DeviceNet Monitor

Datasheet

A-DNM

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1. PREFACE

1.1. ABOUT THIS DOCUMENT

This document contains the technical data for the DeviceNet Monitor.

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 analyzed 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.

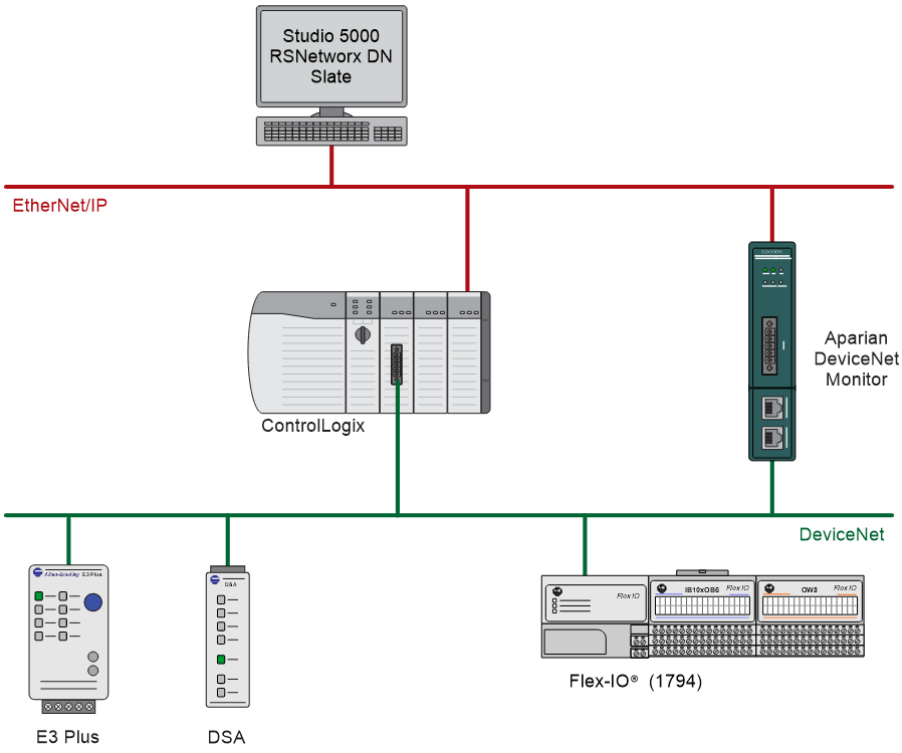


Figure 1.1. – Typical DeviceNet Scanner architecture with the DeviceNet Monitor

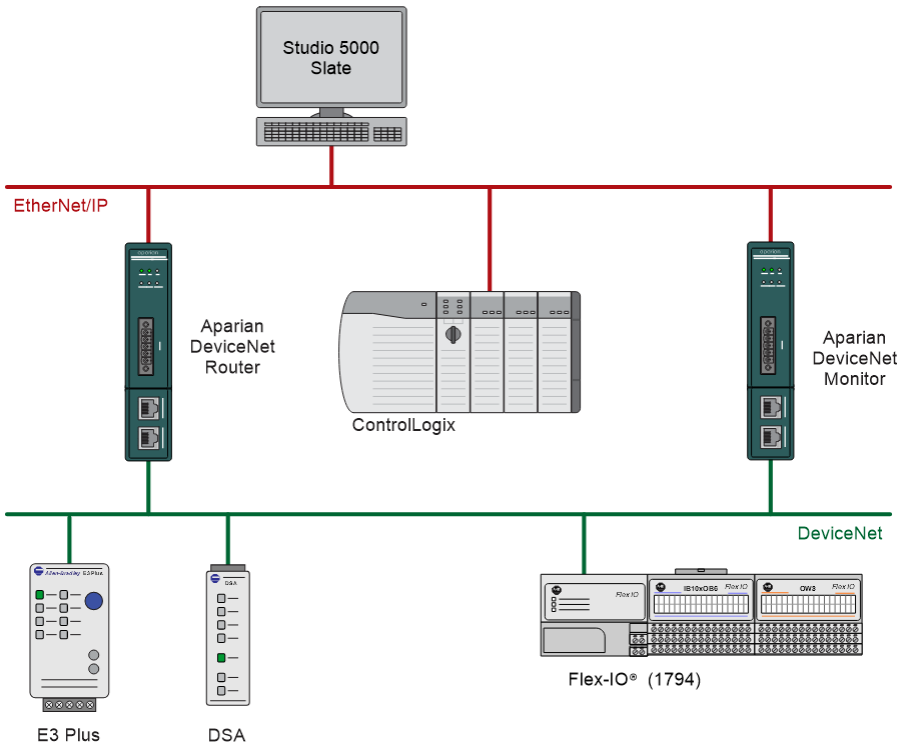


Figure 1.2. – Typical DeviceNet Device architecture with the DeviceNet Router and DeviceNet Monitor

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.

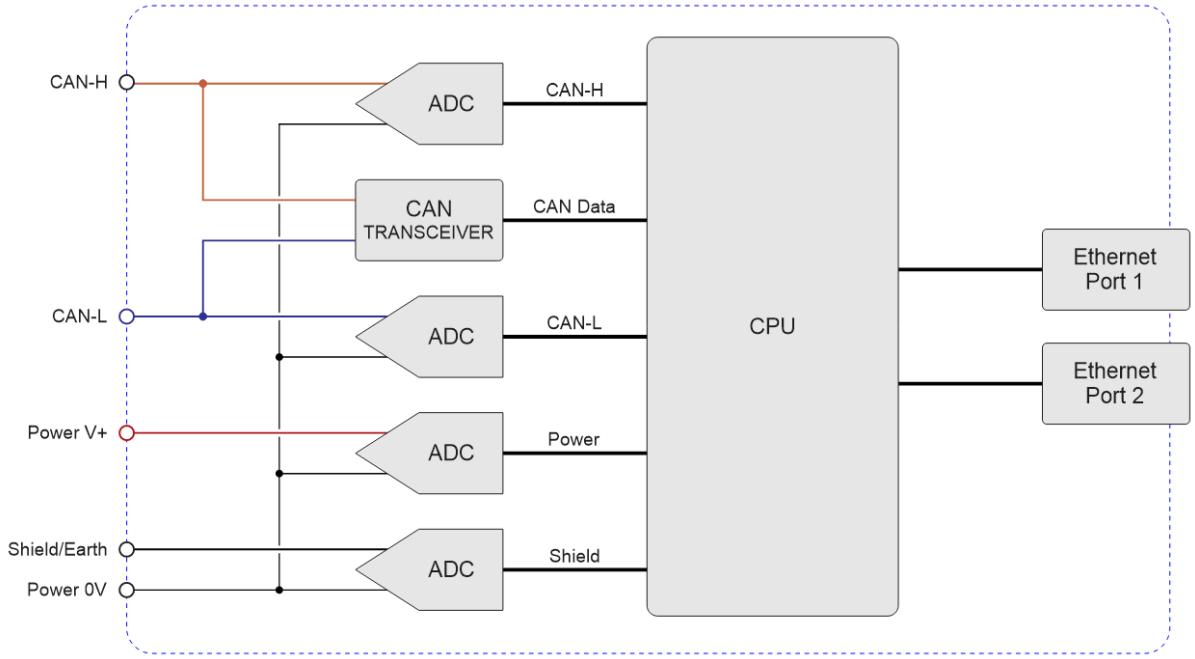


Figure 1.3. – Functional Diagram of DeviceNet Monitor

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.

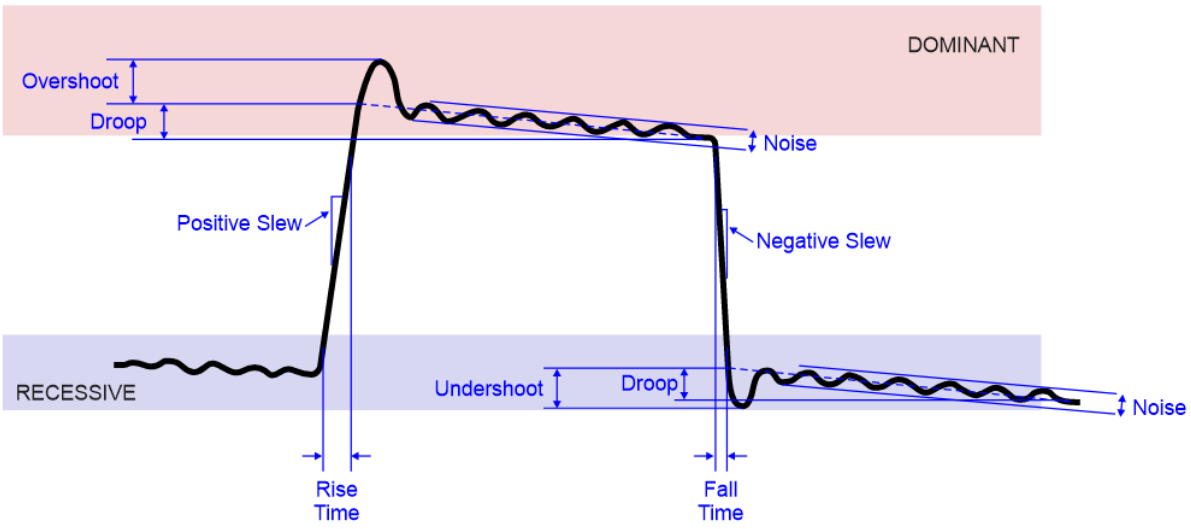


Figure 1.4. – Waveform Parameters

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 1.1. – 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

Table 1.2. - 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 1.3. – Support Details

2. TECHNICAL SPECIFICATIONS

2.1. DIMENSIONS

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

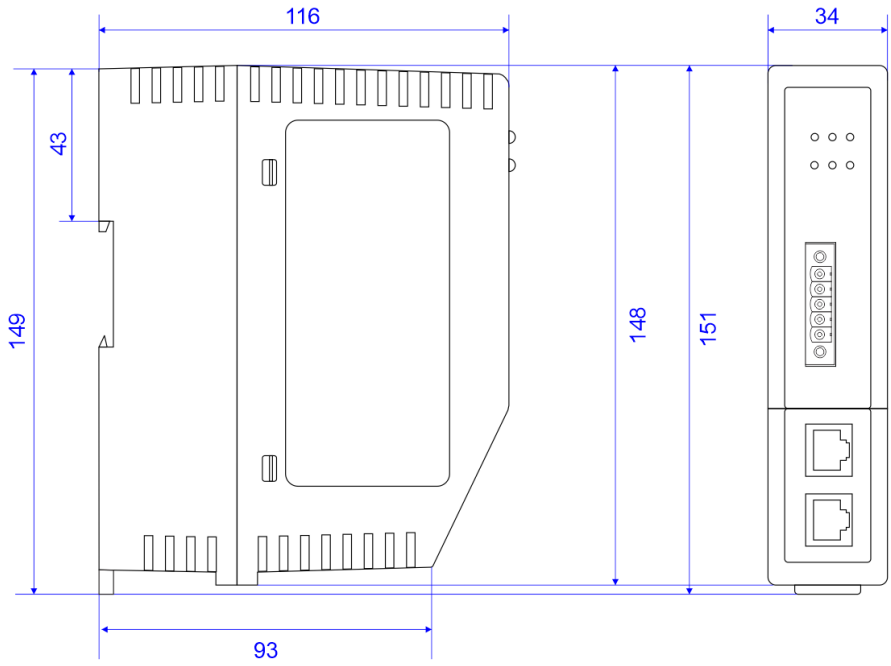


Figure 2.1 – DeviceNet Monitor enclosure dimensions

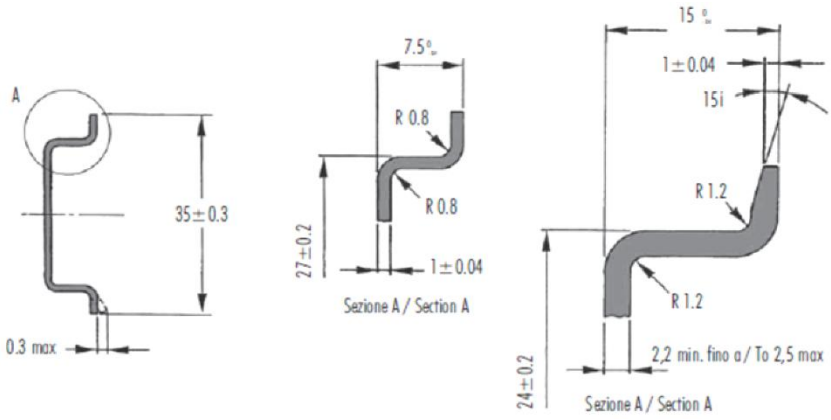


Figure 2.2 - Required DIN dimensions

2.1. 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 2.1 - Electrical specification

2.2. 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 2.2 - Ethernet specification

2.3. 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 2.3 – Analog Sampling specification

2.4. DEVICENET

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

Table 2.4 – DeviceNet specification

2.5. ETHERNET/IP TARGET

Specification	Rating
Class 1 Cyclic connection count	4

Table 2.5 – EtherNet/IP Target specification

2.6. CERTIFICATIONS

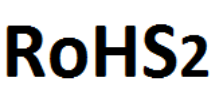
Certification	Mark
CE Mark	
RoHS2 Compliant	
UL Mark File: E494895	 CLASS 1, DIV 2, GROUPS A, B, C, D T4A
UKCA	
ODVA Conformance	

Table 2.6 – Certifications