DV Scanner

User Manual

A-DVS

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aparian

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Revision History

Revision	Date	Comment
1.0	7 June 2022	Initial document
1.1	13 November 2023	Added the UKCA Conformance Mark

1. PREFACE

1.1. INTRODUCTION TO THE DV SCANNER

This manual describes the installation, operation, and diagnostics of the Aparian DV Scanner. The DV Scanner allows interfacing between a Rockwell Automation Logix system and the DeltaV™ M-series IO. (DeltaV™ is a mark of one of the Emerson Process Management family of companies.)

The DV Scanner connects to a Rockwell Automation Logix Controller (e.g. ControlLogix or CompactLogix) via EtherNet/IP and connects to the DeltaV™ M-series LocalBus via a Right Carrier Extender (KJ4001X1-NA1) using a standard D-shell cable (KJ4002X1-BF2).

This allows the DV Scanner to connect to, and control, the IO in an M-series system

A typical DV Scanner (as a Standalone Master) connecting to the DeltaV™ M-series IO is shown below.

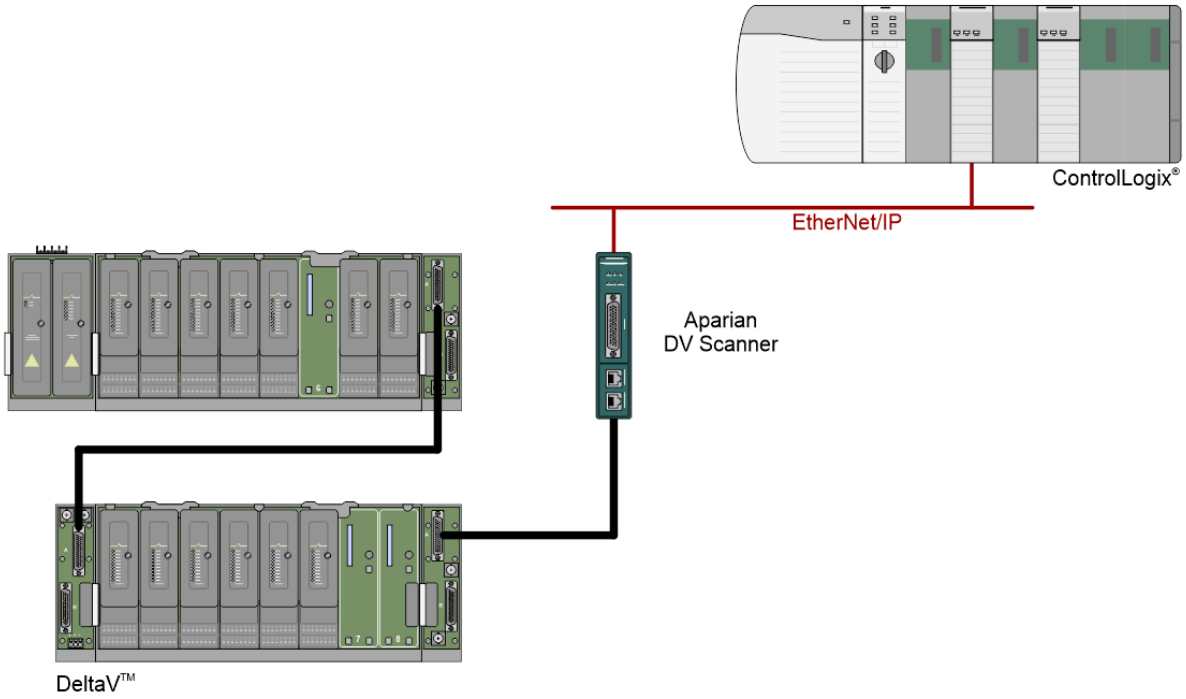


Figure 1.1 – Typical Standalone Setup

1.2. FEATURES

The DV Scanner provides an interface between DeltaV™ M-series IO and a Logix system using multiple EtherNet/IP class 1 connections. The DV Scanner supports up to 32 DeltaV™ M-series IO cards and consumes 8 Logix IO (Class 1) connections.

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

Within the Slate environment each DV IO card can be configured to match the application. The following IO cards are supported:

- **KJ3001X1-CA1** – 32 Channel, 24Vdc Dry Contact, Digital Input (DI)
- **KJ3204X1-BA1** – 32 Channel, 24Vdc High-Side, Series 2 Digital Output (DO)
- **KJ3222X1-BA1** – 8 Channel, 4-20mA HART, Series 2 Analog Input (AI)
- **KJ3221X1-BA1** – 8 Channel, 4-20mA HART, Series 2 Analog Output (AO)
- **KJ3001X1-BA1** – 8 Channel, 24Vdc Isolated, Digital Input (DI)
- **KJ3001X1-BG1** – 8 Channel, 24Vdc Isolated, Digital Output (DO)
- **KJ3002X1-BC1**– 8 Channel, 4-20mA, Analog Input (AI)
- **KJ3002X1-BB1**– 8 Channel, 4-20mA, Analog Output (AO)

Using the EDS AOP (Add-On-Profile) in Studio 5000, the DV 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 DV Scanner.

To aid in migration, the DV Scanner provides a Shadow mode where the DV Scanner can run in parallel with the existing DeltaV™ M-series controller. In this mode the existing CPU is controlling the IO cards and the DV Scanner is listening-in and providing the input and output readback data to the Logix.

The DV 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 DV 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 DV Scanner can be employed in a number of architectures based on the following options:

- Logix System – Standalone or Redundant
- Ethernet – Linear or Device Level Rung (DLR)
- DV Scanner – Standalone or Redundant

Examples of some of these combinations are described below.

1.3.1. STANDALONE MODE, LINEAR ETHERNET, SINGLE LOGIX CONTROLLER

In this architecture, a single DV Scanner is connected to the DeltaV™ M- series system, with a linear Ethernet network connecting to a single Logix Controller.

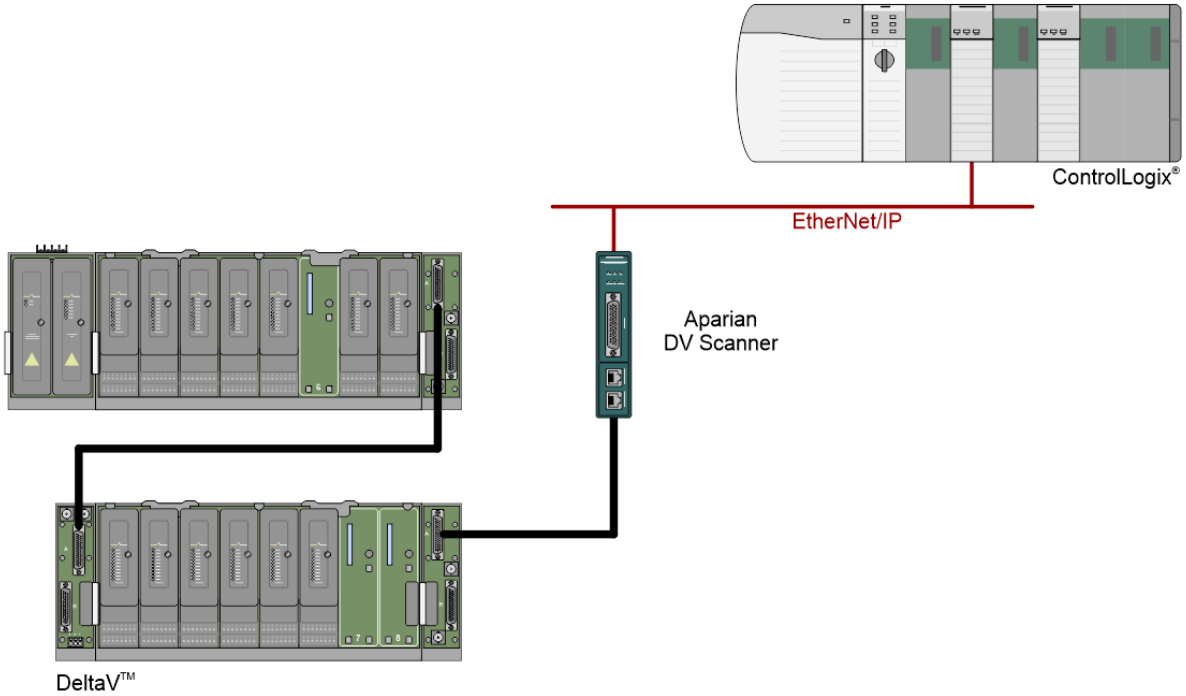


Figure 1.2 – Standalone mode, linear Ethernet, single Logix Controller

1.3.2. STANDALONE MODE, RING ETHERNET, SINGLE LOGIX CONTROLLER

In this architecture, a single DV Scanner is connected to the DeltaV™ M-series system with a ring DLR Ethernet network connecting to a single Logix Controller.

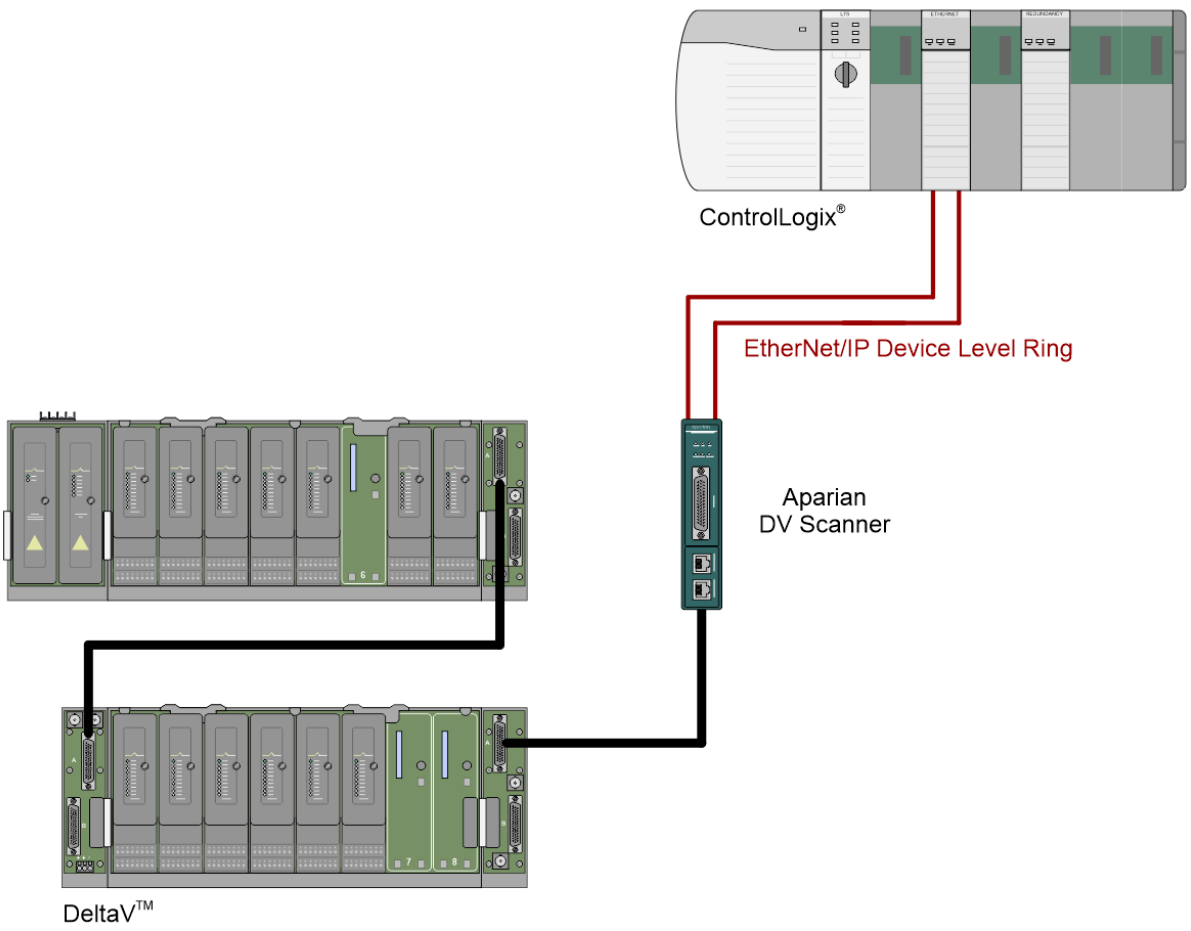


Figure 1.3 – Standalone mode, ring Ethernet, single Logix Controller

1.3.3. Redundant Mode, Linear Ethernet, Single Logix Controller

In this architecture, two DV Scanners are connected to the DeltaV™ M-series system, with a linear Ethernet network connecting them a single Logix Controller.

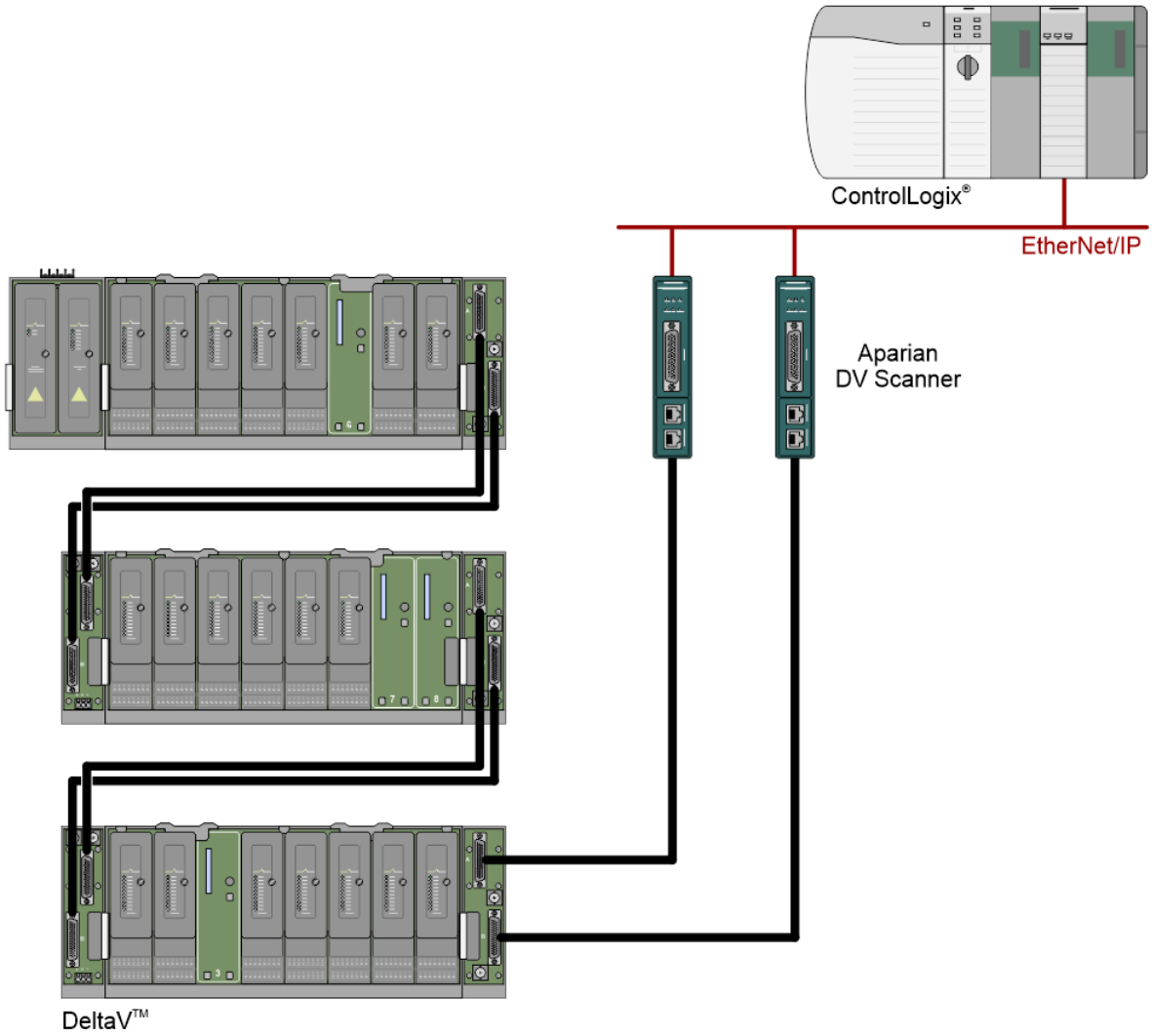


Figure 1.4 – Redundant mode, linear Ethernet, single Logix Controller

1.3.4. Redundant Mode, Ring Ethernet, Redundant Logix Controller

In this architecture, a redundant pair of DV Scanners are both connected to the DeltaV™ M-series system, with a DLR Ethernet network connecting to a redundant pair of Logix Controllers.

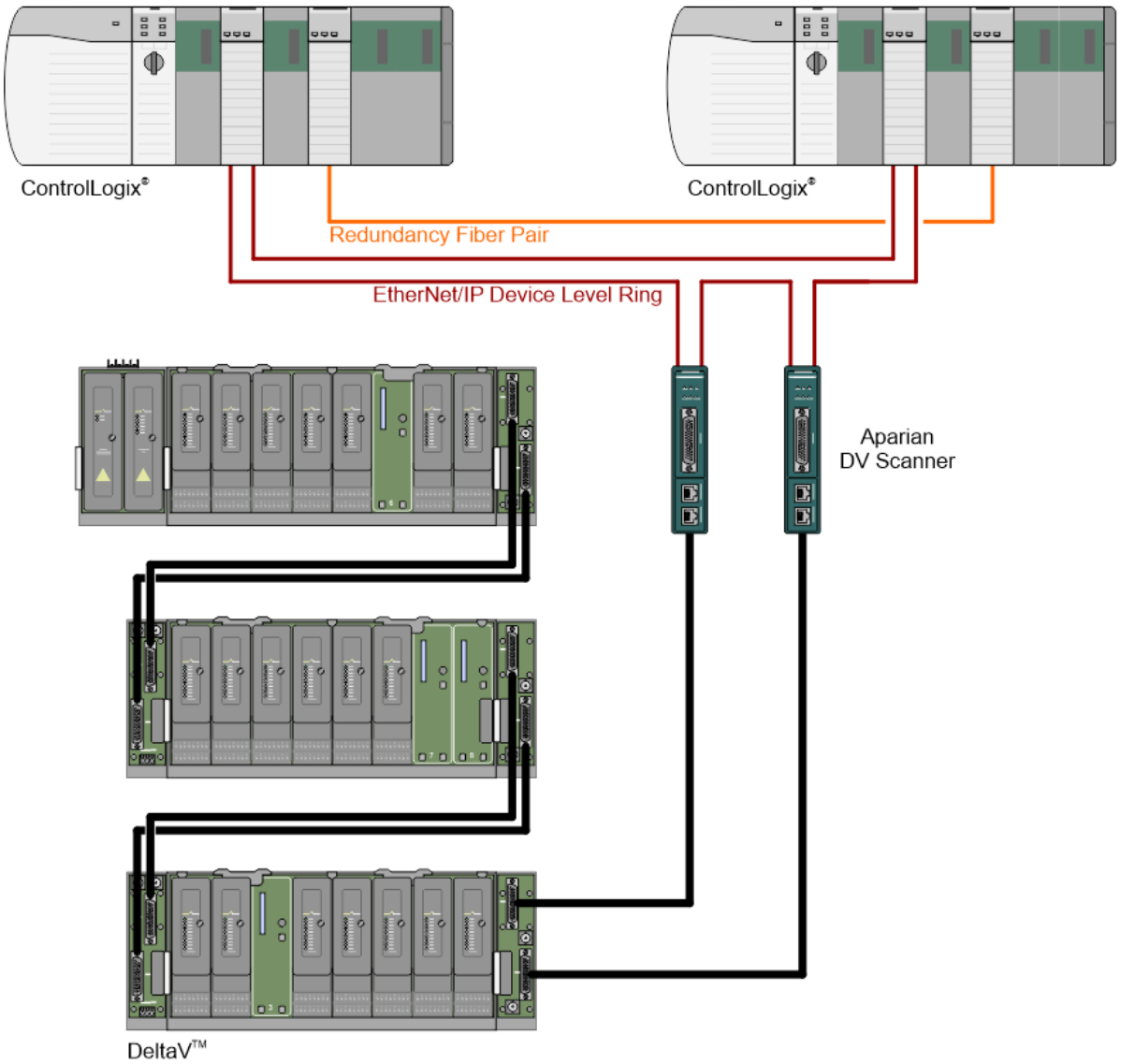


Figure 1.5 – Redundant mode, ring Ethernet, redundant Logix Controller

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
DV Scanner User Manual DV Scanner Datasheet Example Code & UDTs	http://www.aparian.com/products/dvscanner

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

The module has one port at the bottom of the enclosure, two Ethernet ports on the angled front, and one port at the front as shown in the figure below.

The port at the bottom is used for power. The power port uses a three-way connector which is used for the DC power supply positive and negative (ground) voltage as well as the earth connection.

The I/O Bus port on the front of the module is a DB44 connector that connects to the DeltaV™ M-series system via a Right Carrier Extender (KJ4001X1-NA1) and standard D-shell cables (KJ4002X1-BF2 / -BF3 / -BF4).

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

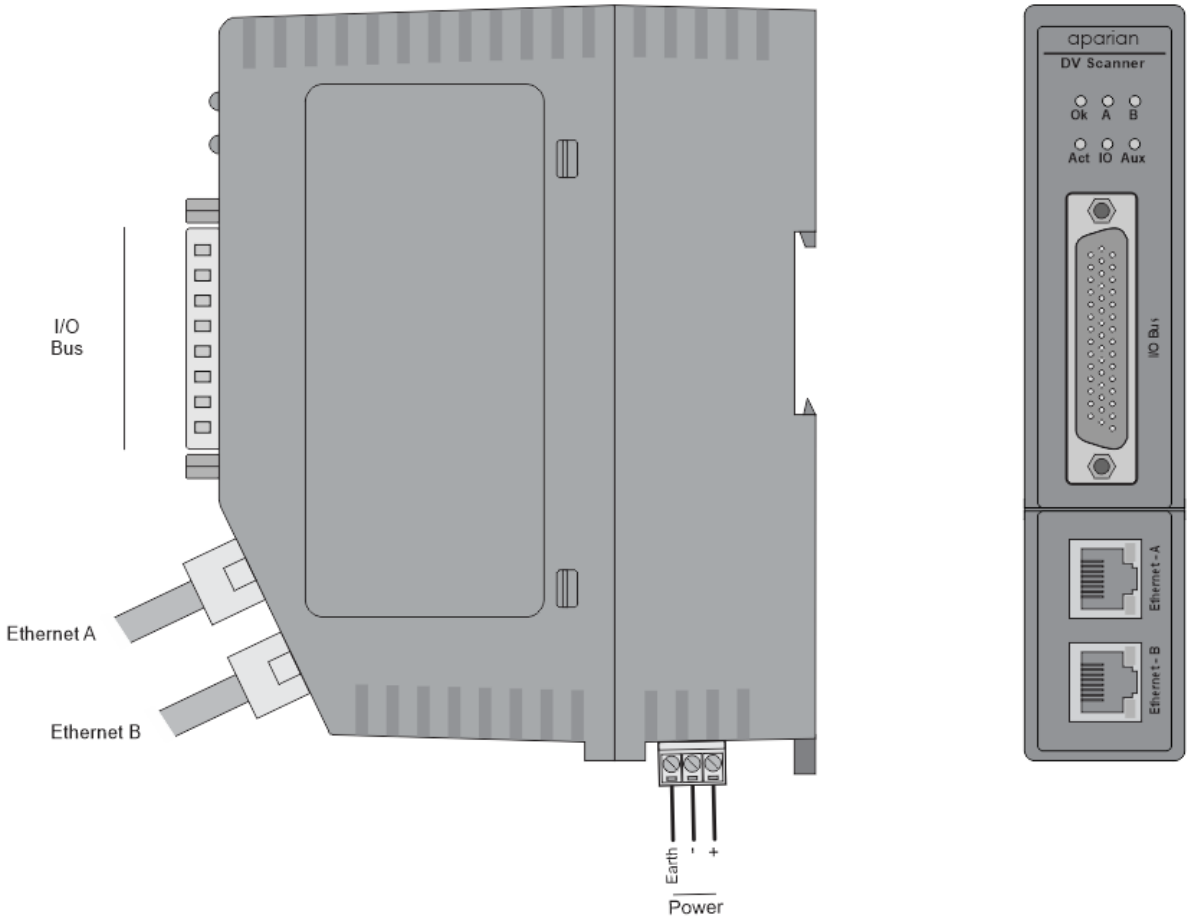


Figure 2.1 – DV Scanner side and front view

The module provides six diagnostic LEDs as shown in the front view figure above. These LEDs are used to provide information regarding the module system operation, the Ethernet interface, and the DeltaV™ M-series communication.

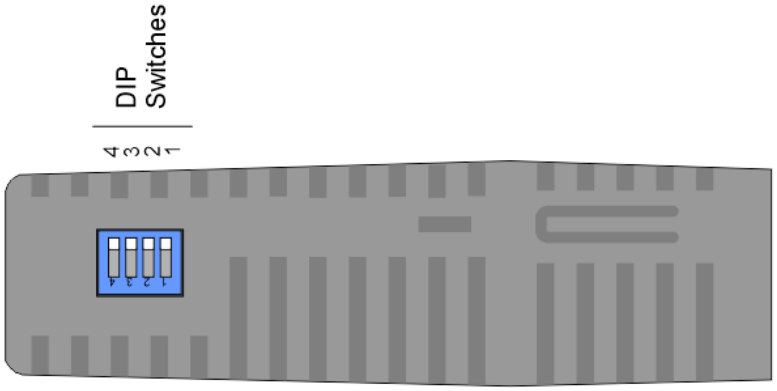


Figure 2.2 – DV Scanner top view

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

DIP Switch	Description
DIP Switch 1	Used to force the module into “Safe Mode”. When in “Safe Mode” the module will not load the application firmware and will wait for new firmware to be downloaded. This should only be used in the rare occasion when an earlier firmware update was interrupted at a critical stage.
DIP Switch 2	This will force the module into DHCP mode which is useful when the user has forgotten the IP address of the module.
DIP Switch 3	This DIP Switch is used to lock the configuration from being overwritten by the Slate. When set Slate will not be able to download to the module.
DIP Switch 4	When this DIP Switch is set at bootup it will force the module Ethernet IP address to **192.168.1.100** and network mask 255.255.255.0. The user can then switch the DIP switch off and assign the module a static IP address if needed.

Table 2.1 - DIP Switch Settings

2.1. MODULE MOUNTING



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

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

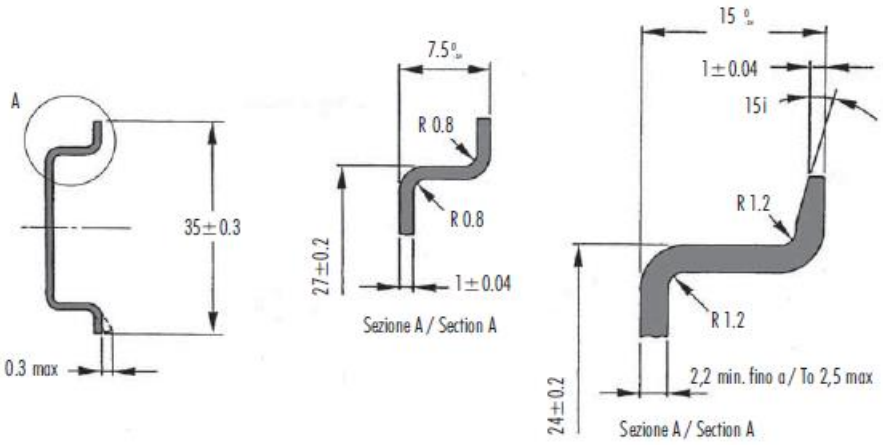


Figure 2.3 - DIN rail specification

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

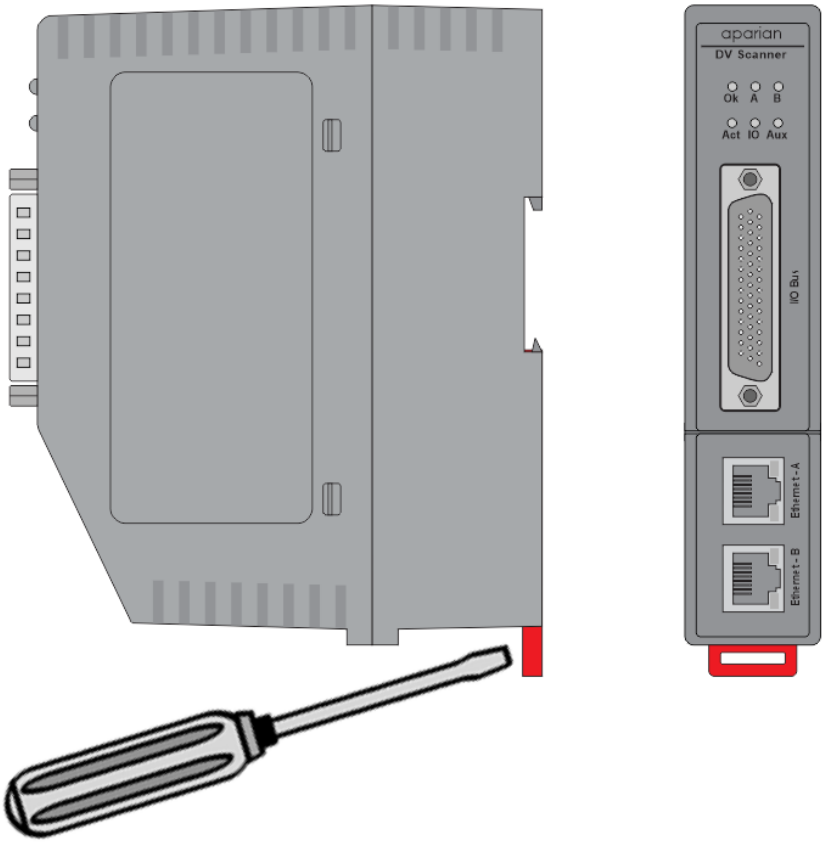


Figure 2.4 - DIN rail mounting

2.2. POWER

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

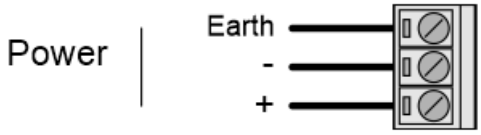


Figure 2.5 - Power connector

2.3. ETHERNET PORTS

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

The module has an embedded switch connecting the two Ethernet ports.

2.4. IO BUS (DB44) CONNECTOR

The IO Bus (DB44) connector is used to connect the DV Scanner to the DeltaV™ M-series IO Right Extender. The DeltaV™ Right Carrier Extender (KJ4001X1-NA1) must be plugged into the last carrier (rack) of the system and a standard D-shell cable (KJ4002X1-BF2 / -BF3 / -BF4) is used to connect the DV Scanner to the Right Carrier Extender.

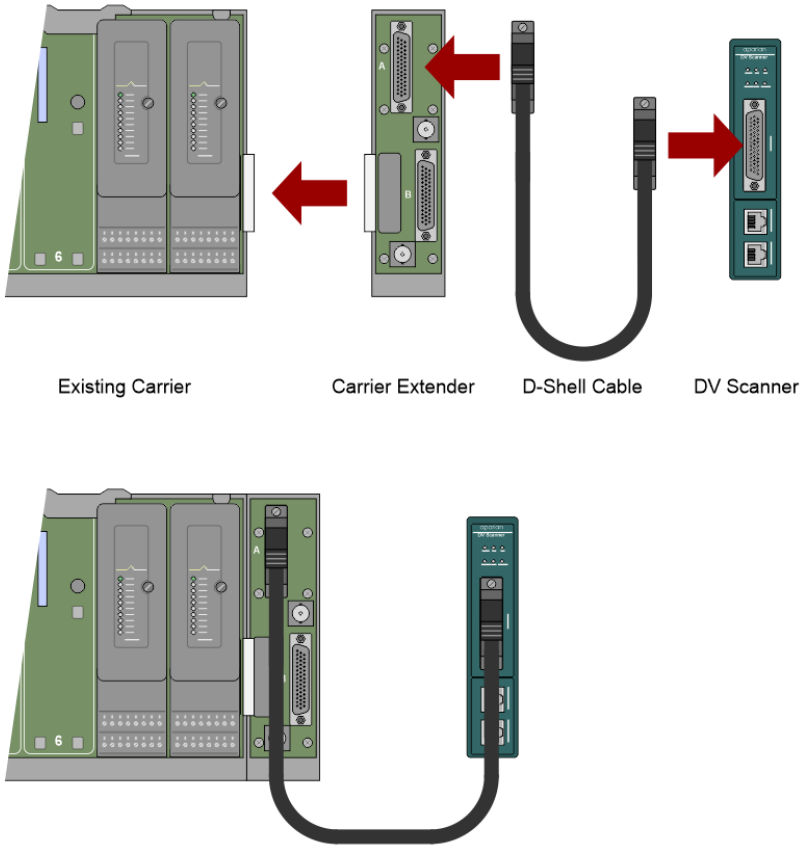


Figure 2.6 – DV Scanner to Carrier connection

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

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

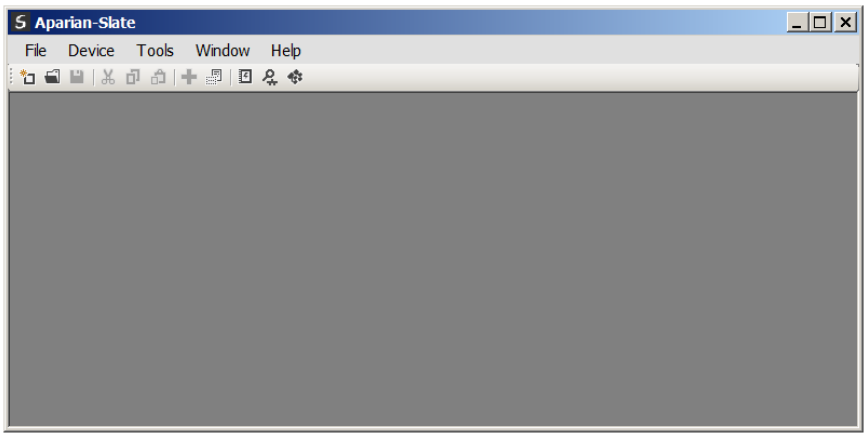


Figure 3.1. - Aparian Slate Environment

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.

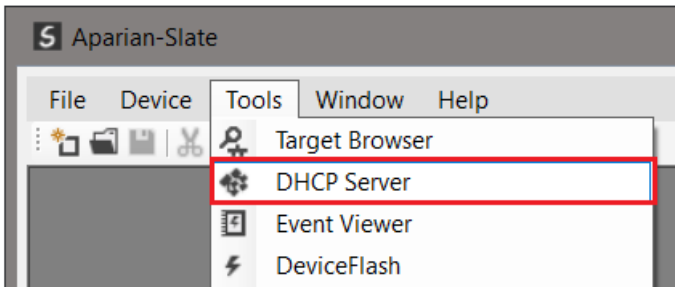


Figure 3.2. - Selecting DHCP Server

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

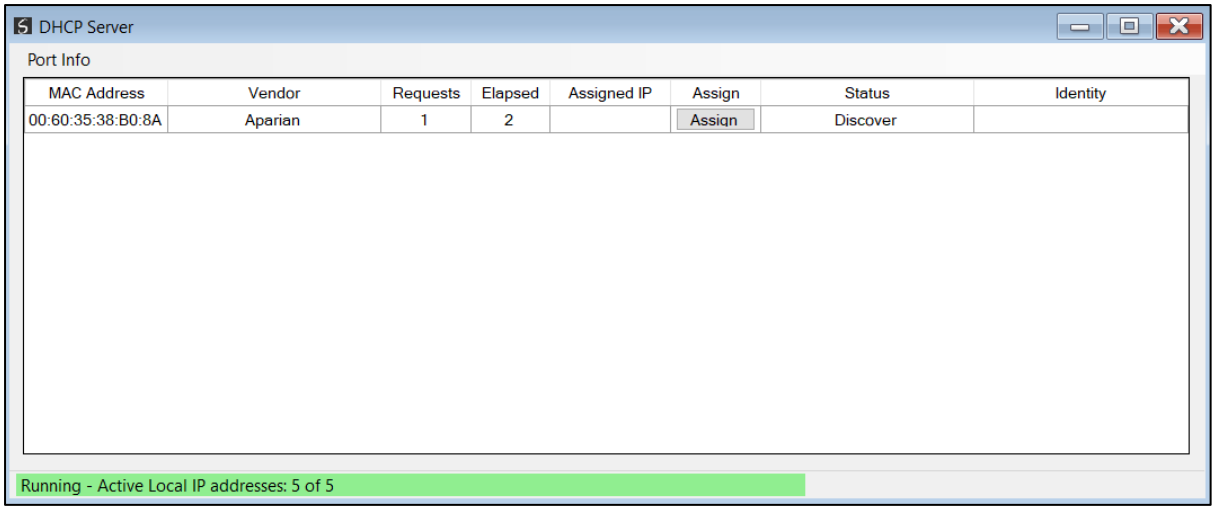


Figure 3.3. - DHCP Server

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.

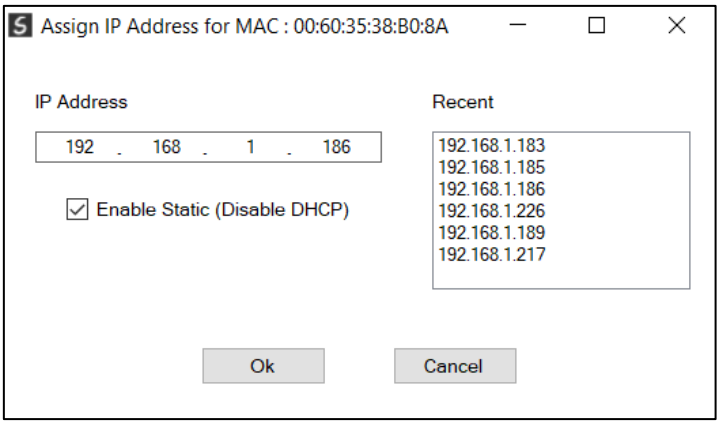


Figure 3.4. - Assigning IP Address

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.

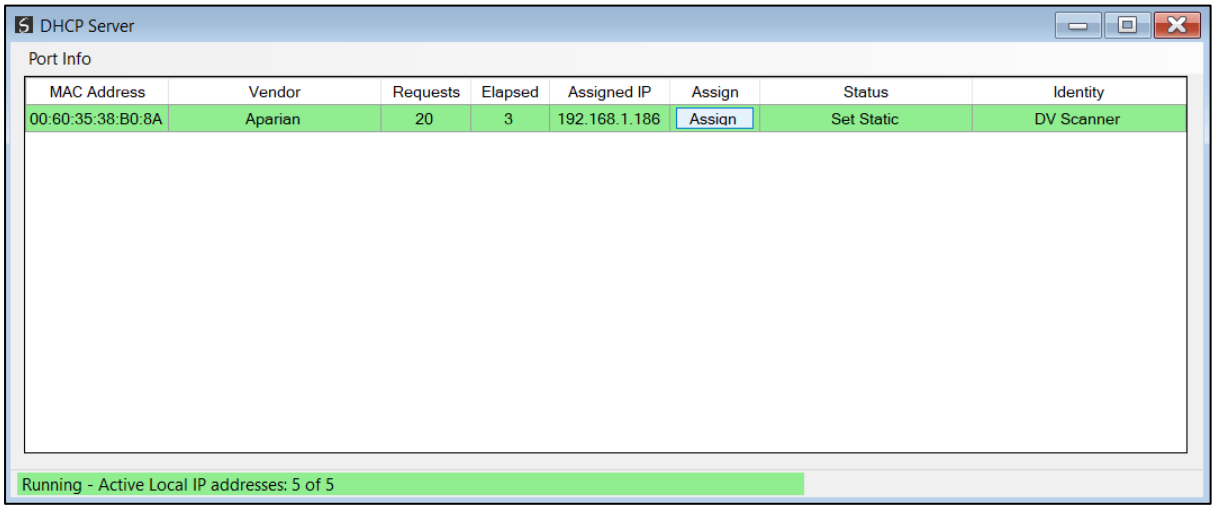


Figure 3.5. - Successful IP address assignment

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.

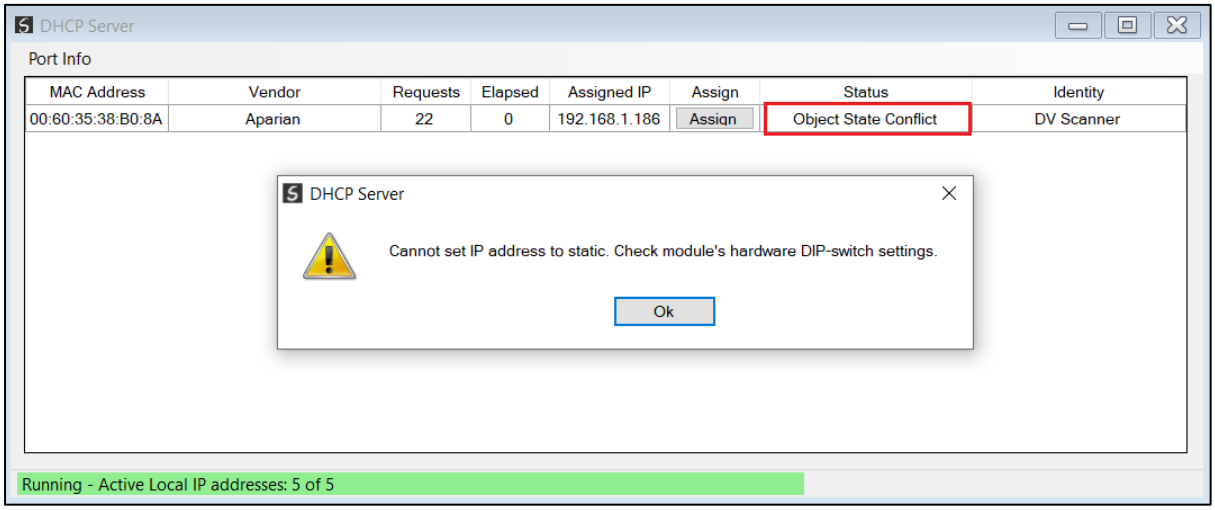


Figure 3.6. - Force DHCP warning

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.

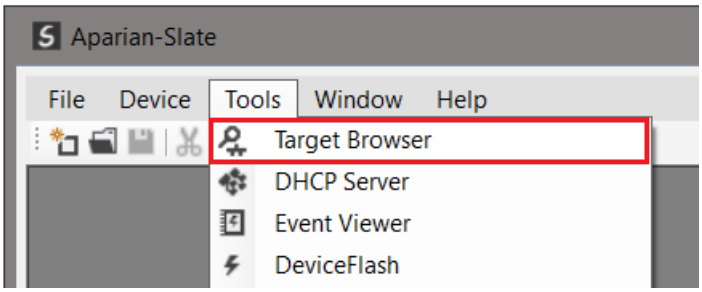


Figure 3.7. - Selecting the Target Browser

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

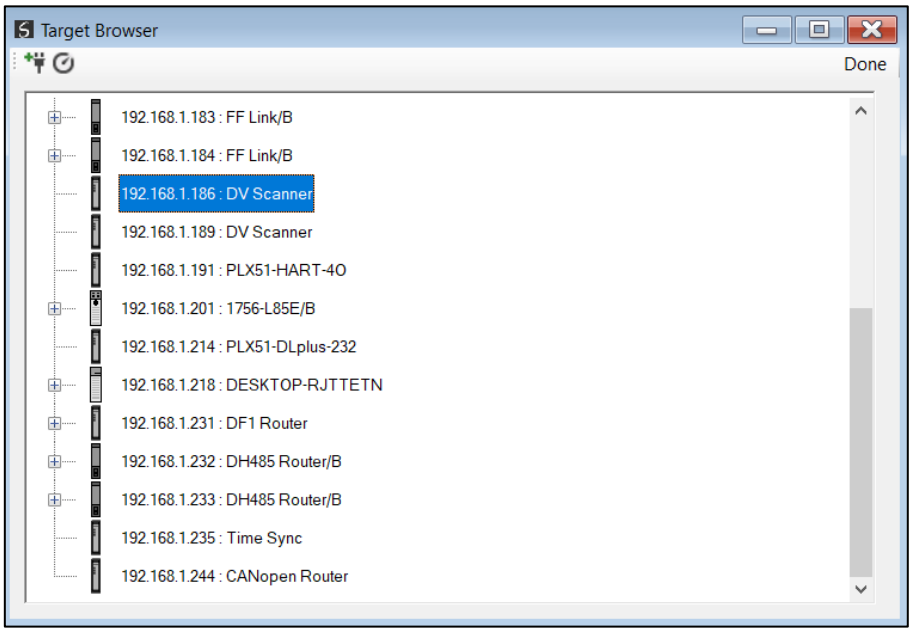


Figure 3.8. - Target Browser

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

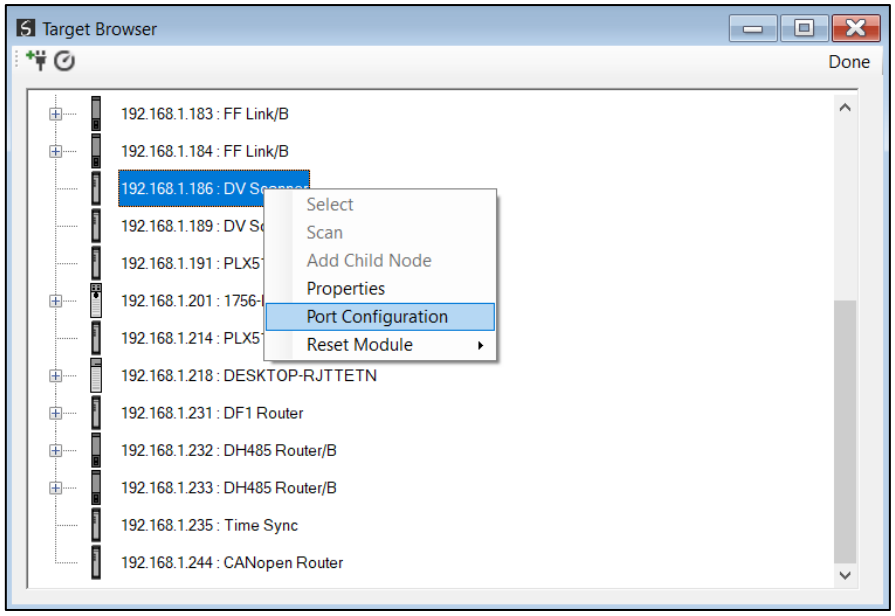


Figure 3.9. - Selecting Port Configuration

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

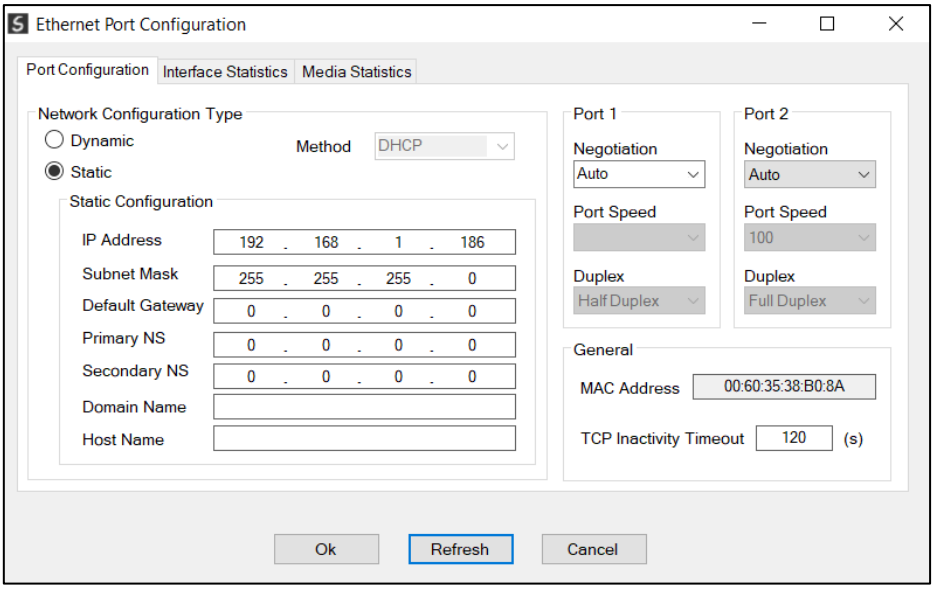


Figure 3.10. - Port Configuration

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

3.3. CREATING A NEW PROJECT

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

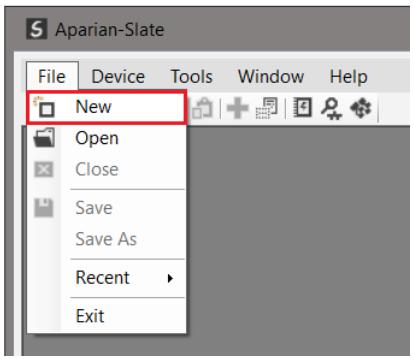


Figure 3.11. - Creating a new project

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.

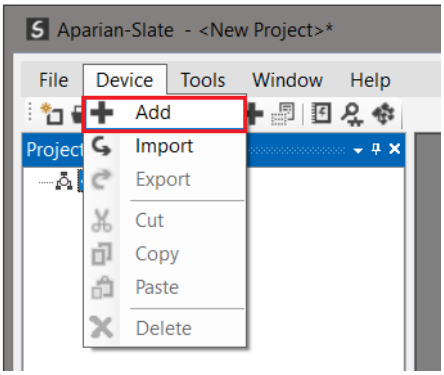


Figure 3.12. - Adding a new device

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

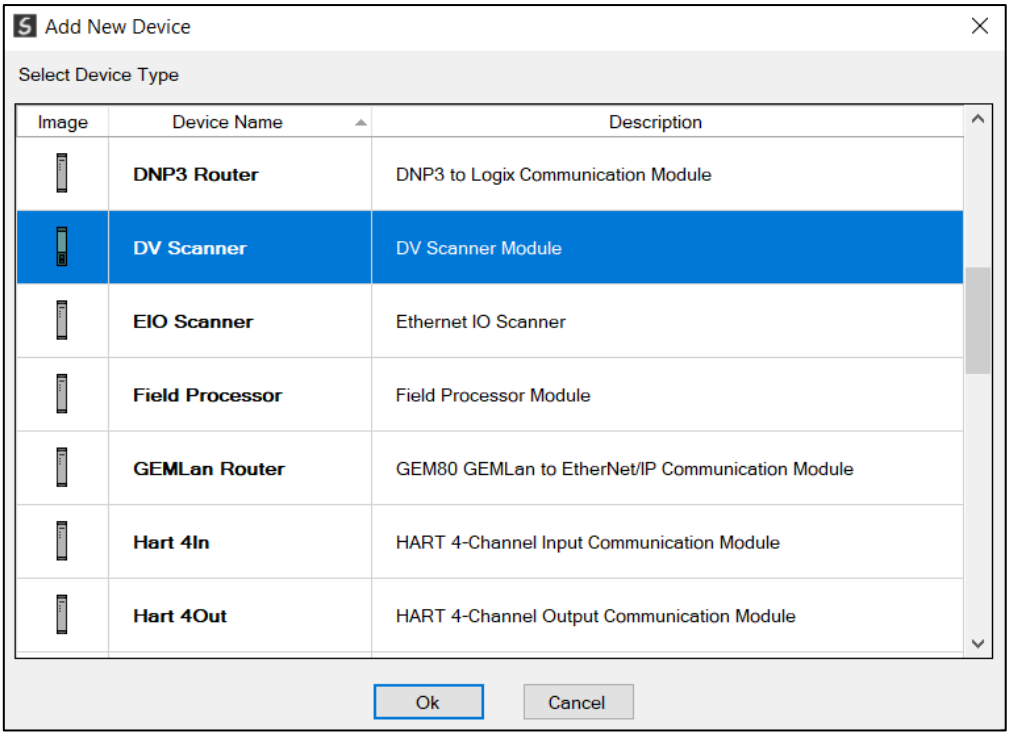


Figure 3.13 – Selecting a new DV Scanner

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. DV SCANNER CONFIGURATION

The DV 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 DV Scanner configuration.

3.4.1. GENERAL PARAMETERS

The general configuration is shown in the figure below. The DV 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***.

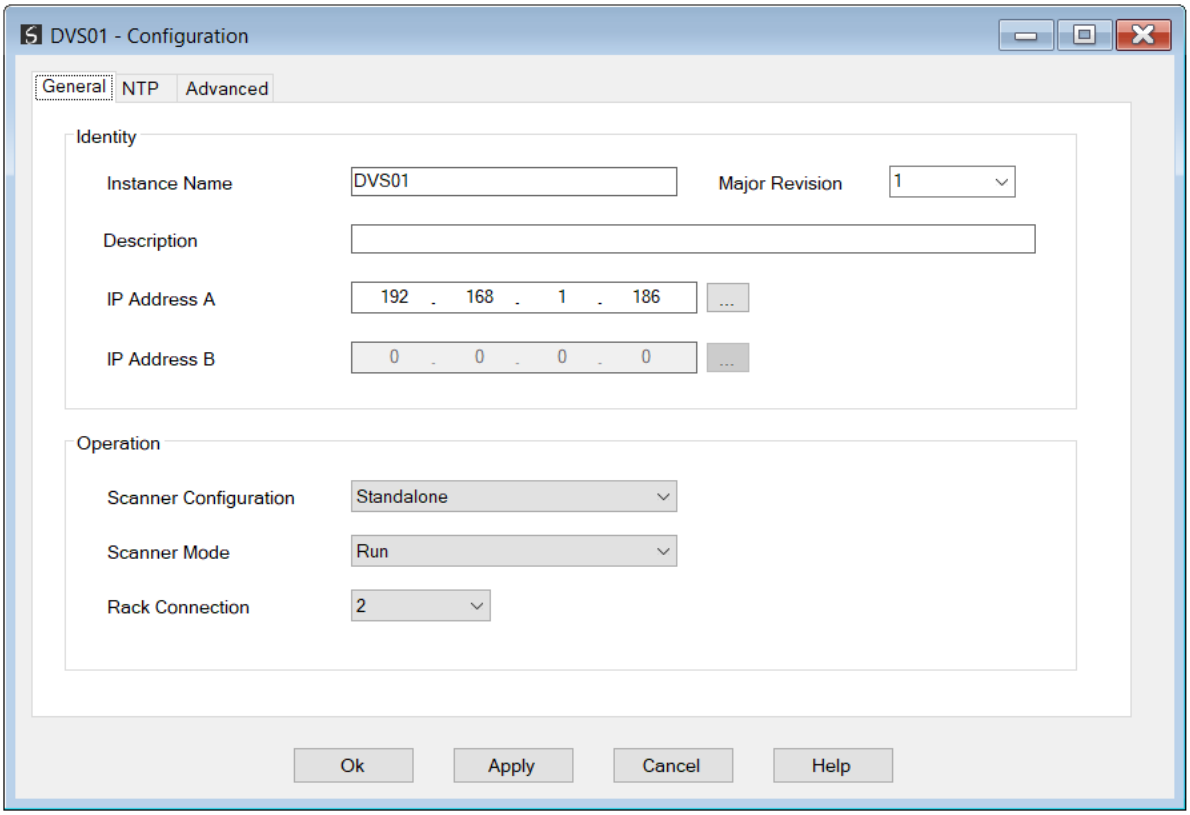


Figure 3.14 – General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify the DV Scanner module(s).
Description	This parameter is used to provide a more detailed description of the application for the DV 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 DV 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 DV Scanner on the network. IP Address B is available only when Redundant Scanner Configuration is selected.
Scanner Configuration	This option selects the configuration mode selected for the scanner. **Standalone** In this mode, the DV Scanner will be a single Master on the DeltaV™ M-series LocalBus communicating with the IO cards. In the Logix controller there will also be a single DV Scanner in the IO tree to read/write data to the DeltaV™ M-series IO cards. **Redundant** In this mode, the DV Scanners will be used as a pair of redundant modules, where one of the DV Scanners will be the active Master on the DeltaV™ M-series LocalBus and the other will be standby Master. If the active Master is lost, then the standby Master will take over control of the DeltaV™ M-series LocalBus.

	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 DV Scanner is the master of the DeltaV™ M-series IO cards. It configures and controls the I/O cards. This mode is for normal operation where the existing DeltaV™ M-series CPU has been removed. **Shadow (Listen-Only)** In Shadow mode, the DV Scanner only listens on the DeltaV™ M-series backplane and provides the I/O cards inputs and output read-back data to Logix. The outputs are still controlled by the existing DeltaV™ M-series CPU. **Disabled** This mode is used to disable all communication on the DeltaV™ M-series backplane and only packet capture functionality works.
Rack Connection	This is the rack number (carrier) to which the DV Scanner is connected. For example, if the DV Scanner is connected to the second carrier, then this value must be set to 2. **Warning**: Incorrectly setting the Rack Connection parameter will cause the DV Scanner to incorrectly address the IO cards resulting in unexpected behaviour.

Table 3.1 - General configuration parameters

3.4.2. NTP CONFIGURATION

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

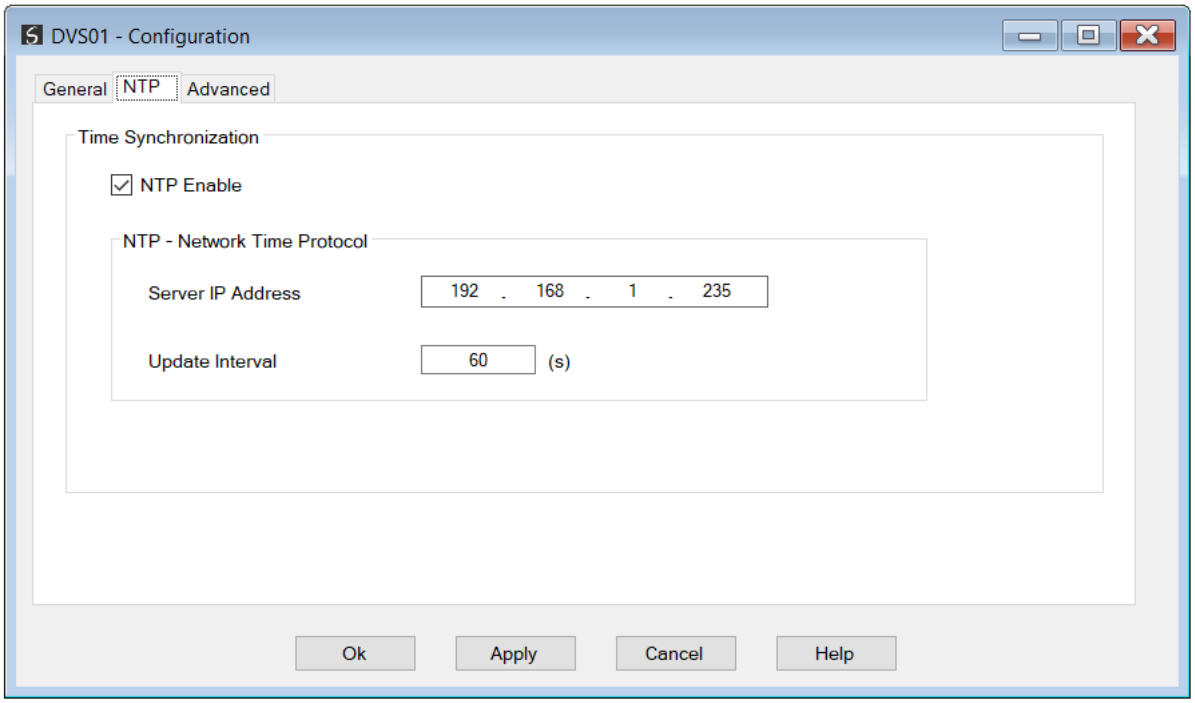


Figure 3.15 – NTP Configuration

The NTP configuration consists of the following parameters:

Parameter	Description
NTP Enable	Enables the DV 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 DV 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.

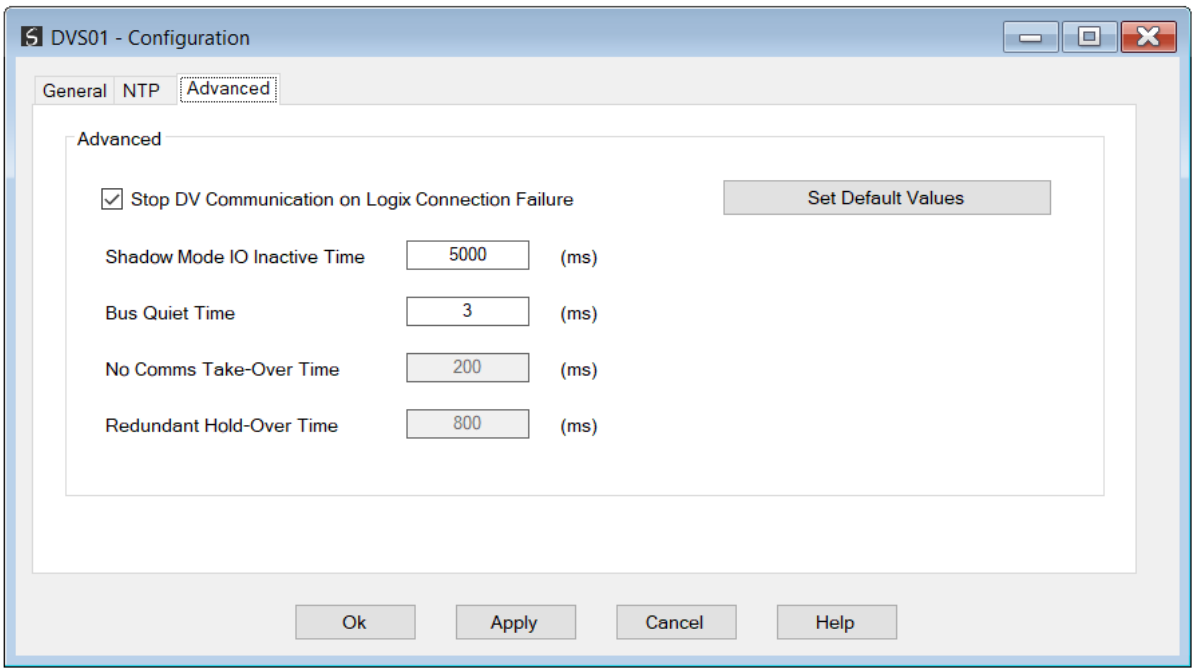


Figure 3.16 – DV Scanner - Advanced Configuration

The Advanced consists of the following parameters:

Parameter	Description
Stop DV Communication when Logix Connection Failure	When this parameter is set, the communication to Output IO cards in the DeltaV™ M-series LocalBus will be stopped when the Logix connection is disrupted, forcing the IO cards to implement their fail-safe states.

Shadow Mode IO Inactive Time	When operating in shadow mode, this parameter is the number of milliseconds of no communication from a specific DeltaV™ M-series IO card, before it is determined that IO card is offline.
Bus Quiet Time	The minimum delay between LocalBus packets.
No Comms Take-Over Time	When running as a standby Master on the DeltaV™ M-series LocalBus (in a redundant architecture), the standby Master will automatically take over as the Active master if no communication is received within this time. See the Redundancy section for more information regarding the redundant operation.
Redundant Hold-Over Time	The amount of time (milliseconds) a newly appointed Active master will remain in the Active master state before the Logix system has acknowledged this transition. See the Redundancy section for more information regarding the redundant operation.

Table 3.3 – Advanced Configuration parameters

3.5. ADDING IO CARDS

Once the general DV Scanner configuration is complete, the user can configure the required IO cards.

IO cards can either be added manually or imported from a DeltaV™ ***FHX*** (ASCII) file, which is described in the next section.

Manually adding IO cards is achieved by right-clicking on the ***IO Cards*** item in the project tree and selecting the ***Add IO Card*** option.

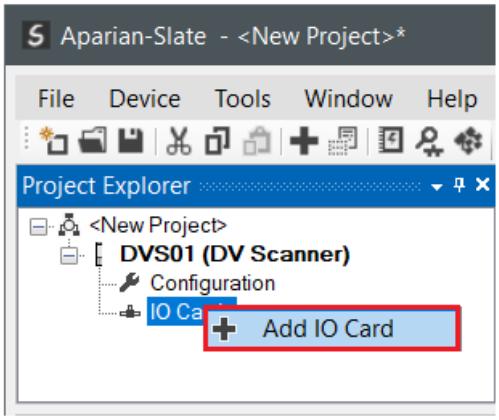


Figure 3.17 – Adding IO Cards

The ***Select IO Card*** window will appear. Select the appropriate card and press ***Ok***.

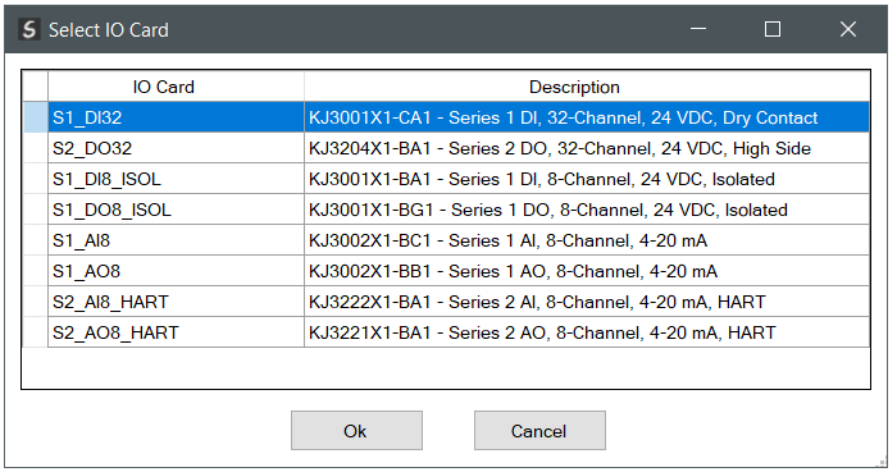


Figure 3.18 – Select IO Card

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

3.5.1. General IO Card Configuration

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

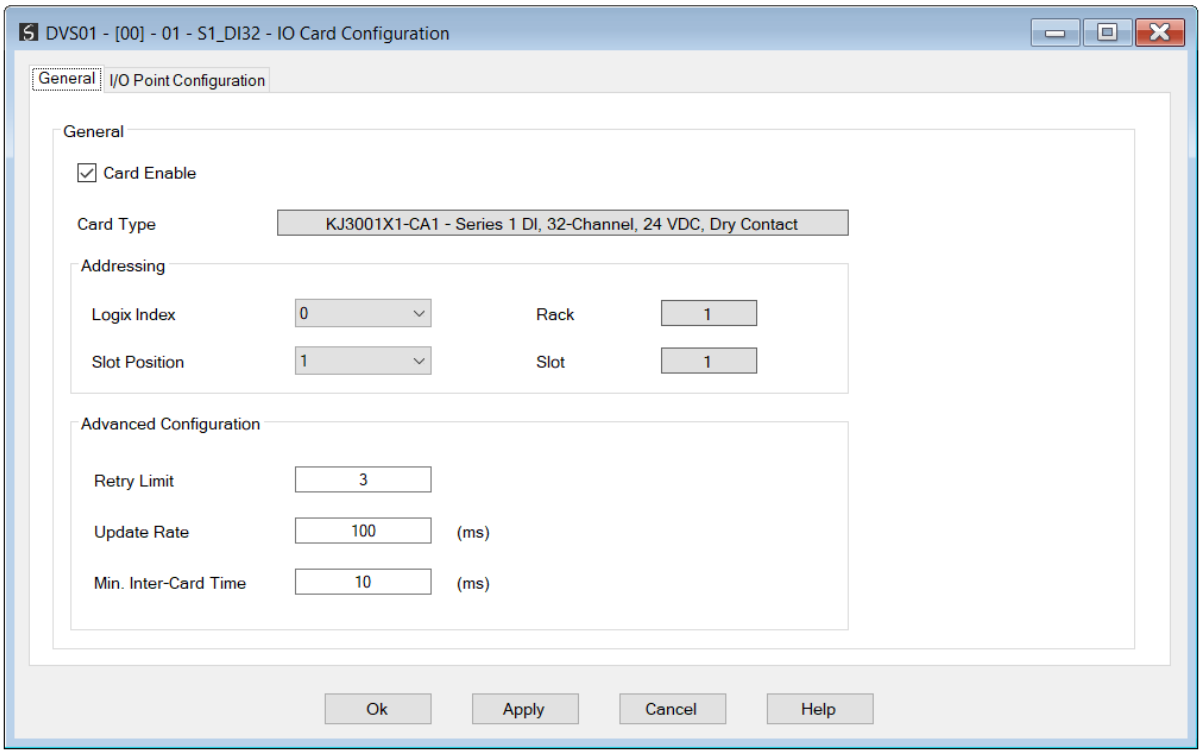


Figure 3.19 – IO Card - General Configuration

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

Parameter	Description
Card Enable	This option can be used to Disable the card from the DV Scanner polling strategy.
Card Type	The selected IO card type.
Logix Index	This is the card index (0-31) used in the Logix tag for the specific IO card. For example, if the Logix Index is 7 then the input data for the card will appear in the Logix tag: [*ScannerName*]Input.IOCard[7].
Slot Position	The physical slot position of the IO card within the LocalBus (1-64).
Rack	The implied physical rack number, based on the Slot Position. (1-8)
Slot	The implied physical slot number, based on the Slot Position. (1-8)
Advanced Configuration	
Retry Limit	The number of times a request to this IO card will be retried before the IO card is deemed to be offline.
Update Rate	The amount of time (milliseconds) between successive updates for this IO card.
Min. Inter-Card Time	The minimum time (milliseconds) between communication to this IO card and the next.

Table 3.4 – IO Card - General configuration parameters

3.5.2. IO POINT CONFIGURATION

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

3.5.2.1. 32 CHANNEL DIGITAL INPUT (DI32)

Part Number: **KJ3001X1-CA1**

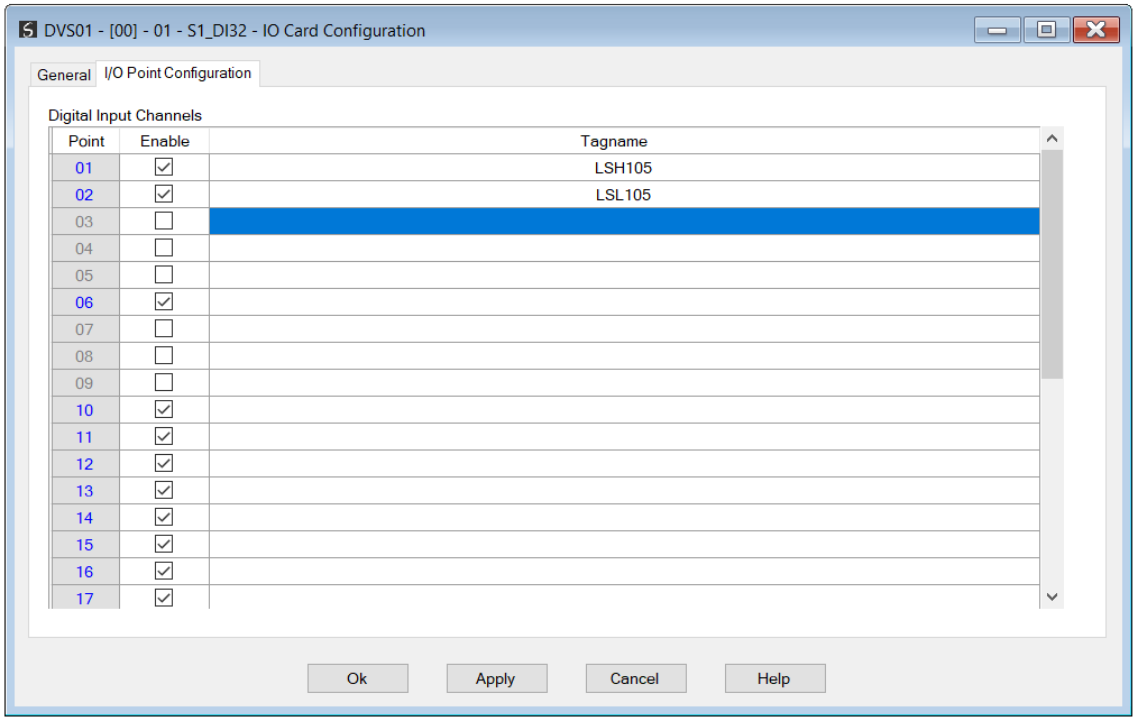


Figure 3.20 – 32 Channel DI Card - IO Point Configuration

The 32 Channel Digital Input IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Tagname	Custom name given to each IO Point.

Table 3.5 – 32 Channel DI Card - IO Point Configuration parameters

3.5.2.2. 32 CHANNEL DIGITAL OUTPUT (DO32)

Part Number: **KJ3204X1-BA1**

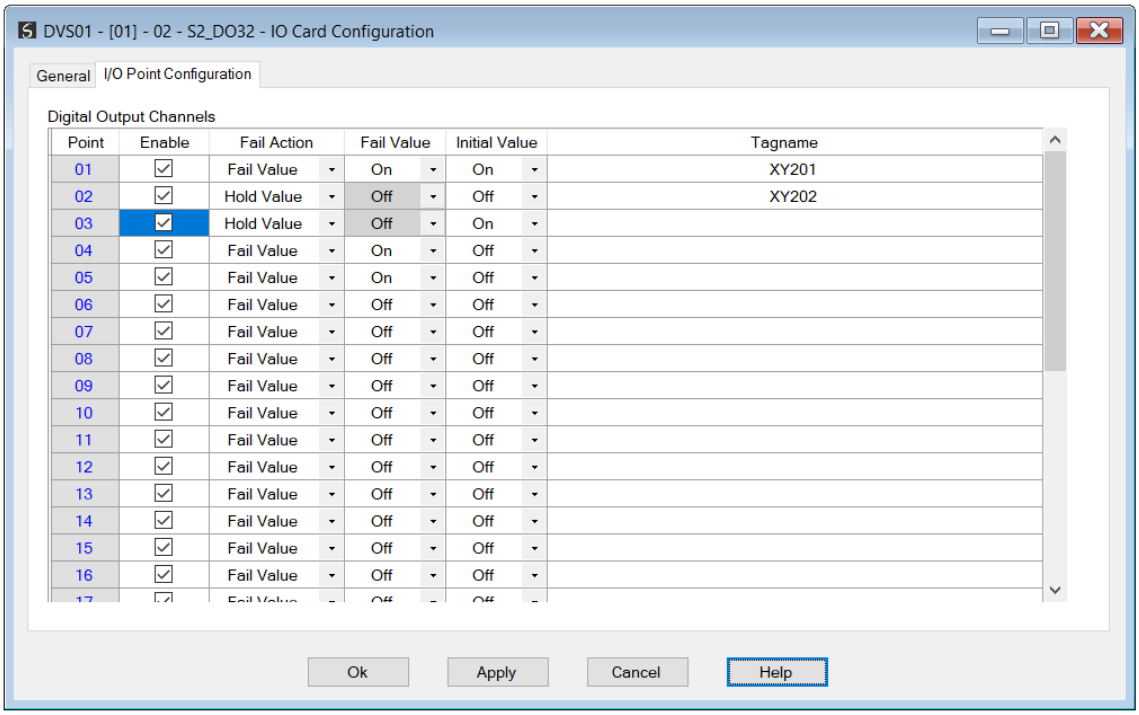


Figure 3.21 – 32 Channel DO Card - IO Point Configuration

The 32 Channel Digital Output IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Fail Action	This parameter will determine the behavior of the specific IO Point when communication to the IO card is lost. **Fail Value** Go to the Fail Value parameter (On or Off). **Hold Value** Keep the IO Point value at the last assigned.
Fail Value	When the Fail Action parameter for a specific point has been set to *Fail Value*, then the Fail Value parameter will determine the state to which the IO Point will go (On / Off).
Initial Value	The Initial Value parameter will determine the state of the IO Point at power up (On / Off).
Tagname	Custom name given to each IO Point.

Table 3.6 – 32 Channel DO Card - IO Point Configuration parameters

3.5.2.3. 8 CHANNEL ISOLATED DIGITAL INPUT (DI8 ISOL)

Part Number: **KJ3001X1-BA1**

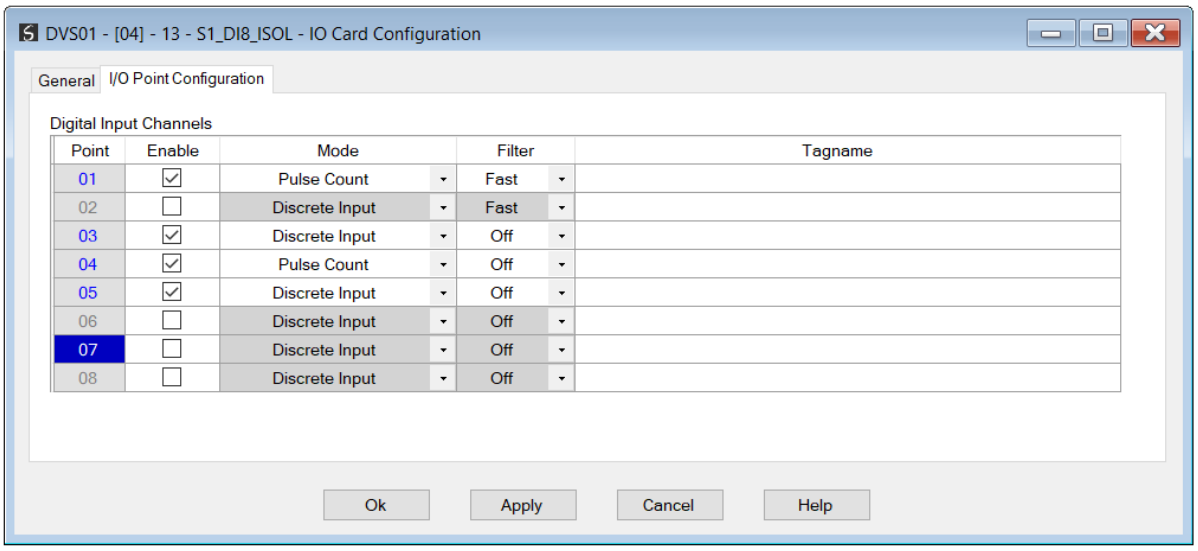


Figure 3.22 – 8 Channel Isolated DI Card - IO Point Configuration

The 8 Channel Isolated Digital Input IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Mode	The Mode parameter allows each IO point to operate in a specific mode. **Discrete Input** When the discrete input is selected, the selected IO Point will operate as a normal digital input IO point providing the status of the input (On/Off). **Pulse Count** When the Pulse Count mode is selected, it will enable the IO point to also count the number of times the input signal has transitioned from 0 to 1 (number of pulses).
Filter	The filter value for the input IO point (Off, Slow, or Fast).
Tagname	Custom name given to each IO Point.

Table 3.7 – 8 Channel Isolated DI Card - IO Point Configuration parameters

3.5.2.4. 8 CHANNEL ISOLATED DIGITAL OUTPUT (DO8 ISOL)

Part Number: **KJ3001X1-BG1**

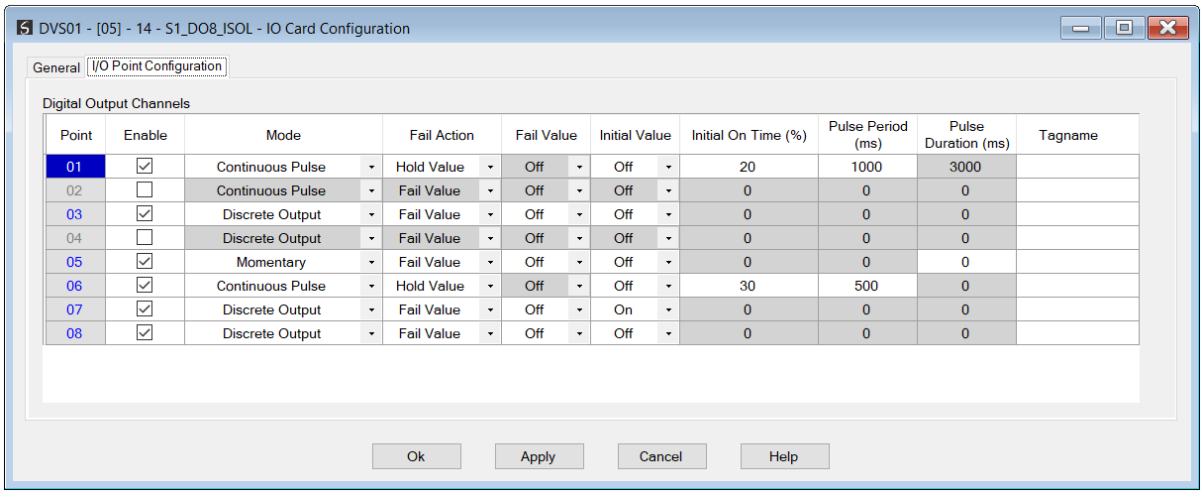


Figure 3.23 – 8 Channel Isolated DO Card - IO Point Configuration

The 8 Channel Isolated Digital Output IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Mode	The Mode parameter allows each IO point to operate in a specific mode. **Discrete Output** When the discrete output is selected, the selected IO Point will operate as a normal digital output IO point setting the status of the output (On/Off). **Continuous Pulse** When the Continuous Pulse mode is selected, it will enable the IO point to output a pulse at a configured frequency (see the *Pulse Period* parameter) while controlling the duty cycle from 0 – 100% On Time (time the signal is high). **Momentary** With the momentary pulse, the IO card will output a pulse with a configured duration (see the *Pulse Duration* parameter) each time the output value is set from 0 to 1.
Fail Action	This parameter will determine the behavior of the specific IO Point when communication to the IO card is lost. **Fail Value** Go to the Fail Value parameter (On or Off). **Hold Value** Keep the IO Point value at the last assigned.

Fail Value	When the Fail Action parameter for a specific point has been set to *Fail Value*, then the Fail Value parameter will determine the state to which the IO Point will go (On / Off).
Initial Value	The Initial Value parameter will determine the state of the IO Point at power up (On / Off).
Initial On Time	When the card is configured for Continuous Pulse mode, this is the initial on time (in milliseconds) during the Pulse Period.
Pulse Period	When the card is configured for Continuous Pulse mode, this parameter is the duration of the pulse (in milliseconds). If the duty cycle is set to 50% then the output will be on for half the Pulse Period.
Pulse Duration	The time (in milliseconds) the output point is on when the output point has been changed from 0 to 1.
Tagname	Custom name given to each IO Point.

Table 3.8 – 8 Channel Isolated DO Card - IO Point Configuration parameters

3.5.2.5. 8 CHANNEL 4-20MA HART ANALOG INPUT (AI8 HART)

Part Number: **KJ3222X1-BA1**

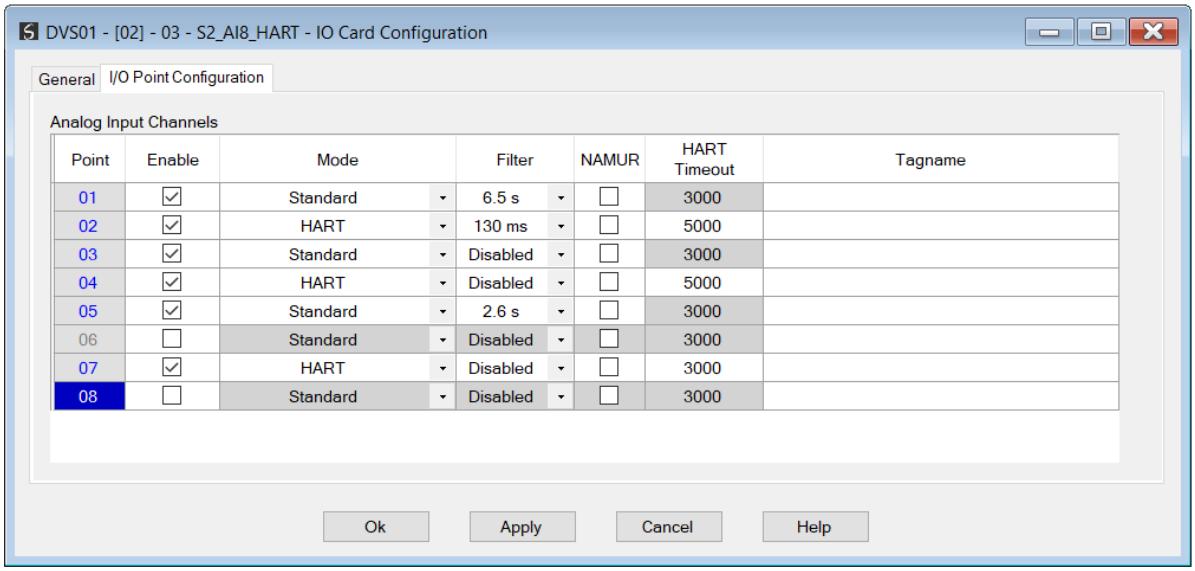


Figure 3.24 – 8 Channel 4-20mA HART Analog Input - IO Point Configuration

The 8 Channel 4-20mA HART Analog Input IO Point configuration parameters are as follows:

Parameter	**Description**
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.

Mode	The Mode parameter allows each IO point to operate in a specific mode. **Standard** When the standard is selected, the selected IO Point will operate as a normal 4-20mA analog input. **HART** When the HART mode is selected, it will enable the IO point to also communicate to a field device using HART. **NOTE:** It that only HART instruments with short address 0 can be used.
Filter	The filter time in milliseconds for the analog input IO point.
NAMUR	When this parameter is enabled, NAMUR alarming is performed on the data point. If the analog value is outside the NAMUR limits of 106.25% and -2.5% for 4 seconds, then the status will be shown as Bad.
HART Timeout	The number of milliseconds the DV Scanner will wait for a HART response, before flagging it as a no response.
Tagname	Custom name given to each IO Point.

Table 3.9 – 8 Channel 4-20mA HART Analog Input - IO Point Configuration

3.5.2.6. 8 CHANNEL 4-20MA HART ANALOG OUTPUT (AO8 HART)

Part Number: **KJ3221X1-BA1**

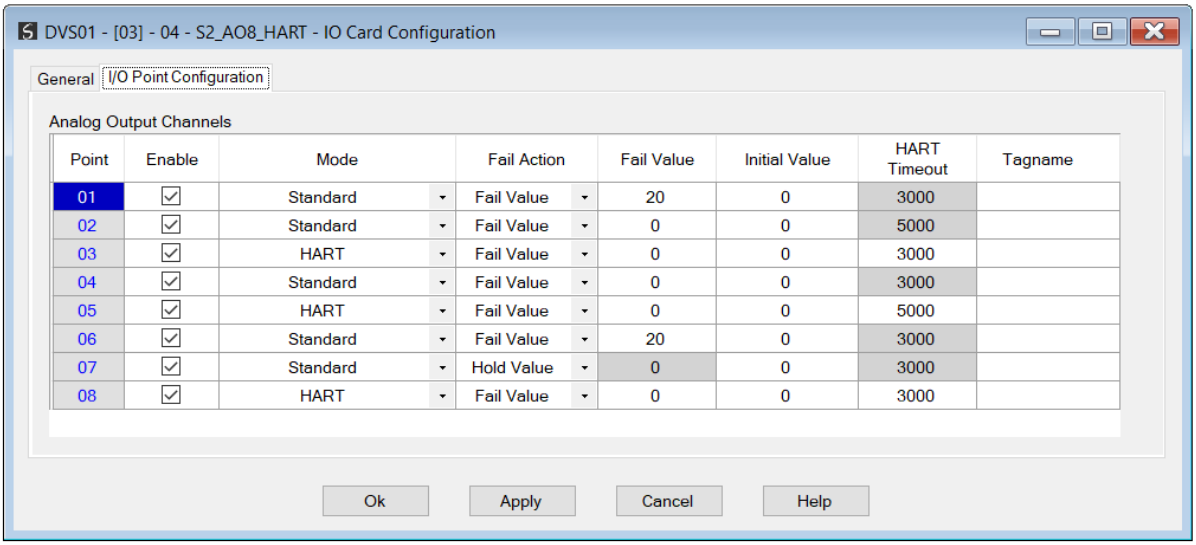


Figure 3.25 – 8 Channel 4-20mA HART Analog Output - IO Point Configuration parameters

The 8 Channel 4-20mA HART Analog Output IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Mode	The Mode parameter allows each IO point to operate in a specific mode. **Standard** When the standard is selected, the selected IO Point will operate as a normal 4-20mA analog output. **HART** When the HART mode is selected, it will enable the IO point to also communicate to a field device using HART.  **NOTE:** It that only HART instruments with short address 0 can be used.
Fail Action	This parameter will determine the behavior of the specific IO Point when communication to the IO card is lost. **Fail Value** Go to the Fail Value parameter. **Hold Value** Keep the IO Point value at the last assigned.
Fail Value	When the Fail Action parameter for a specific point has been set to *Fail Value*, then the Fail Value parameter will determine the value to which the IO Point will go.
Initial Value	The Initial Value parameter will determine the value of the IO Point at power up.
HART Timeout	The number of milliseconds the DV Scanner will wait for a HART response, before flagging it as a no response.
Tagname	Custom name given to each IO Point.

Table 3.10 – 8 Channel 4-20mA HART Analog Output - IO Point Configuration parameters

3.5.2.7. 8 CHANNEL 4-20MA ANALOG INPUT (AI8)

Part Number: **KJ3002X1-BC1**

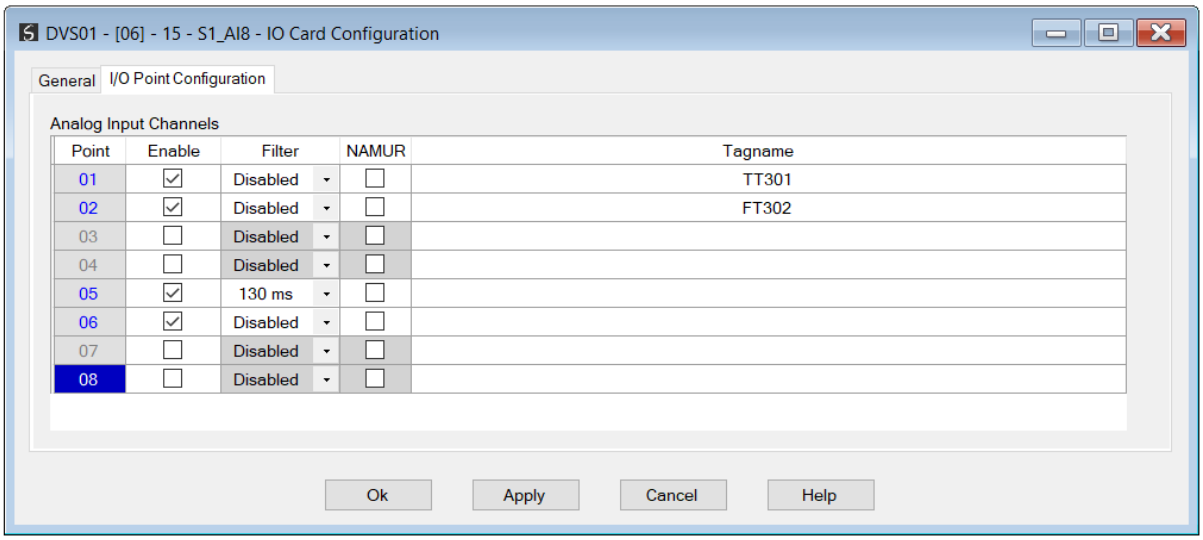


Figure 3.26 – 8 Channel 4-20mA Analog Input - IO Point Configuration

The 8 Channel 4-20mA Analog Input IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Filter	The filter time in milliseconds for the analog input IO point.
NAMUR	When this parameter is enabled, NAMUR alarming is performed on the data point. If the analog value is outside the NAMUR limits of 106.25% and -2.5% for 4 seconds, then the status will be shown as Bad.
Tagname	Custom name given to each IO Point.

Table 3.11 – 8 Channel 4-20mA Analog Input - IO Point Configuration

3.5.2.8. 8 CHANNEL 4-20MA ANALOG OUTPUT (AO8)

Part Number: **KJ3002X1-BB1**

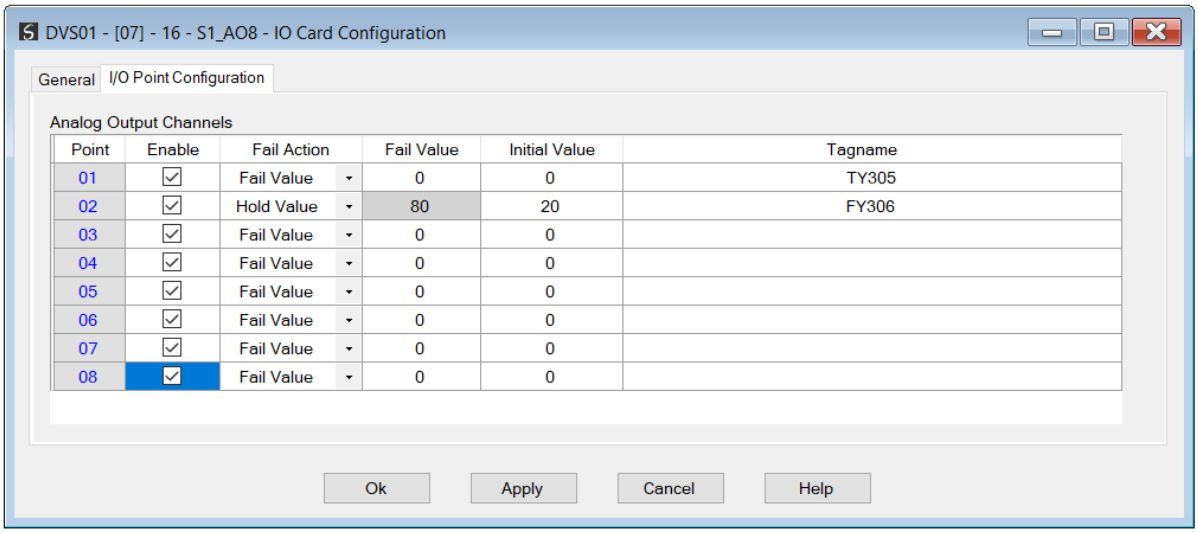


Figure 3.27 – 8 Channel 4-20mA Analog Output - IO Point Configuration parameters

The 8 Channel 4-20mA Analog Output IO Point configuration parameters are as follows:

Parameter	Description
Point	The IO point (channel) index. **NOTE**: The DeltaV™ M-series system numbers start at 1, whereas in Logix the index starts at 0.
Enable	When checked, the specific IO point is enabled.
Fail Action	This parameter will determine the behavior of the specific IO Point when communication to the IO card is lost. **Fail Value** Go to the Fail Value parameter. **Hold Value** Keep the IO Point value at the last assigned.
Fail Value	When the Fail Action parameter for a specific point has been set to *Fail Value*, then the Fail Value parameter will determine the value to which the IO Point will go.
Initial Value	The Initial Value parameter will determine the value of the IO Point at power up.
Tagname	Custom name given to each IO Point.

Table 3.12 – 8 Channel 4-20mA Analog Output - IO Point Configuration parameters

3.6. IMPORT DELTAV™ M-SERIES CONFIGURATION

Instead of manually configuring each IO card and IO point, the full IO configuration can be imported into Slate.

Firstly, the IO configuration must be exported from the DeltaV™ system to an FHX (ASCII) file.

In Slate, right-click on the DV Scanner and select the ***Import FHX File*** option.

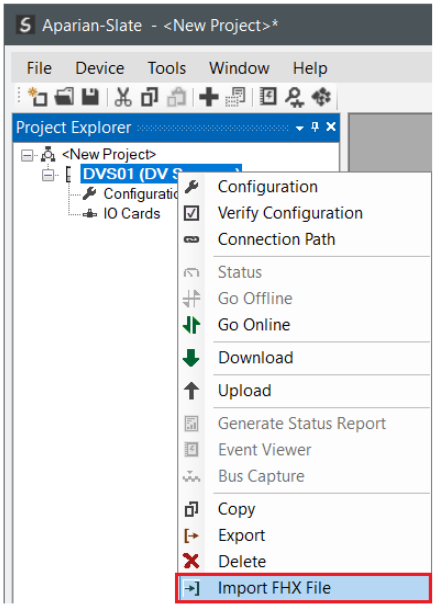


Figure 3.28 –Import FHX File Option

Then navigate to the previously exported FHX file.

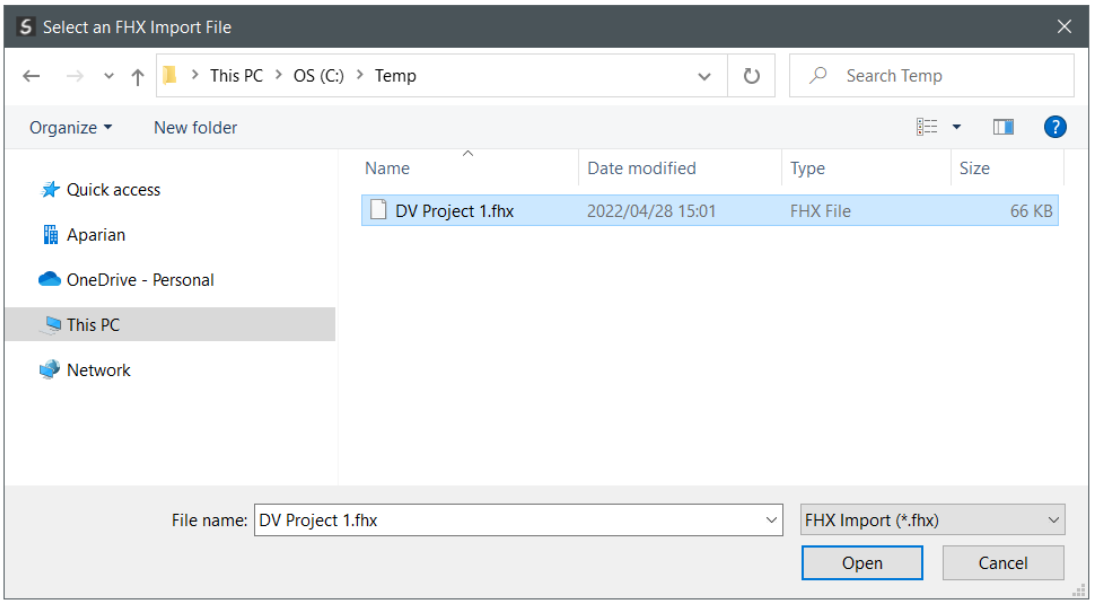


Figure 3.29 – File Browse to FHX file

Once the file has been imported, the ***FHX Import Selection*** form will open displaying all the IO cards extracted from the FHX file.

The user can now select which IO cards to import, by checking the ***Selected*** option adjacent to each IO card.

To select a range of IO cards, the ***Import Slot Range*** can be adjusted and then the ***Select*** button clicked to update the selection.

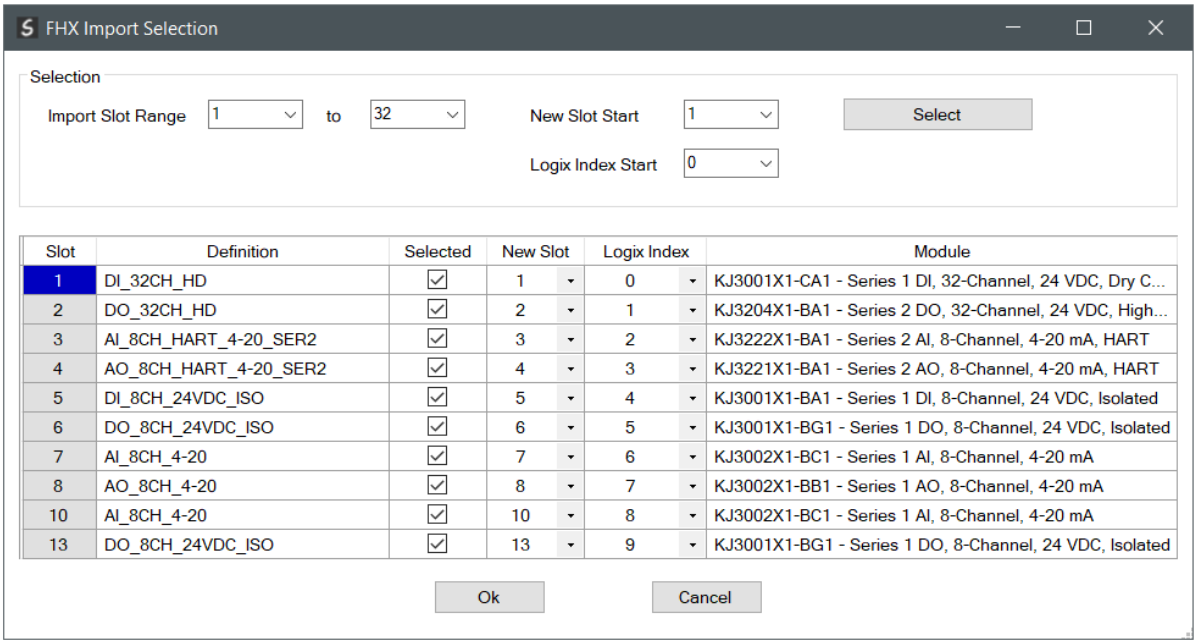


Figure 3.30 – FHX IO card import candidates

Clicking on the ***Ok*** button will import the selected IO cards into the Slate DV Scanner project.

3.7. REDUNDANCY

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

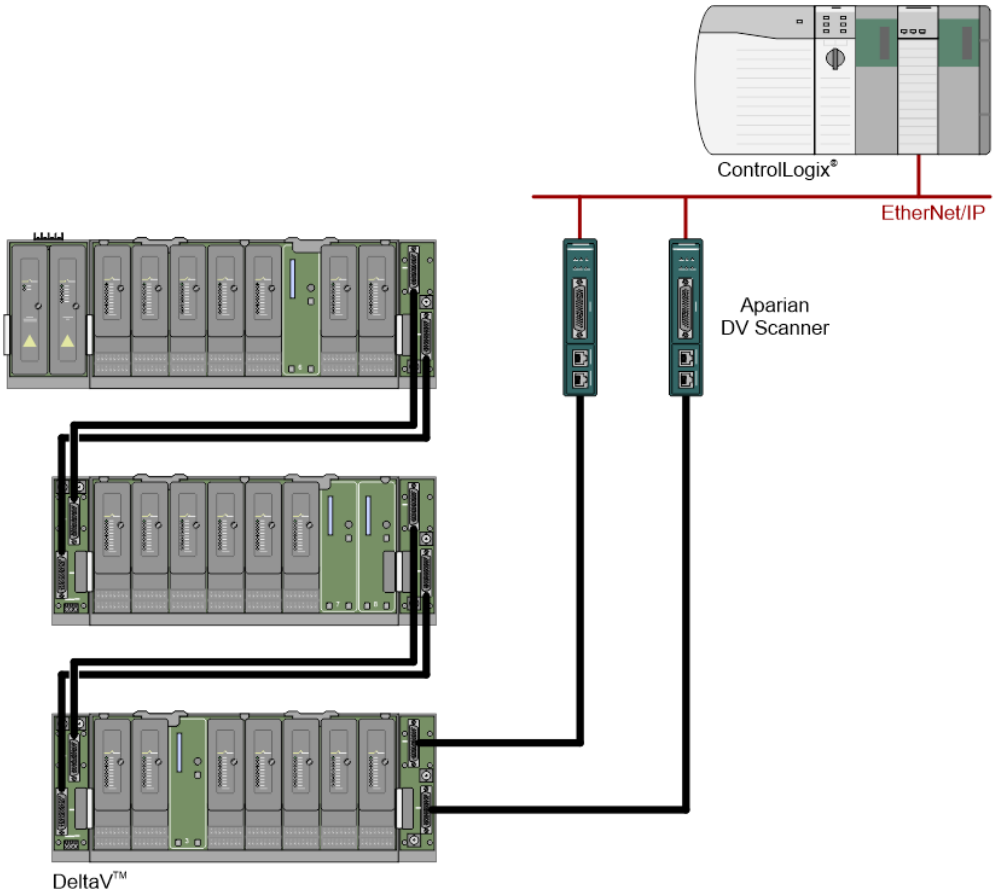


Figure 3.31 – DV Scanner Redundant configuration

When successfully configured, the DV Scanner redundant pair will provide fault tolerant communication to the DeltaV™ M-series IO. Should any the following conditions occur, the standby DV Scanner will automatically take over the communication from the previous active DV Scanner and become the new active DV Scanner:

- DV Scanner is powered down.
- DV Scanner IO extender cable is removed from the module.
- Ethernet communication between the DV Scanner and Logix is interrupted.
- DV Scanner is disabled in Logix.

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

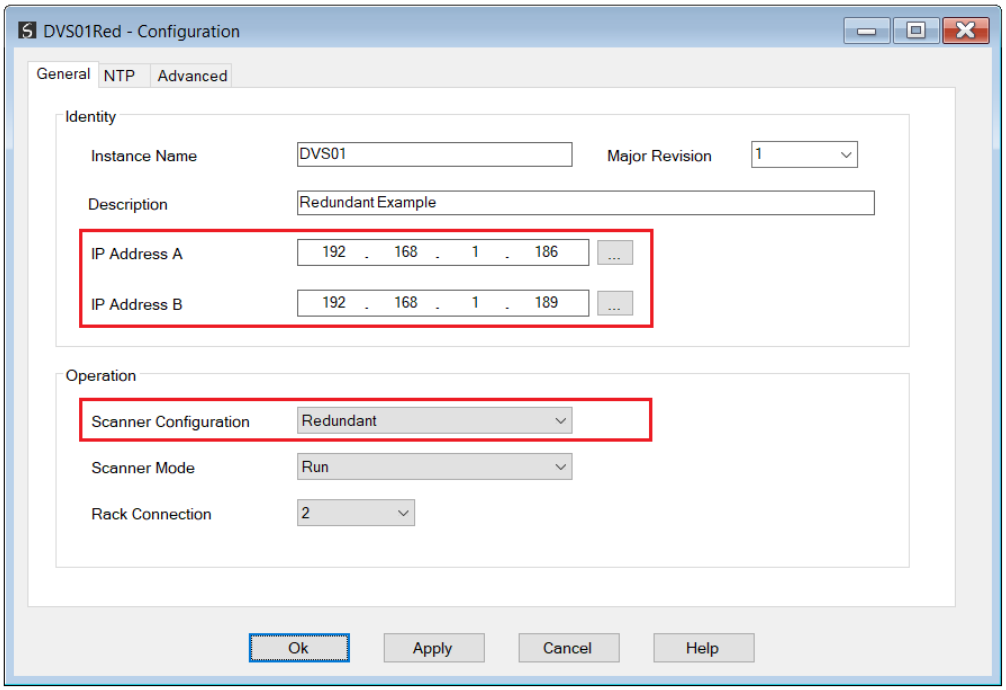


Figure 3.32 – DV Scanner redundant configuration

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

For the DV Scanner redundancy to operate correctly, the ***AparianDVSRedundancyMaster*** Add-On-Instruction (AOI) must be used.

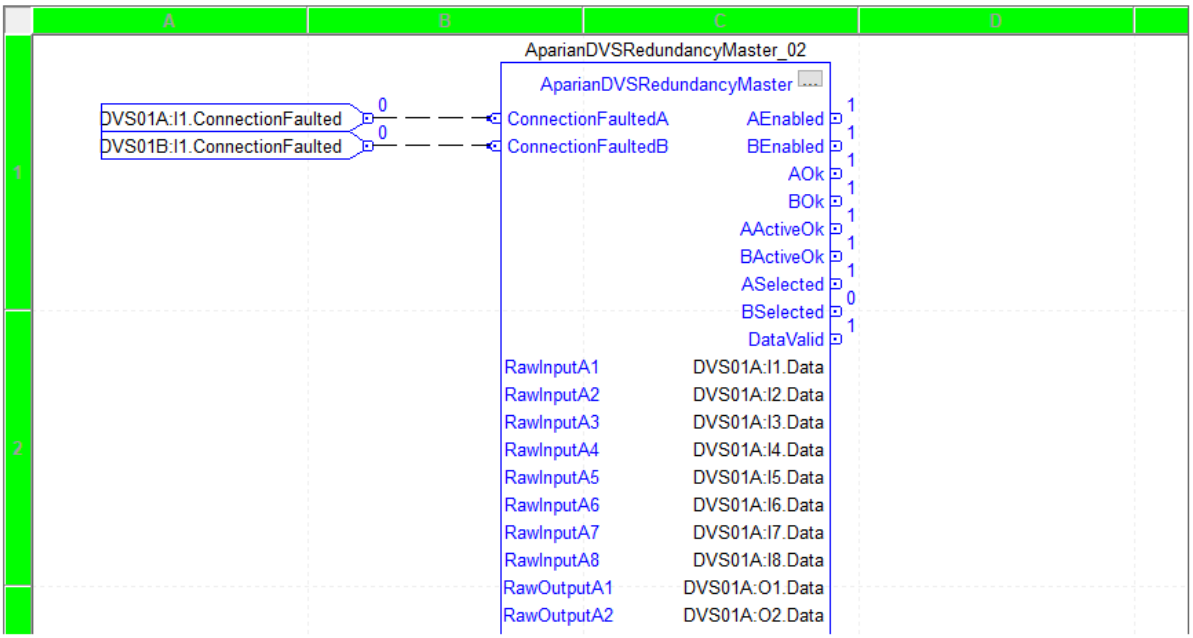


Figure 3.33 – DV Scanner Redundancy AOI

This AOI not only controls the switch-over between the two DV Scanners, but also marshals each IO card's data and status information from the active DV Scanner to a common tag for the user's application to access.

3.7.1. Theory of Operation

The DV Scanner make use of an Active / Standby redundancy strategy, where, at any one time, one of the DV Scanners is Active and the other in Standby.

The redundancy operation is governed by two parameters which are configurable in the Advanced tab:

- No Comms Take-Over Time
- Redundant Hold-Over Time

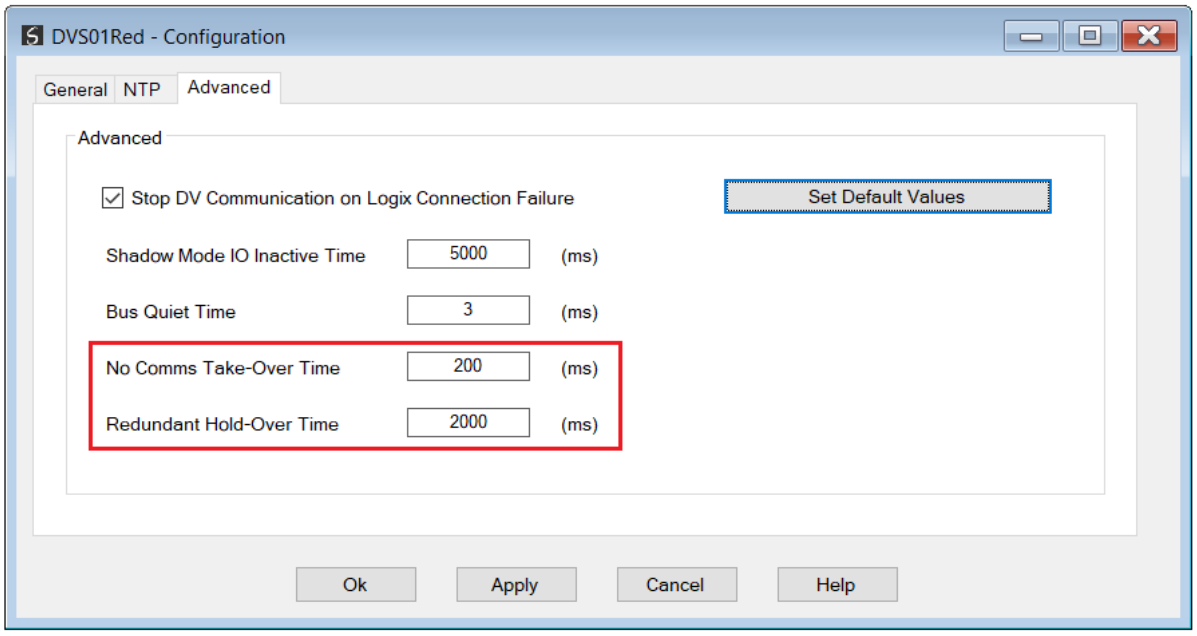


Figure 3.34 – DV Scanner Advanced configuration

When the Standby unit detects that the current Active master is no longer operational it will take over. This detection is based on the Standby master not receiving any LocalBus traffic for a period exceeding the ***No Comms Take-Over Time*** parameter.

Note that this parameter needs to be sufficiently large to accommodate for IO card time-outs and retries.

Since the switch-over may need to happen faster than the DV Scanner's RPI, the Standby master will automatically, and immediately, take over the LocalBus communication, which, initially, may be in conflict with the redundancy AOI's command.

The newly promoted Active master can remain in the Master state for a maximum of the ***Redundant Hold-Over Time*** parameter without the ControlLogix AOI accepting its new role.

The ***Redundant Hold-Over Time*** parameter must be greater than 4 times that of the DV Scanner's configured RPI in Logix.

During the ***Redundant Hold-Over Time*** period, the IO card data in Logix will remain unchanged.

3.8. MODULE DOWNLOAD

Once the configuration has been concluded, it must be downloaded to the DV 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 DV 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.

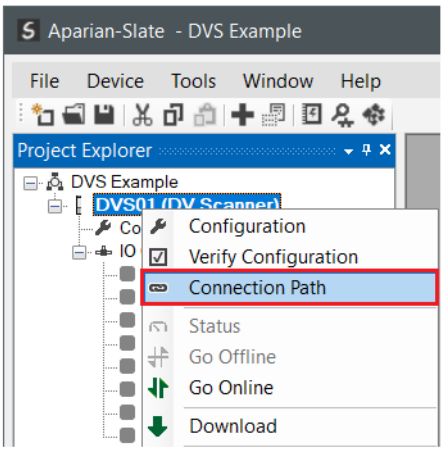


Figure 3.35 - Selecting Connection Path

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.

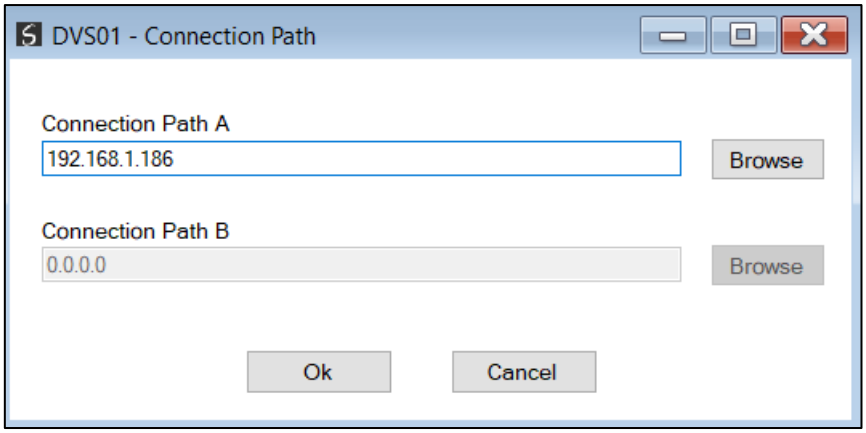


Figure 3.36 - Connection Path

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 DV Scanners. It is recommended that the user always download to ***Both Modules*** to avoid configuration conflicts.

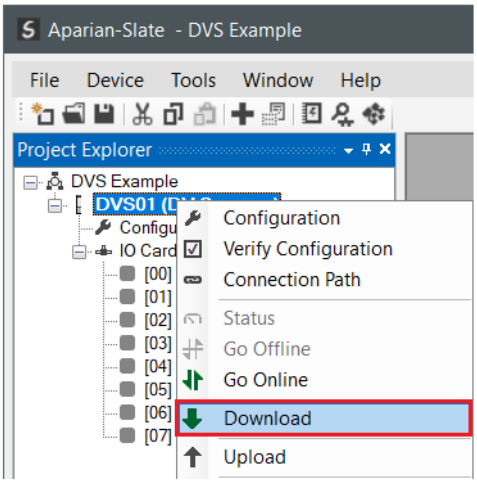


Figure 3.37 - Selecting Download

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

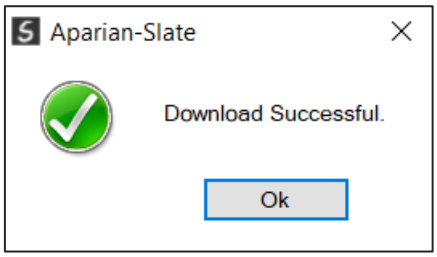


Figure 3.38 - Successful download

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.

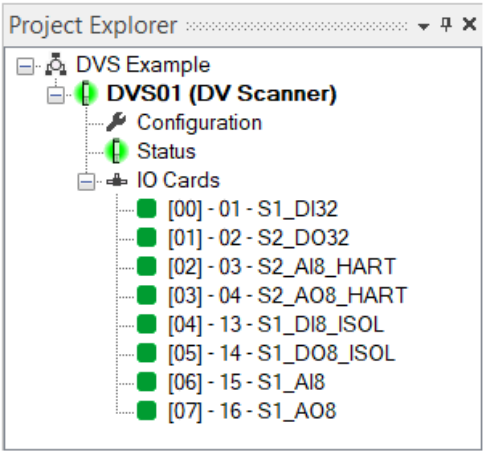


Figure 3.39 - Module online

3.9. STUDIO 5000 CONFIGURATION

NOTE: The minimum Studio 5000 version that can be used is v21. The DV Scanner uses an EDS AOP to support the 8 Class 1 connections.

3.9.1. 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.

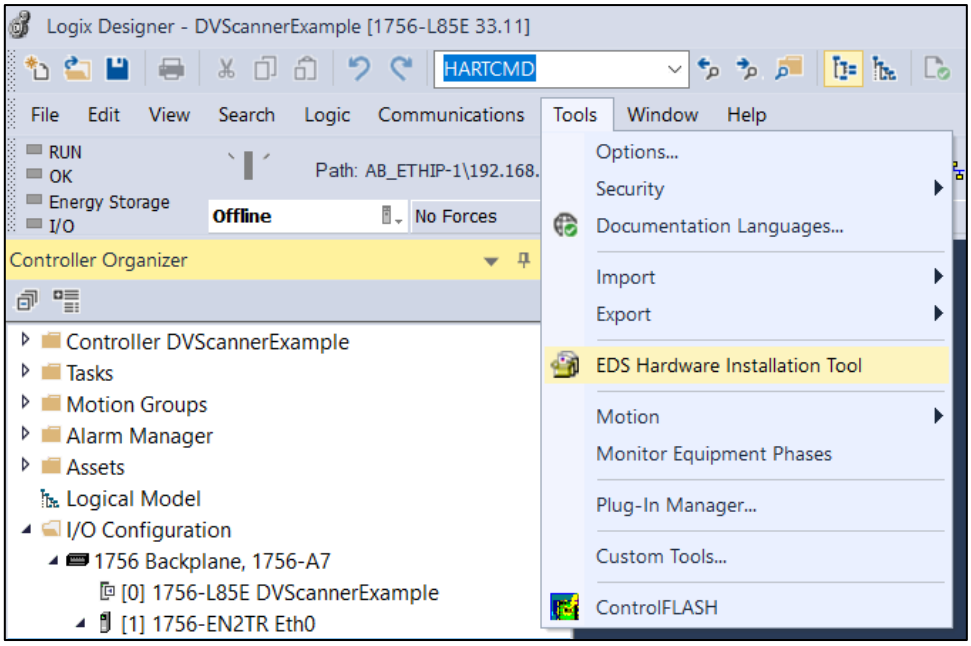


Figure 3.40 - EDS Hardware Installation Utility

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.

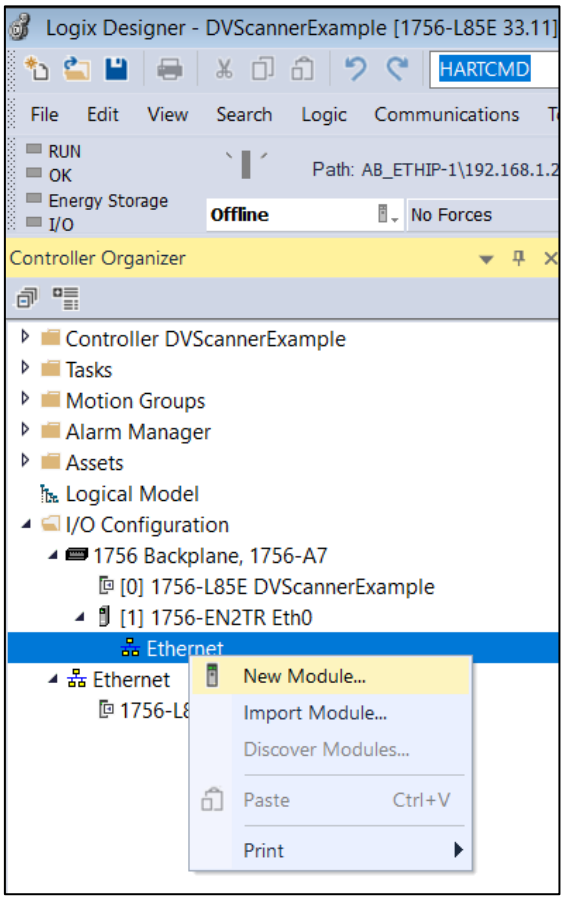


Figure 3.41 – Adding a module

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.

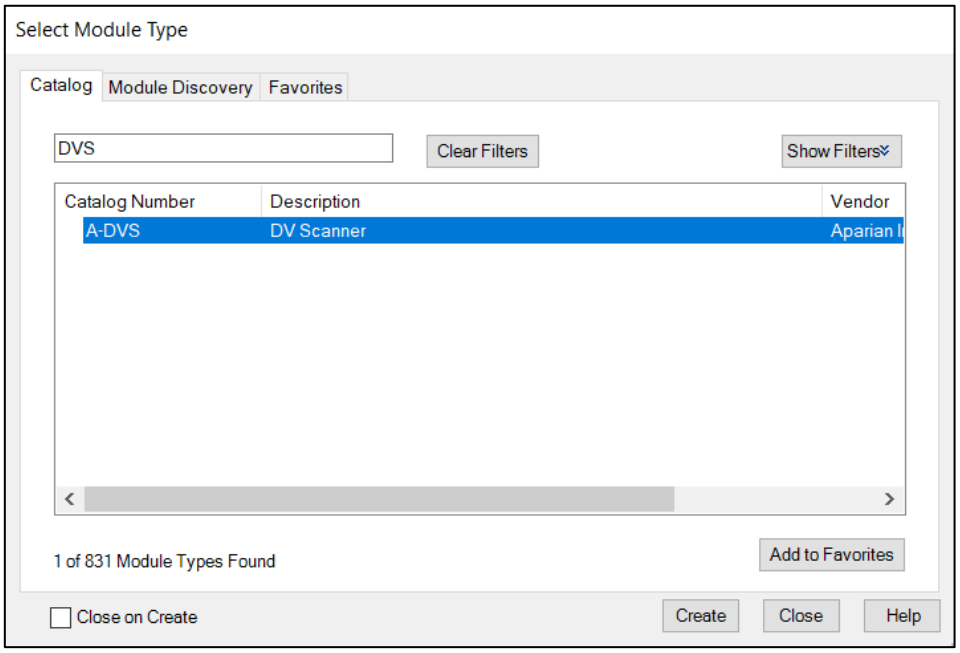


Figure 3.42 – Selecting the module

Locate and select the DV 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.

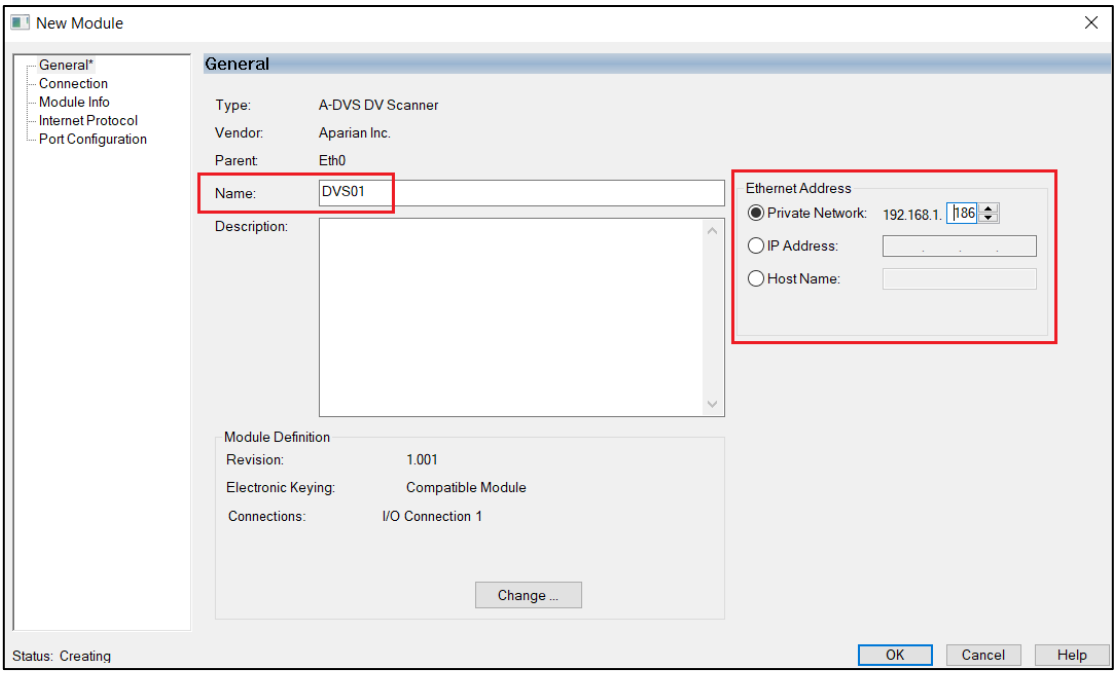


Figure 3.43 – Module instantiation

NOTE: The DV Scanner uses **eight** Class 1 connections to the Logix controller to operate. The user will need to set this up in the Module General Configuration as well as the EDS AOP (as shown below).

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

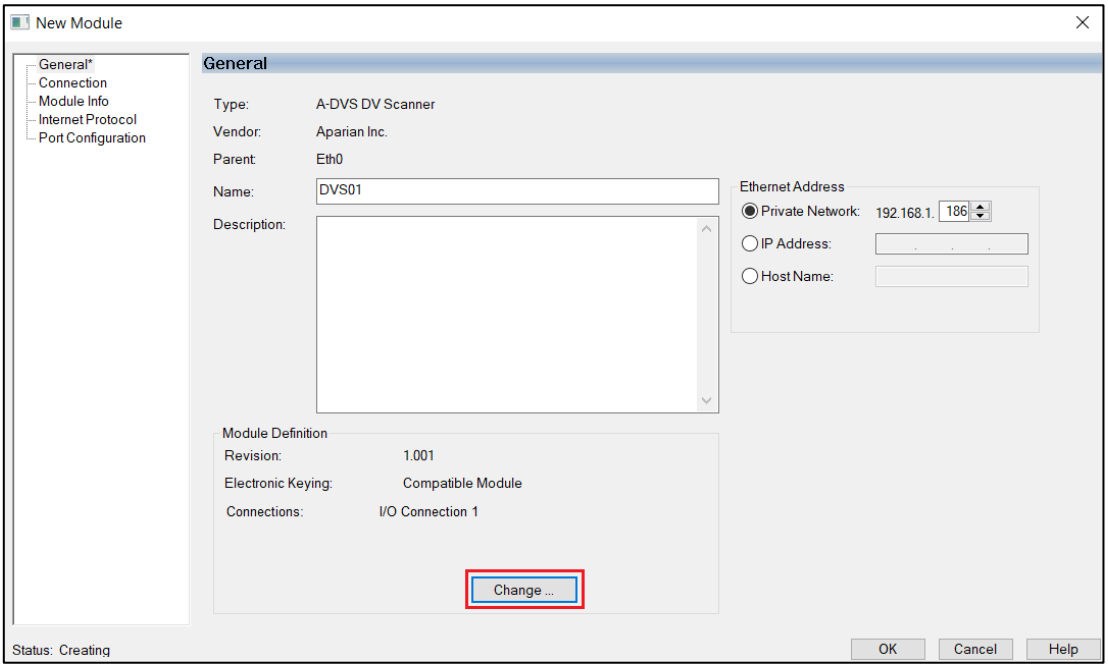


Figure 3.44 – Change the IO connections

Add **all** eight IO Connections to the EDS AOP Module Definition.

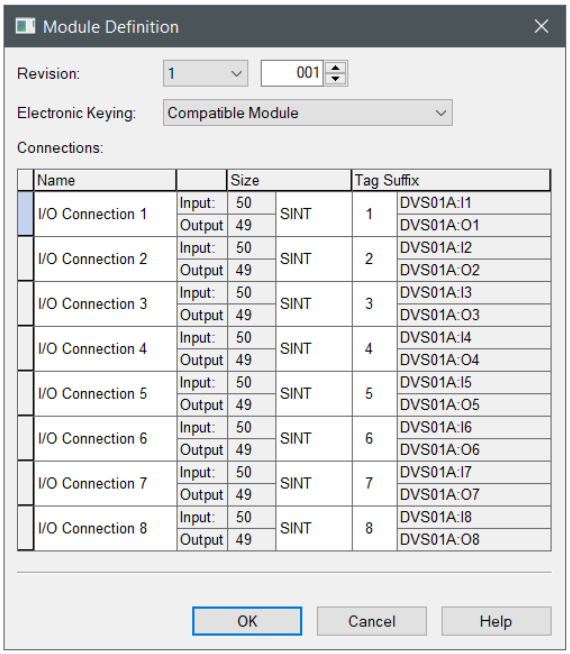


Figure 3.45 – Add All 8 IO Connection.

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

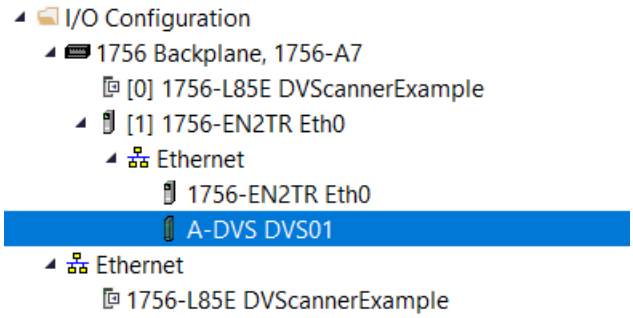


Figure 3.46 – Logix IO tree

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

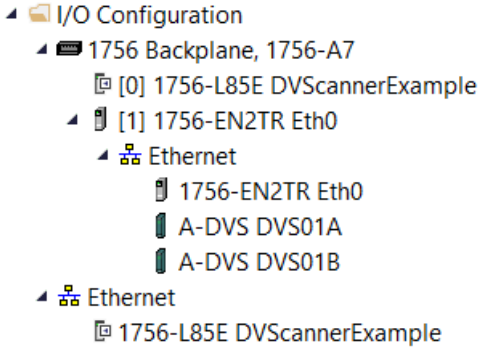


Figure 3.47 – Logix IO tree – Redundant DV Scanner

3.9.2. Importing UDTs, AOIs and Mapping Routines

To simplify the mapping of the input and output assemblies of each connection, a number of Studio 5000 Routine Partial Import (L5X) files are provided.
Import only one of these files depending on the type of application required.

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

- ***DVScannerStandaloneFBV1.L5X*** – Standalone Application (Function Block format)
- ***DVScannerStandaloneLDV1.L5X*** – Standalone Application (Ladder format)
- ***DVScannerRedundantFBV1.L5X*** – Redundant Application (Function Block format)
- ***DVScannerRedundantLDV1.L5X*** – Redundant Application (Ladder format)

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

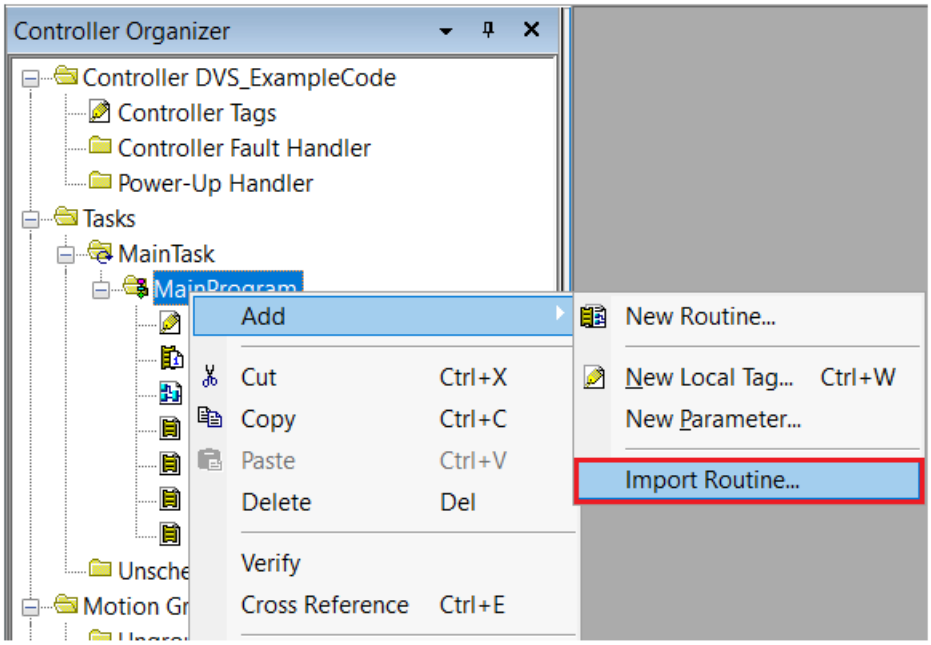


Figure 3.48 – Logix 5000 Importing DV Scanner specific routine

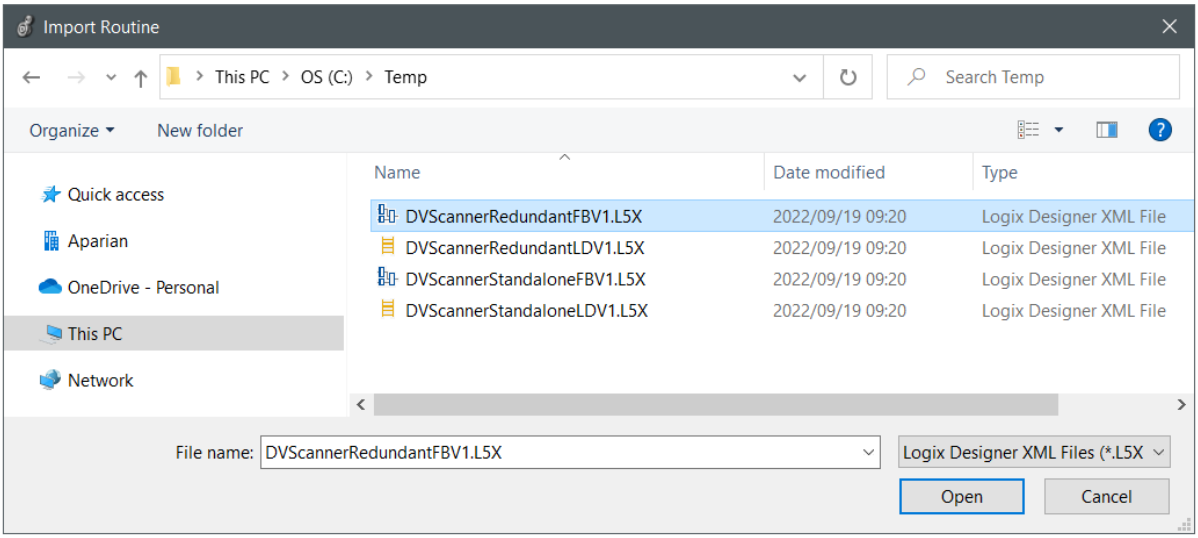


Figure 3.49 - Selecting partial import file

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 DV Scanner modules to the AOI.

NOTE: The imported standalone example code assumes the DV Scanner instance name is "**DVS01**". 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 DV Scanner instance names are "**DVS01A**" and "**DVS01B**". 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 DV Scanner modules instance names, and make sure that the mapping routine is called by the Program's Main Routine.

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

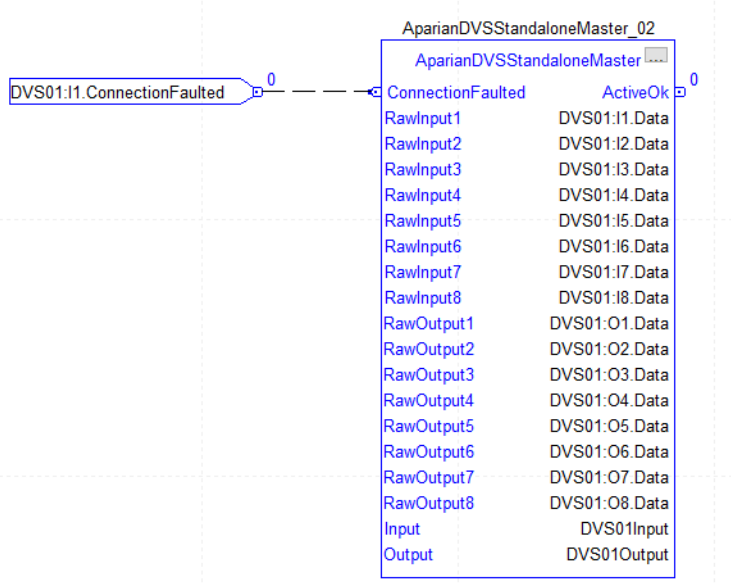


Figure 3.50 - Imported Standalone Mapping AOI (FB)

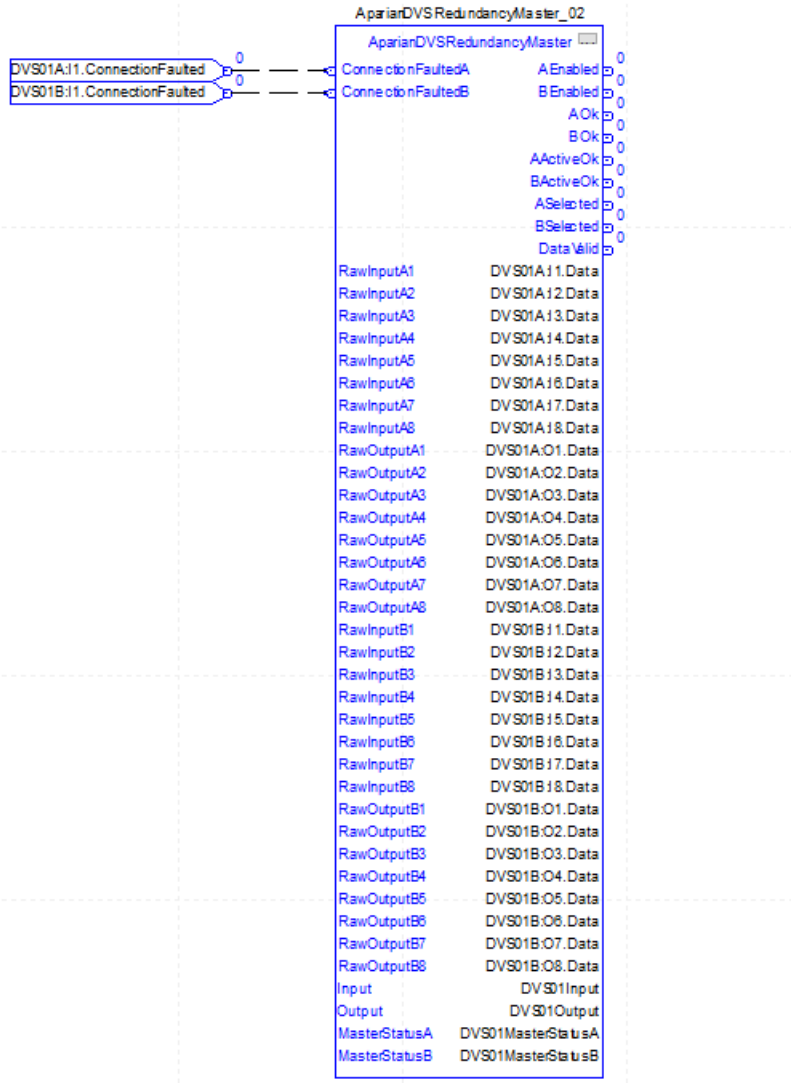


Figure 3.51 - Imported Redundant Mapping AOI (FB)

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 - INPUT / OUTPUT ASSEMBLIES

Each DV Scanner consumes eight 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 eight connections from each DV Scanner and manage the DV Scanner redundancy to update a single tag (UDT) which will represent the DeltaV™ M-series 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 DV Scanner and the DeltaV™ M-series IO system.

Name	Value	Style	Data Type	Description
DVS01Input	{...}		AparianDVSInput	
DVS01Input.Master	{...}		AparianDVSMasterInput	
DVS01Input.Master.ConfigValid	1	Decimal	BOOL	DV Scanner configuration is valid.
DVS01Input.Master.ControllerRun	1	Decimal	BOOL	Logix controller in Run mode.
DVS01Input.Master.MasterControlDisable	0	Decimal	BOOL	Master Disabled by AOI command.
DVS01Input.Master.RedundantCRCMismatch	0	Decimal	BOOL	Partner DV Scanner configuration is different.
DVS01Input.Master.Owned	1	Decimal	BOOL	Logix connected.
DVS01Input.Master.RedundancyEnabled	0	Decimal	BOOL	Redundancy enabled: 0 = Standalone, 1 = Redundant
DVS01Input.Master.RedundancyStatus	0	Decimal	BOOL	Redundancy Status: 0 = Standby, 1 = Active
DVS01Input.Master.DataValid	0	Decimal	BOOL	Data from Scanner is Valid (Set by AOI)
DVS01Input.Master.AtLeastOneCardRunning	1	Decimal	BOOL	At least one IO card running
DVS01Input.Master.RunMode	1	Decimal	BOOL	Configured Mode: 0 = Shadow, 1 = Run
DVS01Input.Master.ConfigCRC	16#7e22	Hex	INT	DV Configuration Checksum
DVS01Input.Master.TransactionRate	106	Decimal	INT	Bus Transactions per Second.
DVS01Input.Master.SwitchOverTimeOut	800	Decimal	INT	Redundancy Switchover Time
DVS01Input.Master.Temperature	39.875538	Float	REAL	Module CPU Temperature (deg. C)
DVS01Input.Master.LiveList	{...}	Decimal	BOOL[32]	IO Card Live List
DVS01Input.Master.RunList	{...}	Decimal	BOOL[32]	IO Card Live List
DVS01Input.Master.Reserved	{...}	Decimal	SINT[8]	
DVS01Input.IOCard	{...}		AparianDVSIOCardInput[32]	
DVS01Input.IOCardHART	{...}		AparianDVSIOCardHART[32]	

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

Parameter	Data Type	Description
ConfigValid	BOOL	The active DV Scanner has valid configuration.
ControllerRun	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.
Owned	BOOL	The active DV 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 DV 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.
AtLeastOneCardRunning	BOOL	This bit indicates that at least one IO card is present and running.
RunMode	BOOL	This bit indicates that the DV Scanner has been configured for Run Mode.
ConfigCRC	INT	The configuration signature of the active DV Scanner. This must match that of the standby DV Scanner to ensure both DV Scanners have the same configuration.
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 DV Scanners. During this time the input data will be frozen.
Temperature	REAL	The DV Scanner module CPU temperature.
LiveList	BOOL[32]	The live list of the card addresses 0-31. Each bit represents an address. For example, **Bit-0** is Set – the IO card at address **0** is **Ok** **Bit-1** is not Set – the IO card at address **1** is **NOT Ok**
RunList	BOOL[32]	The run list of the card addresses 0-31. Each bit represents an address. For example, **Bit-0** is Set – the IO card at address **0** is **Exchanging Data.** **Bit-1** is not Set – the IO card at address **1** is **NOT Exchange Data.**

Table 4.1 – Parameters for General Status Tag

4.1.2. MASTER CONTROL

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

Name	Value	Style	Data Type	Description
DVS01Output	{...}		AparianDVSOutput	
DVS01Output.Master	{...}		AparianDVSMasterOutput	
DVS01Output.Master.MasterControl	16#0000	Hex	INT	DV Scanner Master Control
DVS01Output.Master.PartnerConfigCRC	16#0000	Hex	INT	DV Scanner Configuration Checksum of Redundant Partner
DVS01Output.Master.Reserved	{...}	Decimal	SINT[16]	

Figure 4.2 – Parameters for the General Control Tag

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

Table 4.2 – Parameters for General Control Tag

4.1.3. IO CARD INPUT

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

Name	Value	Style	Data Type	Description
DVS01Input	{...}		AparianDVSInput	
DVS01Input.Master	{...}		AparianDVSMasterInput	
DVS01Input.IOCard	{...}		AparianDVSIOCardInput[32]	
DVS01Input.IOCard[0]	{...}		AparianDVSIOCardInput	
DVS01Input.IOCard[0].Online	1	Decimal	BOOL	IO Card is Online
DVS01Input.IOCard[0].Running	1	Decimal	BOOL	IO Card is Running
DVS01Input.IOCard[0].Error	0	Decimal	BOOL	IO Card is in Error State
DVS01Input.IOCard[0].CardMismatch	0	Decimal	BOOL	IO Card Configuration Mismatch
DVS01Input.IOCard[0].HARTCommsOk	0	Decimal	BOOL	HART Communication Ok
DVS01Input.IOCard[0].Slot	1	Decimal	SINT	Configured Slot Address
DVS01Input.IOCard[0].Rack	1	Decimal	SINT	Configured Rack Address
DVS01Input.IOCard[0].IOCardStatus	2	Decimal	SINT	IO Card Status
DVS01Input.IOCard[0].DigitalInputs	2#0000_0000...	Binary	DINT	Status of Digital Input
DVS01Input.IOCard[0].ChannelStatus	{...}	Decimal	SINT[16]	Channel Status
DVS01Input.IOCard[0].ChannelPV	{...}	Float	REAL[16]	Channel Process Variables
DVS01Input.IOCard[0].ChannelCounter	{...}	Decimal	INT[8]	Channel Counter Values
DVS01Input.IOCard[0].HARTCommsStatus	0	Decimal	INT	HART Communication Status
DVS01Input.IOCard[0].Reserved1	0	Decimal	INT	
DVS01Input.IOCard[0].HARTMUXChIndex	0	Decimal	SINT	HART Multiplexed Channel Index
DVS01Input.IOCard[0].HARTMUXPVIndex	0	Decimal	SINT	HART Multiplexed PV Index
DVS01Input.IOCard[0].HARTPVUnit	0	Decimal	SINT	HART Multiplexed PV Unit Value
DVS01Input.IOCard[0].HARTMUXIndex	112	Decimal	SINT	HART Multiplexed Total Index
DVS01Input.IOCard[0].HARTPVValue	0.0	Float	REAL	HART Multiplexed PV Value

Figure 4.3 – Input data provided from each IO card

NOTE: All the HART values for the specific Analog IO card (PV, SV, TV, and FV for each channel) are multiplex for the specific Analog IO card. See the HART multiplexing section below.

Parameter	Datatype	Description
Online	BOOL	Indicates that the IO card is online. (Communicating on the bus).
Running	BOOL	Indicates that the IO card is running and exchanging data.

Error	BOOL	Indicates the IO card is in an error state.
CardMismatch	BOOL	Indicates that the configured IO card does not match the physical IO card.
Slot	SINT	Slot Number of the IO card.
Rack	SINT	Rack Number of the IO card.
IOCardStatus	SINT	The low-level IO card Status.
DigitalInputs	DINT	Indicates the current value of each digital input. Each bit represents a digital point. **NOTE:** This is only applicable for digital cards.
ChannelStatus[16]	SINT[16]	Indicates the channel status for each Analog channel. Bit 0 – When set the IO Channel does not have external power. Bit 5 – When set there is not HART communication on the channel (if HART has been enabled for the channel). **NOTE:** This is only applicable for Analog cards.
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 cards.
ChannelCounter[8]	INT[8]	When using IO Digital Input cards that support counters, the counter value for each Digital Input. **NOTE:** The counter values can be reset by setting Bit 0 in the respective Channel Control in the IO output assembly.
HARTCommsStatus	INT	Each bit represents a channel on the analog IO module. When the bit is set then HART communication is OK and HART data is being exchanged. When the bit is cleared then the HART communication is **not** OK and there is no HART communication. For example; Bit 2 is set (1) – The HART communication on Channel 2 on the Analog IO card is OK.
HARTMUXChIndex	SINT	The Analog Card Channel number from which the value was received from the HART device.
HARTMUXPVIndex	SINT	The HART value process variable index. 0 – PV 1 – SV 2 – TV 3 – FV
HARTPVUnit	SINT	The process variable HART unit number to indicate the engineering units of the value shown.
HARTMUXIndex	SINT	The HART value multiplex confirmation number. This is the number that needs to be put into the output assembly for the specific Analog IO card to indicate that the HART value has been received and the next value can be displayed.

HARTPVValue	REAL	The HART process variable.

Table 4.3 - Parameters for Card Input

WARNING: When making use of the IO card 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 card's ***Online*** and ***Running*** bits.

4.1.1. IO CARD HART INPUT

The following parameters are used to provide the HART data of each configured HART Analog IO card:

Name	Value	Style	Data Type	Description
DVS01Input	{...}		AparianDVSInput	
DVS01Input.Master	{...}		AparianDVSMasterInput	
DVS01Input.IOCard	{...}		AparianDVSIOCardInput[32]	
DVS01Input.IOCardHART	{...}		AparianDVSIOCardHART[32]	
DVS01Input.IOCardHART[0]	{...}		AparianDVSIOCardHART	
DVS01Input.IOCardHART[0].HARTChannels	{...}		AparianDVSIOHARTData[16]	
DVS01Input.IOCardHART[0].HARTChannels[0]	{...}		AparianDVSIOHARTData	
DVS01Input.IOCardHART[0].HARTChannels[0].PV	0.0	Float	REAL	Primary Variable
DVS01Input.IOCardHART[0].HARTChannels[0].SV	0.0	Float	REAL	Secondary Variable
DVS01Input.IOCardHART[0].HARTChannels[0].TV	0.0	Float	REAL	Third Variable
DVS01Input.IOCardHART[0].HARTChannels[0].FV	0.0	Float	REAL	Fourth Variable
DVS01Input.IOCardHART[0].HARTChannels[0].PVUnit	0	Decimal	SINT	Primary Variable Unit Code
DVS01Input.IOCardHART[0].HARTChannels[0].SVUnit	0	Decimal	SINT	Secondary Variable Unit Code
DVS01Input.IOCardHART[0].HARTChannels[0].TVUnit	0	Decimal	SINT	Third Variable Unit Code
DVS01Input.IOCardHART[0].HARTChannels[0].FVUnit	0	Decimal	SINT	Fourth Variable Unit Code

Figure 4.4 – HART Input data provided from each IO card

These tags contain the demultiplexed HART values for each HART channel.

Parameter	Datatype	Description
PV	REAL	Primary Variable
SV	REAL	Secondary Variable
TV	REAL	Third Variable
FV	REAL	Fourth Variable
PVUnit	SINT	Primary Variable Engineering Unit Code
SVUnit	SINT	Secondary Variable Engineering Unit Code
TVUnit	SINT	Third Variable Engineering Unit Code
FVUnit	SINT	Fourth Variable Engineering Unit Code

Table 4.4 - Parameters for HART Input

4.1.2. IO CARD OUTPUT

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

Name	Value	Style	Data Type	Description
DVS01Output	{...}		AparianDVSOutput	
DVS01Output.Master	{...}		AparianDVSMasterOutput	
DVS01Output.IOCard	{...}		AparianDVSIOCardOutput[32]	
DVS01Output.IOCard[0]	{...}		AparianDVSIOCardOutput	
DVS01Output.IOCard[0].CardControl	16#0000	Hex	INT	Card Control Word - Reserved
DVS01Output.IOCard[0].HartMUXAckIndex	-26	Decimal	SINT	HART Multiplexed Ack Index
DVS01Output.IOCard[0].Reserved	0	Decimal	SINT	
DVS01Output.IOCard[0].DigitalOutputs	2#0000_0000...	Binary	DINT	Digital Output Value
DVS01Output.IOCard[0].ChannelPV	{...}	Float	REAL[16]	Analog Channel Value
DVS01Output.IOCard[0].ChannelControl	{...}	Decimal	SINT[16]	Analog Channel Control
DVS01Output.IOCard[0].Reserved2	{...}	Decimal	SINT[8]	

Figure 4.5 – Output data provided for each input card

Parameter	Datatype	Description
CardControl	INT	Card Control command. Reserved for future.
HartMUXAckIndex	SINT	The HART multiplex confirmation number that will be sent to the DV Scanner to inform it that the current multiplexed HART value has been read and the next can be loaded.
DigitalOutputs	INT	The value of the digital outputs being sent to the IO card. Each bit represents a digital channel. **NOTE:** This is only applicable for Digital Output cards.
ChannelPV[16]	REAL[16]	The value of the Analog outputs being sent to the IO card. **NOTE:** This is only applicable for Analog output cards.
ChannelControl[16]	SINT[16]	Channel control command. Bit 0 – When this bit is set, it will clear the current Counter values for that specific Discrete Input channel. Once the value is set back to zero again, will the counter start increasing again. **NOTE:** This is only applicable to the DI8 cards.

Table 4.5 - Parameters for Card Output

4.2. LOGIX 5000 - REDUNDANCY

When using a redundant DV Scanner configuration, then both the DV Scanners (A and B) must be added in the Logix IO tree.

The process of adding each of these DV Scanners is identical to that of adding a standalone DV Scanner, with the exception of adding an “A” and “B” suffix to the instance name.

The base instance of each DV Scanner must be the same as the instance name configured in Slate.

In the example below the names are as follows:

Parameter	Name Example
Slate DV Scanner Instance	**DVS01**
Logix IO Tree DV Scanner **A** Instance	**DVS01A**
Logix IO Tree DV Scanner **B** Instance	**DVS01B**

Table 4.6 – Redundant Instance Names

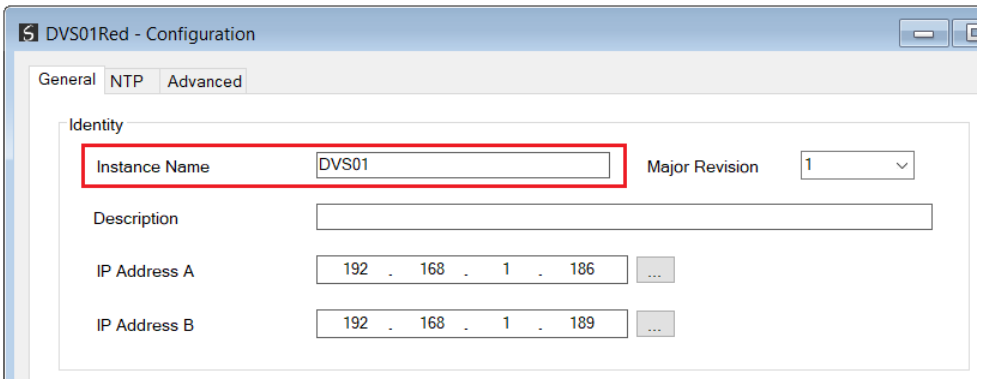


Figure 4.6 – DV Scanner Instance Name - Slate

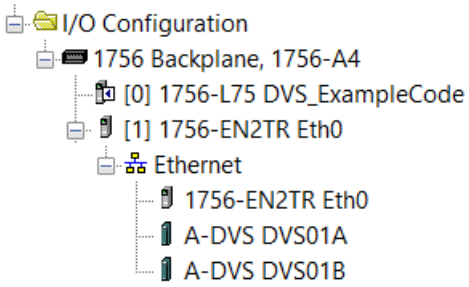


Figure 4.7 – Logix IO Tree – Redundant DV Scanner pair

5. DIAGNOSTICS

5.1. LEDS

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

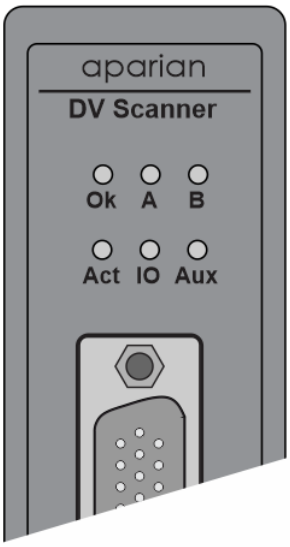


Figure 5.1 – DV Scanner front LEDs

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 **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.
A / B	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic is detected. This module has two Ethernet ports A and B. Each LEDs represents each specific port.
Act	The LED indicates the Active Master status. **Green (solid)** – The DV Scanner is the ***Active*** Master on the LocalBus.

	Green (flashing) – The DV Scanner is the ***Standby*** Master on the LocalBus. **Off** – The DV Scanner is not sending TX packets but just listening.
IO	Each time a packet is received from a DeltaV IO card, this LED will flash either green or red. If the packet was successful it will flash green, if there was a error (e.g., checksum error), then the LED will flash red.
Aux	Each time a packet is received from the auxiliary interface (i.e., EtherNet/IP), then this LED will flash green.

Table 5.1 - Module LED operation

5.2. MODULE STATUS MONITORING IN SLATE

The DV 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.

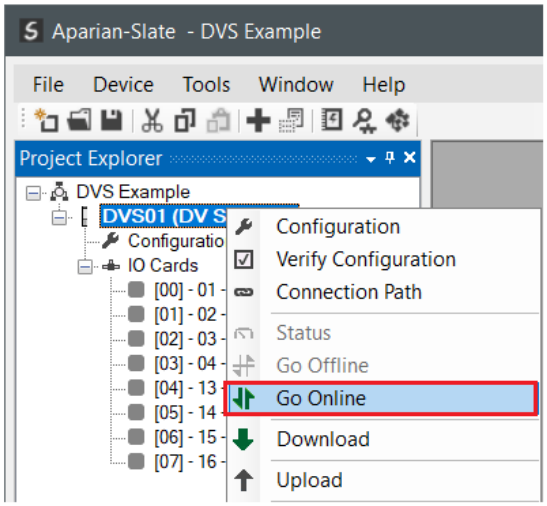


Figure 5.2 - Selecting to Go Online

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 colors. The online project tree differs for Standalone and Redundant DV Scanner configurations.

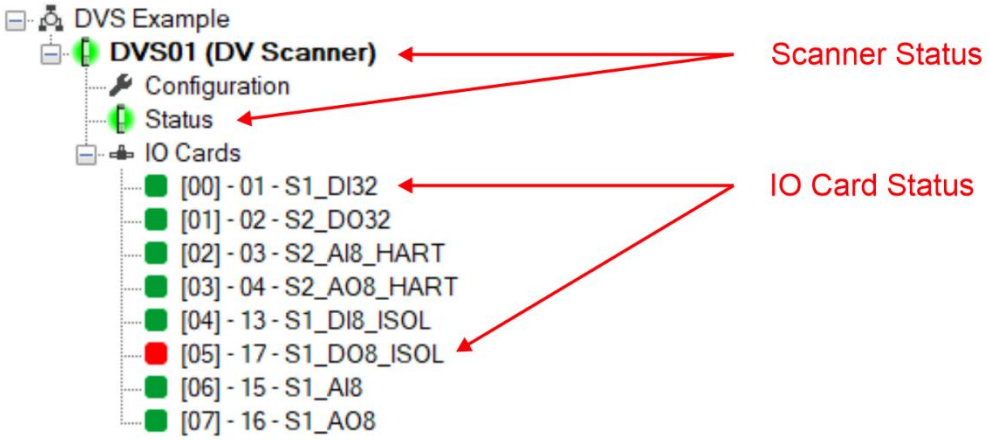


Figure 5.3 – Project Explorer Online Status - Standalone

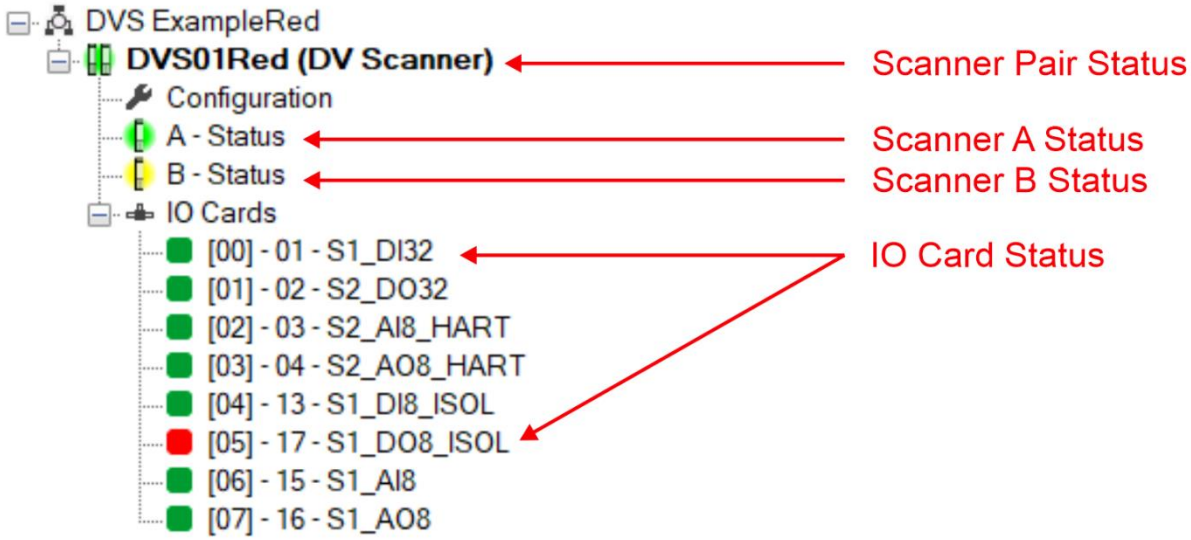
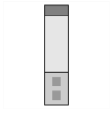
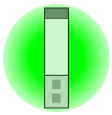
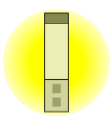


Figure 5.4 – Project Explorer Online Status - Redundant

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

Icon	Description
	Offline
	Online and Active
	Online and Standby

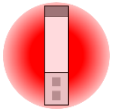
	Offline – Scanner was disconnected when previously online.

Table 5.2 – Scanner Status

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

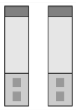
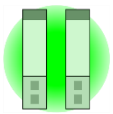
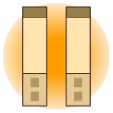
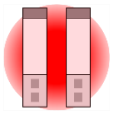
Icon	Description
	Offline
	Online (Both Scanners connected)
	Online – Partially (Only one of the scanners connected)
	Offline – Scanners were disconnected when previously online.

Table 5.3 – Scanner Pair Status

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

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

Table 5.4 – IO Card 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***, ***Status A*** or ***Status B***. The status window contains multiple tabs to display the current

status of the module.

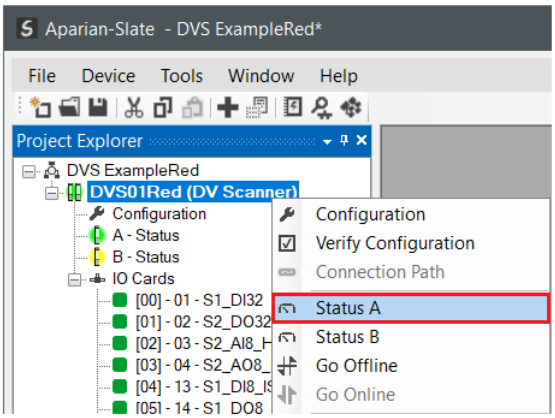


Figure 5.5 - Selecting online Status

5.2.2.1. SCANNER STATUS - GENERAL

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

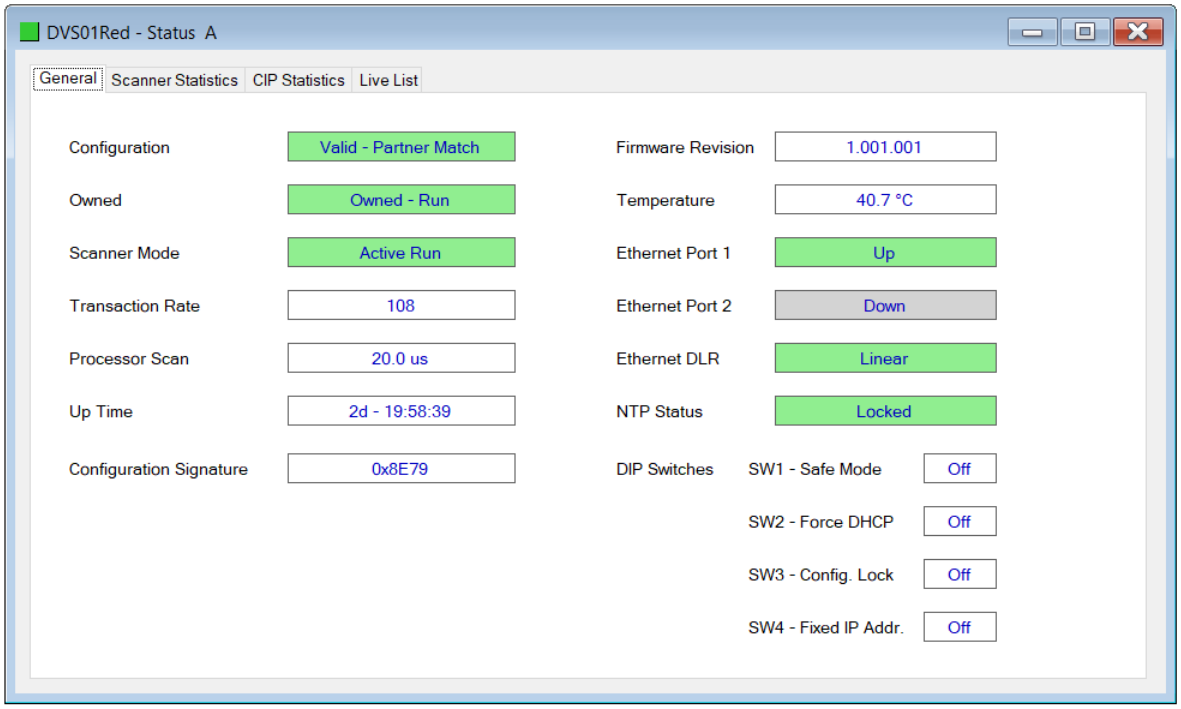


Figure 5.6 - Status monitoring – Active – General

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 the class 1 EtherNet/IP connections from the controller.
Scanner Mode	The current mode of the DV Scanner: **Disabled** The DV Scanner has been disabled. **Standalone Operation:** **Run** The DV Scanner is in Run mode and is connected to an active LocalBus. **Run Disconnected** The DV Scanner is in Run mode but not connected to an active LocalBus. **Shadow** The DV Scanner is in Shadow mode and is connected to an active LocalBus.

	Shadow Disconnected The DV Scanner is in Shadow mode but not connected to an active LocalBus. **<u>Redundant Operation:</u>** **Active Run** The DV Scanner is the Active master, is in Run mode and is connected to an active LocalBus. **Active Disconnected** The DV Scanner is the Active master, is in Run mode but not connected to an active LocalBus. **Standby Run** The DV Scanner is the Standby master, is in Run mode and is connected to an active LocalBus. **Standby Disconnected** The DV Scanner is the Standby master, is in Run mode but not connected to an active LocalBus. **Active Shadow** The DV Scanner is the Active master, is in Shadow mode and is connected to an active LocalBus. **Active Shadow Disconnected** The DV Scanner is the Active master, is in Shadow mode but not connected to an active LocalBus. **Standby Shadow** The DV Scanner is the Standby master, is in Shadow mode and is connected to an active LocalBus. **Standby Shadow Disconnected** The DV Scanner is the Standby master, is in Shadow mode but not connected to an active LocalBus.
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.
Configuration Signature	The current configuration checksum (CRC).
Firmware Revision	The firmware revision of the module.
Temperature	The internal temperature of the module's CPU.
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.
Ethernet DLR	The status of the Ethernet DLR. **Disabled** Device Level Ring functionality has been disabled. **Linear** The DLR functionality has been enabled and the Ethernet network architecture is linear. **Ring – Fault** The DLR functionality has been enabled and the Ethernet network architecture is ring, but there is a fault with the network. **Ring – Ok** The DLR functionality has been enabled and the Ethernet network architecture is ring and is operating as expected.
NTP Status	The status of the local NTP Client. **Disabled** The NTP time synchronization has been disabled. **Locked** NTP time synchronization has been enabled and the PA Link has locked onto the target time server. **Not Locked** NTP time synchronization has been enabled and the PA Link has not locked onto the target time server.
DIP Switch Position	The status of the DIP switches when the module booted. SW1 – Safe Mode SW2 – Force DHCP SW3 – Configuration Lock SW4 – Fixed IP Address 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.

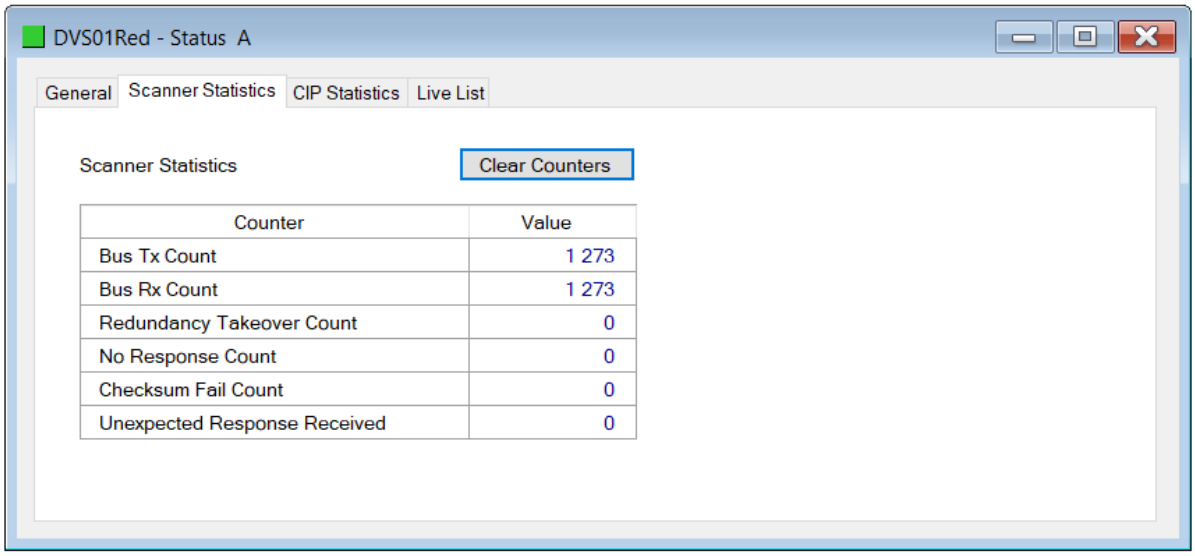


Figure 5.7 - Status monitoring – Scanner Statistics

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 DV Scanner has taken over the Active Bus Master role.
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 – Scanner Statistic

5.2.2.3. SCANNER STATUS - CIP STATISTICS

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

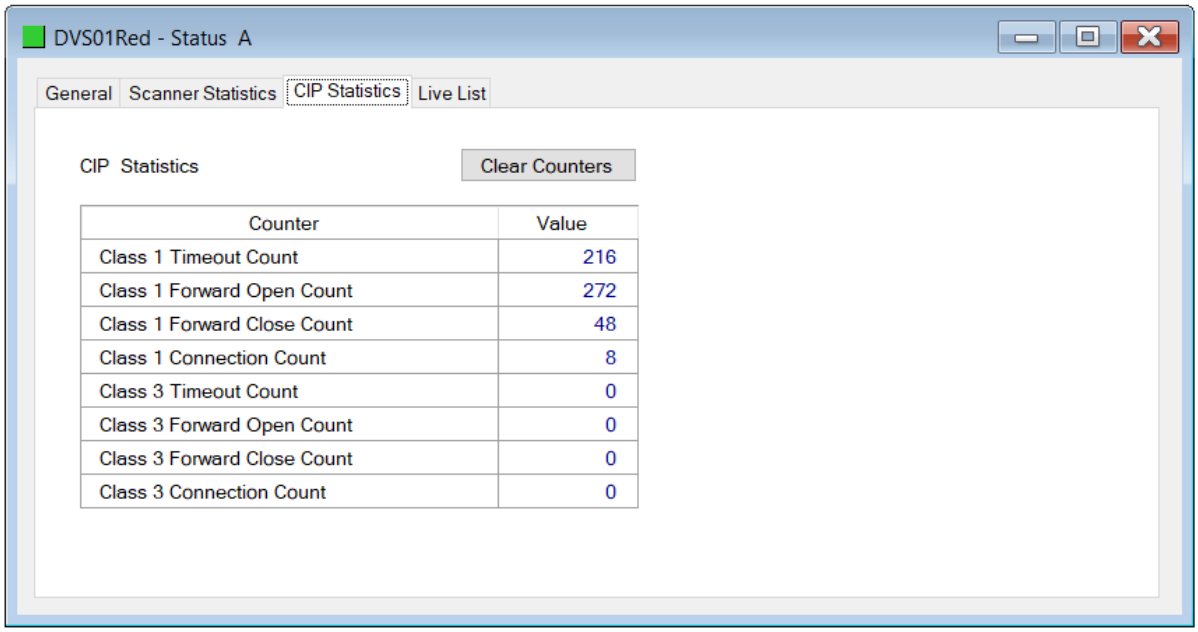


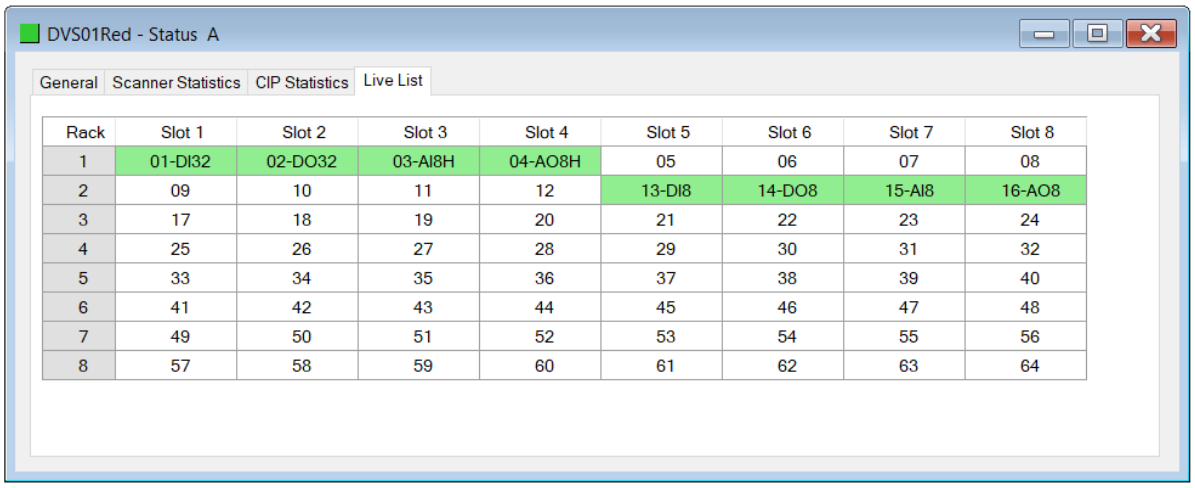
Figure 5.8 - Status monitoring – CIP Statistics

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

5.2.2.4. SCANNER STATUS – LIVE LIST

The DV Scanner provides a live list of all the IO cards found as shown below:



Rack	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8
1	01-DI32	02-DO32	03-AI8H	04-AO8H	05	06	07	08
2	09	10	11	12	13-DI8	14-DO8	15-AI8	16-AO8
3	17	18	19	20	21	22	23	24
4	25	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39	40
6	41	42	43	44	45	46	47	48
7	49	50	51	52	53	54	55	56
8	57	58	59	60	61	62	63	64

Figure 5.9 - Status monitoring – Live List

5.2.1. IO CARD STATUS

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

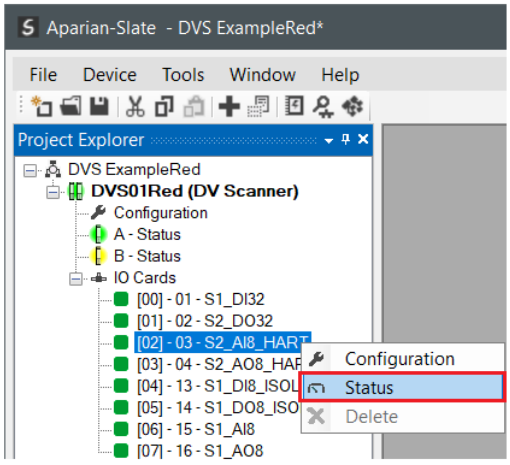


Figure 5.10 - Selecting IO Card Status

5.2.1.1. IO CARD STATUS - GENERAL

The IO Card – General status tab is shown below.

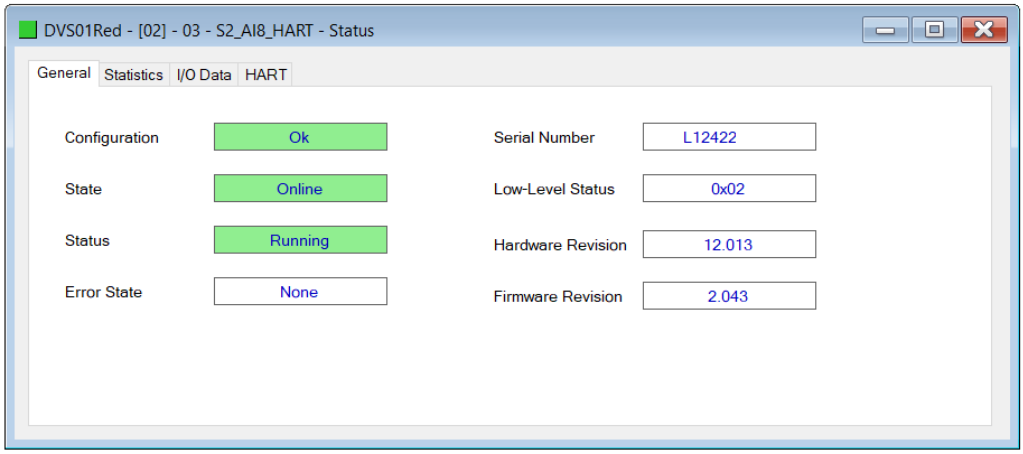


Figure 5.11 – IO Card Status - General

Statistic	Description
Configuration	Indicates whether the configuration is valid and matches the physical IO card: **Ok** The configuration sent to the IO card was accepted and is ok. **Mismatch** The configured IO card does not match the physical IO card at that slot address.
State	Indicates the online state of the IO card: **Online** The IO card is online and communicating. **Offline** The IO card is offline and no responses are being received.
Status	Indicates the current operational status of the IO card. **Running** The IO card is online and exchanging data with the DV Scanner. **Running – Shadow** The IO card is online and exchanging data with the DV Scanner, but no outputs are being sent to the IO card. **Not Running** The IO card is online, but noy exchanging data with the DV Scanner.
Error State	Indicates whether or not the IO card is in an error state. **None** The IO card has no errors. **Error** An error occurred with the IO card.

Serial Number	Serial Number of the IO card.
Low-Level State	Shows the IO card's low-level state. The hexadecimal value is card specific.
Hardware Revision	Hardware revision of the IO card.
Firmware Revision	Firmware revision of the IO card.

Table 5.8 – IO Card Status – General

5.2.1.2. IO CARD STATUS - STATISTICS

The IO Card Statistics tab is shown below.

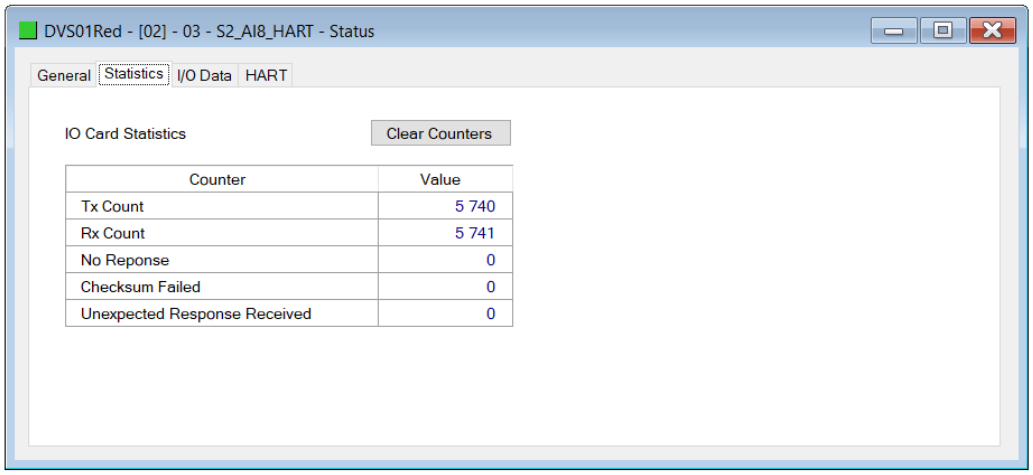


Figure 5.12 – IO Card Status - Statistics

Statistic	**Description**
Tx Count	The number of transmitted bus packets to the IO card.
Rx Count	The number of received bus packets from the IO card.
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.

Table 5.9 – IO Card Status - Statistics

5.2.1.3. IO CARD STATUS – I/O DATA

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

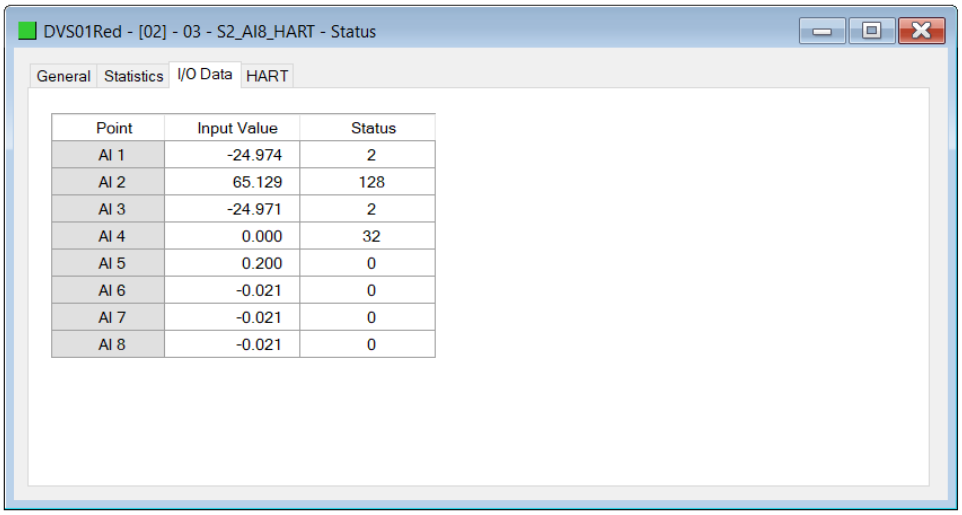


Figure 5.13 – IO Card Status – I/O Data

5.2.1.4. IO CARD STATUS – HART

The IO Card HART tab will provide the HART Process Variables, Status, Statistics, Device Info, and Device Configuration for each specific channel of the HART IO cards.

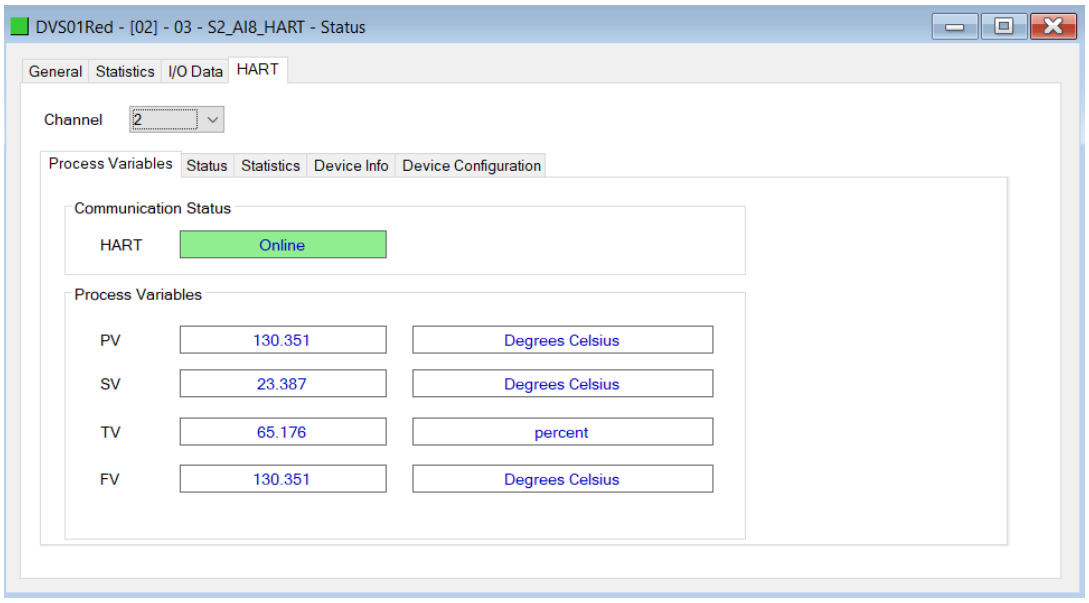


Figure 5.14 – IO Card Status – HART Process Variables

NOTE: Only values for the selected HART Channel is displayed.

Parameter	Description
Communication Status	The current status of the HART communication.
PV (and Units)	The primary variable displayed in engineering units, with the engineering unit enumeration.
SV (and Units)	The secondary variable displayed in engineering units, with the engineering unit enumeration.
TV (and Units)	The third variable displayed in engineering units, with the engineering unit enumeration.
FV (and Units)	The fourth variable displayed in engineering units, with the engineering unit enumeration.

Table 5.10 - IO Card Status – HART Process Variables

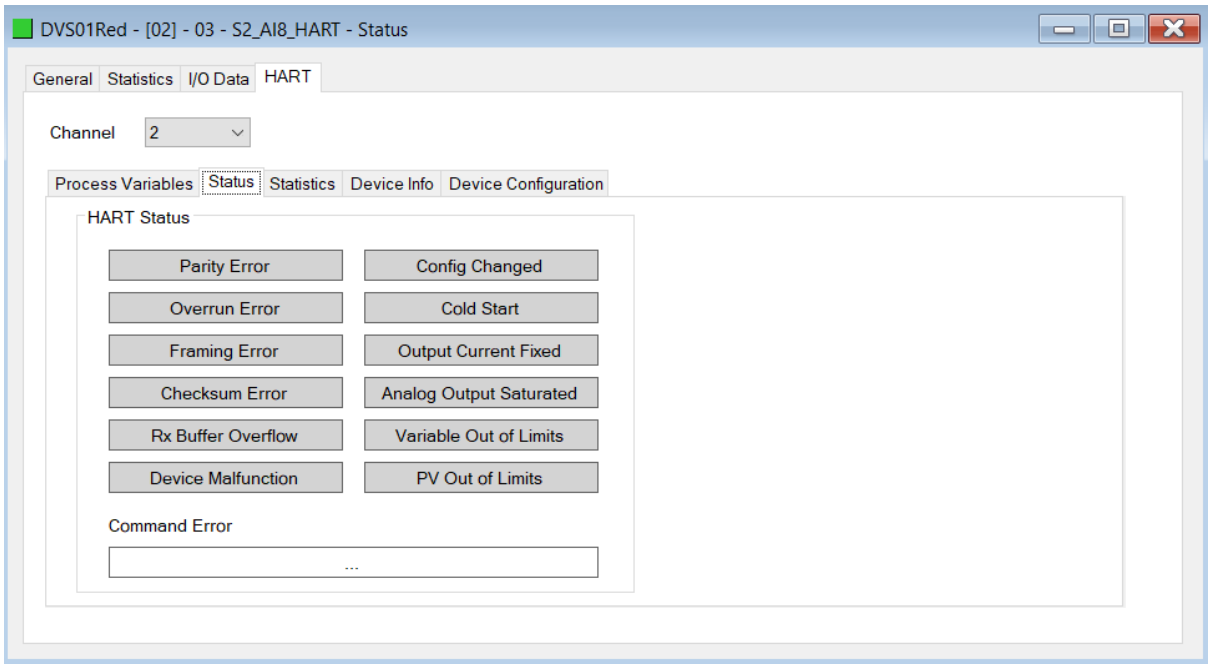


Figure 5.15 – IO Card Status – HART Status

Parameter	Description
Parity Error	Flagged if the field device received a message with a parity error
Overrun Error	Flagged if the field device receive buffer is overrun.
Framing Error	Flagged if the field device receives a message with an invalid stop delimiter.
Checksum Error	Flagged if the field device receives a message with an invalid checksum.
Rx Buffer Overflow	Flagged if the field device receives a message too long for the receive buffer.
Device Malfunction	Flagged if the field device has detected an error or suffered some hardware failure.
Config Changed	Flagged if an operation resulted in the configuration changing.
Cold Start	Flagged if the field device has experienced a power failure or reset.

Output Current Fixed	Flagged if the loop current is set at a fixed value and is not responding to process variations
Analog Output Saturated	Flagged if the Loop Current has reached its upper or lower limit
Variable Out of Limits	Flagged if a variable other than the PV is beyond its operating limits.
PV Out of Limits	Flagged if the PV is beyond its operating limits.
Command Error	An enumerated error in response to the last command issued.

Table 5.11 - Channel Status Parameters – HART Status

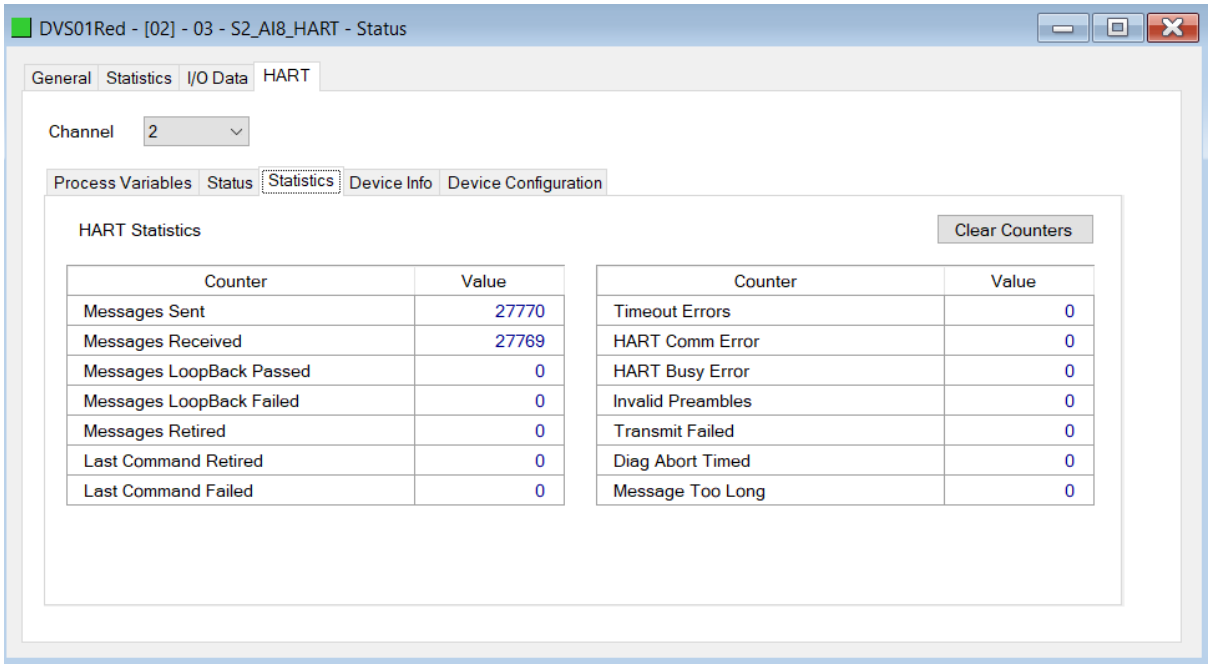


Figure 5.16 – IO Card Status – HART Statistics

The HART statistics are compiled by, and received from, the HART IO card.

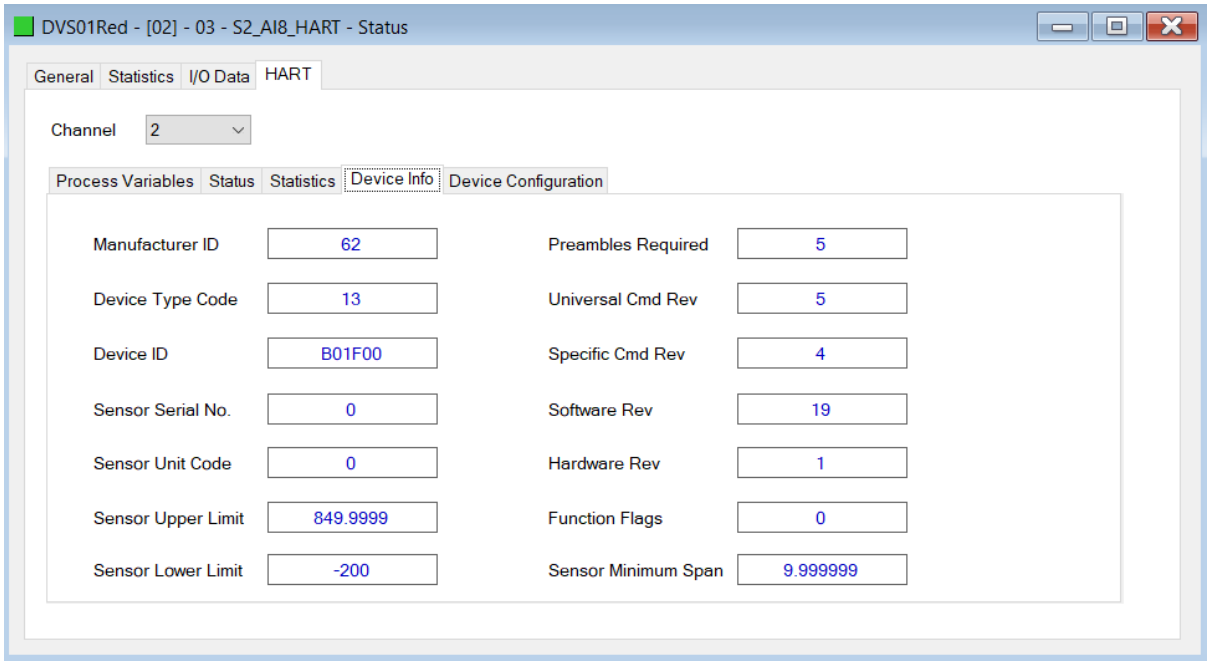


Figure 5.17 – IO Card Status – HART Device Info

Parameter	Description
Manufacturer ID	The field device manufacturer unique identification code.
Device Type Code	The device type code assigned by the manufacturer.
Device ID	The device identification code assigned by the manufacturer.
Sensor Serial Number	The serial number of the field device sensor.
Sensor Unit Code	The engineering unit code used for the sensor limits.
Sensor Upper Limit	The upper limit of the sensor in the aforementioned engineering units.
Sensor Lower Limit	The lower limit of the sensor in the aforementioned engineering units.
Preambles Required	The minimum number of preambles required by the field device to process a HART request.
Universal Command Revision	The universal command revision supported by the field device.
Specific Command Revision	The specific command revision supported by the field device.
Software Revision	The software revision of the field device.
Hardware Revision	The hardware revision of the field device electronics.
Function Flags	The Device Function Flags as reported by the field device.
Sensor Minimum Span	The minimum span allowed by the sensor.

Table 5.12 - Channel Status Parameters – HART Device Info

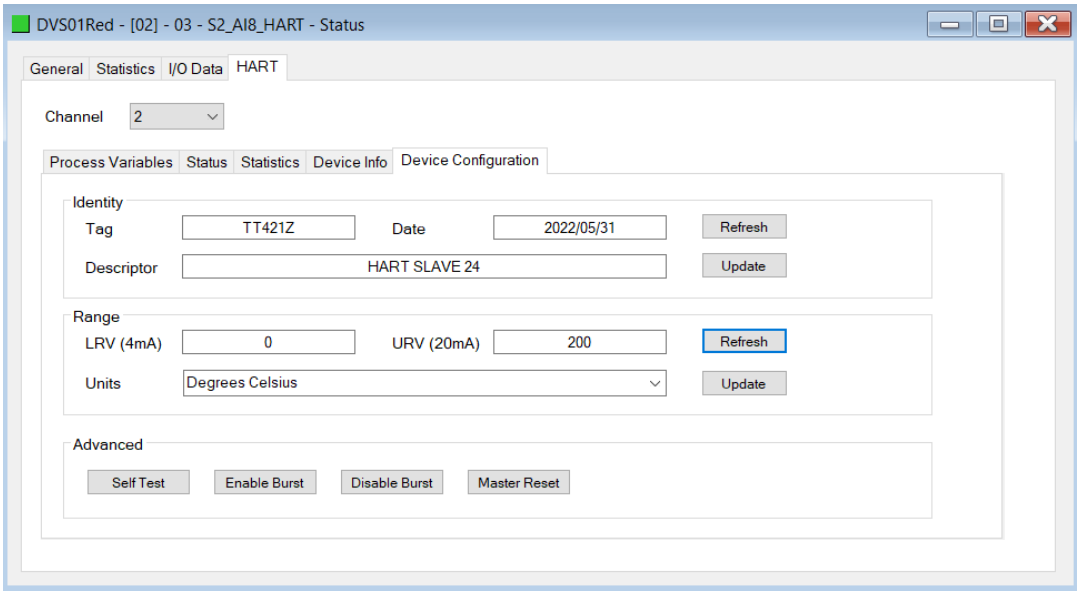


Figure 5.18 – IO Card Status – HART Device Configuration

Parameter	Description
Tag	The user tag name configured in the field device. (8 characters). Note: The Tag, Descriptor and Date are updated together.
Descriptor	The user descriptor configured in the field device. (16 characters). Note: The Tag, Descriptor and Date are updated together.
Date	The date when the tag and descriptor configuration was last modified. Note: The Tag, Descriptor and Date are updated together.
LRV	The Lower Range Value in engineering units represented by the 4 mA analog signal. Note: The LRV, URV and Range Units are updated together.
URV	The Upper Range Value in engineering units represented by the 20 mA analog signal. Note: The LRV, URV and Range Units are updated together.
Range Units	The engineering units in which the LRV and URV values are specified. Note: The LRV, URV and Range Units are updated together.
Damping	The damping value specified in seconds. Damping refers to the digital filtering of process variables to remove transient and potentially erroneous deviations from the actual measure variable.
Message	A user defined 32-character message stored in the field device.
Master Reset	Resets the field device
Enable Burst Mode	This instructs the field device to enter burst mode. Note that only Burst of HART command 3 is supported
Disable Burst Mode	This instructs the field device to exit burst mode.

Table 5.13 – IO Card Status – HART Device Configuration

A parameter can be modified by entering the new value into the appropriate text box and clicking the adjacent ***Update*** button. When the parameter is pending, that is, edited but not yet committed, then the text box will be shaded yellow. Once the value has been written (updated) the value will be written to the field device and then re-read from the field device, after which the parameter background will return to normal.

5.3. MODULE EVENT LOG

The DV 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, right-click on the DV Scanner and select the ***Event Viewer*** option.

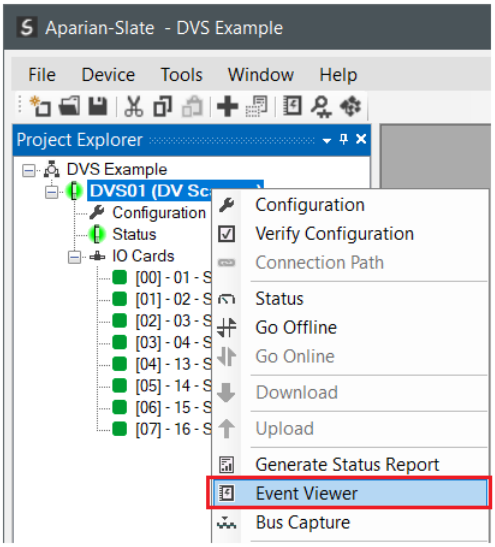


Figure 5.19 - Selecting the module Event Log

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.

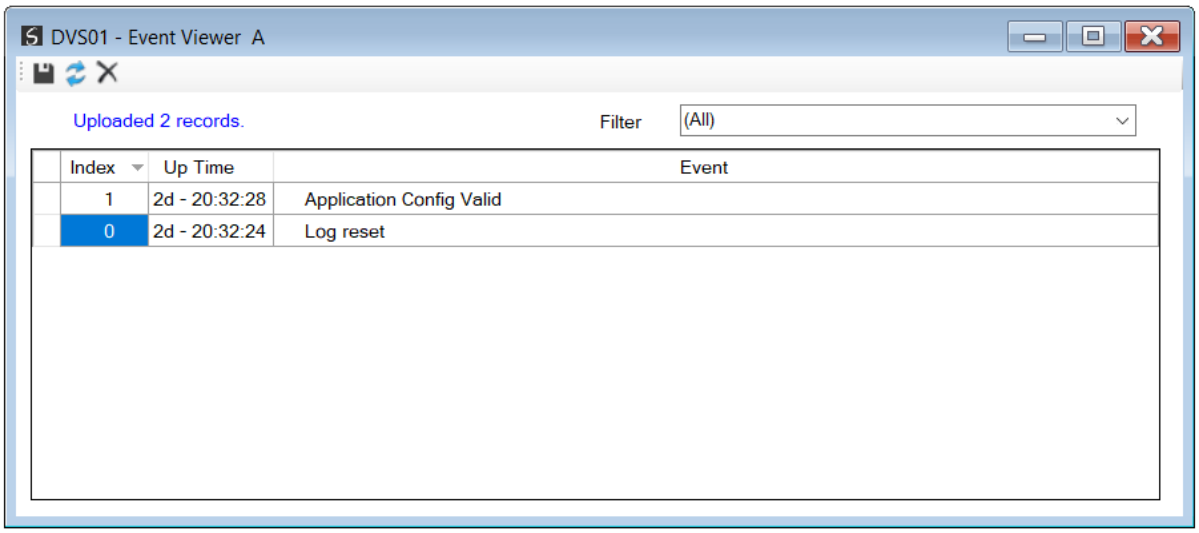


Figure 5.20 - Module Event Log

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 DV 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.

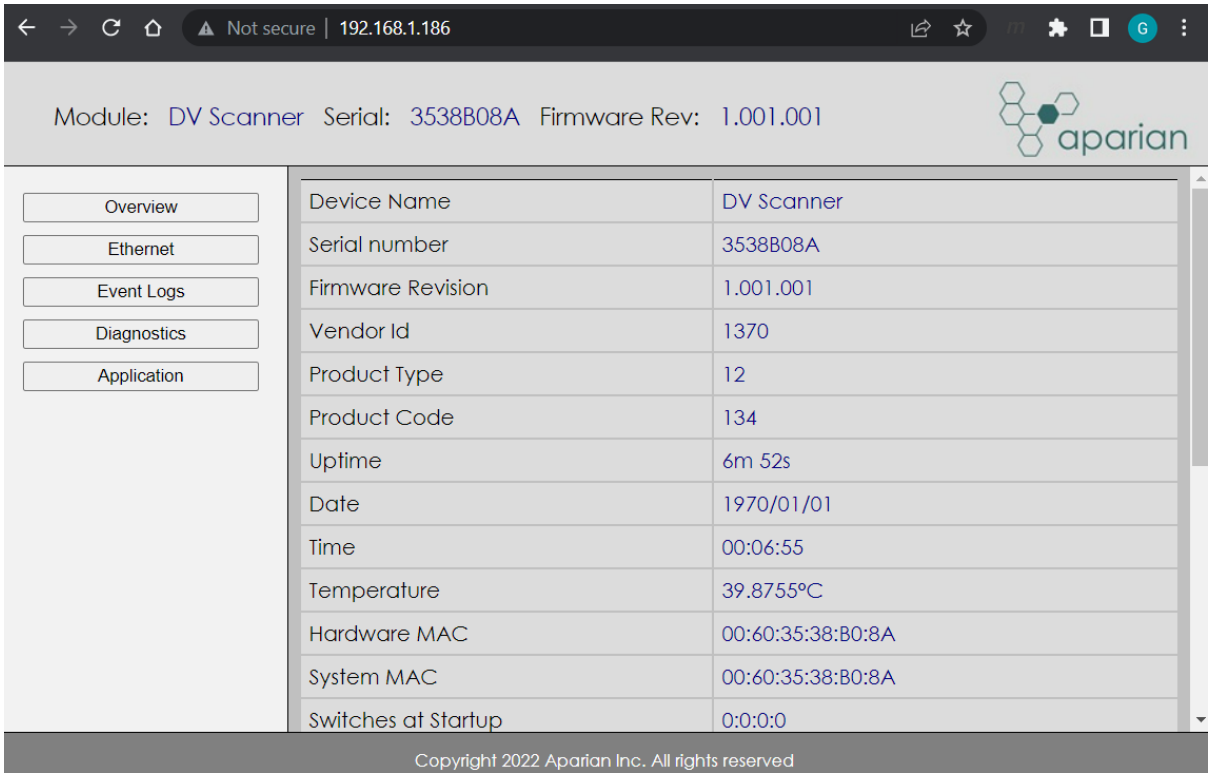


Figure 5.21 – Web interface

6. TECHNICAL SPECIFICATIONS

6.1. DIMENSIONS

Below are the DV Scanner enclosure dimensions and DIN rail dimensions. All dimensions are in millimeters.

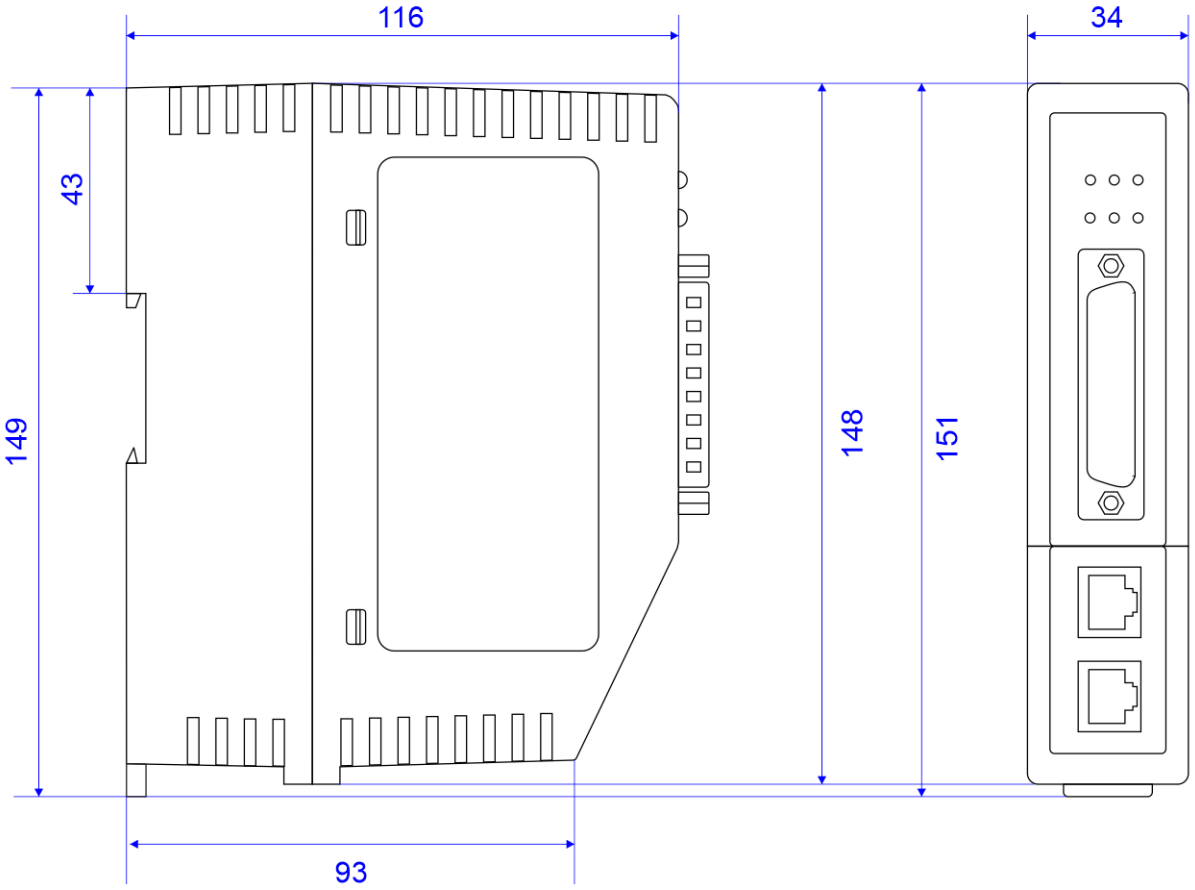


Figure 6.1 – DV Scanner Dimensions

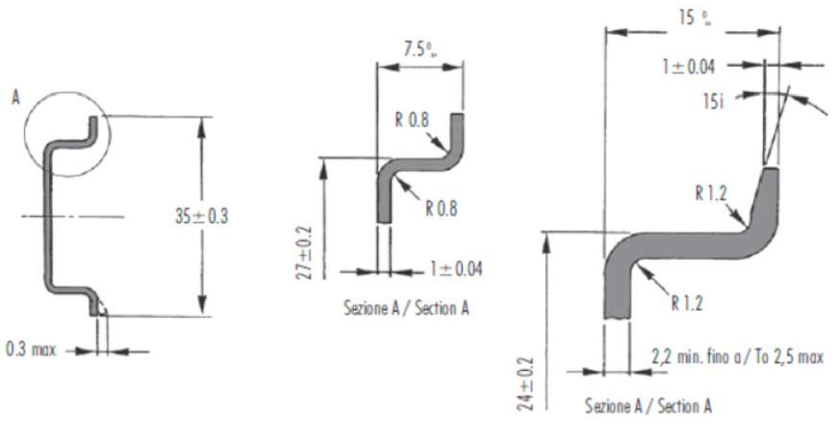


Figure 6.2 - Required DIN dimensions

6.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 32V DC
Power consumption	1.5 W (Max.) Current: 140 mA @ 10 V Current: 60 mA @ 24 V
Connector	3-way terminal
Conductors	24 – 18 AWG
Enclosure rating	IP20, NEMA/UL Open Type
Temperature	-20 – 70 °C
Earth connection	Yes, terminal based
Emissions	IEC61000-6-4
ESD Immunity	EN 61000-4-2
Radiated RF Immunity	IEC 61000-4-3
EFT/B Immunity	EFT: IEC 61000-4-4
Surge Immunity	Surge: IEC 61000-4-5
Conducted RF Immunity	IEC 61000-4-6

Table 6.1 - Electrical specification

6.3. ENVIRONMENTAL

Specification	Rating
Mounting	External DIN Rail mounted.
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. IO BUS (LOCALBUS)

Specification	Rating
IO Card Count	Max of 32
Cards Supported	**KJ3001X1-CA1** – 32 Channel, 24Vdc Dry Contact, Digital Input (DI) **KJ3204X1-BA1** – 32 Channel, 24Vdc High-Side, Series 2 Digital Output (DO) **KJ3222X1-BA1** – 8 Channel, 4-20mA HART, Series 2 Analog Input (AI) **KJ3221X1-BA1** – 8 Channel, 4-20mA HART, Series 2 Analog Output (AO) **KJ3001X1-BA1** – 8 Channel, 24Vdc Isolated, Digital Input (DI) **KJ3001X1-BG1** – 8 Channel, 24Vdc Isolated, Digital Output (DO) **KJ3002X1-BC1**– 8 Channel, 4-20mA, Analog Input (AI) **KJ3002X1-BB1**– 8 Channel, 4-20mA, Analog Output (AO)
Connection Port	DB44 D-Shell (male)
Connection Cable	Requires D-shell extender cable, either: **KJ4002X1-BF2** - Standard cable (1.2m, or **KJ4002X1-BF3** - Short cable (0.87m), or **KJ4002X1-BF4** - Extended cable (1.53m) ***Note***: Cables are **not** supplied with the DV Scanner.
IO Carrier Extender	Requires a Right Carrier Extender: **KJ4001X1-NA1** - Right Carrier Extender (or similar) ***Note***: Carrier Extenders are **not** supplied with the DV Scanner.

Table 6.4 – IO Bus specification

6.6. CERTIFICATIONS

Certification	Mark
CE Mark	CE
RoHS2 Compliant	RoHS2
UKCA	UK CA

Table 6.5 – Certifications

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