i90 Scanner

User Manual

A-i90S

Document No. D147-003
04/2026
Revision 1.10

aparian

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Revision History

Revision	Date	Comment
1.0	22 September 2020	Initial document
1.1	5 November 2021	Added IMASI03/13 modules
1.2	13 March 2022	Added ODVA and UL (C1D2) Conformance Mark.
1.3	4 August 2022	Added information required for UL regarding open type device enclosures.
1.4	13 April 2023	Added IMFEC11 and IMFEC12 IO cards to the supported list
1.5	13 November 2023	Added UKCA Conformance Mark
1.6	27 November 2023	Added IMFBS01 and IMDSM04
1.7	26 January 2024	Added import tools.
1.8	20 May 2025	Add duplicate IP address indication to LEDs in the Diagnostics section.
1.9	21 May 2025	Added Emulation Mode
1.10	21 April 2026	Added UL North American Hazardous Location Approval.

1. PREFACE

1.1. INTRODUCTION TO THE I90 SCANNER

This manual describes the installation, operation, and diagnostics of the Aparian i90 Scanner. The i90 Scanner allows interfacing between a Rockwell Automation Logix system and Bailey INFI 90® IO. (INFI 90® is a registered trademark of ABB Automation Inc.)

The i90 Scanner connects to a Rockwell Automation Logix Controller (e.g. ControlLogix or CompactLogix) via EtherNet/IP and plugs directly into the i90 IO rack (MMU). This allows the i90 Scanner to connect to, and control, the IO in the i90 rack(s).

The i90 Scanner derives all required power from the Bailey i90 rack (MMU).

A typical i90 Scanner (as a Standalone Master) connecting to the Bailey® i90 IO is shown below.

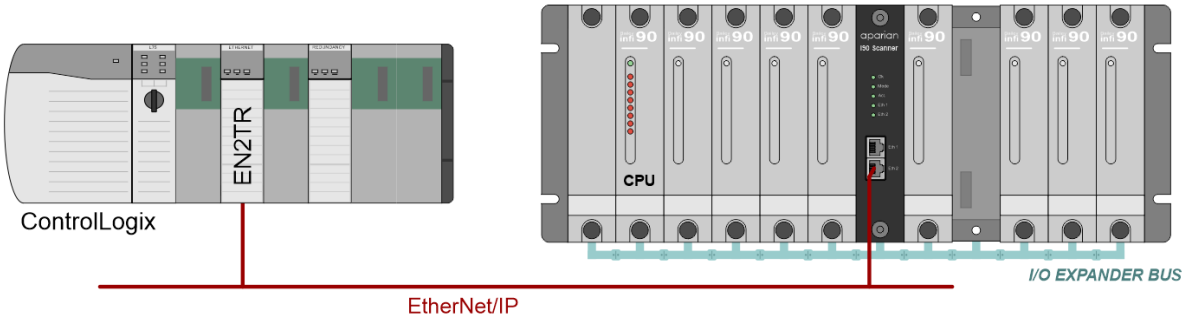


Figure 1.1 – Typical Standalone Setup

1.2. FEATURES

The i90 Scanner provides an interface between Bailey Network 90® IO and a Logix system using multiple EtherNet/IP class 1 connections. The i90 Scanner supports up to 34 Bailey® IO modules and consumes 7 Logix IO connections.

The i90 Scanner is configured using the Aparian Slate application which can be downloaded from www.aparian.com free of charge.

Within the Slate environment each i90 IO module can be configured to match the application. The following IO modules are supported:

- **IMASI02/NASI02** – 15 Channel Analog Input
- **IMASI03/NASI03** – 16 Channel Universal Analog Input

- **IMASI13/NASI13** – 16 Channel Universal Analog Input
- **IMDSI02/NDSI02** – 16 Channel Digital Input
- **IMDSO04/NDSO04** – 16 Channel Digital Output
- **IMASO01/NASO01** – 14 Channel Analog Output
- **IMDSM05/NDSM05** – 2 x 8 Channel Digital Input/Output
- **IMCIS02/NCIS02** – Combination IO (4 Channel Analog Input, 2 Channel Analog Output, 3 Channel Digital Input, 4 Channel Digital Output)
- **IMFEC11 / IMFEC12** - 15 Channel Analog Input
- **IMFBS01** - 15 Channel Analog Input
- **IMDSM04** – 8 Channel Pulse Input

Using the EDS AOP (Add-On-Profile) in Studio 5000, the i90 Scanner can be added directly into the Logix IO tree. AOIs (Add-On-Instructions) are provided for both Standalone and Redundant architectures and facilitate the mapping of IO and diagnostic information to meaningful (UDT) structures.

In the case of a redundant system, the AOI also automatically switches between the Active and Standby i90 Scanner.

To aid in migration, the i90 Scanner provides a Shadow mode where the i90 Scanner can run in parallel with the existing Bailey® processor. In this mode the existing CPU is controlling the IO modules and the i90 Scanner is listening-in and providing the input and output readback data to the Logix.

The i90 Scanner also supports an Emulation mode, where a limited number of IO modules can be emulated by the i90 Scanner. This mode allows the transfer of digital and analog data between the Bailey® CPU and the Logix controller.

The i90 Scanner hosts two Ethernet ports which can either be used as an unmanaged switch or in a Device-Level-Ring (DLR) topology providing Ethernet redundancy.

The i90 Scanner has a range of diagnostics, statistics, and tools to support the user during the migration process. This will speed up fault finding and reduce down-time.

1.3. ARCHITECTURE

The i90 Scanner can be employed in a number of architectures.

1.3.1. STANDALONE MODE, LINEAR ETHERNET, SINGLE LOGIX CONTROLLER

In this architecture, a single i90 Scanner is inserted into the Bailey i90 MMU, with a linear Ethernet network connecting to a single Logix Controller.

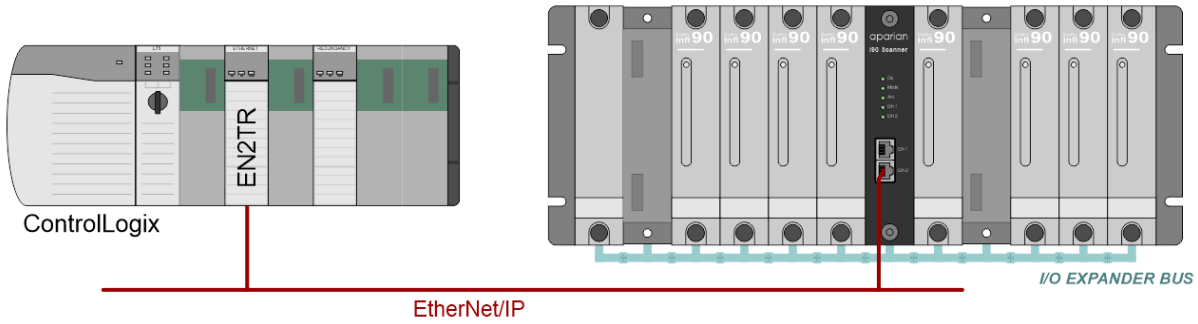


Figure 1.2 – Standalone mode, linear Ethernet, single Logix Controller

1.3.2. STANDALONE MODE, RING ETHERNET, SINGLE LOGIX CONTROLLER

In this architecture, a single i90 Scanner is inserted into the Bailey i90 MMU, with a ring DLR Ethernet network connecting to a single Logix Controller.

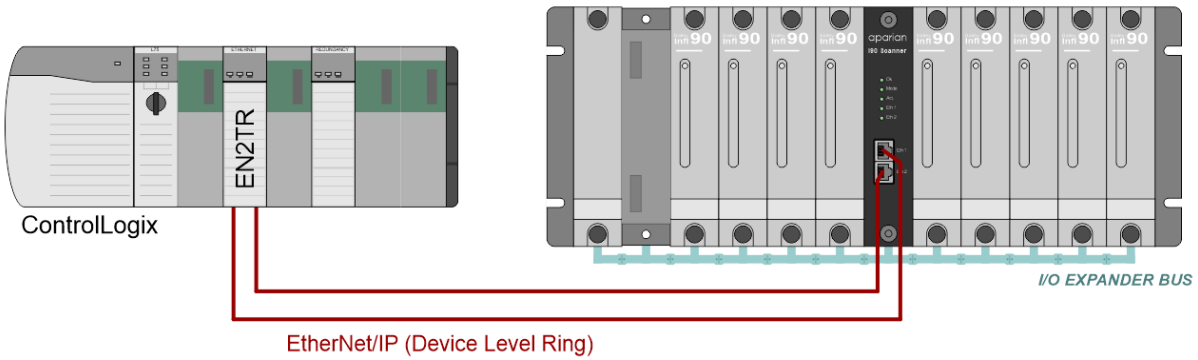


Figure 1.3 – Standalone mode, ring Ethernet, single Logix Controller

1.3.3. STANDALONE MODE, RING ETHERNET, REDUNDANT LOGIX CONTROLLER

In this architecture, a single i90 Scanner is inserted into the Bailey i90 MMU, with a DLR Ethernet network connecting to a redundant pair of Logix Controllers.

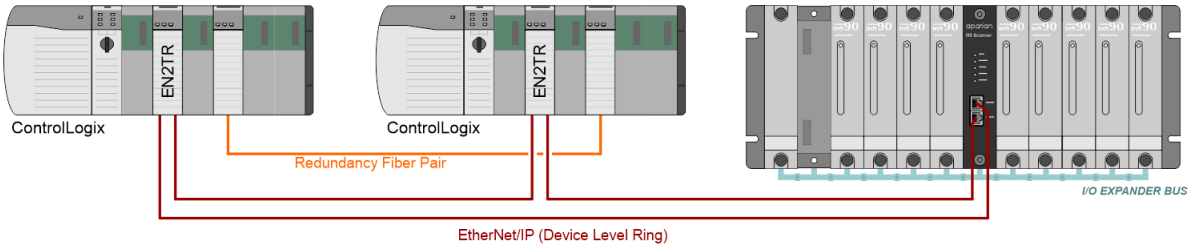


Figure 1.4 – Standalone mode, ring Ethernet, redundant Logix Controller

1.3.4. Redundant Mode, Ring Ethernet, Single Logix Controller

In this architecture, two i90 Scanners are inserted into the Bailey i90 MMU, with a DLR Ethernet network connecting them a single Logix Controller.

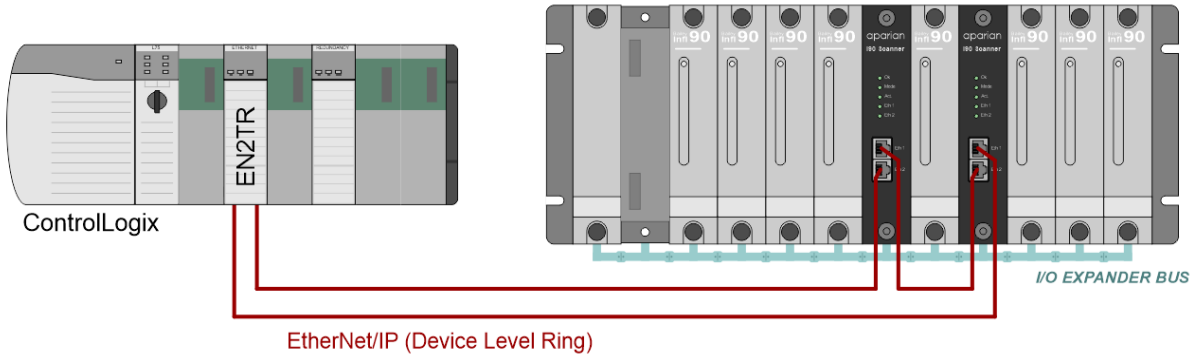


Figure 1.5 – Redundant mode, linear Ethernet, single Logix Controller

1.3.5. Redundant Mode, Ring Ethernet, Redundant Logix Controller

In this architecture, a two i90 Scanners are inserted into the Bailey i90 MMU, with a DLR Ethernet network connecting to a redundant pair of Logix Controllers.

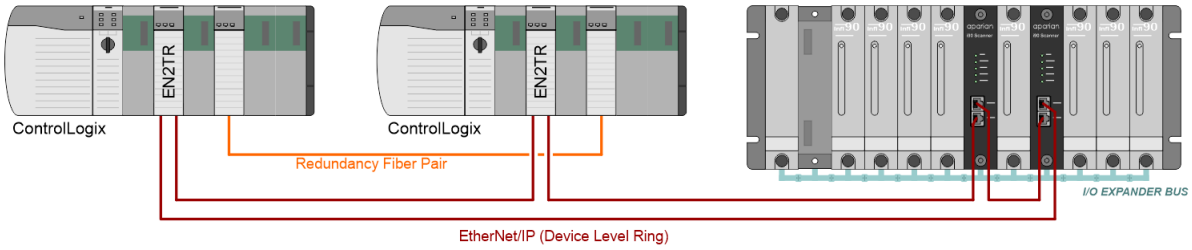


Figure 1.6 – Redundant mode, ring Ethernet, redundant Logix Controller

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
I90 Scanner User Manual I90 Scanner Datasheet Example Code & UDTs	http://www.aparian.com/products/i90scanner
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html

Table 1.1. - Additional Information

1.5. SUPPORT

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

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

Table 1.2. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

The i90 Scanner slots directly into a Bailey i90 MMU (rack).

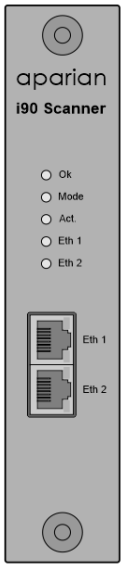


Figure 2.1 – i90 Scanner front view



Figure 2.2 – i90 Scanner side view

There are two Ethernet RJ45 connectors on the front of the module which are used for the Ethernet connections (linear or ring topology). The Ethernet cable must be wired according to industry standards which can be found in the additional information section of this document.

The module provides five diagnostic LEDs on the front of the module. These LEDs are used to provide information regarding the module system operation, the Ethernet interfaces, and i90 Scanner redundancy status.

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

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode” the module will not load the application firmware, but rather wait for new firmware to be downloaded. This should only be used in the rare occasion when a previous 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. **NOTE:** When the i90 Scanner module is booted with this DIP Switch set, then the DHCP will also be updated in the module’s Non-Volatile (NV) memory. Thus, once the module is rebooted (without DIP2 set) it will still be in DHCP mode. For more information, see the *Force DHCP Using DIP Switches* section.
DIP Switch 3	This DIP Switch is used to lock the configuration from being overwritten by the Slate Configuration Utility. When set the Slate Configuration Utility will not be able to download to the i90 Scanner.
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. **NOTE:** When the i90 Scanner module is booted with this DIP Switch set, then the fixed IP address (192.168.1.100) will also be updated in the module’s Non-Volatile (NV) memory. Thus, once the module is rebooted (without DIP4 set) it will still have the IP address 192.168.1.100. For more information, see the *Forced Fixed IP Address Using DIP Switches* section.

Table 2.1. - DIP Switch Settings

2.2. MODULE MOUNTING

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

The module is inserted into a Bailey® i90 MMU (Module Mounting Unit) or rack.

2.3. POWER

All required power for the i90 Scanner is derived from the i90 MMU (rack).

2.4. ETHERNET PORTS

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

The module has an embedded switch connecting the two Ethernet ports which can be used in either a Liner or DLR (Device-Level-Ring) Ethernet topology.

2.5. NORTH AMERICAN HAZARDOUS LOCATION APPROVAL

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

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

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

THIS EQUIPMENT IS OPEN-TYPE DEVICE AND IS MEANT TO BE INSTALLED IN AN ENCLOSURE SUITABLE FOR THE ENVIRONMENT SUCH THAT THE EQUIPMENT IS ONLY ACCESSIBLE WITH THE USE OF A TOOL.

The A-i90S is intended for installation in a Rockwell Automation Logix System.

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

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

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

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

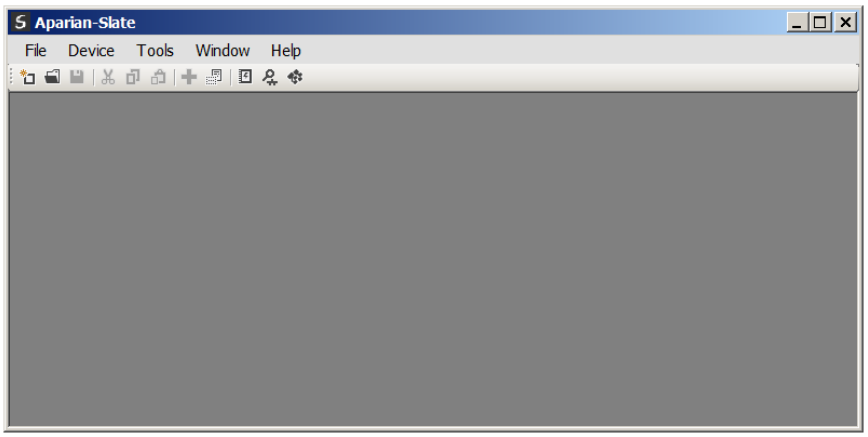


Figure 3.1. - Aparian Slate Environment

3.2. NETWORK PARAMETERS

The module will have DHCP (Dynamic Host Configuration Protocol) enabled as factory default. Thus, a DHCP server must initially 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.

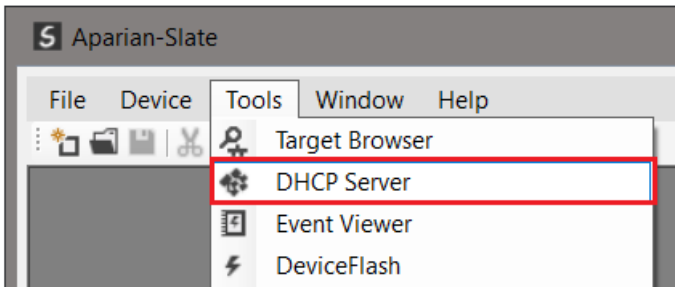


Figure 3.2. - Selecting DHCP Server

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

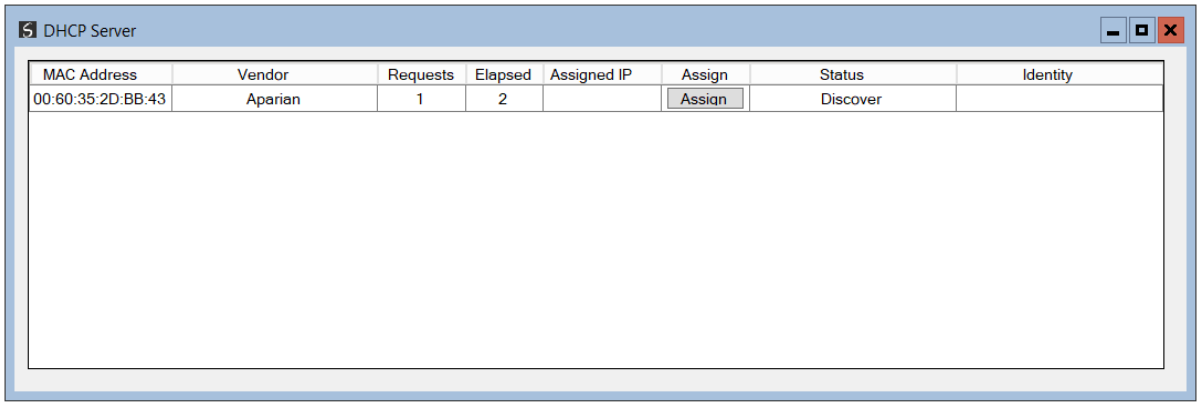


Figure 3.3. - DHCP Server

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.

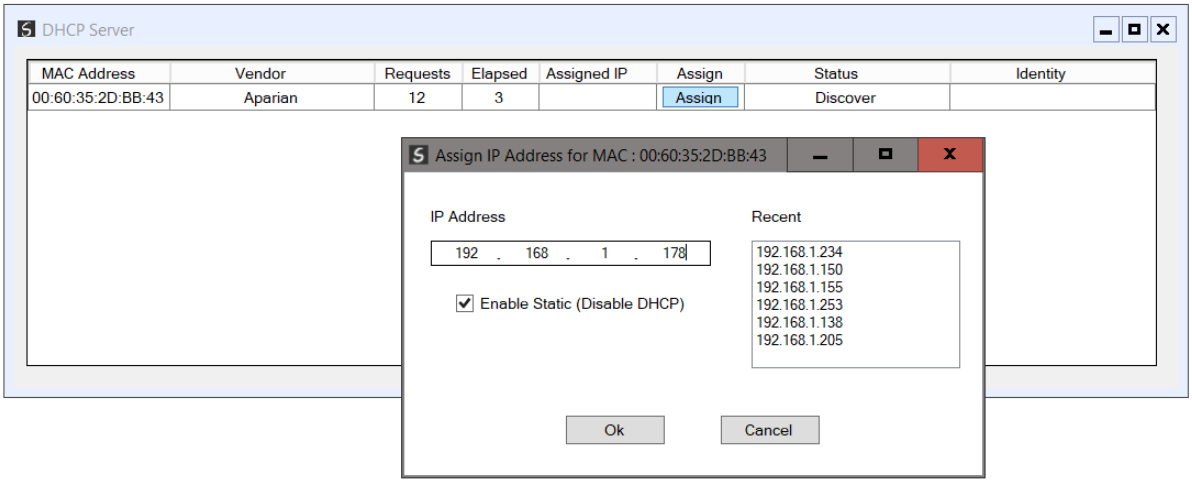


Figure 3.4. - Assigning IP Address

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 Product Name (Identity Object) from the device. The successful assignment of the IP address by the device is indicated by the green

background of the associated row.

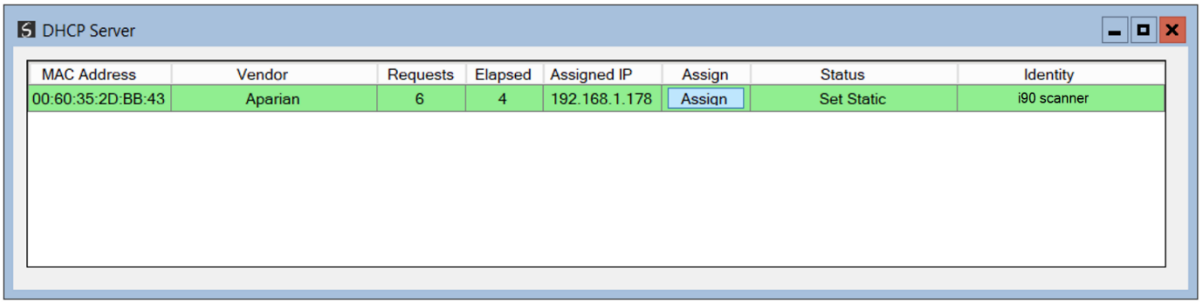


Figure 3.5. - Successful IP address assignment

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 remains in the ***On*** position during the address assignment, the user will be warned by the following message.

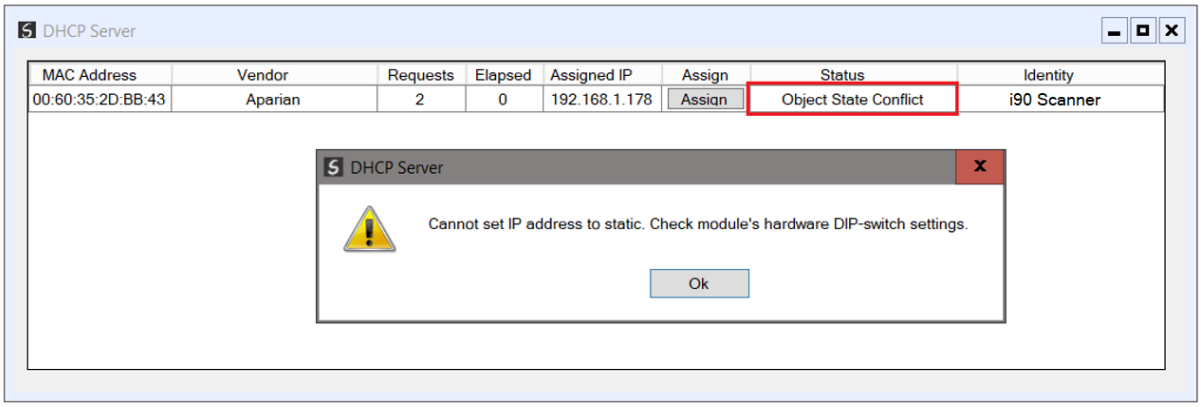


Figure 3.6. - Force DHCP warning

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.

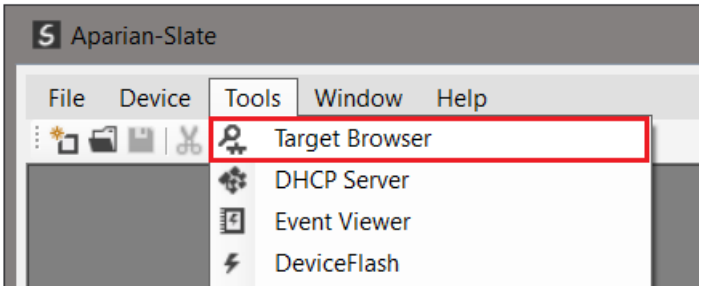


Figure 3.7. - Selecting the Target Browser

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

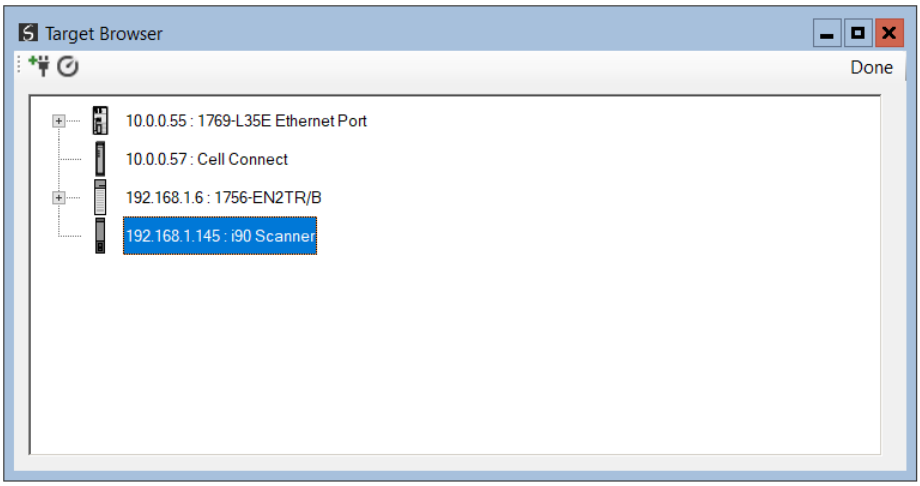


Figure 3.8. - Target Browser

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

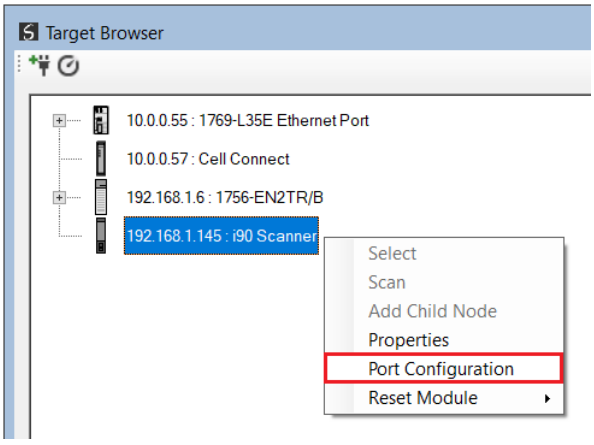


Figure 3.9. - Selecting Port Configuration

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

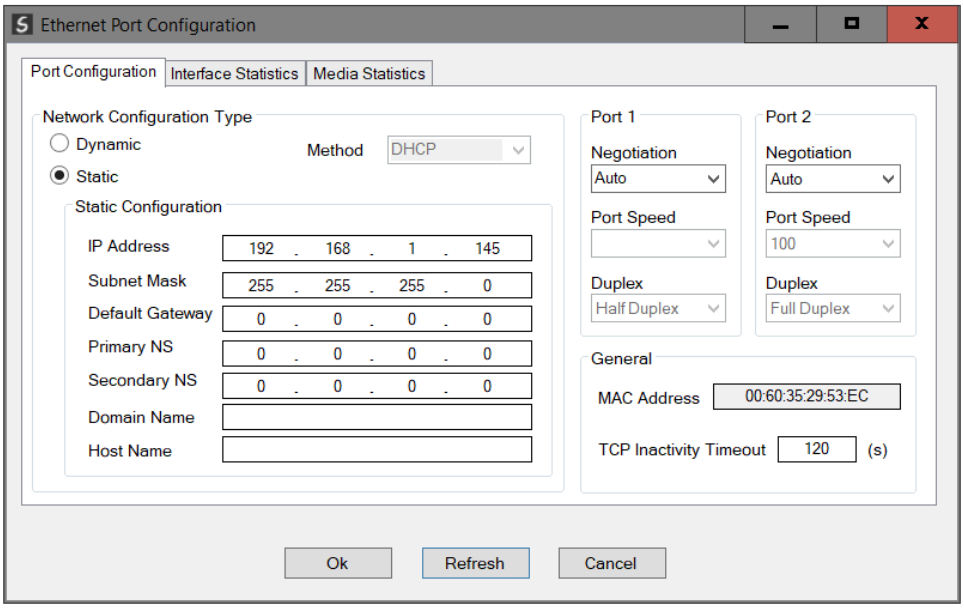


Figure 3.10. - Port Configuration

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

3.2.1. Force DHCP Using DIP Switches

In the case of forgetting the module IP address or needing to forcefully change the network parameters, the user can use the DIP Switches to do this.

DIP Switch 2 will allow the user to force the module into DHCP mode. Follow the steps below to force the module to DHCP enabled.



NOTE: When the i90 Scanner module is booted with this DIP Switch set, then the DHCP will also be updated in the module's Non-Volatile (NV) memory. Thus, once the module is rebooted (without DIP2 set) it will still be in DHCP mode.

Step 1 – Remove the i90S from the Bailey Rack and set DIP2 to the **On** position.
Step 2 – Reinsert the i90S into the Bailey Rack and wait for it to successfully boot.
Step 3 – Remove the i90S from the Bailey Rack and set DIP2 to the **Off** position.
Step 4 – Reinsert the i90S into the Bailey Rack and wait for it to successfully boot.

The i90S will now have DHCP enabled.

3.2.2. Force Fixed IP Address Using DIP Switches

In the case of forgetting the module IP address or needing to forcefully change the network

parameters, the user can use the DIP Switches to do this.

DIP Switch 4 will allow the user to force the module to have an IP address of 192.168.1.100. Follow the steps below to force the module to have an IP address of 192.168.1.100.

NOTE: When the i90 Scanner module is booted with this DIP Switch set, then the fixed IP address (192.168.1.100) will also be updated in the module's Non-Volatile (NV) memory. Thus, once the module is rebooted (without DIP4 set) it will still have the IP address 192.168.1.100.

Step 1 – Remove the i90S from the Bailey Rack and set DIP4 to the **On** position.
Step 2 – Reinsert the i90S into the Bailey Rack and wait for it to successfully boot.
Step 3 – Remove the i90S from the Bailey Rack and set DIP4 to the **Off** position.
Step 4 – Reinsert the i90S into the Bailey Rack and wait for it to successfully boot.

The i90S will now be at IP address 192.168.1.100.

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***.

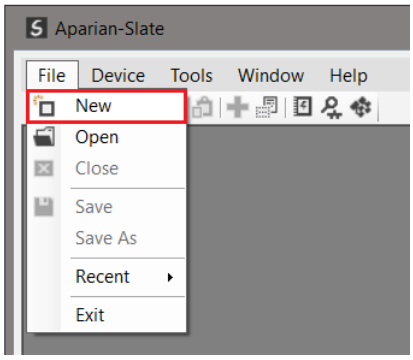


Figure 3.11. - Creating a new project

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 the ***Add*** option under the ***Device*** menu.

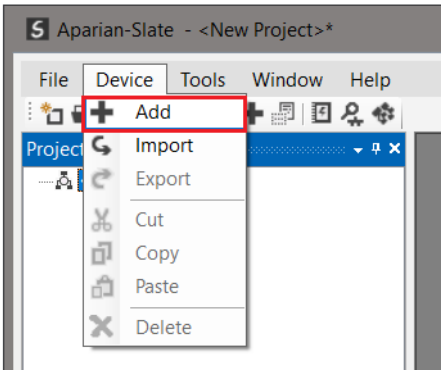


Figure 3.12. - Adding a new device

In the ***Add New Device*** window select the i90 Scanner, and click the ***Ok*** button.

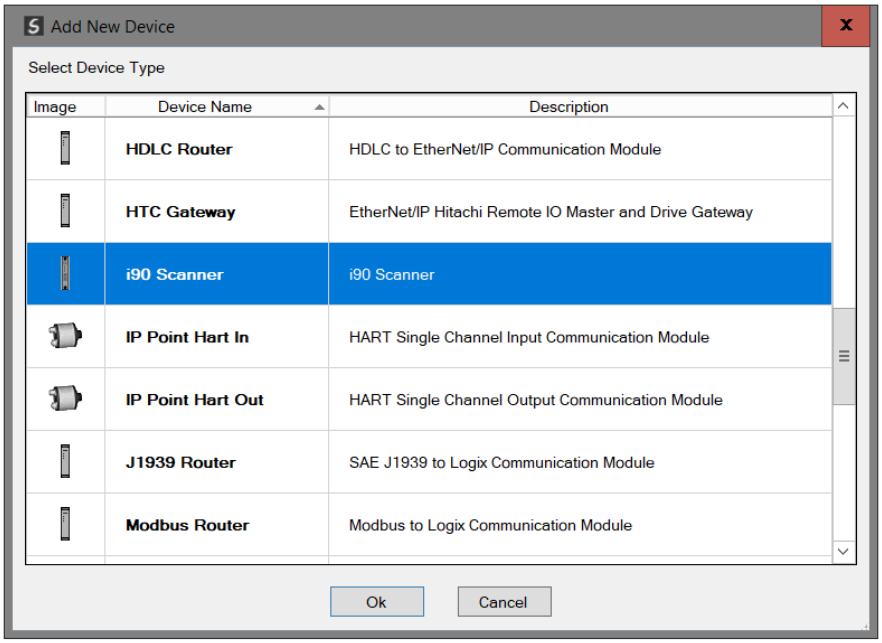


Figure 3.13 – Selecting a new i90 Scanner

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***.

3.4. I90 SCANNER CONFIGURATION

The i90 Scanner parameters are configured using the Slate utility. When downloading this configuration to 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 i90 Scanner configuration.

3.4.1. GENERAL PARAMETERS

The general configuration is shown in the figure below. The i90 Scanner's general configuration window is opened by either double clicking on the module in the tree or right-clicking the module and selecting ***Configuration***.

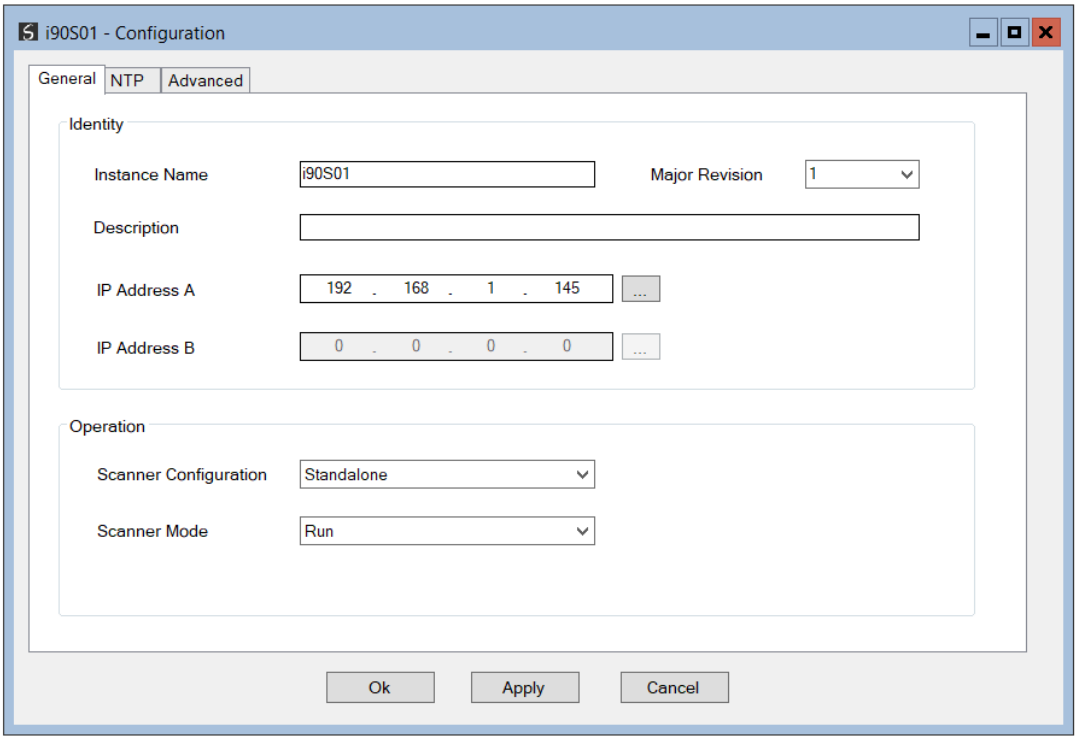


Figure 3.14 – General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify the i90 Scanner module(s).
Description	This parameter is used to provide a more detailed description of the application for the i90 Scanner module(s).
Major Revision	The major revision of the module.
IP Address A	The IP address of the Standalone or target "A" module. The user can use the target browse button "…" to launch the ***Target Browser*** and select a i90 Scanner on the network.
IP Address B	The IP address of the target "B" module. The user can use the target browse button "…" to launch the ***Target Browser*** and select a i90 Scanner on the network. IP Address B is available only when Redundant Scanner mode is selected.
Scanner Configuration	This option selects the configuration mode selected for the scanner.

	Standalone In this mode, the i90 Scanner will be a single Master on the i90 bus communicating with the IO modules. In the Logix controller there will also be a single i90 Scanner in the IO tree to read/write data to the i90 IO modules. **Redundant** In this mode, the i90 Scanners will be used as a pair of redundant modules, where one of the i90 Scanners will be the active Master on the i90 bus and the other will be standby Master. If the active Master is lost, then the standby Master will take over control of the i90 bus. See the Redundancy section for more information regarding the redundant operation.
Scanner Mode	The Scanner Mode has the following options: **Run** In Run mode, the i90 Scanner is the master of the IO Expander bus. It configures and controls the I/O modules. This mode is for normal operation where the existing Bailey® CPU has been removed. **Shadow (Listen-Only)** In Shadow mode, the i90 Scanner only listens on the Expander bus and provides the I/O Module inputs and output read-back data to Logix. The outputs are still controlled by the existing Bailey® CPU. **Emulation** In Emulation mode the i90 Scanner emulates the configured I/O modules, allowing the transfer of data between the Bailey® CPU and the Logix controller. **Disabled** This mode is used to disable all communication on the IO Expander Bus.

Table 3.1 - General configuration parameters

3.4.2. NTP CONFIGURATION

The NTP (Network Time Protocol) configuration tab is shown in the figure below.

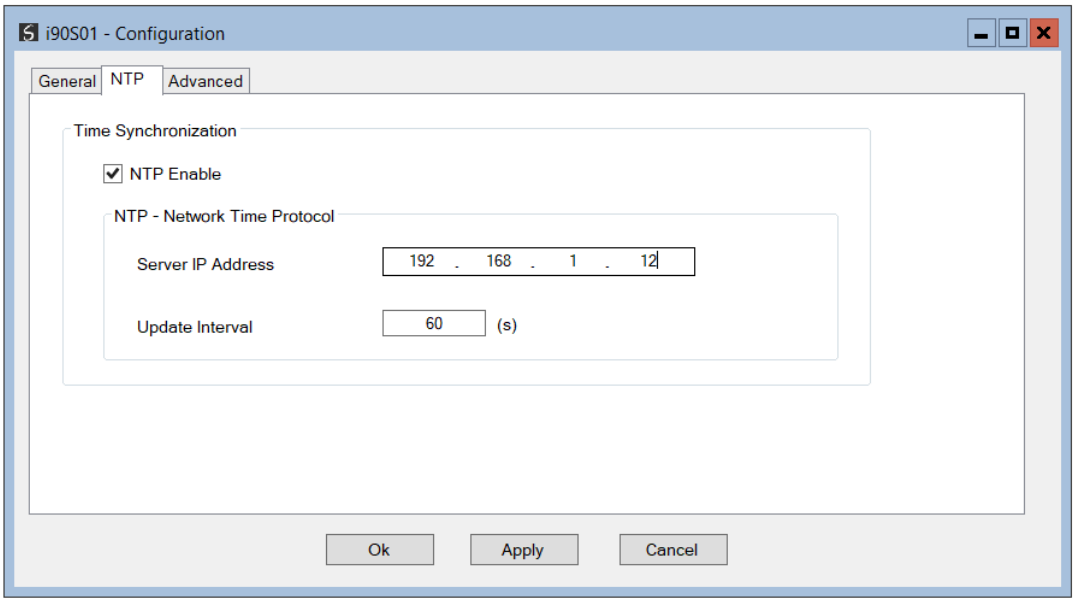


Figure 3.15 – NTP Configuration

The Ethernet IO configuration consists of the following parameters:

Parameter	Description
NTP Enable	Enables the i90 Scanner to synchronize its onboard clock to an external NTP Server.
Server IP Address	The IP address of the NTP Server which will be used as a time source.
Update Interval	The update interval (in seconds), specifying how often the i90 Scanner will request time from the NTP Server.

Table 3.2 – NTP configuration parameters

3.4.3. ADVANCED

The Advanced configuration is shown in the figure below.

NOTE: It is recommended that the user not modify these parameters without first consulting Aparian.

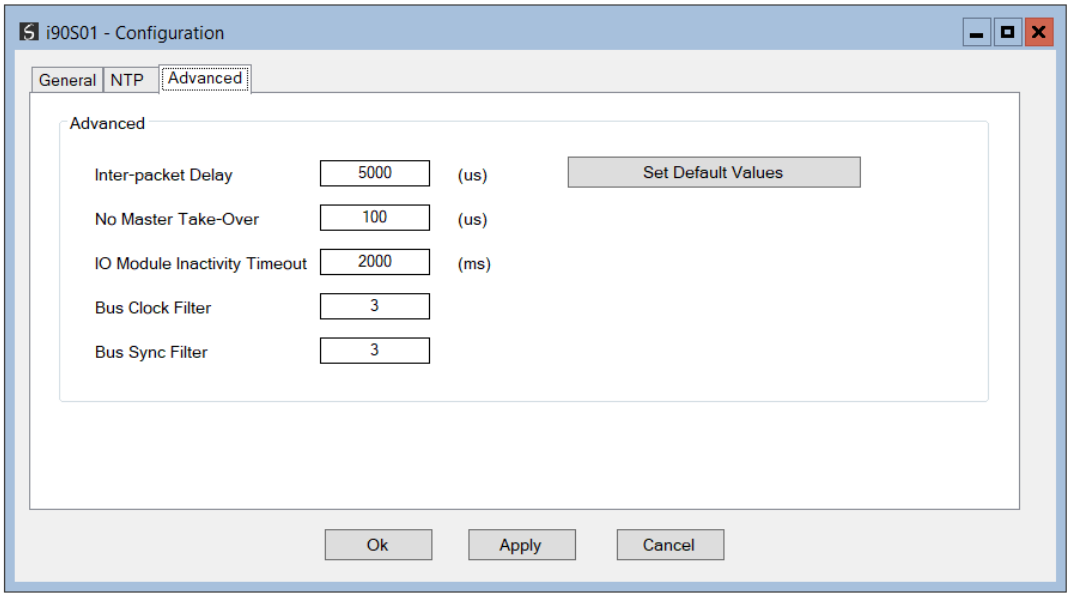


Figure 3.16 – i90 Scanner - Advanced Configuration

The Advanced consists of the following parameters:

Parameter	Description
Inter-packet Delay	Delay (in microseconds) between bus requests.
No Master Take-Over	Inactivity timeout (in microseconds) before a redundant i90 Scanner partner takes ownership of the bus.
IO Module Inactivity Timeout	Timeout (in milliseconds) before a particular IO module is deemed unavailable.
Bus Clock Filter	Digital filter option for bus clock line.

Bus Sync Filter	Digital filter option for bus sync line.

Table 3.3 – Advanced Configuration parameters

3.5. ADDING IO MODULES

Once the general i90 Scanner configuration is complete, the user can configure the required IO modules.

IO modules can either be added manually or imported from a Bailey® Control Logic Document (CADEWS) export file, which is described in the next section.

Manually adding IO modules is achieved by right-clicking on the ***IO Modules*** item in the project tree and selecting the ***Add IO Module*** option.

In ***Shadow*** and ***Run*** mode a maximum of 34 IO modules can be added.

In ***Emulation*** mode, the maximum number, and module type, is limited to:

8 x IMDSI02/NDSI02 – 16 Channel Digital Input
8 x IMDSO04/NDSO04 – 16 Channel Digital Output
1 x IMASI02/NASI02 – 15 Channel Analog Input
1 x IMASO01/NASO01 – 14 Channel Analog Output

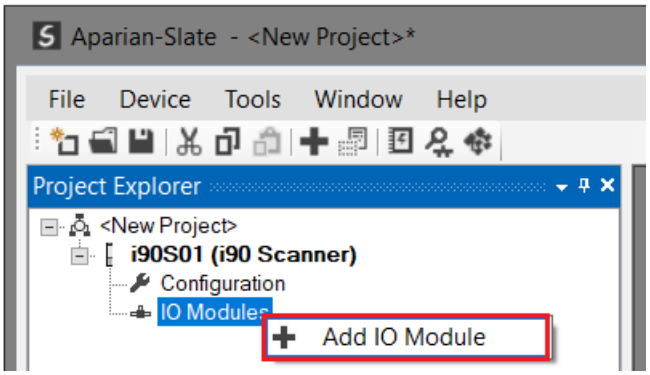


Figure 3.17 – Adding IO Modules

The ***Select IO Module*** window will appear. Select the appropriate module and press ***Ok***.

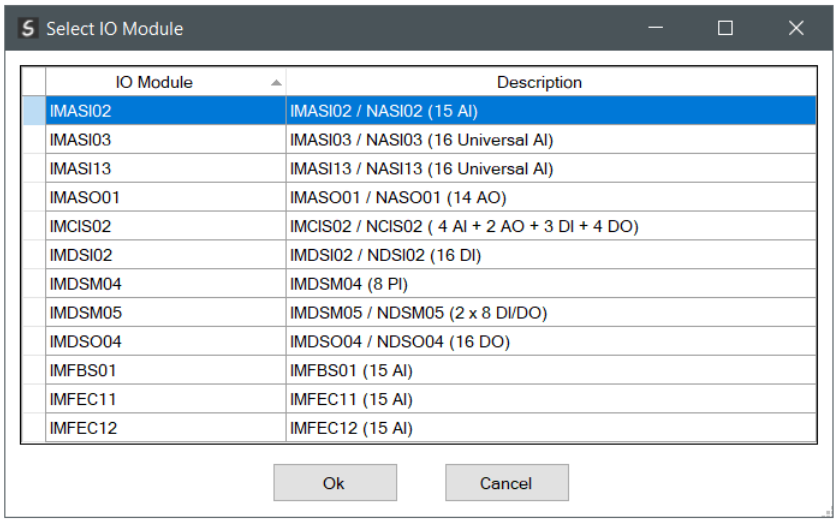


Figure 3.18 – Select IO Module

The configuration window for the selected IO module will then open.

3.5.1. General IO Module Configuration

The available configuration parameters for the IO module will depend on the type of IO module selected.

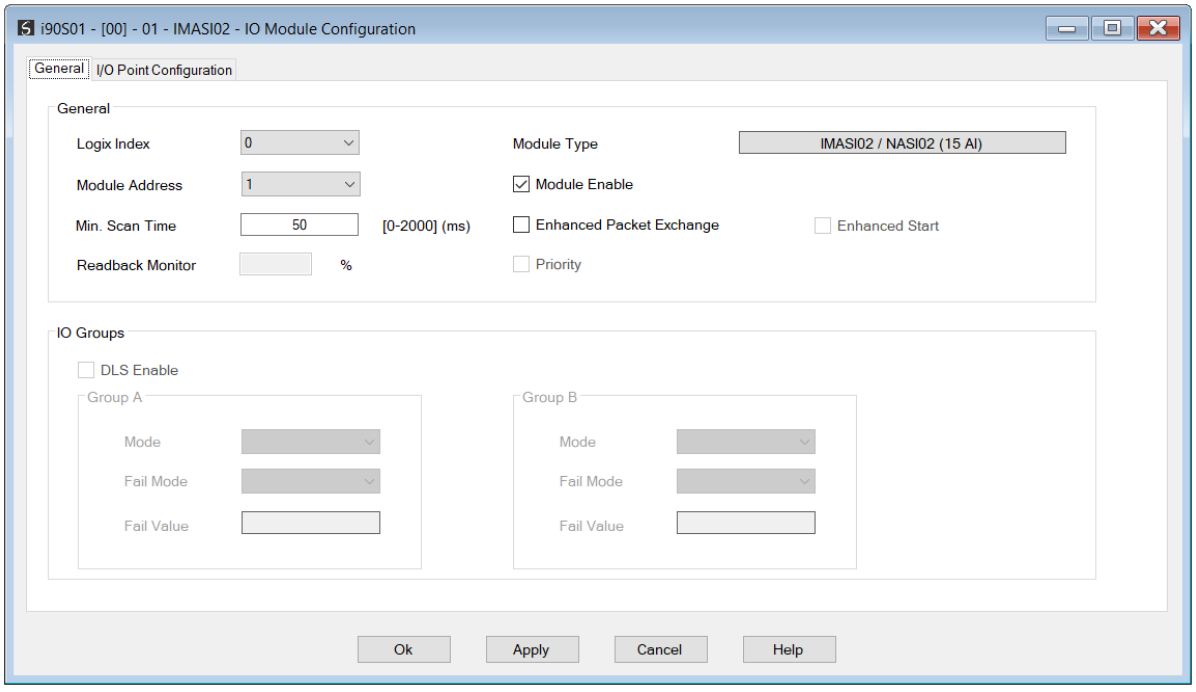


Figure 3.19 – IO Module - General Configuration

The general IO module configuration consists of the following parameters (where applicable):

Parameter	Description
Logix Index	This is the module index (0-33) used in the Logix tag for the specific IO module. For example, if the index is 7 then the input data for the module will appear in the Logix tag: [*ScannerName*]Input.IOModule[7].
Module Address	The IO module's physical address (0-63) configured by its onboard DIP switches.
Min. Scan Time	The minimum scan time (ms) to update the module. Generally, each IO card is scanned as fast as possible. Setting this parameter allows an IO card to not be updated too quickly.
Analog Readback Monitor %	The allowed deviation (%) of the analog readback from the intended output before a fault condition is reported. **NOTE:** This setting is only applicable for analog output modules.
Module Type	The IO module type.
Module Enable	This option can be used to Disable the module from the i90 Scanner polling strategy.
Enhanced Packet Exchange	Newer versions of certain IO cards support a more efficient method of data transfer, using fewer (but larger) packets. This option may need to be enabled for newer IO cards.
Enhanced Start	Newer versions of certain cards may require a slightly different configuration during start-up. This option may need to be enabled for newer IO cards.
Priority	IO cards with this option enabled will have all their transactions completed within a single scan. When disabled, the transactions will be spread across multiple scans. Enabling this option will increase the update rate of this specific card, but will effectively slow down the update rate for all the other non-priority IO cards.
IO Groups	IO Group configuration. **NOTE:** This setting is only applicable for certain Digital IO modules.
DLS Enable	Used to enable use with a Digital Logic Station (DLS).
Digital IO Group A / B	Specify the IO mode and failure modes for Group A and Group B. **NOTE:** This setting is only applicable for digital modules.
Mode	Specify the mode (Input/Output) of the group. Must match that configured on the module's DIP switches. **NOTE:** This setting is only applicable for IMDSM05 / NDSM05 modules.
Fail Mode	The mode to be adopted by the output during communication failure. • ***Hold*** – Outputs remain constant. • ***Set Value*** – Outputs are set to a preconfigured state (Fail Value) **NOTE:** This setting is only applicable for digital output modules.

Fail Value	The preconfigured value for digital outputs during communication failure, when the Fail Mode is set to Hold. **NOTE:** This setting is only applicable for digital output modules.

Table 3.4 – IO Module - General configuration parameters

NOTE: Depending on the type of module selected, parameters that are not relevant will be either disabled or not visible.

3.5.1. IO Point Configuration

Depending on the IO module type, additional IO Point configuration parameters will be available in the ***I/O Point Configuration*** tab.

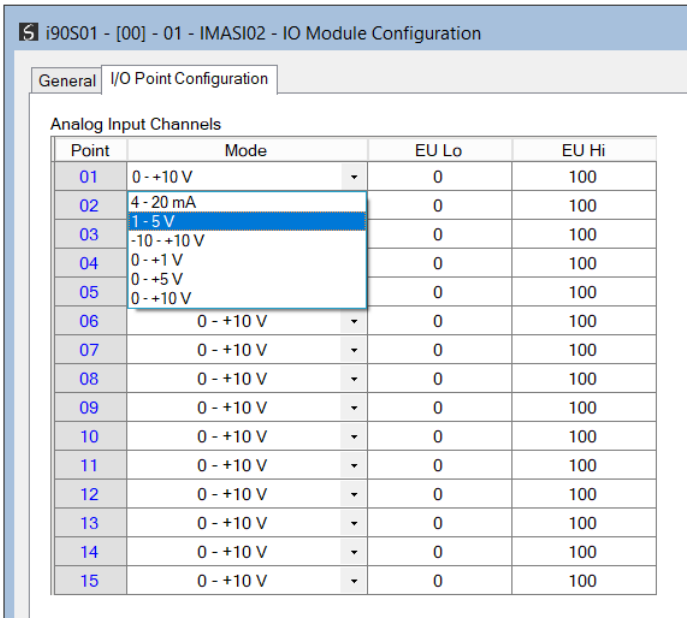


Figure 3.20 – IO Module – IO Point Configuration

NOTE: not all parameters are applicable for each module type.

The general IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The INFI 90® system numbers start at 1, whereas in Logix the index starts at 0.
Mode	The mode of IO point, typically the input range (Voltage / Current)

	• 4 – 20 mA • 1 – 5 V • -10 – 10 V • 0 – 1 V • 0 – 5 V • 0 – 10 V **NOTE**: The mode options depend on the IO module type.
Enable	When checked, the specific IO point is enabled.
Fail State	Determines the analog output value in the event of communication failure. • Low – Set to -6.25 % • High – Set to 106.25 % • Hold – Maintain current value
EU Lo	Engineering value when the analog is at its minimum value (0%). Used for scaling to/from engineering units.
EU High	Engineering value when the analog is at its maximum value (100%). Used for scaling to/from engineering units.

Table 3.5 – IO Card – IO Point configuration parameters

To simplify the configuration of similar IO points, two shortcuts are available to multiplicate the configuration of an IO point. These can be invoked by right-clicking on the IO point and selecting either:

- Copy IO Point Configuration to All
- Copy IO Point Configuration to Rest

The former copies the configuration of the selected IO point to all the other points of that card. The latter copies the configuration to only the IO points below the selected point.

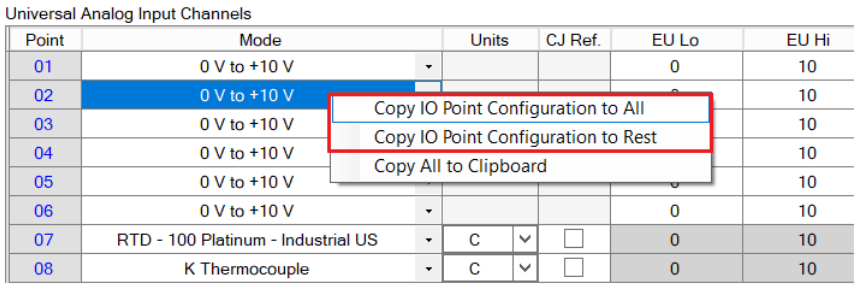


Figure 3.21 – IO Point Configuration Shortcuts

3.6. IMPORT BAILEY CONFIGURATION

Instead of manually configuring each INFI 90® IO module, a Bailey® Control Logic Document

(CADEWS) export file can be imported into Slate.

First, the export file must be opened in Microsoft Excel and saved as a CSV (comma separated variable) file.

To import the file, right-click on the i90 Scanner in Slate and select the ***Import Bailey File*** option.

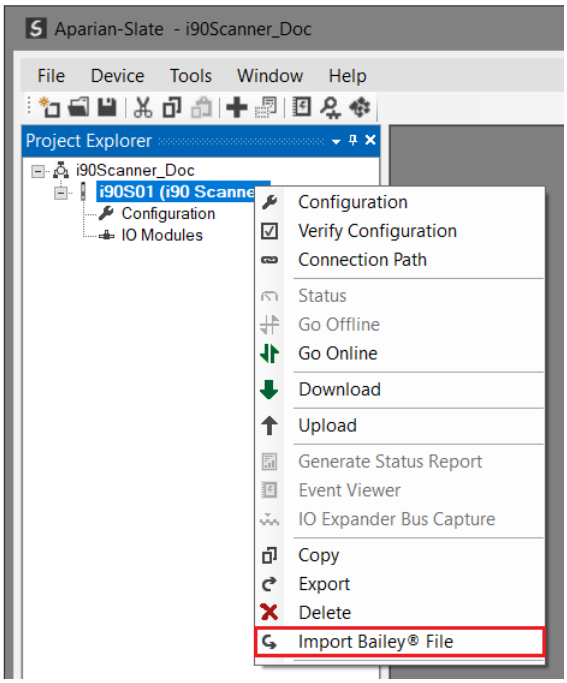


Figure 3.22 – Import Bailey Configuration File

Using the file open dialog, navigate to, and select the appropriate CSV file.

The Bailey configuration file will then be imported and a summary of the IO modules displayed in a table. The user is able to select which modules will be imported into the current i90 Scanner configuration. In the case of certain module classes, (e.g. 15 channel Analog Input), the user is able to select which specific module type to be instantiated.

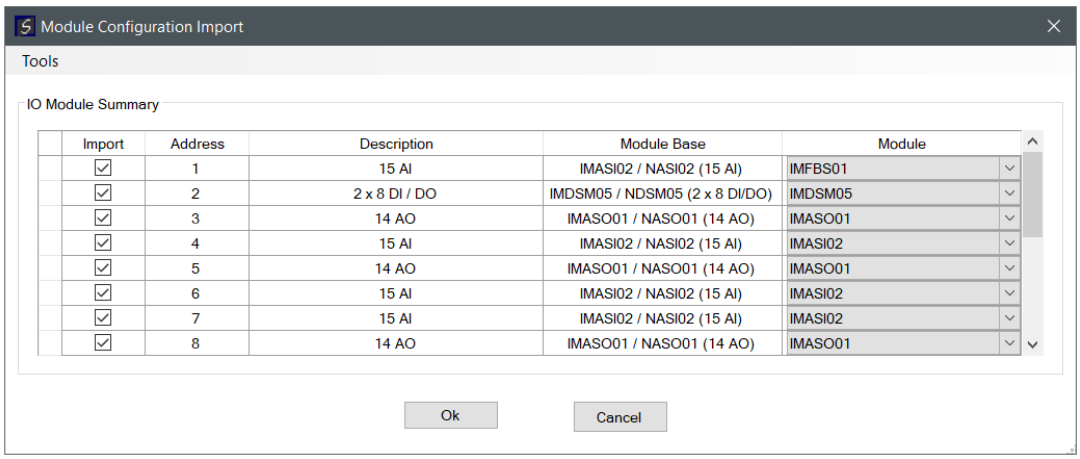


Figure 3.23 – Import IO Module Summary

A number of Import Summary tools are available under the ***Tools*** menu.

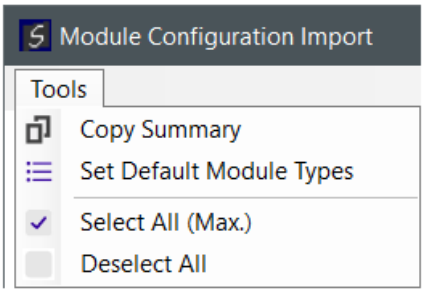


Figure 3.24 – Import Summary Tools

Copy Summary

This option copies a CSV formatted summary of all the import IO modules to the clipboard.

Set Default Module Types

This option allows the user to select which Analog Input modules should be used for the import.

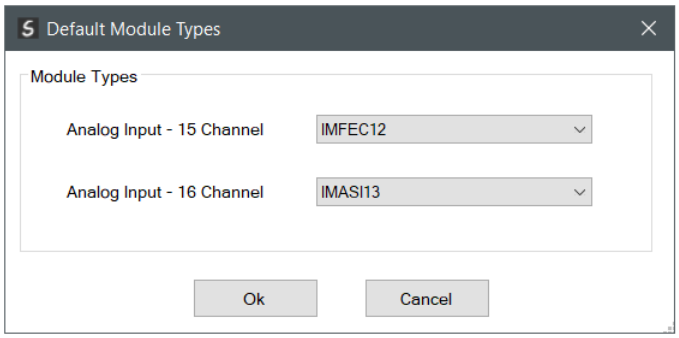


Figure 3.25 – Import – Default Module Selection

After selecting the ***Ok*** button, all the 15- and 16-channel Analog Input modules will be set to

the module types selected.

Select All (Max.)
This option selects the first 34 (max) IO modules.

Deselect All
This option deselects all the modules.

After pressing the ***Ok*** button, the selected IO modules will be imported into the i90 Scanner configuration.

3.7. REDUNDANCY

A pair of i90 Scanner modules can be configured to operate in a redundant (active / standby) architecture.

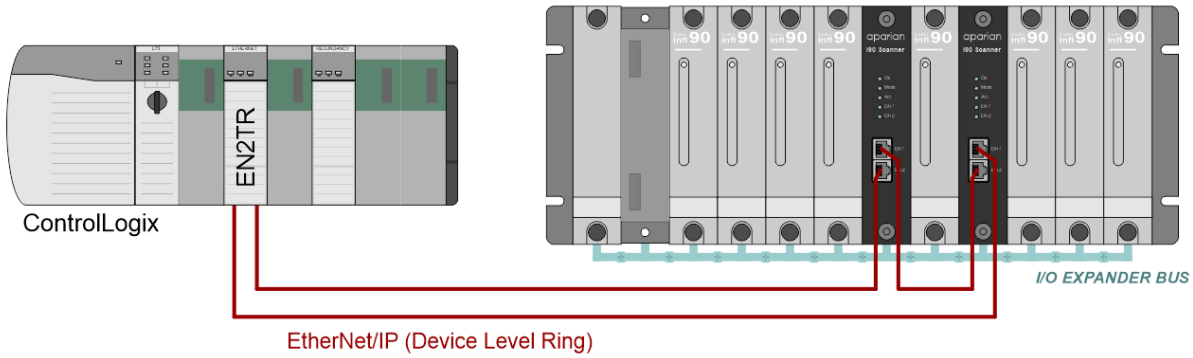


Figure 3.26 – i90 Scanner redundancy setup

When successfully configured, the i90 Scanner redundant pair will provide fault tolerant communication to the INFI 90® IO rack. If the following conditions occur, the standby i90 Scanner will take over the communication from the previous active i90 Scanner and become the active i90 Scanner:

- i90 Scanner is removed from the MMU (rack).
- Ethernet communication between the i90 Scanner and Logix is interrupted.
- i90 Scanner is disabled in Logix.

The configuration of a redundant pair of i90 Scanners is the same as that for a standalone i90 Scanner, except the ***Scanner Configuration*** is set to ***Redundant***, and both IP addresses (A&B) must be configured.

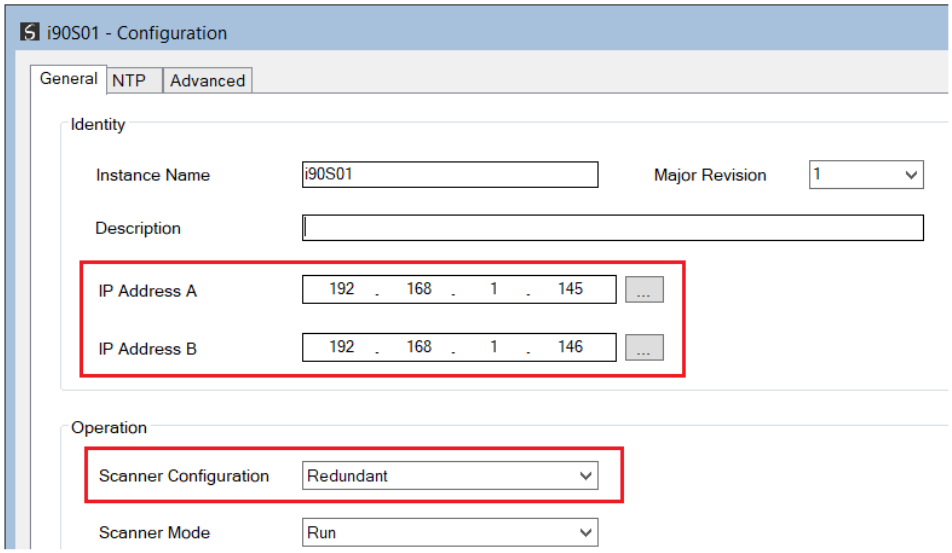


Figure 3.27 – i90 Scanner redundant configuration

When downloading the configuration, the Slate configuration utility will automatically download to both i90 Scanners.

3.8. EMULATION MODE

Emulation mode provides a mechanism to exchange data between the existing Bailey® CPU and a Logix controller.

This can be useful in certain phases of a migration project where communication between the legacy (Bailey®) controller and the newer Logix controller is required.

Not all module types are supported in this mode, and the type and maximum quantities of each are limited to the following:

8 x IMDSI02/NDSI02 – 16 Channel Digital Input
8 x IMDSO04/NDSO04 – 16 Channel Digital Output
1 x IMASI02/NASI02 – 15 Channel Analog Input
1 x IMASO01/NASO01 – 14 Channel Analog Output

NOTE: It is important that the Slave addresses of the configured modules do not conflict with any of the existing physical I/O modules. Failure to observe this will cause communication faults for these physical I/O modules and the i90 scanner virtual modules and may cause the Bailey® CPU to fault.

3.8.1. Virtual Input Modules

When the i90 Scanner has input modules configured, these appear to the Bailey® CPU as standard input modules (either IMDSI02 or IMASI02).

The Logix application code must write to the i90 Scanner as if these were output modules, and the data would appear in the Bailey® CPU as inputs.

For example, for a virtual Digital Input module (IMDSI02) located at Logix Index 0, the application code should address the 4th digital channel as follows:

i90EMU01Output.IOModule[0].DigitalOutputs.3

And, for a virtual Analog Input module (IMASI02) located at Logix Index 1, the application code should address the 6th analog channel as follows:

i90EMU01Output.IOModule[1].ChannelPV[5]

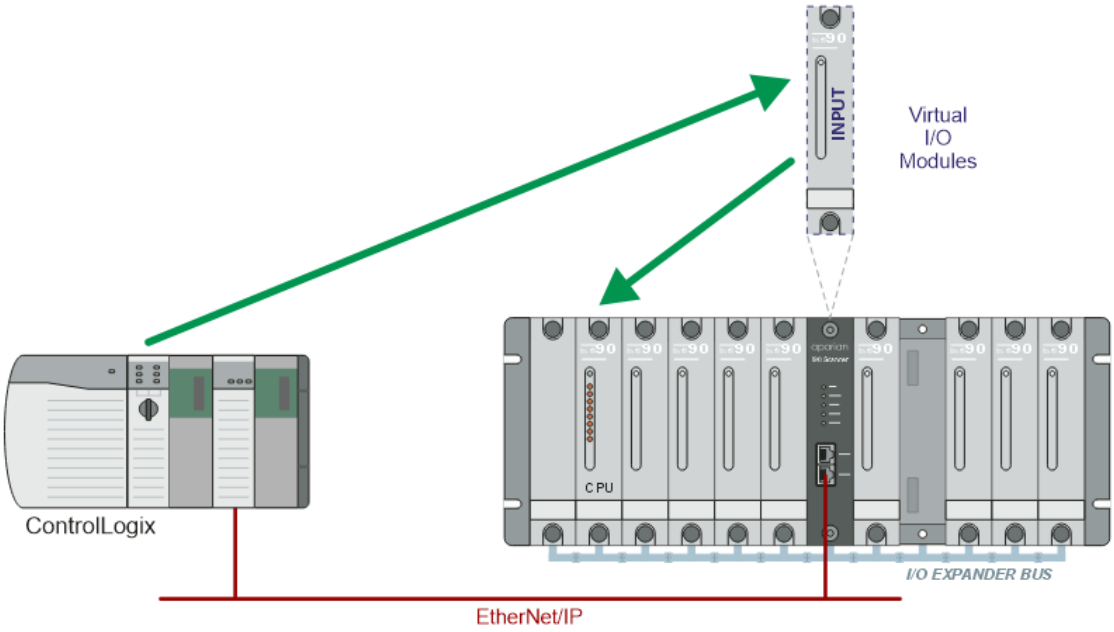


Figure 3.28 – i90 Scanner Emulation mode – Input module

3.8.2. Virtual Output Modules

When the i90 Scanner has output modules configured, these appear to the Bailey® CPU as standard output modules (either IMDSO04 or IMASO01).

The Logix application code must read the i90 Scanner as if these were input modules, and the data would be written by the Bailey® CPU as outputs.

For example, for a virtual Digital Output module (IMDSO04) located at Logix Index 2, the

application code should address the 5th digital channel as follows:

i90EMU01Input.IOModule[2].DigitalInputs.4

And, for a virtual Analog Output module (IMASI02) located at Logix Index 3, the application code should address the 8th analog channel as follows:

i90EMU01Input.IOModule[3].ChannelPV[7]

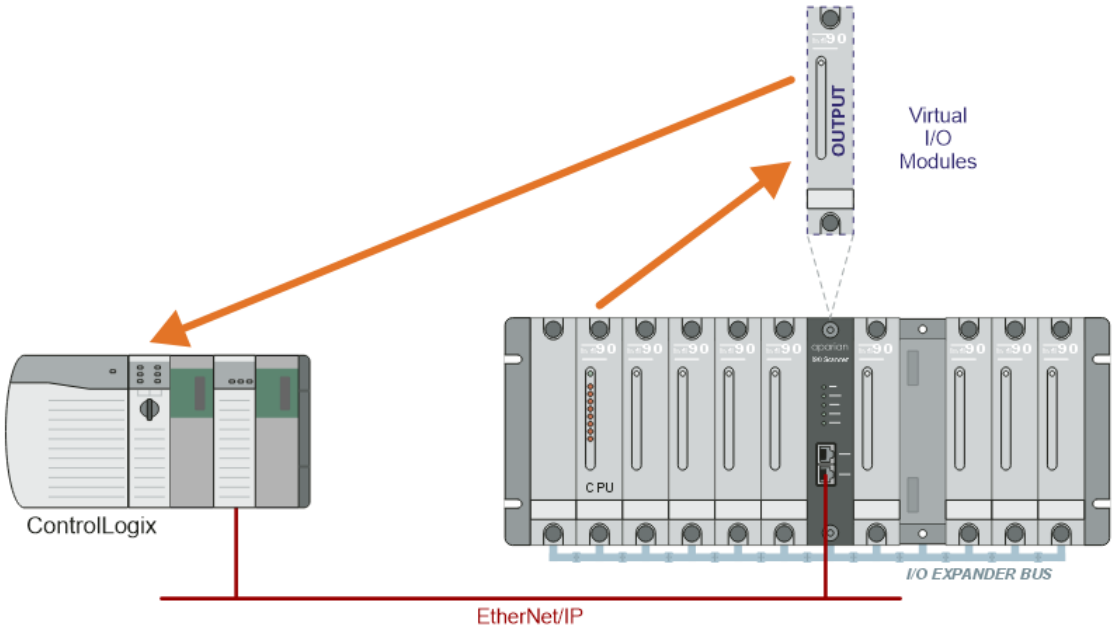


Figure 3.29 – i90 Scanner Emulation mode – Output module

3.9. MODULE DOWNLOAD

Once the configuration has been concluded, it must be downloaded to the i90 Scanner/s. 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 i90 Scanner is not on a local network.

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

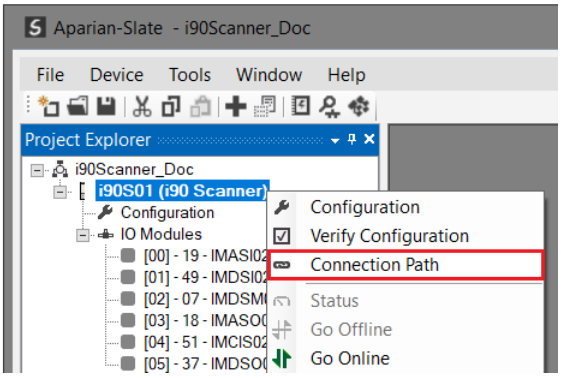


Figure 3.30 - Selecting Connection Path

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

NOTE: The ***Connection Path B*** is enabled only when the ***Redundant*** Scanner Configuration is selected.

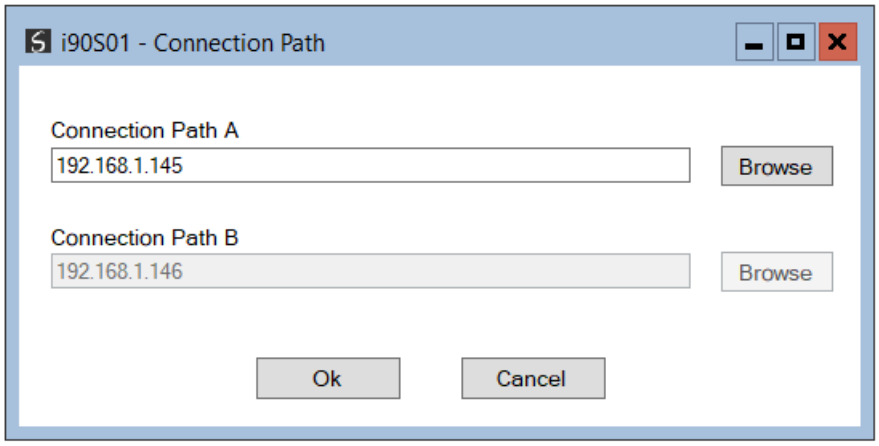


Figure 3.31 - Connection Path

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

NOTE: When the ***Redundant*** Scanner Configuration is selected, the user can download to either A, B, or both i90 Scanners. It is recommended that the user always download to ***Both Modules*** to avoid configuration conflicts.

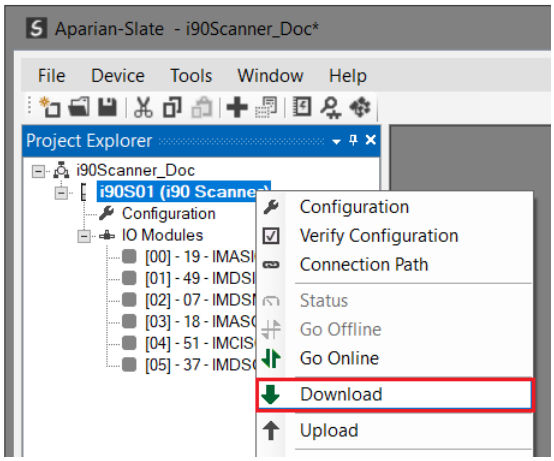


Figure 3.32 - Selecting Download

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

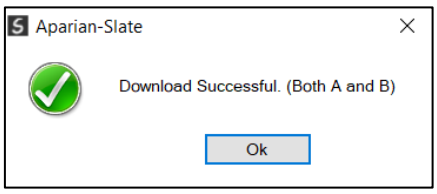


Figure 3.33 - Successful download

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.

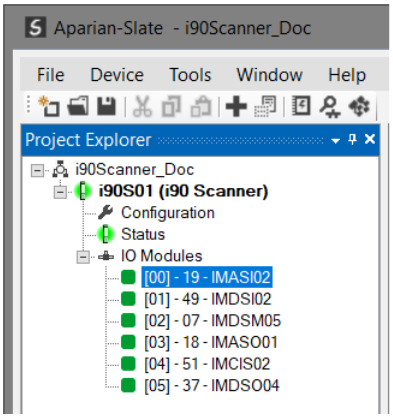


Figure 3.34 - Module online

3.10. STUDIO 5000 CONFIGURATION

NOTE: The minimum Studio 5000 version that can be used is v21. The i90 Scanner uses an EDS AOP to support multiple Class 1 connections.

3.10.1. ADD MODULE TO LOGIX I/O CONFIGURATION

Integration with the Logix family in Studio5000 makes use of the EDS AOP. Before the module can be added to the IO 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*** (within Studio 5000,) can be selected to complete the registration.

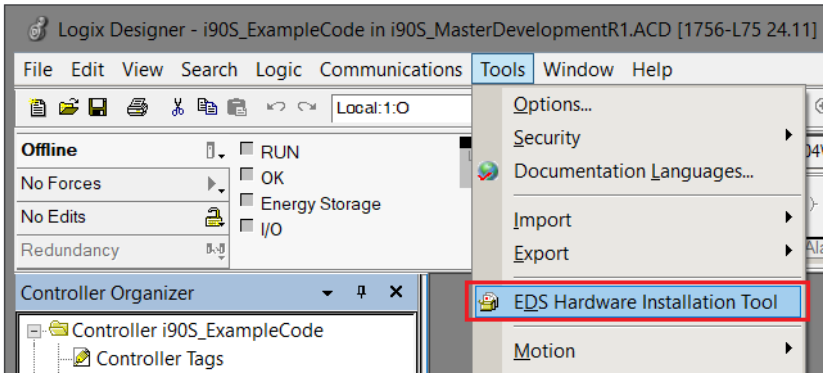


Figure 3.35 - EDS Hardware Installation Utility

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.

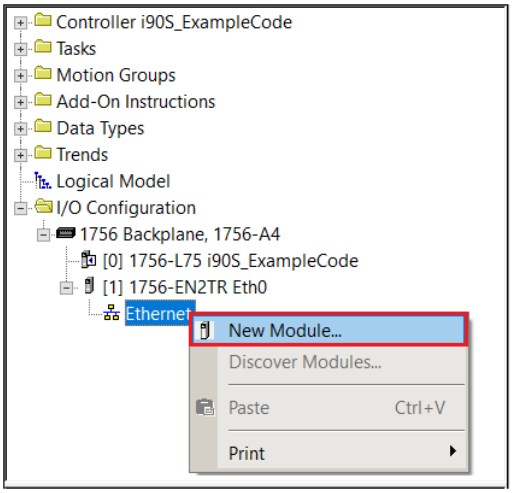


Figure 3.36 – Adding a module

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.

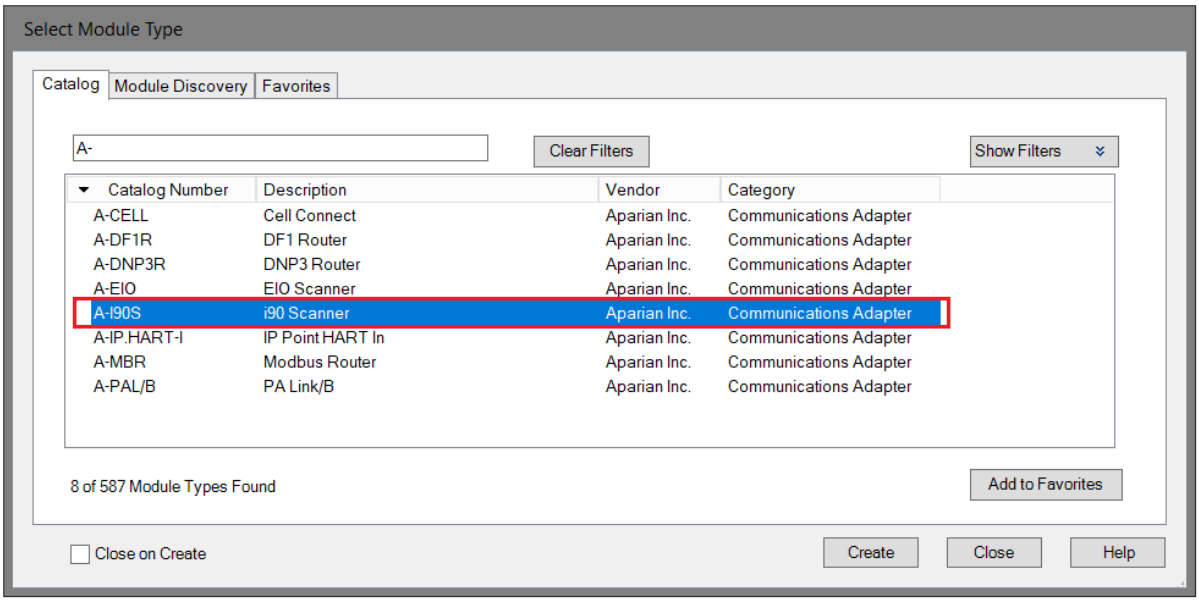


Figure 3.37 – Selecting the module

Locate and select the i90 Scanner module and select the ***Create*** option. The module configuration dialog will open, where the user must specify the ***Name*** and ***Ethernet (IP) Address*** as a minimum to complete the instantiation process.

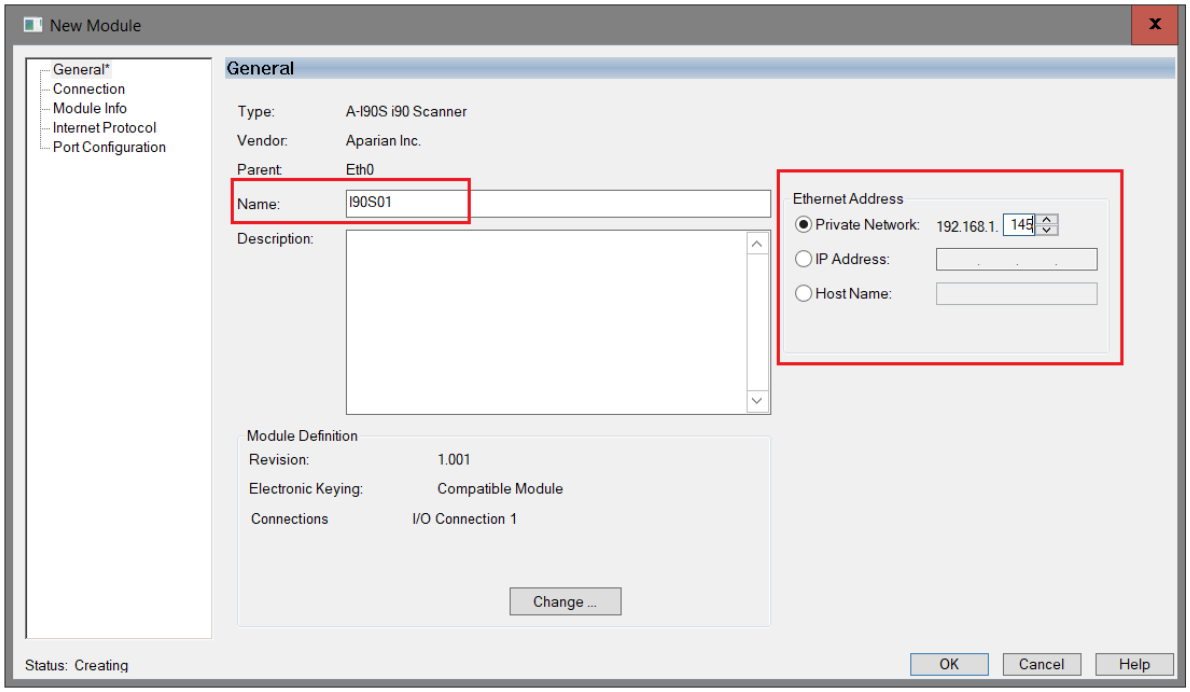


Figure 3.38 – Module instantiation

NOTE: The i90 Scanner requires **seven** Class 1 connections to the Logix controller to operate. The user will need to set this up as shown below or the module will not communicate with the i90 bus.

Select the ***Change*** button in the Module Definition to add more IO Connections to the EDS AOP.

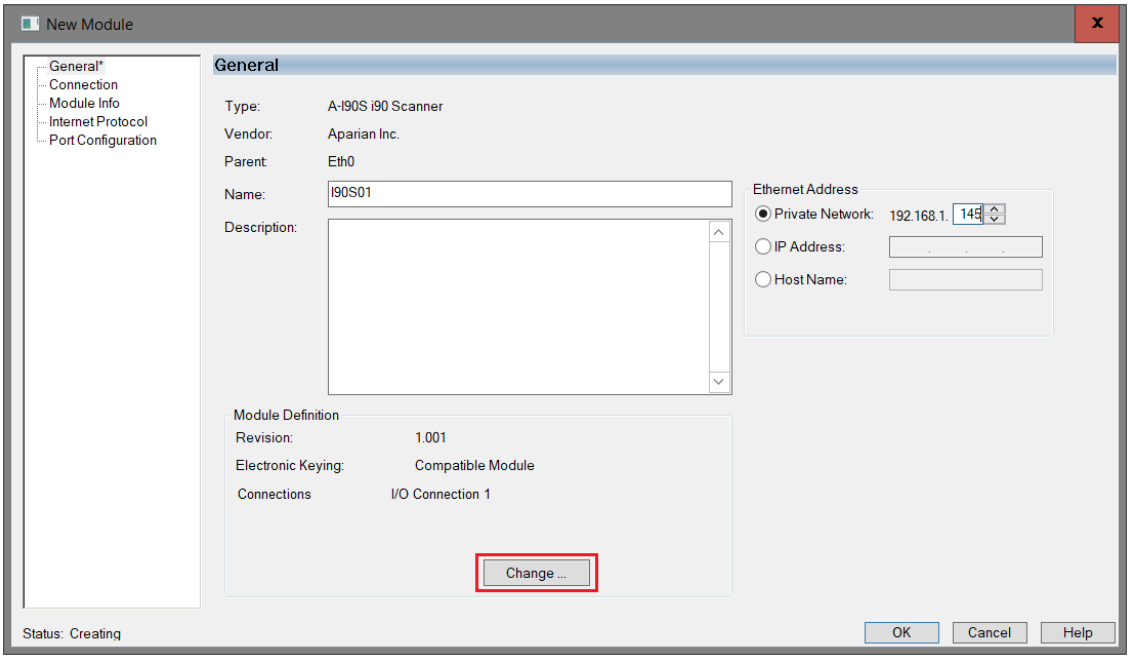


Figure 3.39 – Change the IO connections

Add all seven IO Connections to the EDS AOP Module Definition.

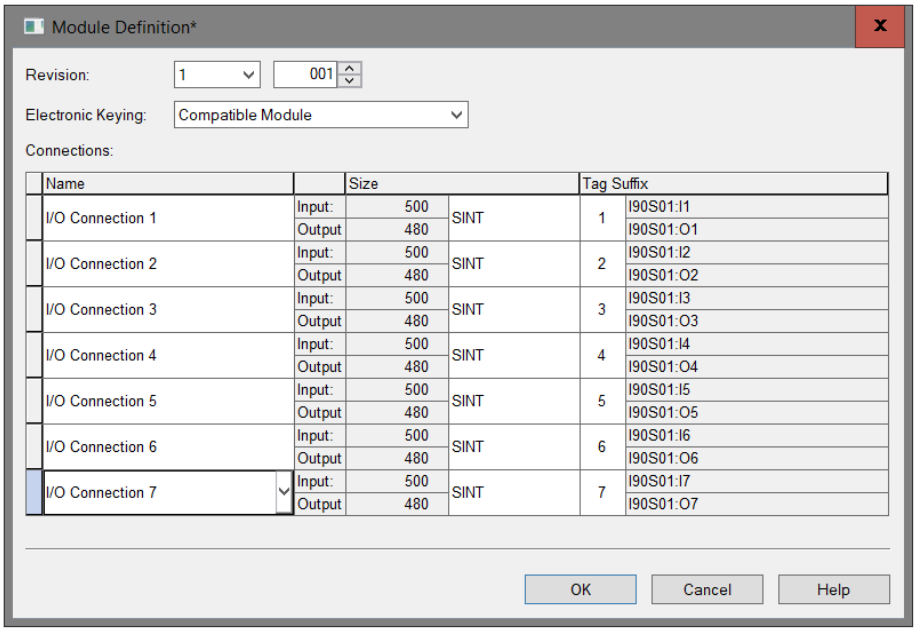


Figure 3.40 – Add IO Connection 2 through 7.

Once the instantiation is complete the module will appear in the Logix IO tree.

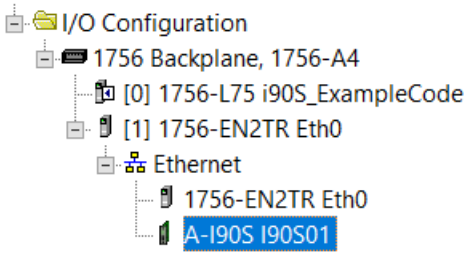


Figure 3.41 – Logix IO tree

When using a redundant i90 Scanner configuration, both the A and B i90 Scanner modules must be added in the Logix IO tree.

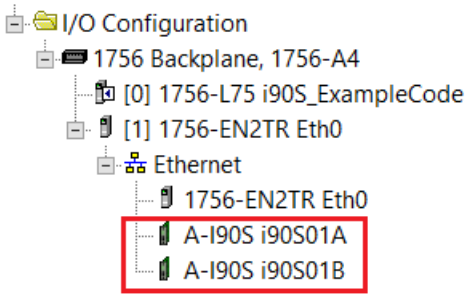


Figure 3.42 – Logix IO tree – Redundant i90 Scanner

3.10.2. Importing UDTs, AOIs and Mapping Routines

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

The example mapping routine import files (L5X) are available on the Aparian website:

- ***i90ScannerStandaloneMappingV2.L5X*** – Standalone Applications
- ***i90ScannerRedundantMappingV2.L5X*** – Redundant Applications

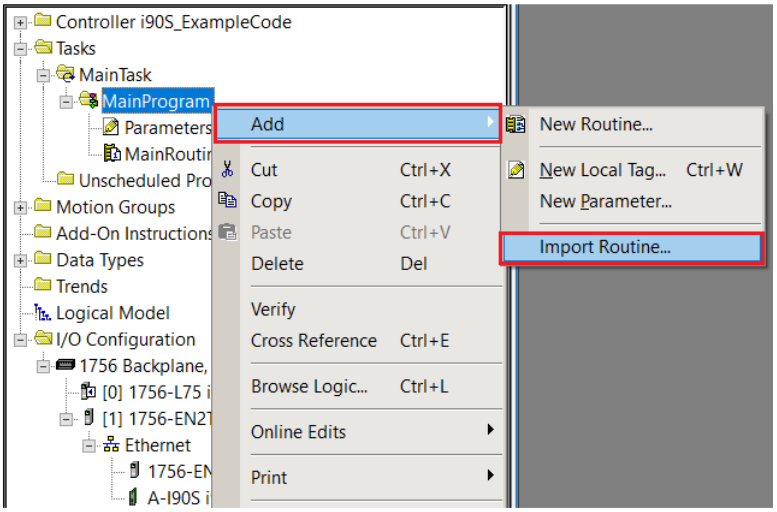


Figure 3.43 – Logix 5000 Importing i90 Scanner specific routine

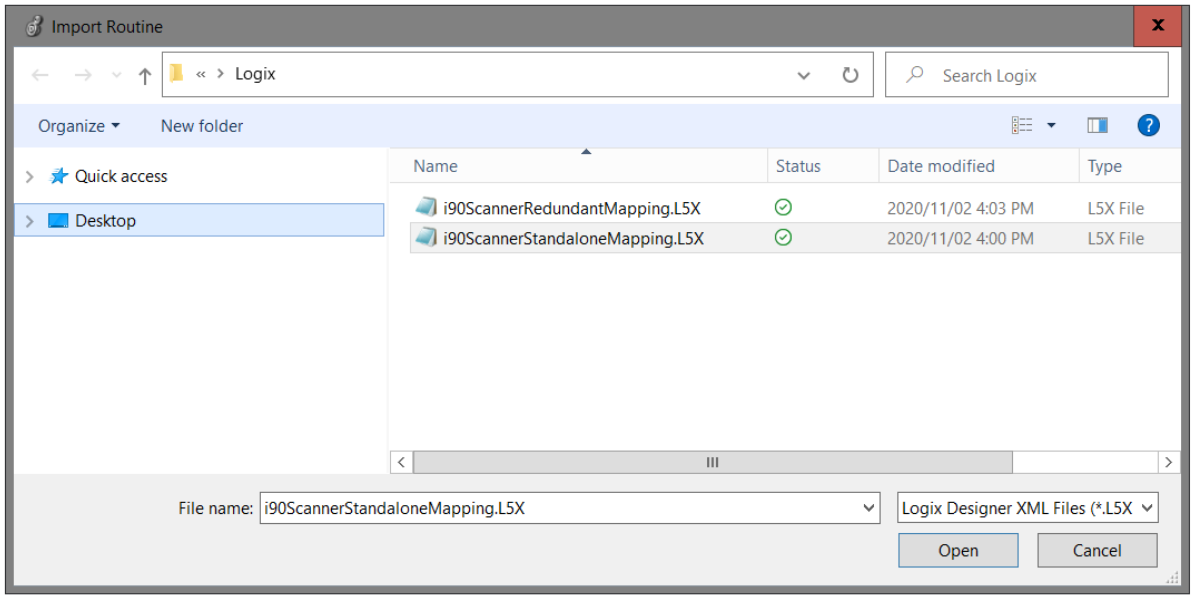


Figure 3.44 - Selecting partial import file

The import will create the following:

- The required UDTs (user defined data types)
- AOI (add on Instruction) definition.
- Controller (backing) tag for the AOI.
- A routine mapping the i90 Scanner modules to the AOI.

NOTE: The imported standalone example code assumes the i90 Scanner instance name is "**i90S01**". If this is not the intended name, then the imported tags and ladder code would need to be modified accordingly.

NOTE: The imported redundant example code assumes the i90 Scanner instance names are "**i90S01A**" and "**i90S01B**". If these are not the intended names, then the imported tags and ladder code would need to be modified accordingly.

The user will need to change the routine to map to the correct i90 Scanner modules instance names, and make sure that the mapping routine is called by the Program's Main Routine.

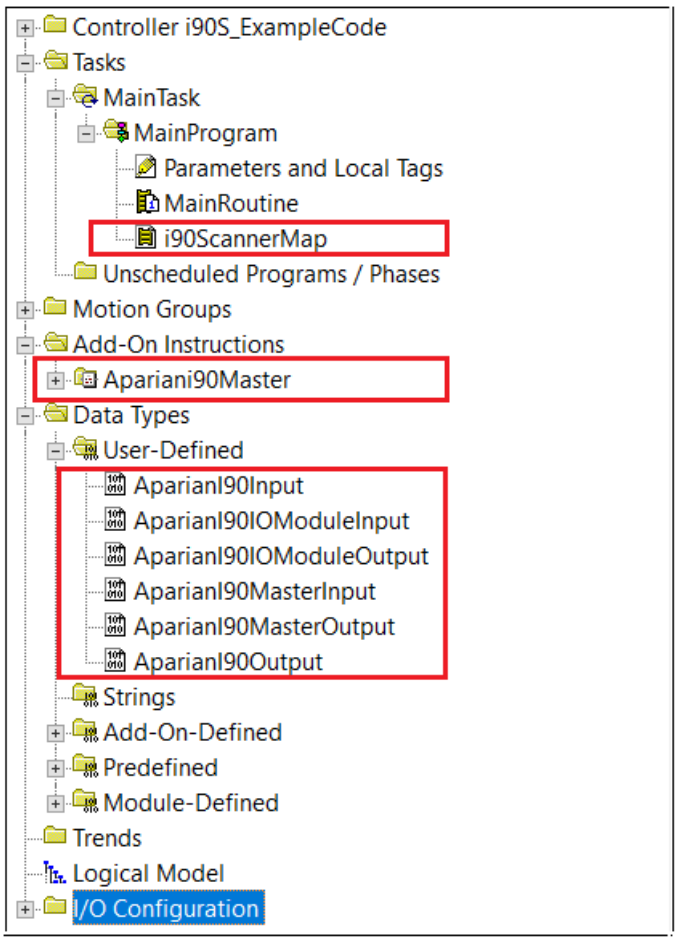


Figure 3.45 - Imported Logix 5000 objects

All the required mapping is facilitated by a single Add-On-Instruction (AOI).

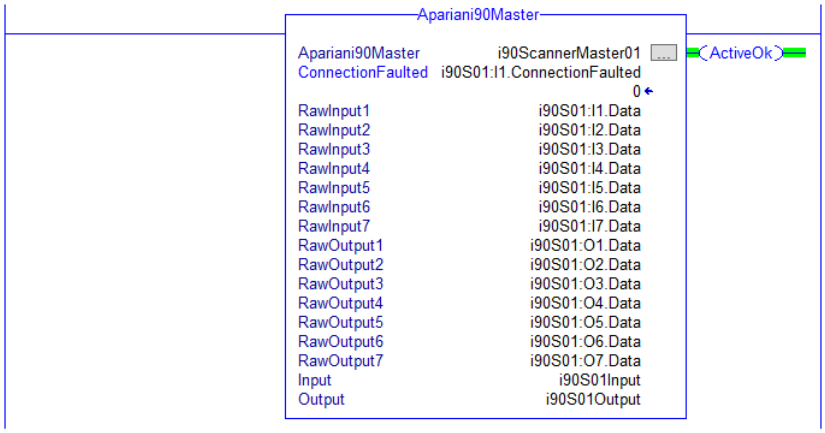


Figure 3.46 - Imported Standalone Mapping AOI

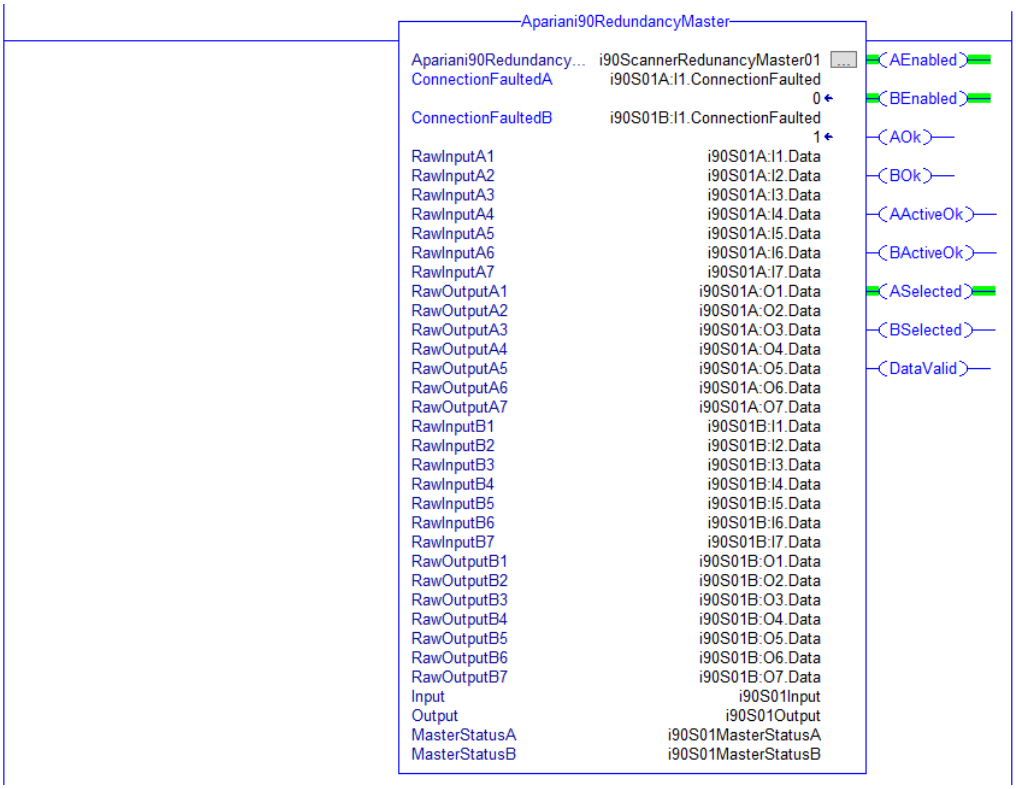


Figure 3.47 - Imported Redundant Mapping AOI

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

4. OPERATION

4.1. LOGIX 5000 - IO RACK TAG

Each i90 Scanner uses seven cyclic class 1 IO connections to exchange data with the Logix controller. An input and output assembly for each IO connection is exchanged at a fix interval (RPI). The AOI will map the seven connections from each i90 Scanner and manage the i90 Scanner redundancy to update a single tag (UDT) which will represent the INFI 90® IO system.

NOTE: It is recommended to use the default RPI of 50ms per Logix IO connection.

4.1.1. MASTER STATUS

The following parameters are used to provide the status of the i90 Scanner and the INFI 90® rack in which it resides.

Name	Value	Style	Data Type
i90S01Input	{...}		AparianI90Input
i90S01Input.Master	{...}		AparianI90MasterInput
i90S01Input.Master.ConfigValid	1	Decimal	BOOL
i90S01Input.Master.PLCRun	1	Decimal	BOOL
i90S01Input.Master.MasterControlDisable	0	Decimal	BOOL
i90S01Input.Master.RedundantCRCMismatch	0	Decimal	BOOL
i90S01Input.Master.OtherMasterActive	1	Decimal	BOOL
i90S01Input.Master.PFILineStatus	1	Decimal	BOOL
i90S01Input.Master.Owned	1	Decimal	BOOL
i90S01Input.Master.RedundancyEnabled	0	Decimal	BOOL
i90S01Input.Master.RedundancyStatus	1	Decimal	BOOL
i90S01Input.Master.DataValid	0	Decimal	BOOL
i90S01Input.Master.ConfigCRC	16#7261	Hex	INT
i90S01Input.Master.Reserved0	0	Decimal	INT
i90S01Input.Master.TransactionRate	78	Decimal	INT
i90S01Input.Master.SwitchOverTimeOut	50	Decimal	INT
i90S01Input.Master.LiveList0to31	786560	Decimal	DINT
i90S01Input.Master.LiveList32to63	655392	Decimal	DINT
i90S01Input.Master.BusTx	8838	Decimal	DINT
i90S01Input.Master.BusRx	8539	Decimal	DINT
i90S01Input.Master.TakeOverCount	0	Decimal	DINT
i90S01Input.Master.BusQuiet	0	Decimal	DINT
i90S01Input.Master.NoResponse	32	Decimal	DINT
i90S01Input.Master.ChksumFailed	0	Decimal	DINT
i90S01Input.IOModule	{...}		AparianI90IOModuleInput[34]

Figure 4.1 – Status section of the Master (Input) Tag

Parameter	Data Type	Description
ConfigValid	BOOL	The active i90 Scanner has valid configuration.
PLCRun	BOOL	Indicates the module's perspective of the controller's RUN status.
MasterControlDisable	BOOL	Indicates that the Scanner has been disabled. (Logix Control)
RedundantCRCMismatch	BOOL	Indicates that the configuration in the A and B redundant pair are not identical.
OtherMasterActive	BOOL	Indicates that another bus master is active.
PFILineStatus	BOOL	Indicates the status of the Power Failure bus line.
Owned	BOOL	The active i90 Scanner is owned by the Logix Controller.
RedundancyEnabled	BOOL	Indicates that scanner redundancy has been enabled in the current configuration.
RedundancyStatus	BOOL	Indicates that current scanner is the Active scanner in the pair.
DataValid	BOOL	Indicates that the data received from the i90 Scanner is up-to-date and valid. This bit is set by the AOI (not the module) and is based on the ConnectionStatus, ConfigValid, and OwnedStatus of the Active master.
ConfigCRC	INT	The configuration signature of the active i90 Scanner. This must match that of the standby i90 Scanner to ensure both i90 Scanners have the same configuration.
Reserved0	INT	Reserved for future use.
TransactionRate	INT	The number of bus transaction completed in the last 1 second interval.
SwitchOverTimeOut	INT	The current maximum allowed time (milliseconds) to complete a changeover between redundant i90 Scanners. During this time the input data will be frozen.
LiveList0to31	DINT	The live list of the physical module addresses 0-31. Each bit of the 32bit DINT represents a hardware address (DIP switch). For example, **Bit-0** is Set – the IO module at address **0** is **Ok** **Bit-1** is not Set – the IO module at address **1** is **NOT Ok**
LiveList32to63	DINT	The live list of the physical module addresses 32-63.
BusTx	DINT	The number of transmitted bus packets
BusRx	DINT	The number of received bus packets
TakeOverCount	DINT	The number of occurrences where the i90 Scanner has taken over the Active Bus Master role.
BusQuiet	DINT	The number of occurrences where no bus activity has been detected.

NoResponse	DINT	The number of request packets sent that yielded no reply.
ChksumFailed	DINT	The number of received bus packets that failed the packet checksum.

Table 4.1 – Parameters for Status part of Rack Tag

4.1.2. Master Control

The following parameters are used to provide the master control data to the i90 Scanner:

Name	Value	Style	Data Type
⊟ i90S01Output	{...}		AparianI90Output
⊟ i90S01Output.Master	{...}		AparianI90MasterOutput
⊞ i90S01Output.Master.MasterControl	0	Decimal	INT
⊞ i90S01Output.Master.PartnerConfigCRC	16#0000	Hex	INT
⊞ i90S01Output.IOModule	{...}		AparianI90IOModuleOutput[34]

Figure 4.2 – Control section of the Master Rack Tag

Parameter	Data Type	Description
MasterControl	INT	Master Control Command Bit 0 – Disable (0 = Normal, 1 = Disable)
PartnerConfigCRC	INT	Configuration CRC of the partner i90 Scanner module. **NOTE:** This is set by the AOI.

4.1.3. IO Module Inputs

The following parameters are used to provide the status and input data of each configured IO module:

⊟ i90S01Input	{...}	ApparianI90Input
⊞ i90S01Input.Master	{...}	ApparianI90MasterInput
⊟ i90S01Input.IOModule	{...}	ApparianI90IOModuleInput[34]
⊞ i90S01Input.IOModule[0]	{...}	ApparianI90IOModuleInput
⊞ i90S01Input.IOModule[1]	{...}	ApparianI90IOModuleInput
⊞ i90S01Input.IOModule[2]	{...}	ApparianI90IOModuleInput
⊞ i90S01Input.IOModule[3]	{...}	ApparianI90IOModuleInput
⊟ i90S01Input.IOModule[4]	{...}	ApparianI90IOModuleInput
⊞ i90S01Input.IOModule[4].SlaveAddress	51	SINT
i90S01Input.IOModule[4].Online	1	BOOL
i90S01Input.IOModule[4].Running	1	BOOL
i90S01Input.IOModule[4].Error	0	BOOL
i90S01Input.IOModule[4].ConfigMismatch	0	BOOL
i90S01Input.IOModule[4].Reference1Err	0	BOOL
i90S01Input.IOModule[4].Reference2Err	0	BOOL
⊞ i90S01Input.IOModule[4].LowLevelStatus	16#5f5f	INT
⊞ i90S01Input.IOModule[4].DigitalStatus	0	DINT
⊞ i90S01Input.IOModule[4].DigitalInputs	2#0000_0000_0000_0000_0000_0000_0000_0000	DINT
i90S01Input.IOModule[4].Reference1	0.999	REAL
i90S01Input.IOModule[4].Reference2	4.985	REAL
⊞ i90S01Input.IOModule[4].ChannelStatus	{...}	SINT[16]
⊟ i90S01Input.IOModule[4].ChannelPV	{...}	REAL[16]
i90S01Input.IOModule[4].ChannelPV[0]	22.99	REAL
i90S01Input.IOModule[4].ChannelPV[1]	43.075	REAL
i90S01Input.IOModule[4].ChannelPV[2]	0.5	REAL
i90S01Input.IOModule[4].ChannelPV[3]	58.6	REAL
i90S01Input.IOModule[4].ChannelPV[4]	0.0	REAL
i90S01Input.IOModule[4].ChannelPV[5]	0.0	REAL

Figure 4.3 – Input data provided from each IO module

Parameter	Datatype	Description
SlaveAddress	BOOL	The i90 IO module's physical address (0-63) configured by its onboard DIP switches.
Online	BOOL	Indicates that the i90 IO module is online. (Communicating on the bus).
Running	BOOL	Indicates that the i90 IO module is running and exchanging data.
Error	BOOL	Indicates the i90 IO module is in an error state.
ConfigMismatch	BOOL	Indicates that the configuration is invalid and does not match the physical i90 IO Module DIP switches.
Reference1Err	BOOL	Indicates that the Internal Reference 1 is out of acceptable limits. **NOTE:** This is only applicable for certain Analog i90 IO modules.
Reference2Err	BOOL	Indicates that the Internal Reference 2 is out of acceptable limits. **NOTE:** This is only applicable for certain Analog i90 IO modules.
LowLevelStatus	INT	Indicates the module's low-level status. The hexadecimal value is module specific.
DigitalStatus	DINT	This is currently reserved.
DigitalInputs	DINT	Indicates the current value of each digital input, (or digital output readback in the case of a digital output module).

		Each bit represents a digital point. **NOTE:** This is only applicable for digital or combination modules.
Reference1	REAL	Indicates the IO Module's Internal Reference 1. **NOTE:** This is only applicable for certain Analog module.
Reference2	REAL	Indicates the IO Module's Internal Reference 2. **NOTE:** This is only applicable for certain Analog module.
ChannelStatus[16]	SINT[16]	Indicates the channel status for each Analog channel. Bit 0 – Indicates channel error (0= Normal, 1=Fault) **NOTE:** This is only applicable for Analog modules.
ChannelPV[16]	REAL[16]	Indicates the Analog value for each input channel. In the case of an Analog output module provides the readback value. **NOTE:** This is only applicable for Analog modules.

Table 4.2 - Parameters for Module Input



WARNING: When making use of the IO module data in Logix application code it is important that the user makes use of both the master's ***DataValid*** bit as well as the relevant IO module's Online and ***Running*** bits.

4.1.4. Module Outputs

The following parameters are used to provide the output for each configured IO module.

Name	Value	Style	Data Type
i90S01Output	{...}		AparianI90Output
i90S01Output.Master	{...}		AparianI90MasterOutput
i90S01Output.IOModule	{...}		AparianI90IOModuleOutput[34]
i90S01Output.IOModule[0]	{...}		AparianI90IOModuleOutput
i90S01Output.IOModule[1]	{...}		AparianI90IOModuleOutput
i90S01Output.IOModule[2]	{...}		AparianI90IOModuleOutput
i90S01Output.IOModule[3]	{...}		AparianI90IOModuleOutput
i90S01Output.IOModule[4]	{...}		AparianI90IOModuleOutput
i90S01Output.IOModule[4].ModuleControl	0	Decimal	DINT
i90S01Output.IOModule[4].DigitalOutputs	5	Decimal	DINT
i90S01Output.IOModule[4].ChannelControl	{...}	Decimal	SINT[16]
i90S01Output.IOModule[4].ChannelPV	{...}	Float	REAL[16]
i90S01Output.IOModule[4].ChannelPV[0]	50.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[1]	75.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[2]	0.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[3]	0.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[4]	0.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[5]	0.0	Float	REAL
i90S01Output.IOModule[4].ChannelPV[6]	0.0	Float	REAL

Figure 4.4 – Output data provided for each input card

Parameter	Datatype	Description
ModuleControl	INT	Module control command. Reserved for future.
DigitalOutputs	INT	The value of the digital outputs being sent to the IO module. Each bit represents a digital channel. **NOTE:** This is only applicable for Digital Output Modules.
ChannelControl[16]	SINT[16]	Channel control command. Used for (IMDSM04) Pulse Input module, where: Bit 0: 0 = Normal, 1= Counter Reset Bit 1: 0 = Normal, 1 = Counter Hold
ChannelPV[16]	REAL[16]	The value of the Analog outputs being sent to the IO module. **NOTE:** This is only applicable for Analog output modules.

Table 4.3 - Parameters for Module Output

5. DIAGNOSTICS

5.1. LEDS

The module provides five LEDs for diagnostics purposes as shown in the front view figure below.

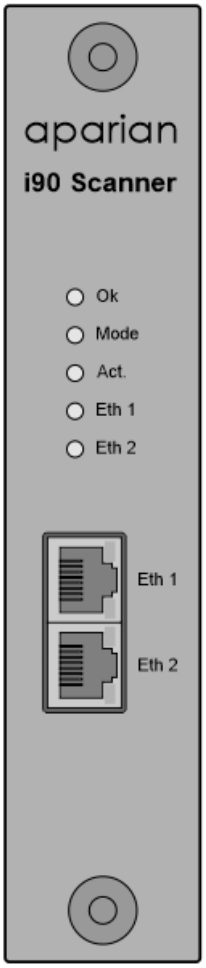


Figure 5.1 – i90 Scanner front view

A description of each LED is given in the table below.

LED	Description
Ok	The module LED will provide information regarding the system-level operation of the module. If the LED is briefly **flashing red**, and then returning to either flashing green or solid green, then there is a duplicate IP address on the Ethernet network similar to that of the local module. If the LED is **red**, then the module is not operating correctly. For example, if the module

	application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is **green (flashing)**, then the module has booted and is running correctly **without** any application configuration loaded. If the LED is **green (solid)**, then the module has booted and is running correctly **with** application configuration loaded.
Mode	Mode LED will provide an indication of the status of the connection to the redundant i90 Scanner partner. **Flashing Green** – The i90 Scanner is in Standby or has been disabled by the Logix output assembly. **Solid Green** – The i90 Scanner is Active and is the current i90 IO Bus master.
Act	The Activity (Act) LED will provide an indication of the IO Bus activity. **Flashing Red** – The i90 Scanner has received an invalid response from an IO module. **Flashing Green** – The i90 Scanner has received a valid response from an IO module.
Eth 1 Eth 2	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic is detected. This module has two Ethernet ports A and B. Each LEDs represents each specific port.

Table 5.1 - Module LED operation

5.2. MODULE STATUS MONITORING IN SLATE

The i90 Scanner provides various statistics which can assist with module operation, maintenance, and fault finding. The statistics can be accessed in full by Slate or using the web server in the module.

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

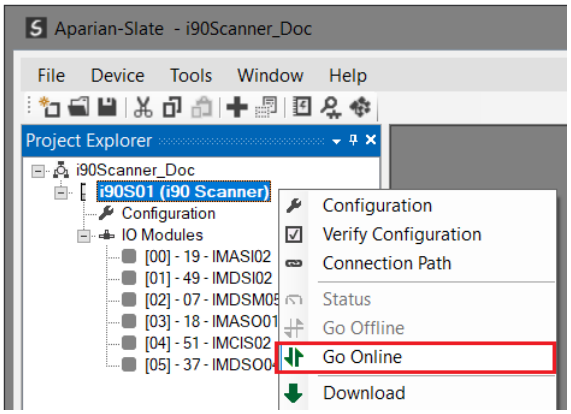


Figure 5.2 - Selecting to Go Online

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

5.2.1. Project Tree Status

The Slate project tree provides status information by employing various icon colours. The online project tree differs for Standalone and Redundant i90 Scanner configurations.

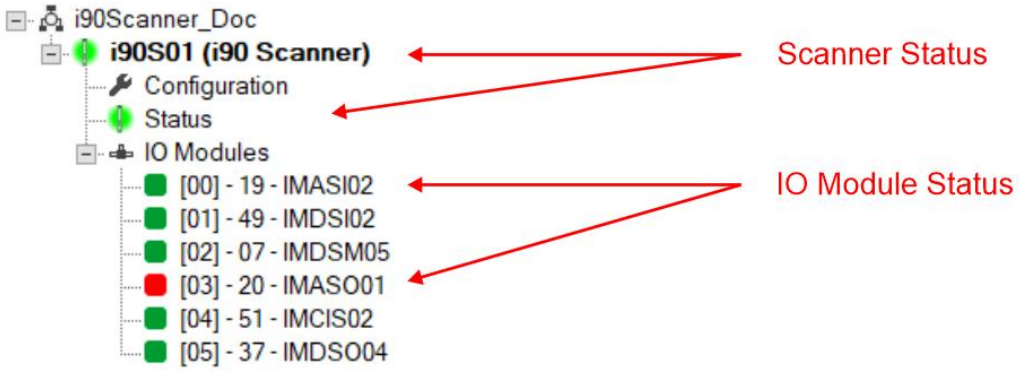


Figure 5.3 – Project Explorer Online Status - Standalone

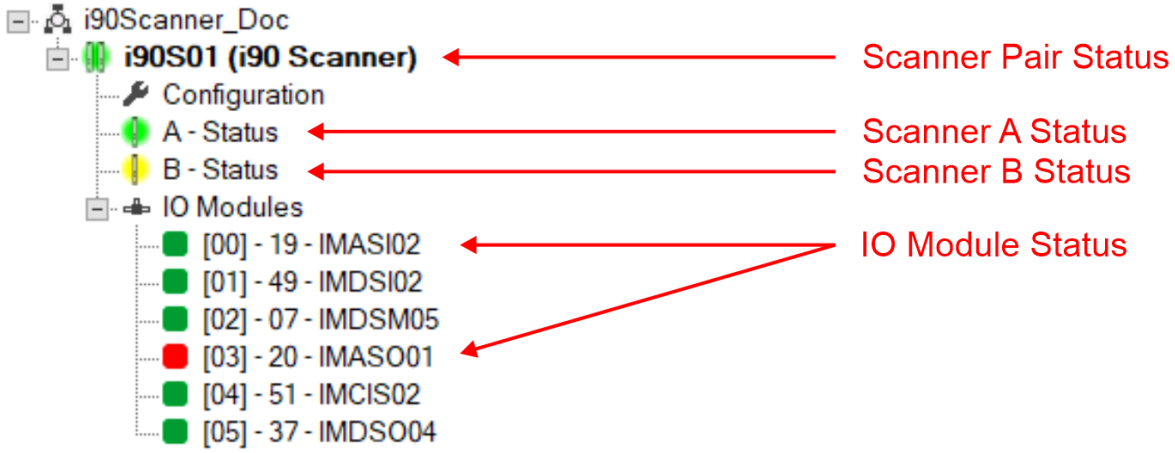


Figure 5.4 – Project Explorer Online Status - Redundant

The status of the individual A and B i90 Scanners is illustrated as follows:

Icon	Description
	Offline

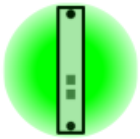
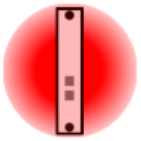
	Online and Active
	Online and Disabled
	Online and Standby (Redundant mode)
	Offline – Scanner was disconnected when previously online.

Table 5.2 – Scanner Status

The status of the i90 Scanner pair (redundant mode) is illustrated as follows:

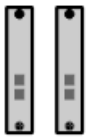
Icon	Description
	Offline
	Online (Both Scanners connected)
	Online – Partially (Only one of the scanners connected)
	Offline – Scanners were disconnected when previously online.

Table 5.3 – Scanner Pair Status

The status of the i90 IO modules is illustrated as follows:

Icon	Description
	i90 Scanner Offline or IO Module Disabled
	Module Configured, Online with no Error
	Module Configured, Online but reporting an Error.
	Module Offline (missing or incorrect address)

Table 5.4 – IO Module Status

5.2.2. SCANNER STATUS

The Status monitoring window can be opened by either double-clicking on the ***A-Status*** or ***B-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.

NOTE: When the user selects the *Status* option when right-clicking on a redundant pair it will open the active i90 Scanner.

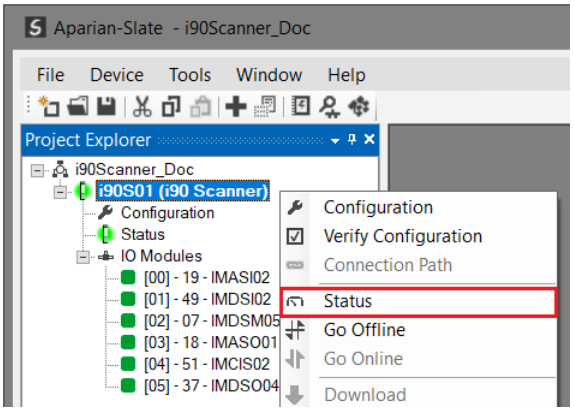


Figure 5.5 - Selecting online Status

5.2.2.1. SCANNER STATUS - GENERAL

The General tab displays the operational status of the i90 Scanner.

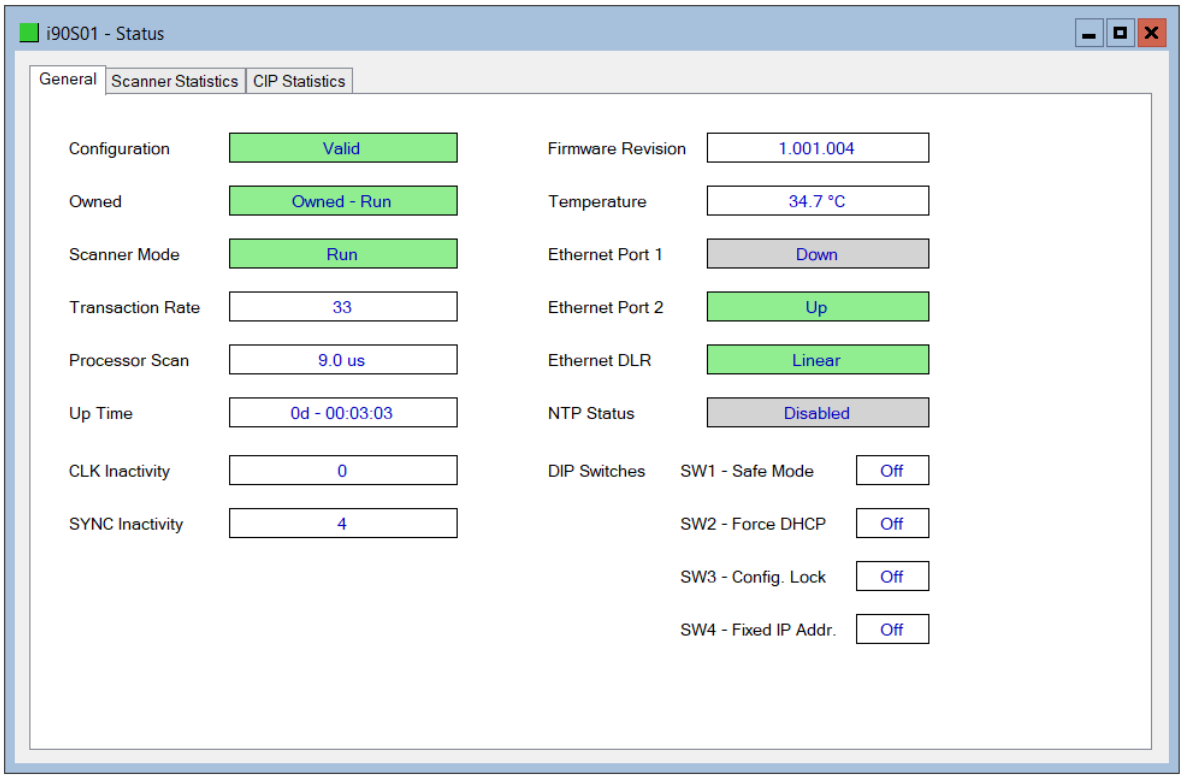


Figure 5.6 - Status monitoring – Active – General

The General tab displays the following general parameters:

Parameter	Description
Configuration	Indicates whether or not the module configuration is valid, and, in the case of a redundant system, whether or not the configuration of the two scanners match. **Valid** Configuration is valid. **Valid – Partner Match** Configuration is valid and the partner module has the same configuration. **Valid – Partner Mismatch** Configuration is valid and the partner module does not have the same configuration. **Invalid** The configuration loaded is not valid or corrupt.
Owned	Indicates whether or not the module is currently owned (Class 1) by a Logix controller and the mode of that controller. **Owned – Run** The module is owned by the Logix controller and the Logix controller is in run mode. **Owned – Program** The module is owned by the Logix controller and the Logix controller is in run mode.

	Not Owned The module does not have a class 1 EtherNet/IP connection to the controller.
Scanner Mode	The current mode of the i90 Scanner: **Disabled** This mode is used to disable all communication on the IO Expander Bus. **Shadow** In Shadow mode, the i90 Scanner only listens on the Expander bus and provides the I/O Module inputs and output read-back data to Logix. The outputs are still controlled by the existing Bailey® CPU. **Run** In Run mode, the i90 Scanner is the master of the IO Expander bus. It configures and controls the I/O modules. **Standby** (Redundant system) In Standby mode, the module is configured and ready, but not communicating as it is the standby Master in case of the failure of the primary i90 IO Master.
Transaction Rate	The number of bus transactions completed per second.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
Up Time	Indicates the elapsed time since the module was powered-up.
CLK Inactivity	The number of detected occurrences of no Bus Clock activity.
SYNC Inactivity	The number of detected occurrences of no Bus Sync activity.
Firmware Revision	The firmware revision of the module.
Temperature	The internal temperature of the module.
Ethernet Port 1/2	This is the status of each Ethernet port. **Down** The Ethernet connector has **not been** successfully connected to an Ethernet network. **Up** The Ethernet connector has successfully connected to an Ethernet network.
NTP Status	The status of the connection to the configured Network Time Protocol server.
DIP Switch Position	The status of the DIP switches when the module booted. Note that this status will not change if the DIP switches are altered when the module is running.

Table 5.5 - Parameters displayed in the Status Monitoring – General Tab

5.2.2.2. SCANNER STATUS – SCANNER STATISTICS

The Scanner Statistics tab displays the overall Scanner bus communication statistics.

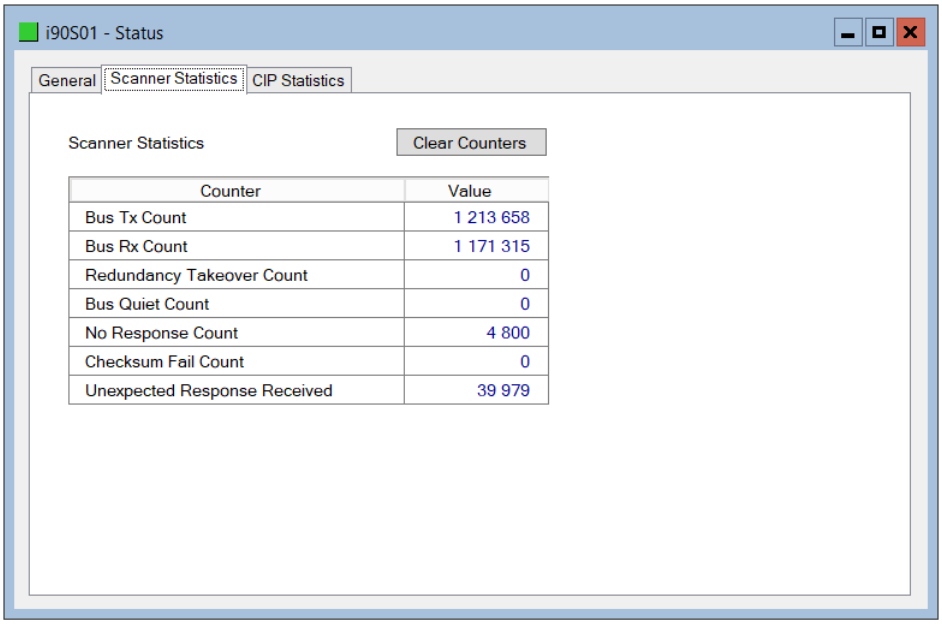


Figure 5.7 - Status monitoring – Scanner Statistics

Parameter	Description
Bus Tx Count	The number of transmitted bus packets.
Bus Rx Count	The number of received bus packets.
Redundancy Takeover Count	The number of occurrences where the i90 Scanner has taken over the Active Bus Master role.
Bus Quiet Count	The number of occurrences where no bus activity has been detected.
No Response Count	The number of request packets sent that yielded no reply.
Checksum Fail Count	The number of received bus packets that failed the packet checksum.
Unexpected Response Received	The number of unexpected responses received. These responses do not match the previous request.

Table 5.6 – Rack Status

5.2.2.3. SCANNER STATUS - CIP STATISTICS

The i90 Scanner provides Common Industrial Protocol (CIP) communication statistics as shown below:

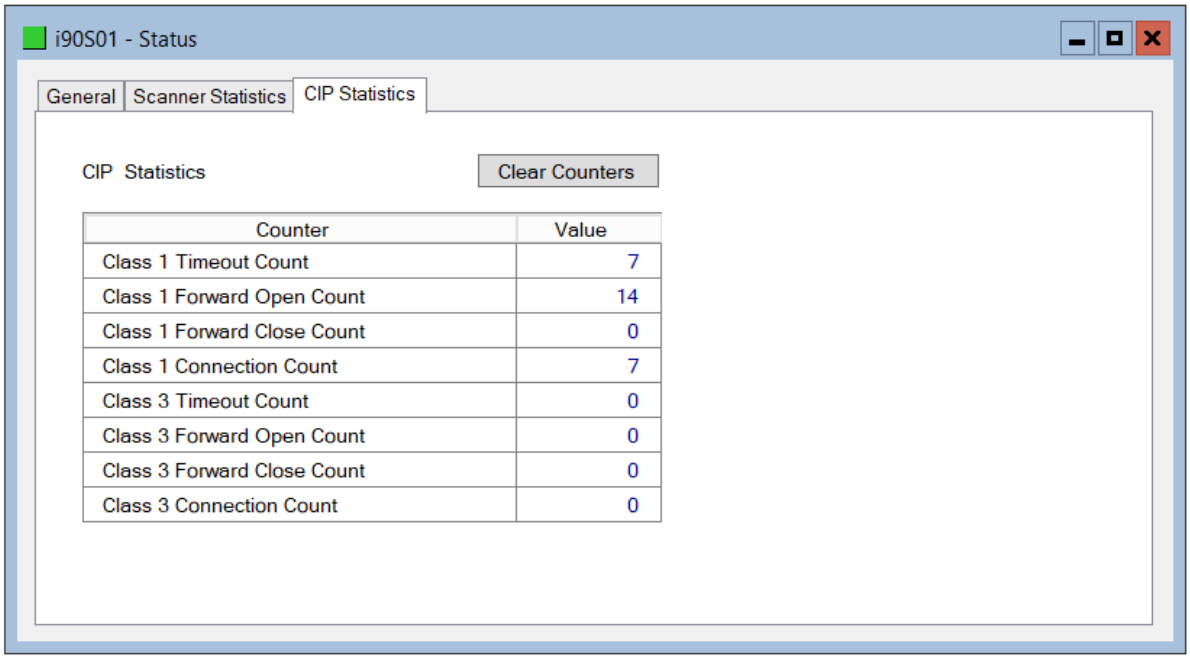


Figure 5.8 - Status monitoring – CIP Statistics

Statistic	Description
Class 1 Timeout Count	Number of occurrences a Class 1 connection has timed out.
Class 1 Forward Open Count	Number of Class 1 Connection establish attempts.
Class 1 Forward Close Count	Number of Class 1 Connection close attempts.
Class 1 Connection Count	Number of Class 1 Connections currently active.
Class 3 Timeout Count	Number of occurrences a Class 3 connection has timed out.
Class 3 Forward Open Count	Number of Class 3 Connection establish attempts.
Class 3 Forward Close Count	Number of Class 3 Connection close attempts.
Class 3 Connection Count	Number of Class 3 Connections currently active.

Table 5.7 – CIP statistics

5.2.1. IO MODULE STATUS

The IO Module Status monitoring window can be opened by right-clicking on the specific IO Module and selecting ***Status***. The status window contains multiple tabs to display the current status of the module.

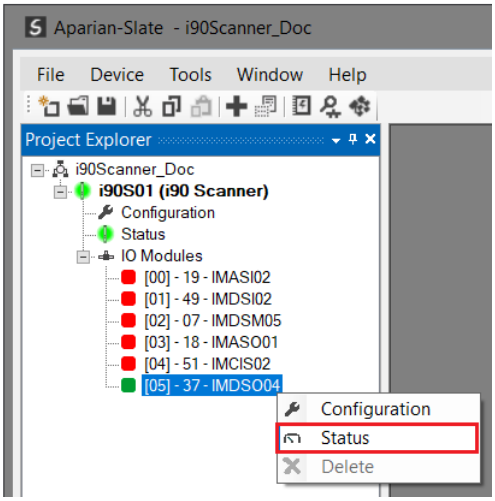


Figure 5.9 - Selecting IO Module Status

5.2.1.1. IO MODULE STATUS - GENERAL

The IO Module – General status tab is shown below.

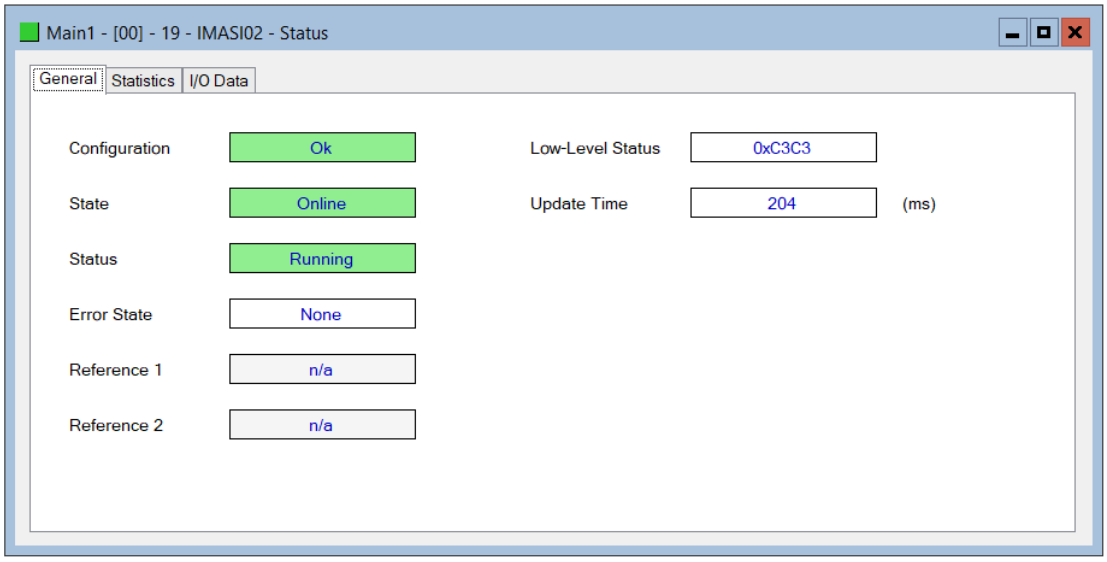


Figure 5.10 – IO Module Status - General

Statistic	Description
Configuration	Indicates whether the configuration is valid and matches the physical IO Module DIP Switches. **Ok** The configuration sent to the i90 IO module was accepted and is ok. **Mismatch (DIP)**

	The configuration sent to the i90 IO module does not match the DIP Switches configured on the i90 IO modules.
State	Indicates the online state of the IO Module **Online** The i90 IO module is online and communicating. **Offline** The i90 IO module is offline and no responses are being received.
Status	Indicates the current operational status of the IO Module. **Running** The i90 IO module is online and exchanging data with the i90 Scanner. **Running – Shadow** The i90 IO module is online and exchanging data with the i90 Scanner, but no outputs are sent to the i90 IO module. **Not Running** The i90 IO module is online, but no exchanging data with the i90 Scanner.
Error State	Indicates whether or not the IO Module is in an error state. **None** The i90 IO module has no errors. **Error** An error occurred with the i90 IO module.
Reference 1/2	Displays the IO Module's Internal Reference (Ref 1 and Ref 2). Applicable only for certain analog modules.
Low-Level Status	Shows the IO Module's low-level status. The hexadecimal value is module specific.
Update Time	Indicates how frequently (in milliseconds) the specific IO Module is being updated.

Table 5.8 – IO Module Status – General

5.2.1.2. IO MODULE STATUS - STATISTICS

The IO Module Statistics tab is shown below.

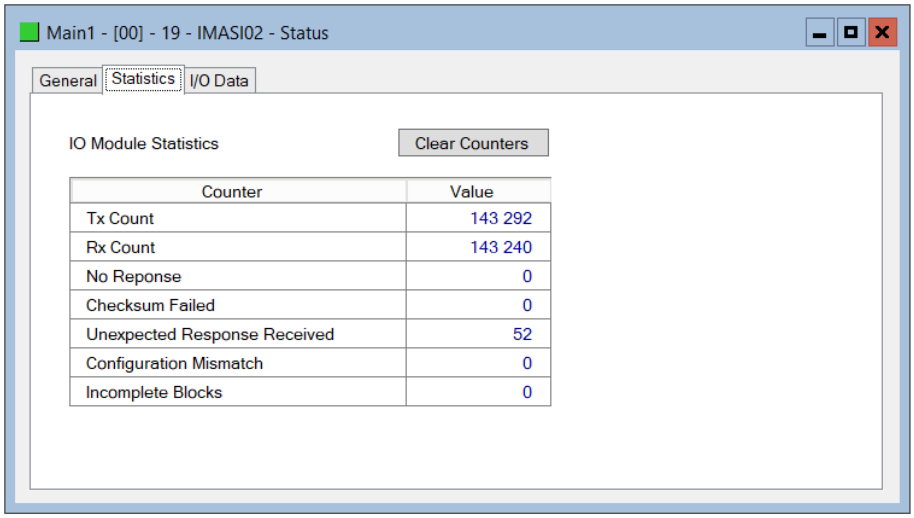


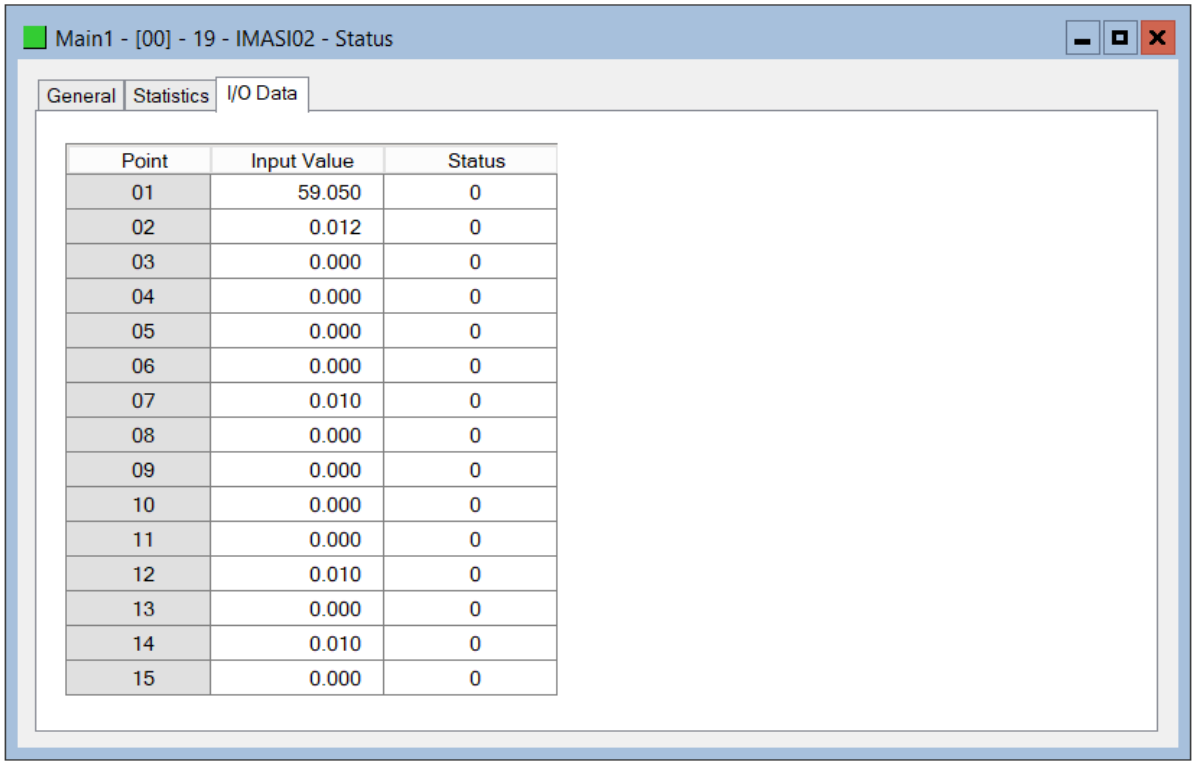
Figure 5.11 – IO Module Status - Statistics

Statistic	Description
Tx Count	The number of transmitted bus packets to the IO Module.
Rx Count	The number of received bus packets from the IO Module.
No Response	The number of request packets sent that yielded no reply.
Checksum Failed	The number of received bus packets that failed the packet checksum.
Unexpected Response Received	The number of unexpected responses received. These responses do not match the previous request.
Configuration Mismatch	The number of occurrences where the i90 Scanner configuration does not match that of the physical IO module (DIP switches).
Incomplete Blocks	The number of occurrences where one or more blocks in a bus sequence is missing.

Table 5.9 – IO Module Status - Statistics

5.2.1.3. IO MODULE STATUS – I/O DATA

The IO Module I/O Data tab is shown below. It displays a summary of the IO Module's Input and Output Assembly data.



Point	Input Value	Status
01	59.050	0
02	0.012	0
03	0.000	0
04	0.000	0
05	0.000	0
06	0.000	0
07	0.010	0
08	0.000	0
09	0.000	0
10	0.000	0
11	0.000	0
12	0.010	0
13	0.000	0
14	0.010	0
15	0.000	0

Figure 5.12 – IO Module Status – I/O Data

5.3. MODULE EVENT LOG

The i90 Scanner 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 from the dropdown menu.

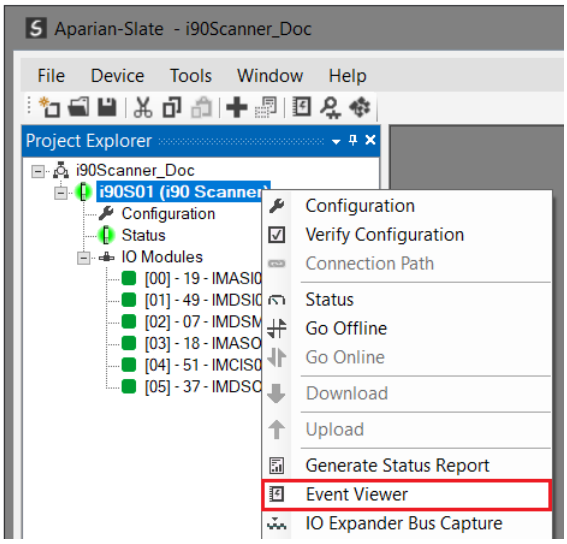


Figure 5.13 - Selecting the module Event Log

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

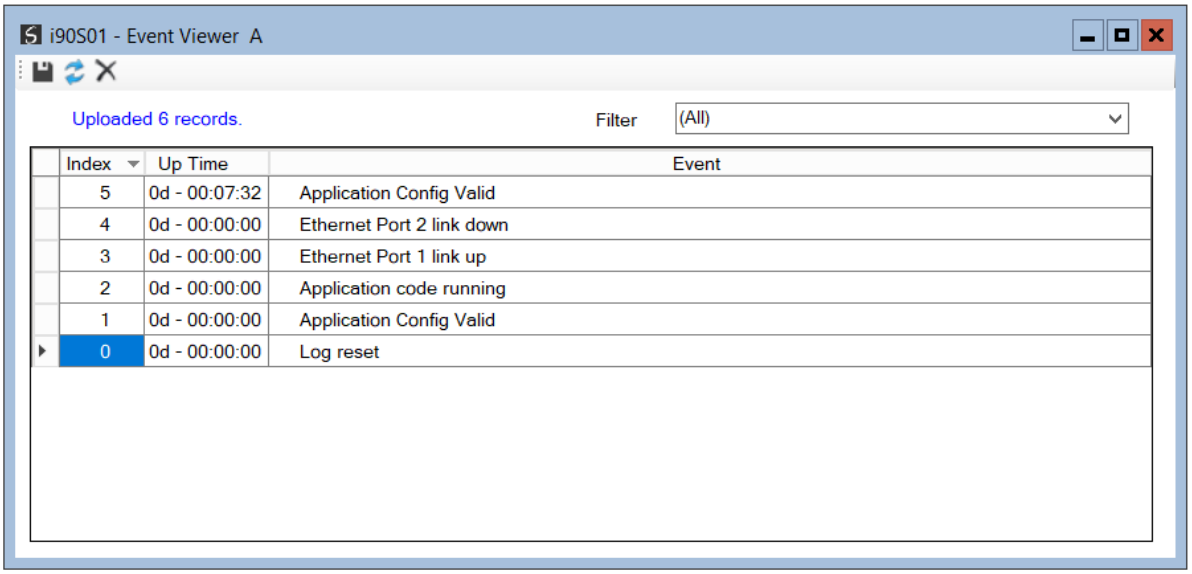


Figure 5.14 - Module Event Log

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

5.4. WEB SERVER

The i90 Scanner provides a web server allowing a user without Slate to view various diagnostics of the module. This includes Ethernet parameters, system event log, advanced

diagnostics, and application diagnostics.

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

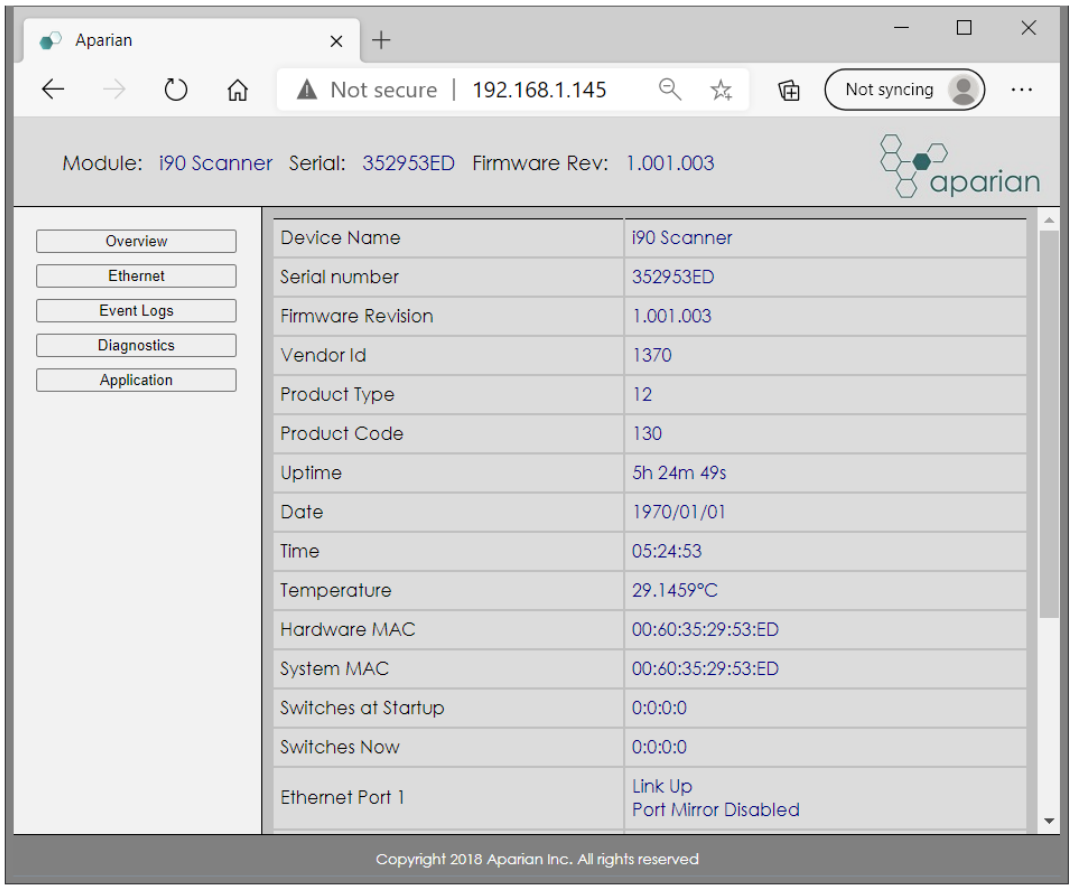


Figure 5.15 – Web interface

6. TECHNICAL SPECIFICATIONS

6.1. DIMENSIONS

Below are the enclosure dimensions. All dimensions are in millimetres.

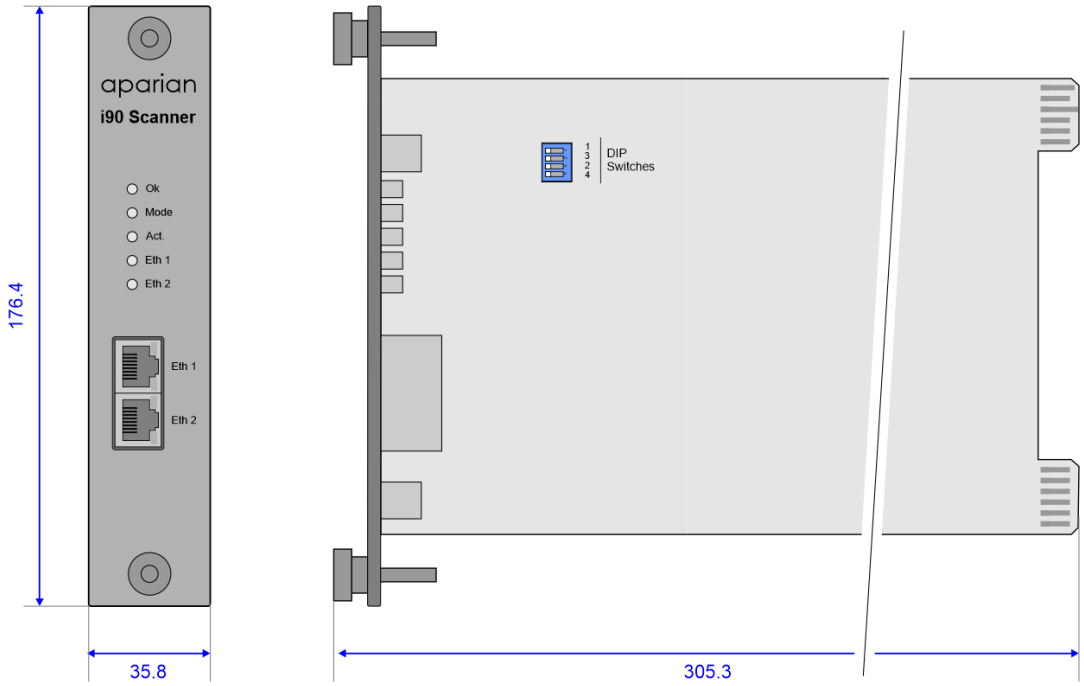


Figure 6.1 – i90 Scanner Dimensions

6.2. ELECTRICAL

Specification	Rating
Power requirements	5V DC, 540 mA (derived from INFI 90® MMU)
Power consumption	2.7 W
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 6.1 - Electrical specification

6.3. ENVIRONMENTAL

Specification	Rating
Mounting	Occupies single slot in standard INFI 90® MMU.
Temperature	-20 – 70 °C
Air Quality	Non-corrosive

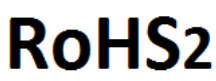
Table 6.2 - Environmental specification

6.4. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 40
TCP connections	Max 40
CIP connections	Max 10
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes
Embedded switch	2 x Ethernet ports Supports DLR (Device-Level-Ring) and Linear topology.

Table 6.3 - Ethernet specification

6.5. CERTIFICATIONS

Certification	Mark
CE Mark	
RoHS2 Compliant	

UL Mark File: E494895	 CLASS 1, DIV 2, GROUPS A, B, C, D
ODVA Conformance	
UKCA	

Table 6.4 – Certifications

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