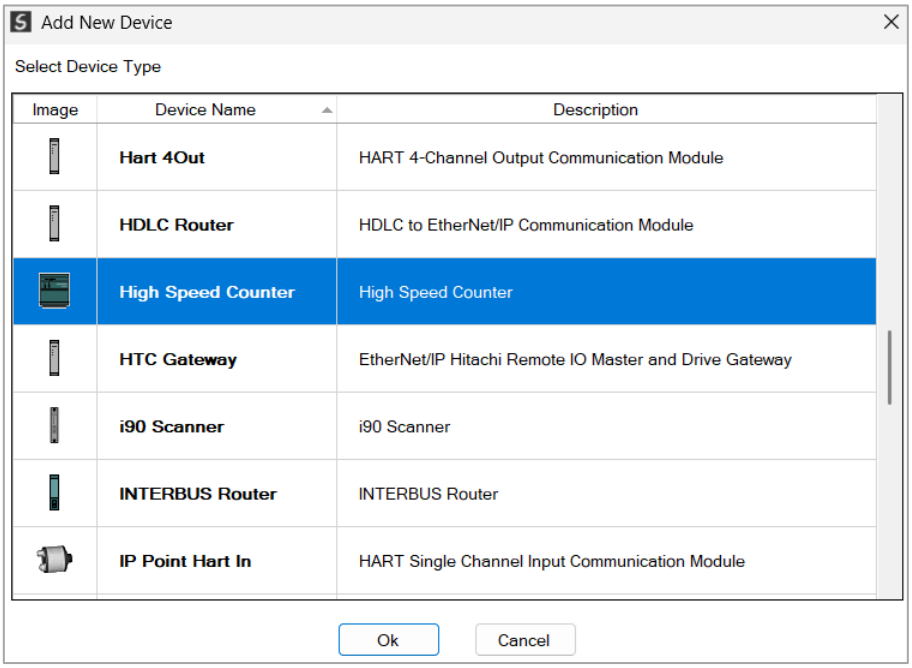


Figure 3.13 – Selecting a new High Speed Counter

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***.

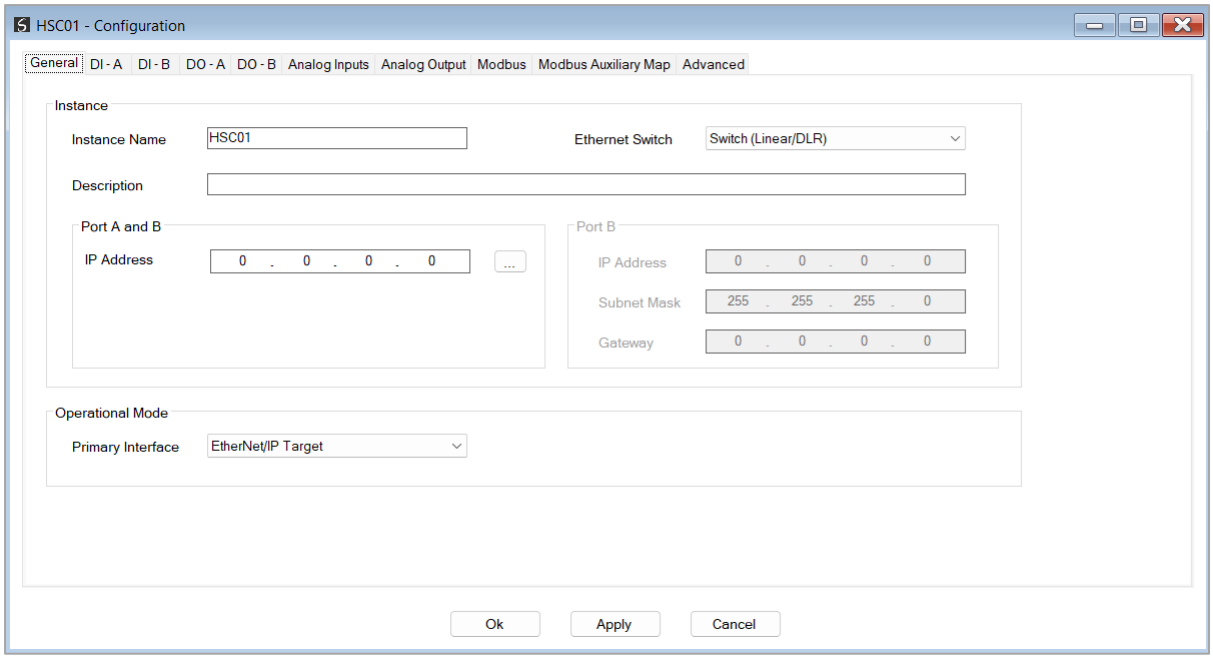


Figure 3.14. – High Speed Counter configuration

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

3.4. GENERAL PARAMETERS

The module 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 High Speed Counter general configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration***.

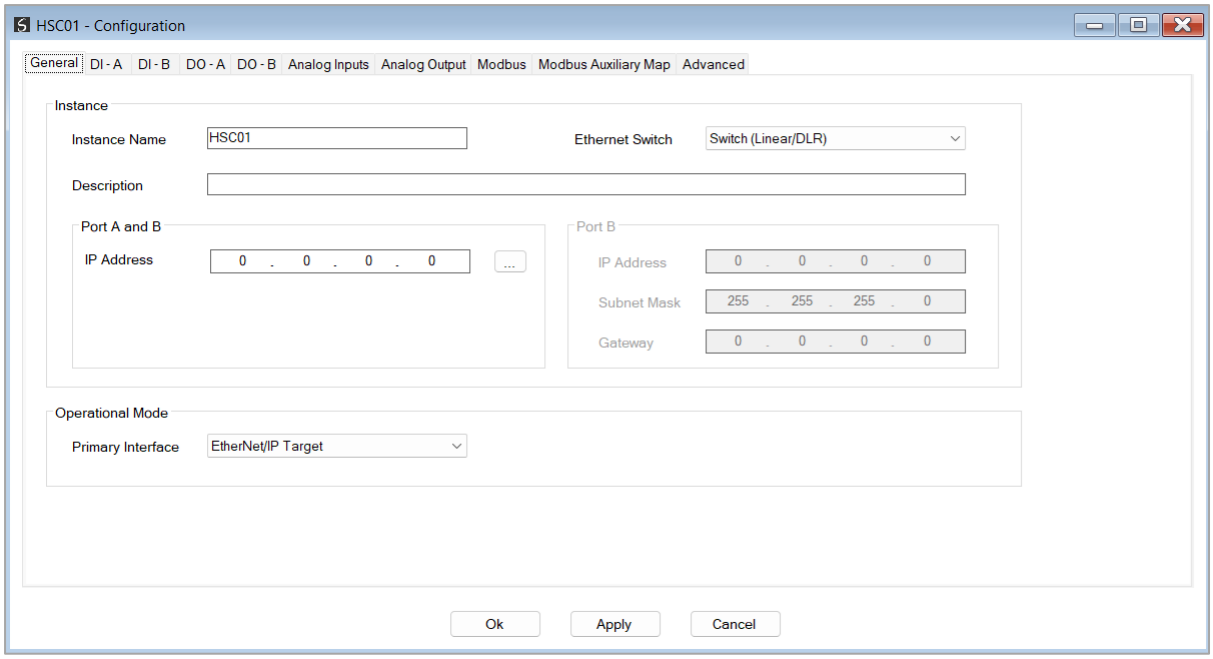


Figure 3.15 - General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various High Speed Counters.
Description	This parameter is used to provide a more detailed description of the application for the module.
Ethernet Switch	The operational mode of the embedded Ethernet switch. **Switch (Linear/DLR)** This is the default mode where the embedded switch is enabled. The two Ethernet ports are identical in functionality and (foreign) traffic received on one port is transmitted out the other. Both ports use the IP address configured using DHCP or set the Target browser. **Split (Dual-IP)** In this mode the embedded switch is disabled. Traffic received on one port is not transmitted to the other. Port A: The IP address is the one configured using DHCP or via the Target browser. EtherNet/IP requests and connections will be processed. Modbus TCP requests will be processed. Port B:

	The IP address is the one contained within the configuration below (Port B). EtherNet/IP requests and connections will not be processed. Modbus TCP requests will be processed.
Port A IP Address	The primary configured IP address of the module.
Port B IP Address	**THIS IS RELEVANT ONLY IN SPLIT (DUAL-IP) ETHERNET SWITCH MODE** The IP address used on Port B.
Port B Subnet Mask	**THIS IS RELEVANT ONLY IN SPLIT (DUAL-IP) ETHERNET SWITCH MODE** The Subnet Mask used on Port B.
Port B Gateway	**THIS IS RELEVANT ONLY IN SPLIT (DUAL-IP) ETHERNET SWITCH MODE** The Default Gateway address used on Port B.  **NOTE**: If the IP address ranges for Port A and Port B overlap, then only one Port's Gateway address can be non-zero.
Primary Interface	**EtherNet/IP Target** A Logix controller can own the High Speed Counter over EtherNet/IP using 1 class 1 connections. **Modbus Server** A Modbus Client can read and write data to the module which can then be mapped to the various IO points. The module can operate as a Modbus Server on Ethernet TCP. **Modbus Client** A module can read and write data from various Modbus devices which can then be mapped to the various IO points. The module can operate as a Modbus Client on Ethernet TCP.

Table 3.1 - General configuration parameters

3.5. DIGITAL INPUT CONFIGURATION

The Digital Input 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 ***DI-A*** or ***DI-B*** tab. The configuration for Digital Inputs 0 to 3 are located on the DI-A tab and the configuration for Digital Inputs 4 to 7 are located on the DI-B tab.

Each Digital Input can operate in various modes. Some Modes (e.g., Quadrature X1), when selected, will use other digital inputs for operation as well, meaning that those digital inputs will automatically be assigned and will be greyed-out for the user to select.

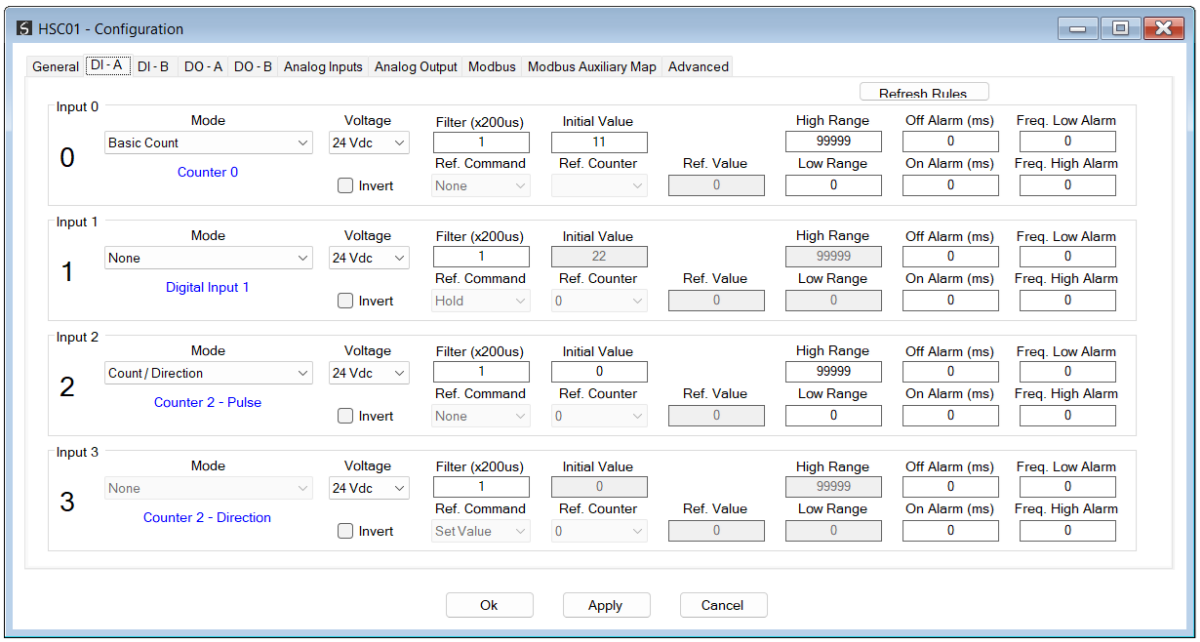


Figure 3.16 – Digital Input Configuration

The **Digital Input** configuration consists of the following parameters for each Input:

Parameter	Description
Mode	The operating mode/ function for the specific digital input. Note that certain modes will consume other digital inputs, which means those digital inputs will automatically be assigned and will be greyed-out for the user to select. **None** When none has been selected, the input will function as just a normal digital input with no counter functionality. **Basic Count** In addition to the normal digital input, the digital input will count every time the digital input changes to an ON state. The count direction (i.e., counting up or down) will depend on the count direction variable that is set, for each digital input, by the Operating Interface. **Count / Direction** The Count / Direction mode will consume the current digital input as well as the next one (for example, if DI0 is selected, DI1 will also be used for the DI0 operation). **NOTE:** Only DI0, DI2, DI4, and DI6 can have this mode. The counter will be triggered each time the first DI (DI0, DI2, DI4, or DI6) transitions from zero to one and the direction of the count (up or down) is determined by the second DI (DI1, DI3, DI5, or DI7), where 0 = Count Up and 1 = Count Down. See section 7.3 for the details regarding the operation of the DI mode. **Count Up, Count Down** The Count Up, Count Down mode will consume the current Digital input as well as the next one (for example, if DI0 is selected, DI1 will also be used for the DI0 operation). **NOTE:** Only DI0, DI2, DI4, and DI6 can have this mode.

	The counter will increase each time the first DI (DI0, DI2, DI4, or DI6) transitions from zero to one and will decrease each time the second DI (DI1, DI3, DI5, or DI7) transitions from zero to one. See section 7.3 for the details regarding the operation of the DI mode. **Quadrature X1** The Quadrature X1 mode will consume the current Digital input as well as the next two (for example, if DI0 is selected, DI1 and DI2 will also be used for the DI0 operation). **NOTE:** Only DI0 and DI4 can have this mode. See section 7.3 for the details regarding the operation of the DI mode. **Quadrature X2** The Quadrature X2 mode will consume the current Digital input as well as the next two (for example, if DI0 is selected, DI1 and DI2 will also be used for the DI0 operation). **NOTE:** Only DI0 and DI4 can have this mode. See section 7.3 for the details regarding the operation of the DI mode. **Quadrature X4** The Quadrature X4 mode will consume the current Digital input as well as the next two (for example, if DI0 is selected, DI1 and DI2 will also be used for the DI0 operation). **NOTE:** Only DI0 and DI4 can have this mode. See section 7.3 for the details regarding the operation of the DI mode. **Command** The Command mode is used to execute an instruction on the counter of another digital input. The Ref. Command, Ref. Counter, and Ref. Value are used to adjust the value or operation of another DI Counter when the DI with the command mode is set to one. See section 7.3 for the details regarding the operation of the DI mode. **TimeStamp** The exact time when the digital input changed will be logged for each DI that has the TimeStamp mode selected. The DI information and timestamp can be unloaded from the module via the Primary Interface. See section 7.3 for the details regarding the operation of the DI mode.
Voltage	Each digital input can be configured for 24Vdc or 5Vdc inputs.
Invert	When this is selected, the received digital input signal is inverted for all operations and information in the module and the primary interface. So, if the digital input signal is high, then a value of zero will be shown, and if the signal is low a value of one will be shown.
Filter (x200us)	Each digital input can have a filter on the input with a resolution of 200us allowing the module to filter spikes, glitches, and noise from the digital inputs.
Ref. Command	This is relevant when the **Command Mode** has been selected on the specific digital input. The Reference Command will determine what action needs to be taken on the selected digital input counter when this input goes high. **None** No action will be taken. **Reset** The referenced counter will be reset to its configured ***Initial*** value. **Set Static**

	The referenced counter value will be set to the value provided in the primary interface variables. **Set Value** The referenced counter value will be set to the *Reference Value* parameter set in the configuration. **Hold** The referenced counter value will be paused.
Ref. Counter	This is relevant when the **Command Mode** has been selected on the specific digital input. The Reference Counter is the digital input counter to which the reference command will be applied.
Ref. Value	This is relevant when the **Command Mode** has been selected on the specific digital input. When the Set Value Reference Command has been selected, this is the value that will be applied to the Reference Counter count value.
Initial Value	This is the start value of the digital input counter when the module powers up, configuration is downloaded, or when a Reset Counter command is issued.
High Range	The maximum value of the digital input counter before the counter value rolls over to the Low Range value and starts counting again.
Low Range	The minimum value of the digital input counter before the counter value rolls over to the High Range value and starts counting again.
Off Alarm (ms)	The Off Alarm will be activated when digital input has been off for longer than the time configured in this parameter. The Off Alarm indicator can be seen in the primary interface as well as the diagnostics in Slate. **NOTE:** When this parameter is set to zero, then the Off Alarm operation is disabled.
On Alarm (ms)	The On Alarm will be activated when digital input has been on for longer than the time configured in this parameter. The On Alarm indicator can be seen in the primary interface as well as the diagnostics in Slate. **NOTE:** When this parameter is set to zero, then the On Alarm operation is disabled.
Freq. Low Alarm	The Frequency Low Alarm will be activated when digital input frequency is lower than the configured low frequency in this parameter. The Frequency Low Alarm indicator can be seen in the primary interface as well as the diagnostics in Slate. **NOTE:** When this parameter is set to zero, then the Frequency Low Alarm operation is disabled.
Freq. High Alarm	The Frequency High Alarm will be activated when digital input frequency is lower than the configured low frequency in this parameter. The Frequency High Alarm indicator can be seen in the primary interface as well as the diagnostics in Slate. **NOTE:** When this parameter is set to zero, then the Frequency High Alarm operation is disabled.

Table 3.2 – Digital Input configuration parameters

3.6. DIGITAL OUTPUT CONFIGURATION

The Digital Output 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 ***DO-A*** or ***DO-B*** tab. The configuration for Digital Output 0 and 1 are on the DO-A tab and the configuration for Digital Inputs 2 and 3 are on the DO-B tab.

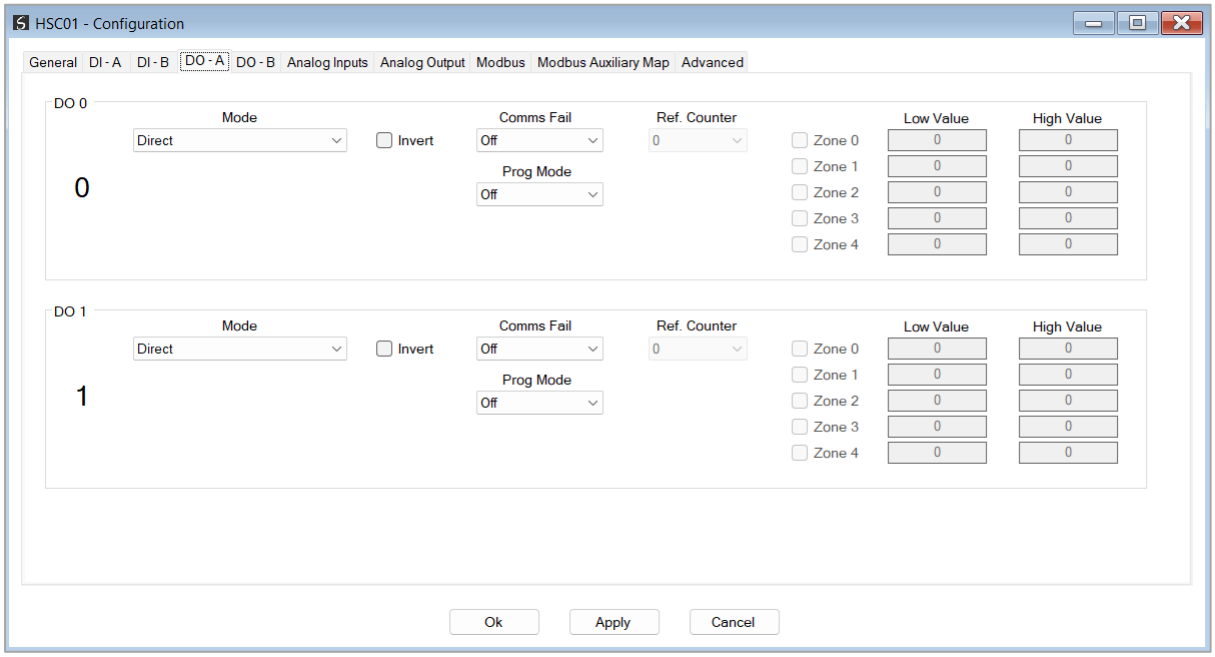


Figure 3.17 – Digital Output Configuration

The **Digital Output** configuration consists of the following parameters:

Parameter	Description
Mode	The operating mode/function for the specific digital output (DO) relay. **Direct** The digital output signal will directly match the value sent by the Primary Interface (e.g., EtherNet/IP or Modbus). **Pulse** When the output value received from the Primary Interface transitions from zero to one, then the digital output will create a single pulse with the period provided by the Primary Interface. See section 7.4 for the details regarding the operation of the DO mode. **PWM (Pulse Width Modulation)** The digital output will send out a continuous PWM signal, where the pulse period and duty cycle values are provided by the Primary Interface. See section 7.4 for the details regarding the operation of the DO mode.

	Counter The digital output will be set based on the selected digital input counter value. The digital counter is selected with the Ref. Counter parameter in the DO configuration. The Zone values (0 to 4) will determine when the digital output will be set high based on the counter value of the reference digital input counter. See section 7.4 for the details regarding the operation of the DO mode. **Comms Ok** When this mode is selected, the digital output will be on when the Primary Interface communication is healthy, and will be off when the Primary Interface communication has faulted.
Invert	When this is selected, the digital output signal will be inverted from the digital output value. When the primary interface sets the digital output to one, then the signal will be zero, and vice versa.
Comms Fail	Each digital output can be configured to go to a specific state when the Primary Interface communication fails. **NOTE:** when the digital output has been configured with the Comms Ok mode, then this parameter will be disabled.
Prog Mode	Each digital output can be configured to go to a specific state when the Primary Interface has been selected as EtherNet/IP and the Controller goes to Program/Fault mode. **NOTE:** when the digital output has been configured with the Comms Ok mode, then this parameter will be disabled.
Ref. Counter	When the **Counter** mode has been selected for the specific digital output, then this parameter will be used to determine which digital input counter value will be used to calculated the configured zone activity. See section 7.4 for the details regarding the operation of the DO mode.
Zone 0 – 4 Low/High Value	The Zone 0 to 4 Low and High Value is used to determine when to set the specific digital output. When a zone has been enabled and the reference digital input counter value is between (or equal to) the low and high values, then the digital output will be on, else it will be off. See section 7.4 for the details regarding the operation of the DO mode.

Table 3.3 – Digital Output parameters

3.7. ANALOG INPUT CONFIGURATION

The Analog Input 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 ***Analog Inputs*** tab.

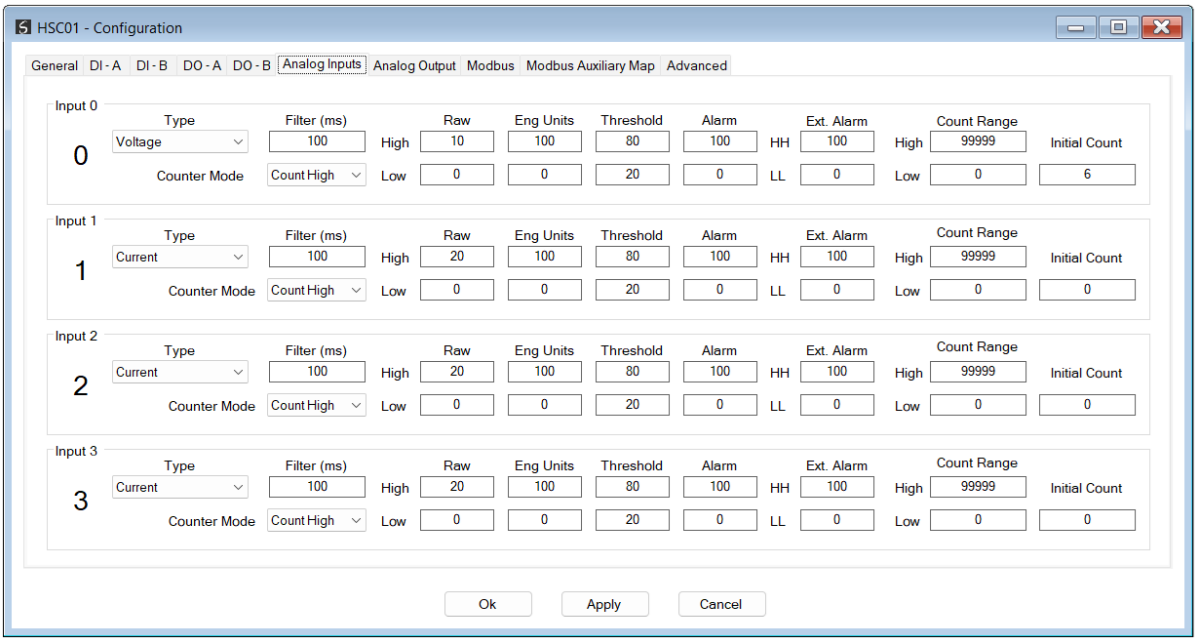


Figure 3.18 – Analog Inputs Configuration

The **Analog Inputs** configuration consists of the following parameters:

Parameter	Description
Type	Each analog input can be configured for either voltage or current input. **Voltage** The analog voltage input with a voltage range of 0 to 10Vdc. **Current** The analog current input with a current range of 0 to 20mA.
Filter	Analog filter for each analog input (in milliseconds).
Raw High/Low	The upper and lower analog value to be used for the scaling to engineering units. The scaling (to engineering units (EU)) is calculated as follows: **EU = EuLow + (RawValue – RawHigh) * ((EuHigh – EuLow) / (RawMax – RawLow))**
Eng. Units High/Low	The upper and lower engineering value used for the scaling to engineering units. The scaled engineering value will equal the high value when the analog value is equal to the Raw High value. The scaled engineering value will equal the low value when the analog value is equal to the Raw Low value.
Counter Mode	The analog inputs can trigger a counter value to increase each time the high threshold has been reached. This is done by selecting *Count High* for the Counter Mode. **NOTE:** Once the analog input value has reached the High Threshold and increased the counter, the analog input value will first need to decrease **below** the Low Threshold before the counter will increase again once the High Threshold is crossed. See section 7.5 for the details regarding the operation of the AI mode.

Threshold High/Low	The high and low thresholds when the analog input has the counter mode selected. See section 7.5 for the details regarding the operation of the AI mode.
Alarm High/Low	When the alarm high or low is reached by the analog input value, then the analog input alarm will be indicated which can be seen by the Primary Interface as well as Slate.
Ext. Alarm High/Low	When the extended alarm high-high or low-low is reached by the analog input value, then the analog input extended alarm will be indicated which can be seen by the Primary Interface as well as Slate. **NOTE:** The extended alarm is intended to have a wider range than the normal alarm. For example, if the alarm high is set to 80, then the high-high alarm would be set above 80. See section 7.5 for the details regarding the operation of the AI mode.
Count – Initial	This is the start value of the analog input counter when the module powers up, configuration is downloaded, or when the analog input counter rolls-over.
Count – High Range	The maximum value of the counter before the counter value rolls over to the Low Range value and starts counting again.
Count – Low Range	The minimum value of the counter before the counter value rolls over to the High Range value and starts counting again.

Table 3.3 – Analog Input parameters

3.8. ANALOG OUTPUT CONFIGURATION

The Analog Output 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 ***Analog Output*** tab.

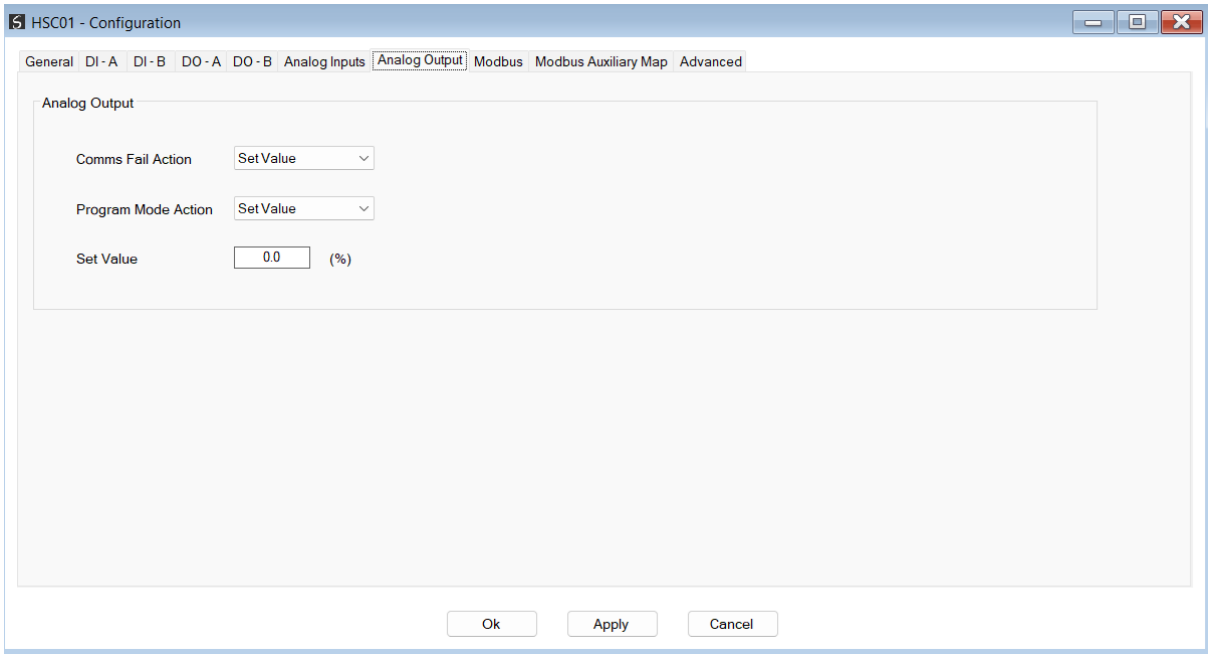


Figure 3.19 – Analog Output Configuration

The **Analog Output** configuration consists of the following parameters:

Parameter	Description
Comms Fail Action	The analog output can be configured to either go to a specific value or hold the last value when the Primary Interface communication fails.
Program Mode Action	The analog output can be configured to either go to a specific value or hold the last value when the Primary Interface has been selected as EtherNet/IP and the Controller goes to Program/Fault mode.
Set Value	The value the analog output will be set to this value if *Set Value* was selected for Comms Fail Action or Program Mode Action.

Table 3.3 – Analog Output parameters

3.9. PRIMARY INTERFACE

The High Speed Counter module supports three modes for the Primary Interface.

3.9.1. ETHERNET/IP TARGET

A controller (e.g. Logix controller) can own the High Speed Counter over EtherNet/IP using a single Class 1 EtherNet/IP connection when the Primary Interface is set to EtherNet/IP target. This will allow the High Speed Counter to exchange data with the controller using the input and output assembly of the Class 1 EtherNet/IP connections. Data from the onboard IO can be mapped to the Logix controller over EtherNet/IP.

3.9.1.1. STUDIO / LOGIX 5000 CONFIGURATION

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

The High Speed Counter 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) or a Generic Module Profile.

EDS AOP (LOGIX V21+)

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.

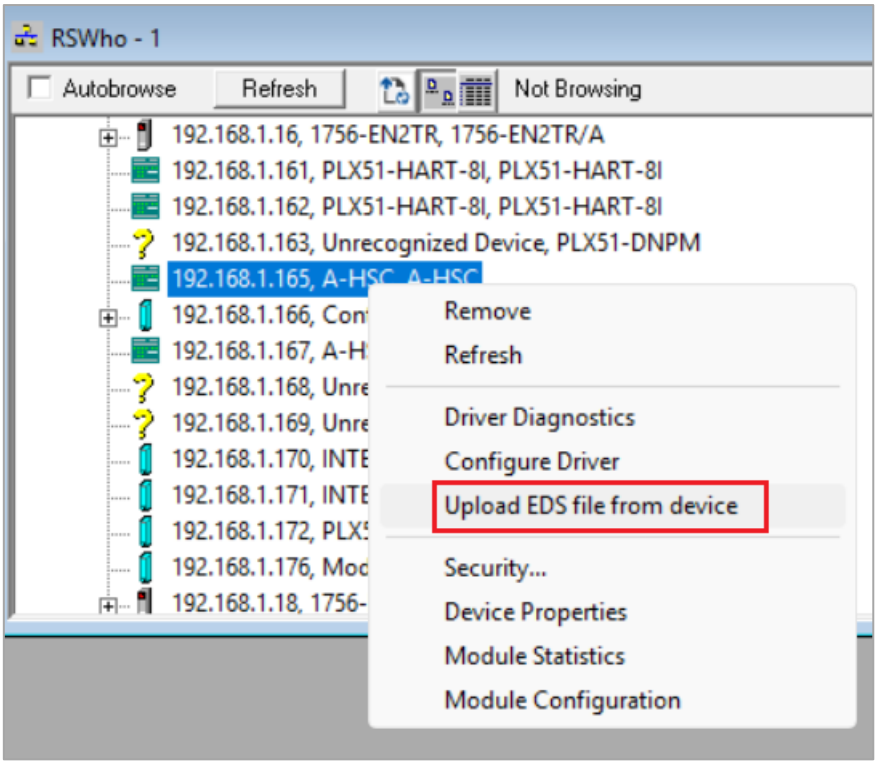


Figure 3.20 – EDS file upload from High Speed Counter

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.

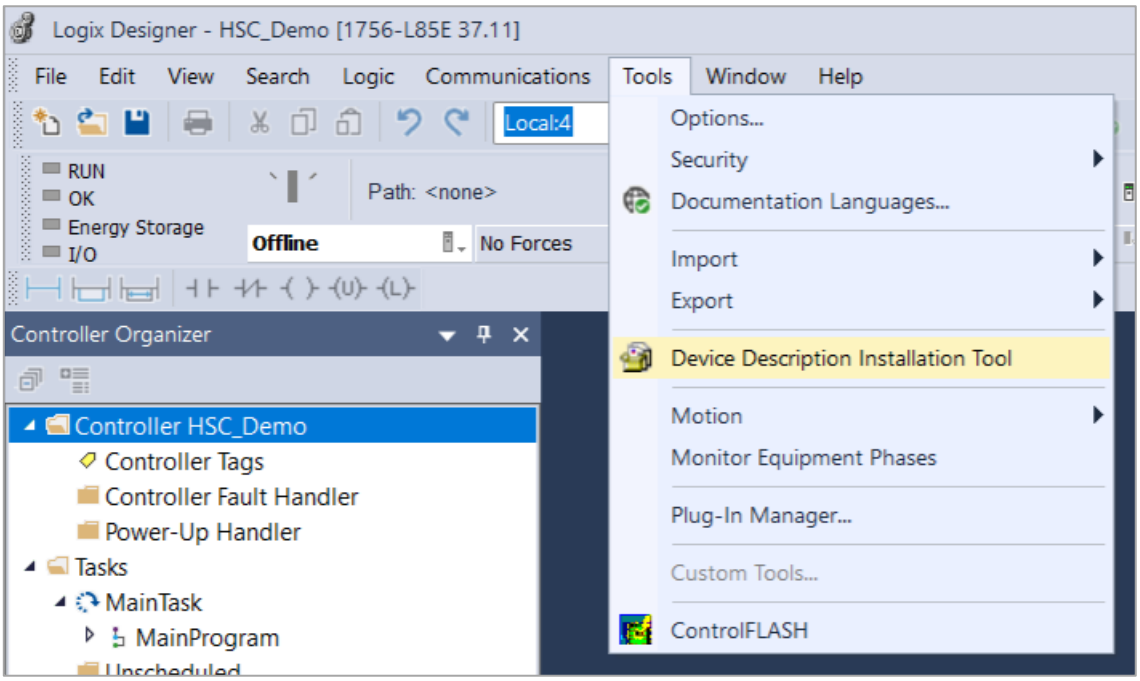


Figure 3.21 - EDS Hardware Installation Utility

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.

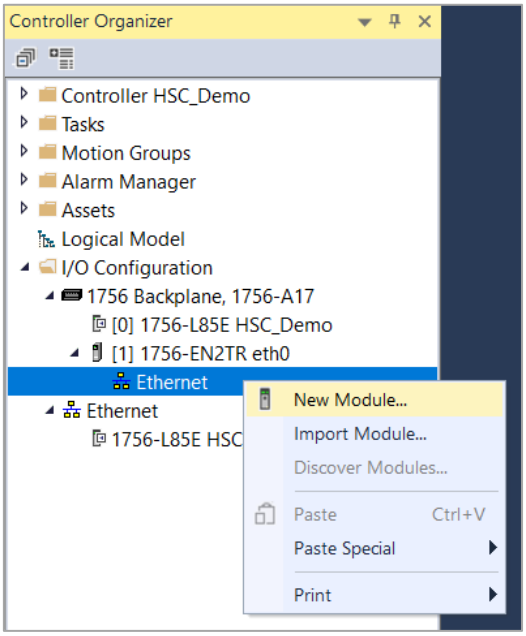


Figure 3.22 – Adding a module

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.

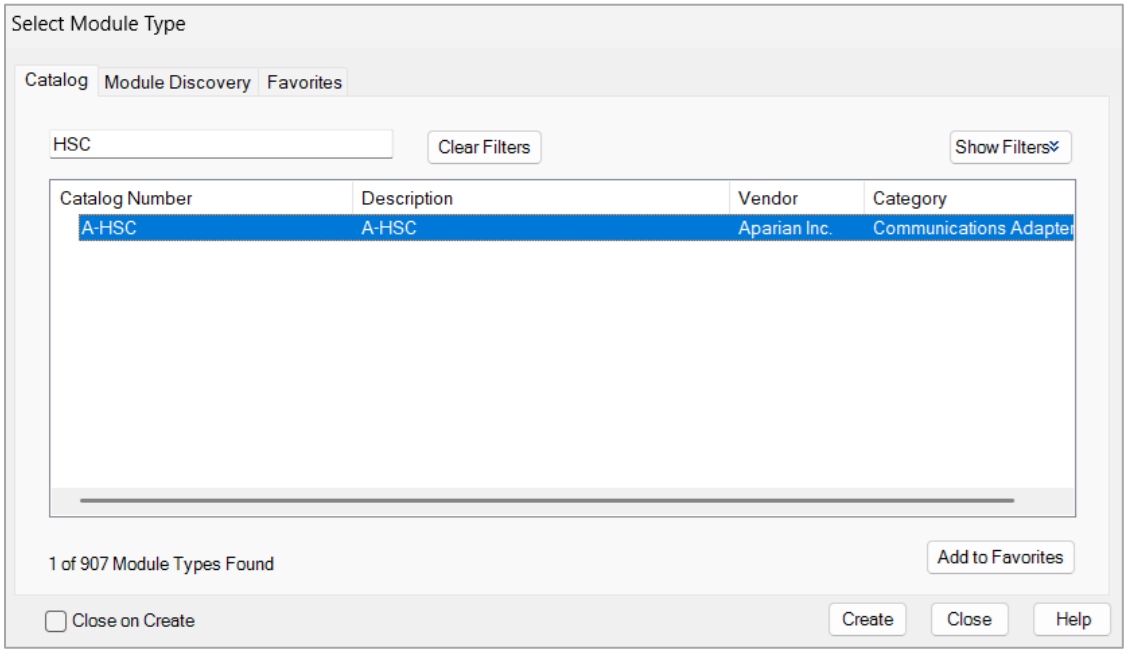


Figure 3.23 – Selecting the module

Locate and select the High Speed Counter 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.

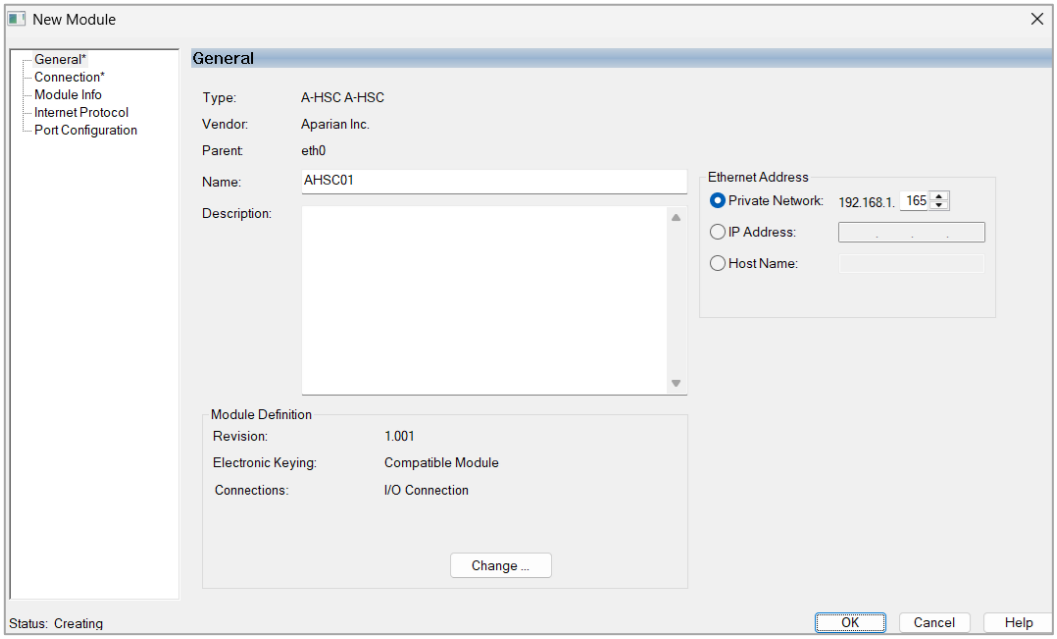


Figure 3.24 – Module instantiation

Now the High Speed Counter module will be in the Logix IO tree.

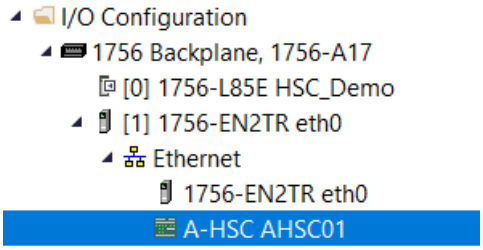


Figure 3.25 – Logix IO tree

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.

NOTE: The Logix example code (which can be downloaded from the Aparian website) can be imported into the Logix project, which will have all the UDT structures required for the module. See section 3.9.1.2 for more information.

GENERIC MODULE PROFILE (LOGIX PRE-V21)

When using Logix versions prior to version 21, then the HSC module must be added to the RSLogix 5000 I/O tree as a generic Ethernet module. This is achieved by right clicking on the

Ethernet Bridge in the RSLogix 5000 and selecting *New Module* after which the *ETHERNET-MODULE* is selected to be added as shown in the figure below.

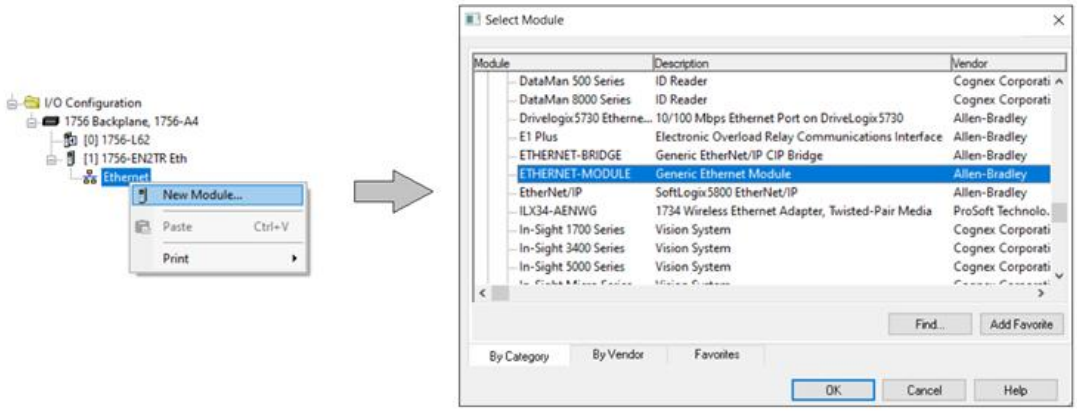


Figure 3.26 - Add a Generic Ethernet Module in RSLogix 5000

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

The required connection parameters for the module are shown below:

Connection Parameter	Assembly Instance	Size
Input	140	500 (8-bit)
Output	141	496 (8-bit)
Configuration	102	0 (8-bit)

Table 3.3 - RSLogix class 1 connection parameters for the HSC module

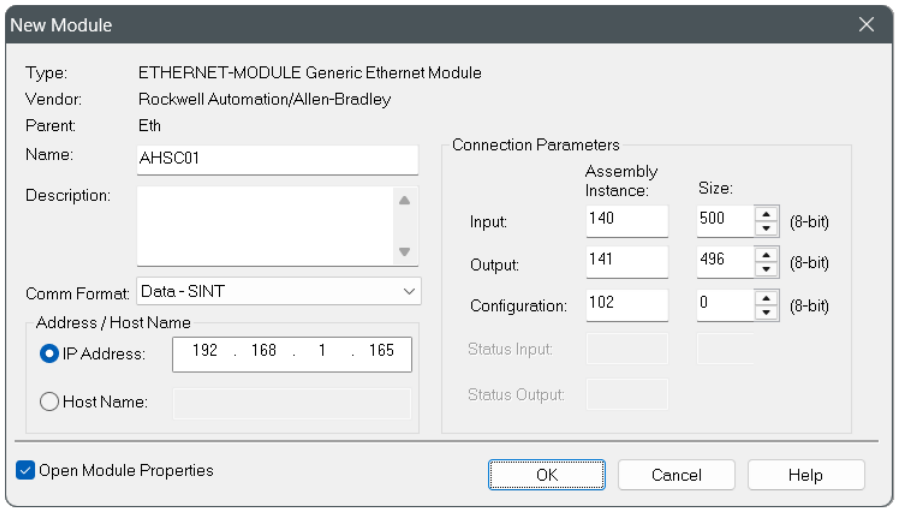


Figure 3.27 - RSLogix 5000 General module properties for HSC module

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. Refer to the technical specification section in this document for further details on the limits of the RPI.

NOTE: The Logix example code (which can be downloaded from the Aparian website) can be imported into the Logix project, which will have all the UDT structures required for the module. See section 3.9.1.2 for more information.

3.9.1.2. IMPORT MAPPING ROUTINE

The HSC Mapping Routine is available on the Aparian website.

HSC01Map.L5X

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

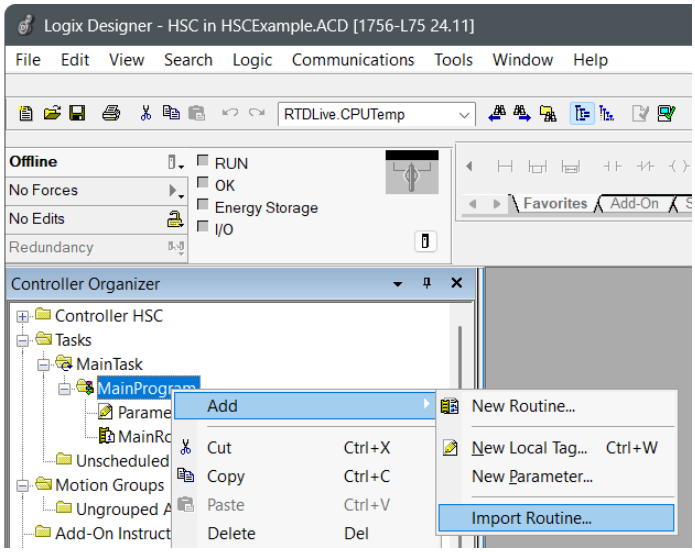


Figure 3.28 – Importing the L5X file into Studio 5000

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

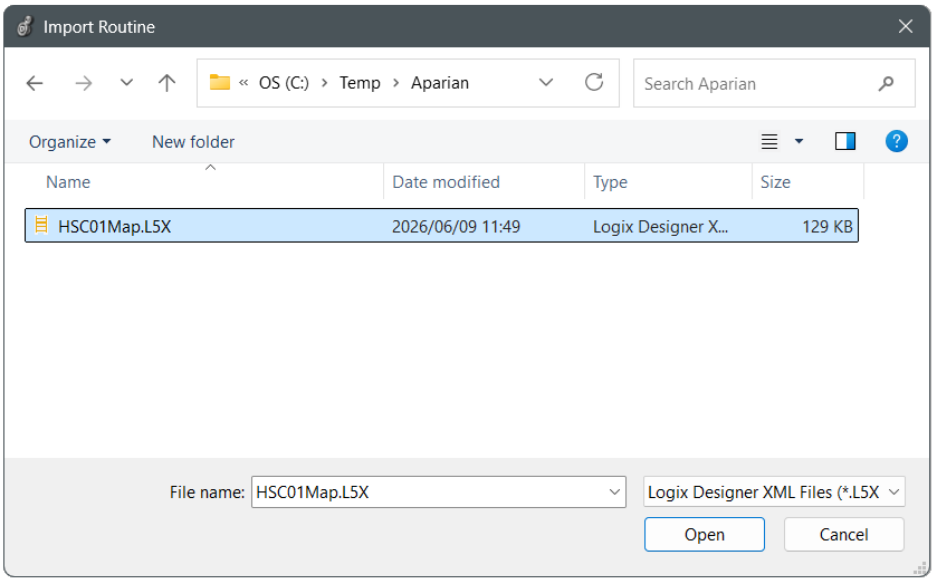


Figure 3.29 – Select L5X file

The import will create the following:

- Mapping Routine
- Multiple UDT (User-Defined Data Types)
- Multiple Controller Tags
- Event Unload AOI (Add-On-Instruction)

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

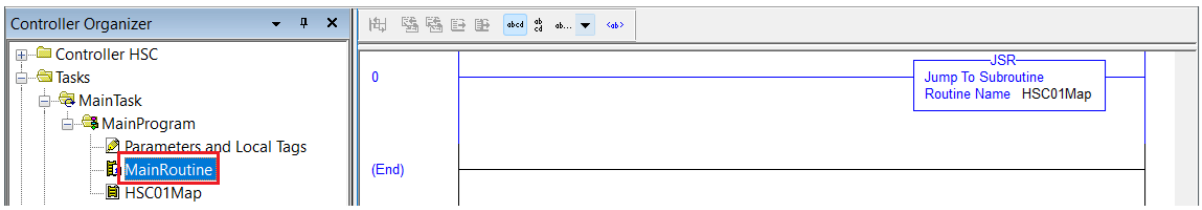


Figure 3.30 – Calling the mapping routine

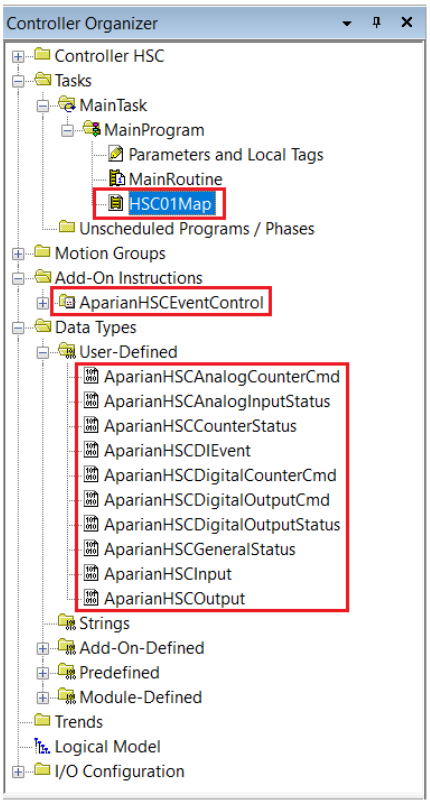


Figure 3.31 – Imported Logix Objects

There are two High Speed Counter specific (UDT) tags created. One for the Input data ("…In") and one for the Output data ("…Out").

Name	Value	Style	Data Type
HSC01Input	{...}		AparianHSCInput
HSC01Input.GeneralStatus	{...}		AparianHSCGeneralStatus
HSC01Input.DigitalInputs	0	Decimal	INT
HSC01Input.DigitalOutputs	15	Decimal	INT
HSC01Input.AnalogInputs	{...}	Float	REAL[4]
HSC01Input.AnalogInputs[0]	-0.019944679	Float	REAL
HSC01Input.AnalogInputs[1]	-0.019962516	Float	REAL
HSC01Input.AnalogInputs[2]	-0.021319529	Float	REAL
HSC01Input.AnalogInputs[3]	-0.019946374	Float	REAL
HSC01Input.AnalogOutput	0.0	Float	REAL
HSC01Input.DigitalCounters	{...}		AparianHSCCounterStatus[8]
HSC01Input.DigitalCounters[0]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[1]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[2]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[3]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[4]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[5]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[6]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalCounters[7]	{...}		AparianHSCCounterStatus
HSC01Input.DigitalOutputStatus	{...}		AparianHSCDigitalOutputStatus[4]
HSC01Input.DigitalOutputStatus[0]	{...}		AparianHSCDigitalOutputStatus
HSC01Input.DigitalOutputStatus[1]	{...}		AparianHSCDigitalOutputStatus
HSC01Input.DigitalOutputStatus[2]	{...}		AparianHSCDigitalOutputStatus
HSC01Input.DigitalOutputStatus[3]	{...}		AparianHSCDigitalOutputStatus
HSC01Input.AnalogInputStatus	{...}		AparianHSCAnalogInputStatus[4]
HSC01Input.DlEventBufferCount	0	Decimal	INT
HSC01Input.DlEvent	{...}		AparianHSCDlEvent

Figure 3.32 – HSC Input tag

Name	Value	Style	Data Type
HSC01Output	{...}		AparianHSCOutput
HSC01Output.DigitalOutputCommand	15	Decimal	SINT
HSC01Output.DigitalOutputForceOn	0	Decimal	SINT
HSC01Output.DigitalOutputForceOff	0	Decimal	SINT
HSC01Output.AnalogOutput	0.0	Float	REAL
HSC01Output.DigitalCounterCommand	{...}		AparianHSCDigitalCounterCmd[8]
HSC01Output.DigitalCounterCommand[0]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[1]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[2]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[3]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[4]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[5]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[6]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalCounterCommand[7]	{...}		AparianHSCDigitalCounterCmd
HSC01Output.DigitalOutputPWM	{...}		AparianHSCDigitalOutputCmd[4]
HSC01Output.DigitalOutputPWM[0]	{...}		AparianHSCDigitalOutputCmd
HSC01Output.DigitalOutputPWM[1]	{...}		AparianHSCDigitalOutputCmd
HSC01Output.DigitalOutputPWM[2]	{...}		AparianHSCDigitalOutputCmd
HSC01Output.DigitalOutputPWM[3]	{...}		AparianHSCDigitalOutputCmd
HSC01Output.AnalogCounterCommand	{...}		AparianHSCAnalogCounterCmd[4]
HSC01Output.AnalogCounterCommand[0]	{...}		AparianHSCAnalogCounterCmd
HSC01Output.AnalogCounterCommand[1]	{...}		AparianHSCAnalogCounterCmd
HSC01Output.AnalogCounterCommand[2]	{...}		AparianHSCAnalogCounterCmd
HSC01Output.AnalogCounterCommand[3]	{...}		AparianHSCAnalogCounterCmd
HSC01Output.DlEventConfirmIndex	6	Decimal	DINT

Figure 3.33 – HSC Output tag

See section 7.1 for more information regarding the EtherNet/IP input and output assemblies.

3.9.2. MODBUS (SERVER AND CLIENT)

The High Speed Counter can operate as a Modbus Server or Modbus Client for Modbus TCP, RTU232, and RTU485.

When configured as a Modbus Server, a remote Modbus Client can read and write to the full Modbus Register range in the High Speed Counter. The HSC can operate as a Modbus Server for Modbus TCP, Modbus RTU232, and Modbus RTU485 simultaneously.

When configured as a Modbus Client, the user will need to configure the Modbus Auxiliary Map. This map will allow the user to configure various read and write functions to external Modbus Registers in remote Modbus devices, to and from the internal Modbus registers.

The Modbus Parameters will need to be configured for either Modbus modes.

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.

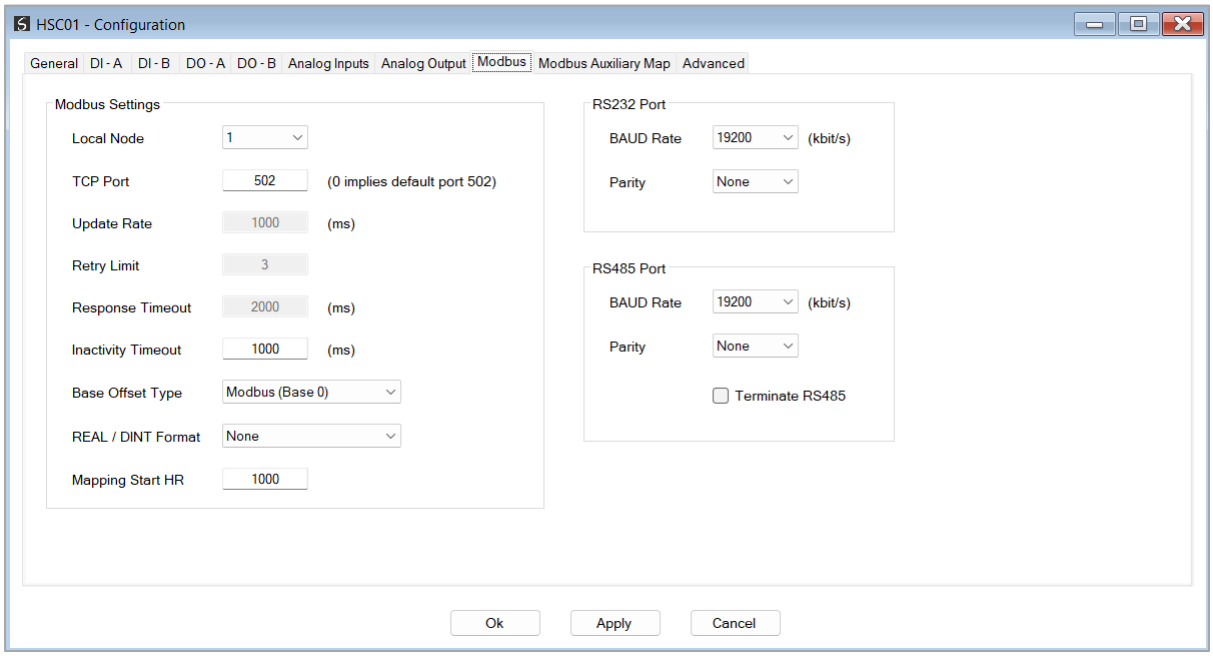


Figure 3.34 – Modbus Configuration

The Modbus Communication configuration consists of the following parameters:

Parameter	Description
Local Node	The Modbus Node address assigned to the High Speed Counter. **(Modbus Client mode only)**

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 High Speed Counter 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.
Real / DINT Format	For a Real (single floating point) of 32-bit Integer number this setting shows the format of the data will be presented when using a Modbus Primary Interface. The format (byte re-ordering) options are as follows: • None • BB AA • BB AA DD CC • DD CC BB AA • CC DD AA BB
Mapping Start HR	The module will provide a fixed structure in the Modbus Holding registers to provide the data to exchange with another Modbus device. The Mapping Start is the Modbus Holding Register address where the structure will start.
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

3.9.2.1. MODBUS AUXILIARY MAP

The Modbus Auxiliary Map configuration is shown in the figure below. The Modbus configuration is applicable only 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 50 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***.

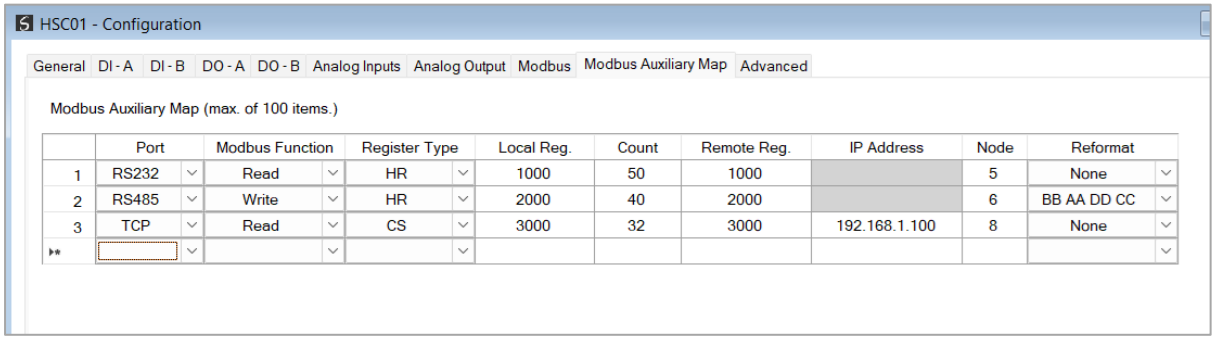


Figure 3.35 – Modbus Auxiliary Map Configuration

The Modbus Auxiliary Map configuration consists of the following parameters:

Parameter	Description
Port	This specifies the port from which the request will be sent. **TCP** **RS232** **RS485**
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) High Speed Counter 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

3.10. 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*.

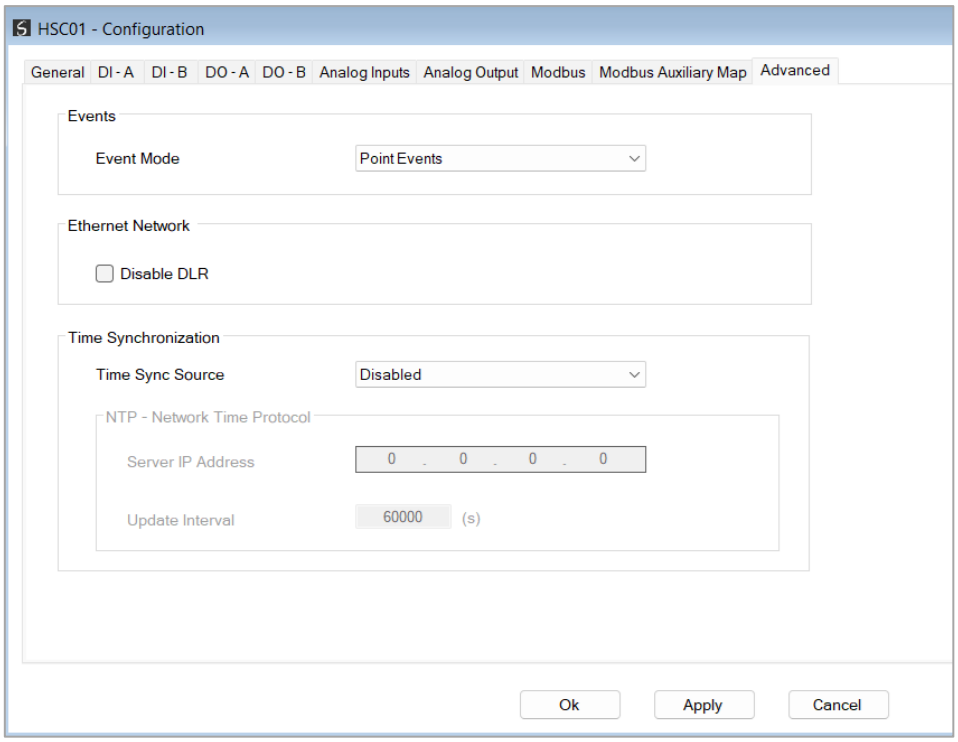


Figure 3.36 – Advanced configuration

The Advanced configuration consists of the following parameters:

Parameter	Description
Event Mode	When using the Digital Input time stamp functionality, the module can provide the timestamp with the value of all the digital inputs or only the point that has changed and is configured for time stamp. Bank Events – All the digital input values are provided in the time stamp. Point Events – Only the configured time stamp point value will be provided.
Disable DLR	Disable the Ethernet Device Level Ring (DLR) functionality.
Time Sync Source	The source used to synchronize the module's time. **Disabled** **NTP (Network Time Protocol)** **PTP (1588 Precision Time Protocol)**
NTP – Server IP Address	This setting is the IP address of the NTP Server which will be used as a time source. **NOTE:** Relevant only when the Time Sync Source is set to NTP.
NTP – Update Interval	This setting is the updated interval (in seconds) that the High Speed Counter will request time from the NTP Server. **NOTE:** Relevant only when the Time Sync Source is set to NTP.

Table 3.6 – Advanced configuration parameters

3.11. MODULE DOWNLOAD

Once the High Speed Counter 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 High Speed Counter is not on a local network.

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

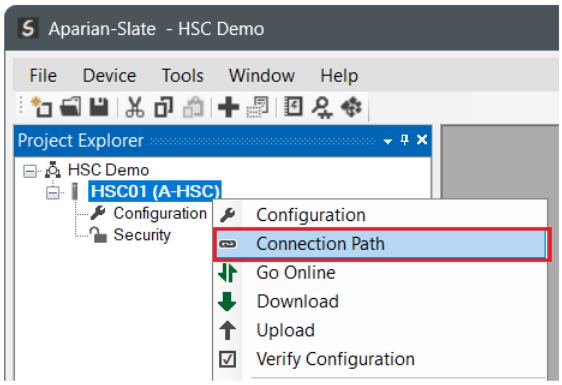


Figure 3.37 - Selecting Connection Path

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

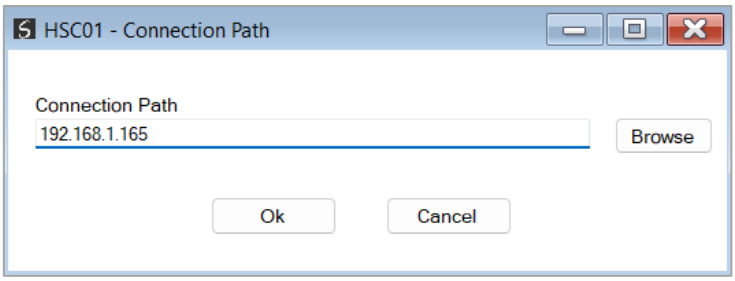


Figure 3.38 - Connection Path

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

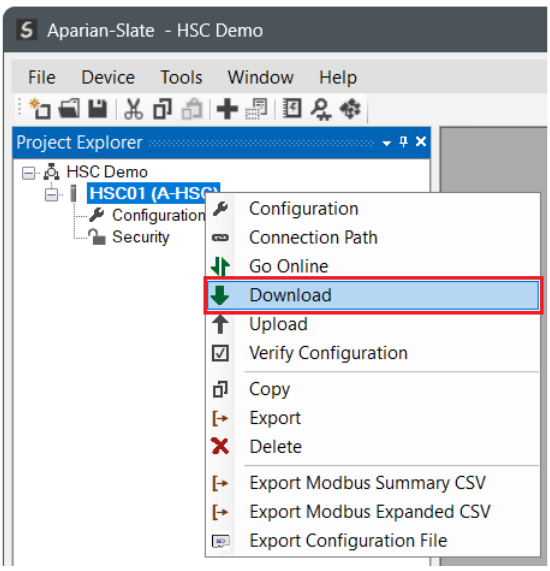


Figure 3.39 - Selecting Download

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

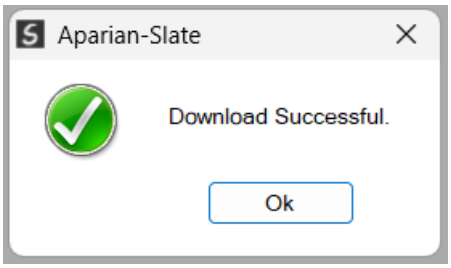


Figure 3.40 - Successful download

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.

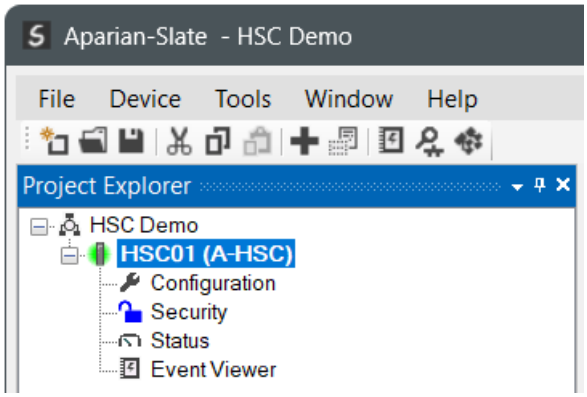


Figure 3.41 - Module online

4. SD CARD RECOVERY

The High Speed Counter supports an SD Card (see below) which can be used for disaster recovery. The SD Card can be pre-loaded with the required firmware, network configuration and/or application and security configuration.

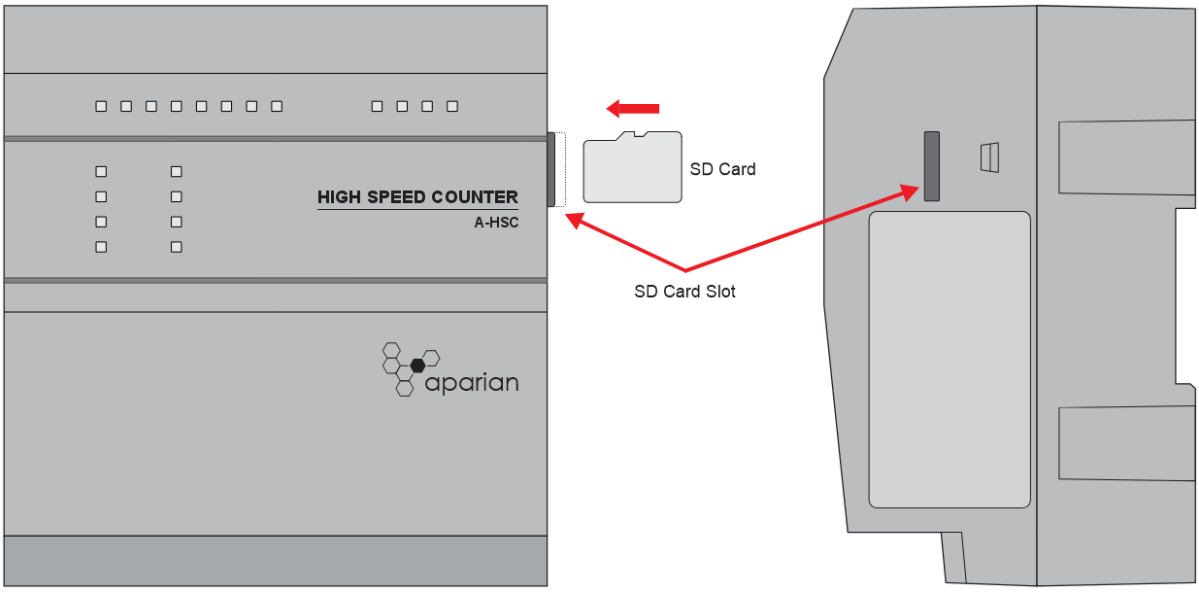


Figure 4.1 – Module Side View – SD Card Slot

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.

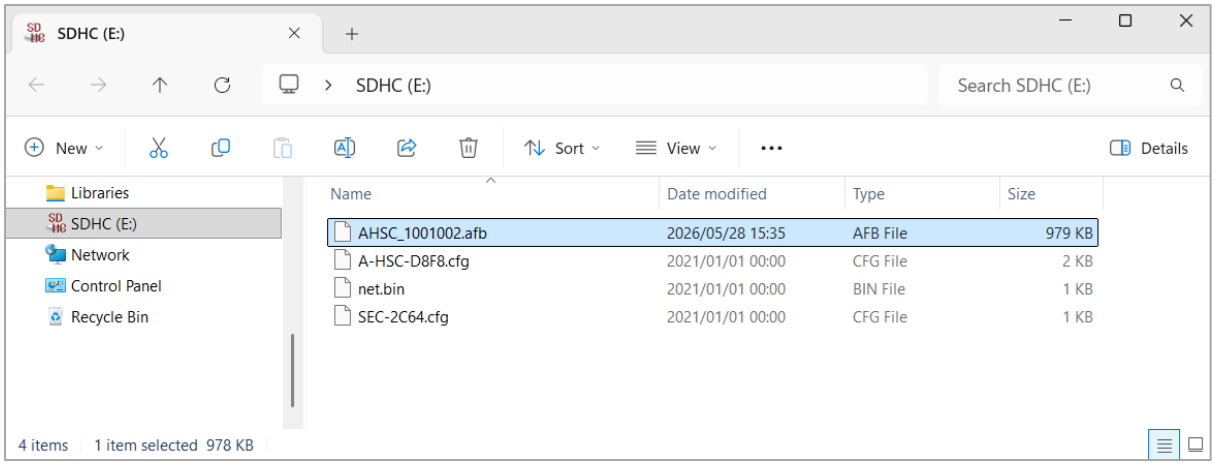


Figure 4.2 – SD Card – Firmware file

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 High Speed Counter will only use the "AHSC_xxxxxxx.afb" 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 defective 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 module's current network parameters to the SD Card.

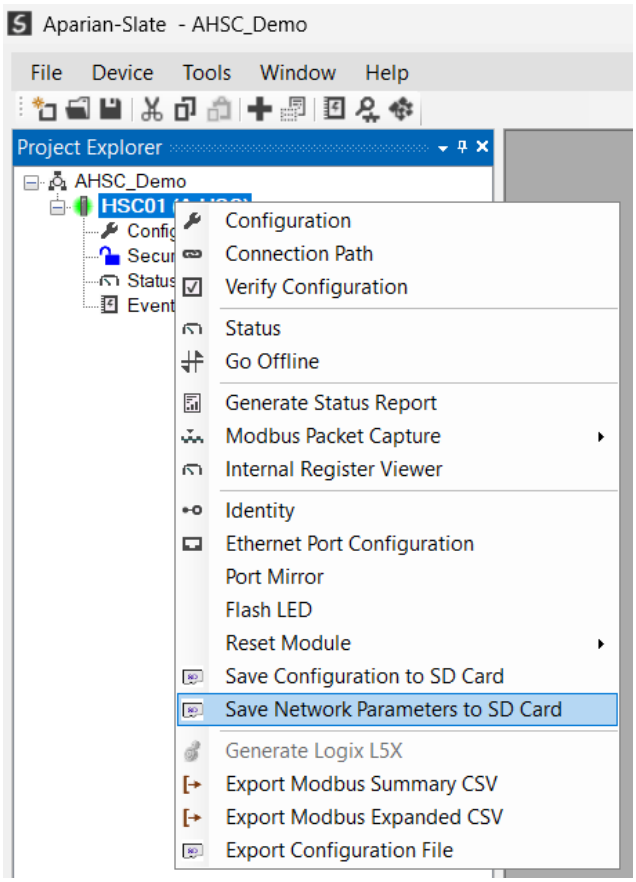


Figure 4.3 – SD Card – Network Parameters

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

4.3. CONFIGURATION

If a module needs to be replaced, the user can insert the SD Card (with the configuration file) 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.

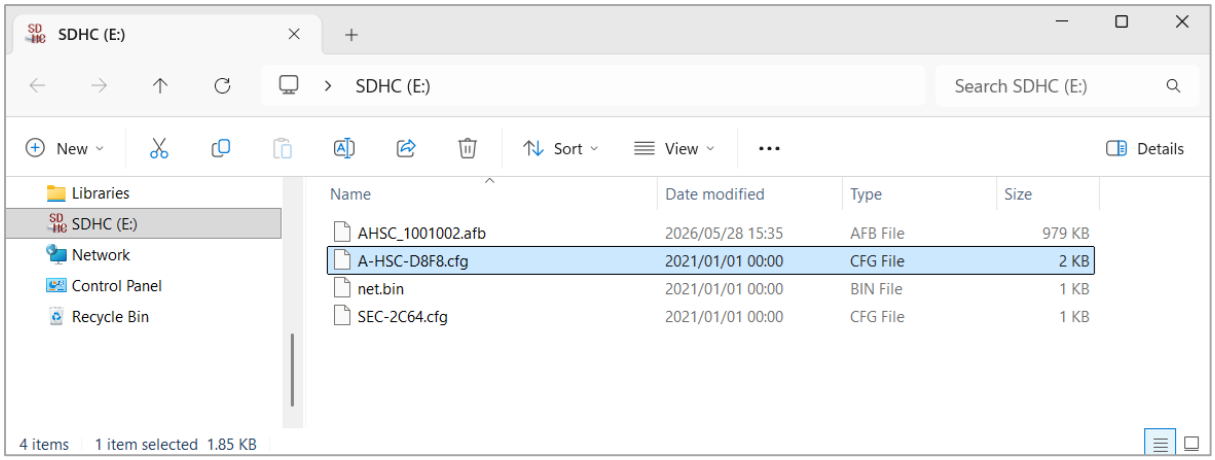


Figure 4.4 – SD Card – Configuration file

4.3.1. Manual Copy

Once the user has created the 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.

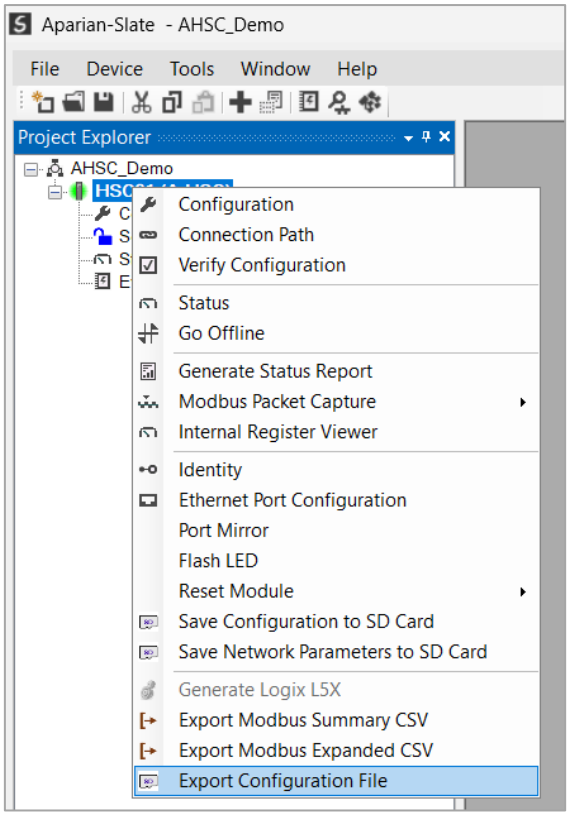


Figure 4.5 – Configuration Export for SD Card

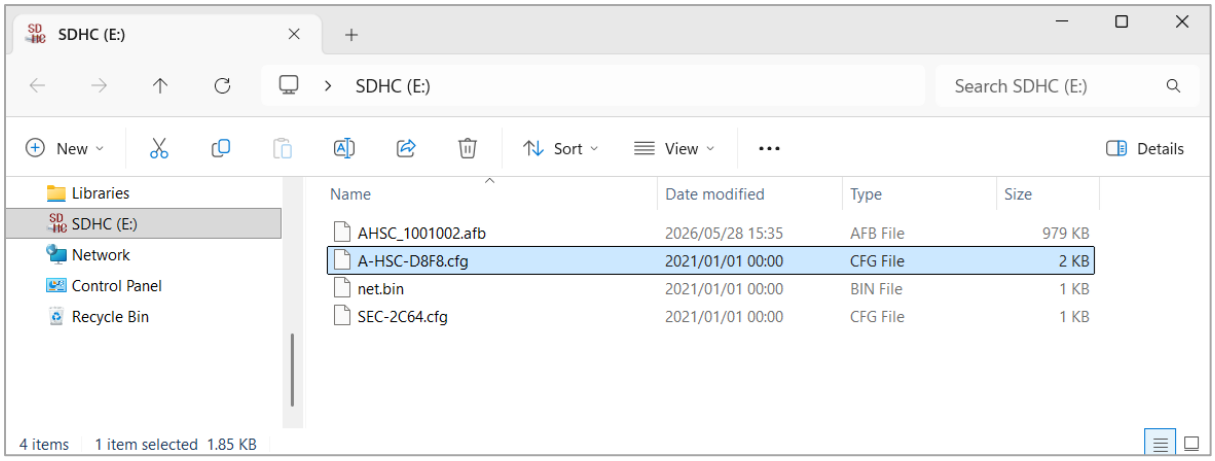


Figure 4.6 – Configuration Export for SD Card

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 High Speed Counter will only use the HSC 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.

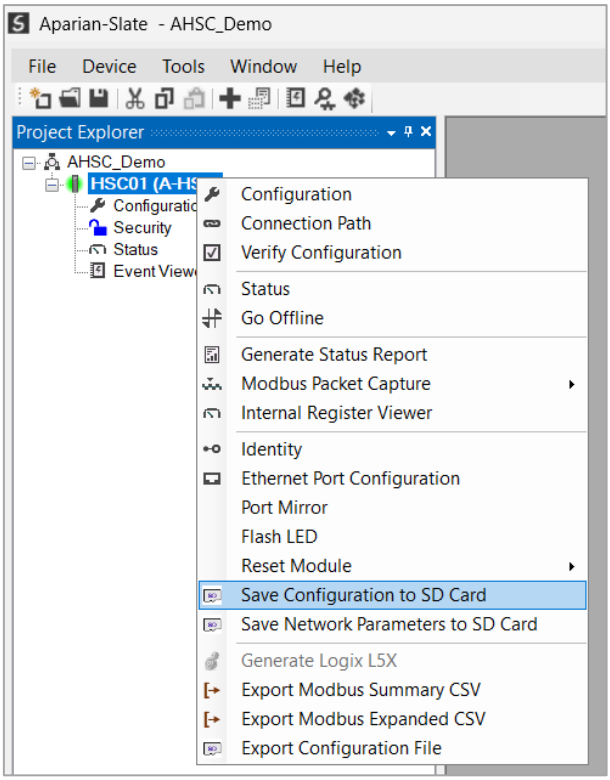


Figure 4.7 – Save Configuration to SD Card

5. DEVICE FIRMWARE UPDATE

The High Speed Counter 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.

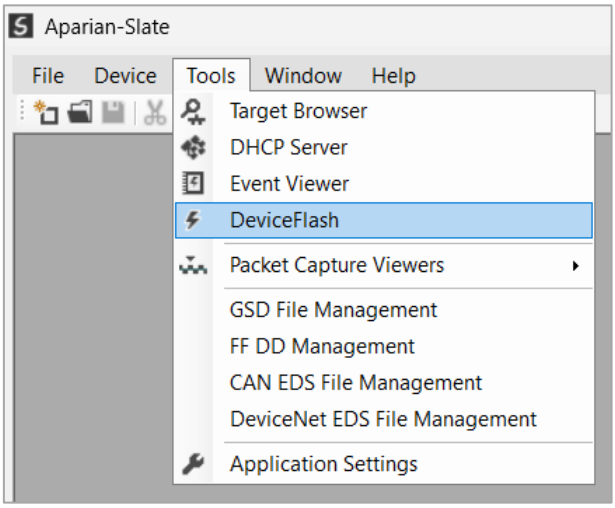


Figure 5.1 – Select DeviceFlash utility from Slate

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

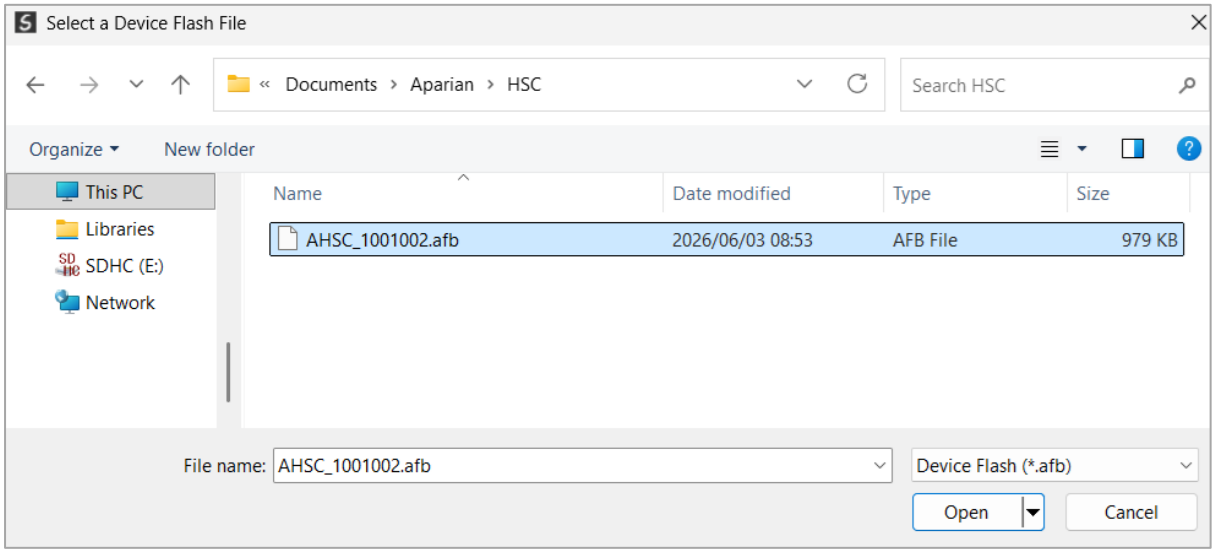


Figure 5.2 – Select the binary file

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

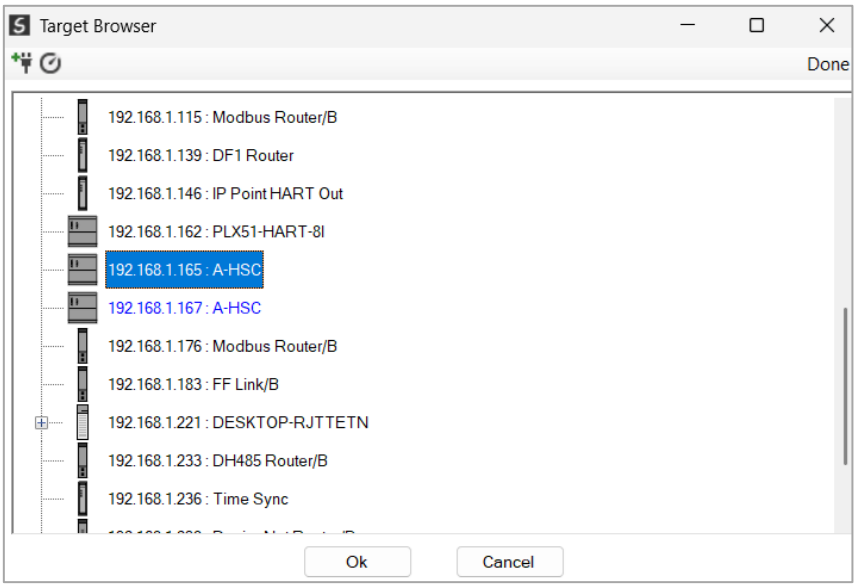


Figure 5.3 – Select the device to be updated

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

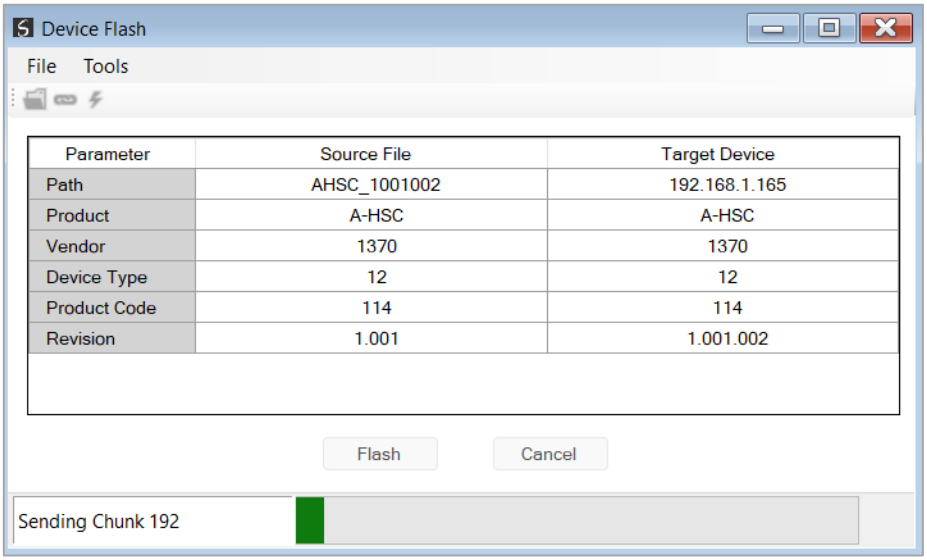


Figure 5.4 – Firmware update busy

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

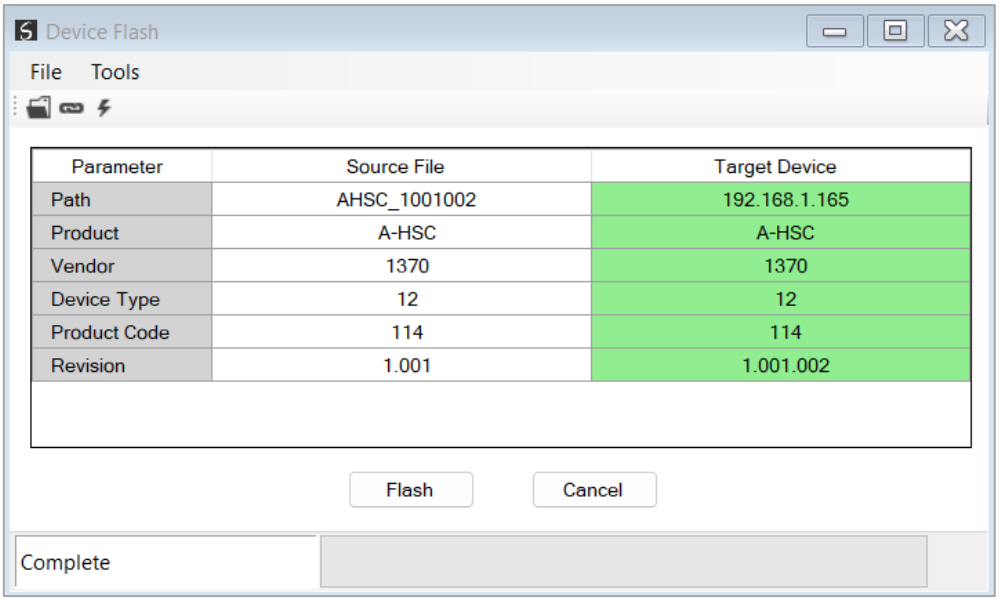


Figure 5.5 – Firmware update successfully completed

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. SECURITY

The High Speed Counter supports security services allowing the user to configure various levels of module security.

When security is enabled all EtherNet/IP communication between Slate and the module is encrypted preventing information from being intercepted by a third party.

Security of the module is configured and downloaded separately to the module's primary (application) configuration and can thus be configured online without affecting the running process.

The security services provide the following features:

- Configurable level of security
- Encrypted EtherNet/IP communication
- Fixed User Roles and Custom Users
- Configurable Password rules
- Login Expiry
- Failed Login Cool-off and Account Disable options
- Configurable Global Services and Custom Ports
- Optional IP Address Access Control List
- Optional MAC Access Control List
- Restrictions on Reset command
- Restrictions on Device Flash options
- Security Audit trail in Event Log

Optional user authentication can be enabled, requiring users to login to the module when connecting. In addition to the fixed role users, (viz. Administrator, Engineer, Operator, Auditor and Viewer) up to 5 custom users can be configured. Each custom user is assigned one of the aforementioned fixed roles.

Once user authentication has been initialized, only users with Administrator privileges are able to change the security configuration and reset passwords etc.

Associated privileges for each user role, is tabulated below:

Privileges / Roles	Administrator	Engineer	Operator	Auditor	Viewer	None
System						
Identity Object	✓	✓	✓	✓	✓	✓
Device Flash (Firmware Upgrade)	✓	-	-	-	-	-
Reset Module	✓	✓	-	-	-	-
Change Ethernet Interface Settings	✓	✓	-	-	-	-
Application						
Download/Upload Configuration	✓	✓	-	-	-	-
View Status and Statistics	✓	✓	✓	✓	✓	-
Clear Statistics	✓	✓	✓	-	-	-
Packet Capture	✓	✓	✓	✓	-	-
View Event Log	✓	✓	✓	✓	✓	-
Clear Event Log	✓	-	-	-	-	-
Generate Status Report	✓	✓	✓	✓	-	-
Modbus Pass Through Functions	✓	✓	-	-	-	-
Internal Register Viewer	✓	✓	-	-	-	-
Security						
Download/Upload Security Configuration	✓	-	-	-	-	-
Clear All Security	✓	-	-	-	-	-
View Security Status and Statistics	✓	✓	-	✓	-	-
Clear Security Statistics	✓	-	-	-	-	-
Change Own Password	✓	✓	✓	✓	✓	-
Change Another User's Password	✓	-	-	-	-	-

Table 6.1 – User Role Privileges

6.1. SECURING PROCESS

The process to secure a module involves the following basic steps:

- Setup Security **Configuration**
- **Download** Security Configuration to the module
- **Initialize** User Authentication

6.1.1. CONFIGURATION

The Security Configuration is accessed by right-clicking on the ***Security*** item in the device tree and selecting the ***Security Configuration*** option.

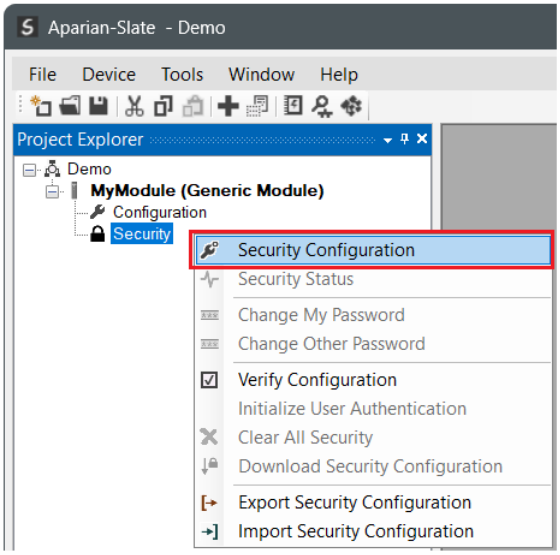


Figure 6.1 – Selecting Security Configuration

The configuration form will open and display multiple configuration tabs.

6.1.1.1. GENERAL CONFIGURATION

The ***General*** configuration tab is shown below.

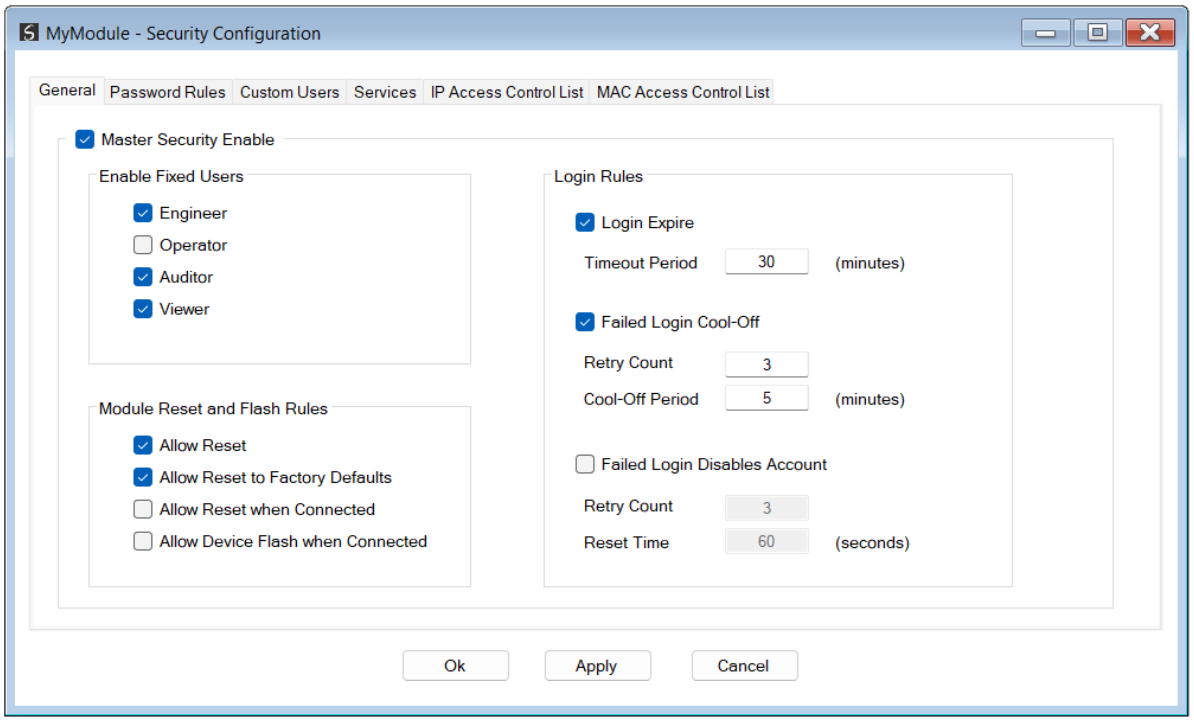


Figure 6.2 – Security Configuration – General

The ***General*** configuration tab comprises the following parameters:

Parameter	Description
Master Security Enable	Used to enable or disable the master security.  **NOTE**: If this option is disabled then all Security measures are disabled.
Enable Fixed Users ***Engineer*** ***Operator*** ***Auditor*** ***Viewer***	Allows each of the fixed users to be enabled or disabled.  **NOTE**: The fixed ***Administrator*** user cannot be disabled.
Module Reset and Device Flash Rules	
Allow Reset	Must be checked to allow any type of Reset via EtherNet/IP.
Allow Reset to Factory Defaults	Must be checked to allow Reset to Factory Defaults (including Reset to Factory Defaults except Communication settings).
Allow Reset when Connected	Must be checked to allow any type of Reset when the module is connected, where connected implies an EtherNet/IP Class 1 connection.
Allow Device Flash when Connected	Must be checked to allow Device Flash when the module is connected, where connected implies an EtherNet/IP Class 1 connection.
Login Rules	
Login Expire	Selecting this option causes all users to be automatically logged-out after the Login Expire Timeout Period.
Login Expire Timeout Period	The duration, in minutes, after which all users will be automatically logged-out. Min: 1 minute Max: 1440 minutes (24 hours)
Failed Login Cool-Off	Selecting this option initiates a Cool-off period after a user has entered an incorrect password the Retry Count times in succession. During the cool off period the user will not be able to login.  **NOTE**: This option, and the Failed Login Disable Account option, cannot be simultaneously selected.
Failed Login Cool-Off Retry Count	The number of retries before the Login Cool-Off period is applied.
Failed Login Cool-Off Period	The Cool-Off duration, in minutes. Once a user has entered an incorrect password the Retry Count times in succession, they would need to wait this period before they can login again. Min: 1 minute Max: 1440 minutes (24 hours)

Failed Login Disables Account	Selecting this option causes the user's account to be disabled if they enter an incorrect password the Retry Count times in succession before the Reset Time has expired. **NOTE**: Once the user's account has been disabled, an Administrator would need to reset their password. **NOTE**: This option will not be applicable for the Administrator user account.
Failed Login Disables Account Retry Count	The number of retries while the Reset Time is active before the user's account is disabled.
Failed Login Disables Account Reset Time	The Reset Time duration, in seconds. Once a user has entered an incorrect password, the Disable Account Reset Time will be applied and starts counting down to zero. If the user enters the incorrect Password the Retry Count times before the Reset Time has expired, the user's account will be disabled. Once the Reset Time has expired (gone back to zero), then the login process can be restarted. Min: 1 second. Max: 65000 seconds (18 hours)

Table 6.2 – Security Configuration – General

6.1.1.2. PASSWORD RULE CONFIGURATION

The ***Password Rules*** tab is shown below.

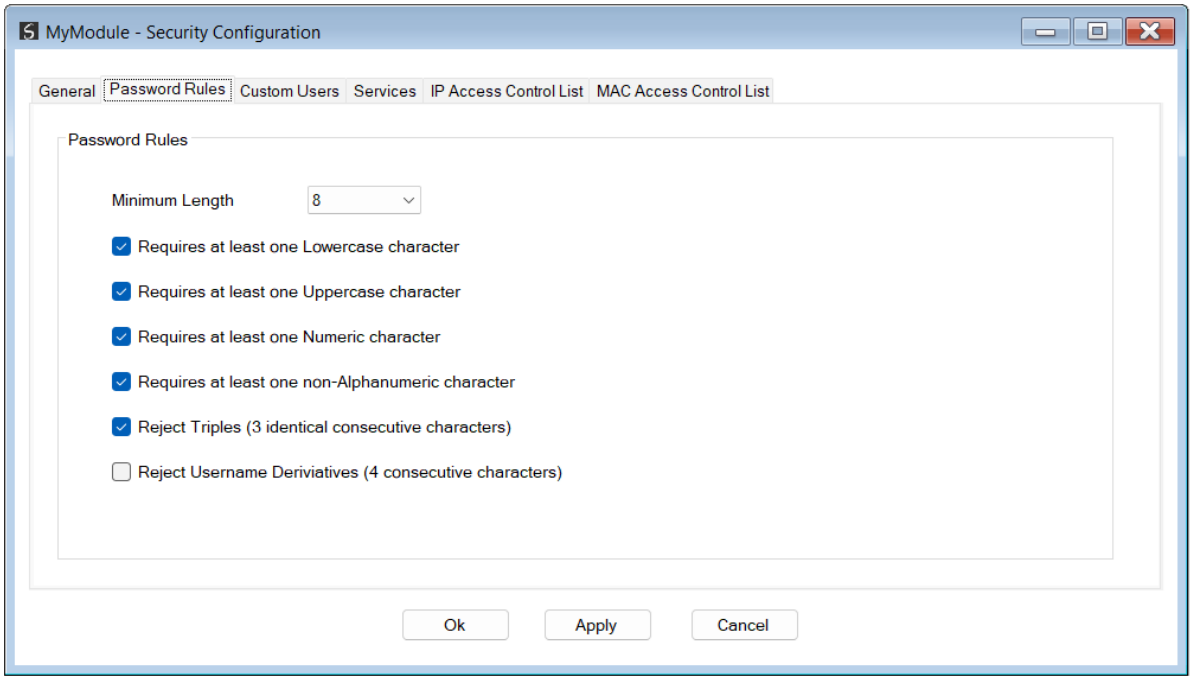


Figure 6.3 – Security Configuration – Password Rules

The ***Password Rules*** tab comprises the following parameters:

Parameter	Description
Minimum Length	The minimum number of characters the password must contain. Min: 1 Max: 32
Requires at least one **Lowercase** character	When selected, all passwords will require at least one lowercase character. e.g. a b c d
Requires at least one **Uppercase** character	When selected, all passwords will require at least one uppercase character. e.g. A B C D
Requires at least one **Numeric** character	When selected, all passwords will require at least one non-alphanumeric character. e.g. 1 2 3 4
Requires at least one **Non-Alphanumeric** character	When selected, all passwords will require at least one non-alphanumeric character. e.g. ! @ # $ %
Reject **Triples**	When selected, all passwords may not contain 3 identical (case-insensitive) consecutive characters. e.g. MyDDDog, strangecCcat.
Reject Username Derivative	When selected, all passwords may not contain any derivative of the respective username. A derivative is defined as any 4 consecutive characters of the password case-insensitive-matching any 4 consecutive characters of the username.

Table 6.3 – Security Configuration – Password Rules

6.1.1.3. CUSTOM USERS CONFIGURATION

The ***Custom Users*** configuration tab is shown below.

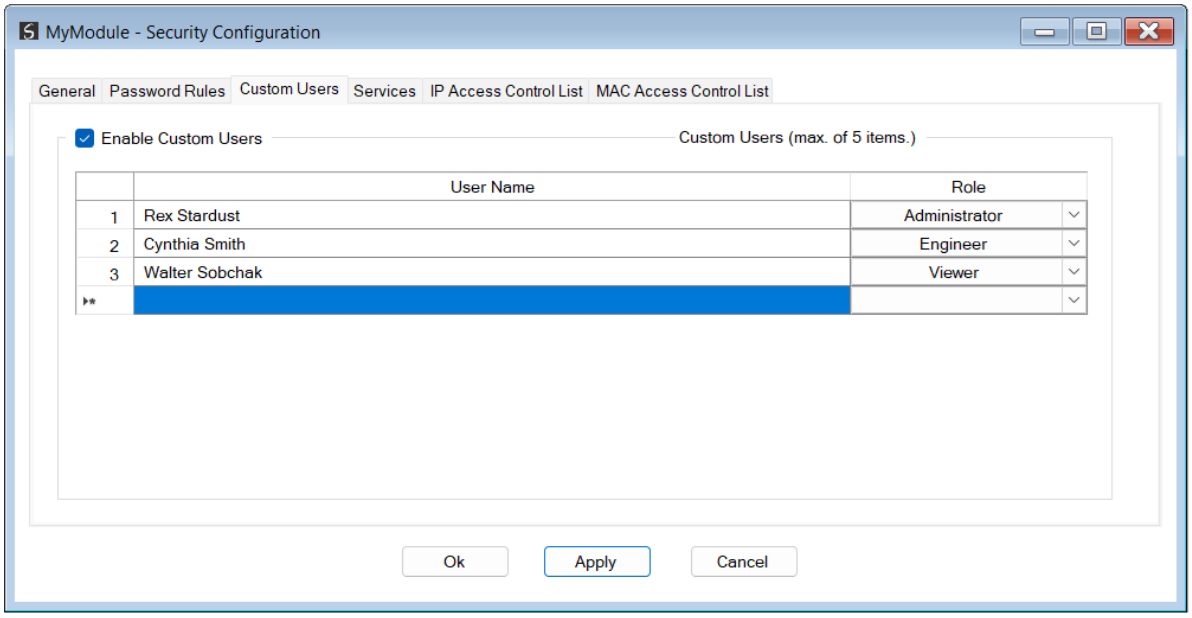


Figure 6.4 – Security Configuration – Custom Users

The ***Custom Users*** configuration tab comprises the following parameters:

Parameter	Description
Enable Custom Users	Global Enable / Disable for all Custom Users
User Name	User Name of the Custom User. **NOTE**: The User Name cannot exceed 32 characters. **NOTE**: The User Name cannot be the same as any of the fixed roles. (Administrator, Engineer etc.)
Role	The role allocated to this user. Select one of the following: Administrator Engineer Operator Auditor Viewer

Table 6.4 – Security Configuration – Custom Users

6.1.1.4. SERVICES CONFIGURATION

The ***Services*** configuration tab is shown below.

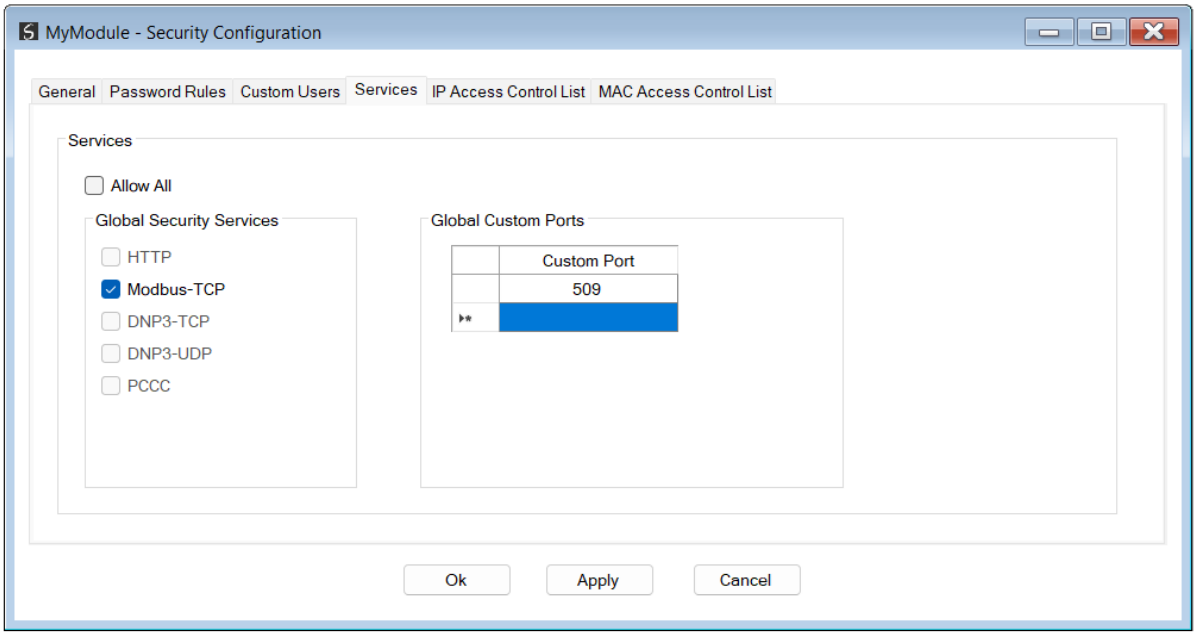


Figure 6.5 – Security Configuration – Services

The ***Services*** configuration tab comprises the following parameters:

Parameter	Description
Allow All	When selected all services are allowed by default.
HTTP	Allow HTTP web server connections to be accepted.
Modbus-TCP	Allow Modbus-TCP connections to be accepted.
DNP3-TCP	Allow DNP3 TCP connections to be accepted.
DNP3-UDP	Allow DNP3 UDP connections to be accepted.
PCCC	Allow PCCC connections to be accepted.
Custom Ports	Up to 4 custom (TCP / UDP) ports can be added to the allowed list. **NOTE**: When the application is using non-standard ports for communication services (e.g. Modus-TCP) then these ports will need to be added to the Custom Ports list.

Table 6.5 – Security Configuration – Services

6.1.1.5. IP ACCESS CONTROL LIST CONFIGURATION

Enabling the IP Access Control List will block all communication from PCs (and other devices) unless their IP addresses are explicitly included in the list with the allowed services.

The ***IP Access Control List*** configuration tab is shown below.

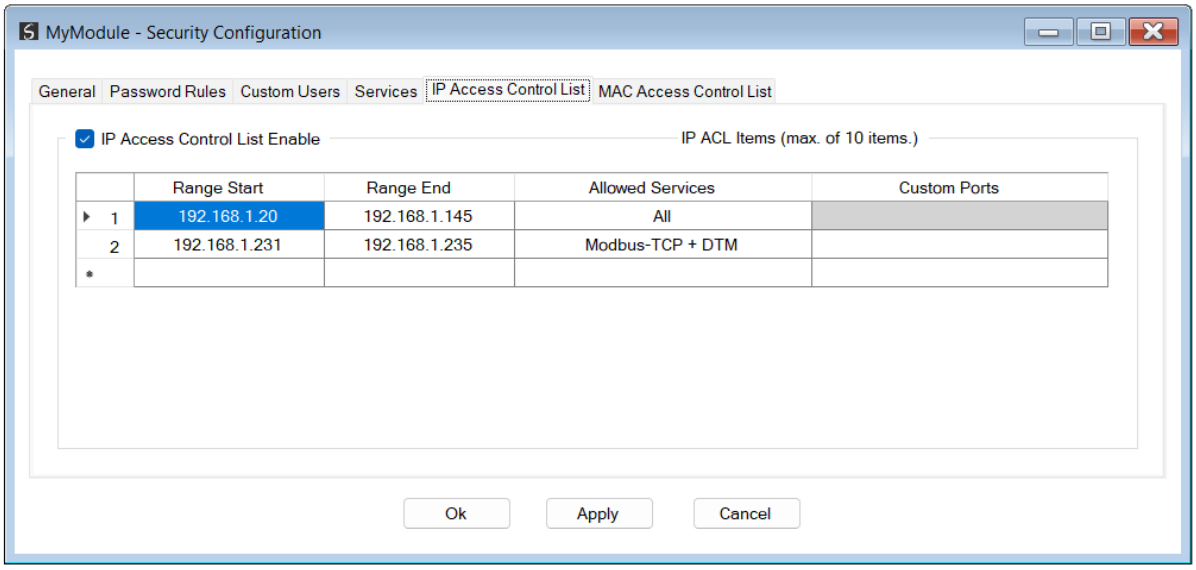


Figure 6.6 – Security Configuration – IP Access Control List

The ***IP Access Control List*** configuration tab comprises the following parameters:

Parameter	**Description**
IP Access Control List Enable	Enable / Disable for all IP Access Control List
IP Access Control List	
Range Start	First IP address in the range.
Range End	Last IP address in the range.
Allowed Services	The services allowed for this IP range.
Custom Ports	Additional custom ports allowed for this IP range.

Table 6.6 – Security Configuration – IP Access Control List.

To modify the Allowed Services the user can either click on the specific Allowed Service cell, or right-click on the specific row and select the ***Edit Services*** option.

The Service Selection form will open allowing the user to select each service's checkbox.

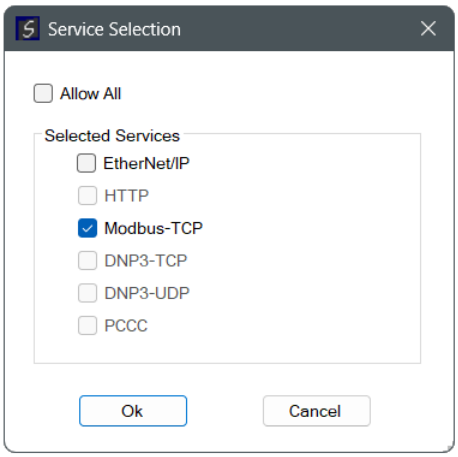


Figure 6.7 – Security Configuration – Service Selection

To modify the Custom Ports the user can either click on the specific ***Custom Ports*** cell, or right-click on the specific row and select the ***Edit Custom Ports*** option.

NOTE: The Custom Ports option is not available if the ***Allow All*** option has been selected in the Allowed Services.

The ***Custom Ports Selection*** form will open allowing the user to modify the Custom Ports.

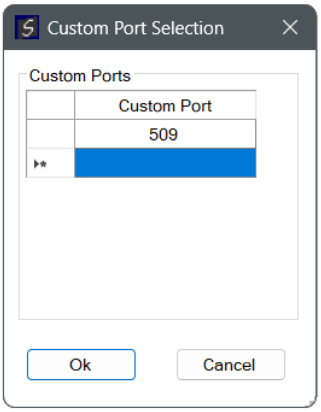


Figure 6.8 – Security Configuration – Custom Ports

6.1.1.6. MAC ACCESS CONTROL LIST CONFIGURATION

Enabling the MAC Access Control List will block all communication from PCs (and other devices) unless their MAC addresses are explicitly added to the list

NOTE: Incorrectly configuring the MAC Access Control List may result in the module no longer being able to communicate with Slate.

The ***MAC Access Control List*** configuration tab is shown below.

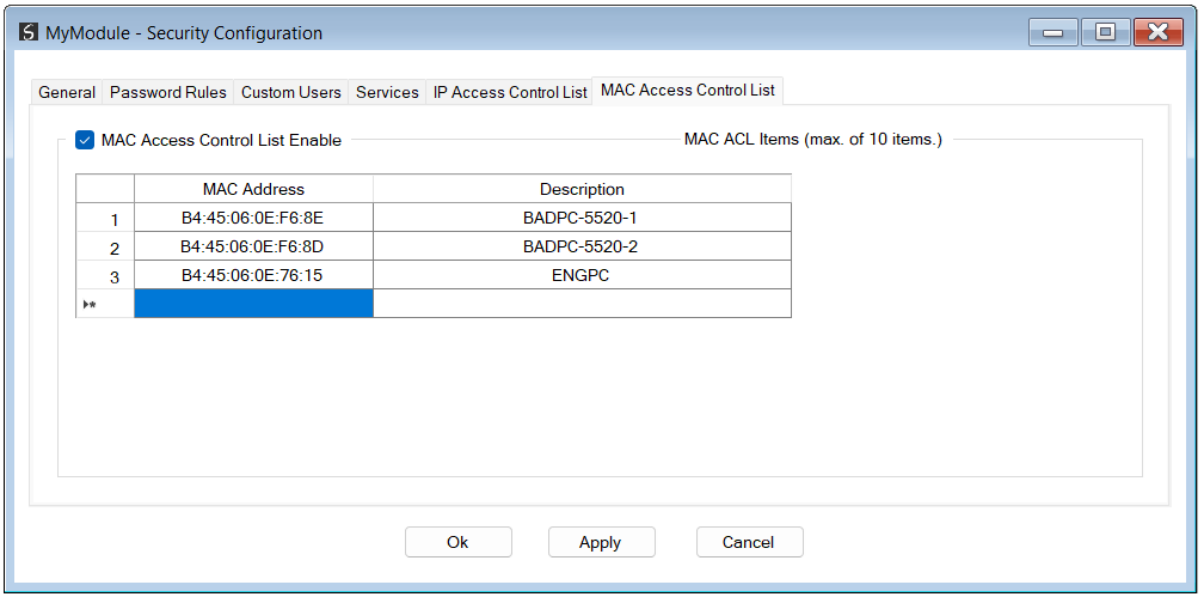


Figure 6.9 – Security Configuration – MAC Access Control List

The ***MAC Access Control List*** configuration tab comprises the following parameters:

Parameter	**Description**
MAC Access Control List Enable	Enable / Disable for all MAC Access Control List
MAC Access Control List	
MAC Address	The MAC address which will be allowed to communicate with the module.
Description	An optional description for the Device with the matching MAC address.

Table 6.7 – Security Configuration – MAC Access Control List

The MAC addresses can be entered manually, or the user can right-click and select the ***Browse*** option.

This will open the ***Network Interface Browser*** displaying all the network interfaces and their corresponding MAC addresses found on the local pc. The user can then select which MAC addresses to be added to the MAC Access Control List.

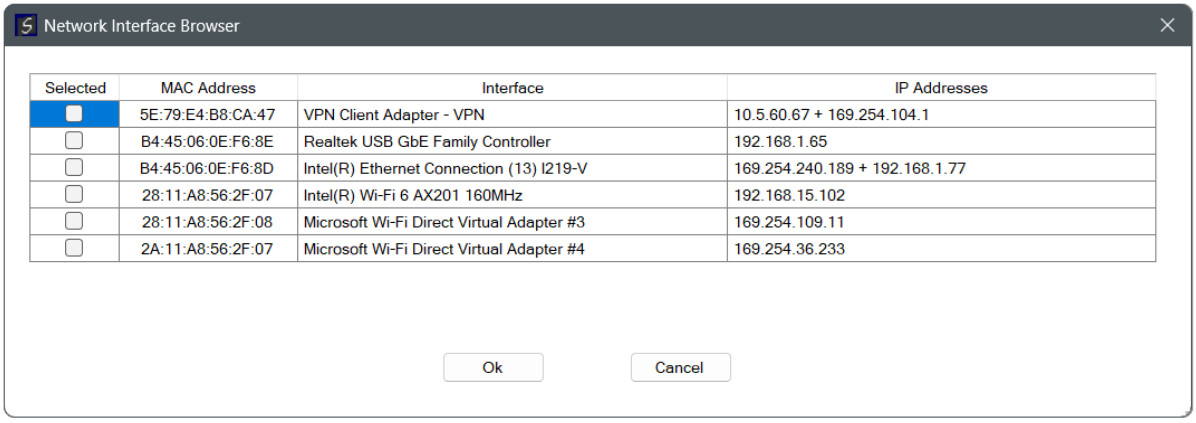


Figure 6.10 – Security Configuration – Network Interface Browser

6.1.2. Download Security Configuration

Once the security configuration has been completed it must be downloaded to the module.

When online with the module, the current state of the security will be indicated by the icon of the Security node in the project tree as follows:

Icon	Description
	Module Offline – Master Security Disabled
	Module Offline – Master Security Enabled
	Module Online – No Security Configuration Downloaded
	Module Online – Master Security Disabled
	Module Online – Master Security Enabled, User Authentication Uninitialized
	Module Online - Secured

Table 6.8 – Security Status Icons

To download the security configuration right-click on the Security item in the project tree and select the ***Download Security Configuration*** item.

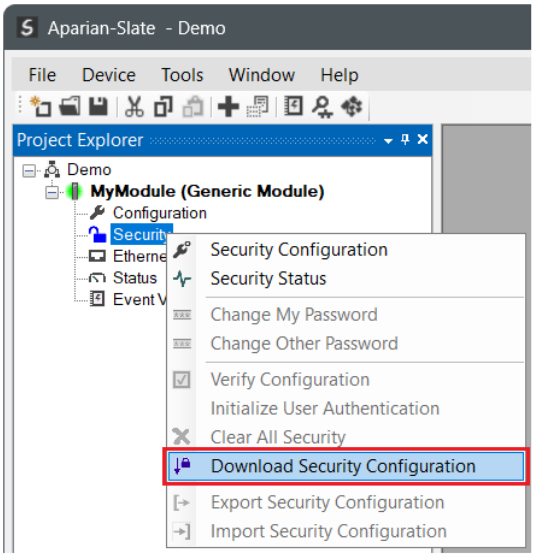


Figure 6.11 – Download Security Configuration

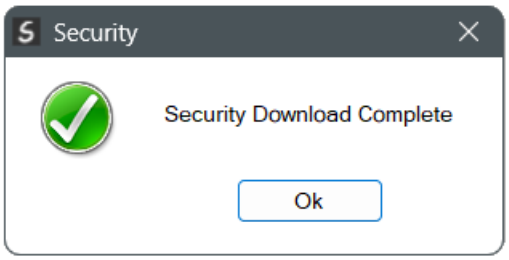


Figure 6.12 – Download Security Configuration Complete

6.1.3. Initialize User Authentication

The final step in securing the module is to initialize user authentication. This involves creating an Administrator password as well as setting the Default password to be used by all other users for their initial login.

To commence with this step, right-click on the Security node in the project tree and select the ***Initialize User Authentication*** option.

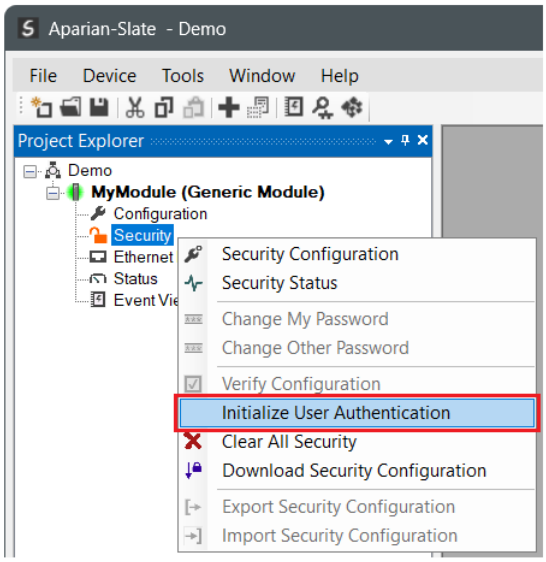


Figure 6.13 – Initialize User Authentication

The user (now deemed to be the Administrator) will need to configure a password for the fixed ***Administrator*** user.

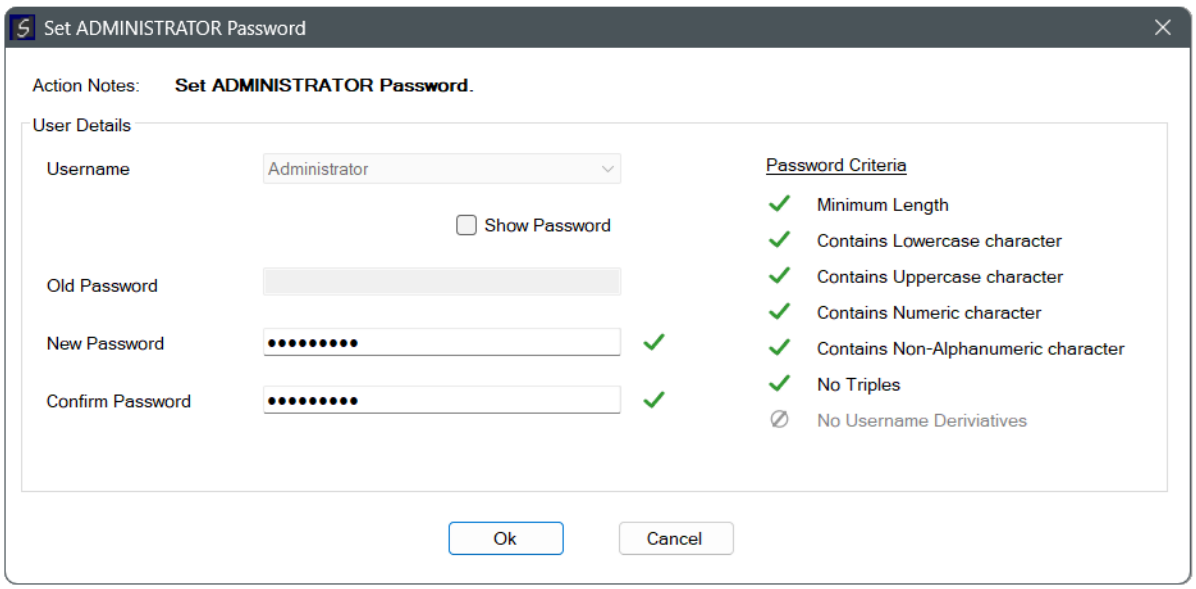


Figure 6.14 – Set Administrator Password.

As the new password is entered, it will be checked against the configured password rules. The icons adjacent to each password rule will indicate if the criteria are fulfilled or not, or not applicable, as shown below:

Icon	Description
	Criteria Not Applicable
	Failed Criteria
	Passed Criteria

Table 6.9 – Password Rule Status Icons.

A green tick icon will be displayed to the right of the ***New Password*** once it meets all the password criteria. A green tick adjacent to the ***Confirm Password*** will indicate that it matches the ***New Password***.

The entered passwords can either be displayed or masked by clicking on the ***Show Password*** check box.

Once the Administrator password has been set, then the ***Default*** password must be set. The ***Default*** password is the password to be used by all other users for their initial login.

The ***Default*** password is configured in similar manner and must also comply with the configured password rules.

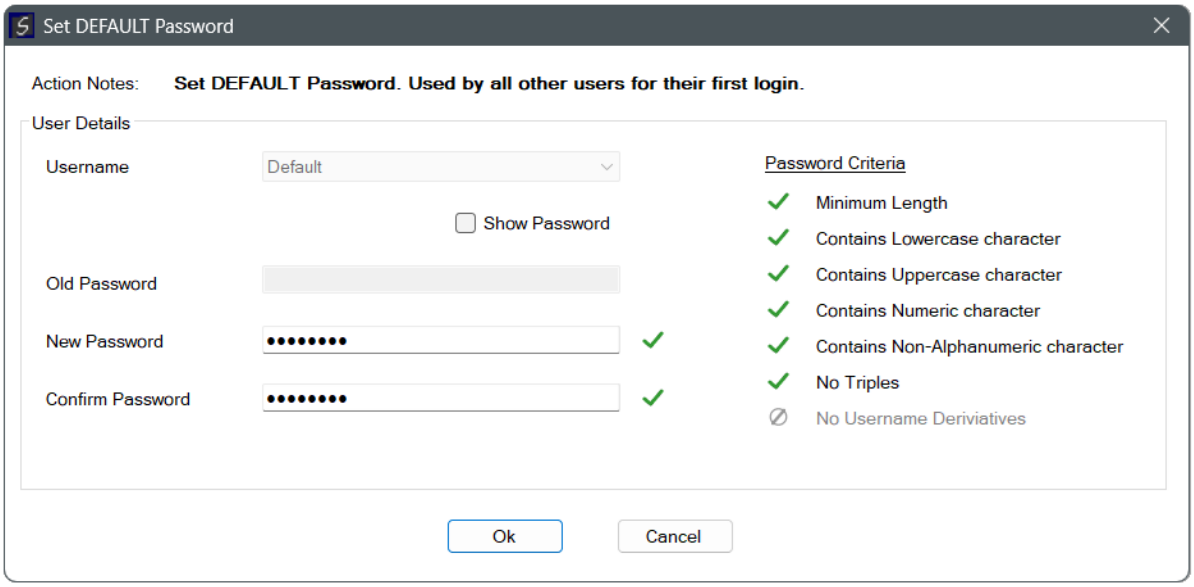


Figure 6.15 – Set Default Password.



NOTE: If required, the Administrator can change the default password individually for each user, by using the ***Change Other Password*** option.

On completion of the User Authentication Initialization step, the module will be secured indicated by the green Locked icon.

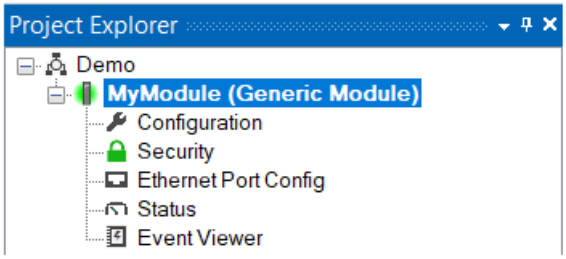


Figure 6.16 – Secured Module

6.2. OPERATION

To interact with a secured, and user initialized module, each user will need to first login.

6.2.1. INITIAL USER LOGIN

Similar, to an unsecured module, a user would open the existing Slate project, right-click on the module, and select ***Go Online***.

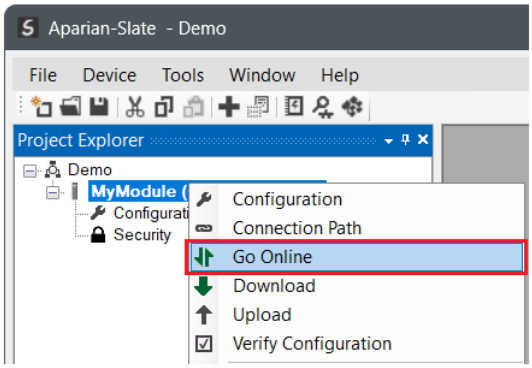


Figure 6.17 – Go Online

Since the module has been secured, it will then prompt the user to login.

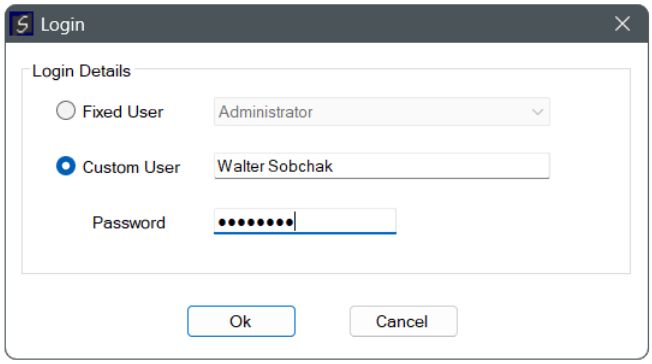


Figure 6.18 – Custom User Login

The user will need to select either one of the ***Fixed Users*** or select the ***Custom User*** option and then enter the Custom Username.

The user will then need to enter their password.

Should this be the initial login with the Default password, or if the Administrator has reset the password and selected the option for the user to change the password, then the Set Password form will open. The user will then need to set an appropriate password before continuing.

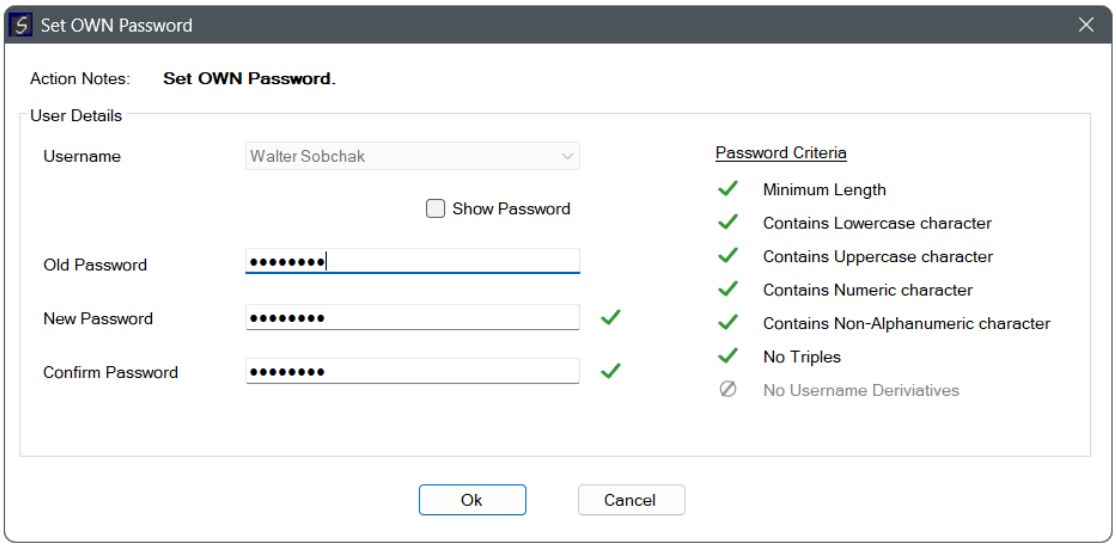


Figure 6.19 – Change Own Password

NOTE: The *Old Password* that needs to be entered on the Initial User Login, will be the same password that was used to login.

All users are permitted to change their password at any time by right-clicking on the ***Security*** node in the project tree and selecting the ***Change My Password*** option.

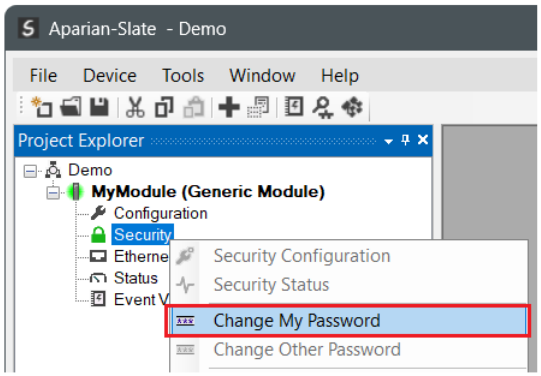


Figure 6.20 – Select Change My Password

6.2.2. ROLE SPECIFIC OPERATIONS

Users with Administrator, Engineer and Auditor roles are permitted to access additional functions not available by other users.

6.2.2.1. SECURITY STATUS

The Security Status can be viewed by right-clicking on the ***Security*** node in the project tree and selecting the ***Security Status*** option.

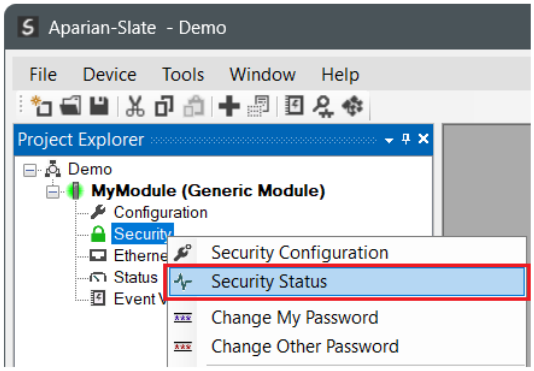


Figure 6.21 – Select Security Status

The Security Status window will open displaying various status and statistics regarding the security services.

The ***General*** tab displays an overview of the security status.

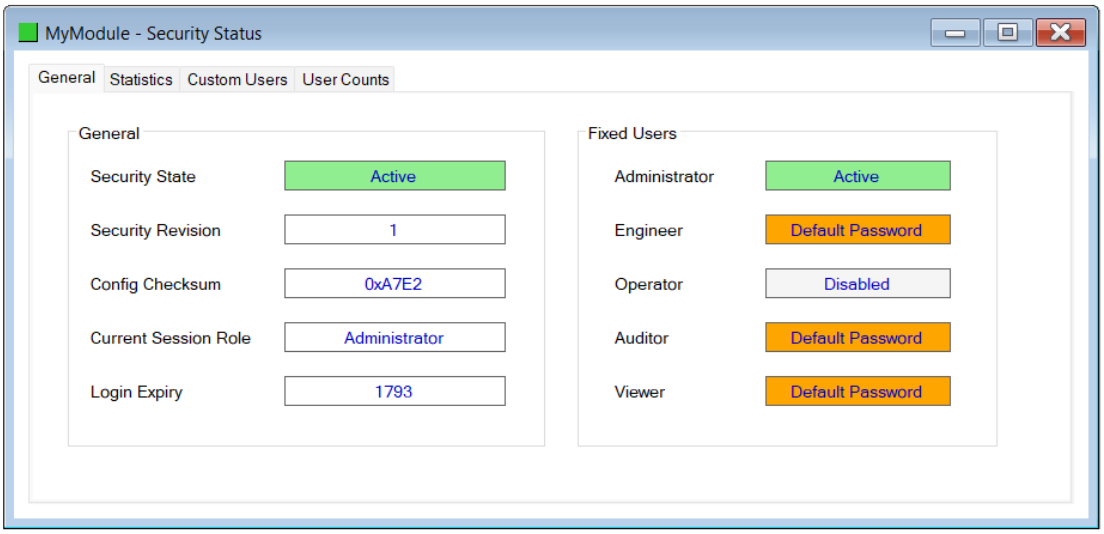


Figure 6.22 – Security Status – General

The General status tab displays the following:

Parameter	Description
General	
Security State	The current status of the security services: ***No Config*** No security configuration has been downloaded to the module. ***Disabled*** Security configuration has been downloaded to the module, but the master Enable Security option in the configuration has been disabled. ***Uninitialized*** The security configuration has been downloaded and enabled, but the Initialize User Authentication step has not yet been completed. ***Active*** The module has been successfully secured.
Security Revision	The revision of the security services currently running on the module. This is a function of the module's firmware revision.
Config Checksum	The checksum of the current security configuration.
Current Session Role	The role assigned to the user that is currently logged in.
Login Expiry	The time (seconds) until the user is automatically logged out. Applicable only if the ***Login Expire*** option has been enabled in the security configuration.

Fixed Users	
Fixed Users Status Administrator Engineer Operator Auditor Viewer	The status of each fixed user: ***Disabled*** The user has not been enabled in the security configuration. ***Default Password*** The user has not changed from their Default assigned password, or from when an Administrator reset their password. ***No Password*** No password exists for the user. This would typically occur when a fixed user is enabled after ***the User Authentication Initialization*** step has taken place. An Administrator would need to reset the password for this specific user. ***Active*** The user is enabled and has a valid password configured.

Table 6.10 – Security Status – General

The Statistics tab displays a number of security service statistics.

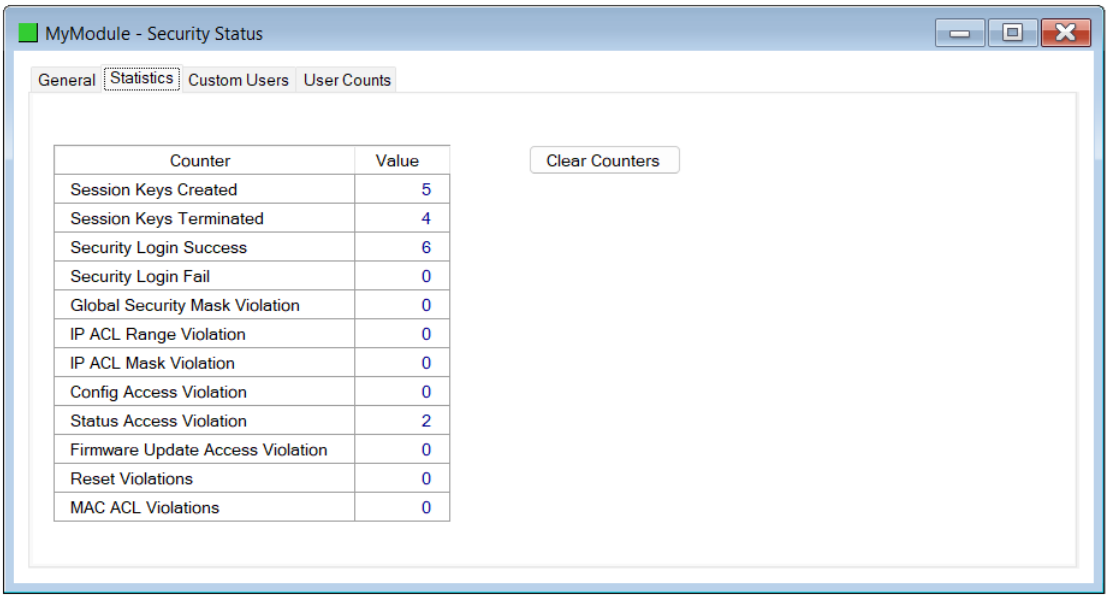


Figure 6.23 – Security Status – Statistics

NOTE: Only an Administrator is permitted to select the ***Clear Counters*** option.

Parameter	Description
Session Keys Created	The number of security session keys created between the configuration software and the module. Each time a user connects to the module with the configuration software, and the module has been secured, a new session key will be created.
Session Keys Terminated	The number of times when either the connection from the configuration software has been terminated or there was an error in the connection decryption. In both these cases the session keys will be deleted.
Security Login Success	The number of successful logins.
Security Login Fail	The number of failed login attempts.
Global Security Mask Violation	The number of times a connection request is received from another device on the Ethernet network, which has not been enabled in the module's global security mask configuration.
IP ACL Range Violation	Each time a request or packet is received from a device that has an IP address outside the IP ACL range, this number will be incremented.
IP ACL Mask Violation	Each time a request or packet is received from a device that has an IP address outside the Subnet ACL range, this number will be incremented.
Config Access Violation	The number of times a connection with the incorrect role privileges tried to access the module security configuration.
Status Access Violation	The number of times a connection with the incorrect role privileges tried to access the module security status.
Firmware Update Access Violation	The number of times an attempt to flash upgrade the module in an incorrect state (e.g., while running a class 1 EtherNet/IP connection) was made.
Reset Violations	The number of times an attempt to reset the module in an incorrect state (e.g., while running a class 1 EtherNet/IP connection) was made.
MAC ACL Violations	Each time a request or packet is received from a device that does not have a matching MAC address to those in the MAC ACL list, this number will increase.

Table 6.11 – Security Status – Statistics

The Custom Users status tab displays the following:

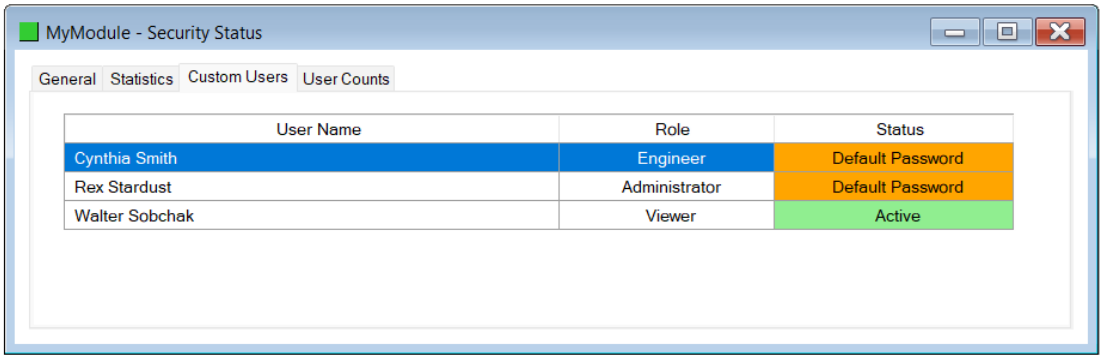


Figure 6.24 – Security Status – Custom Users

Parameter	Description
User Name	The configured user name.
Role	The configured role for this specific user.
Status	The status of the specific user: ***Default Password*** The user has not changed from their Default assigned password, or from when an Administrator reset their password. ***No Password*** No password exists for the user. This would typically occur when a user is added after the User Authentication Initialization has taken place. An Administrator would need to reset the password for this specific user. ***Active*** The user is enabled and has a valid password configured.

Table 6.12 – Security Status – Custom Users

The User Counts status tab displays the following:

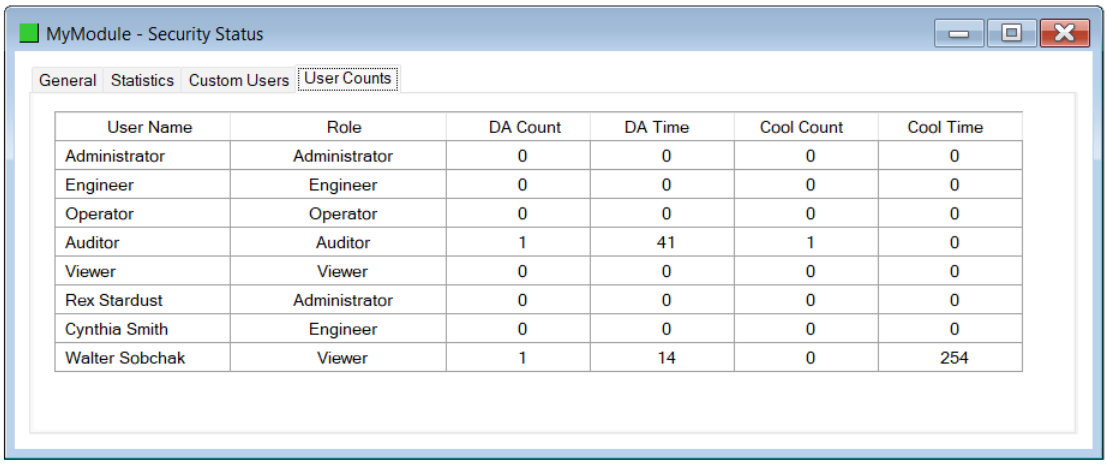


Figure 6.25 – Security Status – User Counts

The following statistics are displayed for each user:

Parameter	Description
User Name	The configured user name.
Role	The configured role for this specific user.
DA Count	The number of failed login occurrences with respect to Disabling the account.

DA Time	The time (seconds) since the last failed login occurrence with respect to Disabling the account.
Cool Count	The number of failed login occurrences with respect to account Cool Down period.
Cool Time	The time (seconds) remaining for the account cool down period.

Table 6.13 – Security Status – User Count

6.2.3. Change Other Password

An Administrator can change (or reset) any user's password by right-clicking on the Security node in the project tree and selecting the ***Change Other Password*** option.

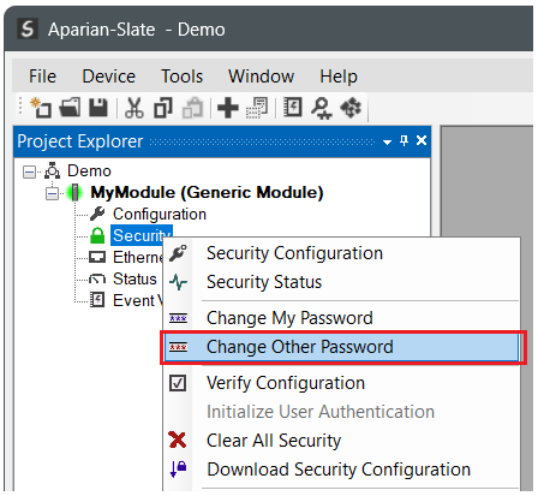


Figure 6.26 – Select Change Other Password.

The Set Password form will open, and the Administrator can then select the User's password to change. The Administrator will need to re-enter their password as well as the new password for the user.

The ***Require User to Change Password*** option forces that user to change the password the next time they login.

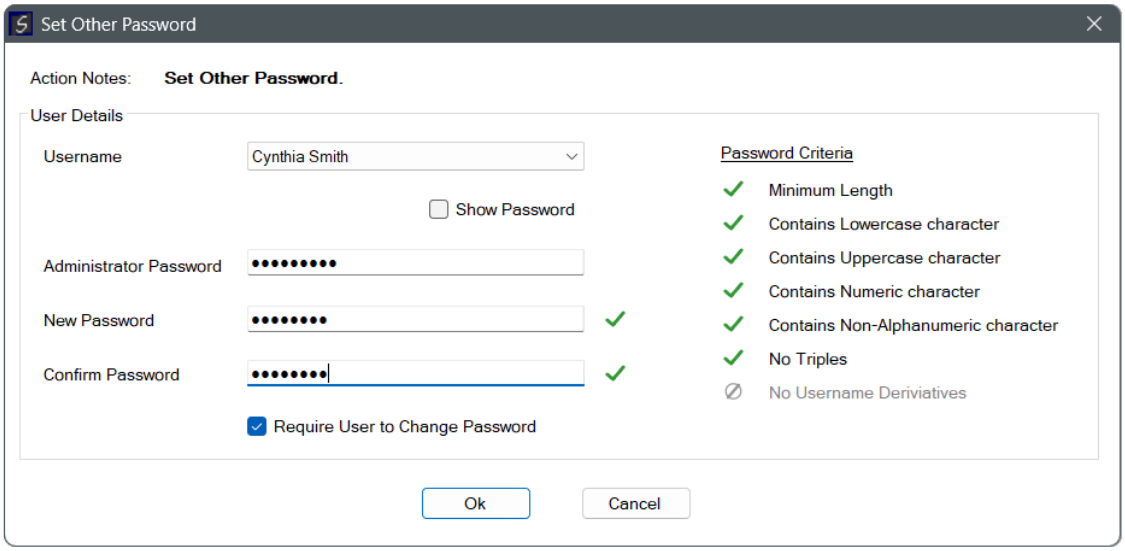


Figure 6.27 – Set Other Password

6.2.4. Clear All Security

An Administrator can remove all the security from a module and return it to an unsecured state. This is done by right-clicking on the Security node in the project tree and selecting the ***Clear All Security*** option.

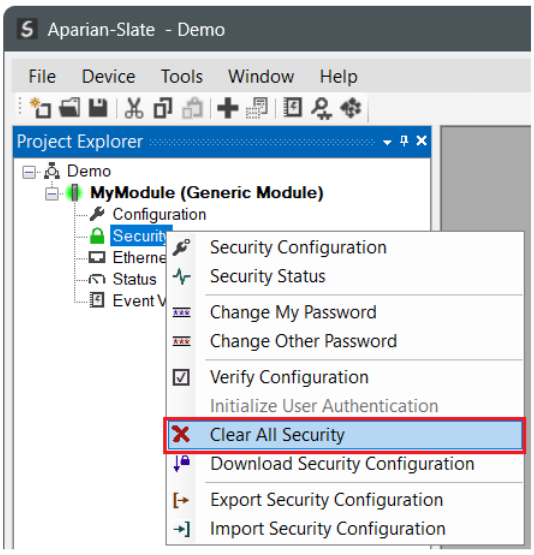


Figure 6.28 – Select Clear All Security.

This action will require the Administrator to enter their password. The security configuration and all passwords will be removed with this action.

NOTE: This process will remove all module security configuration including all passwords.

6.3. EVENT LOG

All security related events are added to the module's event log.

NOTE: Only an Administrator is permitted to select the ***Clear*** the event log.

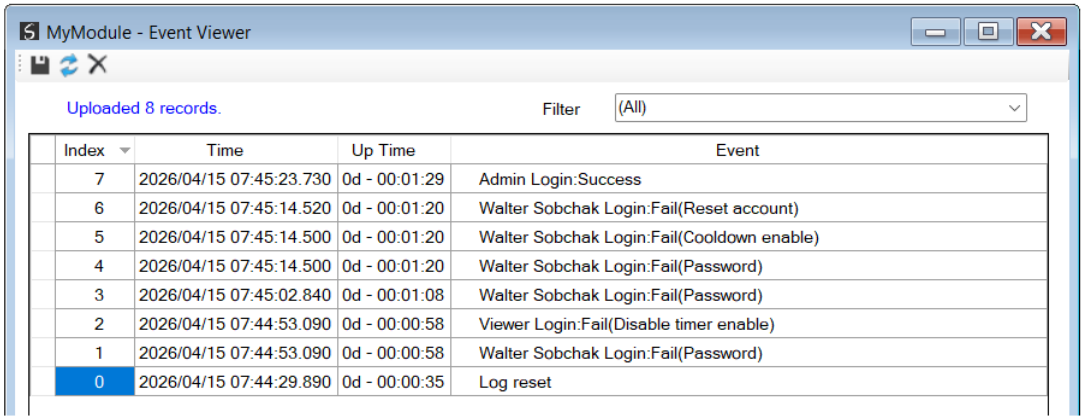


Figure 6.29 – Event Log

6.4. RESET SECURITY CONFIGURATION

The module's security configuration can be reset (cleared) by powering-up the module with DIP switches 2, 3, and 4 set to the ON position.

NOTE: This process will remove all module application configuration and security configuration including all passwords.

NOTE: Once the module has booted-up, the DIP switches should be returned to normal (all OFF). New security configuration cannot be downloaded with the Reset DIP switch combination active.

7. OPERATION

7.1. ETHERNET/IP TARGET

A controller (e.g. Logix controller) can own the High Speed Counter over EtherNet/IP using a single Class 1 EtherNet/IP connections when the High Speed Counter is operating as an EtherNet/IP target. This will allow the High Speed Counter to exchange data with the controller using the input and output assembly of the Class 1 EtherNet/IP connection.

7.1.1. 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 High Speed Counter. The assemblies are exchanged at a fixed interval (RPI).



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

Once the L5X file has been imported the user will be able to use the tags generated for the specific High Speed Counter (HSC). Below are the input and output assemblies for the HSC.

Name	Value	Style	Data Type	Description
HSC01Input	{...}		AparianHSCInput	
HSC01Input.GeneralStatus	{...}		AparianHSCGeneralStatus	Module General Status
HSC01Input.GeneralStatus.ConfigValid	1	Decimal	BOOL	Configuration Valid (0=Invalid, 1=Valid)
HSC01Input.GeneralStatus.EIPOwned	1	Decimal	BOOL	EtherNet/IP Target: (0=Not-Owned, 1=Owned)
HSC01Input.GeneralStatus.ModbusOnline	0	Decimal	BOOL	Modbus Status (0=Offline,1=Online)
HSC01Input.GeneralStatus.Power1Ok	1	Decimal	BOOL	Power Input 1 (0=Off, 1=On)
HSC01Input.GeneralStatus.Power2Ok	0	Decimal	BOOL	Power Input 2 (0=Off, 1=On)
HSC01Input.GeneralStatus.ControllerRunMode	1	Decimal	BOOL	Controller Mode (0=Program, 1=Run)
HSC01Input.GeneralStatus.RTCValid	1	Decimal	BOOL	Real-Time Clock Status (0=Fail, 1=Ok)
HSC01Input.GeneralStatus.CANBusOk	0	Decimal	BOOL	CAN Bus Status (0=Fail, 1=Ok)
HSC01Input.GeneralStatus.ConfigCRC	16#0000	Hex	INT	Configuration Checksum
HSC01Input.GeneralStatus.CurrentCANBaud	-1357	Decimal	INT	Current CAN bus BAUD (0=10k,1=20k,2=50k,3=125k,4=250k,5=5...
HSC01Input.GeneralStatus.Uptime	1981	Decimal	DINT	Uptime
HSC01Input.GeneralStatus.FreeRunCounter	198976	Decimal	DINT	Free Running Counter
HSC01Input.GeneralStatus.DateYear	2026	Decimal	INT	Date Year
HSC01Input.GeneralStatus.DateMonth	6	Decimal	INT	Date Month
HSC01Input.GeneralStatus.DateDay	9	Decimal	INT	Date Day
HSC01Input.GeneralStatus.TimeHour	10	Decimal	INT	Time Hour
HSC01Input.GeneralStatus.TimeMinute	52	Decimal	INT	Time Minute
HSC01Input.GeneralStatus.TimeSecond	37	Decimal	INT	Time Second
HSC01Input.GeneralStatus.DeviceTemperature1	37.0	Float	REAL	Device Temperature (Degrees Celsius)
HSC01Input.GeneralStatus.DeviceTemperature2	37.996094	Float	REAL	Device Temperature (Degrees Celsius)
HSC01Input.GeneralStatus.DIPSwitchesAtStartup	0	Decimal	INT	DIP Switches at startup
HSC01Input.GeneralStatus.DIPSwitchesCurrent	0	Decimal	INT	DIP Switches current
HSC01Input.GeneralStatus.EthPort1Status	0	Decimal	INT	Ethernet Port 1 Status (Bit0: 0=LinkDown, 1=LinkUp, Bit1: 1=Mirror)
HSC01Input.GeneralStatus.EthPort2Status	1	Decimal	INT	Ethernet Port 2 Status (Bit0: 0=LinkDown, 1=LinkUp, Bit1: 1=Mirror)
HSC01Input.GeneralStatus.EthSwitchMode	0	Decimal	INT	Ethernet Switch Mode (0=Switch, 1=Split)
HSC01Input.GeneralStatus.DLRStatus	1	Decimal	INT	Device Level Ring Status (Bit0: 0=Disable,1=Enabled; Bit1: 0=Li...
HSC01Input.GeneralStatus.NTPStatus	3	Decimal	INT	NTP Status (Bit0: 0=Disabled,1=Enabled; Bit1: 0=NotLocked,1=...

HSC01Input.GeneralStatus.PTPStatus	0	Decimal	INT	PTP Status (Bit0: 0=Disabled,1=Enabled; Bit1: 0=NotLocked,1=...
HSC01Input.GeneralStatus.Reserved	0	Decimal	DINT	Module General Status
HSC01Input.DigitalInputs	0	Decimal	INT	Digital Input Value (DI0 to DI7)
HSC01Input.DigitalOutputs	15	Decimal	INT	Digital Output Value (DO0 to DO3)
HSC01Input.AnalogInputs	{...}	Float	REAL[4]	Analog Input Value (AI0 to AI3)
HSC01Input.AnalogInputs[0]	-0.019944679	Float	REAL	Analog Input Value (AI0 to AI3)
HSC01Input.AnalogInputs[1]	-0.020085648	Float	REAL	Analog Input Value (AI0 to AI3)
HSC01Input.AnalogInputs[2]	-0.019945022	Float	REAL	Analog Input Value (AI0 to AI3)
HSC01Input.AnalogInputs[3]	-0.019944698	Float	REAL	Analog Input Value (AI0 to AI3)
HSC01Input.AnalogOutput	0.0	Float	REAL	Analog Output Value (AO0)
HSC01Input.DigitalCounters	{...}		ApanianHSCCounterStatus[8]	Digital Input Counter Status
HSC01Input.DigitalCounters[0]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[0].Enabled	1	Decimal	BOOL	The Digital Input Counter has been enabled
HSC01Input.DigitalCounters[0].HoldHard	0	Decimal	BOOL	The Counter Value is being held at the current value, because ...
HSC01Input.DigitalCounters[0].HoldSoft	0	Decimal	BOOL	The Counter Value is being held at the current value, because t...
HSC01Input.DigitalCounters[0].ResetHard	0	Decimal	BOOL	The Counter Value is reset to the configured init value, because...
HSC01Input.DigitalCounters[0].ResetSoft	0	Decimal	BOOL	The Counter Value is reset to the configured init value, because...
HSC01Input.DigitalCounters[0].SetHard	0	Decimal	BOOL	The Counter Value is set to the value in the data exchange from...
HSC01Input.DigitalCounters[0].SetSoft	0	Decimal	BOOL	The Counter Value is set to the value in the data exchange from...
HSC01Input.DigitalCounters[0].Direction	0	Decimal	BOOL	When the mode for the DI is basic count, this will indicate the co...
HSC01Input.DigitalCounters[0].InputStuckOffAlarm	0	Decimal	BOOL	The Off Alarm will be activated when digital input has been low f...
HSC01Input.DigitalCounters[0].InputStuckOnAlarm	0	Decimal	BOOL	The On Alarm will be activated when digital input has been high...
HSC01Input.DigitalCounters[0].FrequencyHighAlarm	0	Decimal	BOOL	The Frequency High Alarm will be activated when digital input fr...
HSC01Input.DigitalCounters[0].FrequencyLowAlarm	0	Decimal	BOOL	The Frequency Low Alarm will be activated when digital input fr...
HSC01Input.DigitalCounters[0].CountValue	3	Decimal	DINT	The current count value for the digital input.
HSC01Input.DigitalCounters[0].Frequency	0.0	Float	REAL	The current frequency value for the digital input.
HSC01Input.DigitalCounters[0].Period	0.0	Float	REAL	The current period value for the digital input.
HSC01Input.DigitalCounters[1]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[2]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[3]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[4]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[5]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[6]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalCounters[7]	{...}		ApanianHSCCounterStatus	Digital Input Counter Status
HSC01Input.DigitalOutputStatus	{...}		ApanianHSCDigitalOutputStat...	Digital Output Status
HSC01Input.DigitalOutputStatus[0]	{...}		ApanianHSCDigitalOutputStat...	Digital Output Status
HSC01Input.DigitalOutputStatus[0].Enabled	1	Decimal	BOOL	The digital output has been enabled.
HSC01Input.DigitalOutputStatus[0].Command	0	Decimal	BOOL	N/A
HSC01Input.DigitalOutputStatus[0].OverrideOn	0	Decimal	BOOL	The current output value has been forced to on from the overrid...
HSC01Input.DigitalOutputStatus[0].OverrideOff	0	Decimal	BOOL	The current output value has been forced to off from the overrid...
HSC01Input.DigitalOutputStatus[0].Zone0	0	Decimal	BOOL	When the mode for the DO is Counter and the reference DI Cou...
HSC01Input.DigitalOutputStatus[0].Zone1	0	Decimal	BOOL	When the mode for the DO is Counter and the reference DI Cou...
HSC01Input.DigitalOutputStatus[0].Zone2	0	Decimal	BOOL	When the mode for the DO is Counter and the reference DI Cou...
HSC01Input.DigitalOutputStatus[0].Zone3	0	Decimal	BOOL	When the mode for the DO is Counter and the reference DI Cou...
HSC01Input.DigitalOutputStatus[0].Zone4	0	Decimal	BOOL	When the mode for the DO is Counter and the reference DI Cou...
HSC01Input.DigitalOutputStatus[0].PWMPeriod	0	Decimal	DINT	When the DO has been configured for the PWM mode, this is th...
HSC01Input.DigitalOutputStatus[0].PWMDutyCycle	0.0	Float	REAL	When the DO has been configured for the PWM mode, this is th...
HSC01Input.DigitalOutputStatus[0].Reserved	0	Decimal	DINT	N/A
HSC01Input.DigitalOutputStatus[1]	{...}		ApanianHSCDigitalOutputStat...	Digital Output Status
HSC01Input.DigitalOutputStatus[2]	{...}		ApanianHSCDigitalOutputStat...	Digital Output Status
HSC01Input.DigitalOutputStatus[3]	{...}		ApanianHSCDigitalOutputStat...	Digital Output Status
HSC01Input.AnalogInputStatus	{...}		ApanianHSCAnalogInputStat...	Analog Input Status
HSC01Input.AnalogInputStatus[0]	{...}		ApanianHSCAnalogInputStatus	Analog Input Status
HSC01Input.AnalogInputStatus[0].LoAlarm	1	Decimal	BOOL	This will be set when the current AI value is lower than the config...
HSC01Input.AnalogInputStatus[0].LoLoAlarm	1	Decimal	BOOL	This will be set when the current AI value is lower than the config...
HSC01Input.AnalogInputStatus[0].HiAlarm	0	Decimal	BOOL	This will be set when the current AI value is lower than the config...
HSC01Input.AnalogInputStatus[0].HiHiAlarm	0	Decimal	BOOL	This will be set when the current AI value is lower than the config...
HSC01Input.AnalogInputStatus[0].LoThreshold	0	Decimal	BOOL	When the AI is configured to have a counter, then this bit will be ...
HSC01Input.AnalogInputStatus[0].HiThreshold	0	Decimal	BOOL	When the AI is configured to have a counter, then this bit will be ...
HSC01Input.AnalogInputStatus[0].CalibrationFactoryCurrentOk	0	Decimal	BOOL	Factory Calibration for AI current has been successfully loaded.
HSC01Input.AnalogInputStatus[0].CalibrationFactoryVoltageOk	0	Decimal	BOOL	Factory Calibration for AI voltage has been successfully loaded.
HSC01Input.AnalogInputStatus[0].CalibrationUserCurrentOk	0	Decimal	BOOL	User Calibration for AI current has been successfully loaded.
HSC01Input.AnalogInputStatus[0].CalibrationUserVoltageOk	0	Decimal	BOOL	User Calibration for AI voltage has been successfully loaded.
HSC01Input.AnalogInputStatus[0].AnalogInputScaled	-0.019942688	Float	REAL	The current scaled analog input value (Engineering Units).
HSC01Input.AnalogInputStatus[0].AnalogInputRaw	-3	Decimal	INT	The current raw analog input value.
HSC01Input.AnalogInputStatus[0].CurrentCountValue	0	Decimal	DINT	The current counter value for the AI when the Counter Mode has...
HSC01Input.AnalogInputStatus[0].CurrentFrequency	0.0	Float	REAL	The current frequency of the AI when the Counter Mode has be...
HSC01Input.AnalogInputStatus[0].CurrentPeriod	0.0	Float	REAL	The current period of the AI when the Counter Mode has been s...
HSC01Input.AnalogInputStatus[1]	{...}		ApanianHSCAnalogInputStatus	Analog Input Status
HSC01Input.AnalogInputStatus[2]	{...}		ApanianHSCAnalogInputStatus	Analog Input Status
HSC01Input.AnalogInputStatus[3]	{...}		ApanianHSCAnalogInputStatus	Analog Input Status
HSC01Input.DIEventBufferCount	0	Decimal	INT	Sequence of Events - Pending Count
HSC01Input.DIEvent	{...}		ApanianHSCDIEvent	Sequence of Events - Current Event Record
HSC01Input.DIEvent.Index	4	Decimal	DINT	The event index of the last unloaded SOE event.
HSC01Input.DIEvent.TimeStamp	DT#2026-06-09-...	Date/Time	LINT	The event time stamp of the last unloaded SOE event.
HSC01Input.DIEvent.Point	1	Decimal	SINT	The point that is relevant for this SOE event.
HSC01Input.DIEvent.NewValue	1	Decimal	SINT	The current state of the DI that triggered the SOE event.
HSC01Input.DIEvent.PrevValue	0	Decimal	SINT	The previous state of the DI that triggered the SOE event.
HSC01Input.DIEvent.ChangeXOR	1	Decimal	SINT	The XOR value between the current and previous DI that has ch...

Figure 7.1 – Logix – HSC Input Assembly Tag

Name	Value	Style	Data Type	Description
HSC01Output	{...}		ApanianHSCOutput	
HSC01Output.DigitalOutputCommand	15	Decimal	SINT	When the DO mode is direct, this value will be the value written t...
HSC01Output.DigitalOutputForceOn	0	Decimal	SINT	This output will force the specific output to the on state (regardle...
HSC01Output.DigitalOutputForceOff	0	Decimal	SINT	This output will force the specific output to the off state (regardle...
HSC01Output.AnalogOutput	0.0	Float	REAL	The value written to the Analog Output as a percentage (%).
HSC01Output.DigitalCounterCommand	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[0]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[0].Hold	0	Decimal	BOOL	When this bit is set, it will hold the current counter value of the DI ...
HSC01Output.DigitalCounterCommand[0].Reset	0	Decimal	BOOL	When this bit is set, it will reset the current counter value of the D...
HSC01Output.DigitalCounterCommand[0].Set	0	Decimal	BOOL	When this bit is set, it will set the current counter value of the DI t...
HSC01Output.DigitalCounterCommand[0].Direction	0	Decimal	BOOL	The count direction of the basic count DI. When 0 - the value will...
HSC01Output.DigitalCounterCommand[0].SetValue	0	Decimal	DINT	The value that the DI counter will be set to when the Set bit has ...
HSC01Output.DigitalCounterCommand[1]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[2]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[3]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[4]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[5]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[6]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalCounterCommand[7]	{...}		ApanianHSCDigitalCounterC...	Operational commands that are sent for the DI Counter values.
HSC01Output.DigitalOutputPWM	{...}		ApanianHSCDigitalOutputCm...	When the DO has been configured as a Pulse or PWM mode, t...
HSC01Output.DigitalOutputPWM[0]	{...}		ApanianHSCDigitalOutputCmd	When the DO has been configured as a Pulse or PWM mode, t...
HSC01Output.DigitalOutputPWM[0].PWMPeriod	0	Decimal	DINT	When the DO has been configured for the PWM mode, this is th...
HSC01Output.DigitalOutputPWM[0].PWMDutyCycle	0.0	Float	REAL	When the DO has been configured for the PWM mode, this is th...
HSC01Output.DigitalOutputPWM[1]	{...}		ApanianHSCDigitalOutputCmd	When the DO has been configured as a Pulse or PWM mode, t...
HSC01Output.DigitalOutputPWM[2]	{...}		ApanianHSCDigitalOutputCmd	When the DO has been configured as a Pulse or PWM mode, t...
HSC01Output.DigitalOutputPWM[3]	{...}		ApanianHSCDigitalOutputCmd	When the DO has been configured as a Pulse or PWM mode, t...
HSC01Output.AnalogCounterCommand	{...}		ApanianHSCAnalogCounterC...	Operational commands that are sent for the AI Counter values.
HSC01Output.AnalogCounterCommand[0]	{...}		ApanianHSCAnalogCounterC...	Operational commands that are sent for the AI Counter values.
HSC01Output.AnalogCounterCommand[0].Hold	0	Decimal	BOOL	When this bit is set, it will hold the current counter value of the AI ...
HSC01Output.AnalogCounterCommand[0].Reset	0	Decimal	BOOL	When this bit is set, it will reset the current counter value of the AI...
HSC01Output.AnalogCounterCommand[0].Set	0	Decimal	BOOL	When this bit is set, it will set the current counter value of the AI t...
HSC01Output.AnalogCounterCommand[0].Direction	0	Decimal	BOOL	The count direction of the basic count AI. When 0 - the value will...
HSC01Output.AnalogCounterCommand[0].SetValue	0	Decimal	DINT	The value that the AI counter will be set to when the Set bit has ...
HSC01Output.AnalogCounterCommand[1]	{...}		ApanianHSCAnalogCounterC...	Operational commands that are sent for the AI Counter values.
HSC01Output.AnalogCounterCommand[2]	{...}		ApanianHSCAnalogCounterC...	Operational commands that are sent for the AI Counter values.
HSC01Output.AnalogCounterCommand[3]	{...}		ApanianHSCAnalogCounterC...	Operational commands that are sent for the AI Counter values.
HSC01Output.DIEventConfirmIndex	4	Decimal	DINT	The event index sent to the module to confirm that the current ev...

Figure 7.2 – Logix – HSC Output Assembly Tag

7.2. MODBUS

When the High Speed Counter module has the Primary Interface set to either Modbus Client or Modbus Server, then the IO data can be exchanged via Modbus Holding Registers (HR). The module has a fixed structure for the Modbus HR and a configurable Modbus HR start offset. See section 3.9.2 for more information regarding the *Mapping Start HR* parameter.

Below are the mapping structures for the module data in the Modbus Holding Registers. The first set of Modbus HRs are used to provide data from the module while the second set of Modbus HRs are used to consume data from the Primary Interface.

7.2.1. MAPPING STRUCTURE – GENERAL STATUS

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
General Status *Bit 0 – Config Valid* *Configuration Valid (0=Invalid, 1=Valid)* *Bit 1 – EipOwned* *EtherNet/IP Target: (0=Not-Owned, 1=Owned)* *Bit 2 – Modbus Online* *Modbus Status (0=Offline,1=Online)* *Bit 3 – Power 1 Ok* *Power Input 1 (0=Off, 1=On)* *Bit 4 – Power 2 Ok* *Power Input 2 (0=Off, 1=On)* *Bit 5 – Controller Run Mode* *Controller Mode (0=Program, 1=Run)* *Bit 6 – RTC Valid* *Real-Time Clock Status (0=Fail, 1=Ok)* *Bit 7 – CANbus Ok* *CAN Bus Status (0=Fail, 1=Ok)*	2	INT	0
Reserved	2	INT	1
Configuration CRC Configuration Checksum	2	INT	2
Current CAN Baud Current CAN bus BAUD 0 - 10k 1 - 20k 2 - 50k 3 - 125k 4 - 250k 5 - 500k 6 - 800k 7 - 1M	2	INT	3
Uptime Uptime in seconds.	4	DINT	4
Free Run Counter Free Running Counter.	4	DINT	6
Date-Year	2	INT	8
Date-Month	2	INT	9
Date-Day	2	INT	10
Time-Hour	2	INT	11
Time-Minute	2	INT	12
Time-Second	2	INT	13
Temperature01 Device Temperature (Degrees Celsius).	4	REAL	14
Temperature02 Device Temperature (Degrees Celsius).	4	REAL	16
DIP Switch at Startup	2	INT	18

DIP Switches at startup.			
DIP Switch Current DIP Switches current.	2	INT	19
Ethernet Port A Status Bit 0 – Link 0 – Down 1 - Up Bit 1 – Mirror 0 – Disabled 1 – Enabled	2	INT	20
Ethernet Port B Status Bit 0 – Link 0 – Down 1 - Up Bit 1 – Mirror 0 – Disabled 1 – Enabled	2	INT	21
Ethernet Switch Mode 0 – Switch 1 – Split Port	2	INT	22
Device Level Ring (DLR) Status Bit 0: 0 - Disable, 1 - Enabled Bit 1: 0 - Linear, 1 - Ring Bit 2: 0 - Normal, 1 - Fault	2	INT	23
Network Time Protocol (NTP) Status Bit 0: 0 - Disabled, 1 - Enabled Bit 1: 0 – Not Locked, 1 - Locked	2	INT	24
Precision Time Protocol (PTP) Status Bit 0: 0 - Disabled, 1 - Enabled Bit 1: 0 – Not Locked, 1 - Locked	2	INT	25
Reserved	4	DINT	26

Table 7.1 – Modbus Mapping Structure for General Status

7.2.2. Mapping Structure – Input IO Data

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Inputs Bit 0: Digital Input 0 Bit 1: Digital Input 1 … Bit 7: Digital Input 7	2	INT	28
Digital Outputs Bit 0: Digital Output 0 Bit 1: Digital Output 1 … Bit 3: Digital Output 3 Bit 4 – 7: Reserved	2	INT	29

Analog Inputs Analog Input Value (AI0 to AI3)	16	REAL[4]	30
Analog Output	4	REAL	38

Table 7.2 – Modbus Mapping Structure for Input IO Data

7.2.3. Mapping Structure – Digital Input Counter Status

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Input 0 Status *Bit 0 – Enabled* *The Digital Input Counter has been enabled.* *Bit 1 – Hold Hard* *The Counter Value is being held at the current value, because of another digital input that has a command to hold the value has a high input.* *Bit 2 – Hold Soft* *The Counter Value is being held at the current value, because the hold option has been set in the data exchange from the Primary Interface.* *Bit 3 – Reset Hard* *The Counter Value is reset to the configured Init value, because of another digital input that has a command to reset the value has a high input.* *Bit 4 – Reset Soft* *The Counter Value is reset to the configured Init value, because the reset option has been set in the data exchange from the Primary Interface.* *Bit 5 – Set Hard* *The Counter Value is set to the value in the data exchange from the Primary Interface, because of another digital input that has a command to set the value has a high input.* *Bit 6 – Set Soft* *The Counter Value is set to the value in the data exchange from the Primary Interface, because the reset option has been set in the data exchange from the Primary Interface.* *Bit 7 – Down Direction* *When the mode for the DI is basic count, this will indicate the count direction (up or down) for the counter. The count direction is in the data exchange from the Primary Interface.* *Bit 8 – Input Stuck Off Alarm* *The Off Alarm will be activated when digital input has been low for longer than the time configured in the Off Alarm parameter.* *Bit 9 – Input Stuck On Alarm* *The On Alarm will be activated when digital input has been high for longer than the time configured in the On Alarm parameter.* *Bit 10 – Frequency High Alarm* *The Frequency High Alarm will be activated when digital input frequency is lower than the configured Freq. High Alarm.* *Bit 11 – Frequency Low Alarm* *The Frequency Low Alarm will be activated when digital input frequency is lower than the configured Freq. Low Alarm.*	4	DINT	40
Digital Input 0 Count Value	4	DINT	42

The current count value for the digital input.			
Digital Input 0 Frequency The current frequency value for the digital input.	4	REAL	44
Digital Input 0 Period The current period value for the digital input.	4	REAL	46
Digital Input 1 Status	4	DINT	48
Digital Input 1 Count Value	4	DINT	50
Digital Input 1 Frequency	4	REAL	52
Digital Input 1 Period	4	REAL	54
Digital Input 2 Status	4	DINT	56
Digital Input 2 Count Value	4	DINT	58
Digital Input 2 Frequency	4	REAL	60
Digital Input 2 Period	4	REAL	62
Digital Input 3 Status	4	DINT	64
Digital Input 3 Count Value	4	DINT	66
Digital Input 3 Frequency	4	REAL	68
Digital Input 3 Period	4	REAL	70
Digital Input 4 Status	4	DINT	72
Digital Input 4 Count Value	4	DINT	74
Digital Input 4 Frequency	4	REAL	76
Digital Input 4 Period	4	REAL	78
Digital Input 5 Status	4	DINT	80
Digital Input 5 Count Value	4	DINT	82
Digital Input 5 Frequency	4	REAL	84
Digital Input 5 Period	4	REAL	86
Digital Input 6 Status	4	DINT	88
Digital Input 6 Count Value	4	DINT	90
Digital Input 6 Frequency	4	REAL	92
Digital Input 6 Period	4	REAL	94
Digital Input 7 Status	4	DINT	96
Digital Input 7 Count Value	4	DINT	98
Digital Input 7 Frequency	4	REAL	100
Digital Input 7 Period	4	REAL	102

Table 7.3 – Modbus Mapping Structure for Digital Input Counter Status

7.2.4. MAPPING STRUCTURE – DIGITAL OUTPUT STATUS

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Output 0 Status *Bit 0 – Enabled* *The digital output has been enabled.* *Bit 1 – Command*	4	DINT	104

N/A. *Bit 2 – Override On* *The current output value has been forced to on from the override value in the data exchange from the Primary Interface.* *Bit 3 – Override Off* *The current output value has been forced to off from the override value in the data exchange from the Primary Interface.* *Bit 4 – Zone 0* *When the mode for the DO is Counter and the reference DI Counter value is between the Zone 0 Low and High Value, then this bit will be on.* *Bit 5 – Zone 1* *When the mode for the DO is Counter and the reference DI Counter value is between the Zone 1 Low and High Value, then this bit will be on.* *Bit 6 – Zone 2* *When the mode for the DO is Counter and the reference DI Counter value is between the Zone 2 Low and High Value, then this bit will be on.* *Bit 7 – Zone 3* *When the mode for the DO is Counter and the reference DI Counter value is between the Zone 3 Low and High Value, then this bit will be on.* *Bit 8 – Zone 4* *When the mode for the DO is Counter and the reference DI Counter value is between the Zone 4 Low and High Value, then this bit will be on.*			
Digital Output 0 PWM Period When the DO has been configured for the PWM mode, this is the current PWM period value (in us) received from the data exchange from the Primary Interface. When the DO has been configured for Pulse Mode, then this will be the pulse period when the digital output is triggered.	4	DINT	106
Digital Output 0 PWM Duty Cycle When the DO has been configured for the PWM mode, this is the current PWM duty cycle (0 - 100%) value received from the data exchange from the Primary Interface.	4	REAL	108
Reserved	4	DINT	110
Digital Output 1 Status	4	DINT	112
Digital Output 1 PWM Period	4	DINT	114
Digital Output 1 PWM Duty Cycle	4	REAL	116
Reserved	4	DINT	118
Digital Output 2 Status	4	DINT	120
Digital Output 2 PWM Period	4	DINT	122
Digital Output 2 PWM Duty Cycle	4	REAL	124
Reserved	4	DINT	126
Digital Output 3 Status	4	DINT	128
Digital Output 3 PWM Period	4	DINT	130
Digital Output 3 PWM Duty Cycle	4	REAL	132
Reserved	4	DINT	134

Table 7.4 – Modbus Mapping Structure for Digital Output Status

7.2.5. MAPPING STRUCTURE – ANALOG INPUT STATUS

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Analog Input 0 Status *Bit 0 – Low Alarm* *This will be set when the current AI value is lower than the configured Low Alarm.* *Bit 1 – Low-Low Alarm* *This will be set when the current AI value is lower than the configured Low-Low Alarm.* *Bit 2 – High Alarm* *This will be set when the current AI value is lower than the configured High Alarm.* *Bit 3 – High-High Alarm* *This will be set when the current AI value is lower than the configured High-High Alarm.* *Bit 4 – Low Threshold* *When the AI is configured to have a counter, then this bit will be set when the current AI value is less than the configured low threshold.* *Bit 5 – High Threshold* *When the AI is configured to have a counter, then this bit will be set when the current AI value is greater than the configured high threshold.* *Bit 6 – Factory Calibration for Current Ok* *Factory Calibration for AI current has been successfully loaded.* *Bit 7 – Factory Calibration for Voltage Ok* *Factory Calibration for AI voltage has been successfully loaded.* *Bit 8 – User Calibration for Current Ok* *User Calibration for AI current has been successfully loaded.* *Bit 9 – User Calibration for Voltage Ok* *User Calibration for AI voltage has been successfully loaded.*	4	DINT	136
Analog Input 0 Scaled Value The current scaled analog input value.	4	REAL	138
Analog Input 0 Raw The current raw analog input value.	2	INT	140
Reserved	2	INT	141
Analog Input 0 Count Value The current counter value for the AI when the Counter Mode has been set to Count High.	4	DINT	142
Analog Input 0 Frequency The current frequency of the AI when the Counter Mode has been set to Count High.	4	REAL	144
Analog Input 0 Period The current period of the AI when the Counter Mode has been set to Count High.	4	REAL	146
Analog Input 1 Status	4	DINT	148
Analog Input 1 Scaled Value	4	REAL	150
Analog Input 1 Raw	2	INT	152
Reserved	2	INT	153
Analog Input 1 Count Value	4	DINT	154
Analog Input 1 Frequency	4	REAL	156

Analog Input 1 Period	4	REAL	158
Analog Input 2 Status	4	DINT	160
Analog Input 2 Scaled Value	4	REAL	162
Analog Input 2 Raw	2	INT	164
Reserved	2	INT	165
Analog Input 2 Count Value	4	DINT	166
Analog Input 2 Frequency	4	REAL	168
Analog Input 2 Period	4	REAL	170
Analog Input 3 Status	4	DINT	172
Analog Input 3 Scaled Value	4	REAL	174
Analog Input 3 Raw	2	INT	176
Reserved	2	INT	177
Analog Input 3 Count Value	4	DINT	178
Analog Input 3 Frequency	4	REAL	180
Analog Input 3 Period	4	REAL	182

Table 7.5 – Modbus Mapping Structure for Analog Input Status

7.2.6. Mapping Structure – Digital Input Events

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Event Buffer Count The number of SOE events in the module buffer than needs to be unloaded.	2	INT	184
Reserved	2	INT	185
Event Index The event index of the last unloaded SOE event.	4	DINT	186
Event Time Stamp The event time stamp of the last unloaded SOE event.	8	LINT	188
Event Point The point that is relevant for this SOE event.	2	INT	192
Event New Value The current state of the DI that triggered the SOE event.	2	INT	193
Event Previous Value The previous state of the DI that triggered the SOE event.	2	INT	194
Event Change XOR The XOR value between the current and previous DI that has changed.	2	INT	195
Reserved	4	DINT	196

Table 7.6 – Modbus Mapping Structure for Digital Input Events

7.2.7. Mapping Structure – Output IO Data

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Output Value When the DO mode is direct, this value will be the value written to the DO points. When the DO mode is Pulse, the pulse will be started once this bit value transitions from zero to one. Bit 0: Digital Output 0 Bit 1: Digital Output 1 … Bit 3: Digital Output 3	2	INT	300
Digital Output Force On This output will force the specific output to the on state (regardless of the current configuration or state). Bit 0: Digital Output 0 Bit 1: Digital Output 1 … Bit 3: Digital Output 3	2	INT	301
Digital Output Force Off This output will force the specific output to the off state (regardless of the current configuration or state). Bit 0: Digital Output 0 Bit 1: Digital Output 1 … Bit 3: Digital Output 3	2	INT	302
Reserved	2	INT	303
Analog Output Value The value written to the Analog Output as a percentage (%).	4	REAL	304

Table 7.7 – Modbus Mapping Structure for Output IO Data

7.2.8. Mapping Structure – Digital Input Command

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Input 0 Command Bit 0: Hold When this bit is set, it will hold the current counter value of the DI regardless of the triggers. Bit 1: Reset When this bit is set, it will reset the current counter value of the DI to the Init value. Bit 2: Set	2	INT	306

When this bit is set, it will set the current counter value of the DI to the Set Value variable in this tag structure. Bit 3: Direction The count direction of the basic count DI. When 0 - the value will count up, when 1 - the value will count down.			
Reserved	2	INT	307
Digital Input 0 Set Value The value that the DI counter will be set to when the Set bit has been triggered.	4	DINT	308
Digital Input 1 Command	2	INT	310
Reserved	2	INT	311
Digital Input 1 Set Value	4	DINT	312
Digital Input 2 Command	2	INT	314
Reserved	2	INT	315
Digital Input 2 Set Value	4	DINT	316
Digital Input 3 Command	2	INT	318
Reserved	2	INT	319
Digital Input 3 Set Value	4	DINT	320
Digital Input 4 Command	2	INT	322
Reserved	2	INT	323
Digital Input 4 Set Value	4	DINT	324
Digital Input 5 Command	2	INT	326
Reserved	2	INT	327
Digital Input 5 Set Value	4	DINT	328
Digital Input 6 Command	2	INT	330
Reserved	2	INT	331
Digital Input 6 Set Value	4	DINT	332
Digital Input 7 Command	2	INT	334
Reserved	2	INT	335
Digital Input 7 Set Value	4	DINT	336

Table 7.8 – Modbus Mapping Structure for Digital Input Command

7.2.9. Mapping Structure – Digital Output Command

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Output 0 PWM Period When the DO has been configured for the PWM mode, this is the PWM period value (in us) that will be sent to the module. When the DO has been configured for Pulse Mode, then this will be the pulse period (in us) sent to the module.	4	DINT	338
Digital Input 0 PWM Duty Cycle When the DO has been configured for the PWM mode, this is the current PWM duty cycle (0 - 100%) value sent to the module.	4	REAL	340
Digital Output 1 PWM Period	4	DINT	342

Digital Input 1 PWM Duty Cycle	4	REAL	344
Digital Output 2 PWM Period	4	DINT	346
Digital Input 2 PWM Duty Cycle	4	REAL	348
Digital Output 3 PWM Period	4	DINT	350
Digital Input 3 PWM Duty Cycle	4	REAL	352

Table 7.9 – Modbus Mapping Structure for Digital Output Command

7.2.10. MAPPING STRUCTURE – ANALOG INPUT COMMAND

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Analog Input 0 Command Bit 0: Hold When this bit is set, it will hold the current counter value of the AI regardless of the triggers. Bit 1: Reset When this bit is set, it will reset the current counter value of the AI to the Init value. Bit 2: Set When this bit is set, it will set the current counter value of the AI to the Set Value variable in this tag structure. Bit 3: Direction The count direction of the basic count AI. When 0 - the value will count up, when 1 - the value will count down.	2	INT	354
Reserved	2	INT	355
Analog Input 0 Set Value The value that the AI counter will be set to when the Set bit has been triggered.	4	DINT	356
Analog Input 1 Command	2	INT	358
Reserved	2	INT	359
Analog Input 1 Set Value	4	DINT	360
Analog Input 2 Command	2	INT	362
Reserved	2	INT	363
Analog Input 2 Set Value	4	DINT	364
Analog Input 3 Command	2	INT	366
Reserved	2	INT	367
Analog Input 3 Set Value	4	DINT	368

Table 7.10 – Modbus Mapping Structure for Analog Input Command

7.2.11. MAPPING STRUCTURE – DIGITAL INPUT CONFIRM INDEX

Register Type:	**Holding Registers**		
Parameter	Byte Length	Date Type	Offset from the *Mapping Start HR* parameter.
Digital Input Event Confirmation Index The event index sent to the module to confirm that the current event has been copied and that the next event can be unloaded. This should match the Event Index in the Input Assembly once the SOE event has been processed.	4	DINT	370

Table 7.11 – Modbus Mapping Structure for Digital Output Command

7.3. DIGITAL INPUTS

The High Speed Counter (HSC) module supports 8 Digital Inputs that can be configured for multiple counter configuration, command, or time stamping sequence of events.

7.3.1. COUNTERS

The HSC module supports six different counter types. Some of the counter types require multiple digital inputs, which will consume other digital inputs. Thus, certain counter types can only be configured for certain digital inputs (DI).

The counter values can also be manipulated externally via software or hardware. The counter values can be held at the current value (regardless of any triggers), reset to Initial Value, or set to a specific value. See section 7.1.1 (for EtherNet/IP) or section 7.2.9 (for Modbus) for more information regarding the bits that can be set in the Digital Input Command structures. See section 7.3.2 for more information on the DI Command mode where the DI input (i.e., hardware) can manipulate the counter value.

7.3.1.1. BASIC COUNT

Each DI point can be configured for Basic Count and it only uses one DI point. Each time the DI point transitions from zero to one, it will trigger the counter to either increase or decrease. The direction of the count will be determined by the *Direction* bit in the *Digital Input* Command from either the EtherNet/IP Input assembly or the Modbus Holding Registers. See section 7.1.1 for the EtherNet/IP mapping and section 7.2.8 for the Modbus mapping.

Below is the Basic Count logic with the various commands operations that can be provided from the Operating Interface.

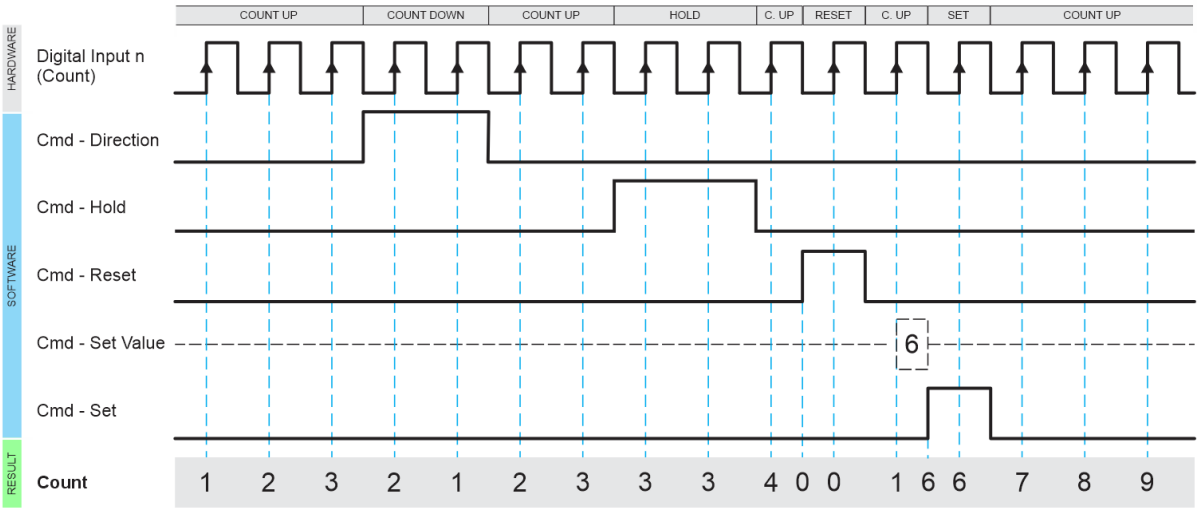


Figure 7.3 – Basic Count Logic

7.3.1.2. COUNT WITH DIRECTION

The Count / Direction configuration consumes two DI points, because the first DI point triggers the increase or decrease while the second DI point determines the direction of the count. For this reason, only DI0, DI2, DI4, and DI6 can be configured to use the Count / Direction mode, because the next DI point will be used for the direction (i.e., DI1, DI3, DI5, and DI7).

When the direction DI (DI1, DI3, DI5, or DI7) point is zero, then the counter value will increase each time the trigger DI point (DI0, DI2, DI4, or DI6) transitions from zero to one. If the direction DI point is one, then the counter value will decrease each time the trigger DI point transitions from zero to one.

Below is the Count with Direction logic with the various commands operations that can be provided from the Operating Interface.

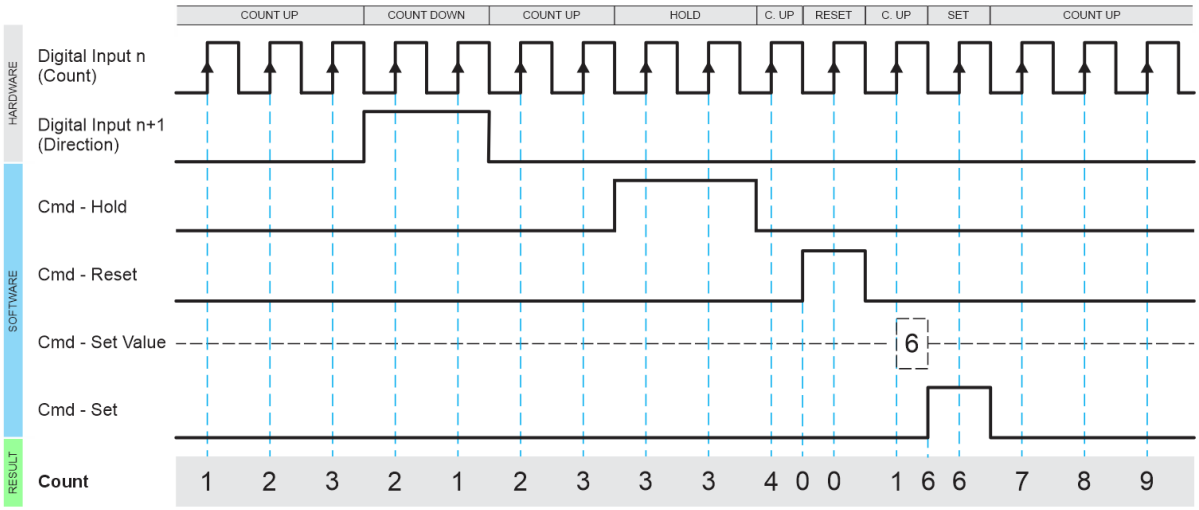


Figure 7.4 – Count with Direction Logic

7.3.1.3. COUNT UP, COUNT DOWN

The Count Up, Count Down configuration consumes two DI points, because the first DI point triggers (when the DI point transitions from zero to one) the increase of the count while the second DI point triggers (when the DI point transitions from zero to one) the decrease of the count. For this reason, only DI0, DI2, DI4, and DI6 can be configured to use the Count Up, Count Down mode, because two DI signals are required.

Below is the Count Up, Count Down logic with the various commands operations that can be provided from the Operating Interface.

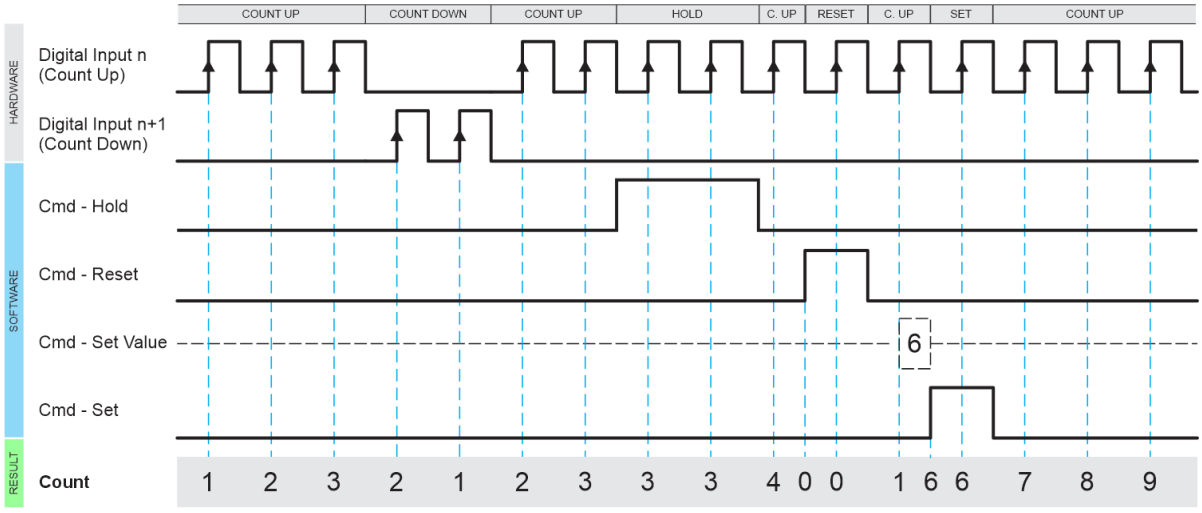


Figure 7.5 – Count Up, Count Down Logic

7.3.1.4. QUADRATURE X1

The Quadrature X1 configuration consumes three DI points (ABZ), because the first two DI points (A & B) triggers the change in the counter value (increase or decrease) based on when which DI point transitions from zero to one, while the third DI point (Z) is used to reset the counter value (when the DI point is high) to the SetValue provided in the operating interface. For this reason, only DI0 and DI4 can be configured to use the Quadrature X1 mode, because three DI signals are required.

Below is Quadrature X1 logic with the various commands operations that can be provided from the Operating Interface.

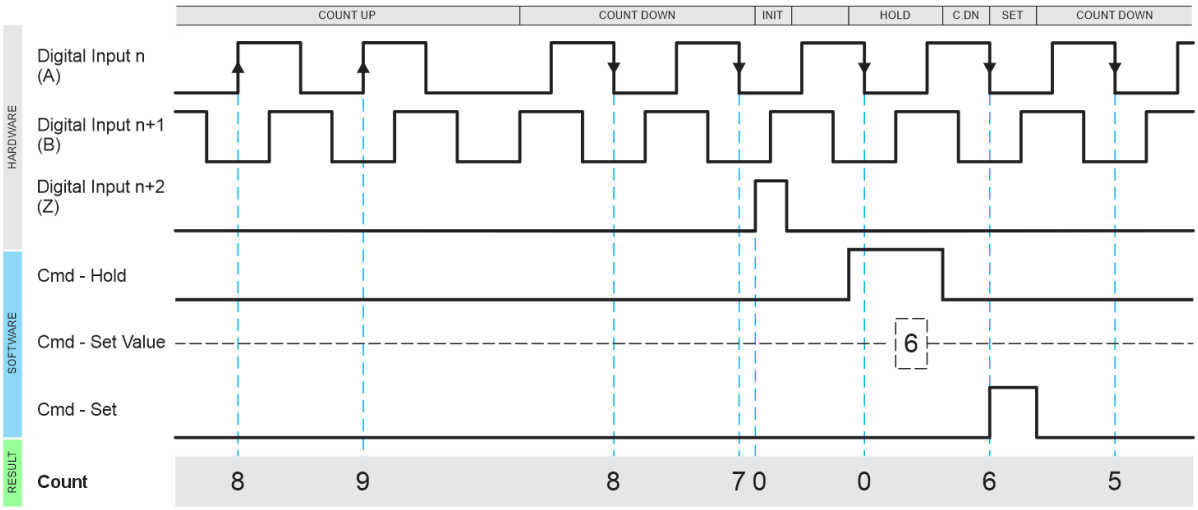


Figure 7.6 – Quadrature X1 Logic

7.3.1.5. QUADRATURE X2

The Quadrature X2 configuration consumes three DI points (ABZ), because the first two DI points (A & B) triggers the change in the counter value (increase or decrease) based on when which DI point transitions from zero to one, while the third DI point (Z) is used to reset the counter value (when the DI point is high) to the SetValue provided in the operating interface. For this reason, only DI0 and DI4 can be configured to use the Quadrature X2 mode, because three DI signals are required.

Below is Quadrature X2 logic with the various commands operations that can be provided from the Operating Interface.

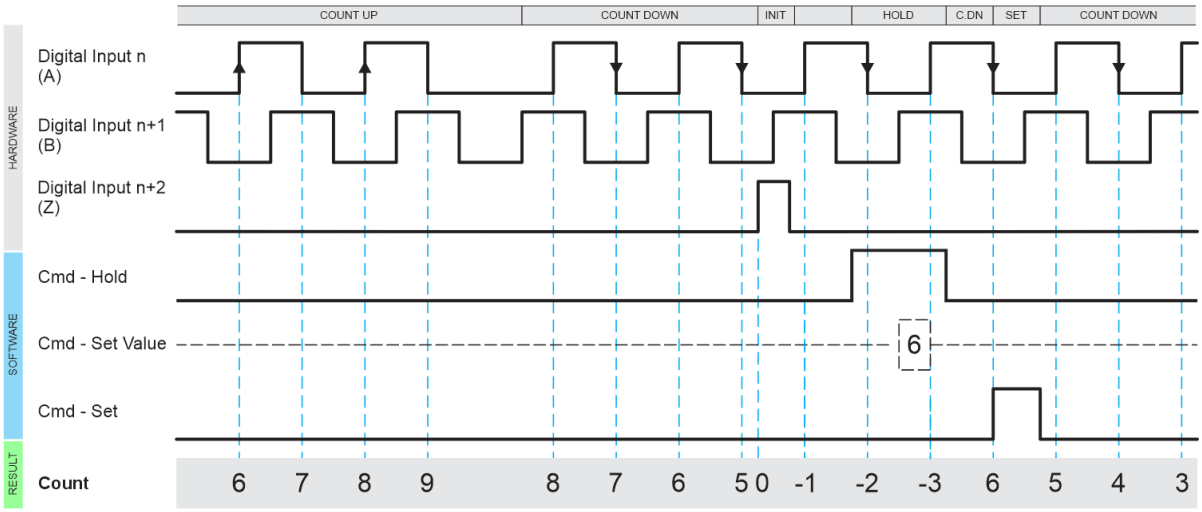


Figure 7.7 – Quadrature X2 Logic

7.3.1.6. QUADRATURE X4

The Quadrature X4 configuration consumes three DI points (ABZ), because the first two DI points (A & B) triggers the change in the counter value (increase or decrease) based on when which DI point transitions from zero to one, while the third DI point (Z) is used to reset the counter value (when the DI point is high) to the SetValue provided in the operating interface. For this reason, only DI0 and DI4 can be configured to use the Quadrature X4 mode, because three DI signals are required.

Below is Quadrature X4 logic with the various commands operations that can be provided from the Operating Interface.

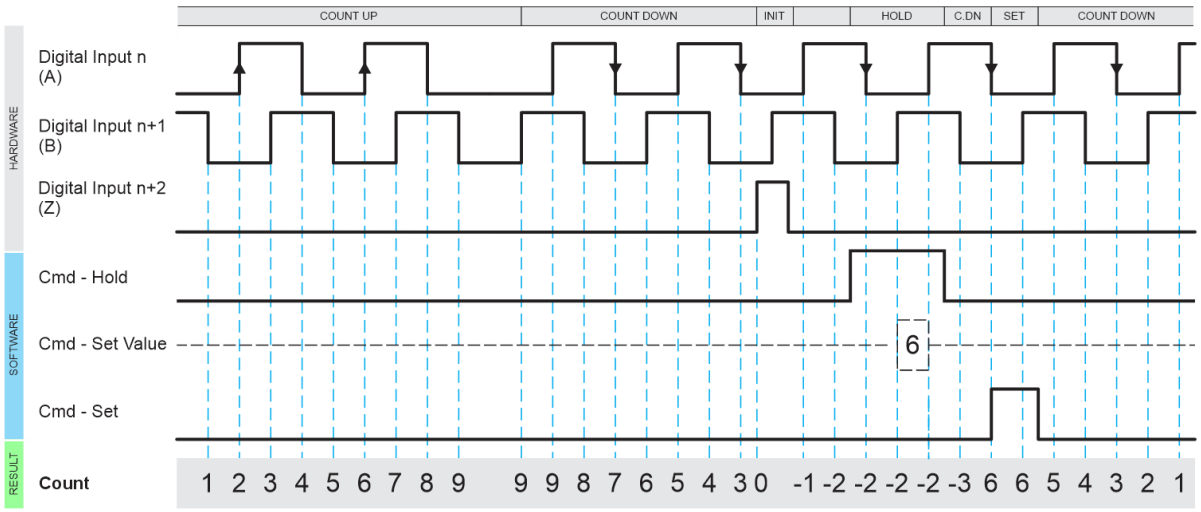


Figure 7.8 – Quadrature X4 Logic

7.3.2. COMMAND

Each DI point can be configured for the *Command* mode, which will allow that specific DI point to manipulate the counter value of another DI point. When the DI point transitions from zero to one, it will trigger the configured command to be executed.

The Reference Command has one of five options:

Option	Description
None	No action will be taken.
Reset	The referenced DI counter will be reset to zero.
Set Static	The referenced DI counter value will be set to the value provided in the Digital Output Command structure from the Primary Interface. See section 7.1.1 (for EtherNet/IP) or section 7.2.9 (for Modbus) for more information regarding the Set Value.
Set Value	The referenced DI counter value will be set to the Reference Value parameter set in the configuration (i.e. Ref. Value). See section 3.5 for more information.
Hold	The refenced DI counter value will be paused.

Table 7.12 – Reference Command Option

7.3.3. TIME STAMP

The High Speed Counter (HSC) module supports Sequence-of-events (SOE) for the Digital Input (DI) points. The HSC will time stamp the exact time when the DI (configured for Timestamping) changes state. These events can be unloaded via the primary interface by writing the Event Confirmation Index back to the HSC module. The HSC will need to have its local time synchronized to an external clock. This can be done using either Network Time Protocol (NTP) or 1588 Precision Time Protocol (PTP). The PTP time synchronization is generally more accurate than NTP, which should be used when accurate time stamping is required (less than 100us).

The relevant variables for the SOE unloading and reporting are shown below:

Variable	Description
Event Buffer Count	The number of SOE events in the module buffer that needs to be unloaded. The HSC module can buffer up to 16834 events.
Event Index	The event index of the last unloaded SOE event.
Event Time Stamp	The time stamp of the SOE event. This is a 64-bit number and will be the number of microseconds since 1 Jan 1970.
Event Point	The point that is relevant for this SOE event. **NOTE:** When the Bank Points have been selected for the Event Mode (in the Advanced page of the configuration), then this will be zero.

Event New Value	The current state of the DI that triggered the SOE event.
Event Previous Value	The previous state of the DI that triggered the SOE event.
Event Change XOR	The XOR value between the current and previous DI that has changed.

When the event count is greater than zero, the first buffered event will be shown. Once the event count returns to zero, the last unloaded event will be shown.

To unload an event, the Event Index number provided in the Primary Interface (see above) must be written to the Event Confirm Index which the HSC module will receive via the Primary Interface. See section 7.1.1 (for EtherNet/IP) or section 7.2.11 (for Modbus) for more information regarding the Event Confirmation Index.

7.4. DIGITAL OUTPUTS

The High Speed Counter (HSC) module supports 4 Digital Outputs that can be configured for multiple modes; *Direct, Pulse, PWM, Counter,* and *Comms Ok*.

7.4.1. DIRECT

The digital output signal will directly match the value sent by the Primary Interface. See section 7.1.1 (for EtherNet/IP) or section 7.2.7 (for Modbus) for more information regarding the Digital Output Value.

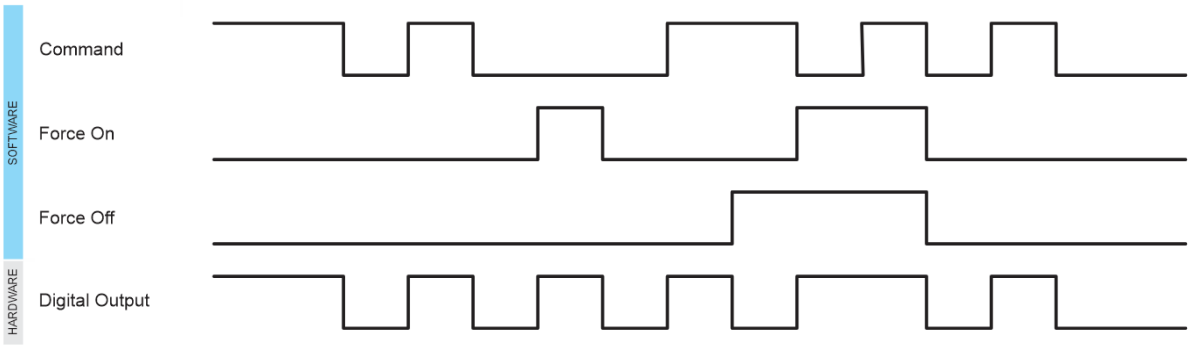


Figure 7.9 – Digital Output – Direct Logic

7.4.2. PULSE

When the output value received from the Primary Interface transitions from zero to one, then the digital output will create a single pulse with the period provided by the *PWM Period* in the *Digital Output Command* for the specific DO in the Primary Interface. The PWM Period is

the time provided in microseconds. See section 7.1.1 (for EtherNet/IP) or section 7.2.9 (for Modbus) for more information regarding the PWM Period Value.

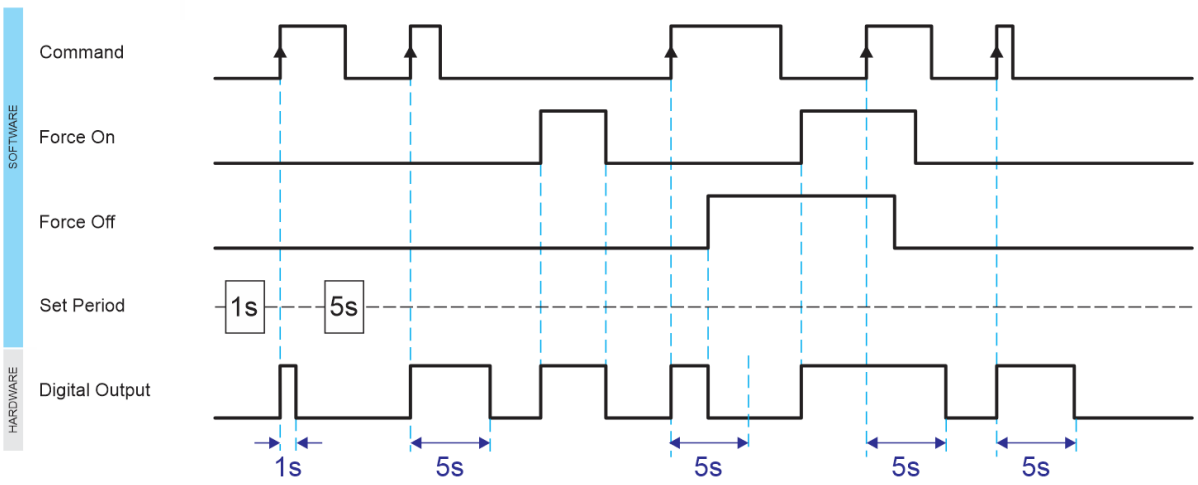


Figure 7.10 – Digital Output – Pulse Logic

7.4.3. PWM

The digital output will send out a continuous Pulse Width Modulation (PWM) signal, where the pulse period and duty cycle values are provided by the *PWM Period* and *PWM Duty Cycle* in the *Digital Output Command* for the specific DO in the Primary Interface. See section 7.1.1 (for EtherNet/IP) or section 7.2.9 (for Modbus) for more information regarding the PWM Period Value.

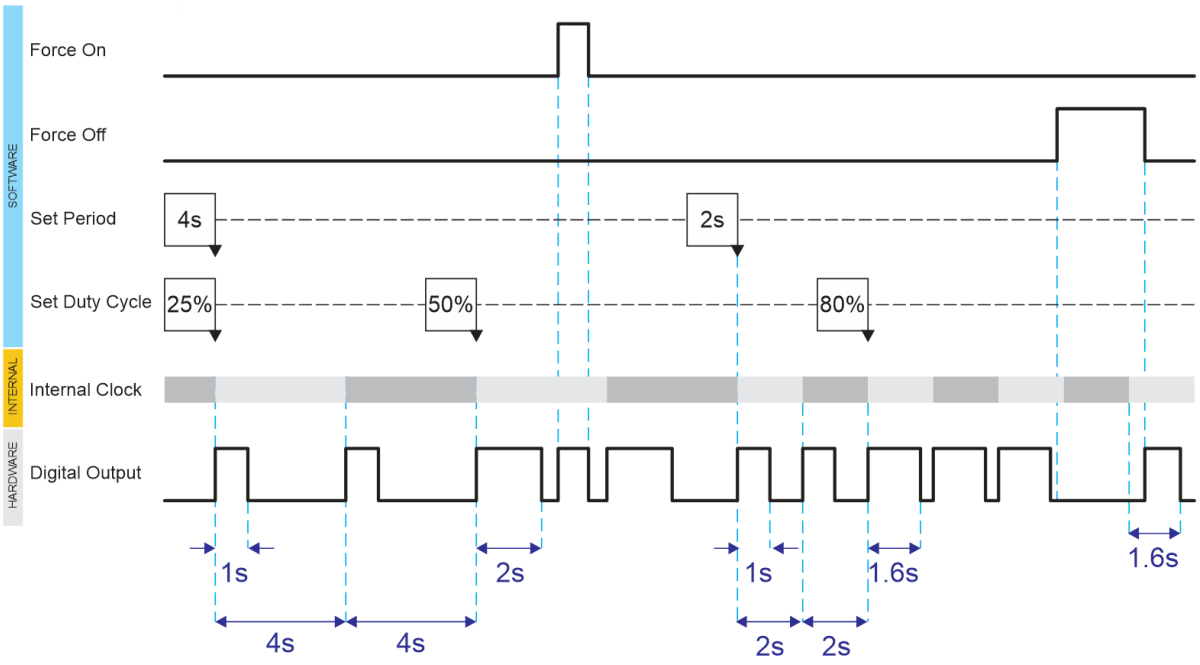


Figure 7.11 – Digital Output – PWM Logic

7.4.4. COUNTER

The digital output will be set based on the selected digital input counter value. The digital counter is selected with the Ref. Counter parameter in the DO configuration. The Zone values (0 to 4) will determine when the digital output will be set high based on the counter value of the referenced digital input counter.

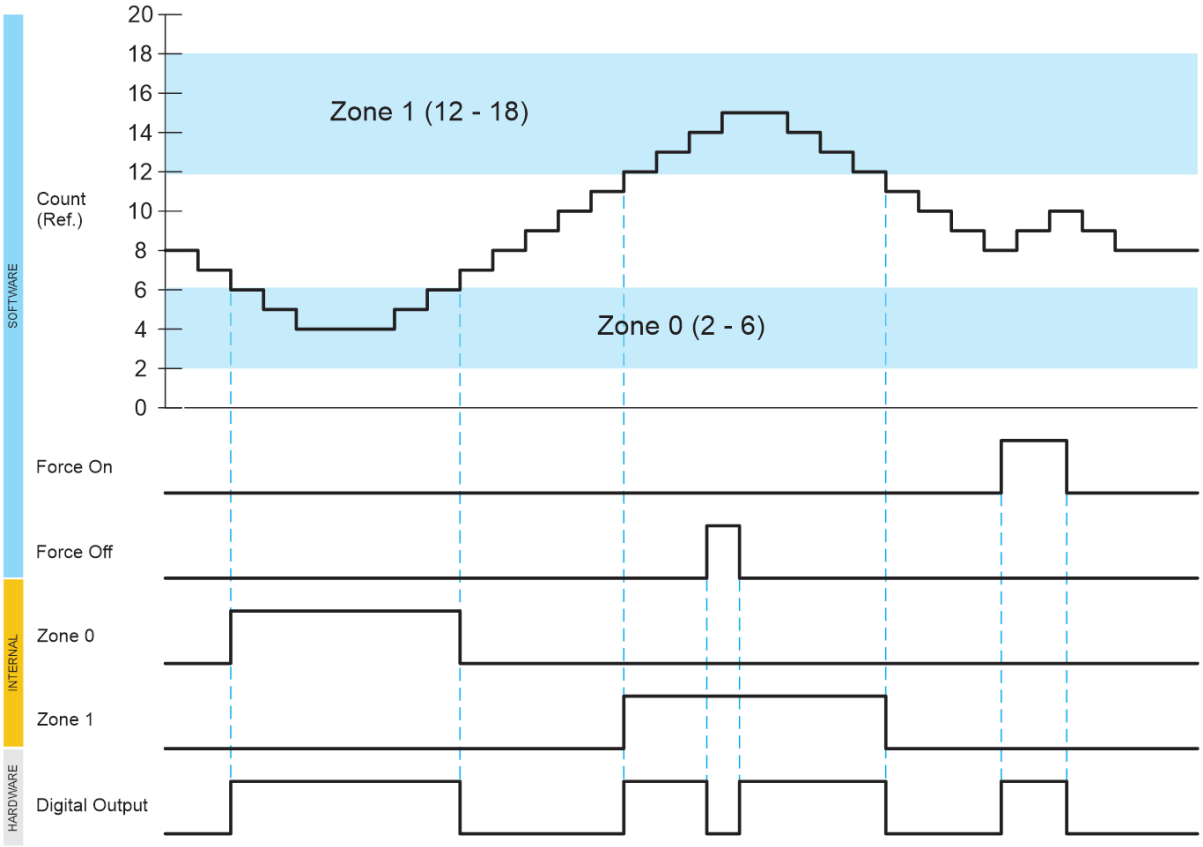


Figure 7.12 – Digital Output – Counter Logic

7.4.5. COMMS OK

When this mode is selected, the digital output will be on when the Primary Interface communication is healthy, and will be off when the Primary Interface communication has faulted.

7.5. ANALOG INPUTS

The Analog Inputs (AI) can be configured to provide a counter value based on the AI signal crossing the configured High Threshold.

NOTE: Once the analog input value has reached the High Threshold and increased the counter, the analog input value will first need to decrease to a value lower than the Low Threshold before the counter will increase again once the High Threshold is crossed.

7.5.1. COUNTER

The Counter Mode will need to be set to Count High which will enable the counter functionality for the specific AI. The counter values can also be manipulated externally via software. The counter values can be held at the current value (regardless of any triggers), reset to the Initial value, or set to a specific value. See section 7.1.1 (for EtherNet/IP) or section 7.2.10 (for Modbus) for more information regarding the bits that can be set in the Analog Input Command structures.

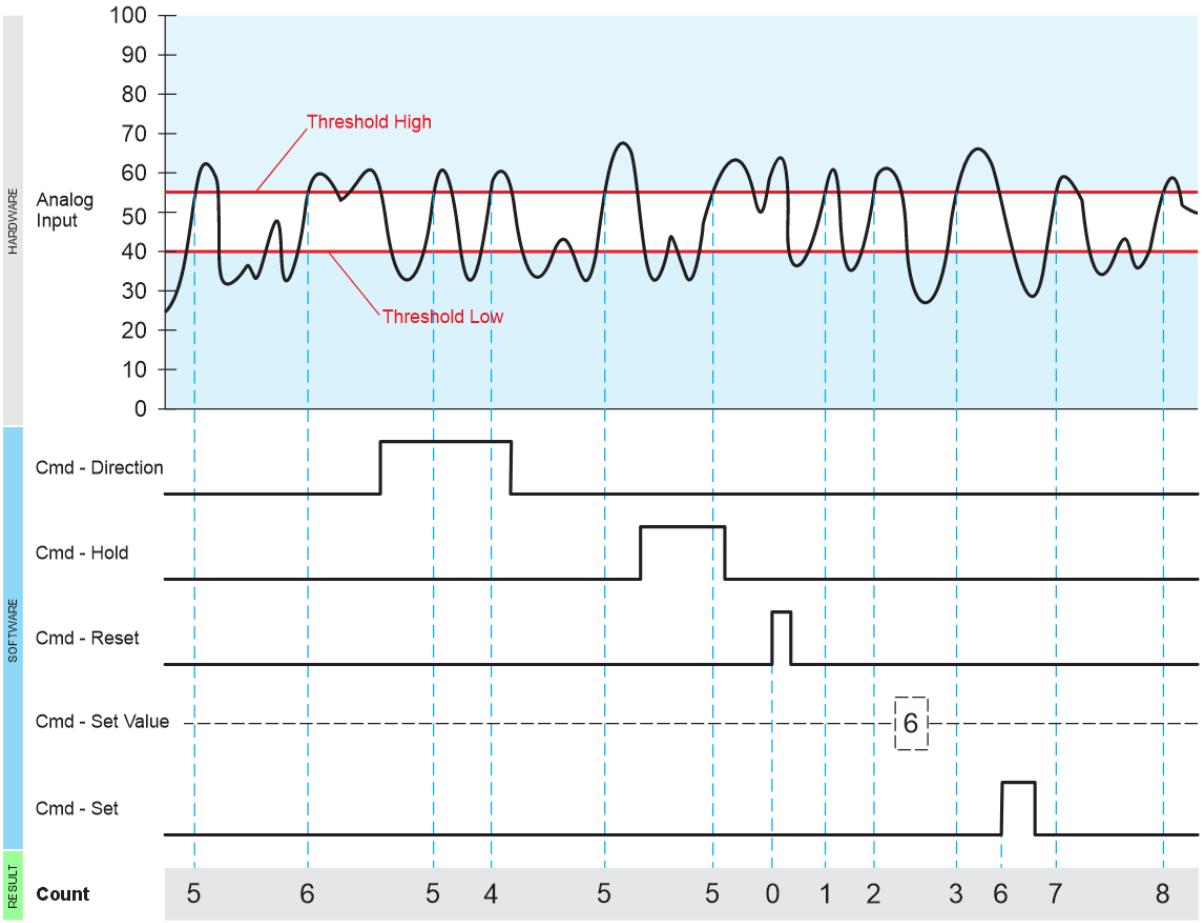


Figure 7.13 – Analog Input Counter

8. DIAGNOSTICS

8.1. LEDS

The HSC provides 20 LEDs for diagnostics purposes.

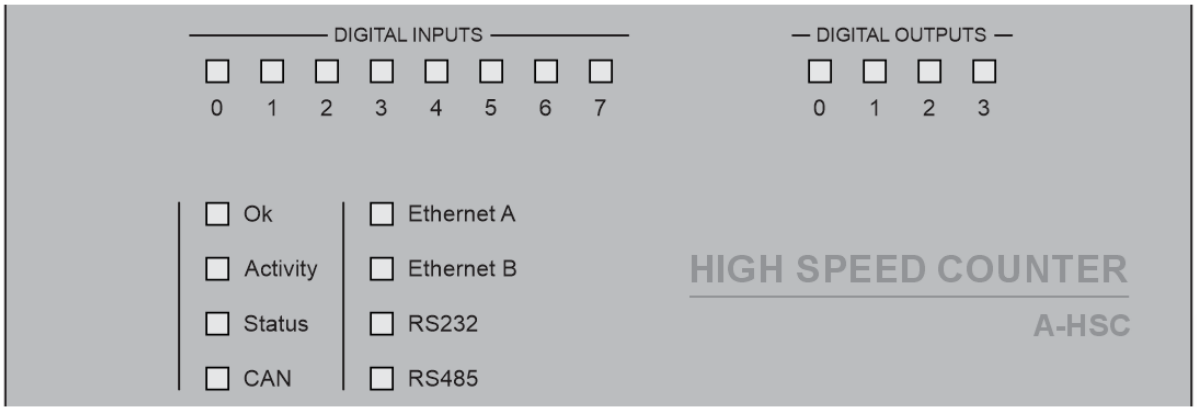


Figure 8.1 - Module top view

LED	Description
Ok	Indicates the system-level operation of the module. **Red**: 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. **Green (flashing)**: The module has booted and is running correctly without any application configuration loaded. **Green (solid)**: The module has booted and is running correctly with application configuration loaded. **Blue (solid)**: The module is busy updating the application configuration from the SD Card during startup.
Activity	Indicates the activity on the primary interface (EtherNet/IP Target, Modbus Server, or Modbus Client). **Blinking Green**: A successful transaction was completed on the primary interface. **Blinking Red**: The transaction failed on the primary interface (e.g., invalid request).
Status	Indicates the status from the primary interface (EtherNet/IP Target, Modbus Server, or Modbus Client). **EtherNet/IP Target** **Solid Green**: The module is connected (with the correct number of connections) to the Logix Controller, and the Logix Controller is in RUN mode. **Flashing Green**: The module is connected (with the correct number of connections) to the Logix Controller, and the Logix Controller is in PROG/FAIL mode. **Solid Red**: The module is not connected to a Logix Controller or it is connected, but the actual number of connections does not match the configured number of connections.

	Modbus Client **Solid Green**: All the Modbus requests configured in the Modbus Auxiliary map are successfully executing. **Solid Red**: One or more of the Modbus requests configured in the Modbus Auxiliary map are failing. **Modbus Server** **Solid Green**: The module has received a Modbus request within the Modbus Slave Timeout configuration. **Solid Red**: The module has **not** received a Modbus request within the Modbus Slave Timeout configuration.
CAN	*This is currently not used.*
Ethernet A / B	The Ethernet LED will illuminate when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash when traffic is detected. This module has two Ethernet ports A and B. Each LED represents each port.
RS232	Indicates if there was activity on the RS232 port as well as the status of the activity. The Modbus transaction was successfully received when **blinking green** or there was a checksum error when **blinking red**.
RS485	Indicates if there was activity on the RS485 port as well as the status of the activity. The Modbus transaction was successfully received when **blinking green** or there was a checksum error when **blinking red**.
Digital Inputs (0-7)	Each channel LED represents the status of that specific digital input point. **Off**: The DI signal is low. **Solid Green**: The DI signal is high.. **Solid Yellow/Orange**: The frequency of the DI is greater than 15Hz.
Digital Outputs (0-3)	Each channel LED represents the status of that specific digital output point. **Off**: The DO signal is low. **Solid Green**: The DO signal is high. **Solid Blue**: The frequency of the DO is greater than 10Hz.

Table 8.1 - Module LED operation

8.2. MODULE STATUS MONITORING IN SLATE

The High Speed Counter provides various statistics which can assist with module operation, maintenance, and fault finding. The statistics can be accessed in full by Slate.

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

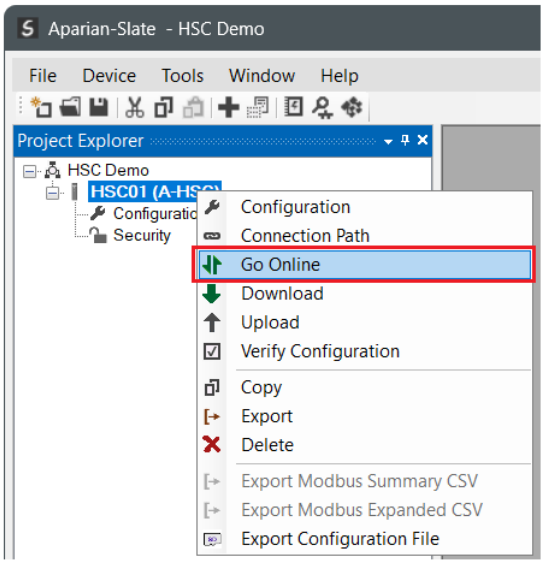


Figure 8.2 - Selecting to Go Online

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

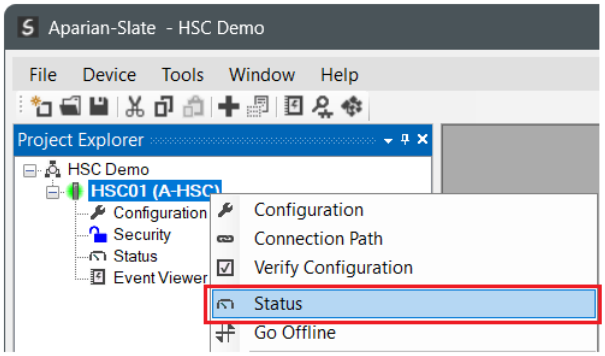


Figure 8.3 - Selecting online Status

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

8.2.1. General

The General tab displays the general status for the local High Speed Counter module.

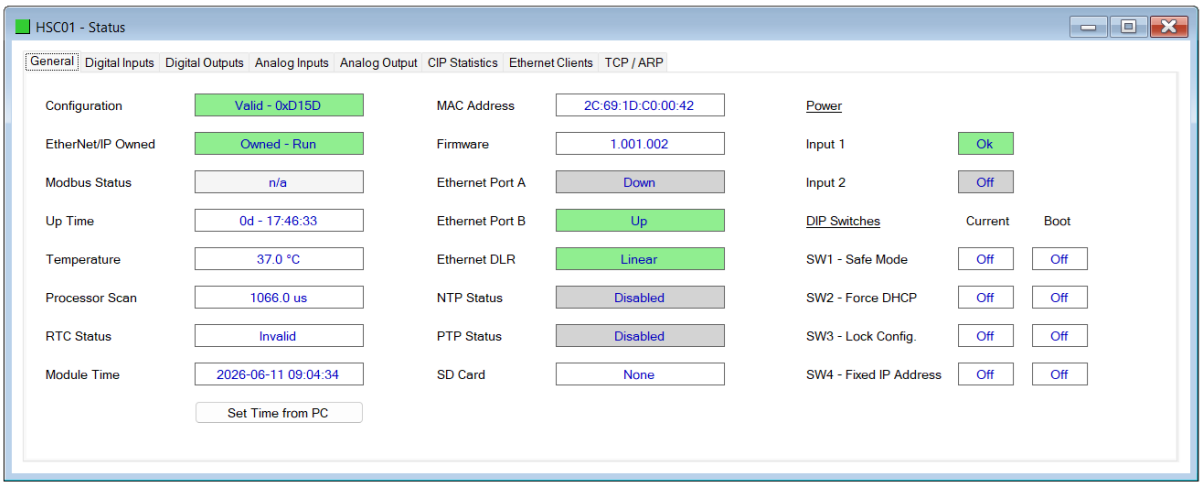


Figure 8.4 - Status monitoring – General

The General tab displays the following general parameters:

Parameter	Description
Configuration	Indicates whether the current configuration is valid or not, as well as the configuration checksum.
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.
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 successfully.
Up Time	Indicates the elapsed time since the module was powered-up.
Temperature	The internal temperature of the module's CPU.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
RTC Status	The status of the on-board Real Time Clock (RTC). **Ok**: The RTC has valid time. **Invalid**: The RTC no longer has valid time. This is typically due to the module been unpowered for more than 7 days.
Module Time	The current module time.
MAC Address	Displays the module's unique Ethernet MAC address.
Firmware	The version of the module's firmware.
Ethernet Port A/B	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 a ring, but there is a fault with the network. **Ring – Ok** The DLR functionality has been enabled, and the Ethernet network architecture is a 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.
PTP Status	The status of the PTP Synchronization. **Disabled** The PTP time synchronization has been disabled. **Locked** PTP time synchronization has been enabled, and the module is synchronized with a PTP Master. **Not Locked** PTP time synchronization has been enabled, but the module is not synchronized to a PTP Master.
SD Card	Indicates if a SD Card is present or not.
DIP Switches	The status of the DIP switches when the module booted and currently.
Power	The status of the two power inputs.

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

8.2.2. DIGITAL INPUTS

The Digital Inputs Statistics tab displays the status of the Digital Inputs as well as their counters, frequency, period, and flags.

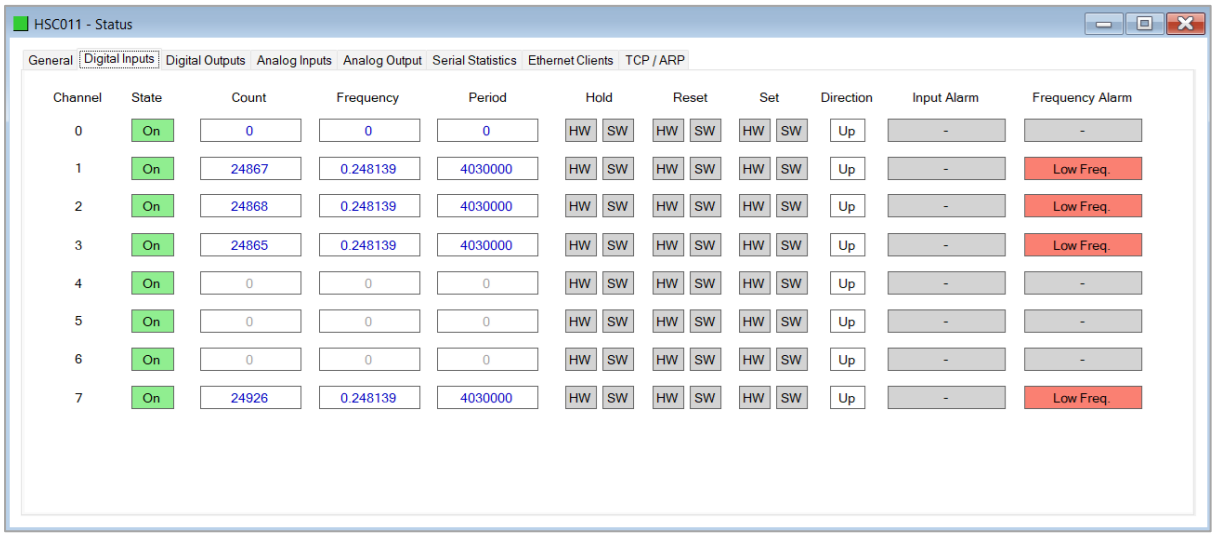


Figure 8.5 - Status monitoring – Digital Inputs

Parameter	Description
State	The current state of the digital input: On or Off.
Count	The current count value. Applicable only if configured as a counter.
Frequency	The current frequency (Hz). Applicable only if configured as a counter.
Period	The current period value (µs). Applicable only if configured as a counter.
Hold	A green highlight indicates a ***Hold*** command for this counter. Applicable only if configured as a counter. HW – Indicates a Hardware command from another digital input. SW – Indicates a Software command issued from the primary interface.
Reset	A green highlight indicates a ***Reset*** command for this counter. Applicable only if configured as a counter. HW – Indicates a Hardware command from another digital input. SW – Indicates a Software command issued from the primary interface.
Set	A green highlight indicates a ***Set Value*** command for this counter. Applicable only if configured as a counter. HW – Indicates a Hardware command from another digital input. SW – Indicates a Software command issued from the primary interface.
Direction	Indicates the current direction of the counter: Up or Down.

Input Alarm	Indicates if the input is in an alarm state: Stuck On, Stuck Off.
Frequency Alarm	Indicates if the input is in a frequency alarm state: High Freq. or Low Freq.

Table 8.3 – Digital Inputs

8.2.3. DIGITAL OUTPUTS

The Digital Outputs tab displays the status of the Digital Outputs as well as their frequency, period, override, and zones.

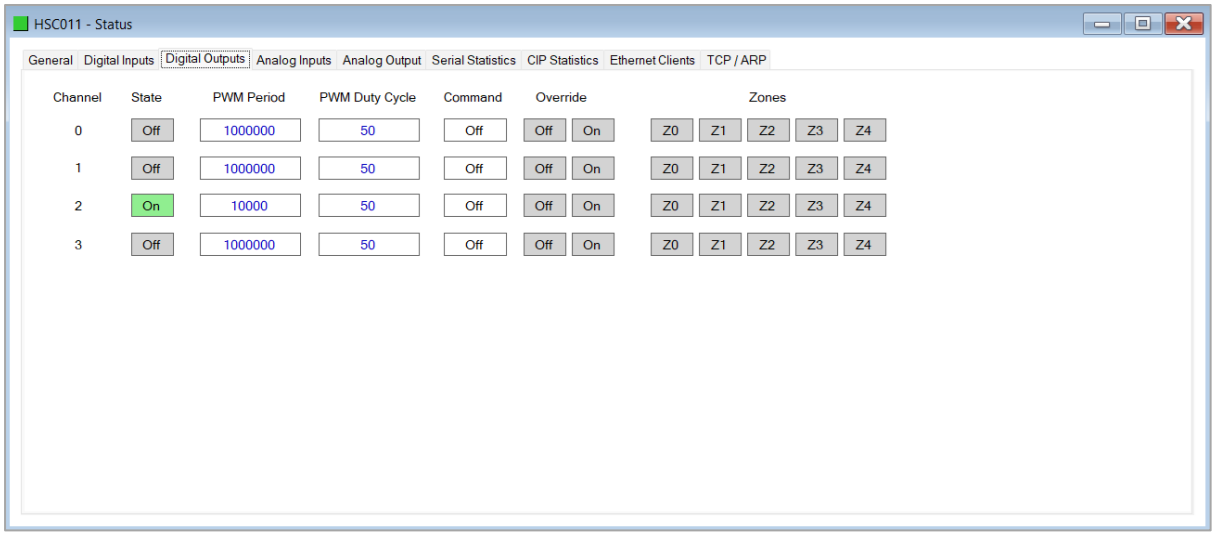


Figure 8.6 - Status monitoring – Digital Outputs

Parameter	**Description**
State	The current state of the digital output: On or Off.
PWM Period	The current pulse width modulation period (µs).
PWM Duty Cycle	The current pulse width modulation duty cycle (%).
Command	The current state of the output command, received from the primary interface.
Override	The current state of the output override commands received from the primary interface. Off – A green highlight indicates a Force-Off command On – A green highlight indicates a Force-On command
Zones	A green highlight indicates that the output's referenced counter has a count value within the respective zone's Low and High value. Z0 – Zone 0 Active Z1 – Zone 1 Active

	Z2 – Zone 2 Active Z3 – Zone 3 Active Z4 – Zone 4 Active

Table 8.4 – Digital Outputs

8.2.4. ANALOG INPUTS

The Analog Inputs tab displays the status of the Analog Inputs as well as their count, frequency, period, alarms, and calibration status.

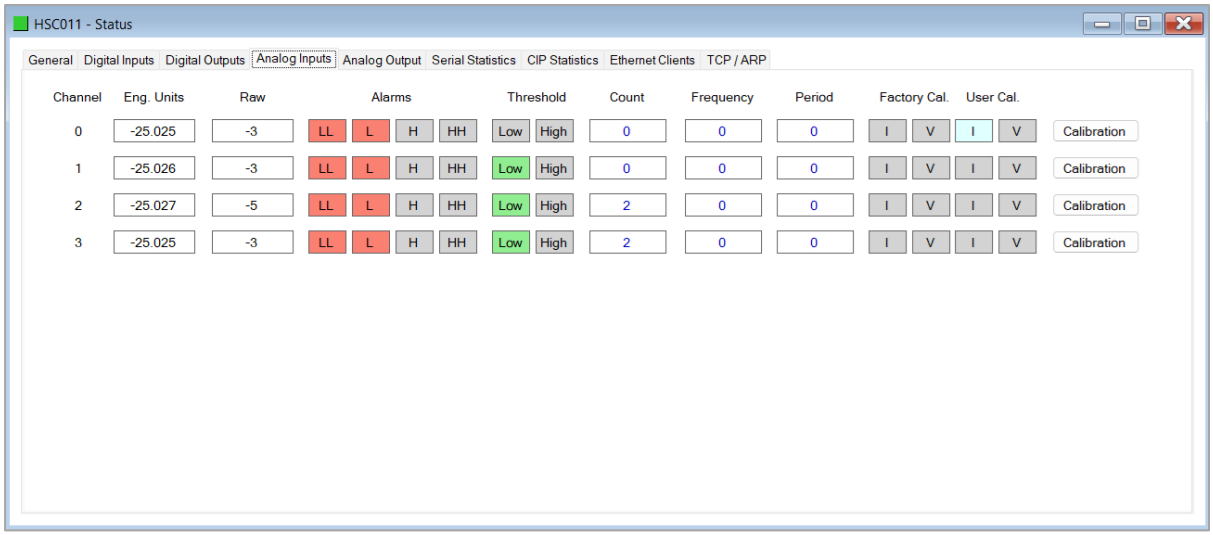


Figure 8.7 - Status monitoring – Analog Inputs

Statistic	Description
Eng. Units	The scaled (engineering units) value.
Raw	The raw (ADC count) of the analog input.
Alarm	A light-red highlight indicates that the analog input is in an alarm state: LL – Low-Low Alarm: Value is below the configured Low-Low Alarm limit. L – Low Alarm: Value is below the configured Low Alarm limit. H – High Alarm: Value is above the configured High Alarm limit. HH – High-High Alarm: Value is above the configured High-High Alarm limit.
Threshold	A green highlight indicates the analog is beyond the configured threshold: Low – Value is below the configured Low threshold High – Value is above the configured High threshold.
Count	Current Count value. Applicable only if configured as a counter.

Frequency	The current frequency (Hz). Applicable only if configured as a counter.
Period	The current period value (µs). Applicable only if configured as a counter.
Calibration	Calibration status Factory Calibration: I – Highlighted light-red if Current (mA) Factory calibration is not valid. V – Highlighted light-red if Voltage (V) Factory calibration is not valid. User Calibration: I – Highlighted cyan if Current (mA) User calibration has been configured. V – Highlighted cyan if Voltage (V) User calibration has been configured.

Table 8.5 – Analog Inputs

8.2.5. ANALOG OUTPUTS

The Analog Output tab displays the status of the Analog Output as well as the calibration status.

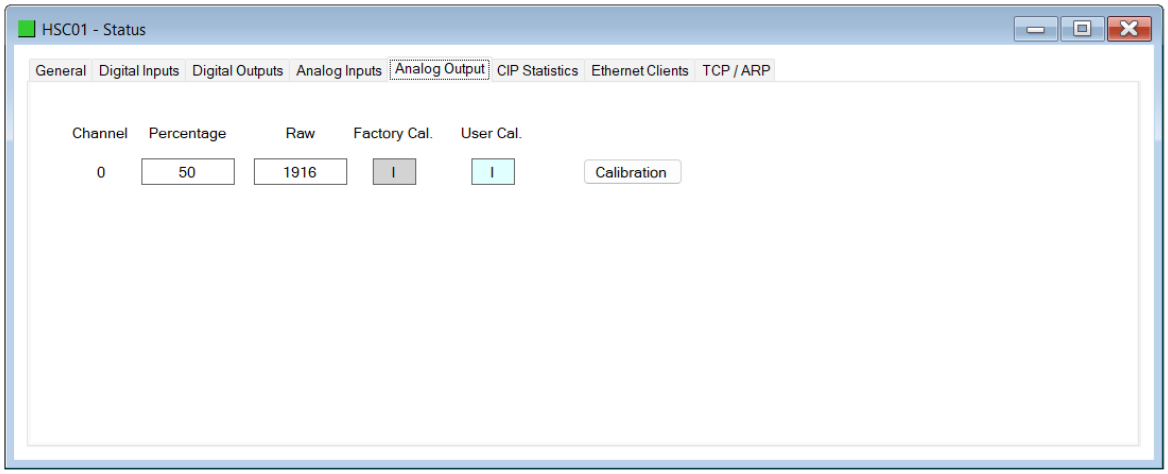


Figure 8.8 - Status monitoring – Analog Output

Parameter	**Description**
Percentage	Analog output value in percentage.
Raw	Analog output raw value.
Calibration	Calibration status Factory Calibration: I – Highlighted light-red if Factory calibration is not valid. User Calibration: I – Highlighted cyan if User calibration has been configured.

Table 8.6 – Analog Output

8.2.6. MODBUS

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

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

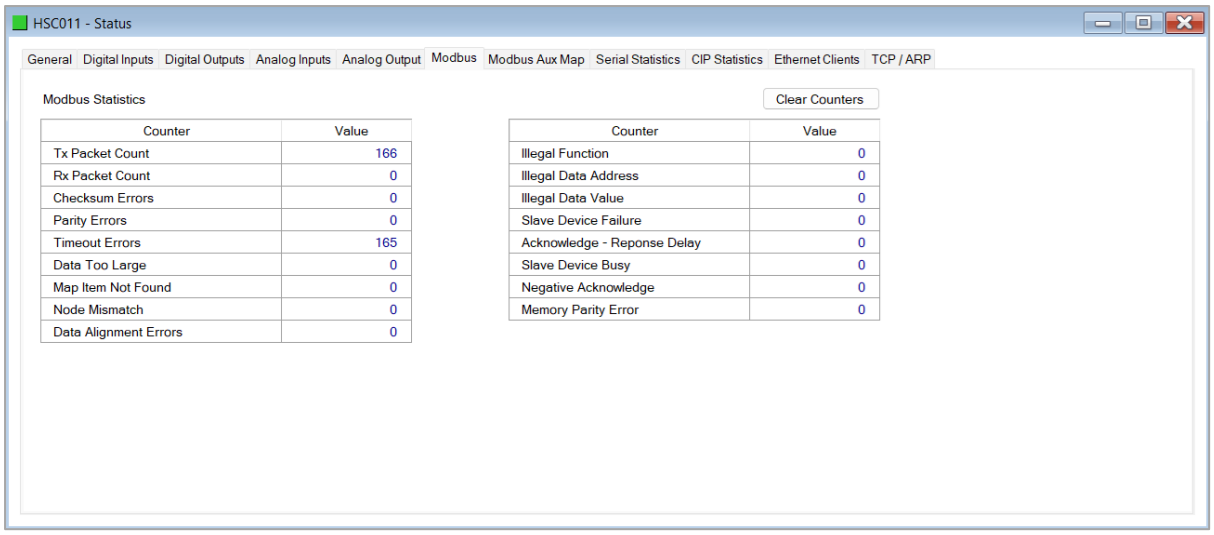


Figure 8.9. - Status monitoring – Modbus Statistics

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.

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 8.7 - Modbus Statistics Tab

8.2.7. MODBUS AUXILIARY MAP

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

NOTE: The Modbus Auxiliary tab is displayed only if the module has the primary interface set to Modbus Client.

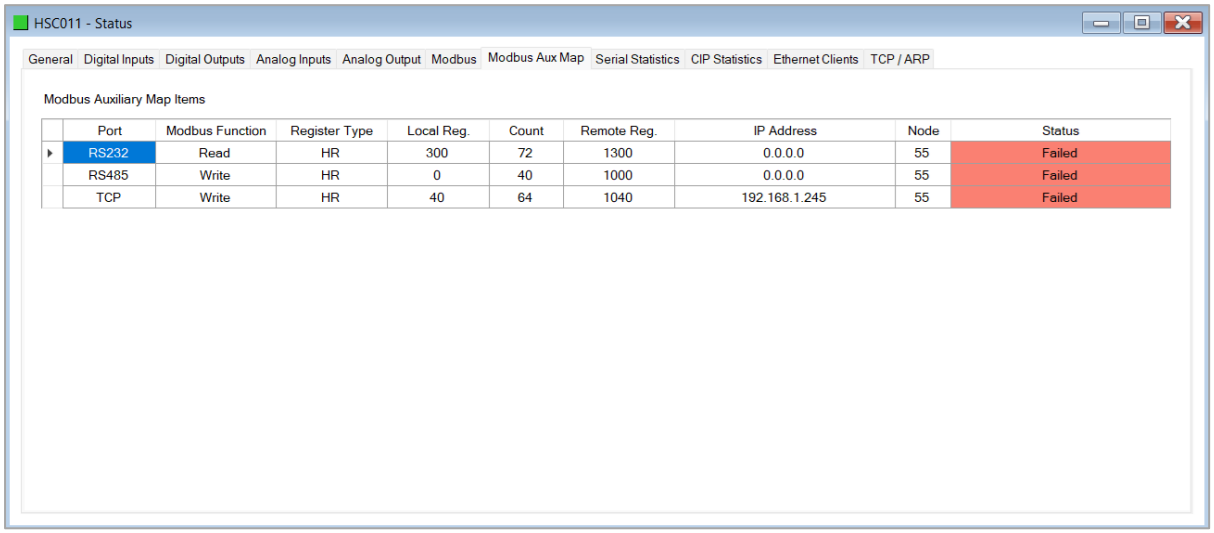


Figure 8.10. - Status monitoring – Modbus Auxiliary Map

The Modbus Auxiliary Map tab displays the following parameters:

Parameter	Description
Port	This specifies the port from which the request is sent. **TCP** **RS232** **RS485**
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) High Speed Counter Modbus register address (0-4999).
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. (Applicable only if Modbus TCP).
Node	The Modbus Node address of the remote Modbus Server.
Status	The status of the most recent attempted Modbus transaction for this mapped item.

Table 8.8 – Modbus Auxiliary Map Status

8.2.8. SERIAL STATISTICS

The Serial Statistics tab displays the RS232 and RS485 statistics when the module is a Modbus Server or Modbus Client.



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

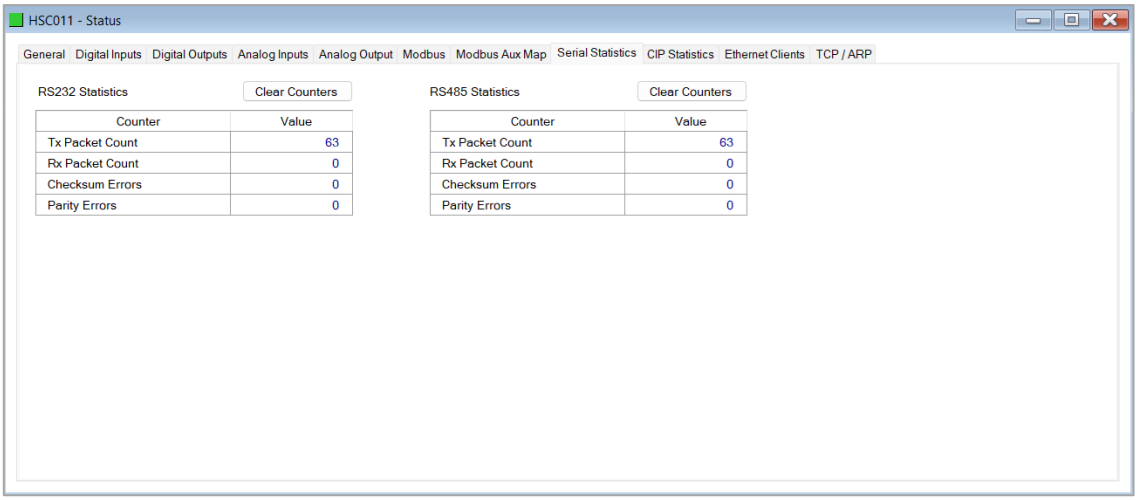


Figure 8.11. - Status monitoring – Serial Statistics

The Modbus tab displays the following parameters:

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

Table 8.9 - Serial Statistics Tab

8.2.9. CIP STATISTICS

The CIP tab displays the Ethernet CIP statistics.

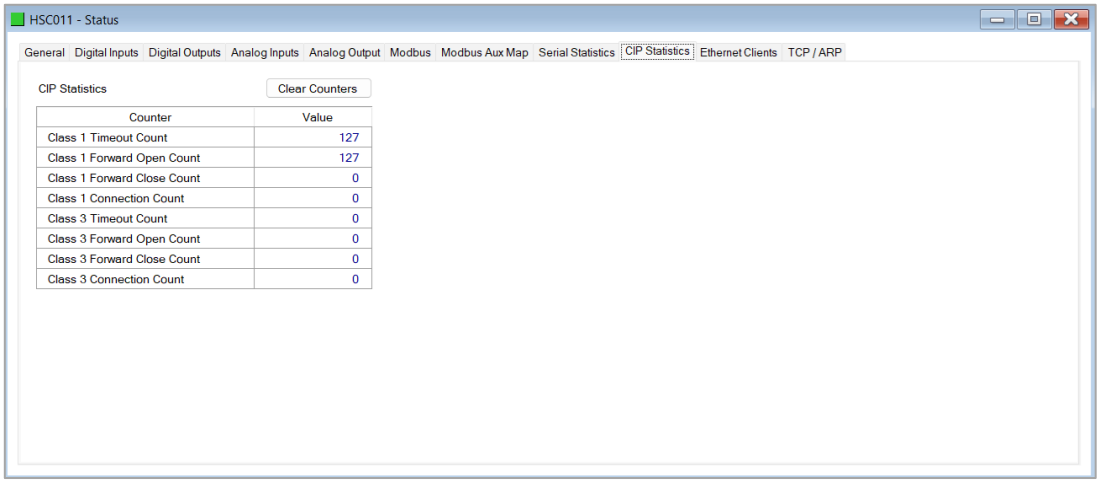


Figure 8.12 - Status monitoring – CIP Statistics

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

Table 8.10 – Mapped Item statistics

8.2.10. ETHERNET CLIENTS

The Ethernet Clients tab displays details of the Ethernet and EtherNet/IP clients connected to the High Speed Counter.

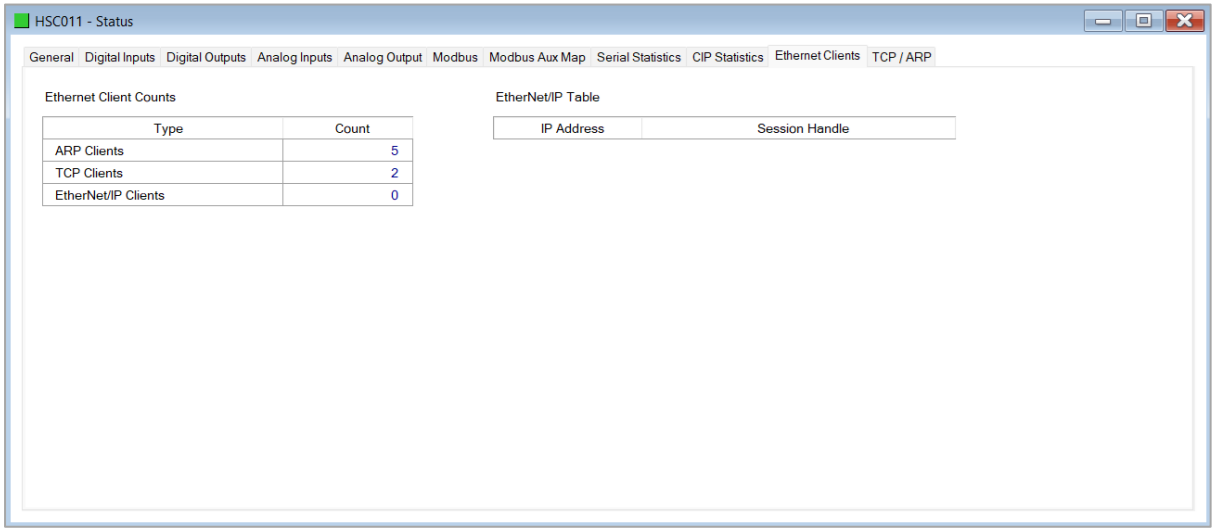


Figure 8.13 –Status monitoring – Ethernet Client Statistics

8.2.11. TCP/ARP

The TCP/ARP tab displays details of the internal Ethernet ARP and TCP lists of the High Speed Counter.

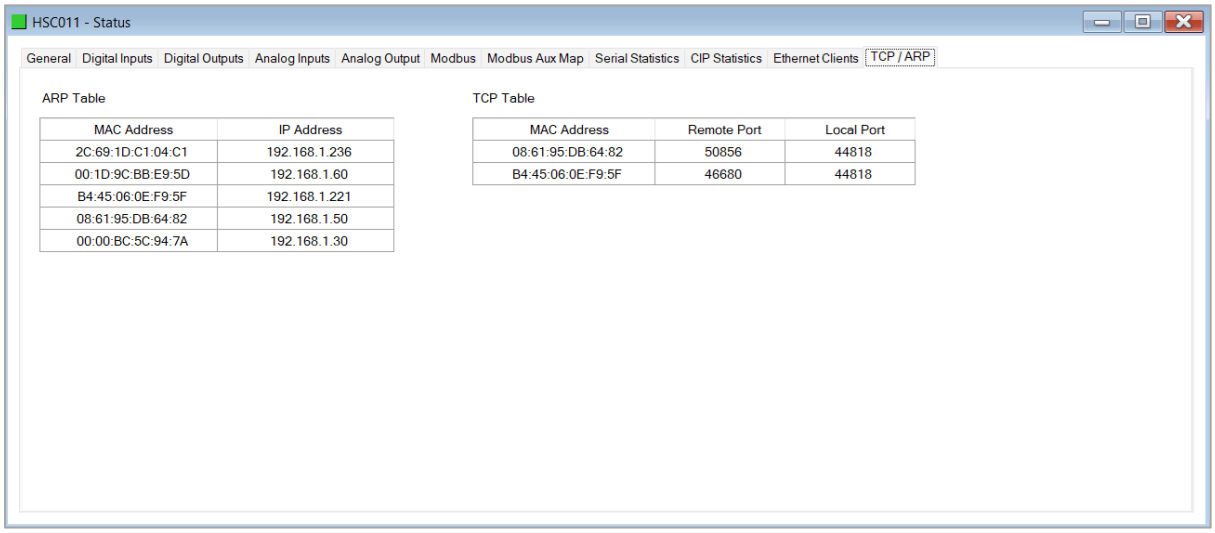


Figure 8.14 – Status monitoring – Ethernet TCP / ARP Statistics

8.3. ANALOG CALIBRATION

NOTE: Before commencing with calibration ensure that it is safe to do so. The simulated current values could translate to extreme process variables in the connected control system which may cause unexpected results. Failure to do so could result in severe equipment damage and personal injury.

8.3.1. ANALOG INPUT

To calibrate an analog input channel, open the ***Status*** form and navigate to the ***Analog Inputs*** tab. Then select the ***Calibration*** button adjacent to the required channel.

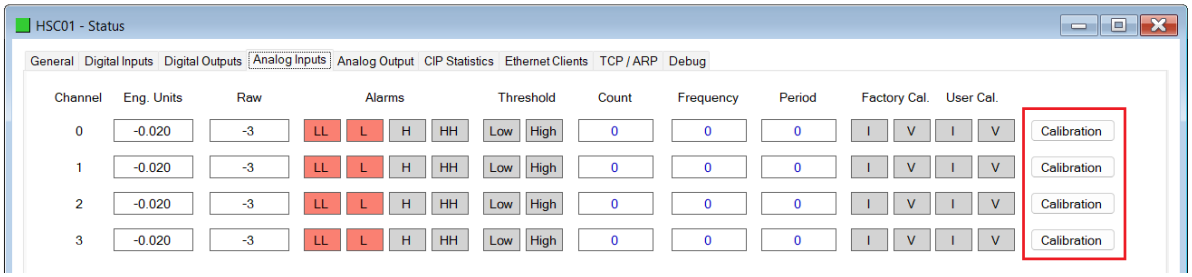


Figure 8.15 – Calibration – Analog Inputs

8.3.1.1. CURRENT CALIBRATION

NOTE: In order to calibrate the analog input's current (mA), the channel ***Type*** must be configured for ***Current.***

The analog input current calibration procedure is as follows:

1. Using an external milliamp source, adjust the current to 4 mA, or as close as possible to 4 mA.
2. Enter the exact milliamp value, read from an external meter, into the ***Low Value Actual (mA)*** numeric input.
3. Press the Low Value (4 mA) ***Capture*** button, to capture the current (uncalibrated value) into the ***Capture (mA)*** field.
4. Using the external milliamp source, adjust the current to 20 mA, or as close as possible to 20 mA.
5. Enter the exact milliamp value, read from an external meter, into the ***High Value Actual (mA)*** numeric input.
6. Press the High Value (20 mA) ***Capture*** button, to capture the current (uncalibrated value) into the ***Capture (mA)*** field.

7. The new ***Span*** and ***Offset*** calibration settings will be automatically calculated. (See figure below).
8. Press ***Accept*** to write these new calibration figures to the module.
9. The ***Calibration Type*** will then change to ***User Calibration***, to reflect the changes.

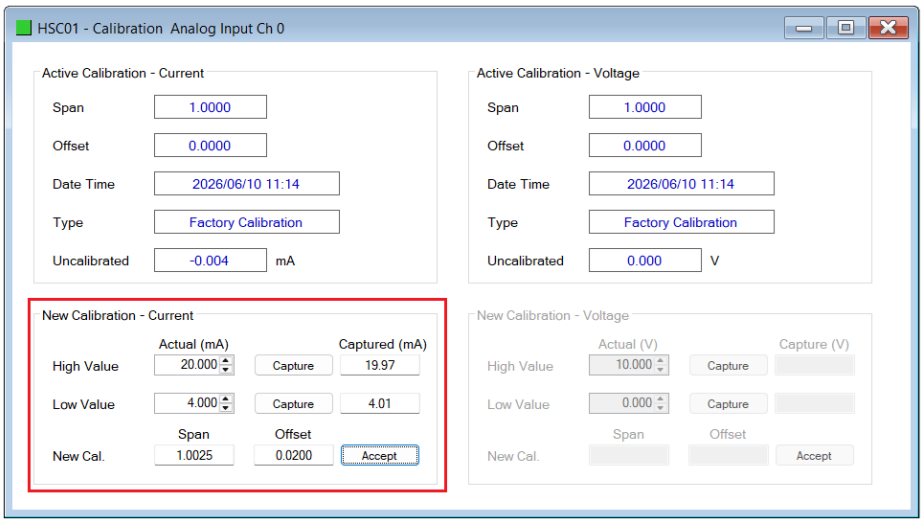


Figure 8.16 – Calibration – Analog Input Current (mA)

8.3.1.2. VOLTAGE CALIBRATION

NOTE: In order to calibrate the analog input's voltage (V), the channel ***Type*** must be configured for ***Voltage.***

The analog input voltage calibration procedure is as follows:

1. Using an external voltage source, adjust the voltage to 0 Vdc, or as close as possible to 0 Vdc.
2. Enter the exact voltage value, read from an external meter, into the ***Low Value Actual (V)*** numeric input.
3. Press the Low Value (0 Vdc) ***Capture*** button, to capture the voltage (uncalibrated value) into the ***Capture (V)*** field.
4. Using the external voltage source, adjust the voltage to 10 Vdc, or as close as possible to 10 Vdc.
5. Enter the exact voltage value, read from an external meter, into the ***High Value Actual (V)*** numeric input.
6. Press the High Value (10 Vdc) ***Capture*** button, to capture the voltage (uncalibrated value) into the ***Capture (V)*** field.

7. The new ***Span*** and ***Offset*** calibration settings will be automatically calculated. (See figure below).
8. Press ***Accept*** to write these new calibration figures to the module.
9. The ***Calibration Type*** will then change to ***User Calibration***, to reflect the changes.

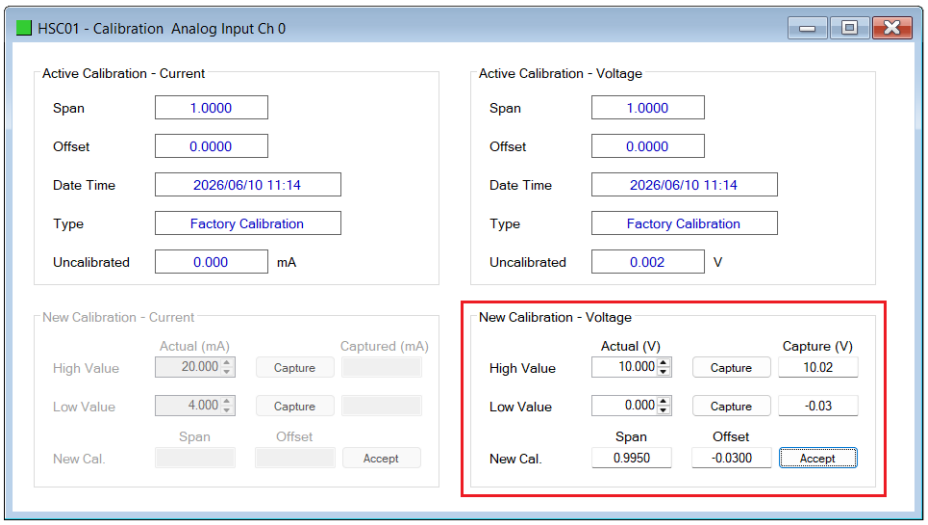


Figure 8.17 – Calibration – Analog Input Voltage (V)

8.3.2. Analog Output Current Calibration

To calibrate the analog output channel, open the ***Status*** form and navigate to the ***Analog Output*** tab. Then select the ***Calibration*** button.

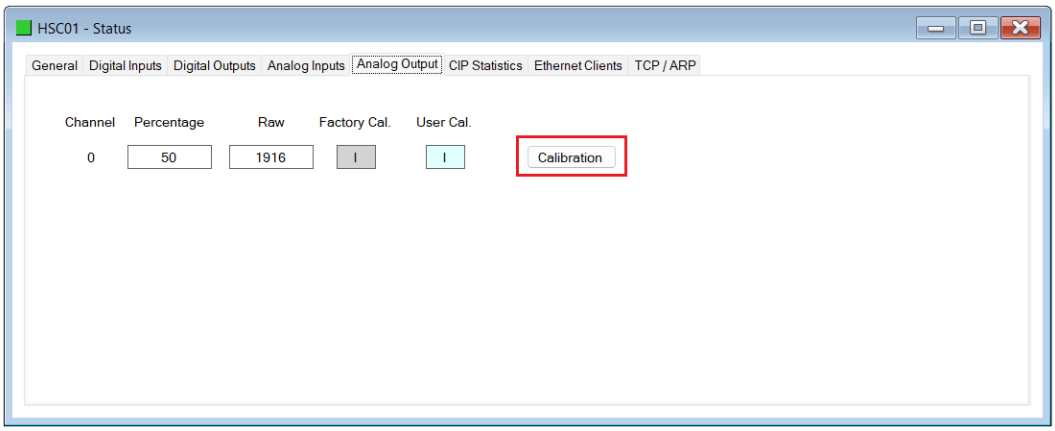


Figure 8.18 – Calibration – Analog Output

The analog output current calibration procedure is as follows:

1. Using the primary interface, set the output to 20% (4 mA).
2. Enter 4.00 mA in the ***Low Value Set (mA)*** numeric input.

3. Enter the actual exact milliamp value, read from an external meter, into the ***Low Value Actual (mA).***
4. Using the primary interface, set the output to 100% (20 mA).
5. Enter 20.00 mA in the ***High Value Set (mA)*** numeric input.
6. Enter the actual exact milliamp value, read from an external meter, into the ***High Value Actual (mA).***
7. The new Span and Offset calibration settings will be automatically calculated. (See figure below).
8. Press ***Accept*** to write these new calibration figures to the module.
9. The ***Calibration Type*** will then change to ***User Calibration***, to reflect the changes.

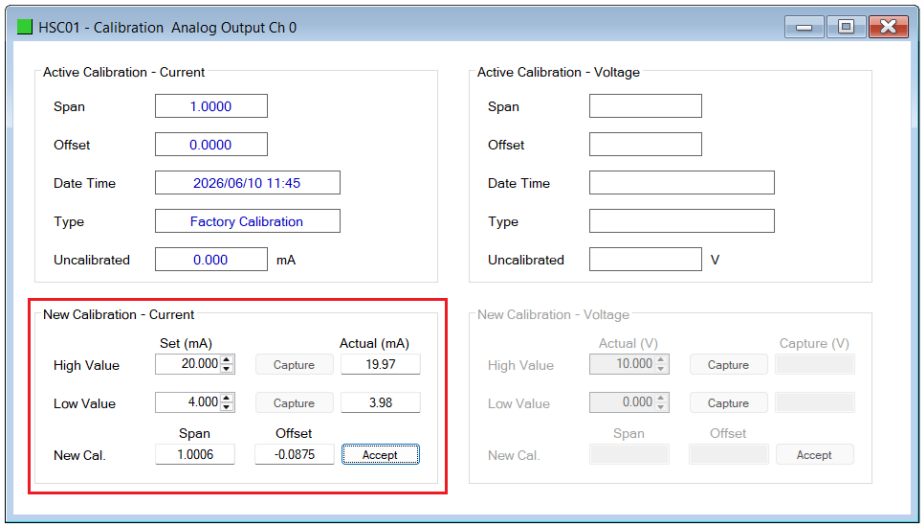


Figure 8.19 – Calibration – Analog Output (mA)

8.4. MODULE EVENT LOG

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

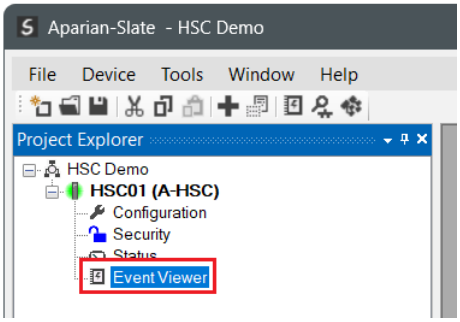
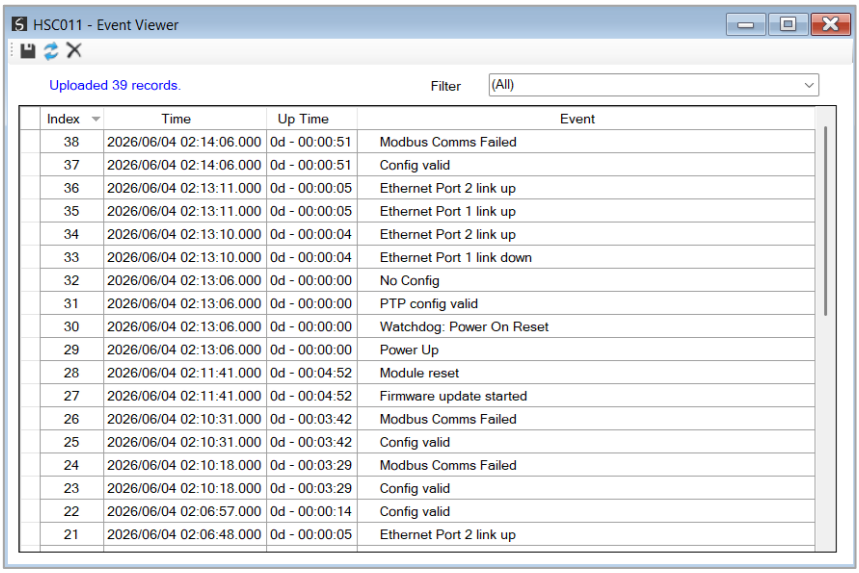


Figure 8.20 - Selecting the module Event Log

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
38	2026/06/04 02:14:06.000	0d - 00:00:51	Modbus Comms Failed
37	2026/06/04 02:14:06.000	0d - 00:00:51	Config valid
36	2026/06/04 02:13:11.000	0d - 00:00:05	Ethernet Port 2 link up
35	2026/06/04 02:13:11.000	0d - 00:00:05	Ethernet Port 1 link up
34	2026/06/04 02:13:10.000	0d - 00:00:04	Ethernet Port 2 link up
33	2026/06/04 02:13:10.000	0d - 00:00:04	Ethernet Port 1 link down
32	2026/06/04 02:13:06.000	0d - 00:00:00	No Config
31	2026/06/04 02:13:06.000	0d - 00:00:00	PTP config valid
30	2026/06/04 02:13:06.000	0d - 00:00:00	Watchdog: Power On Reset
29	2026/06/04 02:13:06.000	0d - 00:00:00	Power Up
28	2026/06/04 02:11:41.000	0d - 00:04:52	Module reset
27	2026/06/04 02:11:41.000	0d - 00:04:52	Firmware update started
26	2026/06/04 02:10:31.000	0d - 00:03:42	Modbus Comms Failed
25	2026/06/04 02:10:31.000	0d - 00:03:42	Config valid
24	2026/06/04 02:10:18.000	0d - 00:03:29	Modbus Comms Failed
23	2026/06/04 02:10:18.000	0d - 00:03:29	Config valid
22	2026/06/04 02:06:57.000	0d - 00:00:14	Config valid
21	2026/06/04 02:06:48.000	0d - 00:00:05	Ethernet Port 2 link up

Figure 8.21 - Module Event Log

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

8.5. MODBUS PACKET CAPTURE

The module provides the capability to capture the Modbus traffic for each interface 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.

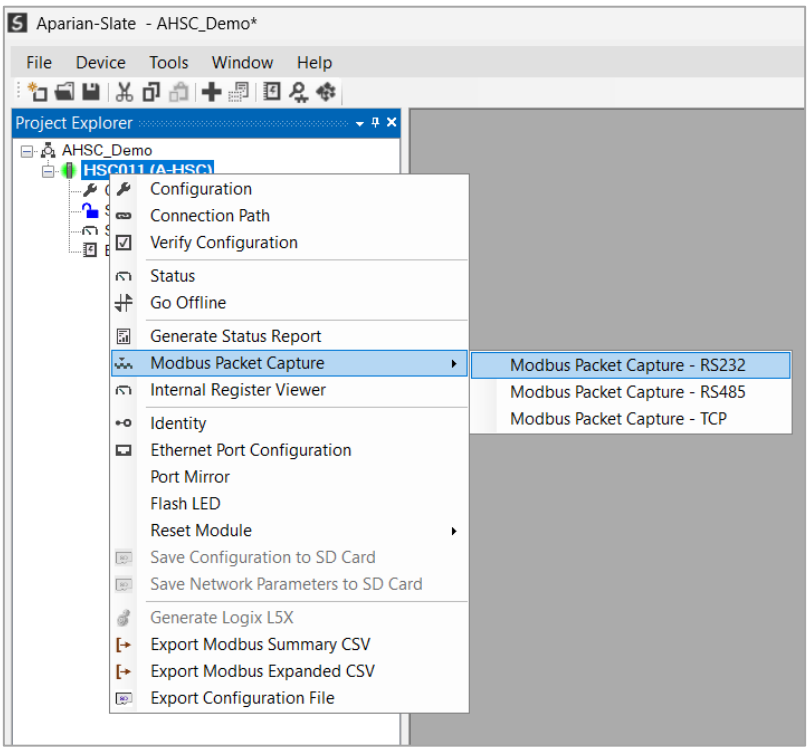


Figure 8.22 - Selecting Modbus Packet Capture

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

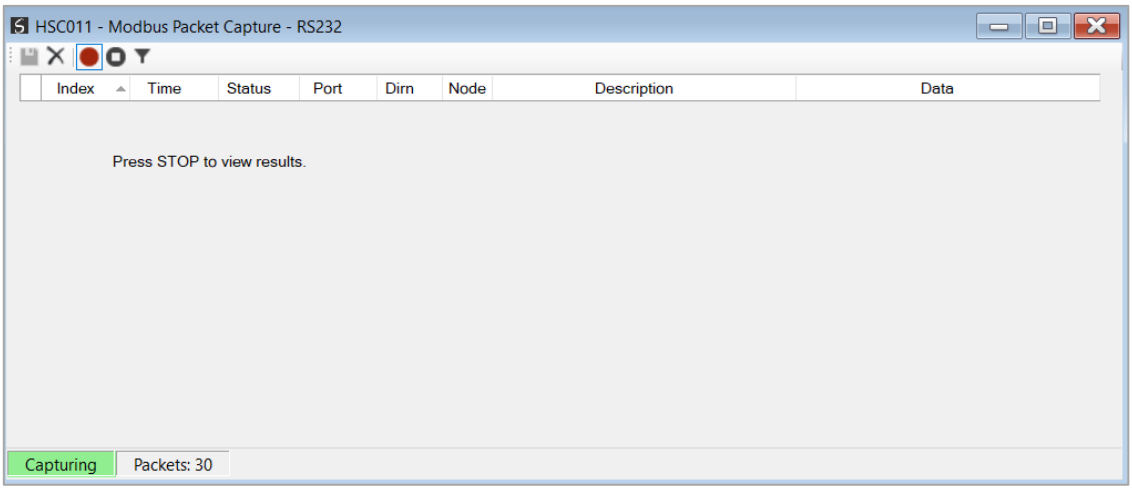


Figure 8.23 – Modbus packet capture

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

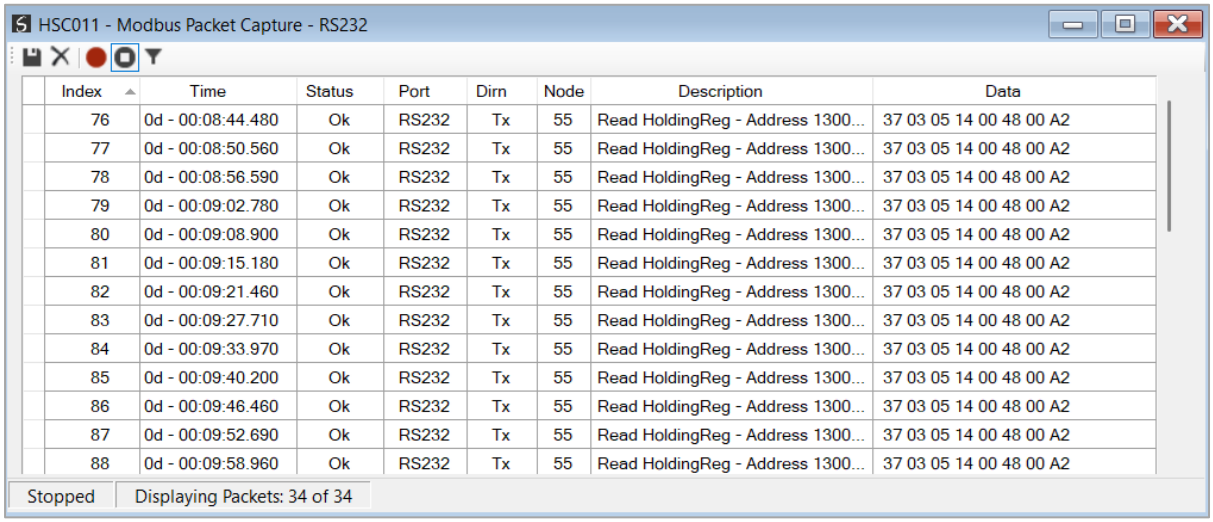


Figure 8.24 – Modbus Packet Capture complete

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)
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 8.11 – 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.

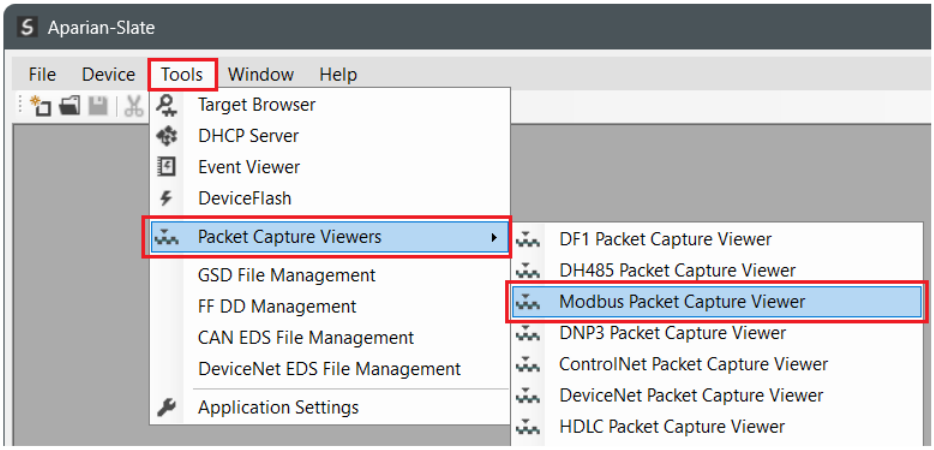


Figure 8.25 - Selecting the Modbus Packet Capture Viewer

8.6. 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*.

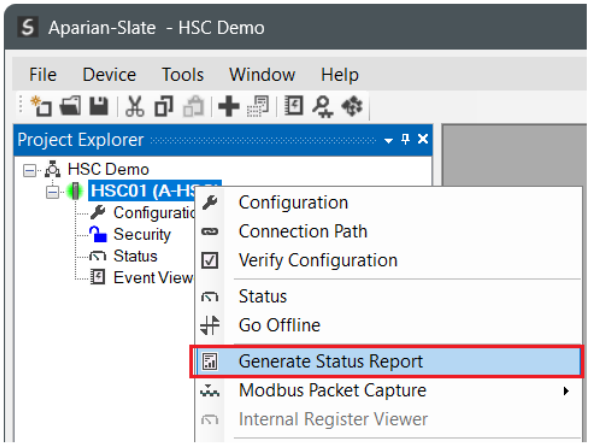


Figure 8.26 – Module Status Report

8.7. 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 High Speed Counter module configuration). To generate the Modbus Summary CSV, right-click on the module (when online in Slate), and select *Export Modbus Summary CSV*.

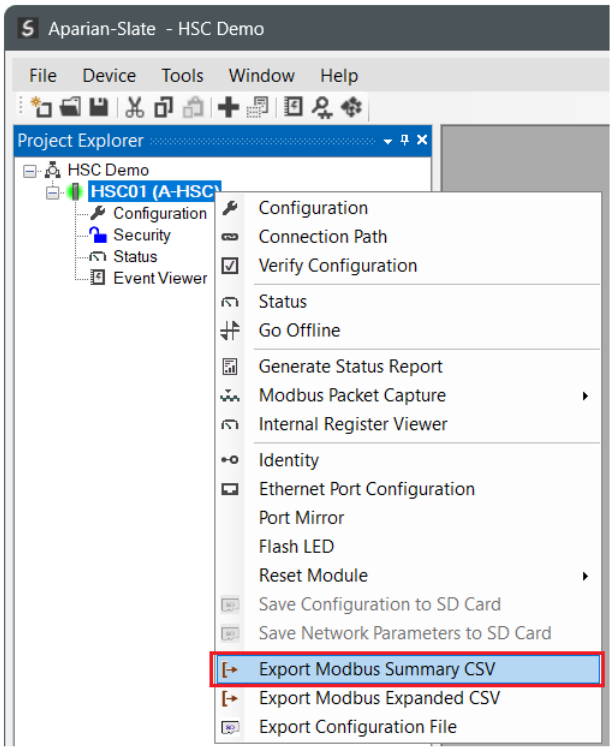


Figure 8.27 – Modbus Summary Report Generation

	A	B	C	D	E	F
1	Reg Type	Modbus Function	Start Address	End Address	Element Count	Description
2	HR	Read	1000	1027	28	HSC Status
3	HR	Read	1028	1028	1	Digital Inputs
4	HR	Read	1029	1029	1	Digital Output State
5	HR	Read	1030	1037	8	Analog Inputs
6	HR	Read	1038	1039	2	Analog Output Readback
7	HR	Read	1040	1103	64	Digital Input Counters
8	HR	Read	1104	1135	32	Digital Output Statuses
9	HR	Read	1136	1183	48	Analog Input Status
10	HR	Read	1184	1197	14	Digital Events
11	HR	Write	1300	1303	4	Digital Output Command
12	HR	Write	1304	1305	2	Analog Output Command
13	HR	Write	1306	1337	32	Digital Input Counter Control
14	HR	Write	1338	1353	16	Digital Output PWM Control
15	HR	Write	1354	1369	16	Analog Input Counter Control
16	HR	Write	1370	1371	2	DI Event Confirm
17	(End)					

Figure 8.28 – Modbus Summary CSV

8.8. 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 High Speed Counter module configuration). To generate the Modbus Expanded CSV, right-click on the module (when online in Slate), and select *Export Modbus Expanded CSV*.

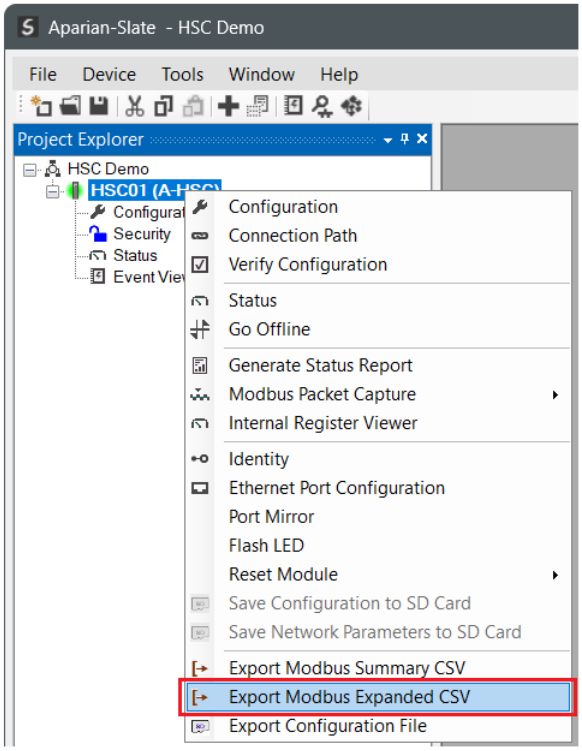


Figure 8.29 – Modbus Expanded Report Generation

	A	B	C	D	E	F
1	Reg Type	Modbus Function	Start Address	End Address	Element Count	Description
2	HR	Read	1000	1000	1	General Status
3	HR	Read	1001	1001	1	Reserved
4	HR	Read	1002	1002	1	ConfigCRC
5	HR	Read	1003	1003	1	CurrentCANBaud
6	HR	Read	1004	1005	2	Uptime
7	HR	Read	1006	1007	2	FreeRunCounter
8	HR	Read	1008	1008	1	DateYear
9	HR	Read	1009	1009	1	DateMonth
10	HR	Read	1010	1010	1	DateDay
11	HR	Read	1011	1011	1	TimeHour
12	HR	Read	1012	1012	1	TimeMinute
13	HR	Read	1013	1013	1	TimeSecond
14	HR	Read	1014	1015	2	DeviceTemperature1
15	HR	Read	1016	1017	2	DeviceTemperature2
16	HR	Read	1018	1018	1	DIPSwitchesAtStartup
17	HR	Read	1019	1019	1	DIPSwitchesCurrent
18	HR	Read	1020	1020	1	EthPort1Status
19	HR	Read	1021	1021	1	EthPort2Status
20	HR	Read	1022	1022	1	EthSwitchMode
21	HR	Read	1023	1023	1	DLRStatus
22	HR	Read	1024	1024	1	NTPStatus
23	HR	Read	1025	1025	1	PTPStatus
24	HR	Read	1026	1027	2	Reserved
25	HR	Read	1028	1028	1	Digital Inputs
26	HR	Read	1029	1029	1	Digital Output State
27	HR	Read	1030	1031	2	Analog Input Ch 0

Figure 8.30 – Modbus Expanded CSV

9. TECHNICAL SPECIFICATIONS

9.1. DIMENSIONS

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

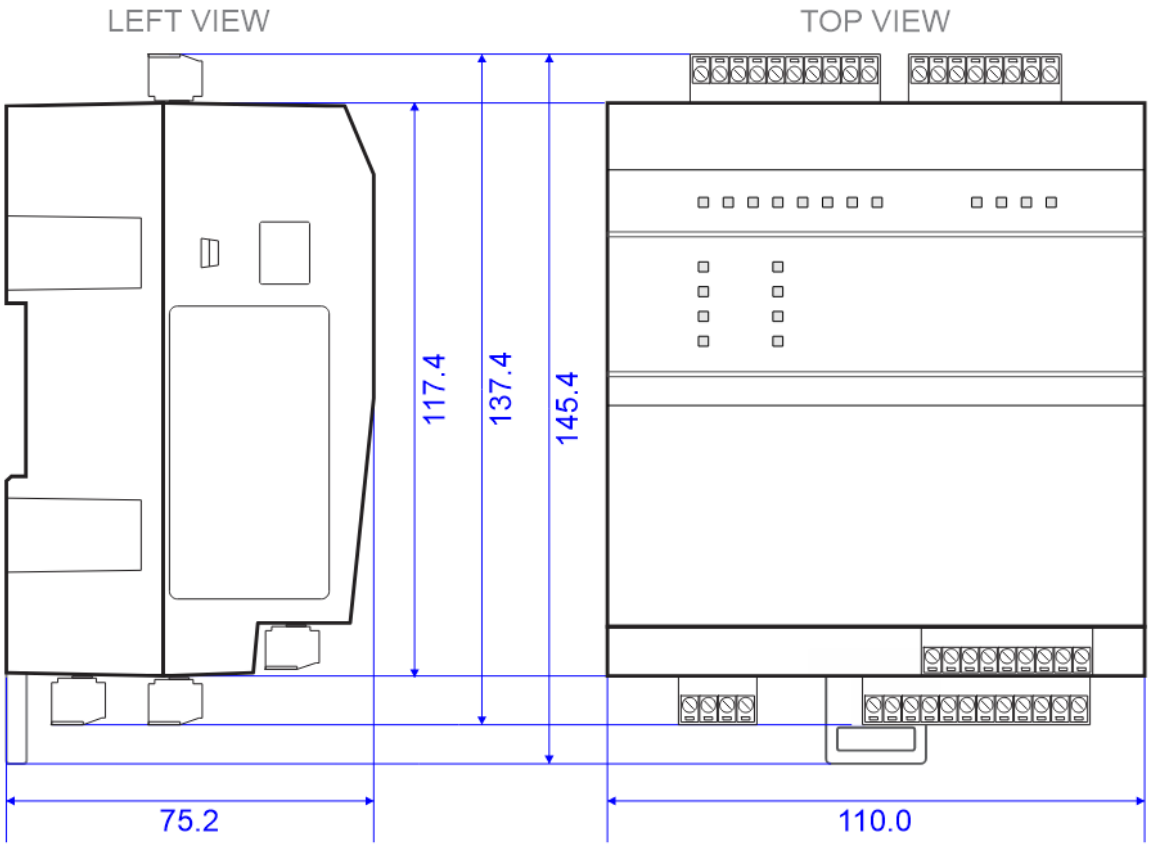


Figure 9.1 – High Speed Counter enclosure dimensions

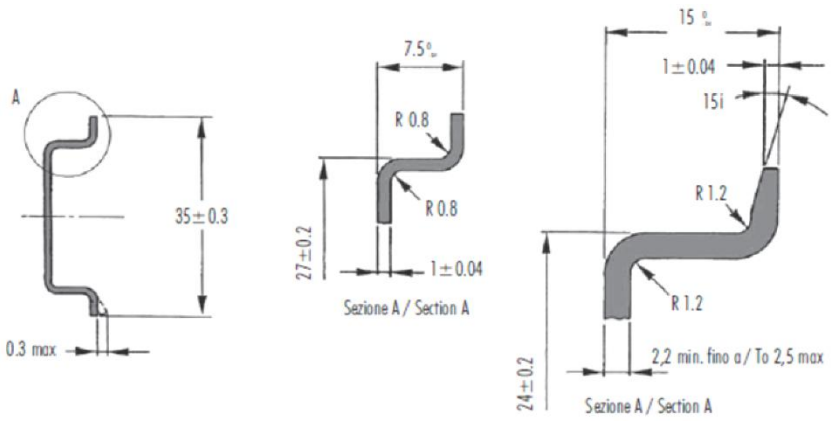


Figure 9.2 - Required DIN dimensions

9.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 32 VDC (Class 2)
Power consumption	3.8 W (Max.) Current: 285 mA @ 10 VDC Current: 142 mA @ 24 VDC
Connector	4-way terminal Tightening Torque: 0.22 – 0.25 Nm
Dual Power Input	Yes, individually monitored
Conductors	24 – 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 9.1 - Electrical specification

9.3. DIGITAL INPUTS

Specification	Rating
Connector	10-way terminal Tightening Torque: 0.22 – 0.25 Nm
Organization	2 banks of 4 inputs each. Each bank with individual reference.
Isolation	1000 V RMS
Input Voltage Selection	Software controlled: 24V Mode or 5V Mode
Maximum Input Voltage	32 VDC
Input Threshold Voltage	24V Mode: 9.5 VDC typical @ 25 °C

	5V Mode: 3.4 VDC typical @ 25 °C
Input Current	24V Mode: 2.9 mA @ 12 VDC 4.8 mA @ 24 VDC 4.9 mA @ 32 VDC 5V Mode: 2.2 mA @ 5 VDC
Maximum Input Frequency	1 MHz (50% duty cycle)

Table 9.2 – Digital Input specification

9.4. DIGITAL OUTPUTS

Specification	Rating
Connector	8-way terminal Tightening Torque: 0.22 – 0.25 Nm
Organization	4 isolated outputs (normal open)
Isolation	1000 V RMS
Maximum Switching Voltage	32 VDC
Maximum Switching Current	300 mA
Maximum Switching Frequency	100 Hz (50% duty cycle)

Table 9.3 – Digital Output specification

9.5. ANALOG INPUTS

Specification	Rating
Connector	12-way terminal (shared with Analog Output) Tightening Torque: 0.22 – 0.25 Nm
Organization	4 inputs with common reference
Isolation	500 VDC (between analog I/O and rest of module)
Input Selection	Software controlled: Current Mode: 0-20 mA Voltage Mode: 0-10 VDC
Maximum Input Voltage	11 VDC

ADC Resolution	16 bit
Sampling Rate	10 Hz

Table 9.4 – Analog Input specification

9.6. ANALOG OUTPUT

Specification	Rating
Connector	12-way terminal (shared with Analog Output) Tightening Torque: 0.22 – 0.25 Nm
Organization	1 current output with external power
Isolation	500 VDC (between analog I/O and rest of module)
External Voltage	24 VDC
Output Current	0-21 mA
Minimum Load Resistance	200 Ω
DAC Resolution	12 bit
Update Rate	10 Hz

Table 9.5 – Analog Output specification

9.7. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 100
TCP connections	Max 100
CIP connections	Max 20
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

1588 Precision Time Protocol (PTP)	Supported

Table 9.6 - Ethernet specification

9.8. SERIAL PORT (RS232)

Specification	Rating
Connector	9-way terminal (shared with RS485, CAN) Tightening Torque: 0.22 – 0.25 Nm
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 9.7 – RS232 Serial Port specification

9.9. SERIAL PORT (RS485)

Specification	Rating
Connector	9-way terminal (shared with RS232, CAN) Tightening Torque: 0.22 – 0.25 Nm
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 9.8 – RS485 Serial Port specification

9.10. CAN BUS

Specification	Rating
Connector	9-way terminal (shared with RS232, RS485) Tightening Torque: 0.22 – 0.25 Nm
Conductor	24 – 18 AWG
Electrical Isolation	1500 Vrms for 1 minute.
Supported Baud Rates	125k 250k 500k
CAN Terminator	120 Ω - Software Enabled

Table 9.9 – CAN bus specification

9.11. ETHERNET/IP TARGET

Specification	Rating
Class 1 Cyclic connection count	1
RPI Range	2 – 1000 ms

Table 9.10 – EtherNet/IP Target specification

9.12. MODBUS CLIENT

Specification	Rating
Modes Supported	Modbus TCP, RTU-RS232, RTU-RS485
Max. Modbus Server Devices	50
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 9.11 – Modbus Client specification

9.13. MODBUS SERVER

Specification	Rating
Modes Supported	Modbus TCP, RTU-RS232, RTU-RS485
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 9.12 – Modbus Server specification

9.14. 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 T4

ATEX	 UL 26 ATEX 3612X Ta: -20°C to +70°C II 3 G Ex ec IIC T4 Gc
UKCA	
ODVA Conformance	

Table 9.13 – Certifications

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