Allen-Bradley

Compact™ I/O 1769-ADN DeviceNet Adapter

1769-ADN

User Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

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

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

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Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

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.

ATTENTION

Identifies information about practices or circumstances that can 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

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

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Notes:

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- how to use this manual
- related publications
- conventions used in this manual
- Allen-Bradley support

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley Compact I/O adapters.

How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate, and troubleshoot a control system using the 1769 I/O modules.

Manual Contents

If you want:	See:
To install your DeviceNet adapter module	Chapter 1
Information on how communication takes place and on I/O image table mapping	Chapter 2
To configure your Series A DeviceNet adapter	Chapter 3
To configure your Series B DeviceNet adapter	Chapter 4
Information on adapter diagnostics and troubleshooting	Chapter 5
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Information on 1769-ADN throughput characteristics	Appendix C
Information on the differences between Series A and B DeviceNet adapters	Appendix D

Related Documentation

The table below provides a listing of publications that contain important information about Compact I/O products.

Title	Publication Number
MicroLogix 1500 System Overview	1764-SO001
CompactLogix Selection Guide	1769-SG001
Compact I/O Analog Modules User Manual	1769-UM002
1769-ADN Adapter User Manual	1769-UM001
Compact I/O 1769-ADN DeviceNet Adapter Module Installation Instructions	1769-IN001
Compact 1769-IQ6XOW4 24V dc Sink/Source Input AC/DC Relay Output Module Installation Instructions	1769-IN002
Compact 1769-OW8 AC/DC Relay Output Module Installation Instructions	1769-IN003
Compact 1769-OB16P 24V DC Installation Instructions	1769-IN004
Compact 1769-OW8I Individually Isolated AC/DC Relay Output Module Installation Instructions	1769-IN005
Compact 1769-OW16 16-Point ac/dc Relay Module Installation Instructions	1769-IN062
Compact 1769-IA16 120V ac Input Module Installation Instructions	1769-IN006
Compact 1769-IQ16 24V dc Sink/Source Input Module Installation Instructions	1769-IN007
Compact 1769-OB16 Solid State 24V dc Source Output Module Installation Instructions	1769-IN008
Compact 1769-OA8 100 to 240V ac Solid State Output Module Installation Instructions	1769-IN009
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Compact 1769-OV16 Solid State 24V dc Sink Output Module Installation Instructions	1769-IN010
Compact 1769-IM12 240V ac Input Module Installation Instructions	1769-IN011
Compact 1769-IA8I Individually Isolated 120V ac Input Module Installation Instructions	1769-IN012
Compact 1769-HSC High Speed Counter Module Installation Instructions	1769-IN030
Compact 1769-HSC High Speed Counter Module User Manual	1769-UM006
Compact 1769-IF4XOF2 Combination Analog Module Installation Instructions	1769-IN057
Compact 1769-IF4XOF2 Combination Analog User Manual	1769-UM008
Compact 1769 Power Supplies Installation Instructions	1769-5.14

Title	Publication Number
Compact I/O Communication Bus Expansion Cables Installation Instructions	1769-5.15
Compact 1769-ECR Right End Cap/Terminator	1769-5.9
Compact 1769-ECL Left End Cap/Terminator	1769-5.16
Compact 1769-IF4 Analog Input Module Installation Instructions	1769-IN016
Compact 1769-OF2 Analog Output Module Installation Instructions	1769-IN017

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- purchase a printed manual by:
  - contacting your local distributor or Rockwell Automation representative
  - visiting www.theautomationbookstore.com and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists (like this one) provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.
- Text in this `font` indicates words or phrases you should type.

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Local Product Support

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- sales and order support
- product technical training
- warranty support
- support service agreement

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in Chapter 4, *Troubleshooting* first. Then call your local Allen-Bradley representative.

Your Questions or Comments on the Manual

If you find a problem with this manual, please notify us using the self-mailer Publications Problem Report in the back of this manual.

If you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

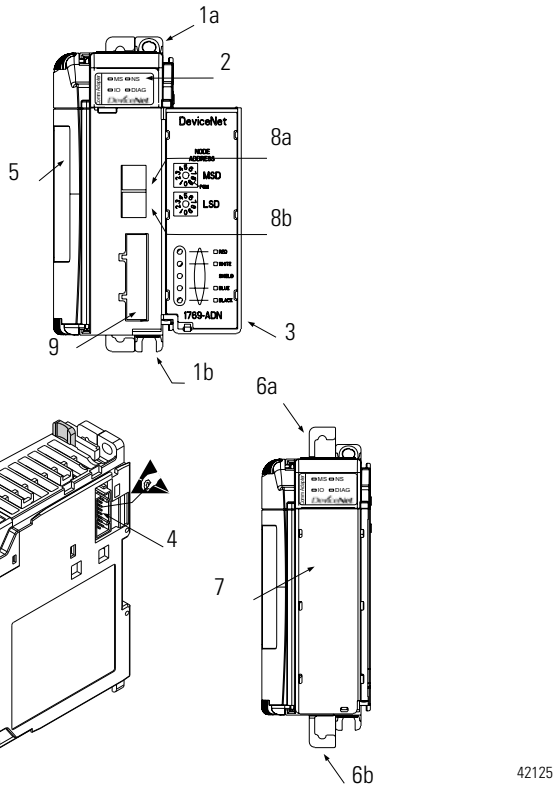
Rockwell Automation
Technical Communication Department
1 Allen-Bradley Drive
Mayfield Heights, OH 44124

Installing Your DeviceNet Adapter Module

This chapter explains how to install your DeviceNet™ adapter. Included is information about:

- System Assembly
- Replacing the 1769-ADN within a System
- Field Wiring Connections
- Setting the Network Address Switches

Compact I/O Module Description



Item	Description	Item	Description
1a	Upper panel mounting tab	6a	Upper DIN-rail latch
1b	Lower panel mounting tab	6b	Lower DIN-rail latch
2	I/O diagnostic LEDs	7	Write-on label (user I.D. tag)
3	Module door with terminal identification label	8a	DeviceNet node address rotary selection switches - Most Significant Digit (MSD)
4	Stationary bus connector with male pins	8b	DeviceNet node address rotary selection switches - Least Significant Digit (LSD)
5	Nameplate label	9	Removable DeviceNet terminal connector

Module Installation

Compact I/O 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 circuits not exceeding Over Voltage Category II[2] (IEC 60664-1).[3]

1. Pollution Degree 2 is an environment where, normally, only non-conductive 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.

Prevent Electrostatic Discharge

ATTENTION

Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins or the terminal block. 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.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

Remove Power

ATTENTION

Remove power before removing or inserting this adapter. When you remove or insert an adapter 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

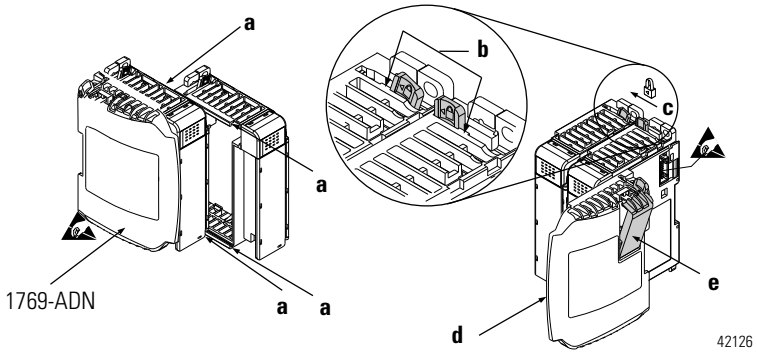
Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

System Configuration

Refer to Using Banks of I/O on page 3-7 for system configuration rules.

System Assembly

The adapter can be attached to adjacent 1769 modules *before* or *after* mounting. For mounting instructions, see "Panel Mounting" on page 1-4, or "DIN Rail Mounting" on page 1-6. To work with a system that is already mounted, see "Replacing the 1769-ADN within a System" on page 1-6. The following procedure shows you how to assemble the Compact I/O system.



1. Disconnect power.

2. Check that the bus lever of the module to the right of the 1769-ADN is in the unlocked (fully right) position.

3. Use the upper and lower tongue-and-groove slots (**a**) to secure the modules together.

4. Move the module back along the tongue-and-groove slots until the bus connectors line up with each other.

5. Push the bus lever of the module to the right of the 1769-ADN back slightly to clear the positioning tab (**b**) using your fingers or a small screwdriver.

6. To allow communication between the adapter and I/O modules, move the bus lever of the module to the right of the 1769-ADN fully to the left (**c**) until it clicks. Make sure it is locked firmly into place.

ATTENTION

When attaching a 1769-ADN adapter, it is very important that the bus connectors are securely locked together to create a proper electrical connection.

7. Attach an end cap terminator (**d**) to the last I/O module in the system by using the tongue-and-groove slots as before.

8. Lock the end cap bus terminator (**e**).

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

9. Refer to the "DeviceNet Wiring" section on page 1-7.

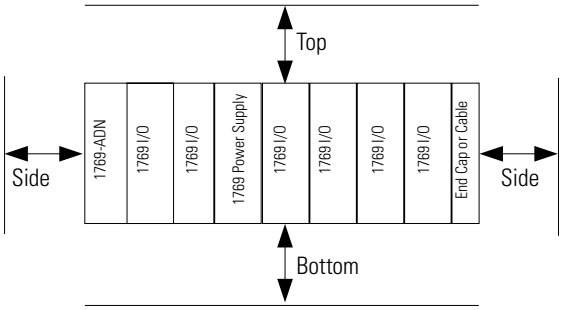
Mounting the Adapter and an I/O Module

ATTENTION

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

Minimum Spacing

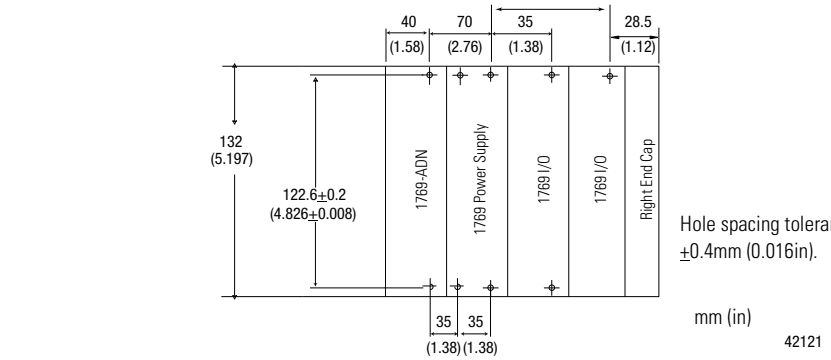
Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50mm (2in) of space on all sides for adequate ventilation, as shown:



Panel Mounting

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

Panel Mounting Using the Dimensional Template



Panel Mounting Procedure Using Modules as a Template

The following procedure allows you to use the assembled adapter and modules as a template for drilling holes in the panel. If you have sophisticated panel mounting equipment, you can use the dimensional template provided on page 1-5.

Due to the 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.

   NOTE: 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 through 6 for any remaining modules.

DIN Rail Mounting

The adapter can be mounted using the following DIN rails:

- 35 x 7.5mm (EN50022 - 35 x 7.5)
- 35 x 15mm (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.

Replacing the 1769-ADN within a System

The adapter can be replaced while the system is mounted to a panel (or DIN rail).

1. Remove power. See important note on page 1-2.
2. Remove the DeviceNet cable from the module by loosening the upper and lower retaining screws of the DeviceNet connector and removing the connector from the module.
3. Remove the upper and lower mounting screws from the adapter (or open the DIN latches using a flat-blade or phillips-style screwdriver).
4. On the right-side adjacent module, move its bus lever to the right (unlock) to disconnect it from the adapter being removed.
5. Gently slide the disconnected adapter forward.

   If you feel excessive resistance, make sure that you disconnected the adapter from the bus and that you removed both mounting screws (or opened the DIN latches).

   Note: It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.
6. Before installing the replacement adapter, be sure that the bus lever on the right-side adjacent module is in the unlocked (fully right) position.
7. Slide the replacement adapter into the open slot.
8. Connect the adapter and modules together by locking (fully left) the bus lever on the right-side adjacent module.
9. Replace the mounting screws (or snap the adapter onto the DIN rail).

10. Replace the DeviceNet cable on the module by tightening the upper and lower retaining screws and attaching the connector to the module.

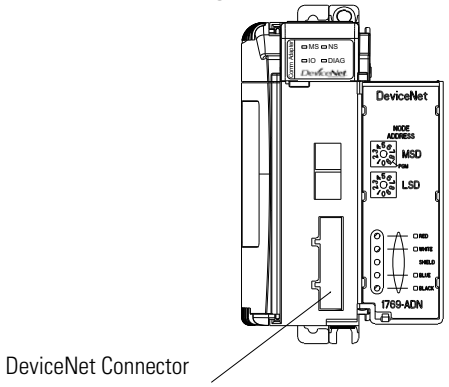
Set the network address switches to the same value as the removed adapter.

Field Wiring Connections

Grounding the Adapter

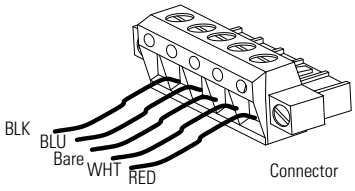
This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the adapter's mounting tabs or metal DIN rail (if used), are not required unless you cannot ground the mounting surface. Refer to *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1, for additional information.

DeviceNet Wiring



1. Connect the DeviceNet cable to the removable connector as shown.

Connect	To
BLK Wire	-V
BLU Wire	CAN Low
Bare Wire	Drain
WHT Wire	CAN High
RED Wire	+V



2. Insert the removable female connector into the mating male connector on the DeviceNet adapter module.

3. Screw the removable connector to the adapter case with the upper and lower mounting screws. Screw torque is 5-6 in-lbs.

TIP

DeviceNet cable colors are shown on the wiring label on the front of the adapter.

Note: A 10-pin linear plug (i.e., 1787-PLUG10R) will not fit while a 1799-DNETCON or -DNETSCON will fit.

IMPORTANT

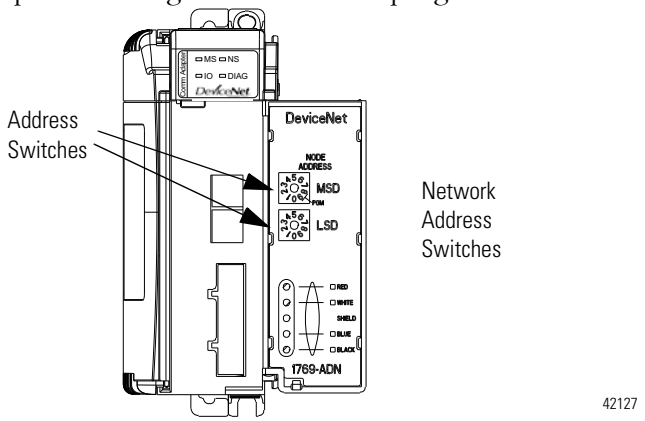
If the 1769-ADN is the last device connected to the DeviceNet network trunkline, be sure to add or move the termination resistor (Allen-Bradley part number 1485A-C2 or a 120Ω 5% or > ¼W resistor) across the Blue (CAN Low) and White (CAN High) wires. We recommend 121Ω ¼W 1% metal film.

Setting the Network Address Switches

Set the network node address with the two rotary switches on the front of the module. Use a small, slotted screwdriver to set the switches. The switch labeled MSD (Most Significant Digit) sets the 10s digit while the switch labeled LSD (Least Significant Digit) sets the 1s digit.

Valid network node addresses are 00 through 63. Switch settings from 00 to 63 select network addresses 00 to 63. Switch settings from 64 to 99 instruct the adapter to use the software programmed value for the node network address. (Address 95 is reserved and should not be used for normal operation.)

The software programmed value is set via RSNetworx™ for DeviceNet and stored in non-volatile memory on the 1769-ADN. The initial, factory-preset setting of the software programmed value is 63.



NOTE: The baud rate for the adapter is set by way of the module's automatic "auto baud" function at power-up.

Use the removable, write-on label to mark your I.D. tag, etc. with permanent ink. Your markings are visible when the module door is closed.

TIP

Series B adapters that have their node address switches set to 95, startup in a special factory mode that does not support I/O connections. Series B adapters should **not** have their node address set to 95 for normal use.

Configuring the 1769-ADN

The 1769-ADN must be configured with RSNetworx for DeviceNet. This configuration tool allows you to identify all of the devices (I/O modules, power supplies, expansion cables, end caps) and their locations in your 1769 system. The 1769-ADN must have the I/O configuration loaded into its' memory to perform the network communication function.

The 1769-ADN will not accept I/O connections if the programmed system configuration does not match the actual system configuration. The 1769-ADN retains the programmed system configuration in non-volatile memory so it can compare it with the actual system configuration on power-up. For more information, refer to *Configuring Your Compact I/O Series A DeviceNet Adapter* in Chapter 3 or *Configuring Your Compact I/O Series B DeviceNet Adapter* in Chapter 4.

Notes:

How Communication Takes Place and I/O Image Table Mapping

This chapter explains how communication takes place and about I/O image table mapping. Included is information about:

- I/O Structure
- Communication Choices
- Mapping I/O Data into the Image Table

Communication Over the 1769 Bus

One 1769-ADN DeviceNet adapter can interface with up to 30 Compact I/O modules to make a Compact I/O system. The adapter communicates to other network system components (typically a controller or scanner and/or programming terminals) over the DeviceNet network.

The adapter communicates with its I/O modules over the 1769 bus. The adapter and I/O modules also receive 5Vdc and 24V dc power through the bus interface via a 1769 power supply. The 1769 bus and all devices on the 1769 bus have system configuration limits. Refer to Using Banks of I/O on page 3-7 for more information.

The I/O map for an I/O module is divided into input data words and output data words. The number of input data words or output data words can be 0 or more. The length of each I/O module's input data words or output data words vary in size, depending on the module's complexity. Each I/O module will support at least one input data word or one output data word.

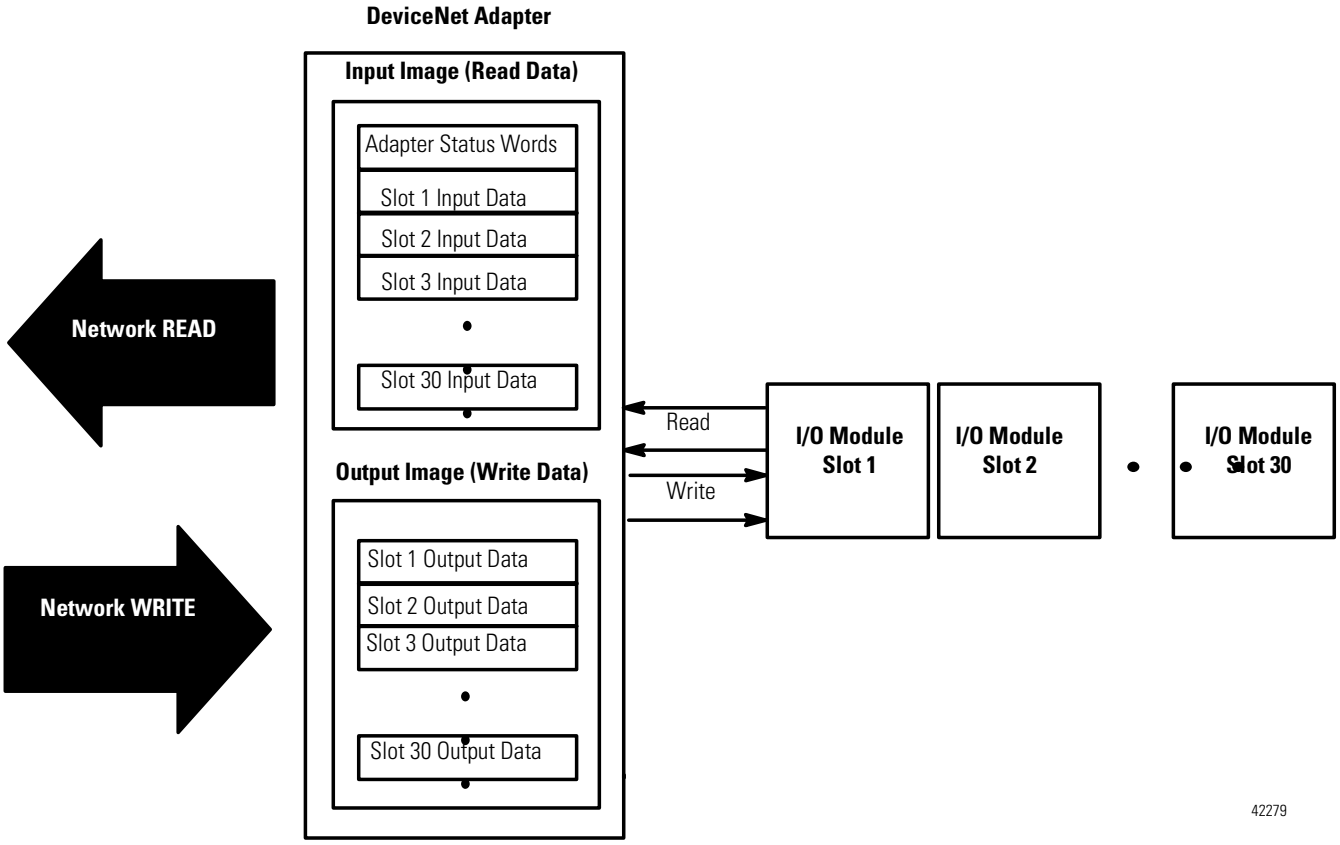
I/O Structure

Output data is received by the adapter in the order of the installed I/O modules. The output data for Slot 1 is received first, followed by the output data for Slot 2, and so on up to Slot 30.

The amount of output data in the adapter's output image for each I/O module is based on the configuration of each I/O module done as part of the 1769-ADN configuration. If an I/O module is configured to have 0 words of output data, then it does not appear in the output image of the 1769-ADN. Only a module's output data can be in the 1769-ADN output image - a module's configuration data cannot.

The first two words of input data sent by the adapter are the Adapter Status Words. This is followed by the input data from each slot, in the order of the installed I/O modules. The input data from Slot 1 is first after the status words, followed by Input data from Slot 2, and so on up to Slot 30.

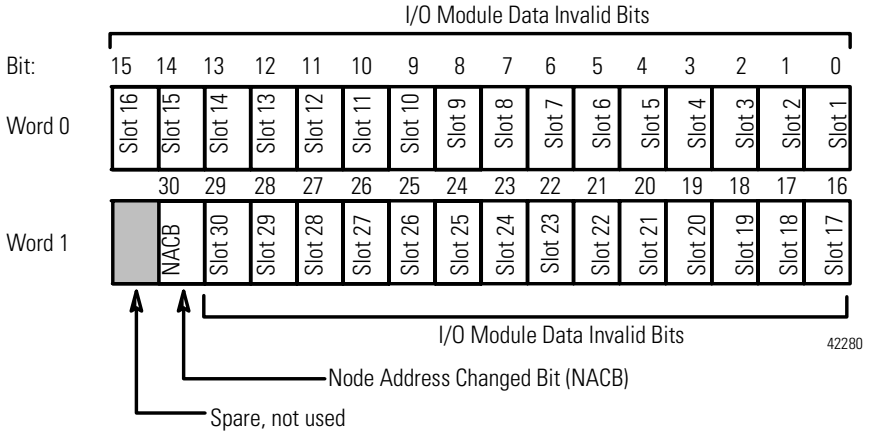
The amount of input data in the adapter's input image for each I/O module is based on the configuration of each I/O module done as part of the 1769-ADN configuration. If an I/O module is configured to have 0 words of input data, then it does not appear in the input image of the 1769-ADN.



Adapter Status Words

The first two words (0 and 1) of the adapter input image contain the adapter status. The adapter status consists of:

- I/O module data invalid bits - 1 status bit for each slot
- node address changed - 1 bit



The adapter status bit descriptions are shown in the following table.

Bit Description	Word 0 Bit	Is set (1) when I/O module data is invalid for slot position	Bit Description	Word 1 Bit	Is set (1) when I/O module data is invalid for slot position
I/O Module Data Invalid	0	1	I/O Module Data Invalid	0	17
	1	2		1	18
	2	3		2	19
	3	4		3	20
	4	5		4	21
	5	6		5	22
	6	7		6	23
	7	8		7	24
	8	9		8	25
	9	10		9	26
	10	11		10	27
	11	12		11	28
	12	13		12	29
	13	14		13	30
	14	15	Node Address Changed	14[1]	-
	15	16	Not Used	15[2]	-

1 This bit is set (1) when the node address switch setting has been changed since powerup.

2 Not used - sent as zeroes.

Possible causes for an I/O Module Data Invalid are:

- transmission errors on the Compact I/O backplane
- a failed module
- incorrect module inserted in a slot position
- the configuration for an I/O module is invalid

The node address changed bit is set when the node address switch setting has been changed since power up. The new node address does not take affect until the adapter has been powered down and then powered back up.

Communication Choices

The Compact I/O DeviceNet adapter module supports multiple communication choices. These choices all use the DeviceNet adapter input image and output image structure previously described. The DeviceNet master makes the actual communication choice. The choices are:

Polled[1] - data is sent by the adapter in response to received data

Strobe - data is sent by the adapter in response to the strobe command. The single bit allocated to the adapter in the strobe message is not used. If the configured size of the input image (sent from the adapter) is greater than 8 bytes, only the first 8 bytes of the input image are returned (of which, the first 4 bytes, or 2 words, are the adapter status words).

Change of State - data is sent by the adapter based on detection of any changed value within the input data. Data is independently received based on change of state from the sender. Data in both directions can be acknowledged or unacknowledged depending on the run time configuration of the system.

Cyclic - data is sent cyclically by the adapter based on a configured time value. Data is independently received cyclically from the sender. Data in both directions can be acknowledged or unacknowledged depending on the run time configuration of the system.

1 Refer to Appendix C for some important system characteristics when using the polled mode (minimum inter-scan delay I.D. for polled connections).

Mapping I/O Data into the Image Table

All Compact I/O modules are supported by the Series B DeviceNet adapter. At present, these consist of:

Module Description	For I/O data definition, see:
1769-IA8I Individually Isolated 120V AC Input Module (8 Point)	2-5
1769-IA16 120V ac Input Module (16 Point) (16 Point)	2-5
1769-IF4 (Series A and B) Analog Current/Voltage Input Module (4 Channel)	2-6
1769-IM12 240V AC Input Module (12 Point)	2-6
1769-IQ16 24V DC Sink/Source Input Module (16 Point)	2-6
1769-OA8 100 to 240V AC Solid State Output Module (8 Point)	2-7
1769-OA16 100 to 240V AC Solid State Output Module (16 Point)	2-8
1769-OB16 Solid State 24V DC Source Output Module (16 Point)	2-9
1769-OB16P Electronically Protected Solid-State 24V DC Output Module	2-10
1769-OF2 (Series A and B) Analog Current/Voltage Output Module (2 Channel)	2-11
1769-OV16 Solid State 24V DC Sink Output Module (16 Point)	2-12

Module Description	For I/O data definition, see:
1769-OW8 AC/DC Relay Output Module (8 Point)	2-13
1769-OW8I Individually Isolated AC/DC Relay Output Module (8 Point)	2-14
1769-OW16 AC/DC Relay Output Module (16 Point)	2-15
1769-IQ6XOW4 24V DC Sink/Source Input AC/DC Relay Output Module (6 Point In, 4 Point Out)	2-16
1769-IT6 Thermocouple/mV Input Module	2-17
1769-IR6 RTD/Resistance Input Module	2-18
1769-IF4XOF2 Combination Analog Module	2-19
1769-HSC High-Speed Counter Module	2-21

IMPORTANT These modules will **only** operate properly with Series B DeviceNet adapters: 1769-OW16, -OA16, -IF4XOF2, -HSC.

The following sections, as referenced above, give the input and output data definitions for each Compact I/O module type. Their mapping into the adapter's input and output images are dependent on their slot number and configured input and output sizes (as defined in the I/O Structure section on page 2-1).

1769-IA8I Individually Isolated 120V AC Input Module (8 Point)

Input Data

For each 1769-IA8I input module, input data word 0 contains the current state of the field input points. Bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	r	r	r	r	r	r	r	r

r = read

1769-IA16 120V ac Input Module (16 Point)

Input Data

For each 1769-IA16 input module, input data word 0 contains the current state of the field input points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

1769-IF4 (Series A and B) Analog Current/Voltage Input Module (4 Channel)

Input Data

For each 1769-IF4 input module, input data words 0-3 contain the analog value of the inputs. Word 4 and 5 contain analog status and error information.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Input Data Channel 0														
1	SGN	Analog Input Data Channel 1														
2	SGN	Analog Input Data Channel 2														
3	SGN	Analog Input Data Channel 3														
4	Not Used												S3	S2	S1	S0
5	U0	O0	U1	O1	U2	O2	U3	O3	Set to 0							

SGN= sign bit in two's format
Sx = general status bit for channels 0 through 3. This bit is set (1) when an error (over- or under-range) exists for that channel.
Ux = under-range flag bits for channels 0 through 3. These bits can be used in the control program for error detection.
Ox = over-range flag bits for channels 0 through 3. These bits can be used in the control program for error detection.

1769-IM12 240V AC Input Module (12 Point)

Input Data

For each 1769-IM12 input module, input data word 0 contains the current state of the field input points. Bits 12 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	r	r	r	r	r	r	r	r	r	r	r	r

r = read

1769-IQ16 24V DC Sink/Source Input Module (16 Point)

Input Data

For each 1769-IQ16 input module, input data word 0 contains the current state of the field input points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

1769-OA8 100 to 240V AC Solid State Output Module (8 Point)

Output Data

For each 1769-OA8 module, output data word 0 contains the control program's directed state of the discrete output points. Bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OA8 module, input data word 0 contains the state of the module's output data (output data echo) word 0. During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode (Hold Last or User-Defined Safe State) configuration
- Fault Mode (Hold Last or User-Defined Safe State) configuration

For the 1769-OA8, input data word 0 bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OA16 100 to 240V AC Solid State Output Module (16 Point)

Output Data File

Data output bits are turned on or off using the bit positions in Word 0.

1 = output on

0 = output off

Example: To turn on bit position 12, type 1 in Word 0, Bit 12.

For each module, slot x, word 0 in the output data file contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write

Output Module's Input Data File

For each module, slot x, input data file word 0 contains the state of the module's output data (output data echo) file word 0. During normal operation, these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (if supported by the controller)
- The Fault Mode configuration (if supported by the controller)

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data file reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

It is important to use this input word if the controller adapter supports the Program Mode or Fault Mode function, and if it is configured to use them.

1769-OB16 Solid State 24V DC Source Output Module (16 Point)

Output Data

For each 1769-OB16 module, output data word 0 contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OB16 module, input data word 0 contains the state of the module's output data (output data echo) word 0. During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode (Hold Last or User-Defined Safe State) configuration
- Fault Mode (Hold Last or User-Defined Safe State) configuration

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OB16P Electronically Protected Solid-State 24V DC Output Module

Output Data

For each 1769-OB16P module, output data word 0 contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OB16P module, input data word 0 contains the state of the module's output data (output data echo) word 0. During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode (Hold Last or User-Defined Safe State) configuration
- Fault Mode (Hold Last or User-Defined Safe State) configuration

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OF2 (Series A and B) Analog Current/Voltage Output Module (2 Channel)

Output Data

For each 1769-OF2 module, output data words 0 and 1 contain the channel 0 and channel 1 output data.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Output Data Channel 0														
1	SGN	Analog Output Data Channel 1														

SGN= sign bit in two's compliment format

Input Data

For each 1769-OF2 module, input data words 0-1 contain analog status and error information. Input data words 2-3 contain the state of the module's output data (output data echo) words 0-1. During normal operation (controller in Run), these input words represent the analog values that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (Hold Last or User-Defined Safe State)
- Fault Mode configuration (Hold Last or User-Defined Safe State)

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	D0	H0	D1	H1	Not Used (Bits set to 0)										S1	S0
1	U0	O0	U1	O1	Bits set to 0											
2	SGN	Output Data Loopback/Echo Channel 0														
3	SGN	Output Data Loopback/Echo Channel 1														

SGN= sign bit in two's format
Sx = general status bits. When set, these bits indicate an error (over-range, under-range, or diagnostic bit) associated with that channel or a module hardware error.
Ux = under-range flag bits
Ox = over-range flag bits
Dx = diagnostic bits. When set, they indicate a broken output wire or high load resistance (not used on voltage outputs).
Hx = hold last state bits. When set, they indicate that the channel is in a hold last state condition.

IMPORTANT The output module's input data reflects the analog output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OV16 Solid State 24V DC Sink Output Module (16 Point)

Output Data

For each 1769-OV16 module, output data word 0 contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OV16 module, input data word 0 contains the state of the module's output data (output data echo) word 0. During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (Hold Last or User-Defined Safe State)
- Fault Mode configuration (Hold Last or User-Defined Safe State)

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OW8 AC/DC Relay Output Module (8 Point)

Output Data

For each 1769-OW8 module, output data word 0 contains the control program's directed state of the discrete output points. Bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OW8 module, input data word 0 contains the state of the module's output data (output data echo). During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (Hold Last or User-Defined Safe State)
- Fault Mode configuration (Hold Last or User-Defined Safe State)

For the 1769-OW8, input data word 0 bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OW8I Individually Isolated AC/DC Relay Output Module (8 Point)

Output Data

For each 1769-OW8I module, output data word 0 contains the control program's directed state of the discrete output points. Bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	w	w	w	w	w	w	w	w

w = write

Input Data

For each 1769-OW8I module, input data word 0 contains the state of the module's output data (output data echo). During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (Hold Last or User-Defined Safe State)
- Fault Mode configuration (Hold Last or User-Defined Safe State)

For the 1769-OW8I, input data word 0 bits 8 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	r	r	r	r	r	r	r	r

r = read

IMPORTANT The output module's input data reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-OW16 AC/DC Relay Output Module (16 Point)

Output Data File

Data output bits are turned on or off using the bit positions in Word 0.

1 = output on

0 = output off

Example: To turn on bit position 12, type 1 in Word 0, Bit 12.

For each module, slot x, word 0 in the output data file contains the control program's directed state of the discrete output points.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

w = write only

Output Module's Input Data File

For each module, slot x, input data file word 0 contains the state of the module's output data (output data echo) file word 0. During normal operation, these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (if supported by the controller)
- The Fault Mode configuration (if supported by the controller).

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

r = read only

IMPORTANT The output module's input data file reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

It is important to use this input word if the controller adapter supports the Program Mode or Fault Mode function, and if it is configured to use them.

1769-IQ6XOW4 24V DC Sink/Source Input AC/DC Relay Output Module (6 Point In, 4 Point Out)

Output Data

For each 1769-IQ6XOW4 module, output data word 0 contains the control program's directed state of the discrete output points. Bits 4 to 15 are not used.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	w	w	w	w

w = write

Input Data

For each 1769-IQ6XOW4 module, input data word 0 contains the current state of the field input points. Input data word 1 contains the state of the module's output data (output data echo). During normal operation (controller in Run), these input bits represent the logic state that the outputs are directed to by the control program. They are also dependent upon the:

- Program Mode configuration (Hold Last or User-Defined Safe State)
- Fault Mode configuration (Hold Last or User-Defined Safe State)

For the 1769-IQ6XOW4, input data word 0 bits 6 to 15 are not used.

Word	Bit Position																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	r	r	r	r	r	r	real inputs
1	0	0	0	0	0	0	0	0	0	0	0	0	r	r	r	r	output data echo

r = read

IMPORTANT Input data word 1 reflects the output data echo of the module, not necessarily the electrical state of the output terminals. It does not reflect shorted or open outputs.

1769-IT6 Thermocouple/mV Input Module

Input Data

The input data file contains the analog values of the inputs.

Word	Bit Position															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Analog Input Data Channel 0															
1	Analog Input Data Channel 1															
2	Analog Input Data Channel 2															
3	Analog Input Data Channel 3															
4	Analog Input Data Channel 4															
5	Analog Input Data Channel 5															
6	OC7	OC6	OC5	OC4	OC3	OC2	OC1	OC0	S7	S6	S5	S4	S3	S2	S1	S0
7	U0	O0	U1	U0	U2	O2	U3	O3	U4	O4	U5	O5	U6	O6	U7	O7

Sx = General status bit for channels 0-5 and CJC sensors (S6 and S7). This bit is set (1) when an error (over-range, under-range, open-circuit, or input data not valid) exists for that channel. An input data not valid condition is determined by the user program. This condition occurs when the first analog-to-digital conversion is still in progress, after a new configuration has been sent to the module. Refer to the *Compact™ I/O Thermocouple/mV Input Module User Manual*, publication 1769-UM004A-EN-P for additional details.

OCx = Open circuit detection bits indicate an open input circuit on channels 0-5 (OC0 - OC5) and on CJC sensors CJC0 (OC6) and CJC1 (OC7). The bit is set (1) when an open-circuit condition exists.

Ux = Under-range flag bits for channels 0-5 and the CJC sensors (U6 and U7). For thermocouple inputs, the under-range bit is set (1) when a temperature measurement is below the normal operating range for a given thermocouple type. For millivolt inputs, the under-range bit indicates a voltage that is below the normal operating range. These bits can be used in the control program for error detection. The bits are reset (0) by the module when within the normal operating range.

Ox = Over-range flag bits for channels 0-5 and the CJC sensors (O6 and O7). For thermocouple inputs, the over-range bit is set (1) when a temperature measurement is above the normal operating range for a given thermocouple type. For millivolt inputs, the over-range bit indicates a voltage that is above the normal operating range. These bits can be used in the control program for error detection.

1769-IR6 RTD/Resistance Input Module

Input Data

The first six words (0 to 5) of the input data file contain the analog RTD or resistance values of the inputs. Words 6 and 7 provide sensor/channel status feedback for use in your control program as shown below.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	RTD/Resistance Input Data Channel 0															
1	RTD/Resistance Input Data Channel 1															
2	RTD/Resistance Input Data Channel 2															
3	RTD/Resistance Input Data Channel 3															
4	RTD/Resistance Input Data Channel 4															
5	RTD/Resistance Input Data Channel 5															
6	Not Used		OC5	OC4	OC3	OC2	OC1	OC0	Not Used		S5	S4	S3	S2	S1	S0
7	U0	O0	U1	O1	U2	O2	U3	O3	U4	O4	U5	O5	Not Used			

Sx = General status bit for channels 0-5. This bit is set (1) when an error (over-range, under-range, open-circuit, or input data not valid) exists for that channel. An input data not valid condition is determined by the user program. This condition occurs when the first analog-to-digital conversion is still in progress, after a new configuration has been sent to the module. Refer to the *Compact™ I/O RTD/Resistance Input Module User Manual*, publication 1769-UM005A-EN-P for additional details.

OCx = Open circuit detection bits indicate an open input circuit on channels 0-5 (OC0 - OC5). The bit is set (1) when either an open or shorted input for RTD inputs or an open input for resistance inputs is detected. **Short-circuit detection for resistance inputs is not indicated because 0 is a valid number.**

Ux = Under-range flag bits for channels 0-5, using RTD inputs only. These bits can be used in the control program for error detection. There is no under-range error for a direct resistance input, because 0 is a valid number.

Ox = Over-range flag bits for channels 0-5, using either RTD or resistance inputs. These bits can be used in the control program for error detection.

1769-IF4XOF2 Combination Analog Module

Input Data

The input data file provides access to input data for use in the control program, over-range indication for the input and output channels, and output data feedback as described below.

IMPORTANT Input words 6 and 7 contain the Output Data Echo/Loopback information for output channels 0 and 1 respectively. Bits 0 through 6 and bit 15 or words 6 and 7 should always be set to zero in your control program. If they are not set to 0, the invalid data flag (Ex) will be set for that channel by the module. However, the channel will continue to operate with the previously converted value.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Input Data Channel 0								0	0	0	0	0	0	0
1	SGN	Analog Input Data Channel 1								0	0	0	0	0	0	0
2	SGN	Analog Input Data Channel 2								0	0	0	0	0	0	0
3	SGN	Analog Input Data Channel 3								0	0	0	0	0	0	0
4	Not Used[1]												I3	I2	I1	I0
5	Not Used	H0	Not Used	H1	Not Used[1]								E1	E0	O1	O0
6	SGN	Output Data Echo/Loopback for Output Channel 0								0	0	0	0	0	0	0
7	SGN	Output Data Echo/Loopback for Output Channel 1								0	0	0	0	0	0	0

1 All unused bits are set to 0 by the module.

SGN = Sign bit in two's complement format. Always positive (equal to zero) for the 1769-IF4XOF2 module.

Ix = Over-range flag bits for input channels 0 through 3. These bits can be used in the control program for error detection. When set to 1, the bits signal that the input signal is outside the normal operating range. However, the module continues to convert analog data to the maximum full-range value. When the over-range condition is cleared, the bits are automatically reset (0).

Ox = Word 5, bits 0 and 1, provide over-range indication for output channels 0 and 1. These bits can be used in the control program for error detection. When set to 1, the bits signal that the output signal is outside the normal operating range. However, the module continues to convert analog data to the maximum full-range value. When the over-range condition is cleared, the bits are automatically reset (0). **Under-range indication is not provided because zero is a valid number.**

Ex = When set (1), this bit indicates that invalid data (e.g. the value sent by the controller is outside the standard output range or increment; e.g. 128, 256, etc.) has been set in the output data bits 0 through 6, or the sign bit (15).

Hx = Hold Last State bits. When set (1), these bits indicate that the channel is in a Hold Last State condition.

Words 6 and 7 = These words reflect the analog output data echo of the analog value being converted by the digital/analog converter, not necessarily the electrical state of the output terminals. They do not reflect shorted or open outputs.

It is only important to use the loopback function of input words 6 and 7 if the controller supports the Program Mode or Fault Mode functions, and if it is configured to use them.

Output Data

The output data file applies only to output data from the module as shown in the table below.

IMPORTANT Bits 0 through 6 and bit 15 of output data words 0 and 1 should always be set to zero in your control program. If they are not set to 0, the invalid data flag (Ex) will be set for that channel. However, the channel will continue to operate with the previously converted value. If a MVM (Move with Mask) instruction is used with a mask of 7F80 (hexidecimal) to move data to the output words, writing to bits 0 through 6 and bit 15 can be avoided.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Output Data Channel 0								0	0	0	0	0	0	0
1	SGN	Analog Output Data Channel 1								0	0	0	0	0	0	0

SGN = Sign bit in two's complement format. Always positive (equal to zero) for the 1769-IF4XOF2 module.

1769-HSC High-Speed Counter Module

Output Array

The Output Array, which consists of 34 words, allows you to access the module's real-time output data to control the module. The default value is all zeros.

IMPORTANT The Output Array contains dynamic configuration data. The settings in the Output Array must be compatible with the settings in the Configuration Array.

For example, do not attempt to set Counter Control Bits for a given counter in the Output Array unless NumberOfCounters in the Configuration Array indicates that the counter is declared to be used.

IMPORTANT All *Not Used* bits (shaded in the table below) must be set to 0 or the InvalidOutput bit in the Input Array will be set. When the InvalidOutput bit is set, the entire Output Array is rejected until an Output Array that does not have this error is sent.

Word	Bit																Function
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	Out 15	Out 14	Out 13	Out 12	Out 11	Out 10	Out 9	Out 8	Out 7	Out 6	Out 5	Out 4	Out 3	Out 2	Out 1	Out 0	Output On Mask
1	Out 15	Out 14	Out 13	Out 12	Out 11	Out 10	Out 9	Out 8	Out 7	Out 6	Out 5	Out 4	Out 3	Out 2	Out 1	Out 0	Output Off Mask
2	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	Range Enable
3	Not Used																Not Used
4	Not Used								RBF	Not Used							Reset Blown Fuse
5	Not Used						RPW	RREZ	Z Inh	Z Inv	D Inh	D Inv	RU	RO	SP	En	Counter 0 Control Bits
6	Not Used						RPW	RREZ	Z Inh	Z Inv	D Inh	D Inv	RU	RO	SP	En	Counter 1 Control Bits
7	Not Used						RPW	Not Used				D Inv	RU	RO	SP	En	Counter 2 Control Bits
8	Not Used						RPW	Not Used				D Inv	RU	RO	SP	En	Counter 3 Control Bits
9	Not Used																Not Used
10 11	Range12To15[0].HiLimOrDirWr																Range High Limit or Direct Write Value
12 13	Range12To15[0].LowLimit																Range Low Limit
14	Range12To15[0].OutputControl																Range Output Control
15	Not Used							Inv	Not Used		LDW	Type	Not Used		ToThisCtr		Range Configuration Flags
16 17	Range12To15[1].HiLimOrDirWr																Range High Limit or Direct Write Value
18 19	Range12To15[1].LowLimit																Range Low Limit

Word	Bit																Function
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
20	Range12To15[1].OutputControl																Range Output Control
21	Not Used							Inv	Not Used		LDW	Type	Not Used		ToThisCtr		Range Configuration Flags
22	Range12To15[2].HiLimOrDirWr																Range High Limit or Direct Write Value
23																	
24	Range12To15[2].LowLimit																Range Low Limit
25																	
26	Range12To15[2].OutputControl																Range Output Control
27	Not Used							Inv	Not Used		LDW	Type	Not Used		ToThisCtr		Range Configuration Flags
28	Range12To15[3].HiLimOrDirWr																Range High Limit or Direct Write Value
29																	
30	Range12To15[3].LowLimit																Range Low Limit
31																	
32	Range12To15[3].OutputControl																Range Output Control
33	Not Used							Inv	Not Used		LDW	Type	Not Used		ToThisCtr		Range Configuration Flags

Input Array

The Input Array, which consists of 35 words, allows read-only access to the module's input data via word and bit access.The Input Array is described below. The functions are described in more detail in the sections following the table.

IMPORTANT During the non-run states (program and fault), the module continues to update the Input Array (continues counting, etc). Depending on the bus master, you may not see this.

TIP Status bits for a particular counter reflect the configuration settings for that counter. To receive valid status, the counter must be enabled and the module must have stored a valid configuration for that counter.

Word	Bit																Function
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
0	Not Used										Z1	B1	A1	Z0	B0	A0	Input State
1	Readback.0 through Readback.15																Readback
2	InvalidRangeLimit12 through InvalidRangeLimit15				InvalidCtrAssignToRange12 through InvalidCtrAssignToRange15				Gen Error	Invalid Output	Mod Config	Not Used	Out0Overcurrent through Out3Overcurrent				Status Flags

Word	Bit																Function
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
3	RangeActive.0 through RangeActive.15																Range Active
4	Ctr[0].CurrentCount																Counter 0 Current Count
5																	
6	Ctr[0].StoredCount																Counter 0 Stored Count
7																	
8	Ctr[0].CurrentRate																Counter 0 Current Rate
9																	
10	Ctr[0].PulseInterval																Counter 0 Pulse Interval
11																	
12	Not Used									C0PW	RV	Not Used	IDW	REZ	CUdf	COvf	Counter 0 Status Flags
13	Not Used																Not Used
14	Ctr[1].CurrentCount																Counter 1 Current Count
15																	
16	Ctr[1].StoredCount																Counter 1 Stored Count
17																	
18	Ctr[1].CurrentRate																Counter 1 Current Rate
19																	
20	Ctr[1].PulseInterval																Counter 1 Pulse Interval
21																	
22	Not Used									C1PW	RV	IC	IDW	REZ	CUdf	COvf	Counter 1 Status Flags
23	Not Used																Not Used
24	Ctr[2].CurrentCount																Counter 2 Current Count
25																	
26	Ctr[2].CurrentRate																Counter 2 Current Rate
27																	
28	Not Used									C2PW	RV	IC	IDW	Not Used	CUdf	COvf	Counter 2 Status Flags
29	Not Used																Not Used
30	Ctr[3].CurrentCount																Counter 3 Current Count
31																	
32	Ctr[3].CurrentRate																Counter 3 Current Rate
33																	
34	Not Used									C3PW	RV	IC	IDW	Not Used	CUdf	COvf	Counter 3 Status Flags

Defaults

Factory defaults are the values assigned when you:

- first power up the system, and
- no previous user-programmed stored settings have been applied

Each I/O module has default values associated with it.

Module defaults for I/O size:	Factory defaults (words)		Real time setting (words)	
Description	**Input**	**Output**	**Input**	**Output**
1769-IA8I Individually Isolated 120V AC Input Module (8 Point)	1	0	1	0
1769-IA16 120V ac Input Module (16 Point)	1	0	1	0
1769-IF4 (Series A and B) Analog Current/Voltage Input Module (4 Channel)	6	0	4	0
1769-IM12 240V AC Input Module (12 Point)	1	0	1	0
1769-IQ16 24V DC Sink/Source Input Module (16 Point)	1	0	1	0
1769-OA8 100 to 240V AC Solid State Output Module (8 Point)	1	1	0	1
1769-OA16 100 to 240V AC Solid State Output Module (16 Point)	1	1	0	1
1769-OA16 100 to 240V AC Solid State Output Module (16 Point)	1	1	0	1
1769-OB16P Electronically Protected Solid-State 24V DC Output Module	1	1	0	1
1769-OF2 (Series A and B) Analog Current/Voltage Output Module (2 Channel)	4	2	0	2
1769-OV16 Solid State 24V DC Sink Output Module (16 Point)	1	1	0	1
1769-OW8 AC/DC Relay Output Module (8 Point)	1	1	0	1
1769-OW8I Individually Isolated AC/DC Relay Output Module (8 Point)	1	1	0	1
1769-OW16 AC/DC Relay Output Module (16 Point)	1	1	0	1
1769-OW16 AC/DC Relay Output Module (16 Point)	2	1	1	1
1769-IT6 Thermocouple/mV Input Module	8	2	4	2

Module defaults for I/O size:	Factory defaults (words)		Real time setting (words)	
Description	**Input**	**Output**	**Input**	**Output**
1769-IR6 RTD/Resistance Input Module	8	0	6	0
1769-IF4XOF2 Combination Analog Module	8	0	6	0
1769-HSC High-Speed Counter Module	35	34	35	34

Factory defaults (for size) set I/O sizes to the maximum amount of I/O data for a module to provide maximum functionality. You can change the I/O data size for a module by reducing the number of words mapped into the adapter module.

The real-time settings option provides optimal real time data to and from the I/O module over the network. You need a software configuration tool to change the size. The real time settings provide the fastest network time by only mapping the points or channels for the I/O modules. Status and output echo information, if available in the input data from a module, is not included.

The software configuration tool selects the factory defaults as default values when a module is added to the configuration.

Factory default for the adapter (out-of-the-box configuration) is no devices in the Compact I/O system. Until the Compact I/O system is configured with the software, no I/O connections can be made. For more information, refer to *Configuring Your Compact I/O Series A DeviceNet Adapter* in Chapter 3 or *Configuring Your Compact I/O Series B DeviceNet Adapter* in Chapter 4.

Notes:

Configuring Your Compact I/O Series A DeviceNet Adapter

Read this chapter to configure your Series A DeviceNet adapter. Included is information about:

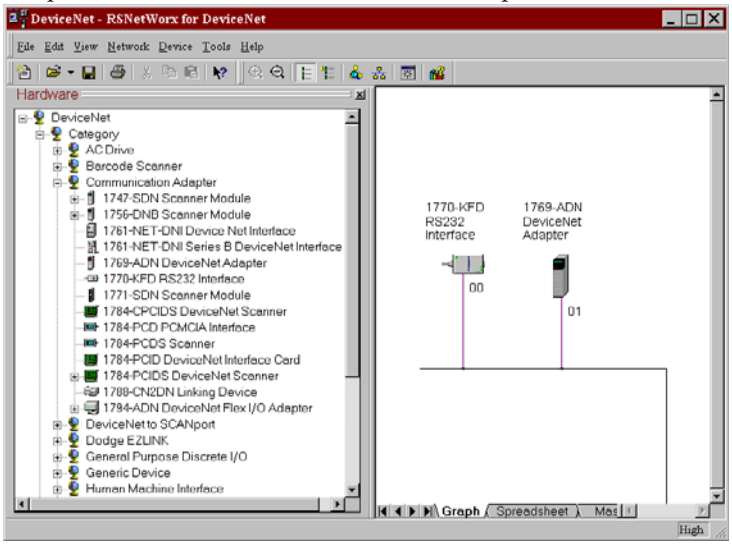
- Adding Your Series A DeviceNet Adapter Offline
- Configuring Your Compact I/O System Offline
- Using Banks of I/O
- Configuring Your Compact I/O System Online

About RSNetworx

RSNetworx for DeviceNet is the software tool used to configure your Compact I/O Series A DeviceNet adapter and its related modules. This software tool can be connected to the adapter via the DeviceNet network.

Adding Your Series A DeviceNet Adapter Offline

To add a Series A 1769-ADN adapter offline, double-click (or drag and drop) on the 1769-ADN DeviceNet Adapter selection on the left.



Notice that the adapter now appears on your network on the right.

TIP

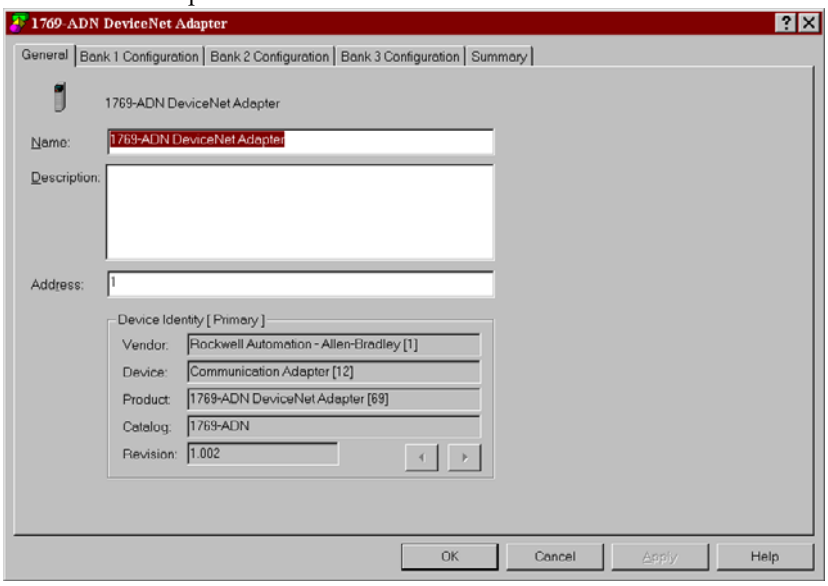
When selecting the adapter from the hardware tree, be sure to drill-down to the Major Revision 1 icon within RSNetWorx, version 4.00 or later. A Major Revision 2 adapter will be added by selecting the "1769-ADN DeviceNet Adapter" top-level option within RSNetWorx, version 4.00 or later.

Configuring Your Compact I/O System Offline

Now that you've added the 1769-ADN DeviceNet adapter offline, you'll need to configure the adapter and all of the devices in the 1769 I/O system.

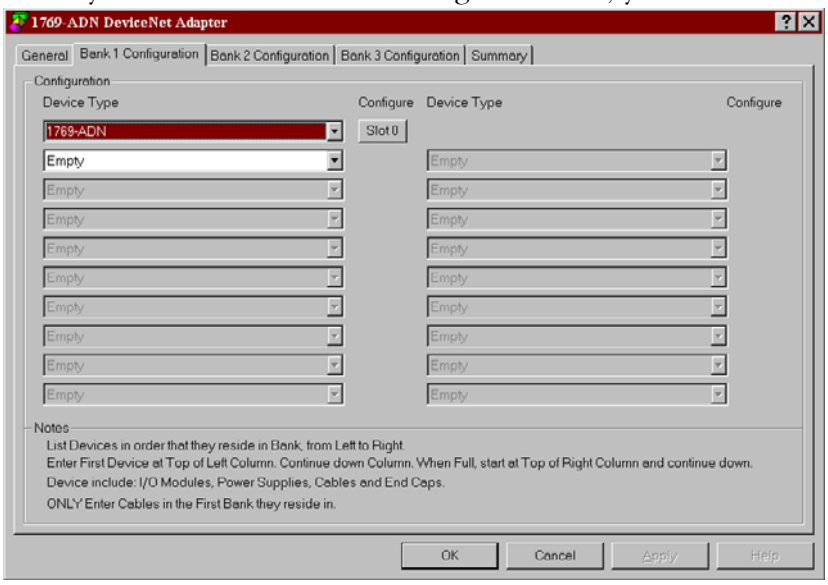
Configuring Your Series A Adapter

You'll see this screen when you double-click on the 1769-ADN DeviceNet adapter icon.



You can add a description, alter the node address, and view the device identity information.

When you choose the Bank 1 Configuration tab, you'll see this screen.



Follow these guidelines when listing devices:

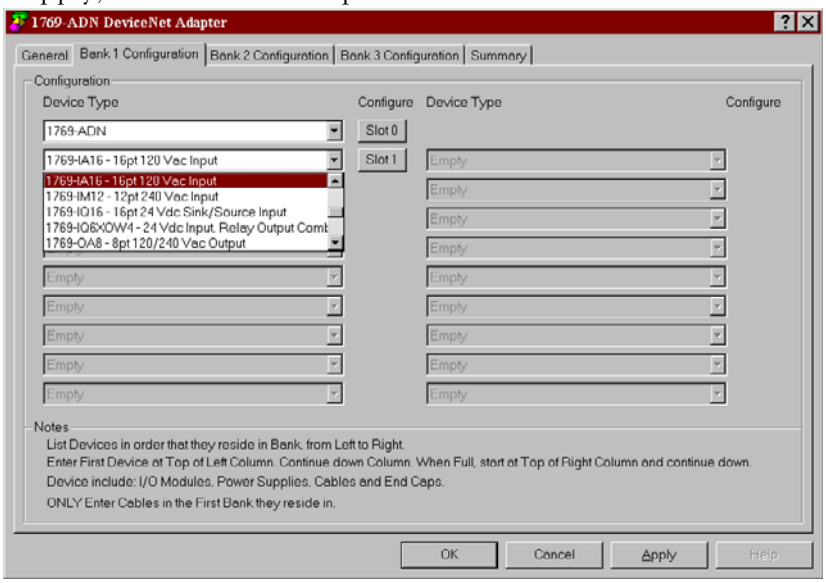
- List devices in the order in which they reside in the bank, from left to right.

  Note: The Series A adapter must be in slot 0 of bank 1.

- Only enter cables in the first bank they reside in.
- Be sure to enter all devices in their proper location, including power supplies, cables, and the end cap.
- Refer to the Configuration Rules for the Series A Adapter on page 3-7.

Follow these directions to add each module, power supply, cable, and end cap to Bank 1.

1. In the field labelled “Empty”, choose your module, power supply, or cable from the pull-down menu.

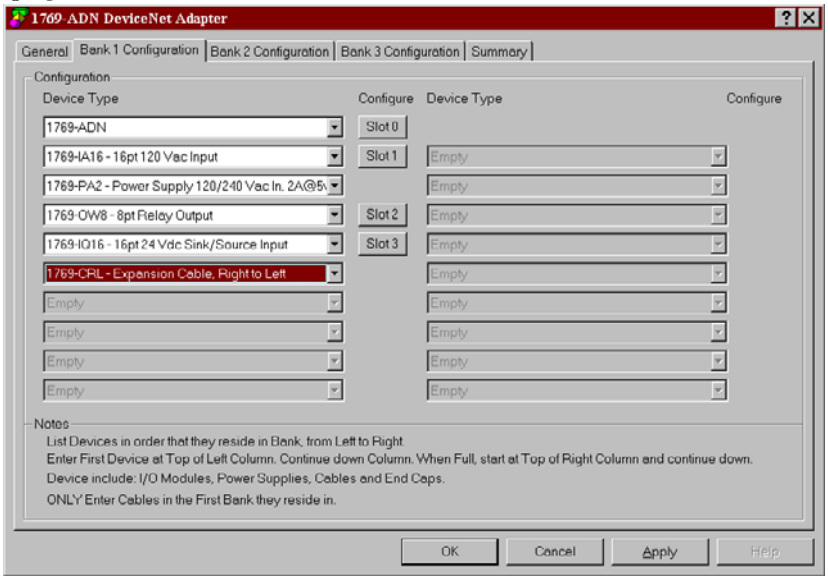


   Notice that this field is now called Slot 1 if an I/O module was selected. This slot-numbering scheme will continue for each I/O module you add to the configuration.

   Note: Power supplies and cable are not assigned slot numbers.

2. Continue to list your devices down the left column and continue at the top right column if necessary.

   Note: To limit the need to reconfigure, make sure you understand the Configuration Rules for the Series A Adapter on page 3-7.



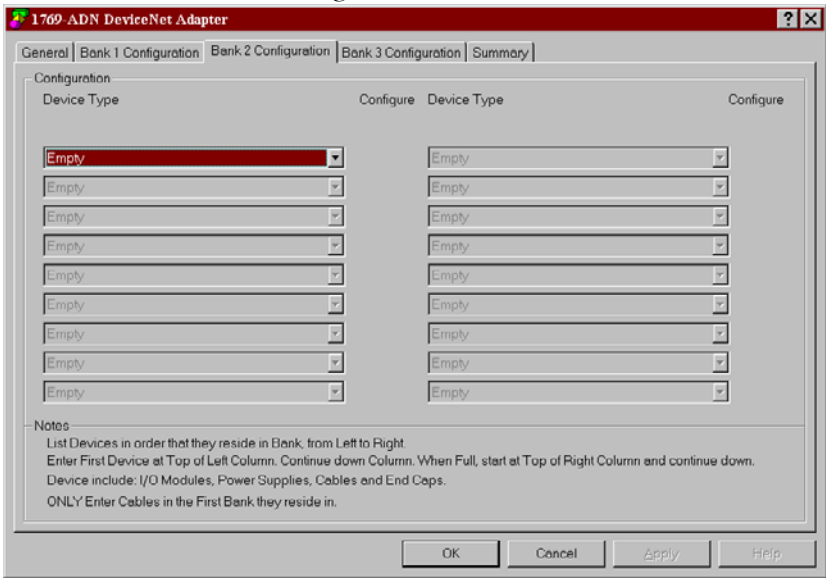
   Notice that only I/O modules are assigned Slot numbers.

3. Once you've listed all of the devices for Bank 1, go on to Bank 2 if necessary.

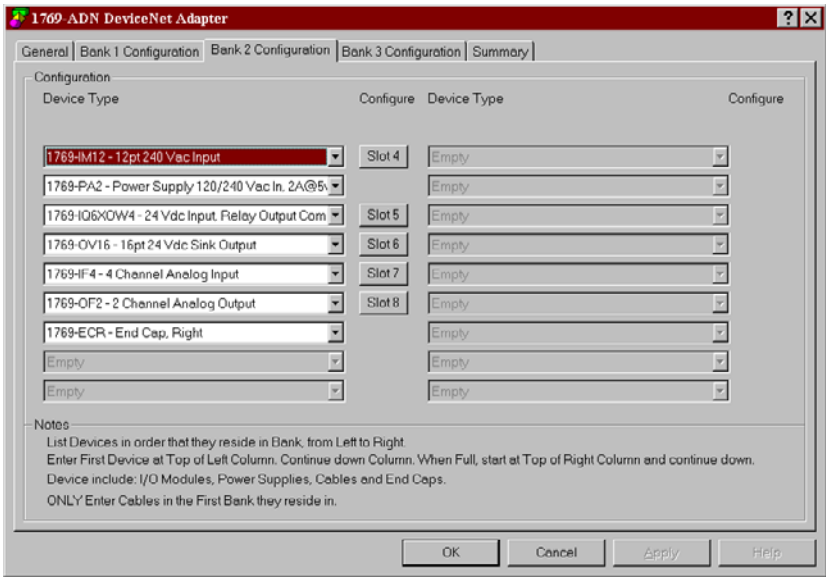
   Note: A second I/O bank may be necessary if your bank 1 power supply has an insufficient power budget for the I/O modules required for your application.

   Note: Make sure your bank-to-bank expansion cable (e.g. 1769-CRR1) is in the last component of bank 1.

4. Choose the Bank 2 Configuration tab.



5. List all of your devices in bank 2 following the same guidelines as for Bank 1.



6. If you have three banks, choose the Bank 3 Configuration tab and follow the same guidelines as for Bank 1 and/or Bank 2.

7. Make sure that the last bank of the node is an end cap/terminator (1769-ECR or 1769-ECL).

   For information on 1769 bus configuration rules, refer to Configuration Rules for the Series A Adapter on page 3-7.

8. Choose Apply to be sure that your system passes the electrical audit.

9. After defining the devices on this 1769-ADN node, refer to the

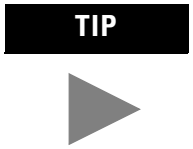
relevant sections on pages 3-9 to 3-20 to configure each 1769 I/O module.

10. Once all of the I/O modules are configured, choose OK.

11. From the File menu, choose Save.

12. Go on-line.

13. Select the adapter you wish to modify and download your changes to make them go into affect.



If your selected adapter is in a scanner's scanlist, you will have to deactivate it's entry in the scanlist before the download will succeed.

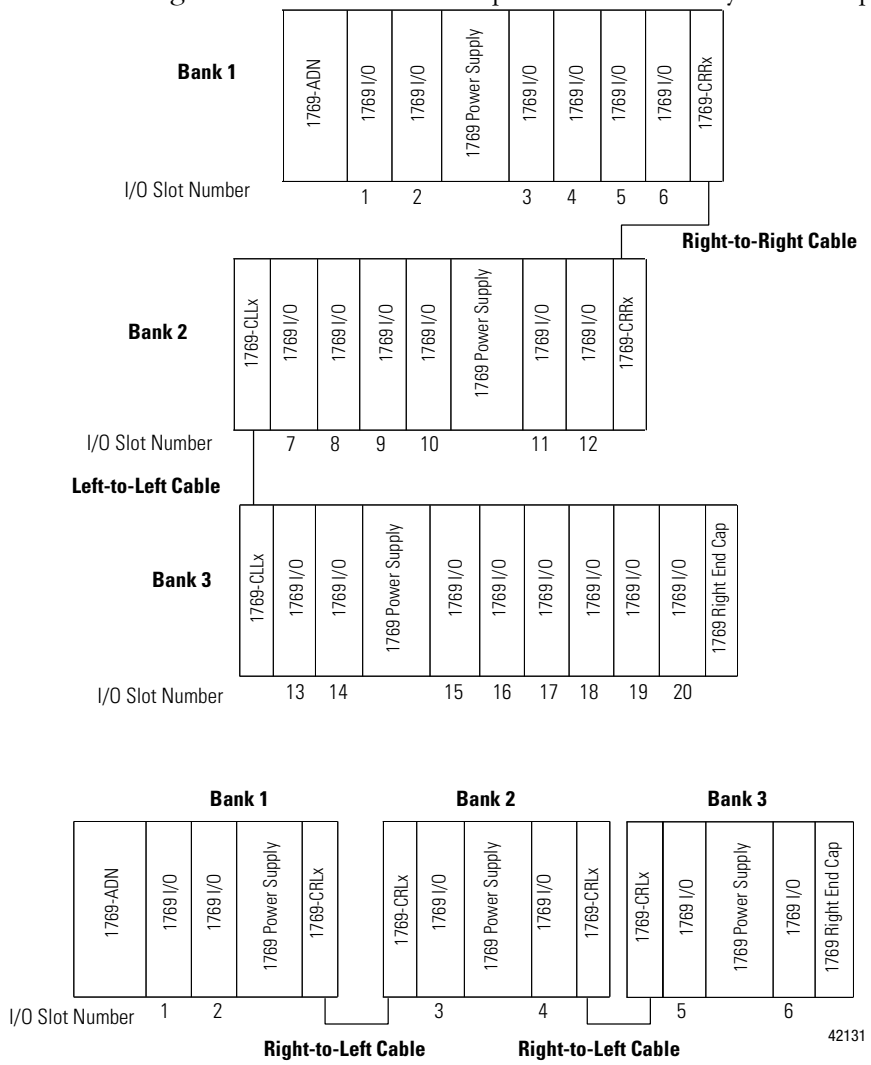
Using Banks of I/O

Configuration Rules for the Series A Adapter

- The Series A adapter must be the first and left-most module in the system (the first module of Bank 1).
- The Series a adapter can communicate with up to 30 modules in a system.
- Each bank of I/O must have its own power supply.
- A bank of I/O can have a maximum of 16 modules with a maximum of eight on either side of the power supply, depending upon module loading on the supply.
- A 1769 I/O power supply has limits in the amount of +5V dc and +24V dc current it can supply to the modules in its I/O bank. These limits depend on the catalog number (e.g. 1769-PA2) of the supply. A bank of modules should not exceed the current limits of the I/O bank power supply. Refer to the *Compact 1769 Expansion I/O Power Supplies Installation Instructions*, publication 1769-5.14.
- The maximum amount of current each bank supports in one direction (either side of the power supply) is: 2A @ 5V dc, 1A @ 24V dc.
- If another bank of I/O is required, use a bus communication expansion cable (e.g. 1769-CRL) to link them together. You can have a maximum of three banks of I/O connected with up to two communication expansion cables.
- Each module type has its own distance rating (the number of modules from the power supply). Each module must be within this rating for its type.
- The Series A adapter has a distance rating of four, therefore the adapter must be within four modules of the power supply.
- The Series A adapter supports a total of:
  - 180 words of input data from the I/O modules.
  - 180 words of output data for the I/O modules.
  - 724 words of configuration data for the I/O modules.
- An end cap/terminator must be on the last I/O bank.

Example Configurations

The following illustrations show examples of two valid system setups.

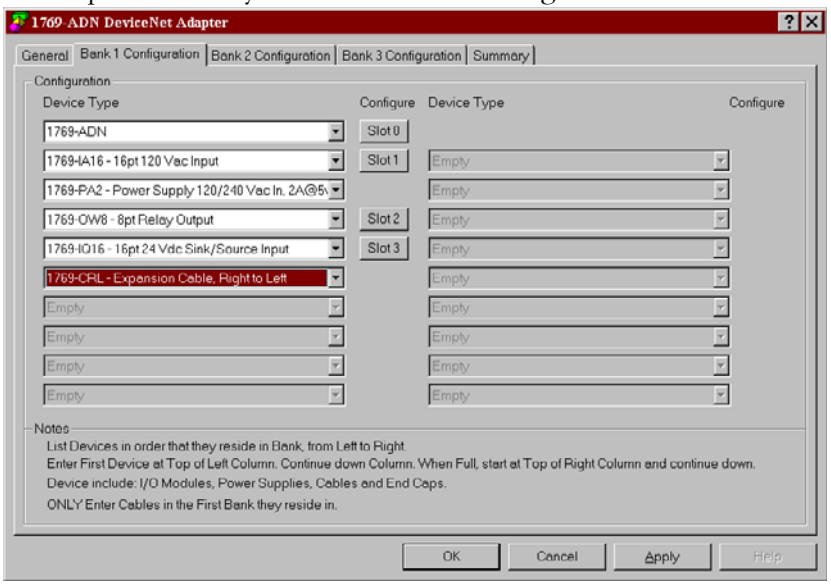


NOTE: I/O modules are not required between either the Series a adapter and an end cap or between the power supply and an end cap.

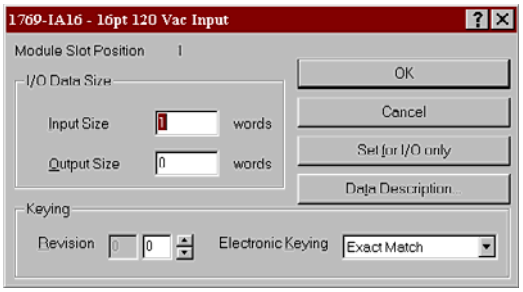
Configuring Discrete Input Modules

Follow these guidelines to configure discrete input modules.

1. From the Bank Configuration tab, click on the slot number of the input module you would like to configure.



You'll see a screen similar to this.



2. To change the input or output size, enter the new word value in the appropriate field.

   If you enter a non-valid number for a particular module, you will see a screen with a range of valid numbers.

3. To change the revision key, enter a new revision value in the field marked revision.

   Note: 0 is not a valid revision number.

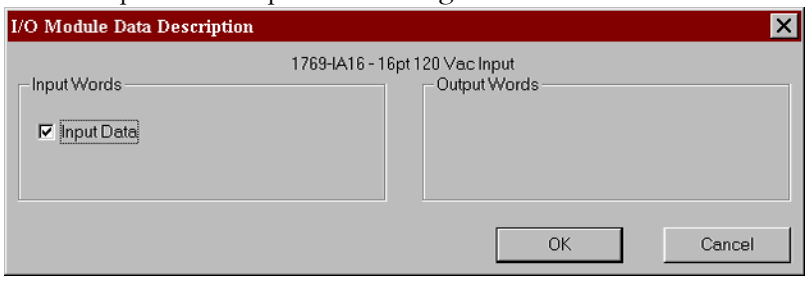
   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

4. You may choose from the pull-down menu to change the electronic keying to exact match, compatible module, or disable keying.
   - **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
   - **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
   - **Disable**: Any module may be used as a replacement.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

5. If desired, choose **Set for I/O Only** to automatically modify the input/output data sizes to real time settings and the other configuration data to their default values.

6. If desired, choose **Data Description** to view the data definitions of each input and output word assigned to the module.



7. To remove specific words/functions, uncheck the appropriate box and choose **OK** on the Data Description screen.

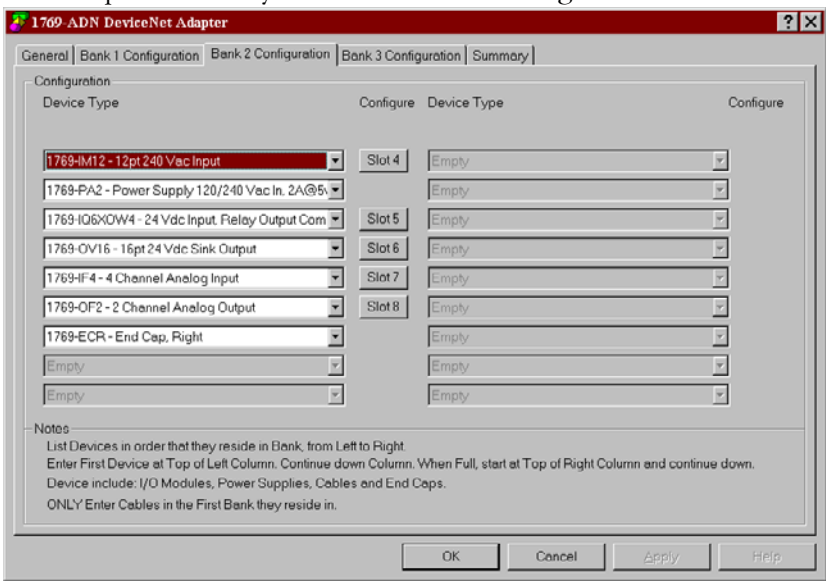
8. To apply the specific words/functions, check the appropriate box and choose **OK** on the Data Description screen.

9. Once you've finished making your changes, you may choose **OK** from the I/O Module screen to return to the Bank Configuration screen.

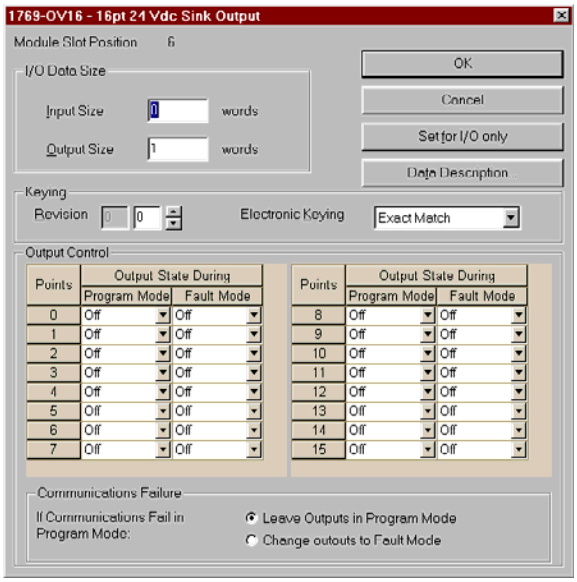
Configuring Discrete Output Modules

Follow these guidelines to configure discrete output modules.

1. From the Bank Configuration tab, click on the slot number of the output module you would like to configure.



You'll see a screen similar to this.



2. To change the input or output size, enter the new word value in the appropriate field.

   If you enter a non-valid number for a particular module, you will see a screen with a range of valid numbers.

3. To change the revision key, enter a new revision value in the field marked revision.

   Note: 0 is not a valid revision number.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

4. You may choose from the pull-down menu to change the electronic keying to exact match, compatible module, or disable keying.
   - **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
   - **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
   - **Disable**: Any module may be used as a replacement.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

5. To change the program and/or fault mode operation (on/off/hold) of an individual point, use the pull-down menu tab and choose **ON**, **OFF**, or **HOLD**.

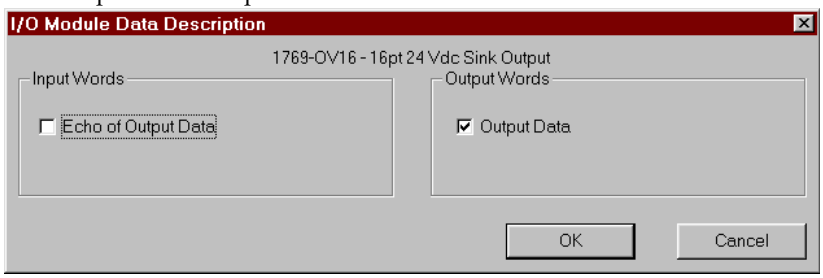
   The communication failure box at the bottom of the screen allows you to change how the outputs react if the system is in program mode and a communication failure/fault occurs.

   Use the radio buttons to choose to leave the outputs in program mode or to change the outputs to fault mode.

   The default is to leave the outputs in program mode.

6. If desired, choose **Set for I/O Only** to automatically modify the input/output sizes to real time size defaults and the other configuration data to their default values.

7. If desired, choose **Data Description** to view the definitions of each input and output word.



8. To remove specific words/functions, uncheck the appropriate box and choose **OK**.

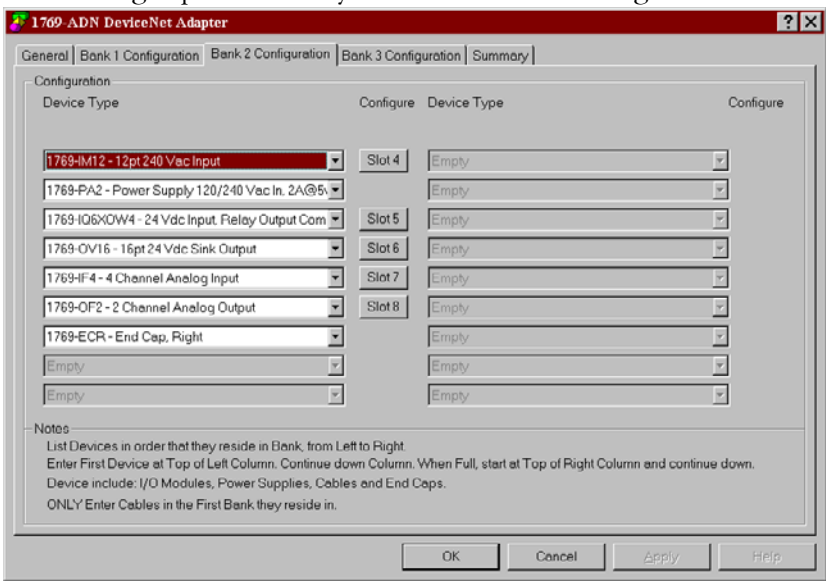
9. To apply the specific words/functions, check the appropriate box and choose **OK**.

10. Once you've finished making your changes, you may choose **OK** from the I/O Module screen to return to the Bank Configuration screen.

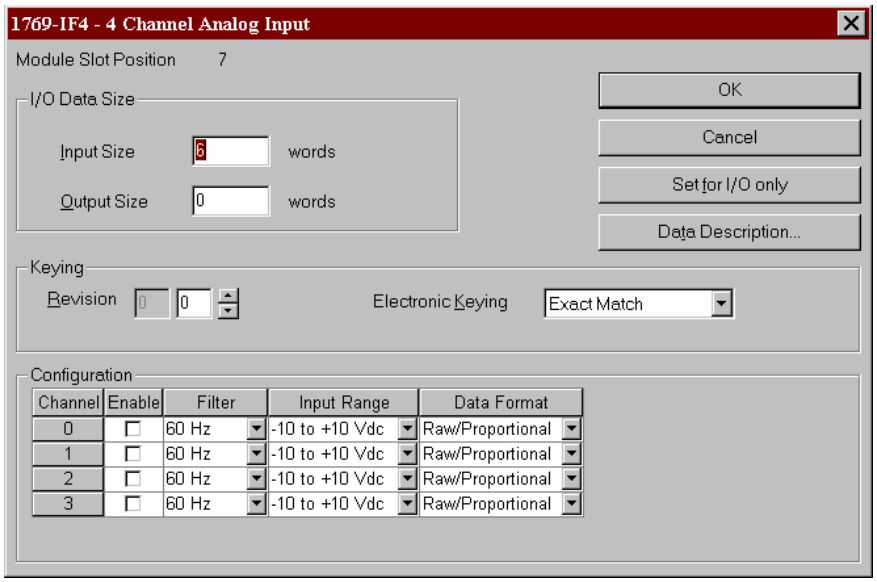
Configuring Analog Input Modules

Follow these guidelines to configure analog input modules.

1. From the Bank Configuration tab, click on the slot number of the analog input module you would like to configure.



You'll see a screen similar to this.



2. To change the input or output size, enter the new word value in the appropriate field.

   If you enter a non-valid number for a particular module, you will see a screen with a range of valid numbers.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

3. To change the revision key, enter a new revision value in the field marked revision.

Note: 0 is not a valid revision number.

Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

4. You may choose from the pull-down menu to change the electronic keying to exact match, compatible module, or disable keying.

- **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual configuration.
- **Compatible Module**: The programmed module type must match the actual configuration, but the revision of the actual configuration can be equal or greater than the programmed configuration.
- **Disable**: Any module may be used as a replacement.

5. To configure individual channels for the particular slot you are working in, use the pull-down menus to select the appropriate option for the Filter, Input Range, and Data Format that best suits your application needs.

For details on these options, refer to the *Compact 1769 Analog I/O User Manual*, publication 1769-6.0.

6. To enable a channel, check the box in the Enable column.

7. If your analog input module has a checkbox for using an external +24V power source, check the box if the +24V for this module is supplied by any +24V power supply other than the 1769 backplane power.

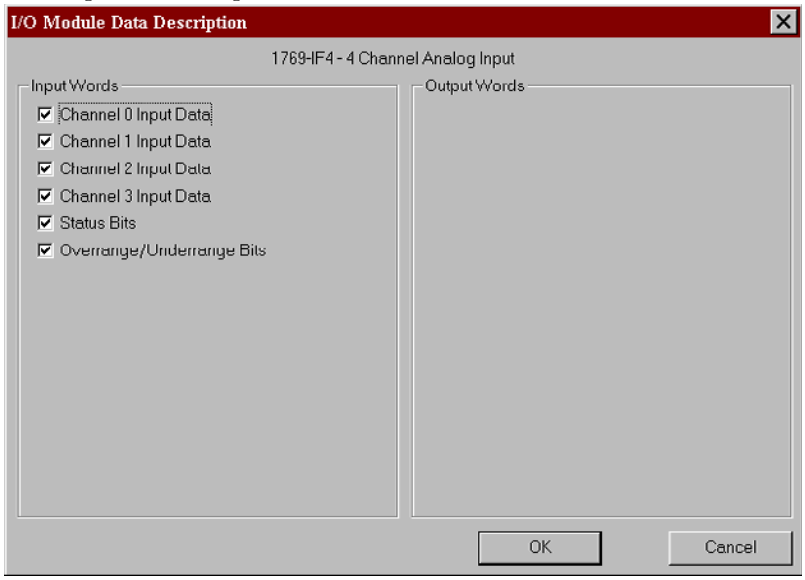
Uncheck the box if the 1769 power supply is supplying the +24V for this module.

RSNetworx uses this information when it performs an audit of the configuration with regards to +24V requirements.

Note: This parameter is not saved in the Series A 1769-ADN adapter. The default is that the 1769 power supply is supplying the +24V for this module any time you perform an upload from the 1769-ADN. Therefore, when online refer to Auditing the Configuration on page 3-20.

8. If desired, choose **Set for I/O Only** to automatically modify the input/output sizes to real time size defaults and other configurations to their default values.

9. If desired, choose **Data Description** to view the definitions of each input and output word.



10. To remove specific words/functions, uncheck the appropriate box and choose **OK**.

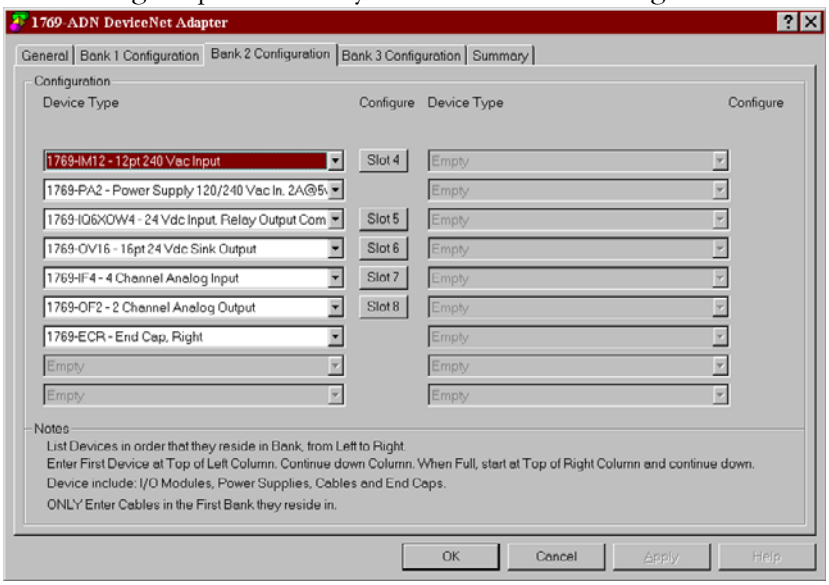
11. To apply the specific words/functions, check the appropriate box and choose **OK**.

12. Once you've finished making your changes, you may choose **OK** from the I/O Module screen to return to the Bank Configuration screen.

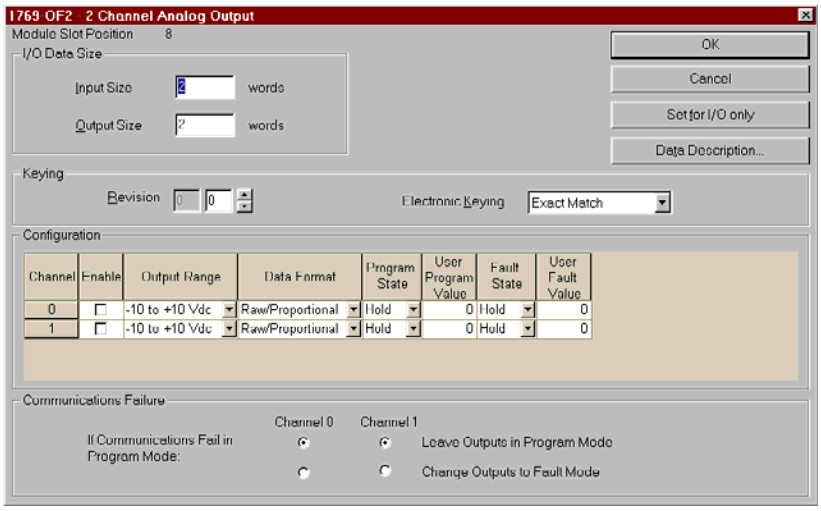
Configuring Analog Output Modules

Follow these guidelines to configure analog output modules.

1. From the Bank Configuration tab, click on the slot number of the analog output module you would like to configure.



You'll see a screen similar to this.



2. To change the input or output size, enter the new word value in the appropriate field.

   If you enter a non-valid number for a particular module, you will see a screen with a range of valid numbers.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

3. To change the revision key, enter a new revision value in the field marked revision.

   Note: 0 is not a valid revision number.

   Refer to the Comparison Feature section on page 3-22 for an explanation on the use of this field.

4. You may choose from the pull-down menu to change the electronic keying to exact match, compatible module, or disable keying.
   - **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual configuration.
   - **Compatible Module**: The programmed module type must match the actual configuration, but the revision of the actual configuration can be equal or greater than the programmed configuration.
   - **Disable**: Any module may be used as a replacement.

5. To enable a channel, check the box in the Enable column.

6. To configure individual channels for the particular slot you are working in, use the pull-down menus to select the appropriate option for the Filter, Input Range, and Data Format that best suits your application needs.

   For details on these options, refer to the *Compact 1769 Analog I/O User Manual*, publication 1769-6.0.

7. To change the default for when communications fail during program mode, choose to leave the outputs in program mode or to change the outputs to fault mode.

   The communication failure notice allows you to change how the outputs react if the system is in program mode (output state during selected) and a communication failure/fault occurs.

   The default is to leave the outputs in program mode.

8. If your analog input module has a checkbox for using an external +24V power source, check the box if the +24V for this module is supplied by any +24V power supply other than the 1769 backplane power.

   Uncheck the box if the 1769 power supply is supplying the +24V for this module.

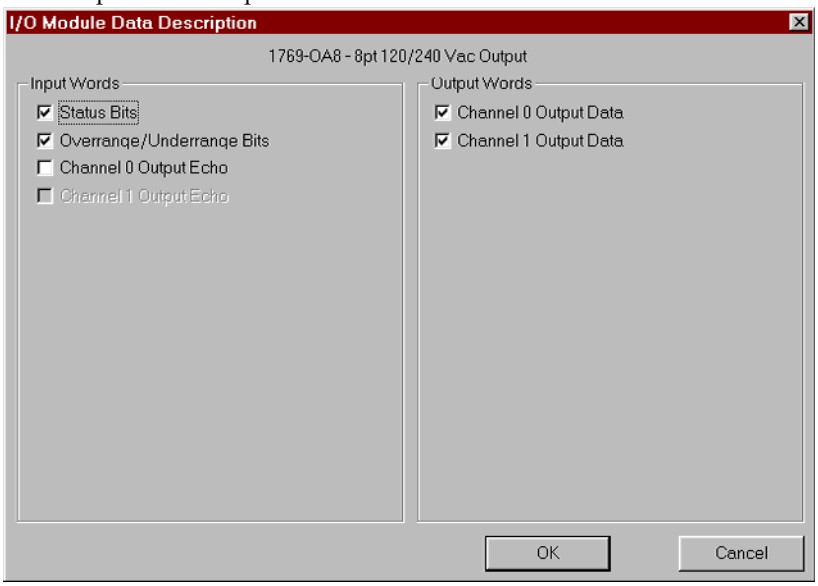
RSNetworx uses this information when it performs an audit of the configuration with regards to +24V requirements.

Note: This parameter is not saved in the Series A 1769-ADN adapter. The default is that the 1769 power supply is supplying the +24V for this module any time you perform an upload from the 1769-ADN adapter. Therefore, when online refer to Auditing the Configuration on page 3-20.

9. To change the default for when communications fail during program mode for each channel, choose to leave the outputs in program mode or to change the outputs to fault mode.

10. If desired, choose **Set for I/O Only** to automatically modify the input/output sizes to real time size defaults and other configurations to their default values.

11. If desired, choose **Data Description** to view the definitions of each input and output word.



12. To remove specific words/functions, uncheck the appropriate box and choose **OK**.

13. To apply the specific words/functions, check the appropriate box and choose **OK**.

14. Once you've finished making your changes, you may choose **OK** from the I/O Module screen to return to the Bank Configuration screen.

Configuring Power Supplies, Cables, and End Cap

Electronic keys for these devices are automatically set to Exact Match. No additional configuration is necessary.

Completing Configuration

After you've finished specifying the Series A adapter configuration and the individual device configurations (I/O modules, power supplies, cables, and end cap), choose Apply or OK to complete the offline configuration.

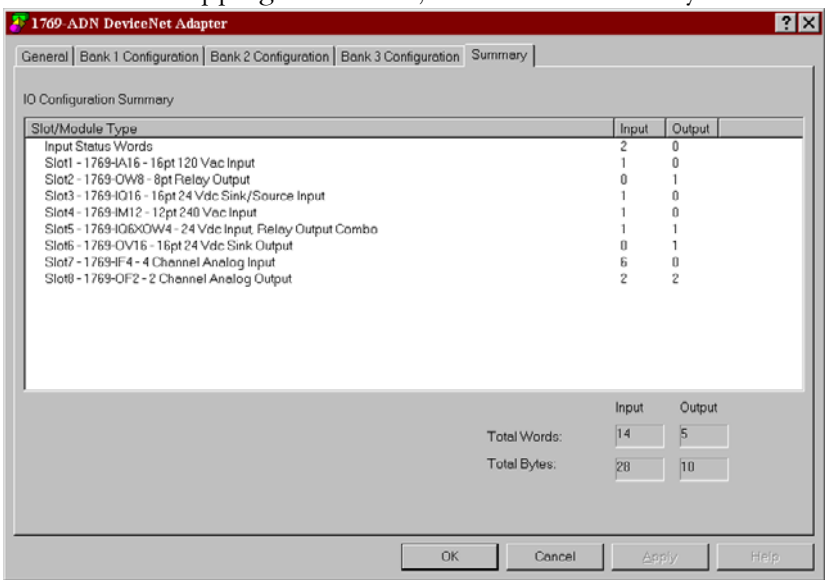
Auditing the Configuration

When you choose Apply or OK, RSNetworx performs an audit on the configuration. This audit consists of checking the requested configuration against all of the Configuration Rules for the Series A Adapter, see page 3-7.

If the audit passes and you chose Apply, the offline configuration is complete and you remain in the current screen. If the audit passes and you chose OK, the offline configuration is complete and you return to the main RSNetworx for DeviceNet screen. If the audit fails, you will see an error describing the problems found. You'll then need to return to the appropriate configuration section and make your changes.

Viewing the Mapping Summaries

To view the mapping summaries, choose the Summary tab.



This is a summary of the configured size and format of the I/O data for the 1769-ADN.

Configuring Your Compact I/O System Online

If your 1769 I/O system physically exists, you'll save time by configuring the Compact I/O system online. By configuring online, you simply upload the entire I/O layout including end caps, cables, and power supplies. Then, you only need to modify the configuration parameters for each I/O module and re-save (download) the final configuration back to the Series A 1769-ADN adapter.

Online configuration is completed in the same way as the offline configuration with the addition of the following features:

Apply/OK Button

When you choose Apply or OK, the software downloads the configuration of the desired devices to the 1769-ADN if the *key check* on the *system keying configuration* has passed.

If the downloaded system keying configuration (the configuration that identifies all the devices present, their location, and keying option) does not *match* the keys of the actual 1769 devices, the 1769-ADN will reject all downloaded configuration and you'll see an error message. You'll then need to return to the appropriate section of the configuration tool and make your changes or change the actual hardware/device on the 1769 bus.

Refer to the Comparison Feature section on page 3-22 for more information on *matching* system keying configuration and keys of the actual 1769 devices. The 1769-ADN will not accept I/O connections from any scanner until the system keying configuration is successfully downloaded.

Once all configuration is successfully downloaded, RSNetworx has the 1769-ADN save all the configuration in non-volatile memory. This includes the Series A adapter configuration and the configuration of all of the 1769 devices.

Comparison Feature

The comparison feature regards *matching*. A *match* or *mismatch* is determined based on a comparison of the programmed devices (the devices stored in the adapter's non-volatile memory) and the actual devices present on the 1769 bus. The electronic keying options (below) are applied on a position-by-position basis.

Each desired device and its location, modified by its electronic key option (if settable), must match the corresponding actual device. If the electronic key option for a device is set to **Exact Match**, then the desired device's type (vendor id, product type, and product code), major revision, and minor revision must exactly match its corresponding actual device to consider this entry a match.

If the electronic key option is set to **Disable Keying**, then the device can be any type and revision and will be considered a match to its corresponding actual device.

IMPORTANT Disable keying is not recommended because it may allow an improper 1769 system configuration.

If the electronic key option for a device is set to **Compatible Module**, then the desired device's type must exactly match and its major/minor revision must be equal to or less than the corresponding actual device's type. A major/minor revision of 2.3 is considered greater than a major/minor revision of 1.9.

Remember, in order for the system keying configuration to be valid, all of the desired devices (modified by their keying option) must match.

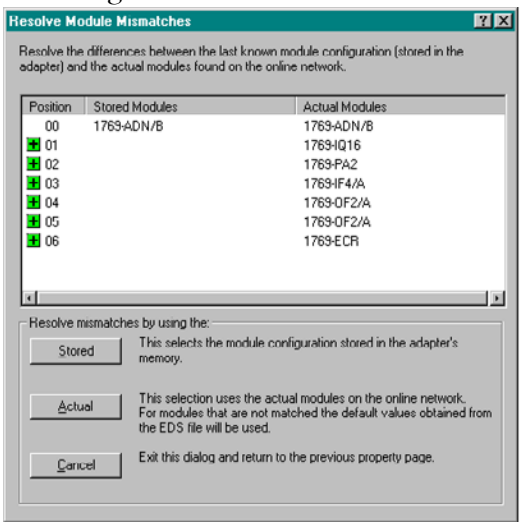
Uploading Configurations

The first time you select a 1769-ADN from RSNetworx when online, the software will upload the configuration saved in the 1769-ADN.

TIP

You may upload the saved configuration from the 1769-ADN at any time when online by clicking the right mouse button.

If there is a mismatch between the saved system keying configuration and the keys of the actual devices on the 1769 bus, you will see the following mismatch screen.



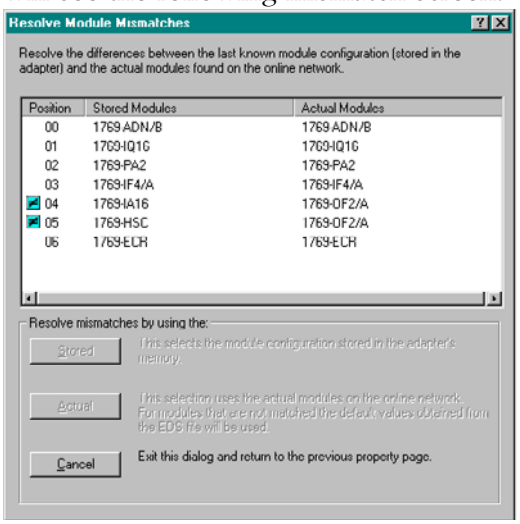
The mismatch screen identifies all of the devices in the saved system keying configuration and all of the actual devices and then highlights the mismatches. You can choose to pull the saved configuration into the configuration software or pull the actual device's information into the configuration software.

When you choose to pull the saved configuration, the individual I/O module configurations that had been saved by the 1769-ADN are used. When you choose to pull the actual device's information, the individual I/O module configurations from the actual devices are used.

Downloading Configurations

When you complete a configuration online and choose Apply or OK, assuming the configuration passes the audit, RSNetworx downloads the configuration to the 1769-ADN. The 1769-ADN then performs a *key check* on the requested devices. Refer to the Comparison Feature on page 3-22.

If there is a mismatch between the desired system keying configuration and the keys of the actual devices on the 1769 bus, you will see the following mismatch screen.



The mismatch screen identifies all of the devices in the desired system keying configuration and all of the actual devices and then highlights the mismatches. You can choose to pull the actual device's information into the configuration software or to cancel.

When you choose to use the actual device's information, RSNetworx will replace *all* of its' configuration settings, *including the individual I/O module configuration, with the configuration of the actual device.*

When you choose cancel, you can go back and edit your requested configuration without losing all of your previous configurations.

Using the Clear Memory Function

The Clear Memory feature is activated by choosing **Reset Configuration and Upload Actual Devices** under the Reset tab. This will return the 1769-ADN to the 'No Adapter or I/O Configuration' state (as if it never was configured for the 1769 modules) and cause the software to pull the configuration from the actual devices.

IMPORTANT The 1769-ADN is not configured with the actual device configuration shown at this point. You must choose Apply or OK to download the Series A adapter and I/O configurations for the Compact I/O system to be properly configured.

Configured 1769-ADN Powerup Behavior

On powerup, the 1769-ADN, with a previous valid configuration, will compare the saved system keying configuration with the actual devices to determine if all of the keys match the actual devices (as defined in the Comparison Feature section on page 3-22).

If they match, the 1769-ADN will complete the configuration of all I/O modules and then wait for a DeviceNet master/scanner to make a connection. If any of the keys do not match, the 1769-ADN will not permit a DeviceNet master/scanner to make an I/O connection and will wait for a valid configuration.

Notes:

Configuring Your Compact I/O Series B DeviceNet Adapter

Read this chapter to configure your Series B DeviceNet adapter. Included is information about:

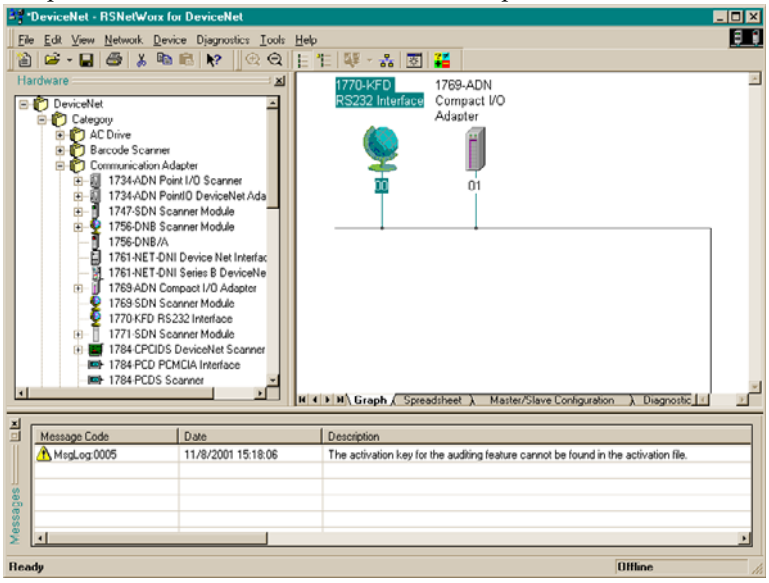
- Adding Your Series B DeviceNet Adapter Offline
- Configuring Your Compact I/O System Offline
- Using Banks of I/O
- Configuring Your Compact I/O System Online

About RSNetworx

RSNetworx for DeviceNet, version 4.00, is the software tool used to configure your Compact I/O Series B DeviceNet adapter and its related modules. This software tool can be connected to the adapter via the DeviceNet network.

Adding Your Series B DeviceNet Adapter Offline

To add a Series B 1769-ADN adapter offline, double-click (or drag and drop) on the 1769-ADN DeviceNet Adapter selection on the left.



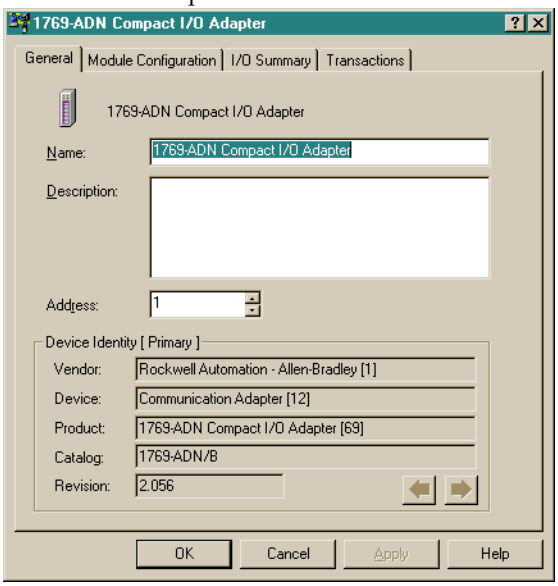
Notice that the adapter now appears on your network on the right.

Configuring Your Compact I/O System Offline

Now that you've added the Series B 1769-ADN DeviceNet adapter offline, you'll need to configure the adapter and all of the devices in the 1769 I/O system.

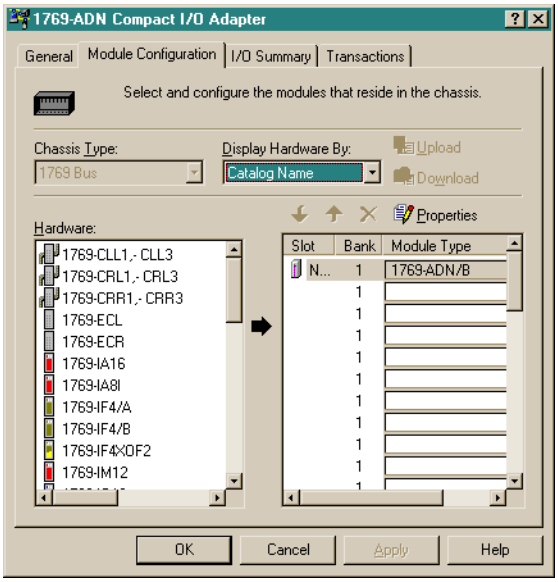
Configuring Your Series B Adapter

You'll see this screen when you double-click on the 1769-ADN DeviceNet adapter icon.



You can add a description, alter the node address, and view the device identity information.

When you choose the Module Configuration tab, you'll see this screen.



Follow these guidelines when adding devices:

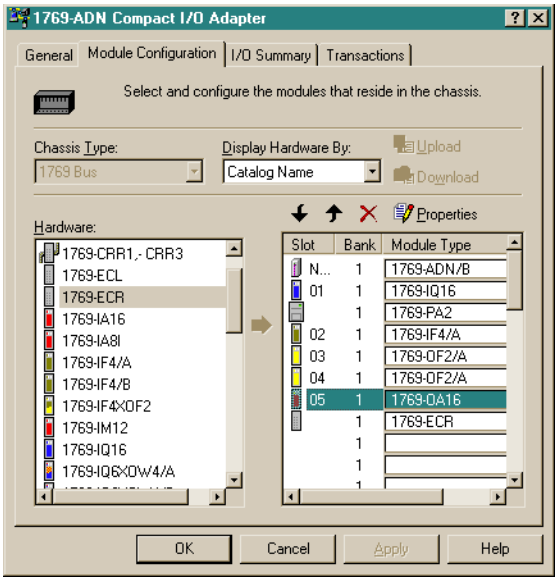
- List devices in the order in which they reside in the bank, from left to right.

  Note: The Series B adapter must be in slot 0 of bank 1.

- Only enter cables in the first bank they reside in.
- Be sure to enter all devices in their proper location, including power supplies, cables, and the end cap.
- Refer to the Configuration Rules for Series B Adapters on page 4-6.

Follow these directions to add each module, power supply, cable, and end cap to the Series B adapter.

1. Choose the product you wish to add on the left side of the screen and click on the arrow in the middle of the screen.



Notice that only I/O modules are assigned Slot numbers.

Note: Power supplies and cables are not assigned slot numbers.

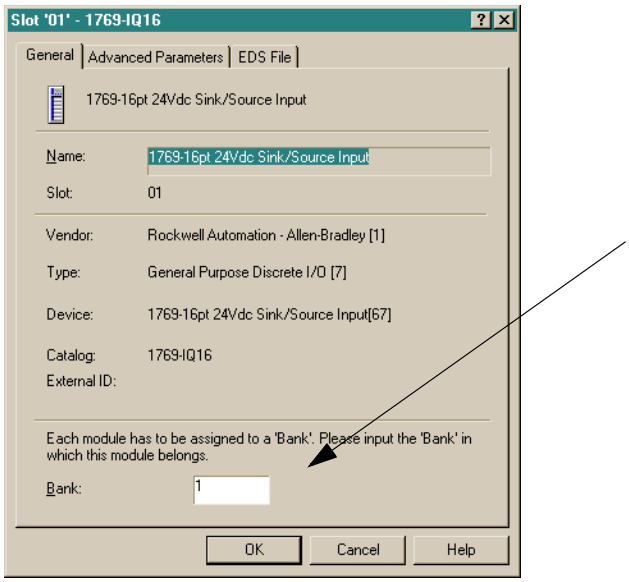
Note: To limit the need to reconfigure, make sure you understand the Configuration Rules for Series B Adapters on page 4-6.

2. Continue adding products as necessary until you have added all of the devices in the system to the list on the right.

3. Once you have added all of the devices to the list in the correct order, assign the appropriate bank to each module.

Follow these steps to assign banks to each module:

a. Select the desired module and choose **Properties**. You'll see a screen similar to this.



b. Enter the bank number in the Bank field.

TIP

To save time, assign the bank numbers to the first (left-most) modules in each bank, starting with bank one. The software ripples the bank modification down the list when you choose OK.

c. Choose **OK**.

Note: A second I/O bank may be necessary if your bank 1 power supply has an insufficient power budget for the I/O modules required for your application.

Note: Make sure your bank-to-bank expansion cable (e.g. 1769-CR1) is in the last (right-most) component of bank 1.

4. Make sure that the last bank of the node is an end cap/terminator (1769-ECR or 1769-ECL).

   For information on 1769 bus configuration rules, refer to Configuration Rules for Series B Adapters on page 4-6.

5. Choose Apply to be sure that your system passes the electrical audit.

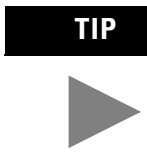
6. After defining the devices on this 1769-ADN node, refer to the relevant sections on pages 4-9 to 4-25 to configure each 1769 I/O module.

7. Once all of the I/O modules are configured, choose OK.

8. From the File menu, choose Save.

9. Go on-line.

10. Select the adapter you wish to modify and download your changes to make them go into affect.



If your selected adapter is in a scanner's scanlist, you may have to deactivate it's entry in the scanlist in order for the download to succeed with no errors. If no input or output sizes were changed, deactivating the adapter's scanlist entry is usually not necessary.

Using Banks of I/O

Configuration Rules for Series B Adapters

- The Series B adapter must be the first and left-most module in the system (the first module of Bank 1).
- The Series B adapter can communicate with up to 30 modules in a system.
- Each bank of I/O must have its own power supply.
- A bank of I/O can have a maximum of 16 modules with a maximum of eight on either side of the power supply, depending upon module loading on the supply.
- A 1769 I/O power supply has limits in the amount of +5V dc and +24V dc current it can supply to the modules in its I/O bank. These limits depend on the catalog number (e.g. 1769-PA2) of the supply. A bank of modules should not exceed the current limits of the I/O bank power supply. Refer to the *Compact 1769 Expansion I/O Power Supplies Installation Instructions*, publication 1769-5.14.
- The maximum amount of current each bank supports in one direction (either side of the power supply) is: 2A @ 5V dc, 1A @ 24V dc.
- If another bank of I/O is required, use a bus communication expansion cable (e.g. 1769-CRL) to link them together. You can have a maximum of three banks of I/O connected with up to two communication expansion cables.
- Each module type has its own distance rating (the number of modules from the power supply). Each module must be within this rating for its type.
- The Series B adapter has a distance rating of five, therefore the adapter must be within five modules of the power supply.
- The Series B adapter supports reading a maximum of 163-251 words (326-502 bytes) of input data distributed across all the modules, depending on the number of modules present in the system.

  Use the following equation to calculate the maximum number of input words:

  Maximum Input Words = 256 - [(Number of Modules +1) x 2 + Number of Output Only Modules + 1]

  Where the "Number of Modules" is the total number of modules (input and output) in the system, and the "Number of Output Only Modules" is the number of output modules configured to have 0 words of input data.

  The maximum number of input words is distributed across all of the input modules.

- The Series B adapter supports a maximum of 196-254 words (392-508 bytes) of output data distributed across all of the modules, depending on the number of modules present in the system.

  Use the following equation to calculate the maximum number of output words:

  Maximum Output Words = 256 - (Number of Output Modules) x 2

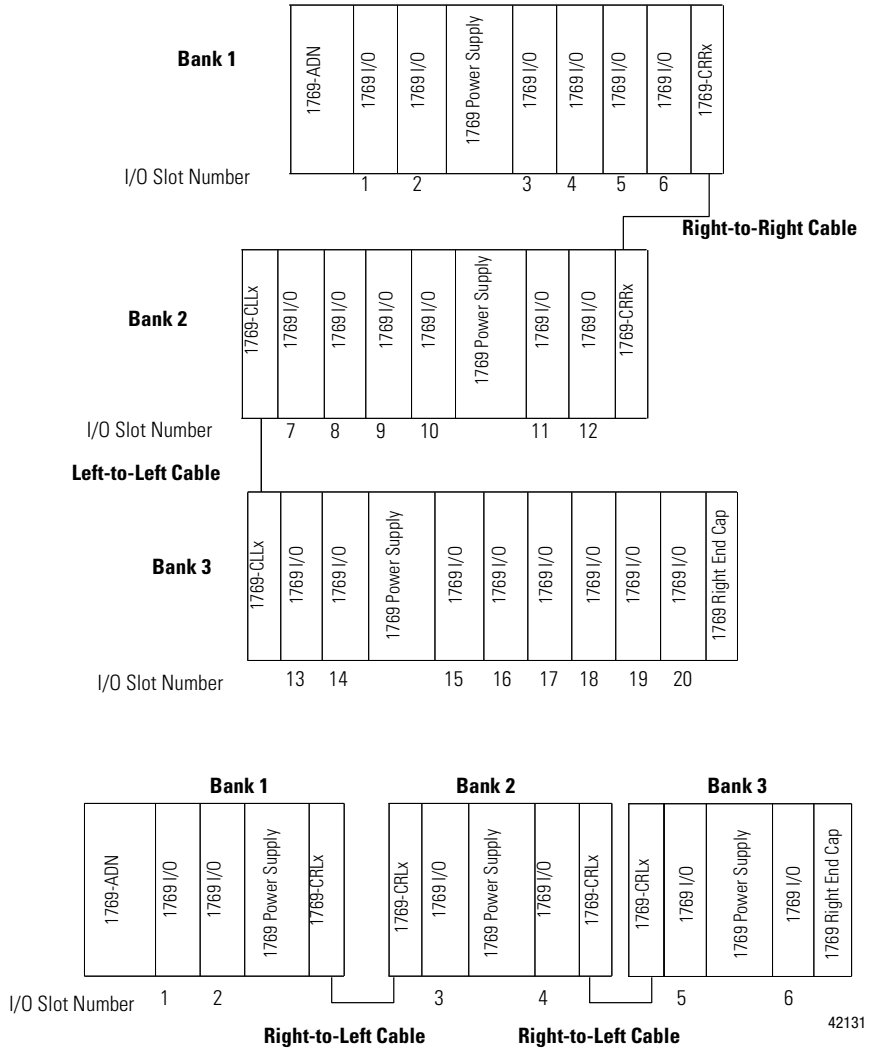
  Where the "Number of Output Modules" is the number of output modules configured to have 1 or more words of output data.

  The maximum number of output words is distributed across all of the output modules.

- The Series B adapter supports a maximum of 254 words (508 bytes) of configuration data to each individual module, for a total capacity of 7,620 words (15,240 bytes). The configuration data is stored within 1 (64K) sector of the external flash part, enabling the maximum for each module to be supported, regardless of the number of modules.
- An end cap/terminator must be on the last I/O bank.

Example Configurations

The following illustrations show examples of two valid system setups.

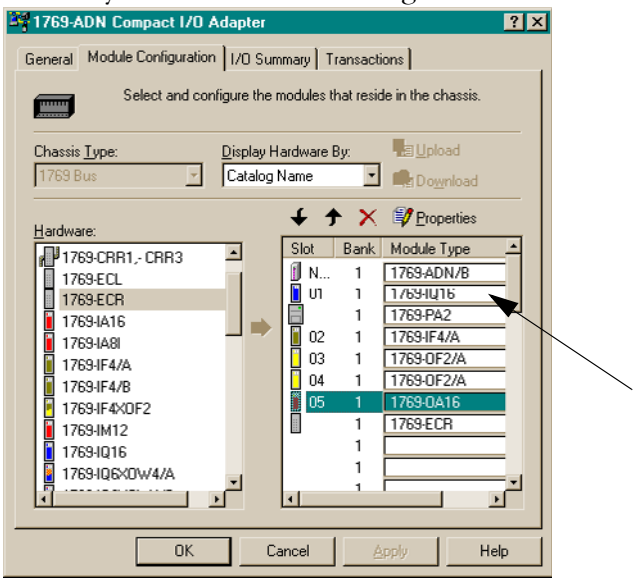


NOTE: I/O modules are not required between either the Series B adapter and an end cap or between the power supply and an end cap.

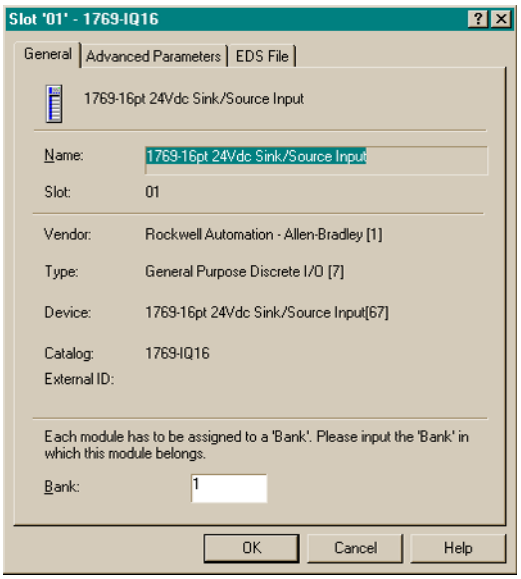
Configuring Discrete Input Modules

Follow these guidelines to configure discrete input modules.

1. From the Module Configuration tab, double-click on the input module you would like to configure.



You'll see a screen similar to this.

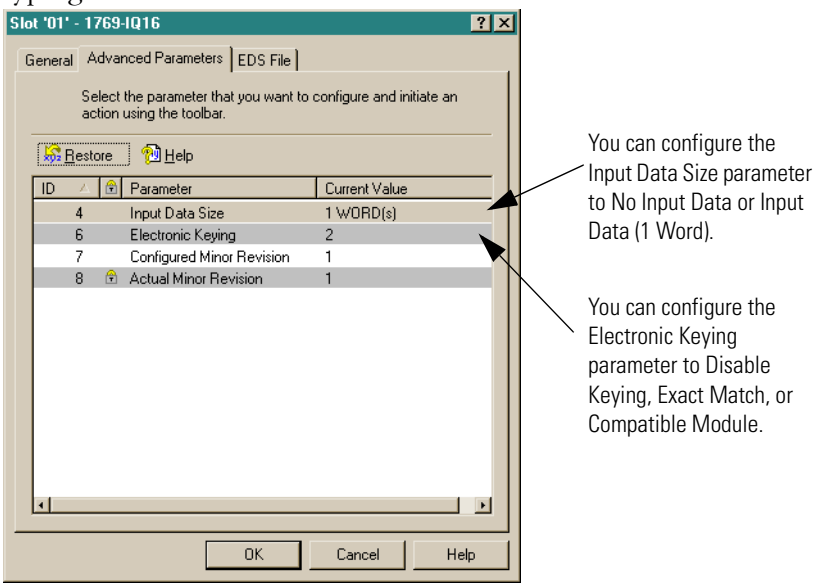


2. To assign the module to a different bank, enter the bank number in the Bank field.

TIP

To save time, assign the bank numbers to the first (left-most) modules in each bank, starting with bank one. The software ripples the bank modification down the list when you close the module's property window.

3. From the Advanced Parameters tab, you can configure editable parameters by selecting from the pull-down menus or directly typing in the value.

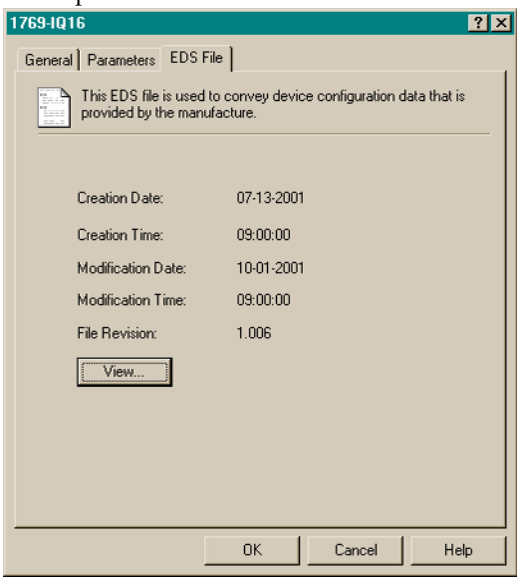


- **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
- **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
- **Disable**: Any module may be used as a replacement.

Refer to the Comparison Feature section on page 4-29 for an explanation on the use of this field.

4. Choose **OK** to return to the Module Configuration tab.

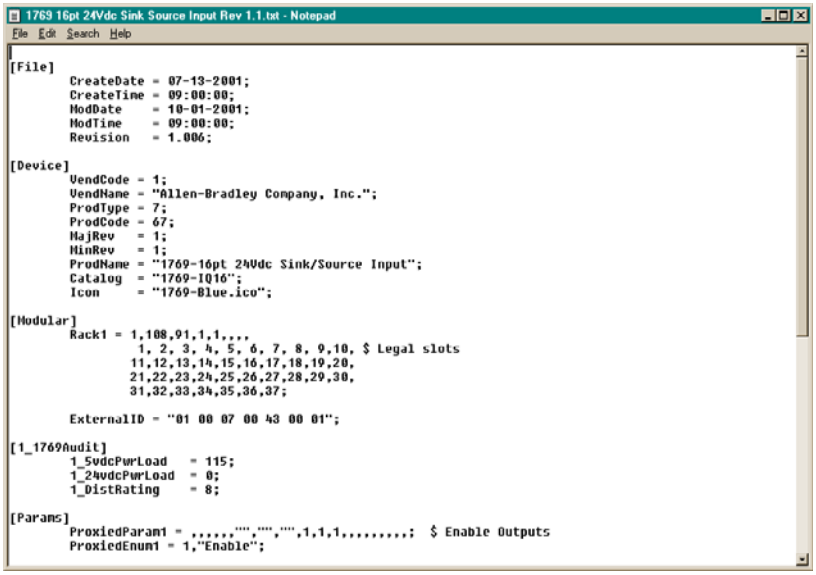
5. From the EDS File tab, you can access the device's configuration description file.



Access to the EDS file is provided to enable you to determine which version of the device's EDS file is installed on your system. The most up-to-date EDS file Allen-Bradley brand modules may be obtained at http://www.ab.com/networks/eds/ or by contacting your local Rockwell Automation representative.

Changes to this file are not recommended except for users with appropriate training or under the guidance of Rockwell Automation, Inc. authorized technical support representative.

6. Choose **View** to see the EDS file.



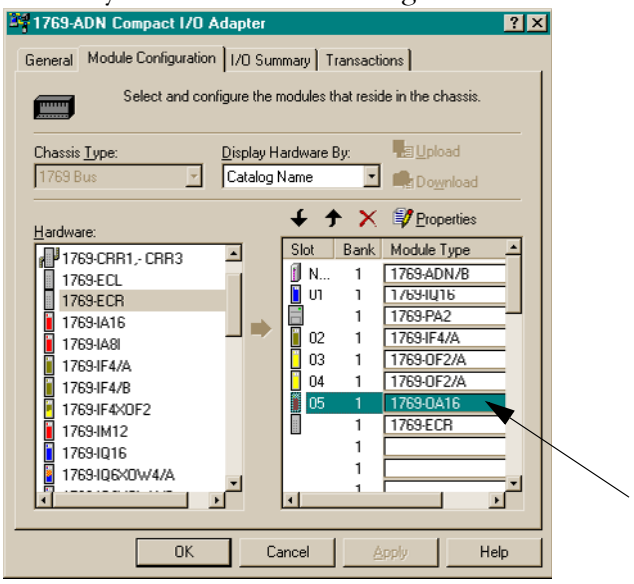
7. When you have finished looking at the EDS file, close the Notepad window.

8. Choose **OK** to return to the Module Configuration tab.

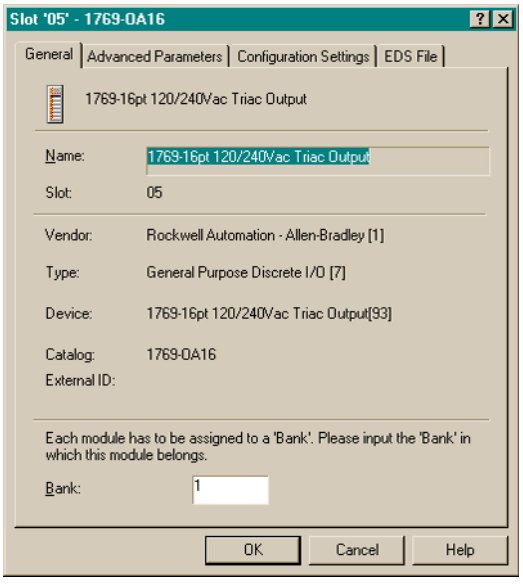
Configuring Discrete Output Modules

Follow these guidelines to configure discrete output modules.

1. From the Module Configuration tab, double-click on the output module you would like to configure.



You'll see a screen similar to this.

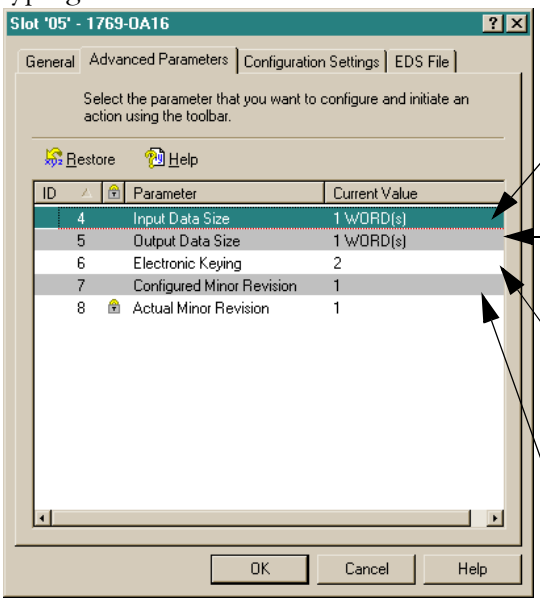


2. To assign the module to a different bank, enter the bank number in the Bank field.

TIP

To save time, assign the bank numbers to the first (left-most) modules in each bank, starting with bank one. The software ripples the bank modification down the list when you close the module's property window.

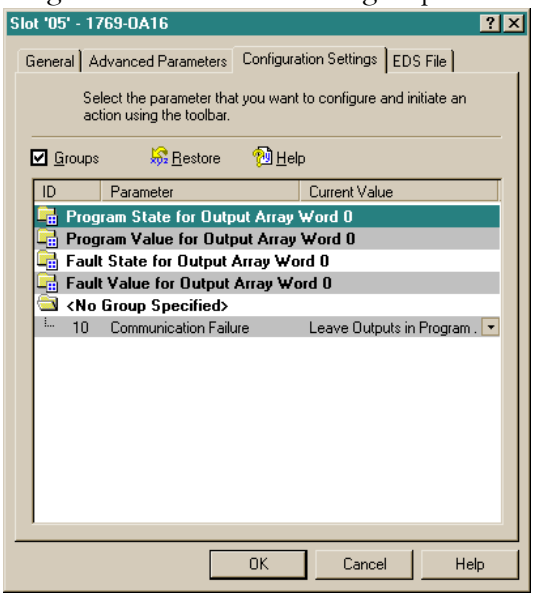
3. From the Advanced Parameters tab, you can configure editable parameters by selecting from the pull-down menus or directly typing in the value.



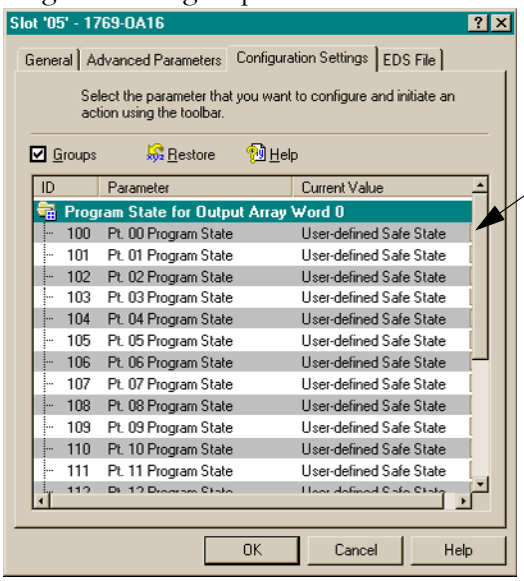
- **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
- **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
- **Disable**: Any module may be used as a replacement.

Refer to the Comparison Feature section on page 4-29 for an explanation on the use of this field.

4. From the Configuration Settings tab, double-click on the Program State or Fault State groups to configure them.



You will see a screen similar to this one when you select a Program State group.

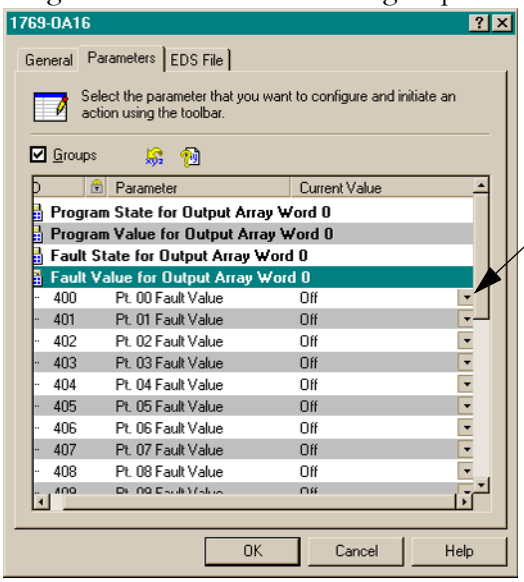


You can configure the Program/Fault State to User-Defined Safe-State or Hold Last State.

TIP

When you uncheck the "Groups" box, you will see all of the module's parameters in a single list. When you check the "Groups" box, the module's parameters will be grouped by channel or function.

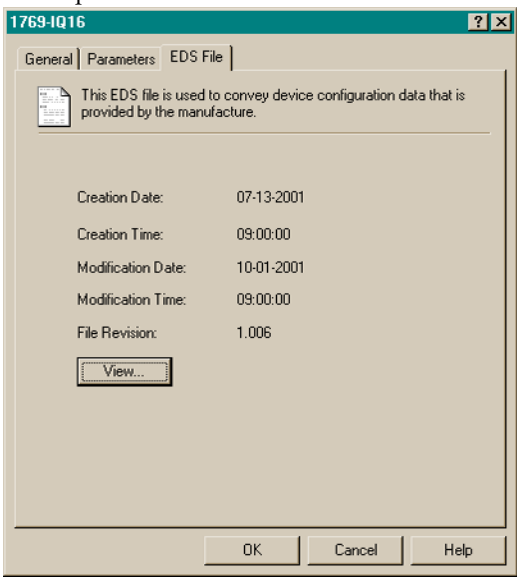
You will see a screen similar to this one when you select a Program Value or Fault Value group.



You can configure the Program/Fault Value to On or Off.

5. Choose **OK**.

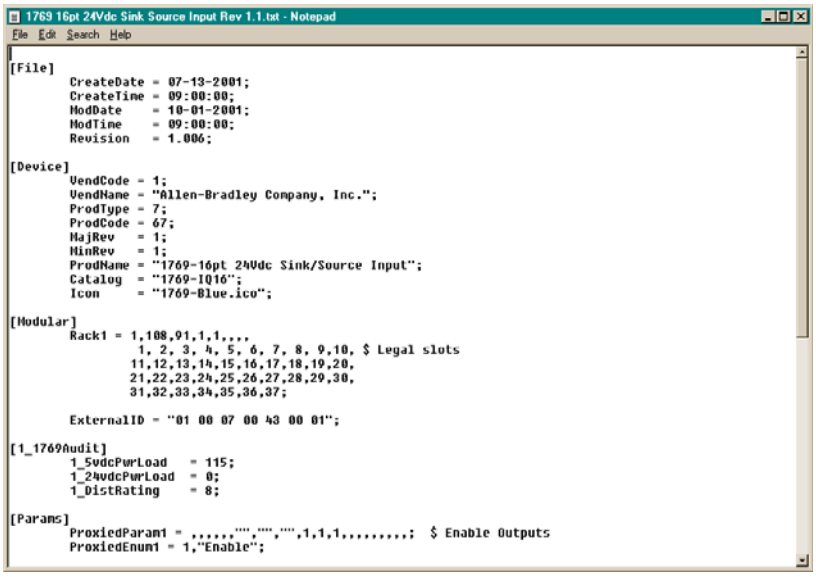
6. From the EDS File tab, you can access the device's configuration description file.



Access to the EDS file is provided to enable you to determine which version of the device's EDS file is installed on your system. The most up-to-date EDS file Allen-Bradley brand modules may be obtained at http://www.ab.com/networks/eds/ or by contacting your local Rockwell Automation representative.

Changes to this file are not recommended except for users with appropriate training or under the guidance of Rockwell Automation, Inc. authorized technical support representative.

7. Choose **View** to see the EDS file.



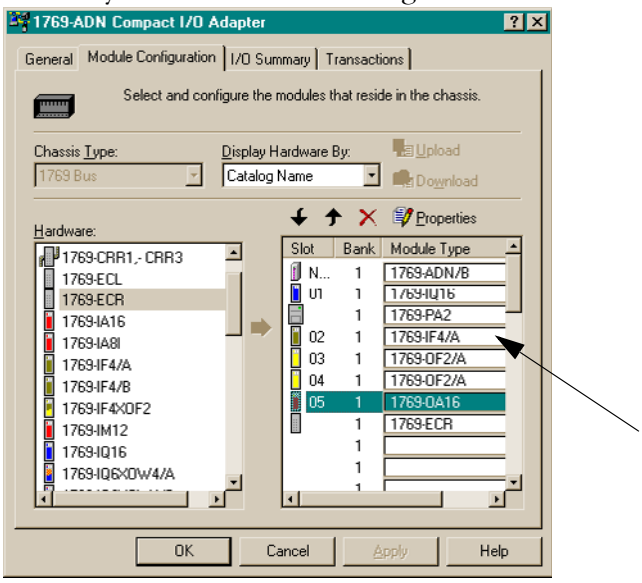
8. When you have finished looking at the EDS file, close the Notepad window.

9. Choose **OK** to return to the Module Configuration tab.

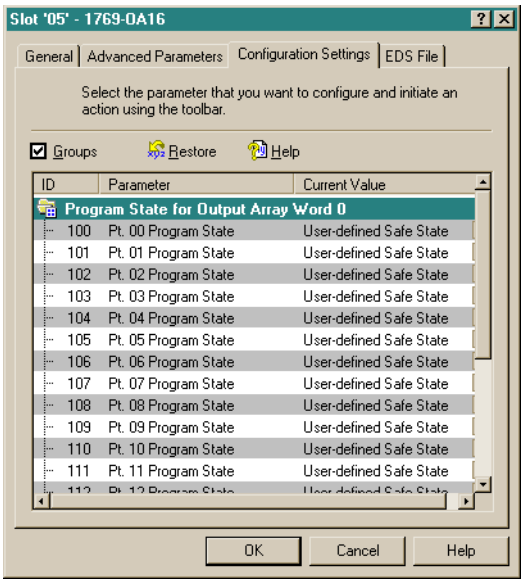
Configuring Analog Input Modules

Follow these guidelines to configure analog input modules.

1. From the Module Configuration tab, double-click on the input module you would like to configure.



You'll see a screen similar to this.

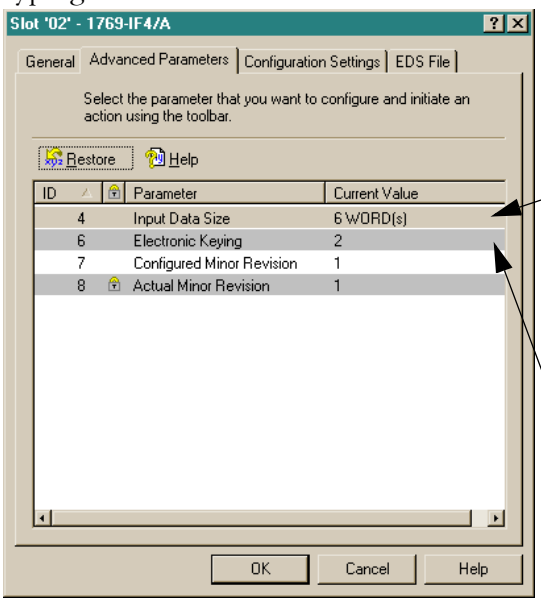


2. To assign the module to a different bank, enter the bank number in the Bank field.

TIP

To save time, assign the bank numbers to the first (left-most) modules in each bank, starting with bank one. The software ripples the bank modification down the list when you close the module's property window.

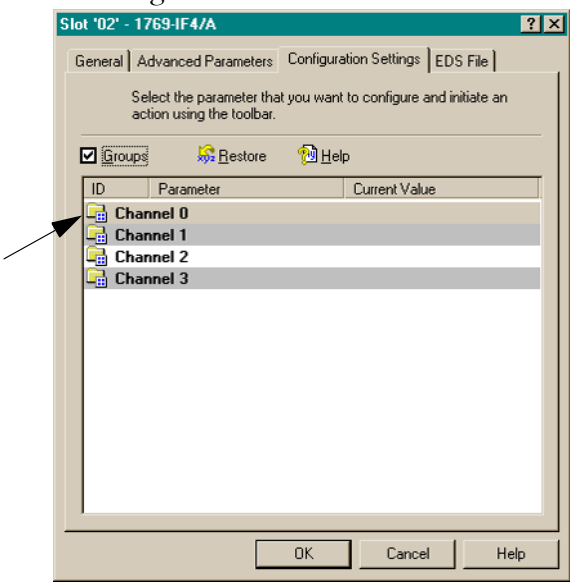
3. From the Advanced Parameters tab, you can configure editable parameters by selecting from the pull-down menus or directly typing in the value.



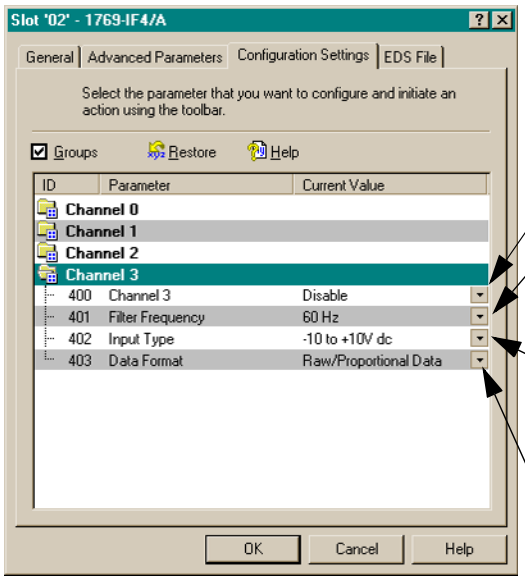
- **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
- **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
- **Disable**: Any module may be used as a replacement.

Refer to the Comparison Feature section on page 4-29 for an explanation on the use of this field.

4. From the Configuration Settings tab, double-click on a Channel to configure it.



You will see a screen similar to this one.



You can configure Channel 3 to Disable or Enable.

You can configure Filter Frequency to 60Hz, 50Hz, 250Hz, or 500Hz.

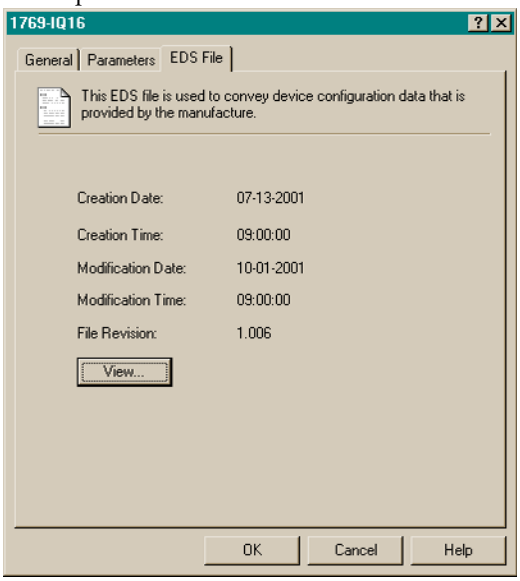
You can configure Input Type to (-10 to +10V dc), (0 to 5V dc), (0 to 10V dc), (4 to 20mA), or (1 to 5V dc).

You can configure Data Format to Raw/Proportional Data, Engineering Units, Scaled-for-PID, or Percent Range.

For details on these options, refer to the *Compact 1769 Analog I/O User Manual*, publication 1769-6.0.

5. Choose **OK**.

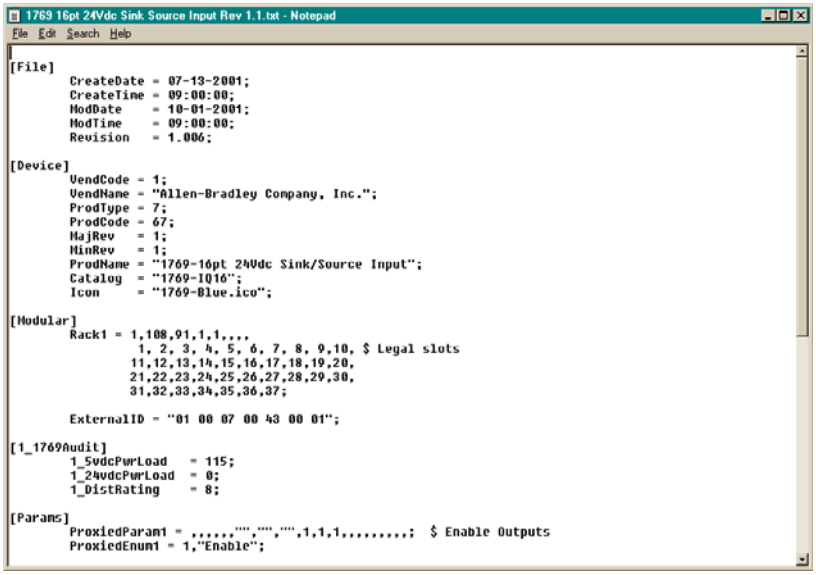
6. From the EDS File tab, you can access the device's configuration description file.



Access to the EDS file is provided to enable you to determine which version of the device's EDS file is installed on your system. The most up-to-date EDS file Allen-Bradley brand modules may be obtained at http://www.ab.com/networks/eds/ or by contacting your local Rockwell Automation representative.

Changes to this file are not recommended except for users with appropriate training or under the guidance of Rockwell Automation, Inc. authorized technical support representative.

7. Choose **View** to see the EDS file.



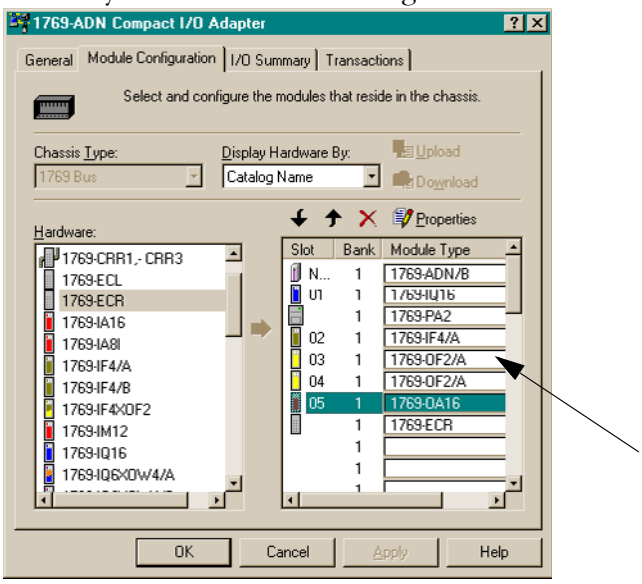
8. When you have finished looking at the EDS file, close the Notepad window.

9. Choose **OK** to return to the Module Configuration tab.

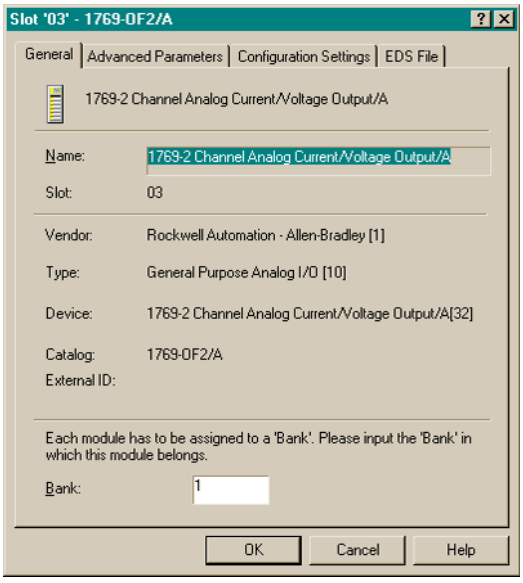
Configuring Analog Output Modules

Follow these guidelines to configure analog output modules.

1. From the Module Configuration tab, double-click on the output module you would like to configure.



You'll see a screen similar to this.

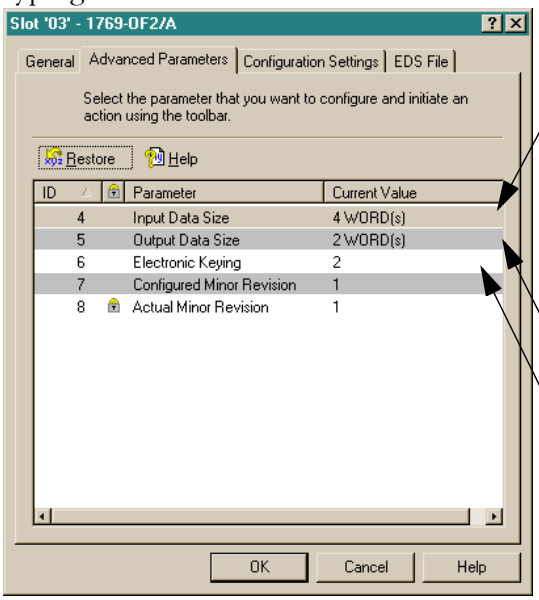


2. To assign the module to a different bank, enter the bank number in the Bank field.

TIP

To save time, assign the bank numbers to the first (left-most) modules in each bank, starting with bank one. The software ripples the bank modification down the list when you close the module's property window.

3. From the Advanced Parameters tab, you can configure editable parameters by selecting from the pull-down menus or directly typing in the value.



You can configure the Input Data Size parameter to No Input Data, Status Bits (1 Word), Overrange/Underrange Bits (2 Words), Channel 0 Output Echo (3 Words), or Channel 1 Output Echo (4 Words).

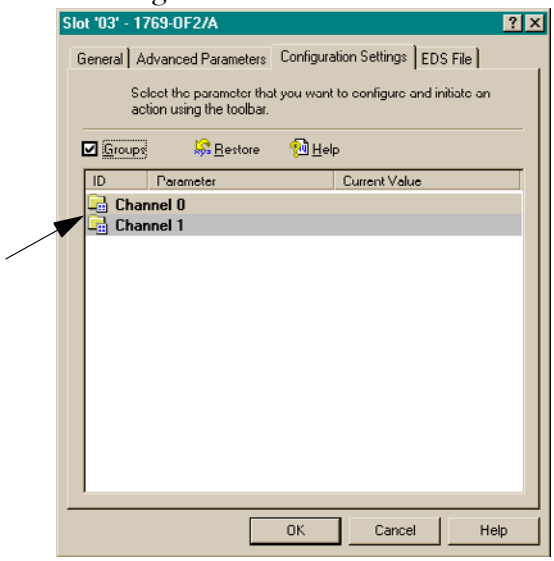
You can configure the Output Data Size parameter to No Output Data, Channel 0 Output Data (1 Word), or Channel 1 Output Data (2 Words).

You can configure the Electronic Keying parameter to Disable Keying, Exact Match, or Compatible Module.

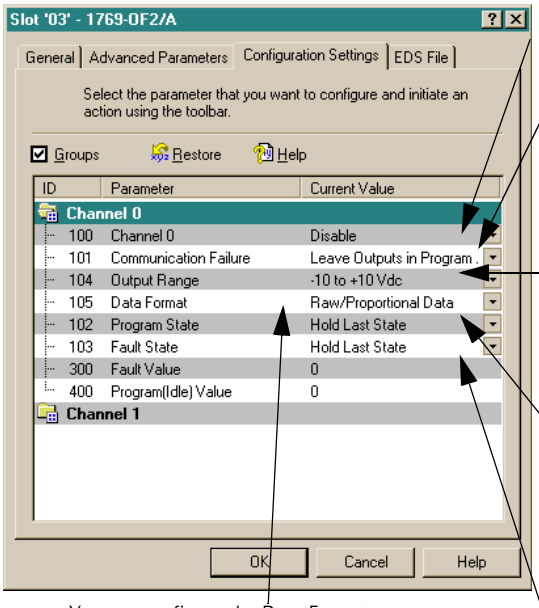
- **Exact Match**: The programmed module type (e.g. 1769-IA16) and the revision must match exactly with the actual module.
- **Compatible Module**: The programmed module type must match the actual module, but the revision of the actual module can be equal or greater than the programmed revision.
- **Disable**: Any module may be used as a replacement.

Refer to the Comparison Feature section on page 4-29 for an explanation on the use of this field.

4. From the Configuration Settings tab, double-click on a Channel to configure it.



You will see a screen similar to this one.



You can configure Channel 0 to Disable or Enable.

You can configure Communication Failure parameter to Leave Outputs in Program Mode or Change Outputs to Fault Mode.

You can configure the Output Range parameter to (-10 to +10V dc), (0 to 5V dc), (0 to 10V dc), (4 to 20mA), or (1 to 5V dc).

You can configure the Program State parameter to Hold Last State or User-Defined Value.

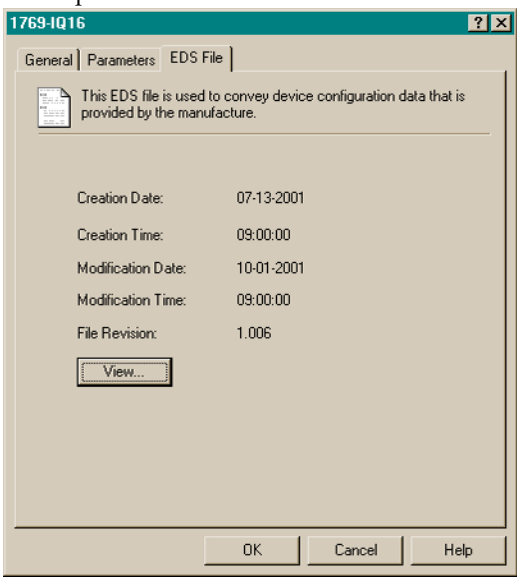
You can configure the Fault State parameter to Hold Last State or User-Defined Value.

You can configure the Data Format parameter to Raw/Proportional Data, Engineering Units, Scaled-for-PID, or Percent Range.

For details on these options, refer to the *Compact 1769 Analog I/O User Manual*, publication 1769-6.0.

5. Choose **OK**.

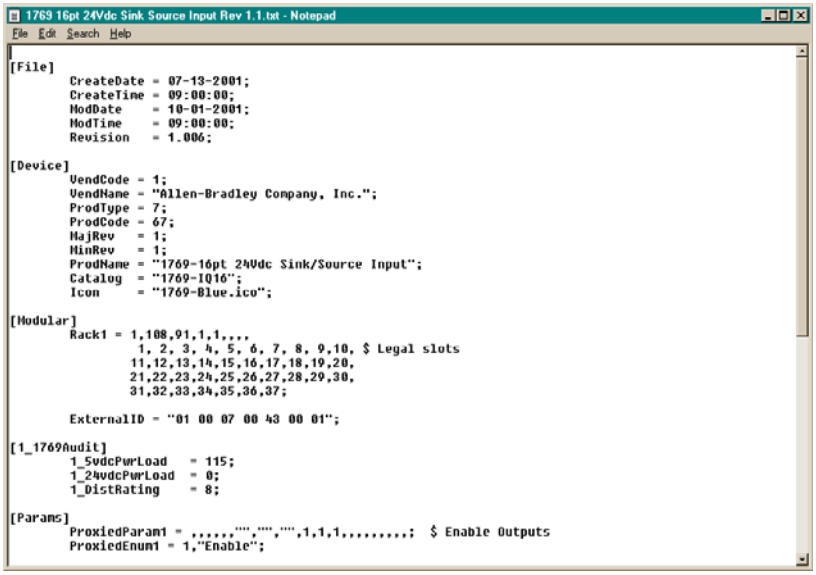
6. From the EDS File tab, you can access the device's configuration description file.



Access to the EDS file is provided to enable you to determine which version of the device's EDS file is installed on your system. The most up-to-date EDS file Allen-Bradley brand modules may be obtained at http://www.ab.com/networks/eds/ or by contacting your local Rockwell Automation representative.

Changes to this file are not recommended except for users with appropriate training or under the guidance of Rockwell Automation, Inc. authorized technical support representative.

7. Choose **View** to see the EDS file.



8. When you have finished looking at the EDS file, close the Notepad window.

9. Choose **OK** to return to the Module Configuration tab.

Configuring Power Supplies, Cables, and End Cap

Electronic keys for these devices are automatically set to Compatible. No additional configuration is necessary.

Completing Configuration

After you've finished specifying the Series B adapter configuration and the individual device configurations (I/O modules, power supplies, cables, and end cap), choose Apply or OK to complete the offline configuration.

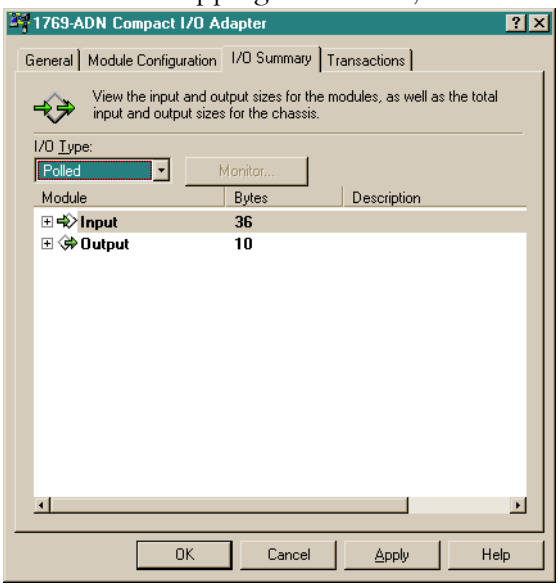
Auditing the Configuration

When you choose Apply or OK, RSNetworx performs an audit on the configuration. This audit consists of checking the requested configuration against all of the Configuration Rules for Series B Adapters, see page 4-6.

If the audit passes and you chose Apply, the offline configuration is complete and you remain in the current screen. If the audit passes and you chose OK, the offline configuration is complete and you return to the main RSNetworx for DeviceNet screen. If the audit fails, you will see an error describing the problems found. You'll then need to return to the appropriate configuration section and make your changes.

Viewing the Mapping Summaries

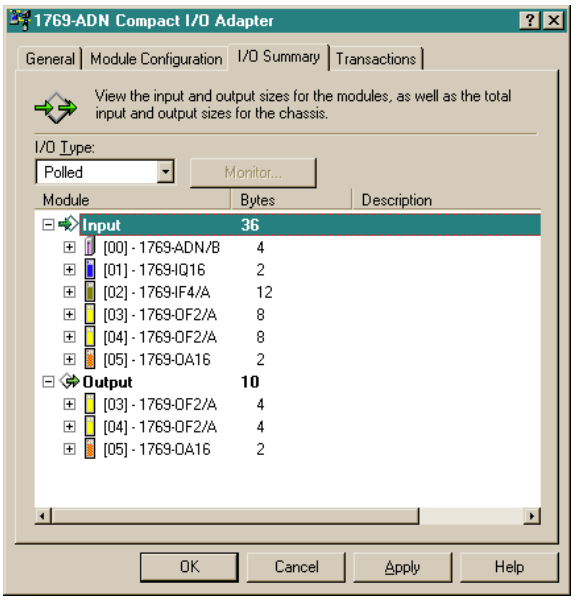
1. To view the mapping summaries, choose the I/O Summary tab.



This is a summary of the configured size and format of the I/O data for the 1769-ADN.

2. To change the I/O messaging type, select Polled, COS (Change of State) or Cyclic from the I/O Type field.

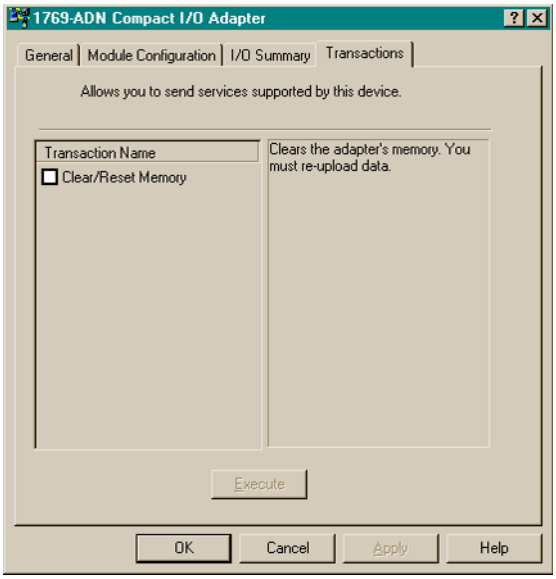
3. Double-click on the module to make any changes to the byte size.



4. Choose **OK**.

Viewing the Transactions

The Transactions tab allows you to send services supported by this device.



The "Clear/Reset Memory" transaction returns the adapter's and all module's configurations to the factory defaults (i.e. empty). This operation cannot be undone. To return all configuration to the factory defaults, check the "Clear/Reset Memory" box and choose **Execute**.

Configuring Your Compact I/O System Online

If your 1769 I/O system physically exists, you'll save time by configuring the Compact I/O system online. By configuring online, you simply upload the entire I/O layout including end caps, cables, and power supplies. Then, you only need to modify the configuration parameters for each I/O module and re-save (download) the final configuration back to the Series B 1769-ADN adapter.

Online configuration is completed in the same way as the offline configuration with the addition of the following features:

Apply/OK Button

When you choose Apply or OK, the software downloads the configuration of the desired devices to the 1769-ADN if the *key check* on the *system keying configuration* has passed.

If the downloaded system keying configuration (the configuration that identifies all the devices present, their location, and keying option) does not *match* the keys of the actual 1769 devices, the 1769-ADN will reject all downloaded configuration and you'll see an error message. You'll then need to return to the appropriate section of the configuration tool and make your changes or change the actual hardware/device on the 1769 bus.

Refer to the Comparison Feature section on page 4-29 for more information on *matching* system keying configuration and keys of the actual 1769 devices. The 1769-ADN will not accept I/O connections from any scanner until the system keying configuration is successfully downloaded.

Once all configuration is successfully downloaded, RSNetworx has the 1769-ADN save all the configuration in non-volatile memory. This includes the Series B adapter configuration and the configuration of all of the 1769 devices.

Comparison Feature

The comparison feature regards *matching*. A *match* or *mismatch* is determined based on a comparison of the programmed devices (the devices stored in the adapter's non-volatile memory) and the actual devices present on the 1769 bus. The electronic keying options (below) are applied on a position-by-position basis.

Each desired device and its location, modified by its electronic key option (if settable), must match the corresponding actual device. If the electronic key option for a device is set to **Exact Match**, then the desired device's type (vendor id, product type, and product code), major revision, and minor revision must exactly match its corresponding actual device to consider this entry a match.

If the electronic key option is set to **Disable Keying**, then the device can be any type and revision and will be considered a match to its corresponding actual device.

IMPORTANT Disable keying is not recommended because it will allow an improper 1769 system configuration.

If the electronic key option for a device is set to **Compatible Module**, then the desired device's type must exactly match and its major/minor revision must be equal to or less than the corresponding actual device's type. A major/minor revision of 2.3 is considered greater than a major/minor revision of 1.9.

Remember, in order for the system keying configuration to be valid, all of the desired devices (modified by their keying option) must match.

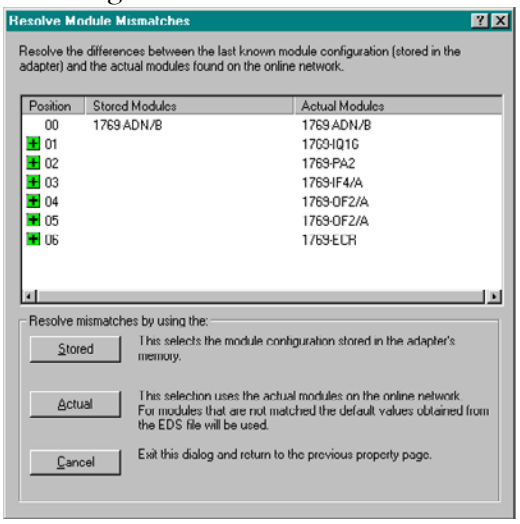
Uploading Configurations

The first time you select a 1769-ADN from RSNetworx when online, the software will upload the configuration saved in the 1769-ADN.

TIP

You may upload the saved configuration from the 1769-ADN at any time when online by clicking the right mouse button.

If there is a mismatch between the saved system keying configuration and the keys of the actual devices on the 1769 bus, you will see the following mismatch screen.



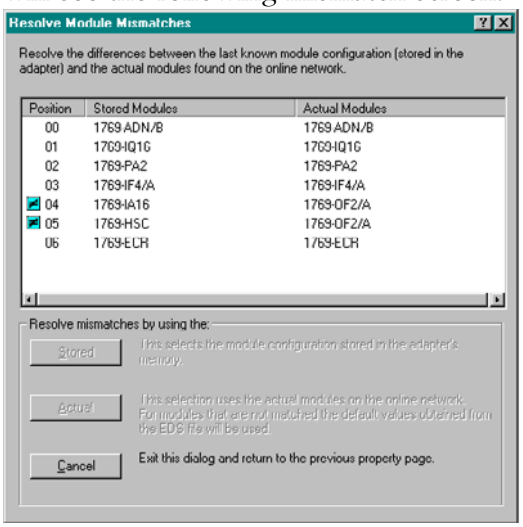
The mismatch screen identifies all of the devices in the saved system keying configuration and all of the actual devices and then highlights the mismatches. You can choose to use the saved configuration into the configuration software or use the actual device's information into the configuration software.

When you choose to use the saved configuration, the individual I/O module configurations that had been saved by the 1769-ADN are used. When you choose to use the actual device's information, the individual I/O module configurations from the actual devices are used.

Downloading Configurations

When you complete a configuration online and choose Apply or OK, assuming the configuration passes the audit, RSNetworx downloads the configuration to the 1769-ADN. The 1769-ADN then performs a *key check* on the requested devices. Refer to the Comparison Feature on page 4-29.

If there is a mismatch between the desired system keying configuration and the keys of the actual devices on the 1769 bus, you will see the following mismatch screen.



The mismatch screen identifies all of the devices in the desired system keying configuration and all of the actual devices and then highlights the mismatches. You can choose to use the actual device's information into the configuration software or to cancel.

When you choose to use the actual device's information, RSNetworx will replace all of its' configuration settings, including the individual I/O module configuration, with the configuration of the actual device.

When you choose cancel, you can go back and edit your requested configuration without losing all of your previous configurations.

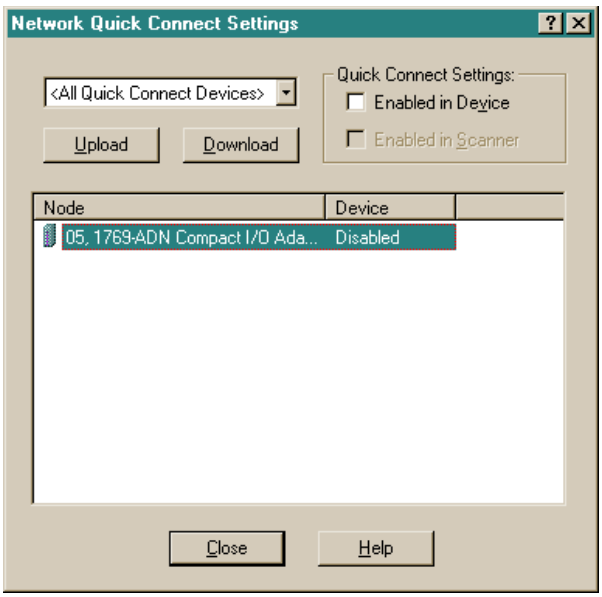
Configuring Your Adapter for Quick Connect Operation

Quick Connect is a recently introduced DeviceNet feature that reduces the amount of time that slave devices (in this case, your 1769 DeviceNet adapter) take to go from their powered-down state to a state where they are ready to accept I/O connections.

To take advantage of this feature, you must enable the Quick Connect parameter in both the scanner and on the 1769 DeviceNet adapter (or other slave device). These settings are available using the Quick Connect Tool in RSNetWorx, version 4.00 or later. Refer to Appendix C for adapter Quick Connect performance capabilities.

To configure one or more adapters for Quick Connection operation, follow these steps:

1. Go on-line with your DeviceNet network.
2. From the Network menu, choose Single Pass Browse.
3. From the Tools menu, select Quick Connect.
4. Choose Yes.



5. For each slave, choose Enable for both the scanner and slave (adapter).
6. Choose Download.
7. Choose Close.

Configured 1769-ADN Powerup Behavior

On powerup, the 1769-ADN, with a previous valid configuration, will compare the saved system keying configuration with the actual devices to determine if all of the keys match the actual devices (as defined in the Comparison Feature section on page 4-29).

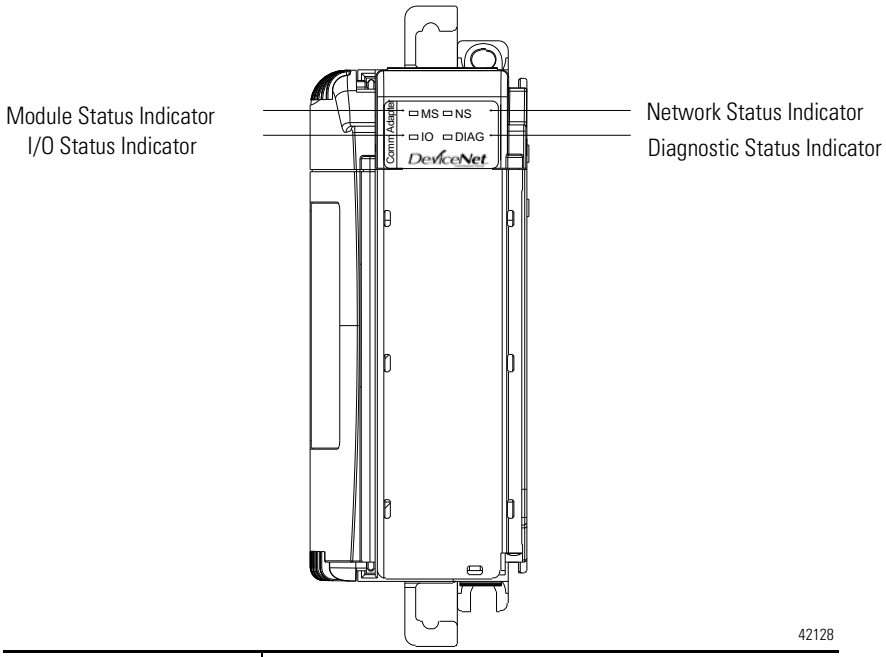
If they match, the 1769-ADN will complete the configuration of all I/O modules and then wait for a DeviceNet master/scanner to make a connection. If any of the keys do not match, the 1769-ADN will not permit a DeviceNet master/scanner to make an I/O connection and will wait for a valid configuration.

Notes:

Troubleshooting with the Indicators

Read this chapter to familiarize yourself with the diagnostic indicators and their meanings.

Diagnostic Indicators



LED Indication	Meaning
Module Status (MS)	
OFF	No power
Flashing GRN/OFF	On-line but configuration missing
Solid GRN	Device operational
Flashing RED/OFF	Recoverable fault • configuration incorrect • duplicate mac id (node address) check failed • node address switch changed • main program checksum failed • configured I/O size too large
Solid RED	Unrecoverable fault • terminator/end cap missing • connector/cable between modules missing/not connected • bad configuration memory • watchdog tripped

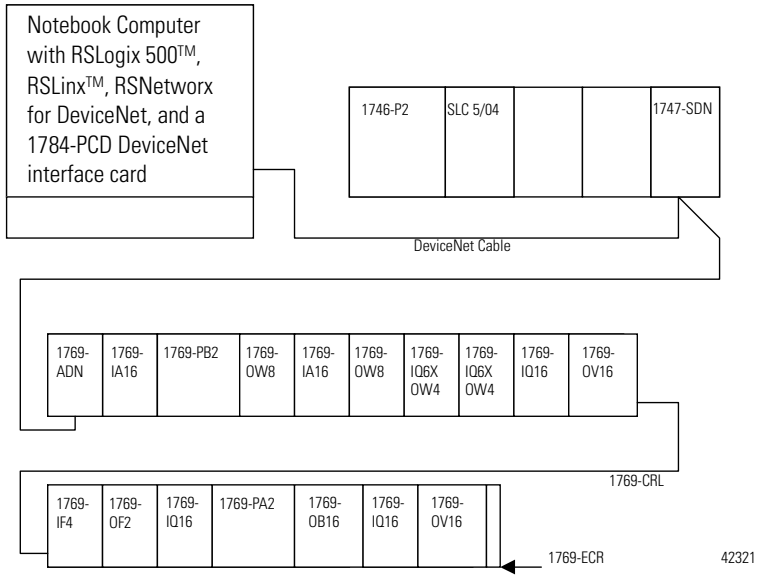
LED Indication	Meaning
Network Status (NS)	
OFF	No DeviceNet power or no network access
Flashing GRN/OFF	On-line but not connected
Solid GRN	On-line and connected
Flashing RED/OFF	Connection time-out
Solid RED	Critical network failure
I/O Status (IO)	
OFF	No power or outputs off
Flashing GRN/OFF	Idle/program mode - one or more I/O modules in Idle Mode
Solid GRN	Device operational - all I/O modules in Run Mode
Flashing RED/OFF	Recoverable fault - one or more I/O modules may be in Fault Mode
Solid RED	Unrecoverable fault - one or more I/O modules may be in Fault Mode
Diagnostic Status (DIAG)	
OFF	No power or no diagnostics running
Flashing Amber	Main Program detected an error - number of flashes indicates the error
Flashing Green/OFF	Diagnostic self-tests are in progress
Flashing RED/OFF	Diagnostics found error - number of flashes indicates which test failed • One flash- RAM test failed • Two flashes- Boot program checksum failed • Three flashes- Main program checksum failed • Four flashes- Configuration checksum failed • Five flashes- Access to program or configuration failed • Six flashes- Backplane power fault (Series B only)
Solid RED	Watchdog tripped

Application Examples

1747-SDN Application Example

The following application example details a 1747-SDN DeviceNet scanner controlling 1769 Compact I/O via DeviceNet and the 1769-ADN DeviceNet Adapter.

Hardware Setup



Configuring the SLC System

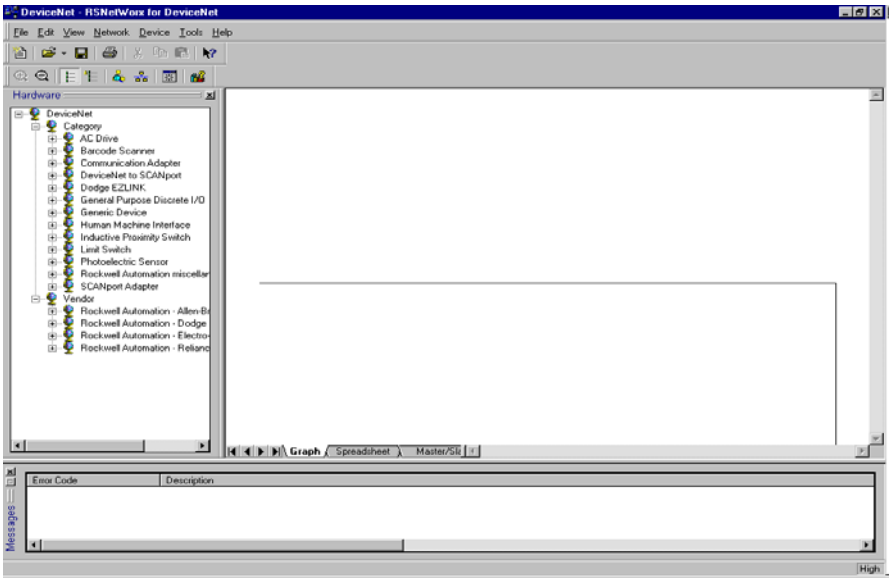
You'll need to enter your SLC 500™ programming software, create a new program, and choose the SLC 5/04 processor to configure the SLC system.

This example uses a 1747-SDN DeviceNet scanner in slot 3. The software automatically creates 32 I/O words and 256 M1 and M0 file words. You can view this by highlighting the 1747-SDN in the I/O configuration screen and choosing **Advanced Config**.

The 1747-SDN maps the 1769 I/O to the I/O image words in the SLC processor. You can then write a ladder program addressing this I/O. Since the I/O data is packed into the SLC I/O image, you'll want to see where this data is actually mapped before attempting to address it in the ladder program. For additional details on configuring your SLC system and writing the ladder program, refer to the *SLC 500 and MicroLogix™ 1000 Instruction Set* (publication 1747-RM001), the *MicroLogix 1200 and 1500 Instruction Set* (publication 1762-RM001), the *SLC 500 Modular Hardware Style User Manual* (publication 1747-RM011), and/or the RSLogix 500 help screens.

Configuring the 1769-ADN DeviceNet Adapter

Start RSNetworx for DeviceNet.



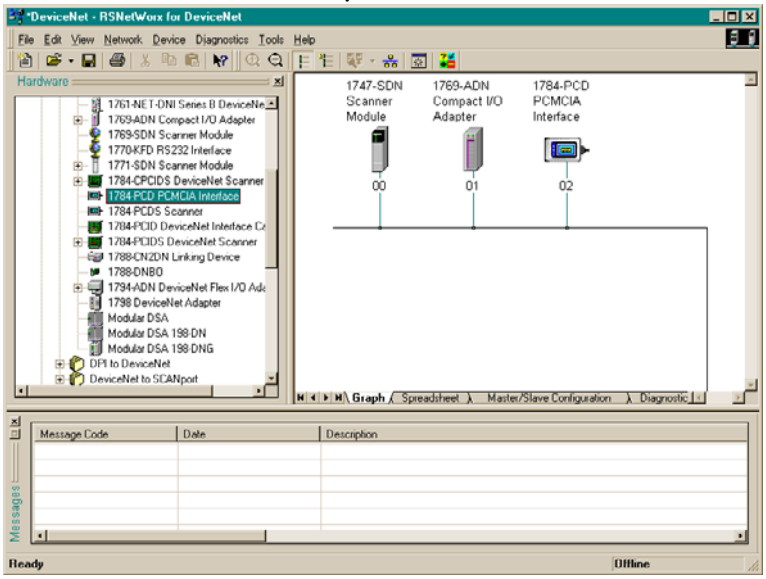
At this point, you could configure your network devices offline and download these configuration files to the network devices. Instead, we will go online to configure our network. Refer to chapter 3 for information on configuring your DeviceNet system offline.

The advantage to configuring your system online is that the RSNetworx software can upload the keys of the actual devices present in the Compact I/O system - its I/O modules, power supplies, inter-rack cables, and end cap - to use for adapter configuration. All you'll need to do is configure the individual I/O modules.

From the Network pull-down menu, choose Online or click on the online icon in the toolbar. You'll see a Browse Network screen where you must select your communication path previously configured in RSLinx for going online with your DeviceNet network.

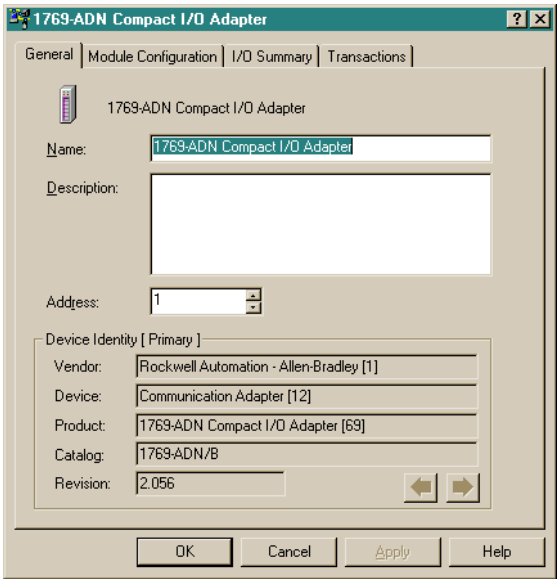
For this example, we're using a notebook computer with a 1784-PCD card. Click on the 1784-PCD and choose **OK** to the subsequent warning message.

You'll see this screen with your network devices.

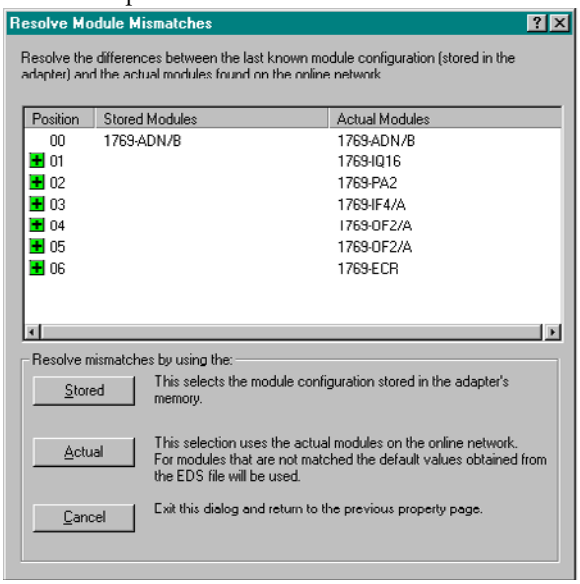


Note that this example has the 1747-SDN at node address 00, the 1769-ADN at node address 30, and the 1784-PCD at node address 62. These node address assignments are arbitrary and each device could be assigned any unique address from 00 to 63.

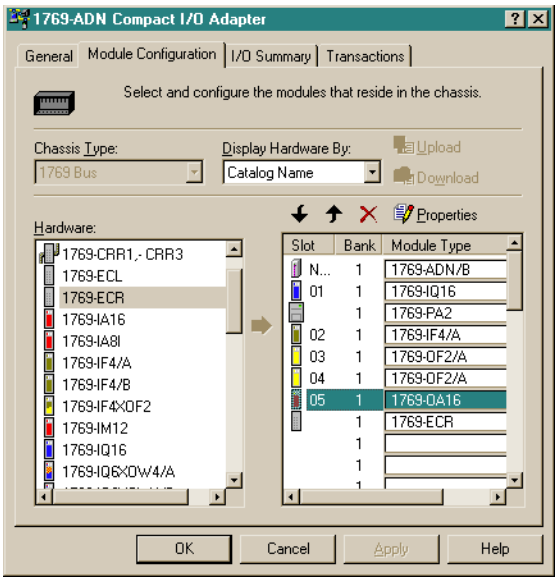
To begin configuring your DeviceNet network you'll configure the Compact I/O system. Double-click on the 1769-ADN icon. You'll see this screen.



Choose the Module Configuration tab. Choose **Yes** when asked if you want to upload. You'll see this screen.



The I/O Module Mismatch screen indicates that configuration has not yet been downloaded to the 1769-ADN. Choose **Resolve Mismatch**. You'll see this screen.



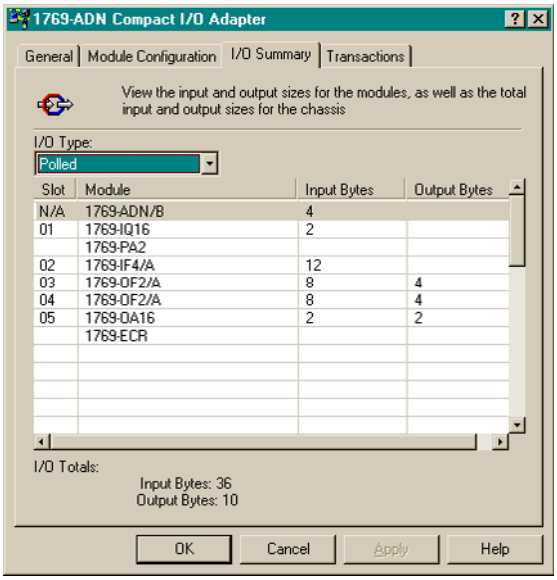
Notice that the 1769 system configuration software is now completely filled in with the actual I/O modules, power supplies, cable, and end cap. You can view the second bank by choosing the I/O Bank 2 Configuration tab. This layout matches the Hardware Setup on page 6-1.

Next, you'll want to configure the individual I/O modules. When you choose the Slot button next to each I/O module, you'll see a screen allowing you to view and modify the I/O data size, module keying, and choose the state of each output (provided the module is an output module) in the event that the SLC processor is placed in the Program or Fault mode.

Modules requiring configuration, like analog I/O modules, must be configured by choosing the Slot button.

Choosing I/O Data Size is useful when determining how the I/O data is packed in the SLC I/O image table. Data Description shows you a description of each word shown in the I/O Data Size dialog. By default, discrete output modules use an output word and an input word. The input word contains an echo of the output data. You could disable this echo to save input image, but for this example we will leave the echo enabled.

Choose the I/O Summary tab for the 1769-ADN DeviceNet adapter. You'll see this screen.

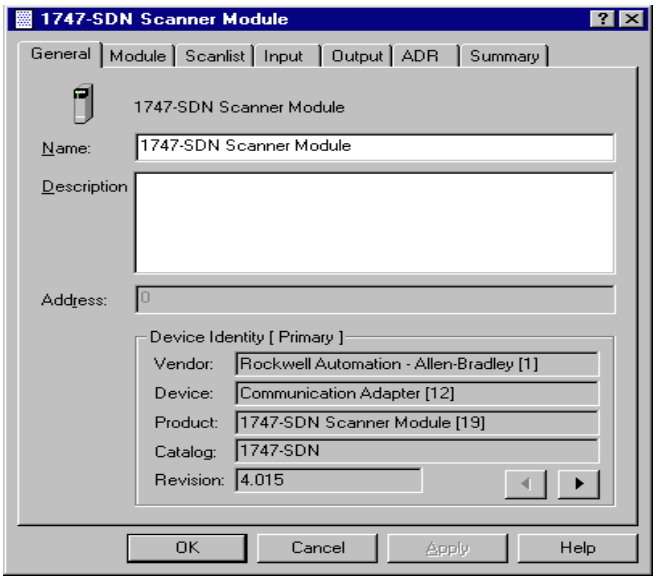


This is a summary of your 1769 system. Note the Total Input and Output Bytes as you'll need this information when configuring the 1747-SDN scanner.

Choose **Apply**. This will download your configuration to the 1769-ADN. Then choose **OK** to close the adapter's window and return to the network screen.

Configuring the 1747-SDN

To configure the 1747-SDN DeviceNet scanner to exchange I/O data with the 1769-ADN, double-click on the 1747-SDN. You'll see this screen.



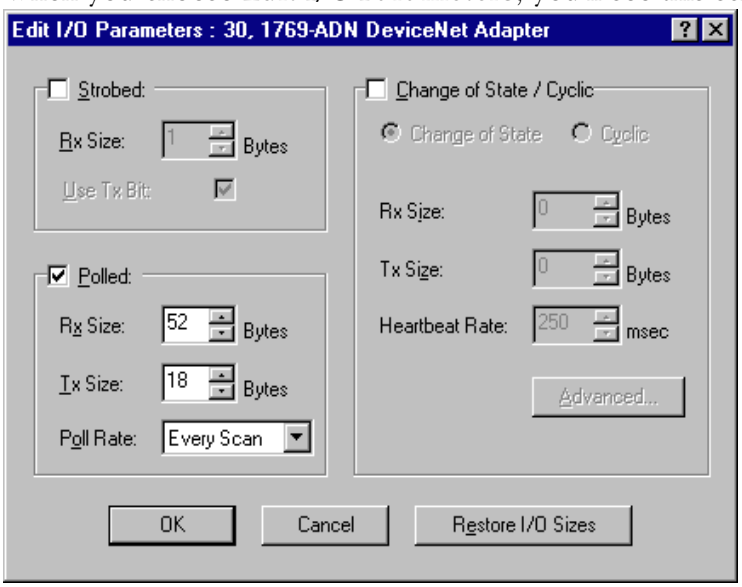
The General tab supplies information about the scanner. Choose the Module tab and choose **Upload** on the Scanner Configuration screen. Once the upload is complete you'll return to the Module tab.

You should accept the defaults except for the 1747-SDN slot number. For this example, the slot number for the 1747-SDN in its SLC chassis is 3.

After modifying the chassis slot number, choose **Download to Scanner**. This will ensure that the correct I/O addresses are displayed under the Input and Output tabs.

Now choose the Scanlist tab. To add the 1769-ADN to the 1747-SDN scanlist, choose the 1769-ADN shown in the Available Devices box on the left. Choose the single right arrow between the Available Devices box and the Scanlist box. This moves the 1769-ADN to the 1747-SDN scanlist.

When you choose **Edit I/O Parameters**, you'll see this screen.



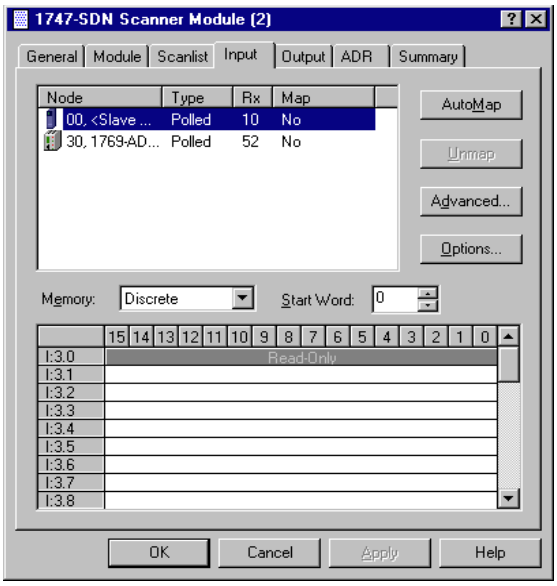
Polled connection is the default[1]. You could choose to enable a Change of State/Cyclic connection, but we won't be using that in this example. Refer to Chapter 2 of this document for more information.

Rx (receive) and Tx (transmit) sizes default to the Total Input and Output bytes from the 1769-ADN summary page. For this example, 52 is the Rx size and 18 is the Tx size.

Choose the Every Scan poll rate. Refer to the 1747-SDN documentation for a complete description of Every Scan and Background Poll Rates.

1 Refer to Appendix C for some important system characteristics when using the polled mode (minimum inter-scan delay I.D. for polled connections).

Choose **OK** to accept the Polled configuration. You'll now see the 1747-SDN Scanner Module screen. Choose the Input tab and you'll see this screen.



From this screen, you can map the input data received from the 1769-ADN into the input image table of the SLC 5/04 processor or to the M1 file. For this example, we'll map the data into the input image table.

To map the data into the input image table, click on the 1769-ADN so that it is highlighted. Now choose **AutoMap**.

Since we chose to map this data into the discrete input image table of the processor, the data is shown mapped to the SLC 5/04 processor's input image beginning with word I:3.1.

Word I:3.0 is used for status information for the scanner. The next two words received into input words I:3.1 and I:3.2 contain status information for the 1769-ADN. Refer to chapter 2 of this manual for additional information concerning status words.

The actual input data begins with word I:3.3 in the SLC 5/04 processor's input image. Note that words I:3.1 through I:3.26 are mapped. This corresponds to the 52 bytes or 26 words we entered into the 1747-SDN scanner's scanlist/Edit I/O Parameters screen (which originally came from the 1769-ADN adapter's Summary screen).

Choose the Output tab. To map the outputs for the SLC 5/04 processor's output image table, follow the same procedure used to map the inputs. Output word O:3.0 is used for control information to the scanner. Word O:3.1 contains the first actual output data. There is no additional offset for the output data as there was for the input data.

Note that words O:3.1 through O:3.9 are mapped. These nine words correspond to the 18 bytes we entered into the 1747-SDN scanner's scanlist/Edit I/O Parameters screen (which originally came from the 1769-ADN adapter's Summary screen).

We chose to map the output data to the SLC 5/04 processor's output image rather than the M0 file. If you prefer to map to the M0 file, choose M file instead of Discrete.

Choose **Apply**. Choose **Yes** to download your configuration to the 1747-SDN.

You have successfully configured your 1747-SDN scanner to exchange I/O data with your 1769-ADN adapter.

Accessing the I/O Data from the 1769-ADN in the SLC Processor

Start your SLC 500 Programming Software. Create a minimal program that includes configuring the I/O with the 1747-SDN in slot 3 of the processor chassis as described in Configuring the SLC System on page 6-1.

Add a single ladder rung to file 2: an unconditional rung with an OTE addressed to O:3.0/0. This is the RUN/IDLE bit for the 1747-SDN. When the SLC processor is placed into the RUN mode, the 1747-SDN will also then be placed into the RUN mode. Save and download the program to the SLC processor.

Place the SLC processor into the RUN mode and follow the I/O maps below to determine where each input module's data will reside as well as which output word(s) are for each output module. Use the Input and Output File Data Monitors in the programming software to experiment with viewing inputs and manipulating outputs, until you are comfortable with the I/O mapping to write your ladder program.

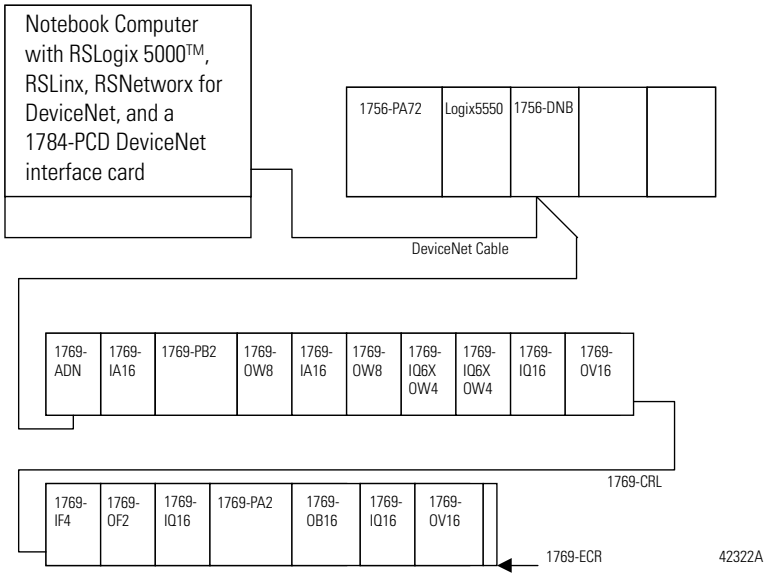
Input Image	
I:3.0	1747-SDN Status
I:3.1	1769-ADN Status Word 0
I:3.2	1769-ADN Status Word 1
I:3.3	Slot 1 Input Card, Input Data (1769-IA16)
I:3.4	Slot 2 Output Card, Output Echo Data (1769-OW8)
I:3.5	Slot 3 Input Card, Input Data (1769-IA16)
I:3.6	Slot 4 Output Card, Output Echo Data (1769-OW8)
I:3.7	Slot 5 Combo Card, Input Data (1769-IQ6XOW4)
I:3.8	Slot 5 Combo Card, Output Echo Data (1769-IQ6XOW4)
I:3.9	Slot 6 Combo Card, Input Data (1769-IQ6XOW4)
I:3.10	Slot 6 Combo Card, Output Echo Data (1769-IQ6XOW4)
I:3.11	Slot 7 Input Card, Input Data (1769-IQ16)
I:3.12	Slot 8 Output Card, Output Echo Data (1769-OV16)
I:3.13	Slot 9 Analog Input Card, Input Data 0 (1769-IF4)
I:3.14	Slot 9 Analog Input Card, Input Data 1 (1769-IF4)
I:3.15	Slot 9 Analog Input Card, Input Data 2 (1769-IF4)
I:3.16	Slot 9 Analog Input Card, Input Data 3 (1769-IF4)
I:3.17	Slot 9 Analog Input Card, Status Data (1769-IF4)
I:3.18	Slot 9 Analog Input Card, Status Data (1769-IF4)
I:3.19	Slot 10 Analog Output Card, Status Data (1769-OF2)
I:3.20	Slot 10 Analog Output Card, Status Data (1769-OF2)
I:3.21	Slot 10 Analog Output Card, Output Echo 0 (1769-OF2)
I:3.22	Slot 10 Analog Output Card, Output Echo 1 (1796-OF2)
I:3.23	Slot 11 Input Card, Input Data (1769-IQ16)
I:3.24	Slot 12 Output Card, Output Echo Data (1769-OB16)
I:3.25	Slot 13 Input Card, Input Data (1769-IQ16)
I:3.26	Slot 14 Output Card, Output Echo Data (1769-OV16)

Output Image	
O:3.0	1747-SDN Control, including the RUN/IDLE bit (0)
O:3.1	Slot 2 Output Card, Output Data (1769-OW8)
O:3.2	Slot 4 Output Card, Output Data (1769-OW8)
O:3.3	Slot 5 Combo Card, Output Data (1769-IQ6XOW4)
O:3.4	Slot 6 Combo Card, Output Data (1769-IQ6XOW4)
O:3.5	Slot 8 Output Card, Output Data (1769-OV16)
O:3.6	Slot 10 Analog Output Card, Output Data 0 (1769-OF2)
O:3.7	Slot 10 Analog Output Card, Output Data 1 (1769-OF2)
O:3.8	Slot 12 Output Card, Output Data (1769-OB16)
O:3.9	Slot 14 Output Card, Output Data 1769-OV16)

1756-DNB Application Example

The following application example details a 1756-DNB DeviceNet scanner controlling 1769 Compact I/O via DeviceNet and the 1769-ADN DeviceNet Adapter.

Hardware Setup



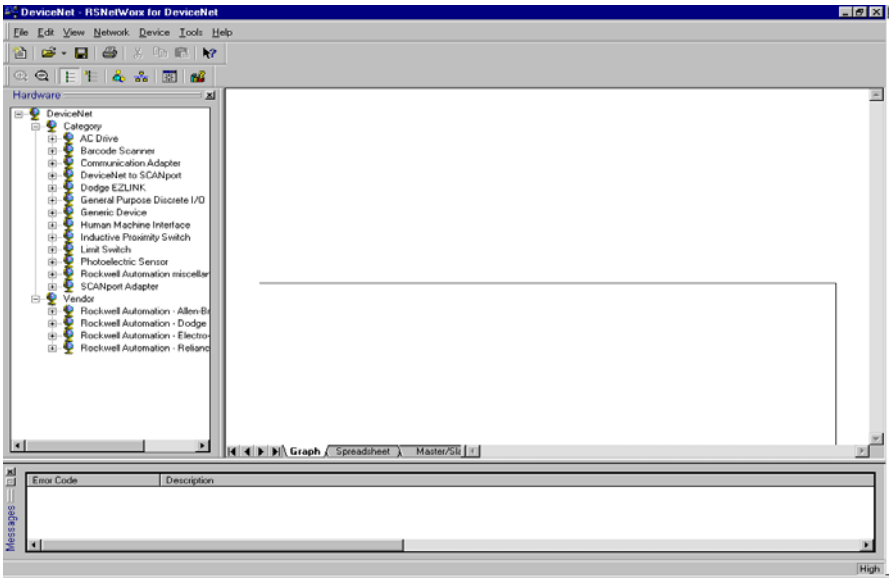
Configuring the Logix5550™ Controller System

Configure your Logix5550 system by selecting the 1756-DNB module under I/O configuration in RSLogix 5000 programming software. For more information on configuring your controller or writing the controller program, refer to your ControlLogix documentation.

The following sections will guide you through configuring your 1756-DNB module to produce output data to the 1769-ADN and consume input data from the 1769-ADN. You'll see how the I/O data is mapped into the Logix5550 controller, allowing you to then write your control program.

Configuring the 1769-ADN DeviceNet Adapter

Start RSNetworx for DeviceNet. You'll see this screen.



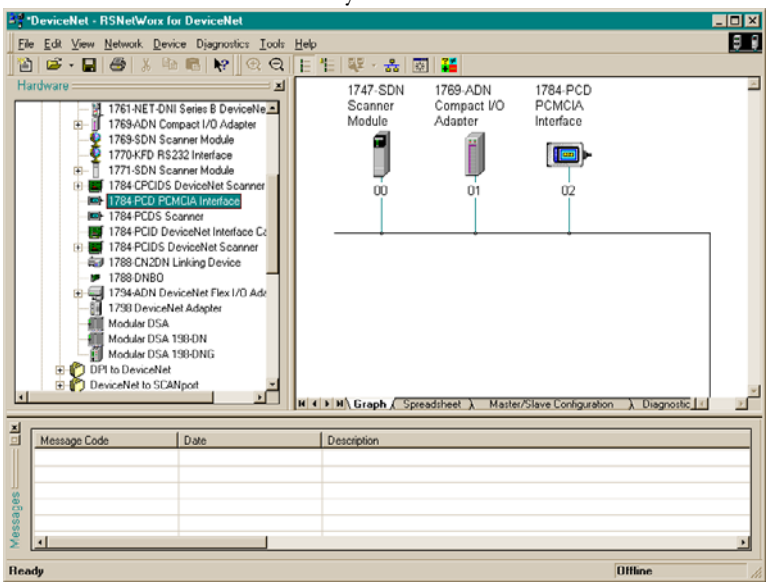
At this point, you could configure your network devices offline and download these configuration files to the network devices. Instead, we will go online to configure our network. Refer to chapter 3 for information on configuring your DeviceNet system offline.

The advantage to configuring your system online is that the RSNetworx software can upload the keys of the actual devices present in the Compact I/O system - its I/O modules, power supplies, inter-rack cable, and end cap - to use for adapter configuration. All you'll need to do is configure the individual I/O modules.

From the Network pull-down menu, choose Online or click on the online icon in the toolbar. You'll see a Browse Network screen where you must select your communication path (previously configured in RSLinx for going online with your DeviceNet network).

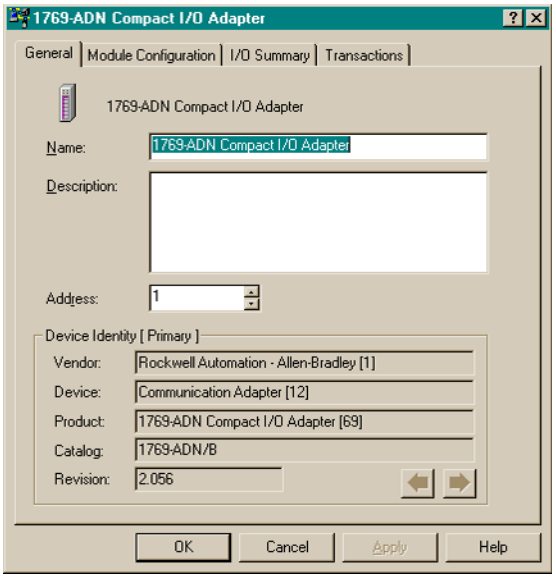
For this example, we're using a notebook computer with a 1784-PCD card. Click on the 1784-PCD and choose **OK** to the subsequent warning message.

You'll see this screen with your network devices.

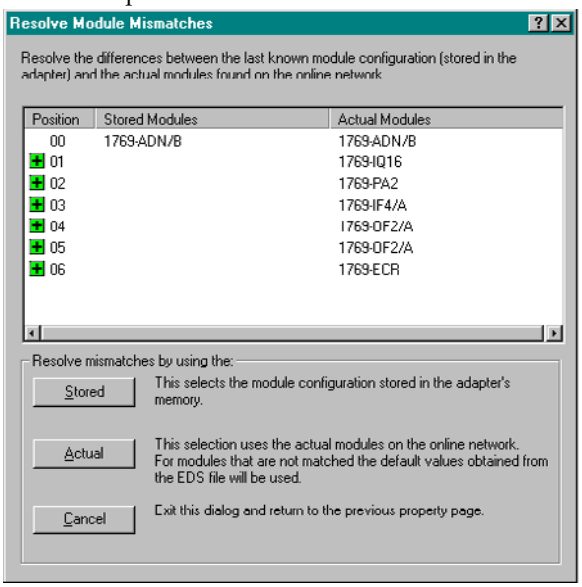


Note that this example has the 1756-DNB at node address 01, the 1769-ADN at node address 30, and the 1784-PCD at node address 62. These node address assignments are arbitrary and each device could be assigned any unique address from 00 to 63.

To begin configuring your DeviceNet network, you'll configure the Compact I/O system. Double-click on the 1769-ADN icon. You'll see this screen.

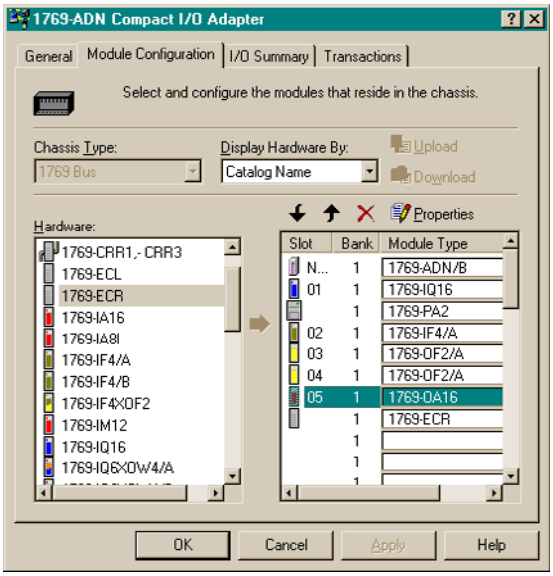


Choose the Module Configuration tab. Choose **Yes** when asked if you want to upload. You'll see this screen.



The I/O Module Mismatch screen indicates that configuration has not yet been downloaded to the 1769-ADN. Choose **Resolve Mismatch**.

You'll see this screen.



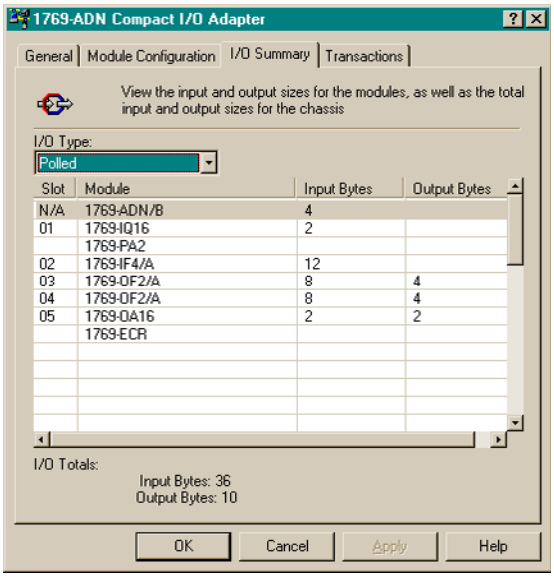
Notice that the 1769 system configuration software is now completely filled in with the actual I/O modules, power supplies, cable, and end cap. You can view the second bank by choosing the I/O Bank 2 Configuration tab. This layout matches the Hardware Setup on page 6-1.

Next, you'll want to configure the individual I/O modules. When you choose the Slot button next to each I/O module, you'll see a screen allowing you to view and modify the I/O data size, module keying, and choose the state of each output (provided the module is an output module) in the event that the SLC processor is placed in the Program or Fault mode.

Modules requiring configuration, like analog I/O modules, must be configured by choosing the Slot button.

Choosing I/O Data Size is useful when determining how the I/O data is packed in the Logix5550 image table. Data Description shows you a description of each word shown in the I/O Data Size dialog. By default, discrete output modules use an output word and an input word. The input word contains an echo of the output data. You could disable this echo to save input image, but for this example we will leave the echo enabled.

Choose the I/O Summary tab for the 1769-ADN DeviceNet adapter. You'll see this screen.

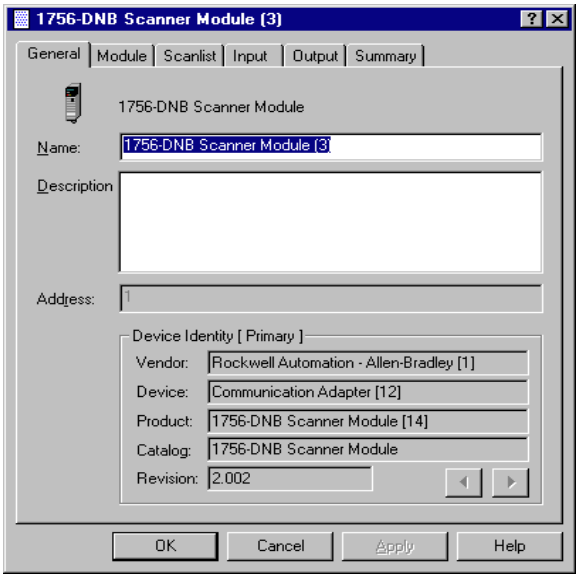


This is a summary of your 1769 system. Note the Total Input and Output Bytes as you'll need this information when configuring the 1756-DNB scanner.

Choose **Apply**. This will download your configuration to the 1769-ADN. Then choose **OK** to close the adapter's window and return to the network screen.

Configuring the 1756-DNB

To configure the 1756-DNB DeviceNet scanner to exchange I/O data with the 1769-ADN, double-click on the 1756-DNB. You'll see this screen.



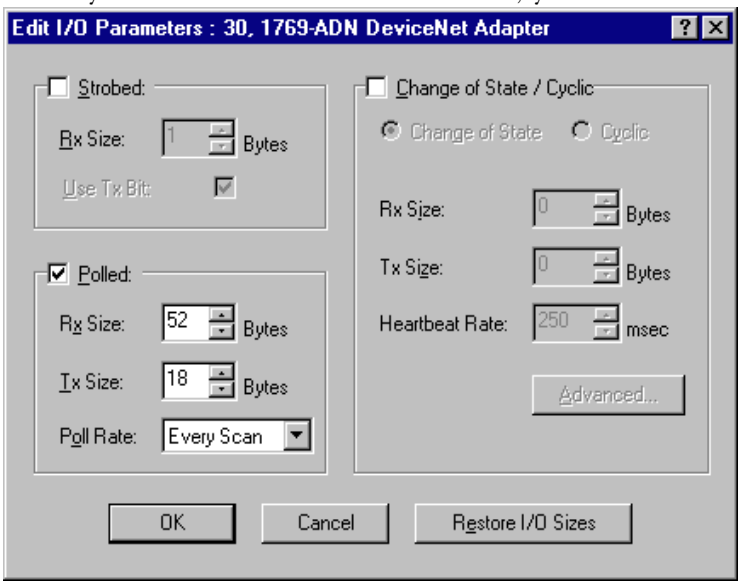
The General tab supplies information about the scanner. Choose the Module tab and choose **Upload** on the Scanner Configuration screen. Once the upload is complete you'll return to the Module tab.

You should accept the defaults except for the 1756-DNB slot number. For this example, the slot number for the 1756-DNB in its ControlLogix chassis is 1 (the default).

After modifying the chassis slot number, choose **Download to Scanner**. This will ensure that the correct I/O addresses are displayed under the Input and Output tabs.

Now choose the Scanlist tab. To add the 1769-ADN to the 1756-DNB scanlist, choose the 1769-ADN shown in the Available Devices box on the left. Choose the single right arrow between the Available Devices box and the Scanlist box. This moves the 1769-ADN to the 1756-DNB scanlist.

When you choose **Edit I/O Parameters**, you'll see this screen.



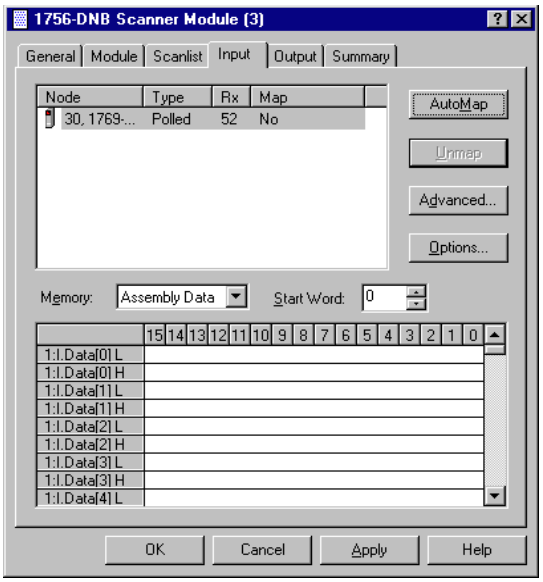
Polled connection is the default[1]. You could choose to enable a Change of State/Cyclic connection, but we won't be using that in this example. For more information on connection types, refer to the Chapter 2.

Rx (receive) and Tx (transmit) sizes default to the Total Input and Output bytes from the 1769-ADN summary page. For this example, 52 is the Rx size and 18 is the Tx size.

Choose the Every Scan poll rate. Refer to the 1756-DNB documentation for a complete description of Every Scan and Background Poll Rates.

1 Refer to Appendix C for some important system characteristics when using the polled mode (minimum inter-scan delay I.D. for polled connections).

Choose **OK** to accept the Polled configuration. You'll now see the 1756-DNB Scanner Module screen. Choose the Input tab and you'll see this screen.



From this screen, you can map the input data received from the 1769-ADN into the input tag of the Logix5550 controller or 1:I.Data.0 through 1:I.Data.12 (these are DINTs, so the total number of 16-bit words is 26 or 52 bytes).

To map the data into the input image table, click on the 1769-ADN so that it is highlighted. Now choose **AutoMap**.

The first two 16-bit words received in 1:I.Data.0 contain status information from the 1769-ADN. Refer to chapter 2 of this manual for additional information concerning status words.

The actual input data begins with tag address 1:I.Data.1 in the Logix5550 controller. Note that DINTs 1:I.Data.0 through 1:I.Data.12 are mapped. This corresponds to the 52 bytes or 26 words we entered into the 1756-DNB scanner's scanlist/Edit I/O Parameters screen (which originally came from the 1769-ADN adapter's Summary screen).

Choose the Output tab. To map the outputs for the Logix5550 controller's output tag, follow the same procedure used to map the inputs. Click on the 1769-ADN so that it is highlighted and choose **AutoMap**.

DINT 1:O.CommandRegister is used for control information to the scanner. Bit 1:O.CommandRegister.RUN is the RUN/IDLE bit which must be set to a logical 1 to place the 1756-DNB into the Run mode when the controller is in the Run mode. 1:O.Data.0 is the first actual output address. There is no offset for the output data as there was for input data.

Note that words 1:O.Data.0 through 1:O.Data.4L are mapped. These 4.5 DINTs correspond to the 18 bytes we entered into the 1756-DNB scanner's scanlist/Edit I/O Parameters screen (which originally came from the 1769-ADN adapter's Summary screen). Choose the Summary tab to view a summary of the mapped I/O data.

Choose **Apply**. Choose **Yes** to download your configuration to the 1756-DNB.

You have successfully configured your 1756-DNB scanner to exchange I/O data with your 1769-ADN adapter.

Accessing the I/O Data from the 1769-ADN in the Logix5550 Controller

Start your RSLogix 5000 Programming Software. Create a minimal program that includes configuring the I/O with the 1756-DNB in slot 1 of the controller chassis as described in Configuring the Logix5550TM Controller System on page 6-12.

Add a single ladder rung to the MainRoutine: an unconditional rung with an OTE addressed to 1:O.CommandRegister.RUN. This is the RUN/IDLE bit for the 1756-DNB. When the Logix5550 controller is placed into the RUN mode, the 1756-DNB will also then be placed into the RUN mode. Save and download the program to the Logix5550 controller.

Place the controller into the RUN mode and follow the I/O maps below to determine where each input module's data will reside as well as which output word(s) are for each output module. Use the Controller Tags screen in the programming software to experiment with viewing inputs and manipulating outputs, until you are comfortable enough with the I/O mapping to write your Logix 5550 controller program.

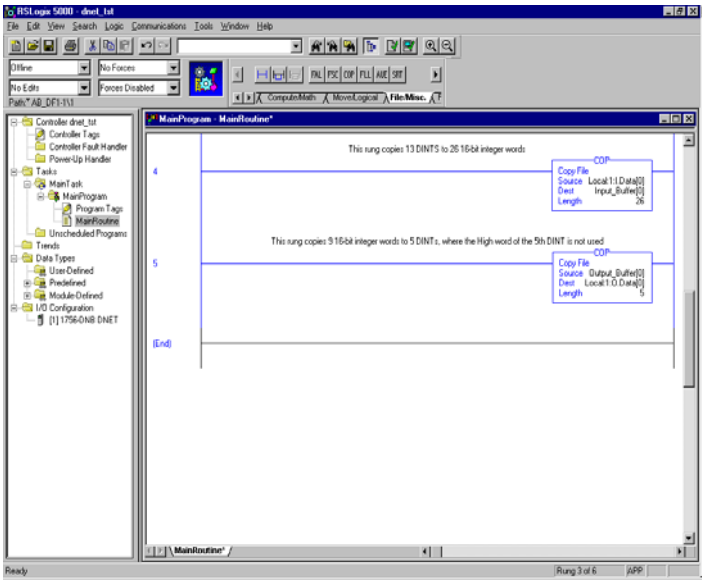
Slot 1 Input Tag Map	
1:I.Data0L	1769-ADN Status Word 0
1:I.Data.0H	1769-ADN Status Word 1
1:I.Data.1L	Slot 1 Input Card, Input Data (1769-IA16)
1:I.Data.1H	Slot 2 Output Card, Output Echo Data (1769-OW8)
1:I.Data.2L	Slot 3 Input Card, Input Data (1769-IA16)
1:I.Data.2H	Slot 4 Output Card, Output Echo Data (1769-OW8)
1:I.Data.3L	Slot 5 Combo Card, Input Data (1769-IQ6XOW4)
1:I.Data.3H	Slot 5 Combo Card, Output Echo Data (1769-IQ6XOW4)
1:I.Data.4L	Slot 6 Combo Card, Input Data (1769-IQ6XOW4)
1:I.Data.4H	Slot 6 Combo Card, Output Echo Data (1769-IQ6XOW4)
1:I.Data.5L	Slot 7 Input Card, Input Data (1769-IQ16)
1:I.Data 5H	Slot 8 Output Card, Output Echo Data (1769-OV16)
1:I.Data.6L	Slot 9 Analog Input Card, Input Data 0 (1769-IF4)
1:I.Data.6H	Slot 9 Analog Input Card, Input Data 1 (1769-IF4)
1:I.Data.7L	Slot 9 Analog Input Card, Input Data 2 (1769-IF4)
1:I.Data.7H	Slot 9 Analog Input Card, Input Data 3 (1769-IF4)
1:I.Data.8L	Slot 9 Analog Input Card, Status Data (1769-IF4)
1:I.Data.8H	Slot 9 Analog Input Card, Status Data (1769-IF4)
1:I.Data.9L	Slot 10 Analog Output Card, Status Data (1769-OF2)
1:I.Data.9H	Slot 10 Analog Output Card, Status Data (1769-OF2)
1:I.Data.10L	Slot 10 Analog Output Card, Output Data 0 (1769-OF2)
1:I.Data.10H	Slot 10 Analog Output Card, Output Data 1 (1796-OF2)
1:I.Data.11L	Slot 11 Input Card, Input Data (1769-IQ16)
1:I.Data.11H	Slot 12 Output Card, Output Echo Data (1769-OB16)
1:I.Data.12L	Slot 13 Input Card, Input Data (1769-IQ16)
1:I.Data.12H	Slot 14 Output Card, Output Echo Data (1769-OV16)

Output Image	
1:O.Data.0L	Slot 2 Output Card, Output Data (1769-OW8)
1:O.Data.0H	Slot 4 Output Card, Output Data (1769-OW8)
1:O.Data.1L	Slot 5 Combo Card, Output Data (1769-IQ6XOW4)
1:O.Data.1H	Slot 6 Combo Card, Output Data (1769-IQ6XOW4)
1:O.Data.2L	Slot 8 Output Card, Output Data (1769-OV16)
1:O.Data.2H	Slot 10 Analog Output Card, Output Data 0 (1769-OF2)
1:O.Data.3L	Slot 10 Analog Output Card, Output Data 1 (1769-OF2)
1:O.Data.3H	Slot 12 Output Card, Output Data (1769-OB16)
1:O.Data.4L	Slot 14 Output Card, Output Data (1769-OV16)

To split the Low and High words of each DINT for better viewing, especially analog data, create an integer tag with a length twice that of the number of DINTs needed to include your input data. Use a COP Instruction to copy the DINT input data to this new integer tag.

In this example, the 13 input DINTS are copied to 26 16-bit integer words. An example of the COP Instruction (with an integer tag name of Input_Buffer) is shown below. The length for a COP Instruction is determined by the destination address. Therefore, the length for this example is 26 integer words.

This COP Instruction example also accomplishes the same purpose for the output data. The integer tag name is Output_Buffer and the length for this example is 5 DINTS, where the High word of DINT 1:O.Data.4 is not used.



1769-SDN Application Example

This example uses the 1769-SDN scanner module with a MicroLogix 1500 controller.

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 as a DeviceNet master and own DeviceNet slave devices. This allows either processor to communicate with intelligent devices like drives, scales, starters and many others, or use DeviceNet to expand the processors I/O capabilities/capacity.

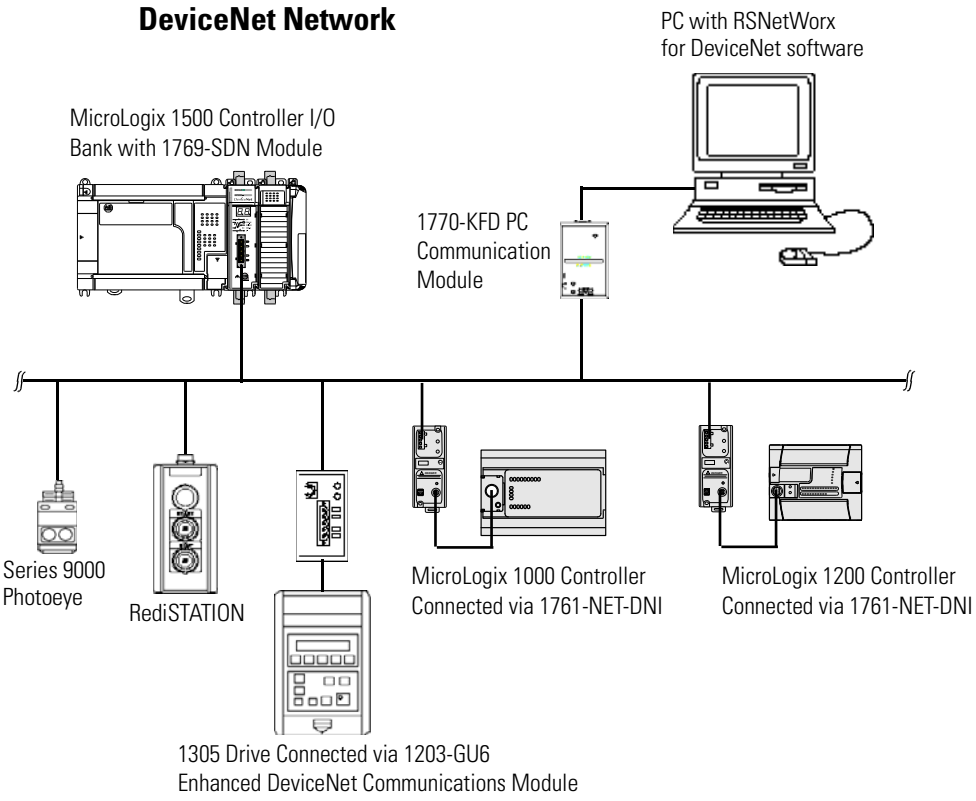
The 1764-LRP processor allows messaging functionality over DeviceNet, so non-I/O data may be exchanged. Multiple 1769-SDN scanner modules may be used in a 1764-LRP system, however only the first two scanners can be used for messaging. This is discussed in greater detail in Configuring a Local DeviceNet Message on page 6-32.

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. To determine if an application can be supported, configuration tools are available from www.ab.com/micrologix. 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 I/O Configuration

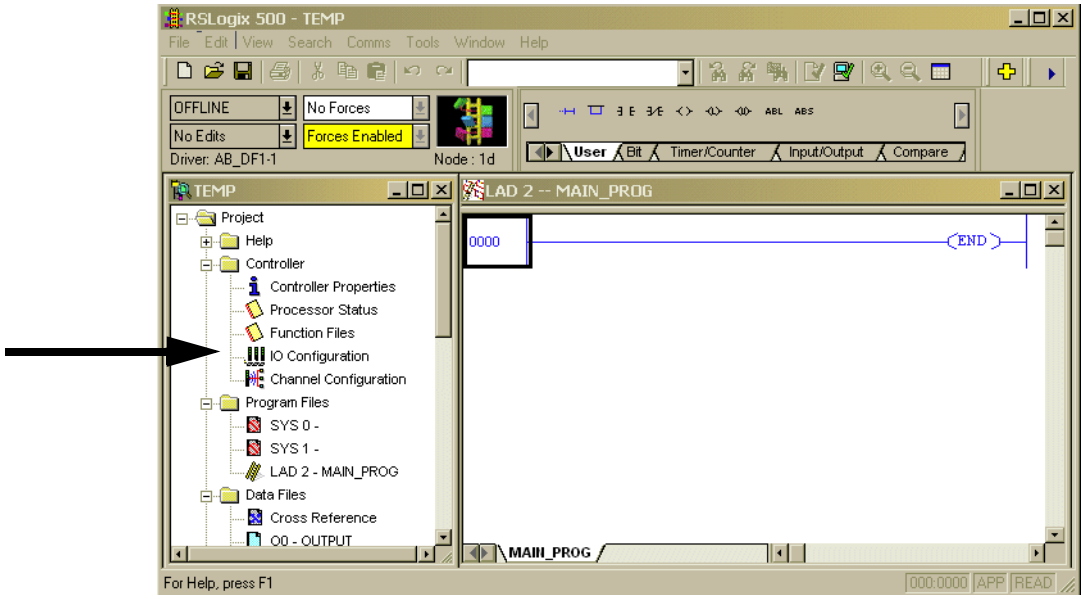
One of the advanced features of RSLogix 500 is the ability to have the programming software establish a communications connection with the controller and read which I/O modules are attached to the controller. This capability significantly reduces the effort involved in configuring a system.

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



Starting the Project

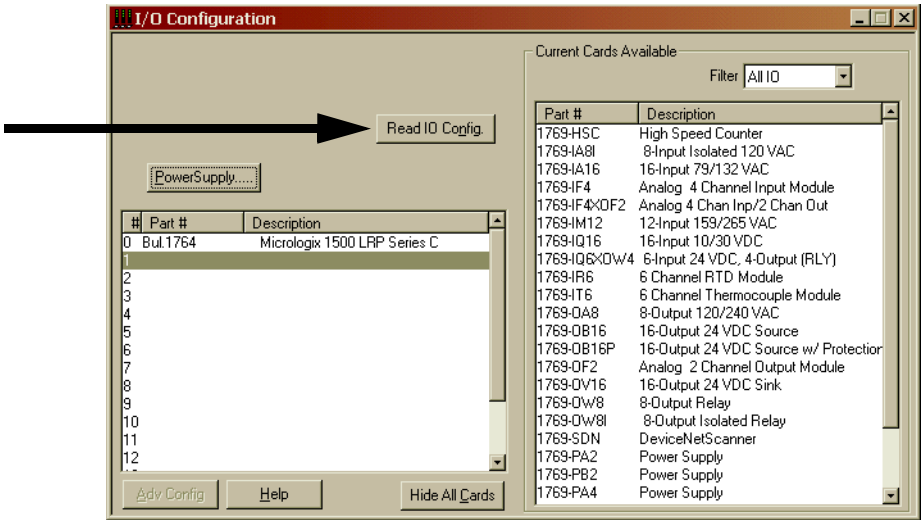
1. Open RSLogix 500.
2. Select **File.**
3. **New.**
4. Choose **MicroLogix 1500 LRP series C.**
5. The screen capture below should match what you see on your computer.



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

6. Double click **I/O Configuration**.

I/O Configuration Screen



The I/O configuration screen shows each of the controllers 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 through 16 are for Compact I/O expansion modules (referred to as local I/O, because they are physically attached to the controller). Slots 9 through 16 are only available using a Series C processor with a Series B base unit[(1)].

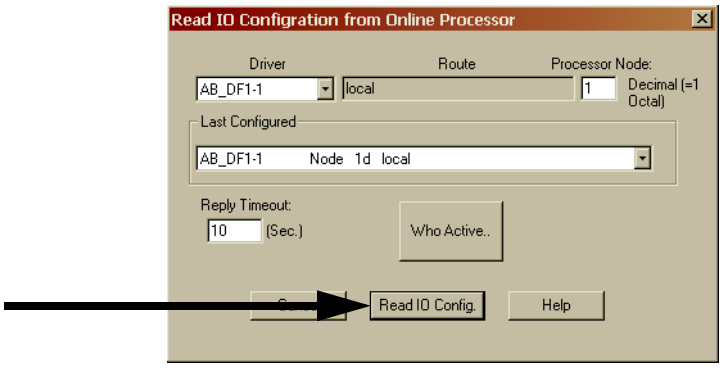
To have RSLogix 500 read the controller's local I/O and configure the slots automatically, select the **Read I/O Config** button.

TIP

To manually configure the controller I/O, simply drag the appropriate modules from the available list (right window), to the appropriate slot on the left. Note, you cannot have open slots, modules must be contiguous from 1 to 16.

(1) Series B base units will be available late in 2001. Contact your local Allen-Bradley distributor for availability.

Read I/O Configuration

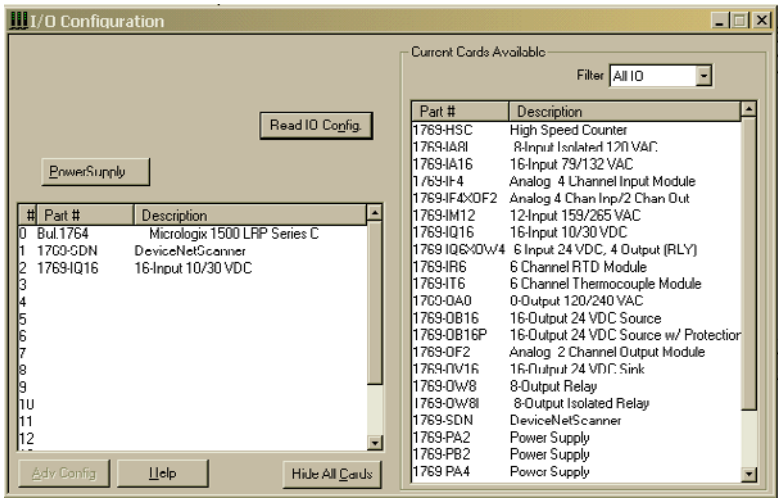


The next screen that appears is a communications dialog that allows you to select a communication path using RSLinx to the MicroLogix controller.

If you have previously connected to a controller, the communications driver that you used before will be the active driver. This dialog screen 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, select **Read I/O Config**.

Installed I/O



RSLogix 500 then 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 discrete input module in slot 2.

1769-SDN Scanner Module Configuration

To configure a specific module, simply double-click on the module. To configure the scanner in this example, **double-click on the module in slot 1**.

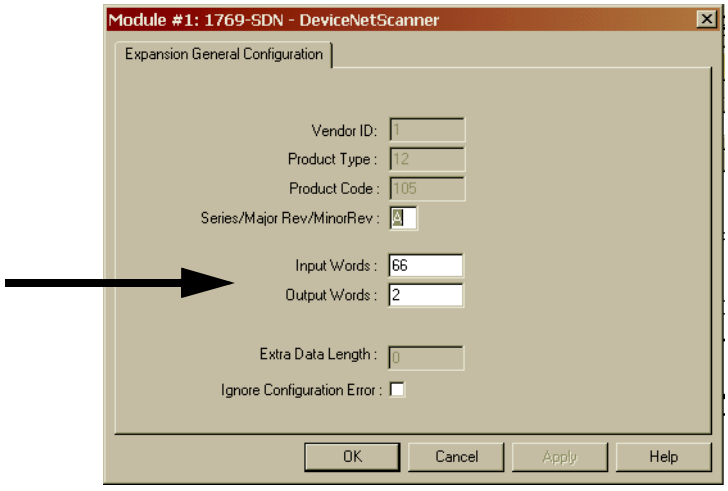
Input Words

This is the number of input words the controller assigns to the module. The first 66 words (0 to 65) are required by the scanner 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 2 words (0 and 1) are required by the scanner 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 outputs = 182).

Changing the 1769-SDN Configuration



Changing (adding or removing) the amount of data the controller has assigned to the scanner is done in the expansion module configuration screen. From within RSLogix 500, **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.

TIP

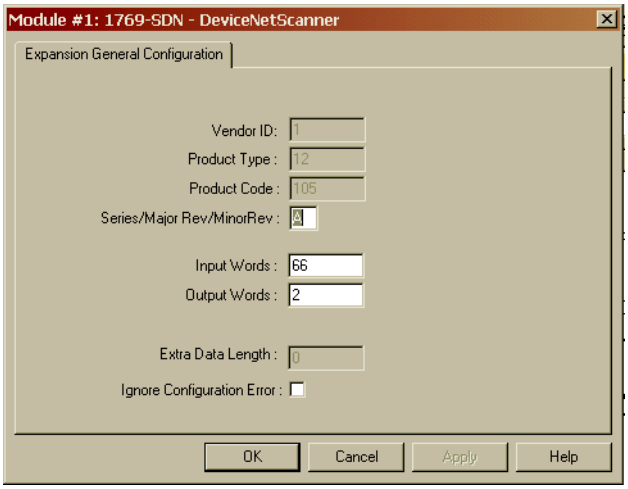
Reducing the number of words for either inputs or outputs will require a change in the 1769-SDN's scanlist, which is done using RSNetWorx.

IMPORTANT

It is recommended that you NOT reduce the number of words assigned to a 1769-SDN'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. Simply add the number of additional words that are needed in the module (using the above example), and change the scanlist using RSNetWorx.

The configuration screen for the scanner is shown below.



Ignore Configuration Error

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

If this box is not checked, the number of data words on the controller side must match the number of words configured by RSNetWorx. 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. (phone 440-646-5800)

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 DeviceNet. 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

PCCC stands for “Programmable Controller Communications Commands”. PCCC provides point to point and master/slave communications 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 communications between Allen-Bradley controllers. PCCC messaging allows program upload/download to occur over DeviceNet, and allows users to message across DeviceNet, just like they did using DH-485 or DH+. There are a number of devices that support PCCC messaging over DeviceNet, including the 1761-NET-DNI (DNI), 1203-GU6 interface, and RSLinx. If the DeviceNet network has DNI’s, either device can initiate a PCCC message.

CIP Messaging

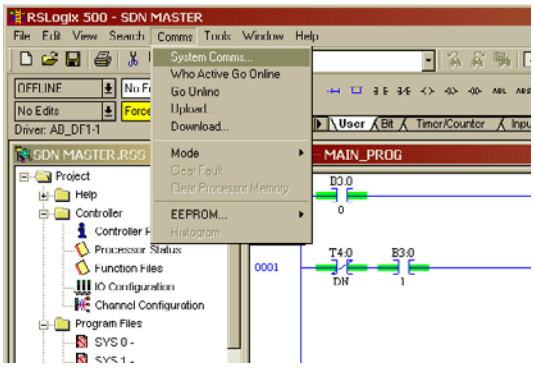
See CIP Generic on page 6-35.

Program Upload/Download

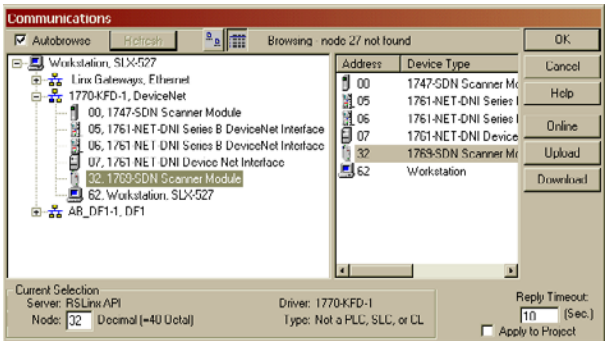
Before performing a program upload/download through the scanner, be sure that the module is properly installed in the system, and that a terminator is present at the end of the Compact I/O expansion bus.

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

To perform program upload/download using RSLogix 500, select **Comms**. From the drop-down menu, select **System Comms**.



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



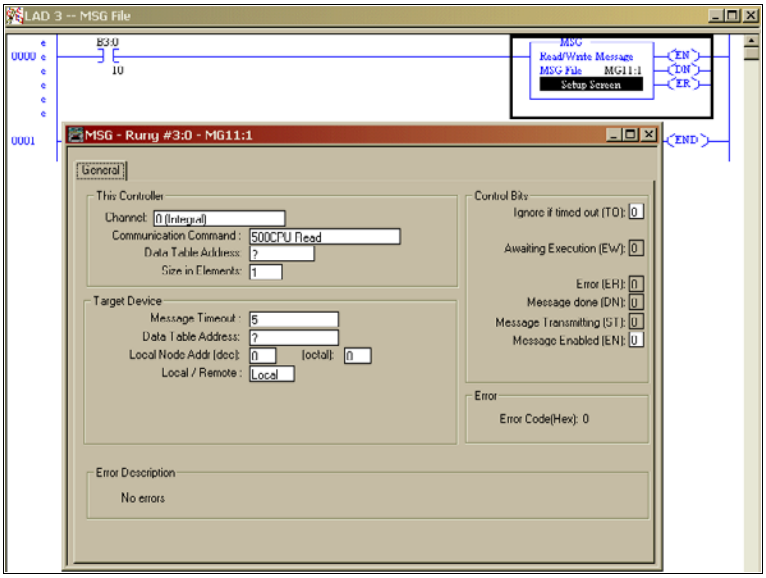
In this example, the DeviceNet interface is a 1770-KFD module. Selecting the 1770-KFD driver will show the devices on the DeviceNet network.

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

Configuring a Local DeviceNet Message

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

Message Setup Screen



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

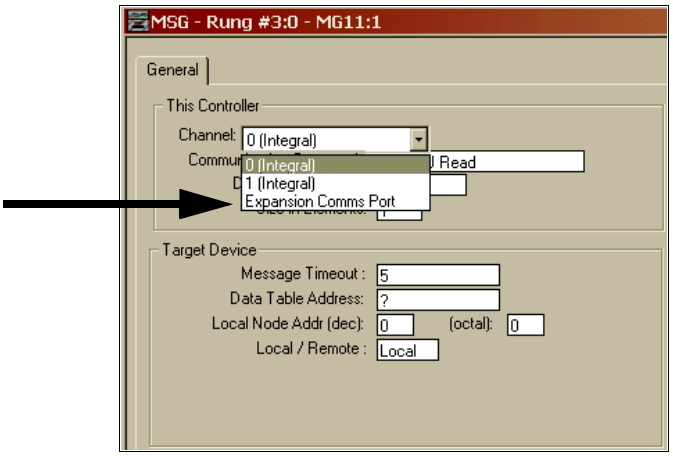
1. Access the message setup screen by double-clicking **Setup Screen**.

2. The RSLogix 500 Message Setup Screen appears. This screen is used to setup or monitor message parameters for “This Controller”, “Target Device”, and “Control Bits”. Descriptions of each of these sections follow.

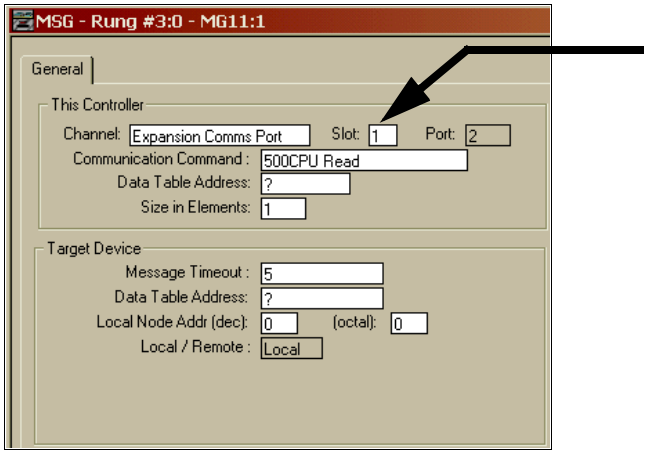
"This Controller" Parameters

Channel

The 1764-LRP 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 also supports backplane communications through the **Expansion Communication Port** (ECP) as illustrated below.



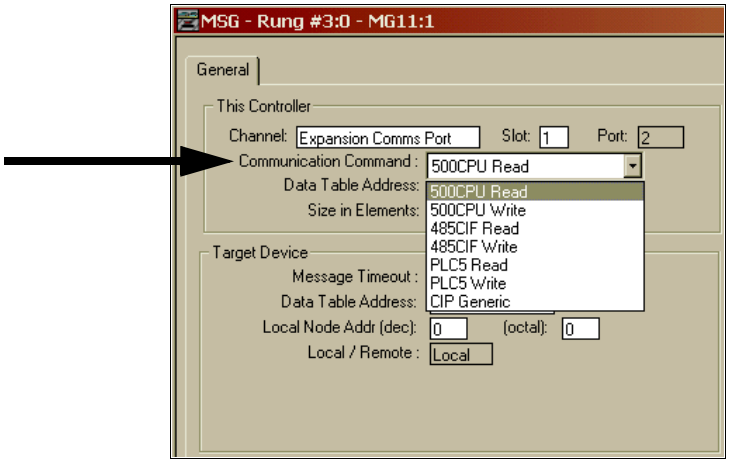
When ECP is chosen, you are able to select which **slot** position (1 to 16) the scanner resides in. The 1764-LRP processor can support up to two 1769-SDN scanner modules with full messaging functionality.



TIP

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

Communication Command



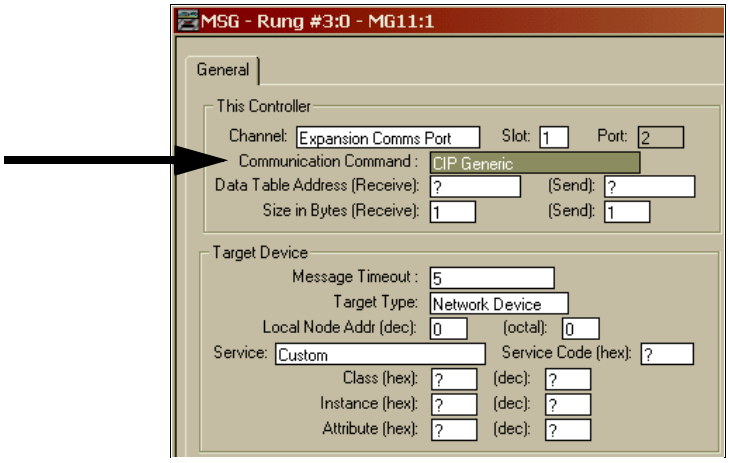
The 1764-LRP processor supports the six standard types of **communications commands** (same as all other MicroLogix 1200 and 1500 controllers) and CIP Generic. When any of these six standard commands are chosen, you can initiate standard messages to destination devices connected to DeviceNet products that support PCCC messaging (including MicroLogix and SLC controllers using 1761-NET-DNI's, other MicroLogix 1500 controllers using 1769-SDN scanner modules, etc.). 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

CIP stands for “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.

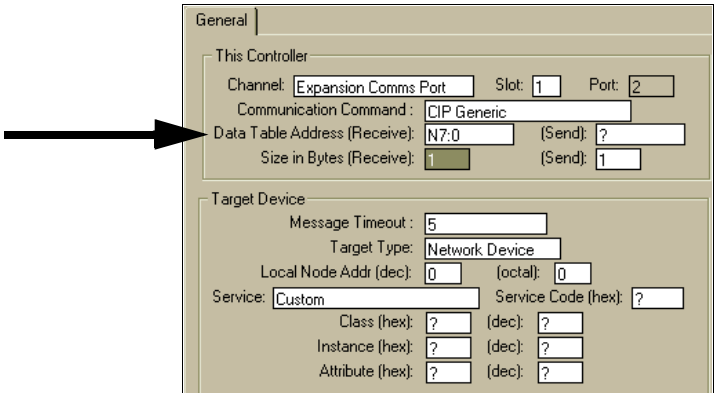
CIP messaging is the native messaging format for DeviceNet. All DeviceNet devices are compliant with CIP messaging. The MicroLogix 1500 1764-LRP processor (Series C) has an enhanced message instruction that provides simple, easy to use CIP messaging.

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.



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.

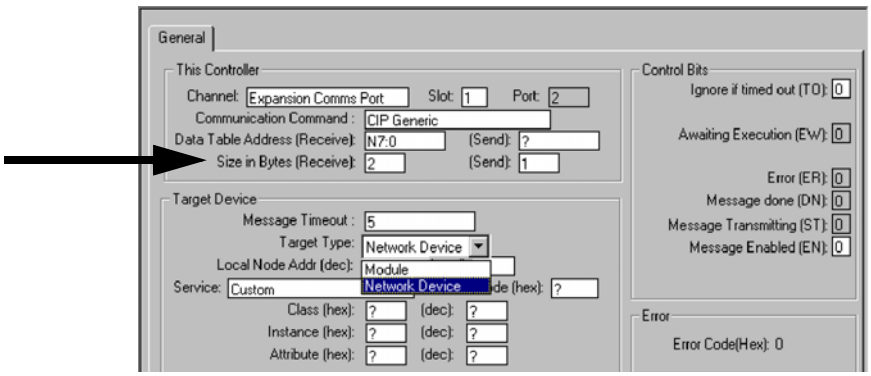


Size in Bytes (Receive and Send)

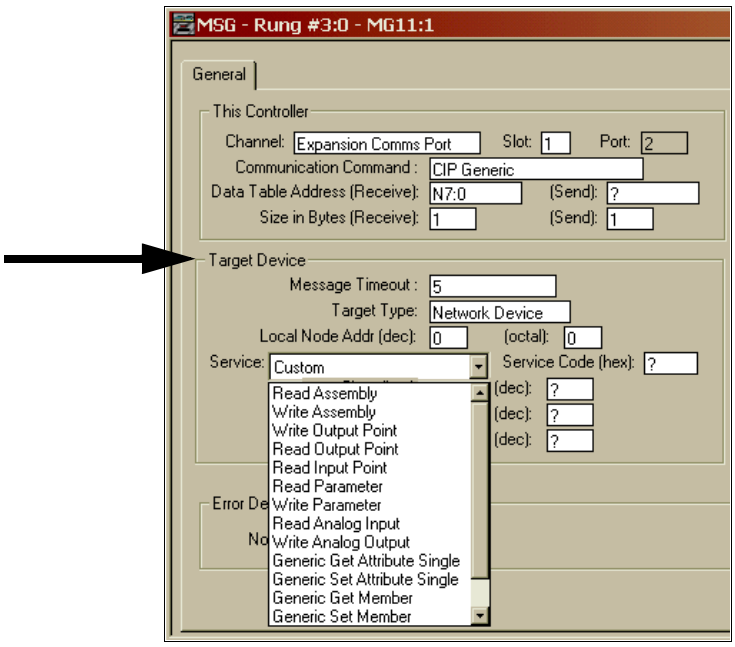
Since all data transmitted on DeviceNet is byte based, you must enter the number of bytes that will be received and sent. You must make sure that enough memory is available in the destination device. Word elements within 1764-LRP controllers contain 2 bytes each. These include Bit and Integer data files. 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 than 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 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 screen shown below, **N7:0** will receive **2** bytes (1 word) of data.



Target Device



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 (see MSG Instruction Error Codes on page 6-39). 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 DeviceNet, 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.

TIP

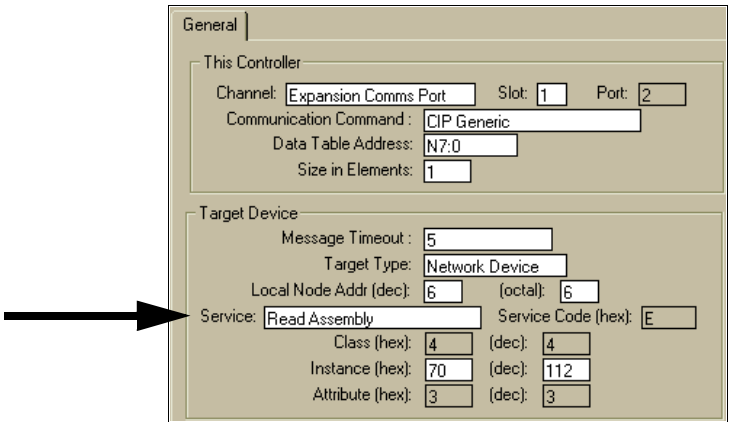
Note, many module parameters are not editable, and some can only be edited when the module is in Idle Mode.

Local Node address

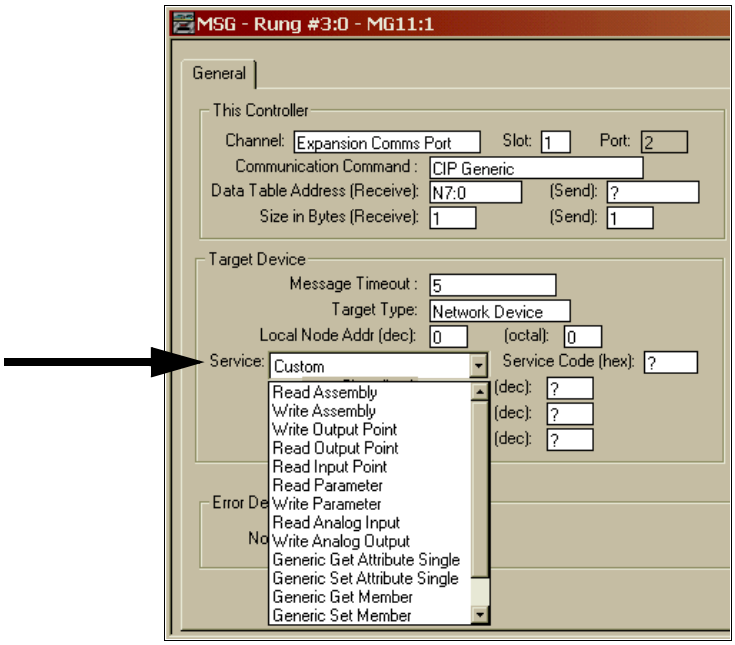
This is the target device's DeviceNet node number.

Service

DeviceNet 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 allows you to 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 subelement #18 that you can monitor from your programming software.

Table 6.1 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 subelement #22 that can be monitored from your program.

Table 6.2 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 Setable
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

Notes:

Specifications

Read this appendix to learn about the 1769-ADN specifications.

1769-ADN Specifications

Series A Adapters General Specifications

Specification	Value
Dimensions	118mm (height) x 87mm (depth) x 50mm (width) height including mounting tabs is 138mm 4.65in (height) x 3.43in (depth) x 1.97in (width) height including mounting tabs is 5.43in
Approximate Shipping Weight (With Carton)	280g (0.61lbs)
Storage Temperature	-40 to +85C (-40F to +185F)
Operating Temperature	0 to +60C (+32F to +140F)
Operating Humidity	5 to 95% non-condensing
Operating Altitude	2000m (6561ft)
Vibration	Operating: 10 to 500Hz, 5G, 0.030in max. peak-to-peak Relay Operation: 2G
Shock	Operating: 30G, 11ms panel mounted (20G 11ms DIN-rail mounted) Relay Operation: 7.5G panel mounted (5G DIN-rail mounted) Non-Operating: 40G panel mounted (30G DIN-rail mounted)
Agency Certification	c UL us CE DeviceNet CONFORMANCE TESTED
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
Electrical/EMC	The adapter has passed testing at the following levels:
• ESD Immunity (IEC1000-4-2)	4kV contact, 8kV air, 4kV indirect
• Radiated Immunity (IEC1000-4-3)	10V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
• Fast Transient Burst (IEC1000-4-4)	2kV, 4 kHz
• Surge Immunity (IEC1000-4-5)	2kV galvanic gun
• Conducted Immunity (IEC1000-4-6)	10V, 0.15 to 80 MHz[1]

1. Conducted immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Series A Adapters Input/Output Specifications

Specification	Value
Bus Current Draw (Maximum)	450mA at 5V dc (2.25W)
Heat Dissipation	4.7W maximum
I/O Capacity	30 modules
Communication Rate	125k bit/s 250k bit/s 500k bit/s
Indicators	Module status - red/grn Network status - red/grn I/O status - red/grn Diagnostic status- red/grn
DeviceNet Power Requirements	24V dc (+4%) @ 90mA maximum, N.E.C. Class 2
DeviceNet Cable	Allen-Bradley part no. 1485C-P1-Cxxx. Refer to publication DN-2.5 for more information.
Power Supply Distance Rating	4 (The adapter may not be more than 4 modules away from the power supply.)
Output to Backplane Isolation	Verified by one of the following qualification tests: 710V dc, 1 minute
Vendor I.D. Code	1
Product Type Code	12
Product Code	69

Series B Adapters Firmware General Specifications

Specification	Value
Dimensions	118mm (height) x 87mm (depth) x 50mm (width) height including mounting tabs is 138mm 4.65in (height) x 3.43in (depth) x 1.97in (width) height including mounting tabs is 5.43in
Approximate Shipping Weight (With Carton)	280g (0.61lbs)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Operating Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27: (Test Ea, Unpackaged Shock) Operating 15g Non-operating 30g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: +2kV at 5kHz on communication ports
Surge Transient Immunity	IEC 61000-4-5: +2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 3Vrms with 1kHz sine-wave 80%AM from 10kHz to 80MHz 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz

Specification	Value	
Enclosure Type Rating	None (open-style)	
Certifications (When Product is Marked)	c-UL-us	UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada
	CE[1]	European Union 89/336/EEC EMC Directive, compliant with: - EN 50082-2; Industrial Immunity - EN 61326; Meas./Control/Lab., Industrial Requirements - EN 61000-6-2; Industrial Immunity -EN 61000-6-4; Industrial Emissions
	C-Tick[1]	Australian Radiocommunications Act, compliant with: - AS/NZS 2064; Industrial Emissions
	ODVA	ODVA conformance tested to DeviceNet specifications

1 See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Series B Adapters Input/Output Specifications

Specification	Value
Bus Current Draw (Maximum)	Series A 450mA at 5V dc (2.25W) Series B 500mA at 5V dc (2.5W)
Heat Dissipation	4.7W maximum
I/O Capacity	30 modules
Communication Rate	125k bit/s 250k bit/s 500k bit/s
Indicators	Module status - red/grn Network status - red/grn I/O status - red/grn Diagnostic status - red/grn
DeviceNet Power Requirements	24V dc (+4%) @ 90mA maximum, N.E.C. Class 2
DeviceNet Cable	Allen-Bradley part no. 1485C-P1-Cxxx. Refer to publication DN-2.5 for more information.
Power Supply Distance Rating	4 (Series A); 5 (Series B) (The adapter may not be more than 4 or 5 modules away from the power supply, depending on the Series.)
Isolation Voltage	Verified by the following qualification test: 710V dc, 1 minute
Vendor I.D. Code	1
Product Type Code	12
Product Code	69

Notes:

Explicit Messaging Application Examples

1756-DNB Explicit Messaging Application Example

The following explicit messaging application example details a 1756-DNB DeviceNet scanner controlling 1769 Compact I/O via DeviceNet and the 1769-ADN DeviceNet Adapter.

While explicit messages are not required when using 1769 I/O on DeviceNet, these messages allow you to read status information from the 1769-ADN adapter and 1769 I/O modules as well as write 1769 I/O module configuration parameters while the system is running.

These operations are not required when using the 1769-ADN adapter, but may be necessary from an application view if, for example, you need to modify the configuration of an I/O module while the system is running. Also, in the event of failure, you may need to read status information from the 1769-ADN or I/O module from a remote terminal.

Before attempting any explicit messages to a 1769-ADN, the adapter must be configured in a DeviceNet scanner's scanlist. This example uses a 1756-DNB DeviceNet scanner in slot 1 of a 1756 ControlLogix chassis. The Logix5550 controller is in slot 0. RSLogix 5000 programming software is used to program the Logix5550 controller and RSNetworx for DeviceNet is used to schedule I/O on DeviceNet.

We'll cover the following list of message commands in this example:

- Get 1769-ADN Status
- Get 1769 I/O Module Status
- Get 1769 I/O Module Configuration File Size
- Set 1769 I/O Module Configuration
- Save 1769 I/O Module Configuration
- Get 1769 I/O Module Configuration

Get 1769-ADN Status

Use a "CIP Generic" MSG instruction to send any explicit message to a 1769-ADN or 1769 I/O module from a Logix5550 controller via a 1756-DNB DeviceNet scanner. You'll see in the ladder logic example to follow, a CIP Generic message is sent to the 1756-DNB scanner and ultimately to the 1769-ADN.

Use a “Single Parameter Read” MSG instruction for the Get 1769-ADN Status message, where one word of status information is read from the 1769-ADN. The user program consists of a single rung containing a MSG instruction to accomplish the Get 1769-ADN Status.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Get 1769-ADN Status message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
e	Service[1]	Service Code
1	Class[2]	Object Type
1	Instance[3]	Object ID
5	Attribute[4]	Object Attribute

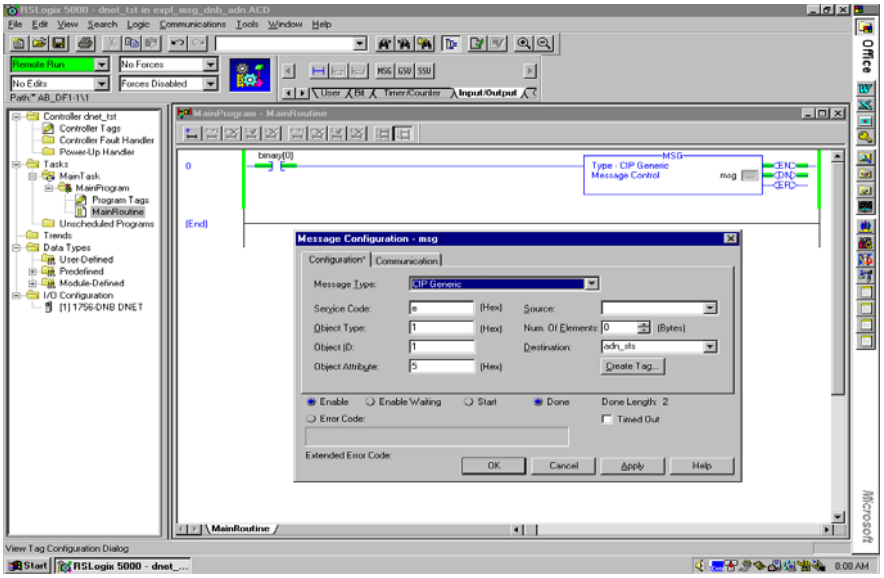
1 Service specifies the type of request being delivered. “e” hexadecimal is a “Single Parameter Read”.

2 Class specifies the desired DeviceNet class. “1” hexadecimal is the class code for the identity object.

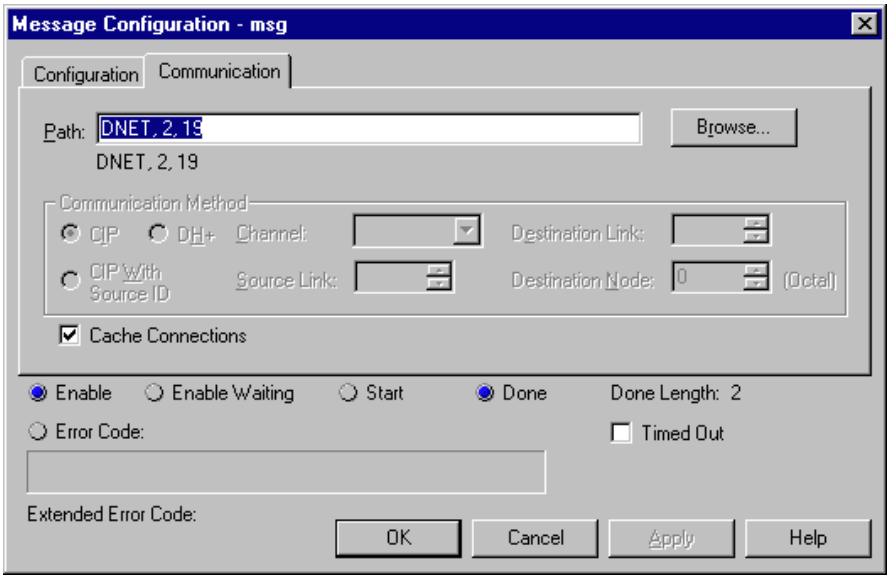
3 Instance identifies the specific instance within the object class towards which the transaction is directed. “1” hexadecimal is the instance of the identity object in the 1769-ADN.

4 Attribute identifies the specific characteristics of the object towards which the transaction is directed. “5” hexadecimal means Status.

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Get 1769-ADN Status message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



You only need to enter the path on this screen. “DNET” refers to the module on the 1756 backplane to which the message is sent. “2” is the DeviceNet port on the 1756-DNB. “19” is the DeviceNet address of the 1769-ADN.

The status word written to the tag specified in the destination field of the MSG instruction is defined as follows:

Bit	Description
0	When true, indicates the device has an owner
1	Reserved, set to 0
2	When true, indicates the application of the devices has been configured beyond out-of-the-box defaults
3	Reserved, set to 0
4-7	Vendor specific
8	When true, indicates the device has experienced a Minor Recoverable Fault
9	When true, indicates the device has experienced a Minor Unrecoverable Fault
10	When true, indicates the device has experienced a Major Recoverable Fault
11	When true, indicates the device has experienced a Major Unrecoverable Fault
12-15	Reserved, set to 0

Refer to the Troubleshooting information in Chapter 4 for additional information on Recoverable and Unrecoverable, Major and Minor faults.

Get 1769 I/O Module Status

Use a "CIP Generic" MSG instruction to send the Get 1769 I/O Module Status explicit message from a Logix5550 controller via a 1756-DNB scanner on DeviceNet. You'll see in the ladder logic example to follow, a CIP Generic message is sent to the 1756-DNB scanner and ultimately to the 1769-ADN and the 1769 I/O module in slot 10.

Use a "Single Parameter Read" MSG instruction for the Get 1769 I/O Module Status message, where one word of status information is read from the 1769 I/O module in slot 10. The user program consists of a single rung containing a MSG instruction to accomplish the Get 1769 I/O Module Status.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Get 1769 I/O Module Status message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
e	Service[1]	Service Code
30c	Class[2]	Object Type
10 (decimal)	Instance[3]	Object ID
c	Attribute[4]	Object Attribute

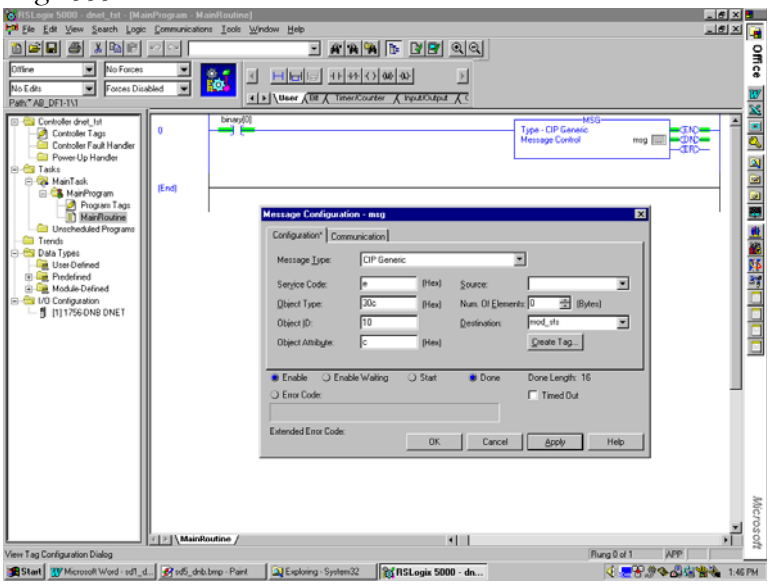
1 Service specifies the type of request being delivered. "e" hexadecimal is a "Single Parameter Read".

2 Class specifies the desired DeviceNet class. "30c" hexadecimal is the class code for the object representing 1769 I/O.

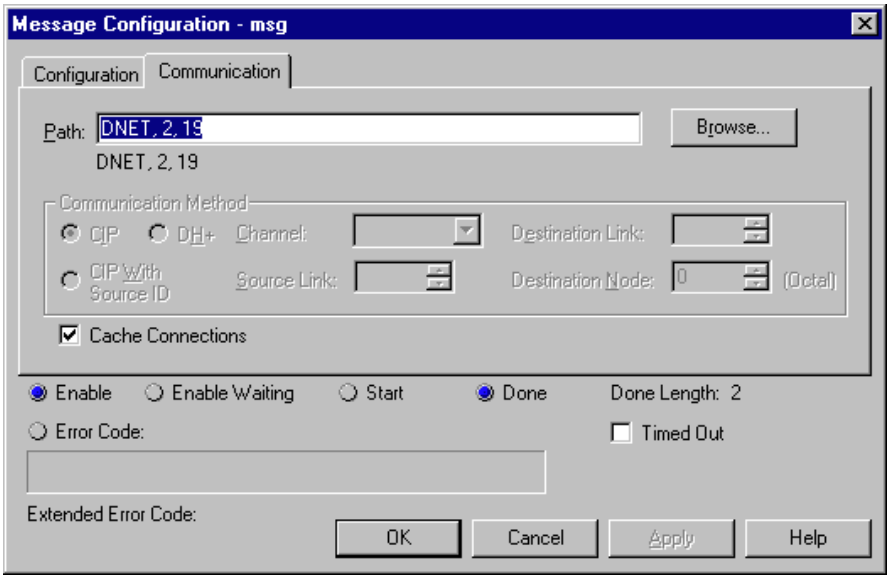
3 Instance represents the slot number of the I/O module from which we want status information. "10" decimal in this example is the analog output module in slot 10.

4 Attribute identifies the specific characteristics of the object towards which the transaction is directed. "c" hexadecimal means Module Status.

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Get 1769 I/O Module Status message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



You only need to enter the path on this screen. “DNET” refers to the module on the 1756 backplane to which the message is sent. “2” is the DeviceNet port on the 1756-DNB. “19” is the DeviceNet address of the 1769-ADN.

The status word written to the tag specified in the destination field of the MSG instruction is defined as follows:

Bit	Description
0	0 = No module error detected 1 = Module detected error present
1	0 = Communication on bus OK 1 = Communication Fault on bus
2	0 = Module is not configured 1 = Module is configured
3-7	Reserved, set to 0

Refer to the Troubleshooting information in Chapter 4 for additional information on Recoverable and Uncoverable, Major and Minor faults.

Get 1769 I/O Module Configuration Size

1769 I/O modules should be configured in RSNetworx for DeviceNet when your DeviceNet system is configured. We'll describe how to modify 1769 I/O module configuration parameters while the system is running. Modifying I/O module configuration parameters dynamically is not a common practice, but for some applications it may be necessary.

We'll use a 1769-OF2 analog output module to get/set configuration parameters dynamically for this example.

The first task is to determine the size of the configuration file for the 1769 I/O module. The following command will read the number of configuration words (not bytes) from the 1769-OF2 in slot 10 of the remote DeviceNet system by sending a CIP Generic message to the 1769 I/O module via DeviceNet. One word will be read from the 1769 I/O module which contains the word count of its configuration file.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Get 1769 I/O Configuration Size message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
e	Service[1]	Service Code
30c	Class[2]	Object Type
10 (decimal)	Instance[3]	Object ID
17	Attribute[4]	Object Attribute

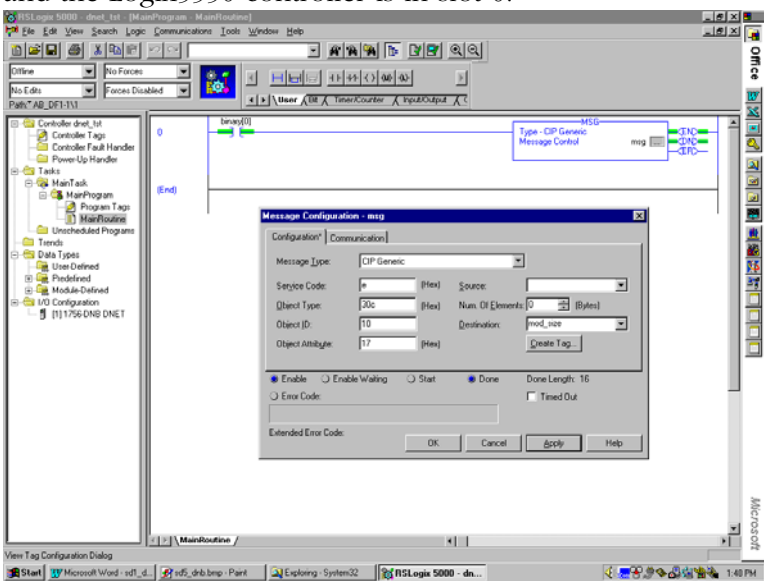
1 Service specifies the type of request being delivered. "e" hexadecimal is a "Single Parameter Read".

2 Class specifies the desired DeviceNet class. "30c" hexadecimal is the class code for the object representing 1769 I/O.

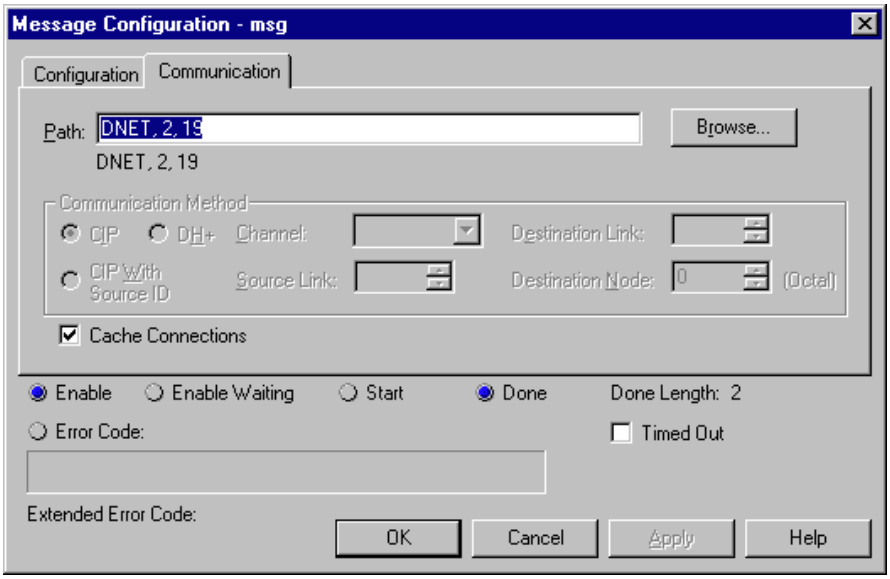
3 Instance represents the slot number of the I/O module from which we want the configuration size. "10" decimal in this example is the analog output module in slot 10.

4 Attribute identifies the specific characteristics of the object towards which the transaction is directed. "17" hexadecimal means Module Configuration Size.

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Get 1769 I/O Module Configuration Size message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



The reply to this message, when successful, will be one word of data containing the word length of the configuration file for the 1769 I/O module to which the message was sent. This data will be stored in the Logix5550 controller at the tag specified in the "Destination" field for the message instruction.

Set 1769 I/O Module Configuration

The length of this command is determined by the size of the configuration file for the 1769 I/O module we will configure. In this case, from the previous section, we read the configuration size for the 1769-OF2 as 8 words (16 bytes). Six words contain the configuration data, while the last two words must be set to 0. The length, however, must be 16 bytes.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Get 1769 I/O Configuration Size message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
10	Service[1]	Service Code
30c	Class[2]	Object Type
10 (decimal)	Instance[3]	Object ID
1a	Attribute[4]	Object Attribute
8304	First word of the 1769-OF2 configuration file[5]	
8304	Second word of the 1769-OF2 configuration file[5]	
1862	Third word of the 1769-OF2 configuration file[5]	
1862	Fourth word of the 1769-OF2 configuration file[5]	
1862	Fifth word of the 1769-OF2 configuration file[5]	
1862	Sixth word of the 1769-OF2 configuration file[5]	
0000	Seventh word of the 1769-OF2 configuration file[5]	
0000	Eighth word of the 1769-OF2 configuration file[5]	

1 Service specifies the type of request being delivered. "10" hexadecimal is a "Single Parameter Write".

2 Class specifies the desired DeviceNet class. "30c" hexadecimal is the class code for the object representing 1769 I/O.

3 Instance represents the slot number of the I/O module for which we want to set the configuration. "10" decimal in this example is the analog output module in slot 10.

4 Attribute identifies the specific characteristics of the object towards which the transaction is directed. "1a" hexadecimal means configuration data.

5 Configuration data is 8 words in length, although only 6 words contain actual configuration data. The last two words must be included, but must be 0000 hexadecimal. The actual configuration data information may be found in the *Compact I/O Analog Module User Manual*, publication 1769-6.0. Chapter 5 of that publication shows the layout of the six configuration words for the 1769-OF2 module.

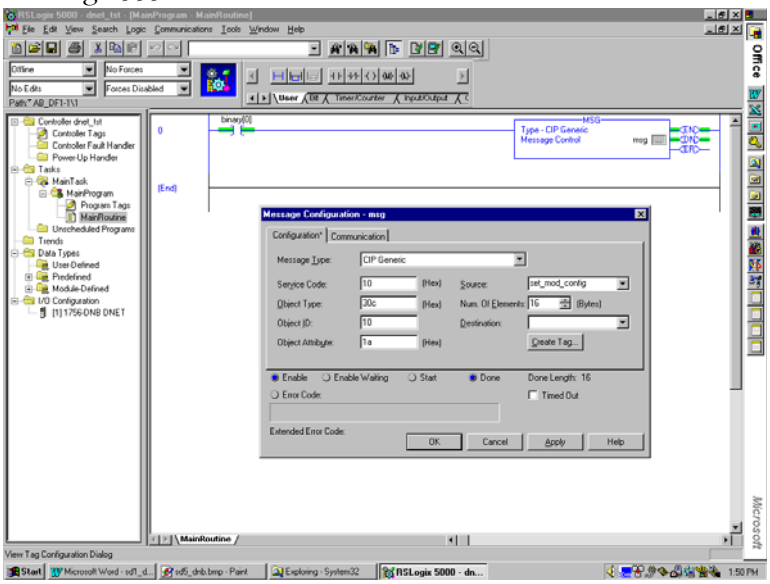
The first two words of the configuration file configure channels 0 and 1 respectively for such features as the output data format (Raw/Proportional Data for this example) and output type (4-20mA for the example).

The next four words are values for the two channels in the event the controlling processor faults or is placed into the Program mode. For this example, these four values must be in the range of 6241 or 31207 decimal (1862 to 79E7 hexadecimal), which represents 4-20mA. Any values out of this range will result in a configuration error.

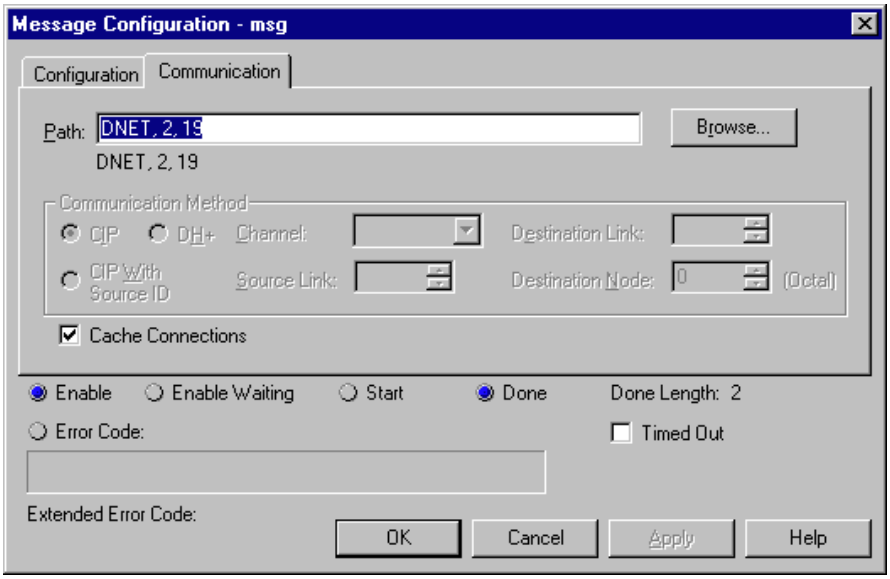
Should a configuration error occur, the Logix5550 controller's MSG instruction will display the error as a hex code as well as in words. The error code is two bytes, where one byte is the General Error Code and the other byte is the Extended Error Code.

If the Extended Error Code is 00ff hexadecimal, the responding object has no additional information to specify. For example, if we make the third, fourth, fifth, or sixth word of the configuration portion in the Set I/O Module Configuration command 0 rather than 1862 hexadecimal, the MSG instruction will set the error bit and display an Error Code of 0009 hexadecimal with an Extended Error Code of 00ff hexadecimal. The error description is "Parameter error in module configuration".

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Set 1769 I/O Module Configuration message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



You only need to enter the path on this screen. “DNET” refers to the module on the 1756 backplane to which the message is sent. “2” is the DeviceNet port on the 1756-DNB. “19” is the DeviceNet address of the 1769-ADN.

Save 1769 I/O Module Configuration

This command is extremely important when modifying the configuration of any 1769 I/O module in a 1769 I/O system. When a Set 1769 I/O Module Configuration message is sent to an I/O module with an explicit message and there are no errors, the module immediately begins using the new configuration parameters.

However, until the Save 1769 I/O Module Configuration message is sent to the 1769-ADN, the adapter does not save the new configuration parameters. The adapter downloads the saved configuration for all configured I/O modules in its system on a power cycle.

This means that if you configure an I/O module with an explicit message and do not send the Save message with another explicit message after the configuration command is successfully completed, a power cycle or mode transition will result in the "old" configuration being downloaded to the I/O module in question. This also indicates that the new configuration parameters sent to the I/O module with the explicit message would be lost.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Save 1769 I/O Module Configuration message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
16	Service[1]	Service Code
f	Class[2]	Object Type
00	Instance[3]	Object ID

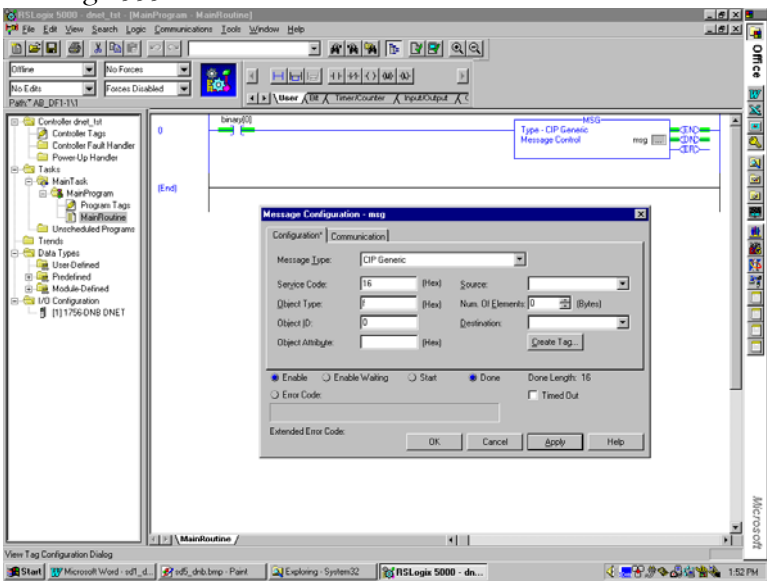
1 Service specifies the type of request being delivered. "16" hexadecimal is a "Save".

2 Class specifies the desired DeviceNet class. "f" hexadecimal is the class code for the object responsible for saving configuration, the parameter object.

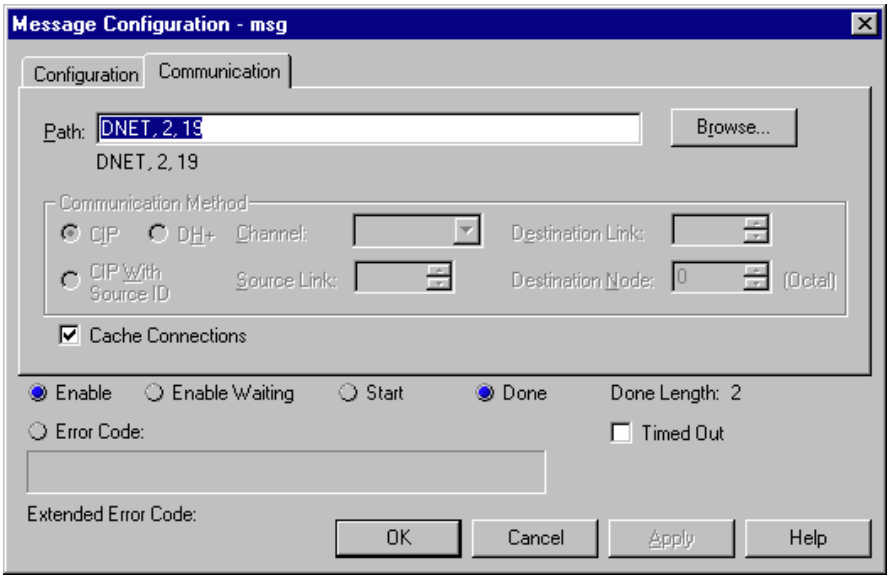
3 Instance for the save command is 00.

There is no Object Attribute for the Save 1769 I/O Module Configuration message.

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Save 1769 I/O Module Configuration message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



You only need to enter the path on this screen. “DNET” refers to the module on the 1756 backplane to which the message is sent. “2” is the DeviceNet port on the 1756-DNB. “19” is the DeviceNet address of the 1769-ADN.

Get 1769 I/O Module Configuration

This command allows you to get the specified I/O module's configuration so that you may verify the configuration of any 1769 I/O module. The MSG instruction will read 8 configuration words from the 1769-OF2 module in this example. The first 6 words contain the configuration data for the module, while the last 2 words are always 0.

The actual configuration data information may be found in the *Compact I/O Analog Module User Manual*, publication 1769-6.0. Chapter 5 shows the layout of the six configuration words for the 1769-OF2 module. The first 2 words of the configuration file are configuration data for channels 0 and 1 respectively, for such features as the output data format and output type. The next 4 words are values for the 2 channels in the event the controlling processor faults or is placed into the Program mode.

The following correlates the CIP Generic message terminology with DeviceNet command terminology and illustrates the values needed specifically for the Get 1769 I/O Module Configuration message:

Values (Hexadecimal)	DeviceNet Terminology	CIP Generic Terminology
e	Service[1]	Service Code
30c	Class[2]	Object Type
10 (decimal)	Instance[3]	Object ID
1a	Attribute[4]	Object Attribute

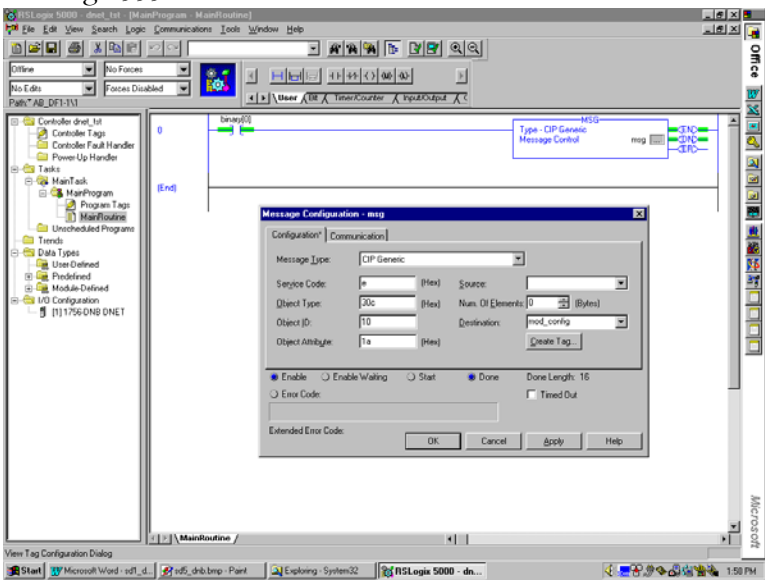
1 Service specifies the type of request being delivered. "e" hexadecimal is a "Single Parameter Read".

2 Class specifies the desired DeviceNet class. "30c" hexadecimal is the class code for the object representing 1769 I/O.

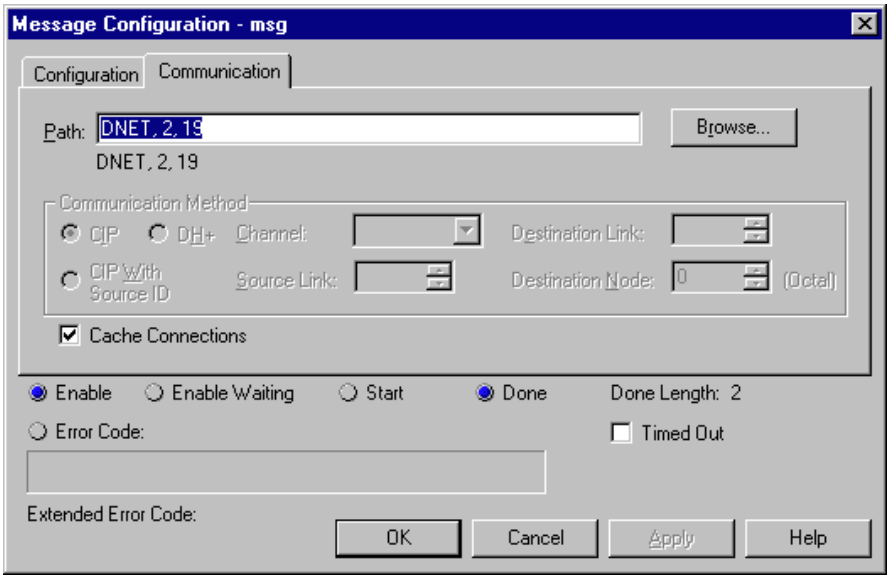
3 Instance represents the slot number of the I/O module from which we want the configuration data. "10" decimal in this example is the analog output module in slot 10.

4 Attribute identifies the specific characteristics of the object towards which the transaction is directed. "1a" hexadecimal means configuration data.

The following ladder logic program is an example of the MSG logic needed to initiate an explicit message to the scanner/adapter. This MSG instruction logic is specifically for the Get 1769 I/O Module Configuration message. Assume the 1756-DNB scanner is in slot 1 and the Logix5550 controller is in slot 0.



The following screen is the Communications tab for the MSG instruction above.



You only need to enter the path on this screen. “DNET” refers to the module on the 1756 backplane to which the message is sent. “2” is the DeviceNet port on the 1756-DNB. “19” is the DeviceNet address of the 1769-ADN.

1747-SDN Explicit Messaging Application Example

The following explicit messaging application example details a 1747-SDN DeviceNet scanner controlling 1769 Compact I/O via DeviceNet and the 1769-ADN DeviceNet Adapter.

While explicit messages are not required when using 1769 I/O on DeviceNet, these messages allow you to read status information from the 1769-ADN adapter and 1769 I/O modules as well as write 1769 I/O module configuration parameters while the system is running.

These operations are not required when using the 1769-ADN adapter, but may be necessary from an application view if, for example, you need to modify the configuration of an I/O module while the system is running. Also, in the event of failure, you may need to read status information from the 1769-ADN or I/O module from a remote terminal.

Before attempting any explicit messages to a 1769-ADN, the adapter must be configured in a DeviceNet scanner's scanlist. This example uses a 1747-SDN DeviceNet scanner in slot 3 of a SLC-5/04 processor chassis. RSLogix 500 programming software is used to program the SLC-5/04 processor.

We'll cover the following list of message commands in this example:

- Get 1769-ADN Status
- Get 1769 I/O Module Status
- Get 1769 I/O Module Configuration File Size
- Set 1769 I/O Module Configuration
- Save 1769 I/O Module Configuration
- Get 1769 I/O Module Configuration

Get 1769-ADN Status

The Get 1769-ADN Status command has 6 words, where the first three are required by the 1747-SDN scanner and the last three are sent to the 1769-ADN. As you will see in the sample ladder logic below, a command is sent to the 1747-SDN via a COPy instruction to the scanner's M0 file. The reply is then received in the scanner's M1 file.

The user program is notified that the command reply is ready when the scanner sets an input image bit (I:s/15, where s is the slot number of the 1747-SDN). When this bit is set, the user program COPies the reply from the scanner's M1 file.

Following each command reply, the user program must MOVe a command value of 4 hexadecimal to the appropriate M0 file word to clear the previous reply from its buffer, making it ready for the next command.

The following illustrates the Get 1769-ADN Status command and the command reply:

Command (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Command[2]
0006	Port #[3]/Byte Count[4]
0E13	Service[5]/Mac ID[6]
0001	Class[7]
0001	Instance[8]
0005	Attribute[9]
Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Status
0002	Port #[3]/Byte Count[4]
8E13	Service[5]/Mac ID[6]
xxxx	Status Word from Adapter

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3 and the data size is one byte.

5 Service specifies the type of request being delivered. "0E" is a Single Parameter Read. In the reply, the high bit of this byte is set, so 8E represents the reply to the 0E service. Service data size is one byte.

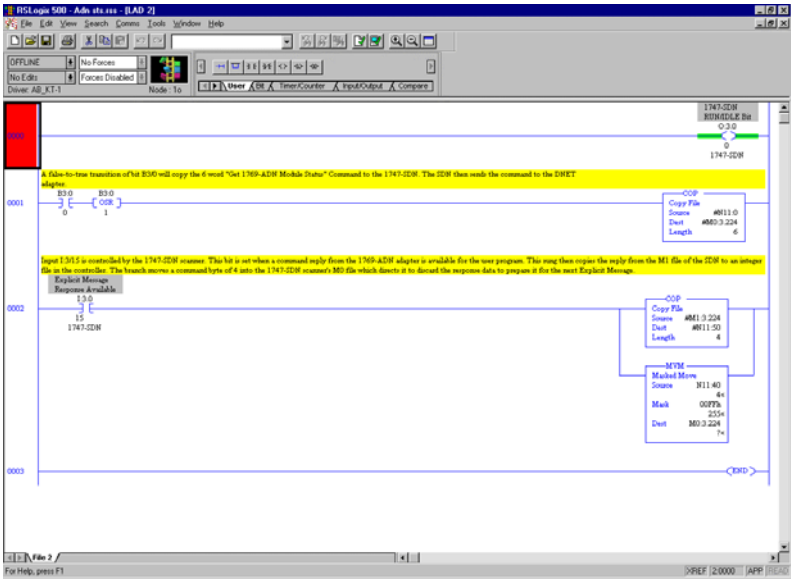
6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class is the desired DeviceNet class. "1" hexadecimal is the class code for the identity object. The class data size is one word.

8 Instance identifies the specific instance within the object class towards which the transaction is directed. "0001" hexadecimal is the instance of the identity object in the 1769-ADN. The instance data size is one word.

9 Attribute identifies the specific characteristic of the object towards which the transaction is directed. "0005" means Status. The attribute data size is one word.

The following ladder logic program is an example of the logic needed to initiate an explicit message to the scanner/adapter and how to obtain the reply. This logic is specifically for the Get 1769-ADN Status message. Assume the 1747-SDN scanner is in slot 3 of the processor chassis.



Data Table File N11 (Shown in Hexadecimal Radix)

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	101	6	E13	1	1	5	0	0	0	0
N11:10	0	0	0	0	0	0	0	0	0	0
N11:20	0	0	0	0	0	0	0	0	0	0
N11:30	0	0	0	0	0	0	0	0	0	0
N11:40	4	0	0	0	0	0	0	0	0	0
N11:50	101	2	8E13	5	0	0	0	0	0	0

The actual status word in the reply, i.e., the fourth word of the reply, is defined as follows:

Bit	Description
0	When true, indicates the device has an owner
1	Reserved, set to 0
2	When true, indicates the application of the devices has been configured beyond out-of-the-box defaults
3	Reserved, set to 0
4-7	Vendor specific
8	When true, indicates the device has experienced a Minor Recoverable Fault
9	When true, indicates the device has experienced a Minor Unrecoverable Fault
10	When true, indicates the device has experienced a Major Recoverable Fault
11	When true, indicates the device has experienced a Major Unrecoverable Fault
12-15	Reserved, set to 0

Refer to the Troubleshooting information in Chapter 4 for additional information on Recoverable and Unrecoverable, Major and Minor faults.

Get 1769 I/O Module Status

The Get 1769 I/O Module Status command has 6 words, where the first three are required by the 1747-SDN and the last three are sent to the 1769-ADN and the specified 1769 I/O module. As you will see in the sample ladder logic below, a command is sent to the 1747-SDN via a COPy instruction to the scanner's M0 file.

The reply is then received in the scanner's M1 file. The user program is notified that the command reply is ready when the scanner sets an input image bit (I:s/15, where s is the slot number of the 1747-SDN). When this bit is set, the user program COPies the reply from the scanner's M1 file.

Following each command reply, the user program must MOVe a command value of 4 hexadecimal to the appropriate M0 file word to clear the previous reply from its buffer, making it ready for the next command.

The following illustrates the Get 1769 Module Status command and the command reply:

Command (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Command[2]
0006	Port #[3]/Byte Count[4]
0E13	Service[5]/Mac ID[6]
030C	Class[7]
00xx	Instance[8]
000C	Attribute[9]
Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Status
0001	Port #[3]/Byte Count[4]
8E13	Service[5]/Mac ID[6]
xxxx	Status Word from Adapter

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3 and the data size is one byte.

5 Service specifies the type of request being delivered. "0E" is a Single Parameter Read. In the reply, the high bit of this byte is set, so 8E represents the reply to the 0E service. Service data size is one byte.

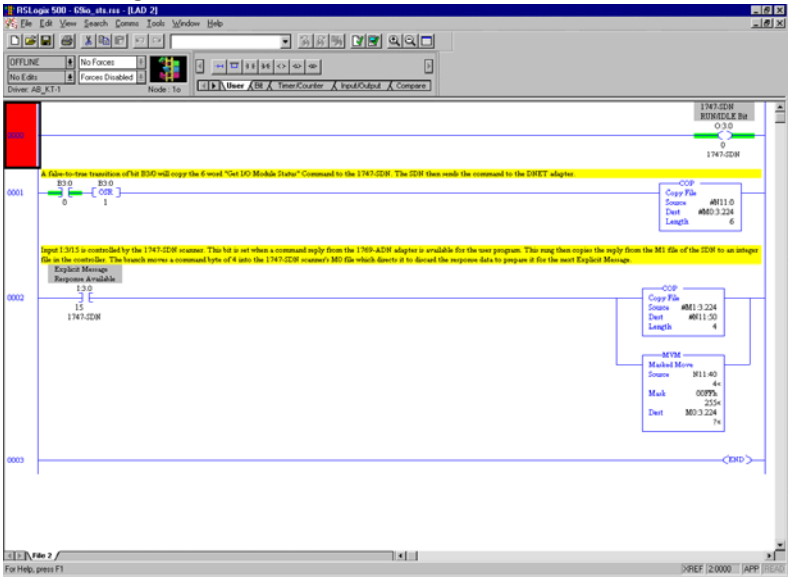
6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class is the desired DeviceNet class. "030C" is the class code for the object representing 1769 I/O. The class data size is one word.

8 Instance represents the slot number of the I/O module from which we want the status information. This analog output module is in slot 10 or "000A" hexadecimal.

9 Attribute identifies the specific characteristic of the object towards which the transaction is directed. "000C" means Module Status. The attribute data size is one word.

The following ladder logic program is an example of the logic needed to initiate an explicit message to the scanner/adapter/1769 I/O module and how to obtain the reply. This logic is specifically for the Get 1769 I/O Module Status command. Assume the 1747-SDN scanner is in slot 3 of the processor chassis and the 1769-OF2 module that we are reading status from is in slot 10 of the 1769-ADN remote system.



Data Table File N11 (Shown in Hexadecimal Radix)

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	101	6	E13	30C	A	C	0	0	0	0
N11:10	0	0	0	0	0	0	0	0	0	0
N11:20	0	0	0	0	0	0	0	0	0	0
N11:30	0	0	0	0	0	0	0	0	0	0
N11:40	4	0	0	0	0	0	0	0	0	0
N11:50	101	1	8E13	4	0	0	0	0	0	0

The actual status word from the 1769 I/O module is the fourth word of the reply, is defined as follows:

Bit	Description
0	0 = No module error detected 1 = Module detected error present
1	0 = Communication on bus ok 1 = Communication fault on bus
2	0 = Module is not configured 1 = Module is configured
3-7	Reserved, set to 0

Get 1769 I/O Module Configuration Size

1769 I/O modules should be configured in RSNetworx for DeviceNet when your DeviceNet system is configured. We'll describe how to modify 1769 I/O module configuration parameters while the system is running. Modifying I/O module configuration parameters dynamically is not a common practice, but for some applications it may be necessary. Refer to the Ladder Logic Example Program on page B-30 for the necessary logic for this command.

We'll use a 1769-OF2 analog output module to get/set configuration parameters dynamically for this example.

The first task is to determine the size of the configuration file for the 1769 I/O module. The following command will read the number of configuration words (not bytes) from the 1769-OF2 in slot 10 of the remote DeviceNet system by sending the following command:

Command (Hexadecimal)	Description (High Byte/Low Byte)
0101	TXID[1]/Command[2]
0006	Port #[3]/Byte Count[4]
0E13	Service[5]/Mac ID[6]
030C	Class[7]
00xx	Instance[8]
0017	Attribute[9]
Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Status
0002	Port #[3]/Byte Count[4]
8E13	Service[5]/Mac ID[6]
xxxx	Status Word from Adapter

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3 and the data size is one byte.

5 Service specifies the type of request being delivered. "0E" is a Single Parameter Read. In the reply, the high bit of this byte is set, so 8E represents the reply to the 0E service. Service data size is one byte.

6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class is the desired DeviceNet class. "030C" hexadecimal is the class code for the object representing 1769 I/O. The class data size is one word.

8 Instance represents the slot number of the I/O module from which we want the configuration file size. This analog output module is in slot 10 or "000A" hexadecimal.

9 Attribute identifies the specific characteristic of the object towards which the transaction is directed. "0017" hexadecimal (23 decimal) means Module Configuration Size. The attribute data size is one word.

Set 1769 I/O Module Configuration

The length of this command is determined by the size of the configuration file for the 1769 I/O module we will configure. In this case, from the previous section, we read the configuration size for the 1769-OF2 as 8 words, the length of this command is 14 words. Refer to the Ladder Logic Example Program on page B-30 to learn how to copy this command to the M0 file of the 1747-SDN as well as how to copy the reply from the scanner's M1 file.

The scanner sets an input image bit (I:s/15, where s is the slot number of the 1747-SDN) to indicate to the user program that a reply is ready. Following each command reply, the user program must move a command value (using a MOV instruction) of 4 hexadecimal to the appropriate M0 file word to clear the previous reply from its buffer, making it ready for the next command.

The following illustrates the Set 1769 Module Configuration command for a 1769-OF2 module and the command reply:

Command (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Command[2]
0016	Port #[3]/Byte Count[4]
1013	Service[5]/Mac ID[6]
030C	Class[7]
00xx	Instance[8]
001A	Attribute[9]
8304	First word of the 1769-OF2 configuration file[10]
8304	Second word of the 1769-OF2 configuration file[10]
1862	Third word of the 1769-OF2 configuration file[10]
1862	Fourth word of the 1769-OF2 configuration file[10]
1862	Fifth word of the 1769-OF2 configuration file[10]
1862	Sixth word of the 1769-OF2 configuration file[10]
0000	Seventh word of the 1769-OF2 configuration file[10]
0000	Eighth word of the 1769-OF2 configuration file[10]
Successful Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Command[2]
0000	Port #[3]/Byte Count[4]
9013	Service[5]/Mac ID[6]

Continued on next page.

Error Reply (Hexadecimal)	Description (High Byte/Low Byte)
0101	TXID[1]/Command[2]
0002	Port #[3]/Byte Count[4]
9413	Service[5]/Mac ID[6]
xxxx	Bad Status for the Configuration Command

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3 and the data size is one byte.

5 Service specifies the type of request being delivered. "10" is a Single Parameter Write. In the reply, the high bit of this byte is set, so 90 represents a good reply to the Single Parameter Write service, while 94 indicates that the Set Configuration command contained an error. The error code can then be found in the next word of the reply (or word 4). Service data size is one byte.

6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class is the desired DeviceNet class. "030C" hexadecimal is the class code for the object representing 1769 I/O. The class data size is one word.

8 Instance represents the slot number of the I/O module we want to configure. This analog output module is in slot 10 or "000A" hexadecimal.

9 Attribute identifies the specific characteristic of the object towards which the transaction is directed. "001A" hexadecimal (26 decimal) represents Configuration Data. The attribute data size is one word.

10 Configuration data is 8 words in length, although only 6 words contain actual configuration data. The last two words must be included, but must be 0000 hexadecimal. The actual configuration data information may be found in the *Compact I/O Analog Module User Manual*, publication 1769-6.0. Chapter 5 of that publication shows the layout of the six configuration words for the 1769-OF2 module.

The first two words of the configuration file configure channels 0 and 1 respectively for such features as the output data format (Raw/Proportional Data for this example) and output type (4-20mA for the example).

The next four words are values for the two channels in the event the controlling processor faults or is placed into the Program mode. For this example, these four values must be in the range of 6241 or 31207 decimal (1862 to 79E7 hexadecimal), which represents 4-20mA. Any values out of this range will result in a configuration error.

Should a configuration error occur, you will receive DeviceNet Error Codes. The error code is a two-byte field, where the low byte is the General Error Code and the high bit is the Additional Error Code. The following is a list of possible DeviceNet Error Codes:

Error Code (Hexadecimal)	Description of Error
00	Success Service was successfully performed by the object specified.
01	Reserved by DeviceNet for future extensions
02	Resource unavailable - Resources needed for the object to perform the requested service were unavailable.
03	Reserved by DeviceNet for future extensions
04	Path segment error - The path segment identifier or the segment syntax was not understood by the processing node. Path processing shall stop when a path segment error is encountered.
05	Path destination unknown - The path is referencing an object class, instance, or structure element that is not known or is not contained in the processing node. Path processing shall stop when a path destination unknown error is encountered.
06	Reserved by DeviceNet for future extensions
07	Connection lost - The messaging connection was lost.
08	Service not supported - The requested service was not implemented or was not defined for the Object Class/Instance.
09	Invalid attribute value, invalid attribute data detected
0A	Attribute list error - An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0B	Already in requested mode/state - The object is already in the mode/state being requested by the service.
0C	Object state conflict - The object cannot perform the requested service in its current mode/state.
0D	Object already exists - The requested instance of the object to be created already exists.
0E	Attribute not settable - A request to modify a non-modifiable attribute was received.
0F	Privilege violation - A permission/privilege check failed.
10	Device state conflict - The device's current mode/state prohibits the execution of the requested service.
11	Reply data too large - The data to be transmitted in the response buffer is larger than the allocated response buffer.
12	Reserved by DeviceNet for future extensions
13	Not enough data - The service did not supply enough data to perform the specified operation.
14	Attribute not supported - The attribute specified in the request is not supported.
15	Too much data - The service supplied more data than was expected.

Error Code (Hexadecimal)	Description of Error
16	Object does not exist - The object specified does not exist in the device.
17	Reserved by DeviceNet
18	No stored attribute data - The attribute data of this object was not saved prior to the requested service.
19	Store operation failure - The attribute data of this object was not saved due to a failure during the attempt.
1A	Reserved by DeviceNet for future extensions
1B	Reserved by DeviceNet for future extensions
1C	Missing attribute list entry data - The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
1D	Invalid attribute value list - The service is returning the list of attributes supplied with status information for those attributes that were invalid.
1E	Reserved by DeviceNet for future extensions
1F	Vendor specific error - A vendor specific error has been encountered. The Additional Code Field of the Error Response defines the particular error encountered. Use of this General Error Code should only be performed when none of the Error Codes presented in this table or within an Object Class definition accurately reflect the error.
20	Invalid parameter - A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements of this specification and/or the requirements defined in an Application Object Specification.
21-26	Reserved by DeviceNet for future extensions
27	Unexpected attribute in list - An attempt was made to set an attribute that is not able to be set at this time.
28	Invalid Member ID - The Member ID specified in the request does not exist in the specified Class/Instance/Attribute.
29	Member not settable - A request to modify a non-modifiable member was received.
2A	Group 2 only server general failure - This error code may only be reported by Group 2 Only servers with 4K or less code space and only in place of Service not supported, Attribute not supported, and Attribute not settable.
2B-CF	Reserved by DeviceNet for future extensions
D0-FF	Reserved for Object Class and service errors - This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be performed when none of the Error Code presented in this table accurately reflect the error that was encountered. Note that the Additional Code Field is available for use in further describing any General Error Code.

If the Extended Error Code is FF hexadecimal, the responding object has no additional information to specify. For example, if we make the third, fourth, fifth, or sixth word of the configuration portion in the Set I/O Module Configuration command 0 rather than 1862 hexadecimal, the following will be returned in the reply:

Reply (Hexadecimal)	Description (High Byte/Low Byte)
0101	TXID/1747-SDN Status
0002	Port # 0/Byte Count = 2
9413	94 is reply to 10 Service, 4 indicates an error is returned, Mac ID is 13 hexadecimal (19 decimal)
FF09	09 hexadecimal means Invalid Attribute Value, FF hexadecimal means that there is no additional information to specify

Save 1769 I/O Module Configuration

This command has 5 words, where the first three are required by the 1747-SDN and the last two are sent to the 1769-ADN. This command is extremely important when modifying the configuration of any 1769 I/O module in a 1769 I/O system. When a Set 1769 I/O Module Configuration message is sent to an I/O module with an explicit message and there are no errors, the module immediately begins using the new configuration parameters.

However, until the Save 1769 I/O Module Configuration message is sent to the 1769-ADN, the adapter does not save the new configuration parameters. The adapter downloads the saved configuration for all configured I/O modules in its system on a power cycle.

This means that if you configure an I/O module with an explicit message and do not send the Save message with another explicit message after the configuration command is successfully completed, a power cycle or mode transition will result in the “old” configuration being downloaded to the I/O module in question. This also indicates that the new configuration parameters sent to the I/O module with the explicit message would be lost. Refer to the Ladder Logic Example Program on page B-30 for this command’s ladder logic.

The following table illustrates the Save 1769 I/O Module Configuration command and the command reply:

Command (Hexadecimal)	Description (High Byte/Low Byte)
0101	TXID[1]/Command[2]
0004	Port #[3]/Byte Count[4]
1613	Service[5]/Mac ID[6]
000F	Class[7]
0000	Instance[8]
Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Status
0000	Port #[3]/Byte Count[4]
9613	Service[5]/Mac ID[6]

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3 and the data size is one byte.

5 Service for the Save command is 16 hexadecimal (22 decimal). Service data size is one byte.

6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class specifies the desired DeviceNet class. "000F" hexadecimal is the class code for the object responsible for saving configuration, the parameter object. The class data size is one word.

8 Instance for the Save command is 0000 hexadecimal.

There is no Attribute for this command.

Get 1769 I/O Module Configuration

This command has 6 words, where the first three are required by the 1747-SDN and the last three are sent to the 1769-ADN and the specified 1769 I/O module. This command allows you to get the specified I/O module's configuration so that you may verify the configuration of any 1769 I/O module. Refer to the Ladder Logic Example Program on page B-30 for the ladder logic containing this command.

The following table illustrates the Get 1769 I/O Module Configuration command and the command reply:

Command (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Command[2]
0006	Port #[3]/Byte Count[4]
0E13	Service[5]/Mac ID[6]
030C	Class[7]
000A	Instance[8]
001A	Attribute[9]
Reply (Hexadecimal)	**Description (High Byte/Low Byte)**
0101	TXID[1]/Status
0010	Port #[3]/Byte Count[4] (10 hexadecimal = 16 decimal)
8E13	Service[5]/Mac ID[6]
8304	First word of the 1769-OF2 configuration file[10]
8304	Second word of the 1769-OF2 configuration file[10]
1862	Third word of the 1769-OF2 configuration file[10]
1862	Fourth word of the 1769-OF2 configuration file[10]
1862	Fifth word of the 1769-OF2 configuration file[10]
1862	Sixth word of the 1769-OF2 configuration file[10]
0000	Seventh word of the 1769-OF2 configuration file[10]
0000	Eighth word of the 1769-OF2 configuration file[10]

1 TXID (Transmission ID) is used by the scanner to track the transaction to completion and returns the same value with the reply. To properly track commands with their replies, this value should be incremented for each new command sent. TXID size is one byte.

2 Command instructs the scanner on how to administer the request. "01" is the Execute This Transaction Block command. The command data size is one byte. Refer to the *1747-SDN User Manual*, publication 1747-5.8, for list of supported commands.

3 Port # is the physical channel of the scanner where the transaction is to be routed. The port # must be 0 (channel A) and the data size is one byte.

4 Byte Count identifies the number of bytes in the transaction body. The transaction body begins with word 3.

5 Service for the Save command is 16 hexadecimal (22 decimal). Service data size is one byte.

6 Mac ID is the DeviceNet network node address of the device for which the transaction is intended. The slave device must be listed in the scanner module's scan list and be online for the explicit message transaction to complete successfully. The Mac ID value must be hexadecimal. In this example, the node address of the 1769-ADN adapter is 19 decimal or 13 hexadecimal. The Mac ID data size is one byte.

7 Class specifies the desired DeviceNet class. "030C" hexadecimal is the class code for the object representing 1769 I/O. The class data size is one word.

8 Instance represents the slot number of the I/O from which we want configuration information. The analog output module is in slot 10 decimal or 000A hexadecimal.

9 Attribute identifies the specific characteristic of the object towards which the transaction is directed. "001A" hexadecimal (26 decimal) represents Configuration Data. The attribute data size is one word.

10 Configuration data is 8 words in length, although only 6 words contain actual configuration data. The last two words must be included, but must be 0000 hexadecimal. The actual configuration data information may be found in the *Compact I/O Analog Module User Manual*, publication 1769-6.0. Chapter 5 of that publication shows the layout of the six configuration words for the 1769-OF2 module.

The first two words of the configuration file configure channels 0 and 1 respectively for such features as the output data format (Raw/Proportional Data for this example) and output type (4-20mA for the example).

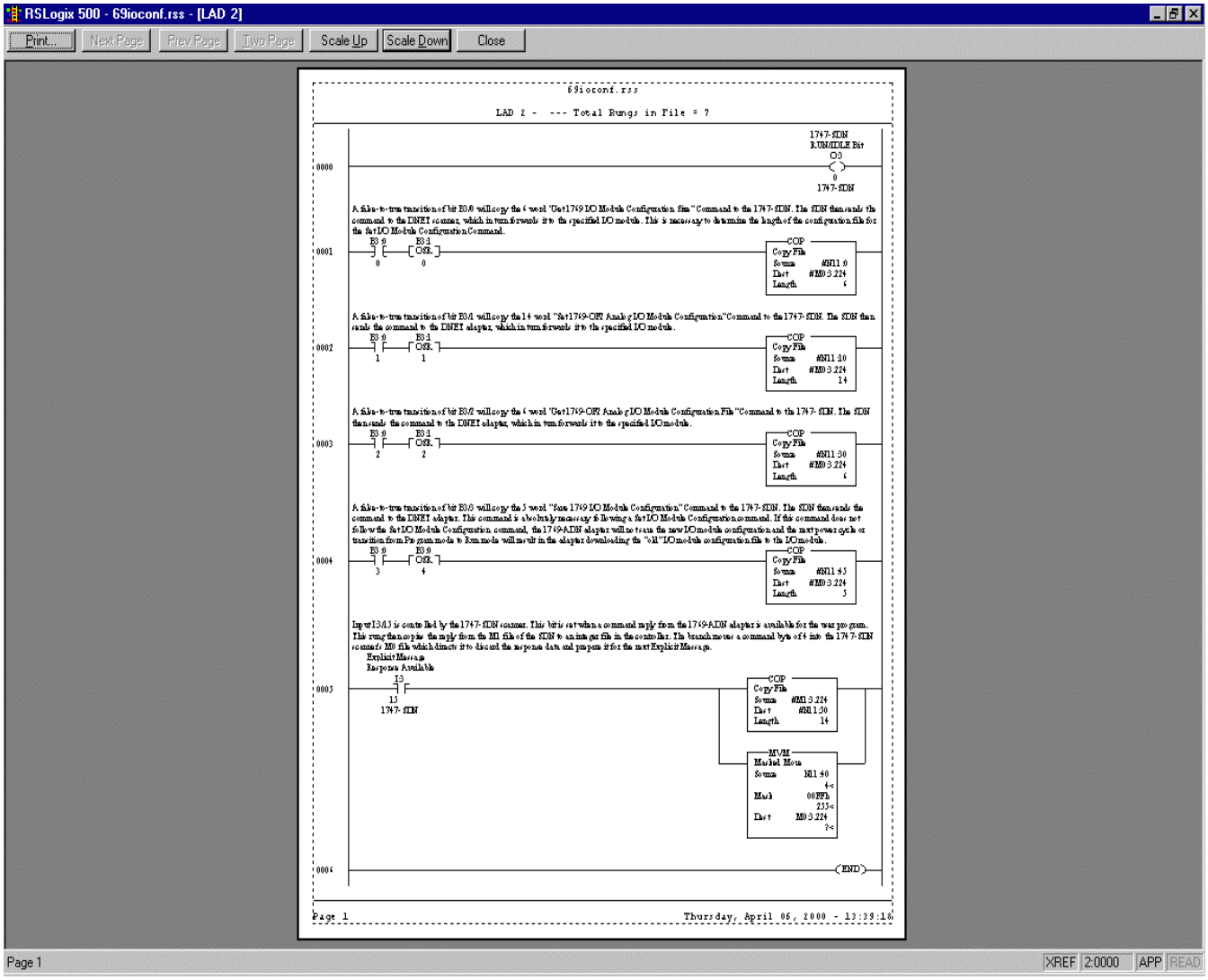
The next four words are values for the two channels in the event the controlling processor faults or is placed into the Program mode. For this example, these four values must be in the range of 6241 or 31207 decimal (1862 to 79E7 hexadecimal), which represents 4-20mA. Any values out of this range will result in a configuration error.

Ladder Logic Example Program

The following ladder program is an example of the logic needed to initiate explicit messages to the scanner/adapter/1769 I/O modules and how to obtain the replies. Assume the 1747-SDN is in slot 3 and the 1769-OF2 module is in 0A hexadecimal (10 decimal).

A copy of Data Table File N11 follows the ladder program to show the location of the commands. The following program includes these commands:

- Get 1769 I/O Module Configuration Size
- Set 1769 I/O Module Configuration
- Save 1769 I/O Module Configuration
- Get 1769 I/O Module Configuration



Data Table File N11 (Shown in Hexadecimal Radix)										
Offset	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
N11:0	101	6	E13	30C	A	17	0	0	0	0
N11:10	101	16	1013	30C	A	1A	8304	8304	1862	1862
N11:20	1862	1862	0	0	0	0	0	0	0	0
N11:30	101	6	E13	30C	A	1A	0	0	0	0
N11:40	4	0	0	0	0	101	4	1613	F	0
N11:50	101	2	8E13	8	0	0	0	0	0	0

Discrete Module Configuration Files

The following configuration information applies to these modules:

- 1769-OA8
- 1769-OB16
- 1769-OV16
- 1769-IQ6XOW4
- 1769-OW8
- 1769-OW8I

The read/writable configuration data file allows the setup of the hold last state and user-defined state conditions.

The manipulation of the bits from this file is normally done with programming software (e.g. RSLogix 500, RSNetworx for DeviceNet, etc.) during initial configuration of the system. In that case, graphical screens are provided via the programmer to simplify configuration. However, some systems (e.g. 1769-ADN DeviceNet adapter) also allow the bits to be altered as part of the control program using communication rungs. In that case, it is necessary to understand the bit arrangement.

Word	**Bit Position**															
	15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	PFE
1	Program State[1] for Output Array Word 0															
2	Program Value[2] for Output Array Word 0															
3	Fault State[3] for Output Array Word 0															
4	Fault Value[4] for Output Array Word 0															

1 Program State Word (word 1) selects the hold last state or user-defined safe state condition on a system transition from Run to Program. User-Defined Safe State = Bit Setting 0 and Hold Last State = Bit Setting 1

2 Program Value Word (word 2) is used to program the user-defined safe state value (0 = Off, 1 = On). Each output is individually configurable for on or off.

3 Fault State Word (word 3) selects the hold last state or user-defined safe state condition on a system transition from Run to Fault. User-Defined Safe State = Bit Setting 0 and Hold Last State = Bit Setting 1

4 Fault Value Word (word 4) is used to program the fault state value (0 = Off, 1 = On). Each output is individually configurable for on or off. Off = Bit Setting 0 and On = Bit Setting 1

Notes:

1769-ADN Throughput Characteristics

Read this appendix to learn about the 1769-ADN throughput characteristics.

Series A Adapters

About Adapter Throughput Characteristics

The following calculations provide a baseline for a 2-node network, a scanner, and a 1769-ADN. These calculations do not incorporate the impact of additional nodes on the network.

Specifically, nodes with addresses less than the node (1769-ADN) being analyzed will produce higher priority (with respect to the DeviceNet network) I/O messages and hence will lengthen any of the times calculated.

Turn-Around Time (t_{tat})

Turn-around time is defined as the time from when the 1769-ADN receives an output update from the scanner to the time it produces the entire input update that reflects the change provided in the output update with a Change of State connection without acknowledgement.

Specifically, from the time the last output-update fragment is received to the time that the last fragment[2] of the corresponding input-update is sent. This includes:

- time for the 1769-ADN to distribute the output update to all of the output modules on the 1769 backplane/bus
- the output module's turn-on/off time
- the input module's filter time
- time for the 1769-ADN to collect the (new) values from the input modules
- time for the 1769-ADN to transmit the complete input-update on the network

Note: The following equations represent the 1769-ADN turn-around time using a discrete input (1769-IQ16) and output (1769-OV16) pair wired in a loop-back fashion. For this configuration, the settling/filter time of the two modules is 8.6ms on average[1]. For other I/O modules, consult the appropriate product installation instructions to determine the appropriate filter times to use. Modules that consume/produce more than one word of data will have a slightly increased timing as well.

Baud Rate	t_{tat}[a] in ms; i = Number of Input Bytes Configured in Node (from I/O Summary Tab)
125K bps	$t_{tat} = 0.18 * i + 8.6$
250K bps	$t_{tat} = 0.10 * i + 8.6$
500K bps	$t_{tat} = 0.07 * i + 8.6$

a t_{tat} = turn-around time

Minimum Inter-Scan Delay (ISD) for Polled Connections

For mid to large 1769-ADN systems that are going to be scanned with a polled connection, it is critical that the following polled-response time (t_{pr}) be calculated to make sure that the scanner's inter-scan delay (ISD) is set correctly to ensure the proper behavior of the connection.

If the ISD is set lower than the time it takes the 1769-ADN to return its response, connections will exhibit undesirable behavior (e.g. intermittent connection dropout).

Note that the presence of higher priority traffic on the network will require the ISD to be further increased to maintain a robust connection.

Baud Rate	t_{pr}[a] in ms; i = Number of Input Bytes Configured in Node (from I/O Summary Tab)
125K bps	$t_{pr} = 0.16 * i + 0.4$
250K bps	$t_{pr} = 0.09 * i + 0.4$
500K bps	$t_{pr} = 0.06 * i + 0.4$

a t_{pr} = polled-response time

1 The 1769-IQ16 has a nominal filter time of 8ms, and the 1769-OV16 turn-on/turn-off times average out to 0.6ms.

2 Input/output update messages that contain more than 8 bytes will result in fragmented transmission on the DeviceNet network.

Quick Connect Performance

The Quick Connect performance depends on:

- the start-up time of the power supplies in the adapter system.
- the number of modules in the system.
- the type of modules in the system.

The typical time for adapter system to go from power applied to ready to accept an I/O connection request is from 1.4s to 3.0s. Use the following table as a guide when selecting your power supplies:

Catalog Number	Typical Startup Time (ms)
1769-PA2	621.00
1769-PB2	497.00
1769-PB4	388.40
1769-PA4	354.00

Once power is available to the adapter (from the power supply installed in the first bank of the system), it performs its startup process (including self-tests, detection of modules installed, and configuration of each module in the system) before transmitting it's first Duplicate MAC ID check message.

Transmission of the first Duplicate MAC ID check message is the end of the adapter's startup process and signals to a Quick Connect-enabled scanner that the adapter is ready to accept an I/O connection request.

An adapter's startup process execution time will vary based on the number of modules installed in the system, and the amount of configuration data that must be applied to each module. The minimum time will be approximately 1.0s for a two-discrete module system. A 30-module system with a mix of 22 discrete and 8 analog modules took approximately 1.8s to startup.

Adding the power supply startup time with the adapter's startup process time estimate will provide an estimate of the adapter system's overall Quick Connect startup time.

Quick Connect Limitations

The 1769-HSC is not compatible with the 1769 adapter's Quick Connection operation. The 1769-HSC does not respond quickly enough to adapter requests after startup. In general, modules that require longer than 650ms after power is applied to respond to the adapter will not be compatible with the adapter's Quick Connect mode of operation.

If a mix of power supplies is used in your adapter system, the slowest power supply must be installed in the first bank. This will ensure that the adapter will recognize the modules in the second and third banks (if installed). Power must be applied to all power supplies in a multi-bank system at the same time.

In Quick Connect mode, the adapter will accept I/O connection requests prior to the completion of the Duplicate MAC ID check completing. If an I/O connection is started, and then the Duplicate MAC ID check fails, the adapter will terminate the I/O connection, instruct all the modules to take their configured FAULT action, and cease communicating on the network.

Differences Between Series A and B DeviceNet Adapters

About the Differences

The following list details the differences/enhancements between DeviceNet Series A and B adapters:

- Series B adapters (that have their Mac ID switches set to 64-99) support the recovery of nodes that fail the Dup Mac test via RSNetWorx Faulted Address Recovery Wizard.
- Series B adapters, along with the new configuration applet within RSNetWorx (version 4.01 and later), eliminate the ADR and pass-through/bridging limitations associated with the Series A and custom applet.
- Series B adapters add support for additional 1769 bus-specific features that enable you to use the 1769-HSC.
- Series B adapters have increased input, output, and configuration data capacities.
- Series B adapters have slightly different performance characteristics. For example, the delay/throughput for the Series B is slightly more than the Series A due to the revised hardware memory architecture.
- Series B and RSNetWorx (version 4.01) are required for compatibility with these modules:
  - 1769-IF4XOF2
  - 1769-HSC
  - 1769-OW16
  - 1769-OA16
  - all future 1769 I/O modules
- Quick Connect

Notes:

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