DeviceNet Monitor

User Manual

A-DNM

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CONTENTS

Revision History

Revision	Date	Comment
1.0	27 July 2026	Initial document

1. PREFACE

This manual describes the installation, operation, and diagnostics of the Aparian DeviceNet Monitor module. The DeviceNet Monitor, (hereafter referred to as the **module**) provides real-time diagnostic information of a DeviceNet network.

1.1. INTRODUCTION TO DEVICENET

DeviceNet is a Common Industrial Protocol (CIP) implementation on CAN bus. Other CIP implementations include ControlNet and EtherNet/IP.

DeviceNet media typically comprises 5 conductors, two for device power (24VDC), two for CAN bus communication and a shield for noise immunity.

Signal	Wire Colour	Function	Description
V+	Red	Power	24V Positive
V-	Black		24V Negative (0V)
CAN-H	White	CAN bus	CAN High
CAN-L	Blue		CAN Low
Shield	(Bare)	EMI / EMC Protection	Earth

Table 1.1 – DeviceNet Signals

1.1.1. Power

The power conductors provide power to all the devices on the DeviceNet network. A suitable 24VDC power supply must be selected to meet the current requirements of all the devices and to remain within 3.25% of the nominal voltage (24.0V) under all conditions including startup, temperature drift and changes in load.

1.1.2. CAN Bus Signalling

The Controller Area Network (CAN) Bus is a robust bus standard originally designed for communication between devices within a vehicle. A key feature of CAN Bus is its use of differential signalling for data transmission. This method significantly enhances noise immunity and ensures reliable communication in electrically noisy environments such as vehicles.

The CAN Bus uses two wires to carry signals: CAN-H (CAN High) and CAN-L (CAN Low). These two wires carry inverted versions of the same signal. The system compares the voltage difference between the two wires rather than measuring their absolute voltage levels with respect to ground.

In the recessive state, both CAN-H and CAN-L maintain a voltage level of approximately 2.5V, resulting in a differential voltage of 0V. This state represents a logic '1'.

In the dominant state, CAN-H is pulled up to approximately 3.5V and CAN-L is pulled down to approximately 1.5V, creating a differential voltage of approximately 2V. This state represents a logic '0'.

This differential signalling method provides strong resistance to external electrical noise. Since both wires are affected equally by interference, the differential voltage remains stable, ensuring accurate data transmission.

State	CAN-H (V)	CAN-L (V)	Differential Voltage (CAN-H – CAN-L)	Logic Level
Recessive	2.5	2.5	0.0	1
Dominant	3.5	1.5	2.0	0

Table 1.2 – CAN Bus Signals

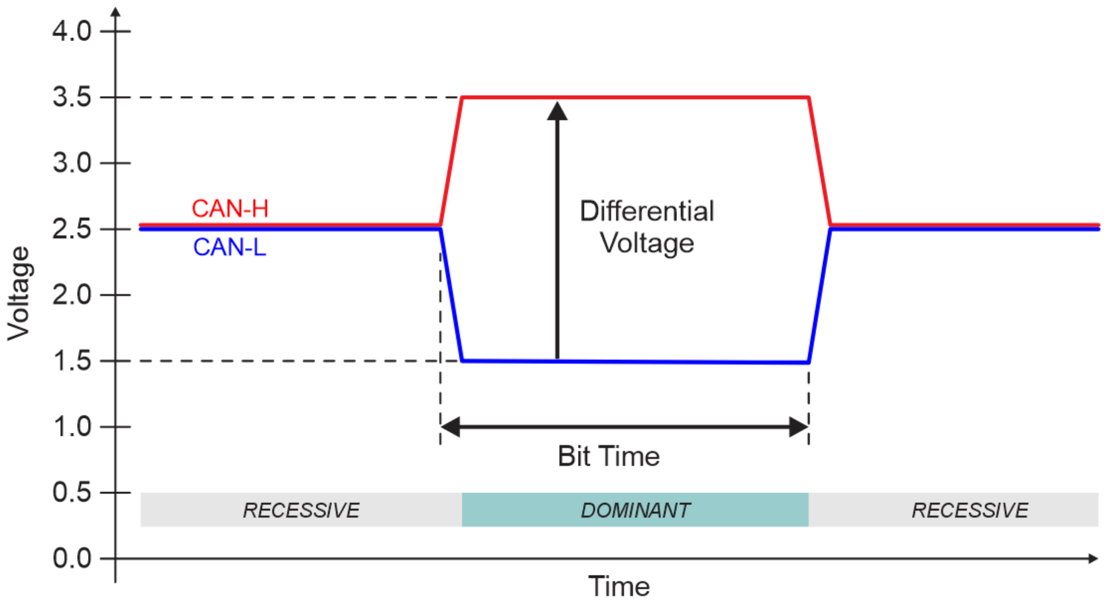


Figure 1.1. – CAN Bus Signals

CAN Bus operates using a bit-wise arbitration scheme. Each bit on the CAN Bus is transmitted over a fixed time slice called a bit time. The bit time is a function of the selected BAUD rate. Although CAN bus can support many different BAUD rates, DeviceNet is limited to then following:

- 125 k bit/s

- 250 k bit/s
- 500 k bit/s

CAN Bus utilizes Non-Return to Zero (NRZ) encoding, where the signal does not return to zero between bits. However, to prevent long periods without voltage changes (which would disrupt synchronization), the protocol uses bit stuffing. After five consecutive bits of the same level, a complementary (inverted) bit is inserted.

To maintain signal integrity, the CAN Bus requires termination resistors at each end of the bus line. These are typically 120-ohm resistors, matching the characteristic impedance of the twisted-pair cable used for CAN communication. Without proper termination, signal reflections can occur, causing communication errors.

When the bus is idle (i.e., no dominant bits are transmitted), both CAN-H and CAN-L remain at 2.5V, providing a noise-tolerant equilibrium state. Any external noise affecting both lines equally is cancelled out during differential reception.

This electrical design enables CAN to function reliably even in harsh environments such as engine compartments, industrial machinery, or aerospace systems where electromagnetic interference (EMI) is prevalent.

1.2. INTRODUCTION TO THE DEVICENET MONITOR

The Aparian DeviceNet Monitor module provides real-time diagnostic information of the DeviceNet network to which it is attached, and provides this information to a controller via multiple class 1 EtherNet/IP connections.

The module makes use of fast Analog to Digital Convertors (ADC) to sample the voltage of the DeviceNet conductors (Power, Shield, CAN-H and CAN-L) with respect to V- line.

The resulting waveforms are then analysed against a number of preset Warning and Alarm setpoints. The results of this analysis are made available in a Logix controller, which can then be used to alert an operator to the anomaly and/or deteriorating quality the DeviceNet network infrastructure.

The DeviceNet monitor can be added to any existing DeviceNet network.

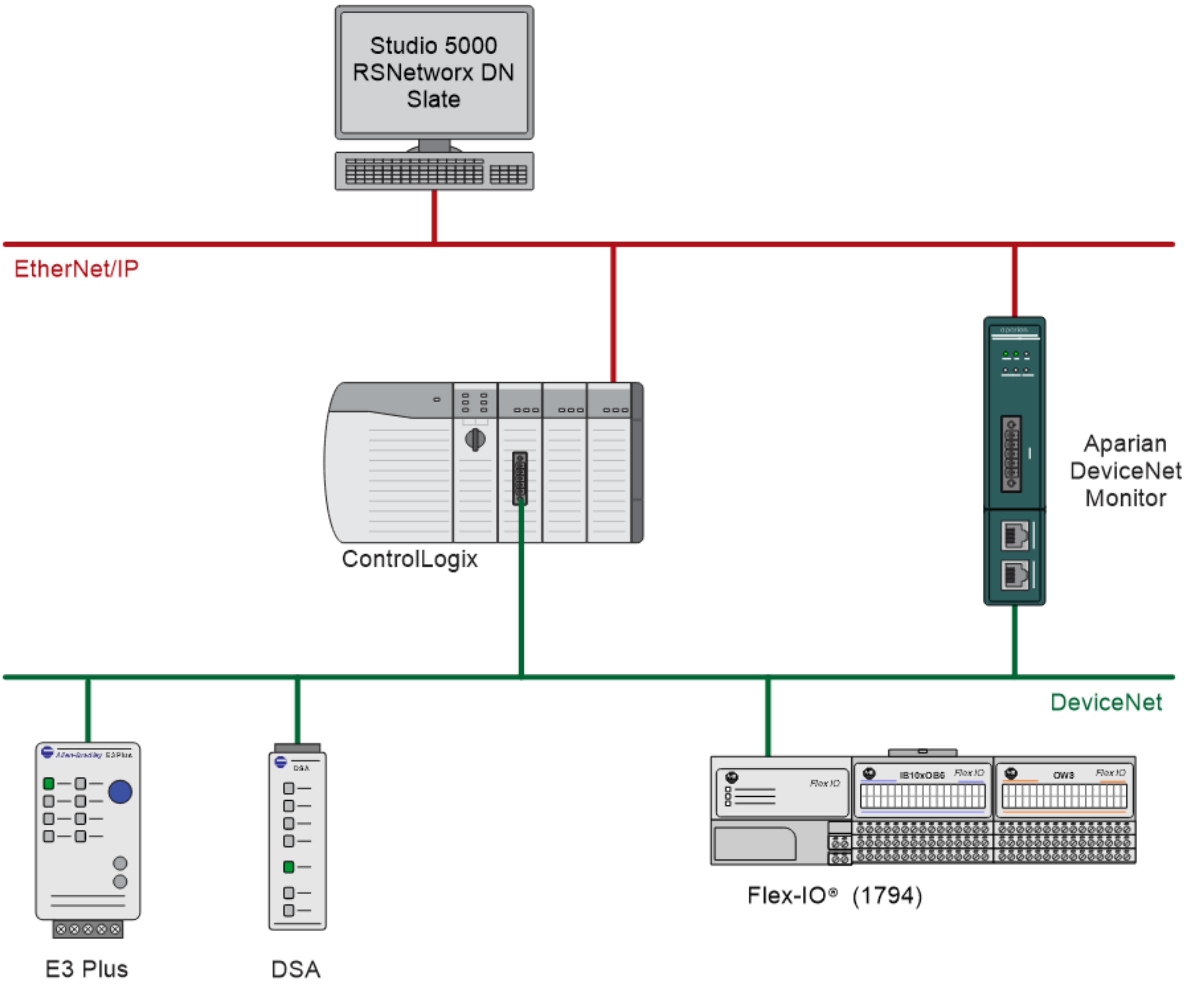


Figure 1.2. – Typical DeviceNet Scanner architecture with the DeviceNet Monitor

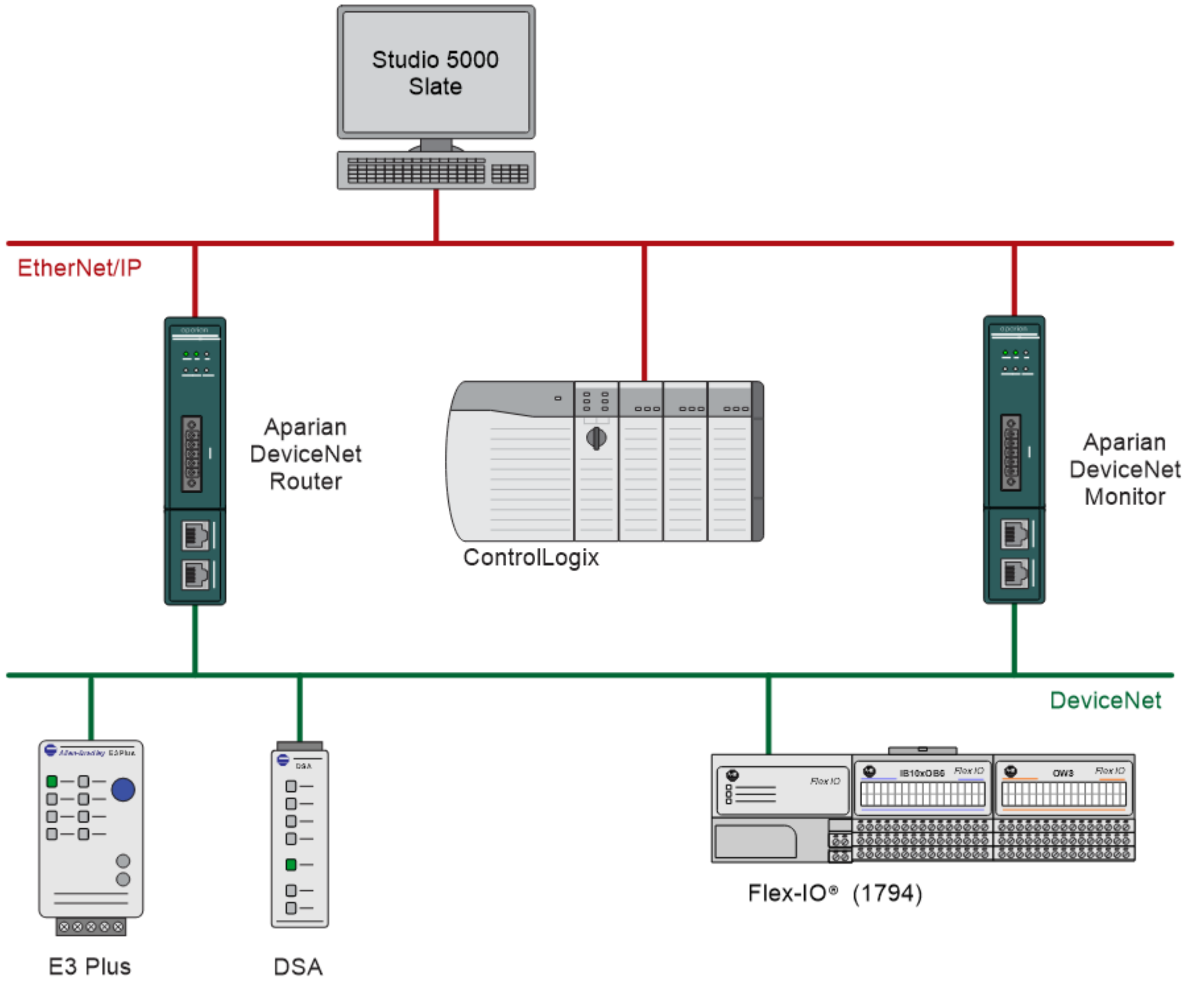


Figure 1.3. – Typical DeviceNet Device architecture with the DeviceNet Router and DeviceNet Monitor

The DeviceNet Monitor is configured using the Aparian Slate application. This software can be downloaded from www.aparian.com free of charge.

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

1.3. FEATURES

- Can be easily connected to any existing DeviceNet network.
- Monitors up to (all) 64 nodes on a DeviceNet network, with analysis linked to specific nodes.
- Analysis results are available directly in Logix.
- Slate software provides a DeviceNet packet capture utility for better diagnosis of issues.
- Supports all DeviceNet Baud Rates (125k, 250k, 500k).
- Dual Ethernet ports which support Device-Level-Ring (DLR).
- Network Time Protocol (NTP) supported for external time synchronization.
- Small form factor – DIN rail mounted.

1.4. THEORY OF OPERATION

The DeviceNet Monitor makes use of fast Analog to Digital Convertors (ADC) to sample the voltage of the DeviceNet conductors (Power, Shield, CAN-H and CAN-L) with respect to V-line. The ADCs sample the CAN-L and CAN-H signals at 60 Mbps, while the Power (V+) and Shield lines are sampled at 30 Mbps.

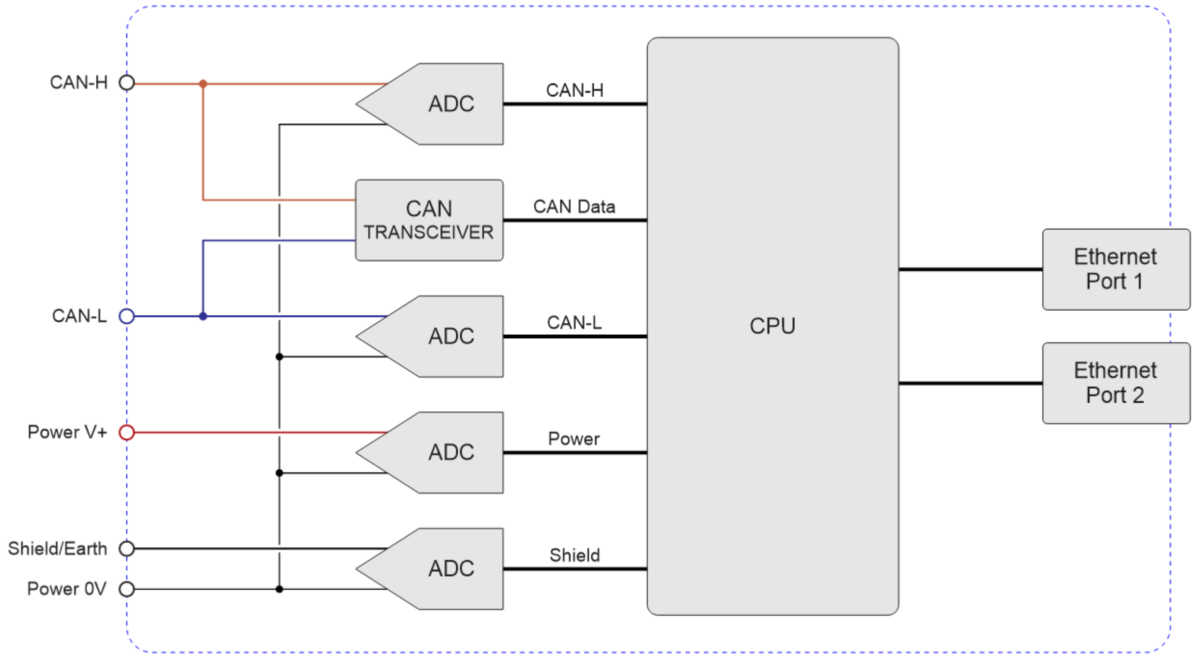


Figure 1.4. – Functional Diagram of DeviceNet Monitor

The sampling of each node is synchronised with the data received from the CAN transceiver. This allows the sampled data to be linked to the particular node that was transmitting at the time. This CAN transceiver is configured to be receive-only, and can thus not affect the existing DeviceNet network.

Each sample set consists of approximately 16 000 samples. Once the sample set has been taken it is analysed, and a number of measured parameters are calculated. Many of these parameters differentiate between the dominant and recessive state. The deemed state (dominant or recessive) is determined by the differential CAN voltage, which is the instantaneous CAN-H voltage minus the CAN-L voltage.

The configured setpoints determine this threshold, but typically a CAN voltage above 1.4V is deemed to be dominant, and a CAN voltage below 0.5V is deemed to be recessive.
A CAN voltage between these two thresholds is indicative of a transition between these states.

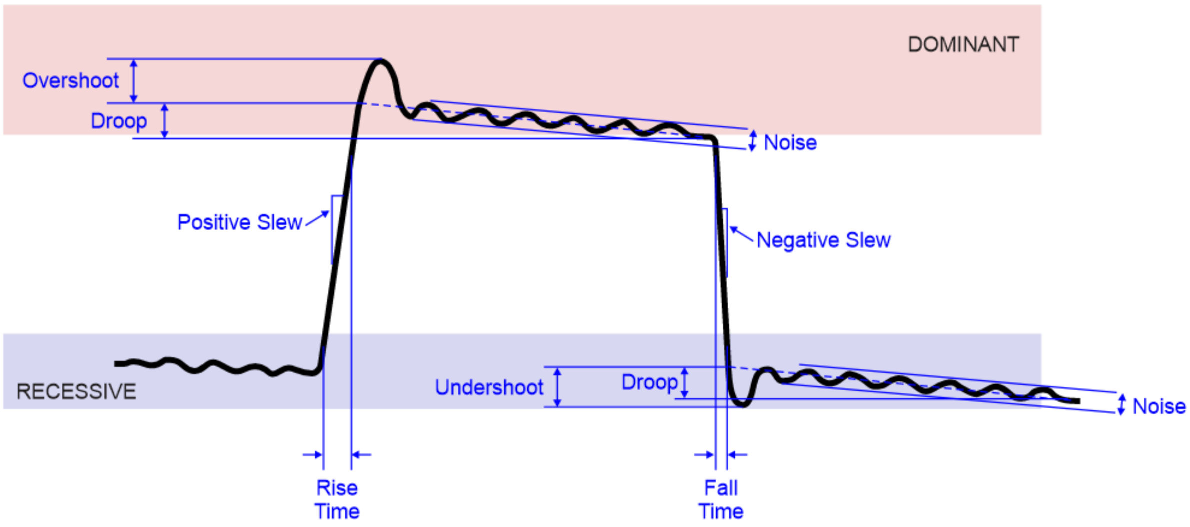


Figure 1.5. – Waveform Parameters

Each of the 5 channels (Power, Shield, CAN, CAN-H and CAN-L) are analysed. Note that the CAN channel is calculated (from CAN-H and CAN-L) whereas the others are measured directly. The following parameters are calculated during the sample analysis. Note that not all parameters are relevant for each channel.

Parameter	Units	Channels	Description
Voltage	V	Power, Shield	The measured voltage across the entire sample set.
Noise (Peak-to-Peak)	mV	Power, Shield	The peak-to-peak noise calculated as the difference between the maximum and minimum voltage across the sample set.
Noise (RMS)	mV	Power, Shield	The RMS (root mean square) noise. Calculated by taking the square root of the mean of the square of the difference between the sampled voltage and the voltage average.
Voltage Dominant	V	CAN, CAN-H, CAN-L	The measured voltage during the CAN dominant state.
Voltage Recessive	V	CAN, CAN-H, CAN-L	The measured voltage during the CAN recessive state.
Common Mode	V	CAN	The common mode voltage calculated by the average between the CAN-H and CAN-L during the CAN recessive state.
Rise Time	ns	CAN	The time taken to transition from the CAN recessive state to the dominate state.
Fall Time	ns	CAN	The time taken to transition from the CAN dominate state to the recessive state.

Positive Slew Rate	V/µs	CAN, CAN-H, CAN-L	The rate of change of voltage during a rising transition.
Negative Slew Rate	V/µs	CAN, CAN-H, CAN-L	The negative rate of change of voltage during a falling transition.
Overshoot	mV	CAN, CAN-H, CAN-L	The overshoot voltage is the voltage above the current state's average voltage following a positive voltage transition.
Undershoot	mV	CAN, CAN-H, CAN-L	The undershoot voltage is the voltage below the current state's average voltage following a negative voltage transition.
Noise RMS Dominant	mV	CAN, CAN-H, CAN-L	The RMS (root mean square) noise during the CAN dominant state. Calculated by taking the square root of the mean of the square of the difference between the sampled voltage and the dynamic voltage average. The dynamic average takes into account the voltage droop.
Noise RMS Recessive	mV	CAN, CAN-H, CAN-L	The RMS (root mean square) noise during the CAN recessive state. Calculated by taking the square root of the mean of the square of the difference between the sampled voltage and the dynamic voltage average. The dynamic average takes into account the voltage droop.
Droop Dominant	mV/µs	CAN, CAN-H, CAN-L	The droop dominant voltage is the average negative voltage rate (voltage / time) during the dominant state following the overshoot / undershoot allowance.
Droop Recessive	mV/µs	CAN, CAN-H, CAN-L	The droop recessive voltage is the average negative voltage rate (voltage / time) during the recessive state following the overshoot / undershoot allowance.

Table 1.3. – Analysis Parameters

Once these parameters have been calculated, they are compared to the configured Alarm and Warning setpoints.

If a parameter value is above the High Warning setpoint, it will set the High Warning flag and latch. If it is above the High Alarm setpoint, it will set the High Alarm flag and latch.

Conversely, if the parameter value is below the Low Warning setpoint, it will set the Low Warning flag and latch, and if it is below the Low Alarm setpoint, it will set the Low Alarm flag and latch. If the parameter value recovers from an Alarm condition, the Alarm flag will clear, but the latch will remain set. Similarly, if the parameter value recovers from a Warning condition, the Warning flag will clear, but the latch will remain set.

The user must issue a manual "Clear" command to clear any Alarm and Warning latches.

The DeviceNet Monitor module also counts the number of Warning and Alarm conditions for each node. These counters are available in Slate and in Logix.

The module also provides access to the latest, maximum and minimum value for each parameter, for each node, in both Slate and Logix.

1.5. 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
DeviceNet Monitor User Manual DeviceNet Monitor Datasheet Example Code & UDTs	https://aparian.com/products/devicenetmonitor
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
DeviceNet	http://www.odva.org

Table 1.4. - Additional Information

1.6. SUPPORT

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

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

Resource	Link
Contact Us web link	https://www.prosoft-technology.com/Services-Support/Customer-Support
Support email	support@prosoft-technology.com

Table 1.5. – Support Details

2. INSTALLATION

2.1. MODULE LAYOUT

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

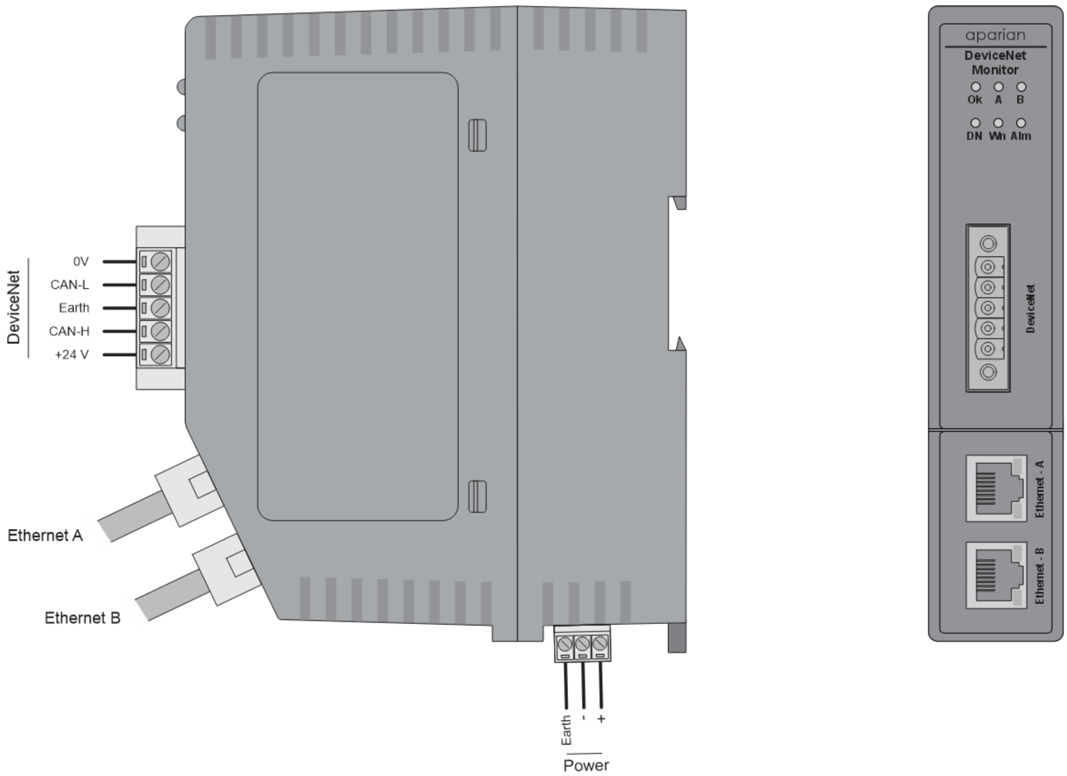


Figure 2.1 – DeviceNet Monitor side and front view

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 DeviceNet status.

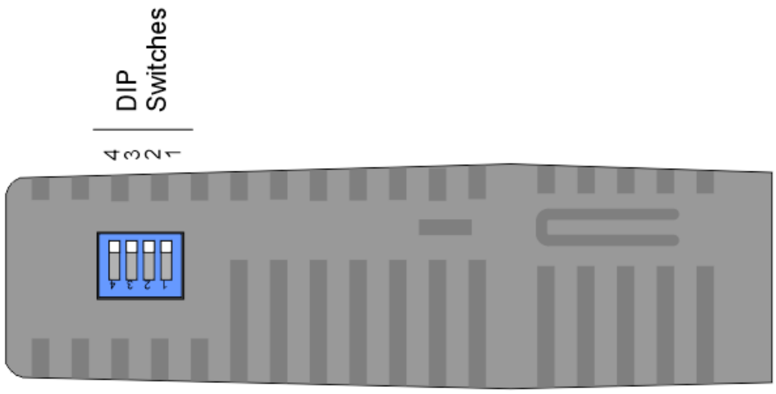


Figure 2.2 – DeviceNet Monitor top view

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.

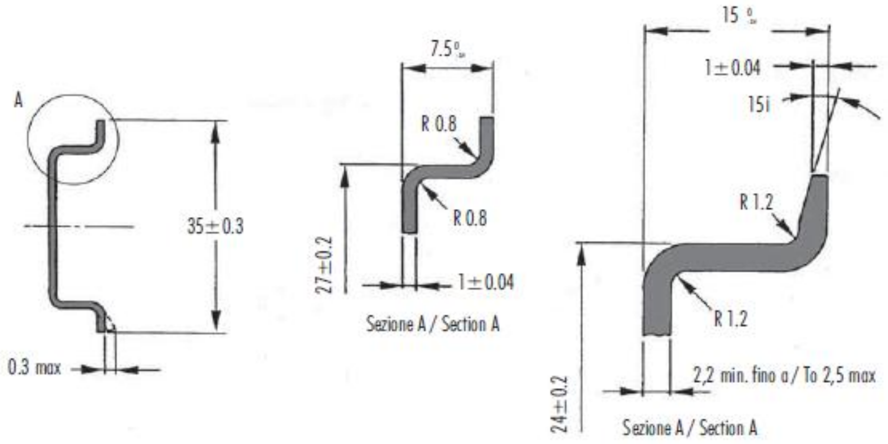


Figure 2.3 - DIN rail specification

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.

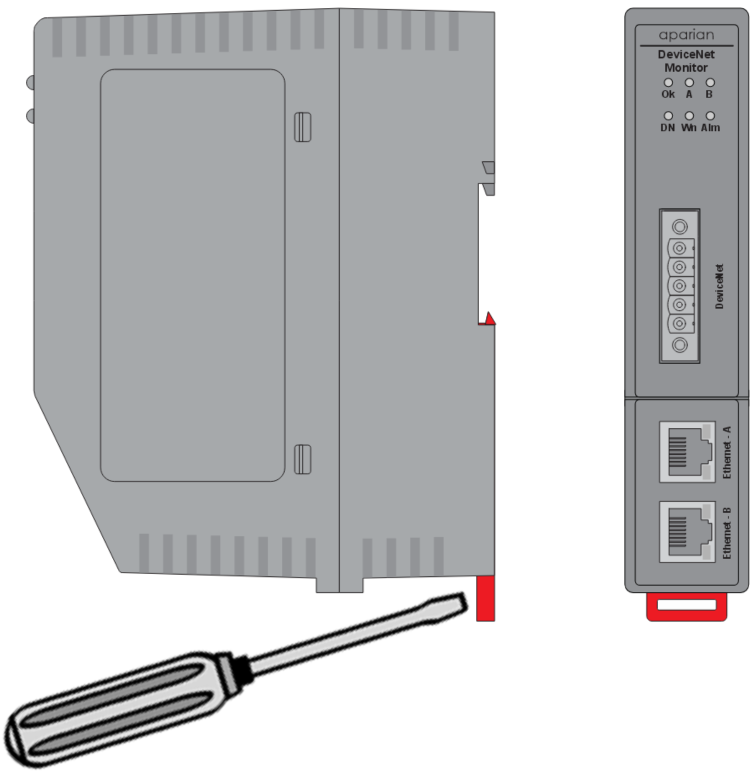


Figure 2.4 - DIN rail mouting

2.2. BOTTOM POWER

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

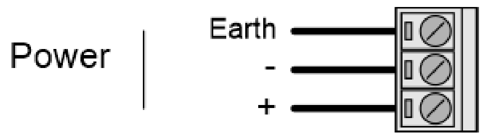


Figure 2.5 - Power connector

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. DEVICENET PORT

A five-way CAN connector is used to connect the DeviceNet CAN bus.

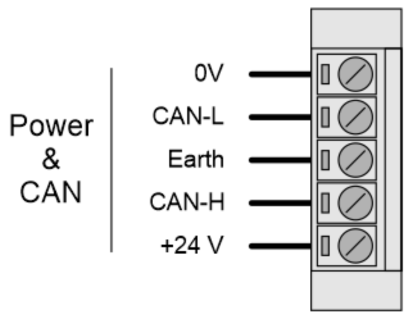


Figure 2.6 – DeviceNet connector

3. SETUP

3.1. INSTALL CONFIGURATION SOFTWARE

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

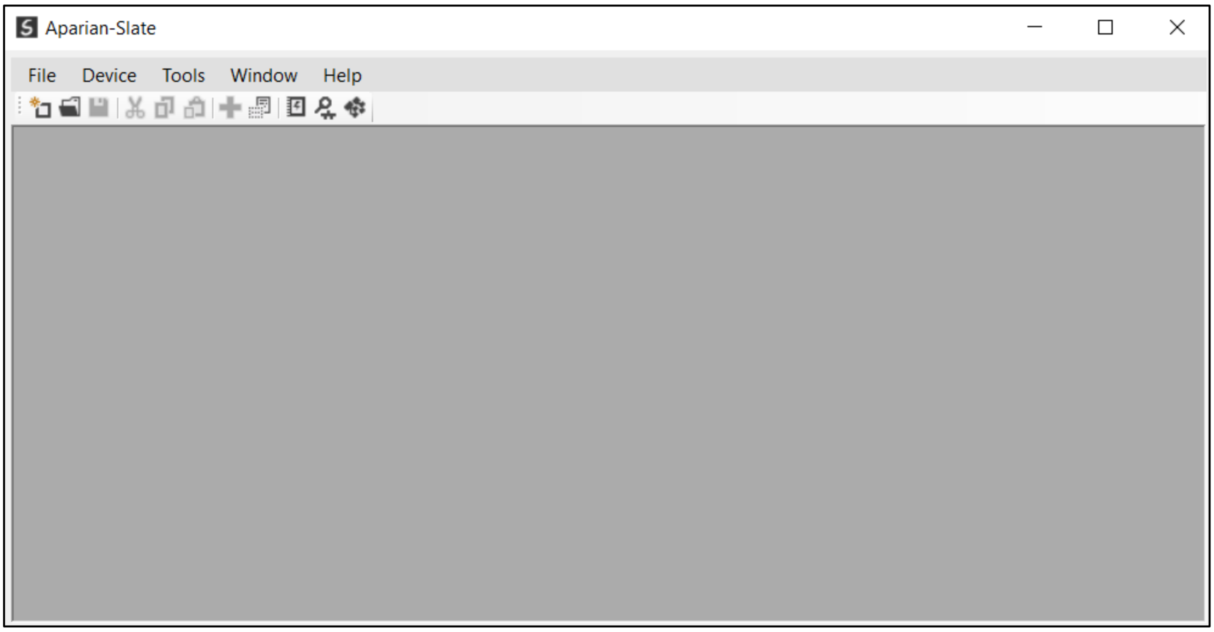


Figure 3.1. - Aparian Slate Environment

3.2. NETWORK PARAMETERS

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

Within the Slate environment, the ***DHCP Server*** utility can be found under the ***Tools*** menu.

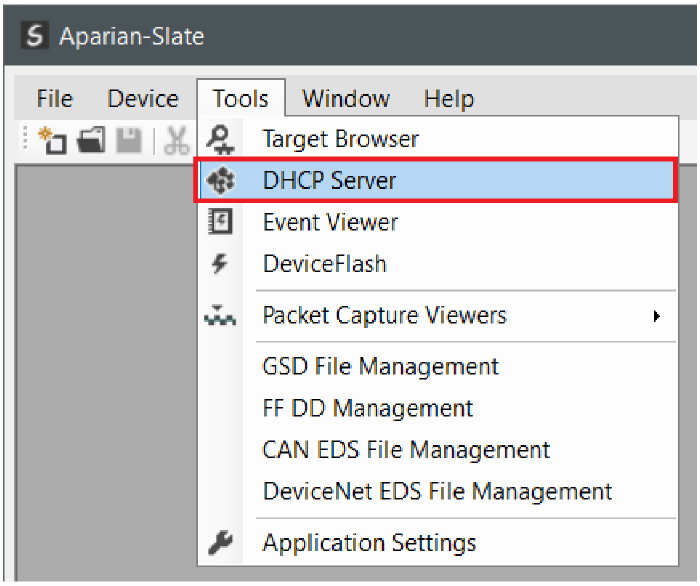


Figure 3.2. - Selecting DHCP Server

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

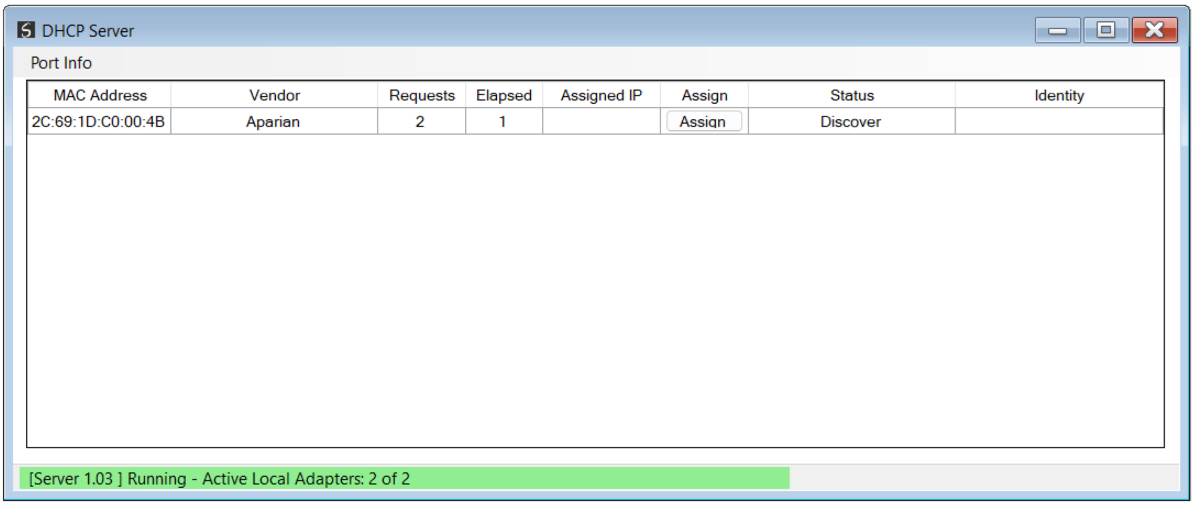


Figure 3.3. - DHCP Server

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

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

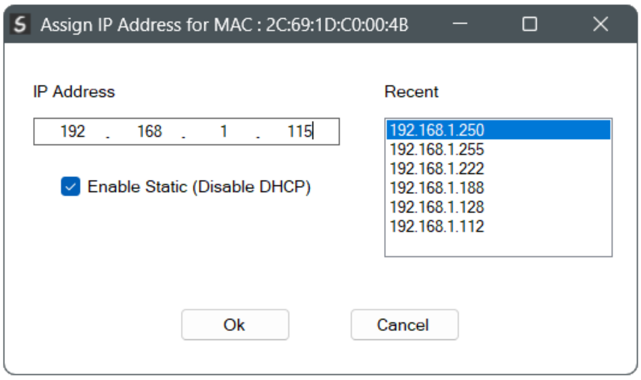


Figure 3.4. - Assigning IP Address

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

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

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

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

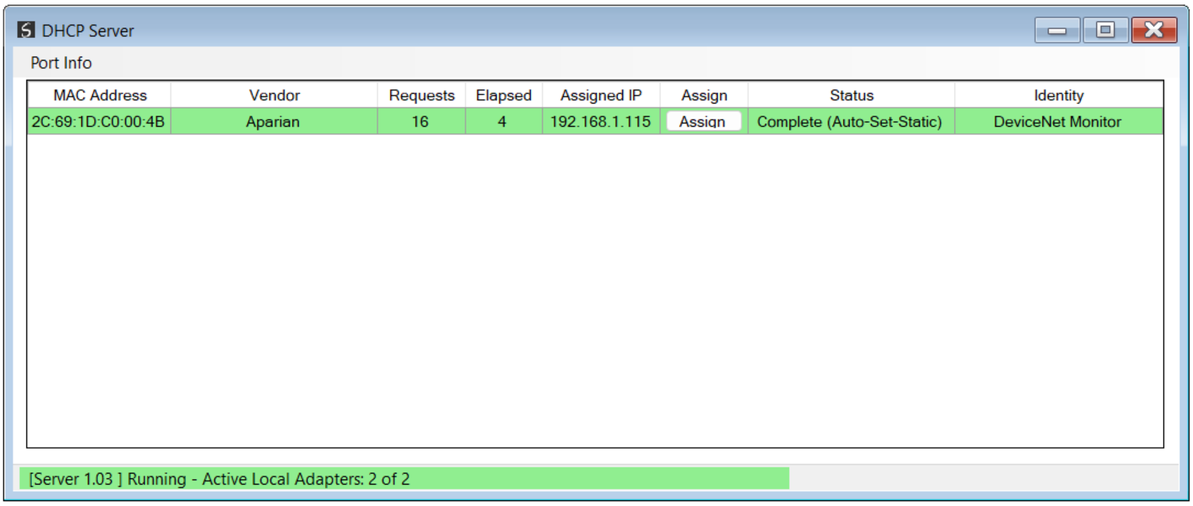


Figure 3.5. - Successful IP address assignment

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

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

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

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

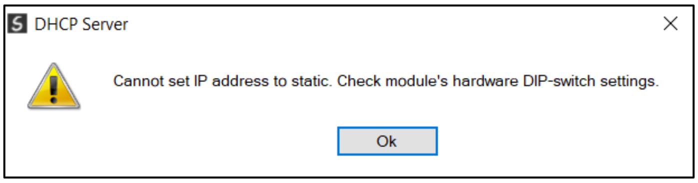


Figure 3.6. - Force DHCP warning

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

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

The ***Target Browser*** can be accessed under the ***Tools*** menu.

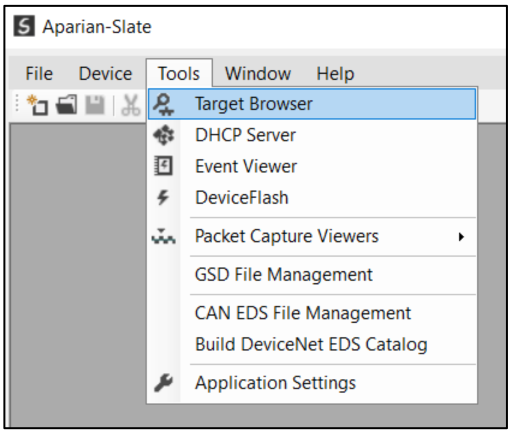


Figure 3.7. - Selecting the Target Browser

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

Figure 3.8. - Target Browser

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

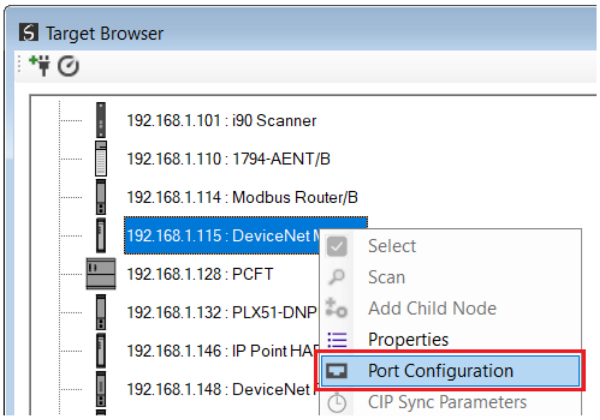


Figure 3.9. - Selecting Port Configuration

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

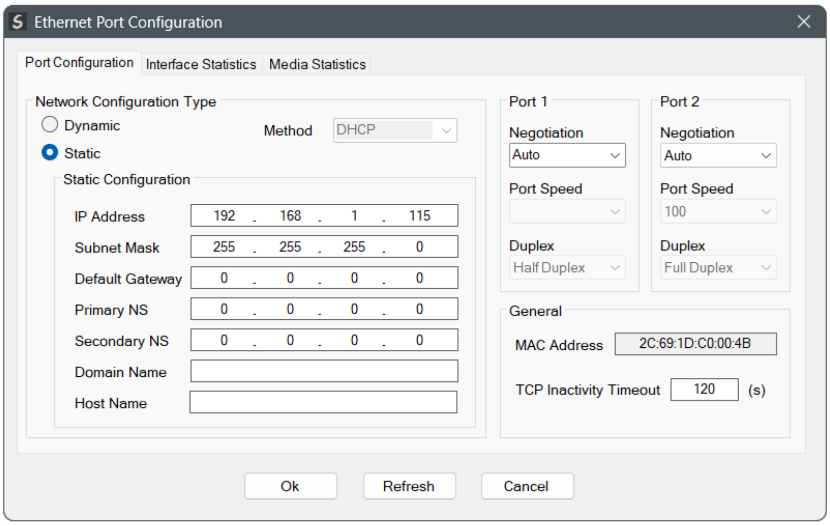


Figure 3.10. - Port Configuration

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

3.3. CREATING A NEW PROJECT

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

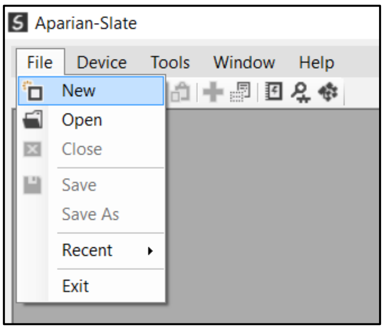


Figure 3.11. - Creating a new project

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

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

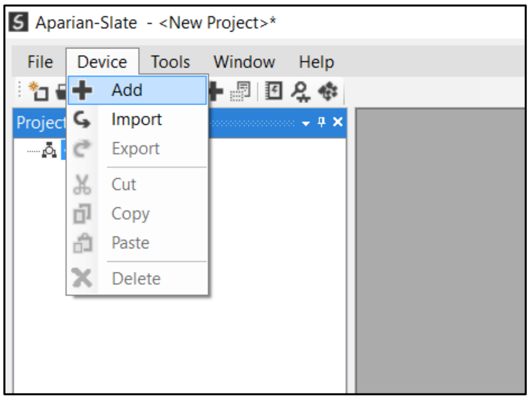


Figure 3.12. - Adding a new device

In the ***Add New Device*** window select the ***DeviceNet Monitor*** and click the ***Ok*** button.

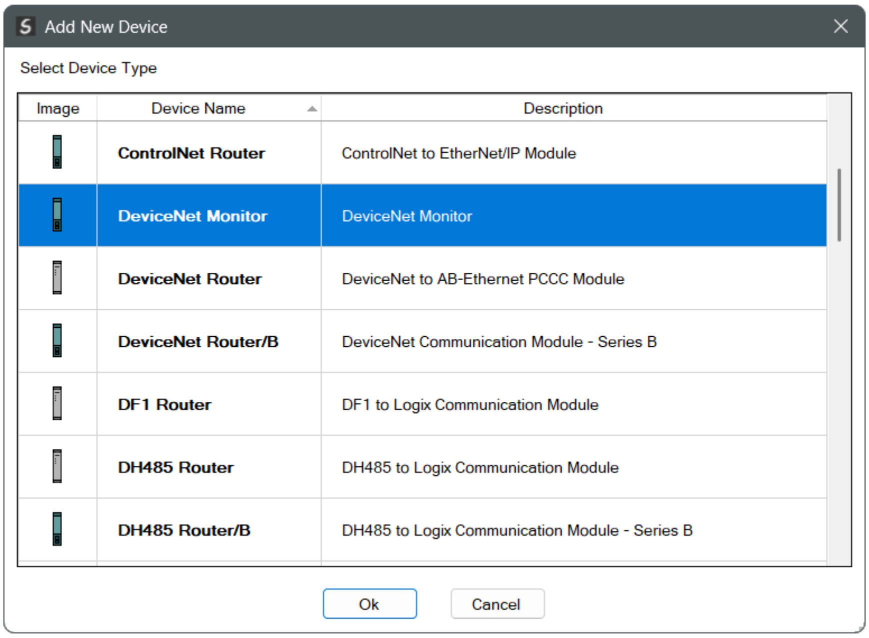


Figure 3.13 – Selecting a new DeviceNet Monitor

The device will appear in the Project Explorer tree as shown below, and its configuration window opened. The device configuration window can be reopened by either double clicking the module in the Project Explorer tree or right-clicking the module and selecting ***Configuration***.

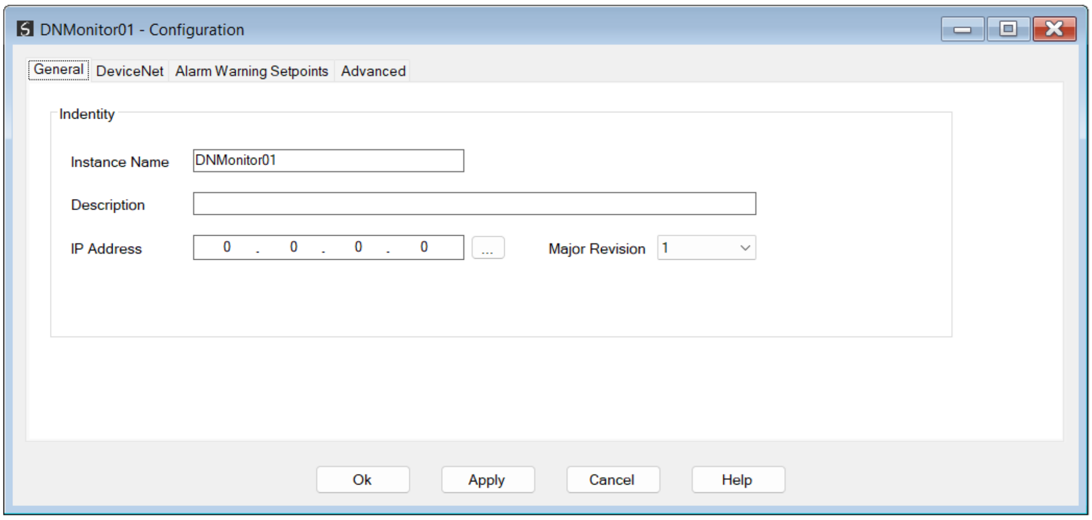


Figure 3.14. – DeviceNet Monitor configuration

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

3.4. GENERAL PARAMETERS

The DeviceNet parameters will be configured by Slate. When downloading this configuration into the module it will be saved in non-volatile memory that persists when the module is powered down.

NOTE: When a firmware upgrade is performed the module will clear all the module configuration stored in non-volatile storage.

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

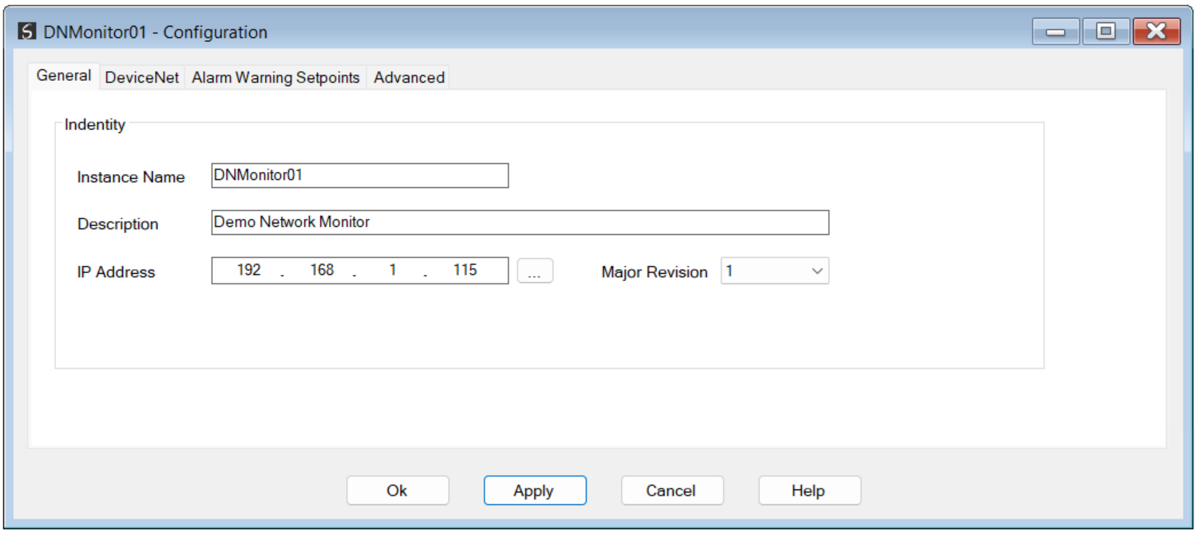


Figure 3.15 - General Configuration

The general configuration consists of the following parameters:

Parameter	Description
Instance Name	This parameter is a user defined name to identify between various DeviceNet Monitors.
Description	This parameter is used to provide a more detailed description of the application for the module.
Major Revision	The major revision of the module.
IP Address	The IP address of the target module. The user can use the target browse button to launch the target browser to the select the DeviceNet Monitor on the network.

Table 3.1 - General configuration parameters

3.5. DEVICENET CONFIGURATION

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

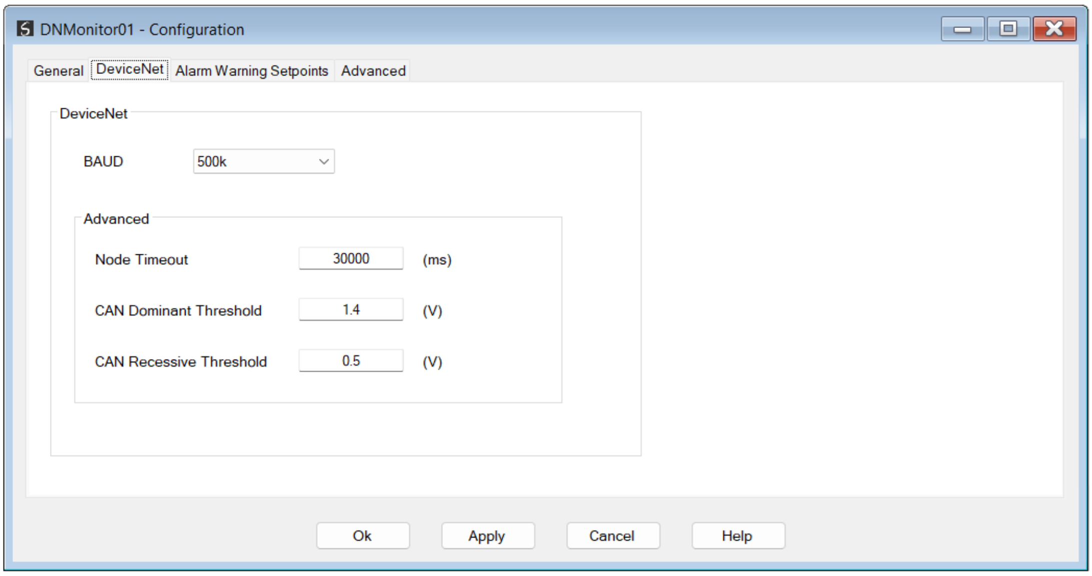


Figure 3.16 - General Configuration

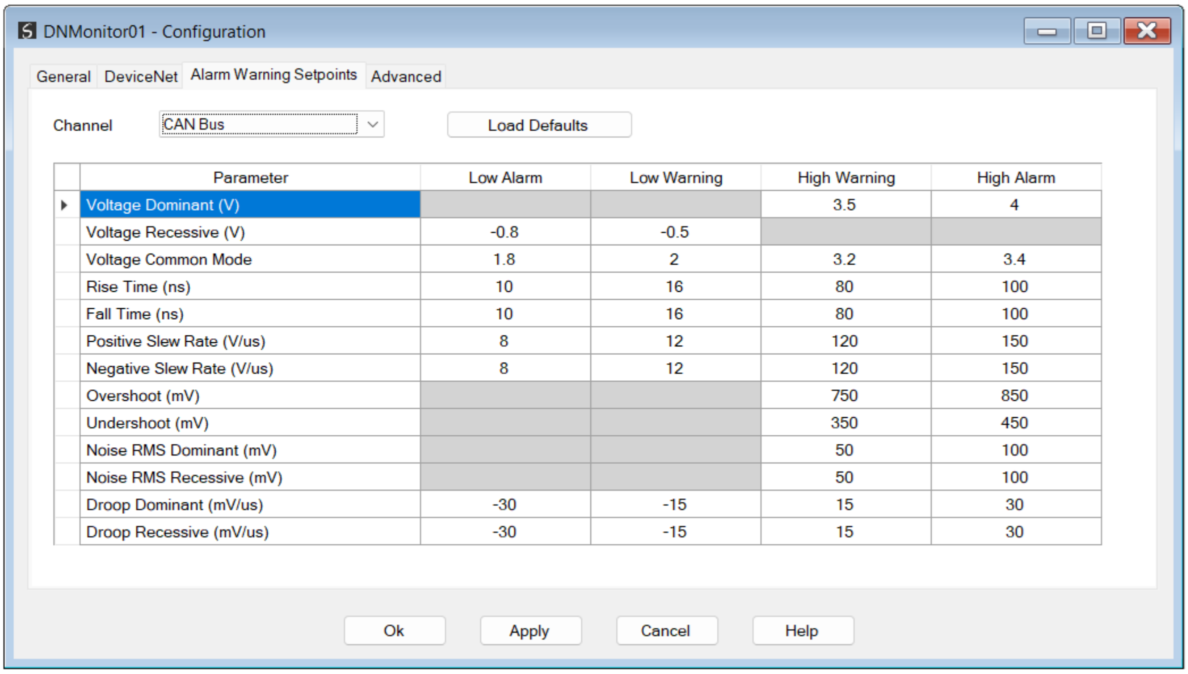
The DeviceNet configuration consists of the following parameters:

Parameter	**Description**
BAUD Rate	The DeviceNet bus BAUD rate. The following options are available: • 125k • 250k • 500k
Node Timeout	The amount of time (milliseconds) no traffic is detected from a particular node before it is deemed to be offline.
CAN Dominant Threshold	The differential CAN voltage above which the CAN logic state is deemed to be dominant.
CAN Recessive Threshold	The differential CAN voltage below which the CAN logic state is deemed to be recessive.

Table 3.2 - DeviceNet configuration parameters

3.6. ALARM / WARNING SETPOINTS

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



Parameter	Low Alarm	Low Warning	High Warning	High Alarm
Voltage Dominant (V)			3.5	4
Voltage Recessive (V)	-0.8	-0.5		
Voltage Common Mode	1.8	2	3.2	3.4
Rise Time (ns)	10	16	80	100
Fall Time (ns)	10	16	80	100
Positive Slew Rate (V/us)	8	12	120	150
Negative Slew Rate (V/us)	8	12	120	150
Overshoot (mV)			750	850
Undershoot (mV)			350	450
Noise RMS Dominant (mV)			50	100
Noise RMS Recessive (mV)			50	100
Droop Dominant (mV/us)	-30	-15	15	30
Droop Recessive (mV/us)	-30	-15	15	30

Figure 3.17 – CAN Bus Alarm Warning Setpoints

The Alarm and Warning setpoints can be configured for each of the channels.

NOTE: Not all the channel parameters have low and high setpoint options.

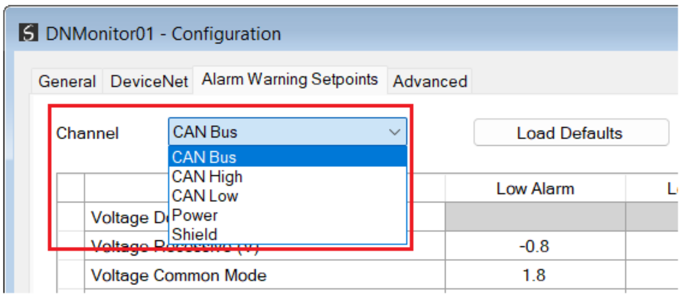


Figure 3.18 – CAN Bus Alarm Warning Setpoints – Channel Selection

Using the channel combo-box, select the require channel to modify. The default setpoint values (for the selected channel) can be loaded by clicking the ***Load Defaults*** button.

See section 1.4 for a detailed description of each parameter.

3.7. ADVANCED

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

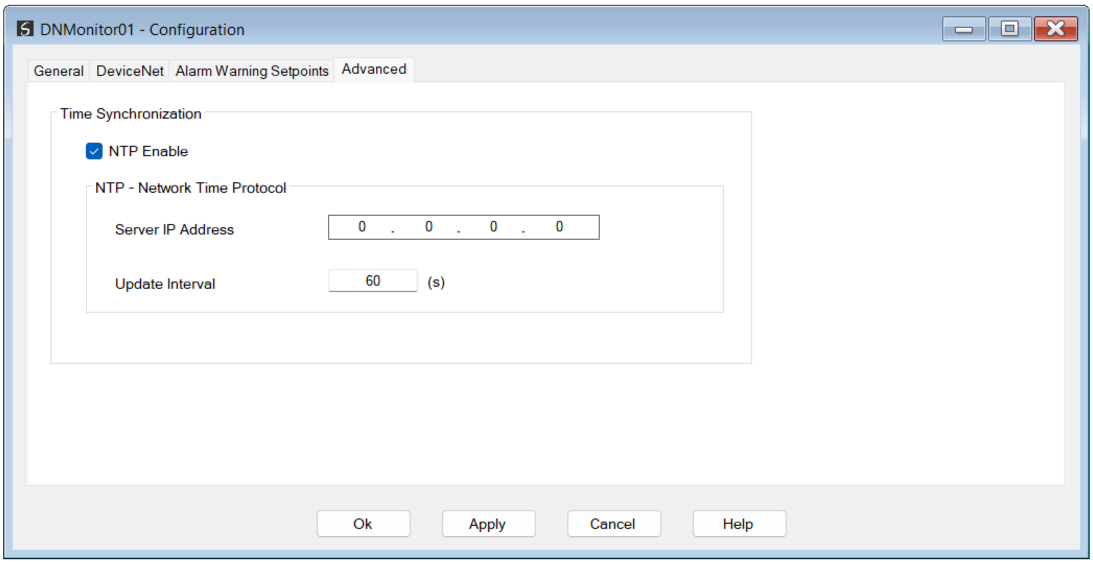


Figure 3.19 – Advanced configuration

The Advanced configuration consists of the following parameters:

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

Table 3.3 – Advanced configuration parameters

3.8. MODULE DOWNLOAD

Once the DeviceNet Monitor configuration has been completed, it must be downloaded to the module. Before downloading the ***Connection Path*** of the module should be set. This path will automatically default to the IP address of the module, as set in the module configuration. It can however be modified, if the DeviceNet Monitor is not on a local network.

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

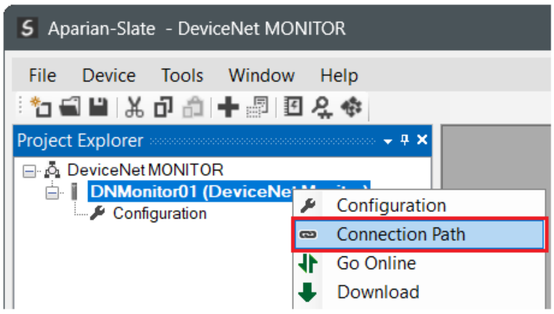


Figure 3.20 - Selecting Connection Path

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

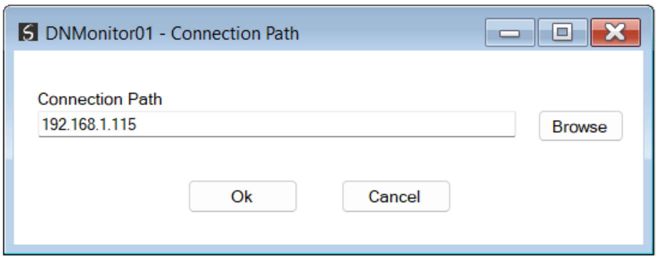


Figure 3.21 - Connection Path

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

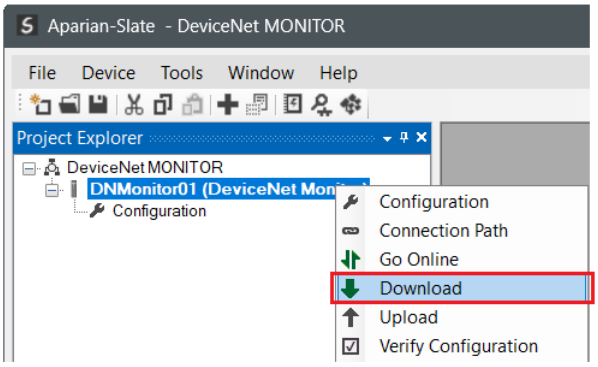


Figure 3.22 - Selecting Download

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

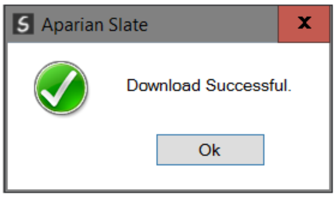


Figure 3.23 - Successful download

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.

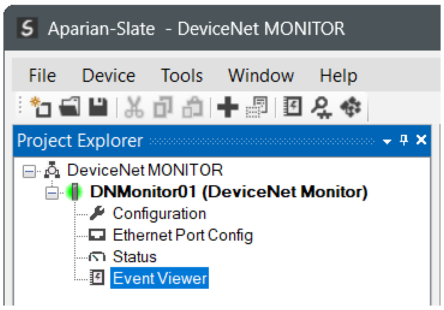


Figure 3.24 - Module online

3.9. STUDIO 5000 CONFIGURATION

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

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

NOTE: Logix version 21 and newer supports EDS AOPs.

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

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

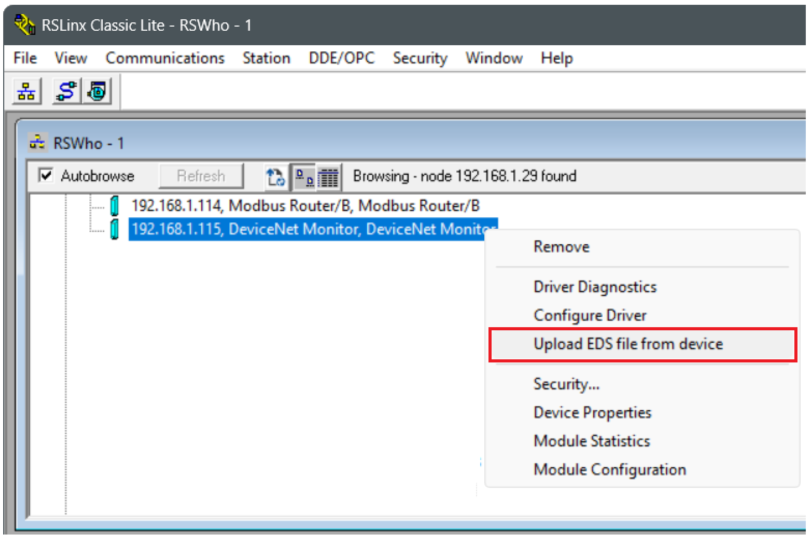


Figure 3.25 – EDS file upload from DeviceNet Monitor

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

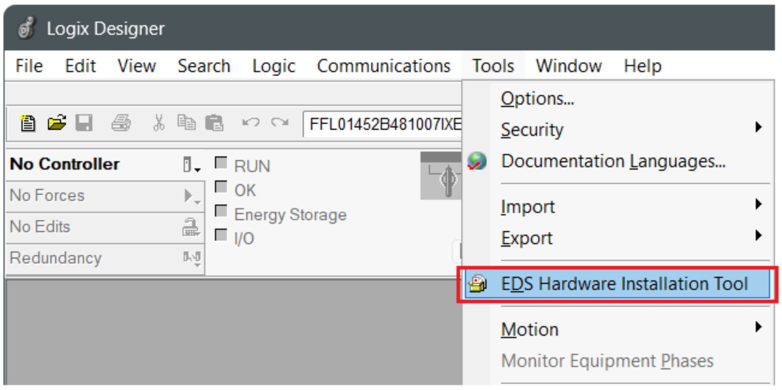


Figure 3.26 - EDS Hardware Installation Utility

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.

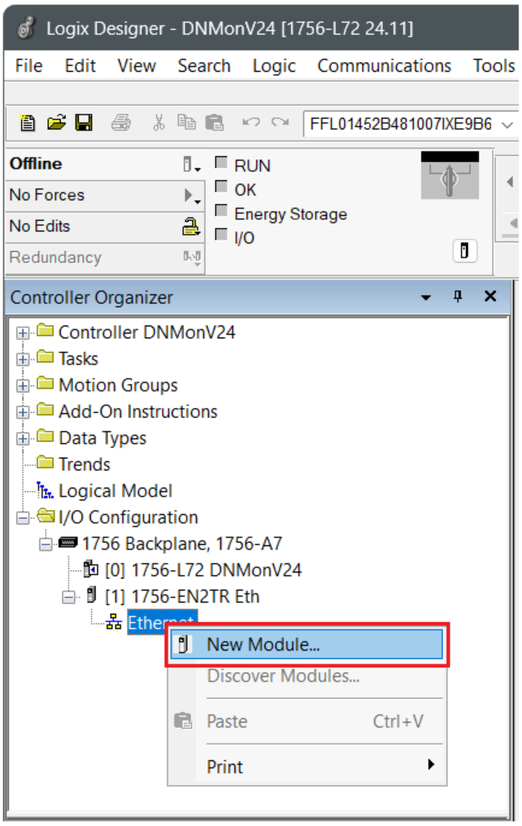


Figure 3.27 – Adding a module

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.

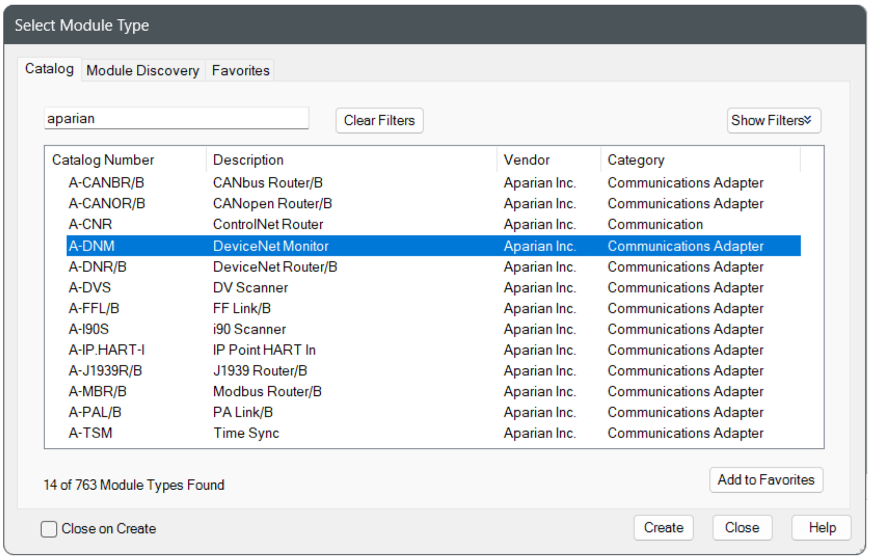


Figure 3.28 – Selecting the module

Locate and select the DeviceNet Monitor module and select the ***Create*** option. The module configuration dialog will open, where the user must specify the Name, IP address and Module Definition (connection count) to complete the instantiation.

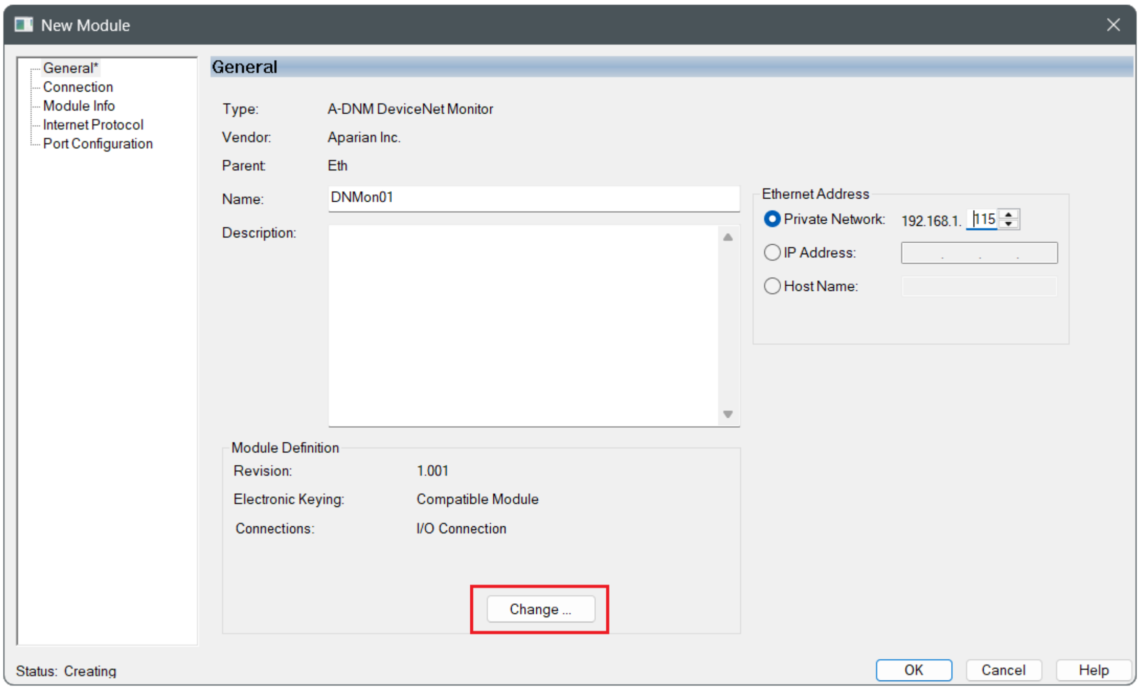


Figure 3.29 – Module instantiation

The DeviceNet Monitor requires 4 class 1 EtherNet/IP connections. The user will need to ensure that all 4 connections are added by clicking on the ***Change*** button in the ***Module Definition*** group.

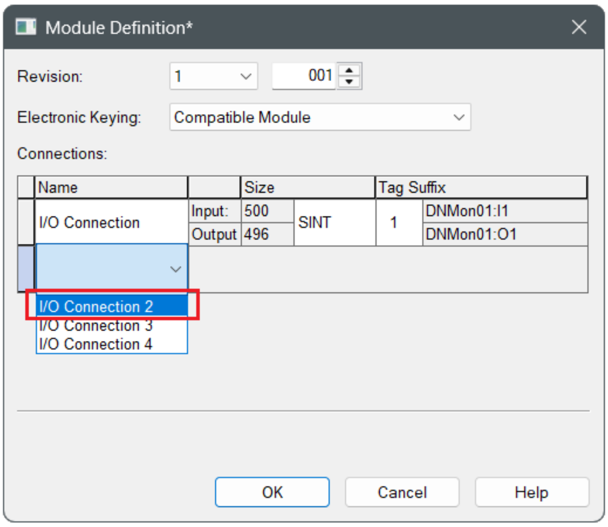


Figure 3.30 – Selection of IO Connections

The user can then manually add connections 2, 3 and 4.

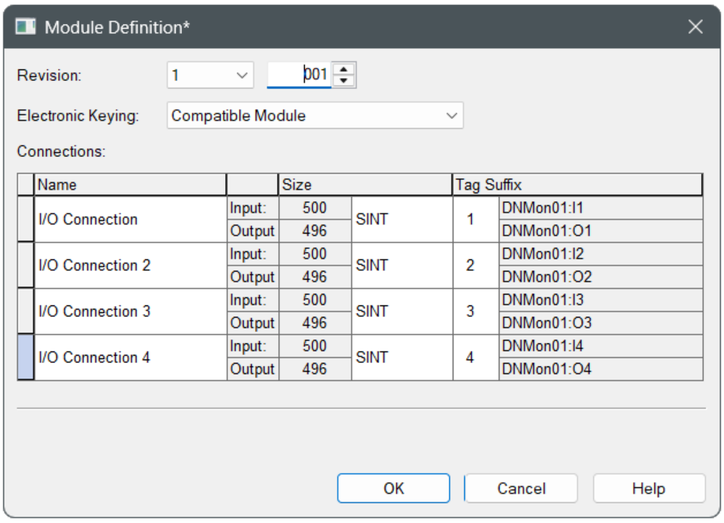


Figure 3.31 – Add all 4 IO Connections

Now the DeviceNet Monitor module will be in the Logix IO tree.

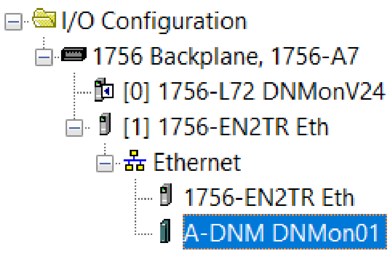


Figure 3.32 – Logix IO tree

3.9.2. Import Mapping Add-On-Instruction (AOI)

A standard mapping Add On Instruction (AOI) is provided for the DeviceNet Monitor module which performs two basic functions:

- It maps the data from connection 1 to a static General Status UDT, and
- It demultiplexes the detailed node information received via connections 2, 3 and 4.

This AOI and the associated UDTs and tags are available in an L5X routine which can be imported into a Studio 5000 project. Download the L5X routine "DNMon01Mapping.L5X" from the Aparian website.

In Studio 5000, right-click on a suitable Program and select ***Add***, and then the ***Import Routine*** option.

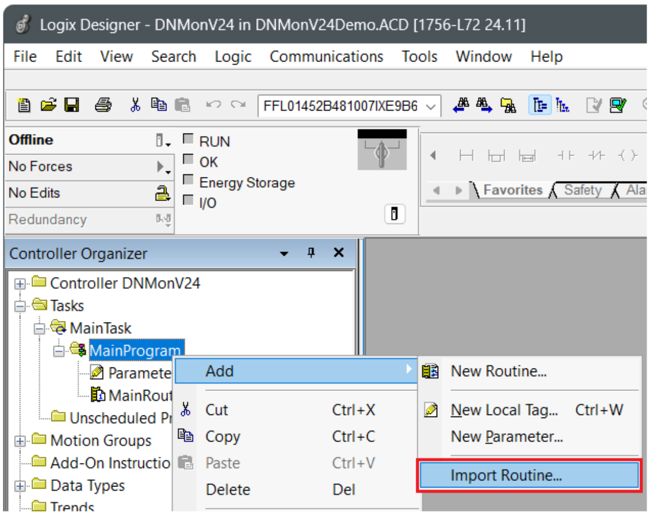


Figure 3.33 – Import Mapping Routine

Then select the downloaded L5X file.

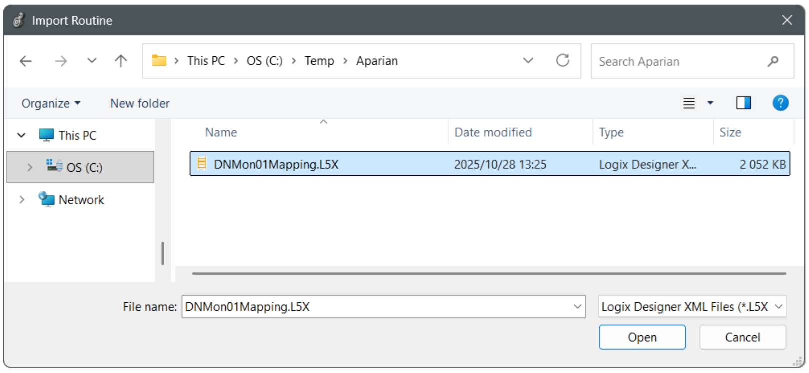


Figure 3.34 – Select Mapping Routine L5X file

In the project tree you will notice the new routine, AOI and UDTs that have been created.

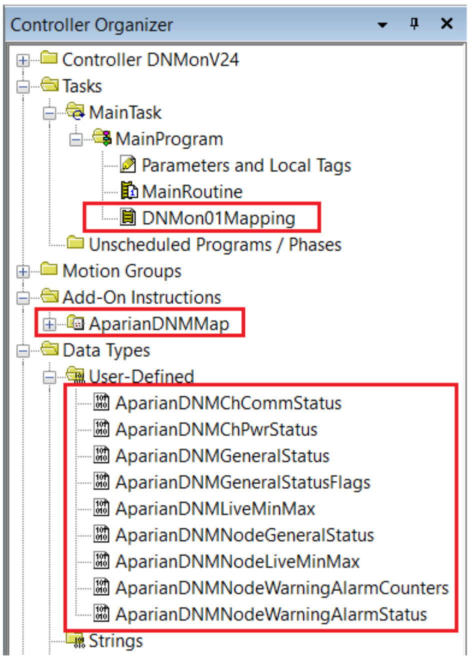


Figure 3.35 – Imported Routine, AOI and UDTs

The newly imported routine will need to be called from the Program’s Main routine, see below.

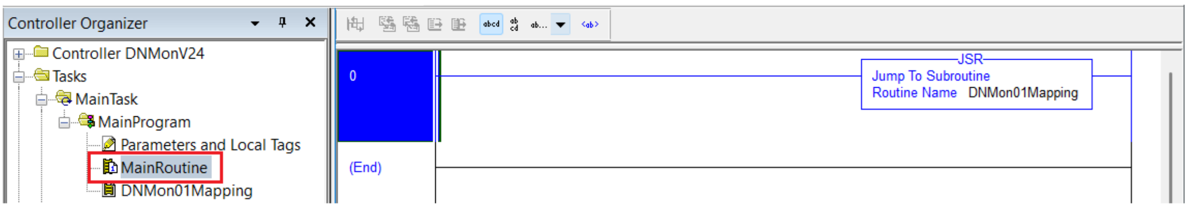


Figure 3.36 – Call Routine

The imported routine comprises a single rung with a single instance of the mapping AOI.

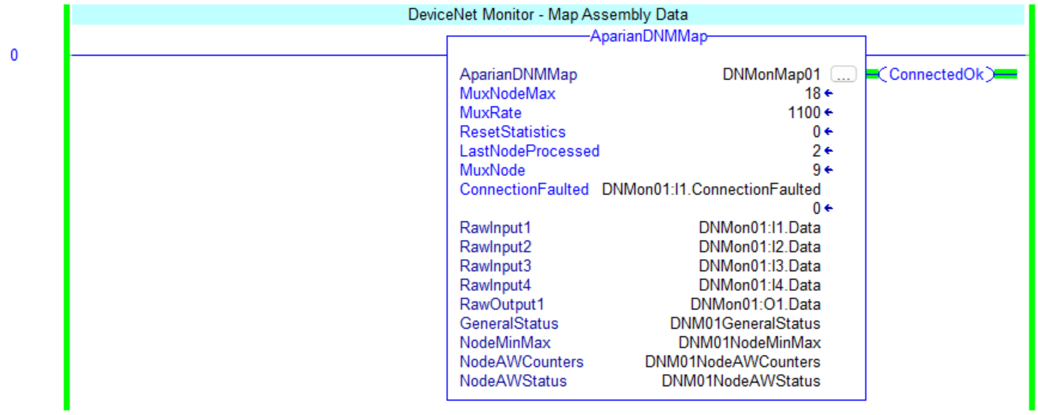


Figure 3.37 – Instantiated Mapping AOI

The AOI will sequentially update all the detailed Node data that is multiplexed on the EtherNet/IP connections 2, 3 and 4.

Ensure that the ***MuxNodeMax*** parameter is set to the highest Node address on the DeviceNet network.

4. DEVICE FIRMWARE UPDATE

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

To firmware upgrade the module, follow the steps below:

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

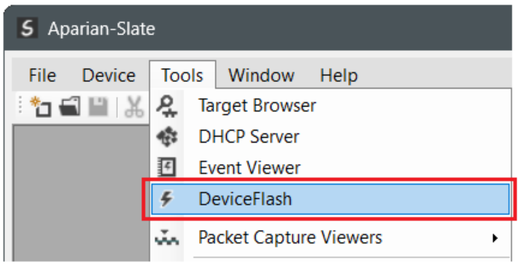


Figure 4.1 – Select DeviceFlash utility from Slate

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

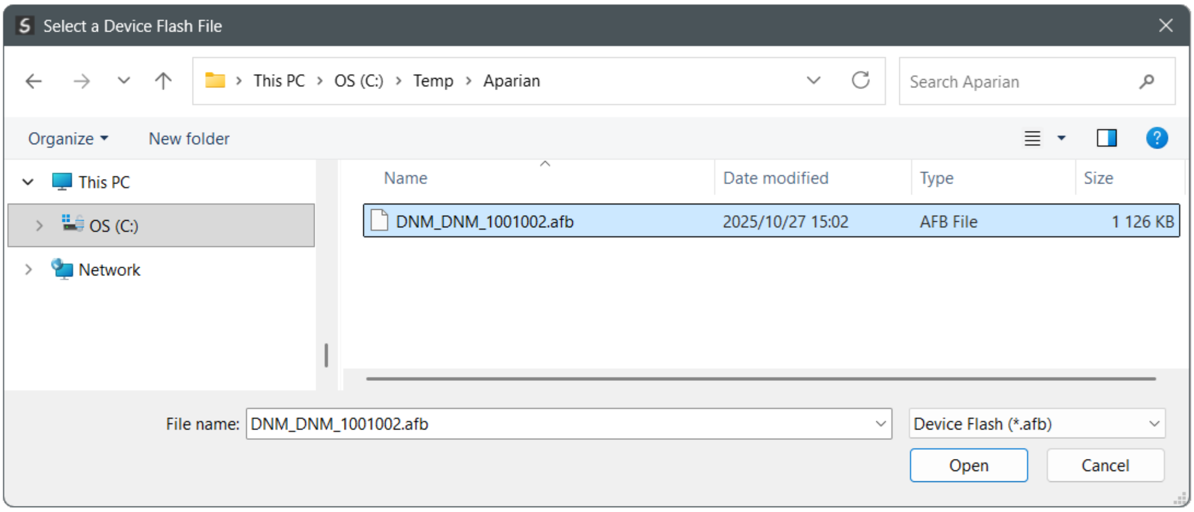


Figure 4.2 – Select the binary file

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

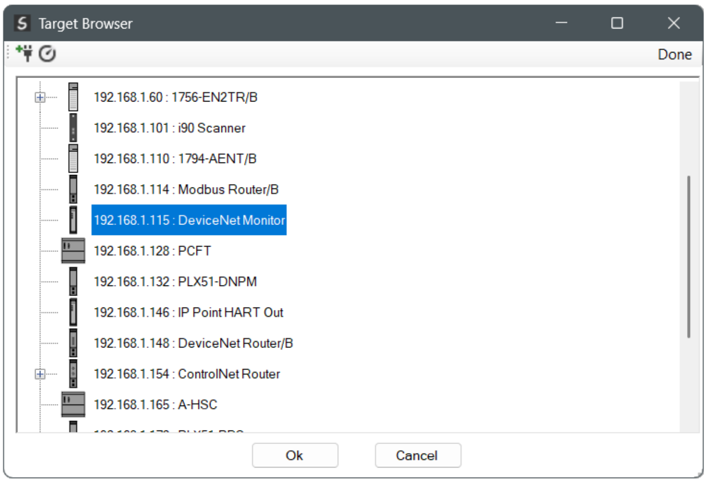


Figure 4.3 – Select the device to be updated

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

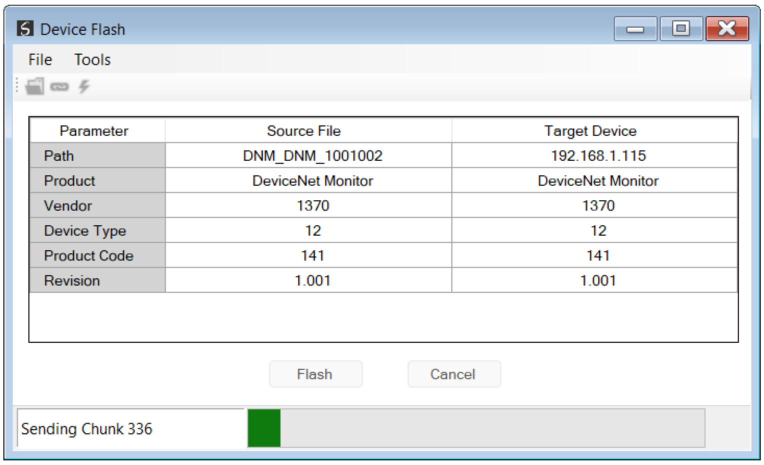


Figure 4.4 – Firmware update busy

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

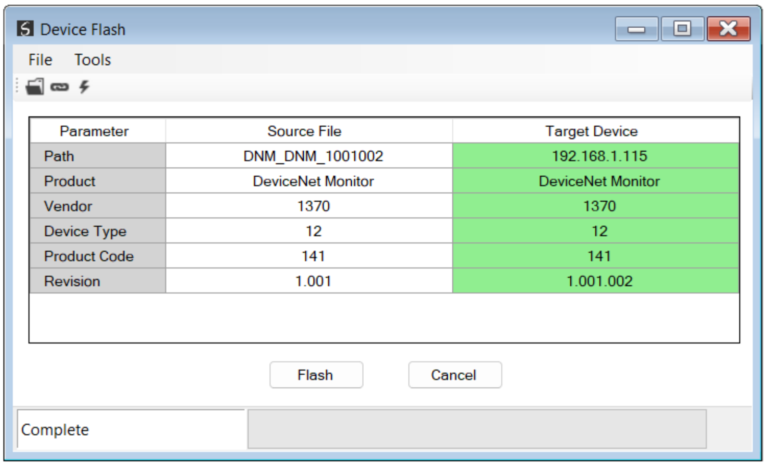


Figure 4.5 – Firmware update successfully completed.

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

5. OPERATION

5.1. LOGIX STRUCTURES

5.1.1. MAPPING AOI

The mapping Add On Instruction (AOI) performs two basic functions:
It maps the data from connection 1 to a static General Status UDT, and it demultiplexes the detailed node information received via connections 2, 3 and 4.

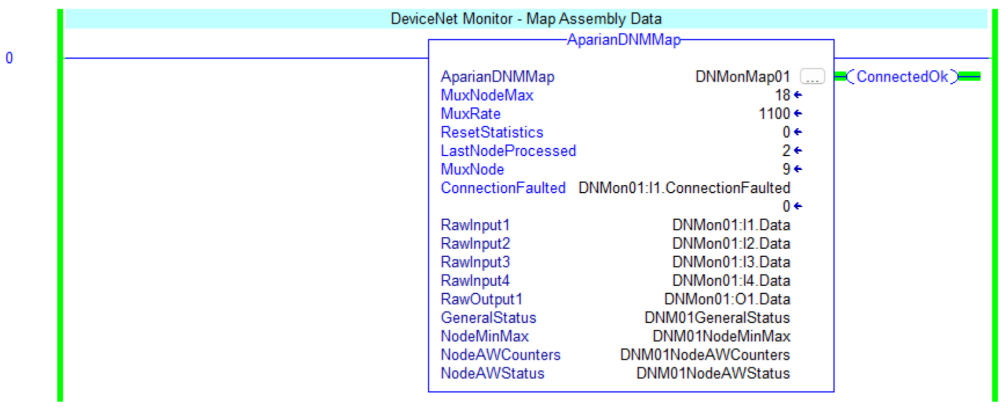


Figure 5.1 – DeviceNet Monitor AOI

All the information mapped by the AOI is already in tags of specific UDTs.
The data format of the connections is shown below.

5.1.2. CONNECTION 1 INPUT – GENERAL STATUS

Parameter	DataType	Byte Offset	Description
Status.ConfigValid	BOOL	0.0	Configuration Valid (0=Invalid, 1=Valid)
Status.EIPOwned	BOOL	0.1	EtherNet/IP Ownership (0=Not Owned, 1=Owned)
Status.NTPOk	BOOL	0.2	Network Time Protocol (0=Invalid, 1= Ok)
Status.ControllerRun	BOOL	0.3	Controller Mode (0=Program, 1=Run)
Status.PowerCalibrationOk	BOOL	0.4	Power Channel Calibration (0=Fail, 1=Ok)
Status.ShieldCalibrationOk	BOOL	0.5	Shield Channel Calibration (0=Fail, 1=Ok)
Status.CANHCalibrationOk	BOOL	0.6	CAN-H Channel Calibration (0=Fail, 1=Ok)

Status.CANLCalibrationOk	BOOL	0.7	CAN-L Channel Calibration (0=Fail, 1=Ok)
ConfigCRC	INT	4	Configuration Checksum
NodeStatus[0]			
NodeStatus[0].NodeActive	BOOL	8.0	Node Active (0=Inactive 1=Active)
NodeStatus[0].PowerAlarm	BOOL	8.1	Power Alarm (0=Ok 1=Alarm)
NodeStatus[0].PowerAlarmLatch	BOOL	8.2	Power Alarm Latch (0=Ok 1=AlarmLatch)
NodeStatus[0].PowerWarning	BOOL	8.3	Power Warning (0=Ok 1=Warning)
NodeStatus[0].PowerWarningLatch	BOOL	8.4	Power Warning Latch (0=Ok 1=WarningLatch)
NodeStatus[0].ShieldAlarm	BOOL	8.5	Shield Alarm (0=Ok 1=Alarm)
NodeStatus[0].ShieldAlarmLatch	BOOL	8.6	Shield Alarm Latch (0=Ok 1=AlarmLatch)
NodeStatus[0].ShieldWarning	BOOL	8.7	Shield Warning (0=Ok 1=Warning)
NodeStatus[0].ShieldWarningLatch	BOOL	9.0	Shield Warning Latch (0=Ok 1=WarningLatch)
NodeStatus[0].CANAlarm	BOOL	9.1	CAN Alarm (0=Ok 1=Alarm)
NodeStatus[0].CANAlarmLatch	BOOL	9.2	CAN Alarm Latch (0=Ok 1=AlarmLatch)
NodeStatus[0].CANWarning	BOOL	9.3	CAN Warning (0=Ok 1=Warning)
NodeStatus[0].CANWarningLatch	BOOL	9.4	CAN Warning Latch (0=Ok 1=WarningLatch)
NodeStatus[0].CNLAlarm	BOOL	9.5	CAN-L Alarm (0=Ok 1=Alarm)
NodeStatus[0].CNLAlarmLatch	BOOL	9.6	CAN-L Alarm Latch (0=Ok 1=AlarmLatch)
NodeStatus[0].CNLWarning	BOOL	9.7	CAN-L Warning (0=Ok 1=Warning)
NodeStatus[0].CNLWarningLatch	BOOL	10.0	CAN-L Warning Latch (0=Ok 1=WarningLatch)
NodeStatus[0].CNHAlarm	BOOL	10.1	CAN-H Alarm (0=Ok 1=Alarm)
NodeStatus[0].CNHAlarmLatch	BOOL	10.2	CAN-H Alarm Latch (0=Ok 1=AlarmLatch)
NodeStatus[0].CNHWarning	BOOL	10.3	CAN-H Warning (0=Ok 1=Warning)
NodeStatus[0].CNHWarningLatch	BOOL	10.4	CAN-H Warning Latch (0=Ok 1=WarningLatch)
NodeStatus[1..63] (Repeat the above for nodes 1..63)			

LiveCNHVoltage	REAL	264	Live CAN-H Voltage
LiveCNLVoltage	REAL	268	Live CAN-L Voltage
LivePowerVoltage	REAL	272	Live Power Voltage
LiveShieldVoltage	REAL	276	Live Shield Voltage
LiveCNHRaw	INT	280	Live CAN-H Raw
LiveCNLRaw	INT	282	Live CAN-L Raw
LivePowerRaw	INT	284	Live Power Raw
LiveShieldRaw	INT	286	Live Shield Raw
LiveCNHUncal	REAL	288	Live CAN-H Uncalibrated Voltage
LiveCNLUncal	REAL	292	Live CAN-L Uncalibrated Voltage
LivePowerUncal	REAL	296	Live Power Uncalibrated Voltage
LiveShieldUncal	REAL	300	Live Shield Uncalibrated Voltage
LastNodeProcessed	INT	304	Last Node Processed
LastNodeTimeSinceProcessed	DINT	308	Time (ms) Since Last Node Processed

Table 5.1 – Connection 1 - Input Assembly

Name	Value	Style	Data Type	Description
DNM01GeneralStatus	{...}		AparianDNMGeneralStatus	
DNM01GeneralStatus.ConfigCRC	16#ca7b	Hex	INT	Configuration Checksum
DNM01GeneralStatus.LastNodeProcessed	12	Decimal	INT	Last Node Processed
DNM01GeneralStatus.LastNodeTimeSinceProcessed	1140	Decimal	DINT	Time (ms) Since Last Node Processed
DNM01GeneralStatus.LiveCNHRaw	703	Decimal	INT	Live CAN-H Raw
DNM01GeneralStatus.LiveCNHUncal	2.7654614	Float	REAL	Live CAN-H Uncalibrated Voltage
DNM01GeneralStatus.LiveCNHVoltage	2.7609923	Float	REAL	Live CAN-H Voltage
DNM01GeneralStatus.LiveCNLRaw	706	Decimal	INT	Live CAN-L Raw
DNM01GeneralStatus.LiveCNLUncal	2.7772627	Float	REAL	Live CAN-L Uncalibrated Voltage
DNM01GeneralStatus.LiveCNLVoltage	2.7655945	Float	REAL	Live CAN-L Voltage
DNM01GeneralStatus.LivePowerRaw	1623	Decimal	INT	Live Power Raw
DNM01GeneralStatus.LivePowerUncal	6.3845572	Float	REAL	Live Power Uncalibrated Voltage
DNM01GeneralStatus.LivePowerVoltage	24.342772	Float	REAL	Live Power Voltage
DNM01GeneralStatus.LiveShieldRaw	-2	Decimal	INT	Live Shield Raw
DNM01GeneralStatus.LiveShieldUncal	-0.0078676	Float	REAL	Live Shield Uncalibrated Voltage
DNM01GeneralStatus.LiveShieldVoltage	-0.032902732	Float	REAL	Live Shield Voltage
DNM01GeneralStatus.NodeStatus	{...}		AparianDNMNodeGeneralStatus[64]	
DNM01GeneralStatus.Status	{...}		AparianDNMGeneralStatusFlags	
DNM01GeneralStatus.Status.CANHCalibrationOk	1	Decimal	BOOL	CAN-H Channel Calibration (0=Fail, 1=Ok)
DNM01GeneralStatus.Status.CANLCalibrationOk	1	Decimal	BOOL	CAN-L Channel Calibration (0=Fail, 1=Ok)
DNM01GeneralStatus.Status.ConfigValid	1	Decimal	BOOL	Configuration Valid (0=Invalid, 1=Valid)
DNM01GeneralStatus.Status.ControllerRun	1	Decimal	BOOL	Controller Mode (0=Program, 1=Run)
DNM01GeneralStatus.Status.EIPOwned	1	Decimal	BOOL	EtherNet/IP Ownership (0=Not Owned, 1=Owned)
DNM01GeneralStatus.Status.NTPOk	0	Decimal	BOOL	Network Time Protocol (0=Invalid, 1= Ok)
DNM01GeneralStatus.Status.PowerCalibrationOk	1	Decimal	BOOL	Power Channel Calibration (0=Fail, 1=Ok)
DNM01GeneralStatus.Status.ShieldCalibrationOk	1	Decimal	BOOL	Shield Channel Calibration (0=Fail, 1=Ok)

Figure 5.2 – Connection 1 – Input Data Tag

Name	Value	Style	Data Type	Description
DNM01GeneralStatus.NodeStatus	{...}		AparianDNMNodeGeneralStatus[64]	
DNM01GeneralStatus.NodeStatus[0]	{...}		AparianDNMNodeGeneralStatus	
DNM01GeneralStatus.NodeStatus[0].CANAlarm	0	Decimal	BOOL	CAN Alarm (0=Ok 1=Alarm)
DNM01GeneralStatus.NodeStatus[0].CANAlarmLatch	0	Decimal	BOOL	CAN Alarm Latch (0=Ok 1=AlarmLatch)
DNM01GeneralStatus.NodeStatus[0].CANWarning	0	Decimal	BOOL	CAN Warning (0=Ok 1=Warning)
DNM01GeneralStatus.NodeStatus[0].CANWarningLatch	0	Decimal	BOOL	CAN Warning Latch (0=Ok 1=WarningLatch)
DNM01GeneralStatus.NodeStatus[0].CNHAlarm	0	Decimal	BOOL	CAN-H Alarm (0=Ok 1=Alarm)
DNM01GeneralStatus.NodeStatus[0].CNHAlarmLatch	0	Decimal	BOOL	CAN-H Alarm Latch (0=Ok 1=AlarmLatch)
DNM01GeneralStatus.NodeStatus[0].CNHWarning	0	Decimal	BOOL	CAN-H Warning (0=Ok 1=Warning)
DNM01GeneralStatus.NodeStatus[0].CNHWarningLatch	0	Decimal	BOOL	CAN-H Warning Latch (0=Ok 1=WarningLatch)
DNM01GeneralStatus.NodeStatus[0].CNLAlarm	0	Decimal	BOOL	CAN-L Alarm (0=Ok 1=Alarm)
DNM01GeneralStatus.NodeStatus[0].CNLAlarmLatch	0	Decimal	BOOL	CAN-L Alarm Latch (0=Ok 1=AlarmLatch)
DNM01GeneralStatus.NodeStatus[0].CNLWarning	0	Decimal	BOOL	CAN-L Warning (0=Ok 1=Warning)
DNM01GeneralStatus.NodeStatus[0].CNLWarningLatch	0	Decimal	BOOL	CAN-L Warning Latch (0=Ok 1=WarningLatch)
DNM01GeneralStatus.NodeStatus[0].NodeActive	1	Decimal	BOOL	Node Active (0=Inactive 1=Active)
DNM01GeneralStatus.NodeStatus[0].PowerAlarm	0	Decimal	BOOL	Power Alarm (0=Ok 1=Alarm)
DNM01GeneralStatus.NodeStatus[0].PowerAlarmLatch	0	Decimal	BOOL	Power Alarm Latch (0=Ok 1=AlarmLatch)
DNM01GeneralStatus.NodeStatus[0].PowerWarning	0	Decimal	BOOL	Power Warning (0=Ok 1=Warning)
DNM01GeneralStatus.NodeStatus[0].PowerWarningLatch	0	Decimal	BOOL	Power Warning Latch (0=Ok 1=WarningLatch)
DNM01GeneralStatus.NodeStatus[0].ShieldAlarm	0	Decimal	BOOL	Shield Alarm (0=Ok 1=Alarm)
DNM01GeneralStatus.NodeStatus[0].ShieldAlarmLatch	0	Decimal	BOOL	Shield Alarm Latch (0=Ok 1=AlarmLatch)
DNM01GeneralStatus.NodeStatus[0].ShieldWarning	0	Decimal	BOOL	Shield Warning (0=Ok 1=Warning)
DNM01GeneralStatus.NodeStatus[0].ShieldWarningLatch	0	Decimal	BOOL	Shield Warning Latch (0=Ok 1=WarningLatch)

Figure 5.3 – Connection 1 – Input Data Tag – Node Status

5.1.3. Connection 1 Output – Control

The connection 1 output assembly is used to control which DeviceNet node's detailed data should be transferred in the connections 2, 3 and 4.

Parameter	**DataType**	**Byte Offset**	**Description**
ControlWord	DINT	0	Reserved
MUXDeviceNetNode	DINT	4	DeviceNet Node selection for Multiplexer

Table 5.2 – Connection 1 - Output Assembly

5.1.4. Connection 2 Input – Alarm & Warning Status

The connection 2 input assembly provides the detailed Alarm and Warning status information for the selected (multiplexed) node.

The structure uses two sub-structures to define:

1. Power / Shield Channel Status (PCSW)
2. Communication Channel Status (CCSW)

These structures are defined as follows:

PCSW : Power / Shield Channel Status Word			
Flag	Data Type	Byte Offset	Description
VoltAll	BOOL	0.0	Voltage
NoisePP	BOOL	0.1	Noise Peak-Peak
NoiseRMSGen	BOOL	0.2	Noise RMS

Table 5.3 – PCSW Data Type

CCSW : Communication Channel Status Word			
Flag	Data Type	Byte Offset	Description
VoltDom	BOOL	0.0	Dominant Voltage
VoltRec	BOOL	0.1	Recessive Voltage
VoltCM	BOOL	0.2	Common Mode Voltage
RiseTime	BOOL	0.3	Rise Time
FallTime	BOOL	0.4	Fall Time
PosSlew	BOOL	0.5	Positive Slew Rate
NegSlew	BOOL	0.6	Negative Slew Rate
Overshoot	BOOL	0.7	Overshoot
Undershoot	BOOL	1.0	Undershoot
NoiseRMSDom	BOOL	1.1	Dominant Noise RMS
NoiseRMSRec	BOOL	1.2	Recessive Noise RMS
DroopDom	BOOL	1.3	Dominant Droop
DroopRec	BOOL	1.4	Recessive Droop

Table 5.4 – CCSW Data Type

The connection 2 input assembly is defined as follows:

Parameter	**Data Type**	**Byte Offset**	**Description**
DeviceNode	DINT	0	Current (Multiplexed) Device Node
SampleCount	DINT	4	Analysis Sample Counts
TimeSinceLastAnalysis	DINT	8	Time (ms) since last analysis
PWRLowAlarm	PCSW	12	Power Low Alarm Flags
PWRLowWarn	PCSW	16	Power Low Warning Flags
PWRHighWarn	PCSW	20	Power High Warning Flags

PWRHighAlarm	PCSW	24	Power High Alarm Flags
PWRLowAlarmLatch	PCSW	28	Power Low Alarm Latch Flags
PWRLowWarnLatch	PCSW	32	Power Low Warning Latch Flags
PWRHighWarnLatch	PCSW	36	Power High Warning Latch Flags
PWRHighAlarmLatch	PCSW	40	Power High Alarm Latch Flags
SHDLowAlarm	PCSW	44	Shield Low Alarm Flags
SHDLowWarn	PCSW	48	Shield Low Warning Flags
SHDHighWarn	PCSW	52	Shield High Warning Flags
SHDHighAlarm	PCSW	56	Shield High Alarm Flags
SHDLowAlarmLatch	PCSW	60	Shield Low Alarm Latch Flags
SHDLowWarnLatch	PCSW	64	Shield Low Warning Latch Flags
SHDHighWarnLatch	PCSW	68	Shield High Warning Latch Flags
SHDHighAlarmLatch	PCSW	72	Shield High Alarm Latch Flags
CNLLowAlarm	CCSW	76	CAN-L Low Alarm Flags
CNLLowWarn	CCSW	80	CAN-L Low Warning Flags
CNLHighWarn	CCSW	84	CAN-L High Warning Flags
CNLHighAlarm	CCSW	88	CAN-L High Alarm Flags
CNLLowAlarmLatch	CCSW	92	CAN-L Low Alarm Latch Flags
CNLLowWarnLatch	CCSW	96	CAN-L Low Warning Latch Flags
CNLHighWarnLatch	CCSW	100	CAN-L High Warning Latch Flags
CNLHighAlarmLatch	CCSW	104	CAN-L High Alarm Latch Flags
CNHLowAlarm	CCSW	108	CAN-H Low Alarm Flags
CNHLowWarn	CCSW	112	CAN-H Low Warning Flags
CNHHighWarn	CCSW	116	CAN-H High Warning Flags
CNHHighAlarm	CCSW	120	CAN-H High Alarm Flags
CNHLowAlarmLatch	CCSW	124	CAN-H Low Alarm Latch Flags
CNHLowWarnLatch	CCSW	128	CAN-H Low Warning Latch Flags
CNHHighWarnLatch	CCSW	132	CAN-H High Warning Latch Flags
CNHHighAlarmLatch	CCSW	136	CAN-H High Alarm Latch Flags
CANLowAlarm	CCSW	140	CAN Low Alarm Flags
CANLowWarn	CCSW	144	CAN Low Warning Flags
CANHighWarn	CCSW	148	CAN High Warning Flags
CANHighAlarm	CCSW	152	CAN High Alarm Flags

CANLowAlarmLatch	CCSW	156	CAN Low Alarm Latch Flags
CANLowWarnLatch	CCSW	160	CAN Low Warning Latch Flags
CANHighWarnLatch	CCSW	164	CAN High Warning Latch Flags
CANHighAlarmLatch	CCSW	168	CAN High Alarm Latch Flags

Table 5.5 – Connection 2 - Input Assembly

Name	Value	Style	Data Type	Description
DNM01NodeAWStatus	{...}		AparianDNMNodeWarningAlarmSta...	
DNM01NodeAWStatus[0]	{...}		AparianDNMNodeWarningAlarmSta...	
DNM01NodeAWStatus[0].CANHighAlarm	{...}		AparianDNMChCommStatus	CAN High Alarm
DNM01NodeAWStatus[0].CANHighAlarm.DroopDom	0	Decimal	BOOL	Dominant Droop
DNM01NodeAWStatus[0].CANHighAlarm.DroopRec	0	Decimal	BOOL	Recessive Droop
DNM01NodeAWStatus[0].CANHighAlarm.FallTime	0	Decimal	BOOL	Fall Time
DNM01NodeAWStatus[0].CANHighAlarm.NegSlew	0	Decimal	BOOL	Negative Slew Rate
DNM01NodeAWStatus[0].CANHighAlarm.NoiseRMSDom	0	Decimal	BOOL	Dominant Noise RMS
DNM01NodeAWStatus[0].CANHighAlarm.NoiseRMSRec	0	Decimal	BOOL	Recessive Noise RMS
DNM01NodeAWStatus[0].CANHighAlarm.Overshoot	0	Decimal	BOOL	Overshoot
DNM01NodeAWStatus[0].CANHighAlarm.PosSlew	0	Decimal	BOOL	Positive Slew Rate
DNM01NodeAWStatus[0].CANHighAlarm.RiseTime	0	Decimal	BOOL	Rise Time
DNM01NodeAWStatus[0].CANHighAlarm.Undershoot	0	Decimal	BOOL	Undershoot
DNM01NodeAWStatus[0].CANHighAlarm.VoltCM	0	Decimal	BOOL	Common Mode Voltage
DNM01NodeAWStatus[0].CANHighAlarm.VoltDom	0	Decimal	BOOL	Dominant Voltage
DNM01NodeAWStatus[0].CANHighAlarm.VoltRec	0	Decimal	BOOL	Recessive Voltage
DNM01NodeAWStatus[0].CANHighAlarmLatch	{...}		AparianDNMChCommStatus	CAN High Alarm Latch
DNM01NodeAWStatus[0].CANHighWarn	{...}		AparianDNMChCommStatus	CAN High Warning
DNM01NodeAWStatus[0].CANHighWarnLatch	{...}		AparianDNMChCommStatus	CAN High Warning Latch

Figure 5.4 – Connection 2 - Input Assembly – Per Node Tags

5.1.5. Connection 3 Input – Alarm & Warning Counters

The connection 3 input assembly provides the detailed Alarm and Warning counters for the selected (multiplexed) node. The structure is as follows:

Parameter	**Data Type**	**Byte Offset**	**Description**
DeviceNode	DINT	0	Current (Multiplexed) Device Node
PWRVoltAllLowAlarm	DINT	4	Power Voltage Low Alarm Count
PWRVoltAllLowWarn	DINT	8	Power Voltage Low Warning Count
PWRVoltAllHighWarn	DINT	12	Power Voltage High Warning Count
PWRVoltAllHighAlarm	DINT	16	Power Voltage High Alarm Count
PWRNoisePPHighWarn	DINT	20	Power Noise Peak-Peak High Warning Count
PWRNoisePPHighAlarm	DINT	24	Power Noise Peak-Peak High Alarm Count
PWRNoiseRMSGenHighWarn	DINT	28	Power Noise RMS High Warning Count
PWRNoiseRMSGenHighAlarm	DINT	32	Power Noise RMS High Alarm Count
SHDVoltAllLowAlarm	DINT	36	Shield Voltage Low Alarm Count

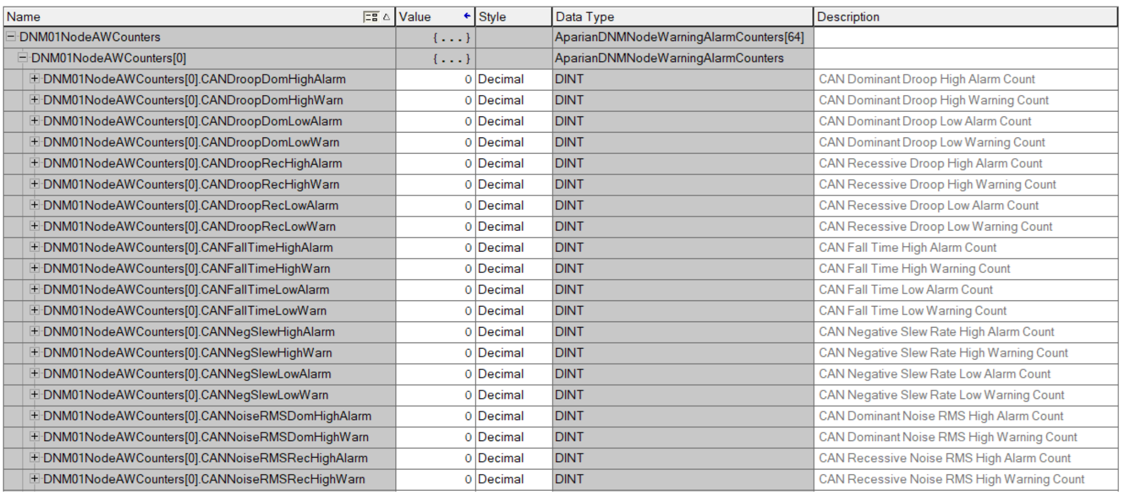
SHDVoltAllLowWarn	DINT	40	Shield Voltage Low Warning Count
SHDVoltAllHighWarn	DINT	44	Shield Voltage High Warning Count
SHDVoltAllHighAlarm	DINT	48	Shield Voltage High Alarm Count
SHDNoisePPHighWarn	DINT	52	Shield Noise Peak-Peak High Warning Count
SHDNoisePPHighAlarm	DINT	56	Shield Noise Peak-Peak High Alarm Count
SHDNoiseRMSGenHighWarn	DINT	60	Shield Noise RMS High Warning Count
SHDNoiseRMSGenHighAlarm	DINT	64	Shield Noise RMS High Alarm Count
CNLVoltDomLowAlarm	DINT	68	CAN-L Dominant Voltage Low Alarm Count
CNLVoltDomLowWarn	DINT	72	CAN-L Dominant Voltage Low Warning Count
CNLVoltDomHighWarn	DINT	76	CAN-L Dominant Voltage High Warning Count
CNLVoltDomHighAlarm	DINT	80	CAN-L Dominant Voltage High Alarm Count
CNLVoltRecLowAlarm	DINT	84	CAN-L Recessive Voltage Low Alarm Count
CNLVoltRecLowWarn	DINT	88	CAN-L Recessive Voltage Low Warning Count
CNLVoltRecHighWarn	DINT	92	CAN-L Recessive Voltage High Warning Count
CNLVoltRecHighAlarm	DINT	96	CAN-L Recessive Voltage High Alarm Count
CNLPosSlewLowAlarm	DINT	100	CAN-L Positive Slew Rate Low Alarm Count
CNLPosSlewLowWarn	DINT	104	CAN-L Positive Slew Rate Low Warning Count
CNLPosSlewHighWarn	DINT	108	CAN-L Positive Slew Rate High Warning Count
CNLPosSlewHighAlarm	DINT	112	CAN-L Positive Slew Rate High Alarm Count
CNLNegSlewLowAlarm	DINT	116	CAN-L Negative Slew Rate Low Alarm Count
CNLNegSlewLowWarn	DINT	120	CAN-L Negative Slew Rate Low Warning Count
CNLNegSlewHighWarn	DINT	124	CAN-L Negative Slew Rate High Warning Count
CNLNegSlewHighAlarm	DINT	128	CAN-L Negative Slew Rate High Alarm Count
CNLOvershootHighWarn	DINT	132	CAN-L Overshoot High Warning Count
CNLOvershootHighAlarm	DINT	136	CAN-L Overshoot High Alarm Count
CNLUndershootHighWarn	DINT	140	CAN-L Undershoot High Warning Count
CNLUndershootHighAlarm	DINT	144	CAN-L Undershoot High Alarm Count
CNLNoiseRMSDomHighWarn	DINT	148	CAN-L Dominant Noise RMS High Warning Count
CNLNoiseRMSDomHighAlarm	DINT	152	CAN-L Dominant Noise RMS High Alarm Count
CNLNoiseRMSRecHighWarn	DINT	156	CAN-L Recessive Noise RMS High Warning Count
CNLNoiseRMSRecHighAlarm	DINT	160	CAN-L Recessive Noise RMS High Alarm Count

CNLDroopDomLowAlarm	DINT	164	CAN-L Dominant Droop Low Alarm Count
CNLDroopDomLowWarn	DINT	168	CAN-L Dominant Droop Low Warning Count
CNLDroopDomHighWarn	DINT	172	CAN-L Dominant Droop High Warning Count
CNLDroopDomHighAlarm	DINT	176	CAN-L Dominant Droop High Alarm Count
CNLDroopRecLowAlarm	DINT	180	CAN-L Recessive Droop Low Alarm Count
CNLDroopRecLowWarn	DINT	184	CAN-L Recessive Droop Low Warning Count
CNLDroopRecHighWarn	DINT	188	CAN-L Recessive Droop High Warning Count
CNLDroopRecHighAlarm	DINT	192	CAN-L Recessive Droop High Alarm Count
CNHVoltDomLowAlarm	DINT	196	CAN-H Dominant Voltage Low Alarm Count
CNHVoltDomLowWarn	DINT	200	CAN-H Dominant Voltage Low Warning Count
CNHVoltDomHighWarn	DINT	204	CAN-H Dominant Voltage High Warning Count
CNHVoltDomHighAlarm	DINT	208	CAN-H Dominant Voltage High Alarm Count
CNHVoltRecLowAlarm	DINT	212	CAN-H Recessive Voltage Low Alarm Count
CNHVoltRecLowWarn	DINT	216	CAN-H Recessive Voltage Low Warning Count
CNHVoltRecHighWarn	DINT	220	CAN-H Recessive Voltage High Warning Count
CNHVoltRecHighAlarm	DINT	224	CAN-H Recessive Voltage High Alarm Count
CNHPosSlewLowAlarm	DINT	228	CAN-H Positive Slew Rate Low Alarm Count
CNHPosSlewLowWarn	DINT	232	CAN-H Positive Slew Rate Low Warning Count
CNHPosSlewHighWarn	DINT	236	CAN-H Positive Slew Rate High Warning Count
CNHPosSlewHighAlarm	DINT	240	CAN-H Positive Slew Rate High Alarm Count
CNHNegSlewLowAlarm	DINT	244	CAN-H Negative Slew Rate Low Alarm Count
CNHNegSlewLowWarn	DINT	248	CAN-H Negative Slew Rate Low Warning Count
CNHNegSlewHighWarn	DINT	252	CAN-H Negative Slew Rate High Warning Count
CNHNegSlewHighAlarm	DINT	256	CAN-H Negative Slew Rate High Alarm Count
CNHOvershootHighWarn	DINT	260	CAN-H Overshoot High Warning Count
CNHOvershootHighAlarm	DINT	264	CAN-H Overshoot High Alarm Count
CNHUndershootHighWarn	DINT	268	CAN-H Undershoot High Warning Count
CNHUndershootHighAlarm	DINT	272	CAN-H Undershoot High Alarm Count
CNHNoiseRMSDomHighWarn	DINT	276	CAN-H Dominant Noise RMS High Warning Count
CNHNoiseRMSDomHighAlarm	DINT	280	CAN-H Dominant Noise RMS High Alarm Count

CNHNoiseRMSRecHighWarn	DINT	284	CAN-H Recessive Noise RMS High Warning Count
CNHNoiseRMSRecHighAlarm	DINT	288	CAN-H Recessive Noise RMS High Alarm Count
CNHDroopDomLowAlarm	DINT	292	CAN-H Dominant Droop Low Alarm Count
CNHDroopDomLowWarn	DINT	296	CAN-H Dominant Droop Low Warning Count
CNHDroopDomHighWarn	DINT	300	CAN-H Dominant Droop High Warning Count
CNHDroopDomHighAlarm	DINT	304	CAN-H Dominant Droop High Alarm Count
CNHDroopRecLowAlarm	DINT	308	CAN-H Recessive Droop Low Alarm Count
CNHDroopRecLowWarn	DINT	312	CAN-H Recessive Droop Low Warning Count
CNHDroopRecHighWarn	DINT	316	CAN-H Recessive Droop High Warning Count
CNHDroopRecHighAlarm	DINT	320	CAN-H Recessive Droop High Alarm Count
CANVoltDomHighWarn	DINT	324	CAN Dominant Voltage High Warning Count
CANVoltDomHighAlarm	DINT	328	CAN Dominant Voltage High Alarm Count
CANVoltRecLowAlarm	DINT	332	CAN Recessive Voltage Low Alarm Count
CANVoltRecLowWarn	DINT	336	CAN Recessive Voltage Low Warning Count
CANVoltCMLowAlarm	DINT	340	CAN Common Mode Voltage Low Alarm Count
CANVoltCMLowWarn	DINT	344	CAN Common Mode Voltage Low Warning Count
CANVoltCMHighWarn	DINT	348	CAN Common Mode Voltage High Warning Count
CANVoltCMHighAlarm	DINT	352	CAN Common Mode Voltage High Alarm Count
CANRiseTimeLowAlarm	DINT	356	CAN Rise Time Low Alarm Count
CANRiseTimeLowWarn	DINT	360	CAN Rise Time Low Warning Count
CANRiseTimeHighWarn	DINT	364	CAN Rise Time High Warning Count
CANRiseTimeHighAlarm	DINT	368	CAN Rise Time High Alarm Count
CANFallTimeLowAlarm	DINT	372	CAN Fall Time Low Alarm Count
CANFallTimeLowWarn	DINT	376	CAN Fall Time Low Warning Count
CANFallTimeHighWarn	DINT	380	CAN Fall Time High Warning Count
CANFallTimeHighAlarm	DINT	384	CAN Fall Time High Alarm Count
CANPosSlewLowAlarm	DINT	388	CAN Positive Slew Rate Low Alarm Count
CANPosSlewLowWarn	DINT	392	CAN Positive Slew Rate Low Warning Count
CANPosSlewHighWarn	DINT	396	CAN Positive Slew Rate High Warning Count
CANPosSlewHighAlarm	DINT	400	CAN Positive Slew Rate High Alarm Count

CANNegSlewLowAlarm	DINT	404	CAN Negative Slew Rate Low Alarm Count
CANNegSlewLowWarn	DINT	408	CAN Negative Slew Rate Low Warning Count
CANNegSlewHighWarn	DINT	412	CAN Negative Slew Rate High Warning Count
CANNegSlewHighAlarm	DINT	416	CAN Negative Slew Rate High Alarm Count
CANOvershootHighWarn	DINT	420	CAN Overshoot High Warning Count
CANOvershootHighAlarm	DINT	424	CAN Overshoot High Alarm Count
CANUndershootHighWarn	DINT	428	CAN Undershoot High Warning Count
CANUndershootHighAlarm	DINT	432	CAN Undershoot High Alarm Count
CANNoiseRMSDomHighWarn	DINT	436	CAN Dominant Noise RMS High Warning Count
CANNoiseRMSDomHighAlarm	DINT	440	CAN Dominant Noise RMS High Alarm Count
CANNoiseRMSRecHighWarn	DINT	444	CAN Recessive Noise RMS High Warning Count
CANNoiseRMSRecHighAlarm	DINT	448	CAN Recessive Noise RMS High Alarm Count
CANDroopDomLowAlarm	DINT	452	CAN Dominant Droop Low Alarm Count
CANDroopDomLowWarn	DINT	456	CAN Dominant Droop Low Warning Count
CANDroopDomHighWarn	DINT	460	CAN Dominant Droop High Warning Count
CANDroopDomHighAlarm	DINT	464	CAN Dominant Droop High Alarm Count
CANDroopRecLowAlarm	DINT	468	CAN Recessive Droop Low Alarm Count
CANDroopRecLowWarn	DINT	472	CAN Recessive Droop Low Warning Count
CANDroopRecHighWarn	DINT	476	CAN Recessive Droop High Warning Count
CANDroopRecHighAlarm	DINT	480	CAN Recessive Droop High Alarm Count

Table 5.6 – Connection 3 - Input Assembly



Name	Value	Style	Data Type	Description
DNM01NodeAWCounters	{...}		AparianDNMNodeWarningAlarmCounters[64]	
DNM01NodeAWCounters[0]	{...}		AparianDNMNodeWarningAlarmCounters	
DNM01NodeAWCounters[0].CANDroopDomHighAlarm	0	Decimal	DINT	CAN Dominant Droop High Alarm Count
DNM01NodeAWCounters[0].CANDroopDomHighWarn	0	Decimal	DINT	CAN Dominant Droop High Warning Count
DNM01NodeAWCounters[0].CANDroopDomLowAlarm	0	Decimal	DINT	CAN Dominant Droop Low Alarm Count
DNM01NodeAWCounters[0].CANDroopDomLowWarn	0	Decimal	DINT	CAN Dominant Droop Low Warning Count
DNM01NodeAWCounters[0].CANDroopRecHighAlarm	0	Decimal	DINT	CAN Recessive Droop High Alarm Count
DNM01NodeAWCounters[0].CANDroopRecHighWarn	0	Decimal	DINT	CAN Recessive Droop High Warning Count
DNM01NodeAWCounters[0].CANDroopRecLowAlarm	0	Decimal	DINT	CAN Recessive Droop Low Alarm Count
DNM01NodeAWCounters[0].CANDroopRecLowWarn	0	Decimal	DINT	CAN Recessive Droop Low Warning Count
DNM01NodeAWCounters[0].CANFallTimeHighAlarm	0	Decimal	DINT	CAN Fall Time High Alarm Count
DNM01NodeAWCounters[0].CANFallTimeHighWarn	0	Decimal	DINT	CAN Fall Time High Warning Count
DNM01NodeAWCounters[0].CANFallTimeLowAlarm	0	Decimal	DINT	CAN Fall Time Low Alarm Count
DNM01NodeAWCounters[0].CANFallTimeLowWarn	0	Decimal	DINT	CAN Fall Time Low Warning Count
DNM01NodeAWCounters[0].CANNegSlewHighAlarm	0	Decimal	DINT	CAN Negative Slew Rate High Alarm Count
DNM01NodeAWCounters[0].CANNegSlewHighWarn	0	Decimal	DINT	CAN Negative Slew Rate High Warning Count
DNM01NodeAWCounters[0].CANNegSlewLowAlarm	0	Decimal	DINT	CAN Negative Slew Rate Low Alarm Count
DNM01NodeAWCounters[0].CANNegSlewLowWarn	0	Decimal	DINT	CAN Negative Slew Rate Low Warning Count
DNM01NodeAWCounters[0].CANNoiseRMSDomHighAlarm	0	Decimal	DINT	CAN Dominant Noise RMS High Alarm Count
DNM01NodeAWCounters[0].CANNoiseRMSDomHighWarn	0	Decimal	DINT	CAN Dominant Noise RMS High Warning Count
DNM01NodeAWCounters[0].CANNoiseRMSRecHighAlarm	0	Decimal	DINT	CAN Recessive Noise RMS High Alarm Count
DNM01NodeAWCounters[0].CANNoiseRMSRecHighWarn	0	Decimal	DINT	CAN Recessive Noise RMS High Warning Count

Figure 5.5 – Connection 3 – Input Assembly – Per Node Tags

5.1.6. Connection 4 Input – Live, Minimum and Maximum Values

The connection 4 input assembly provides the detailed Live, Minimum and Maximum values for the selected (multiplexed) node.

The structure uses a sub-structure (LMM) which is defined as follows:

LMM : Live Minimum Maximum			
Sub Parameter	Data Type	Byte Offset	Description
Live	REAL	0	Most Recent Analysis Mean Value
Min	REAL	4	Minimum of all Analysis Mean Values
Max	REAL	8	Maximum of all Analysis Mean Values

Table 5.7 – Live Minimum Maximum (LMM) Data Type

The structure of the connection 4 input assembly is as follows:

Parameter	**Data Type**	**Byte Offset**	**Description**
DeviceNode	DINT	0	Current (Multiplexed) Device Node
PWRVoltAll	LMM	4	Power Voltage - Live,Min,Max
PWRNoisePP	LMM	16	Power Noise Peak-Peak - Live,Min,Max
PWRNoiseRMSGen	LMM	28	Power Noise RMS - Live,Min,Max
SHDVoltAll	LMM	40	Shield Voltage - Live,Min,Max
SHDNoisePP	LMM	52	Shield Noise Peak-Peak - Live,Min,Max
SHDNoiseRMSGen	LMM	64	Shield Noise RMS - Live,Min,Max
CNLVoltDom	LMM	76	CAN-L Dominant Voltage - Live,Min,Max
CNLVoltRec	LMM	88	CAN-L Recessive Voltage - Live,Min,Max
CNLPosSlew	LMM	100	CAN-L Positive Slew Rate - Live,Min,Max
CNLNegSlew	LMM	112	CAN-L Negative Slew Rate - Live,Min,Max
CNLOvershoot	LMM	124	CAN-L Overshoot - Live,Min,Max
CNLUndershoot	LMM	136	CAN-L Undershoot - Live,Min,Max
CNLNoiseRMSDom	LMM	148	CAN-L Dominant Noise RMS - Live,Min,Max
CNLNoiseRMSRec	LMM	160	CAN-L Recessive Noise RMS - Live,Min,Max
CNLDroopDom	LMM	172	CAN-L Dominant Droop - Live,Min,Max

CNLDroopRec	LMM	184	CAN-L Recessive Droop - Live,Min,Max
CNHVoltDom	LMM	196	CAN-H Dominant Voltage - Live,Min,Max
CNHVoltRec	LMM	208	CAN-H Recessive Voltage - Live,Min,Max
CNHPosSlew	LMM	220	CAN-H Positive Slew Rate - Live,Min,Max
CNHNegSlew	LMM	232	CAN-H Negative Slew Rate - Live,Min,Max
CNHOvershoot	LMM	244	CAN-H Overshoot - Live,Min,Max
CNHUndershoot	LMM	256	CAN-H Undershoot - Live,Min,Max
CNHNoiseRMSDom	LMM	268	CAN-H Dominant Noise RMS - Live,Min,Max
CNHNoiseRMSRec	LMM	280	CAN-H Recessive Noise RMS - Live,Min,Max
CNHDroopDom	LMM	292	CAN-H Dominant Droop - Live,Min,Max
CNHDroopRec	LMM	304	CAN-H Recessive Droop - Live,Min,Max
CANVoltDom	LMM	316	CAN Dominant Voltage - Live,Min,Max
CANVoltRec	LMM	328	CAN Recessive Voltage - Live,Min,Max
CANVoltCM	LMM	340	CAN Common Mode Voltage - Live,Min,Max
CANRiseTime	LMM	352	CAN Rise Time - Live,Min,Max
CANFallTime	LMM	364	CAN Fall Time - Live,Min,Max
CANPosSlew	LMM	376	CAN Positive Slew Rate - Live,Min,Max
CANNegSlew	LMM	388	CAN Negative Slew Rate - Live,Min,Max
CANOvershoot	LMM	400	CAN Overshoot - Live,Min,Max
CANUndershoot	LMM	412	CAN Undershoot - Live,Min,Max
CANNoiseRMSDom	LMM	424	CAN Dominant Noise RMS - Live,Min,Max
CANNoiseRMSRec	LMM	436	CAN Recessive Noise RMS - Live,Min,Max
CANDroopDom	LMM	448	CAN Dominant Droop - Live,Min,Max
CANDroopRec	LMM	460	CAN Recessive Droop - Live,Min,Max

Table 5.8 – Connection 4 - Input Assembly (Per Node)

Name	Value	Style	Data Type	Description
− DNM01NodeMinMax	{...}		ApparianDNMNodeLiveMinMax[64]	
− DNM01NodeMinMax[0]	{...}		AparianDNMNodeLiveMinMax	
− DNM01NodeMinMax[0].CANDroopDom	{...}		AparianDNMLiveMinMax	CAN Dominant Droop
DNM01NodeMinMax[0].CANDroopDom.Latest	1.5020862	Float	REAL	Most Recent Value
DNM01NodeMinMax[0].CANDroopDom.Max	2.9382527	Float	REAL	Maximum Value
DNM01NodeMinMax[0].CANDroopDom.Min	0.97507775	Float	REAL	Minimum Value
+ DNM01NodeMinMax[0].CANDroopRec	{...}		AparianDNMLiveMinMax	CAN Recessive Droop
+ DNM01NodeMinMax[0].CANFallTime	{...}		AparianDNMLiveMinMax	CAN Fall Time
+ DNM01NodeMinMax[0].CANNegSlew	{...}		AparianDNMLiveMinMax	CAN Negative Slew Rate
+ DNM01NodeMinMax[0].CANNoiseRMSDom	{...}		AparianDNMLiveMinMax	CAN Dominant Noise RMS
+ DNM01NodeMinMax[0].CANNoiseRMSRec	{...}		AparianDNMLiveMinMax	CAN Recessive Noise RMS
+ DNM01NodeMinMax[0].CANOvershoot	{...}		AparianDNMLiveMinMax	CAN Overshoot
+ DNM01NodeMinMax[0].CANPosSlew	{...}		AparianDNMLiveMinMax	CAN Positive Slew Rate
+ DNM01NodeMinMax[0].CANRiseTime	{...}		AparianDNMLiveMinMax	CAN Rise Time
+ DNM01NodeMinMax[0].CANUndershoot	{...}		AparianDNMLiveMinMax	CAN Undershoot
+ DNM01NodeMinMax[0].CANVoltCM	{...}		AparianDNMLiveMinMax	CAN Common Mode Voltage
+ DNM01NodeMinMax[0].CANVoltDom	{...}		AparianDNMLiveMinMax	CAN Dominant Voltage
+ DNM01NodeMinMax[0].CANVoltRec	{...}		AparianDNMLiveMinMax	CAN Recessive Voltage
+ DNM01NodeMinMax[0].CNHDroopDom	{...}		AparianDNMLiveMinMax	CAN-H Dominant Droop
+ DNM01NodeMinMax[0].CNHDroopRec	{...}		AparianDNMLiveMinMax	CAN-H Recessive Droop
+ DNM01NodeMinMax[0].CNHNegSlew	{...}		AparianDNMLiveMinMax	CAN-H Negative Slew Rate
+ DNM01NodeMinMax[0].CNHNoiseRMSDom	{...}		AparianDNMLiveMinMax	CAN-H Dominant Noise RMS
+ DNM01NodeMinMax[0].CNHNoiseRMSRec	{...}		AparianDNMLiveMinMax	CAN-H Recessive Noise RMS
+ DNM01NodeMinMax[0].CNHOvershoot	{...}		AparianDNMLiveMinMax	CAN-H Overshoot
+ DNM01NodeMinMax[0].CNHPosSlew	{...}		AparianDNMLiveMinMax	CAN-H Positive Slew Rate

Figure 5.6 – Connection 4 Input Assembly - Per Node Tag

6. DIAGNOSTICS

6.1. LEDS

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

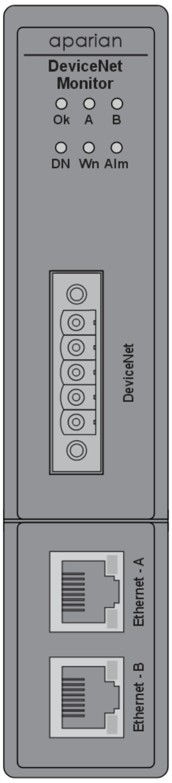


Figure 6.1 – DeviceNet Monitor front view

LED	Description
Ok	The module LED will provide information regarding the system-level operation of the module. If the LED is **red**, then the module is not operating correctly. For example, if the module application firmware has been corrupted or there is a hardware fault the module will have a red Module LED. If the LED is briefly **flashing red**, and then returning to either flashing green or solid green, then there is a duplicate IP address on the Ethernet network similar to that of the local module. If the LED is **green (flashing)**, then the module has booted and is running correctly **without** any application configuration loaded.

	If the LED is **green (solid)**, then the module has booted and is running correctly **with** application configuration loaded.
A / B	The Ethernet LED will light up when an Ethernet link has been detected (by plugging in a connected Ethernet cable). The LED will flash every time traffic was detected. This module has two Ethernet ports A and B. Each LEDs represents each specific port.
DN	The DeviceNet LED indicates the activity on the DeviceNet network. Flashing Red – A corrupted or incorrect DeviceNet packet was received. Flashing Green – A valid DeviceNet packet was received. Off – No DeviceNet packets are being received.
Wn	The Warning LED indicates the status of the Warning flag and latch. Solid Green – No warning flag or warning latch. Flashing Green – No current warning flags, but warning latch is set. Flashing Red – Warning flag set. Off – No analysis in progress.
Alm	The Alarm LED indicates the status of the Alarm flag and latch. Solid Green – No alarm flag or alarm latch. Flashing Green – No current alarm flags, but alarm latch is set. Flashing Red – Alarm flag set. Off – No analysis in progress.

Table 6.1 - Module LED operation

6.2. MODULE STATUS MONITORING IN SLATE

The DeviceNet Monitor 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.

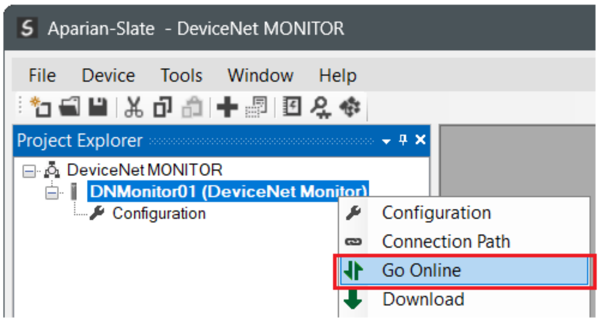


Figure 6.2 - Selecting to Go Online

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

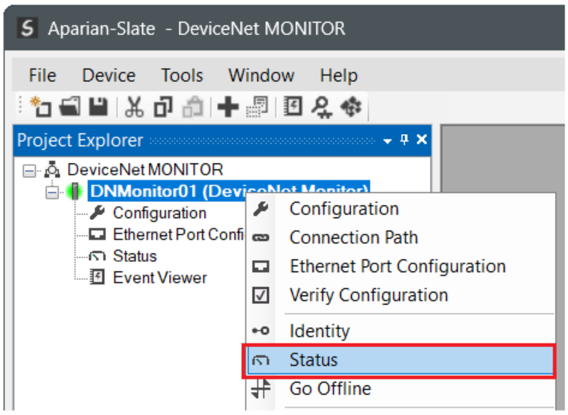


Figure 6.3 - Selecting online Status

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

6.2.1. General

The General tab displays the general status for the local DeviceNet Monitor module.

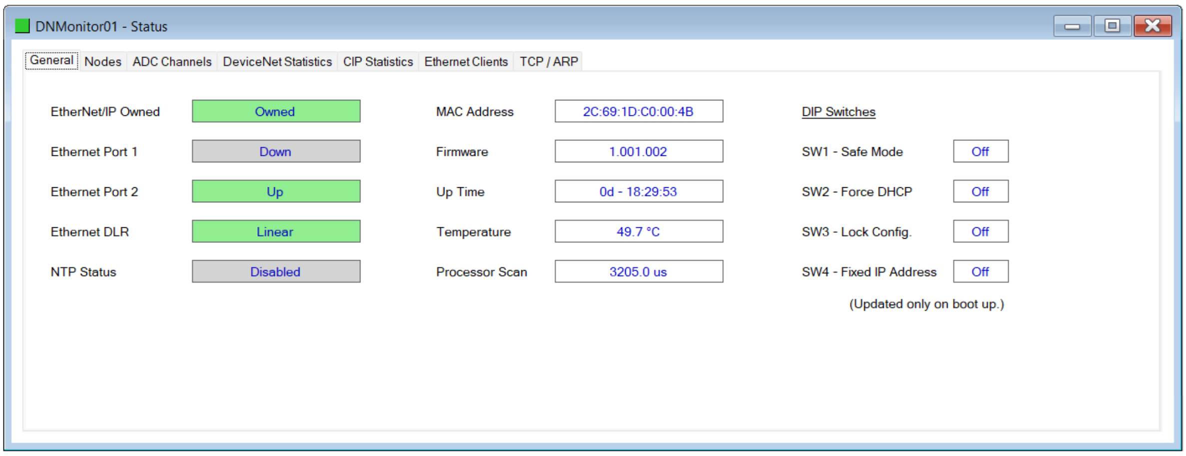


Figure 6.4 - Status monitoring – General

The General tab displays the following general parameters:

Parameter	Description
EtherNet/IP Owned	Indicates if the module is owned by an EtherNet/IP connection originator, e.g. Logix.
Ethernet Port 1/2	This is the status of each Ethernet port. **Down** The Ethernet connector has **not been** successfully connected to an Ethernet network. **Up** The Ethernet connector has successfully connected to an Ethernet network. **Mirror Enabled** The Ethernet port is mirroring the traffic on the other Ethernet port.
Ethernet DLR (Device Level Ring)	The status of the Ethernet DLR. **Disabled** Device Level Ring functionality has been disabled. **Linear** The DLR functionality has been enabled and the Ethernet network architecture is linear. **Ring – Fault** The DLR functionality has been enabled and the Ethernet network architecture is ring, but there is a fault with the network.

	Ring – Ok The DLR functionality has been enabled and the Ethernet network architecture is ring and is operating as expected.
NTP Status	The status of the local NTP Client. **Disabled** The NTP time synchronization has been disabled. **Locked** NTP time synchronization has been enabled and the module has locked onto the target time server. **Not Locked** NTP time synchronization has been enabled and the module has not locked onto the target time server.
MAC Address	Displays the module's unique Ethernet MAC address.
Firmware	The version of the module's firmware.
Up Time	Indicates the elapsed time since the module was powered-up.
Temperature	The internal temperature of the module.
Processor Scan	The amount of time (microseconds) taken by the module's processor in the last scan.
DIP Switch Position	The status of the DIP switches when the module booted. **NOTE**: This status will not change if the DIP switches are altered when the module is running.

Table 6.2 - Parameters displayed in the Status Monitoring – General Tab

6.2.2. Nodes

The DeviceNet Nodes tab displays the status associated with each DeviceNet node.

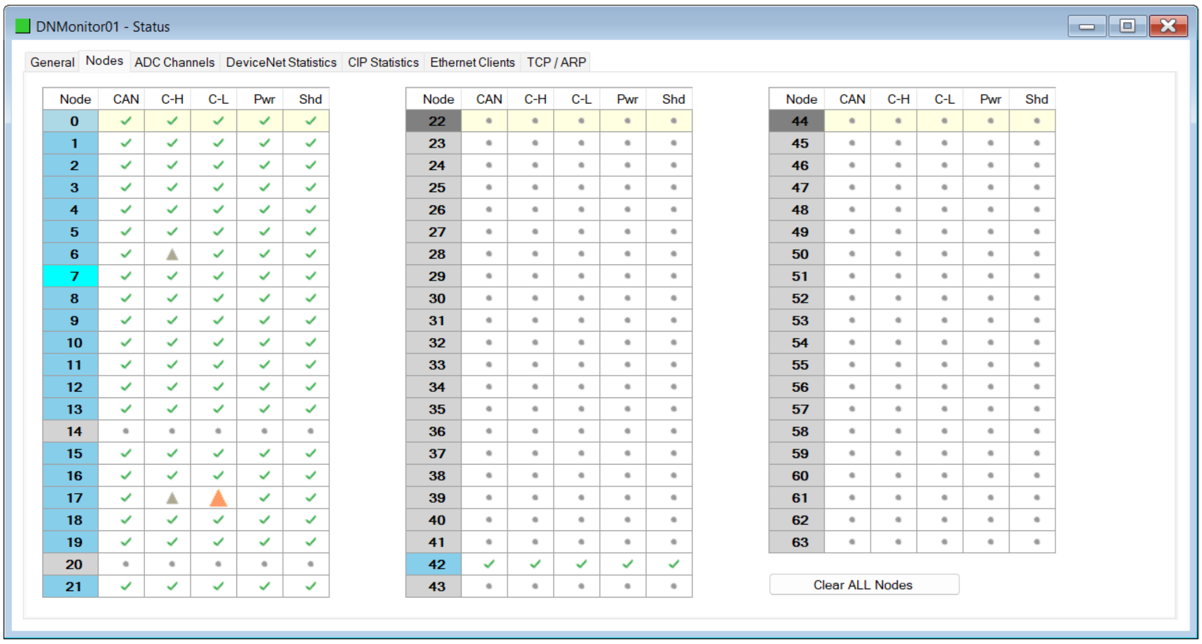


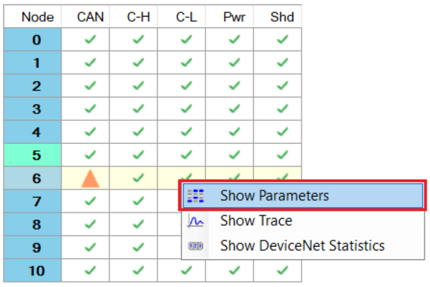
Figure 6.5 - Status monitoring – Nodes

The Alarm and Warning status for each DeviceNet node's channel is displayed by the following icons:

Icon	Description
	Device is offline.
	Device is healthy with no latches.
	Device has a current Warning.
	Device has a current Warning and a latched Alarm.
	Device is currently healthy but has a latched Warning.
	Device is currently in Alarm.
	Device is currently healthy but has a latched Alarm.

Table 6.3 – DeviceNet Node Alarm Warning Status Icons

To view the Parameter summary for a specific node, right-click on the node in select the ***Show Parameters*** option.

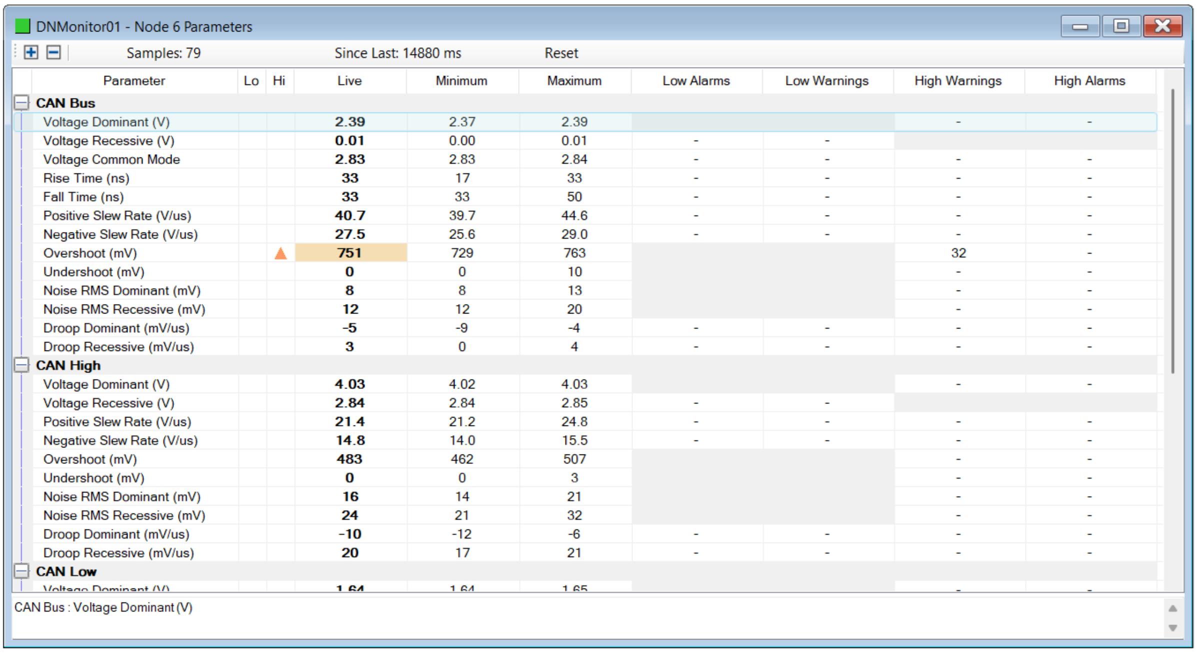


Node	CAN	C-H	C-L	Pwr	Shd
0	✓	✓	✓	✓	✓
1	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓
6	▲	✓	✓	✓	✓
7	✓	✓			
8	✓	✓			
9	✓	✓			
10	✓	✓	✓	✓	✓

Figure 6.6 – Nodes Status – Select Parameters

The Node parameter form will be shown for the selected node. For each the channel parameter, the following is displayed:

- Alarm and Warning Status is displayed in the Lo and Hi column using the same icons as previosuly described.
- The Live value from the most recent analysis, and the Minimum and Maximum of all the values since the last reset command.
- The counts of all the Low Alarms, Low Warnings, High Warnings and High Alarms since the last reset command.



DNMonitor01 - Node 6 Parameters

Samples: 79 Since Last: 14880 ms Reset

Parameter	Lo	Hi	Live	Minimum	Maximum	Low Alarms	Low Warnings	High Warnings	High Alarms
CAN Bus									
Voltage Dominant (V)			**2.39**	2.37	2.39			-	-
Voltage Recessive (V)			**0.01**	0.00	0.01	-	-		
Voltage Common Mode			**2.83**	2.83	2.84	-	-	-	-
Rise Time (ns)			**33**	17	33	-	-	-	-
Fall Time (ns)			**33**	33	50	-	-	-	-
Positive Slew Rate (V/us)			**40.7**	39.7	44.6	-	-	-	-
Negative Slew Rate (V/us)			**27.5**	25.6	29.0	-	-	-	-
Overshoot (mV)		▲	**751**	729	763			32	-
Undershoot (mV)			**0**	0	10			-	-
Noise RMS Dominant (mV)			**8**	8	13			-	-
Noise RMS Recessive (mV)			**12**	12	20			-	-
Droop Dominant (mV/us)			**-5**	-9	-4	-	-	-	-
Droop Recessive (mV/us)			**3**	0	4	-	-	-	-
CAN High									
Voltage Dominant (V)			**4.03**	4.02	4.03			-	-
Voltage Recessive (V)			**2.84**	2.84	2.85	-	-		
Positive Slew Rate (V/us)			**21.4**	21.2	24.8	-	-	-	-
Negative Slew Rate (V/us)			**14.8**	14.0	15.5	-	-	-	-
Overshoot (mV)			**483**	462	507			-	-
Undershoot (mV)			**0**	0	3			-	-
Noise RMS Dominant (mV)			**16**	14	21			-	-
Noise RMS Recessive (mV)			**24**	21	32			-	-
Droop Dominant (mV/us)			**-10**	-12	-6	-	-	-	-
Droop Recessive (mV/us)			**20**	17	21	-	-	-	-
CAN Low									
Voltage Dominant (V)			**1.64**	1.64	1.65			-	-

CAN Bus : Voltage Dominant (V)

Figure 6.7 – Node Parameters

To view the latest Node (oscilloscope) trace for a specific node, right-click on the node in select the ***Show Trace*** option.

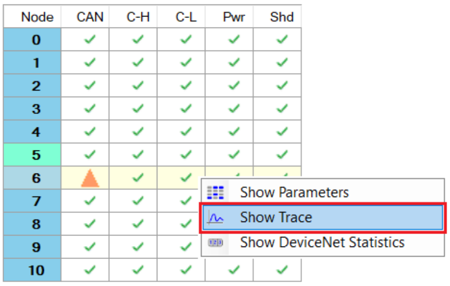


Figure 6.8 – Nodes Status – Select Trace

The Node Trace form will be shown for the selected node. All 5 channels are plotted with voltage on the Y-axis and time (µs) on the x-axis.

The CAN traces are faded after the analysis period.

NOTE: The analysis period is shorter than the entire CAN frame. This is to avoid the Acknowledge bit contaminating the sample which is transmitted by other nodes and not the selected node.

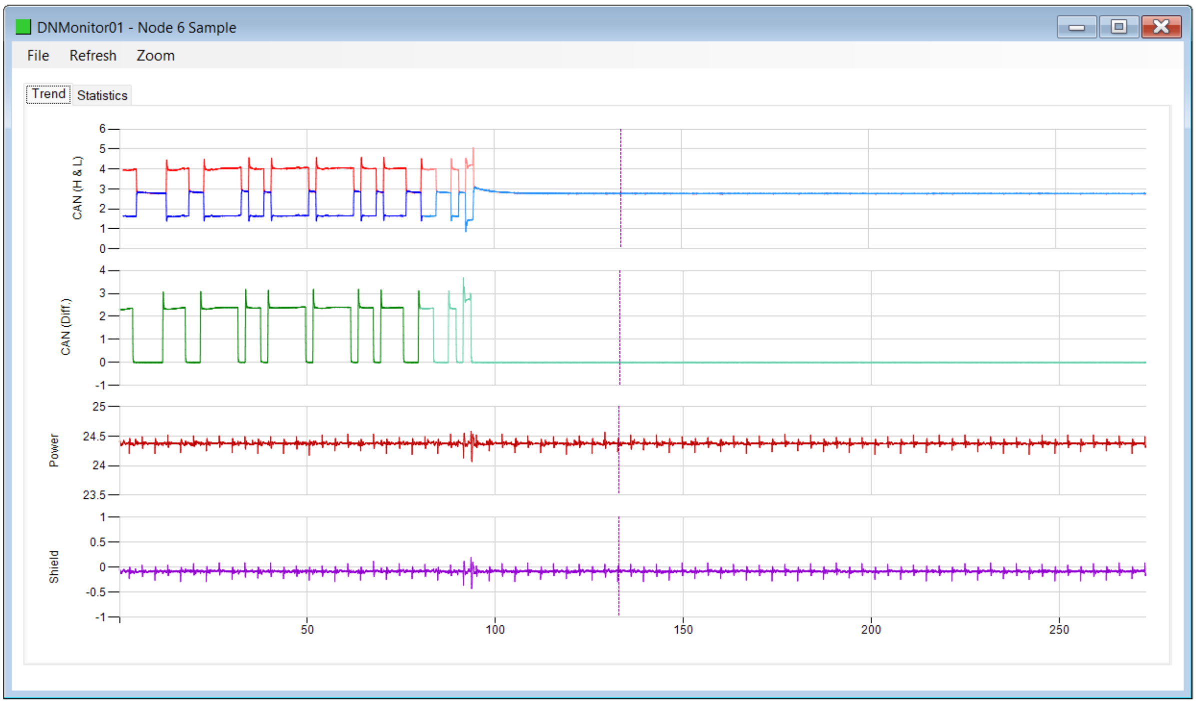


Figure 6.9 – Node specific Trace

Zooming in on the trace can be done by highlighting a portion on the trace using the left-button on the mouse.

Alternatively, the Zoom menu at the top of the form, or the right-click context menu, can be used to either Zoom-In, Zoom-Out or Reset the Zoom to the original view.

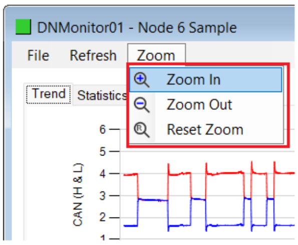


Figure 6.10 – Node Trace – Selecting Zoom options

When the zooming into the trace, a horizontal scroll-bar will appear to navigate in the time domain.

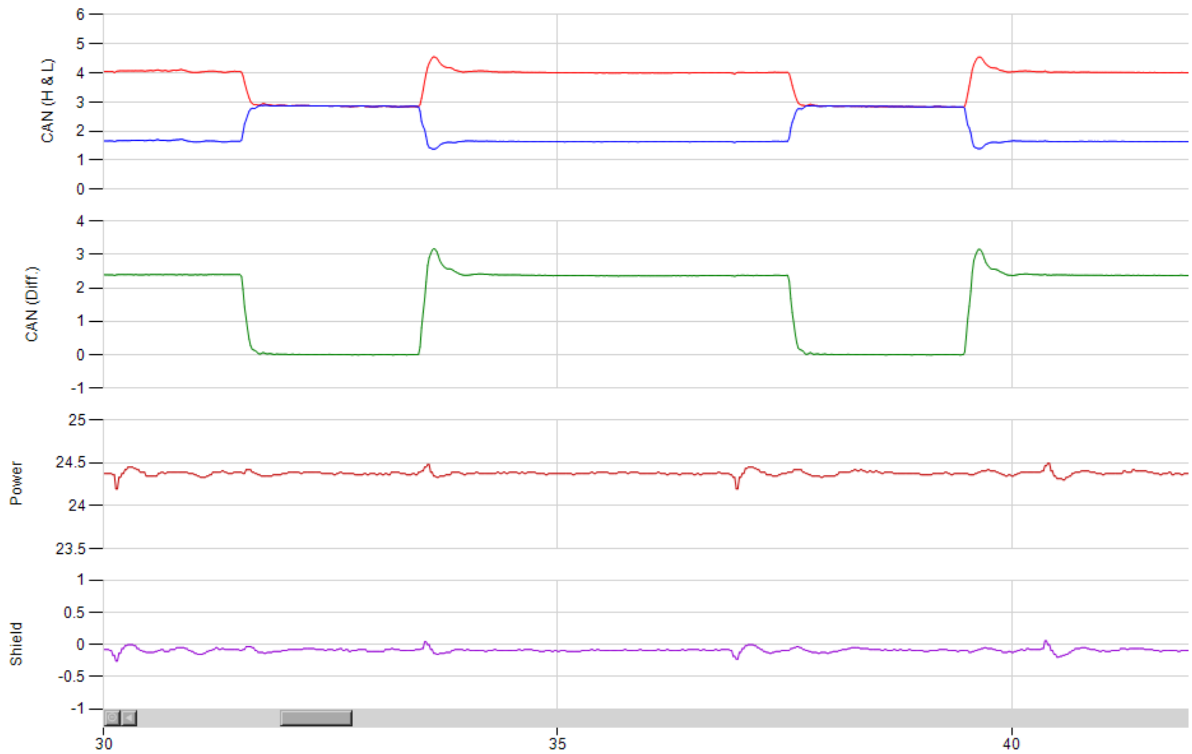


Figure 6.11 – Node Trace – Zoomed In

The trace data, and calculated parameters can be exported to a CSV (comma separated variable format) file by selecting the ***Export*** option under the ***Tools*** menu.

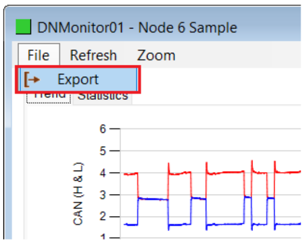
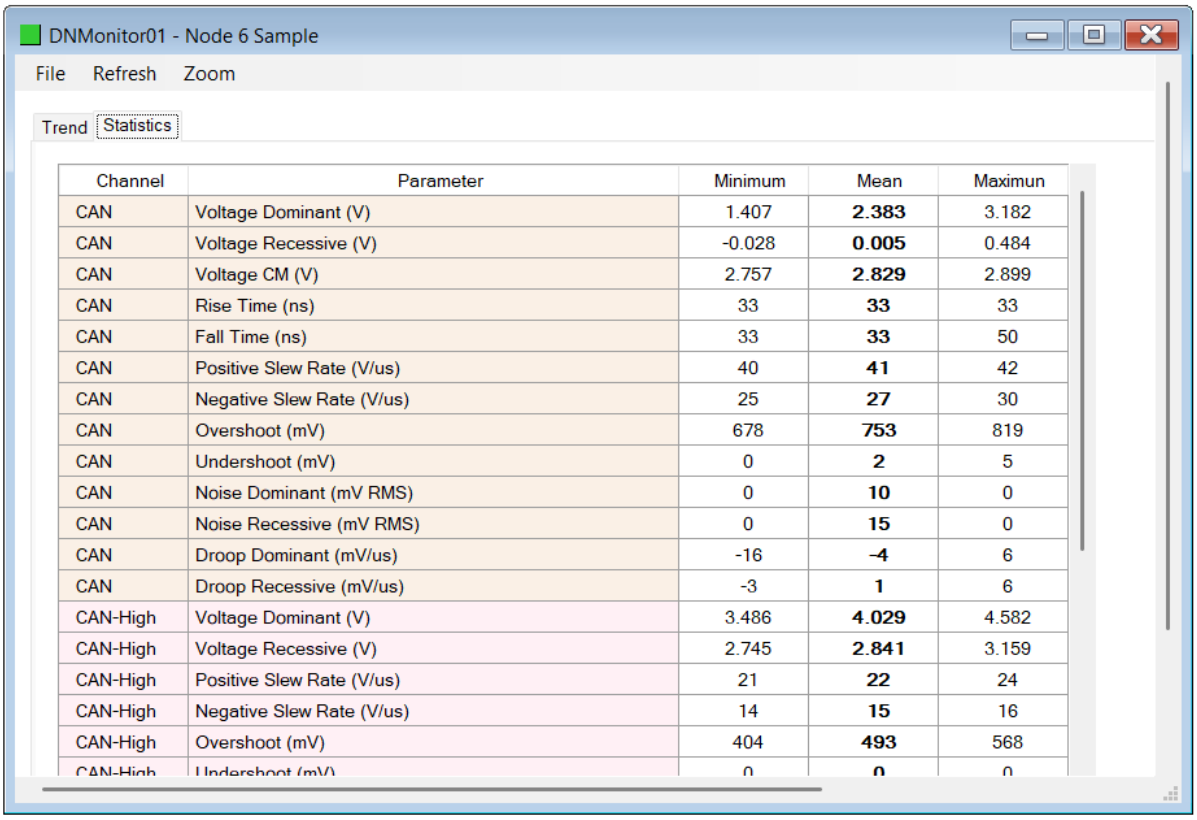


Figure 6.12 – Trace – Export Option

To view the calculated parameters for this specific sample set, select the Statistics tab. For each parameter the Minimum, Mean and Maximum values will be displayed. Only the Mean value will be used in the subsequent Alarm and Warning flag determination.



Channel	Parameter	Minimum	Mean	Maximun
CAN	Voltage Dominant (V)	1.407	**2.383**	3.182
CAN	Voltage Recessive (V)	-0.028	**0.005**	0.484
CAN	Voltage CM (V)	2.757	**2.829**	2.899
CAN	Rise Time (ns)	33	**33**	33
CAN	Fall Time (ns)	33	**33**	50
CAN	Positive Slew Rate (V/us)	40	**41**	42
CAN	Negative Slew Rate (V/us)	25	**27**	30
CAN	Overshoot (mV)	678	**753**	819
CAN	Undershoot (mV)	0	**2**	5
CAN	Noise Dominant (mV RMS)	0	**10**	0
CAN	Noise Recessive (mV RMS)	0	**15**	0
CAN	Droop Dominant (mV/us)	-16	**-4**	6
CAN	Droop Recessive (mV/us)	-3	**1**	6
CAN-High	Voltage Dominant (V)	3.486	**4.029**	4.582
CAN-High	Voltage Recessive (V)	2.745	**2.841**	3.159
CAN-High	Positive Slew Rate (V/us)	21	**22**	24
CAN-High	Negative Slew Rate (V/us)	14	**15**	16
CAN-High	Overshoot (mV)	404	**493**	568
CAN-High	Undershoot (mV)	0	**0**	0

Figure 6.13 – Node Trace – Statistics

To view the DeviceNet Statistics for a specific node, right-click on the node in select the ***Show DeviceNet Statistics*** option.

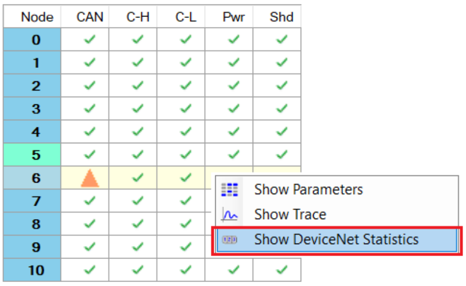


Figure 6.14 – Nodes Status – Select DeviceNet Statistics

The DeviceNet Statistics form will be shown for the selected node.

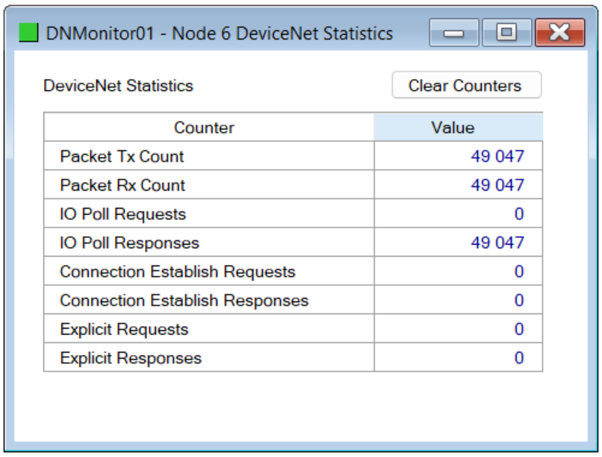


Figure 6.15 – Node DeviceNet Statistics

The following node specific DeviceNet statistics are displayed:

Statistic	Description
Packet Tx Count	The number of DeviceNet packets sent by this node.
Packet Rx Count	The number of DeviceNet packets sent to this node.
IO Poll Requests	The number of IO Poll Requests sent to this node.
IO Poll Responses	The number of IO Poll Responses sent by this node.
Connection Establish Requests	The number of connection establishment requests sent or received by this node.
Connection Establish Responses	The number of connection establishment responses sent or received by this node.
Explicit Requests	The number of explicit requests sent or received by this node.
Explicit Responses	The number of explicit responses sent or received by this node.

Table 6.4 – DeviceNet statistics

6.2.3. ADC Channels

The ADC Channels tab displays the statistics associated with the DeviceNet communication network.

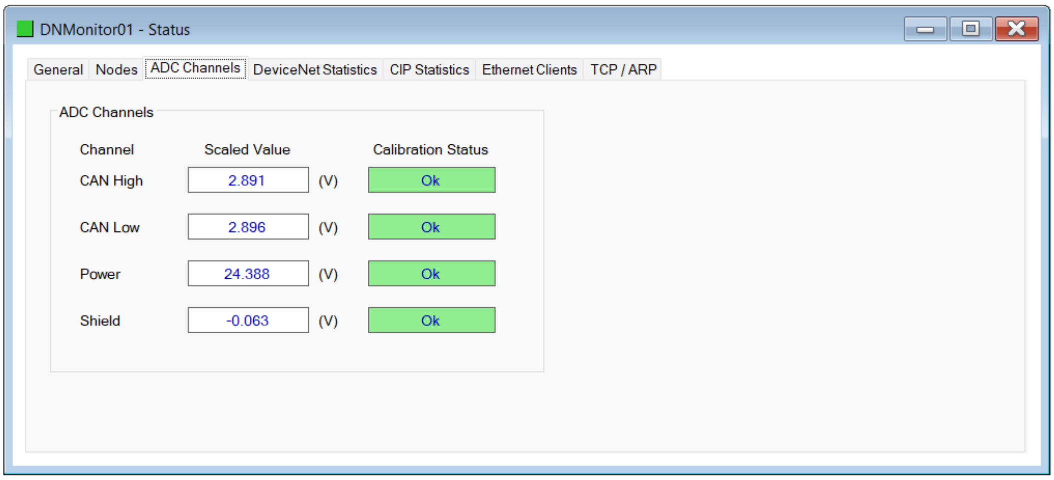


Figure 6.16 - Status monitoring – ADC Channels

The live voltage value for each channel is displayed in this tab as well as the status of the channel’s calibration.

6.2.4. DeviceNet Statistics

The DeviceNet Statistics tab displays the non-node-specific statistics associated with the DeviceNet communication network.

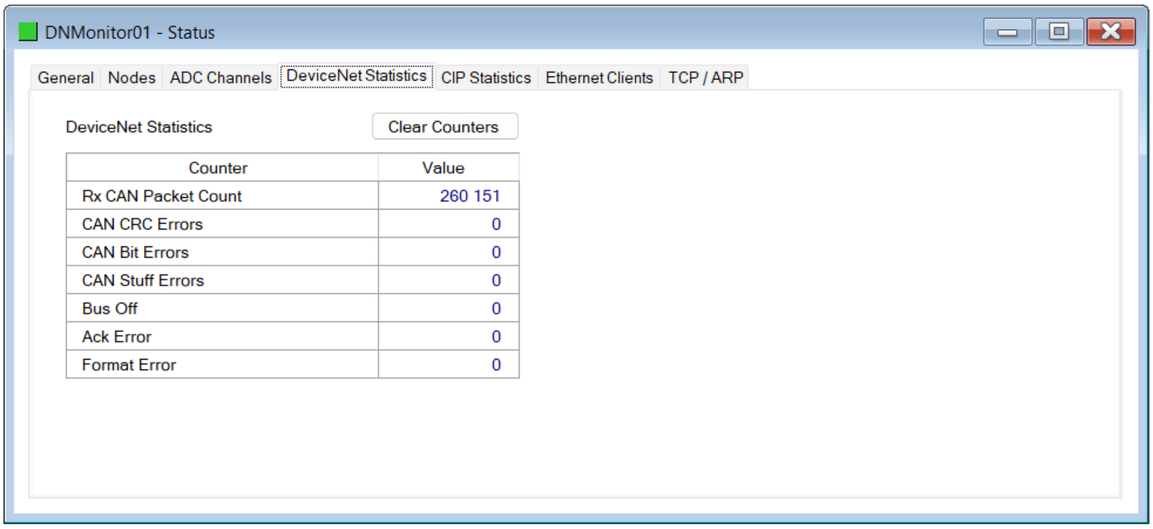


Figure 6.17 - Status monitoring – DeviceNet Statistics

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

Table 6.5 – DeviceNet statistics

6.2.5. CIP Statistics

The CIP tab displays the Ethernet CIP statistics.

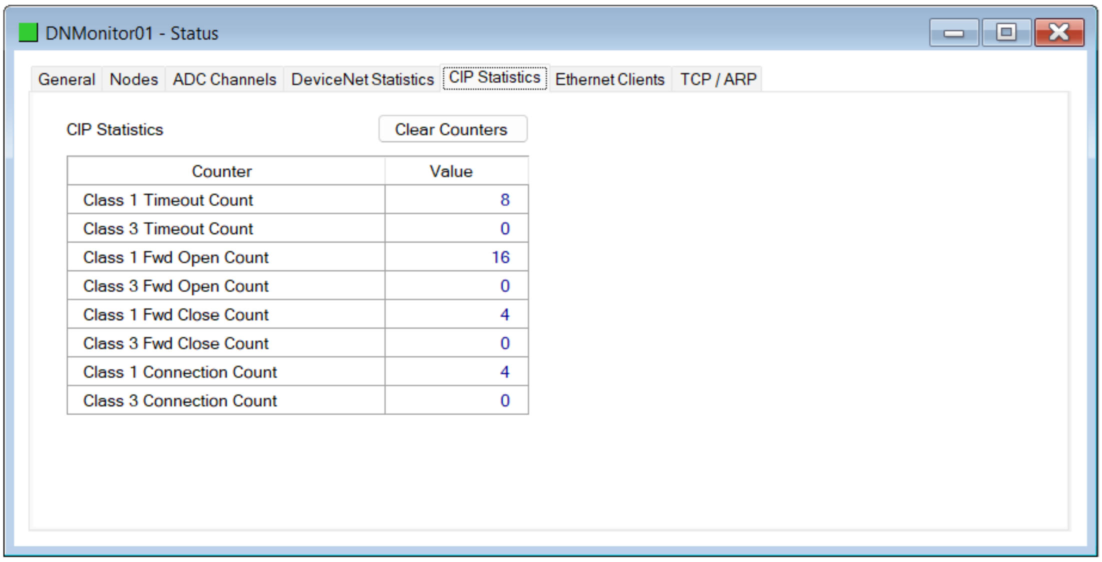


Figure 6.18 - Status monitoring – CIP Statistics

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

Table 6.6 – Status Monitoring - CIP Statistics

6.2.6. ETHERNET CLIENTS

The Ethernet Clients tab displays details of the Ethernet and EtherNet/IP clients connected to the DeviceNet Monitor.

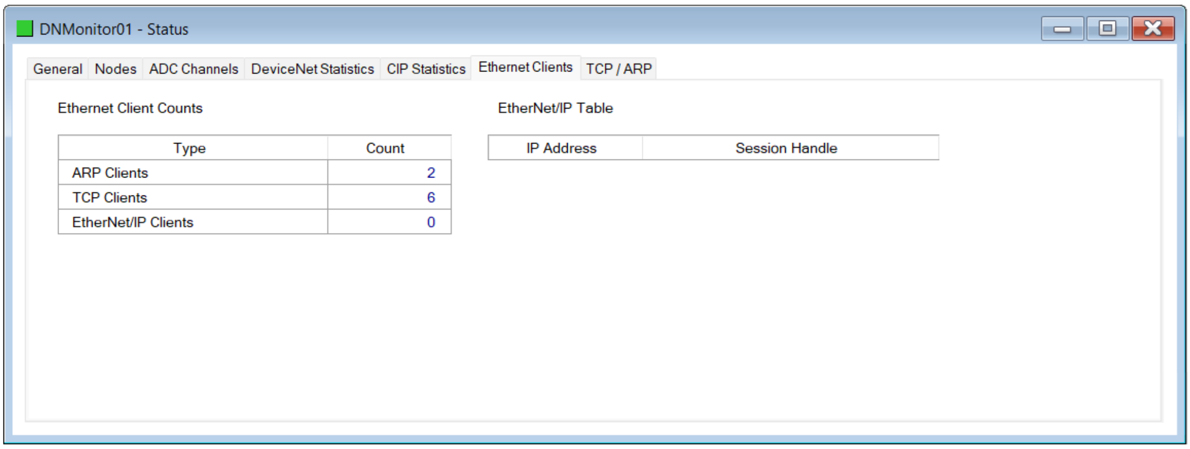


Figure 6.19 –Status monitoring – Ethernet Client Statistics

6.2.7. TCP/ARP

The TCP/ARP tab displays details of the internal Ethernet ARP and TCP lists of the DeviceNet Monitor.

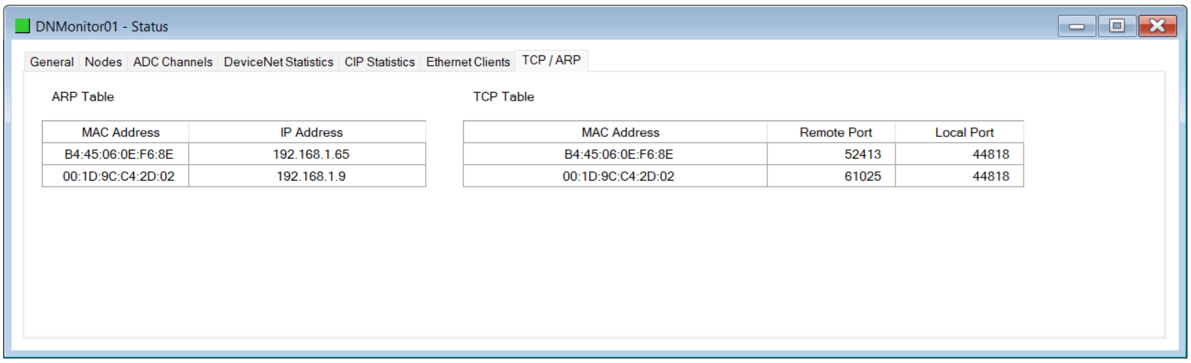


Figure 6.20 – Status monitoring – Ethernet TCP / ARP Statistics

6.3. MODULE EVENT LOG

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

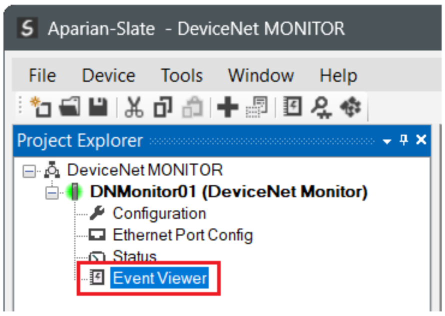
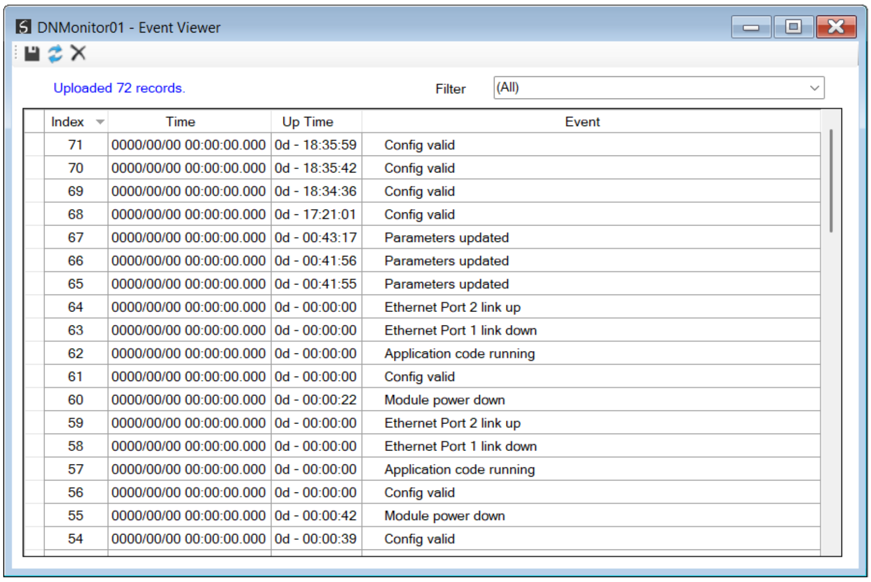


Figure 6.21 - Selecting the module Event Log

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



Index	Time	Up Time	Event
71	0000/00/00 00:00:00.000	0d - 18:35:59	Config valid
70	0000/00/00 00:00:00.000	0d - 18:35:42	Config valid
69	0000/00/00 00:00:00.000	0d - 18:34:36	Config valid
68	0000/00/00 00:00:00.000	0d - 17:21:01	Config valid
67	0000/00/00 00:00:00.000	0d - 00:43:17	Parameters updated
66	0000/00/00 00:00:00.000	0d - 00:41:56	Parameters updated
65	0000/00/00 00:00:00.000	0d - 00:41:55	Parameters updated
64	0000/00/00 00:00:00.000	0d - 00:00:00	Ethernet Port 2 link up
63	0000/00/00 00:00:00.000	0d - 00:00:00	Ethernet Port 1 link down
62	0000/00/00 00:00:00.000	0d - 00:00:00	Application code running
61	0000/00/00 00:00:00.000	0d - 00:00:00	Config valid
60	0000/00/00 00:00:00.000	0d - 00:00:22	Module power down
59	0000/00/00 00:00:00.000	0d - 00:00:00	Ethernet Port 2 link up
58	0000/00/00 00:00:00.000	0d - 00:00:00	Ethernet Port 1 link down
57	0000/00/00 00:00:00.000	0d - 00:00:00	Application code running
56	0000/00/00 00:00:00.000	0d - 00:00:00	Config valid
55	0000/00/00 00:00:00.000	0d - 00:00:42	Module power down
54	0000/00/00 00:00:00.000	0d - 00:00:39	Config valid

Figure 6.22 - 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.

6.4. WEB SERVER

The DeviceNet Monitor 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 (DeviceNet diagnostics).

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

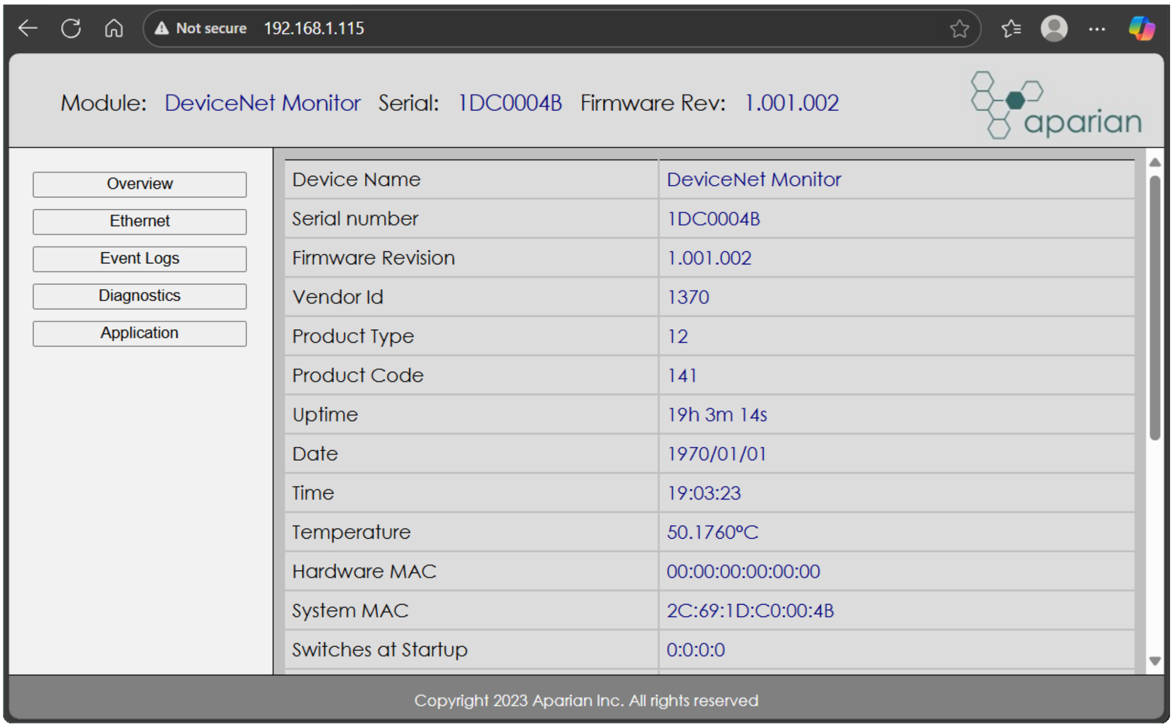


Figure 6.23 – Web interface

6.5. DEVICENET PACKET CAPTURE

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

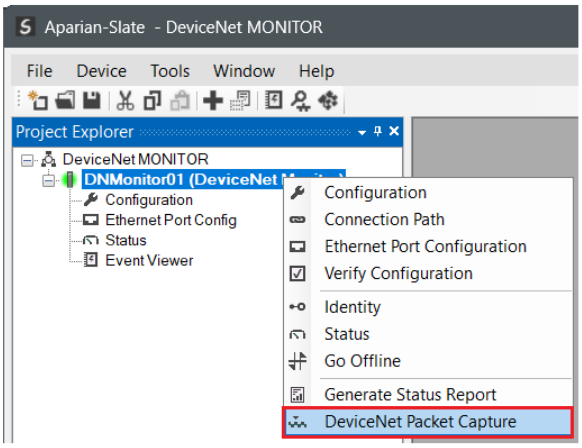


Figure 6.24 - Selecting DeviceNet Packet Capture

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

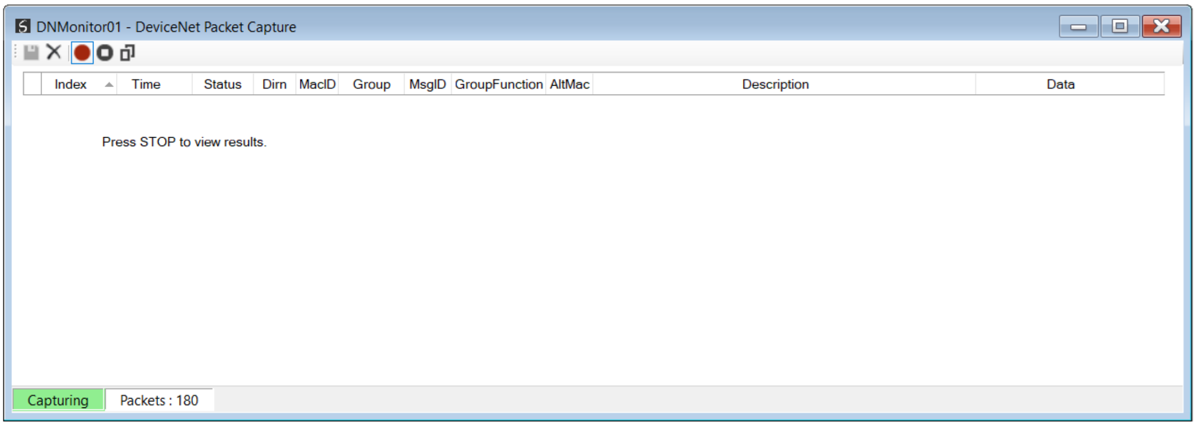


Figure 6.25 – DeviceNet packet capture

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

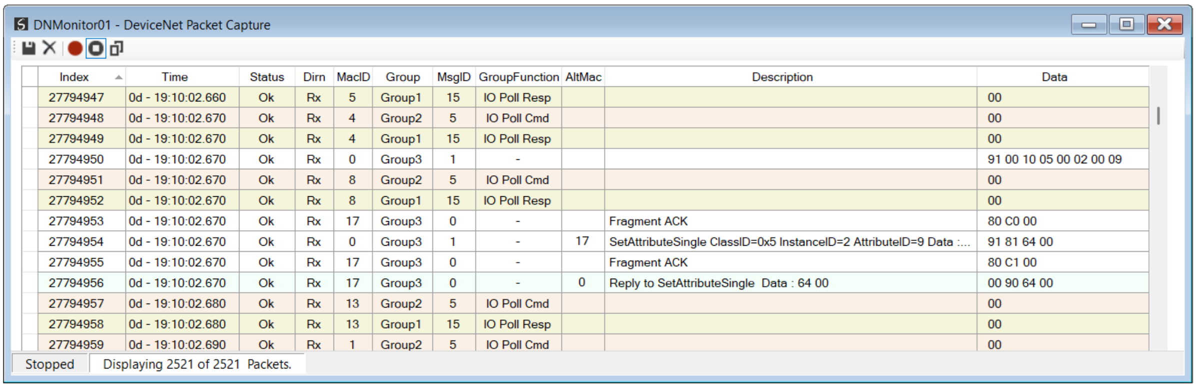


Figure 6.26 – DeviceNet Packet Capture complete

The captured DeviceNet packets are tabulated as follows:

Statistic	**Description**
Index	The packet index, incremented for each packet sent or received.
Time	The elapsed time since the module powered up.
Status	The status of the packet. Received packets are checked for valid DeviceNet constructs and valid checksums.
Dirn	The direction of the packet, either transmitted (Tx) or received (Rx).

MacID	The DeviceNet MAC ID (0-63) of the packet. This is usually the source MAC, but with IO connection data can be the destination MAC.
Group	The message group number. Either Group 1,2,3 or 4.
MsgID	The Message ID is used to identify a message within a particular group. Can be used to indicate specific types of messages, or specific (previously established) connections.
Group Function	The Group Function. Certain Group and Message ID combination have specific meanings which are displayed here.
Alt MAC	The alternate MAC, depending on the type of message. This is usually the destination MAC ID.
Description	A brief description of the packet.
Data	The raw packet data.

Table 6.7 – DeviceNet Packet Capture fields

The packet capture can be saved to a file for further analysis, by selecting the ***Save*** button on the toolbar. Previously saved DeviceNet Packet Capture files can be viewed by selecting the ***DeviceNet Packet Capture Viewer*** option in the ***Tools*** menu.

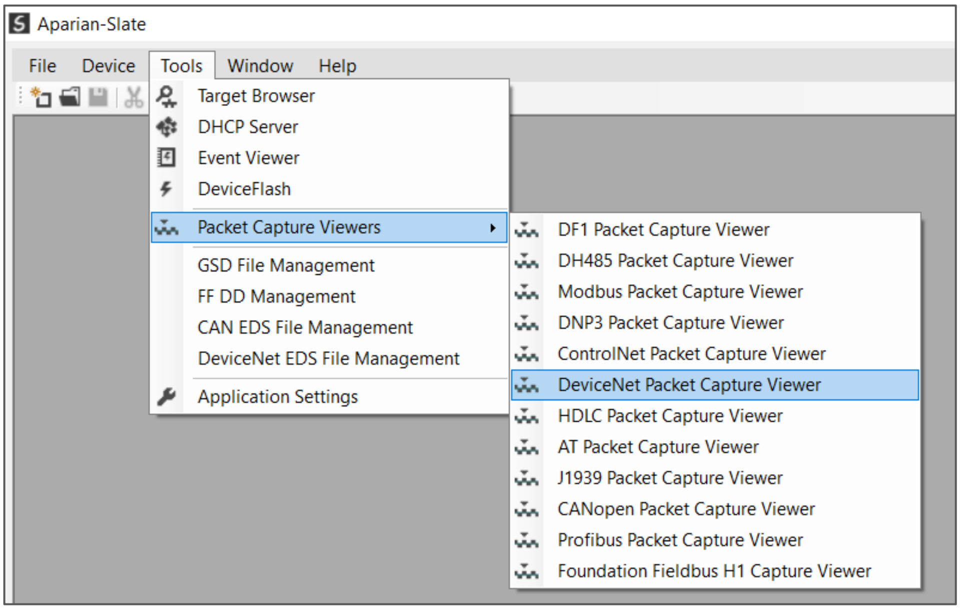


Figure 6.27 - Selecting the DeviceNet Packet Capture Viewer

6.6. MODULE STATUS REPORT

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

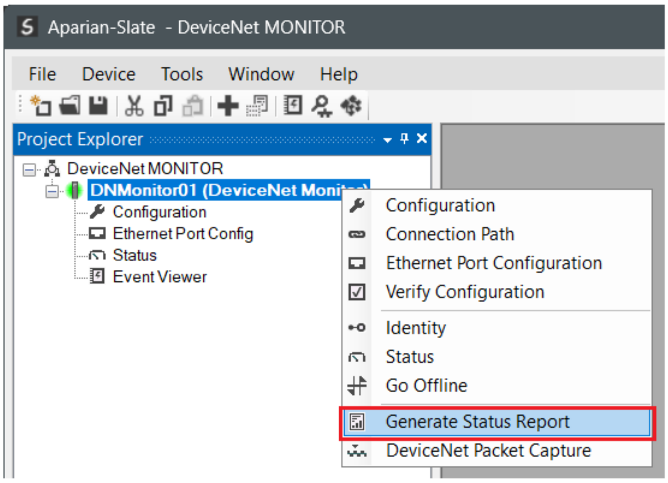


Figure 6.28 – Module Status Report

7. TECHNICAL SPECIFICATIONS

7.1. DIMENSIONS

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

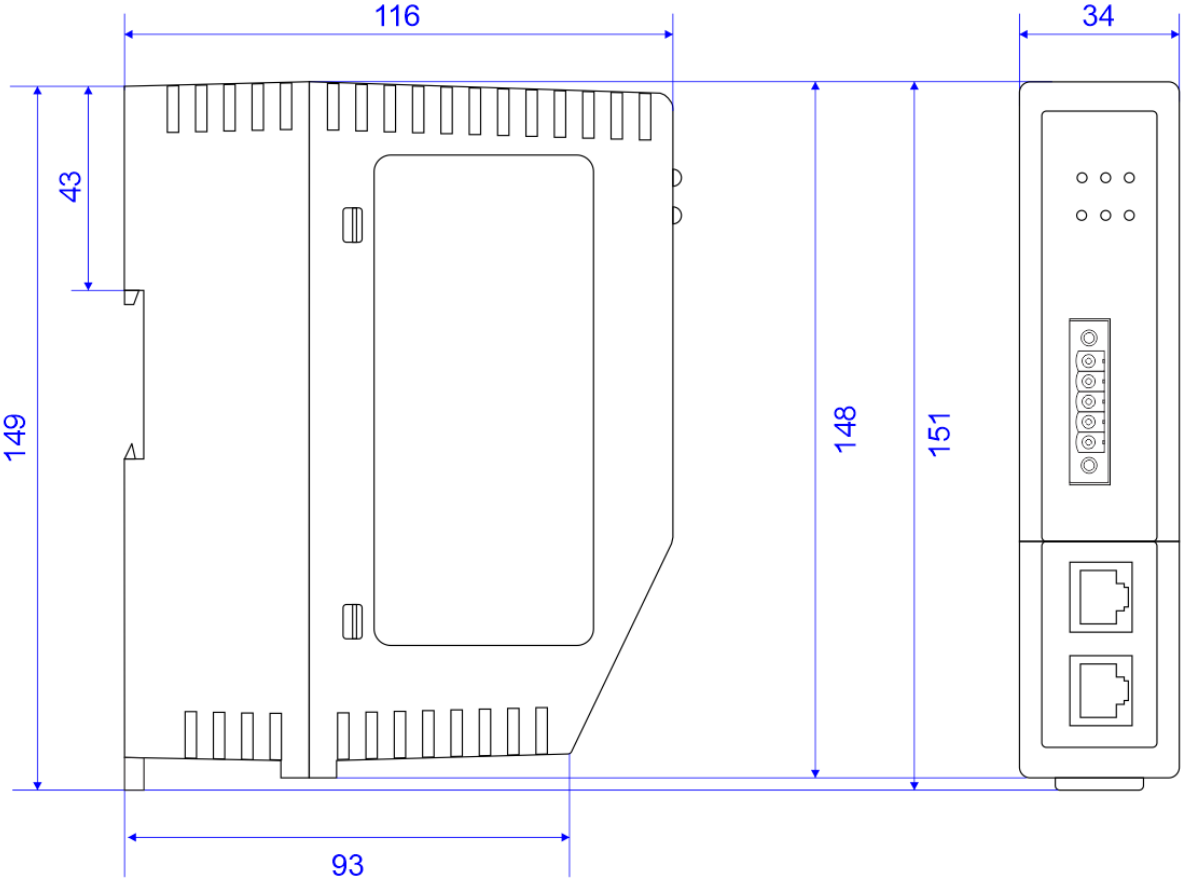


Figure 7.1 – DeviceNet Monitor enclosure dimensions

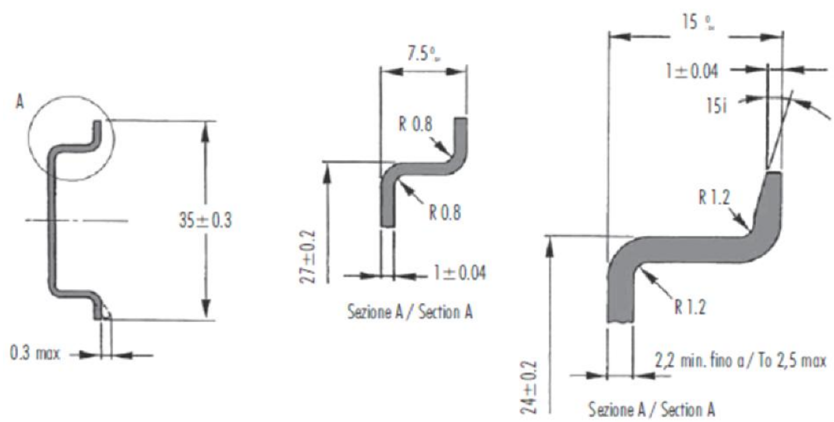


Figure 7.2 - Required DIN dimensions

7.2. ELECTRICAL

Specification	Rating
Power requirements	Input: 10 – 32 VDC (Class 2)
Power consumption	4.5 W (Max.) Current: 420 mA @ 10 V Current: 185 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 7.1 - Electrical specification

7.3. ETHERNET

Specification	Rating
Connector	RJ45
Conductors	CAT5 STP/UTP
ARP connections	Max 100
TCP connections	Max 100
CIP connections	Max 15
Communication rate	10/100Mbps
Duplex mode	Full/Half
Auto-MDIX support	Yes
Embedded switch	Yes, 2 x Ethernet ports

Device Level Ring (DLR)	Supported
Network Time Protocol (NTP)	Supported

Table 7.2 - Ethernet specification

7.1. ANALOG SAMPLING (ADC)

Specification	Rating
Sample Rate	60 Msps (CAN-L and CAN-H) 30 Msps (Power and Shield)
Resolution	3.9 mV (CAN-L and CAN-H) 15 mV (Power and Shield)
Range	-8.0 – +8.0 V (CAN-L and CAN-H) -30 – +30 V (Power and Shield)

Table 7.3 – Analog Sampling specification

7.2. DEVICENET

Specification	Rating
Connector	5-way terminal, 5.08mm pitch.
Modes	Listen Only
Supported Baud Rates	125k 250k 500k

Table 7.4 – DeviceNet specification

7.3. ETHERNET/IP TARGET

Specification	Rating
Class 1 Cyclic connection count	4

Table 7.5 – EtherNet/IP Target specification

7.4. CERTIFICATIONS

Certification	**Mark**
CE Mark	
RoHS2 Compliant	
UL Mark File: E494895	CLASS 1, DIV 2, GROUPS A, B, C, D T4A
UKCA	

Table 7.6 – Certifications

8. INDEX