Allen-Bradley

842D DeviceNet Encoder

Catalog Numbers:
842D-60131331BDA and
842D-60131331BXA Revision 4.001

User Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- Identify a hazard.
- Avoid the hazard.
- Recognize the consequences.

Important: Identifies information that is critical for successful application and understanding of the product.

Table of Contents

Using this Manual

Objectives

Read this preface to become familiar with the organization of the manual. In this preface, you will read about the following:

- Who should use this manual.
- An overview of the 842D DeviceNet™ absolute rotary shaft encoder.
- The purpose of this manual.
- Terms and abbreviations.
- Conventions used in this manual.
- Rockwell Automation support.

Who Should Use this Manual?

Use this manual if you are responsible for installing, wiring, programming, or troubleshooting control systems that use the 842D encoder.

This manual is intended for qualified service personnel responsible for setting up and servicing the 842D encoder. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, networking, required equipment and software, and safety precautions.

Purpose of this Manual

This manual is a learning and reference guide for the 842D encoder. It describes the procedures needed to install, configure, and troubleshoot the encoder.

Contents of this Manual

This manual contains the following information:

Chapter	Title	Contents
Preface	*Using this Manual*	Describes the purpose, background and scope of this manual. Also provides information on safety precautions and technical support.
1	*Overview*	Provides an overview of the 842D Encoder.
2	*Installation*	Provides a procedure for installing the 842D encoder.
3	*Configuring the DeviceNet Encoder DIP Switches*	Describes the setting of node address, bus termination, baud rate and PRESET function.
4	*Configuring the Encoder Using RSNetWorx for DeviceNet*	Provides information that you need to configure the encoder (online and offline) over the DeviceNet network.
5	*Configuring a Scanner to Communicate with the Encoder*	Provides instructions for configuring a PLC or SLC scanner to communicate with the encoder.
6	*Using DeviceNet Explicit Messaging*	Includes information you need to monitor and configure the encoder using explicit messaging on DeviceNet. Features an example of explicit messaging.
A	*Specifications and Dimensions*	Provides the specifications and physical dimensions of the 842D encoder.
B	*DeviceNet Objects*	Defines the DeviceNet object classes, class services, and attributes that are supported by the DeviceNet encoder.

Related Publications

Title	Publication Number
RSNetWorx for DeviceNet Getting Results Manual	9398-DNETGR
1747-SDN DeviceNet Scanner Configuration Manual	1747-6.5.2
1747-SDN DeviceNet Scanner Module Manual	1747-5.8
DeviceNet Media, Sensors and Distributed I/O	1485-CG001A-EN-P
DeviceNet Cable System Planning and Installation Manual	DN-6.7.2
RSLogix 5 Getting Results Guide	9399-RL53GR
RSLogix 500 Getting Results Guide	9399-RL50GR
RSLogix 5000 Getting Results Guide	9399-RLD300GR

Safety Precautions

Please read the following safety precautions carefully.

ATTENTION: Only personnel familiar with DeviceNet products and associated machinery should plan or implement the installation, start-up, configuration, and subsequent maintenance of the DeviceNet absolute encoder. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: Remove all power before installing the DeviceNet absolute encoder. Failure to disconnect power may result in death or serious injury. Verify all power is removed before installing the DeviceNet absolute encoder.

ATTENTION: Hazard of equipment damage exists. If explicit messages are programmed to frequently write parameter data to the 842D EEPROM, the EEPROM can exceed its life cycle and cause the product to malfunction. Do not create a program that frequently uses explicit messages to write parameter data to a product. (See EEPROM Life specification on page A-1.)

Terms and Abbreviations

For a complete listing of Allen-Bradley terminology, refer to the Allen-Bradley *Industrial Automation Glossary*, Publication AG-7.1.

Terms	Definition
DeviceNet	An open network that provides probabilistic I/O control through a managed bit-wise non-destructive multiplexing scheme.
842D DeviceNet Encoder	An Allen-Bradley encoder that communicates directly with the DeviceNet network without requiring additional adapters. In this manual, the terms “encoder” and “842D” are also used when referring to the 842D DeviceNet Encoder.
RSNetWorx for DeviceNet	A Rockwell Software application that can be used to set up DeviceNet networks and configure connected devices. RSNetWorx for DeviceNet (version 3.00.00) and RSLinx (version 2.20.02) were used for examples in the manual. Different versions may differ in appearance and procedures.

Abbreviation	Full Name	Definition
CAN	Controller Area Network	Physical layer definition
ODVA	Open DeviceNet Vendor Association	User organization for DeviceNet.
ID	Identifier	
EDS	Electronic Data Sheet	
ScF	Scaling factor	Measuring units per revolution / Single turn resolution
Pos_calc	calculated position value	calculated current position value, after clearing with Offset, ScF, Preset
Pos_num	numerical position value	numerical (physical) position value before clearing with Offset, ScF, Preset
Data Types		
BOOL	Boolean	Bit
BYTE	Bit String	1 Byte (8 Bit)
WORD	Bit String	2 Byte (16 Bit)
USINT	Unsigned Short Integer	Int (1 Byte) - (0...255)
UINT	Unsigned Integer	Int (2 Byte) - (0...65,535)
UDINT	Unsigned Double Integer	Int (4 Byte) - (0...+2^{32} -1)
SINT	Signed Short Integer	Int (1 Byte) - (-128...+127)
INT	Signed Integer	Int (2 Byte) - (-32,768...+32,767)
DINT	Signed Double Integer	Int (4 Byte) - (-2^{31}...+2^{31} - 1)
LSB	Least Significant Bit / Byte	
MSB	Most Significant Bit / Byte	

Conventions Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for chapter names and for parameter names.
- **Bold** type is used for names of menus, menu options, screens, and dialog boxes.

Important: This type of paragraph contains tips or notes that have been added to call attention to useful information.

Rockwell Automation Support

Rockwell Automation offers support services worldwide, with more than 75 sales/support offices, more than 500 authorized distributors, and more than 250 authorized systems integrators located throughout the United States alone. In addition, Rockwell Automation representatives are in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

- Sales and order support.
- Product technical training.
- Warranty support.
- Support service agreements.

Technical Product Support

If you need to contact Rockwell Automation for technical assistance, please call your local Rockwell Automation representative.

Refer to http://www.ab.com for updates and supporting documentation.

Notes:

Overview

Chapter Objectives

Chapter 1 provides an overview of your 842D DeviceNet absolute encoder. In this chapter, you will read about the following:

- Function of the 842D encoder.
- Features of the 842D encoder.
- Steps for setting up the encoder.
- Required tools and equipment.

Overview of the Encoder

The 842D absolute multi-turn encoder provides a total resolution of 26 bits. The single-turn position value is transmitted with 13 bits. The number of multi-turn revolutions is 13 bits. Revolutions are counted by the use of a gear mechanism. The bus interface is located in the encoder and is configured as a DeviceNet slave according to DeviceNet specification, release 2.0.

Features of the Encoder

The DeviceNet network is an open, global industry-standard communication network designed to provide an interface through a single cable from a programmable controller directly to “smart” devices such as sensors, push buttons, motor starters, operator interfaces and drives.

The 842D DeviceNet encoder connects directly to the a DeviceNet network without the need for additional adapters. Features of the 842D include:

- 26-bit absolute multi-turn operation (8192 steps per revolution x 8192 revolutions) without batteries
- Supports Polling, Cyclic, Change of State (COS) and Bit Strobed I/O messaging
- Transmission rate up to 500 kBaud.
- Programmable functions
  - Electronic alignment (PRESET or Number-SET). Electronic alignment may be carried out via DeviceNet or via a push-button in the bus connector of the 842D.
  - Clockwise or Counterclockwise (CW/CCW) counting direction

  - Scaling function - Setting the single-turn resolution as well as the number of turns. The single-turn resolution is any whole number from 1 to 8192. The number of turns must be 1, 2, 4, 8, 16, 32, 64... up to 8192.
  - Up to eight programmable cams
  - Velocity Warning Flags
- Status information is available via the Network Status LED on the back of the encoder.
- Velocity Feedback (Steps per second, RPM, or RPS)
- Diagnostic and Position Error Alarms
- Node address, Baud rate, and bus termination resistance are selected via DIP switches under the removable cover on the back of the encoder.

Overview of Setting Up the Encoder

To set up the 842D DeviceNet encoder, you must perform the following tasks:

1. Install the encoder. Refer to Chapter 2, *Installation*.
2. Set the encoder's node address, transmission rate and bus termination. Refer to Chapter 3, *Configuring the DeviceNet Encoder DIP Switches*.
3. Configure the encoder's parameters. Refer to Chapter 4, *Configuring the Encoder Using RSNetWorx for DeviceNet*.
4. Configure a scanner (either PLC or SLC) to communicate with the encoder. Refer to Chapter 5, *Configuring a Scanner to Communicate with the Encoder*.

Installation

Chapter Objectives

Chapter 2 provides the information that you need to install the 842D DeviceNet encoder. In this chapter, you will read about the following:

- Cable connections.
- Installing the encoder.

Installing a Bulletin 842D DeviceNet Encoder

Selecting Cables

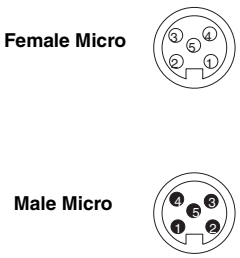
To connect the encoder to the DeviceNet network, you must select an appropriate DeviceNet drop cable. A drop line connects a node, such as an encoder, to the DeviceNet trunk cable. Use the following information to select appropriate cables for each connection.

Bulletin 842D DeviceNet encoders are available with a single 5-pin micro quick disconnect or two 5-pin quick disconnects (one male and one female) for 'daisy chain' connections.

Catalog Number	Electrical Connection
842D-60131331BDA	One 5-pin male micro QD
842D-60131331BXA	Two 5-pin micro QDs (one male & one female)

Pin configurations are per the DeviceNet specification as follows:

Figure 2.1 DeviceNet Micro Connections



Refer to the table below for recommended drop cables. .

Length	Right Angle Micro Male to Straight Micro Female
1m	1485R-P1R5-F5
2m	1485R-P2R5-F5
3m	1485R-P3R5-F5
4m	1485R-P4R5-F5
5m	1485R-P5R5-F5
6m	1485R-P6R5-F5

It is also important to determine the limitations of the trunk and drop cables. Refer to the following table.

Data Rates	125 Kbps	250 Kbps	500 Kbps
Thick Trunk Line	500 m (1,640 ft)	250 m (820 ft)	100 m (328 ft)
Thin Trunk Line	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Maximum Drop Length	6 m (20 ft)	6 m (20 ft)	6 m (20 ft)
Cumulative Drop Budget	156 m (512 ft)	78 m (256 ft)	39 m (128 ft)

For more information on DeviceNet cables and cable systems, refer to the DeviceNet Cable System Planning and Installation Manual, Publication DN-6.7.2.

Installing the DeviceNet Encoder

The following instructions explain how to physically install your DeviceNet encoder.

1. Be sure to select the proper size flexible coupling clamp to mate to the encoder shaft, e.g., 845-FC-*-*. See the Encoder Accessories section in the Allen-Bradley *Sensors* catalog.

ATTENTION: Only personnel familiar with DeviceNet products and associated machinery should plan or implement the installation, start-up, configuration, and subsequent maintenance of the DeviceNet absolute encoder. Failure to comply may result in personal injury and/or equipment damage.

2. Use the dimension drawings to determine the encoder mounting hole locations. See Appendix A.
3. Slide the flexible coupling onto the shaft, but do not tighten the set screws.
4. Mount the encoder and tighten with three size M4 mounting screws (not supplied).
5. Center the flexible coupling and tighten the set screws.
6. Rotate the machine slowly and verify that the flexible coupling is not deforming beyond specifications.

Configuring the DeviceNet Encoder DIP Switches

Chapter Objectives

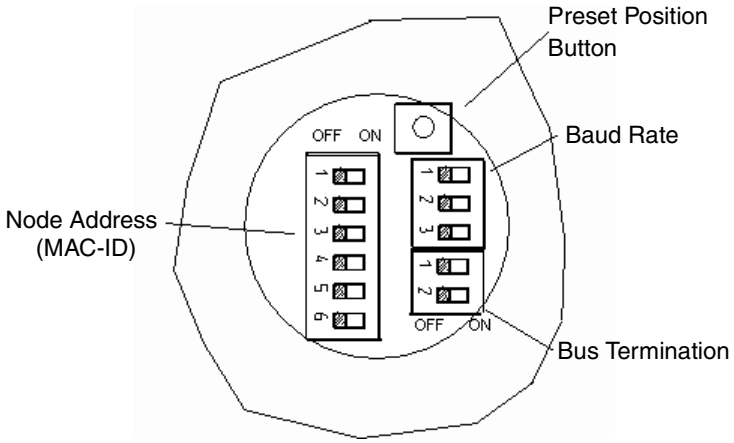
Chapter 3 provides information that you need to configure the encoder. In this chapter, you will read about the following:

- Setting the node address.
- Setting the transmission baud rate
- Activating bus termination.
- Diagnostic LED
- The Preset function.

Setting up the 842D DeviceNet Encoder

Specific features of the 842D must be configured by means of hardware settings. (Remote setting of the DIP switches via a Node Commissioning Tool is not supported at this time.) These features are Node Address, Baud Rate and the DeviceNet bus termination. In addition, the encoder can be set to a fixed position value (PRESET function) by actuating a push-button. In order to execute this function, the large PG plug on the rear of the encoder has to be removed. Inside, three DIP switches and a micro push-button become visible.

Figure 3.1 Encoder DIP Switches



Setting the Node Address

The Node Address is set via the 6-pole DIP switch. The DIP switch settings are binary starting with switch number 1 = (2^0) and ending with switch number 6 (= 2^5).

DIP-1	DIP-2	DIP-3	DIP-4	DIP-5	DIP-6	Address
2^0	2^1	2^2	2^3	2^4	2^5	
0	0	0	0	0	0	0
1	0	0	0	0	0	1
...	...	...	...	...	...	...
1	1	1	1	1	1	63

0 = DIP switch is OFF
1 = DIP switch is ON

Setting the baud rate

The 3-pole DIP switch allows for setting the transmission baud rate.

DIP-1	DIP-2	DIP-3	Baud rate
0	0	X	125 kBaud
1	0	X	250 kBaud
0	1	X	500 kBaud
1	1	X	125 kBaud

X = don't care
0 = DIP switch is OFF
1 = DIP switch is ON

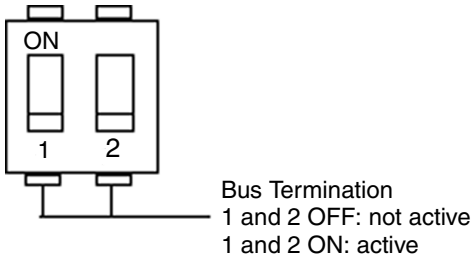
Bus termination

The recommended method for connecting DeviceNet products is to run a “trunk line” with 120-ohm resistors connected at each end. DeviceNet products are then connected as “drops” along the length of the trunk line. In this configuration, the internal termination resistor of the 842D should not be used and the bus termination DIP switches should be in the OFF position.

When 842D encoders are connected in a “daisy chain” configuration, the internal termination resistor may be used on the **end positions only**. In this configuration, only 842D(s) at either end of the network should have their bus termination 2-pole DIP switches placed in the ON position. Further details on termination resistors can be found in publication DN-6.7.2 *DeviceNet Cable System Planning and Installation Manual.*

ATTENTION: If you do not use terminating resistors as described here and in publication DN-6.7.2, the DeviceNet system will **not** operate properly.

Figure 3.2 Bus Termination Switches



Note: Remote setting of the DIP switches via a Node Commissioning Tool is not supported at this time.

Diagnostic LED

Once the DIP switches have been properly set, the 842D may be connected to a DeviceNet network. LED functions are as follows:

LED	Status
Off	Not connected, not on line
Green Blinking	Active but not allocated by master
Green Steady	Active and allocated by master
Red Blinking	Minor fault and/or connection interrupt
Red Steady	Critical communication fault

Preset function

The 842D 'POSITION VALUE' is set to zero when the PRESET function is executed (by Reset Position Button or DeviceNet). This predefined value is stored in the EEPROM. The factory default PRESET value is zero.

ATTENTION: The PRESET function results in a change of position reading. This can cause unexpected motion which could result in personal injury and damage to the product or equipment. During PRESET, steps should be taken to ensure the shaft is stationary and will remain so.

The PRESET function is not intended for use in dynamic parameter setting operations but as an electronic adjustment function during commissioning, in order to allocate a specific value to the mechanical rotary position of the 842D.

If the PRESET value is set by DeviceNet, the value must be within the total working range currently configured (steps per revolution and number of revolutions).

The Reset Position Button should only be operated when the encoder is powered and the green LED is blinking or steady.

Notes:

Configuring the Encoder Using RSNetWorx for DeviceNet

Chapter Objectives

Chapter 4 provides information that you need to configure the encoder over the DeviceNet network. In this chapter, you will read about the following:

- RSNetWorx for DeviceNet software and the equipment required to use it.
- Going online.
- Installing the Electronic Data Sheet (EDS) file.
- Online and offline configuration of the 842D encoder.
- Accessing, editing and saving encoder parameters.

What is RSNetWorx for DeviceNet?

RSNetWorx for DeviceNet is a Rockwell Software application that can be used to set up DeviceNet networks and configure connected devices. RSNetWorx for DeviceNet (version 3.00.00) and RSLinx (version 2.20.02) were used for examples in the manual. Different versions may differ in appearance and procedures.

RSNetWorx supports online and offline commissioning of a DeviceNet system.

During offline commissioning, the bus network is configured and parameters for the bus participants are set without an established connection to the bus network. Thereafter the bus connection is made and the user data are transferred to the master as well as to the bus participants.

In the online commissioning the bus structure and the parameters of the participants are configured using an established bus connection.

After installing or mounting the encoder, you can use RSNetWorx for DeviceNet to configure or edit the encoder's parameters.

Required Equipment and Software

Before configuring the encoder and editing its parameters, your PC must be:

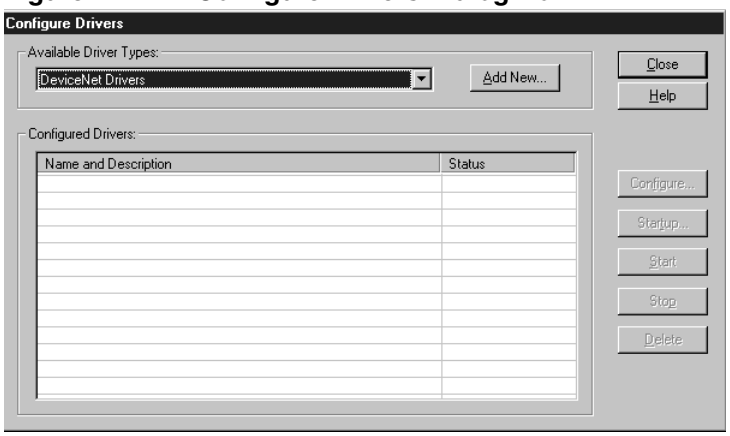
- Running RSNetWorx for DeviceNet. Refer to http://www.software.rockwell.com for more information on this product.
- Connected to and communicating with the DeviceNet network using a DeviceNet interface such as a 1784-PCD card or a 1770-KFD adapter.

Going Online

To use RSNetWorx for DeviceNet, you must first set up a driver in RSLinx. The driver provides a communications link between the computer and DeviceNet network. Then, you can view the devices on a DeviceNet network by going online. A device may appear as an unrecognized device if RSNetWorx for DeviceNet does not have an EDS file for it.

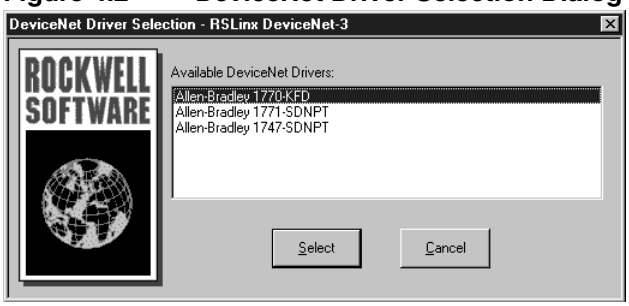
1. Start RSLinx, and select **Communications > Configure Drivers** to display the Configure Drivers dialog box.

Figure 4.1 Configure Drivers Dialog Box



2. In the Available Driver Types box, select **DeviceNet Drivers**, and then click **Add New**. The DeviceNet Driver Selection dialog box appears.

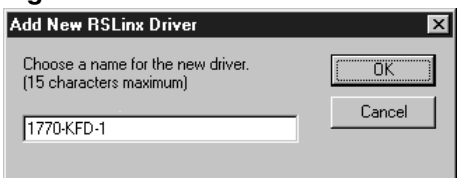
Figure 4.2 DeviceNet Driver Selection Dialog Box



3. In the Available DeviceNet Drivers list, select the adapter connected to your computer, and then click **Select**. A Driver Configuration dialog box appears.

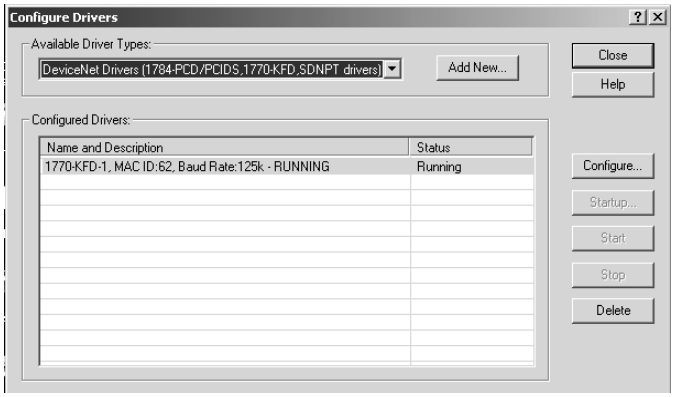
4. Configure the driver for your computer and network settings, and then click **OK**. The Configure Drivers dialog box reports the progress of the configuration. The Add New RSLinx Driver dialog box appears.

Figure 4.3 Add New RSLinx Driver Dialog Box



5. Type a name (if desired), and then click **OK**. The Configure Drivers dialog box reappears, and the new driver is in the Configured Drivers List

Figure 4.4 Configure Drivers Dialog Box with a DeviceNet Driver



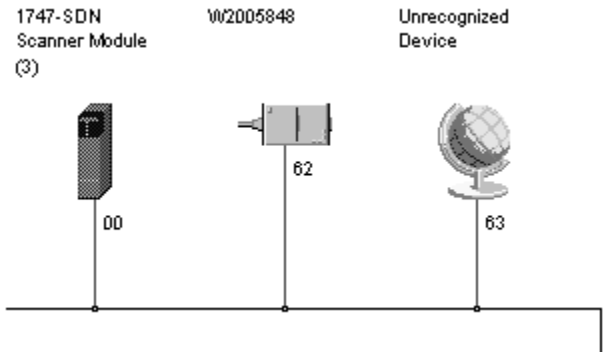
6. Click **Close** to close the dialog box. Leave RSLinx running.

7. Start RSNetWorx for DeviceNet, and then select **Network > Online**. If the Browse for Network dialog box appears, RSLinx has drivers for multiple networks. Select your DeviceNet network, and click **OK**. A message appears.

Figure 4.5 DeviceNet Configuration Services Message

8. Click **OK** to go online. The devices in the network appear in the Configuration view.

Figure 4.6 Online in RSNetWorx for DeviceNet

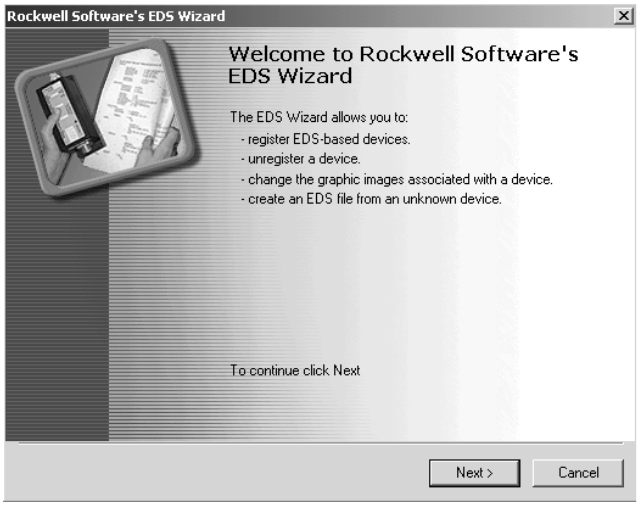


Installation of the EDS File

The Electronic Data Sheet, or EDS file, must be installed with RSNetWorx. The EDS file may be downloaded from our website at http//www.ab.com/networks/eds/. Simply select **DeviceNet** followed by **RA Miscellaneous** and then press the **Search** button. By selecting the 842D encoder, you can begin downloading the 842D EDS file.

1. Go to **Tools - EDS Wizard** and click **Next** to start the process.

Figure 4.7 EDS Wizard

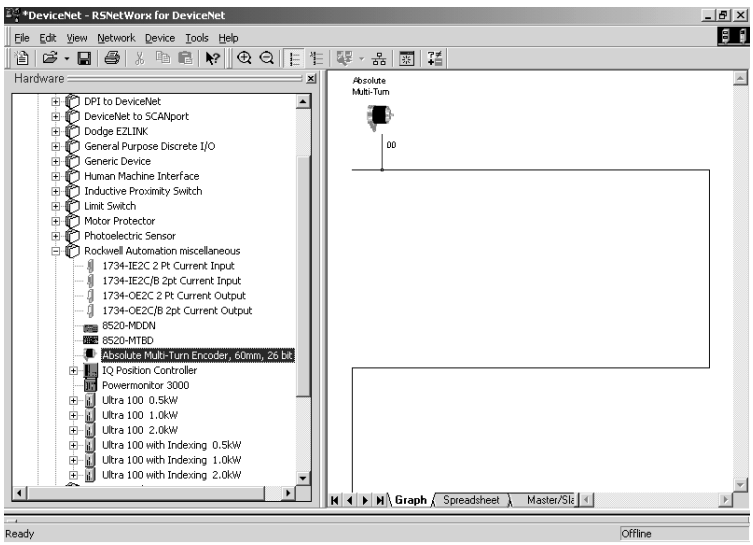


2. Follow the prompts to install the 842D EDS file.
3. Click **Finish** to complete the process.

Offline Integration into the Network

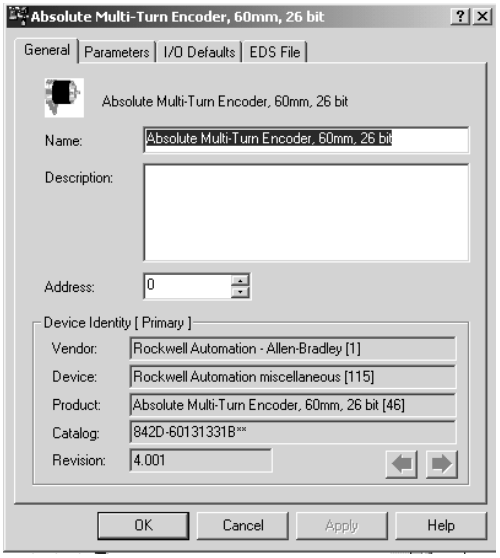
After a new project is started select the 842D encoder under the Rockwell Automation Miscellaneous category in the hardware window. Double-click or drag and drop the 842D Multiturn Encoder into the network view.

Figure 4.8 RSNetworx Graph View



To assign a name, description and node address, double-click on the encoder in the Graph view window. In the General tab of the Edit dialog box, enter the node address that has been set via the six pole DIP switch.

Figure 4.9 General Tab in the Edit Dialog Box



Accessing and Editing Parameters

In order to modify the parameter values of the encoder on DeviceNet, RSNetWorx offers two configuration modes:

- Class Instance Editor
- Enhanced Device Configuration

The Enhanced Device Configuration is a more comfortable way to read and modify encoder parameters. This mode can be used online and offline (file access only). In the Enhanced Device Configuration mode the parameters can be stored to a file (*.dnt) for later transfer to the device.

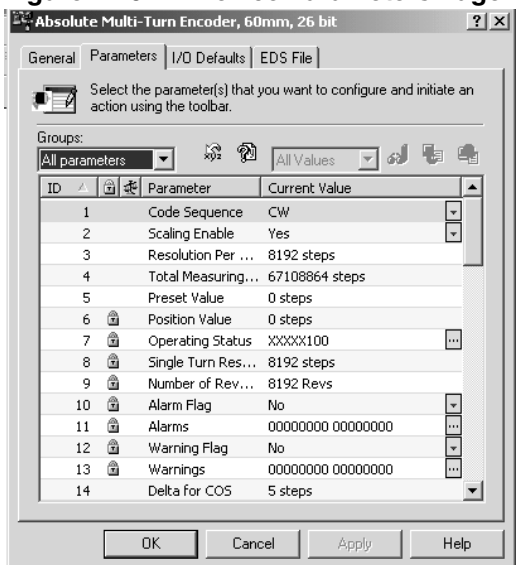
In order to protect parameter values against loss due to a power failure they can be stored in the encoder EEPROM with the "Save" service. The "Reset" service sets all parameters to default values. The "Restore" service sets all parameters to the values stored in the EEPROM--see page 4-7.

The Save, Reset, and Restore services can only be executed in the Class Instance Editor.

Enhanced Device Configuration in Offline Mode

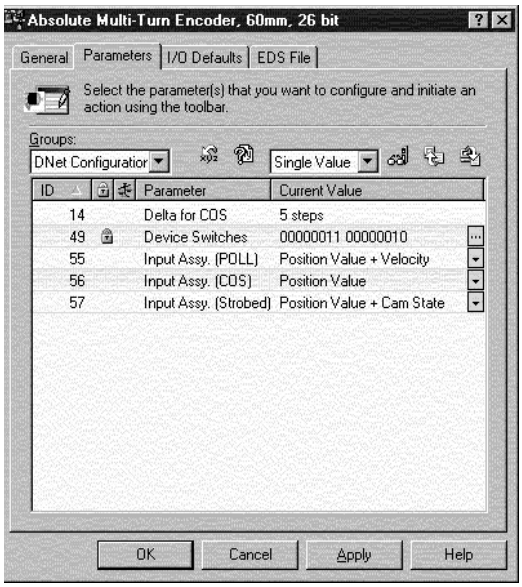
The Enhanced Device Configuration is started by double-clicking on the encoder symbol and clicking on the Parameter tab. In offline mode the parameters are preset to the default values in the EDS file.

Figure 4.10 Device Parameters Page in the Edit Dialog Box



Parameters are displayed in numerical order in the Parameter column. You can either scroll through the list or select a specific group of parameters in the Groups box (for example, DeviceNet Module).

Figure 4.11 Device Parameters Arranged by Groups



Parameters labeled with a padlock represent encoder status information and are ‘read-only’. All other data can be modified; in the Current Value column, double-click a value to edit it.

After all parameters are set they can be stored using the File - Save command.

Enhanced Device Configuration in Online Mode

The Enhanced Device Configuration is selected by double-clicking on the encoder symbol. In on-line mode the parameter values currently stored in the encoder are accessed.

By clicking on the Apply or Download to Device buttons, the parameters can be saved to the encoder. The updated encoder values are stored in the encoder RAM and are valid immediately. Saving the new values to the EEPROM is done with a separate command.

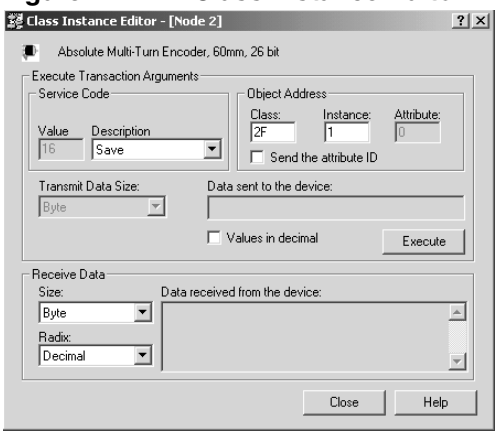
Saving Parameter Values to EEPROM

Saving the parameter values to the EEPROM is performed in the Class Instance Editor.

To access the Class Instance Editor, select the device in the graph window and click on Class Instance Editor in the Device menu. Select the service Save (16_{hex}) of Class $2F_{hex}$ (encoder object), Instance 1, with the 'Send the attribute ID' box unchecked.

Finish by clicking on the Execute button.

Figure 4.12 Class Instance Editor



Restoring Parameters to EEPROM Values

In order to set the parameters to the EEPROM values, the service Restore (15_{hex}) of the encoder object is used.

This is done in the Class Instance Editor . Select the service Restore (15_{hex}) of the object $2F_{hex}$ (encoder object), Instance 1, with the 'Send the attribute ID' box unchecked. Finish by clicking on the Execute button..

ATTENTION: The Restore function results in a change of position reading. This can cause unexpected motion which could result in personal injury and damage to the product or equipment. During Resore, steps should be taken to ensure the shaft is stationary and will remain so.

Setting Parameters to Default Values

In order to reset the parameters to the factory default values, the service Reset (05_{hex}) of the encoder object is used. This is done in the Class Instance Editor. Select the service Reset (05_{hex}) of the object $2F_{hex}$ (encoder object), Instance 1, with the 'Send the attribute ID' box unchecked. Finish by clicking on the **Execute** button.

Configuring a Scanner to Communicate with the Encoder

Chapter Objectives

Chapter 5 provides instructions for configuring a PLC or SLC scanner to communicate with the encoder.

Required Equipment and Software

Before configuring the scanner, your PC must be:

- Running RSNetWorx for DeviceNet. Refer to http://www.software.rockwell.com for more information.
- Connected to and communicating with the DeviceNet network using a DeviceNet interface such as a 1784-PCD card or a 1770-KFD adapter.

Operating Modes of the Encoder

There are two fundamentally different DeviceNet protocols:

- Explicit messaging
- I/O messaging

Explicit messaging

Explicit messaging is used for modifying the device configurations, reading diagnostic values, program upload / download, etc.

Characteristics of explicit messaging:

- Very flexible
- Less efficient because each device must interpret and generate a response
- "Unbound" connections ("Hit and Run")
- Contents of the data field:
  - Protocol information
  - Instructions for service to be performed
  - Internal address to which the service is to be applied

I/O messaging

I/O messaging is used for fast or time-critical data transfer. All of the 8 data bytes of the CAN telegram can be used for data transmission. Characteristics of I/O messaging:

- Less flexible

- Highly efficient for both bandwidth and node processing
- "Bound" connections
- Data field contains data only
- Meaning of data is predefined

Input data specification of the 842D

The 842D encoder is an Input Device. This means the encoder only produces (sends) data and does not consume any data from the master.

The 842D supports the following I/O operating modes (message connections):

- Polling
- Change of State (COS) / Cyclic
- Bit Strobed mode

All these modes can be adjusted simultaneously with different assembly instances. To use a particular Assembly, there are installed 3 special attributes "assembly number" (Input Ass_xx) in the manufacturer section of the encoder object. These attributes have to be configured with the number (1...n) of the corresponding assembly instance, containing the different data components. By default this number is set to 1 ("Position Value").

Each of the 3 different I/O message connections is assigned its own attribute.

The table below shows how the different data components are used:

Data Component	Assembly	Supported modes	Update cycle time
Position Value	1, 2, 3, 4	COS, Strobe, Poll	0.3 ms
Velocity Value	3	Strobe, Poll	50 ms
Flag (Alarm, Warning)	2	COS, Strobe, Poll	0.3 ms
Cam State	4	COS, Strobe, Poll	0.3 ms

Update cycle time is the time required for the encoder to calculate a new value for one of the listed data components. For example, the encoder is able to send new position values in intervals of approx. 0.3ms.

Note: For all the different I/O messages applied, the number of the configured assembly instance determines the data components to be sent as an input data.

For more detail see the Assembly object manufacturer specific functions in Appendix B.

Polling mode

The standard mode in the master-slave communication is the polling mode. In this mode the master contacts all bus participants cyclically. The output data are transmitted to the slaves and the input data are read from the slaves over the course of one scan.

Because the 842D is an Input Device, output data from the master is ignored. The Poll Command is used to trigger the transmission of return input data in the response message.

COS mode / Cyclic mode

In Change of State (COS) mode, the encoder sends input data if the value of one of the data components changes or at the Heartbeat Rate (See Figure 5.4, *Edit I/O Parameters Dialog Box - COS*).

In addition, a Cycle Time is used to trigger the transmission of the input data. This is done after the internal Cycle Time period has elapsed, no matter if the value of one of the data components has changed.

Additionally, a time delay (inhibit time) in the range of 1 msec. to 65,535 msec. can be configured to reduce the bus load.

When getting a trigger only from the "cam state" or "Flag" data components by using Instance 2 or 4 in a COS connection, you should set the value of "COS / Hyst." (attr. 11) to "0" (zero) to avoid a trigger from the data component "position value" (see Appendix B).

In Cyclic mode the encoder only sends input data after the internal Cycle Time period has elapsed.

Bit Strobed mode

The Bit_Strobe Command sends one bit of output data to each Slave whose node address appears in the Master's scan list.

Because the 842D encoder is an Input Device, the output data bit is ignored. The Bit Strobe Command is only used to trigger a transmission of return input data in the response message.

Example DeviceNet Network

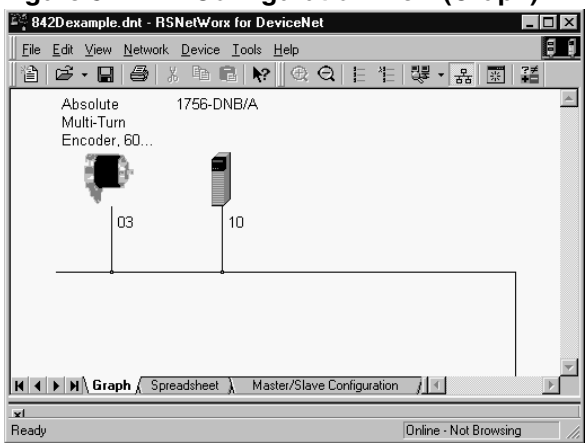
This section provides the steps that are needed to configure a simple network that includes 1756-DNB/A scanner (Node 10) and an 842D DeviceNet encoder (Node 03).

Setting Up the Scan List

For the scanner to communicate with a product, the scanner must be configured and the product's node number must be added to its scan list.

1. Go online with RSNetWorx for DeviceNet. Refer to the "Going Online" section in Chapter 4.
2. Select **Network > Single Browse Path**. The devices on the network are displayed in the configuration view.

Figure 5.1 Configuration View (Graph)

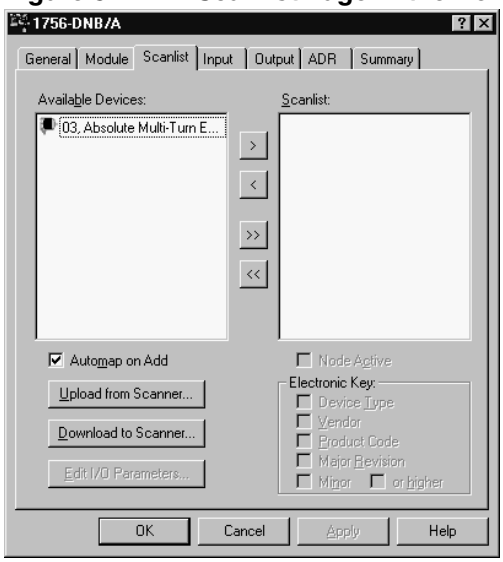


3. Right-click the DeviceNet scanner (node 10 in Figure 5.1) and select **Properties**. The Scanner Module dialog box appears.

Important: If your scanner is an unrecognized device, you must create an EDS file for it and then configure it. Click **Help** or refer to your scanner documentation if you need more information. Configure the scanner using the General and Module tabs.

4. Click the **Scanlist** tab. A message box prompts you to upload.
5. Click **Upload**. Data is uploaded from the scanner, and then the Scanlist page appears.

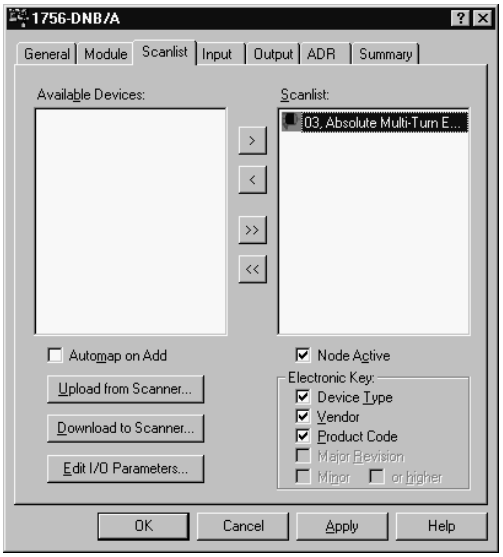
Figure 5.2 Scanlist Page in the Device Edit Dialog Box



6. Select the **Automap on Add** box (a check mark will appear).

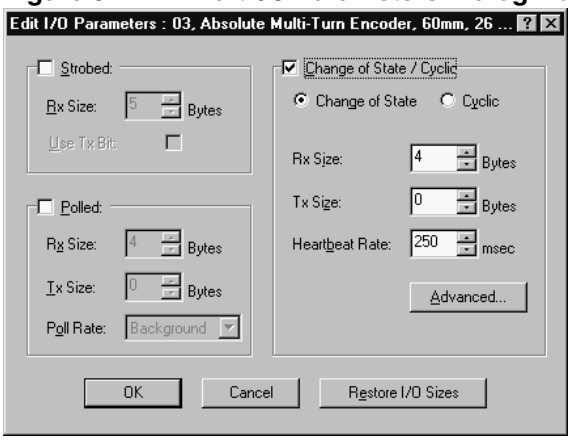
7. Under Available Devices, select the encoder, and then click **>** (Right Arrow) to add it to the scanlist.

Figure 5.3 Scanlist Page in the Scanner Module Dialog Box



8. Under Scanlist, select the encoder, and then click **Edit I/O Parameters**. The Edit I/O Parameters dialog box appears.

Figure 5.4 Edit I/O Parameters Dialog Box - COS



9. Select the type(s) of data exchange (Polled, Change of State, and/or Cyclic). In our example, we selected Change of State.

10. Type the number of bytes that will be required for your I/O in the Rx Size and Tx Size. See *Assembly Data Format*, page B-4, for data sizes.

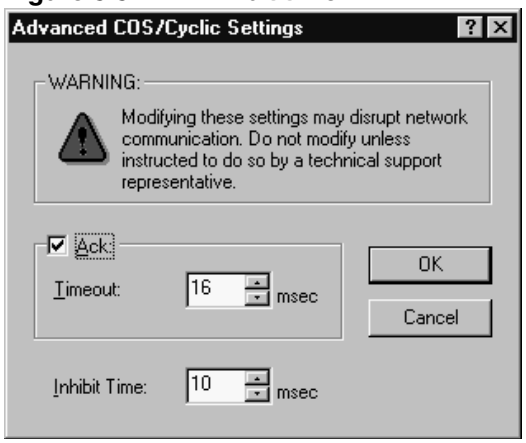
11. Set the scan rate:

Data Exchange	Rate to set
Polled	Polled Rate
Change of State	Heartbeat Rate
Cyclic	Send Rate

Click **Help** for more information.

12. When using COS in high speed and/or high resolution applications, it may be necessary to limit how often the device will report to the master in order to lessen network traffic. To do so requires either setting the hysteresis to over 10% of the 'RESOLUTION PER REVOLUTION' value or increasing the 'Inhibit Time'. To increase the inhibit time to 10ms, click on the **Advanced...** button under 'Change of State/Cyclic.' Adjust the Inhibit Time and click **OK**.

Figure 5.5 Inhibit time



13. In the Edit I/O Parameters box, click **OK**. If you changed any settings, a Scanner Applet appears and asks if it is OK to unmap the I/O. Click **Yes** to continue. The Edit I/O Parameters dialog box closes and then the Scanner Module dialog box (Figure 5.3) reappears. You will map the I/O in the next section in this chapter.

Mapping the Product's Data in the Scanner

Data from I/O messages must be mapped in the scanner. This mapping determines where a ladder logic program can find data transmitted on the network.

Mapping the Input I/O

In the Scanner Module dialog box, click the **Input** tab. (If you need to display this dialog box, right-click the scanner in the configuration view. See Figure 5.1.). Below, the input pages for Change of State, Polled and Strobed are shown.

Figure 5.6 Scanner Module Dialog Box, Input Page - COS

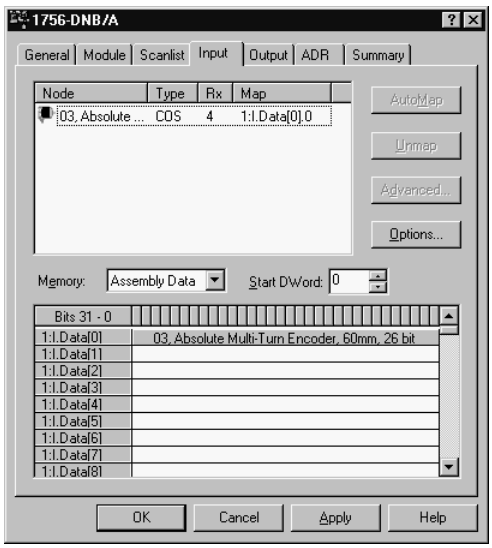


Figure 5.7 Scanner Module Dialog Box, Input Page - Polled

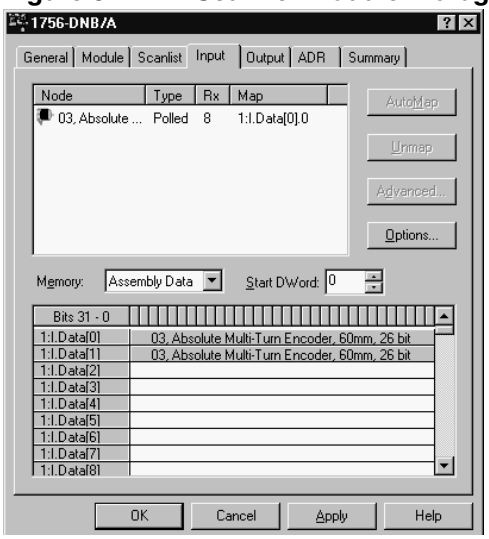
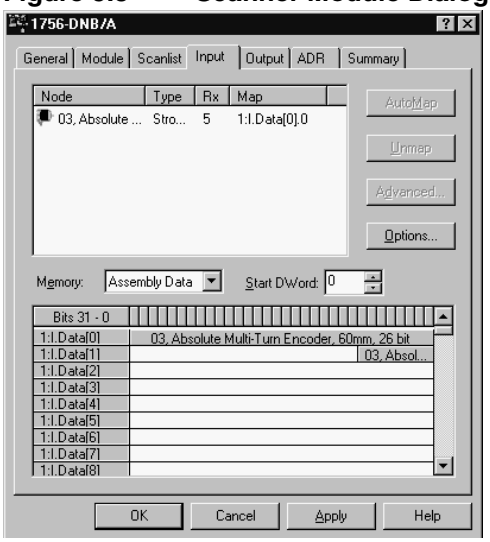


Figure 5.8 Scanner Module Dialog Box, Input Page - Strobed



If you selected the **Automap on Add** box (Figure 5.2) in the Scanlist page (Figure 5.3) and did not change any settings, RSNetWorx has already mapped the I/O. If I/O is not mapped, click **AutoMap** to map it. If you need to change the mapping, click **Advanced** and change the settings. Click **Help** for assistance.

Saving the Configuration

After configuring a scanner, you must download it to the scanner. You should also save it to a file on your computer.

1. In the Scanner Module dialog box, click **Apply** to save the configuration to the scanner. A Scanner Configuration Applet appears and asks if it is OK to download the changes.
2. Click **Yes** to download the changes. The changes are downloaded and then the Scanner Module dialog box reappears.
3. Click **OK** to close the Scanner Module dialog box.
4. Select **File > Save**. If this is the first time that you saved the project, the Save As dialog box appears. Navigate to a folder, type a file name, and click **Save** to save the configuration to a file.

Using DeviceNet Explicit Messaging

Chapter Objectives

Chapter 6 provides information you need to monitor and configure the encoder using explicit messaging on DeviceNet. In this chapter, you will read about the following:

- Required equipment.
- Messaging guidelines for the 1747-SDN scanner.
- An Explicit Messaging example.

Refer to Appendix B, *DeviceNet Objects*, for information on object data support.

Required Equipment

Before using messaging, your PC must be:

- Running RSLogix500 and RSLinx if you are using an SLC. Refer to http://www.software.rockwell.com for more information on these products.
- Running RSLogix5000 and RSLinx for Logix platforms. Refer to http://www.software.rockwell.com for more information on these products.
- Connected to and communicating with the controller.

ATTENTION: The PRESET function results in a change of position reading. This can cause unexpected motion which could result in personal injury and damage to the product or equipment. During PRESET, steps should be taken to ensure the shaft is stationary and will remain so.

Explicit Messaging Examples

Explicit Messaging Preset Example for the 1747-SDN Scanner

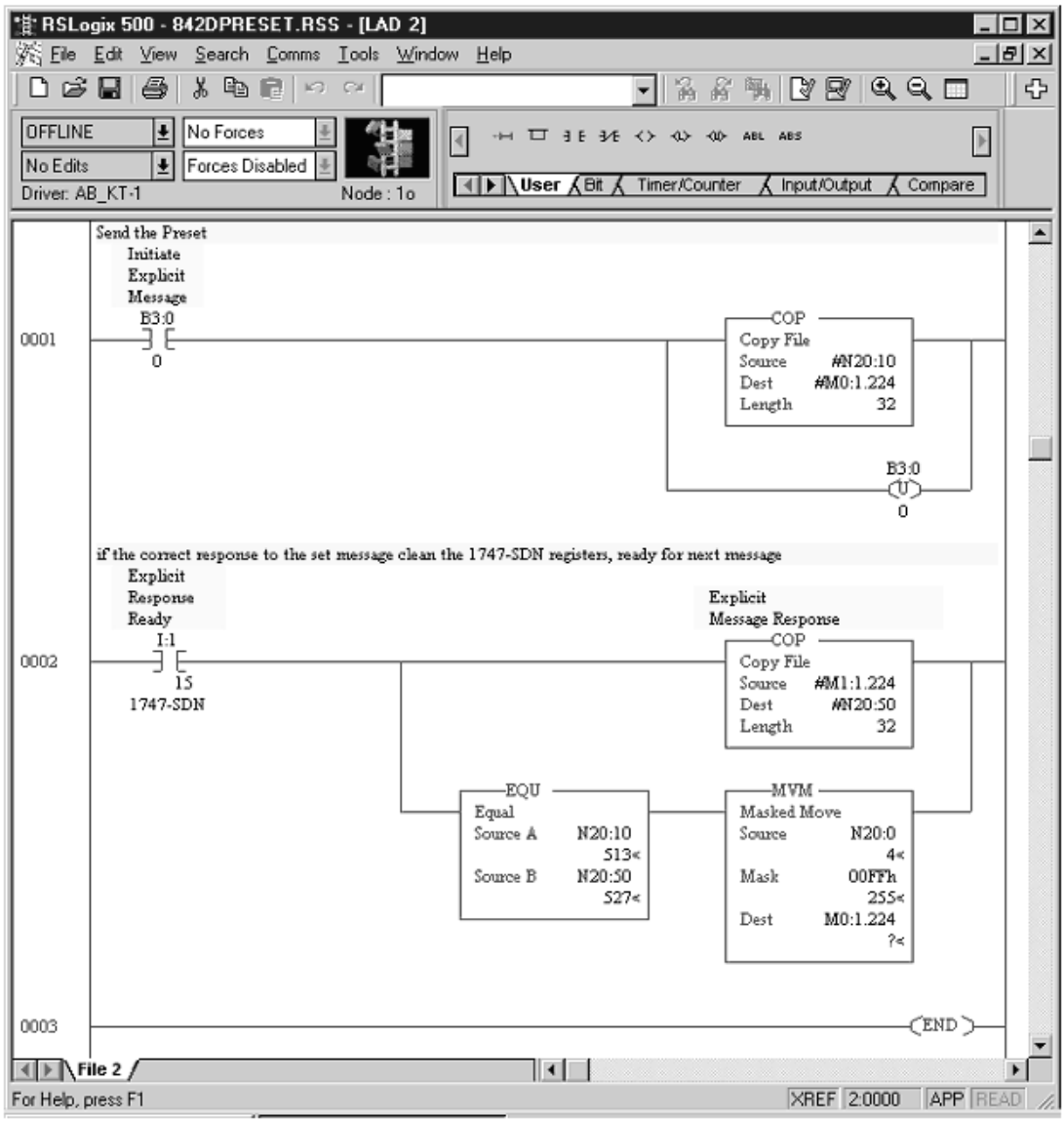
The SLC copies an Explicit Message into the scanner's M0-file. When the copy is completed the scanner moves the message into a queue for processing. Up to 10 Explicit Messages can be in this queue.

When the scanner receives a response message it is placed into a queue. The first response in the queue is available from the M1-file. When the message delete command is copied into the scanner the message is complete and the next available response will appear in the M1-file.

In this example a value is sent to the preset attribute in the encoder. The encoder stores the preset value sent in non-volatile memory. Storing the preset value applies the preset value to the encoder position value.

The following program fragment sends an explicit message and confirms the message reception. The N20 user defined integer file is used to hold message data:

Figure 6.1 1747SDN Explicit Messaging Example



Example Values

One of the following tables of data is sent to and received from the 1747-SDN. Values shown are in hexadecimal (even the MAC ID).

Table 1: Preset (set service) Example to position 00 00 00 00h (0 decimal)

Offset	0	1	2	3	4	5	6	7
N20:0	00 04	-	-	-	-	-	-	-
N20:10	02 01	00 0A	10 MacID	002F	0001	000A	00 00	00 00
...	-	-	-	-	-	-	-	-
N20:50	02 01	00 00	90 MacID	-	-			
-	-	-	-	-	-	-	-	-

Table 2: Preset (set service) Example to position 01 35 D0 B2h (20304050 decimal)

Offset	0	1	2	3	4	5	6	7
N20:0	00 04	-	-	-	-	-	-	-
N20:10	02 01	00 0A	10 MacID	002F	0001	000A	D0 B2	01 35
...	-	-	-	-	-	-	-	-
N20:50	02 01	00 00	90 MacID	-	-			
-	-	-	-	-	-	-	-	-

Data Description

The table below defines the data types and is followed by their definitions.

Table 3: Data Type (see definitions on next page)

Offset	0	1	2	3	4	5	6	7
N20:0	Delete Block Cmd	-	-	-	-	-	-	-
N20:10	TX ID, Command	Port, Size	Service Req, MacID	Class	Instance	Attribute	Preset ValueLSW	Preset ValueMSW
...	-	-	-	-	-	-	-	-
N20:50	RX ID, Status	Port, Size	Service Rsp, MacID	-	-			
-	-	-	-	-	-	-	-	-

TXID:
This is a one-byte integer the range of 1 to 255. The scanner uses this value to track the transaction to completion, and returns the value with the response that matches the request.

STATUS:
For each upload, the status code provides the processor with status on the device and its response:
0 = Ignore transaction block (block empty)
1 = Transaction completed successfully
2 = Transaction in progress (not ready)
3 = Error — Slave not in scan list
4 = Error — Slave off-line
5 = Error — DeviceNet port disabled or off-line
6 = Error — Transaction TXID unknown
8 = Error — Invalid command code
9 = Error — Scanner out of buffers
10 = Error — Other client/server transaction in progress
11 = Error — Could not connect to slave device
12 = Error — Response data too large for block
13 = Error — Invalid port
14 = Error — Invalid size specified
15 = Error — Connection busy

COMMAND:
A code that instructs the scanner how to administer the request:
1 = Execute this transaction block
4 = Delete this transaction block

PORT:
The port must be zero (Channel A) on a 1747-SDN scanner.

SIZE:
The size of the transaction body in bytes. The transaction body can be up to 29 words (58 bytes) in length. If the size exceeds 29 words, an error code will be returned.

SERVICE REQ/RSP:
The DeviceNet service request and response:
10 = Set Service Request
0 = Set Service Response

MAC ID:
The DeviceNet network address of device where the transaction is sent. This value can range from 0 to 63. The slave device must be listed in the scanner module's scan list and be on-line for the Explicit Message transaction to be completed.
See appendix B of the encoder manual for class/attribute values, access rules, and data types.

CLASS:
002Fh is the encoder class

INSTANCE:
There is only one instance of the encoder - 0001h

ATTRIBUTE:
The value 000Ah is the Preset Value attribute.

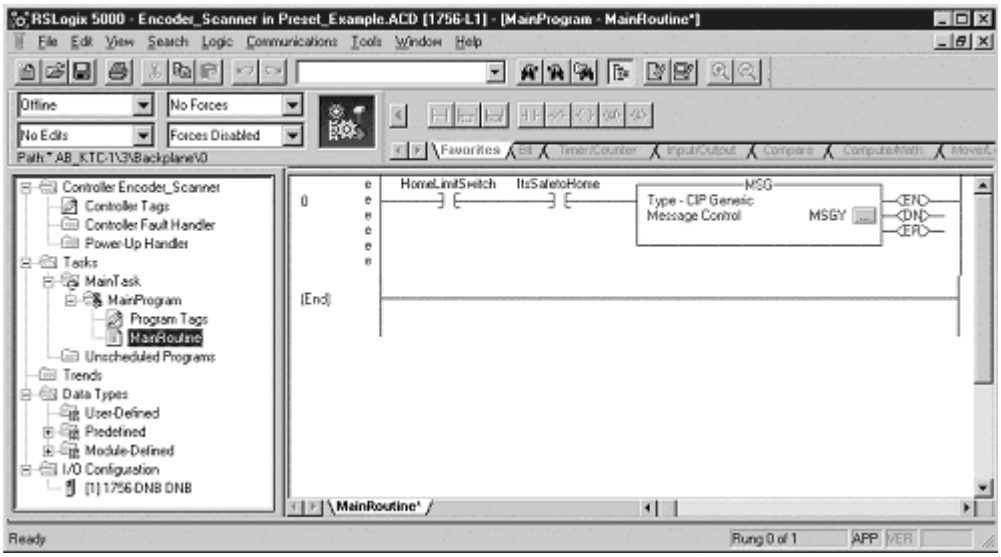
PRESET VALUEMSW / VALUELSW:
This quadword value (limited to 03 FF FF FF) is stored in non-volatile memory when the set service is used. Storing the preset value applies the preset value to the encoder position value.

Explicit Messaging Preset Example for the 1756-DNB

The following is a code segment that will preset the value of the 842D encoder's 'Position Value'. This can be useful for automatic homing or automated error recovery. The following tags are used for the explicit messaging:

- MSGY is a Message type tag
- Lsource is a UDINT type tag the value is preset to
- Ldest is a UDINT type tag that should always return with 0.

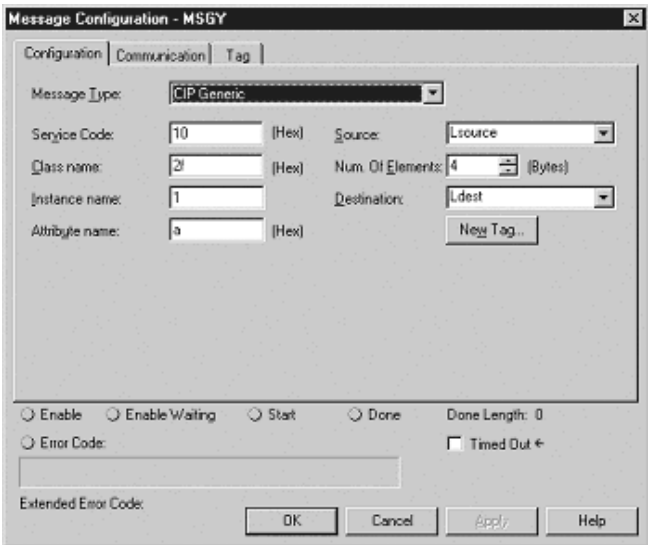
Figure 6.2 Position Value Preset



MSGY needs the service code (set) 10, the class code (encoder) 2F, and the instance 01 (only instance) for the attribute 0A (Preset). The preset data will be sent from the tag 'Lsource.' Since the 'Preset' attribute is a long integer (UDINT), the 'Num. Of Elements' is 4 bytes.

Other attributes maybe read (service code 0E) or set (service code 10) in a similar way. Any response data would return in Ldest.

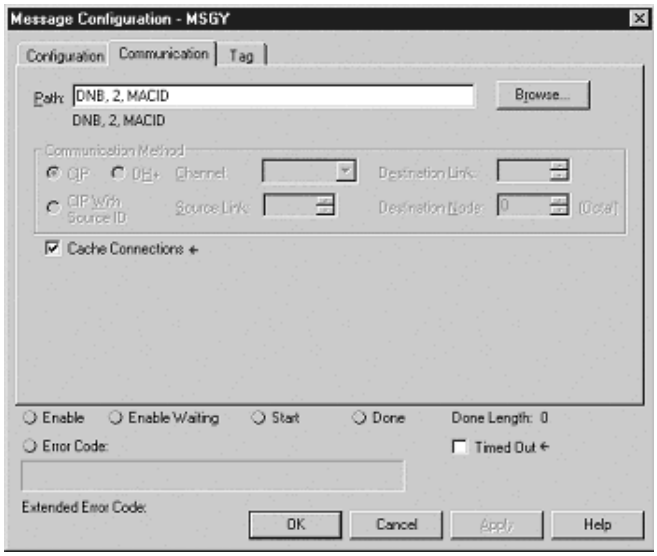
Figure 6.3 Message Configuration



The details where communication is addressed are also required.

'DNB' is the name of the DeviceNet module (1756-DNB) at a port from the (1756-L1) controller, '2', to communicate with encoder at 'MACID' where MACID is a variable SINT with the destination slave DeviceNet node address. The decimal value of the node address may be used if a variable is not desired.

Figure 6.4 Message Configuration - Communication Tab:



Specifications and Dimensions

842D Specifications

Electrical

Code Format	Natural Binary
Code Direction	CW or CCW (programmable)
Electrical Interface	DeviceNet Specification release 2.0
Operating Voltage	11-25V DC
Power Consumption	1.8W (75mA @ 24V DC)
Max # of Steps/Revolution	8192
Max # of Revolutions	8192
Position Forming Time	0.3msec
Delay on Power Up	1050msec
Reset	Via covered rear button
EEPROM Write Life	Greater than 100,000 cycles

Mechanical

Angular Acceleration	5×10^5 radians/sec^2
Moment of Inertia	35gcm^2 (5.0×10^{-4}oz-in-sec^2)
Operating Speed	6000 RPM at max shaft loading
Maximum Working Speed	12,000 RPM
Starting Torque	2.5Ncm (3.5oz-in)
Shaft Loading	Axial 11lb (50N), Radial 67lb (300N)

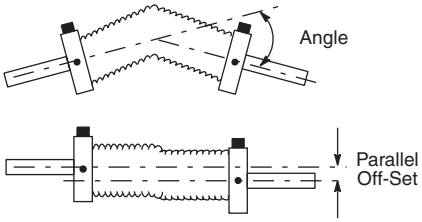
Environmental

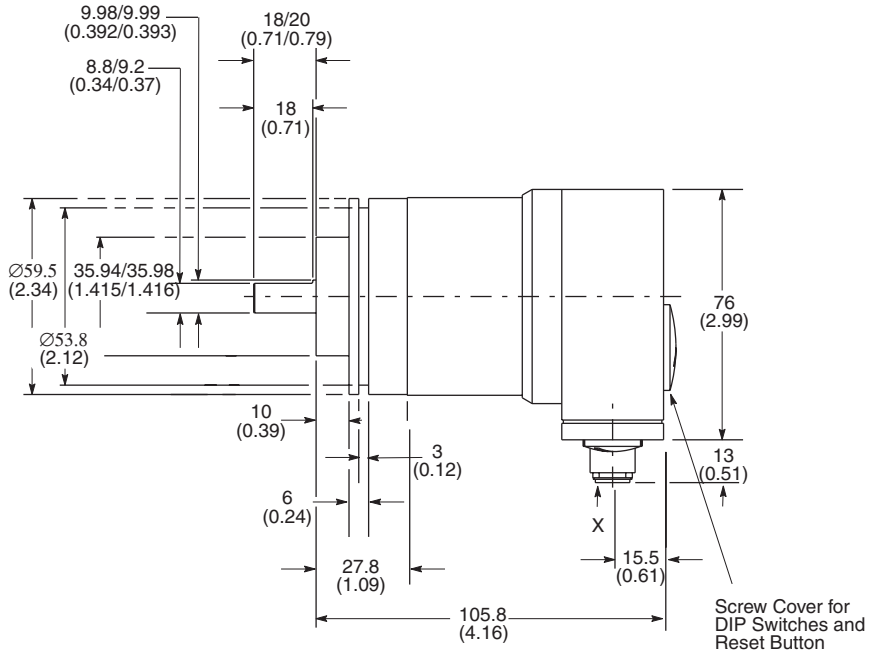
Housing	Aluminum
Operating Temperature	-20°C to 85°C (-4°F to +185°F)
Max Working Temperature	-40°C to 100°C (-40°F to +212°F)
Storage Temperature	-40°C to 125°C (-40°F to +257°F)
Humidity	98% Noncondensing
Protection	NEMA Type 4, 13, IP66 (IEC 529)
Shock	100g/6msec
Vibration	20g (58 to 2000Hz), 1.5mm displacement (10 to 58Hz)
Approximate Weight	0.91kg (2lbs)

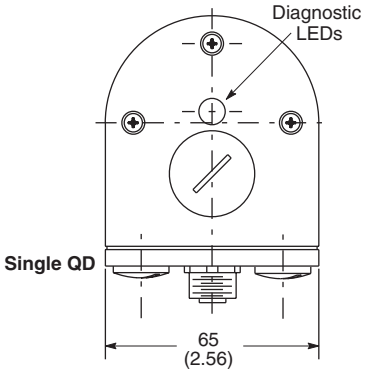
842D Dimensions

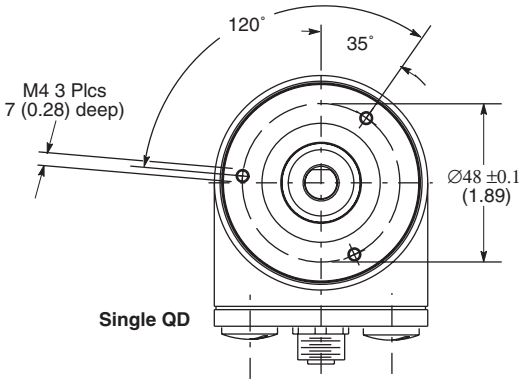
ATTENTION: Rigidly coupling the encoder shaft to the machine shaft **will cause a failure** in either the bearings of the encoder or the bearings of the machine shaft.

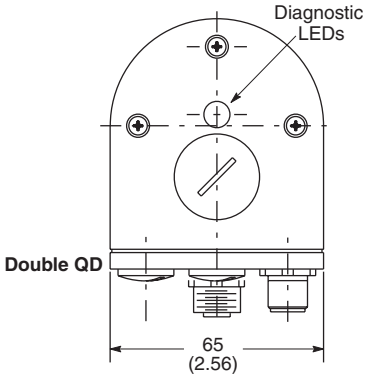
Flexible Shaft Couplings

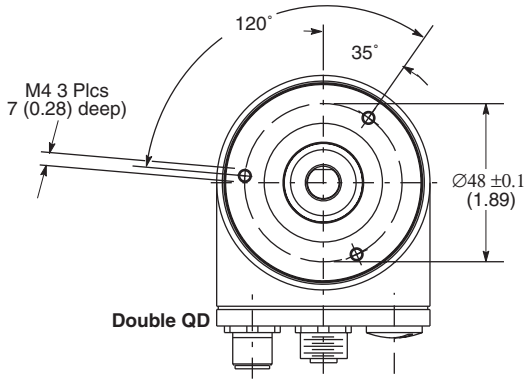












DeviceNet Objects

Appendix Objectives

Appendix B defines the DeviceNet object classes, class services, and attributes that are supported by the DeviceNet encoder. This appendix assumes that you have experience in object programming.

Object Classes

The 842D DeviceNet encoder supports the following object classes:

Class	Object	Page
01_{hex}	Identity	B-1
02_{hex}	Message Router	B-2
03_{hex}	DeviceNet	B-2
04_{hex}	Assembly	B-3
05_{hex}	Connection	B-5
$2F_{hex}$	Encoder	B-7

Class Code 01_{hex} — Identity Object

The identity object provides identification and general information about the device.

Class Attributes

Not supported.

Instance Attributes

Attr. ID	Attribute	Access	Data type	Description
1	Vendor ID	Get	UINT	Allen Bradley = 1
2	Device Type	Get	UINT	Rockwell Misc., 115
3	Product Code	Get	UINT	10626
4	Revision	Get	UINT	4.001
5	Status	Get	WORD	
6	Serial Number	Get	UDINT	
7	Product Name	Get	Short String	842D MULTITURN ENCODER

Services

Service Code	Service Name	Description
$0E_{hex}$	Get_Attribute_Single	Returns the attribute value
05_{hex}	Reset	Value = 0

Class Code 02_{hex} — Message Router

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

Class and Instance Attributes

Not supported.

Services

Not supported.

Class Code 03_{hex} — DeviceNet

The DeviceNet Object is used to provide the configuration and status of a physical attachment to DeviceNet. A product must suppot one (and only one) DeviceNet Object per physical network attachment.

Class Attributes

Attr. ID	Attribute	Access	Data Type	Description
1	Revision	Get	UINT	Revision = 002

Instance Attributes

Attr. ID	Attribute	Access	Data Type	Description
1	Node address	Get	USINT	Range 0-63
2	Baud Rate	Get	USINT	Range 0-2
3	BOI	Get	BOOL	Value=1
4	Bus-OFF-Ctr.	Get/Set	USINT	
5	Allocation Information	Get	Struct. of: BYTE USINT	Allocation choice byte master's Node Address

Services

Service Code	Service Name	Description
$0E_{hex}$	Get_Attribute_Single	Returns the attribute value
10_{hex}	Set_Attribute_Single	Changes the attribute value
$4B_{hex}$	Allocte_Master/ Slave_Connection_Set	Predefined master/slave connection set is requested

Class Code 04_{hex} — Assembly

The Assembly Object combines attributes from different objects into a single object. For a detailed view of the assembly data format, see page B-4.

Class Attributes

Attr. ID	Attribute	Access	Data Type	Description
1	Revision	Get	UINT	Revision = 002

Instance Attributes

Instance ID	Attr ID	Attribute	Access	Data Type	Description
1	3	Data	Get	ARRAY	Position value
2	3	Data	Get	ARRAY	Position+Warning Flag+Alarm Flag
3	3	Data	Get	ARRAY	Position + Velocity
4	3	Data	Get	ARRAY	Position + CAM

Services

Service code	Service name	Description
$0E_{hex}$	Get_Attribute_Single	Returns the value of an attribute

Assembly Data Format

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Position value (Att. 12)							LSB
	1								
	2								
	3	0	0	0	0	0	0	MSB	
2	0	Position value (Att. 12)							LSB
	1								
	2								
	3	0	0	0	0	0	0	MSB	
	4				reserved			Warning flag (Att. 88)	Alarm flag (Att. 85)
3	0	Position value (Att. 12)							LSB
	1								
	2								
	3	0	0	0	0	0	0	MSB	
	4	Velocity value (Not available in COS)							LSB
	5								
	6								
	7	MSB							
4	0	Position value (Att. 12)							LSB
	1								
	2								
	3	0	0	0	0	0	0	MSB	
	4	Cam state							
		Cam 8	Cam 7	Cam 6	Cam 5	Cam 4	Cam 3	Cam 2	Cam 1

Position only	4 Bytes
Position + Flags	5 Bytes
Position + Velocity	8 Bytes
Position + Cams	5 Bytes

Class Code 05_{hex} — Connection

The Connection Class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Class is referred to as a *Connection Instance* or a *Connection Object*.

Important: An externally visible interface to the Connection Class across Explicit Messaging Connections exists. Unless otherwise noted, all services/attributes noted in the following sections are accessible using Explicit Messaging.

A Connection Object within a particular module actually represents one of the end-points of a Connection. It is possible for one of the Connection end-points to be configured and "active" (e.g., transmitting) without the other end-point(s) being present. Connection Objects are used to model the communication specific characteristics of a particular Application-to-Application(s) relationship. A specific Connection Object Instance manages the communication-specific aspects related to an end-point.

A Connection Object on DeviceNet uses the services provided by a Link Producer and/or Link Consumer to perform low-level data transmission and reception functions.

Class Attributes

Not supported

Instance Attributes

Attr. ID	Attribute	Access	Data type	Description
1	State	Get	USINT	State of the connection as defined in the DeviceNet specification
2	Instance_Type	Get	USINT	Indicates I/O or Messaging connection
3	transportclass_trigger	Get	BYTE	The Transport Class Trigger for this instance
4	Produced Cnxn ID	Get	UINT	CAN Identifier to transmit on
5	Consumed Cnxn ID	Get	UINT	CAN Identifier to receive on
6	Initial Comm Char	Get	BYTE	Defines the DeviceNet message groups that the tx/rx Cnxn's apply
7	Produced Cnxn Size	Get	UINT	Max bytes to transmit across this connection
8	Consumed Cnxn Size	Get	UINT	Max bytes to receive across this connection
9	EPR	Get/Set	UINT	Expected Packet Rate
12	Watchdog Action	Get	USINT	How to handle inactivity/watchdog timeouts

Attr. ID	Attribute	Access	Data type	Description
13	Produced Cnxn Path Length	Get	UINT	Number of bytes in the produced connection path attribute
14	Produced Cnxn Path	Get	ARRAY of UINT	Path information of the desired assembly instance (Def. 1)
15	Consumed Cnxn Path Length	Get	UINT	Number of bytes in the consumed connection path attribute
16	Consumed Cnxn Path	Get	ARRAY of UINT	Specifies the application object to receive the data consumed by this application
17	Production inhibit time	Get/Set	UINT	Defines minimum time between new data production for COS connections

Services

Service Code	Service Name	Description
$0E_{hex}$	Get_Attribute_Single	Returns the value of an attribute
10_{hex}	Set_Attribute_Single	Changes the value of an attribute
05_{hex}	Reset	Reset
16_{hex}	Save	Save

Class Code $2F_{hex}$ — Encoder

The Encoder Object contains all encoder data. All input data, parameter data and status data are included here.

Class Attributes

Attr. ID	Attribute	Access	Data Type	Description
1	Revision	Get	USINT	Revision = 01
2	Max. Instance	Get	USINT	1

Instance Attributes

Attr. ID	Attribute	Access	Data type	Description
1	Number of attributes	Get	USINT	Number of supported attributes
2	Attributes	Get	ARRAY of USINT	List of supported attributes
3	Code Sequence	Get/Set	BOOL	Direction control for counting. Defines the increasing 'POSITION VALUE' as clockwise shaft rotation or counter clockwise as seen facing the shaft (CW, CCW).
5	Scaling function control	Get/Set	BOOL	Scaling Enable --Enabling scaling changes the 'POSITION VALUE' I/O data resolution to 'MEASURING UNITS PER REVOLUTION' and 'TOTAL MEASURING RANGE'
7	measuring units per revolution	Get/Set	UDINT	Number of distinguishable steps per revolution. Less than physical resolution.
8	Total measuring range in measuring units	Get/Set	UDINT	The steps over total measuring range. The number is automatically adjusted to a 2^0 - 2^13 multiple of 'RESOLUTION PER REVOLUTION'.Example: if 'RESOLUTION PER REVOLUTION' is set to 3600 then the possible 'TOTAL MEASURING RANGE' values will be 3600, 7200, 14400, 28800, ... 29491200.
10	Preset value	Get/Set	UDINT	This value will be applied to the 'POSITION VALUE'.
11	COS/delta	Get/Set	UDINT	A COS I/O message will be generated when the 'POSITION VALUE' changes by this value. This value will be set to 5 if set to a value larger than the 'TOTAL MEASURING RANGE'. Setting this value to 0 disables COS messaging for 'POSITION VALUE' changes. To lessen network traffic for high speed (4000 RPM+) and/or high resolution (1024+ ppr) applications either: increase the hysteresis to over 10% of the 'RESOLUTION PER REVOLUTION' value, increase the 'Inhibit Time' ('Scanlist', 'Edit I/O Parameters...', 'Advanced...') to 10 msec.
12	Position value	Get	UDINT	The current position value. This value is affected by 'PRESET VALUE', 'RESOLUTION PER REVOLUTION', and 'SCALING CONTROL'.
20	Velocity format	Get/Set	BYTE	This sets the format for velocity and acceleration values. The max and min limits for velocity and acceleration are affected as well. – 0 = Steps per second – 1 = RPM – 2 = RPS

Attr. ID	Attribute	Access	Data type	Description
22	Velocity value	Get	DINT	This is the value of the current velocity according to unit type in 'VELOCITY FORMAT'
23	Minimum velocity	Get/Set	DINT	Value of minimum velocity limit according to unit type of 'VELOCITY FORMAT'. A 'VELOCITY VALUE' under this limit will cause a 'Min. Velocity Underrun' warning and set the warning flag.
24	Maximum velocity	Get/Set	DINT	Value of maximum velocity limit according to unit type of 'VELOCITY FORMAT'. A 'VELOCITY VALUE' over this limit will cause a 'Max. Velocity Exceeded' warning and set the warning flag.
31	Acceleration value	Get	DINT	Value of the current acceleration according to unit type of 'VELOCITY FORMAT'.
32	Minimum acceleration	Get/Set	DINT	Value of minimum acceleration limit according to unit type of 'VELOCITY FORMAT'. An 'ACCELERATION VALUE' under this limit will cause a 'Min. Accel. Underrun' warning and set the warning flag.
33	Maximum acceleration	Get/Set	DINT	Value of maximum acceleration limit according to unit type of 'VELOCITY FORMAT'. An 'ACCELERATION VALUE' over this limit will cause a 'Max. Accel. Exceeded' warning and set the warning flag.
40	CAM state register	Get	BYTE	State of all 8 cams. See *"Designation of Cam Bits'*, page B-10: – Bit 0=Cam_NO_1 State... – Bit 7=Cam_NO_8 State
41	CAM polarity register	Get/Set	BYTE	Polarity for the state of 8 independent CAMs (1-8), See *"Designation of Cam Bits'*, page B-10: – 1 cam state will be active outside of the cam limits – 0 cam state will be active inside of the cam limits
42	CAM enable register	Get/Set	BYTE	Enable / Disable 8 independent CAMs (1-8). See *"Designation of Cam Bits'*, page B-10: – 1 cam state will be affected by position – 0 cam state will always be 0
43, 46, 49, 52, 55, 58, 61, 64	CAM X low limit ($0 \le X < 8$)	Get/Set	UDINT	This is the Switch point for this cam's lower limit. The value must be less than the 'CAM HYSTERESIS' for this cam and less than the 'TOTAL MEASURING RANGE'
44,47,50, 53, 56, 59, 62, 65	CAM X high limit ($0 \le X < 8$)	Get/Set	UDINT	This is the Switch point for this cam's upper limit. The value must be less than the 'TOTAL MEASURING RANGE'.
45,48,51, 54, 57, 60, 63, 66	CAM X hysteresis ($0 \le X < 8$)	Get/Set	UINT	This value will be added to the 'CAM (1) HIGH LIMIT' and subtracted from the 'CAM (1) LOW LIMIT' when calculating the cam state. This value must be less than 'CAM (1) LOW LIMIT'.
80	Operating status	Get	USINT	The 'Direction: CCW' and 'Scaling: On' indicators show enabled modes for 'CODE SEQUENCE' and 'SCALING CONTROL'.
81	Single-turn resolution	Get	UDINT	This is the physical number of steps per revolution. This is the maximum number for 'RESOLUTION PER REVOLUTION'.
82	Number of distinguishable revolutions	Get	UINT	This is the number of revolutions the encoder will rotate before the 'POSITION VALUE' rolls over to 0. Must be a multiple of 2 between 2^0 and 2^{13}.

Attr. ID	Attribute	Access	Data type	Description
83	Alarms	Get	WORD	Malfunction could lead to incorrect position value. See *"Designation of Alarm Bits'*, page B-10. Any alarm will set the 'ALARM FLAG'.
85	Alarm flag	Get	BOOL	This flag indicates a device failure that requires user intervention. The 'ALARMS' indicate the specific failure. This value will be reported if 'INPUT ASSY.' is set to 'Position + Flags' as bit 0 of the 5th byte.
86	Warnings	Get	WORD	Internal parameters exceeded. See *"Designation of Warning Bits'*, page B-10. Any warning will set the 'WARNING FLAG'. The 'Frequency Exceeded' warning is caused by rotating faster then 6000 RPM. The Velocity min/max flag is caused by a 'VELOCITY VALUE' under or over the velocity limits. The Acceleration min/max flag is a 'ACCELERATION VALUE' under or over the acceleration limits. The 'Cam Limits Out of Order' flag is caused by a set of cam limits where the hysteresis value is larger then the cam lower limit, or the higher or lower limit that is greater than the 'TOTAL MEASURING RANGE'.
88	Warning flag	Get	BOOL	Indicates if any of the 'WARNINGS' are active. This value will be reported if the 'INPUT ASSY' is set to 'Position + Flags' as bit 1 of the 5th byte."
90	Operating time	Get	UDINT	Stores operating time for the encoder in operating hours.
91	Offset value	Get	DINT	The offset value is calculated by the preset function. Shift position value by the calculated value.
111	Assembly Number - Polling Mode	Get	USINT	The type of input data that is sent for the Polling I/O connections. – Position = 4 bytes – Position + Cam State = 5 bytes – Position + Flags = 5 bytes – Position + Velocity = 8 bytes – Update time: Velocity 50 mS, other modes 0.3 mS
112	Assembly Number - COS/ Cyclic Mode	Get	USINT	The type of input data that is sent for the Change of State I/O connections. – Position = 4 bytes – Position + Cam State = 5 bytes – Position + Flags = 5 bytes – Update time: 0.3 mS – Velocity not supported.
113	Assembly Number - Bit Strobed Mode	Get	USINT	The type of input data that is sent for the Strobed I/O connections. – Position = 4 bytes – Position + Cam State = 5 bytes – Position + Flags = 5 bytes – Position + Velocity = 8 bytes – Update time: Velocity 50 mS, other modes 0.3 mS.

Designation of Alarm Bits

(see Attribute 83)

Bit	Description
0	Position error: 0=NO, 1=YES
1	Diagnostic: 0=Diagnostic OK, 1=Diagnostic error
2...11	Reserved
12...15	Manufacturer specific (not used)

Designation of Warning Bits

(see Attribute 86)

Bit	Description
0	Frequency exceeded: 0=NO, 1=YES
1	Light control reserve: 0=Not reached, 1=Error
2	CPU watchdog: 0=OK, 1=Reset
3	Operating time limit warning: 0=NO, 1=YES
4	Reserved
5	Reference point: 0=Reached, 1=Not reached
6	Minimum Velocity Flag: 0=OK, 1=Under
7	Maximum Velocity Flag: 0=OK, 1=Over

Designation of Cam Bits

(See Attributes 40, 41, 42)

Bit	Description
0	Cam 1 state
1	Cam 2 state
2	Cam 3 state
3	Cam 4 state
4	Cam 5 state
5	Cam 6 state
6	Cam 7 state
7	Cam 8 state

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Notes:

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