



User Manual

DeviceNet[™]
High Current Pulse Width Modulated (PWM)
Analog Output Module

Model DN001

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Document Type: User Manual
Document Title: *DeviceNet*TM High Current Pulse Width Modulated (PWM)
Analog Output Module
Module Model: DN001
Document Number: DN001-UM1-D2.0
Document Revision: 2.0
Document Status: Released

Document Revision History

Date	Release No.	Notes
April 25, 2000	DN001-UM-D1.0	First document release in draft form for review and comments.
August 14, 2000	DN001-UM-D2.0	Second draft

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Table of Contents

Module Description	5
Module Configuration	5
Module Operation	6
Module Calibration	7
Appendix A: Statement of Compliance	8
Appendix B: Electronic Data Sheet (EDS) Listing	17
Appendix C: Specifications	21
Appendix D: Mechanical Drawings	23

1. Module Description

The Electronic Innovation Inc. "DN" line of modules are intended to provide rugged, reliable, *DeviceNet*[™] I/O capability in unusually harsh environments. These include applications such as on-board control of heavy underground mobile mining equipment or armoured military vehicles.

The DN line has been designed from the ground up to survive these environments with special attention in the following areas:

- a) Mechanical design for high shock, vibration, and concussion tolerance, resistance to liquids such as water or oil, and most forms of corrosion, along with wide operating temperatures.
- b) Electrical design to exceed Mil-Spec. standard reliable operation in the face of severe electrical transients such as the load-dump transient which can occur on heavy vehicle electrical systems.
- c) Electronic design to minimize electromagnetic emissions and provide low susceptibility to external electromagnetic interference.
- d) Extensive design effort has been expended to ensure that hardware, software, or network faults, if and when they occur, will result in a predictable and timely transition of the module to the safest achievable state.

The DN001 *DeviceNet*[™] High Current Pulse Width Modulated (PWM) Analog Output Module provides eight outputs which are well suited to provide high-side control of heavy inductive vehicle loads such as the solenoids used for proportional electric control over hydraulic systems. The duty cycle of these outputs may be varied from true 0% to true 100% allowing them to also be used as discrete digital outputs. The wide PWM frequency range available permits operation with a range of available equipment from many manufacturers.

2. Module Configuration

The DN001 module must be configured for proper operation on the DeviceNet network. This module operates as a Group 2 Only Server, UCMM Incapable Device, and therefore communicates using the Predefined Master/Slave Connection Set. Supported message types include I/O Poll, and Explicit. Change of State, Cyclic, and Bit Strobe message types are not supported in this version of the DN001.

The baud rate and MAC ID may need to be changed from their default shipping values before the module will operate properly on the target network. For the DN001, the only way to change these values is with software using any DeviceNet compliant configuration tool capable of allocating the module and accessing its attributes.

The characteristics of the Pulse Width Modulation (PWM) of the outputs may be changed as well using the same or similar tool. The most common characteristic is the frequency of the PWM output signal. This should be set to match the requirements of the equipment being driven by the output.

All of the above configurations, when changed, are automatically stored in a non-volatile EEPROM. The configuration of the module is not lost when the module is powered down, or, if the module undergoes a reset.

3. Module Operation

Once configured, the DN001 is ready to start PWM driving output loads in response to data sent from the master.

The master can drive an output using either I/O Poll, or Explicit message types. These message types are described below.

3.1 I/O Poll Messages

The master issues I/O Poll Request messages to the DN001. The data portion of these messages contains the values destined for each output channel in ascending channel order. All data channels are contained in every I/O poll message. There is one byte per output channel resulting in the following 8 byte data format:

1	2	3	4	5	6	7	8
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8

where the value of CHx is a number between 0 and 255 (FF_{HEX}). For each channel the duty cycle of the PWM output signal is given by the following equation:

$$\text{Duty Cycle} = \text{CHx}/255, \quad x = 1..8$$

Examples:

CH1 = 0 gives Duty Cycle 1 = 0% (output completely off)
 CH7 = 255 gives Duty Cycle 7 = 100% (output completely on)
 CH3 = 127 gives Duty Cycle 3 = 50%

3.2 Explicit Messages

The master can also set the value of each output individually by setting attribute 3 (Value) of the corresponding AOP object.

The output frequency may be configured by setting attribute 100 (PWM Frequency) of the corresponding AOP object.

4 Module Calibration

There are no calibrations required for the DN001. The basic PWM frequency is guaranteed to drift by less than 100 ppm over the life of the unit.

Appendix A: Statement of Compliance

A.1 General Device Data

Conforms to DeviceNet Specification	Volume I, Release 2.0 Volume II, Release 2.0
Vendor Name	Electronic Innovation Inc.
Device Profile Name	Generic Device
Product Catalog Number	DN001
Product Revision	Hardware Ver. 1.4 Software Ver. 2.1

A.2 DeviceNet Physical Conformance Data

Max. Network Power Consumption	0.15A @ 11 VDC (worst case)
Connector Style	
DN001-OF	Open-Pluggable
DN001-SSE	Sealed-Mini
LED Supported	Combo Mod/Net Status
MAC ID Setting	Software Selectable
Default MAC ID	63
Communication Rate Setting	Software Selectable
Communication Rates Supported	125 kbps, 250 kbps, 500 kbps

A.3 DeviceNet Communications Data

Predefined Master/Slave Connection Set	Supported, Group 2 Only Server
Dynamic Connections Supported (UCMM)	None
Fragmented Explicit Messaging Supported	No

A.4 DeviceNet Information

The DN001 operates as a slave device on a DeviceNet network. It supports Explicit Messages and Polled I/O Messages of the Predefined Master/Slave Connection Set. It does not support the Explicit Unconnected Message Manager (UCMM)

DeviceNet Message Types

As a Group 2 Slave device the DN001 supports the following incoming message types

CAN Identifier Field	Group 2 Message Type
10xxxxxx100	Master Explicit Request Message
10xxxxxx101	Master I/O Poll Command Message
10xxxxxx110	Group 2 Only Unconnected Explicit Request Message
10xxxxxx111	Duplicate MAC ID Check Messages

xxxxxx = DN001 Node Address (0..63)

DeviceNet Class Services

As a Group 2 Slave device, the DN001 module supports the following class and instance services.

Service Code	Service Name
0x05 _{HEX}	Reset
0x0E _{HEX}	Get_Attribute_Single
0x10 _{HEX}	Set_Attribute_Single
0x4B _{HEX}	Allocate_Master/Slave_Connection_Set
0x4C _{HEX}	Release_Master/Slave_Connection_Set

DeviceNet Object Classes

The DN001 module supports the following DeviceNet Object classes

Class Code	Service Name
0x01 _{HEX}	Identity Object
0x02 _{HEX}	Message Router Object
0x03 _{HEX}	DeviceNet Object
0x04 _{HEX}	Assembly Object
0x05 _{HEX}	Connection Object
0x0B _{HEX}	Analog Output Point Object

A.5 DeviceNet Required Object Implementation

Identity Object

Class Code: 01_{HEX}

The Identity Object is required on all devices and provided identification and general information about the device.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	1

Number of Instances: 1

Object Instance

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Vendor ID	UINT	285
2	Get	Device Type	UINT	0
3	Get	Product Code	UINT	1
4	Get	Revision Major Revision Minor Revision	STRUCT of: USINT USINT	2 1
5	Get	Status	WORD	see DeviceNet Specification
6	Get	Serial Number	UDINT	32 bit serial number
7	Get	Product Name	SHORT_STRING	DN001

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
5 (05 _{HEX})	No	Yes	Reset
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single

Message Router Object

Class Code: 02_{HEX}

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	1

Number of Instances: 1

Object Instance

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
2	Get	Number of Connections	UINT	2

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single

DeviceNet Object

Class Code: 03_{HEX}

The DeviceNet Object is required on all devices and is used to provide the configuration and status of a physical attachment to DeviceNet.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	2

Number of Instances: 1

Object Instance

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get/Set	MAC ID	USINT	0 to 63*
2	Get/Set	Data Rate	USINT	0* = 125 kbps 1 = 250 kbps 2 = 500 kbps
3	Get/Set	Bus-Off Interrupt (BOI)	BOOL	0* = Hold CAN chip in Bus off 1 = Reset CAN chip if possible
4	Get/Set	Bus-Off Counter	USINT	0 to 255
5	Get	Allocation Information Alloc. Choice Byte Master's MAC ID	STRUCT of: BYTE USINT	Alloc. Choice Table Range 0..63, 255 255 = not allocated

*Factory default

Alloc. Choice Table

Bit	Service	Value
0	Explicit Message	Supported. Set to 1 to allocate
1	I/O Poll	Supported. Set to 1 to allocate
2	Bit Strobe	Not Supported. Always 0
3	-	Reserved. Always 0
4	Change of State	Not Supported. Always 0
5	Cyclic	Not Supported. Always 0
6	Acknowledge Suppression	Always 0
7	-	Reserved. Always 0

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single
16 (10 _{HEX})	No	Yes	Set_Attribute_Single
75 (4B _{HEX})	No	Yes	Allocate_Master_Slave_Connection_Set
76 (4C _{HEX})	No	Yes	Release_Master_Slave_Connection_Set

Assembly Object

Class Code: 04_{HEX}

The Assembly Object binds attributes of multiple objects which allows data to or from each object to be sent or received over a single connection.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	2

Number of Instances: 1

Object Instance

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
3	Get	Data	BYTE Array	<i>Output Status Byte</i>

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single

Connection Object

Class Code: 05_{HEX}

The Connection Object manages the characteristics of each communication connection. As a Group 2 Only Slave device, the module supports one Explicit Message connection and one I/O Poll Message connection.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	1

Number of Instances: 2

Object Instance 1 – Explicit Messaging

Attribute ID	Access Rule ²	Name	DeviceNet Data Type	Value
1	Get	State	USINT	0 = Non-existent 3 = Established 5 = Deferred Delete
2	Get	Instance Type	USINT	0 = Explicit Messaging
3	Get	Transport Class Trigger	BYTE	83 _{HEX}
4	Get	Produced Connection ID	UINT	10xxxxxx011 _{BIN} xxxxxx = DN001 MAC ID
5	Get	Consumed Connection ID	UINT	10xxxxxx100 _{BIN} xxxxxx = DN001 MAC ID
6	Get	Initial Comm. Characteristics	BYTE	21 _{HEX}
7	Get	Produced Connection Size	UINT	7
8	Get	Consumed Connection Size	UINT	7
9	Get/Set	Expected Packet Rate	UINT	2500 ms
12	Get/Set	Watchdog Timeout Action	USINT	1 (Auto Delete) 3 (Deferred Delete)
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path	Array of USINT	Null (no data)
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path	Array of USINT	Null (no data)
17	Get	Production Inhibit Time	UINT	0 (no inhibit time)

Object Instance 2 – I/O Poll

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	State	USINT	0 = Non-existent 1 = Configuring 3 = Established 4 = Timed Out
2	Get	Instance Type	USINT	1 = I/O Messaging
3	Get	Transport Class Trigger	BYTE	82 _{HEX}
4	Get	Produced Connection ID	UINT	01111xxxxxx _{BIN} xxxxxx = DN001 MAC ID
5	Get	Consumed Connection ID	UINT	10xxxxxx101 _{BIN} xxxxxx = DN001 MAC ID
6	Get	Initial Comm. Characteristics	BYTE	01 _{HEX}
7	Get	Produced Connection Size	UINT	1
8	Get	Consumed Connection Size	UINT	8
9	Get/Set	Expected Packet Rate	UINT	200 ms
12	Get/Set	Watchdog Timeout Action	USINT	0* (Timeout) 1 (Auto Delete) 2 (Auto Reset)
13	Get	Produced Connection Path Length	UINT	6
14	Get	Produced Connection Path	Array of USINT	{20, 04, 24, 64, 30, 03} _{HEX}
15	Get	Consumed Connection Path Length	UINT	6
16	Get	Consumed Connection Path	Array of USINT	{20, 04, 24, 64, 30, 03} _{HEX}
17	Get	Production Inhibit Time	UINT	0 (no inhibit time)

*Factory default

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
5 (05 _{HEX})	No	Yes	Reset
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single
16 (10 _{HEX})	No	Yes	Set_Attribute_Single

A.6 DeviceNet Open Object Implementation

Analog Output Point Object

Class Code: 0B_{HEX}

The Analog Output Point (AOP) models the point level attributes and services of the analog outputs in the DN001.

Object Class

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
1	Get	Revision	UINT	1
2	Get	Max. Object Instance	UINT	8

Number of Instances: 8

Object Instances 1 to 8

Attribute ID	Access Rule	Name	DeviceNet Data Type	Value
3	Get/Set	Value	BYTE	Range 0..255
100	Get/Set	PWM Frequency	UINT	Range: 1-4: 4..2500 5-8: 1..2500 (45*)
101	Get/Set	Analog Output Range	USINT	1 (0V to 10V) 3* (-10V to 10V) 4 (0V to 5V) 5 (-5V to 5V)
102	Get	PWM Output	BOOL	0 (Analog) 1* (PWM)

*Factory default

Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
14 (0E _{HEX})	Yes	Yes	Get_Attribute_Single
16 (10 _{HEX})	No	Yes	Set_Attribute_Single

Appendix B: Electronic Data Sheet (EDS) Listing

\$ Electronic Innovation Inc.
\$ DN001 - 8 PWM Output Module - EDS

[File]

```
DescText= "DN001 EDS";
CreateDate= 8-11-2000;
CreateTime= 10:00:00;
ModDate= 8-11-2000;
ModTime= 10:00:00;
Revision= 2.0;
```

[Device]

```
VendCode= 285;
ProdType= 0;
ProdCode= 1;
MajRev= 2;
MinRev= 1;
VendName= "Electronic Innovation Inc.";
ProdTypeStr="Generic Device";
ProdName= "DN001";
Catalog= "DN001";
```

[IO_Info]

```
Default= 0x0001;
PollInfo= 0x0001,1,1;

Input1= 1,0,0x0001,"Producing IO/Data",6,"20 04 24 64 30 03","Poll Produced";
Output1= 8,0,0x0001,"Consuming IO/Data",6,"20 04 24 64 30 03","Poll Consumed";
```

[ParamClass]

```
MaxInst=24;
Descriptor=0;
CfgAssembly=0;
```

[Params]

```
$ ----- $
$ CHANNEL 1 $
$ ----- $

Param1=
  0, $ reserved
  6, "20 0B 24 1 30 3", $ link size and path
  0x00, $ descriptor
  0xD1, 1, $ data type, data size (in bytes)
  "Value 1", $ parameter name
  "/255", $ units string
  "AOP Output Value", $ help string
  0,255,0, $ minimum, maximum and default values
  , , , , , , , , ; $ optional fields

Param2=
  0, $ reserved
  6, "20 0B 24 1 30 64", $ link size and path
  0x00, $ descriptor
  0xC7, 2, $ data type, data size (in bytes)
  "PWM Freq 1", $ parameter name
  "Hz", $ units string
  "PWM outputs only", $ help string
  20,2500,45, $ minimum, maximum and default values
  , , , , , , , , ; $ optional fields

Param3=
```

```

0,                                $ reserved
6, "20 0B 24 1 30 65",           $ link size and path
0x02,                             $ descriptor
0xC6, 1,                          $ data type, data size (in bytes)
"Analog Range 1",                 $ parameter name
" ",                               $ units string
"Analog outputs only ('2' not supported)", $ help string
1,5,3,                             $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

$ ----- $
$                                     CHANNEL 2                               $
$ ----- $

Param4=
0,                                $ reserved
6, "20 0B 24 2 30 3",           $ link size and path
0x00,                             $ descriptor
0xD1, 1,                          $ data type, data size (in bytes)
"Value 2",                         $ parameter name
"/255",                             $ units string
"AOP Output Value",               $ help string
0,255,0,                           $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

Param5=
0,                                $ reserved
6, "20 0B 24 2 30 64",           $ link size and path
0x00,                             $ descriptor
0xC7, 2,                          $ data type, data size (in bytes)
"PWM Freq 2",                     $ parameter name
"Hz",                              $ units string
"PWM outputs only",               $ help string
20,2500,45,                       $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

Param6=
0,                                $ reserved
6, "20 0B 24 2 30 65",           $ link size and path
0x02,                             $ descriptor
0xC6, 1,                          $ data type, data size (in bytes)
"Analog Range 2",                 $ parameter name
"N/A",                             $ units string
"Analog outputs only ('2' not supported)", $ help string
1,5,3,                             $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

$ ----- $
$                                     CHANNEL 3                               $
$ ----- $

Param7=
0,                                $ reserved
6, "20 0B 24 3 30 3",           $ link size and path
0x00,                             $ descriptor
0xD1, 1,                          $ data type, data size (in bytes)
"Value 3",                         $ parameter name
"/255",                             $ units string
"AOP Output Value",               $ help string
0,255,0,                           $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

Param8=
0,                                $ reserved
6, "20 0B 24 3 30 64",           $ link size and path
0x00,                             $ descriptor
0xC7, 2,                          $ data type, data size (in bytes)
"PWM Freq 3",                     $ parameter name
"Hz",                              $ units string
"PWM outputs only",               $ help string
20,2500,45,                       $ minimum, maximum and default values
, , , , , , , , ;                 $ optional fields

```

```

Param9=
  0,                                $ reserved
  6, "20 0B 24 3 30 65",           $ link size and path
  0x02,                              $ descriptor
  0xC6, 1,                           $ data type, data size (in bytes)
  "Analog Range 3",                 $ parameter name
  "N/A",                             $ units string
  "Analog outputs only ('2' not supported)", $ help string
  1,5,3,                             $ minimum, maximum and default values
  , , , , , , , , ;                 $ optional fields

$ ----- $
$                                     CHANNEL 4 $
$ ----- $

Param10=
  0,                                $ reserved
  6, "20 0B 24 4 30 3",           $ link size and path
  0x00,                              $ descriptor
  0xD1, 1,                           $ data type, data size (in bytes)
  "Value 4",                         $ parameter name
  "/255",                             $ units string
  "AOP Output Value",               $ help string
  0,255,0,                           $ minimum, maximum and default values
  , , , , , , , , ;                 $ optional fields

Param11=
  0,                                $ reserved
  6, "20 0B 24 4 30 64",           $ link size and path
  0x00,                              $ descriptor
  0xC7, 2,                           $ data type, data size (in bytes)
  "PWM Freq 4",                     $ parameter name
  "Hz",                              $ units string
  "PWM outputs only",               $ help string
  20,2500,45,                       $ minimum, maximum and default values
  , , , , , , , , ;                 $ optional fields

Param12=
  0,                                $ reserved
  6, "20 0B 24 4 30 65",           $ link size and path
  0x02,                              $ descriptor
  0xC6, 1,                           $ data type, data size (in bytes)
  "Analog Range 4",                 $ parameter name
  "N/A",                             $ units string
  "Analog outputs only ('2' not supported)", $ help string
  1,5,3,                             $ minimum, maximum and default values
  , , , , , , , , ;                 $ optional fields

$ ----- $
$                                     CHANNEL 5 $
$ ----- $

Param13=
  0,                                $ reserved
  6, "20 0B 24 5 30 3",           $ link size and path
  0x00,                              $ descriptor
  0xD1, 1,                           $ data type, data size (in bytes)
  "Value 5",                         $ parameter name
  "/255",                             $ units string
  "AOP Output Value",               $ help string
  0,255,0,                           $ minimum, maximum and default values
  , , , , , , , , ;                 $ optional fields

Param14=
  0,                                $ reserved
  6, "20 0B 24 5 30 64",           $ link size and path
  0x00,                              $ descriptor
  0xC7, 2,                           $ data type, data size (in bytes)
  "PWM Freq 5",                     $ parameter name
  "Hz",                              $ units string
  "PWM outputs only",               $ help string

```

```

20,2500,45,          $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

Param15=
0,                  $ reserved
6, "20 0B 24 5 30 65", $ link size and path
0x02,              $ descriptor
0xC6, 1,          $ data type, data size (in bytes)
"Analog Range 5", $ parameter name
"N/A",            $ units string
"Analog outputs only ('2' not supported)", $ help string
1,5,3,            $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

$ ----- $
$                               CHANNEL 6                               $
$ ----- $

Param16=
0,                  $ reserved
6, "20 0B 24 6 30 3", $ link size and path
0x00,              $ descriptor
0xD1, 1,          $ data type, data size (in bytes)
"Value 6",        $ parameter name
"/255",           $ units string
"AOP Output Value", $ help string
0,255,0,          $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

Param17=
0,                  $ reserved
6, "20 0B 24 6 30 64", $ link size and path
0x00,              $ descriptor
0xC7, 2,          $ data type, data size (in bytes)
"PWM Freq 6",     $ parameter name
"Hz",             $ units string
"PWM outputs only", $ help string
20,2500,45,       $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

Param18=
0,                  $ reserved
6, "20 0B 24 6 30 65", $ link size and path
0x02,              $ descriptor
0xC6, 1,          $ data type, data size (in bytes)
"Analog Range 6", $ parameter name
"N/A",            $ units string
"Analog outputs only ('2' not supported)", $ help string
1,5,3,            $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

$ ----- $
$                               CHANNEL 7                               $
$ ----- $

Param19=
0,                  $ reserved
6, "20 0B 24 7 30 3", $ link size and path
0x00,              $ descriptor
0xD1, 1,          $ data type, data size (in bytes)
"Value 7",        $ parameter name
"/255",           $ units string
"AOP Output Value", $ help string
0,255,0,          $ minimum, maximum and default values
, , , , , , , , ;   $ optional fields

Param20=
0,                  $ reserved
6, "20 0B 24 7 30 64", $ link size and path
0x00,              $ descriptor
0xC7, 2,          $ data type, data size (in bytes)
"PWM Freq 7",     $ parameter name

```

```

    "Hz",                                $ units string
    "PWM outputs only",                  $ help string
    20,2500,45,                           $ minimum, maximum and default values
    , , , , , , , , ;                      $ optional fields

Param21=
    0,                                    $ reserved
    6, "20 0B 24 7 30 65",                $ link size and path
    0x02,                                  $ descriptor
    0xC6, 1,                               $ data type, data size (in bytes)
    "Analog Range 7",                      $ parameter name
    "N/A",                                  $ units string
    "Analog outputs only ('2' not supported)", $ help string
    1,5,3,                                  $ minimum, maximum and default values
    , , , , , , , , ;                      $ optional fields

$ -----
$                                     CHANNEL 8
$ -----
Param22=
    0,                                    $ reserved
    6, "20 0B 24 8 30 3",                 $ link size and path
    0x00,                                  $ descriptor
    0xD1, 1,                               $ data type, data size (in bytes)
    "Value 8",                             $ parameter name
    "/255",                                  $ units string
    "AOP Output Value",                     $ help string
    0,255,0,                                 $ minimum, maximum and default values
    , , , , , , , , ;                      $ optional fields

Param23=
    0,                                    $ reserved
    6, "20 0B 24 8 30 64",                $ link size and path
    0x00,                                  $ descriptor
    0xC7, 2,                               $ data type, data size (in bytes)
    "PWM Freq 8",                          $ parameter name
    "Hz",                                  $ units string
    "PWM outputs only",                     $ help string
    20,2500,45,                             $ minimum, maximum and default values
    , , , , , , , , ;                      $ optional fields

Param24=
    0,                                    $ reserved
    6, "20 0B 24 8 30 65",                $ link size and path
    0x02,                                  $ descriptor
    0xC6, 1,                               $ data type, data size (in bytes)
    "Analog Range 8",                      $ parameter name
    "N/A",                                  $ units string
    "Analog outputs only ('2' not supported)", $ help string
    1,5,3,                                  $ minimum, maximum and default values
    , , , , , , , , ;                      $ optional fields

[EnumPar]
Param3="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param6="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param9="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param12="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param15="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param18="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param21="0-10V","N/A","-10-10V","0-5V","-5V-5V";
Param24="0-10V","N/A","-10-10V","0-5V","-5V-5V";

[Groups]
Group1 = "AOP Object",24,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24;

```

Appendix C: Specifications

DeviceNet Power Supply:

Power Supply Voltage:	8.8 V to 65.0 V, continuous operating
Power Supply Isolation:	1.2kVrms
Current Consumption:	200 mA @ 8.8 V Supply 150 mA @ 11.0 V Supply 80 mA @ 25.0 V Supply
Overvoltage Withstand:	120V, 20 seconds
Operation During Overvoltage:	Module operation maintained without disruption throughout transient
Applicable Military Standard:	Exceeds Quadripartite Standardization Agreement 307, Annex B (28VDC Military Vehicles), including Load-Dump Transient protection.

Aux Power Supply:

Operating Voltage:	Min. 4.5 V Max: 39 V
Operating Current:	Max: 18A sum of all PWM output currents
Reverse Polarity Protection:	Parallel diode
Overvoltage Withstand:	Max. 120V, indefinite duration
Operation During Overvoltage:	Outputs turned off to protect load when Aux. Supply > max. operating voltage
Applicable Military Standard:	Exceeds Quadripartite Standardization Agreement 307, Annex B (28VDC Military Vehicles), including Load-Dump Transient protection.

Pulse Width Modulated (PWM) Outputs:

Output Type:	High-side switched Aux. Power
PWM Frequency:	Min. 20 Hz (extended ranges possible) Max. 2.5 kHz (consult factory)
PWM Frequency Stability:	100 ppm
PWM Resolution:	8 bits
PWM Duty Cycle Range:	0% to 100%
Overvoltage Shutdown:	39.5V – 42V
Undervoltage Shutdown:	2.4V – 4.5V
Operating Current:	Max. 5 A, note: must also consider limit on Aux. Power sum of PWM output currents
Overcurrent Trip Point:	Initial Peak: 7-35 A Repetitive: 6-10 A
Overcurrent Shutdown Delay:	Min. 80 μ s Max. 400 μ s

Overcurrent Recovery Mode:	Electronic fuse: cycle Aux. Power to reset
Thermal Overload Trip Temp:	Min. 150°C
Inductive Spike Protection:	Output clamped at 42V, 1500W max. pulse
Loss of Ground Protection:	Yes
Loss of Aux. Power Protection:	Yes
Applied External Voltage:	Current will not flow into PWM output
State of Outputs on Power Up:	All outputs off. Outputs do not come on during processor reset or boot-up
DeviceNet State Behaviour:	All outputs immediately turned off any time the module is not in Established state.

Communications:

Data Rates Supported:	125 kbps, 250 kbps, 500 kbps
Maximum Distances:	500 m (1,640 ft) at 125 kbps 200 m (650 ft) at 250 kbps 100 m (330 ft) at 500 kbps

Electromagnetic Interference Control:

Emissions:	Meets MIL-STD 461D: RE102, Navy Mobile and Army
Susceptibility:	Meets MIL-STD 461D: RS103, Ground Vehicles
Note:	Only –SSE enclosure option is qualified to MIL-STD 461D EMI Limits

Environmental

Operating Temperature:	-40°C to +85°C
Storage Temperature:	-55°C to +125°C

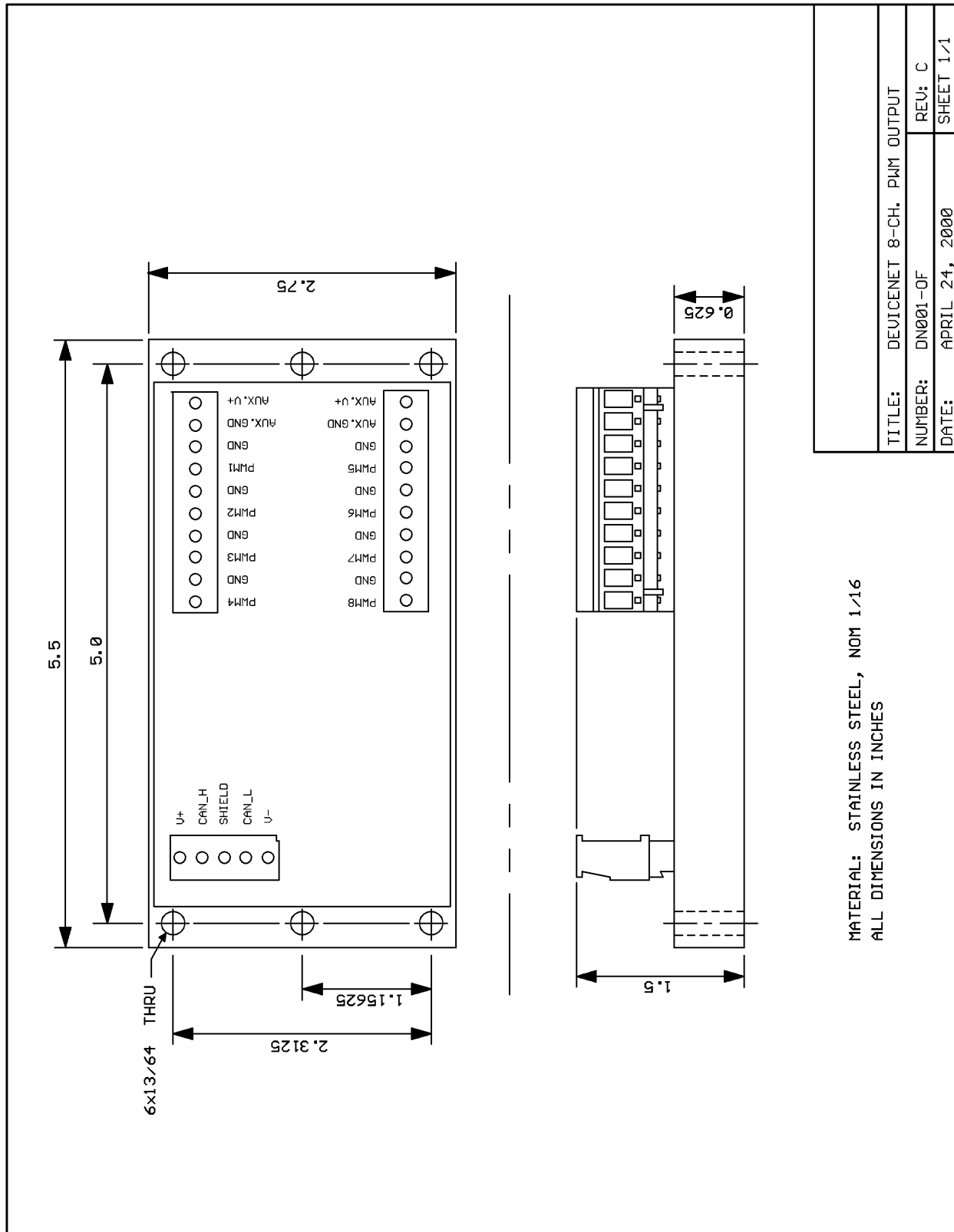
Shipping Configuration:

MAC ID:	63
Data Rate:	125 kbps
PWM Frequency:	45 Hz
Note:	will be shipped with customer requested configuration if specified in order

Ordering Information

DN001-OF	Potted into Open Frame stainless steel tray, Terminal block connectors
DN001-SSE	Potted into Stainless Steel Enclosure, sealed stainless steel Mini-style DeviceNet and Aux. connectors, sealed stainless steel micro-style connectors for outputs

Appendix D: Mechanical Drawings



MATERIAL: STAINLESS STEEL, NOM 1/16
ALL DIMENSIONS IN INCHES

TITLE:	DEVICENET 8-CH. PWM OUTPUT
NUMBER:	DN001-OF
DATE:	APRIL 24, 2000
REV:	C
SHEET:	1/1

