

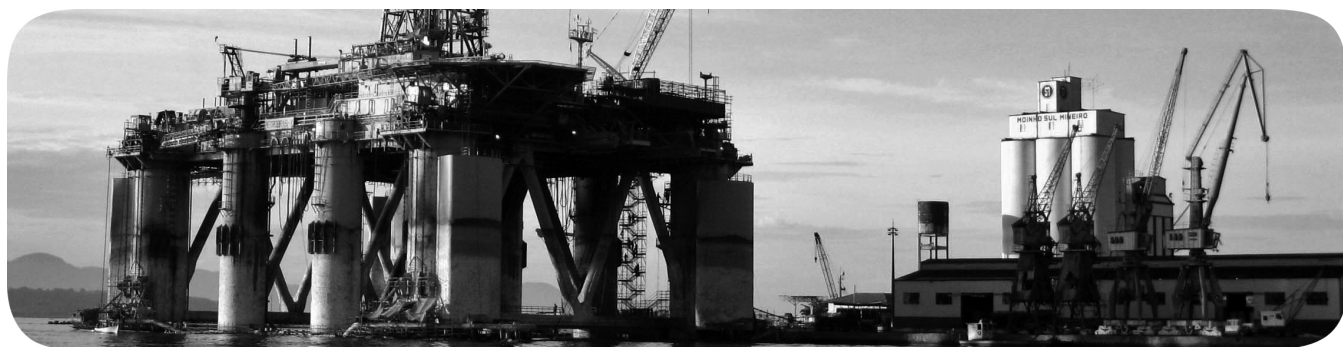
1769-SDN DeviceNet Scanner Module



Allen-Bradley

Catalog Numbers 1769-SDN

User Manual



Allen-Bradley • Rockwell Software

**Rockwell
Automation**

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication [SGI-1.1](#) available from your local Rockwell Automation sales office or online at <http://www.rockwellautomation.com/literature/>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING



Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

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

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence

SHOCK HAZARD



Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

BURN HAZARD



Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

The information below summarizes the changes to this manual since the last printing.

We have included change bars as shown to the right of this paragraph to help you find new and updated information in this release of the manual. The table below lists the changes that have been made to this revision of the manual.

Topic	Page
Automatically Configure a DeviceNet Network	Chapter 4
Updated information	Index

Preface	About This Manual	9
	Who Should Use This Manual.	9
	Conventions in This Manual	10
	Additional Resources	10
	Chapter 1	
Overview	Introduction	11
	Module Features.	12
	Scanner Module Operation	13
	Communication with Your Slave Devices	14
	1769-SDN Scanner Module Data Tables	15
	Input Data Image - MicroLogix 1500.	15
	Output Data Image - MicroLogix 1500	15
	Input Data Image - CompactLogix.	16
	Output Data Image - CompactLogix	16
	RSNetWorx for DeviceNet Software as a Configuration Tool	17
	Chapter 2	
Quick Start for Experienced Users	Introduction	19
	Required Tools and Equipment	19
	What You Need to Do.	20
	Chapter 3	
Installation and Wiring	Power Requirements	23
	General Considerations	24
	Hazardous Location Considerations.	24
	Preventing Electrostatic Discharge	25
	Removing Power	25
	Reducing Noise	25
	Protecting the Circuit Board from Contamination	26
	System Planning	26
	System Assembly	27
	System Mounting	28
	Minimum Spacing	28
	Panel Mounting	28
	DIN Rail Mounting	30
	Replace the Scanner Module within a System.	31
	Field Wiring Connections	32
	Grounding the Scanner Module	32
	Scanner Module Power-up.	33

Automatically Configure a DeviceNet Network

Chapter 4

Introduction	35
How AutoScan Operates	36
Determine If You Can Use AutoScan.	38
How AutoScan Effects Your Network.	38
Connect Each Device to the Network	39
Set the Baud Rate of a Device Via a DeviceNet Configuration Terminal.	40
Set the Node Address of a Device Via a DeviceNet Configuration Terminal.	42
Add the Scanner to the RSLogix 5000 Project.	44
Add the Scanner to the I/O Configuration Folder	44
Define the Properties of the Scanner	45
Implement AutoScan	46
Initiate AutoScan Via the User Program	49
Initiate AutoScan via the 193-DNCT Terminal.	51
Additional Considerations Regarding AutoScan	53
Type of Connection that the Scanner Sets Up.	56
Access Device Data	57
Put the Scanner in Run Mode	60

Manually Configure the DeviceNet Network

Chapter 5

Introduction	61
Software Versions	61
Install the Software.	62
Use RSLinx Software to Configure Your DeviceNet Driver.	62
Use RSNetWorx for DeviceNet Software to Configure the 1769-SDN Scanlist.	64
Set Up an Online Connection.	64
Set the Node Address	67
Configure the I/O Devices	70
General Tab	71
Module Tab	72
Scanlist Tab	76
Input Tab	78
Auto Device Replacement (ADR) Tab.	80
Summary Tab.	84
Download and Save Your Configuration	84

DeviceNet I/O Image**Chapter 6**

Introduction	87
1769-SDN Input Structure	87
MicroLogix 1500 Status Structure	88
Scan Counter	88
Device Failure Array	89
Autoverify Failure Array	89
Slave Device Idle Array	90
Active Node Array	91
Scanner Module Status	91
Reserved Array	92
Device Status Array	92
Module Status Register	93
CompactLogix Status Structure	94
Scan Counter	94
Device Failure Register	95
Autoverify Failure Register	95
Device Idle Register	96
Active Node Register	97
Status Display	97
Scanner Address	97
Scanner Status	97
Scrolling Device Address	97
Scrolling Device Status	98
Device Status	98
CompactLogix Status Register	98
Run	98
Fault	99
Disable Network	99
Device Failure	99
Autoverify Failure	99
Comm Failure	99
Dup Node Failure	100
Dnet Power Detect	100
CompactLogix Command Register	100
Run	100
Fault	101
Disable Network	101
Halt Scanner	101
Reset	101
Input Data Image	102
1769-SDN Output Structure	102

Use the 1769-SDN Scanner Module with MicroLogix Controllers	Chapter 7
	Introduction 103
	MicroLogix 1500 Controllers. 103
	RSLogix 500 Programming Software I/O Configuration 104
	Start the Project 105
	I/O Configuration Screen. 106
	Read I/O Configuration 107
	Installed I/O 107
	1769-SDN Scanner Module Configuration 108
	Changing the 1769-SDN Configuration. 109
	Backplane Messaging 111
	PCCC Messaging 111
	Program Upload and Download 112
	Configure a Local DeviceNet Message. 113
	Message Setup Dialog 113
	MSG Instruction Error Codes. 120
Troubleshooting	Chapter 8
	Introduction 121
	Status Indicators. 121
	Error Codes 124
1769-SDN DeviceNet Class Codes	Appendix A
	Introduction 127
CompactLogix Backup on the DeviceNet Network	Appendix B
	Introduction 129
	How the Backup Works. 130
	Backup System Requirements 131
	Configure the Backup System 132
	Develop the CompactLogix Backup Application. 134
	Backup Heartbeat Configuration Rungs. 134
	Reading Backup State Rung 138
	Reading Backup Status 140
	Using Indicators to Check Status 141
	Module Status Indicator 141
	Node Address and Status Display. 142
	Development and Debugging Tips 144
Glossary	
Index	

Read this preface to familiarize yourself with the rest of the manual.

About This Manual

This manual is a user manual for the Compact I/O 1769-SDN DeviceNet scanner module. It describes the procedures you use to install, program, and troubleshoot your scanner module. This manual:

- provides instructions on installing the scanner module.
- contains information about using the scanner module on the DeviceNet network.
- provides tips on troubleshooting the scanner module.
- contains application examples to show how the scanner module is used with various programmable controllers.

IMPORTANT

This manual focuses on the 1769-SDN scanner module with a MicroLogix 1500 control system on the DeviceNet network. Topics covered include using AutoScan, configuring, bridging, connecting, and controlling your DeviceNet network.

For information about using the 1769-SDN scanner module with a CompactLogix system, refer to DeviceNet Modules in Logix5000 Control Systems User Manual, publication [DNET-UM004](#).

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Rockwell Automation programmable controllers.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Conventions in This Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.

Additional Resources

The following documents contain additional information concerning Rockwell Automation products. Contact your local Rockwell Automation distributor to order hard copy publications. For electronic copies, go to <http://literature.rockwellautomation.com>.

Resource	Description
DeviceNet Modules in Logix5000 Control Systems User Manual, publication DNET-UM004	Describes configuring the CompactLogix controllers on the DeviceNet network.
ControlNet Modules in Logix5000 Control Systems User Manual, publication CNET-UM001	Describes configuring the CompactLogix controllers on the ControlNet network.
RSNetWorx for DeviceNet Getting Results Guide, publication DNET-GR001	Describes using RSNetWorx for DeviceNet software (catalog number 9357-DNETL3).
CompactLogix System User Manual, publication 1769-UM007	Describes planning, mounting, wiring, and troubleshooting your CompactLogix system. This manual focuses on the 1769-L20 and 1796-L30 CompactLogix controllers.
MicroLogix 1500 Programmable Controllers User Manual, publication 1764-UM001	Planning, mounting, wiring, and troubleshooting your MicroLogix 1500 system
Compact I/O Analog Modules User Manual, publication 1769-UM002	Installing, configuring, and using Compact I/O analog modules
DeviceNet Interface User Manual, publication 1761-UM005	How to install and use the DeviceNet Interface (catalog number 1761-NET-DNI)
DeviceNet Media Design and Installation Guide, publication DNET-UM072	DeviceNet network planning information
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Grounding and wiring Allen-Bradley programmable controllers
National Electrical Code - Published by the National Fire Protection Association of Boston, MA.	Wire sizes and types for grounding electrical equipment

Overview

Introduction

This chapter provides an overview of communication between the CompactLogix and MicroLogix 1500 programmable controllers and DeviceNet devices via the 1769-SDN scanner module.

Topic	Page
Module Features	12
Scanner Module Operation	13
Communication with Your Slave Devices	14
1769-SDN Scanner Module Data Tables	15
RSNetWorx for DeviceNet Software as a Configuration Tool	17

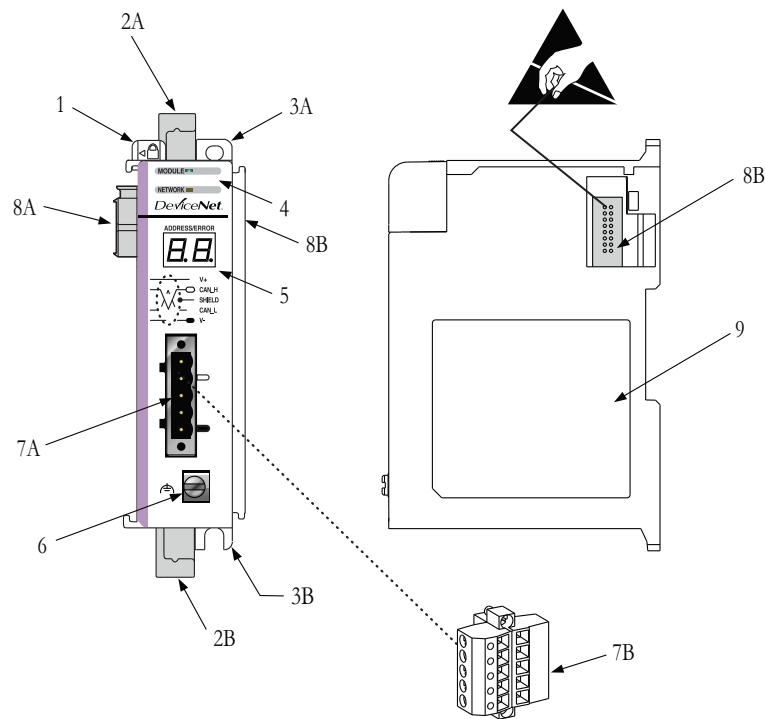
The configuration data tables and the RSNetWorx for DeviceNet dialog boxes used to configure the data tables are also described in this chapter. Before configuring your scanner, you must understand these items:

- Data exchange between the programmable controller and DeviceNet devices through the scanner
- User-configurable scanner module data tables
- Role of RSNetWorx for DeviceNet software

These topics are covered briefly in this chapter and in more detail throughout the rest of the manual.

Module Features

Use the following figure to identify the features of the scanner.



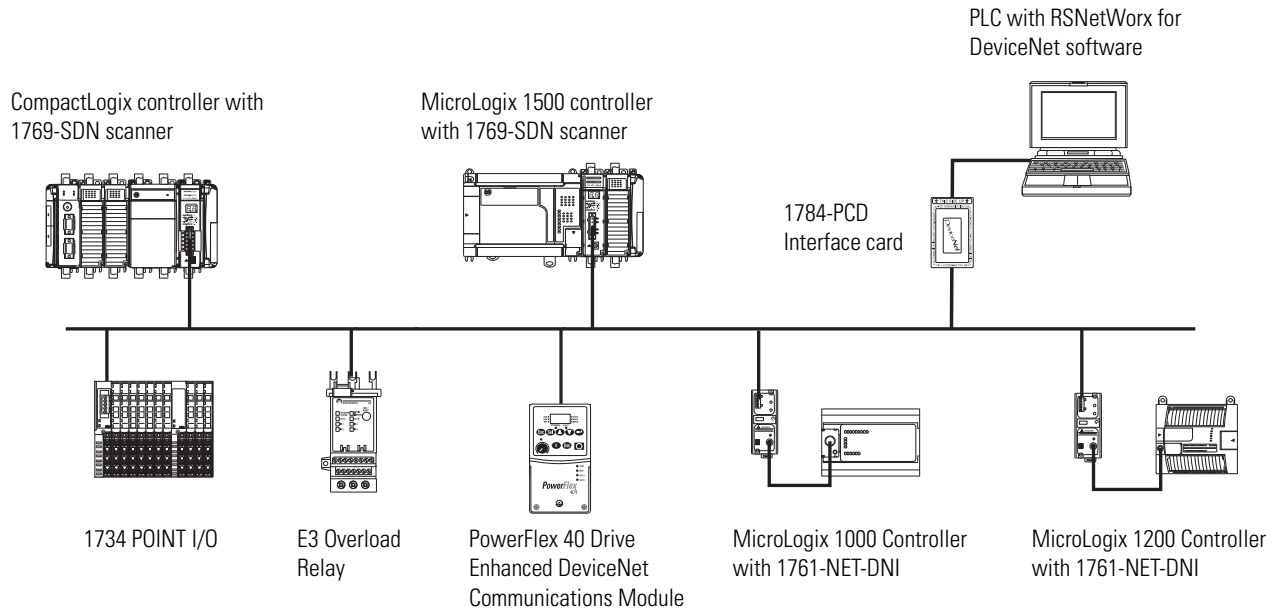
Module Features

Item	Description
1	Bus lever (with locking function)
2A	Upper DIN rail latch
2B	Lower DIN rail latch
3A	Upper panel mounting tab
3B	Lower panel mounting tab
4	Module and Network status LEDs
5	Address and Error numeric display
6	Grounding screw
7A	DeviceNet mating male receptacle
7B	Removable DeviceNet female connector
8A	Movable bus connector with female pins
8B	Bus connector with male pins
9	Nameplate label

Scanner Module Operation

In a typical configuration, the scanner module acts as an interface between DeviceNet devices and the programmable controller.

Device Network



The scanner module communicates with DeviceNet devices over the network to:

- Read inputs from slave devices
- Write outputs to slave devices
- Communicate with peer devices (messaging)
- Upload/download programs to a 1764-LRP based MicroLogix 1500 controller across a DeviceNet network

Communication with Your Slave Devices

The scanner module communicates with devices via strobe, poll, change of state, or cyclic I/O messages. It uses these messages to solicit data from or deliver data to each device. Data received from the devices, input data, is organized by the scanner module and made available to the controller. Data sent from your controller, output data, is organized in the scanner module and sent on to your devices.

- A strobe message is a multicast transfer of data that is 64 bits in length sent by the scanner module that initiates a response from each strobed slave device.

The strobe devices respond with their data, which can be as much as 8 bytes of information. As a slave device, the scanner module does not support the strobe message.

- A poll message is a point-to-point transfer of data from 0...128 bytes sent by the scanner module to the slave device.

The poll message also initiates a response from each poll slave. The slave device responds with its input data from 0...128 bytes.

- A change-of-state message is a transfer of data sent whenever a data change occurs.

A user-configurable heartbeat rate allows devices to indicate proper operation during intervals between data changes.

- A cyclic message is a transfer of data sent at a specific user-configurable rate, such as every 50 ms.

IMPORTANT

Throughout this document, input and output are defined from the controller's point of view. Output is data sent from the controller to a device. Input is data collected by the controller from a device.

In addition to I/O messaging, the scanner module also supports PCCC and CIP explicit messaging, defined later in this manual.

1769-SDN Scanner Module Data Tables

The scanner module uses input and output data images to transfer data, status, and command information between the scanner module and the MicroLogix controller to manage the flow of data between your controller and network devices.

Input Data Image - MicroLogix 1500

The input data image is transferred from the scanner module to the controller across the Compact I/O bus.

Word	Description	Data Type
0...65	Status structure	66-word array
66...245	DeviceNet slave inputs	180-word array

See [Chapter 6](#) for definitions of the Status structure.

Output Data Image - MicroLogix 1500

The output data image is transferred from the controller to the scanner module across the Compact I/O bus.

Word	Description	Data Type
0 and 1	Module command array	2-word array
2...181	DeviceNet slave outputs	180-word array

Module Command Array Bit Assignments

Output Word	Bit	Description	Behavior
0	0	Run	This bit controls when the module scans its mapped slave devices. When set (1), the scanner module will process I/O data as defined by its scanlist. The Fault and Disable Network command bits must be clear (0) to scan the network.
	1	Fault	When set, the scanner's I/O mode will be Halt; messaging will still operate. The fault bit is primarily used to artificially set the slave devices into a fault state due to some event or condition within the control program.
	2	Disable network	When set, the scanner module is functionally removed from the network.
	3	Reserved ⁽¹⁾	N/A
	4	Reset	Restarts access to the DeviceNet network.
	5...15	Reserved ⁽¹⁾	N/A
1	16...31	Reserved ⁽¹⁾	N/A

⁽¹⁾ Do not manipulate reserved bits. Doing so may interfere with future compatibility.

Input Data Image - CompactLogix

The input data image is transferred from the scanner module to the controller across the Compact I/O bus.

Word	Description	Data Type
0...89	DeviceNet slave inputs	90-DINT array

Output Data Image - CompactLogix

The output data image is transferred from the controller to the scanner module across the Compact I/O bus.

Word	Description	Data Type
0...89	DeviceNet slave outputs	90-DINT array

For additional information about the CompactLogix image structure, refer to the DeviceNet Modules in Logix5000 Control Systems User Manual, publication [DNET-UM004](#).

RSNetWorx for DeviceNet Software as a Configuration Tool

RSNetWorx for DeviceNet software is used to configure the scanner's slave devices. This software tool connects to the scanner module over the DeviceNet network via an RS-232 interface (1770-KFD module) or PC card (1784-PCD or 1784-PCID).

We recommend RSNetworx for DeviceNet software, version 3.00 or later.

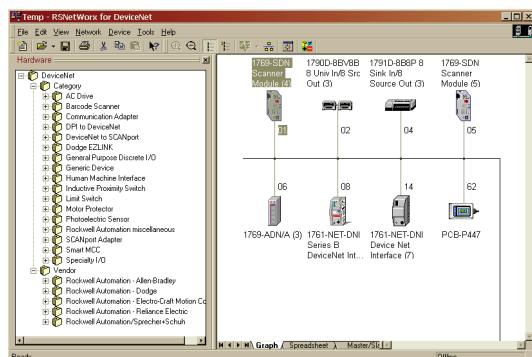
If your RSNetWorx configuration software does not include the required electronic data sheet (EDS) file, go to <http://www.ab.com/networks/eds>.

Register the new EDS file by using the EDS wizard in RSNetWorx for DeviceNet software. Access the wizard from the Tools menu. This configuration tool lets you to identify all of the DeviceNet devices and their locations in your system.

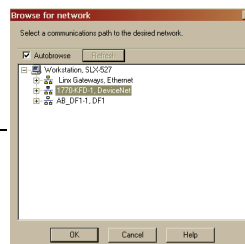
The controller must be in Program mode, or the scanner module in Idle mode (bit 0 of the Module Command Array = 0) for the scanner module to accept the configuration information.

RSNetWorx Configuration Dialog Map

The main **RSNetWorx** dialog.



Double-click the 1769-SDN icon to access the 1769-SDN scanner module.

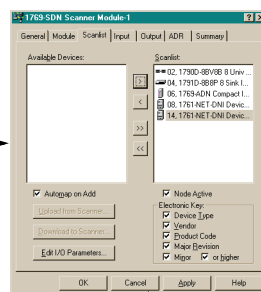
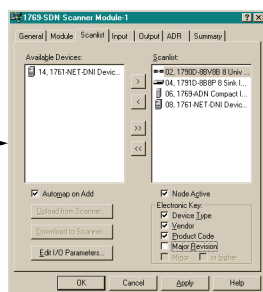
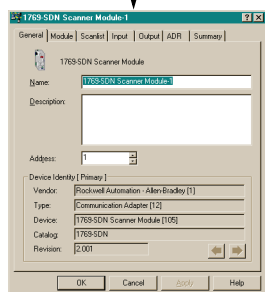


Click Online and select the driver to browse the network.

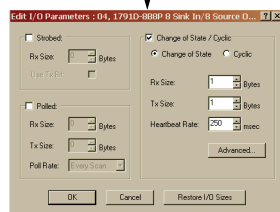
Click on the Scanlist tab to access the scanlist.

Move the device into the scanlist.

Click Download to Scanner to download the scanlist.

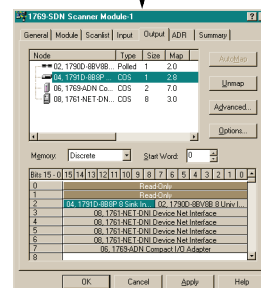
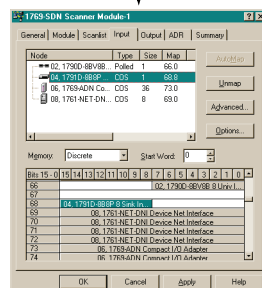


Double-click the device in the scanlist to edit a device's I/O parameters.



Click the Input tab and click the AutoMap button to automatically map input devices.

Click the Output tab and click the AutoMap button to automatically map output devices.



Quick Start for Experienced Users

Introduction

This chapter helps you get started using the 1769-SDN scanner module.

Topic	Page
Required Tools and Equipment	19
What You Need to Do	20

Procedures are based on the assumption that you have an understanding of Rockwell Automation controllers. You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application. Because it is a start-up guide for experienced users, this chapter does not contain detailed explanations about the procedures listed.

Required Tools and Equipment

Have the following tools and equipment ready:

- Personal computer
- Programmable controller: CompactLogix or MicroLogix 1500 system
- 1770-KFD RS-232 DeviceNet adapter or 1784-PCIDS, 1784-U2DN DeviceNet interface card
- For network communication: RSLinx software, version 2.30 or later
- For DeviceNet network configuration:
 - RSNetWorx for DeviceNet software, version 3.00 or later
- For ladder logic programming:
 - RSLogix 500 programming software, version 5.00.10 or later, or
 - RSLogix 5000 programming software, version 8.02 or later
- 1769-SDN scanner module
- Mounting hardware
- Screwdriver

What You Need to Do

Follow these steps to get started using the 1769-SDN scanner module.

1. Verify planned system configuration.
 - a. Ensure system power supply has sufficient current.

Maximum Current Draw

Module	5V DC	24V DC
1769-SDN	440 mA	0 mA

The scanner module cannot be located more than four modules away from the system power supply.

- b. Verify that the DeviceNet network has adequate power.

DeviceNet Power Requirements

Module	DeviceNet Power Requirements
1769-SDN	N.E.C. Class 2 90 mA @ 11V DC, max. 110 mA @ 25V DC, max. 200 mA for 1.5 ms inrush

2. Remove power.

ATTENTION



Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system’s field devices, causing unintended machine motion.
- causing an explosion in a hazardous environment.

Electrical arcing causes excessive wear to contacts on both the module and its mating connector and can lead to premature failure.

3. Assemble and mount the I/O bank.

The scanner module can be attached to an adjacent controller, power supply, or I/O module. The scanner module can be panel or DIN-rail mounted. Modules can be assembled before or after mounting.

Be sure to observe minimum spacing guidelines for adequate ventilation.

4. Ground the scanner module and complete the DeviceNet network wiring.**5. Apply power to the system.****6. Be sure that the programming software and equipment is ready.****7. Use RSLogix to configure drivers.****8. Use RSNetWorx for DeviceNet software to configure the 1769-SDN scanner module and the DeviceNet devices.****9. Use RSLogix software to create your project and ladder logic.****10. Start the system.**

- a. Apply power.
- b. Download your program and put the controller into Run mode.
- c. status indicators turn on solid green.

11. Monitor the scanner module status to check if the scanner module is operating correctly.

Module status is reported by the status indicators and numeric display on the front of the scanner module. The information is also stored in the scanner module's input data file, so these bits can be used in your control program to flag an error.

Notes:

Installation and Wiring

This chapter describes how to install and wire the 1769-SDN scanner module. This table describes what this chapter contains and where to find specific information.

Topic	Page
Power Requirements	23
General Considerations	24
System Planning	26
System Assembly	27
System Mounting	28
Replace the Scanner Module within a System	31
Field Wiring Connections	32
Scanner Module Power-up	33

Power Requirements

The scanner module receives power through the Compact I/O bus interface from the +5V DC system power supply.

Maximum Current Draw

Module	5V DC	24V DC
1769-SDN	440 mA	0 mA

The scanner module also draws power from the DeviceNet network.

DeviceNet Power Requirements

Module	DeviceNet Power Requirements
1769-SDN	N.E.C. Class 2 90 mA @ 11V DC, max. 110 mA @ 25V DC, max. 200 mA for 1.5 ms, inrush

General Considerations

The Compact I/O system is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution Degree 2⁽¹⁾) and to circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or nonhazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING**EXPLOSION HAZARD**

Substitution of components may impair suitability for Class I, Division 2.

Do not replace components or disconnect equipment unless power has been switched off or the area is known to be nonhazardous.

Do not connect or disconnect components unless power has been switched off or the area is known to be nonhazardous.

This product must be installed in an enclosure.

All wiring must comply with N.E.C. article 501-4(b).

⁽¹⁾ Pollution Degree 2 is an environment where, normally, only nonconductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

⁽²⁾ Over Voltage Category II is the load level section of the electrical distribution system. At this level, transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

⁽³⁾ Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

Preventing Electrostatic Discharge

ATTENTION

Electrostatic discharge (ESD) can damage integrated circuits or semiconductors if you touch the bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
 - Wear an approved wrist-strap grounding device.
 - Do not touch the bus connector or connector pins.
 - Do not touch circuit components inside the module.
 - Use a static-safe work station, if available.
 - Keep the module in its static-shield box when it is not in use.
-

Removing Power

ATTENTION

Remove power before removing or inserting this module. When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion.
- causing an explosion in a hazardous environment.

Electrical arcing causes excessive wear to contacts on both the module and its mating connector and can lead to premature failure.

Reducing Noise

We recommend installing this module in an industrial enclosure to reduce the effects of electrical interference. Group your modules to minimize adverse effects from radiated electrical noise and heat.

Protecting the Circuit Board from Contamination

The printed circuit boards of the modules must be protected from dirt, oil, moisture, and other airborne contaminants. We recommend installing the system in an enclosure suitable for the environment to protect these boards. The interior of the enclosure should be kept clean and the enclosure door should be kept closed whenever possible.

System Planning

Consider the following when planning your system:

- The scanner module can communicate with up to 63 DeviceNet devices.
- The scanner, as a master, can own up to 63 slave I/O nodes.
- The scanner module can simultaneously be a master and a slave owned by another DeviceNet master.
- A 1769-ECR right end cap or 1769-ECL left end cap is required to terminate the end of the Compact I/O bus.
- Each bank of Compact I/O modules must have its own power supply.

A MicroLogix 1500 controller acts as the power supply for modules directly connected to it.

- A Compact I/O power supply, or MicroLogix 1500 base unit, has limits on the amount of +5V DC and +24V DC current it can supply to modules in its I/O bank.

These limits depend on the catalog number of the power supply, for example, 1769-PA2. A bank of modules must not exceed the current limits of the I/O bank power supply or MicroLogix 1500 base unit.

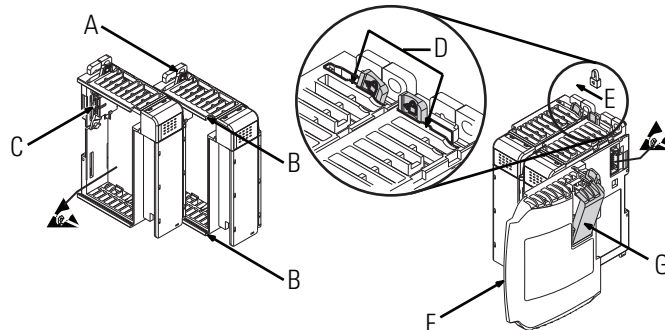
Refer to the Compact 1769 Expansion I/O Power Supplies Installation Instructions, publication [1769-IN028](#), or the MicroLogix 1500 User Manual, publication [1764-UM001](#).

- The scanner module has a distance rating of four, therefore, the scanner module must be within four modules of the I/O bank's power supply.
- Determine the DeviceNet communication rate, based on standard DeviceNet considerations.
- Consider the number of words of I/O data the host controller supports.

For more information on planning your DeviceNet network, refer to the DeviceNet Media Design Installation Guide, publication [DNET-UM072](#).

System Assembly

The scanner module can be attached to an adjacent controller, power supply, or I/O module. This procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.
2. Check that the bus lever of the scanner module (A) is in the unlocked (fully right) position.
3. Use the upper and lower tongue-and-groove slots (B) to secure the modules together.
4. Move the scanner module back along the tongue-and-groove slots until the bus connectors (C) line up with each other.
5. Use your fingers or a small screwdriver to push the bus lever back slightly to clear the positioning tab (D).
6. Move the scanner module's bus lever fully to the left (E) until it clicks. Make sure it is locked firmly in place.

ATTENTION

When attaching I/O modules, it is very important that the bus connectors are securely locked together for a proper electrical connection.

7. Attach an end cap terminator (F) to the last module in the system by using the tongue-and-groove slots as before.
8. Lock the end cap bus terminator (G).

IMPORTANT

A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the serial communication bus.

System Mounting

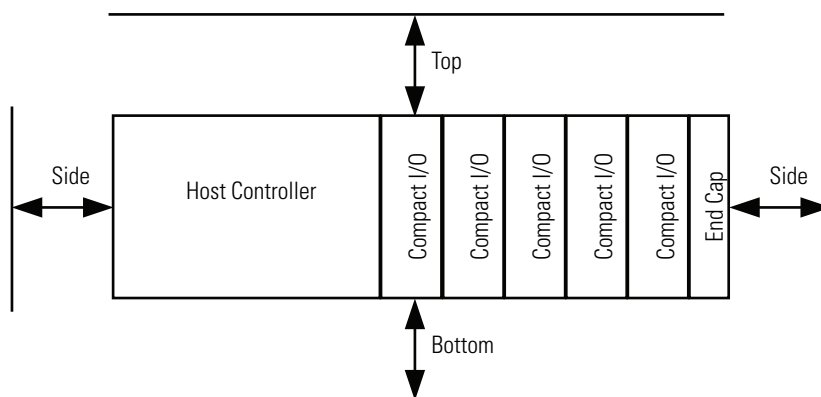
ATTENTION



During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands) is prevented from falling into the module. Debris that falls into the module could cause damage at power up.

Minimum Spacing

Maintain spacing from enclosure walls, wireways, and adjacent equipment. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown below.



Allow at least 110 mm (4.33 in.) of enclosure depth to accommodate the scanner module and the DeviceNet connector.

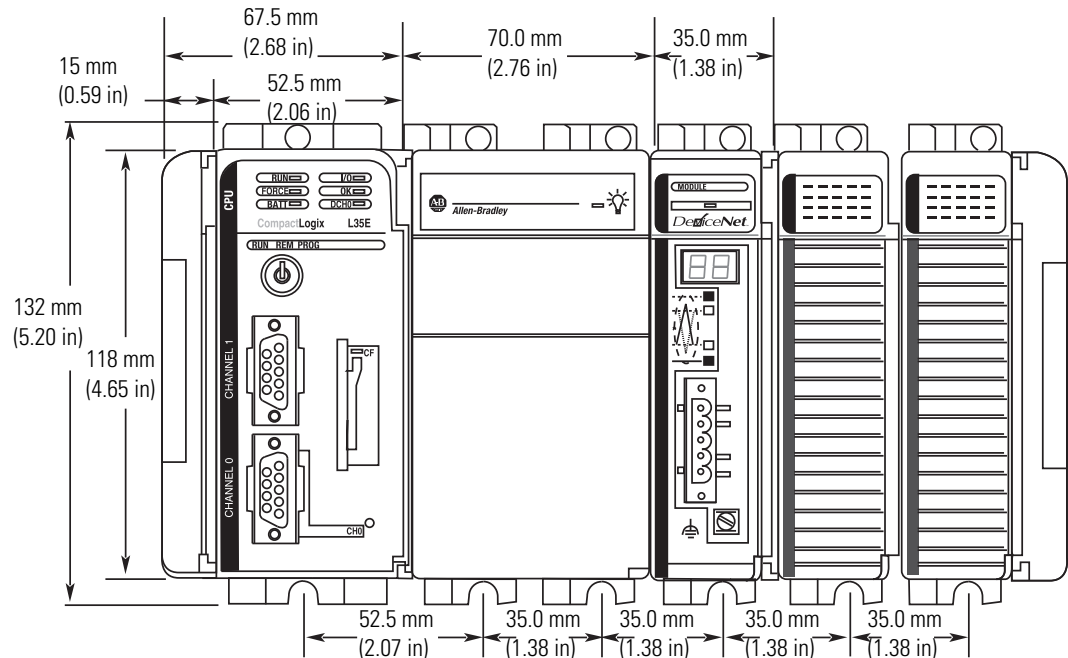
Panel Mounting

Mount the scanner module to a panel, using two screws per scanner module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

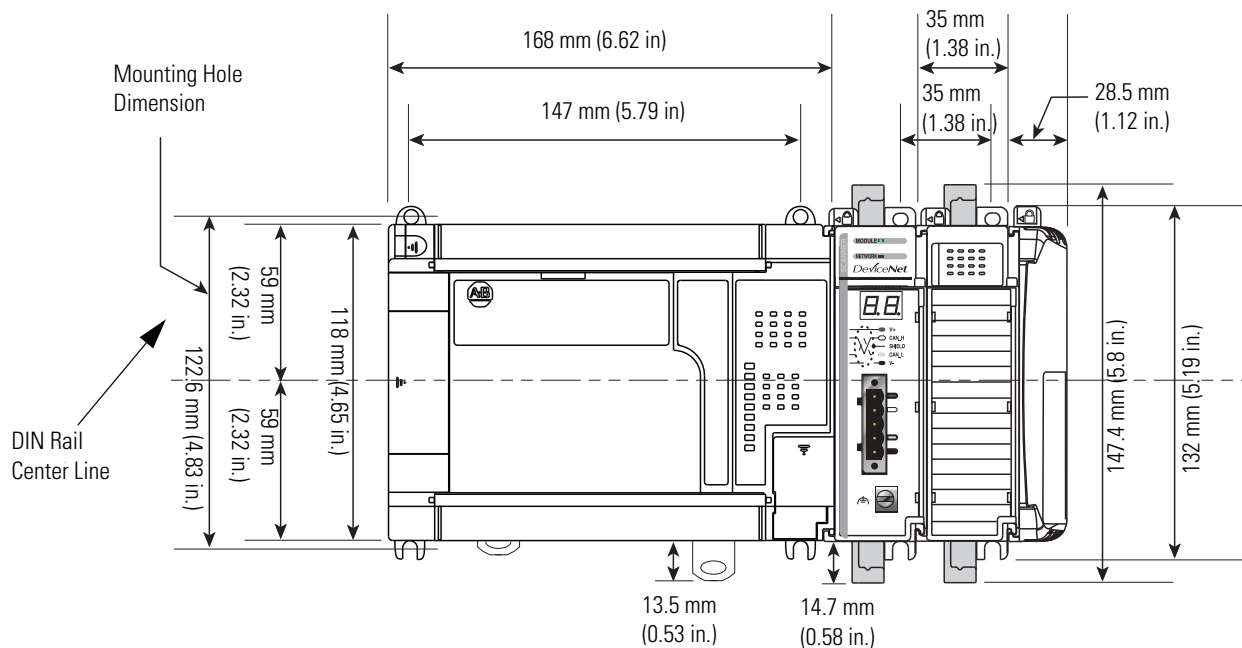
Panel Mounting Using the Dimensional Drawing

All dimensions are in millimeters (inches). Hole spacing tolerance: ± 0.4 mm (0.016 in.).

Compact I/O System with L35E CompactLogix Controller and Power Supply



Compact I/O System with MicroLogix 1500 Base Unit and Processor



Panel Mounting Procedure Using Modules as a Template

This procedure lets you use the assembled modules as a template for drilling holes in the panel. Due to module mounting hole tolerance, it is important to follow these procedures.

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.

If mounting more modules, mount only the last one of this group and put the others aside. This reduces remounting time during drilling and tapping of the next group.

7. Repeat steps 1...6 for any remaining modules.

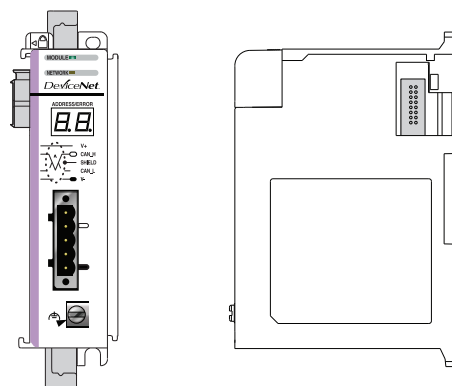
DIN Rail Mounting

The module can be mounted using the following DIN rails:

- 35 x 7.5 mm (EN 50022 - 35 x 7.5) or 35 x 15 mm (EN 50022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latches. Press the DIN rail mounting area of the module against the DIN rail. The latches will momentarily open and lock into place. DIN rail mounting dimensions are shown below.

DIN rail mounting dimensions



Dimension	Height
A	118 mm (4.65 in.)
B	59 mm (2.325 in.)

Replace the Scanner Module within a System

The scanner module can be replaced while the system is mounted to a panel (or DIN rail) once power is removed.

1. Remove power.
2. Remove the DeviceNet cable from the scanner module by removing the DeviceNet connector.
3. Remove the upper and lower mounting screws from the scanner module (or open the DIN rail latches using a flat-blade screwdriver).
4. On the scanner module to be replaced and the right-side adjacent module (or end cap if the scanner module is the last module in the bank), move the bus levers to the right (unlock) to disconnect the scanner module from the adjacent modules.
5. Gently slide the disconnected scanner module forward.
6. If you feel excessive resistance, make sure that you disconnected the scanner module from the bus and that you removed both mounting screws (or opened the DIN latches).

It may be necessary to rock the scanner module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

7. Before installing the replacement scanner, be sure that the bus lever on the right-side adjacent module is in the unlocked (fully right) position.
8. Slide the replacement scanner module into the open slot.
9. Connect the scanner module and modules together by locking (fully left) the bus levers on the replacement scanner module and the right-side adjacent module or end cap.
10. Replace the mounting screws (or snap the scanner module onto the DIN rail).
11. Replace the DeviceNet cable on the scanner module by attaching the connector to the scanner.
12. Restore the scanner module configuration using RSNetWorx for DeviceNet software.

IMPORTANT

Be sure that the new module has the same node address and communication rate as the module that was replaced.

Field Wiring Connections

Follow these procedures to wire the scanner module.

Grounding the Scanner Module

This product is intended to be mounted to a well-grounded mounting surface, such as a metal panel. Additional grounding connections from the scanner's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded.

ATTENTION



The grounding screw on the front of the scanner module must be connected to a suitable ground source when operating in electrically noisy environments. Use a 2.1 mm² (14 AWG) wire to make this connection.

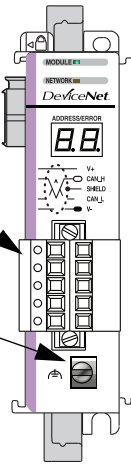
For additional information on grounding the scanner module, refer to Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication [1770-4.1](#).

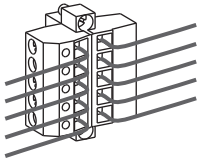
DeviceNet Wiring

DeviceNet Connector

Grounding Screw

Use 2.1 mm² (14 AWG) wire to connect to panel ground.





Connect ⁽¹⁾	To
Red Wire	V+
White Wire	CAN High
Bare Wire	Shield
Blue Wire	CAN Low
Black Wire	V-

⁽¹⁾ DeviceNet cable colors are shown on the wiring label on the front of the scanner

1. Connect the DeviceNet cable to the removable connector as shown.
2. Insert the removable female connector into the mating male connector on the DeviceNet scanner module.
3. Screw the removable connector to the scanner module case with the upper and lower mounting screws to a torque of 0.6...0.7 Nm (5...6 in-lbs).

IMPORTANT

If the 1769-SDN scanner module is the first or last device connected to the DeviceNet network trunkline, be sure to add a termination resistor ($120\ \Omega$ $1\% \geq \frac{1}{4}W$ resistor, Allen-Bradley part number 1485A-C2) across the Blue (CAN Low) and White (CAN High) wires.

Scanner Module Power-up

When power is applied via the Compact I/O bus, the scanner module goes through a self test sequence. Upon successful completion of the self test, the scanner module is ready to communicate.

The default scanner module settings are:

- Communication rate = 125 Kbps
- Node address = 63

Use your configuration software to change the communication rate and node address.

Notes:

Automatically Configure a DeviceNet Network

Introduction

This chapter provides a quick method for configuring a DeviceNet network. It uses the AutoScan feature to establish communication between the controller and your devices with minimal steps.

Topic	Page
Determine If You Can Use AutoScan	38
Review How AutoScan Effects Your Network	38
Connect Each Device to the Network	39
Add the Scanner to the RSLogix 5000 Project	44
Implement AutoScan	46
Additional Considerations Regarding AutoScan	53
Access Device Data	57
Put the Scanner in Run Mode	60

The DeviceNet AutoScan feature enables a scanner to automatically map a network of slave devices into its scanlist without the use of RSNetWorx for DeviceNet software. This greatly improves the ease of setting up a DeviceNet network, especially networks comprised of simple devices.

When the feature is enabled, a DeviceNet scanner continuously searches for devices on the network. Once a qualifying slave device is found, it is added to the scanner's scanlist and its I/O data is mapped into a predefined location in the scanner's I/O memory table based on the device's node address.

How AutoScan Operates

AutoScan is active when the feature is enabled and the scanner is in IDLE mode. When active, the scanner attempts to connect to each device not enabled in the scan list. The scanner only checks for devices with node addresses between 0 and 61, inclusive. The connections to these devices are made on a round robin basis.

When a device is found, the scanner gets the Produced and Consumed data sizes from the slave devices's Connection Object instance(s).

- If the Produced data size is greater than the configured I/O allocation size, the device is added to the scanlist with a produced size set equal to the I/O allocation size.

When this happens, an I/O connection is made with the device. But it errors and error code #77 is displayed on the 1769-SDN for the device's node number.

- If the Consumed data size is greater than the configured I/O allocation size, then the node is rejected and not entered into the scan list.

However, you can change the I/O allocation size, as described in [Configure I/O Allocation Size Via the User Program](#), to accommodate the device with the largest Produced and Consumed data sizes in your scanlist.

For qualifying nodes, the scanner enters the device into the scan list and attempts to allocate an I/O connection using one of the following communication format choices, in this particular order:

- Change Of State (COS) EPR = 250ms
- Poll EPR = 75ms
- Strobe EPR = 75ms
- Cyclic EPR = 500ms

EXAMPLE

If a photoeye was connected on a network that only supported strobed connections, the scanner does a couple of things.

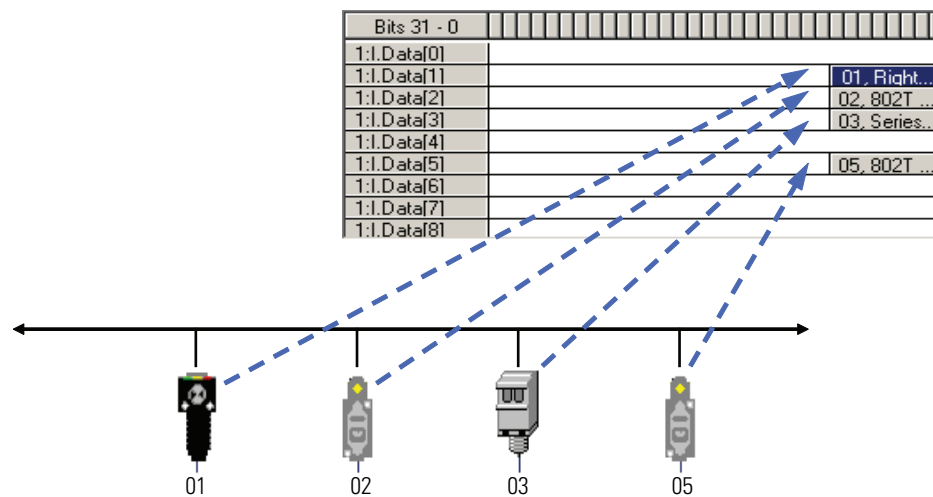
- First, the scanner recognizes that a device exists for which memory was available for the node number with the configured allocation size on a network that was not currently mapped.
 - Then, the scanner would attempt to initiate both COS and polled connections first, but the strobed connection would be selected as that is the only connection that the photoeye supported.
-

The input and output data is mapped into the scanner's I/O data table based on the device's node address and the configured fixed mapping size. The DINT-based formula is used with the CompactLogix controller for calculating the Input or Output data location is:

$$\text{Input (Output) Offset} = [(\text{Node Address}) \times (\text{Allocation Size})] / 4$$

EXAMPLE

When using the default fixed mapping size of 4 bytes, the input data for the devices shown in the example below is allocated in the 1769-SDN's input table as shown below. Notice node 1 is located in the data map at DINT location 1, node 2 at DINT location 2, and so on.



Notice that, in this example, node 4 is unused. However, the I/O memory slot remains allocated for it.

IMPORTANT

If you are using a MicroLogix 1500 controller with a 1769-SDN scanner, you must use the following WORD-based formula for calculating the Input or Output data location:

$$\text{Input (Output) Offset} = ((\text{Node Address}) \times (\text{Allocation Size}) / 2) + \text{Data Offset}$$

In this formula the Data Offset = 66 for Input Offset and 2 for Output Offset.

The data offset value is used to account for scanners that have a fixed status field at the start of the input or output data, for example, the 1769-SDN scanner.

Determine If You Can Use AutoScan

Make sure your network meets the following requirements to use this chapter:

- The scanner's I/O allocation size is configured to accommodate the input and output data sizes of all devices on your DeviceNet network.
- The default AutoScan setting allocates a 4-byte entry in both the input and output memory maps in the scanner for each slave device detected on the network. This default size is chosen to accommodate the default Logix native data size of 32 bits, that is a DINT.
- If you use a device that sends more than 4 bytes of input or output data, for example, an E3 Solid State Overload Relay (catalog number 193-ECxx), you must change the I/O allocation size.
- You are using the CompactLogix 1769-SDN DeviceNet scanner with firmware revision 4.1 or greater.

If your network does not meet the requirements listed above, then use [Chapter 5](#) and [Chapter 7](#) to configure your network and control your devices.

How AutoScan Effects Your Network

As you use AutoScan, keep the following in mind:

Consideration	Description
AutoScan clears the current configuration.	With AutoScan, the scanner automatically sets up communication with the devices on your DeviceNet network. When you turn on the AutoScan option, the scanner removes any previous configuration that was done to the scanner.
AutoScan allocates a fixed memory size for each device.	At its default setting, AutoScan allocates 1 DINT of input memory and 1 DINT of output memory for each device on the DeviceNet network. The actual data for the device fills the portion that it needs and the rest remains unused. DINT 0 1 2 Input Memory device at address 0 device at address 1 device at address 2
The bytes/node value defines how much memory for each address.	AutoScan lets you specify how much input and output memory to give to each address on your network. For example, if you specify 2 DINTs (8 bytes) per address, the scanner sets aside 2 DINTs for each address. DINT 0 1 2 3 4 5 Input Memory device at address 0 device at address 1 device at address 2 The actual data for the device fills the portion that it needs and the rest remains unused.

Consideration	Description
New devices are automatically available.	While the scanner is in idle mode, AutoScan continues to establish communication with devices that you connect to the network, as long as the device uses input data and output data sizes that fit in the scanner's I/O allocation size.
The Automatic Device Recovery (ADR) option is <i>not</i> available.	You have to use RSNetWorx for DeviceNet software to edit the configuration of the scanner to use the Automatic Device Recovery (ADR) option of a DeviceNet scanner. This turns off AutoScan.

Connect Each Device to the Network

As you connect your devices to the DeviceNet network, follow these guidelines:

1. Assign an address to each device. The following addresses are recommended but not required.

Give this address	To this device
0	scanner
1...61	your devices
62	hand held configurator, such as the DeviceNet Configuration Terminal, catalog number 193-DNCT
63	Leave open. Out of the box, a DeviceNet device is preset for address 63. Leaving address 63 open lets you get a new device on the network without conflicting with another device.

2. Connect the scanner and any network interface to the network.

By first connecting the scanner and/or network interface device to the network, you reduce the number of baud rate errors as you connect the rest of your devices:

- Scanners and network interface devices use a fixed baud rate.
- Sensors and similar DeviceNet devices use autobaud to set their baud rate. They wait for another device to communicate. Then they set their baud rate to the same baud rate as the other device.
- By first placing a scanner or network interface on the network, the other devices have a baud rate against which to set their baud rate.
- Initially, leave the baud rate of the scanner and network interface at the default setting of 125K bits/s. If you want to change the baud rate, wait until after you establish communication with all your devices at the default setting (125K).
- See [Set the Node Address of a Device Via a DeviceNet Configuration Terminal](#) on [page 42](#) to set the scanner's DeviceNet address.

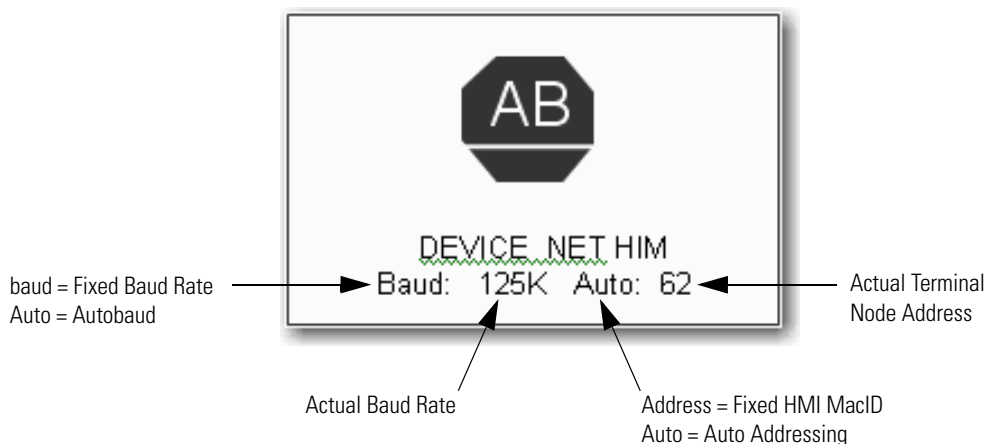
3. Connect the rest of your devices to the network one at a time.

- Out of the box, a DeviceNet device is preset for address 63. Connect and set the devices one at a time to set the scanner's DeviceNet address. Otherwise the address conflicts may prevent communication with them.
- If a device has a switch to set its baud rate, set the switch to autobaud, if available. Otherwise, set the device to the baud rate of the network.
- After you change the address or baud rate of a device via a switch, cycle power to the device.
- If a device has no switch or pushbutton for its address or baud rate, see [Set the Baud Rate of a Device Via a DeviceNet Configuration Terminal](#) below.
- After you set the address of a device, check its network status indicator. Typically, a solid red indicator means an address conflict or problem with the baud rate.

Set the Baud Rate of a Device Via a DeviceNet Configuration Terminal

Follow these steps to set the baud rate for your DeviceNet network via the DeviceNet Configuration Terminal, catalog number 193-DNCT. For the rest of the chapter, the terminal is referred to as the 193-DNCT terminal.

1. Connect the 193-DNCT terminal to the network. The following display appears for 10 seconds which shows the unit setup and the baud rate and node number values it has determined.



IMPORTANT

The 193-DNCT terminal is shipped so that when it is placed on a DeviceNet network for the first time, it automatically sets its baud rate to that of the traffic on the network. The terminal uses Auto Addressing to assign itself an unused network node address.

After 10 seconds a **Network Who** screen similar to the example shown below should appear that displays all Nodes and associated devices on the network.

```

NETWORK WHO  Node: 43
0 -- DeviceNet Scanner
2 -- 1732D 24Vdc 8 Conf
5 -- E1 Plus
6 -- E3 Plus (0.4 -2A)
7 -- SMC Flex Standard
8 -- PowerFlex 700 VC 2
62 -- This DeviceNet HIM
  
```

If the **Network Who** screen does not appear as expected, then the 193-DNCT terminal may be set to **autobaud enabled** and is not able to determine a communication rate because no communication is occurring on the network at this time.

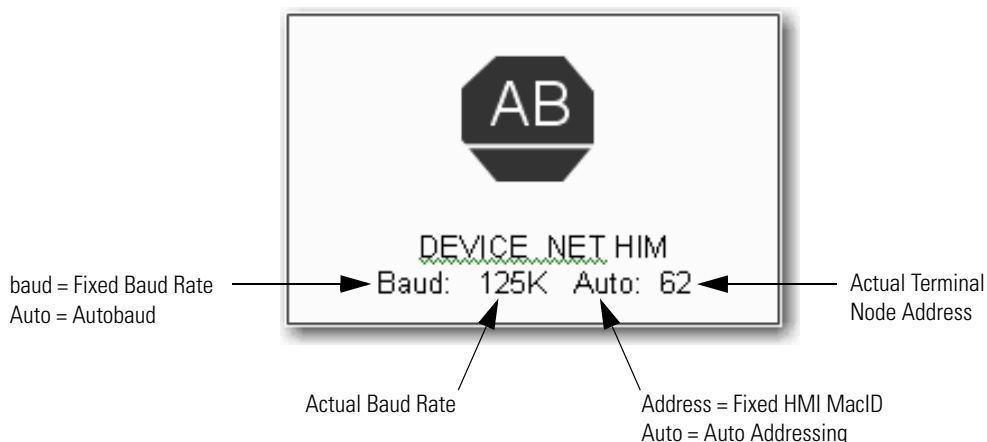
Follow these steps to disable the autobaud feature and set the baud rate.

1. On the 193-DNCT terminal keypad, press <ESC> .
2. Select the **AutoBaud** option and use <Up Arrow>  to select Disable.
3. Press <SEL>  to advance to the **BaudRate** option.
4. With the **BaudRate** option selected, use <Up Arrow>  to select the appropriate baud rate.
5. Press <Enter>  to complete the node commissioning function.
6. Press <ESC>  to exit setup.

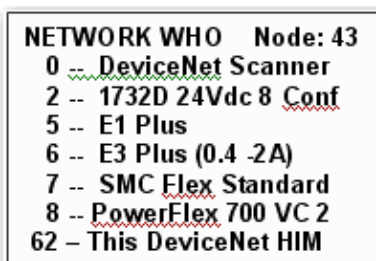
Set the Node Address of a Device Via a DeviceNet Configuration Terminal

Follow these steps to set the node address of a device on your DeviceNet network via the 193-DNCT terminal.

1. Connect the 193-DNCT terminal to the network. The following display should appear for 10 seconds that shows the unit setup and the baud rate and node number values it has determined.



After 10 seconds a Network Who screen similar to the example shown below should appear that displays all Nodes and associated devices on the network.



2. Use <Down Arrow>  on the 193-DNCT terminal to scroll down through the list until the last entry for node 63 is highlighted, which should read 63 - No Product Name.
3. Press <Enter>  to advance to the configuration screen.
4. Use <Down Arrow>  to select the Tools option.

5. Press <Enter>  and a screen appears with the **NodeComm** option highlighted.
6. Press <Enter>  and the Node Commissioning screen appears as shown below with the BaudRate option highlighted.



7. Because you do not need to change the baud rate, press <SEL>  to advance to the Address option and highlight it.
8. Press the numbers on the key pad for the node number that you plan to use for the device that was just installed on the DeviceNet network and press <Enter> .

When the address is changed an Apply Changes messages appears on the screen.

9. Press <SEL>  to highlight the **Apply Changes** message.
10. Press <Enter>  to complete the node commissioning function.

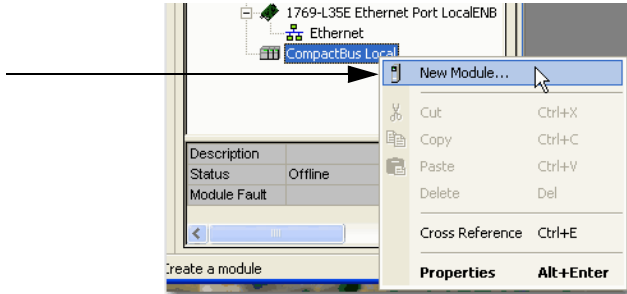
After approximately two seconds, the 193-DNCT terminal re-initializes and in another 10 seconds, the 193-DNCT terminal again displays the Network Who screen. At this point, the new node appears in the table.

Add the Scanner to the RSLogix 5000 Project

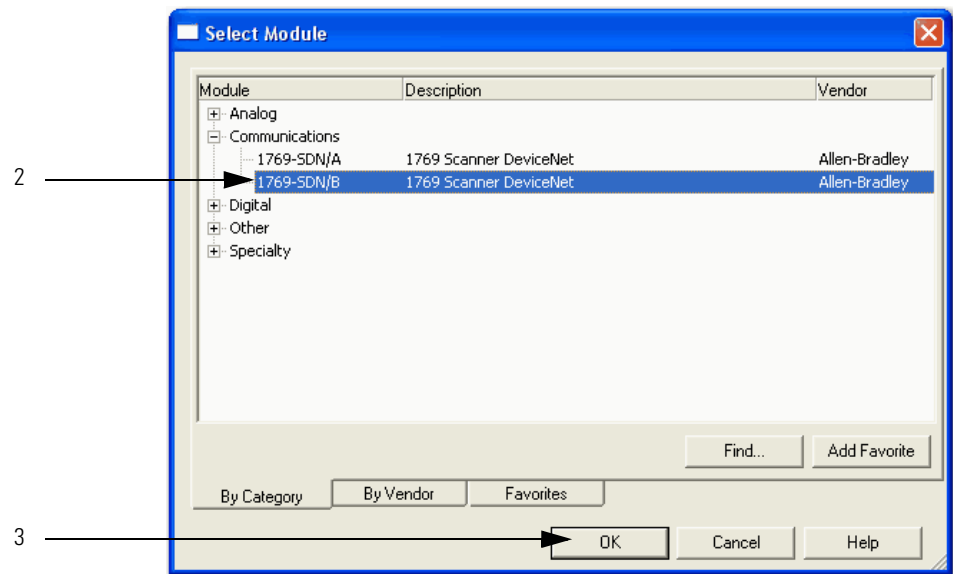
Add the scanner to the I/O configuration of the controller to access the data of your network.

Add the Scanner to the I/O Configuration Folder

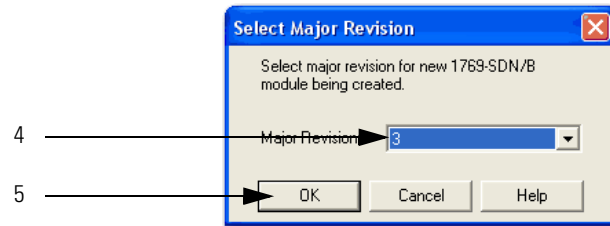
1. Right-click and choose New Module.



2. Choose the type of scanner.
3. Click OK.

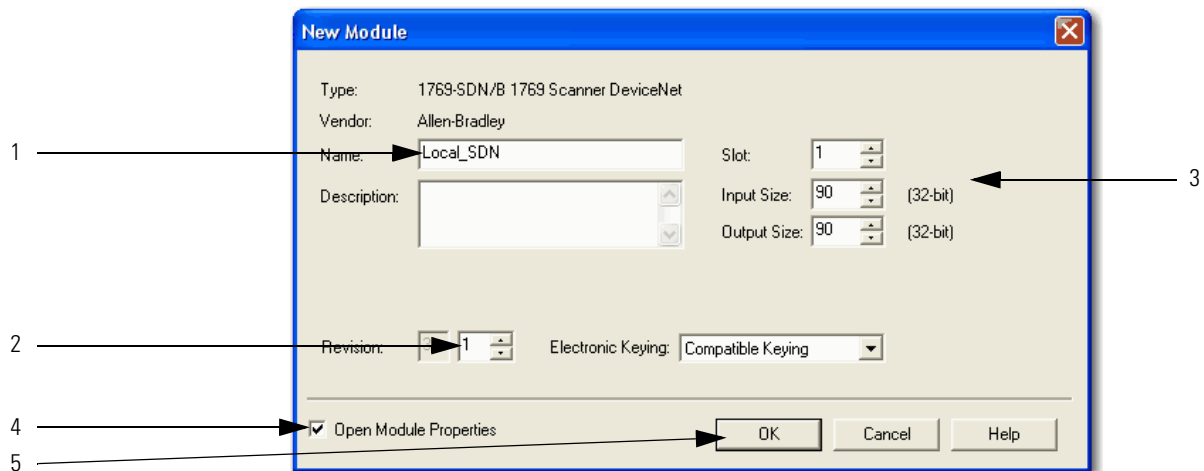


4. Select the Major revision of the scanner.
5. Click OK.



Define the Properties of the Scanner

1. Name the scanner.
2. Set the scanner Minor Revision.
3. Choose the size of the input and output memory maps that the scanner will allocate for each device it detects on the network. Valid values range from 0 to 32 bytes per node.
4. If you need to make additional configuration changes, such as setting the Requested Packet Interval (RPI), leave the Open Module Properties box checked.
5. Click OK



6. When the Module Properties dialog appears, that is, if you left the Open Module Properties box checked, make additional required configuration changes.

Implement AutoScan

Make sure that the appropriate version of DeviceNet scanner is used to implement this feature. You must use the CompactLogix 1769-SDN DeviceNet scanner with firmware revision 4.1 or greater

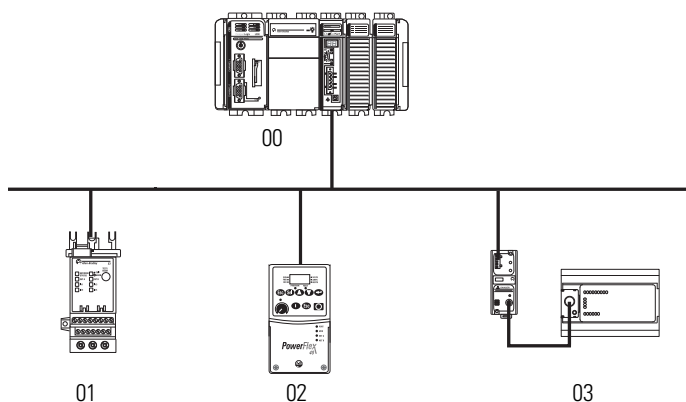
This section describes how to set up the feature and how it operates. Notice that explicit messaging is used for some of the steps. There are several ways that an explicit message can be sent on DeviceNet.

- A user ladder program
- External programming/configuration devices, such as the 193-DNCT terminal
- RSNetWorx for DeviceNet software

Since the purpose of the AutoScan feature is to eliminate the use of RSNetWorx for DeviceNet, instructions on how to send an explicit message via the class instance editor in RSNetWorx for DeviceNet are not covered in this document.

1. Set up the physical network. Make sure all devices are addressed appropriately, that is, there are no address conflicts, and are communicating at the same baud rate.

The diagram below shows an example system using the 1769-SDN scanner.



You can commission the node addresses via hardware switches on the device(s) or through the 193-DNCT terminal.

2. Set up I/O allocation size in the scanner.**TIP**

This step is optional.

The default AutoScan setting allocates a 4-byte entry in both the input and output memory maps in the scanner for each slave device detected on the network. This default size is chosen to accommodate the default Logix native data size of 32 bits (DINT). If that is adequate for the application, skip to [step 3](#).

For applications where the user would like to customize the I/O allocation size, the 4-byte allocation could be adjusted through an Explicit Message to the scanner using the SetAttributeSingle service. The entry allocation could be configured for 1 to 32 bytes per node. One way to set the allocation size is described in section [Configure I/O Allocation Size Via the User Program](#).

The following table lists devices that most commonly use the AutoScan feature and their respective I/O allocation sizes.

Device	Bulletin Number	Input Allocation	Output Allocation
ArmorStart Distributed Motor Controller	280D/281D	1 byte	1 byte
193-E Electronic Overload Relays	193	8 bytes	1 byte
PowerFlex 40 Adjustable Frequency AC Drive	22B	4 bytes	4 bytes

Configure I/O Allocation Size Via the User Program

Use the parameters shown in the MSG message setup screen below to adjust the I/O allocation size. Make sure that the message is sent to the appropriate DeviceNet Scanner.

This data tag should be configured as an SINT, and should contain the value of the desired per-node fixed mapping size (1 - 32)

IMPORTANT

You can only change the I/O allocation size when:

- the scanner is in IDLE mode, and
- the AutoScan feature is disabled.

3. Execute an Explicit message to the scanner using the SetAttributeSingle service to enable AutoScan. There are multiple ways to send an explicit message on DeviceNet, including the following:

- [Initiate AutoScan Via the User Program](#)
- [Initiate AutoScan via the 193-DNCT Terminal](#)

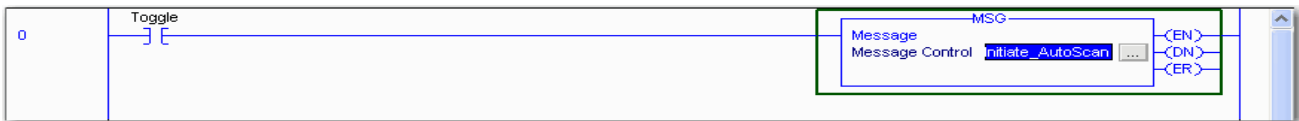
Initiate AutoScan Via the User Program

Follow these steps to initiate AutoScan using a MSG instruction.

1. Verify that the scanner is in IDLE mode, that is bit 0 in the scanner control output word = 0, and that all slave nodes are connected to and communicating on the DeviceNet network.
2. In the RSLogix 5000 programming software Tag Editor, create new tags to initiate AutoScan via ladder programming as shown in the example below.

Name	Alias For	Base Tag	Data Type	Style	Description
Local1:1			AB:1769_SDN_4...		
Local1:0			AB:1769_SDN_3...		
Toggle			DINT	Decimal	
Initiate_AutoScan			MESSAGE		

3. Create a MSG instruction that uses the new tags.



4. Configure the MSG instruction to use the proper parameters.

Message Configuration - InitiateAutoScan

Configuration* | Communication | Tag

Message Type: CIP Generic

Service Type: Set Attribute Single Source Element: AutoScanEnable

Service Code: 10 (Hex) Class: 90 (Hex) Source Length: 1 (Bytes)

Instance: 1 Attribute: 10 (Hex) Destination: [Dropdown]

New Tag...

☐ Enable
 ☐ Enable Waiting
 ☐ Start
 ☐ Done
 Done Length: 0

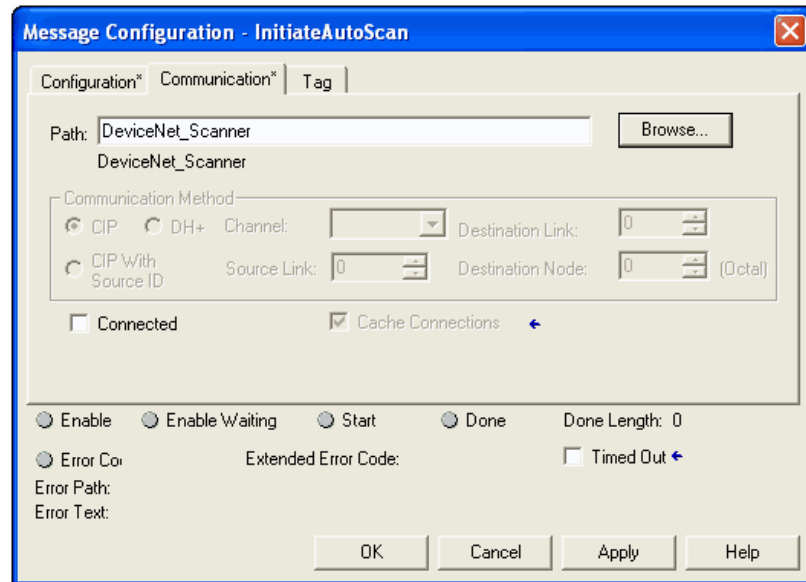
☐ Error Code:
 Extended Error Code:
 ☐ Timed Out

Error Path:

Error Text:

OK Cancel Apply Help

5. Set the path to your DeviceNet scanner.



6. Return the scanner to Run mode, that is bit 0 in the scanner control output word = 1, and the scanner status display should display the scanner node address.

The previous example is from RSLogix 5000 programming software; refer to the appropriate user manuals to determine how to perform explicit messaging in other PLC platforms.



Initiate AutoScan via the 193-DNCT Terminal

Follow these steps to enable AutoScan using the 193-DNCT terminal, version 2.1 or higher.

1. Put your controller into Program mode, and verify that the scanner is in Idle mode (CommandRegister.Run = 0) and that all slave nodes are connected and communicating on the DeviceNet network.
2. Plug the 193-DNCT terminal into the DeviceNet network.
3. In the Network Who dialog, press <Up Arrow>  to navigate to and select the first line (0 - 1769-SDN DeviceNet Scanner).
4. Press <Enter>  to go to the scanner's configuration dialog.
5. Press <Down Arrow>  to navigate to Scanner and press <Enter> .
6. Press <Down Arrow>  to navigate to AutoScan and press <Enter> .

The AutoScan Setup dialog appears.

7. If AutoScan is selected and set to Enable, press <Up Arrow>  to change the setting to Disable.
8. Press <SEL>  to scroll down to Save. This disables the AutoScan feature.
9. Press <SEL>  to scroll down to Mapping.
10. Type in the number of bytes that you want to automap to each DeviceNet node, that is, 1...32. The default is 4 bytes.
11. Press <SEL>  to scroll down to Save, and press <Enter>  to commit your byte size selections.

The AutoScan feature is now configured with the byte size entered in [step 9](#) and [step 10](#). For the 1769-SDN scanner to remap the network with this new setting, the AutoScan feature must be re-enabled.

12. Change AutoScan setting to Enable and press <SEL>  to scroll down to Save.

IMPORTANT

When setting the AutoScan mode from Disable to Enable, the 1769-SDN scanner clears all existing configuration.

Notice that the 1769-SDN module status indicator flashes red and back to green, while the status display momentarily shows 72.

When the AutoScanning is complete, the status display blinks between 65 and the node address of the scanner.

13. On the AutoScan set-up screen, press either the <Up Arrow>  or <Down Arrow> .
14. Press <SEL>  twice and then press <Enter>  to save your changes.
15. Press <ESC>  three times to return to the Network Who screen on the 193-DNCT terminal.

If all the devices on the network are properly mapped, the scanner status display blinks back and forth between 80 and the node address of the scanner.

IMPORTANT

With 193-DNCT terminal, version 2.1 and higher, the active nodes line on the Network Who screen should show a number that exactly matches how many slave devices are on the DeviceNet network.

If the number on the active nodes line does not match the number of slave devices on the network, the cause typically is one of the following:

- The consume I/O data size of a device is greater than the selected I/O allocation size.
- The slave device is not on the network.

16. Put the controller into Run mode and verify that the scanner is in Run mode (CommandRegister.Run is 1) in the scanner control output word = 0.

The scanner status should display only the node address of the scanner. If it is flashing other codes as well, refer to [Chapter 8, Troubleshooting](#) for more information.

Additional Considerations Regarding AutoScan

The factory default setting for AutoScan is disabled for all products.

Make sure that input or output data memory size in the scanner is large enough to accommodate the size required based on the number of nodes on the network and the AutoScan I/O allocation size per node.

TIP

Nodes 0...61 inclusive are scanned and added to the scanlist if they are not already mapped and I/O space exists. For maximum capacity for slave devices, the scanner node address could be configured as node 62; node 63 could also be used but to avoid duplicate node address issues with a new device, this is not recommended.

IMPORTANT

According to the ODVA DeviceNet Technical Overview, the maximum number of nodes on a DeviceNet network is 64. However, the normal useful number of slave nodes is 62 because:

- the DeviceNet scanner requires a node

and

- we recommend that you leave node 63 unused for devices that are added to the network in the future.

If a network interface is used on the network, and the above bullets are taken into consideration, then the useful number of nodes becomes 61.

EXAMPLE

If the I/O allocation size per node is configured for 16 bytes and there are 32 slave devices on the network (node addresses 1 - 32), AutoScan requires $16 \text{ bytes} \times 32 = 512 \text{ bytes}$ (128 DINT) of I/O space in both the scanner's input and output table. Assuming it is a CompactLogix system, the maximum scanner input data table size is 90 DINT and 90 DINT for output. The required space exceeds what the 1769-SDN can support. The user would need to adjust the I/O allocation size or reduce the slave device count on the network to include all of the devices in the scanlist.

Devices outside of the scanner's allowable I/O image space will be rejected and will not be included in the scanlist.

[See Scanlist on page 54](#) for an accurate maximum node count by allocation size.

Scanlist

Data Allocation (bytes)	Max Node
1	61
2	61
3	61
4	61
5	61
6	60
7	51
8	45
9	40
10	36
11	32
12	30
13	27
14	25
15	24
16	22
17	21
18	20
19	18
20	18
21	17
22	16
23	15
24	15
25	14
26	13
27	13
28	12
29	12
30	12
31	11
32	11

The AutoScan feature is automatically disabled in the scanner as soon as the scanner configuration is modified by RSNetWorx for DeviceNet software. For example, any manual changes to the scanlist using RSNetWorx for DeviceNet software disables the AutoScan feature in the scanner.

One new status code has been added to the Node Status list. This code is presented in the Node Status Table.

Status Code (Decimal)	Description of Status
65	AutoScan Active (Scanner only status)

When the scanner is in Run mode with AutoScan enabled, the scanner display alternates between 65 and the scanner node address.

When a scanner is transitioned from Run mode to Idle mode while AutoScan is enabled, it only scans the network for nodes that are not already in the scanlist. However, while in Idle mode, an AutoScan DISABLE to ENABLE transition causes the scanner to erase the existing scanlist and scan for all nodes on the network.

The AutoScan feature checks for the Quick Connect setting in each slave device and enables Quick Connect in the scanner if it is enabled in the slave devices.

Type of Connection that the Scanner Sets Up

The type of update (connection) that the scanner sets up with each device depends on the device. The scanner chooses the first connection type that the device supports in this order:

1. change-of-state (COS)
2. polled
3. strobed
4. cyclic at 1000 ms

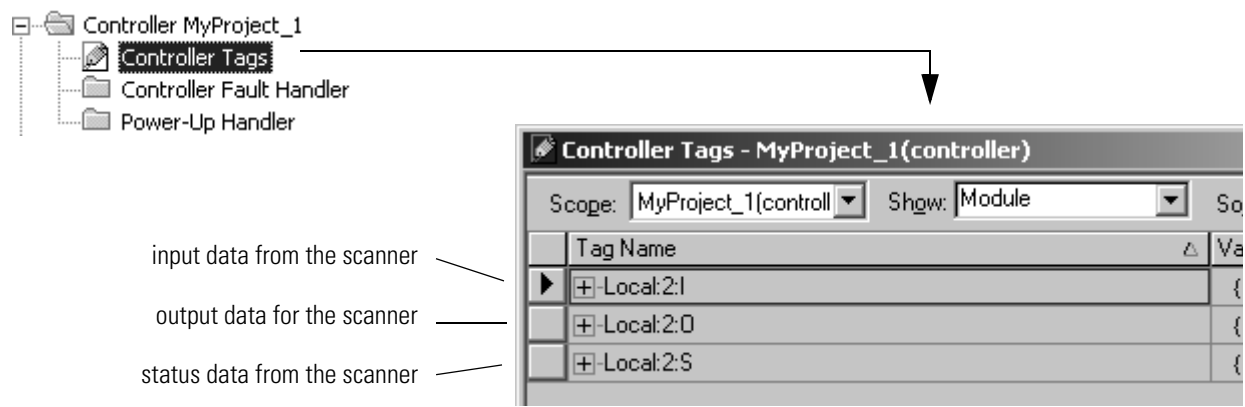
The scanner tries to set up a change-of-state connection. If the device doesn't support change-of-state, then the scanner tries to set up a polled connection, etc. The type of connection that the scanner sets up may *not* be the default for the device.

As an option, you can allocate more memory for each device.

Consideration:	Description:
The scanner sets-up communication with any device that fits within the allocated memory size.	The scanner automatically sets up communication with those devices that fit within the memory allocated for each address. - For example, if you allocate 2 DINTs (8 bytes) per address, the scanner sets up communication with any device that sends or receives 0 - 8 bytes of data. - The scanner adds as many device as it can until it runs out of memory. - If you give too much memory to each address, you may not have enough memory for all your devices.
The scanner skips devices that are too large.	If a device needs more memory than is allocated, the scanner skips it and <i>does not</i> set up communication with it. IMPORTANT: If the Produced data size is greater than the configured I/O allocation size, the device is added to the scanlist with a produced size set equal to the I/O allocation size. When this happens, an I/O connection is made with the device. But it errors and error code #77 is displayed on the 1769-SDN for the device's node number. For example, if you specify 2 DINTs (8 bytes) per address but a device sends 9 bytes, the scanner <i>does not</i> add the device to the scan list.
Manually editing the scan list turns off AutoScan.	If you use RSNetWorx for DeviceNet software to edit the configuration of the scanner, the scanner turns off AutoScan. <i>Do not</i> turn it back on or you will clear the configuration that you just entered. For example, if you use RSNetWorx for DeviceNet software to manually add a device to the scan list, the scanner turns off AutoScan. If turn on AutoScan again, the scanner clears out the current configuration and starts over.

Access Device Data

When you add the scanner to the I/O configuration of the controller, RSLogix 5000 software automatically creates a set of tags for the input, output, and status data of the network:



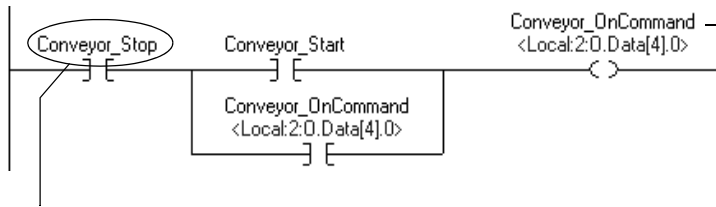
The tags for your DeviceNet data follow this format:

location :type .Data IO_offset .bit

 = Optional

Where	Is		
location	location of the scanner in the system		
	If you have the 1769-SDN scanner in a		Then location is
		local chassis	Local:slot_number_of_scanner
		remote chassis	adapter:slot_number_of_scanner where: adapter is the name of the EtherNet/IP or ControlNet module in the remote chassis.
type	type of data:		
	Where	Is	
	input from a device	I	
	output to a device	O	
IO_offset_address	address of the device on the DeviceNet network (based on 4 bytes per node)		
bit	specific bit within the data of the device		

While you can use the input and output tags of the scanner directly in your logic, it is a lot easier to use alias tags.

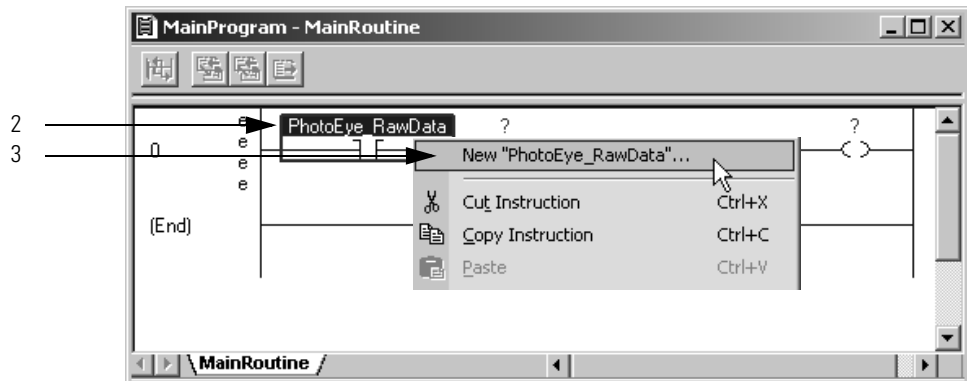


As an option, create tags that describe each device without pointing them to the actual addresses of the devices. Later, convert the tags to aliases for the data of the devices.

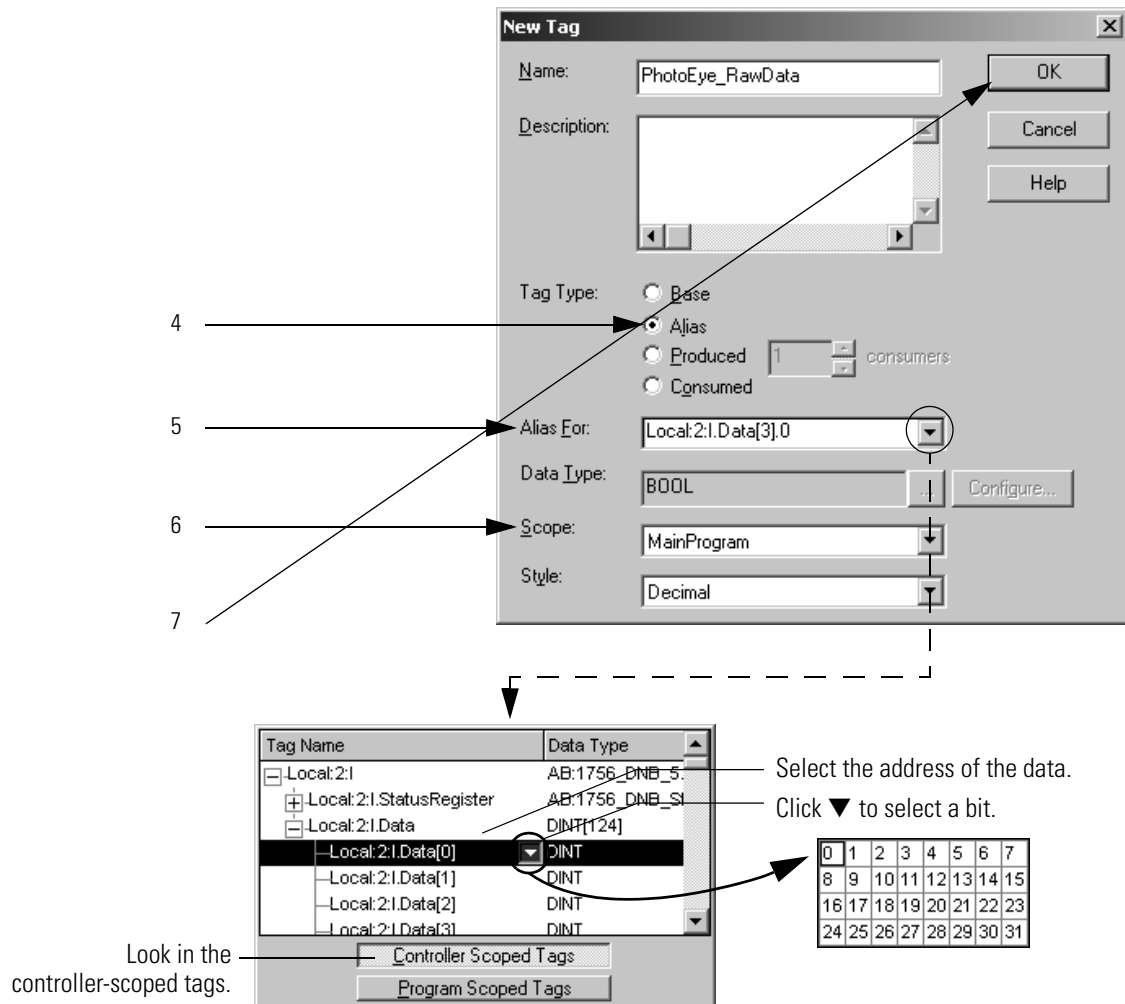
alias tag – a tag that represents another tag

- Both tags share the same data.
- When the data changes, both tags change.
- An alias tag provides a descriptive name for data, such as DeviceNet input or output data.
- If the location of the data changes, simply point the alias tag lets to the new location without editing your logic.

1. Enter your logic.
2. Type a descriptive tag name for the DeviceNet data.
3. Right-click the tag name and choose New...



4. Select the Alias button.
5. Select the tag that this alias tag represents.
6. Select the scope for the alias tag.
7. Choose OK.



Put the Scanner in Run Mode

Follow these steps to run the DeviceNet network.

1. Place the controller in Run/Remote Run mode.
2. Set the following bit of the output structure for the scanner.

If you want to	Set this bit	To:
run the network	...O.CommandRegister.Run	1
not run the network (idle mode)	...O.CommandRegister.Run	0

3. Check to see if the scanner is in Run mode, by making sure an 80 status code does not appear on the scanner's display.

Manually Configure the DeviceNet Network

Introduction

This chapter describes how to configure the DeviceNet network using RSLinx and RSNetWorx for DeviceNet software. This table describes what this chapter contains and where to find specific information.

Topic	Page
Software Versions	61
Install the Software	62
Use RSLinx Software to Configure Your DeviceNet Driver	62
Use RSNetWorx for DeviceNet Software to Configure the 1769-SDN Scanlist	64

Software Versions

This table lists the software and revision level required to operate with the 1769-SDN scanner module.

Function	Software	Version
Communication	RSLinx	2.30 or later
DeviceNet configuration	RSNetWorx for DeviceNet	3.00 or later
Ladder logic programming software	RSLogix 500	5.00.10 or later
	RSLogix 5000	8.02 or later

You will also need one of the following interfaces to use your computer to communicate with the DeviceNet network:

- 1770-KFD RS-232 DeviceNet adapter
- 1784-PCD or 1784-PCID DeviceNet interface card

If your RSNetWorx for DeviceNet software does not include the required Electronic Data Sheet (EDS) file, go to <http://www.ab.com/networks/eds>.

Register the new EDS file using the EDS Wizard in RSNetWorx for DeviceNet software. Access the wizard from the Tools menu.

Install the Software

Follow these steps to install RSLinx and RSNetWorx for DeviceNet software

1. Insert the software CD-ROM in the drive.

The CD-ROM supports Windows Autorun. If you have Autorun configured, the installation will automatically start when you insert the CD-ROM in your drive. If you do not have Autorun configured, perform steps 2 and 3.

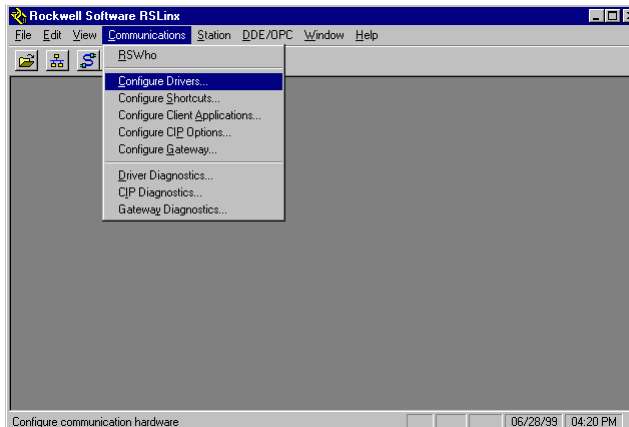
2. From the Windows Start menu, choose Run.
3. Browse for the Setup program on the CD-ROM and open it.
4. Follow the prompts that appear as you install the software.

After software installation is complete, you will use RSLinx software to configure your DeviceNet driver and RSNetWorx for DeviceNet software to configure the network.

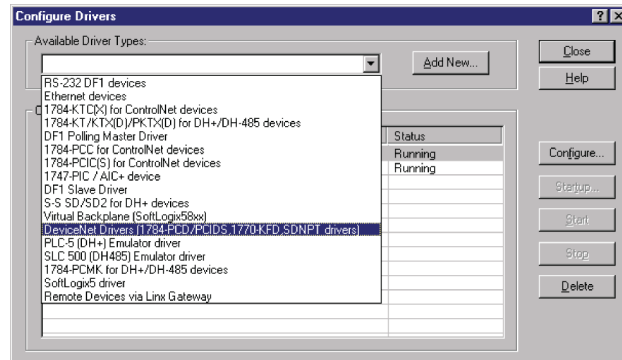
Use RSLinx Software to Configure Your DeviceNet Driver

Follow these steps to configure the DeviceNet driver.

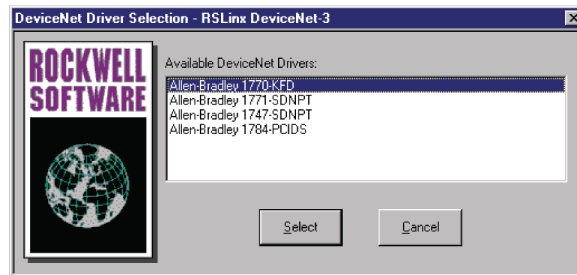
1. Start RSLinx software.



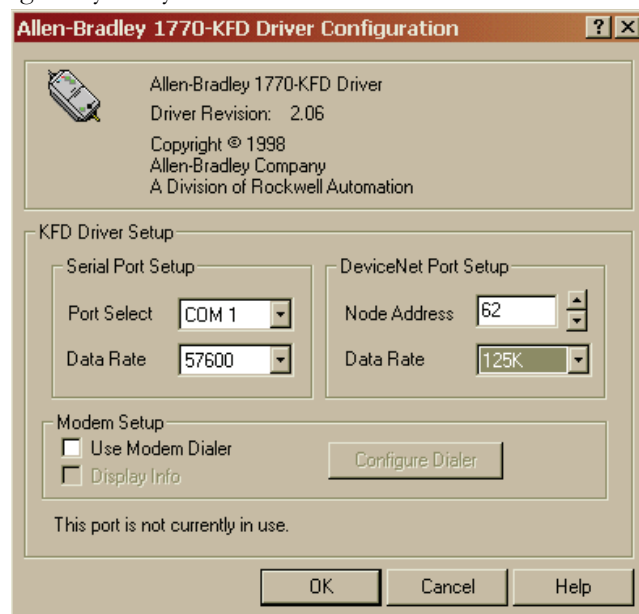
2. From the Communications menu, choose Configure Drivers.
3. From the Available Driver Types pull-down menu, choose Add/New.



4. Select your driver.

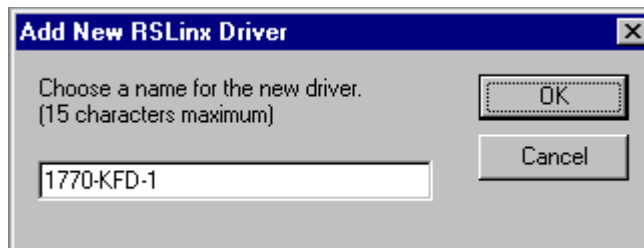


5. Your driver setup will depend on your particular system setup (COM port, communication rate, node address). Choose the appropriate settings for your system.



The software will take a few seconds to configure the driver.

6. Click OK.



7. Click OK to use the default driver name.

8. Minimize RSLink software.

You will use the driver you just configured to browse and configure the network with RSNetWorx for DeviceNet software.

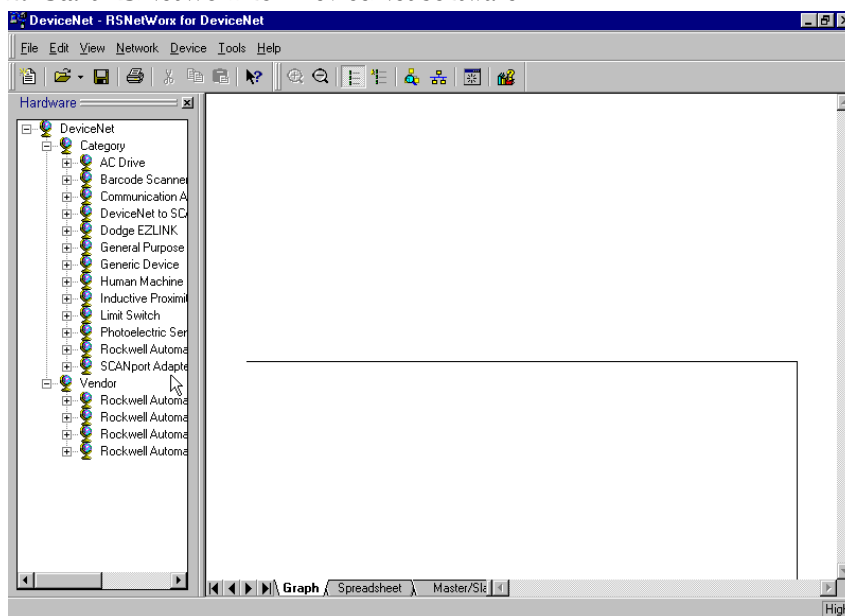
Use RSNetWorx for DeviceNet Software to Configure the 1769-SDN Scanlist

This manual assumes a certain level of familiarity with RSNetWorx for DeviceNet software. For detailed information on RSNetWorx for DeviceNet software, refer to your software's documentation.

Set Up an Online Connection

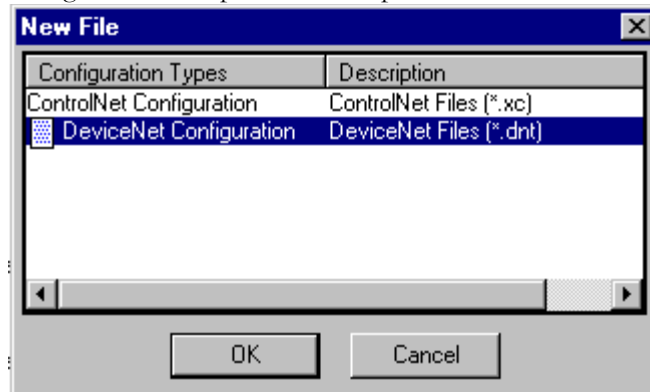
Follow the procedure below to set up an online connection to the DeviceNet network using the 1770-KFD driver.

1. Start RSNetWorx for DeviceNet software.



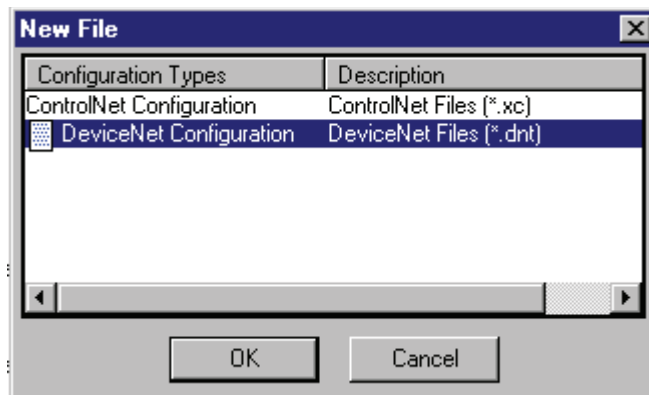
2. From the File menu, choose New.

If you have ControlNet configured on your system you may see this dialog. Otherwise, proceed to step 4.



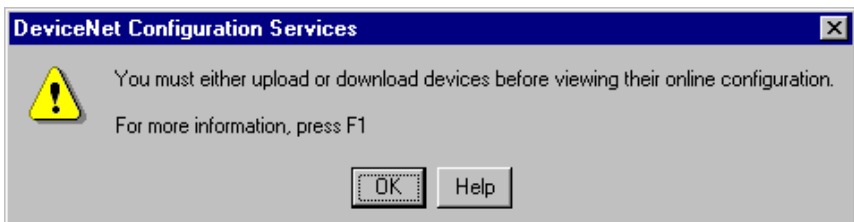
3. Select DeviceNet Configuration and click OK.
4. Click the Online button  on the toolbar.

A list of the available networks will appear. Your list may be different from that shown below, depending upon the drivers you have configured on your system.



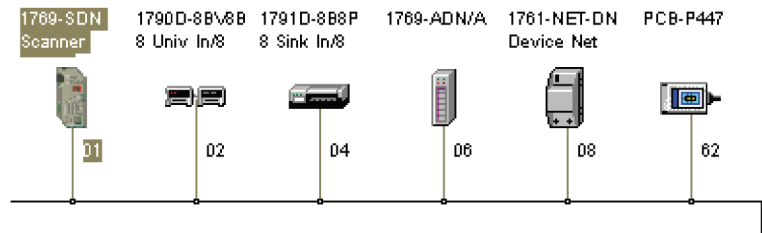
5. Select your DeviceNet driver and click OK.

You will be prompted to upload or download devices before going online.



6. Click OK to upload the devices and go online.

RSNetWorx for DeviceNet software begins browsing for network devices. When the software is done browsing, your network is displayed.



RSNetWorx for DeviceNet software performs a single pass browse when you go online or choose the browse feature. The software will poll for devices one time and display the results. If a node that was online later goes offline, there will be no live indication in RSNetWorx for DeviceNet software. You must manually perform a browse to detect the missing node.

Click the  button to manually perform the browse.

If RSNetWorx for DeviceNet software fails to find a device, check the physical connection to the device. If the physical connection is intact, verify that the device's communication rate is the same as the communication rate of the DeviceNet driver.

If your RSNetWorx for DeviceNet software does not include the required electronic data sheet (EDS) file, go to <http://www.ab.com/networks/eds>.

Use the EDS Wizard in RSNetWorx for DeviceNet software to register the new EDS file. Access the wizard from the Tools menu.

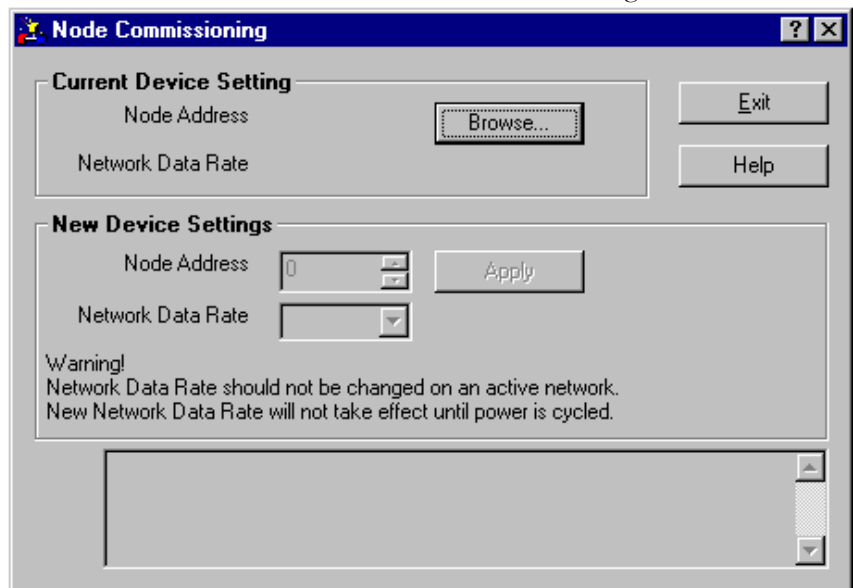
Set the Node Address

Once the network browse is complete, the node addresses appear to the right of their icons.

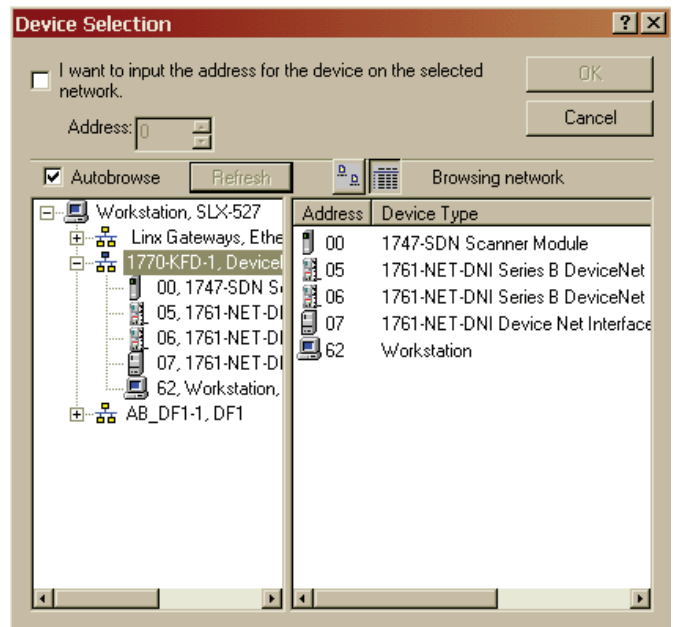
Use this procedure to change the node address of devices on the network (such as a photoeye). You can also change the network communication rate (baud rate) of some devices. Depending upon the device, you may need to cycle power for communication rate changes to take effect.

The controller must be in Program mode, or the scanner module in Idle mode (bit 0 of the Module Command Array = 0), for the scanner module to accept the configuration information.

1. From the Tools menu, choose Node Commissioning.



2. Click Browse.



3. Select the DeviceNet network.

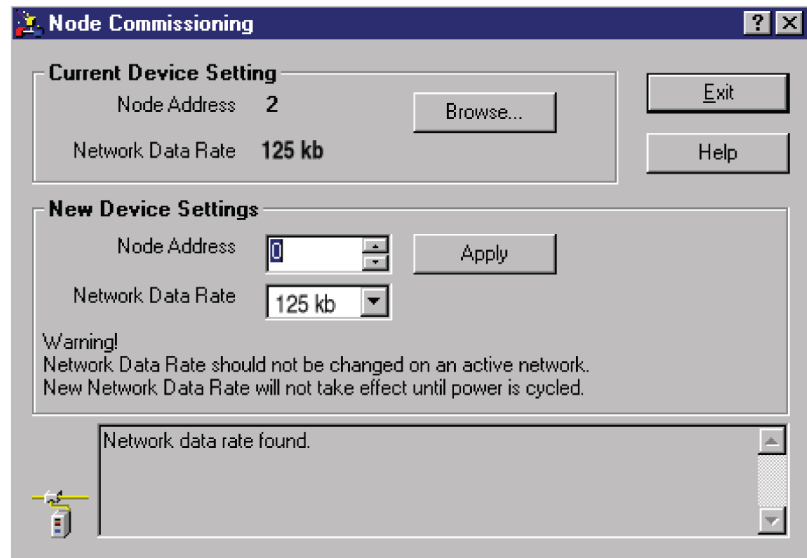
The devices on the network will appear in the right panel of the dialog.

4. Select the device you are commissioning in the right panel and click OK.

You will see the Node Commissioning dialog with the current settings for your scanner module.

The default scanner module settings are as follows.

- Communication rate = 125 Kbps
- Node address = 63

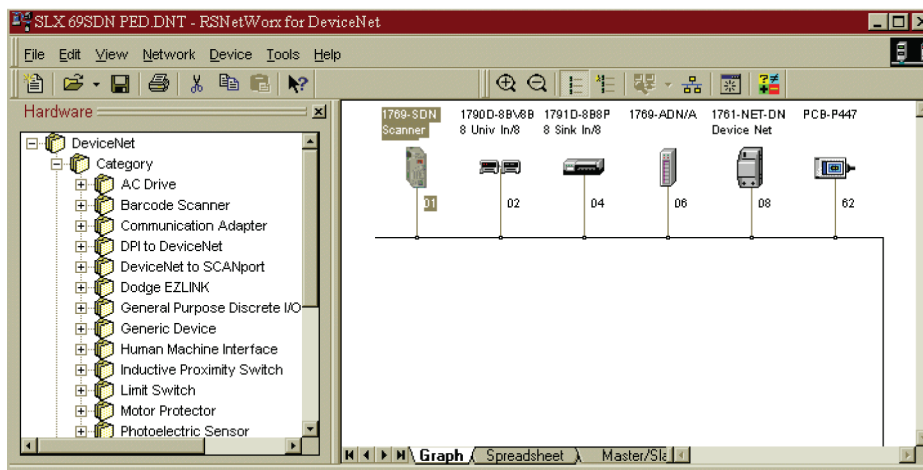


5. In the Node Address box, enter the new node address.
6. Click Apply and Exit the dialog.

Configure the I/O Devices

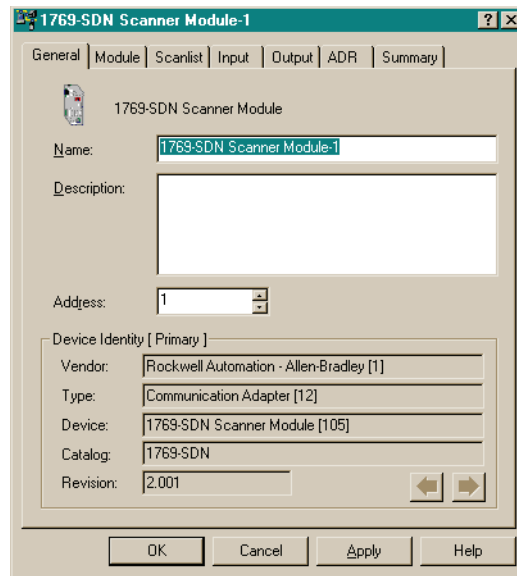
The information in this section will focus on the scanner module's configuration and parameters that you can change by using RSNetWorx for DeviceNet software.

This dialog shows how a DeviceNet network is shown within RSNetWorx for DeviceNet software. As you can see, node one is a 1769-SDN scanner. Double-click on the scanner module to view or modify the scanner's parameters.



General Tab

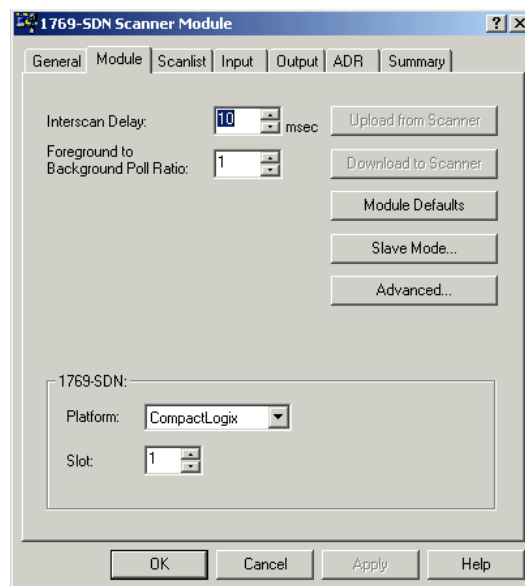
This dialog shows the properties that RSNetWorx for DeviceNet software displays for the 1769-SDN scanner module.



Available items are accessed through a series of tabs located across the top of the dialog. The General tab is the default tab and provides information relative to the module.

If you ever need product support, you will need to provide the revision number when you contact Rockwell Automation Technical Support.

Module Tab



Interscan Delay

This parameter defines the delay time the scanner module uses between scans of the DeviceNet network. If you have slave devices configured for polled behavior in the 1769-SDN scanner module scanlist, Interscan Delay (ISD) defines the amount of time the scanner module waits between DeviceNet I/O updates.

Increasing the ISD time causes a longer network scan, which adversely affects overall input-to-output performance. However, the increase allows lower priority messages to get more network access. These lower priority messages include those used to do network browsing and configuration upload/download functions. So, if these network functions are sluggish on your system, increase the ISD time.

Foreground to Background Poll Ratio

Devices set for polled behavior can be polled on every I/O scan (foreground) or they can be polled less frequently (background). Setting a device for foreground or background behavior is done when you configure each device in the scanner's input section.

Foreground/Background Polling Behavior

Each waveform shows polling frequency for the given Foreground to Background Poll Ratio.

Where:

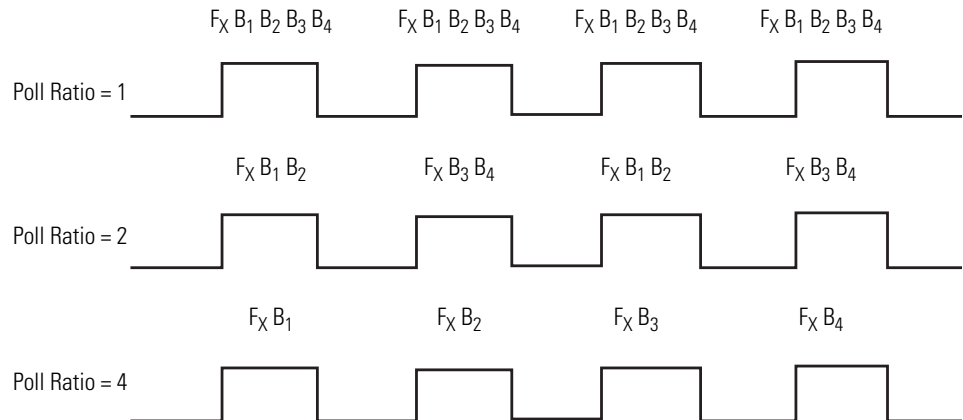
F_X = x foreground slave devices.

B_1 = 1st background slave device.

B_2 = 2nd background slave device.

B_3 = 3rd background slave device.

B_4 = 4th background slave device.



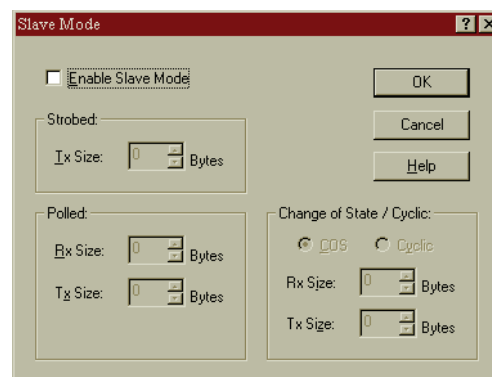
Module Defaults

Clicking Module Defaults sets Interscan Delay and Foreground to Background Poll Ratio to the following values:

- Interscan Delay: 10 ms
- Foreground to Background Poll Ratio: 1

Slave Mode

Enable Slave mode only if you want to use this scanner module as a slave. Clicking Enable Slave Mode opens this dialog.



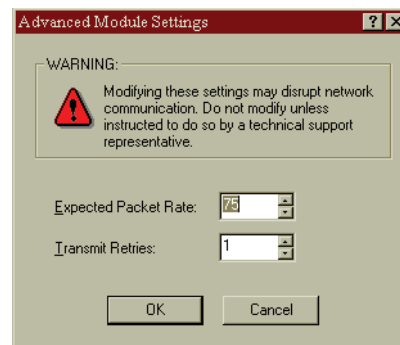
This parameter enables the slave functionality of the scanner, and lets you set the I/O behavior, with the amount of data to be exchanged. The Slave mode settings are described in this table.

Slave Mode Settings

Connection Format	Description
Strobed	Not supported by the 1769-SDN scanner module.
Polled	Values entered into Rx and Tx parameters define how much data will be exchanged over the polled connection that owns the scanner's slave I/O. Maximum size is 128 bytes.
Change of State / Cyclic	Values entered into Rx and Tx parameters define how much data will be exchanged over the change of state or cyclic connection that owns the scanner's slave I/O. Maximum size is 128 bytes.

Advanced Module Settings

Clicking Advanced opens this dialog.



Expected Packet Rate (EPR)

When the scanner module opens a polled or strobed I/O connection, it sets a maximum timeout (expected packet rate) with the device. If the device does not receive a packet from the scanner module within four times the EPR value, the slave device drops the connection. If the scanner module does not receive a packet from the slave within four times the EPR value, it drops the connection and periodically attempts to open a new connection.

When a connection is dropped, status bits in the scanner module identify that the slave is not online. Slave behavior when a connection is dropped is a function of the slave device. If the slave is an I/O device, the outputs will be cleared, held at last state, or set to a fault condition (refer to the slave device's documentation for actual I/O behavior when a connection is dropped).

The EPR default value is 75 ms.

IMPORTANT

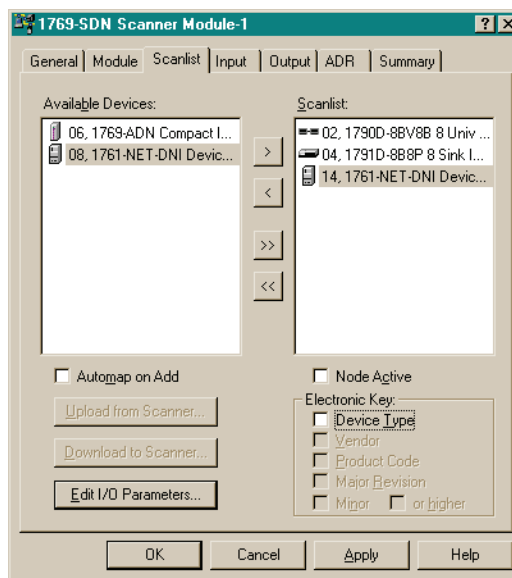
Changing the EPR number should be done carefully because it effects how long it takes the scanner module to detect a missing device.

Transmit Retries

Transmit Retries specifies the number of times the scanner module attempts to retransmit a change of state or cyclic message that has not been acknowledged by the slave device. The connection is not necessarily dropped as a result of reaching the retry limit.

Scanlist Tab

The Scanlist defines which devices on the DeviceNet network are owned by the scanner.



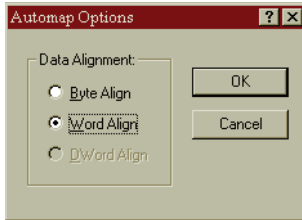
Available Devices

These are the devices on the network that have the ability to be slave I/O devices. Slave-capable devices do not have to be used as slave I/O by a scanner. They may alternately be used as slave I/O by another scanner module on the same network, or they may have dual functionality. An example of a dual function device is the 1761-NET-DNI module. The DNI can be used as slave I/O, or as a communication interface for PLCs or other DF1 full-duplex devices.

Scanlist

These devices have been assigned to be slave I/O to this scanner. A slave device on the DeviceNet network can be owned by only one master at a time. Devices in the scanlist are configured using the input and output tabs.

Automap on Add



Automap allows a slave's I/O to be automatically mapped into the scanner's input or output image tables when the slave device is added to the scanlist. do not check this box if you intend to map a slave device into a particular input or output memory location.

If you do select Automap, you will be prompted to choose how the data should be aligned in the scanner.

Edit I/O Parameters

These parameters will vary depending upon the slave device. Information on configurable parameters is usually provided in the device's documentation.

Electronic Key

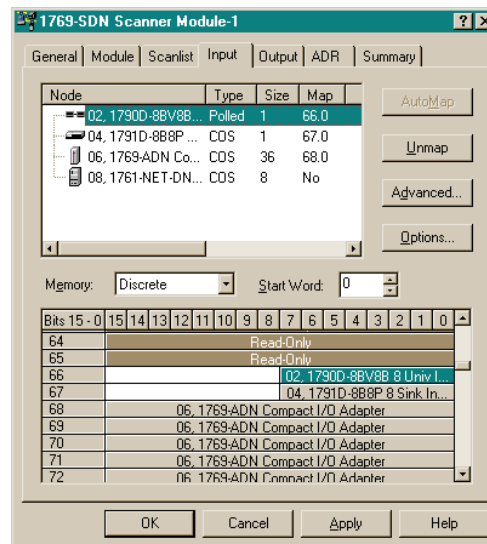
The electronic key is used to make sure that a particular slave device always matches the intended device when the scanner module initiates a connection to it. When one of the devices in the Scanlist section is highlighted, these boxes may be checked to indicate to what extent the key parameters must match the actual device on the network. A match of just Device Type can be selected or the additional parameters of Vendor ID, Product Code, Major Revision, and Minor Revision may be incrementally added.

For Major and Minor Revisions, you can select or higher to indicate that either an exact match, or some higher revision value of the revision is required.

If the scanner module detects a mismatch with any of the key parameters checked, an AutoVerify failure will occur for that slave device and the scanner module will not continue the connection allocation process.

Input Tab

The input tab dialog lets you to define how data from all of the scanner's slave devices are mapped into the input image of the controller.



In this example, four input devices are mapped into the scanner's input image. The dialog shows each device's:

- node number.
- catalog number.
- connection type used between the scanner module and the slave device (strobed, polled, cyclic, or change of state).
- amount of data that will be exchanged (in bytes).
- word within the controller's input image where the data will appear.

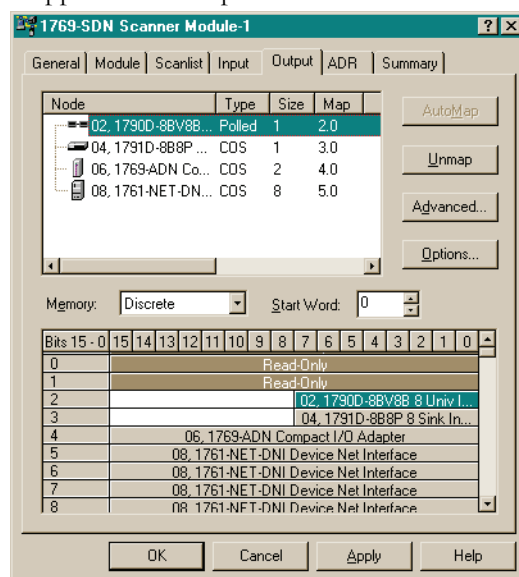
Advanced

The scanner module allows each node's slave data to be broken up (segmented) into separate input image areas. This capability lets you group data from multiple slave nodes into contiguous memory locations. This is simply an ease-of-use feature. For maximum performance, do not segment a slave device's data.



Output Tab

The output tab dialog lets you define how data from the scanner module is mapped to the outputs of the slave devices.



In this example, four output devices are mapped into the scanner's output image. The dialog box shows each device's:

- node number.
- catalog number.
- connection type used between the scanner module and the slave device (strobed, polled, cyclic, or change of state).
- amount of data that will be exchanged (in bytes).
- word within the controller's output image.

Auto Device Replacement (ADR) Tab

The Auto Device Replacement feature automates the replacement of a failed slave device on a DeviceNet network by returning it to the prior level of operation. This includes Configuration Recovery (CR) and Auto-address Recovery (AAR).

CR allows a slave device to be removed from the network and replaced with an identical slave device configured at the same communication rate and node address as the device being replaced.

ADR allows a slave device to be removed from the network and replaced with another identical slave device that is residing on the network at node address 63 and is not in the scan list. The replacement device will have its node address automatically changed to that of the device being replaced. Depending on the level of revision keying, it may be possible for the node address of the replacement device to be changed but not brought online due to a revision-keying mismatch.

The 1769-SDN scanner module can handle any number of device failures simultaneously, however, the AAR feature will be disabled for devices that have the same electronic key. The CR feature will remain active. In this case, you must use the Node Commissioning tool that ships with RSNetWorx for DeviceNet software to change the node's address.

If the electronic key of the replacement device differs only by revision, the CR feature may not work. Before replacing any device, you should make sure that the configuration parameters of the replacement device are compatible with the existing device.

IMPORTANT

This behavior may introduce a possible safety hazard for devices such as drives. Use the full electronic key, including revision. You must be using a 1769-SDN scanner module and RSNetWorx for DeviceNet software to enable electronic key revision checking.

Important Considerations

Keep the following in mind when using the ADR feature with RSNetWorx for DeviceNet software:

- ADR is intended for use in single-master environments.
- The CR and AAR features can be used only with devices that are in the scanlist of the scanner.
- The AAR feature can be enabled for a device only if the CR feature is also enabled.
- The CR feature cannot be enabled for devices that have no writable parameters (for example, a device that is entirely configured using hardware switches).

RSNetWorx for DeviceNet software will notify you of devices that have no writable parameters.

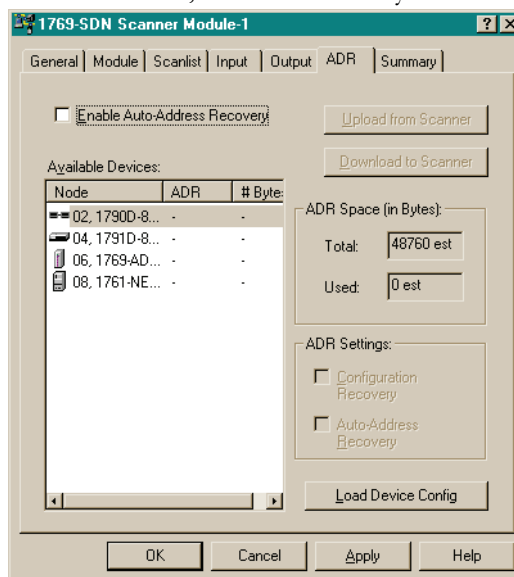
- The AAR feature will not work for devices that do not support changing the node address over the network.

Configure ADR Parameters

On the ADR tab, you can configure the ADR parameters for the 1769-SDN scanner module. Using the controls on this tab, you can select ADR parameters and enable or disable this functionality either globally or on a device-specific basis.

Configure each device on the network. If online, make sure that the configuration is synchronized with the online devices.

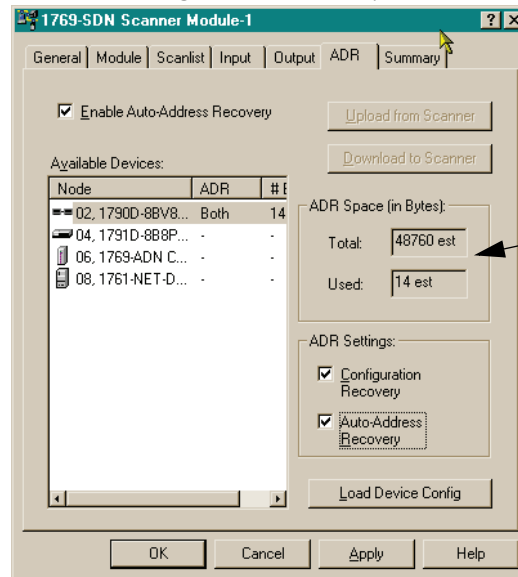
1. On the ADR tab, select the device you want to configure to use ADR.



2. Click Load Device Config.

This will load the configuration of each device selected into the scanner module configuration software. If you are online, but did not upload the network, the configuration retrieved for the devices may not be what is actually used online.

- Click the Configuration Recovery checkbox.



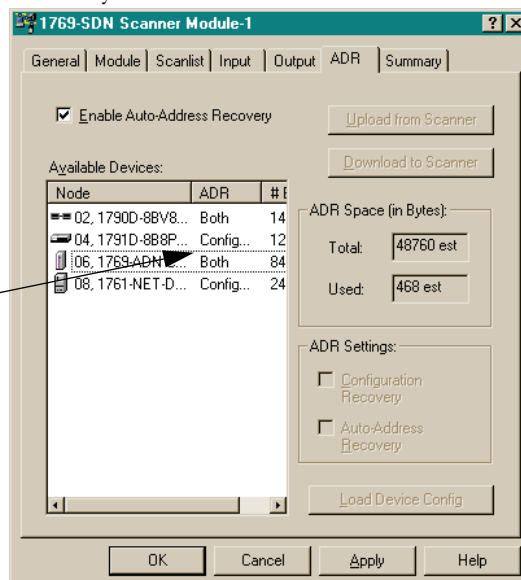
Notice the ADR space (in bytes) is displayed for the module you are updating.

- Click the Auto-Address Recovery checkbox if desired.

The Enable Auto-Address Recovery checkbox needs to be checked in order for AAR to work.

- Repeat steps 1...4 for each desired module.

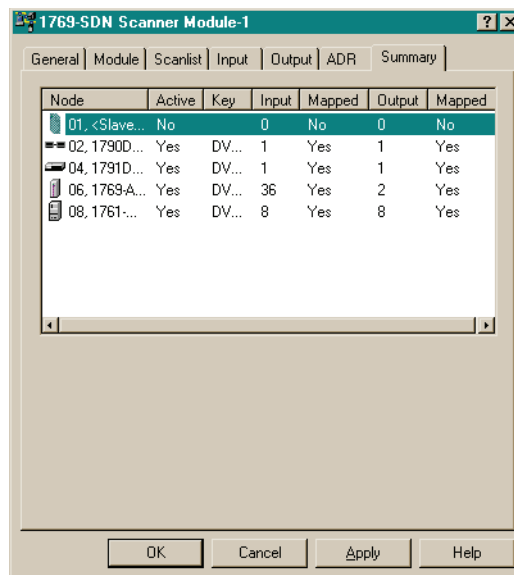
Notice that Both indicates Configuration Recovery and Auto-Address Recovery are enabled while Config indicates that only Configuration Recovery is enabled.



- When finished, click Download to Scanner.
- Click Apply or OK.

Summary Tab

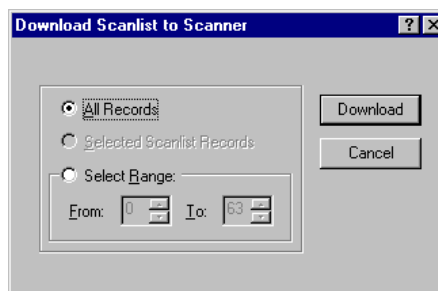
The summary tab provides a condensed picture of the scanner's configuration: which nodes are mapped, if they are active, and receive and transmit information.



Download and Save Your Configuration

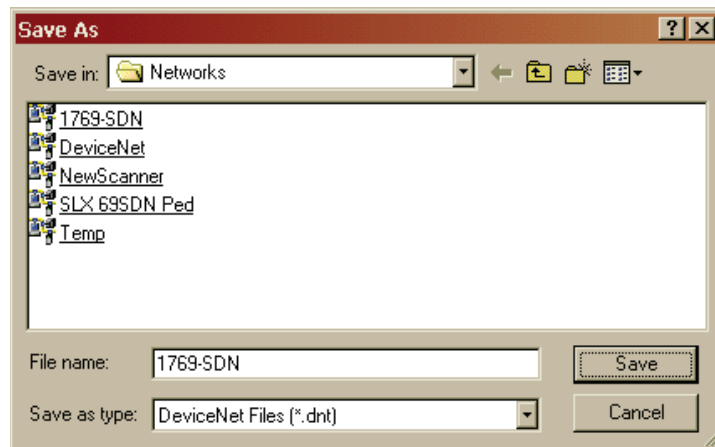
Follow these steps to download and save your configuration.

1. Click the Scanlist tab and then Download to Scanner.



2. Click All Records.
3. Click Download to download the configuration to the scanner.
4. Click OK to complete the DeviceNet scanner module configuration.

5. From the File menu, choose Save As.



6. Save the configuration to a DeviceNet file.
7. Close RSNetWorx for DeviceNet software.

Notes:

DeviceNet I/O Image

Introduction

This chapter describes the input and output data structure. This table describes what this chapter contains and where to find specific information.

Topic	Page
1769-SDN Input Structure	87
MicroLogix 1500 Status Structure	88
Module Status Register	93
CompactLogix Status Structure	94
CompactLogix Status Register	98
CompactLogix Command Register	100
Input Data Image	102
1769-SDN Output Structure	102

1769-SDN Input Structure

The 1769-SDN scanner module's input image is configurable up to 246 words. The input image is broken into two primary components, the status area and the input data area.

Input Image

Name	Size	Word Offset
Status Structure	66-words (fixed)	0...65
Input Data Image	180-word array (configurable)	66...245

MicroLogix 1500 Status Structure

The first area of the MicroLogix 1500 controller input image is the Status Structure. The status words are described in more detail in the following sections.

Description	Words	Data Type
Scan counter	0 and 1	2 words
Device failure array	2...5	64-bit array
Autoverify failure array	6...9	64-bit array
Slave device idle array	10...13	64-bit array
Active node array	14...17	64-bit array
Reserved ⁽¹⁾	18...19	4-byte array
Scanner module status	20 and 21	4-byte array
Reserved array ⁽¹⁾	22...31	20-byte array
Device status array	32...63	64-byte array
Module status register	64 and 65	2 words

⁽¹⁾ Do not manipulate reserved bits. Doing so may interfere with future compatibility.

Scan Counter

This 32-bit unsigned value is incremented each time the DeviceNet network is scanned. The value will automatically roll over to zero and continue counting.

Device Failure Array

These 64 bits provide status information for use in your control program. For each slave device owned by the scanner, you should monitor the respective bit within these four words. If a slave device faults, the bit that corresponds to that node address will be set (1). If a slave device is not faulted or returns from a faulted state to an operating state, the corresponding bit for that node will be cleared (0).

Slave Device Status Information

Input Word	Bit 0...15	Description
2 ⁽¹⁾	Node 0...15	Bit ON (1) = Slave node faulted Bit OFF (0) = Slave node not faulted
3 ⁽²⁾	Node 16...31	
4 ⁽³⁾	Node 32...47	
5 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Autoverify Failure Array

These four words allow the control program to monitor if a slave's Device Key and Size matches the Device Key and Size in the scanner. A bit value of 0 (OFF) represents a configuration match, a bit value of 1 (ON) represents a mismatch.

ATTENTION



A value of 0 does not indicate that the slave has been brought online or is functional, only that there is a configuration match between the slave and the scanner.

Slave Device Configuration Comparison to Scanner Module Configuration

Input Word	Bit 0...15	Description
6 ⁽¹⁾	Node 0...15	Bit ON (1) = Slave node mismatch Bit OFF (0) = Slave node match
7 ⁽²⁾	Node 16...31	
8 ⁽³⁾	Node 32...47	
9 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Slave Device Idle Array

The slave device idle array contains 64 bits of data. Each bit indicates the state of a slave device. A bit value of 0 represents a Non-idle mode or that the slave is not present in the scanlist. A bit value of 1 represents Idle mode where the slave node is present in the scanlist.

Slave Device Status

Input Word	Bit 0...15	Description
10 ⁽¹⁾	Node 0...15	Bit ON (1) = Idle Bit OFF (0) = Non-idle
11 ⁽²⁾	Node 16...31	
12 ⁽³⁾	Node 32...47	
13 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Active Node Array

The Active Node array contains 64 bits of data that represents each slave node's status. A slave node is considered active when it is present and enabled in the master's scanlist. A bit value of 0 means Not Active, a bit value of 1 means Active.

Slave Node Status

Input Word	Bit 0...15	Description
14 ⁽¹⁾	Node 0...15	Bit ON (1) = Active node Bit OFF (0) = Inactive node
15 ⁽²⁾	Node 16...31	
16 ⁽³⁾	Node 32...47	
17 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Scanner Module Status

The Scanner Device Status is a 4-byte array.

Scanner Device Status

Input Word	Bit	Description
20	0...7 (lower byte)	Scanner Address in BCD
	8...15 (upper byte)	Scanner Status in BCD
21	0...7 (lower byte)	Slave Device Address in BCD
	8...15 (upper byte)	Slave Device Status in BCD

Reserved Array

Reserved Array

Input Word	Description ⁽¹⁾
22...31	Always 0

⁽¹⁾ Do not manipulate reserved bits. Doing so may interfere with future compatibility.

Device Status Array

The Device Status Array is a 64-byte array containing the information shown in this table. Each byte indicates the status code of the scanner's master and the slave devices.

Device Status

Input Word	Bit	Description
32	0...7 (lower byte)	Node 0 DeviceNet status
	8...15 (upper byte)	Node 1 DeviceNet status
33	0...7 (lower byte)	Node 2 DeviceNet status
	8...15 (upper byte)	Node 3 DeviceNet status
...	...	...
63	0...7 (lower byte)	Node 62 DeviceNet status
	8...15 (upper byte)	Node 63 DeviceNet status

Module Status Register

The scanner module supports a 32-bit Module Status Register.

Input Word	Bit	Description	Operation
64	0	Run	Bit ON (1) = scanning I/O Bit OFF (0) = halted
	1	Fault	Bit ON (1) = faulted Bit OFF (0) = not faulted
	2	Network disable	Bit ON (1) = disabled Bit OFF (0) = not disabled
	3	Device failure	Bit ON (1) = failure Bit OFF (0) = no failure
	4	Autoverify failure	
	5	Communication failure	
	6	Duplicate node failure	
	7	DeviceNet power detect	Bit ON (1) = power Bit OFF (0) = no power
	8...15	Reserved ⁽¹⁾	N/A
65	0...15	Reserved ⁽¹⁾	N/A

⁽¹⁾ Do not manipulate reserved bits. Doing so may interfere with future compatibility.

CompactLogix Status Structure

The second area of the CompactLogix controller input image is the Status Structure. The status words are described in more detail in the following sections.

Description	Data Type
I.Status.Scan Counter	2 words
I.Status.Device Failure Register	64-bit array
I.Status.Autoverify Failure Register	64-bit array
I.Status.Device Idle Register	64-bit array
I.Status.Active Node Register	64-bit array
I.Status.Status Display	8 bytes
I.Status.Scanner Address	1 byte
I.Status.Scanner Status	1 byte
I.Status.Scrolling Device Address	1 byte
I.Status.Scrolling Device Status	1 byte
I.Status.Device Status	64 bytes

Scan Counter

This 32-bit unsigned value is incremented each time the DeviceNet network is scanned. The value will automatically roll over to zero and continue counting.

Device Failure Register

These 64 bits provide status information for use in your control program. For each slave device owned by the scanner, you should monitor the respective bit within these four words. If a slave device faults, the bit that corresponds to that node address will be set (1). If a slave device is not faulted or returns from a faulted state to an operating state, the corresponding bit for that node will be cleared (0).

Slave Device Status Information

Input Word	Bit 0...15	Description
2 ⁽¹⁾	Node 0...15	Bit ON (1) = Slave node faulted Bit OFF (0) = Slave node not faulted
3 ⁽²⁾	Node 16...31	
4 ⁽³⁾	Node 32...47	
5 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Autoverify Failure Register

These four words allow the control program to monitor if a slave's Device Key and Size matches the Device Key and Size in the scanner. A bit value of 0 (OFF) represents a configuration match, a bit value of 1 (ON) represents a mismatch.

ATTENTION



A value of 0 does not indicate that the slave has been brought online or is functional, only that there is a configuration match between the slave and the scanner.

Slave Device Configuration Comparison to Scanner Module Configuration

Input Word	Bit 0...15	Description
6 ⁽¹⁾	Node 0...15	Bit ON (1) = Slave node mismatch Bit OFF (0) = Slave node match
7 ⁽²⁾	Node 16...31	
8 ⁽³⁾	Node 32...47	
9 ⁽⁴⁾	Node 48...63	

- (1) Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.
- (2) Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.
- (3) Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.
- (4) Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Device Idle Register

The slave device idle array contains 64 bits of data. Each bit indicates the state of a slave device. A bit value of 0 represents a Non-idle mode or that the slave is not present in the scanlist. A bit value of 1 represents Idle mode where the slave node is present in the scanlist.

Slave Device Status

Input Word	Bit 0...15	Description
10 ⁽¹⁾	Node 0...15	Bit ON (1) = Idle Bit OFF (0) = Non-idle
11 ⁽²⁾	Node 16...31	
12 ⁽³⁾	Node 32...47	
13 ⁽⁴⁾	Node 48...63	

- (1) Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.
- (2) Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.
- (3) Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.
- (4) Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Active Node Register

The Active Node array contains 64 bits of data that represents each slave node's status. A slave node is considered active when it is present and enabled in the master's scanlist. A bit value of 0 means Not Active, a bit value of 1 means Active.

Slave Node Status

Input Word	Bit 0...15	Description
14 ⁽¹⁾	Node 0...15	Bit ON (1) = Active node Bit OFF (0) = Inactive node
15 ⁽²⁾	Node 16...31	
16 ⁽³⁾	Node 32...47	
17 ⁽⁴⁾	Node 48...63	

⁽¹⁾ Bit 0 corresponds to Node 0, Bit 1 corresponds to Node 1 ... Bit 15 corresponds to Node 15.

⁽²⁾ Bit 0 corresponds to Node 16, Bit 1 corresponds to Node 17 ... Bit 15 corresponds to Node 31.

⁽³⁾ Bit 0 corresponds to Node 32, Bit 1 corresponds to Node 33 ... Bit 15 corresponds to Node 47.

⁽⁴⁾ Bit 0 corresponds to Node 48, Bit 1 corresponds to Node 49 ... Bit 15 corresponds to Node 63.

Status Display

The Status Display is a 4-byte array of the 1769-SDN display.

Scanner Address

The Scanner Address is the scanner's DeviceNet node number.

Scanner Status

The Scanner Status is the scanner's DeviceNet status.

Scrolling Device Address

The Scrolling Device Address is the DeviceNet address and status of node with errors. The data updates once per second, scrolling through all nodes with errors.

Scrolling Device Status

The Scrolling Device Status is the status of the node with errors. The data updates once per second, scrolling through all nodes with errors.

Device Status

The Device Status is the status of each DeviceNet node, indexed by node number into a 64-byte array.

CompactLogix Status Register

The third area of the CompactLogix controller input image is the Status Register. The status words are described in more detail in the following sections.

Description	Data Type
I.StatusRegister.Run	bit
I.StatusRegister.Fault	
I.StatusRegister.DisableNetwork	
I.StatusRegister.DeviceFailure	
I.StatusRegister.Autoverify	
I.StatusRegister.CommFailure	
I.StatusRegister.DupNodeFail	
I.StatusRegister.DnetPowerDetect	

Run

This bit displays whether the controller is in Idle or Run module.

- 0 = Idle
- 1 = Run

Fault

This bit displays whether the network is faulted.

- 0 = Network is not faulted
- 1 = Network is faulted

Disable Network

This bit displays whether the network is disabled.

- 0 = Network is not disabled
- 1 = Network is disabled

Device Failure

This bit displays whether any device failures have occurred on the network.

- 0 = No device failures exist
- 1 = Device failure exists (examine the status structure for causes)

Autoverify Failure

This bit displays whether the scanner has failed to initialize any devices on the network.

- 0 = The scanner has initialized all devices
- 1 = The scanner has failed to initialize at least one device

Comm Failure

This bit displays whether a communication failure exists on the network.

- 0 = No communication failures exist
- 1 = A communication failure exists

Dup Node Failure

This bit displays whether a network failure exists because of a duplicate node address.

- 0 = No failure exists
- 1 = Failure exists due to duplicate node address

Dnet Power Detect

This bit displays whether a DeviceNet power failure exists on the network.

- 0 = No Devicenet power failure exists on the network
- 1 = DeviceNet power failure exists

CompactLogix Command Register

The first area of the CompactLogix controller output image is the Command Register. The status words are described in more detail in the following sections.

Description	Data Type
O.CommandRegister.Run	bit
O.CommandRegister.Fault	
O.CommandRegister.DisableNetwork	
O.CommandRegister.HaltScanner	
O.CommandRegister.Reset	

Run

This bit changes the DeviceNet network between Idle and Run module.

- 0 = Idle
- 1 = Run

Fault

This bit forces the scanner into a faulted condition.

- 0 = Network is not faulted
- 1 = Network is faulted

Disable Network

This bit disables the DeviceNet network.

- 0 = Network is not disabled
- 1 = Network is disabled

Halt Scanner

This bit halts the scanner.

- 0 = Scanner is not halted
- 1 = Scanner is halted

Reset

This bit resets the scanner.

- 0 = The scanner has not been reset
- 1 = The scanner has been reset.

Do not leave this bit = 1. If you do not change the bit back to 0, the scanner continuously resets.

Input Data Image

The Input Data Image is described on [page 15](#) for the MicroLogix 1500 controller and on [page 16](#) for the CompactLogix controller.

1769-SDN Output Structure

The Output Structure is described on [page 15](#) for the MicroLogix 1500 controller and on [page 16](#) for the CompactLogix controller.

Use the 1769-SDN Scanner Module with MicroLogix Controllers

Introduction

This chapter contains an example in which the 1769-SDN scanner module is used with a MicroLogix 1500 controller. This table describes what this chapter contains and where to find specific information.

Topic	Page
MicroLogix 1500 Controllers	103
RSLogix 500 Programming Software I/O Configuration	104
Backplane Messaging	111
Program Upload and Download	112
Configure a Local DeviceNet Message	113

MicroLogix 1500 Controllers

The MicroLogix 1500 programmable controller has two different processors that are compatible with the 1769-SDN scanner module. The 1764-LSP and 1764-LRP processors can use the scanner module as a DeviceNet master and own DeviceNet slave devices. This allows either processor to communicate with intelligent devices like drives, scales, and starters, or use the DeviceNet network to expand the processor's I/O capacity.

The 1764-LRP processor allows messaging functionality over the DeviceNet network, so non-I/O data may be exchanged. Multiple 1769-SDN scanner modules may be used in a 1764-LRP system. However, only the first two scanners can be used for messaging.

The amount of power that modules draw from the processor or expansion power supply, and the amount of data that the processor can support will determine how many can be used. Configuration tools are available from <http://www.ab.com/micrologix> to determine if an application can be supported.

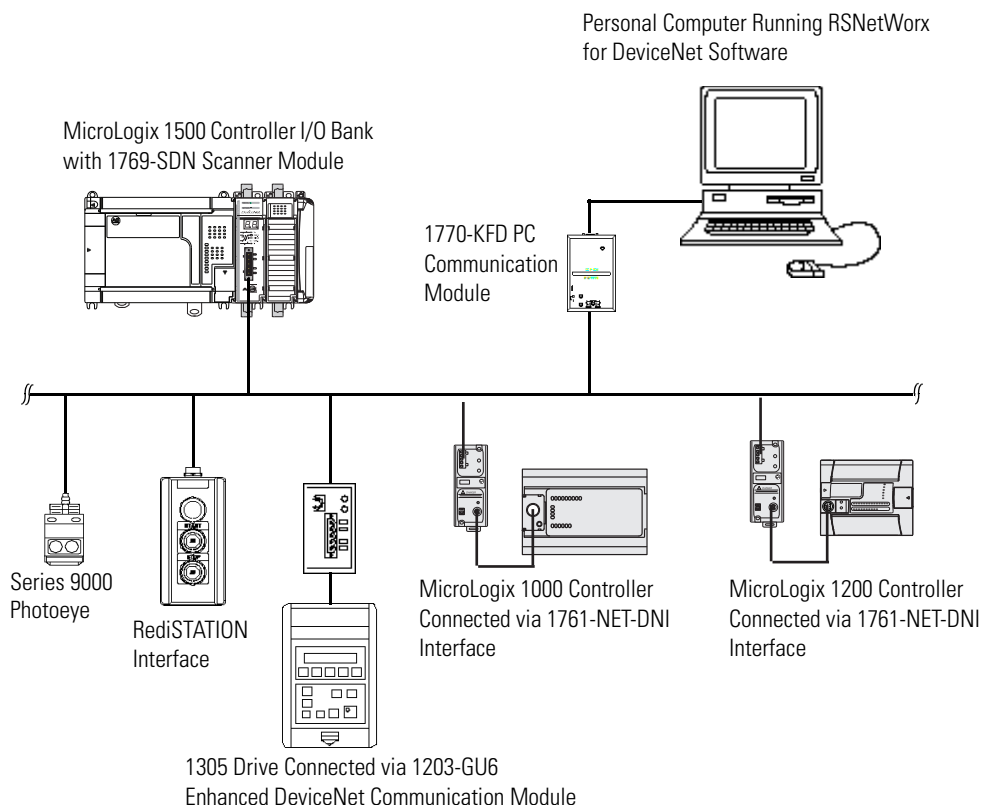
In addition to electrical limitations, data space limitations also exist. The maximum size of the input and output images for each module in the system is 250 input and 250 output words of data.

RSLogix 500 Programming Software I/O Configuration

One of the advanced features of RSLogix 500 software is the ability to have the programming software establish a communication connection with the controller and read which I/O modules are attached to the controller. This capability significantly reduces the effort involved in configuring a system.

This section illustrates how to determine which I/O modules are attached to the controller, and manually configure the modules. We will then configure the scanner. An example network is shown below.

DeviceNet Network

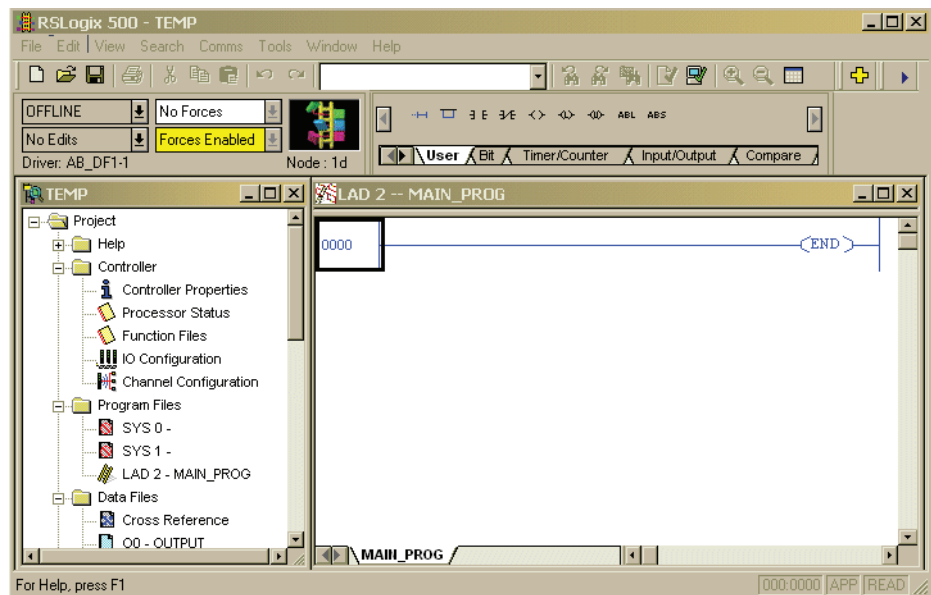


Start the Project

Follow these steps to begin your project.

1. Open RSLogix 500 software.
2. Choose File ⇒ New ⇒ MicroLogix 1500 LRP series C.

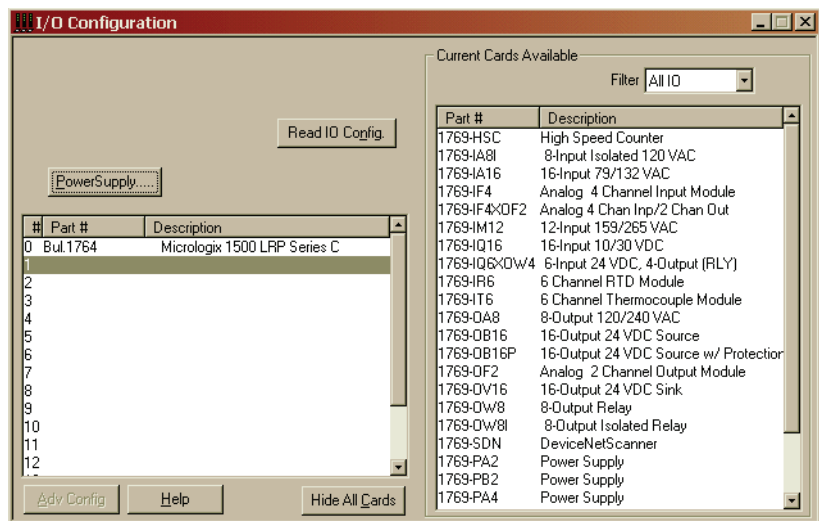
This dialog should match what you see on your computer.



In this example the name for this application is TEMP. In the TEMP dialog, you see everything associated with the application. Within the Controller folder you will see I/O Configuration.

3. Double-click I/O Configuration.

I/O Configuration Screen

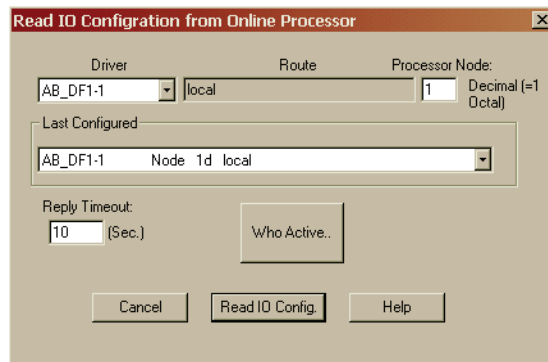


The I/O configuration dialog shows each of the controller I/O slots. For the MicroLogix 1500 controller, slot 0 contains the embedded I/O that is part of the MicroLogix 1500 base unit. Slots 1...16 are for Compact I/O expansion modules (referred to as local I/O, because they are physically attached to the controller). Slots 9...16 are available using only a series C processor with a series B base unit.

Click Read I/O Config to have RSLogix 500 software read the controller's local I/O and configure the slots automatically.

Drag the appropriate modules from the available list (right pane) to the appropriate slot on the left to manually configure the controller I/O. Modules must be contiguous (with no open slots) from 1...16.

Read I/O Configuration

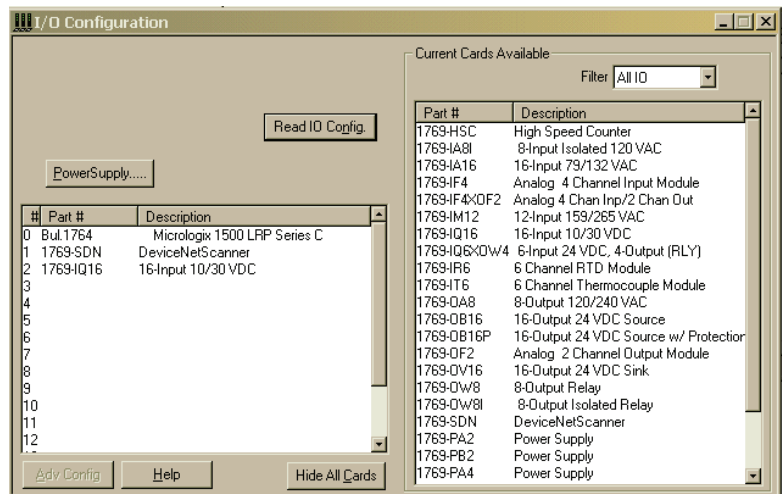


Next you see a communication dialog that lets you select a communication path by using RSLogix software to connect to the MicroLogix controller.

If you have previously connected to a controller, the communication driver that you used before will be the active driver. This dialog provides the ability to change the driver or perform a Who Active across a network to locate the specific MicroLogix controller.

If the driver and path are correct, click Read I/O Config.

Installed I/O



RSLogix 500 software displays all of the I/O modules that are attached to the MicroLogix controller.

In this example, there is a 1769-SDN scanner module at slot 1, and a 16-point digital input module in slot 2.

1769-SDN Scanner Module Configuration

Double-click the module to configure a specific module. Double-click the module in slot 1 to configure the scanner module in this example.

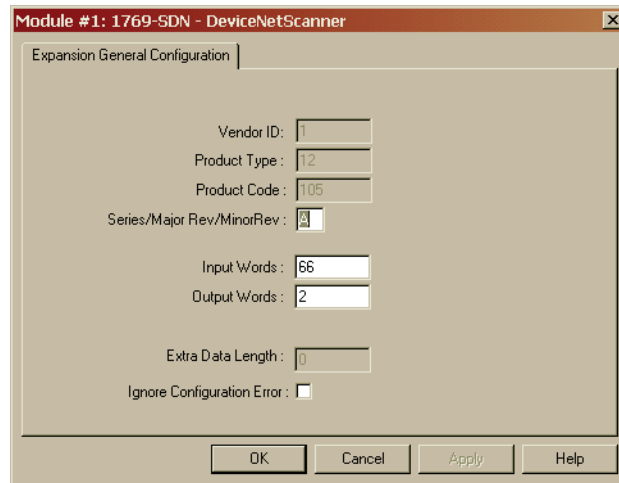
Input Words

This is the number of input words the controller assigns to the module. The first 66 words (0...65) are required by the scanner module for status. DeviceNet slave input data words start at slot word 66. You can have a maximum of 180 input words for DeviceNet slave devices (maximum slot amount for 1769-SDN scanner module inputs = 246).

Output Words

This is the number of output words the controller assigns to the module. The first two words (0 and 1) are required by the scanner module for status. DeviceNet slave output data words start at slot word 2. You can have a maximum of 180 output words for DeviceNet slave devices (maximum slot amount for scanner module outputs = 182).

Changing the 1769-SDN Configuration



You can change (add or remove) the amount of data the controller has assigned to the scanner module in the expansion module configuration dialog. From within RSLogix 500 software, I/O configuration, open the 1769-SDN scanner module and change the input or output words as needed. Save the program and download to the controller.

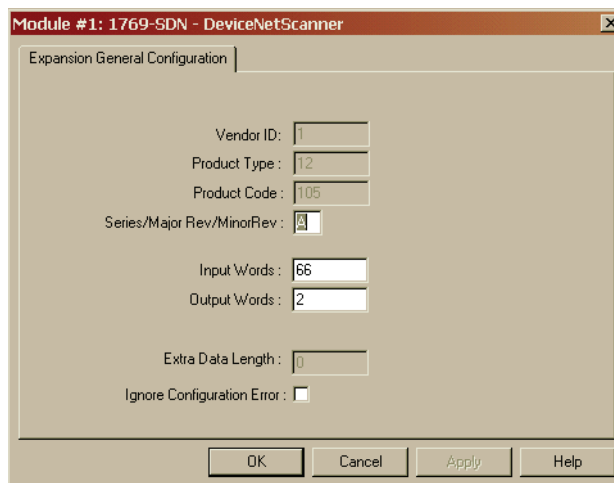
Reducing the number of words for either inputs or outputs will require a change in the 1769-SDN scanner module's scanlist, which is done using RSNetWorx for DeviceNet software.

IMPORTANT

We recommend that you not reduce the number of words assigned to a 1769-SDN scanner module's scanlist once a system is operational. Changing the number of words may cause addressing problems on the controller side, and mapping changes on the DeviceNet network.

Adding words to an existing system is relatively easy to do, because it doesn't affect existing addresses or mapping. Add the number of additional words that are needed in the module (using the above example), and change the scanlist using RSNetWorx for DeviceNet software.

The configuration dialog for the scanner module is shown below.



Ignore Configuration Error

Checking (enabling) the Ignore Configuration error checkbox instructs the module to ignore I/O size mismatches. If this is checked and the input/output scanlist configured by RSNetWorx for DeviceNet software (DeviceNet side of the 1769-SDN scanner module) does not match the amount of I/O data assigned by the controller (0...180 words), the module will not generate an error.

If this checkbox is not checked, the number of data words on the controller side must match the number of words configured by RSNetWorx for DeviceNet software. The default condition is unchecked (report an error on mismatch).

Series/Major Rev/Minor Rev

You will need this information if you contact Rockwell Automation Technical Support.

Backplane Messaging

The MicroLogix 1500 1764-LRP processor and the 1769-SDN scanner module also support backplane messaging. This new level of functionality allows the processor to read (get) or write (set) data to other devices on the DeviceNet network. This is also referred to as Explicit Messaging.

You can use two different types of messages to exchange information with the DeviceNet device. The type of message used is determined by the destination device. You can generate a PCCC message or a CIP message.

PCCC Messaging

Programmable controller communications commands (PCCC) provides point to point and master/slave communication between devices. PCCC is an open protocol that is built into all Allen-Bradley controllers, and many other Allen-Bradley and third-party products.

PCCC messaging has been used for many years on DH-485, DH+, and Ethernet networks, and for point-to-point communication between Allen-Bradley controllers. PCCC messaging lets you upload or download programs over the DeviceNet network, and allows users to message across DeviceNet networks, just like they did using DH-485 or DH+ networks. There are a number of devices that support PCCC messaging over DeviceNet, including the 1761-NET-DNI (DNI) interface, 1203-GU6 interface, and RSLogix software. If the DeviceNet network has DNI interfaces, either device can initiate a PCCC message.

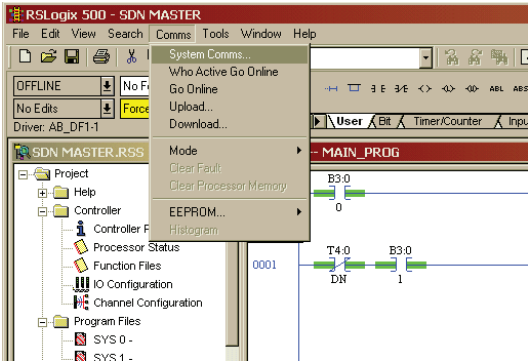
Program Upload and Download

Before performing a program upload or download through the scanner, be sure that the module is properly installed in the system, and that a terminator is present at the end of the Compact I/O expansion bus.

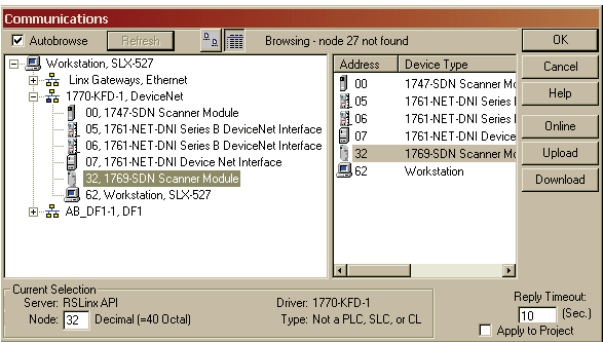
IMPORTANT

DeviceNet networks can operate at 125 Kbps, 250 Kbps, or 500 Kbps. Depending on network size and communication activity, performing program upload or download operations while the network is controlling an application may impact control system performance. It is up to you to know and understand how upload and download will impact operations.

Choose Comms ⇒System Comms to upload or download programs with RSLogix 500 software.



System Comms will generate an RSLinx software dialog similar to the example below.



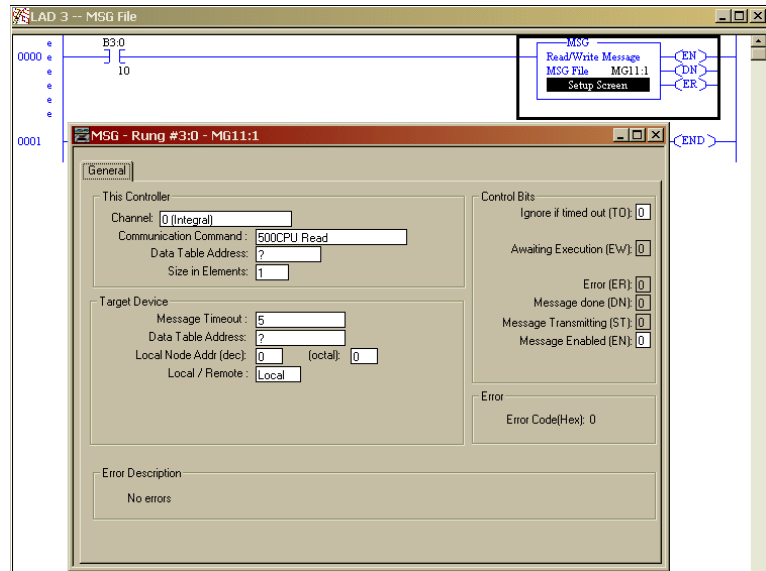
In this example, the DeviceNet interface is a 1770-KFD module. Selecting the 1770-KFD driver will show the devices on the DeviceNet network.

In this example, upload or download can be performed with the devices at nodes 5, 6, 7, and 32. Node 32 is a 1769-SDN module. Simply highlight the 1769-SDN module and click either Upload or Download on the right side of the screen.

Configure a Local DeviceNet Message

This section describes how to configure a local message by using the scanner module and a MicroLogix 1500 1764-LRP processor.

Message Setup Dialog



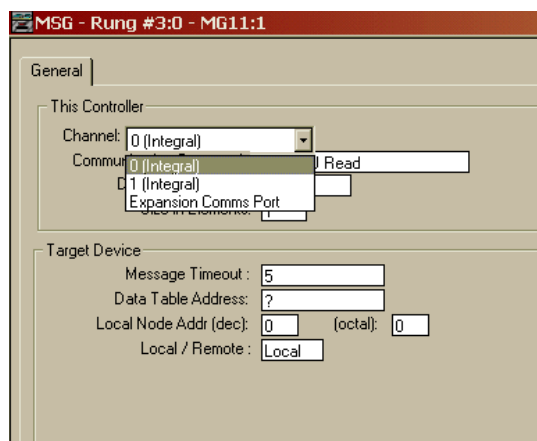
Rung 0 shows a standard RSLogix 500 message (MSG) instruction preceded by conditional logic.

Access the Message Setup dialog by double-clicking the Setup Screen.

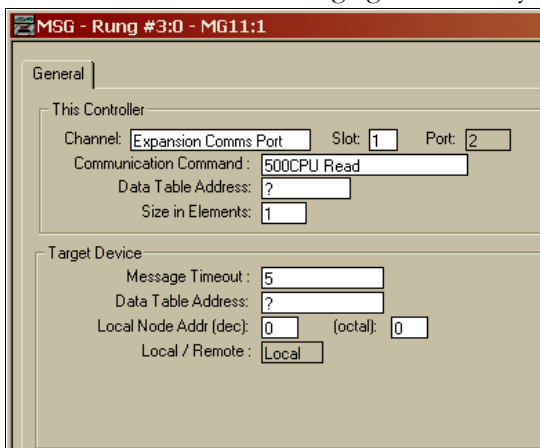
The RSLogix 500 Message Setup dialog appears. This dialog is used to set up or monitor message parameters for this controller, target device, and control bits. Descriptions of each of these sections follow.

Channel Parameter

The 1764-LRP controller supports three different pathways for messaging. Channels 0 and 1 are RS-232 ports and are functionally identical to MicroLogix 1200 and MicroLogix 1500 1764-LSP controllers. The 1764-LRP controller also supports backplane communication through the Expansion Communication Port (ECP) as illustrated below.

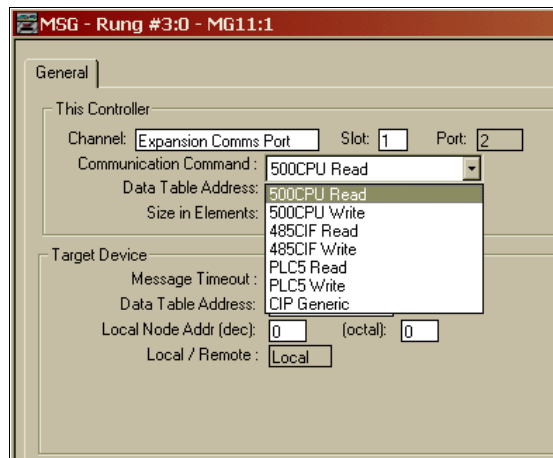


When ECP is chosen, you are able to select which slot position (1...16) the scanner module resides in. The 1764-LRP processor can support up to two 1769-SDN scanner modules with full messaging functionality.



You can use multiple 1769-SDN scanner modules in a MicroLogix 1500 system, but you can message only through the first two. Any other 1769-SDN scanner module can be used only for I/O scanning.

Communication Command



The 1764-LRP controller supports the six standard types of communication commands (same as all other MicroLogix 1200 and 1500 controllers) and CIP Generic. When any of these six standard commands are chosen, you can initiate standard messages to destination devices connected to DeviceNet products that support PCCC messaging (including MicroLogix and SLC controllers using 1761-NET-DNI interfaces, and other MicroLogix 1500 controllers using 1769-SDN scanner modules). You can initiate reads, writes, program upload/download and online monitoring across DeviceNet. This is functionally identical to DH-485 and DH+ networking.

CIP Generic

Control & Information Protocol (CIP) is a newer and more versatile protocol than PCCC. It is an open protocol that is supported by newer Allen-Bradley controllers and third-party products.

CIP messaging is the native messaging format for the DeviceNet network. All DeviceNet devices are compliant with CIP messaging. The MicroLogix 1500 1764-LRP processor (series C) has an enhanced message instruction that provides simple, easy to use CIP messaging.

Selecting CIP Generic configures the message instruction to communicate with DeviceNet devices that do not support PCCC messaging. When CIP Generic is chosen, you will notice that a number of message parameters change and many new ones become available depending upon the service selected.

The screenshot shows the 'MSG - Rung #3:0 - M611:1' configuration window. The 'General' tab is selected. Under 'This Controller', the 'Channel' is 'Expansion Comms Port', 'Slot' is '1', and 'Port' is '2'. The 'Communication Command' is 'CIP Generic'. The 'Data Table Address (Receive)' is '?', 'Size in Bytes (Receive)' is '1', 'Data Table Address (Send)' is '?', and 'Size in Bytes (Send)' is '1'. Under 'Target Device', 'Message Timeout' is '5', 'Target Type' is 'Network Device', 'Local Node Addr (dec)' is '0', 'Local Node Addr (octal)' is '0', 'Service' is 'Custom', 'Service Code (hex)' is '?', 'Class (hex)' is '?', 'Instance (hex)' is '?', 'Attribute (hex)' is '?', and their decimal equivalents are also shown as '?'.

Data Table Address (receive and send)

This value identifies the data file location within the 1764-LRP controller that will receive data from the DeviceNet device, and/or the starting data file location that will be sent to the destination DeviceNet device.

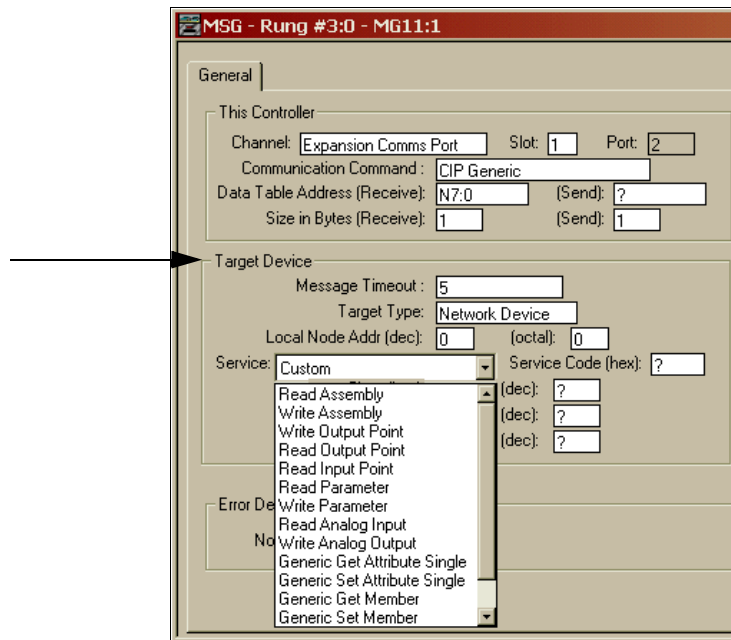
Size in Bytes (receive and send)

Since all data transmitted on the DeviceNet network is byte based, you must enter the number of bytes that will be received and sent. You must make sure that enough memory is available in the destination device. Word elements within 1764-LRP controllers contain 2 bytes each. These include Bit and Integer data files. Long word and Floating point elements contain 4 bytes each.

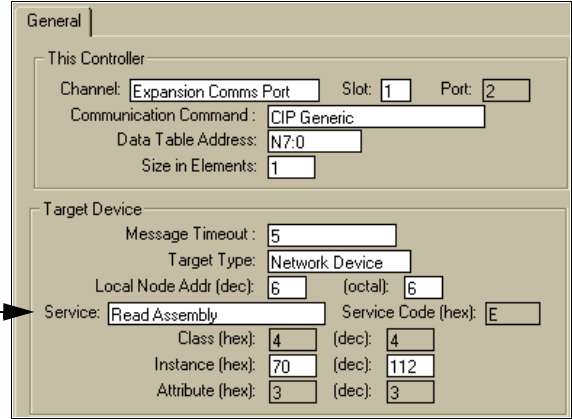
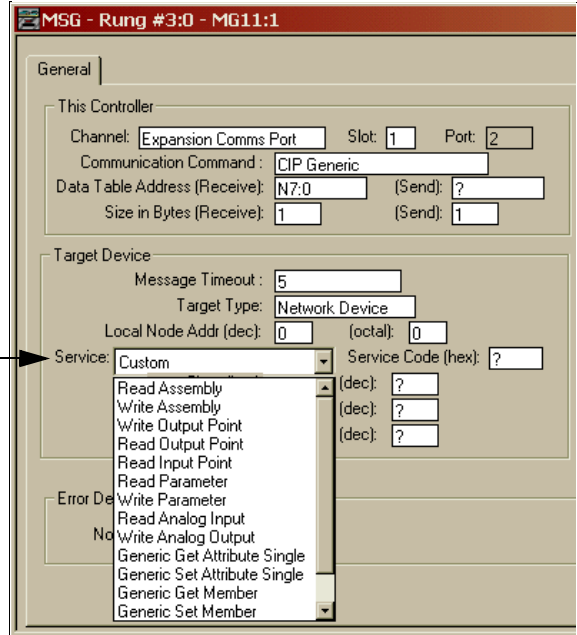
For receive, the size in bytes entered must be greater than or equal to the number of bytes that the DeviceNet device will return. DeviceNet devices return a fixed number of bytes, depending on the class and service. If more data is returned than expected, the message will be in error and no data will be written. If less data is returned than expected, the data will be written and the remainder of the bytes will be filled with zeros.

In the example dialog shown below, N7:0 will receive 2 bytes (1 word) of data.

Target Device



Field	Definition
Message Timeout	Message timeout is specified in seconds. If the target does not respond within this time period, the message instruction will generate a specific error. The amount of time that is acceptable should be based on application requirements and network capacity/loading.
Target Type	You can select either Module or Network Device. If you need to message to a device on the DeviceNet network, select Network Device. If you need to message to a DeviceNet parameter on the scanner, select Module. This allows the control program access to module parameters. Many of the module parameters are not editable, and some can be edited only when the module is in Idle mode.
Local Node Address	This is the target device's DeviceNet node number.

Field	Definition
Service	The DeviceNet network uses services to provide specific messaging functions. A number of standard services with their corresponding parameters have been preconfigured for ease of use.  If you need to use a service that is not available, select one of the generic services. The generic service lets you enter specific service code parameters. Information on what services a target device supports is usually provided in the device's documentation. 

MSG Instruction Error Codes

When the processor detects an error during the transfer of Expansion I/O Communication Module message data, the processor sets the ER bit and writes an error code at MG file sub-element #18 that you can monitor from your programming software.

1769-SDN Module Error Code

Error Code	Description
E0H	Expansion I/O Communication Module Error

The processor also writes general status information related to this error at the high byte of MG file sub-element #22 that can be monitored from your program.

Error Status Information

General Status	Description
01H	Illegal or unsupported service parameter
02H	Resource unavailable
04H	Segment type error in IOI
07H	Connection lost
08H	Service not supported
09H	Invalid attribute value
0BH	Already in requested mode/state
0CH	Object state conflict
0EH	Attribute not settable
10H	Device state conflict
11H	Reply data too large
13H	Not enough data
14H	Attribute not supported
15H	Too much data
16H	Object does not exist
19H	Store operation failure
20H	Invalid parameter
28H	Invalid member ID

Troubleshooting

Introduction

The 1769-SDN scanner module's front panel status indicators aid in troubleshooting the module. The diagnostics provided by these indicators are described in this chapter.

Topic	Page
Status Indicators	121
Error Codes	124

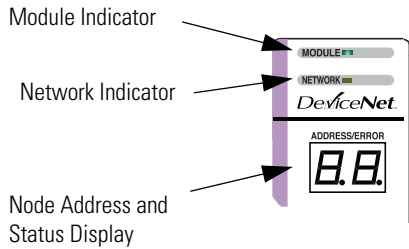
Status Indicators

The first step in troubleshooting is to observe the 1769-SDN scanner module's status indicators and seven-segment numeric displays. The indicators function as follows:

- The bi-color (green/red) Module status indicator shows whether the scanner module has power and is functioning properly.
- The bi-color (green/red) Network status indicator provides information about the DeviceNet channel communication link.
- The numeric display shows node address and status display information.

Status information precedes the node address.

This table summarizes the meanings of the status indicators and numeric codes.



Troubleshooting the Status Indicators and Numeric Display

Indicator	Color/Status	Description
Module	Off	No power applied to module. Apply power.
	Flashing Green	No bus master (MicroLogix or CompactLogix controller) present. Verify module connectors are properly seated. If they are, cycle power to the controller. If this does not correct the problem, replace the controller. If replacing the controller does not correct the problem, replace the scanner.
	Solid Green	Normal operation.
	Flashing Red	- Recoverable Fault - Memory has been erased or is being programmed. Complete the flash update or start a new update. - Bad firmware in module. Replace firmware.
	Solid Red	Unrecoverable fault. Verify module connectors are properly seated. If they are, verify that bus terminator/end cap is installed. Cycle power. If still faulted, replace the module.

Troubleshooting the Status Indicators and Numeric Display

Indicator	Color/Status	Description
Network	Off	No module power, no network power, or communications are not occurring between the module and the DeviceNet network. (This may be an acceptable condition.) Verify module has power. Check that the DeviceNet cable is securely connected and the DeviceNet network is powered. Verify that network power is adequate (11...5V DC).
	Flashing Green	Device is operational. There are no connections established with any of the network devices. If the module is supposed to be controlling DeviceNet slaves, configure the module's scanlist.
	Solid Green	Normal operation. Scanlist is configured. Module is not in Idle mode.
	Flashing Red	One or more of the devices that the scanner module is communicating with is in a timed out state. Monitor the status display, or the module's status field to determine which slave device is offline.
	Solid Red	Critical network failure. Duplicate DeviceNet node address detected. Reset module. Change module's node address or change conflicting device's node address. If failure continues, replace module.
Seven-segment Numeric Display	Node Address and Status Display	Indicates diagnostic information about the status of the module. • When the numeric display is showing 0...63, it is indicating the scanner's DeviceNet node address. • When it shows 67...69, it indicates backup status. • When it shows 70...99, it indicates an error code for the displayed node address. • When it flashes alternating numbers, one is the error code (70...99), and the other is the node number (0...63) that has generated the error.

Error Codes

The following table describes the error codes indicated by the seven-segment numeric display.

Device Status

Code (decimal)	Name	Description
67	Backup Mode	Scanner in Backup Scanner mode.
68	No Backup Scanner	No backup scanner module present. Install and configure a backup scanner, if needed.
69	Backup Scanner Invalid CRC	The configuration of the primary and the secondary controller does not match. Either one or both of the configurations is incorrect. Make sure that the same configuration is downloaded to both scanners.
70	Duplicate Node	Controller has Failed Duplicate Node Address Check. The node address selected is already in use. Change the module's or conflicting device's network address (node number) to an available one.
71	Illegal Scanlist Data	Illegal data in scanlist. Reconfigure the scanlist table and remove any illegal data.
72	Slave Timeout	One of the module's slave devices has stopped communicating. Inspect the module's slave devices and verify the DeviceNet connections.
73	Electronic Key Mismatch	The slave device Vendor ID key parameter does not match the slave's configuration in the module's scanlist. Make sure that the device at the flashing node address matches the desired electronic key (vendor, product code, product type)
75	No Messages Received	No network traffic received by the scanner. 10 seconds have elapsed and no network traffic for the module or for any other device have been received by the module. Verify the scanlist is correctly configured to scan slave devices. Verify DeviceNet network connections.
76	No Message For Scanner	No direct network traffic for the scanner module detected. 10 seconds elapsed and no DeviceNet input being screened by the module has been received.
77	Slave Data Size Mismatch	The data being received from the slave device does not match the configuration in the scanlist. Either reconfigure the slave device, or change the module's scanlist to match the slave device.
78	No Such Device	Slave device in scanlist does not exist. Either add the device to the DeviceNet network, or delete the device's entry in the scanlist.
79	Transmit Failure	The module has failed to transmit a message. Make sure that the module is connected to a valid network. Check for disconnected cables.

Device Status

Code (decimal)	Name	Description
80	In Idle Mode	Module is in Idle mode. Put the controller into RUN mode and enable the RUN bit in the Module Command Array. See page 16 .
81	Scanner Faulted	The scanner module has stopped producing and consuming I/O data. This condition does not affect the scanner's system or messaging modes. Check the FAULT value in the Module Command Array. See page 16 .
82	Fragmentation Error	Error detected in sequence of fragmented I/O messages from device. Check scanlist table entry for slave device to make sure that input and output data lengths are correct. Check slave device configuration.
83	Slave Init Error	Slave device is returning error responses when the module attempts to communicate with it. Check slave device's configuration. Reboot slave device.
84	Not Yet Initialized	Module has not completed its initial attempt to establish communication with its slaves.
85	Receive Buffer Overflow	Data size returned is larger than expected. Configure the slave device for a smaller data size.
86	Device Went Idle	Device is producing idle state. Check the device configuration and slave node status.
89	Auto Device Replacement (ADR) Error	Slave device responded with an error to the initialization data sent to it by the scanner; or the configuration table in the scanner's flash memory is not valid for a slave node. Try the ADR download again. If it still fails, try clearing the ADR flash by downloading an empty ADR configuration to the scanner module and then try the ADR configuration again.
90	Disabled Network	DeviceNet Port is disabled. Check for the DISABLE being set in the Module Command Array. See page 16 .
91	Bus Off	Bus off condition detected on integral DeviceNet port. Check the DeviceNet connections and physical media integrity. Check system for failed slave devices or other possible sources of network interference. Check the Baud Rate.
92	No DeviceNet Power	No network power detected on DeviceNet port. Provide network power. Make sure the module drop cable is providing the proper power to the DeviceNet port.

Device Status

Code (decimal)	Name	Description
95	FLASH Update	Flash Update In Progress IMPORTANT: Do not disconnect the module from the network while a FLASH update is in progress.
98	Firmware Corrupted	Firmware is corrupted. Reflash module firmware. Do not power cycle the module. Doing so may cause the module to become inoperable. If the problem persists contact Rockwell Automation Technical Support.
99	Hard Fault	Cycle power. Reflash module firmware. Contact Rockwell Automation Technical Support.

1769-SDN DeviceNet Class Codes

Introduction

This appendix contains the most commonly used class codes for the 1769-SDN DeviceNet scanner module. They are shown in the following tables.

DeviceNet Object

Name	Class	Instance	Attribute	Data Size	Access
MAC ID	0x03	0x01	0x01	1 byte	Get/Set ⁽¹⁾
Baud Rate	0x03	0x01	0x02	1 byte	Get/Set
Bus Off Counter	0x03	0x01	0x04	1 byte	Get

⁽¹⁾ The set also causes a reset.

Identity Object

Name	Class	Instance	Attribute	Data Size	Access
Vendor ID	0x01	0x01	0x01	2 bytes	Get
Device Type	0x01	0x01	0x02	2 bytes	Get
Product Code	0x01	0x01	0x03	2 bytes	Get
Revision	0x01	0x01	0x04	2 bytes	Get
Status	0x01	0x01	0x05	2 bytes	Get
Serial Number	0x01	0x01	0x06	4 bytes	Get
Product Name	0x01	0x01	0x07	9 bytes	Get

Notes:

CompactLogix Backup on the DeviceNet Network

Introduction

This appendix offers a solution to back up your CompactLogix controller on the DeviceNet network. CompactLogix system backup on the DeviceNet network is a simple, low-cost, back-up system most effective when used in smaller applications that require fast switchovers from a primary to a secondary controller.

Topic	Page
How the Backup Works	130
Configure the Backup System	132
Develop the CompactLogix Backup Application	134
Using Indicators to Check Status	141
Development and Debugging Tips	144

This back-up solution:

- minimizes downtime in case of controller failure when the same program is used in both controllers.
- mitigates the risk of changes adversely affecting the application (use old, proven program in one controller and new, untested program in the other controller). If the new untested program causes a problem, a forced switchover can be made to the older proven program without downloading the program again.

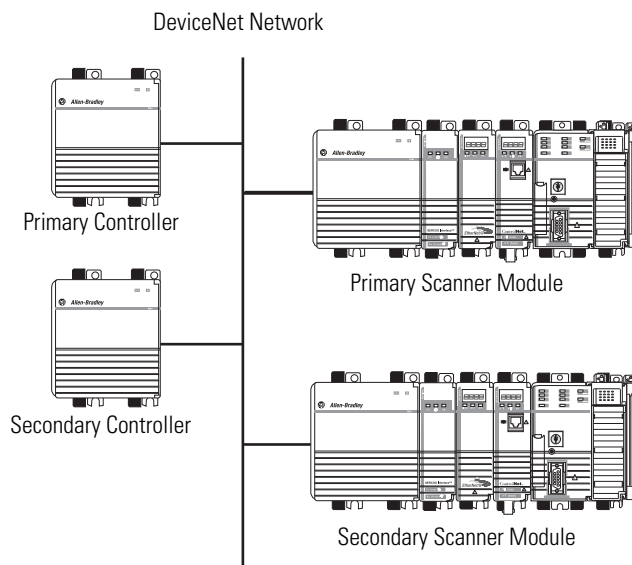
The CompactLogix backup on the DeviceNet network solution takes advantage of Shared DeviceNet Mastership of Slave I/O Devices technology. Typically, only a single DeviceNet master exists for any particular slave. With Shared DeviceNet Mastership, two masters can exist. Heartbeat communication between primary and secondary controllers determines which scanner module is the master and which scanner module remains in Standby mode.

How the Backup Works

The following figure shows an example backup system. In the backup system, the following occurs:

- Both controllers/scanners simultaneously receive all inputs.
- Both controllers execute in parallel but are not synchronized.
- Only the primary controllers send output data to the I/O devices. A virtual switch in the 1769-SDN scanner module is used to switch outputs between primary and secondary controllers.
- After failure or forced switchover, outputs are automatically switched by the 1769-SDN scanner module from the primary controller to secondary. When the switch occurs, the secondary controller becomes the primary controller.

The switchover occurs so quickly that the I/O devices do not timeout; these devices are unaware that redundant controllers/scanners exist and are unaware of the switchover.



Backup System Requirements

The CompactLogix backup on DeviceNet solution requires that you use the following:

- RSLogix 5000 programming software, version 10 or later
- Two CompactLogix controllers, firmware revision 10.x or later
- Two 1769-SDN scanner modules, firmware revision 3.x or later

Additional requirements are as follows:

- When setting up the DeviceNet network, you must set the primary and secondary 1769-SDN scanner modules to the same node address and reserve the next node address.

We recommend that you set the primary and secondary 1769-SDN scanner module node addresses to 0 and reserve node 1. However, you can use any successive node numbers (for example, 30 and 31).

- All I/O and operator interfaces that required backup must be on the DeviceNet network.
- The scanlists in the two DeviceNet scanner modules must be identical.

Configure the Backup System

Follow these steps to configure a CompactLogix backup system on the DeviceNet network. Some of these steps are described in greater detail in the rest of the appendix.

1. Install all I/O and operator interfaces that you need to back up on the DeviceNet network.

We recommend that you reserve node addresses 0 and 1 for the two 1769-SDN scanner modules used with the CompactLogix controllers within a backup system. If you do not use 0 and 1, make sure you reserve two consecutive numbers for the 1769-SDN scanner modules when you install I/O and other devices on the DeviceNet network.

2. Connect a CompactLogix controller with a 1769-SDN scanner module to the DeviceNet network.
3. Set the scanner module node address to 0 (or the lower of the two node addresses reserved for the CompactLogix controller backup system).
4. Apply power to the controller and the network.
5. Use RSNetWorx for DeviceNet software to download the network's scanlist to the 1769-SDN scanner module.

You can either use a scanlist from a new configuration or from a previously-used configuration. If the scanlist is a new configuration, we recommend that you save it to a new project for later use.

6. Use RSLogix 5000 programming software to download the appropriate user program to the CompactLogix controller.

The program should contain the explicit messages that enable the backup feature for this controller and scanner module. The messages are described in the [Develop the CompactLogix Backup Application](#) section beginning on [page 134](#).

7. Put the controller into Run mode.
8. Either disable power to the controller or disconnect the scanner module from the DeviceNet network.

This controller will be the secondary controller.

9. Connect the other CompactLogix controller with a 1769-SDN scanner module on the network.
10. Set the node address to 0.
11. Apply power to the controller and scanner module.
12. Use RSNetWorx for DeviceNet software to download the same scanlist used in [step 5](#).

It may be necessary to browse the network again before downloading the scanlist. This second browsing of the network allows RSNetWorx for DeviceNet software to establish communication to the new scanner module at the same node number as the previous scanner.

13. Use RSLogix 5000 programming software to download the user program to the second CompactLogix controller as you did in [step 6](#).

Typically, you download the same user program to the second CompactLogix controller as you did to the first. However, unlike the scanlists, the user programs in the controllers do not have to be identical.

14. Put the controller into Run mode.

This controller is now ready to use and is the primary controller.

15. Reapply power to the secondary controller and/or reconnect the secondary scanner module to the DeviceNet subnet.

This completes the backup process. For more detailed information on some of the steps listed previously, see the next section.

Develop the CompactLogix Backup Application

The CompactLogix backup is enabled from an RSLogix 5000 programming software user program with a few simple ladder rungs. The following rungs are used in the CompactLogix backup:

- [Backup Heartbeat Configuration Rungs](#) - required
- [Reading Backup State Rung](#) - optional
- [Reading Backup Status](#) - optional

Backup Heartbeat Configuration Rungs

The first, and most critical, step is to set the backup heartbeat constant in the DeviceNet scanner. The heartbeat constant enables the backup feature and determines the switchover time (2 x heartbeat).

By default, the heartbeat is zero; this default value disables the Backup mode. Your user program must set the heartbeat to a non-zero value to enable backup.

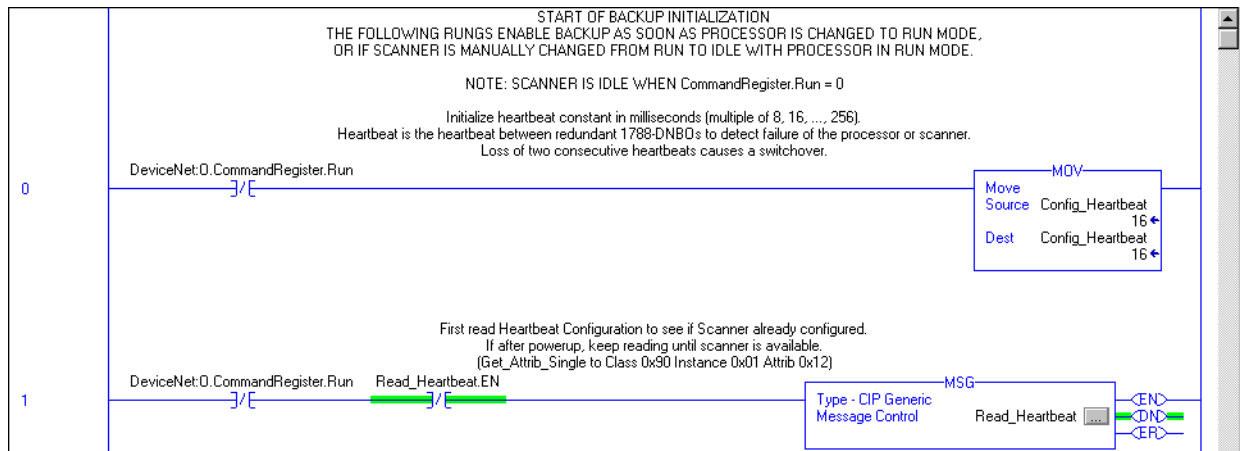
The heartbeat occurs in multiples of 8 ms (8, 16, 24). We recommend a value of 16...48 ms for most applications. The recommended heartbeat times result in switchover times of 32...96 ms. These times do not include controller scan delays.

IMPORTANT

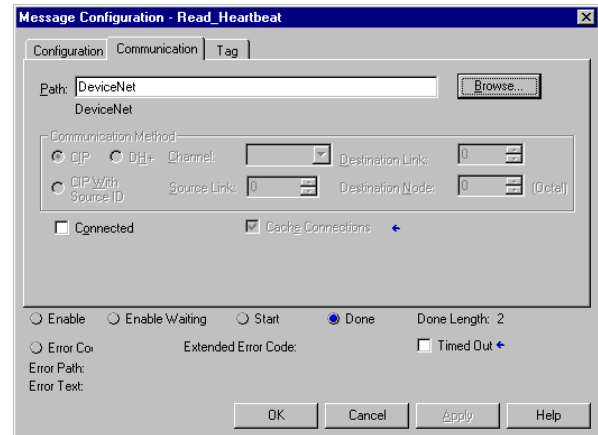
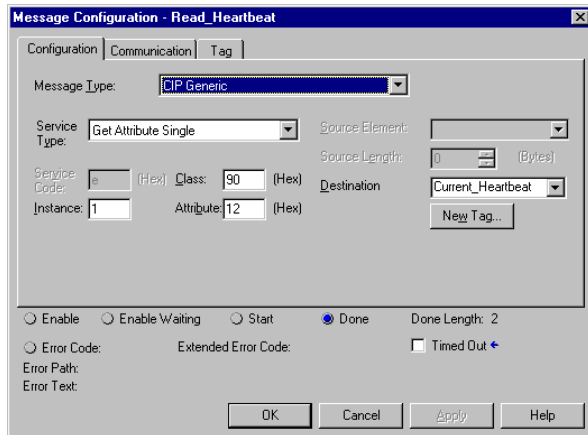
If multiples of 8 are not used for the requested heartbeat, then the DeviceNet scanner module uses the next higher supported heartbeat value that can be read from the scanner. For example, if you set the heartbeat to 10, the scanner module uses a 16 ms heartbeat.

Setting the Heartbeat Constant

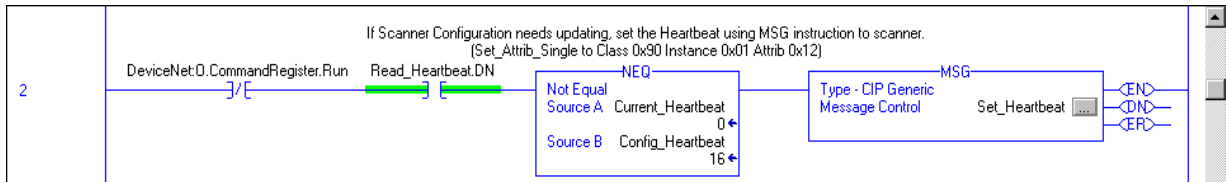
You can set the heartbeat constant with five rungs of ladder logic. This figure shows rungs 0 and 1 and the message setup used in rung 1. The message in rung 1 uses the INT data type.



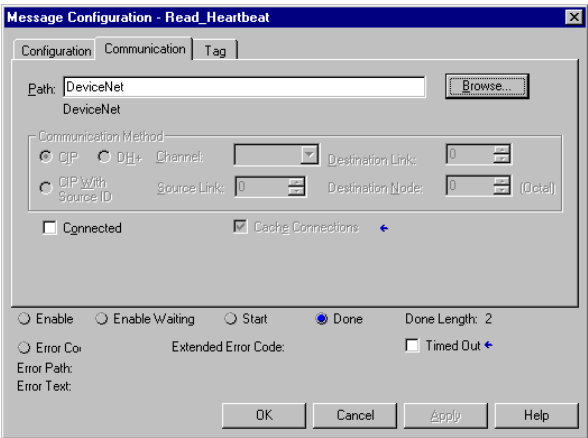
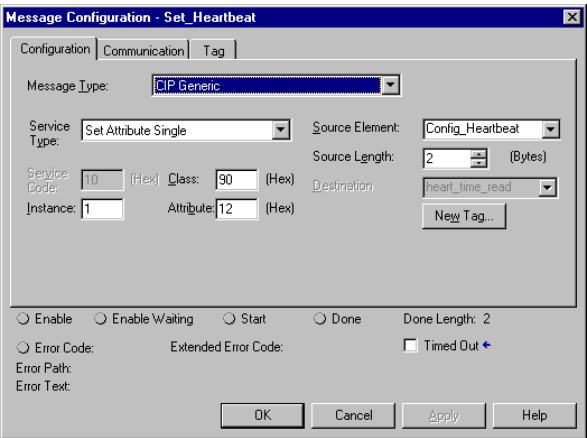
Rung 1 Message Configuration and Communication tabs.



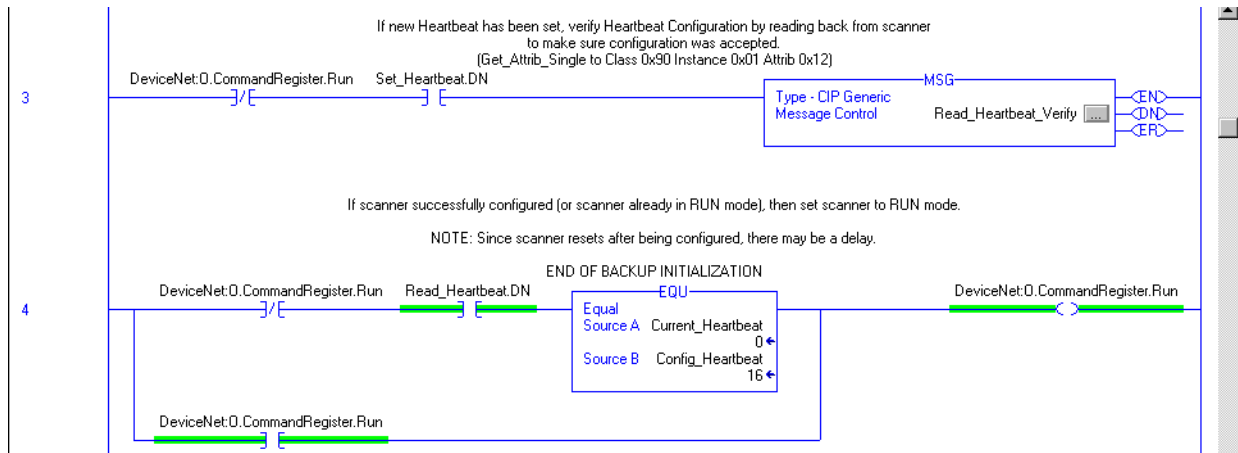
This figure shows rung 2 and the message setup used on it. The message in rung 2 uses the INT data type.



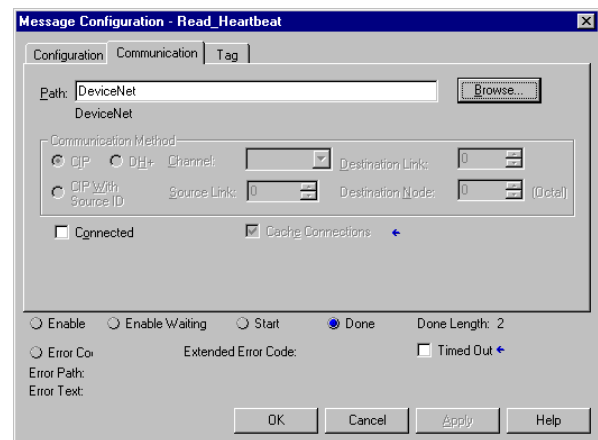
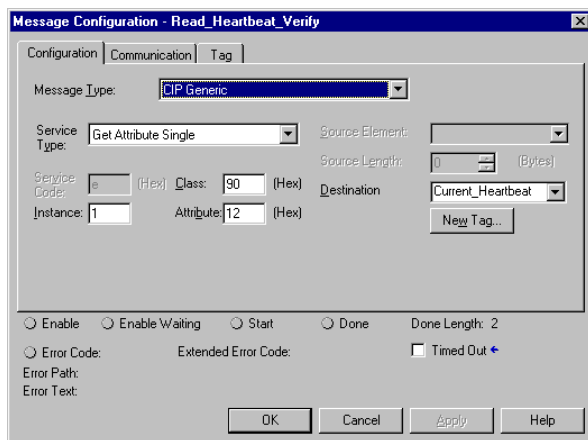
Rung 2 Message Configuration and Communication tabs.



This figure shows rungs 3 and 4 and the message setup used on it. The message in rung 3 uses the INT data type.



Rung 3 Message Configuration and Communication tabs.

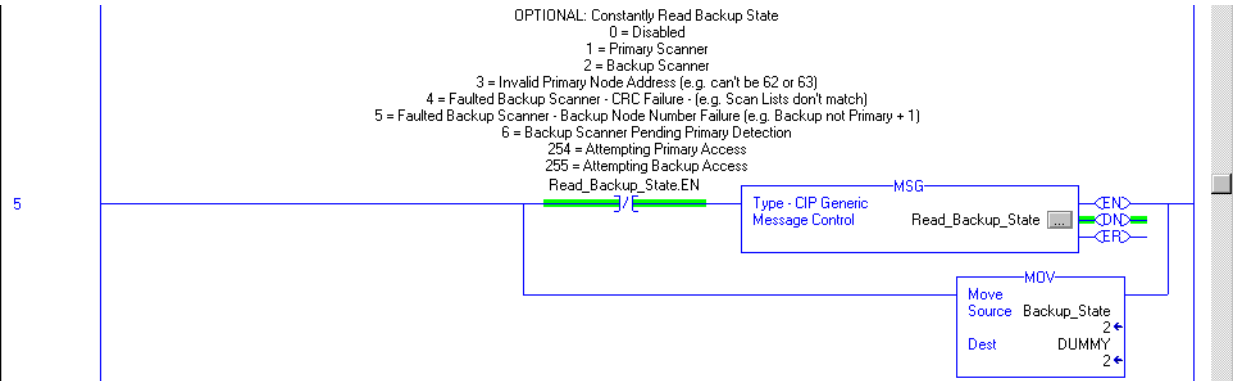


This completes the required portion of ladder logic to enable the CompactLogix backup on the DeviceNet network. The following sections describe how to use additional ladder logic to read backup state and status. However, these sections are not required to complete the backup solution.

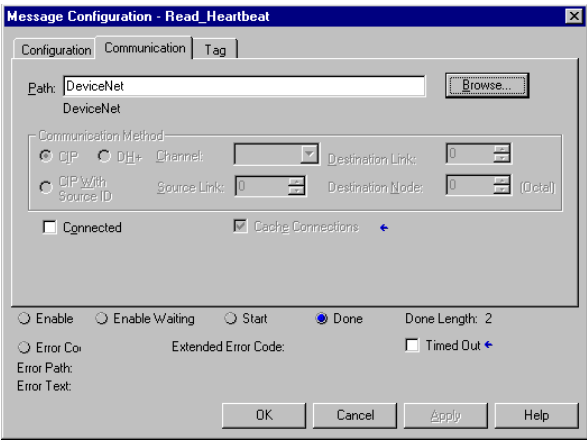
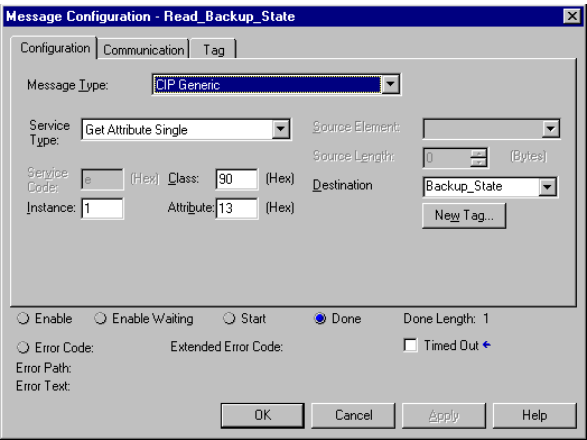
Reading Backup State Rung

You can read the backup state of the DeviceNet scanner module with a single rung of ladder logic. The backup state is useful for debugging or more sophisticated backup schemes. The message in this rung uses the SINT data type.

This figure shows the rung you can use to read the backup state.



Rung 5 Message Configuration and Communication tabs.



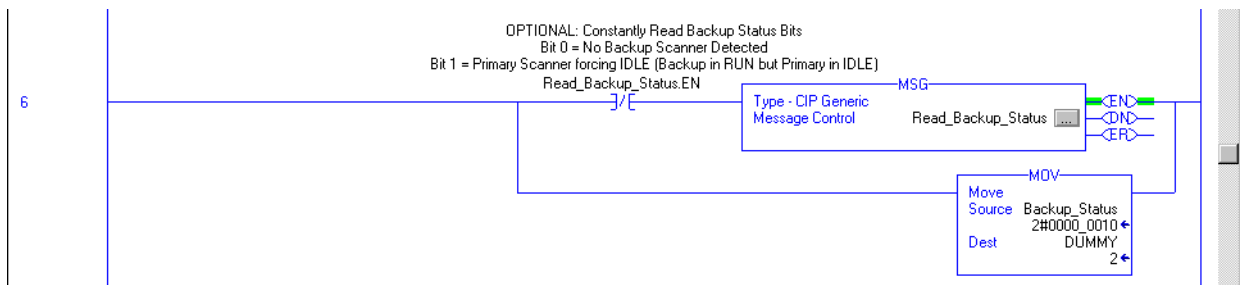
This table describes the possible values this message may return when reading the backup state of the DeviceNet scanner.

If the message reads this value	The backup state of the DeviceNet scanner module is
0	Disabled
1	Primary scanner
2	Backup scanner
3	Invalid primary node address (for example, the node address cannot be 62 or 63)
4	Faulted backup scanner module - CRC failure (for example, the scanlists in the scanners do not match)
5	Faulted backup scanner module - backup node number failure (for example, the backup scanner module is not using a node number = the primary node number + 1)
6	Backup scanner module pending primary detection
254	Attempting primary access
67	Scanner in Backup Scanner mode
68	No backup scanner module present
69	Invalid backup scanner module CRC
255	Attempting backup access

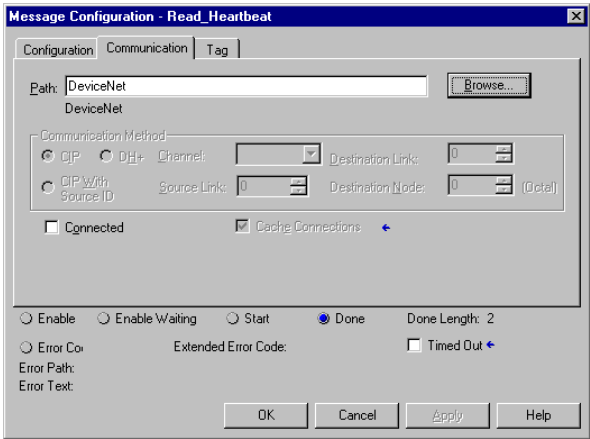
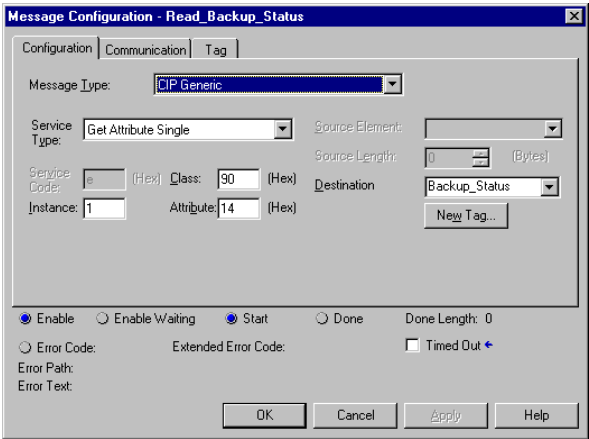
Reading Backup Status

You can read the backup status of the DeviceNet scanner module with a single rung of ladder logic. The backup state is useful for debugging or more sophisticated backup schemes. The message in this rung uses the SINT data type.

This figure shows the rung you can use to read the backup state.



Rung 6 Message Configuration and Communication tabs.

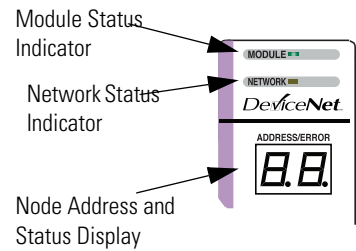


This table describes the possible values this message may return when reading the backup status of the DeviceNet scanner module.

If the message reads this value	The backup state of the DeviceNet scanner module is
0	No backup scanner module detected
1	Primary scanner module forcing Idle (backup in Run mode but primary in Idle mode)
3	Primary scanner in Run mode detects backup scanner in Idle mode

Using Indicators to Check Status

The 1769-SDN scanner module’s status indicators provide useful information (for example, determining which scanner module is primary) about backup scanner module status.



Module Status Indicator

This table lists the indicators to monitor when checking backup status.

Module Status Indicator Behavior

If this indicator	Exhibits this behavior	This condition exists
Module status (MS)	Flashing red	- Recoverable Fault - Memory has been erased or is being programmed. - Bad firmware in module.

Node Address and Status Display

The seven-segment numeric display shows the following information about the primary and secondary scanner modules in either Run or Idle modes.

TIP

If error codes other than those shown in these tables appear in the display, refer to [Chapter 8, Troubleshooting](#), for more information on error codes.

Primary Scanner Module With Valid Backup Scanner Module

Run Mode		
	Primary	Secondary
Node Number	00	01 or 00
Status	00 (Run mode)	67 (Backup mode enabled) or 00 (Run mode)
Primary or Secondary	P - (Primary)	S - (Secondary)
Idle Mode		
	Primary	Secondary
Node Number	00	01 or 00
Status	80 (Idle mode)	67 (Backup mode enabled) or 80 (Idle mode)
Primary or Secondary	P - (Primary)	S - (Secondary)

Primary Scanner Module Without Valid Backup Scanner Module

Run Mode		
	Primary	Secondary
Node Number	00 or 01	01 or 00
Status	68 (No backup scanner present) or 00 (Run mode)	Undefined error or 69 (Backup scanner invalid CRC)
Primary or Secondary	P - (Primary)	--
Idle Mode		
	Primary	Secondary
Node Number	00 or 01	01 or 00
Status	68 (No backup scanner present) or 80 (Idle mode)	Undefined error or 69 (Backup scanner invalid CRC)
Primary or Backup	P - (Primary)	--

Lost Primary Scanner Module With Valid Backup Scanner Module

Run Mode		
	Primary	Secondary
Node Number	00	01 or 00
Status	Undefined error	68 (No backup scanner present) or 00 (Run mode)
Primary or Secondary	--	P - (Primary)
Idle Mode		
	Primary	Secondary
Node Number	00	00 or 01
Status	Undefined error	68 (No backup scanner present) or 80 (Idle mode)
Primary or Secondary	--	P - (Primary)

CRC Error

Run Mode		
	Primary	Secondary
Node Number	00 or 01	00 or 01
Status	68 (No backup scanner present) or 00 (Run mode)	69 (Backup scanner invalid CRC)
Primary or Secondary	P - (Primary)	--
Idle Mode		
	Primary	Secondary
Node Number	00 or 01	00 or 01
Status	68 (No backup scanner present) or 80 (Idle mode)	69 (Backup scanner invalid CRC)
Primary or Secondary	P - (Primary)	--

Lost Primary Scanner Module Without Valid Backup Scanner Module

Run Mode		
	Primary	Secondary
Node Number	Undefined error	Undefined error
Status	--	--
Primary or Secondary	--	--

Development and Debugging Tips

When you implement the CompactLogix system backup on the DeviceNet network, we recommend that you consider the following development and debugging tips:

- Develop and debug the entire application with only the primary controller and scanner module present. When the application is totally verified, then download the program and exact same scanlist to the secondary controller, without the primary controller present. Verify that the secondary is also functioning properly, and then both primary and secondary can be added to the network at the same time.
- No configuration parameters are entered from RSNetworkx for DeviceNet software or RSLogix 5000 programming software to enable backup. All configuration occurs in the user program. The entire application (except for a few ladder rungs) can be developed without knowledge that the application will have a backup controller and scanner module.
- Local I/O still works when this solution is used, but the local I/O is not backed up.
- Switchover time depends on the user configurable heartbeat. Typically, switchover occurs after two heartbeats, plus the time required to complete network polling.
- The I/O during switchover is not bumpless. Since the programs and I/O updates are not synchronized, it is possible for the secondary controller to be either slightly faster or slower than the primary.

For example, if output changes during a switchover, the fact that the primary and secondary controllers are not synchronized because the output to momentarily switch between an older and newer value. If you configure the switchover time slower than the program scan and I/O update, the secondary lags behind the primary and eliminates this.

- State variables, such as counters or timers, are not synchronized. The user program must synchronize the primary and secondary controllers, typically over an EtherNet/IP or ControlNet network link between controllers. If the outputs are dependent on a state variable, the lack of synchronization can also cause a bumpy switchover.
- As with all backup and redundancy systems, the I/O must change at a slower rate than the switchover time. If the inputs change faster than the switchover, the change of state is lost.
- Either the user program or user action determine the primary controller. In its simplest mode, the first scanner module to turn on or become available on the DeviceNet network is the primary.

- Unlike some backup systems (such as PLC-5 controller systems), the primary controller still maintains control of the I/O, and switchover does not occur if the primary controller is set to Program/Idle mode. The secondary 1769-SDN scanner module also indicates that it is in Idle mode.
- By default, a switchover will not occur if the default fault routine or user fault routine is executed in the primary controller. However, the user fault routine can force a switchover if desired.
- If an operator interface is on the DeviceNet network, it can work without knowledge of which controller is primary or secondary.
- Online edits are not automatically performed on both primary and secondary controllers, since no synchronization exists between primary and secondary controllers. Once an online edit occurs on the primary controller, the primary and secondary will have different programs.
- CompactLogix system backup on the DeviceNet network is not hot backup. Hot backup implies complete synchronization of program, program variables, and I/O. Also, I/O switchover is completely bumpless with hot backup.

Notes:

Auto-Address Recovery (AAR)

Auto-Address Recovery (AAR) allows a slave device to be removed from the network and replaced with another identical slave device that is residing on the network at node address 63 and not in the scan list. The replacement device will have its node address automatically changed to that of the device being replaced. Depending on the level of revision keying, it may be possible for the node address of the replacement device to be changed but not brought online due to a revision-keying mismatch.

Auto Device Replacement (ADR)

The Auto Device Replacement feature automates the replacement of a failed slave device on a DeviceNet network by configuring the new device to the prior level of operation. This includes Configuration Recovery (CR) and Auto-Address Recovery (AAR).

Bridge

The scanner module's support of explicit message transfer.

Change of State (COS)

A type of I/O data communication. The scanner module can send and receive data with slave devices that have the change of state feature. Data is sent whenever a data change occurs, or at the predefined heartbeat interval.

Configuration Recovery (CR)

Configuration Recovery (CR) allows a slave device to be removed from the network and replaced with an identical slave device configured at the same communication rate and Node Address as the device being replaced.

Controller

The programmable controller, for example CompactLogix or MicroLogix 1500.

Cyclic

A type of I/O data communication. The scanner module can send and receive data with slave devices that have the cyclic feature. Data is sent at a user-configurable rate.

Dual Mode

The scanner module is in Dual mode when it serves as a master to one or more slaves and as a slave to another master simultaneously.

Electronic Data Sheet (EDS)

A vendor-supplied template that specifies how information is displayed as well as what is an appropriate entry (value).

Explicit Messaging

A type of messaging used for lower priority tasks, such as configuration and data monitoring.

Heartbeat Rate

Devices that are configured for change of state data will send data at this rate if no data change occurs.

Host Platform

The computer on which the application software is run.

I/O

Input and output modules

Input Data

Data produced by a DeviceNet device and collected by the scanner module for the host platform to read.

MAC ID

The network address of a DeviceNet node. Also referred to as node address.

Multicast

Used when describing a strobe message.

Network

The DeviceNet network or the RSNetWorx for DeviceNet software representation of the network.

Node

Hardware that is assigned a single address on the network. Also referred to as a device.

Offline

When the host platform is not communicating on the network.

Online

When the host platform is configured and enabled to communicate on the network.

Output Data

Data produced by the host platform that is written to the scanner module's memory. This data is sent by the scanner module to DeviceNet devices.

Point-to-Point

Used when describing a poll message. The message solicits a response from a single, specified device on the network.

Polled

A type of input/output-data communication. A polled message solicits a response from a single, specified device on the network (a point-to-point transfer of data).

Record

The node address and channel-specific memory assigned in the scanner module's nonvolatile storage for a node in the scanlist.

Rx

Abbreviation for receive

Scanlist

The list of devices (nodes) with which the scanner module is configured to exchange I/O data.

Scanner

The function of the 1769-SDN scanner module to support the exchange of I/O with slave modules.

Slave Mode

The 1769-SDN scanner module is in slave mode when it is placed in another DeviceNet master's scanlist as a slave device.

Strobed

A type of I/O data communication. A strobed message solicits a response from each strobed device (a multicast transfer). It is a 64-bit message that contains one bit for each device on the network.

Tx

Abbreviation for transmit

Numerics

1770-KFD RS-232 DeviceNet adapter 19, 61

193-DNCT terminal 40
initiating AutoScan 51-52

A

accessing device data 57-59

additional resources 10

Auto Device Replacement

in RSNetWorx for DeviceNet software
80-83

AutoScan

additional considerations 53-56
firmware requirements 38
implementing 46-60
initiate via a 193-DNCT terminal 51-52
initiate via a user program 49-50
overview 38
when to use 38

B

backplane messaging 111

backup

CompactLogix backup on the DeviceNet
network 129-145

baud rate

setting via a 193-DNCT terminal 40, 41

before you begin 11, 19

C

change of state message 14

class codes 127

common techniques used in this manual
10

communication with your slave devices
14

**CompactLogix backup on the DeviceNet
network** 129-145

configuring the DeviceNet network

I/O devices 70-84
manually 61-85
scanlist configuration 64
setting up an online connection 64-66
software installation 62
using RSLinx software 62-64
using RSNetWorx for DeviceNet
software 17, 64-85

**connecting devices to the DeviceNet
network** 39

current draw 20

cyclic message 14

D

data tables 15

DeviceNet adapter

1770-KFD 19, 61

DeviceNet driver

adding 62-64

DeviceNet I/O image 87-102

1769-SDN input structure 87
1769-SDN output structure 102
command register 100-101
input data image 102
status register 98-100
status structure 88-98

DeviceNet interface card

1784-PCIDS 19

DeviceNet interface cards

1784-PCD, 1784-PCID 61

DeviceNet network

CompactLogix backup on the network
129-145
power requirements 20, 23

DIN rail mounting 30**E****electrical noise**

reducing 25

electrostatic discharge

preventing 25

equipment required for installation 19

error codes 124

message instructions 120

explicit messaging 14**F**

features of the scanner 12

G

glossary 147-150

grounding 32

H

hazardous location considerations 24

I**I/O allocation**

- configuring via a user program 48
- in CompactLogix controller 37
- in MicroLogix 1500 controller 37
- maximum node number 54

implementing AutoScan 46-60**input data definition** 14**installation** 23-33

- getting started 19
- grounding 32
- heat and noise considerations 25
- required equipment 19

M**manually configuring the DeviceNet network** 61-85**message instruction error codes** 120**messaging**

- backplane 111
- configuring a local DeviceNet message 113-118

MicroLogix 1500 controllers 103-120**minimum spacing** 28**module command array** 16**module features** 12**mounting** 28-30

- DIN rail mounting 30
- panel 28-30

N**node address**

- set via RSNetWorx for DeviceNet software 67
- setting via a 193-DNCT terminal 42-43

O**operating modes** 16**output data definition** 14**P****panel mounting** 28-30**poll message** 14**power requirements**

- DeviceNet network 20, 23
- maximum current draw 20, 23

preventing electrostatic discharge 25**publications, related**

- additional resources 10

R**reducing electrical noise** 25**related publications** 10**RSLinux software**

- configuring the DeviceNet network 62-64
- installation 62
- minimum version 19

RSLogix 500 programming software

104-110

- minimum version 19

RSLogix 5000 programming software 44

- minimum version 19

RSNetWorx for DeviceNet software

- as a configuration tool 17
- Auto Device Replacement 80-83
- configuration screen map 18
- configuring the DeviceNet network 64-85
- installation 62
- minimum version 19

S**scanlist configuration** 70**scanner**

- configure automatically 35-60
- module functions 13
- replacement 31

software installation 62**software versions** 19, 61**spacing**

- minimum 28

start-up instructions 19**strobe message** 14**system assembly** 27**system mounting** 28-30**system planning** 26**T****technical support** 71**tools required for installation** 19**troubleshooting** 121-126

- diagnostic indicators 121
- error codes 124
- status indicators 121

typical network configuration 13, 104**W****what you need to know** 11**wiring** 23-33

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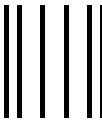
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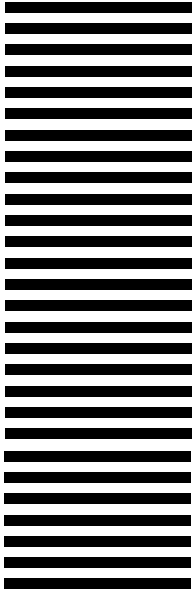
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