

# MICROSCAN®

## DN120 DeviceNet Gateway User's Manual



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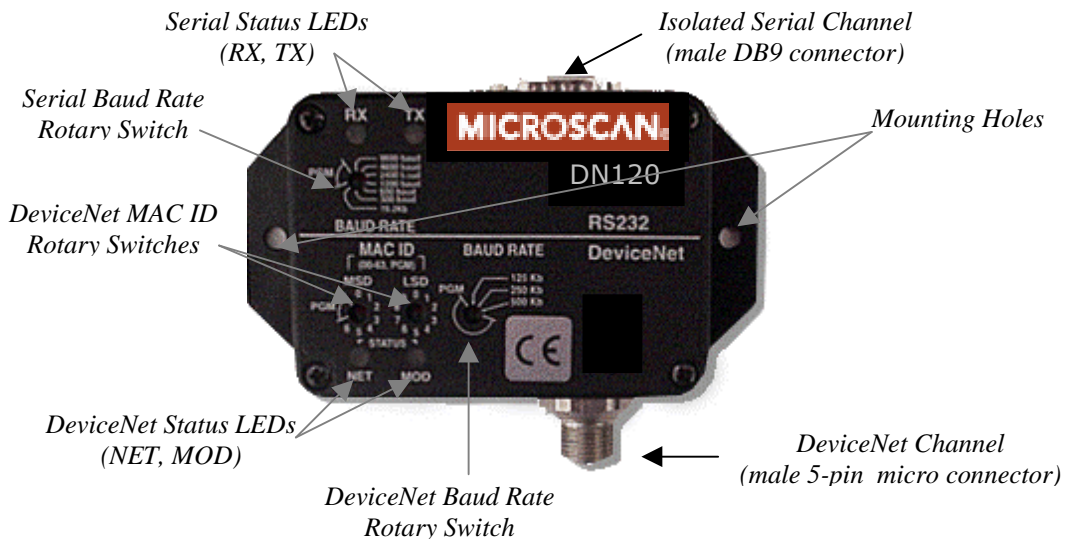
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## Chapter 1 – Overview

This document describes how to install, configure, and operate the DN120 series of serial to DeviceNet gateways. The following products are covered in this user manual:

Part Number	Serial Channel
DN120	RS232 full duplex

The DN120 gateways allow you to easily interface a wide variety of serial devices to any DeviceNet industrial control network. Each gateway contains the feature-packed D.I.P. DeviceNet core. Standard DN120 products are tightly packaged and sealed in a rugged industrial case. Board-level and customized gateways are also available upon request.



### Product Features

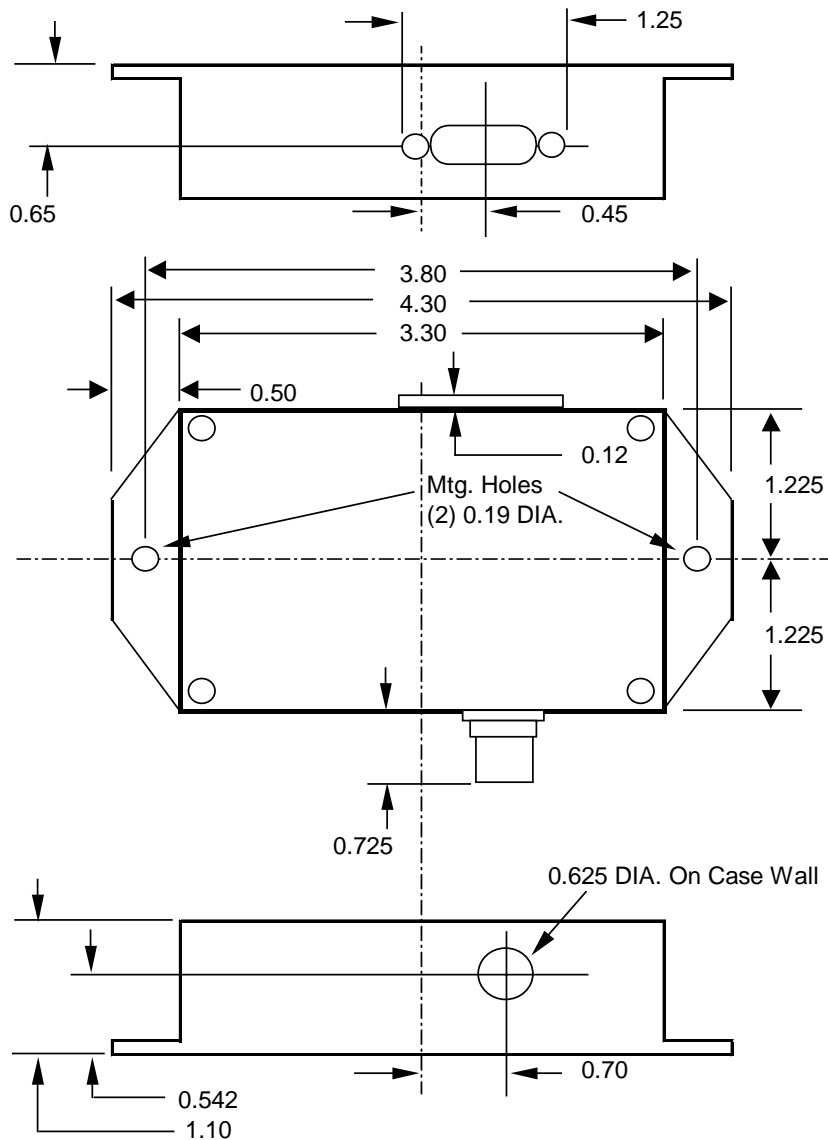
- 500V isolated serial channel
- RS232 with RTS/CTS flow control
- XON/XOFF software flow control
- 300, 600, 1200, 2400, 4800, 9600, 19200 bps serial data rates
- Configurable parity
- 64 byte transmit and receive FIFO buffers
- Powered from DeviceNet 24VDC
- Loss-of-ground protection circuitry
- DeviceNet slave mode supports POLL and EXPLICIT messages
- Rotary switches set DeviceNet baud rate and MAC ID
- Rotary switch sets serial data rate
- 4 bi-color status LEDs
- Encapsulated circuit board in compact industrial case

## Chapter 2 – Installation

This chapter describes how to install and connect the DN120 gateway to a DeviceNet network and your serial device.

### Mounting

Mount on a horizontal or vertical surface. While the RTV encapsulation protects its circuitry, the DN120 serial channel connector is not rated for NEMA4 / IP65 environments. Mount the gateway in a suitable location or enclosure for your application. The gateway will generate up to 1.4W of heat, so provide sufficient clearance and airflow to maintain 0°C to 70°C operating temperature range. Use two screws (not provided) in the 0.19 inch mounting holes shown below to fasten the DN120 to the mounting surface.



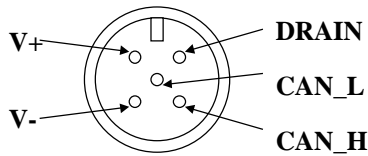
**Wiring**

The DN120 requires two connections – one to the DeviceNet network (male 5-pin micro connector) and one to the target serial device (male DB9 connector). Follow all applicable electrical codes in your area when mounting and wiring any electrical device.

All power is received from the DeviceNet network. The DN120 draws up to 50mA from the 24VDC power supply. Select your DeviceNet cables and power supply so that it can provide sufficient current for all networked devices at their peak operating power.

**DeviceNet Interface**

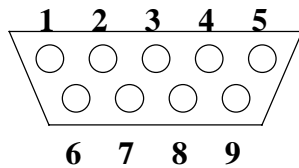
Male 5-Pin Micro Connector



PIN	SIGNAL	COLOR	DESCRIPTION
1	DRAIN	NONE	Cable shield or drain wire.
2	V+	RED	DeviceNet 24VDC(+) power.
3	V-	BLACK	DeviceNet 24VDC(-) power.
4	CAN_H	WHITE	Communication signal.
5	CAN_L	BLUE	Communication signal.

**Serial Channel Interface**

Male DB9 Serial Connector



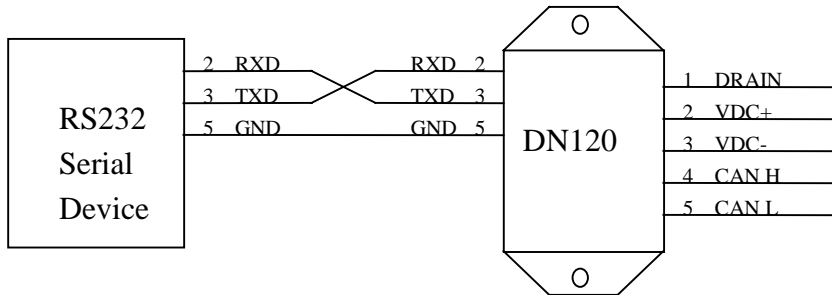
**DN120 (RS232)**

PIN	SIGNAL	DESCRIPTION
1	NC	No Connect. Do not connect any wires to NC pins.
2	RXD	Receive Data. RS232 input signal.
3	TXD	Transmit Data. RS232 output signal.
4	NC	No Connect.
5	GND	Ground. Common for RS232 signals.
6	NC	No Connect.
7	RTS	Request To Send. RS232 output signal.
8	CTS	Clear To Send. RS232 input signal.
9	NC	No Connect.

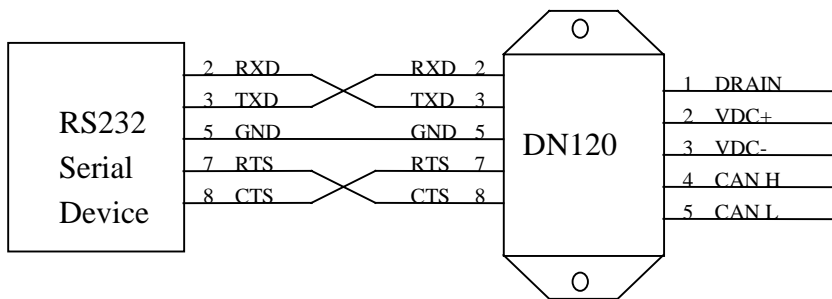
Wiring Examples

The following are typical DN120 gateway wiring configurations. Your RS232 or RS422/485 interface may vary. Refer to your device's documentation for the required data and control signals.

Simple RS232 Interface



RS232 Interface, HW Flow Control

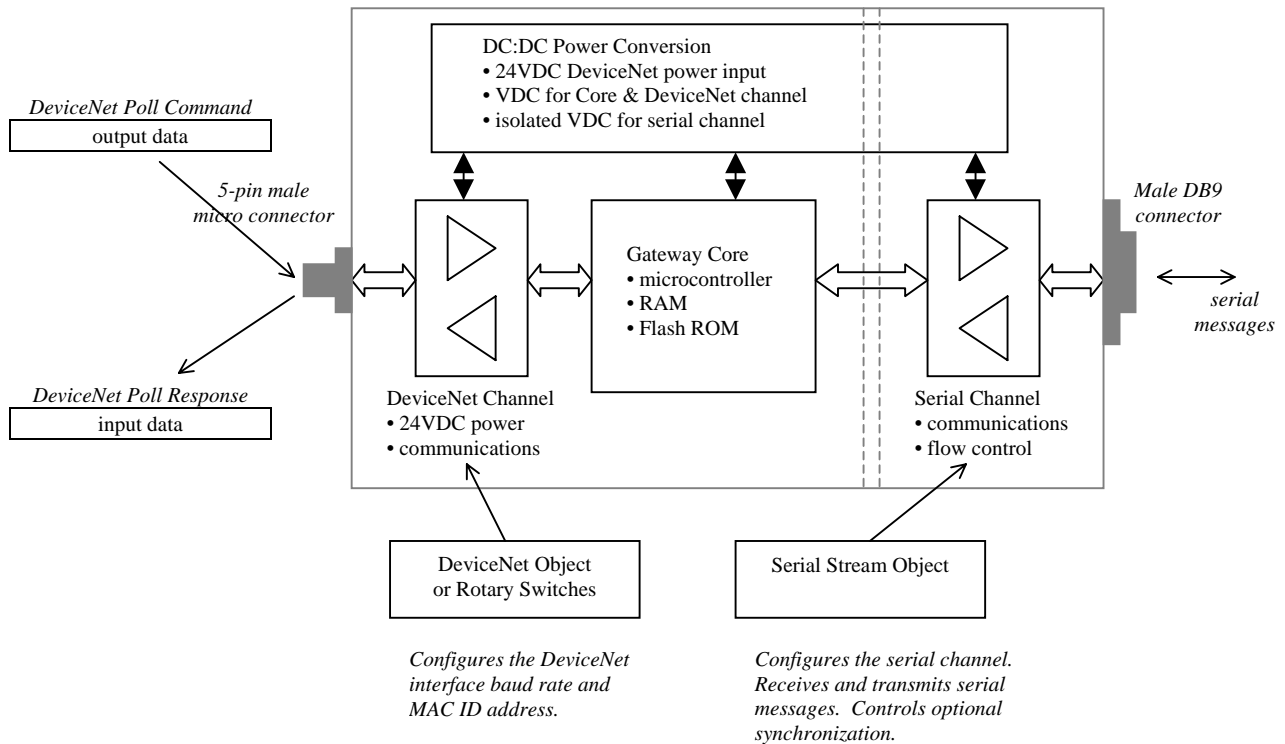


## Chapter 3 – Theory of Operation

This chapter describes how the DN120 gateway operates. You should have a working knowledge of DeviceNet and asynchronous serial communications before continuing. The Open DeviceNet Vendors Association ([www.odva.com](http://www.odva.com)) is a good source for general DeviceNet information. Refer to your serial device documentation for its protocol information.

### Gateway Operation

The DN120 gateway receives asynchronous serial messages over its serial channel and returns the received bytes as input data to the DeviceNet master. The gateway transmits bytes sent as output data from the DeviceNet master out its serial channel. The following diagram shows the major gateway components.



### DeviceNet Object Model

The DeviceNet Specification defines an Object Model that consists of Objects and Attributes. An Object is a predefined software process, and an Object Attribute is a data value used or generated by that process. An Object Instance is one occurrence of an Object, operating on its unique set of Attribute values. The DN120 gateway has six different Object Classes, or types. Five are standard objects defined by the DeviceNet Specification (*Identity, Router, DeviceNet, Assembly, Connection*). One is a device-specific object defined for the DN120 gateway (*Serial Stream*). The *Serial Stream Object* configures and controls the serial channel. It receives and packages serial data into DeviceNet input bytes, and transmits DeviceNet output bytes as serial data. Chapter 5 contains detailed information on each DeviceNet object class, instance, and their associated attributes.



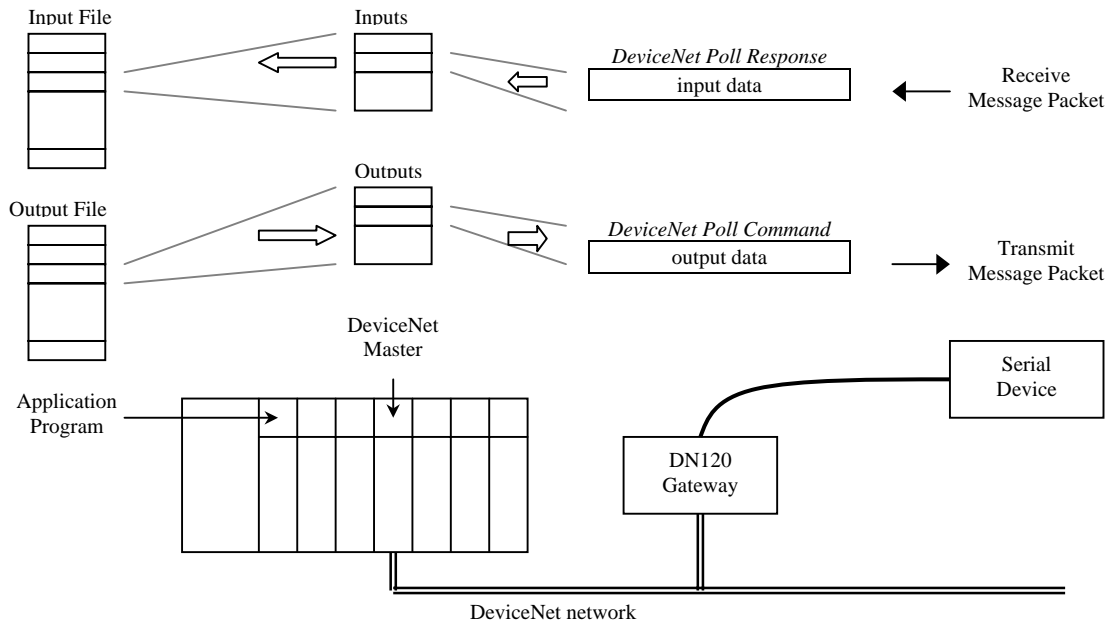
DeviceNet Interface

The DN120 gateway operates as a DeviceNet slave. It supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. The Explicit Unconnected Message Manager (UCMM) is not supported.

There are four independent processes operating in a DN120 gateway application. The first process is the exchange of input and output data between the user application program and the DeviceNet master. The second process is the exchange of input and output data between the gateway and DeviceNet master, using Polled I/O messaging. The third process is receiving serial messages and converting it to input data. The fourth process is converting output data and transmitting it as serial messages.

The DeviceNet Polled I/O Message process consists of the DeviceNet master sending output data to the DN120 in the form of a Poll Command message, and the DN120 returning input data to the DeviceNet master in a Poll Response message. The output and input data bytes are typically mapped into data files inside the DeviceNet master. These data files are exchanged with the user application program. The application processes the received input data from the gateway and writes new output data to the DeviceNet master, which sends them to the gateway.

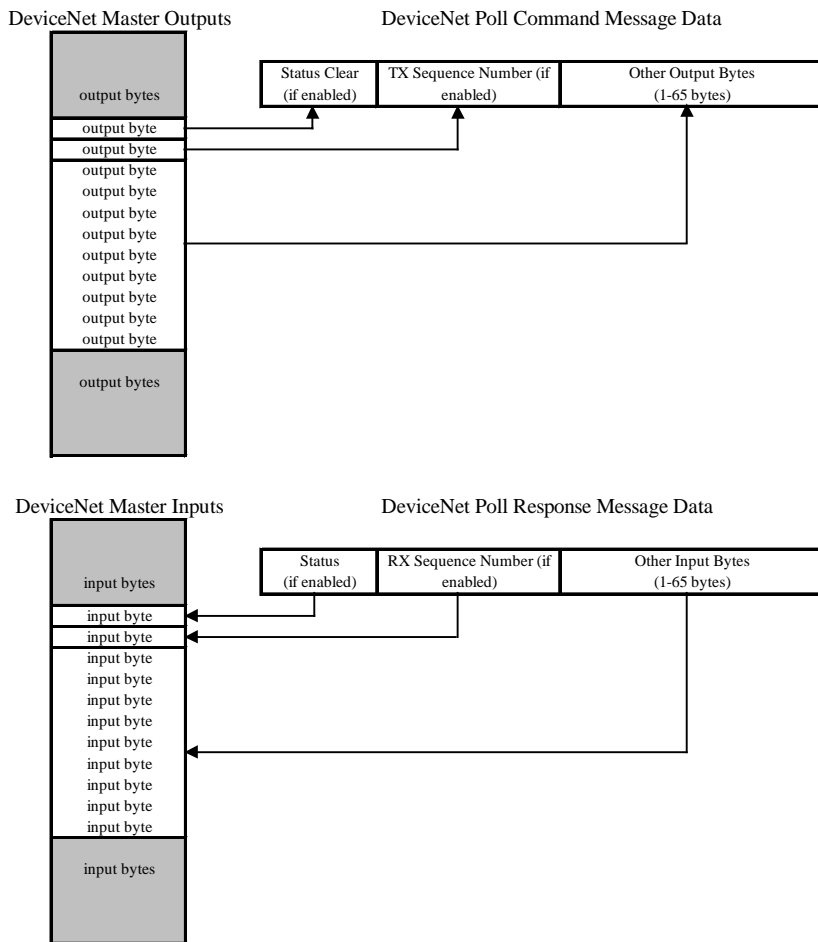
The Polled I/O data exchange typically occurs at a faster rate than the serial transmit and receive operation, because the DeviceNet baud rate is much greater than the serial channel baud rate. The DN120 has transmit and receive buffers to handle the slower serial processes. The gateway also provides synchronization features to ensure delivery of received messages to the application program, and transmission of application messages out the serial channel.



The DN120 configuration defines the number of output bytes in a Poll Command message, and the number of input bytes in a Poll Response message. Each Poll Command and Poll Response message can contain up to 2 overhead bytes for DN120 status and data synchronization information. The remaining bytes contain output data to be transmitted out the serial channel, or input data received by the serial channel.

The following diagram shows how the input and output bytes map into the Poll Response and Poll Command messages. The gateway supports a maximum of 67 output bytes in a Poll Command message, and a maximum of 67 input bytes in a Poll Response message.

**DeviceNet Master Mapping of DeviceNet Poll Command and Poll Response Data**



**Serial Channel Interface**

The DN120 serial channel consists of an asynchronous serial transmitter and receiver. The serial interface is configured and controlled by the *Serial Stream Object*. The *Serial Stream Object* attributes configure the serial channel baud rate, parity, and flow control. This configuration applies to both the serial transmitter and receiver. The DN120 gateway has separate 64-byte serial transmit and receive FIFO buffers, allowing full duplex operation when supported by the physical layer media.

### Asynchronous Serial Communication

Devices communicating on an asynchronous serial link exchange information one bit at a time. Each bit is transmitted for a specific period of time, defined by the baud rate. Devices use internal timing circuitry to generate the baud rate. There is no clocking signal between devices to synchronize the serial data flow, hence the term *asynchronous* serial communications.

Serial data bits are organized into bytes. When a data byte is asynchronously transmitted, it is preceded by a start bit, followed by the data bits, an optional parity bit, and one or more stop bits. There can be a variable transmission delay between successive data bytes, since each byte is framed by its own start and stop bits. The receiver starts saving bits after it receives a valid start bit (0), and stops when it receives the expected number of stop bits (1). The data byte's least-significant bit is transmitted first (data bit 0), and the most-significant bit is last (data bit N).

[ start bit ] [ data bit 0 ] [ data bit 1 ] ... [ data bit N ] [ optional parity bit ] [ stop bit(s) ]

The parity bit detects single-bit errors in the transmission. The parity bit is calculated and inserted by the transmitter. The receiver calculates the parity of an incoming byte, and compares it to the parity bit sent by the transmitter. If the two bit values do not match, then at least one serial bit value was corrupted during transmission.

Flow control enables the receiving device to regulate the rate of incoming data. Hardware flow control uses RTS/CTS signals between the devices to control the rate of transmission. Software flow control uses serial characters XON/OFF to control the rate. CTS Detect Mode uses the CTS signal to enable serial communications. Flow control helps prevent data loss, if the receiving device cannot store incoming data fast enough, or if its Receive Buffer is full and cannot accept more data until existing data is processed.

The DN120 supports baud rates from 300 to 19200 bits per second. It supports 8 data bits with no parity, 7 data bits with parity, and 1 stop bit. The DN120 model supports RTS/CTS, XON/XOFF, and CTS Detect Mode flow control options.

### Status Information

The gateway can be configured to return serial channel status information in the Poll Response message, and receive error-clearing commands in the Poll Command message. When enabled, the *Status* byte is returned as an input byte, and the *Status Clear* byte is received as an output byte. These bytes contain 8 status bits, defined below. Each bit represents either an error or state condition for the serial transmitter and receiver. Clearing the associated error bit in the *Status Clear* output byte will reset Receive Parity Error, Receive Buffer Overflow, Framing Error, and Transmit Buffer Overflow error conditions.

#### **Status / Status Clear Bytes**

Bit	Status (1 <sup>st</sup> input byte)	Status Clear (1 <sup>st</sup> output byte)
0	Transmit Channel Blocked	not used
1	Transmit Buffer Empty	not used
2	Receive Parity Error	Set = 0 to clear Receive Parity Error condition
3	Receive Buffer Empty	not used
4	Receive Buffer Overflow	Set = 0 to clear Receive Buffer Overflow condition
5	Framing Error	Set = 0 to clear Framing Error condition
6	Transmit Buffer Overflow	Set = 0 to clear Transmit Buffer Overflow condition
7	CTS Signal State (1 = asserted)	not used

A user application can use the Transmit Buffer Empty and Receive Buffer Empty status bits to monitor the transmitter and receiver states. However, the DN120 gateway also has three data synchronization features (*Receive Sequence Number*, *Transmit Sequence Number*, *Handshake Protocol*) that an application can use to better monitor the serial operations.

Receiving Messages

The DN120 gateway has two modes for receiving serial data: *Stream Mode* and *Block Mode*. *Stream Mode* is best suited for applications with fixed-length serial messages, but it can also be used to capture any stream of serial data. *Block Mode* is intended for both fixed and variable-length message applications, where a *Delimiter* byte denotes the beginning or end of a message.

Stream Mode

*Stream Mode* saves all received message bytes in the Receive Buffer. There is no defined beginning or end to the message *stream*. The only limitation is the gateway must send bytes from the Receive Buffer to the DeviceNet master (Poll Response message) faster than it saves new message bytes in the Receive Buffer, or the 64-byte buffer may eventually overflow.

Incoming data stream

```
0x45 0x62 0x02 0x31 0x32 0x32 0x42 0x45 0x02 0x42 0x43 0x44 ...
```

**Stream Mode**

```
0x45 0x62 0x02 0x31 0x32 0x32 0x42 0x45 0x02 0x42 0x43 0x44 ...
```

*Message Bytes*

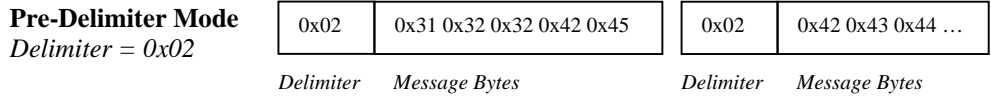
Block Mode

*Block Mode* uses a configurable *Delimiter* byte to signal the start or end of a new message packet. The *Delimiter* cannot be used in any other part of the message, or it would be incorrectly interpreted as the start or end of a message. The gateway can be configured to save the *Delimiter* byte in the Receive Buffer, or discard it. In *Block Mode*, the gateway does not return any new message data to the DeviceNet master until the entire serial message has been received.

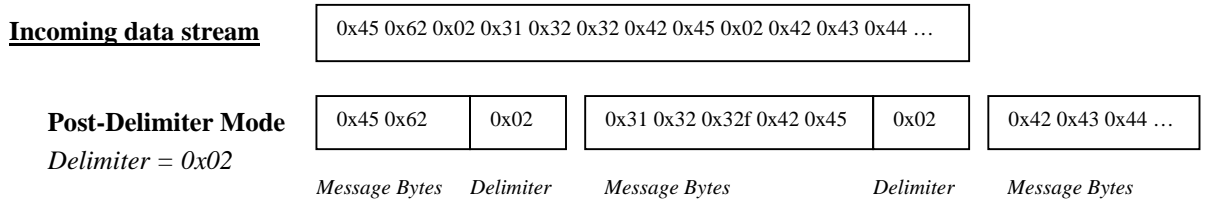
The *Pre-Delimiter Block Mode* configuration expects the *Delimiter* at the start of a message. When a *Delimiter* byte is received, the gateway saves all subsequent bytes in the Receive Buffer until another *Delimiter* is received (signaling the start of another message), or until the *Maximum Receive Size* number of bytes has been saved. All bytes received after the *Maximum Receive Size* and before the next *Delimiter* are discarded. In this mode, the maximum number of bytes in a single message is defined by the *Maximum Receive Size* attribute.

Incoming data stream

```
0x45 0x62 0x02 0x31 0x32 0x32 0x42 0x45 0x02 0x42 0x43 0x44 ...
```



The *Post-Delimiter Block Mode* configuration expects the *Delimiter* at the end of a message. The gateway saves all received bytes in the Receive Buffer until a *Delimiter* is received. In this mode, the maximum number of bytes in a single message is limited by the Receive Buffer size (64 bytes), not the *Maximum Receive Size* attribute.



**Returning Received Data**

When the gateway receives a Poll Command message, it removes some or all of the bytes currently in the Receive Buffer and returns them as input bytes in a Poll Response message. The *Maximum Receive Size* attribute defines the maximum number of bytes that can be returned in a single Poll Response message. If the Receive Buffer contains more bytes than can fit into one Poll Response message, the remaining bytes are returned in subsequent Poll Response messages. *RX Message* is the string of valid message bytes returned in a single Poll Response message. The *RX Message* byte string can be formatted as either a Short\_String (byte array with 1<sup>st</sup> byte = length) or a Byte Array (no length byte). The number of bytes in an *RX Message* string can be less than or equal to the *Maximum Receive Size*, but never larger. When the number is less, the remaining Poll Response input bytes are either padded or undefined.

In *Stream Mode*, the gateway will always try to fill Poll Response message with bytes from the Receive Buffer. The only time the *RX Message* size is less than the *Maximum Receive Size* is when there are no more bytes in the Receive Buffer.

In *Block Mode*, the gateway will not return any data in a Poll Response message unless it has a complete serial message saved in the Receive Buffer. If the message sizes are small, the gateway may have several messages saved in the Receive Buffer, depending upon how fast the DeviceNet master polls the gateway for data. The messages are returned one at a time in a Poll Response message, regardless of their size. If the message is large, then it is returned in multiple Poll Response messages.

**Padding Message Data**

If the number of *RX Message* bytes currently in the Receive Buffer is less than the *Maximum Receive Size* number, then the remaining input bytes are undefined. The gateway can optionally fill the unused input bytes with a *Pad* character. The *Pad* characters can be added at the beginning or end of the message.

**Poll Response Message Data**

Status	Receive Sequence Number	other input bytes
--------	-------------------------	-------------------

1. The are enough message bytes in Receive Buffer to fill Poll Response.

RX Message bytes
------------------

2. The are not enough message bytes in Receive Buffer to fill Poll Response. Unused input bytes are undefined.

RX Message bytes	undefined
------------------	-----------

3. The are not enough message bytes in Receive Buffer to fill Poll Response. Pad bytes are added after message bytes.

RX Message bytes	Pad Bytes
------------------	-----------

4. The are not enough message bytes in Receive Buffer to fill Poll Response. Pad bytes are added before message bytes.

Pad Bytes	RX Message Bytes
-----------	------------------

If configured for *Pre-Delimiter Block Mode* and the *Delimiter* byte is saved, the *Pad* characters are added either after the last valid message byte (right justification) or before the *Delimiter* byte (left justification).

If configured for *Post-Delimiter Block Mode* and the *Delimiter* byte is saved, the *Pad* characters are added either before the first valid message byte (left justification), or after the last valid message byte but before the *Delimiter* byte (right justification).

**Re-sending Received Data**

The DN120 gateway can be configured to return received message bytes only once in a Poll Response message, and return no data (null value) in subsequent Poll Response messages until new message bytes are received. For the *Short\_String* data type, a null value consists of the length byte = 0. For the *Byte Array* data type, a null value consists of no data.

The gateway can also be configured to always return received message bytes in a Poll Response message. If no new bytes in the Receive Buffer, then the last received bytes are returned. If new bytes are in the Receive Buffer, then they are returned. The gateway provides *Receive Sequence Number* or *Handshake Protocol* synchronization options to indicate whether the returned bytes represent old or new data.

Transmitting Messages

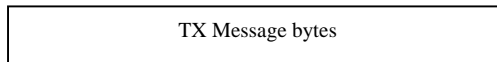
The *Serial Stream Object* receives output bytes (*TX Message*) from the DeviceNet master in a Poll Command message. It saves the output bytes in the Transmit Buffer, to be transmitted when the serial channel is available. The maximum number of bytes that can be sent in one Poll Command message is defined by the *Maximum Transmit Size* attribute. The Transmit Buffer can hold up to 64 bytes. Because the DeviceNet Polled I/O data exchange may occur many times faster than the transmission of serial data, the application may need to synchronize the transmit data exchange with the gateway.

The number of output bytes in the Poll Command message is fixed. The *Status Clear* and *Transmit Sequence Number* bytes are always sent, if enabled. The remaining number of bytes in the Poll Command is defined by the *Maximum Transmit Size* attribute. If the number of *TX Message* bytes sent is less than the *Maximum Transmit Size* number, then the remaining output bytes are undefined. The gateway uses the *Short\_String* length to determine the valid number of bytes to transmit. If Byte Array format is used, all the bytes are transmitted.

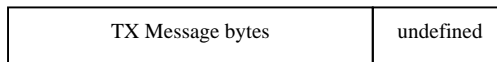
**Poll Command Message Data**

<i>Status Clear</i>	<i>Transmit Sequence Number</i>	<i>other output bytes</i>
---------------------	---------------------------------	---------------------------

1. *TX Message* bytes fill Poll Command message.



2. *TX Message* is smaller than Poll Command message. Unused output bytes are undefined.



Synchronization

To ensure that no information is lost between the gateway's serial channel and the user application program, the DN120 has three synchronization options: *Receive Sequence Number*, *Transmit Sequence Number*, and *Handshake Protocol*.

Receive Sequence Number

When enabled, the gateway returns a *Receive Sequence Number* input byte in the DeviceNet Poll Response message. The 8-bit *Receive Sequence Number* is incremented by the gateway whenever it returns new data in the input bytes. The user application uses the *Receive Sequence Number* to signal the receipt of new message data. Valid numbers are 0-255.

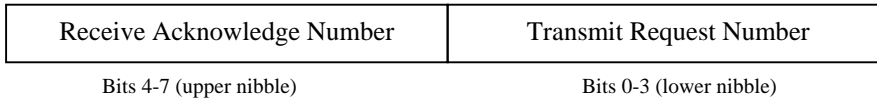
Transmit Sequence Number

When enabled, the gateway receives a *Transmit Sequence Number* output byte in the DeviceNet Poll Command message. The gateway will not send the *TX Message* bytes out the serial channel unless the 8-bit *Transmit Sequence Number* is different than the last received value. Valid numbers are 0-255.

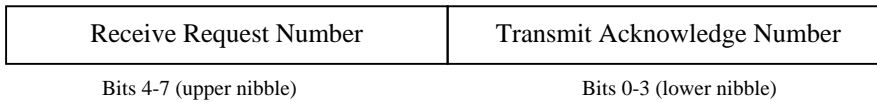
Synchronous Handshake Protocol

The gateway can be configured with a more robust transmit and receive synchronization process. The Handshake protocol requires the user application to acknowledge the receipt of new *RX Message* input bytes. The protocol also requires the gateway to acknowledge the transmission of the last *TX Message* output bytes. When enabled, both the *Receive Sequence Number* input byte and *Transmit Sequence Number* output byte are used. They are segmented into four 4-bit numbers, shown below. Valid numbers are 1 to 15, with 0 reserved to reset the gateway's numbers.

*Transmit Sequence Number byte*

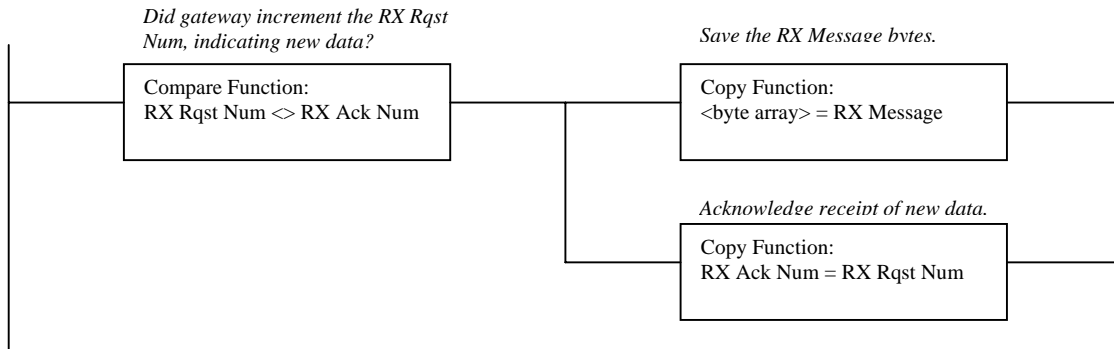


*Receive Sequence Number byte*



The *Receive Request Number* is incremented by the gateway when it returns new *RX Message* input bytes in the Poll Response Message. The gateway will increment from 15 to 1, skipping 0. The user application acknowledges receipt of this *RX Message* by setting the *Receive Acknowledge Number* equal to the *Receive Request Number*. The updated *Receive Acknowledge Number* is sent back to the gateway in the next Poll Command Message. When the *Receive Acknowledge Number* equals the *Receive Request Number*, the gateway can return the next set of *RX Message*. If the user application sends 0 as the *Receive Acknowledge Number*, the gateway resets its *Receive Request Number* to 0.

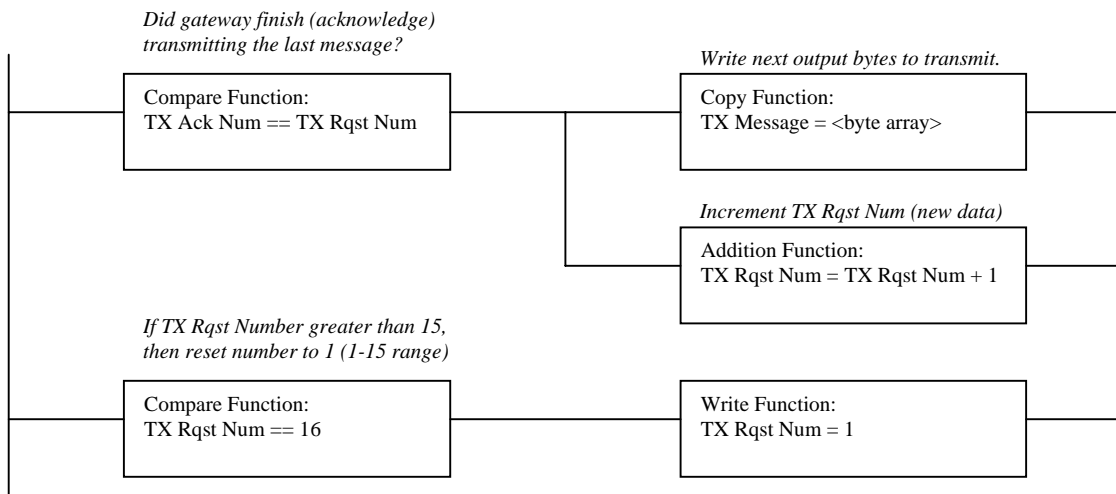
The following ladder-logic rung shows how the user application program can monitor the gateway's *Receive Request Number* (RX Rqst Num), save the new *RX Message* bytes, and set *Receive Acknowledge Number* (RX Ack Num) equal to *Receive Request Number* (RX Rqst Num).





The *Transmit Request Number* is incremented by the user application when it sends new *TX Message* output bytes in the Poll Command Message. After the gateway transmits these *TX Message* bytes, it sets the *Transmit Acknowledge Number* equal to the *Transmit Request Number*, acknowledging the transmission. The updated *Transmit Acknowledge Number* is returned in the next Poll Response Message. If the user application sends 0 as the *Transmit Request Number*, the gateway ignores the *TX Message* output bytes and resets its *Transmit Acknowledge Number* to 0.

The following ladder-logic rungs show how the user application program writes a new *TX Message* value, increments the *Transmit Request Number* (TX Rqst Num), and waits for the *Transmit Acknowledge Number* (TX Ack Num) to equal the *Transmit Request Number* (TX Rqst Num). Note the application must wrap the *Transmit Request Number* from 15 to 1.



## Chapter 4 – Gateway Configuration

This chapter describes how to configure and operate the DN120 gateway. You configure the gateway by reading and writing attribute values over its DeviceNet interface. There are a variety of DeviceNet configuration tools available. Simple configuration tools use GET\_ATTRIBUTE and SET\_ATTRIBUTE explicit message commands to read and write attribute values, addressing each attribute by its Object, Instance, and Attribute numbers. This information is contained in Chapter 5. More sophisticated configuration tools use EDS files to simplify attribute configuration. You can configure the gateway using pull-down menus, buttons, and data entry fields from the gateway's Electronic Data sheet (EDS) file. Chapter 6 contains a configuration example using the Rockwell Software RSNetwork<sup>TM</sup> program.

### Configure DeviceNet Interface

Set the DeviceNet Baud Rate and MAC ID Address using the rotary switches. Configure switches before connecting to the DeviceNet network. There is either a small triangular indicator or white indicator on the switch. Use a small screwdriver to align that indicator with the desired setting. Remove the DN120 cover if necessary to access the rotary switches.

#### DeviceNet Baud Rate Switch

Valid settings are 125K, 250K, 500K, or PGM. When PGM is selected, the DN120 uses the baud rate saved in its retentive memory. A valid baud rate must be stored before the PGM selection can be used. The baud rate is stored from the previous DN120 power cycle. It can also be set over the network (DeviceNet Object Baud Rate attribute).

POSITION	SETTING	POSITION	SETTING
0	125 Kbps	5	invalid
1	250 Kbps	6	invalid
2	500 Kbps	7	invalid
3	invalid	8	invalid
4	invalid	9	PGM

#### MAC ID Switches

The two MAC ID switches represent decimal numbers from 00 to 99. The LSB switch selects the *Ones* digit and the MSB switch selects the *Tens* digit. Valid MAC IDs are 00 to 63. Setting a MAC ID address greater than 63 forces the gateway to use the MAC ID saved in retentive memory. A valid MAC ID must first be stored before this feature can be used. The MAC ID is stored from the previous DN120 power cycle. It can also be set over the network (DeviceNet Object MAC ID attribute).

MSB	LSB	Address	MSB	LSB	Address
0	0 to 9	00 to 09	6	4 to 9	stored address
1	0 to 9	10 to 19	7	0 to 3	stored address
2	0 to 9	20 to 29	8	0 to 9	stored address
3	0 to 9	30 to 39	9	0 to 9	stored address
4	0 to 9	40 to 49			
5	0 to 9	50 to 59			
6	0 to 3	60 to 63			

Serial Channel Baud Rate / Option Switch

The DN120 gateway has a rotary switch for the serial channel. This switch has different functions for the DN120 models.

The DN120 model uses the rotary switch to select the RS232 channel baud rate. Valid settings are 300, 600, 1200, 2400, 4800, 9600, 19200 bits per second, and PRG (table below). When PRG is selected, the DN120 uses the *Baud Rate* attribute in the *Serial Stream Object*. A valid baud rate must be written over DeviceNet to this attribute.

<u>POSITION</u>	<u>SETTING</u>	<u>POSITION</u>	<u>SETTING</u>
0	9600 bps	5	300 bps
1	4800 bps	6	19200 bps
2	2400 bps	7	invalid
3	1200 bps	8	invalid
4	600 bps	9	PRG

**Power Up Gateway**

Connect the gateway to a DeviceNet network to power up the gateway.

DeviceNet Status LEDs

The DN120 gateway has two bi-color status LEDs (*NET* and *MOD*) that indicate operational status. During power-up, the LEDs cycle through a sequence of alternating red and green. After power-up, the *NET* LED should be flashing green (or solid green if allocated to a DeviceNet master) and the *MOD* LED should be solid green. If this does not occur, disconnect from DeviceNet and verify all the switch settings. See Chapter 8 for additional troubleshooting topics.

<b>State</b>	<b>DeviceNet Status LED (<i>NET</i>)</b>
Off	No power.
Flashing Red	Configuration error. Check DeviceNet switch settings.
Solid Red	Unrecoverable error.
Flashing Green	Device not allocated to a DeviceNet master.
Solid Green	Normal runtime, device allocated as a slave.

<b>State</b>	<b>Module Status LED (<i>MOD</i>)</b>
Off	No power.
Flashing Red	Configuration error. Check object attribute settings.
Solid Red	Unrecoverable error.
Flashing Green	Not defined.
Solid Green	Normal Operation.

Serial Channel Status LEDs

The gateway has two bi-color LEDs to indicate serial channel activity. The *TX* LED flashes green when a packet is being transmitted. The *RX* LED flashes green when a packet is being received. A fault is indicated by solid red. After power-up, both LEDs should be off.

<b>State</b>	<b>Transmit Status LED (TX)</b>
Off	No data being transmitted
Flashing Red	Not defined
Solid Red	Transmit error (parity or overrun error)
Flashing Green	Data being transmitted
Solid Green	Not defined

<b>State</b>	<b>Receive Status LED (RX)</b>
Off	No data being received
Flashing Red	Not defined
Solid Red	Receive error (parity or overrun error)
Flashing Green	Data being received
Solid Green	Not defined

Register EDS File

If using a DeviceNet configuration tool that supports Electronic Data Sheet (EDS) files, you should now register the gateway's EDS file with the software. The latest EDS file versions can be downloaded from [www.mkinst.com](http://www.mkinst.com). Select the EDS file that matches your gateway's part number and firmware version. Follow your configuration tool instructions to register EDS file.

**Configure Serial Channel**

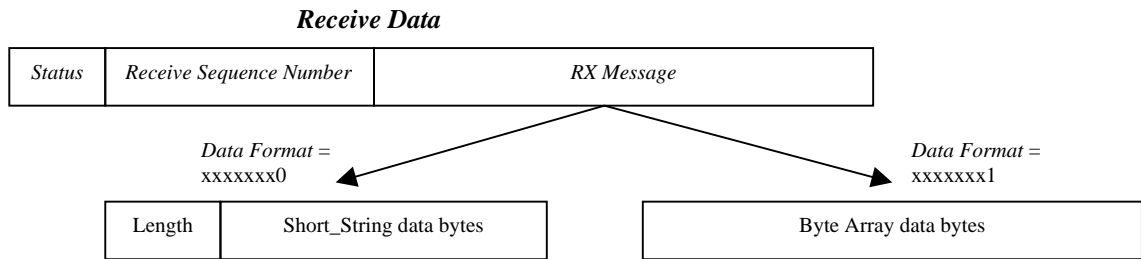
The *Serial Stream Object* attributes control the DN120 serial channel. These settings apply to all serial transmit and receive operations. Before you can set or change any gateway configuration settings, make sure the gateway is not in the DeviceNet master scanlist.

**Serial Stream Object Instance Attributes (Class Code 64)**

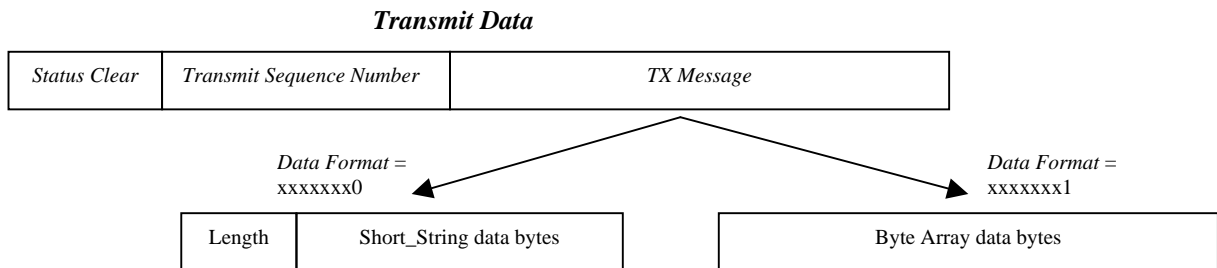
Number	Name	Data Type	Value
3	Receive Data	Short_String or Byte Array	Received message data. Returned in Poll Response Message.
4	Transmit Data	Short_String or Byte Array	Message data to transmit. Received in Poll Command Message.
5	Status	USINT	Bit 0 – Transmit Channel Blocked Bit 1 – Transmit Buffer Empty Bit 2 – Receive Parity Error (set = 0 to clear) Bit 3 – Receive Buffer Empty Bit 4 – Receive Buffer Overflow Error (set = 0 to clear) Bit 5 – Framing Error (set = 0 to clear) Bit 6 – Transmit Buffer Overflow Error (set = 0 to clear) Bit 7 – CTS Signal State (1 = asserted)
6	Baud Rate	USINT	0 = 9600 bps                      4 = 600 bps 1 = 4800 bps                     5 = 300 bps 2 = 2400 bps                    6 = 19200 bps 3 = 1200 bps
7	Parity	USINT	0 = no parity                      5 = mark (force to 1) 1 = even parity                   6 = space (force to 0) 2 = odd parity
8	Data Size	USINT	Read-only. 7 bits if parity enabled, 8 bits if no parity.
9	Stop Bits	USINT	Read-only. Fixed at 1 bit.
10	Flow Control	USINT	0 = none                              2 = CTS / RTS 1 = XON / XOFF                    4 = CTS Detect Mode
11	Receive Count	USINT	Number of bytes in Receive Buffer. Any write clears buffer.
12	Transmit Count	USINT	Number of bytes in Transmit Buffer. Any write clears buffer.
13	Maximum Receive Size	USINT	Defines the maximum #bytes returned by RX Message read.
14	Data Format	USINT	Bit 0 – String Format (0 = Short_String, 1 = Byte Array) Bit 1 – Strip Parity Bits (0 = retain, 1 = strip) Bit 2 – Pad Justification (0 = left justify, 1 = right justify) Bit 3 – Pad Received Message (0 = no, 1 = yes)
15	Block Mode	USINT	Bit 0 – Pre/Post Delimiter (0 = pre-delimiter, 1 = post-delimiter) Bit 1 – Strip Delimiter (0 = keep delimiter, 1 = strip delimiter) Bit 2 – Delimiter Enable (0 = no, 1 = yes) Bit 3 – Enable Receive Sequence Number (0 = no, 1 = yes) Bit 4 – Enable Transmit Sequence Number (0 = no, 1 = yes) Bit 5 – Re-send (0 = no, 1 = yes) Bit 6 – Synchronization (0 = no, 1 = handshake protocol)
16	Delimiter	USINT	Delimiter byte value
17	Pad Character	CHAR	Pad byte value
18	Maximum Transmit Size	USINT	Defines the maximum # bytes that can be transmitted.
19	Idle String	Short_String	1-16 byte string transmitted when gateway receives a null Poll (no input bytes). Short_String length = 0 for no Idle String.

20	Fault String	Short_String	1-16 byte string transmitted when gateway's Polled I/O connection times out. Short_String length = 0 for no Fault String.
21	Status Enable	USINT	Set to any nonzero value to enable Status input byte.
22	Status Clear Enable	USINT	Set to any nonzero value to enable Status Clear output byte.
23	Four Wire	USINT	NA
24	Option Switch	USINT	NA

**Receive Data** – Data from the last valid message packet. *Receive Data* includes the *Status* and *Receive Sequence Number* bytes if enabled, and the *RX Message* bytes. The *RX Message* format is either Short\_String or Byte Array, defined by *Data Format* attribute. If no message data is available, the *RX Message* will be a null packet or Short\_String with length = 0. *Receive Data* is returned in the DeviceNet Poll Response Message.



**Transmit Data** – Data to transmit out the serial channel by the gateway. *Transmit Data* includes the *Status Clear* and *Transmit Sequence Number* bytes if enabled, and the *TX Message* bytes. Format is either Short\_String or Byte Array, defined by *Data Format* attribute. *Transmit Data* is typically received in the DeviceNet Poll Command Message. Reading *Transmit Data* returns the last byte in the Transmit Buffer.



**Status** – Contains bit-mapped serial channel status and error bits for transmit and receive operations. Clearing the bits indicated will clear the error condition.

**Baud Rate** – Sets the serial channel's data or baud rate. Enter number from 1-6 to select corresponding baud rate value. For DN120, the RS232 Baud Rate switch must be set to PRG before this attribute can be used to set the baud rate.

**Parity** – Selects the parity type used in the serial byte.

**Data Size** – Read-only attribute indicates number of data bits in one serial byte. This number does not include start, parity, or stop bits. If parity is enabled, 7 data bits are used. If no parity, 8 data bits are used.

**Stop Bits** – Read-only attribute indicates number of stop bits in one serial byte. Fixed at 1.

**Flow Control** – Selects the method of flow control used across the serial interface.

*NONE* means there is no flow control over the serial data exchange. The transmitting device can overflow the receiving device's buffer.

*XON/XOFF* is a software flow control option. Receiving device sends an XOFF character to the transmitting device when its buffer is full, stopping further transmission. It sends an XON character when it can again receive data. The XOFF and XON characters are not saved as message data.

*CTS/RTS* is an RS232 hardware flow control option, available only on the DN120 gateway. The RTS is an output and CTS is an input signal. The gateway keeps RTS active (low) when it can receive data. It only transmits data when CTS is active (low).

CTS Detect Mode is an RS232 hardware flow control option, available only on the DN120 gateway. When CTS is asserted, the DN120 serial channel can transmit and receive. When CTS is not asserted, the DN120 serial channel is disabled and Receive Buffer cleared.

**Receive Count** – Number of bytes currently available in the Receive Buffer. Writing any value to this attribute will clear the Receive Buffer.

**Transmit Count** – Number of bytes currently in the Transmit Buffer. Writing any value to this attribute will clear the Transmit Buffer.

**Maximum Receive Size** – Defines the maximum number of data bytes to be returned when the Receive Buffer is read using either an Explicit Message or a Poll Response Message.

**Data Format** – Control byte that defines the format of the *TX Message* and *RX Message* bytes transferred across DeviceNet.

Bit 3 selects whether the *RX Message* bytes are padded with the Pad bytes. Set this bit = 1 to enable. If there are not enough message bytes in the Receive Buffer to fill up the *RX Message* input bytes, then Pad characters are added at either the beginning or end of the message bytes.

Bit 2 selects whether Pad bytes are added at the beginning of the message (0 = left justify) or at the end of the message (1 = right justify). This bit is used only if the Pad option is enabled.

Bit 1 defines whether the gateway saves the parity bit in received message bytes (set = 0), or if the gateway forces the parity bit to 0 in received message bytes (set = 1). This is typically used when receiving 7-bit ASCII data.

Bit 0 defines String Format for *TX Message* and *RX Message* byte strings. Set to 0 for Short\_String format, and 1 for Byte Array format. Short\_String defines the first byte as an explicit length byte, containing the number of bytes that follow. Byte Array has an implied length, derived from the *Maximum Receive Size* attribute.

**Block Mode** – Control byte that defines the serial receive mode, synchronization mode, and re-send message option.

Bit 6 enables the Handshake Protocol synchronization option. When enabled, the *Receive Sequence Number* byte is added to *Receive Data* input bytes, and the *Transmit Sequence Number* byte is added to the *Transmit Data* output bytes.

Bit 5 enables the re-send message option. When enabled, the gateway continuously returns *RX Message* data in the Poll Response message. If no new data has been received, then the last data bytes are returned.

Bit 4 enables the *Transmit Sequence Number* synchronization option. When enabled, the *Transmit Sequence Number* byte is added to the *Transmit Data* output bytes.

Bit 3 enables the *Receive Sequence Number* synchronization option. When enabled, the *Receive Sequence Number* byte is added to the *Receive Data* output bytes.

Bit 2 selects the serial receive mode. Set = 0 for *Stream Mode*, and set = 1 for *Block Mode*.

Bit 1 selects whether the Delimiter is saved in the Receive Buffer (set = 0), or it is discarded (set = 1). This bit is only used when *Block Mode* is enabled.

Bit 0 selects *Pre-Delimiter Mode* (set = 0) or *Post-Delimiter Mode* (set = 1). This bit is only used when *Block Mode* is enabled.

**Delimiter** – Byte value used to indicate the start of a new message (*Pre-Delimiter Mode*), or the end of a received message (*Post-Delimiter Mode*). This attribute is only used in *Block Mode*.

**Pad Character** – Byte value used to pad the *RX Message* bytes.

**Maximum Transmit Size** – Defines the maximum size of *TX Message* output bytes, or the maximum number of data bytes to be transmitted across the RS232 channel from one Poll Command message.

**Idle String** – Defines the byte string that is transmitted when the gateway receives a null Poll (no input bytes, or a Short\_String value with length = 0). Enter the byte string in Short\_String data



format, with 1<sup>st</sup> byte = string length. Set the length byte to 0 if you don't want to transmit an Idle String. The Idle String can be from 0 to 16 bytes long, not counting Short\_String length byte.

Example Idle String is [ 0x01 0x41 ], where string length is 1 and data byte is 0x41 ('A'). You must use the RSNetworkx™ Class Instance Editor (Set Attribute Single command) to write a Short\_String attribute value.

***Fault String*** – Defines the byte string that is transmitted when the gateway's connection to the DeviceNet master times out. Enter the byte string in Short\_String data format, with 1<sup>st</sup> byte = string length. Set the length byte to 0 if you don't want to transmit a Fault String. The Fault String can be from 0 to 16 bytes long, not counting Short\_String length byte.

Example Fault String is [ 0x02 0x42 0x43 ], where string length is 2 and data bytes are 0x42 ('B') and 0x43 ('C'). You must use the RSNetworkx™ Class Instance Editor (Set Attribute Single command) to write a Short\_String attribute value.

***Status Enable*** – Write any nonzero value to include the *Status* byte in *Receive Data* input bytes.

***Status Clear Enable*** – Write any nonzero value to include the *Status Clear* byte in *Transmit Data* output bytes.

**Configure DeviceNet Master Scan List**

You must calculate the number of input and output bytes required by your DN120 configuration before you can add the gateway to the DeviceNet master scanlist. You need to configure the DeviceNet master to send the specific number of output bytes in its Poll Command Message, and receive the specific number of input bytes in the gateway's Poll Response Message. Once the input and output bytes are mapped in the DeviceNet master, the user application program will be able to read and write data values to the input and output bytes.

**Poll Consume Size**

The *Poll Consume Size* is the size (in bytes) of the Poll Command Message data field that is sent by the DeviceNet master to the DN120.

Poll Command data:  
 [Status Clear byte][Transmit Sequence Number byte][Short\_String length byte][TX data bytes (0-64)]

The first 3 bytes are present if enabled. The following equation is used to calculate the DN120 *Poll Consume Size*. Only include the overhead bytes that are enabled.

	<i>Status Clear byte</i>	1	
	<i>Transmit Sequence Number byte</i>	1	
	<i>Short_String length byte</i>	1	
+	<i>Maximum Transmit Size</i>	_____	
	<i>Poll Consume Size</i>	_____	

**Poll Produce Size**

The *Poll Produce Size* is the size (in bytes) of the Poll Response Message data field that is sent from the DN120 to the DeviceNet master.

Poll Response data:  
 [Status byte][Receive Sequence Number byte][Short\_String length byte][RX data bytes (0-64)]

The first 3 bytes are present if enabled. The following equation is used to calculate the DN120 *Poll Produce Size*. Only include the overhead bytes that are enabled.

	<i>Status byte</i>	1	
	<i>Receive Sequence Number byte</i>	1	
	<i>Short_String length byte</i>	1	
+	<i>Maximum Receive Size</i>	_____	
	<i>Poll Produce Size</i>	_____	

## Chapter 5 – DeviceNet Specifications

This chapter describes the DN120 gateway DeviceNet specifications.

### DeviceNet Message Types

The DN120 is a Group 2 Slave Device that supports the following message types.

CAN IDENTIFIER	GROUP 2 MESSAGE TYPE
10xxxxxx111	Duplicate MAC ID Check Message
10xxxxxx110	Unconnected Explicit Request Message
10xxxxxx101	Master I/O Poll Command Message
10xxxxxx100	Master Explicit Request Message

xxxxxx = DN120 MAC ID

### DeviceNet Class Services

The DN120 is a Group 2 Slave Device that supports the following class services and instance services.

SERVICE CODE	SERVICE NAME
05 (0x05)	Reset
14 (0x0E)	Get Attribute Single
16 (0x10)	Set Attribute Single
75 (0x4B)	Allocate Group 2 Identifier Set
76 (0x4C)	Release Group 2 Identifier Set

### DeviceNet Object Classes

The DN120 device supports the following DeviceNet object classes.

CLASS CODE	OBJECT TYPE
01 (0x01)	Identity
02 (0x02)	Router
03 (0x03)	DeviceNet
04 (0x04)	Assembly
05 (0x05)	Connection
64 (0x40)	Serial Stream Object

**IDENTITY OBJECT**

The Identity Object is required on all DeviceNet devices. It provides product identification and general information.

Identity Object				Class Code 01 (0x01)
Class Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	7
Instance Attribute	Access	Name	Type	Value
1	Get	Vendor	UINT	59 = D.I.P. Products
2	Get	Product Type	UINT	12 = Communications
3	Get	Product Code	UINT	1
4	Get	Revision	STRUCT of	
		Major Revision	USINT	4
		Minor Revision	USINT	0
5	Get	Device Status	WORD	Bit 0 = owned (0 available, 1 allocated) Bit 2 = configured (0 no, 1 yes) Bit 4-7 = vendor specific (0) Bit 8 = minor configuration fault Bit 9 = minor device fault Bit 10 = major configuration fault Bit 11 = major device fault Bit 1, 3, 12-15 = reserved (0)
6	Get	Serial Number	UDINT	Unique serial number for every device
7	Get	Product Name	STRUCT of	
		Length	USINT	6
		Name	STRING [6]	

Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single

**ROUTER OBJECT**

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 DN120 device.

<b>Router Object</b>				<b>Class Code 02 (0x02)</b>
<b>Class Attribute</b>	<b>Access</b>	<b>Name</b>	<b>Type</b>	<b>Value</b>
1	Get	Revision	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	2
<b>Instance Attribute</b>	<b>Access</b>	<b>Name</b>	<b>Type</b>	<b>Value</b>
2	Get	Number of Connections	UINT	2

Common Services

<b>Service Code</b>	<b>Class</b>	<b>Instance</b>	<b>Service Name</b>
14 (0x0E)	Yes	Yes	Get_Attribute_Single

**DEVICENET OBJECT**

The DeviceNet Object contains information about the DN120 DeviceNet interface configuration.

DeviceNet Object			Class Code 03 (0x03)	
Class Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
Instance Attribute	Access	Name	Type	Value
1	Get/Set	MAC ID	USINT	Settable only if MAC ID switches > 63. Valid numbers are 0 to 63. Returns last value set or switch value.
2	Get/Set	Baud Rate	USINT	Settable only if Baud switch > 2. Valid settings are 0 = 125K, 1 = 250K, 2 = 500K. Returns last value set or switch value.
3	Get/Set	Bus Off Interrupt	BOOL	0 = hold CAN in OFF state (default) 1 = reset CAN
4	Get/Set	Bus Off Counter	USINT	Writing this attribute forces counter value to zero.
5	Get	Allocation Information	STRUCT of	
		Choice Byte	BYTE	bit 0 = explicit msg, set to 1 to allocate bit 1 = polled IO, set to 1 to allocate bit 2 = strobed IO, not supported bits 3-7 = reserved, set to 0
		Master Node Address	USINT	Allocated to this DeviceNet master

Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single
75 (0x4B)	No	Yes	Allocate Master/Slave
76 (0x4C)	No	Yes	Release Master/Slave

**ASSEMBLY OBJECT**

The Assembly Object instances bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

<b>Assembly Object</b>				<b>Class Code 04 (0x04)</b>
<b>Class Attribute</b>	<b>Access</b>	<b>Name</b>	<b>Type</b>	<b>Value</b>
1	Get	Revision	UINT	2
2	Get	Max Class ID	UINT	2
<b>Instance Attribute</b>	<b>Access</b>	<b>Name</b>	<b>Type</b>	<b>Value</b>
3	Get	Data Stream	note 1	Instance 1 for input data stream. Instance 2 for output data stream.

## Common Services

<b>Service Code</b>	<b>Class</b>	<b>Instance</b>	<b>Service Name</b>
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Instance 1 Input Data Stream and Instance 2 Output Data Stream are structured as either an array of bytes or as a Short\_String consisting of a single byte length field and N data bytes. The Input Data Stream is the data returned in the Poll Response Message. The Output Data Stream is the data returned in the Poll Command Message. See Chapter 3 for a complete description of the Poll Format.

Poll Response:

[Status byte][Receive Sequence Number byte][Short\_String Length byte][RX data bytes]

Poll Command:

[Status Clear byte][Transmit Sequence Number byte][Short\_String Length byte][TX data bytes]

**CONNECTION OBJECT**

The Connection Object instances manage the characteristics of each communication connection. The DN120 is a Group 2 Only Slave device that supports 1 Explicit Message Connection (Instance 1) and 1 Poll Message Connection (Instance 2).

Connection Object				Class Code 05 (0x05)
Class Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
Instance Attribute	Access	Name	Type	Value
1	Get	State	USINT	0 = non-existent 1 = configuring 2 = established 3 = timed out
2	Get	Instance Type	USINT	0 = Explicit Message 1 = I/O Message
3	Get	Transport Class Trigger	USINT	0x83 for Explicit Message 0x82 for I/O Message
4	Get	Production Connection	UINT	Explicit Message: 10xxxxxx011 = produced connection id I/O Message: 01111xxxxxx = produced connection id
5	Get	Consumed Connection	UINT	Explicit Message: 10xxxxxx100 = consumed connection id I/O Message: 10xxxxxx101 = consumed connection id
6	Get	Initial Communication Characteristics	USINT	0x21 for Explicit Message 0x01 for I/O Message
7	Get	Production Size	UINT	67 for Explicit Message See Stream Object for I/O Message
8	Get	Consumed Size	UINT	71 for Explicit Message See Stream Object for I/O Message
9	Get/Set	Expected Packet Rate	UINT	Default 2500 msec
12	Get/Set	Timeout Action	USINT	0 = Timeout (Explicit Message default) 1 = Auto Delete 2 = Auto Reset (I/O Message default)
13	Get	Production Path Length	USINT	0 for Explicit Message 6 for I/O Message
14	Get	Production Path	STRUCT of	Null for Explicit Message STRUCT for I/O Message
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log. Seg., Instance	USINT	0x24
		Instance Number	USINT	0x01
		Log. Seg., Attribute	USINT	0x30
Attribute Number	USINT	0x03		
15	Get	Consumed Path Length	USINT	0 for Explicit Message 6 for I/O Message



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16	Get	Consumed Path	STRUCT of	Null for Explicit Message STRUCT for I/O Message
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log. Seg., Instance	USINT	0x24
		Instance Number	USINT	0x02
		Log. Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03
17	Get	Production Inhibit	UINT	0

### Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	Yes	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

**SERIAL STREAM OBJECT**

The Serial Stream Object configures the DN120 serial channel.

Serial Stream Object				Class Code 64 (0x40)
Class Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Object Instance	UINT	1
6	Get	Max Class Identifier	UINT	7
7	Get	Max Instance Attribute	UINT	22
Instance Attribute	Access	Name	Type	Value
3	Get	Receive Data	Data Format	Received message data. Returned in Poll Response
4	Get/Set	Transmit Data	Data Format	Message data to transmit. Received in Poll Command.
5	Get/Set	Status	USINT	Bit 0 – Transmit Channel Blocked Bit 1 – Transmit Buffer Empty Bit 2 – Receive Parity Error (0 to clear) Bit 3 – Receive Buffer Empty Bit 4 – Receive Buffer Overflow Error (0 to clear) Bit 5 – Framing Error (0 to clear) Bit 6 – Transmit Buffer Overflow Error (0 to clear) Bit 7 – CTS Signal State (1 = asserted)
6	Get/Set	Baud Rate	USINT	0 = 9600 bps                      4 = 600 bps 1 = 4800 bps                      5 = 300 bps 2 = 2400 bps                      6 = 19200 bps 3 = 1200 bps
7	Get/Set	Parity	USINT	0 = no parity                      5 = mark (force to 1) 1 = even parity                      6 = space (force to 0) 2 = odd parity
8	Get	Data Size	USINT	7 (parity enabled) or 8 (no parity)
9	Get	Stop Bits	USINT	1
10	Get/Set	Flow Control	USINT	0 = none                              2 = CTS / RTS 1 = XON / XOFF                      4 = CTS Detect Mode
11	Get/Set	Receive Count	USINT	Number of bytes in Receive Buffer. Write to clear.
12	Get/Set	Transmit Count	USINT	Number of bytes in Transmit Buffer. Write to clear
13	Get/Set	Maximum Receive Size	USINT	Maximum # bytes returned by Receive Buffer read.
14	Get/Set	Data Format	USINT	Bit 0 – String Format (0 = Short_String, 1 = Array) Bit 1 – Strip Parity Bits (0 = retain, 1 = strip) Bit 2 – Pad Justification (0 = left, 1 = right) Bit 3 – Pad Received Message (0 = no, 1 = yes)
15	Get/Set	Block Mode	USINT	Bit 0 – Pre/Post Delimiter (0 = Pre-, 1 = Post-) Bit 1 – Strip Delimiter (0 = keep, 1 = strip) Bit 2 – Delimiter Enable (0 = no, 1 = yes) Bit 3 – Enable Receive Sequence Number Bit 4 – Enable Transmit Sequence Number Bit 5 – Re-send (0 = no, 1 = yes) Bit 6 – Synchronization (0 = no, 1 = yes)
16	Get/Set	Delimiter	USINT	Delimiter byte value
17	Get/Set	Pad Character	CHAR	Pad byte value
18	Get/Set	Maximum Transmit Size	USINT	Defines maximum # bytes that can be transmitted.

## DN120 DeviceNet Gateway User's Manual

19	Get/Set	Idle String	Short_String	Byte string transmitted when gateway receives null Poll (no input bytes). Length = 0 for no Idle String.
20	Get/Set	Fault String	Short_String	Byte string transmitted when gateway's Polled I/O connection times out. Length=0 for no Fault String
21	Get/Set	Status Enable	USINT	Nonzero value enables Status input byte.
22	Get/Set	Status Clear Enable	USINT	Nonzero value enables Status Clear output byte.

### Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

## Chapter 6 – RSNetworx™ Configuration Example

This chapter shows how to set up configure a DN120 gateway using the Rockwell Software RSNetworx™ software and your gateway's Electronic Data Sheet (EDS) file. The system configuration uses an Allen-Bradley 1770-KFD DeviceNet adapter (MAC ID 62) to connect the PC running RSNetworx™ to the DeviceNet network. A SLC500 system with a 1747-SDN DeviceNet Scanner (MAC ID 00) is the DeviceNet master. DN120 gateway has MAC ID 03.

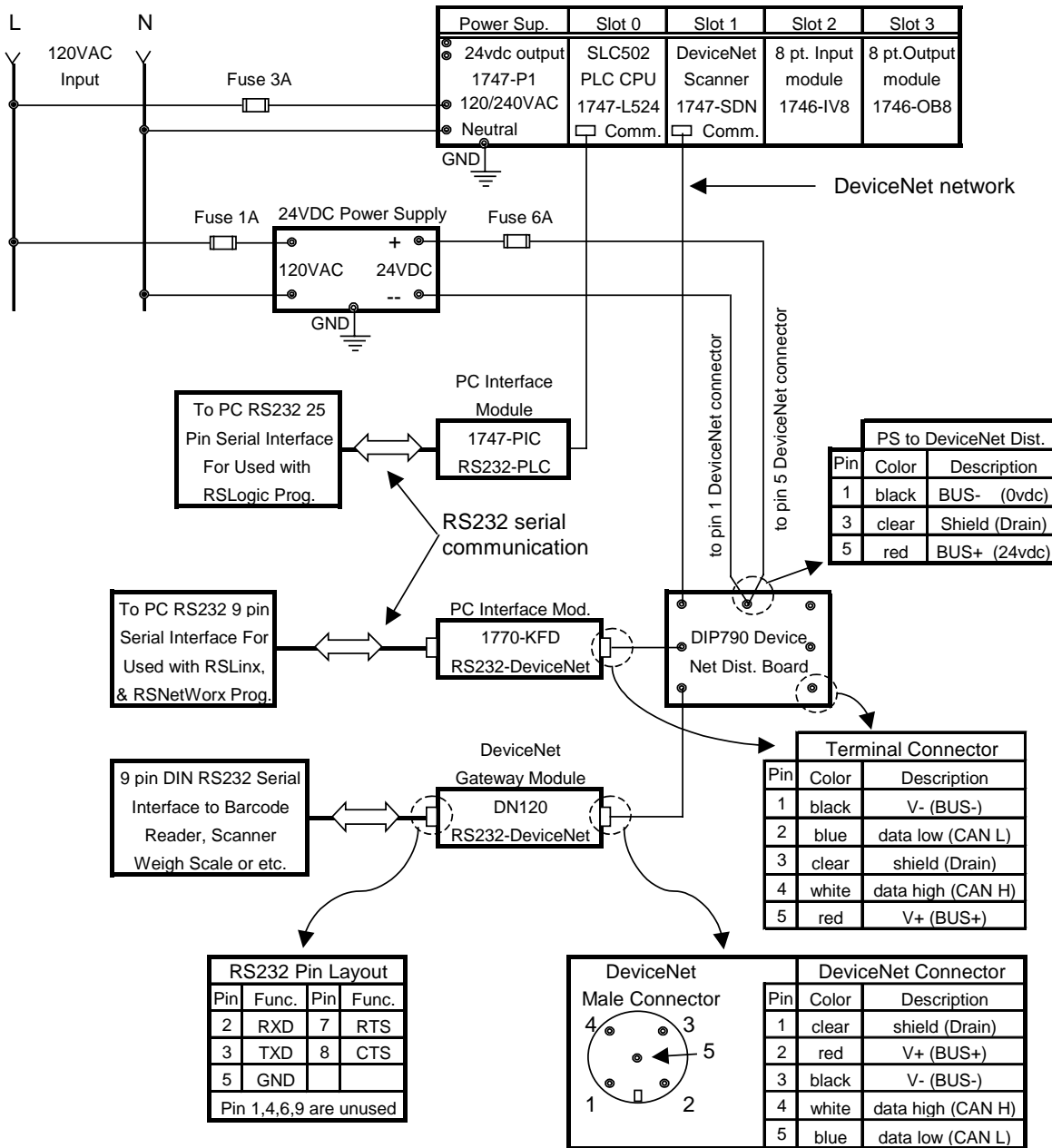


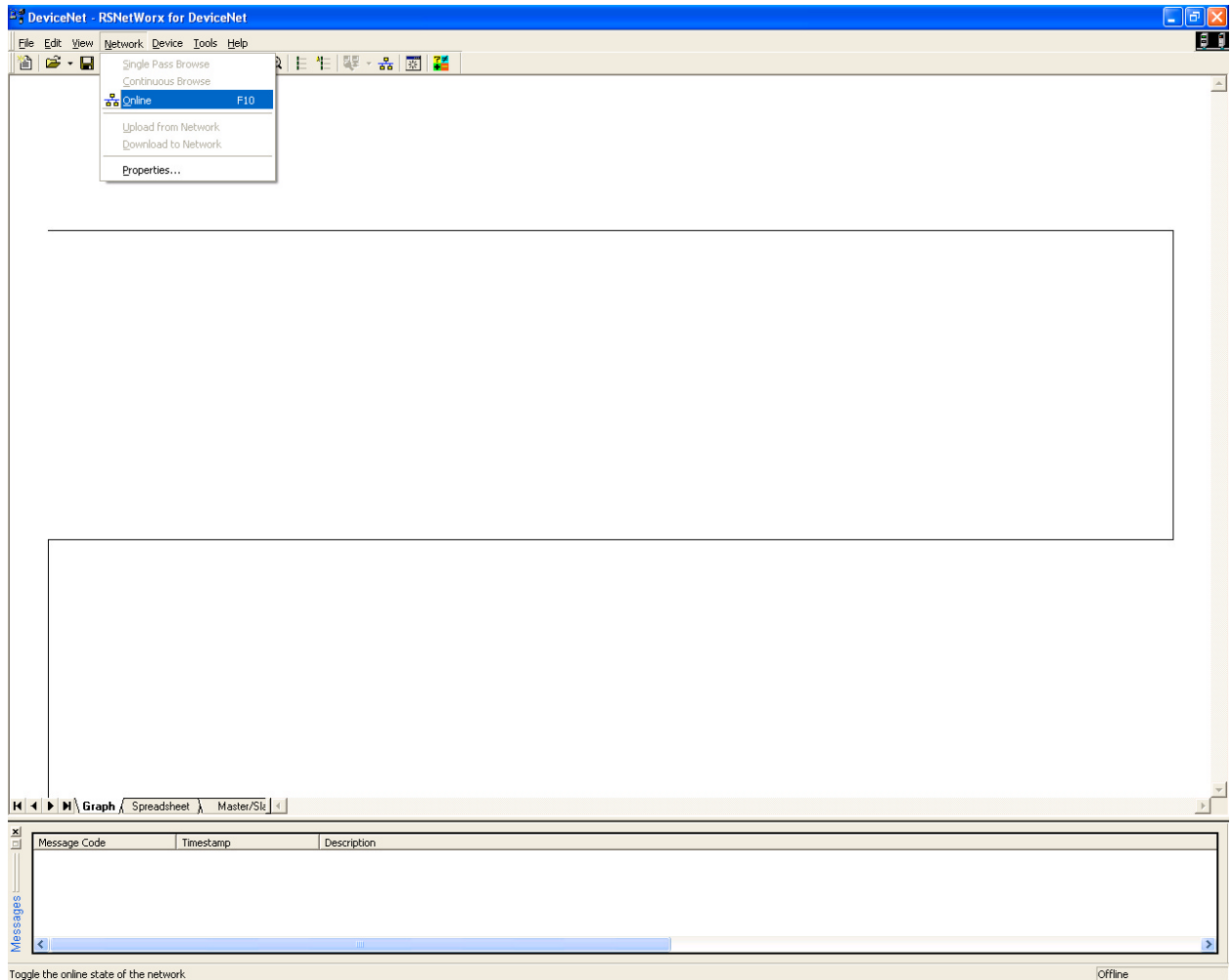
Figure 1. DN120 Integrated with Allen Bradley SLC500

### **Configure DeviceNet Interface**

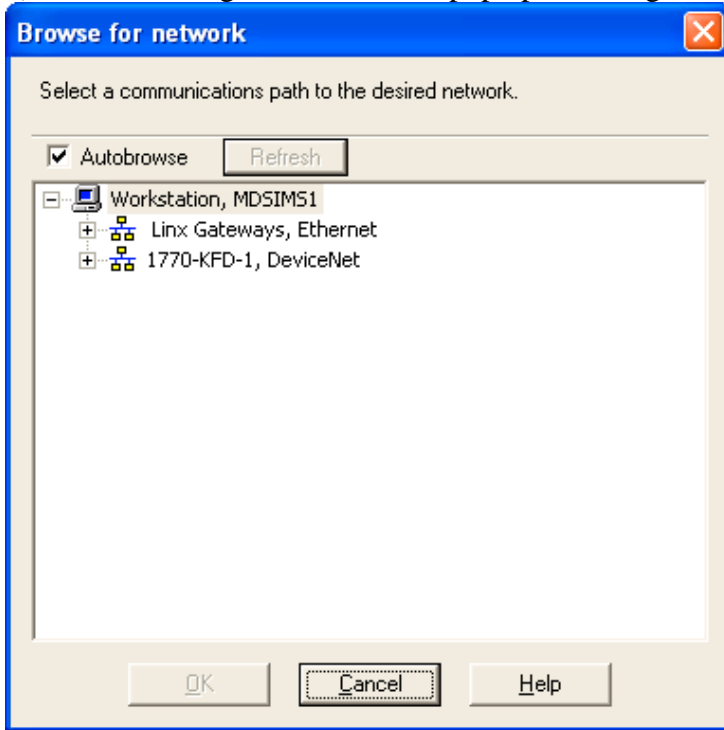
Follow instructions in Chapter 4 to set the gateway's rotary switches to 125Kbps baud rate and MAC ID to 03. Set the RS232 Baud Rate switch to PRG mode. Connect the gateway to the DeviceNet network to power it up. During power-up, the *NET* and *MOD* LEDs cycle through a sequence of alternating red and green. After power-up, the *NET* LED should be flashing green and the *MOD* LED should be solid green.


### **Connect & Register EDS File**

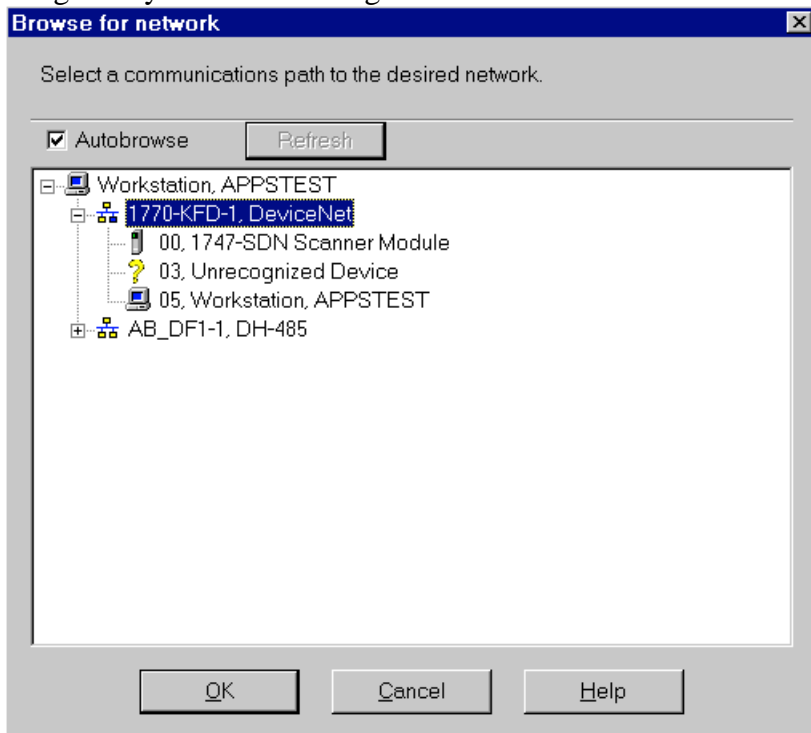
- 1) Start up the RSNetworx program. Select the *Online* operation from the *Network* menu.



2) The following text box should pop up, showing the networks connected to your computer.



3) Click on the *1770-KFD-1*  to show all connected DeviceNet devices. The gateway is at MAC ID 03, verifying its DeviceNet connection. It is an *Unrecognized Device* until the gateway's EDS file is registered with RSNetworkx.



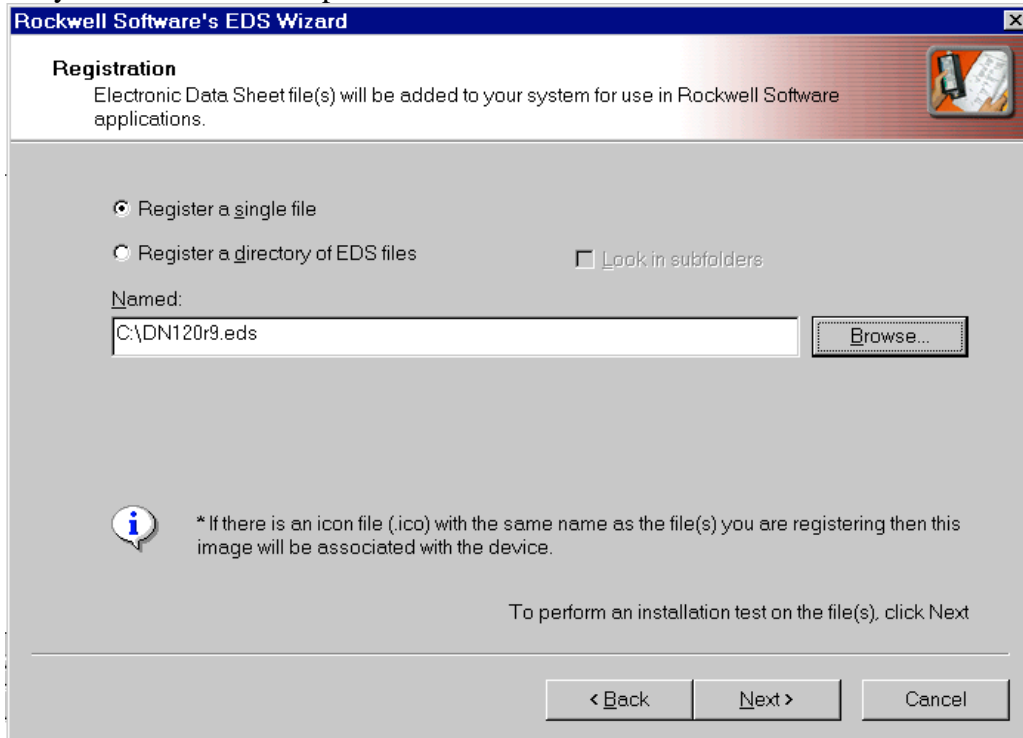
- 4) Click *Cancel* to close *Browse for network* window. Select the *EDS Wizard...* operation from the *Tools* menu. Click *Next>* to continue.



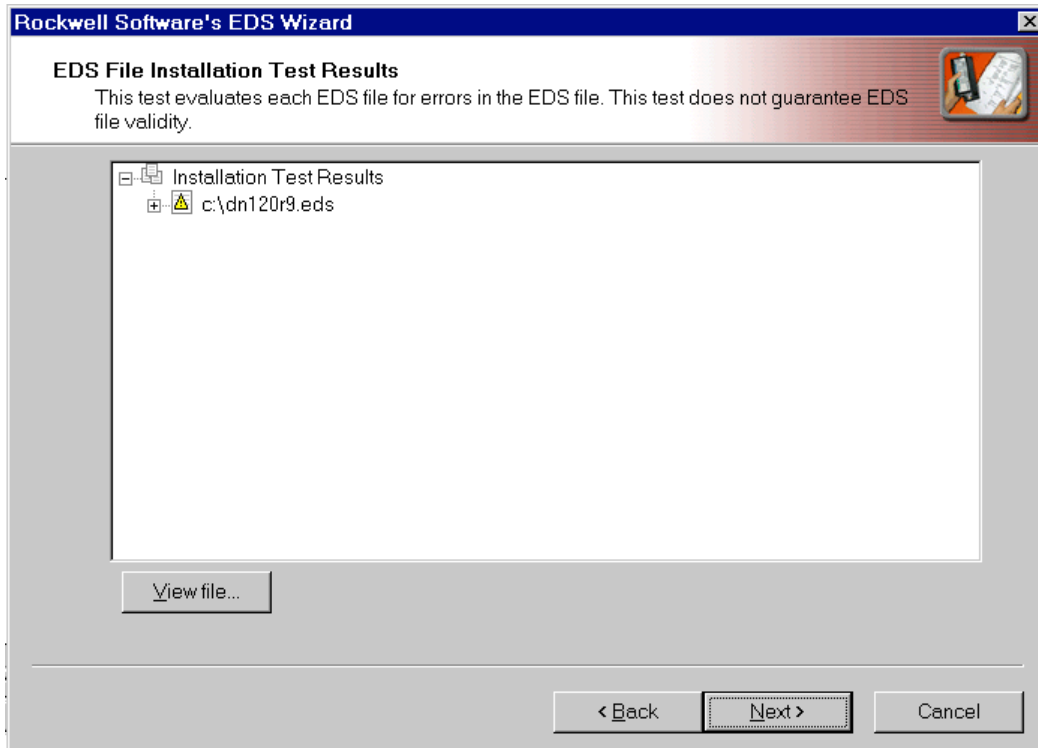
- 5) Select the *Register an EDS file(s)* option and click *Next>*.



- 6) Select *Register a single file* option. *Browse* for your gateway's EDS file. You can download the latest EDS and ICON files from the [www.microscan.com](http://www.microscan.com) website. Click *Next>* when you have the correct path and EDS file name in the *Named:* box.

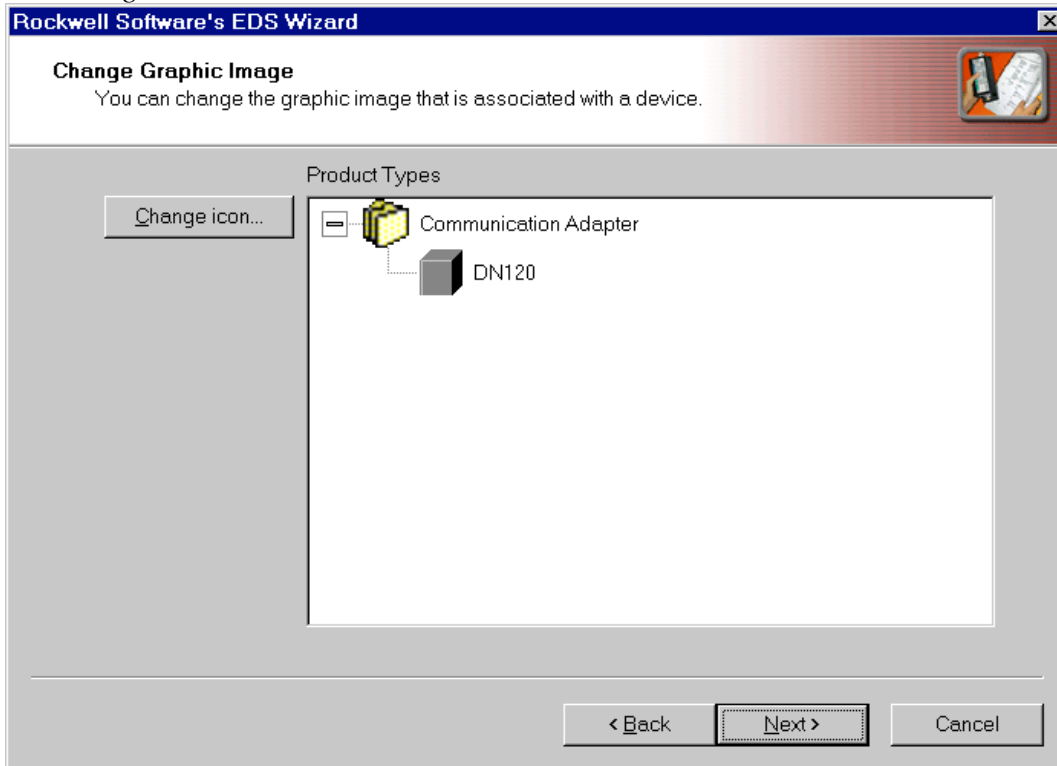


- 7) The next screen shows the RSNetworx installation test results. Click *View file...* to view the actual EDS file text. Click *Next>* to continue.

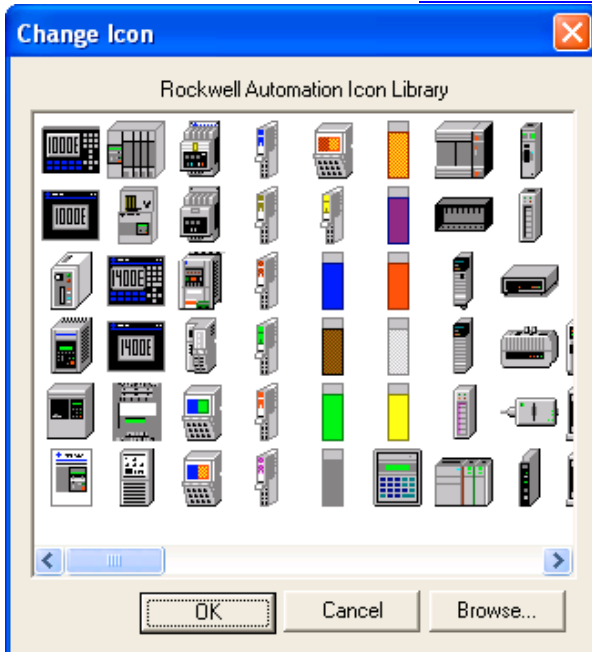




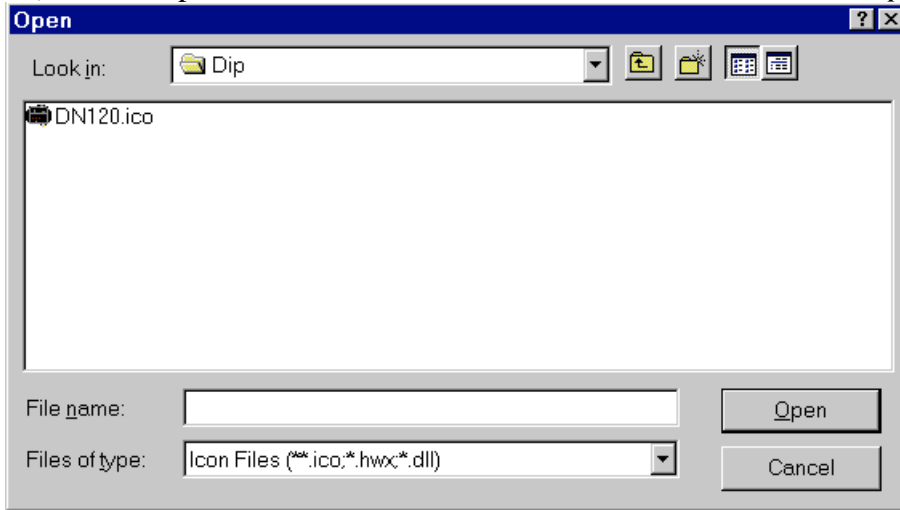
- 8) The next screen allows you to customize the gateway's icon for RSNetworkx. Click on *Change icon...*



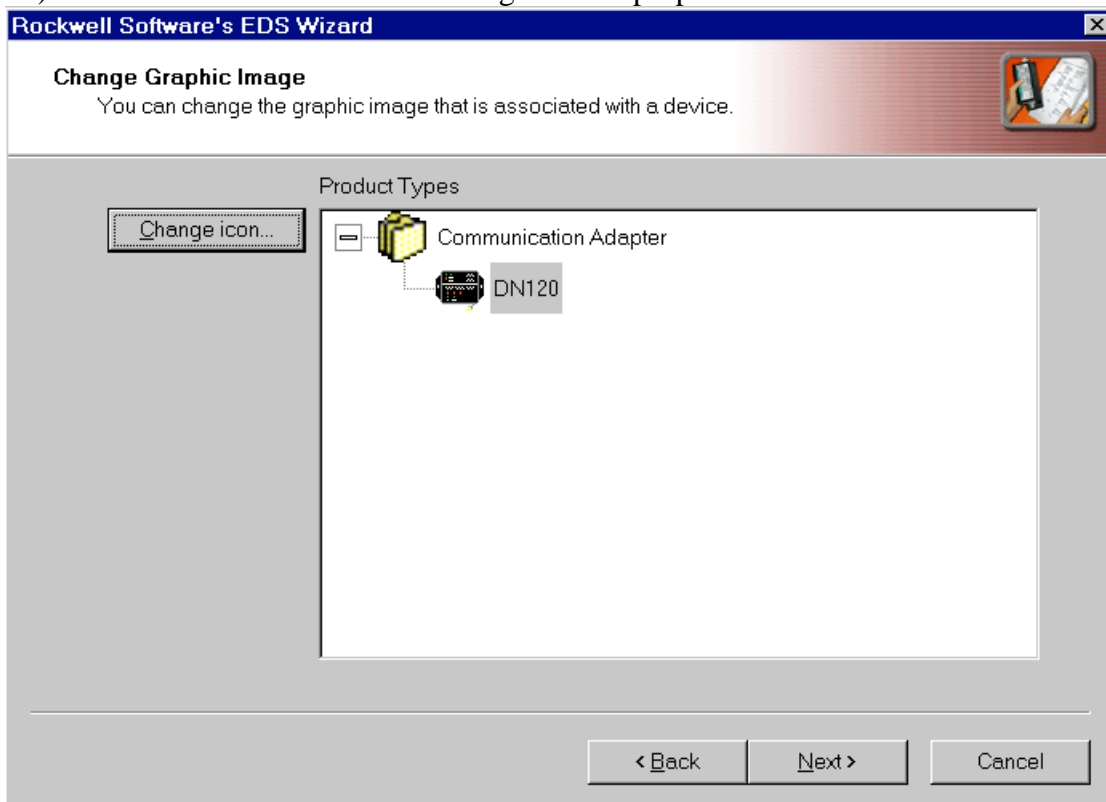
- 9) The Change Icon screen pops up. Click *Browse* to enter path for DN120 icon file. You can download the icon file from [www.microscan.com](http://www.microscan.com).



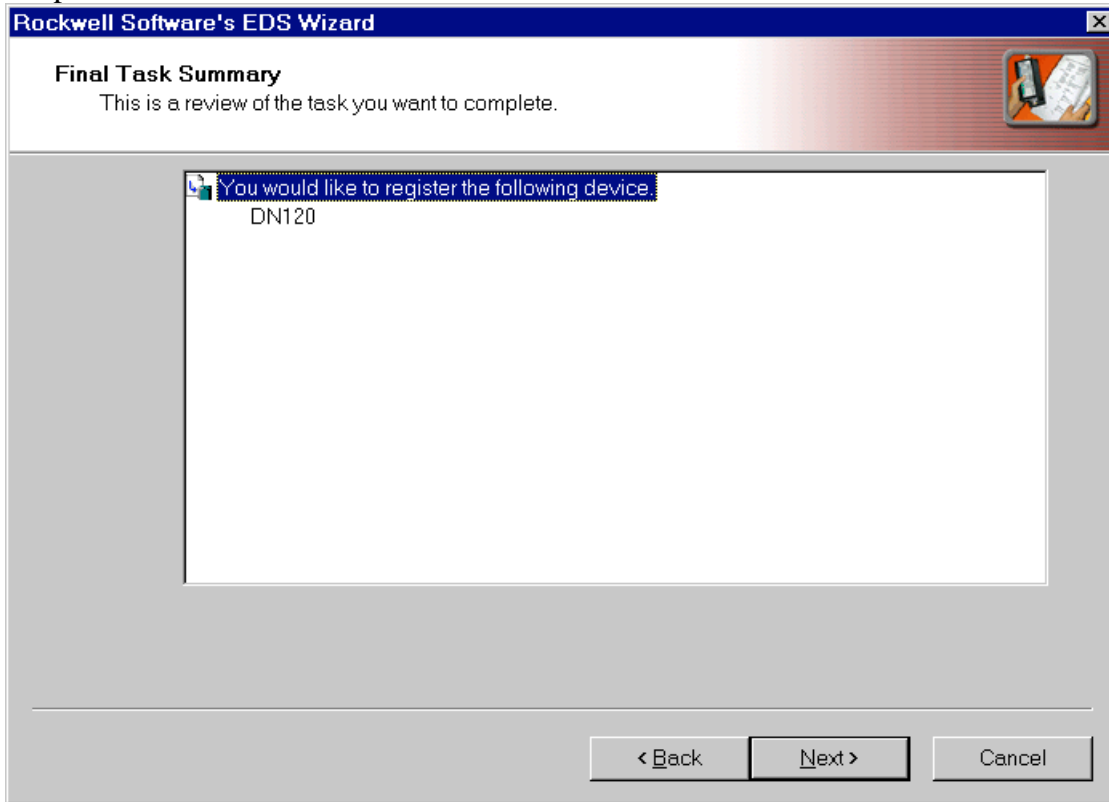
10) Enter the path to DN120 icon file in the *File name:* box. Click *Open* to continue.



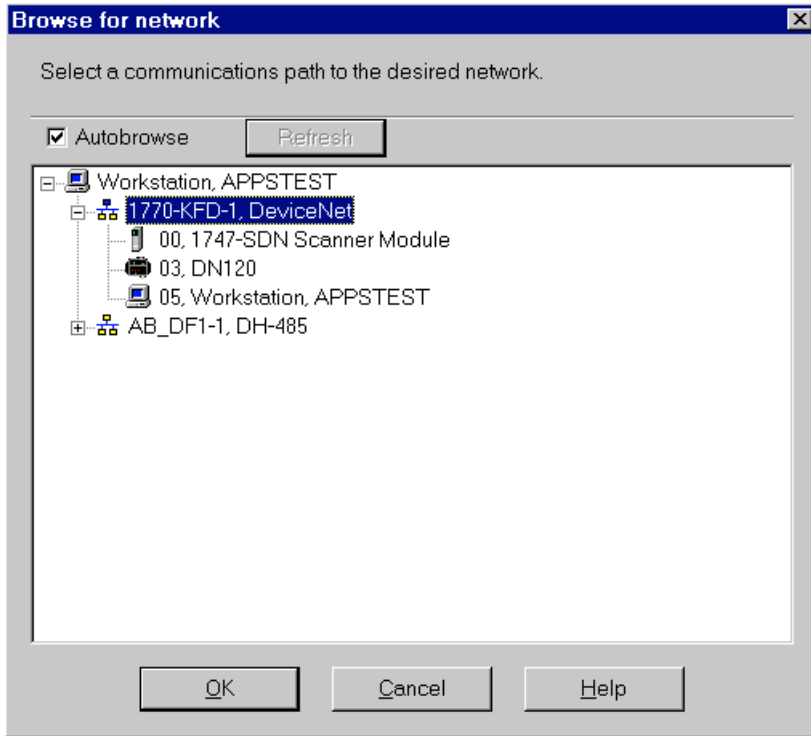
11) The DN120 icon should have changed to the proper icon. Click *Next* to continue.



12) The final step is to finish EDS file registration. Click *Next*> to complete the registration process. Click *Finish* to close the EDS Wizard window.



13) Repeat steps 1, 2, and 3 to browse the DeviceNet network. RSNetworkx should now recognize the device at MAC ID 03 as a DN120 gateway, and display the DN120 icon. Click *Cancel* when finished.

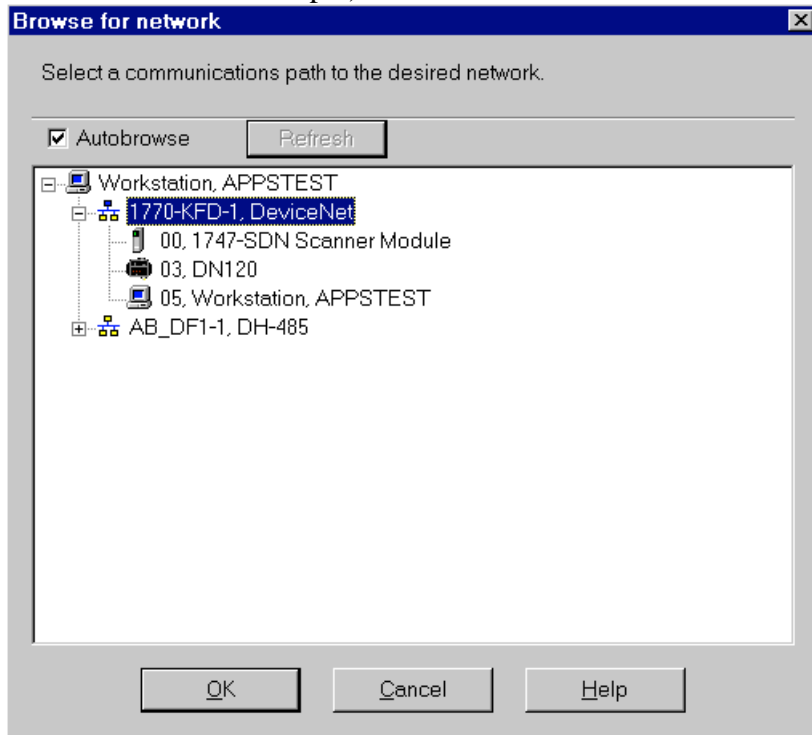


### **Configure Serial Channel**

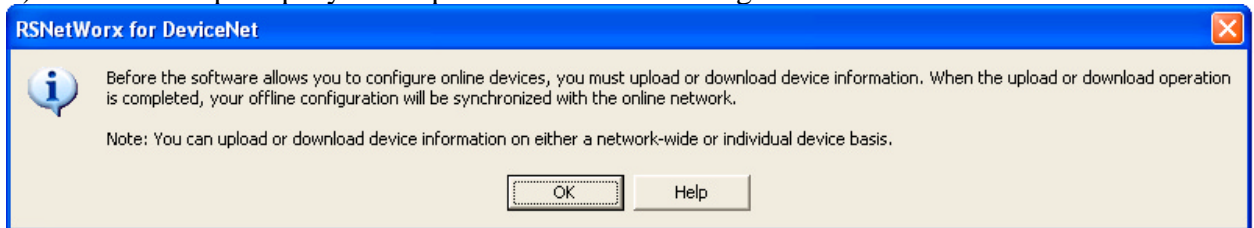
Once the gateway is connected to DeviceNet and communicating with RSNetworx, you can configure its serial channel. Make sure the gateway is not in the DeviceNet master scanlist before changing any attribute values.

The Serial Stream Object attributes control the gateway's serial channel transmit and receive operations. The following steps show how to configure the Serial Stream Object attributes using the RSNetworx program.

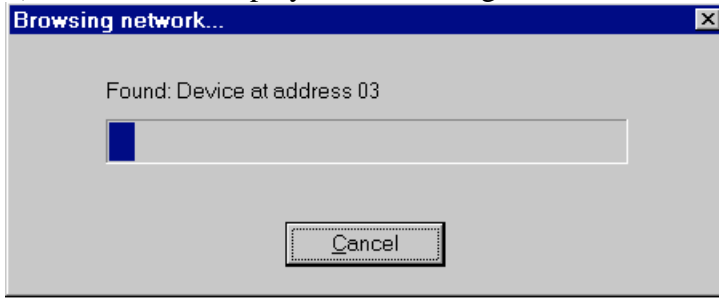
- 1) Select the *Online* operation from the *Network* menu. Select the DeviceNet adapter (*1770-KFD-1* in this example) and click *OK*.



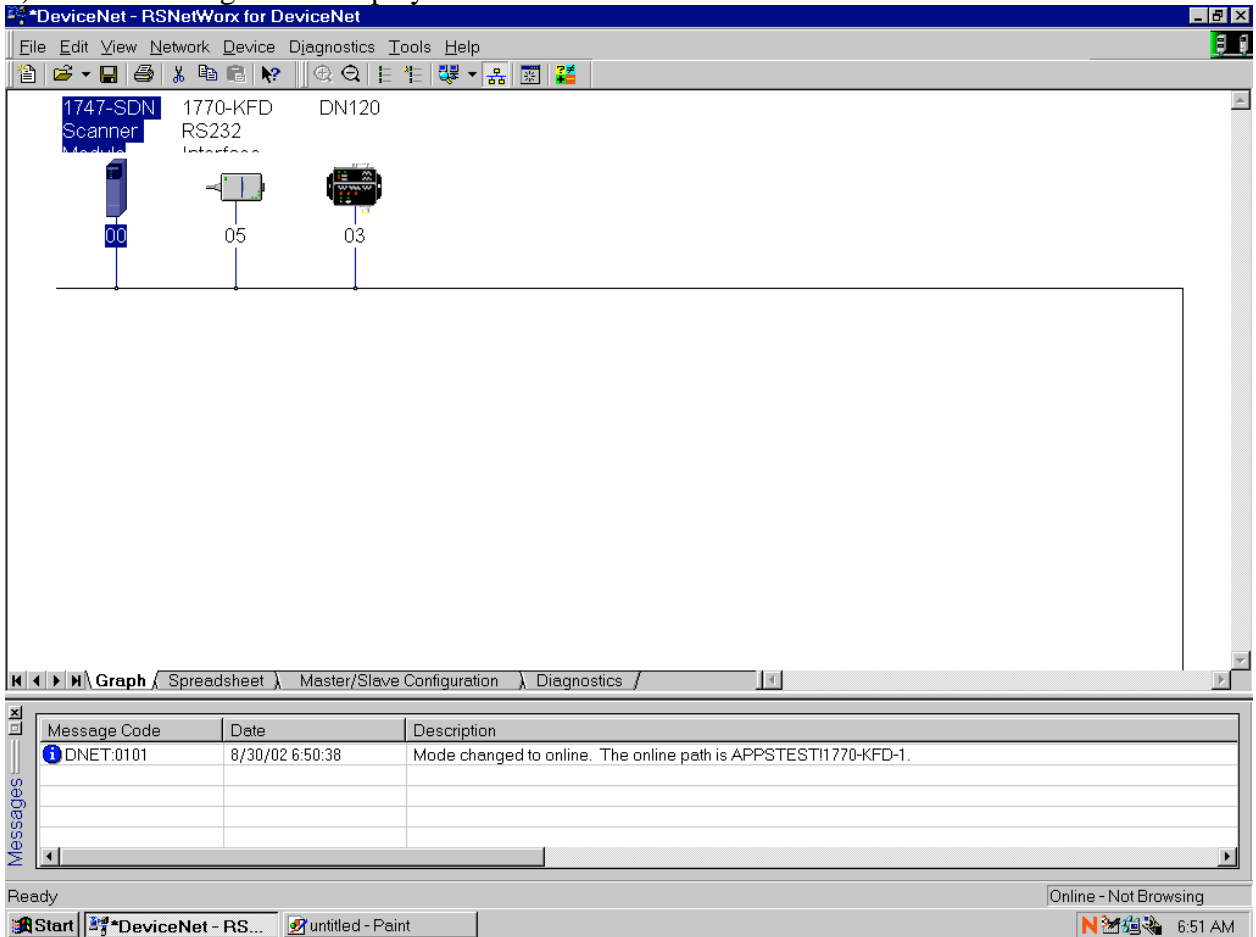
- 2) RSNetworx prompts you to upload the network configuration. Click *OK* to continue.



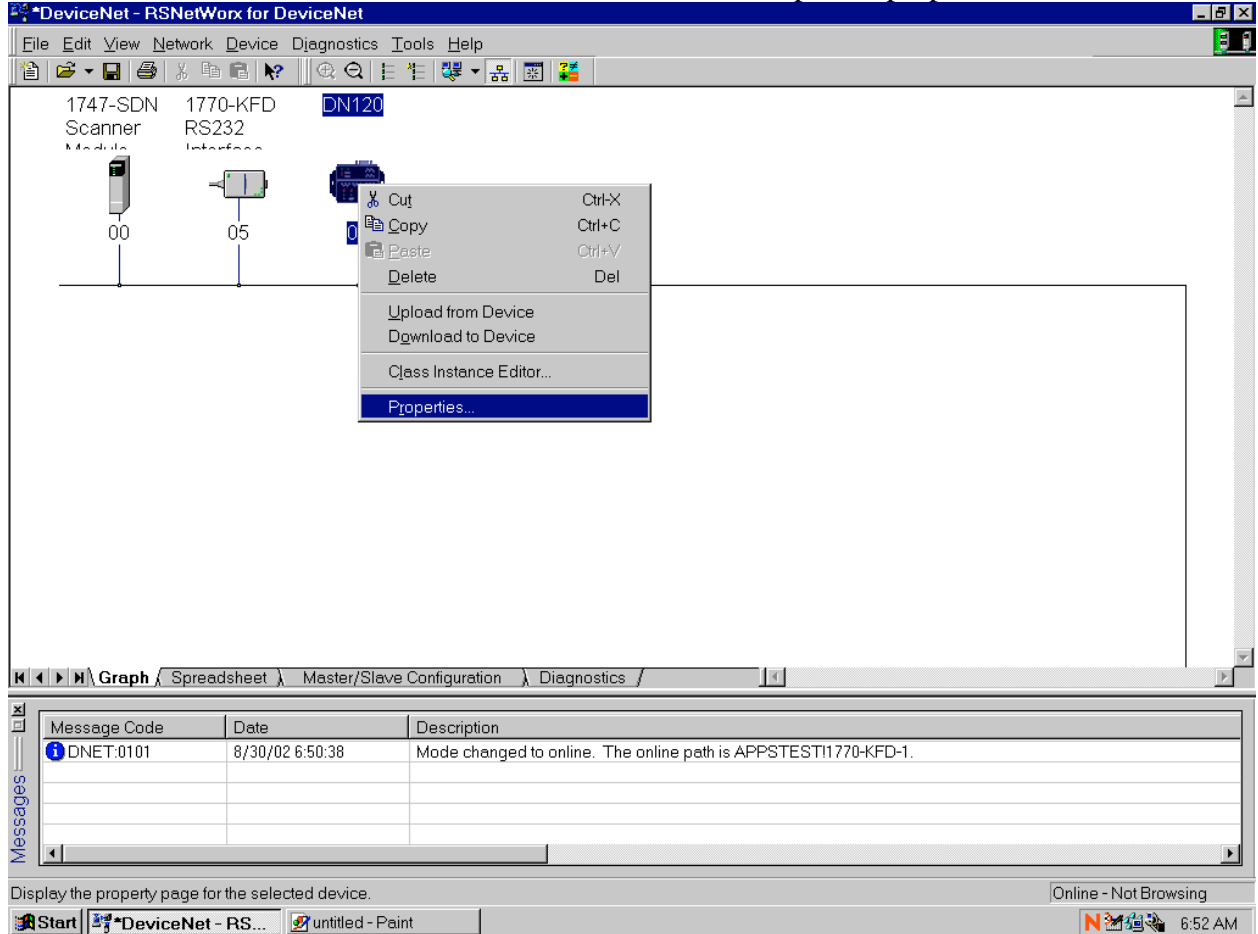
3) RSNetworx displays the following text box while it uploads the network configuration.



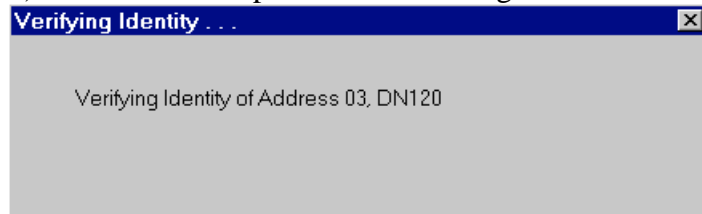
4) The following screen displays the online nodes.



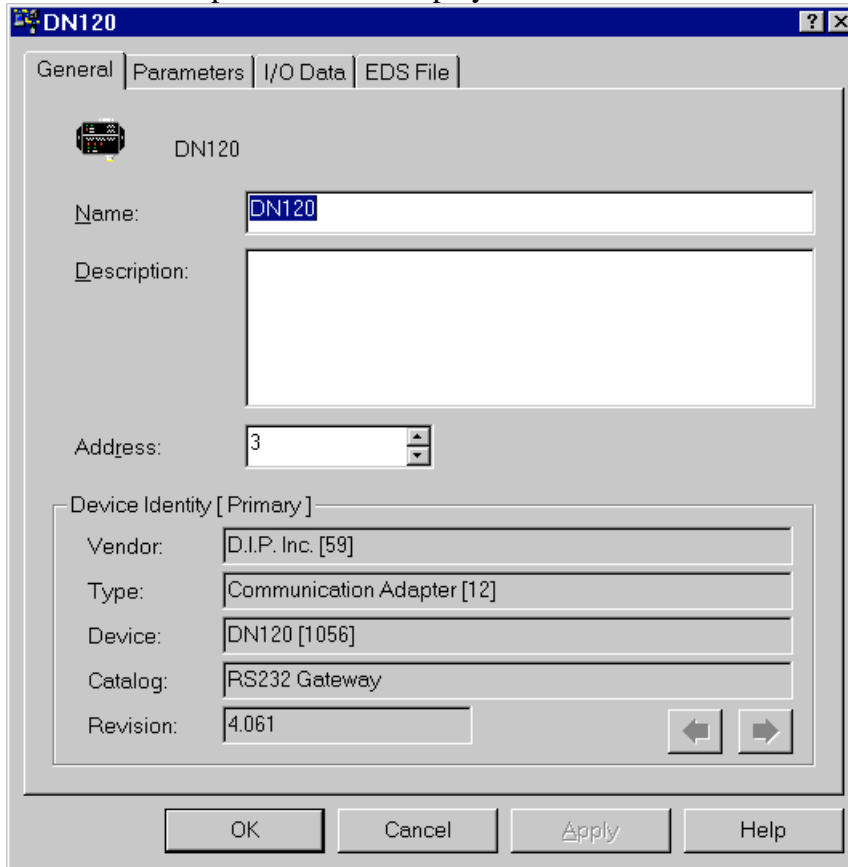
- 5) Left-click on the *DN120 icon* to select it. Right-click and select *Properties* from the pop-up menu. You can also double-click on the *DN120 icon* to open its properties box.



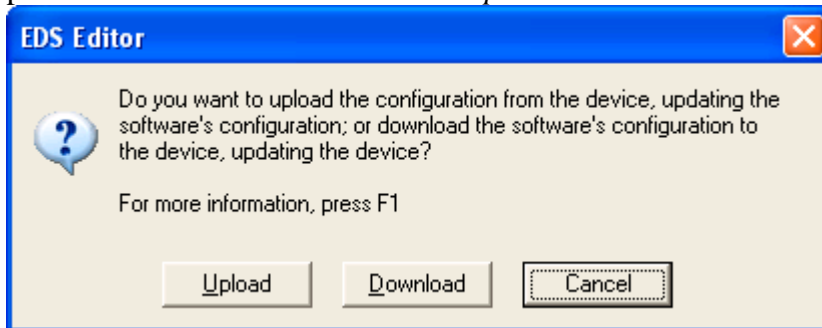
- 6) RSNetworx displaces the following text box while it reads DN120 EDS file.



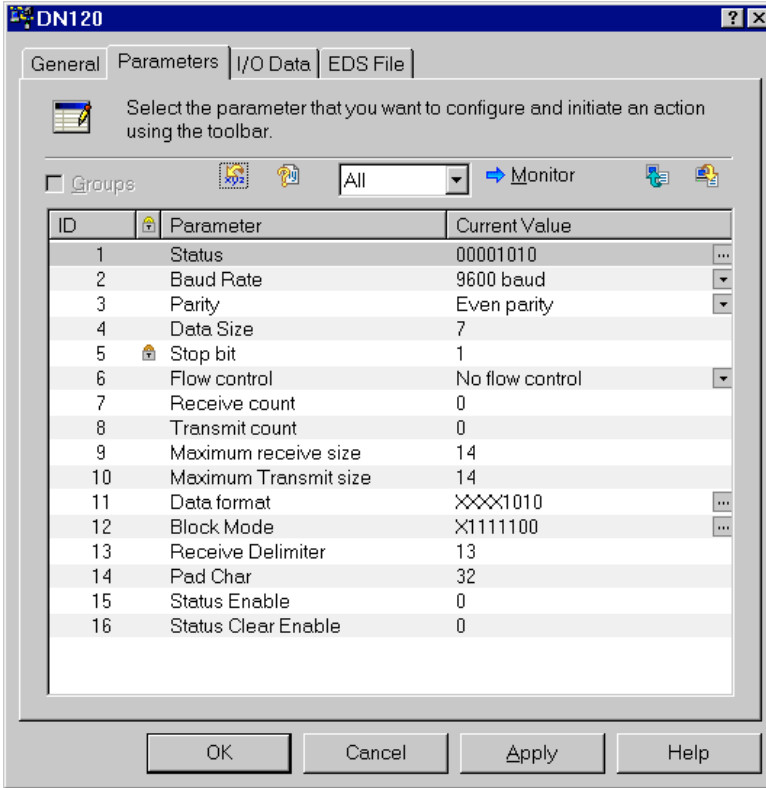
7) The DN120 Properties Box is displayed.



8) Select the *Parameters* tab. You will be prompted for the parameters source. Select the *Upload* button to upload DN120 parameters from the actual device. All the DN120 parameters are now shown in the *Properties* window.



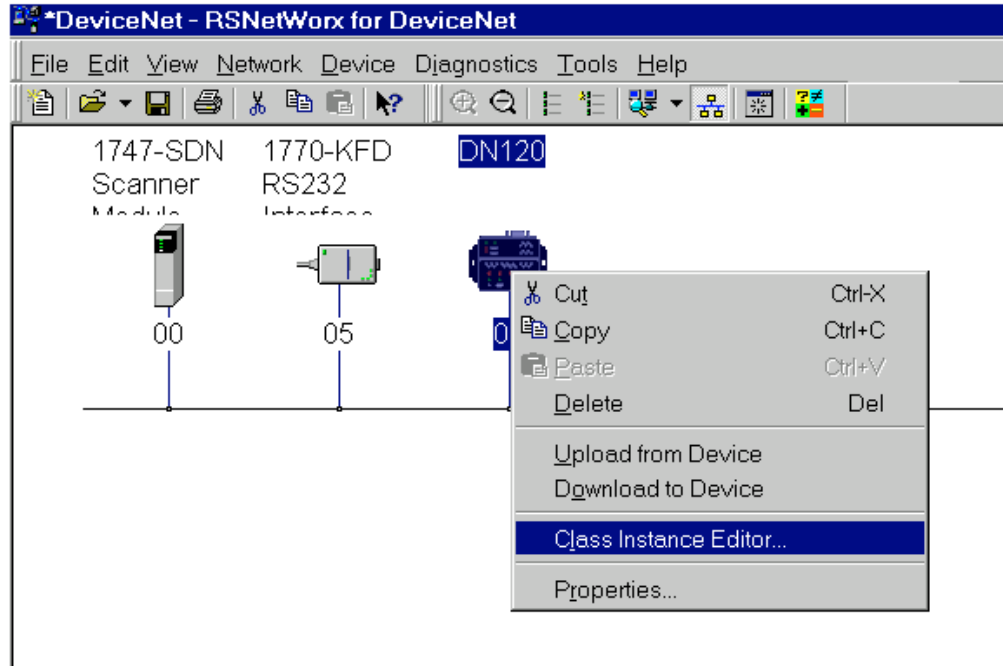




9) You may now edit the Serial Stream Object attributes in this window

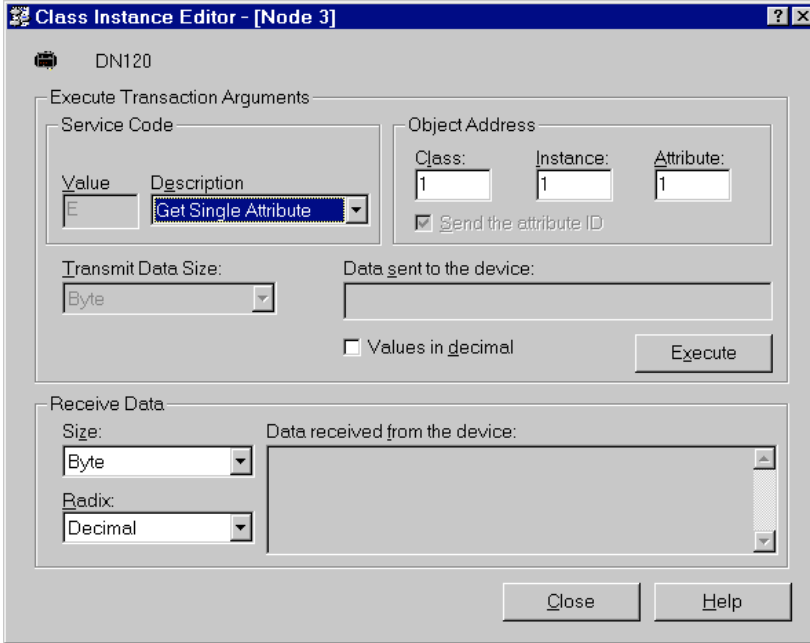
Note that the **Idle String** and **Fault String** attributes are not listed. These attributes use Short\_String data type, which is not supported by RSNetworx EDS File interface.

10) Use the Class Instance Editor to configure Short\_String attributes.



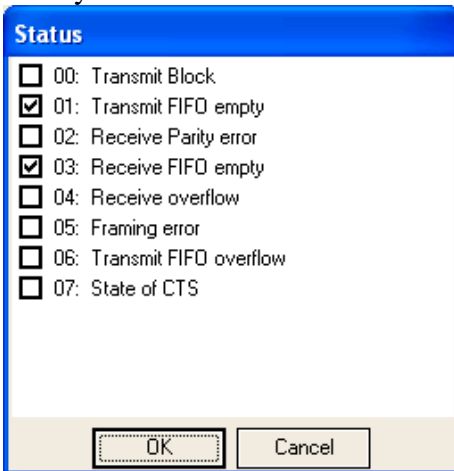
- 11) Select the Set\_Attribute\_Single service code to write an attribute value, and the Get\_Attribute\_Single service code to read an attribute value. Check Values in decimal box to enter class, instance, attribute, and data values in decimal.

The Idle String address is Class 64, Instance 1, Attribute Number 19. The Fault String address is Class 64, Instance 1, Attribute Number 20. Enter the Short\_String data as length byte, then data bytes. Example is [0x01 0x02] for a single byte string 0x02 (ASCII STX).



- 12) Enter the remaining Serial Stream Object attributes in the Parameters Box window.

**Status** – Click on  to open selection box. Shows current status and error information. Click on any errors to clear check. Press OK to continue.



**Baud Rate** – Click on arrow to the right of the *current value* to select from pull-down menu.

**Parity** – Click on arrow to the right of the *current value* to select from pull-down menu.

**Data Size** – Read-only value, set to 8 if no parity selected and 7 if party selected.

**Stop Bit** – Read-only value, always set to 1.

**Flow Control** – Click on arrow to the right of the *current value* to select from pull-down menu.

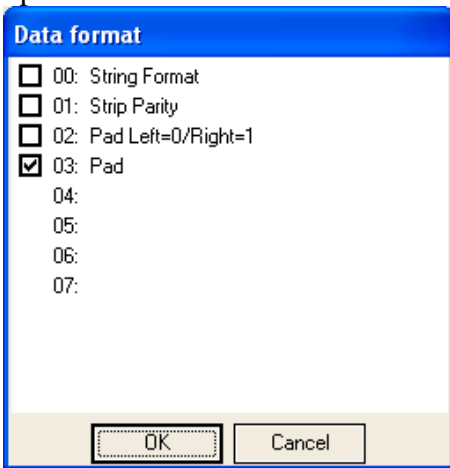
**Receive Count** – Read-only value.

**Transmit Count** – Read-only value.

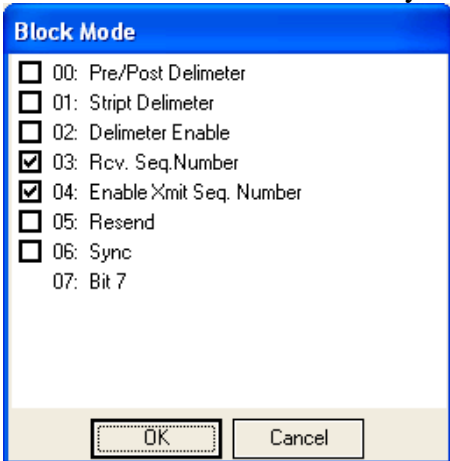
**Maximum Receive Size** – Click on *current value* and enter desired number in decimal.

**Maximum Transmit** – Click on *current value* and enter desired number in decimal.

**Data Format** – Click on  to open selection box. Click on check box to select the desired option. The Delimiter Mode uses bits 0, 1, 2, 3 of the byte. Ignore bits 4 through 7.



**Block Mode** – Click on  to open up selection box. Click on check box to set or clear the desired bit. The Serial Status byte uses bits 0 through 6. Ignore bit 7.



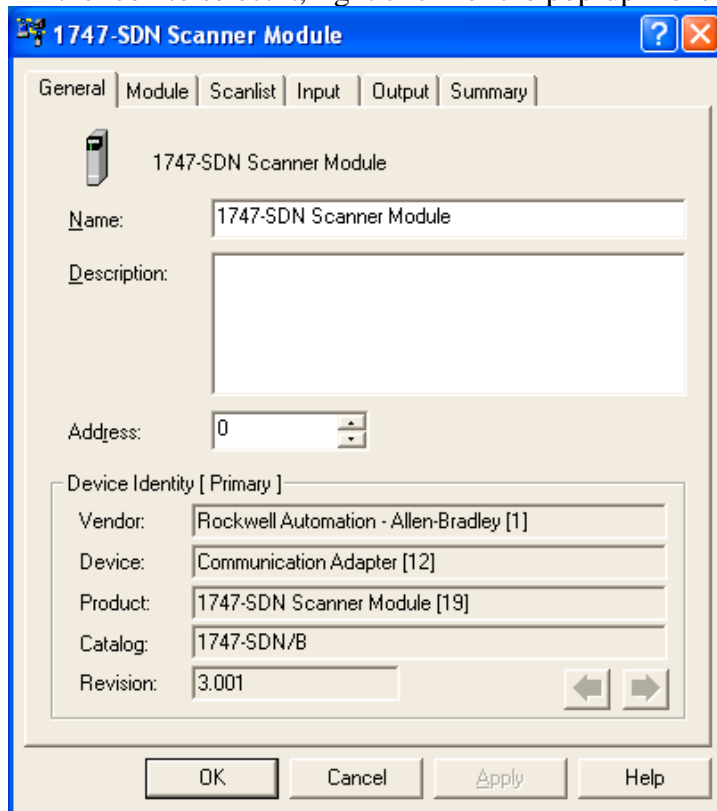
**Receive Delimiter** – Click on *current value* and enter number in decimal.

**Pad Char** – Click on *current value* and enter number in decimal.

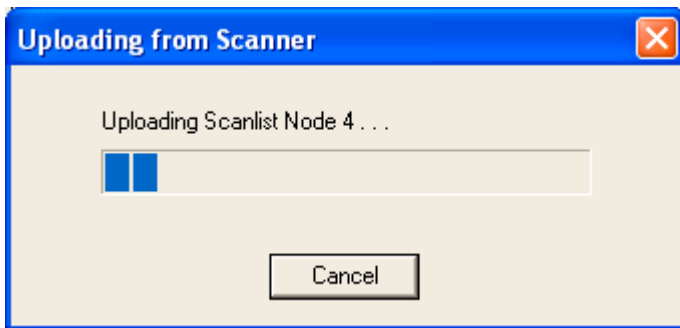
### **Configure DeviceNet Master Scan list**

After all the object instances have been configured, the DeviceNet master can be configured to poll the gateway.

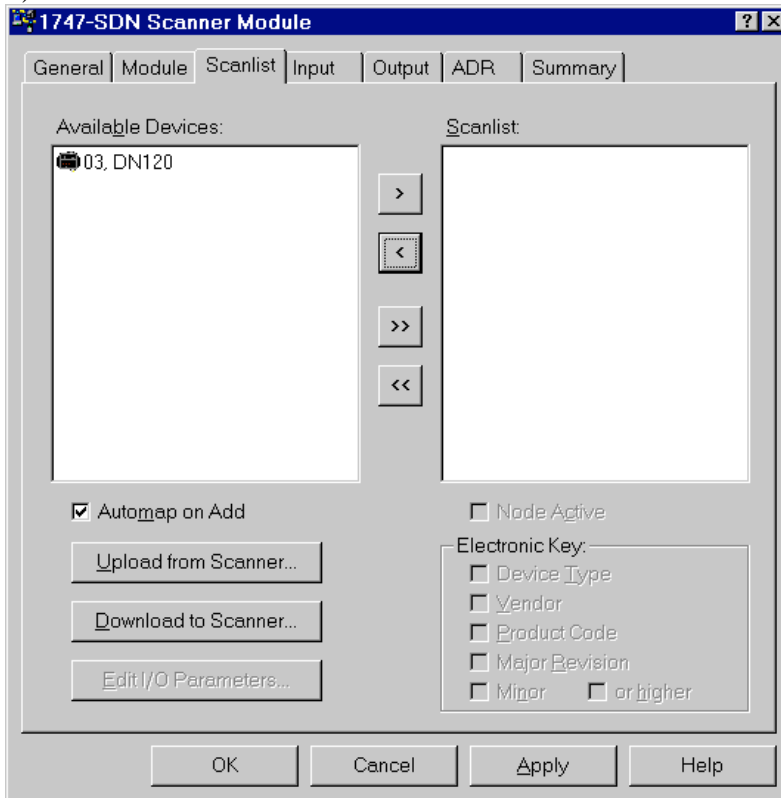
- 1) Before using the RSNetworkx to map the gateway's Polled I/O connection to 1747-SDN DeviceNet master scanner, you must calculate the *Poll Produce Size & Poll Consume Size*. Chapter 4 describes how to calculate these values.
- 2) Double click on the 1747-SDN icon to open its *Properties* box. You can also left click on the icon to select it, right click for the pop-up menu, and select *Properties*.




- 3) Select the Scan list tab. RSNetworkx prompts you for the Scanner Configuration. Click Upload to upload current 1747-SDN configuration from the node. RSNetworkx displays the upload progress.

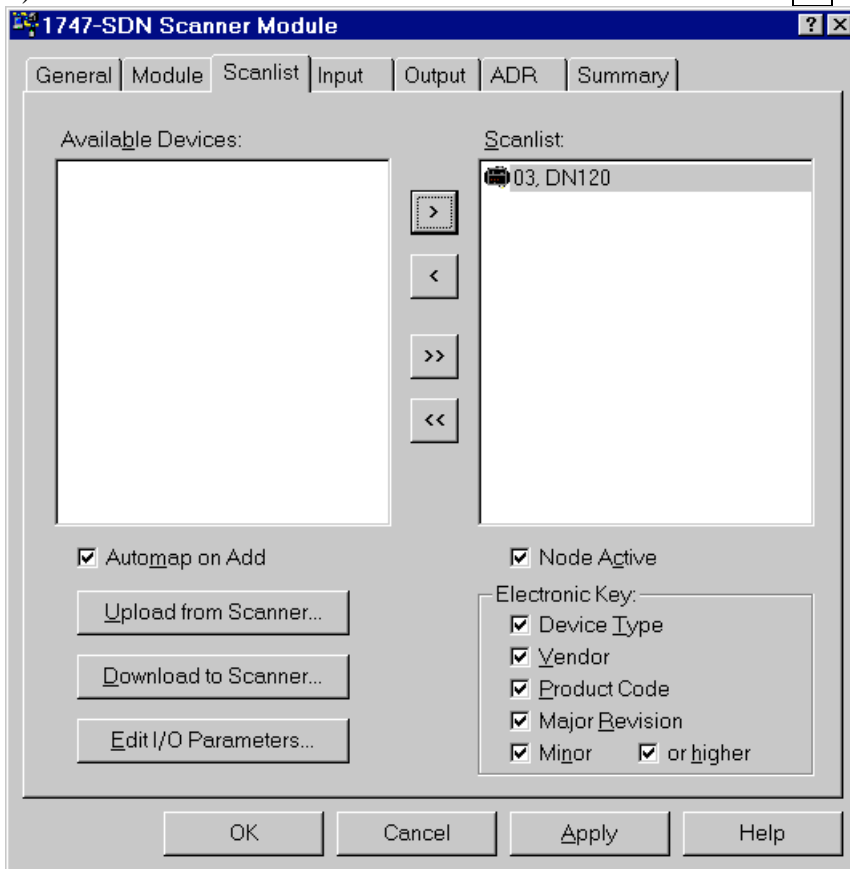


4) The next window shows the *Available Devices*: that can be added to the 1747-SDN *Scanlist*.

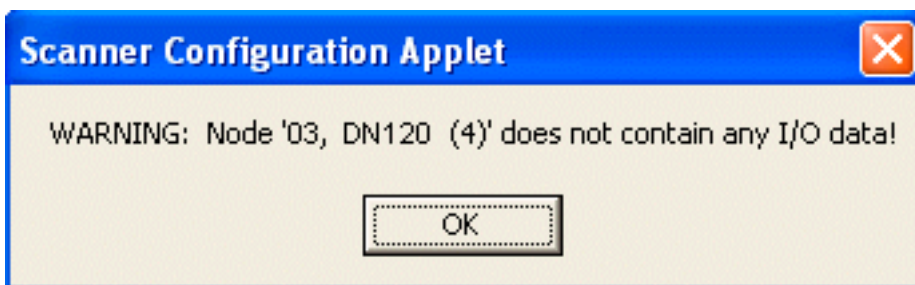


5) Select the Automap on Add checkbox if you want RSNetworkx to automatically map the DN120 input and output bytes into the 1747-SDN memory.

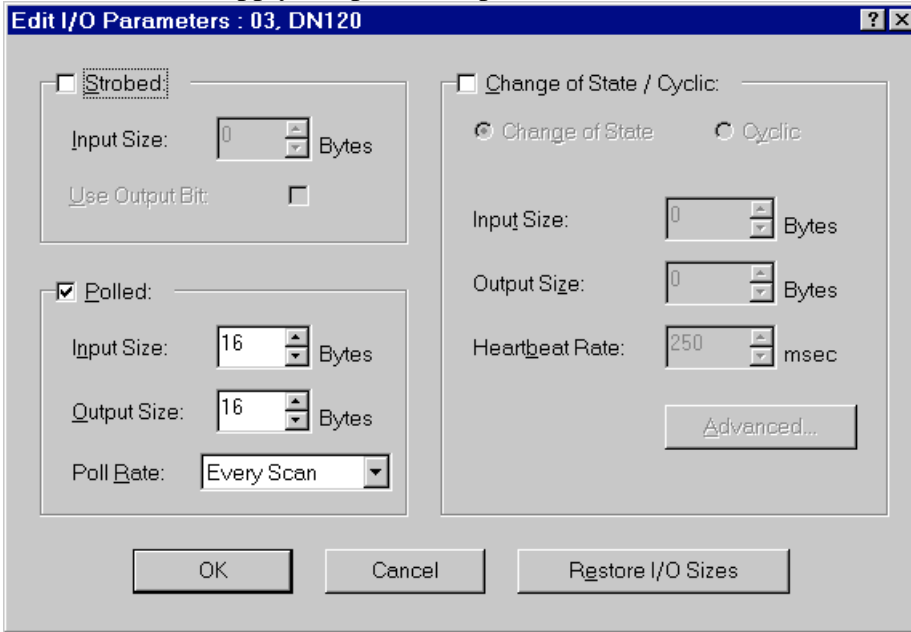
6) Select the DN120 under *Available Devices*: and click the  button to transfer to *Scanlist*.



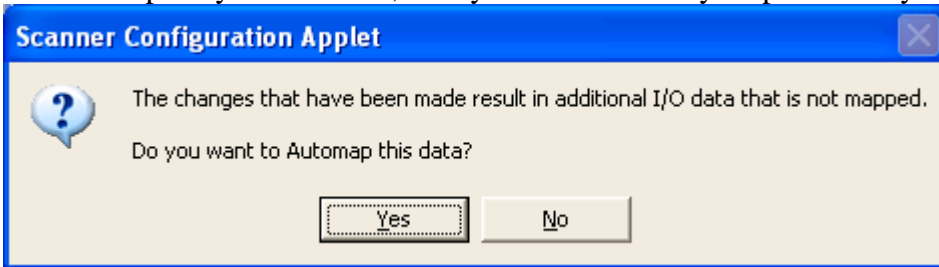
7) RSNetworkx warns that the DN120 does not contain any I/O data. Click *OK* to continue.



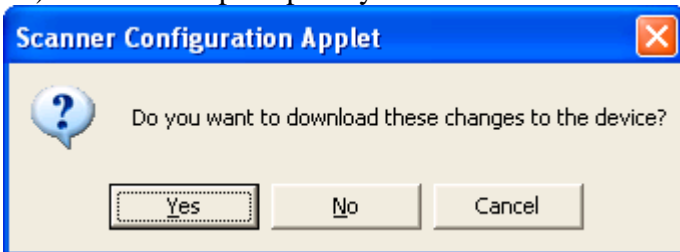
- 8) Click on the Edit I/O Parameters button. Use the ^ and v buttons to set Rx Size: to the calculated Poll Consume Size value and the Tx Size: to the calculated Poll Produce Size value. Click Apply to update I/O parameters.



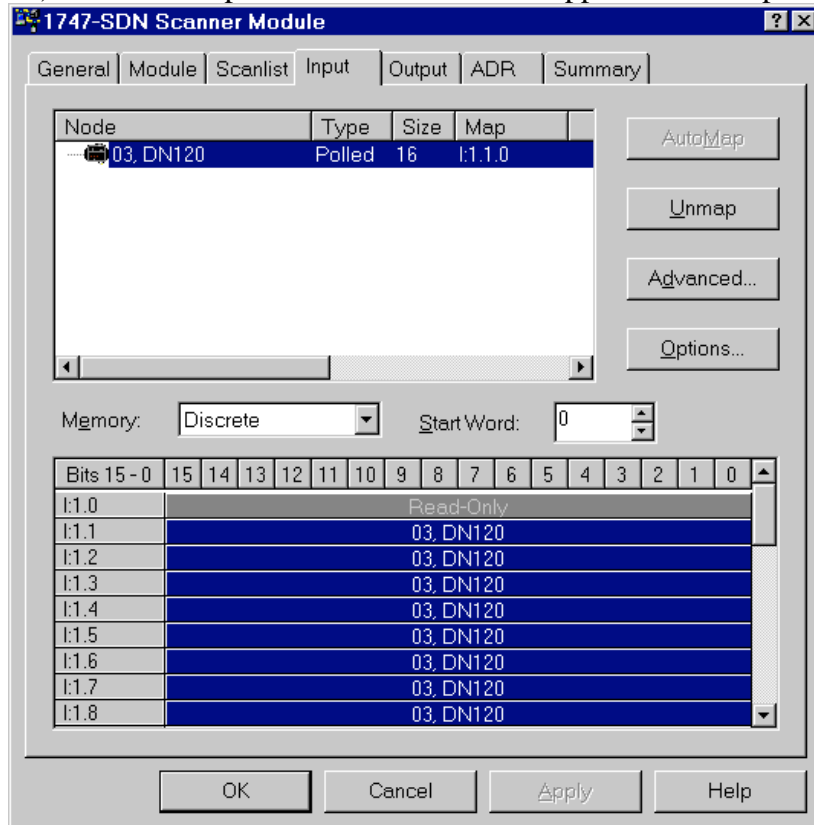
- 9) RSNetworkx prompts to Automap the new input and output data bytes. Select Yes to automap. If you select No, then you must manually map the I/O bytes in the memory tables.



- 10) RSNetworkx prompts if you want to download the changes to the 1747-SDN. Click Yes.

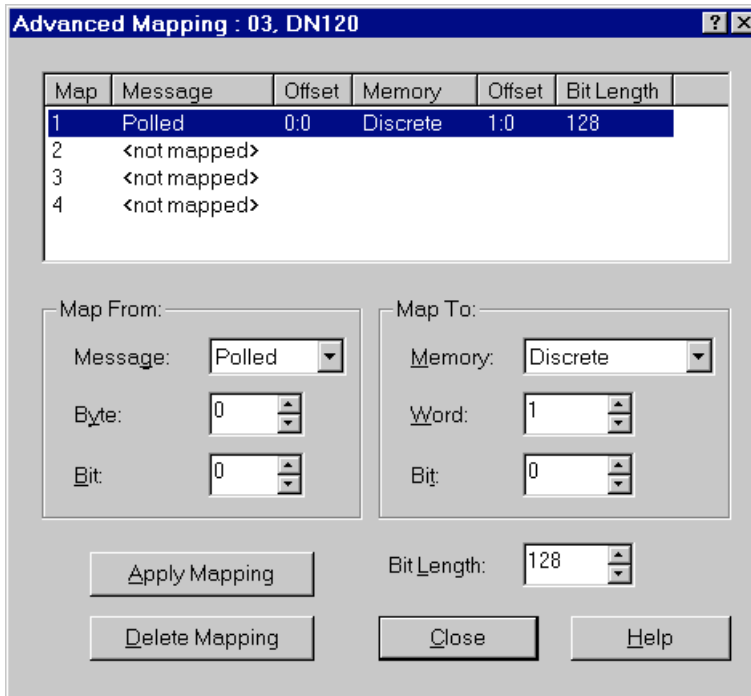


11) Select the Input tab to view the automapped DN120 input bytes.

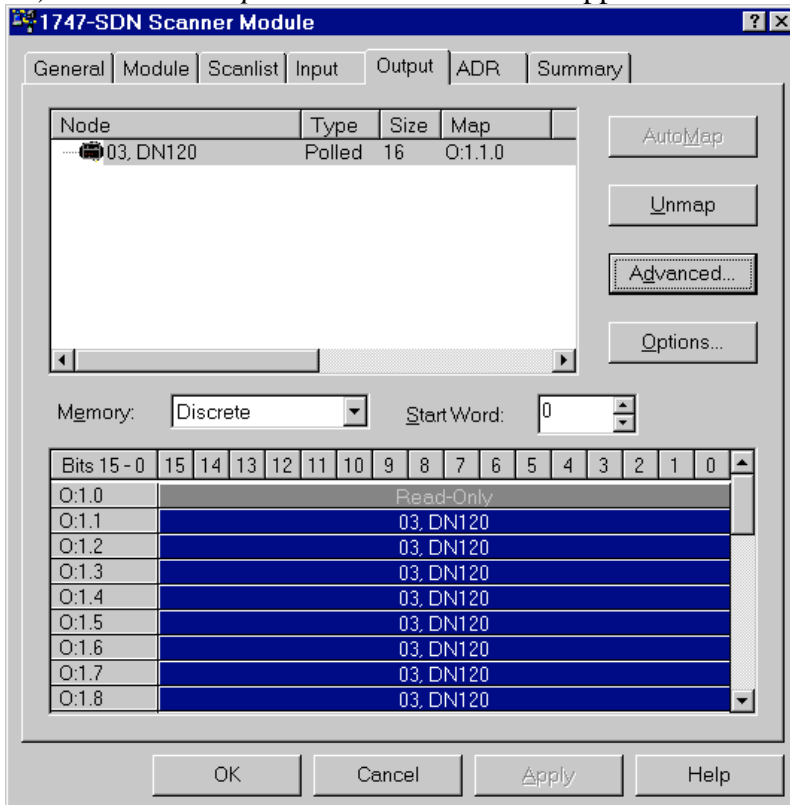


12) Click the Advanced... button to view current input mapping detail. Change the mapping to suit your application. Click Apply Mapping button after you make changes. Click Yes at the RSNetworkx prompt to download any changes to the 1747-SDN. Click Close to continue.

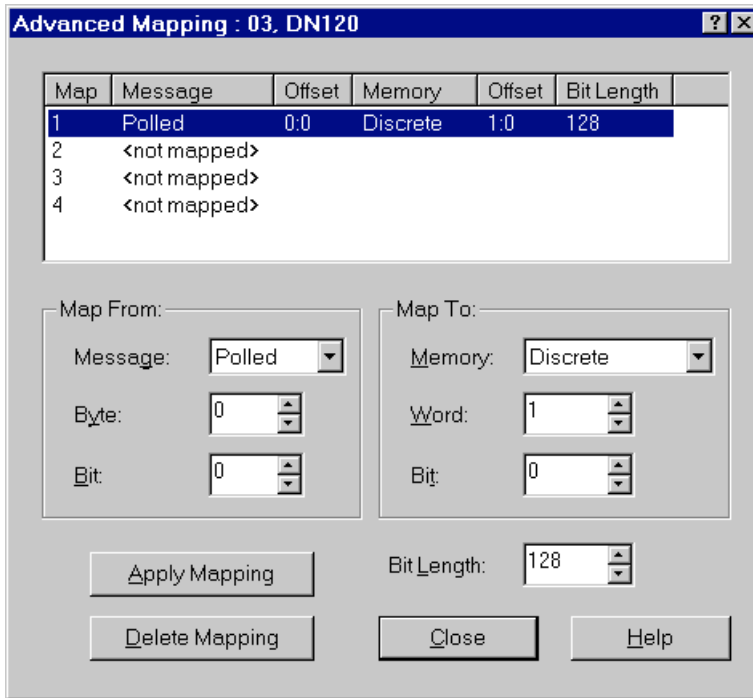




13) Select the *Output* tab to view the automapped DN120 output bytes.



14) Click the *Advanced...* button to view current input mapping detail. Change the mapping to suit your application. Click *Apply Mapping* button after you make changes. Click *Yes* at the RSNetworkx prompt to download any changes to the 1747-SDN. Click *Close* to continue.

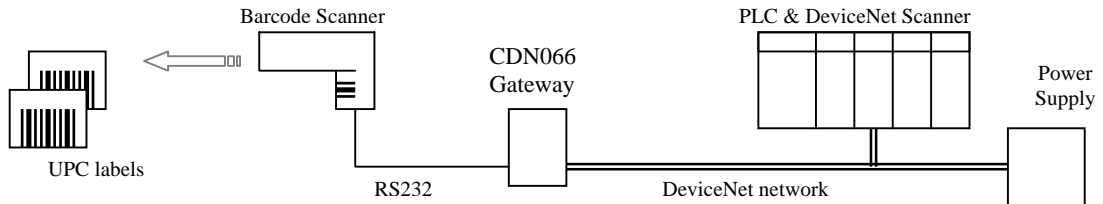


## Chapter 7 – Configuration Examples

This chapter contains four example gateway configurations.

### Example 1 – Receiving Fixed-Length Data

Read UPC labels into a PLC using a serial barcode scanner, a DN120 gateway, and a DeviceNet scanner (master). The barcode scanner RS232 channel is connected to a DN120 serial channel. The DN120 DeviceNet channel is connected to the PLC DeviceNet scanner. The DeviceNet network is powered by an external 24VDC power supply.



#### Barcode Scanner

The barcode scanner's RS232 channel is set for 9600 bps, 8 data bits, no parity, and 1 stop bit. When it reads a UPC label, it transmits a 5-byte serial message, which consists of the 5 ASCII characters printed on the UPC label.

#### DN120 Gateway

The receive mode will be *Stream Mode*, since there is no defined Delimiter for the start of a message or the end of a message. All received data bytes will be returned as DeviceNet input bytes. The *Maximum Receive Size* is 5, because the Barcode Scanner messages have a fixed length of 5 bytes. The data bytes will be returned as a *Short\_String*. The gateway will only return the data bytes once in a Poll Response Message.

The *Serial Stream Object* can now be configured. The following shows the *Serial Stream Object* attribute settings for this application. The 3rd column lists the address string if using *Set\_Attribute\_Single* commands to write the attribute values.

#### Serial Stream Object Configuration (Class Code 64 or 0x40)

Attribute	Data	Class / Instance / Attribute / Data	Description
6. Baud Rate	0	0x40 0x01 0x06 0x00	0 = 9600 bps
7. Parity	0	0x40 0x01 0x07 0x00	0 = no parity
10. Flow Control	2	0x40 0x01 0x0A 0x02	2 = CTS / RTS
13. Max Receive Size	5	0x40 0x01 0x0D 0x05	Fixed message size of 5 bytes
14. Data Format	00000001	0x40 0x01 0x0E 0x01	String Format = Short_String
15. Block Mode	00000000	0x40 0x01 0x0F 0x00	

The gateway will return 6 bytes of Receive Data, because the Maximum Receive Size is set to 5 and the data format is Short String (add 1 for length byte). The Status and Receive Sequence Number bytes are not enabled. The Poll Produce Size can now be calculated for this DN120 configuration.

<i>Status byte</i>	0
<i>Receive Sequence Number byte</i>	0
<i>Short_String length byte</i>	1
+ <i>Maximum Receive Size</i>	5
<i>Poll Produce Size</i>	6

The format of the Poll Response Message input bytes is as follows:

[ Short\_String length ] [ Short\_String data ]  
                           1 byte                          5 bytes

The gateway always returns 6 input bytes in the Poll Response Message, even if a new barcode message has not been received. The gateway will return new message data only once, and return a null data string if there is no new message data. The application should check the Short\_String length byte to determine if a new message is being returned. A length of 5 indicates valid data bytes (new message data). A length of 0 indicates no valid data bytes (no new message).

The Barcode Scanner sends the following 5-byte serial message when it reads a UPC label printed with '12345' (ASCII numbers).

0x31 0x32 0x33 0x34 0x35
--------------------------

The gateway generates the following Poll Response Message in response to the first Poll Command Message after its receives the Barcode message. The Short\_String length is 5, since 5 bytes were received.

0x05	0x31 0x32 0x33 0x34 0x35
------	--------------------------

The gateway generates the following Poll Response Message in response to subsequent Poll Command Messages, until it receives another Barcode message. The Short\_String length is 0, indicating a null data string. The 5 data bytes are undefined.

0x00	XX XX XX XX XX
------	----------------

**Example 2 – Receiving Pre-Delimited Data**

Same configuration as Example 1.

**Barcode Scanner**

The barcode scanner's RS232 channel is set for 9600 bps, 8 data bits, no parity, and 1 stop bit. When it reads a UPC label, it transmits following ASCII message format. The message always begins with the ASCII STX start-of-text (0x02) character. The barcode data will consist of a variable number of 1 to 14 ASCII characters, depending upon the UPC label being scanned. It will not transmit a 0x02 in the barcode data field.

[ STX ] [ ASCII barcode data ]

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The receive mode will be *Pre-Delimiter Mode*, because the barcode messages always begin with the same character. The *Delimiter* is 0x02 (STX). The *Maximum Receive Size* is 15, because the largest message contains 1 STX byte and 14 ASCII bytes. The received bytes will be returned as a *Short\_String*. An ASCII NUL Pad character (0x00) will be added at the end of the message if needed. The gateway will always return the data bytes in the Poll Response Message. The *Receive Sequence Number* will be used to indicate when a new message is returned.

The *Serial Stream Object* can now be configured. The following shows the *Serial Stream Object* attribute settings for this application. The 3rd column lists the address string if using *Set\_Attribute\_Single* commands to write the attribute values.

**Serial Stream Object Configuration (Class Code 64 or 0x40)**

Attribute	Data	Class / Instance / Attribute / Data	Description
6. Baud Rate	0	0x40 0x01 0x06 0x00	0 = 9600 bps
7. Parity	0	0x40 0x01 0x07 0x00	0 = no parity
10. Flow Control	2	0x40 0x01 0x0A 0x02	2 = CTS / RTS
13. Max Receive Size	15	0x40 0x01 0x0D 0x0F	Receive messages up to 15 bytes
14. Data Format	00001101	0x40 0x01 0x0E 0x0D	Pad receive message Pad justification = right (end of msg) String Format = Short_String
15. Block Mode	00101101	0x40 0x01 0x0F 0x2D	Re-send = enabled Receive Sequence Number = enabled Delimiter = enabled Pre-Delimiter
16. Delimiter	STX	0x40 0x01 0x10 0x02	0x02 = ASCII STX character
17. Pad Character	NUL	0x40 0x01 0x11 0x00	0x00 = ASCII NUL character

The gateway will return up to 16 bytes of Receive Data, because the Maximum Receive Size is set to 15 and the data format is Short String (add 1 for length byte). The Status byte is not enabled. The Receive Sequence Number byte is enabled. The Poll Produce Size can now be calculated for this DN120 configuration.

	<i>Status byte</i>	0
	<i>Receive Sequence Number byte</i>	1
	<i>Short_String length byte</i>	1
+	<i>Maximum Receive Size</i>	15
	<i>Poll Produce Size</i>	17

The format of the Poll Response Message input bytes is as follows:

[ Receive Sequence Number ] [ Short\_String length ] [ Short\_String data ] [ Pad bytes ]  
 1 byte                      1 byte                      0-15 bytes

The gateway always returns 17 input bytes in the Poll Response Message, even if the scanned barcode data contains fewer bytes. The application should check the Short\_String length byte to determine the number of valid data bytes being returned in a particular Poll Response Message. The remaining input bytes have undefined values.

The gateway will always return the last received Short\_String data in its Poll Response Message. The gateway increments the Receive Sequence Number when new Short\_String data is returned. The application can use the Receive Sequence Number to determine if the Short\_String data is new or old information.

The Barcode Scanner sends the following 8-byte serial message when it reads a UPC label printed with '1234567' (ASCII numbers).

0x02 0x31 0x32 0x33 0x34 0x35 0x36 0x37
---

The gateway generates the following Poll Response Message. The Receive Sequence Number is 1, since this is the first message received from the Barcode Scanner. The Short\_String length is 8, since 8 bytes were received. 7 Pad characters are added at the end of the message.

0x01	0x08	0x02 0x31 0x32 0x33 0x34 0x35 0x36 0x37	0x00 0x00 0x00 0x00 0x00 0x00 0x00
------	------	---	------------------------------------

**Example 3 – Receiving Post-Delimited Data**

Same configuration as Example 1.

**Barcode Scanner**

The barcode scanner's RS232 channel is set for 9600 bps, 8 data bits, no parity, and 1 stop bit. When it reads a UPC label, it transmits following ASCII message format. The message always begins ends with the ASCII ETX end-of-text (0x03) character. The barcode data will consist of a variable number of 1 to 14 ASCII characters, depending upon the UPC label being scanned. It will not transmit a 0x03 in the barcode data field.

[ ASCII barcode data ] [ ETX ]

**DN120 Gateway**

The receive mode will be *Post-Delimiter Mode*, because the barcode messages always end with the same character. The *Delimiter* is 0x03 (ETX), and will not be included in the receive data. The *Maximum Receive Size* is 15, because the largest message contains 14 ASCII bytes and 1 ETX byte. The received bytes will be returned a Short String. The gateway will only return new data bytes once in the Poll Response Message. The *Status* byte will be enabled.

The *Serial Stream Object* can now be configured. The following shows the *Serial Stream Object* attribute settings for this application. The 3rd column lists the address string if using *Set\_Attribute\_Single* commands to write the attribute values.

**Serial Stream Object Configuration (Class Code 64 or 0x40)**

Attribute	Data	Class / Instance / Attribute / Data	Description
6. Baud Rate	0	0x40 0x01 0x06 0x00	0 = 9600 bps
7. Parity	0	0x40 0x01 0x07 0x00	0 = no parity
10. Flow Control	2	0x40 0x01 0x0A 0x02	2 = CTS / RTS
13. Max Receive Size	15	0x40 0x01 0x0D 0x0F	Receive messages up to 15 bytes
14. Data Format	00000001	0x40 0x01 0x0E 0x01	String Format = Byte Array
15. Block Mode	00000110	0x40 0x01 0x0F 0x06	Delimiter = enabled Strip Delimiter enabled Post-Delimiter
16. Delimiter	ETX	0x40 0x01 0x10 0x03	0x03 = ASCII ETX character

The gateway will return up to 16 bytes of Receive Data, because the Maximum Receive Size is set to 15 and the data format is Short String (add 1 for length byte). The Status byte is enabled. The Receive Sequence Number byte is not enabled. The Poll Produce Size can now be calculated for this DN120 configuration.

	<i>Status byte</i>	1
	<i>Receive Sequence Number byte</i>	0
	<i>Short_String length byte</i>	1
+	<i>Maximum Receive Size</i>	15
	<hr/> <i>Poll Produce Size</i>	<hr/> 17

The format of the Poll Response Message input bytes is as follows:

[ Status ] [ Short\_String length ] [ Short\_String data ] [ undefined bytes ]  
 1 byte                      1 byte                      0-15 bytes

The gateway always returns 16 input bytes in the Poll Response Message, even if the scanned barcode data contains fewer bytes, or if a new barcode message has not been received. The gateway returns new message data only once, and returns a null data string if there is no new message data. The application should use the Short\_String length byte to determine if a new message is being returned. A length greater than zero indicates the number of valid data bytes (new message data). A length of 0 indicates no valid data bytes (no new message).

The Barcode Scanner sends the following 6-byte serial message when it reads a UPC label printed with '12345' (ASCII numbers).

0x31 0x32 0x33 0x34 0x35 0x03
-------------------------------

The gateway generates the following Poll Response Message in response to the first Poll Command Message after its receives the Barcode message. The Status Byte is 0x0A, indicating no transmit or receive errors, an empty Transmit Buffer, and an empty Receive Buffer. The Delimiter is stripped, so the Short\_String length is 5. There are 5 valid data bytes, and the remaining 10 input bytes are undefined.

0x0A	0x05	0x31 0x32 0x33 0x34 0x35	XX XX XX XX XX XX XX XX XX XX
------	------	--------------------------	-------------------------------

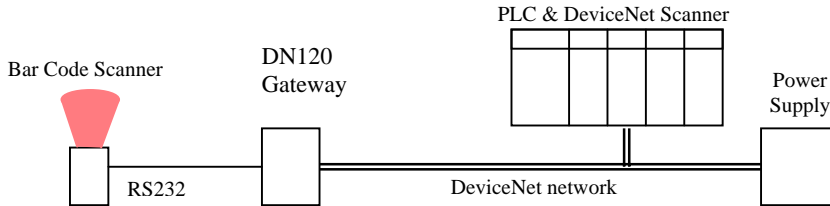
The gateway generates the following Poll Response Message in response to subsequent Poll Command Messages, until it receives another Barcode message. The Short\_String length is 0, indicating a null data string. The 15 other input bytes are undefined.

0x0A	0x00	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX
------	------	--



**Example 4 – Transmitting Fixed-Length Data**

Print an ASCII string from a PLC to a bar code scanner, using a DN120 gateway and a DeviceNet scanner (master). The text message string is always 25 characters long, including any ASCII control characters. The bar code scanner RS232 channel is connected to a DN120 serial channel. The DN120 DeviceNet channel is connected to the PLC DeviceNet scanner. The DeviceNet network is powered by an external 24VDC power supply.



**Bar Code Scanner**

The bar code scanner's RS232 channel is set for 9600 bps, 7 data bits, even parity, and 1 stop bit.

**DN120 Gateway**

The DN120 serial channel is configured to transmit this RS232 message format. A string format will be Byte Array, since the message size is fixed. Transmit Sequence Numbers will be used to signal a new message to transmit. The Maximum Transmit Size is 25, which is the number of message bytes. The *Serial Stream* Object attributes are shown below for this application. The 3rd column lists the address string if using Set\_Attribute\_Single commands to write the attribute values.

**Serial Stream Object Configuration (Class Code 64 or 0x40)**

Attribute	Data	Class / Instance / Attribute / Data	Description
6. Baud Rate	5	0x40 0x01 0x06 0x05	5 = 300 bps
7. Parity	1	0x40 0x01 0x07 0x01	1 = Even parity
10. Flow Control	1	0x40 0x01 0x0A 0x01	1 = XON / XOFF
14. Data Format	00000000	0x40 0x01 0x0E 0x00	String Format = Byte Array
15. Block Mode	00010000	0x40 0x01 0x0F 0x10	Transmit Sequence Number enabled
18. Max Transmit Size	25	0x40 0x01 0x12 0x19	Fixed message size of 25 bytes

The gateway will transmit 25 output bytes received in a Poll Command Message. The Status Clear byte is not enabled. The Transmit Sequence Number is enabled. The Length Byte is not enabled (Byte Array format). The Poll Consume Size can now be calculated for this DN120 configuration.

	<i>Status Clear byte</i>	0
	<i>Transmit Sequence Number byte</i>	1
	<i>Short_String length byte</i>	0
+	<i>Maximum Receive Size</i>	25
	<i>Poll Produce Size</i>	26

The format of the Poll Command Message output bytes is as follows:

[ Transmit Sequence Number ]	[ message data ]
1 byte	25 bytes

The gateway always receives 26 output bytes in the Poll Command Message. It will not transmit a new serial message until the Transmit Sequence Number received in the Poll Command is different than the number received in a previous Poll Command. The application should increment the Transmit Sequence Number when it sends new output byte values in the Poll Command Message, to enable the transmission of the new message.

**Example 5 – Transmitting Variable-Length Data**

Same configuration as Example 4, except the text message string can be from 1 to 25 characters long, including ASCII control characters.

**Bar Code Scanner**

The bar code scanner's RS232 channel is set for 9600 bps, 7 data bits, even parity, and 1 stop bit.

**DN120 Gateway**

The DN120 serial channel is configured to transmit this RS232 message format. A string format will be Short\_String, since the message size is variable. The Maximum Transmit Size is 25, since the largest text message contains 25 characters. The *Serial Stream Object* attributes are shown below for this application. The 3rd column lists the address string if using Set\_Attribute\_Single commands to write the attribute values.

**Serial Stream Object Configuration (Class Code 64 or 0x40)**

Attribute	Data	Class / Instance / Attribute / Data	Description
6. Baud Rate	5	0x40 0x01 0x06 0x05	5 = 300 bps
7. Parity	1	0x40 0x01 0x07 0x01	1 = Even parity
10. Flow Control	1	0x40 0x01 0x0A 0x01	1 = XON / XOFF
14. Data Format	00000001	0x40 0x01 0x0E 0x01	String Format = Short_String
15. Block Mode	00000000	0x40 0x01 0x0F 0x00	Transmit Sequence Number disabled
18. Max Transmit Size	25	0x40 0x01 0x12 0x19	Fixed message size of 25 bytes

The gateway will transmit the output bytes received in a Poll Command Message. The Status Clear byte is not enabled. The Transmit Sequence Number is not enabled. The Length Byte is enabled (Short\_String format). The Poll Consume Size can now be calculated for this DN120 configuration.

<i>Status Clear byte</i>	0	
<i>Transmit Sequence Number byte</i>	0	
<i>Short_String length byte</i>	1	
<i>Maximum Receive Size</i>	25	
<i>Poll Produce Size</i>	26	

The format of the Poll Command Message output bytes is as follows:

[ Short\_String length ] [ message data ]  
                           1 byte                  25 bytes

The gateway always receives 26 output bytes in the Poll Command Message, regardless of the variable length messages. The gateway uses the Short\_String length byte to determine the valid number of message bytes in the Poll Command Message. It will only transmit the valid message bytes. All remaining output bytes are ignored. If the gateway receives a Poll Command Message with Short\_String length = 0, no output bytes are transmitted. The application can send variable-length Short\_Strings to be transmitted, and send Null Data (length = 0) when there is no message to transmit.

## Chapter 8 – Troubleshooting

<b>Problem</b>	<b>Possible Cause</b>
DeviceNet Configuration Program does not recognize Gateway.	<ul style="list-style-type: none"> <li>Register Gateway EDS file with Configuration Program.</li> </ul>
DeviceNet Configuration Program does not recognize Gateway after loading EDS file.	<ul style="list-style-type: none"> <li>Check Major and Minor Revisions for Gateway and EDS file, to see if you have correct EDS file for your Gateway's firmware version.</li> </ul>
Gateway does not appear on DeviceNet network.	<ul style="list-style-type: none"> <li>Check wiring and cable connections.</li> <li>Check DeviceNet power supply voltage.</li> <li>Make sure Gateway baud rate matches network baud rate.</li> <li>Verify Gateway baud rate is set from rotary switches or retentive memory value.</li> <li>Make sure Gateway MAC ID is not used by another device.</li> </ul>
After setting Gateway MAC ID, DeviceNet Master does not recognize Gateway.	<ul style="list-style-type: none"> <li>Disconnect Gateway from network before changing MAC ID.</li> <li>Make sure Gateway MAC ID is not used by another device.</li> <li>Verify Gateway MAC ID is set from rotary switches or retentive memory value.</li> <li>Verify DeviceNet baud rate.</li> </ul>
<i>NET</i> LED is flashing red.	<ul style="list-style-type: none"> <li>Gateway is removed from DeviceNet Master scanlist or network. Power cycle Gateway to reset.</li> </ul>
<i>NET</i> LED is solid red.	<ul style="list-style-type: none"> <li>Make sure Gateway MAC ID is not used by another device. Possible DeviceNet network failure.</li> </ul>
<i>NET</i> LED is off.	<ul style="list-style-type: none"> <li>Check wiring and cable connections.</li> <li>Check DeviceNet power supply voltage.</li> <li>Make sure Gateway baud rate matches network baud rate.</li> <li>Verify Gateway baud rate is set from rotary switches or retentive memory value.</li> </ul>
<i>MOD</i> LED is flashing or solid red.	<ul style="list-style-type: none"> <li>Gateway has failed. Cycle power to reset. Replace Gateway if necessary.</li> </ul>
<i>RX</i> LED does not flash green when data is sent to the Gateway.	<ul style="list-style-type: none"> <li>If Sync enabled, make sure Receive Request Number and Receive Acknowledge Number are equal. Application must acknowledge last received message before gateway will receive the next message.</li> <li>Verify data is being received in Receive Data.</li> <li>Verify source device is transmitting data to Gateway.</li> <li>Make sure hardware flow control signals are properly connected.</li> </ul>
<i>RX</i> LED is solid red after Gateway receives data.	<ul style="list-style-type: none"> <li>Check Status byte for any Receiver errors. Reset Gateway or clear Status error bits if necessary.</li> <li>Make sure parity is set to match transmitting device settings.</li> </ul>
<i>TX</i> LED is solid red after receiving data from DeviceNet Master.	<ul style="list-style-type: none"> <li>Check Status byte for Transmitter errors. Reset Gateway or clear Status error bits if necessary.</li> <li>Make sure parity is set to match receiving device settings.</li> </ul>
<i>TX</i> LED does not flash green when Gateway should be transmitting data.	<ul style="list-style-type: none"> <li>If Transmit Sequence Number enabled, make sure number is being incremented by the application. Gateway will not transmit new data unless the Transmit Sequence Number is changed.</li> <li>Verify data is being saved in Transmit Data.</li> </ul>
1747-SDN Scanner displays error code 77.	<ul style="list-style-type: none"> <li>Gateway Poll Produce Size and/or Poll Consume Size value do not 1747-SDN Poll Rx/Tx settings.</li> </ul>

## **Appendix A – Product Specifications**

### **DeviceNet Interface**

Power Requirements:	11 - 28 Vdc @ 50 mA
Loss of Ground:	Yes
Reverse Polarity:	-30 Vdc
Signal Levels:	ISO11898

### **Serial Channel**

Isolation:	500 Volts
ESD Protection:	+/- 10 kV
Overload Protection:	+/- 30 Volts
Short Circuit:	Indefinite
RS232 Output Levels:	+/- 7.9 Volts (unloaded, typical)

### **Environmental**

Operating Temperature:	0° C to 70° C
Storage Temperature:	-25° C to 85° C
Size (inches):	3.25 x 2.37 x 1.08
Mounting (inches)	0.5 tabs, 3/16 diameter mounting holes
PCB Encapsulation:	RTV Silicon Compound



## Appendix C – ASCII Character Codes

Non-Printable Characters					Printable Characters								
Hex	Dec	Char	Name	Kybd	Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char
0x00	0	NUL	Null	Ctrl @	0x20	32	Space	0x40	64	@	0x60	96	`
0x01	1	SOH	Start of heading	Ctrl A	0x21	33	!	0x41	65	A	0x61	97	a
0x02	2	STX	Start of text	Ctrl B	0x22	34	"	0x42	66	B	0x62	98	b
0x03	3	ETX	End of text	Ctrl C	0x23	35	#	0x43	67	C	0x63	99	c
0x04	4	EOT	End of transmit	Ctrl D	0x24	36	\$	0x44	68	D	0x64	100	d
0x05	5	ENQ	Enquiry	Ctrl E	0x25	37	%	0x45	69	E	0x65	101	e
0x06	6	ACK	Acknowledge	Ctrl F	0x26	38	&	0x46	70	F	0x66	102	f
0x07	7	BEL	Bell	Ctrl G	0x27	39	'	0x47	71	G	0x67	103	g
0x08	8	BS	Backspace	Ctrl H	0x28	40	(	0x48	72	H	0x68	104	h
0x09	9	HT	Horizontal tab	Ctrl I	0x29	41	)	0x49	73	I	0x69	105	i
0x0A	10	LF	Line feed	Ctrl J	0x2A	42	*	0x4A	74	J	0x6A	106	j
0x0B	11	VT	Vertical tab	Ctrl K	0x2B	43	+	0x4B	75	K	0x6B	107	k
0x0C	12	FF	Form feed	Ctrl L	0x2C	44	,	0x4C	76	L	0x6C	108	l
0x0D	13	CR	Carriage return	Ctrl M	0x2D	45	-	0x4D	77	M	0x6D	109	m
0x0E	14	SO	Shift out	Ctrl N	0x2E	46	.	0x4E	78	N	0x6E	110	n
0x0F	15	SI	Shift in	Ctrl O	0x2F	47	/	0x4F	79	O	0x6F	111	o
0x10	16	DLE	Data line escape	Ctrl P	0x30	48	0	0x50	80	P	0x70	112	p
0x11	17	DC1	Device control 1	Ctrl Q	0x31	49	1	0x51	81	Q	0x71	113	q
0x12	18	DC2	Device control 2	Ctrl R	0x32	50	2	0x52	82	R	0x72	114	r
0x13	19	DC3	Device control 3	Ctrl S	0x33	51	3	0x53	83	S	0x73	115	s
0x14	20	DC4	Device control 4	Ctrl T	0x34	52	4	0x54	84	T	0x74	116	t
0x15	21	NAK	Negative acknowledge	Ctrl U	0x35	53	5	0x55	85	U	0x75	117	u
0x16	22	SYN	Synchronous idle	Ctrl V	0x36	53	6	0x56	86	V	0x76	118	v
0x17	23	ETB	End of transmit block	Ctrl W	0x37	55	7	0x57	87	W	0x77	119	w
0x18	24	CAN	Cancel	Ctrl X	0x38	56	8	0x58	88	X	0x78	120	x
0x19	25	EM	End of medium	Ctrl Y	0x39	57	9	0x59	89	Y	0x79	121	y
0x1A	26	SUB	Substitute	Ctrl Z	0x3A	58	:	0x5A	90	Z	0x7A	122	z
0x1B	27	ESC	Escape	Ctrl [	0x3B	59	;	0x5B	91	[	0x7B	123	{
0x1C	28	FS	File separator	Ctrl \	0x3C	60	<	0x5C	92	\	0x7C	124	
0x1D	29	GS	Group separator	Ctrl ]	0x3D	61	=	0x5D	93	]	0x7D	125	}
0x1E	30	RS	Record separator	Ctrl ^	0x3E	62	>	0x5E	94	^	0x7E	126	~
0x1F	31	US	Unit separator	Ctrl _	0x3F	63	?	0x5F	95	_	0x7F	127	DEL