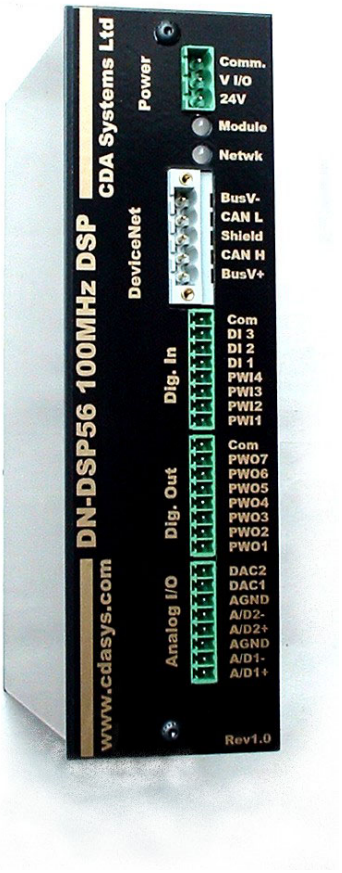
DN-DSP56



This DN-DSP56 is a DIN-rail mountable module containing a powerful Digital Signal Processor (DSP), capable of 100 million mathematical calculations per second. The module has a DeviceNet™ interface for high-speed communication over industrial networks.

The module has 7 discrete digital inputs, 4 of which are PWM capable, and 7 PWM-capable digital outputs.

Two 16-bit accurate analog inputs are individually configurable for gain and coupling. The module has two 16-bit accurate analog output channels. Both the analog input and output are electrically isolated from the digital logic and power supply.

DSP Processor

The DN-DSP56 module is based on a 100 MHz Motorola DSP56303 processor. The processor can be programmed via RS232 interface (inside chassis), or via the Motorola OnCE™ port, located inside the chassis.

Aside from the processor's internal memory, two memory banks of 32K x 24 bits are software configurable to be program or data memory.

DeviceNet Interface

A full function DeviceNet interface is provided on the module's front panel. The interface is programmable from the DSP via serial interface. The DeviceNet interface is ODVA compliant, fully configurable with up to 32 bytes of input and output data.

Mac address and baud rate is selected via a dip switch on the module's printed circuit board.

FEATURES

- DeviceNet™ interface
- 100 MIP 24-bit DSP processor (DSP56303)
- Two differential analog inputs to 16-bit A/D converter – electrically isolated from supply and digital logic.
- Two analog outputs from 18-bit D/A converter. Isolated from supply and digital logic.
- Analog input gain and coupling method individually jumper selectable
- 7 Digital inputs, 4 PWM capable. Industrially rugged digital inputs jumper selectable for 5/12/24V logic.
- 7 Digital outputs, PWM capable. Connection for digital outputs power supply externally provided, allowing digital output logic levels from 5V to 24V

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Table 1: Product Specifications

SPECIFICATION	VALUE	
POWER SUPPLY		
Vsupply	24 Vdc, 250 mA	
V I/O	5 - 24VDC, 100mA	
DIGITAL INPUTS		
All input signals are active high, relative to supply common.		
INPUT CONFIG	24V	5V
Input Impedance	10K Ohm	10K Ohm
Input Low Voltage	8V Max	1.7V Max
Input High Voltage	16V Min	3V Min
Maximum Input Voltage (continuous)	30V	30V
DIGITAL OUTPUTS		
External Power connection - 5 to 24 VDC, active high, Push/Pull. Fused internally at 100mA Internal ESD protection		
Output High Voltage	Load condition	
VIO = 24V	23V with 1 mA load 19V with10 mA load	
VIO = 5V	4.5V with 1 mA load 4.0V with 10 mA load	
Low Voltage	0 V	
Load Resistance	2K Ohms Minimum	
Rise Time	300 nanoseconds	
Fall Time	300 nanoseconds	
ANALOG INPUTS		
Analog input signals relative to AGND signal.		
Input Impedance	100 K Ohms	
Input Type	Differential	
Input Gain	Jumper Selectable See Table 3	
Maximum Voltage	40V	
Electrical Isolation	1500 V from supply	
SampleRate	40-48 KHz	
Resolution	16 bits	

Product Specifications (cont'd)

SPECIFICATION	VALUE
ANALOG OUTPUTS	
Analog outputs relative to AGND	
Resolution	16 Bits
SampleRate	40-48 KHz.
Output Voltage	1V/10V Jumper selectable
Load Impedence	1K min
Electrical isolation	1500 V from supply
Load Resistance	2K minimum.

INDICATORS

Two LED indicators on the module's front housing provide visual status of the DeviceNet interface.

LED	STATE	INDICATION
Module Status	Off	DeviceNet interface not initialized/powered
	Green	DeviceNet interface operational
	Flashing Green	Missing or incorrect configuration
	Red	Unrecoverable fault in Devicenet Interface. Power off then on.
	Flashing Red	Minor fault, recoverable
Network Status	Off	Device not online/powered
	Green	Link OK, On Line, Connected
	Flashing Green	On Line, Not Connected
	Red	Critical link failure
	Flashing red	Connection timeout
	Flashing green/red	Device has detected a Network Access error and is in Communication Faulted State.

CUSTOM PROGRAMMING

CDA Systems Ltd. can provide custom programming of module to perform a particular end-user function. Contact factory for details.

FRONT PANEL CONNECTIONS

There are five main connectors on the front panel of the DN-DSP56. The connector positions are depicted in Figure 1.

It is important to note the orientation of the pin 1 on each connector. The signal names are printed on the face place of the module.

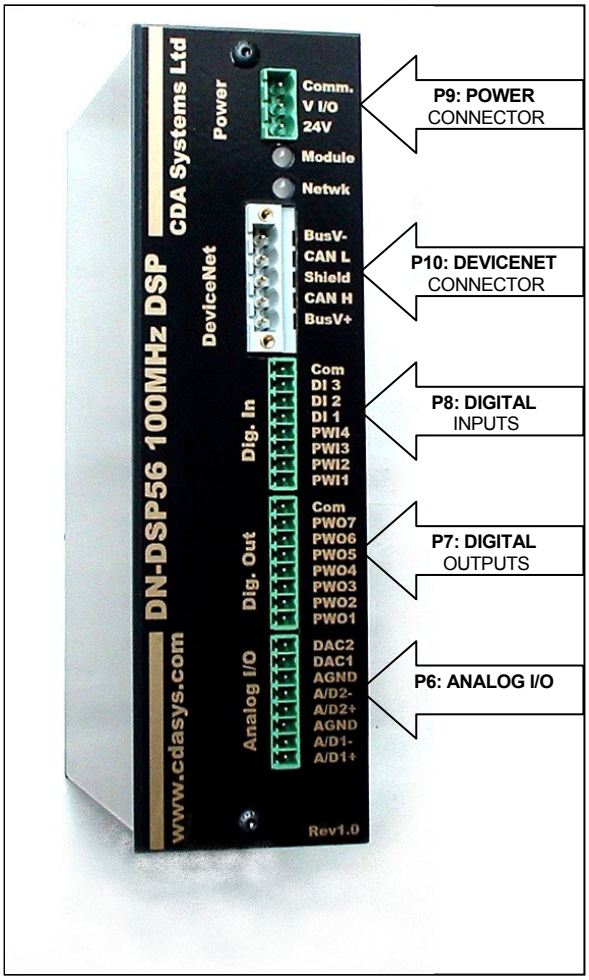


Figure 1: Front Panel Connections

Table 2: P9 - Power Supply Connections

Pin	Name	Description
1	24V	24V Power Supply. Fused internally at 1.6 Amperes
2	VI/O	VI/O Power supply for digital outputs. This pin must be powered with between 5V and 24V DC.
3	Comm.	Supply Common. Note this is common to digital inputs, outputs, but isolated from the analog I/O.

Table 3: P10 – DeviceNet Connections

Pin	Name	Description
1	BUSV+	24V DeviceNet certified power supply
2	CAN H	DeviceNet signal
3	Shield	
4	CAN L	DeviceNet signal
5	BUSV-	Return for power supply

Table 4: P8 – Digital Input Connections

Pin	Name	Description
1	PWI1	PWM capable digital input. Routed to auxiliary microcontroller
2	PWI2	PWM capable digital input. Routed to auxiliary microcontroller
3	PWI3	PWM capable digital input. Routed to auxiliary microcontroller
4	PWI4	PWM capable digital input. Routed to DSP directly.
5	DI1	Digital Input
6	DI2	Digital Input
7	DI3	Digital Input
8	Comm.	Supply Common

Table 4: P7 – Digital Output Connections

Pin	Name	Description
1	PWO1	PWM capable digital output from auxiliary microcontroller. Output voltage set by VI/O pin on power connector. Tri-state output.
2	PWO2	PWM capable digital output from auxiliary microcontroller. Output voltage set by VI/O pin on power connector. Tri-state output.
3	PWO3	PWM capable digital output from auxiliary microcontroller. Output voltage set by VI/O pin on power connector. Tri-state output.
4	PWO4	PWM capable digital output from auxiliary microcontroller. Output voltage set by VI/O pin on power connector. Tri-state output.
5	PWO5	PWM capable digital output from auxiliary microcontroller. Output voltage set by VI/O pin on power connector. Tri-state output.
6	PWO6	PWM capable digital output from DSP. Output voltage set by VI/O pin on power connector. Tri-state output.
7	PWO7	PWM capable digital output from DSP. Output voltage set by VI/O pin on power connector. Tri-state output.
8	Comm.	Supply Common

Table 4: P6 – Analog Output Connections

Pin	Name	Description
1	A/D1+	Positive input of differential analog input signal. Signal relative to AGND, isolated from Supply Common.
2	A/D1-	Negative input of differential analog input signal. Can remain disconnected or tied to AGND in single-ended applications.
3	AGND	Analog signal common. Isolated from Supply Common by 1500V.
4	A/D2+	Positive input of differential analog input signal. Signal relative to AGND, isolated from Supply Common.
5	A/D2-	Negative input of differential analog input signal. Can remain disconnected or tied to AGND in single-ended applications.
6	AGND	Analog signal common. Isolated from Supply Common by 1500V.
7	DAC1	D/A converter output 1. Analog signal configured for +/- 1V or +/-10V.
8	DAC1	D/A converter output 2. Analog signal configured for +/- 1V or +/-10V.

System Block Diagram

The system block diagram is depicted in Figure 2. A Motorola MC68HC11 is connected to the Host port of the DSP56303 processor. The 68HC11 controls the reset signals for the DSP. Depending on the intended end application, the DSP can boot from either the host port or its own EEPROM memory. Code for both the 68HC11 and DSP56303 can be loaded via serial port located behind the front panel of the module. DSP code can be loaded and debugged via the Motorola OnCE™ port located on the printed circuit board.

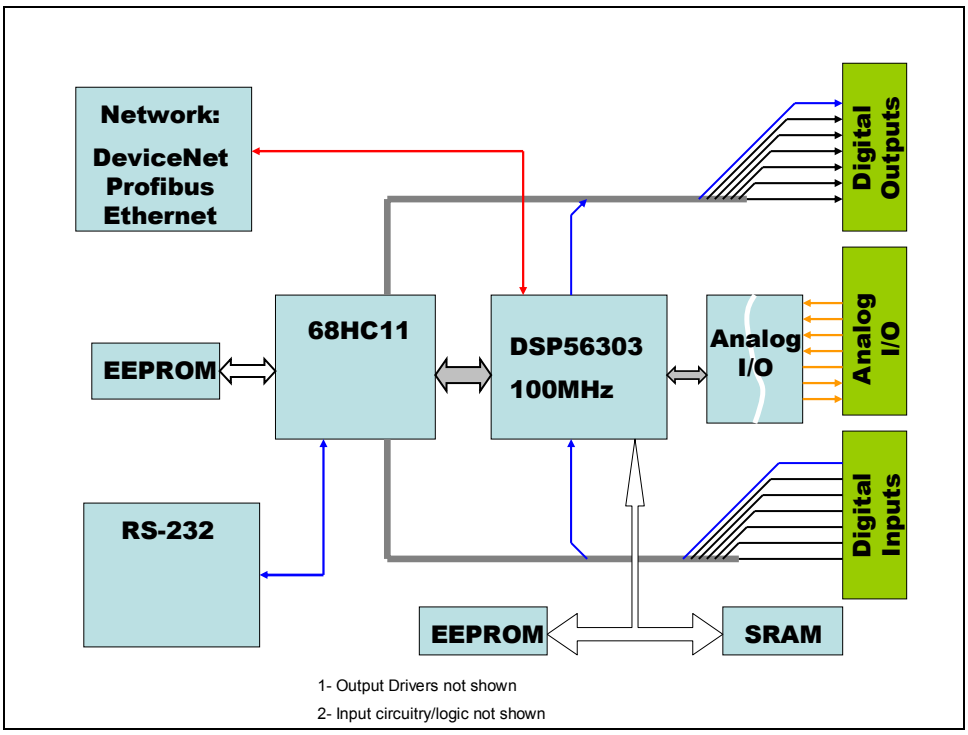


Figure 2: Block Diagram of DSP Module

385 Kilobytes of SRAM are available to the DSP for data storage and filtering.

Most of the digital I/O is connected to timing I/O pins of the 68HC11 allowing measurement and generation of PWM and other timing related measurements. Although not shown, each of the seven digital outputs has a high-side driver. The power for the high side drivers is brought into the board separately from the main device power supply, allowing all the digital outputs to run at any voltage between 5V and 24V.

Digital inputs are individually configured for 5V or 24V logic. Digital inputs are NPN type.

ANALOG I/O

The Analog I/O section of the module was designed to provide accurate measurement of the analog inputs, whether DC or up to 20KHz bandwidth AC. The analog inputs are protected against damage due to over-voltage. The analog inputs are configurable for both gain and coupling (AC/DC) via jumpers.

The A/D converter inputs were designed such that the device can calibrate itself against internal ground and precision voltage references. The D/A signals can be fed back to the A/D converter for full calibration of both analog inputs and outputs.

The analog output section of the module can be configured for a 1V range or a 10V range via jumper. As previously stated, these outputs can be measured by the A/D converter for accuracy and calibration. The Analog outputs are routed through a double-pole double-throw. Software controls this relay. The 'off state' of the relay can be set via jumper to connect the output to ground or leave the output as an open circuit, depending on jumper settings.

The Analog I/O section is fully isolated from the module's power supply (and digital section).

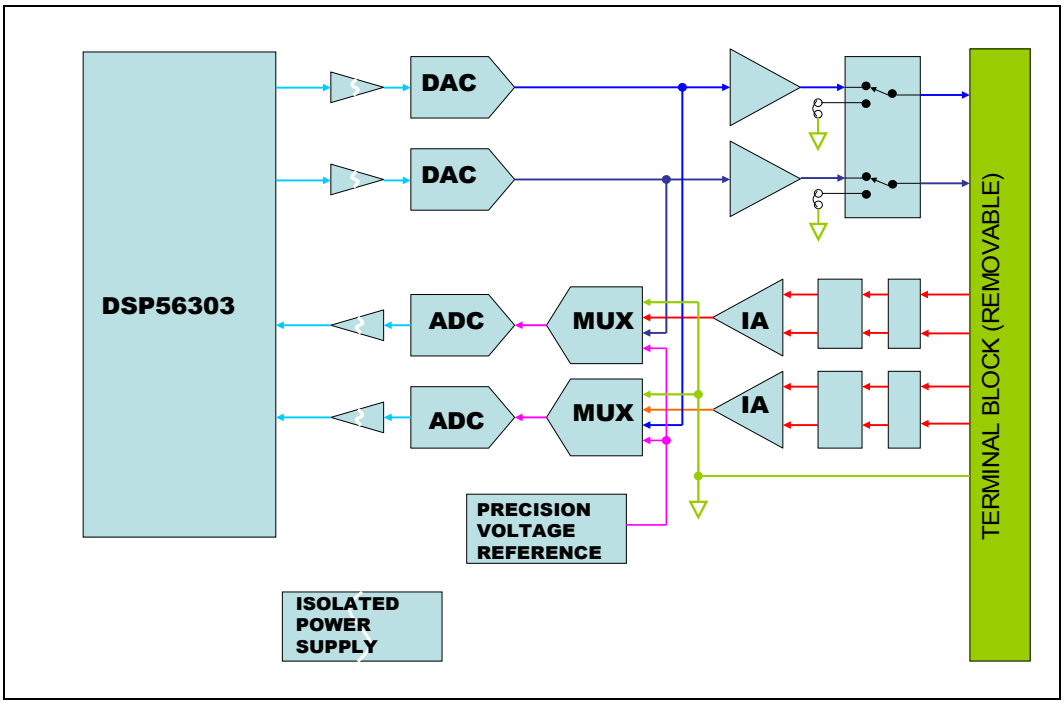


Figure 3: Block Diagram of Analog I/O Section

Analog Inputs

The analog inputs to the DN-DSP56 module are versatile, accommodating a variety of input types. The inputs can be differential DC coupled or AC coupled. Looking at Figure 4, both of our analog input signals are routed through input capacitors, each with a jumper to bypass the capacitor for DC coupling.

The analog input signals are routed through a protection device that limits the output voltage to the analog circuitry's supply rails.

Each analog input has an instrument amplifier with jumper selectable gains. This signal is routed into a precision instrumentation amplifier with five jumper-selectable gains (no jumper is unity gain), 10, 20, 100, and 200. Jumpers JP11 and JP19 (channels 1,2 respectively) provide an attenuation of to $1/10^{th}$ of the instrument amplifier when installed. This effectively gives us gains of 0.1, 0.2 on our input as well.

A special input configuration is provided for small signal AC coupled signals that ride on a larger DC voltage. Referring to Figure 4, jumper JP9 can be installed when we are interested in a small AC input signal superimposed on a large DC signal. When JP9 is installed, the input capacitors can discharge quickly, reducing the settling time for the AC coupled input.. For A/D channel 2, JP17 performs this function.

Figure 4: Analog Input Circuitry

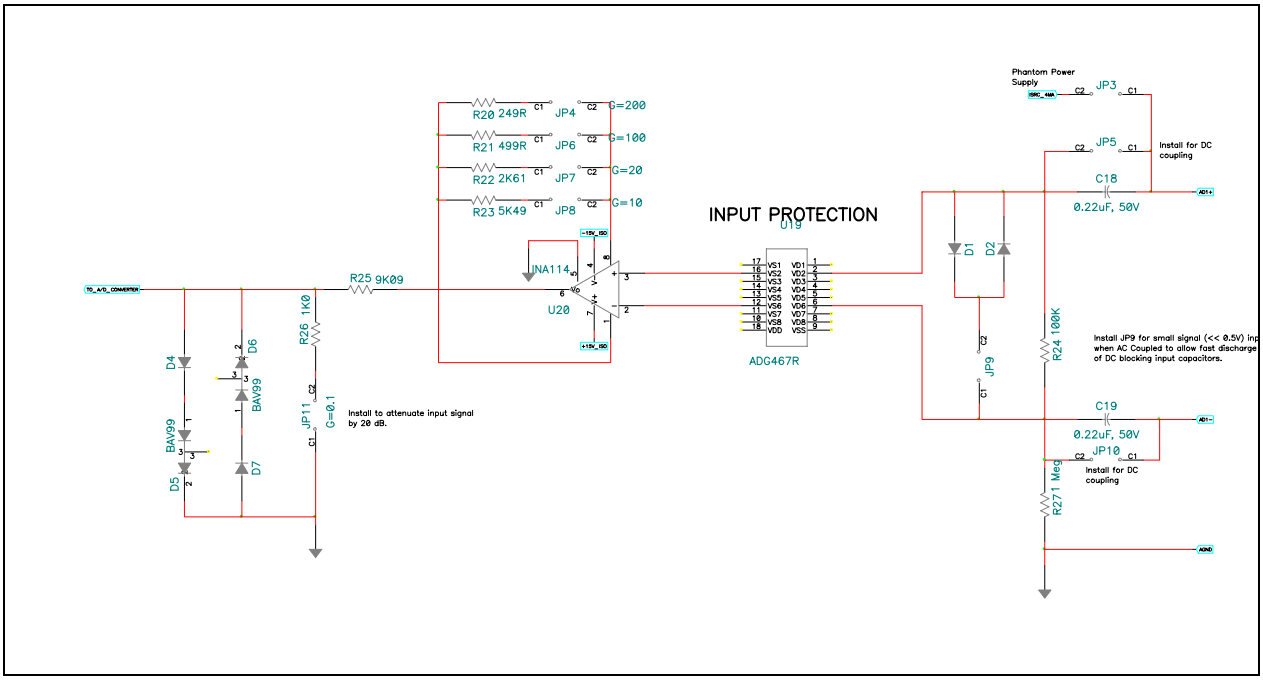


Table 3: Input Gain Jumper Settings - Channel 1

Input Gain	JP11	JP8	JP7	JP6	JP4
0.1	In	Out	Out	Out	Out
0.2	In	Out	Out	Out	Out
1	Out	Out	Out	Out	Out
2	In	Out	In	Out	Out
10	Out	In	Out	Out	Out
20	Out	Out	In	Out	Out
100	Out	Out	Out	In	Out
200	Out	Out	Out	Out	In

Table 4: Input Gain Jumper Settings - Channel 2

Input Gain	JP19	JP16	JP14	JP13	JP12
0.1	In	Out	Out	Out	Out
0.2	In	Out	Out	Out	Out
1	Out	Out	Out	Out	Out
2	In	Out	In	Out	Out
10	Out	In	Out	Out	Out
20	Out	Out	In	Out	Out
100	Out	Out	Out	In	Out
200	Out	Out	Out	Out	In

Configuration Of Analog Outputs

The analog outputs on the DN-DSP56 module have configurable options. The analog outputs come from an 18-bit accurate D/A converter on board. The output signal level can be jumper selected to be scaled to the range of +/- 1 volt, or +/-10 Volts.

Table 4: Analog Output Voltage Selection

Analog Output	Jumper	Output Level
DAC1	JP24	OUT = 1V scale IN = 10V scale
DAC2	JP22	OUT = 1V scale IN = 10V scale

Both of the analog outputs are routed through a double-pole double-throw relay. A pair of jumpers selects whether the analog outputs are 'grounded' or left open when the module is not powered up.

Table 3: Analog Output Offline State Configuration

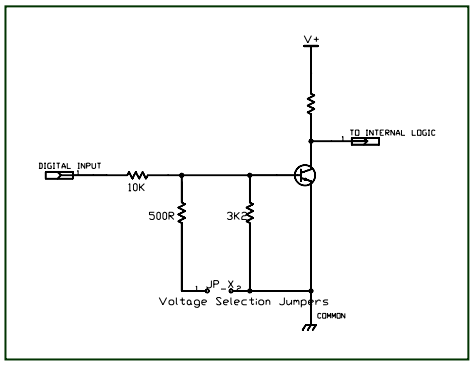
Analog Output	Jumper	Output Level
DAC1	JP23	OUT = Open circuit when powered down IN = Output shorted to AGND when powered down
DAC2	JP22	OUT = Open circuit when powered down IN = Output shorted to AGND when powered down

Configuration Of Digital Inputs

The digital inputs to the DN-DSP56 module can be configured to interface to 5V logic or 24V sourcing logic. All digital inputs are jumper selectable for either 5V or 24V input signals. These are selectable by jumpers on the printed circuit board. Each digital input bit is individually configured.

Typical digital input circuitry is depicted in figure 3. The input configuration jumper changes the input threshold level of the individual input. Jumpers JP13 through JP19 configure the digital inputs. With the jumper installed, the input is configured for 24V logic.

Figure 3: Typical Digital Input

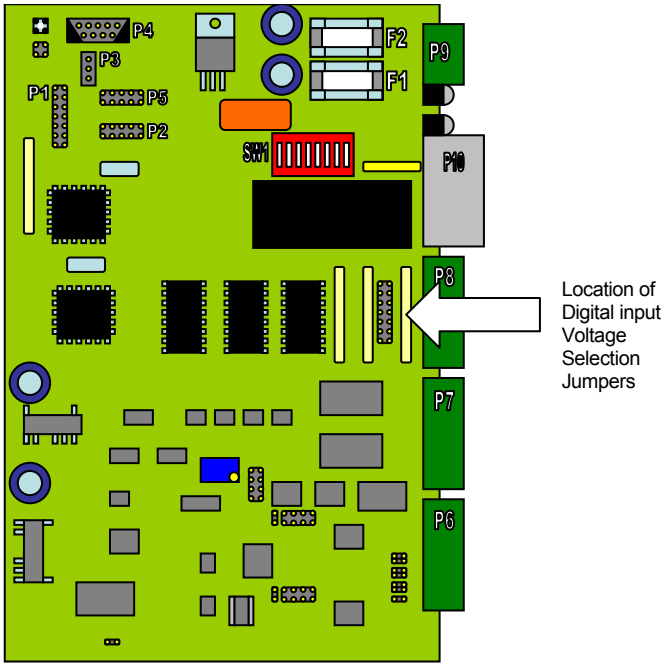


In order to configure the digital inputs, the side panel must be removed from the chassis by removing the four screws that hold it in place (5/64th Allen key). Locate Jumpers JP26 to JP30 and install or remove jumpers, depending on required configuration.

INPUT	JUMPER
PWI1	JP28
PWI2	JP27
PWI3	JP26
PWI4	JP32
DI1	JP25
DI2	JP29
DI3	JP30

Note: Modules are factory configured for 24V operation.

Figure 5: Location of Digital Input Voltage Selection Jumpers

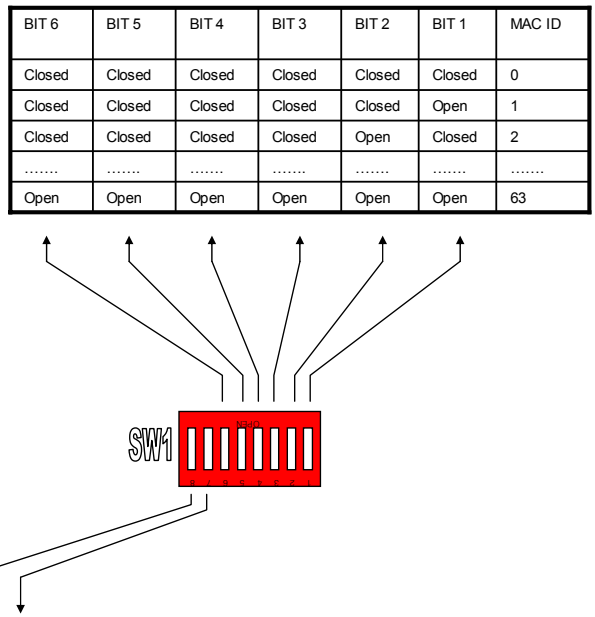


CONFIGURATION OF DEVICENET INTERFACE

The DeviceNet address and baud rate are selected via a DIP switch on the module's printed circuit board. In order to access the DIP switch, the side panel must be removed from the chassis by removing the front panel, (2 screws), the four outer-most screws on the side panel, and one screw on the rear panel of the enclosure. (5/64^{tth} Allen key).

There is only one DIP switch on the PCB. The baud rate and MAC ID are set as depicted below.

Figure 6: DeviceNet DIP Switch Configuration



BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	MAC ID
Closed	Closed	Closed	Closed	Closed	Closed	0
Closed	Closed	Closed	Closed	Closed	Open	1
Closed	Closed	Closed	Closed	Open	Closed	2
…….	…….	…….	…….	…….	…….	…….
Open	Open	Open	Open	Open	Open	63

Bit 8	Bit 7	Baud Rate
Closed	Closed	125 kbps
Closed	Open	250 kbps
Open	Closed	500 kbps
Open	Open	Reserved

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