

Huron Net Works

DeviceNet DN-500 Device Profile

#2200013
Revision History

Rev	Date	Notes
1.1	11/23/96	Original Release
2.1	6/10/04	Redesign for Atmel Processor
2.2	7/12/04	Drop: IO from name Add: Class 0x64 to tables Add: Class 0x79 to tables
2.3	7/30/04	Delete: Class 0x64 Add: Behavior Section
2.4	8/4/04	Change: Base Serial Number Minor typographical corrections

1 Object Model

The DN-500 is a general purpose DeviceNet I/O module. There are five general purpose outputs and five general purpose inputs. The Device Type is zero, denoting a Generic Device.

1.1 Objects Present in Device

Object	Class Id	Number of Instances
Identity Object	0x01	1
Message Router Object	0x02	1
DeviceNet Object	0x03	1
Assembly Object	0x04	2
Connection Object	0x04	1 – Explicit Messaging 1 – Poll I/O 1 – COS/Cyclic
Discrete Input Point Object	0x08	5
Discrete Output Point Object	0x09	5
Acknowledge Handler Object	0x2B	1
Diagnostic Bit Object	0x79	7
Non-Volatile Test Object	**	1
Debug Object	**	1
Vendor Specific Parameter Object	**	1
Factory Test Object	**	1

** Refer to the Vendor Specific Object Library

1.2 Objects That Effect Behavior

Object	Class Id	Effect on Behavior
Identity	0x01	Supports the Reset Service with parameter 0,1
Message Router	0x02	No Effect
DeviceNet	0x03	Configures Port Attributes
Assembly #105	0x04	Input Assembly
Assembly #122	0x04	Output Assembly
Connection	0x05	Establishes the number of connections Supports a reset service
Discrete Input Point	0x08	State of general purpose inputs
Discrete Input Point	0x09	Defines fault and idle behavior for outputs
Acknowledge Handler	0x2B	Defines Ack Behavior for COS/Cyclic connections
Diagnostic Bit Object	0x79	Contains output diagnostic bits. Can modify output values.
Non-Volatile Test	**	Test non-volatile memory
Debug Object	**	Read and Write Memory and Registers
Vendor Specific Parameter	**	Vendor Specific Configuration
Factory Test	**	Vendor Specific Configuration

** Refer to the Vendor Specific Object Library

1.3 Object Interfaces

Object	Class Id	Interface
Identity	0x01	Message Router
Message Router	0x02	Explicit Message Connection Instance
DeviceNet	0x03	Message Router
Assembly #105	0x04	I/O Connection or Message Router
Assembly #122	0x04	I/O Connection or Message Router
Connection	0x05	Message Router
Discrete Input Point	0x08	Message Router
Discrete Output Point	0x09	Message Router
Acknowledge Handler	0x2B	Message Router
Diagnostic Bit	0x79	I/O Connection or Message Router
Non-Volatile Test	**	Message Router
Debug Object	**	Message Router
Vendor Specific Parameter	**	Message Router
Factory Test	**	Message Router

** Refer to the Vendor Specific Object Library

2 Standard Objects

2.1 Identity Object (0x01)

There is a single instance of the identity object for the device.

2.1.1 Class Attributes

No class attributes are supported.

2.1.2 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value	Description
1	Get	Vendor Id	UINT	0x0014	Huron Net Works
2	Get	Product Type	UINT	0x0000	Generic Device
3	Get	Product Code	UINT	0x000A	Huron Net Works specific product code
4	Get	Revision	STRUCT	02.01	Major revision for new board and firmware
5	Get	Status	WORD	0x0000	
6	Get	Serial #	UDINT	0x00007000 ¹	Base Serial Number
7	Get	Product Name	STRUCT	6,"DN-500"	Product Name String
8	Get	State	USINT	[0..5]	
9	Get	CCV	UINT	[0..65535]	Configuration Consistency Value
10	Get/Set	Heartbeat	USINT	[0..255]	Heartbeat Interval

¹ Default base serial number. This attribute is factory programmed to the actual unique serial number.

2.1.3 Instance Services

Service Code	Service Name	Description of Service
0x05	Reset	Reset the device to power up configuration
0x0E	Get Attribute Single	Returns the contents of the specified attribute
0x10	Set Attribute Single	Sets the contents of the specified attribute

2.1.4 Reset Service Parameter

Data Type	Value	Description of Service
UINT	0	Reset the device to its power up configuration
	1	Return the device to its Out-of-Box configuration

2.2 Message Router Object (0x02)

There is a single instance of the Message Router Object. For this single instance of the Message Router Object there is no externally visible interface. There are no class attributes or services, and there are no instance attributes or services. This is consistent with the definition of the attributes and the services as optional. The behavior of this object is required.

2.3 DeviceNet Object (0x03)

There is a single instance of the DeviceNet Object for the device

2.3.1 DeviceNet Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	0x0002

2.3.2 DeviceNet Object Class Services

Service Code	Service Name	Description of Service
0x0E	Get Attribute Single	Return the contents of the specified attribute

2.3.3 DeviceNet Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get/Set ²	MACID	USINT	DIP SWITCH or EEPROM ¹
2	Get/Set ²	Baudrate	USINT	DIP SWITCH or EEPROM ¹
3	Get/Set	BOI	BOOL	0x00 Fault
4	Get/Set	Bus-Off Counter	USINT	0x00
5	Get	Allocation Information	STRUCT	Allocate Service
6	Get	MacId Switch Changed	BOOL	[0..1]
7	Get	Baudrate Switch Changed	BOOL	[0..1]
8	Get	MacId Switches	USINT	[0..63]
9	Get	Baudrate Switches	USINT	[0..3]
10	Get/Set	Quick Connect	USINT	0 = Disabled 1 = Enabled

¹The MACID and Baudrate values are obtained from the DIP SWITCH if the Baudrate value on the DIP SWITCH is 00, 01, or 10. If the Baudrate value on the DIP SWITCH is 11, then the MACID and Baudrate values are obtained from EEPROM. The MACID defaults to 63 and the baudrate defaults to 125Kbaud. As the value of MacId changes it is copied to eeprom and the Network Access State Machine is executed. As the value of Baudrate changes it is copied to EEPROM and takes effect on the next power cycle or RESET.

²Conditional on value of the Baudrate switches.

2.3.4 DeviceNet Object Instance Services

Service Code	Service Name	Description of Service
0x0E	Get Attribute Single	Returns the contents of the specified attribute
0x10	Set Attribute Single	Set the contents of the specified attribute
0x4B	Allocate	Instantiate predefined connections
0x4C	Release	Eliminate predefined connections

2.4 Assembly Object (0x04)

2.4.1 Class Attributes and Services

No class attributes or services are supported

2.4.2 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
3	Get/Set	Value	Array of USINT	See Definitions

2.4.3 Instance Services

Service Code	Service Name	Description of Service
0x0E	Get Attribute Single	Returns the contents of the specified attribute
0x10	Set Attribute Single	Set the contents of the specified attribute

2.4.4 Identification of I/O Assembly Instances

Number	Type	Length	Name
105	Input	2	Input and Diagnostic
122	Output	1	Hardware Output

2.4.5 Format of I/O Assembly Data Attribute

2.4.5.1 Assembly #105

Byte	7	6	5	4	3	2	1	0
0	0	0	0	GPI5	GPI4	GPI3	GPI2	GPI1
1	LF	0	0	DIAG5	DIAG4	DIAG3	DIAG2	DIAG1

Bits GPI1 through GPI5 are general purpose inputs. They represent the state of the push button switches S1 through S5. DIAG1 through DIAG5 are the latched diagnostic status bits from the output drivers. DIAGx = 1 means an output GPOx has a fault, DIAGx = 0 means output GPOx has no fault. Bit LF is the latched fault bit and is the logical OR of the individual fault bits.

2.4.5.2 Mapping for Assembly Instance #105

Data Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
GPI1	Discrete Input	0x08	1	Value	3
GPI2	Discrete Input	0x08	2	Value	3
GPI3	Discrete Input	0x08	3	Value	3

GPI4	Discrete Input	0x08	4	Value	3
GPI5	Discrete Input	0x08	5	Value	3
Data Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
DIAG1	Output Diagnostic	0x79	1	Value	3
DIAG2	Output Diagnostic	0x79	2	Value	3
DIAG3	Output Diagnostic	0x79	3	Value	3
DIAG4	Output Diagnostic	0x79	4	Value	3
DIAG5	Output Diagnostic	0x79	5	Value	3
LF	Output Diagnostic	0x79	120	Value	3

2.4.5.3 Assembly #122

Byte	7	6	5	4	3	2	1	0
0	FR	0	0	GPO5	GPO4	GPO3	GPO2	GPO1

GPO1 through GPO5 are general purpose outputs. These bits control the state of the outputs, which turn on the indicators in S1 through S5. The FR bit is used to reset the latched fault bits in assembly #105, when it is set to a one. When FR is set to zero it has no effect. After clearing the latched fault bits this bit is set to a zero.

2.4.5.4 Mapping for Assembly Instance #122

Data Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
GPO1	Discrete Input	0x09	1	Value	3
GPO2	Discrete Input	0x09	2	Value	3
GPO3	Discrete Input	0x09	3	Value	3
GPO4	Discrete Input	0x09	4	Value	3
GPO5	Discrete Input	0x09	5	Value	3
FR	Output Diagnostic	0x79	122	Value	3

2.5 Connection Object (0x05)

2.5.1 Class Attributes and Services

No class attributes or services are supported.

2.5.2 Instance Attributes

There are three instances of the Connection Object in the device. Instance #1 is assigned to the explicit messaging connection. Instance #2 is assigned to the Polled I/O connection and the COS/Cyclic Connection. Instance #4 is assigned to the COS/Cyclic Connection. The device does not support the strobe connection or the multicast explicit poll connection. The tables below show the attributes and the predefined values where applicable.

Explicit Message Connection (Instance #1) Attribute List

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	instance_type	USINT	0x00
3	Get	Xport Class Trigger	USINT	0x83
4	Get	Produced connection ID	UINT	0x5FB for MAC ID 63
5	Get	consumed connection ID	UINT	0x5FC for MAC ID 63
6	Get	initial comm characteristics	USINT	0x21
7	Get	produced connection size	UINT	0x0019
8	Get	Consumed connection size	UINT	0x0019
9	Get/Set	Expected packet rate	UINT	Application Dependent
10	N/A	N/A	N/A	Obsolete, Not Used
11	N/A	N/A	N/A	Obsolete, Not Used
12	Get	Watchdog timeout action	USINT	0x01 Auto Delete
13	Get	Produced path length	UINT	0x0000
14	Get	produced path	Array of USINT	<NULL>
15	Get	Consumed path length	UINT	0x0000
16	Get	consumed path	Array of USINT	<NULL>
17	Get	production inhibit timer	UINT	0x0000**

** Connection endpoints in a server device do not use this timer.

Poll/COS/Cyclic I/O Message Connection (Instance #2) Attribute List

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	instance_type	USINT	0x01
3	Get	Xport Class trigger	USINT	0x82 0x80 no poll, no Ack
4	Get	produced connection ID	UINT	0x3FF 0xFFFF no Ack for MAC ID 63
5	Get	consumed connection ID	UINT	0x5FD for MAC ID 63
6	Get	initial comm characteristics	USINT	0x01 0xF1 no poll, no Ack
7	Get	produced connection size	UINT	0x0002
8	Get	consumed connection size	UINT	0x0001
9	Get/Set	expected packet rate	UINT	Application Dependent
10	N/A	N/A	N/A	Obsolete, Not Used
11	N/A	N/A	N/A	Obsolete, Not Used
12	Get	watchdog timeout action	USINT	0x00 Time Out
13	Get	produced path length	UINT	0x0006
14	Get	produced path	Array of USINT	20.04.24.69.30.03
15	Get	consumed path length	UINT	0x0006
16	Get	consumed path	Array of USINT	20.04.24.7A.30.03
17	Get	production inhibit timer	UINT	0x0000** -- Poll app dep. -- COS/Cyclic

** Connection endpoints in a server device do not use this timer.

COS/Cyclic I/O Message Connection (Instance #4) Attribute List

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	instance_type	USINT	0x01
3	Get	Xport Class trigger	USINT	0x12 COS 0x02 Cyclic 0x10 COS, no Ack 0x00 Cyclic, no Ack
4	Get	produced connection ID	UINT	0x37F for MAC ID 63
5	Get	consumed connection ID	UINT	0x5FA 0xFFFF no Ack for MAC ID 63
6	Get	initial comm characteristics	USINT	0x01 0x0F no Ack
7	Get	produced connection size	UINT	0x0002
8	Get	consumed connection size	UINT	0x0000
9	Get/Set	expected packet rate	UINT	Application Dependent
10	N/A	N/A	N/A	Obsolete, Not Used
11	N/A	N/A	N/A	Obsolete, Not Used
12	Get	watchdog timeout action	USINT	0x00 Time Out
13	Get	produced path length	UINT	0x0006
14	Get	produced path	Array of USINT	20.04.24.69.30.03
15	Get	consumed path length	UINT	0x0004 or 0x0000 no Ack
16	Get	consumed path	Array of USINT	20.2B.24.01 <null> no Ack
17	Get	production inhibit timer	UINT	app dependent

2.5.3 Connection Object Services

Service Code	Service Name	Description of Service
0x05	Reset	Reset a timed out connection
0x0E	Get Attribute Single	Returns the value of the specified attribute
0x10	Set Attribute Single	Sets the value of the specified attribute

2.6 Discrete Input(0x08)

There are five instances of the Discrete Input Point Object.

2.6.1 Class Attributes

Attribute ID	Access Rule	Name	Data Type	Description	Value
1	Get	Revision	UINT	Revision of this object	2

2.6.2 Class Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified Attribute

2.6.3 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description	Value
3	Get	Value	BOOL	Input Point Value	0=off 1=on

2.6.4 Instance Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified Attribute

2.6.5 Input Point Mapping

Data Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
GPI1	Discrete Input Point	0x08	1	Value	3
GPI2	Discrete Input Point	0x08	2	Value	3
GPI3	Discrete Input Point	0x08	3	Value	3
GPI4	Discrete Input Point	0x08	4	Value	3
GPI5	Discrete Input Point	0x08	5	Value	3

2.7 Discrete Output (0x09)

There are five instances of the Discrete Output Point Object.

2.7.1 Class Attributes

No class attributes or services are supported for this object.

2.7.2 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description	Value
3	Get/Set	Value	BOOL	Output Point Value	0=off 1=on
5	Get/Set	Fault Action	BOOL	Action taken on output's value in Recoverable Fault State	0=Fault Value 1=Hold Last State
6	Get/Set	Fault Value	BOOL	Value to use for Fault Action	0=off 1=on
7	Get/Set	Idle Action	BOOL	Action taken on output's value in Idle State	0=Idle Value 1=Hold Last State
8	Get/Set	Idle Value	BOOL	Value to use for Idle Action	0=off 1=on

2.7.3 Instance Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified attribute
10	Set_Attribute_Single	Modifies an attribute value

2.7.4 Output Point Mapping

Data Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
GPO1	Discrete Output Point	0x09	1	Value	3
GPO2	Discrete Output Point	0x09	2	Value	3
GPO3	Discrete Output Point	0x09	3	Value	3
GPO4	Discrete Output Point	0x09	4	Value	3
GPO5	Discrete Output Point	0x09	5	Value	3

2.8 Acknowledge Handler Object (0x2B)

The Acknowledge Handler Object is used to manage the reception of message acknowledgements for a COS/Cyclic Connection.

2.8.1 Class Attributes

No class attributes are supported.

2.8.2 Class Services

No class services are supported.

2.8.3 Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description	Value
1	Set	Acknowledge Timer	UINT	Time to wait for acknowledge before resending	[1..65535] ms. 0 is invalid default = 16
2	Get/Set	Retry Limit	USINT	Number of Ack Timeouts before retry limit reached event	[0..255] default = 1
3	Get	COS Producing Connection Instance	UINT	Connection Instance which contains the path of the producing IO application	0x0004 Predefined COS Connection

2.8.4 Instance Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified attribute
10	Set_Attribute_Single	Modifies an attribute value

3 Vendor Specific Objects

3.1 Output Diagnostic Object (0x79)

The Output Diagnostic Object contains information on the health of the Discrete Output Points. For each of the Discrete Outputs there is a corresponding instance of the Output Diagnostic Object. If value of a bit is a one, it indicates that the corresponding output is shorted in the ON state. These bits are latched and must be explicitly reset by setting the value attribute of instance #122 of this object to a one. This is the Fault Reset bit (FR, Bit 7 of Byte 0) of assembly instance #122.

3.1.1 Class Attributes

There is one class attribute, and it applies to all instances of the class.

Attribute ID	Access Rule	Name	Data Type	Description	Value
100	Get/Set	Fault Delay	UINT	Fault Delay Time in msec.	0..65535 Default = 200

This attribute defines a holdoff interval between changing an output and sampling the corresponding output diagnostic bit. Inactivity during this interval allows the output load current to reach a steady state value. If an output is on, and shorted, and drawing more than about 60 ma after this interval, then the output is turned off. The output transistor stage is robust and is designed to handle a short circuit for a protracted period of time. The default value of 200 milliseconds is based on a small sampling of incandescent bulbs, and is more than enough time for LED bulbs.

3.1.2 Class Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified Attribute
10	Set_Attribute_Single	Modifies an attribute value

3.1.3 Instance Attributes

Instances #1 through #5

Attribute ID	Access Rule	Name	Data Type	Description	Value
3	Get	DIAG	BOOL	Diagnostic Bit of GPO	0 = No Fault 1 = Fault

Instance #120

Attribute ID	Access Rule	Name	Data Type	Description	Value
3	Get	LF	BOOL	Latched Fault	1 = Fault 0= No Faults

Instance #122

Attribute ID	Access Rule	Name	Data Type	Description	Value
3	Get/Set	FR	BOOL	Fault Reset	1 = Reset Faults 0= No Operation Always Reads 0

3.1.4 Instance Services

Service Code	Service Name	Description of Service
0E	Get_Attribute_Single	Returns the contents of the specified Attribute
10	Set_Attribute_Single	Modifies an attribute value

3.2 Non-Volatile Test Object

This object is used for test, diagnostic, and factory configuration. This object allows control and manipulation of the non-volatile memory from DeviceNet and must be used with extraordinary care.

3.3 Debug Object

This object is used for test, diagnostic, and factory configuration. This object allows control and manipulation of processor memory and registers from DeviceNet and must be used with extraordinary care. This object may or may not be included in any particular firmware release.

3.4 Vendor Specific Parameter Object

This object is used for test, diagnostic, and factory configuration; it affects the non-volatile memory and must be used with extraordinary care.

3.5 Factory Test Object

This object is used for test, diagnostic, and factory configuration; it affects the non-volatile memory and must be used with extraordinary care.

4 Behavior

The outputs on the DN-500 have some additional behaviors not present on a simple output device.

4.1 Output Behavior

4.1.1 Normal Output Behavior

An output with a normal load, either a LED or an incandescent bulb, is controlled by an I/O or an Explicit Message consumed from the network.

4.1.2 Shorted Load Output Behavior

An output with a shorted load may be turned off by the DN-500 to reduce the power dissipation of the device. The DN-500 output stage is designed to tolerate a shorted load for a reasonable, but not infinite period of time. A shorted load detection circuit allows a shorted output to be turned off. In conjunction with the shorted load detection circuit is a variable Fault Delay Timer. This Fault Delay Timer delays the sampling of the short detection circuit until all normal and expected transients have settled out. This feature is especially useful for incandescent bulbs, which have a low resistance and draw large currents when they are cold, and a higher resistance with a lower current demand when they warm up. The Fault Delay Timer reload value is Class Attribute #100 of the Output Diagnostic Class. Its value is expressed in milliseconds and it has a range of 0 to 65,535. A value of zero corresponds to a short, positive non-zero delay. The default value of 200 was selected based on the properties of a typical incandescent bulb.

4.2 Diagnostic Bit Behavior

4.2.1 Latched Output Diagnostic Bits

The output diagnostic bits belonging to class 0x79, that are used to construct the Input Assembly Instance #105, are latched versions of the bits sampled from the shorted load detection circuit. This is done to insure that the controls will not miss transient conditions that are unexpected. The Fault Reset Bit with, either an I/O Message or an Explicit Message must be used to clear the latched output diagnostic bits.

An output can be successfully turned on in the presence of a latched fault bit if the short has been removed. This is because the decision is made on the basis of the present value of the short detection circuit and not on the latched value.