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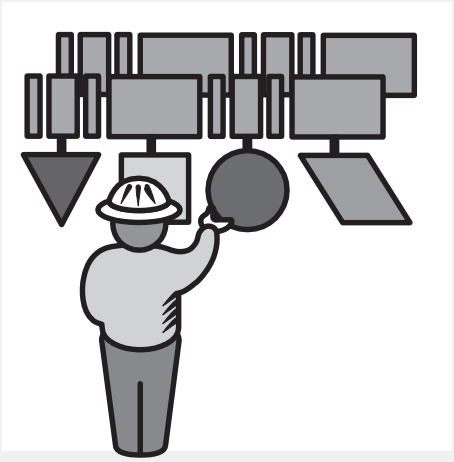
Find the *Rockwell / Allen-Bradley 1771-ACN15/B* at our website: *Click HERE*

Allen-Bradley

ControlNet Adapter Module

(Cat. No. 1771-ACN15 and -ACNR15)

User Manual



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Important User Information

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

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley 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 Allen-Bradley 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 manual we use notes to make you aware of safety considerations:



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

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

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

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Using This Manual

Preface Objectives

Read this preface to familiarize yourself with this manual and to learn how to use it properly and efficiently.

Audience

We assume that you have previously used an Allen-Bradley programmable controller, that you are familiar with its features, and that you are familiar with the terminology we use. If not, read the user manual for your processor before reading this manual.

Vocabulary

In this manual, we refer to:

- the individual ControlNet™ adapter module as the “adapter” or the “module.”
- the programmable controller as the “controller” or the “processor.”

What This Manual Contains

The contents of this manual are as follows:

What This Manual Contains

Chapter	Title	What's Covered
1	Introducing the ControlNet Adapter Modules	Describes features, capabilities, and hardware components.
2	Installing Your ControlNet Adapter Module	Procedures and guidelines for installing the module; including power requirements, location, setting switches, and actual installation.
3	Addressing Modes for Your I/O	Hardware addressing and configuration options
4	Planning to Use Your ControlNet Adapter	How the adapter operates on ControlNet and information to assist in configuring your system.
5	Troubleshooting	Troubleshooting aids, including status display, health indicators and ControlNet status indicators
Appendix		
A	Specifications	Module specifications
B	A Practical Example of ControlNet Concepts	An example program and description thereof

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Terminology Used in This Manual

The following list defines common terms used in this manual.

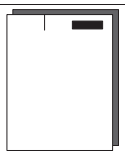
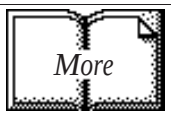
Use this term	To describe
complementary module	a module that performs an opposite function; an input module complements an output module and vice versa
Configuration Manager node	node responsible for distributing ControlNet configuration data to all nodes on the network
ControlNet network	a communication architecture that allows the exchange of messages between Allen-Bradley Company, Inc. products and certified third-party products
connection	an opened communication path between two nodes on a ControlNet network
ControlNet status indicators	channel A and channel B indicators on your node indicating status on the ControlNet link
DF1 protocol	a peer-to-peer link-layer protocol that combines features of ANSI X3.28-1976 specification subcategories D1 (data transparency) and F1 (two-way simultaneous transmission with embedded responses)
DH+™ network (Data Highway Plus™)	an Allen-Bradley local area network made up of one or more token-passing baseband links
discrete I/O data transfer	type of data transfer in which single units of I/O have discrete relationships with values in the processor's data table; uses the processor's input- and output-image tables (I and O files); configured on a per-node basis in the ControlNet I/O map table
drop cable	a cable that connects a node to the trunk cable (this is an integral part of 1786 taps)
frame	single data transfer on a ControlNet link
half–slot addressing	a method of addressing where the processor can address its I/O in 1/2–slot I/O groups
high–density i/o module	a module that provides 16 input or 16 output terminals
I/O Group	an addressing unit that can contain up to 16 input terminals and 16 output terminals
I/O map table	table that you configure using the programming software to map data from an I/O chassis and other devices on the ControlNet network to particular data-table file addresses
link	collection of nodes with unique addresses (in the range of 1-99). Segments connected by repeaters make up a link; links connected by bridges make up a network
map-table entry	one entry in the I/O map table that you configure using the programming software to map data from one I/O chassis (or other device on a ControlNet link) to particular data-table file addresses
maximum scheduled node	node with highest network address that can use scheduled time on a ControlNet link
maximum unscheduled node	node with highest network address that can use unscheduled time on a ControlNet link
network access port (NAP)	port that provides a temporary network connection through an RJ-45 connector
network	a series of nodes connected by some type of communication medium. The connection paths between any pair of nodes can include repeaters, routers, bridges and gateways
network address	a node's address on the network (*this replaces MAC ID and node address).*
node	port of a physical device connecting to the network which requires a network address in order to function on the network — a link may contain a maximum of 107 nodes
network update interval (NUI)	single occurrence of the network update time (NUT)
network update time (NUT)	repetitive time interval in which data can be sent on the ControlNet network
non-discrete I/O data transfer	type of data transfer in which blocks of data transferred to or from I/O modules use integer input and output data-table files that you specify; cannot use the processor's input- and output-image tables (I and O files); scheduled transfers are configured in the ControlNet I/O map table, unscheduled transfers make use of ControlNet I/O (CIO) transfer instructions
one–slot addressing	A method of addressing where the processor can address its I/O in 1–slot I/O groups.
parallel port	an input/output port for a device that transmits multiple data and control bits over wires connected in parallel
PC	An Allen–Bradley programmable controller, such as the PLC–5
PCCC	Programmable Controller Communication Commands, an application-level command set that Allen-Bradley programmable controllers use to communicate across networks
processor	a term used to mean an Allen–Bradley programmable controller
quad–density i/o module	a module that provides 32 input or 32 output terminals
redundant media	dual cable system that allows you to receive the best signal over a network

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Use this term	To describe
repeater	two-port active physical-layer device that reconstructs and retransmits all traffic it hears on one segment to another segment
remote I/O link	a serial link for carrying I/O data between a PLC or SLC processor/scanner and remote I/O adapters
RS-232-C port	a serial port that complies with accepted industry standard for serial binary communication circuits in a point-to-point link
scheduled transfers	deterministic and repeatable transfers that are continuous and asynchronous to the ladder-logic program scan
segment	trunk-cable sections connected via taps with terminators at each end; a segment does not include repeaters
serial port	a port that transmits/receives data and control bits sequentially over a single transmission line (*see RS-232-C port*)
standard–density i/o module	a module that provides up to 8 input terminals or 8 output terminals
tap	a component that connects products to the ControlNet trunk cable. A tap is required for each node and for both sides of each repeater.
terminator	a 75-ohm resistor (mounted in a BNC plug) placed on the ends of segments to prevent reflections from occurring at the ends of cables.
trunk cable	bus or central part of a cable system.
trunk-cable section	length of trunk cable between any two taps
two–slot addressing	a method of addressing where the processor can address its I/O in 2–slot I/O groups
unscheduled transfers	non-deterministic data transfers through ladder-initiated communication or programming devices

Conventions

We use these conventions in this manual:

In this manual, we show:	Like this:
that there is more information about a topic in another chapter in this manual	
that there is more information about the topic in another manual	

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Product Compatibility

The 1771-ACN15 and 1771-ACNR15 adapter modules are two of many hardware components that make up a programmable controller system. The table below lists the hardware components and products with which you can use the adapter module.

Compatible Hardware Products

Product name	Description	Catalog number
Processors	PLC–5/20C15, PLC-5/40C15 and PLC-5/80C15 processors	1785-L20C15, 1785-L40C15, L80C15
Communication Devices	ControlNet KTCx Communication Card ControlNet Serial/Parallel Communication Interface Flex I/O ControlNet Adapter 1771 ControlNet Adapter Module	1784-KTC15x 1770-KFC 1794-ACN15, ACNR15 1771-ACN15, -ACNR15
Universal I/O Chassis	4–slot 8–slot 12–slot 16–slot	1771–A1, –A1B 1771–A2, –A2B 1771–A3B, A3B1 1771–A4, –A4B
I/O Modules	Block transfer modules 8–point I/O Standard density I/O modules 16–point I/O High density I/O modules 32–point I/O Quad–Density I/O modules	All modules that use the 1771 I/O structure
Power Supplies	System power supply Auxiliary power Supply Auxiliary Power Supply module (120V ac input, 3A) Auxiliary Power Supply module (120V ac input, 8A) Redundant Power Supply module Auxiliary Power Supply module (24V dc input, 8A) Auxiliary Power Supply module (220/240V ac input, 8A) Auxiliary Power Supply module (120/220V ac input, 16A) PLC–2 Power Supply (115V ac input) PLC–2 Power Supply (24V dc input) Local Power Supply Auxiliary Power Supply (24V dc input)	1771–P1 1771–P2 1771–P3 1771–P4, –P4S, –P4S1 1771–P4R 1771–P5 1771–P6S, –P6S1 1771–PS7 1772–P1 1772–P4 1774–P1 1777–P4

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Related Publications

For additional information on planning and installing your ControlNet system, see the following publications:

Publication	Publication Number
ControlNet PLC-5 Programmable Controllers (Phase 1.5) User Manual	1785-6.5.22
ControlNet Cable System Component List	AG-2.2
ControlNet Cable System Planning and Installation Manual	1786-6.2.1
ControlNet Coax Tap Installation Instructions	1786-2.3
ControlNet Network Access Cable Installation Instructions	1786-2.6
ControlNet Repeater Installation Instructions	1786-2.7
Industrial Automation Wiring and Grounding Guidelines for Noise Immunity	1770-4.1

Summary

This preface gave you information on how to use this manual efficiently. Chapter 1 introduces you to the ControlNet remote I/O adapter module.

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Publication 1771-6.5.124 – August 1997

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Introducing the ControlNet Adapter Module

Chapter Objectives

This chapter describes the ControlNet adapter modules' (cat. no. 1771-ACN15 and -ACNR15):

- features
- hardware components, including
  - diagnostic indicators
  - communication reset pushbutton
  - network access port (NAP)
  - ControlNet connectors
  - network address switch assemblies

Module Description and Features

The 1771-ACN15 and -ACNR15 adapters control 1771 remote I/O on the ControlNet network. The ControlNet network is a communication architecture that allows the exchange of messages between Allen-Bradley products and certified third-party products.

The 1771-ACN15 and -ACNR15 Adapters features include:

- high speed data transfer
- diagnostic messages
- local communication network access through the network access port (NAP)
- redundant media (1771-ACNR15 only)

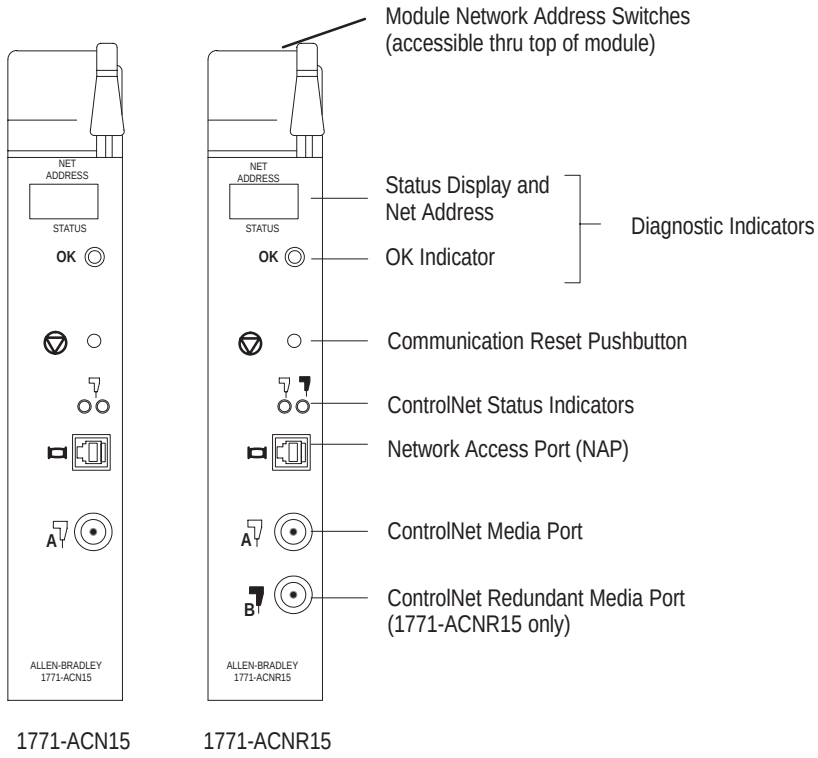
Hardware Components

The adapter module consists of the following major components:

- ControlNet status indicators
- status display
- communication reset pushbutton
- network access port (NAP)
- ControlNet connectors (one on the 1771-ACN15; two on the 1771-ACNR15)
- module net address switch assemblies (on top of module)

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Figure 1.1
ControlNet Adapter Module



Diagnostic Indicators

The OK indicator is located on the front panel of the adapter module (Figure 1.1). It shows both normal operation and error conditions in your remote I/O system.

In addition, an alphanumeric display (net address/status) provides status code indications when an error occurs during initialization or operation.

A complete description of the diagnostic indicators and status display and how to use them for troubleshooting is explained in chapter 5.

Communication Reset Pushbutton

This pushbutton is active whenever the status display shows RSET or PRL. PRL is active only when the I/O chassis backplane switch is in the PRL position. If the above conditions are met, you can use the reset pushbutton (Figure 1.1) to reset the adapter module and resume communication after a communication error occurs.

Network Access Port (NAP)

The network access port (Figure 1.1) provides a bidirectional electrical interface for programming, maintenance, and I/O

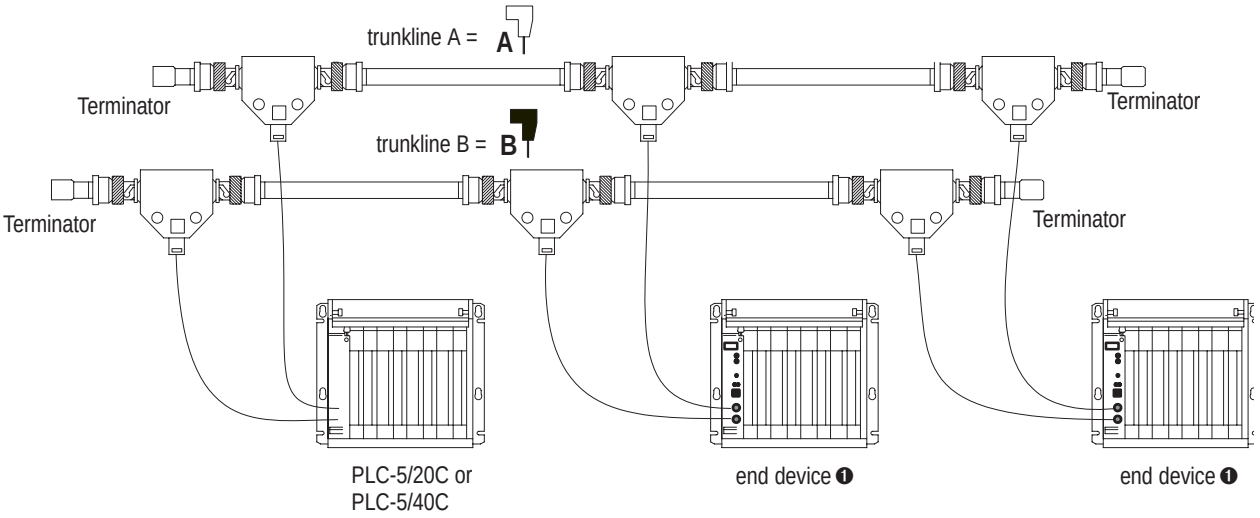
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monitoring devices in both redundant and non-redundant connections. Connecting programming terminals to the network using the NAP is described in Chapter 2.

ControlNet Connectors

Cable connection to the module is through standard BNC connectors on the module frontplate.

Example of a Redundant System



❶ End device supporting redundant cabling is a 1771-ACNR15.

More

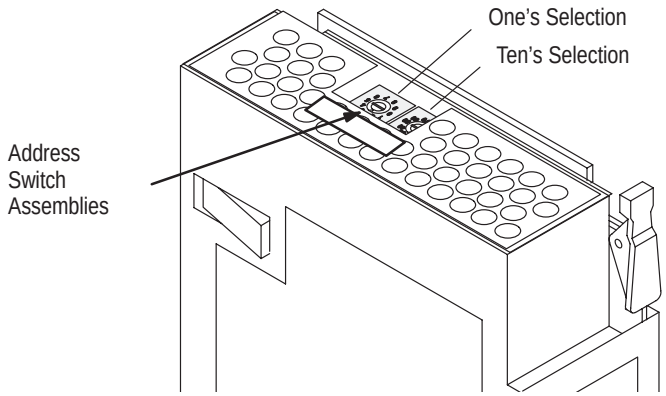
Refer to the ControlNet Cable System Planning and Installation user manual, pub. no. 1786-6.2.1 for more information.

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Network Address Switch Assemblies

You must set two switch assemblies to configure your adapter module with its unique network address. You access these switches through the top of the module. Figure 1.2 shows the location of the switches. These switches are read on powerup to establish the network address of the module. Network address switch settings are described in Chapter 2.

Figure 1.2
Assigning the Network Number



For optimum throughput, assign addresses to your ControlNet nodes in a sequential order starting with 02. Address 01 is reserved for the controlling processor on the network

Chapter Summary

In this chapter we discussed the functions and hardware components of the ControlNet Adapter Module.

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Installing Your ControlNet Adapter Module

Chapter Objectives

This chapter describes the procedures for installing your ControlNet adapter module. These include:

- CE compliance
- determining power requirements
- determining the module location and keying the I/O chassis
- setting the network address switches
- setting the I/O chassis switches
- setting the I/O chassis power supply configuration plug
- installing the adapter module in the chassis
- connecting programming terminals to the network via the network access port (NAP)
- powerup sequence

Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2EMC – Generic Immunity Standard, Part 2 – Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

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For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

Determining Power Requirements

The ControlNet adapter module requires a backplane current of 1.0A at 5V dc. Remember to add this amount to other current requirements for your I/O chassis.

Determining the Module Location and Keying the I/O Chassis

The ControlNet adapter module must be installed in the leftmost slot of the I/O chassis.

The I/O chassis backplane connectors are keyed to accept only one type of module. This prevents accidental insertion of other modules in the wrong module slot.

Position the keying bands (Figure 2.1) in the backplane connectors to correspond to the key slots on the module. This prevents you from inserting the wrong module in this slot. For the ControlNet adapter module, position the keying bands:

- between 54 and 56 on the upper connector, and
- between 16 and 18 on the lower connector



ATTENTION: Observe the following precautions when inserting or removing keys:

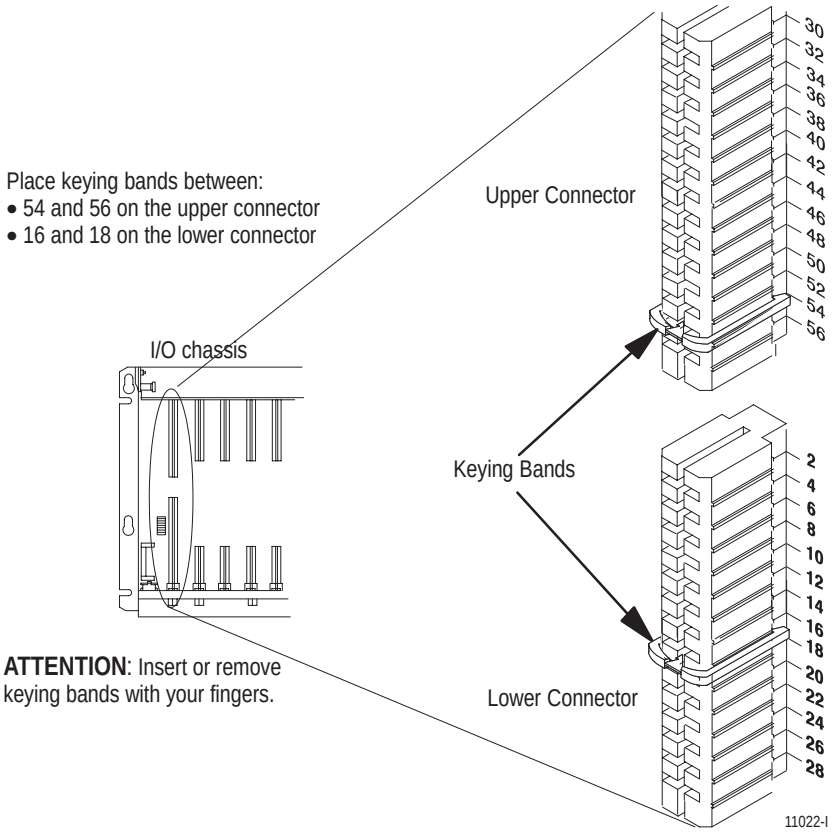
- insert or remove keys with your fingers
- make sure that key placement is correct

Incorrect keying or the use of a tool can result in damage to the backplane connector and possible system faults.

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You can change the position of these bands if subsequent system design and rewiring makes insertion of a different type of module necessary.

Figure 2.1
Keying Band Positions



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Setting the Network Address Switches

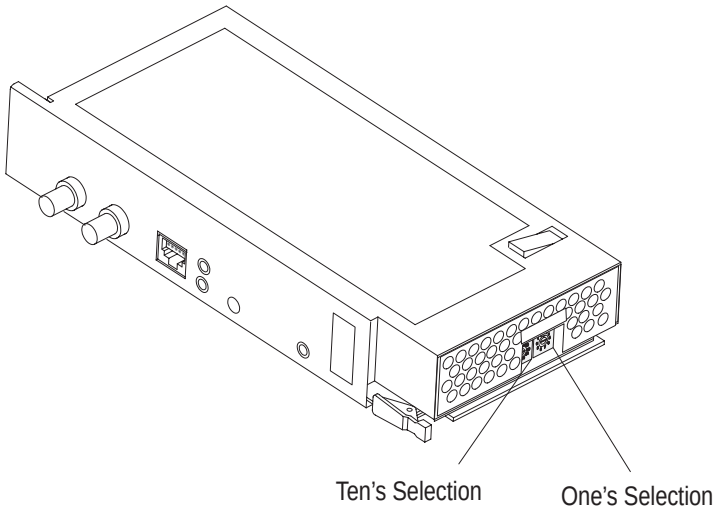
The switches on the top of the adapter module determine the network address of the adapter. The two switches are:

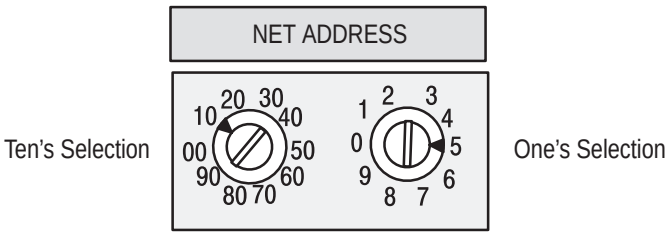
- the ten's switch
- the one's switch

The combination of these switches allows selection of network addresses from 01 to 99.

Use a small bladed screwdriver to rotate the switches.

Figure 2.2
Setting the Network Address





For example, the 10's selection switch is set to 10, and the 1's selection switch is set to 5.

Then, **10** plus **5 = 15**

NOTE: 00 is an invalid number.

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Setting the I/O Chassis Switches

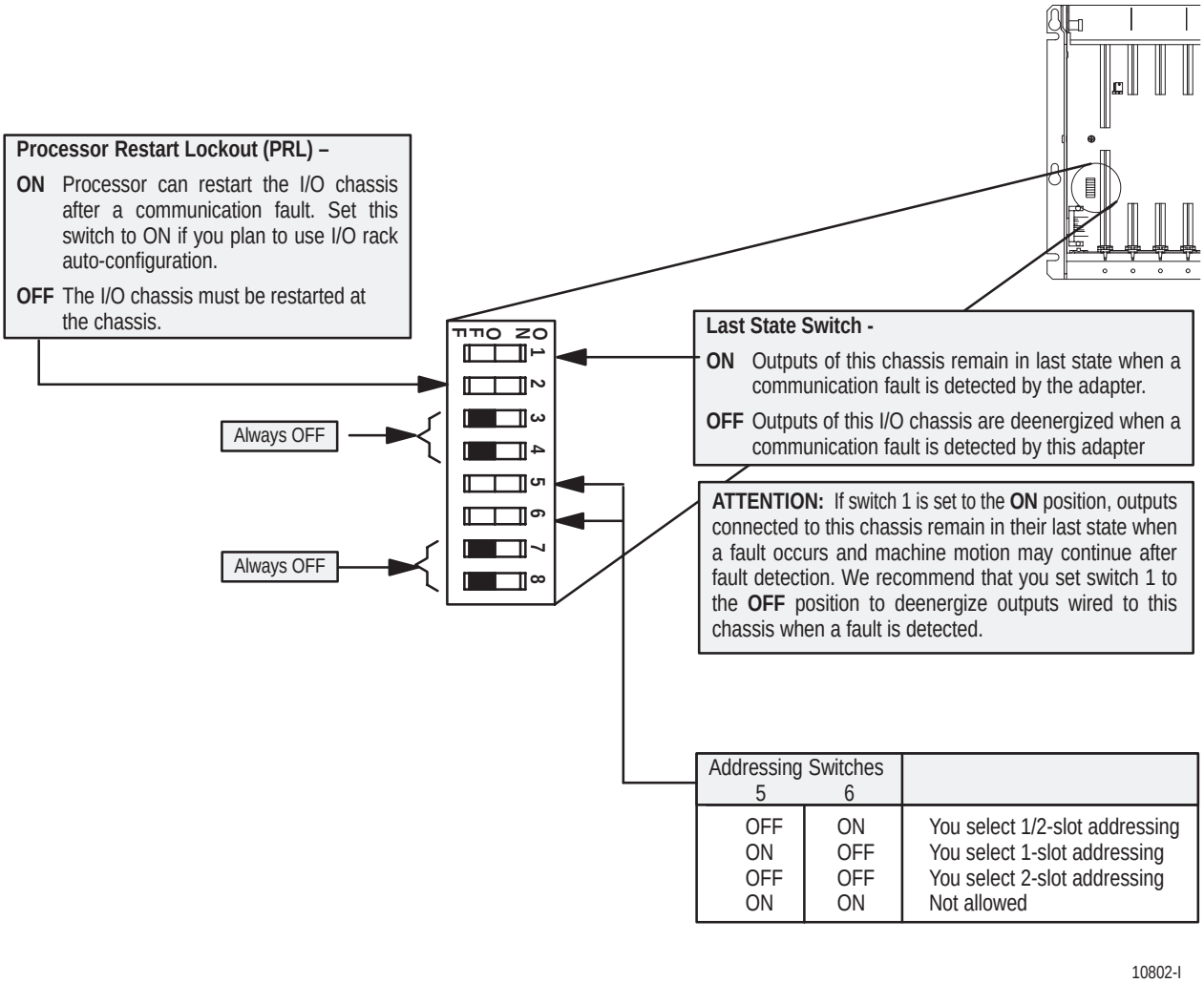
You must set the I/O chassis backplane switches and power-supply configuration plug.

Backplane Switch Assembly

This switch assembly is located on the backplane of the I/O chassis. You use it to select:

- the last state of all outputs
- the processor restart lockout feature
- 1/2-, 1- or 2-slot addressing

Figure 2.3
I/O Chassis Backplane Switch Assembly Settings for ControlNet Adapter Module in PLC-5/20C and PLC-5/40C Processor Systems

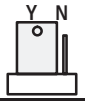
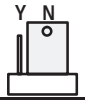


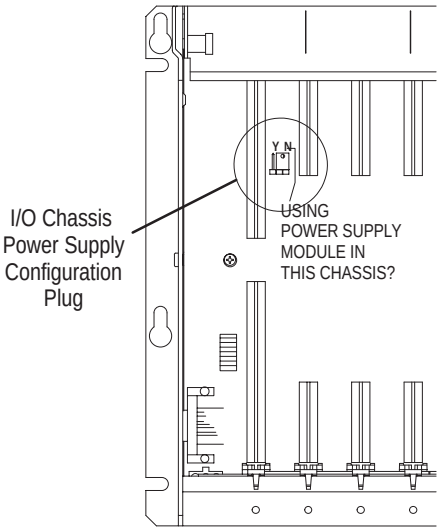
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Setting the I/O Chassis Power Supply Configuration Plug

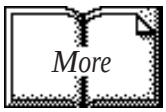
Set the I/O chassis power-supply configuration plug (Figure 2.4) to identify the type of power supply you are using with your remote chassis. This configuration plug is located on the backplane of 1771-A1B through -A4B or later I/O chassis.

Figure 2.4
1771 I/O Chassis Power Supply Configuration Plug Settings

For Use With:	Set Chassis Configuration Plug to:
power supply module installed in chassis	"Y" position 
external power supply in your remote system	"N" position 



Installing the Adapter Module in the Chassis

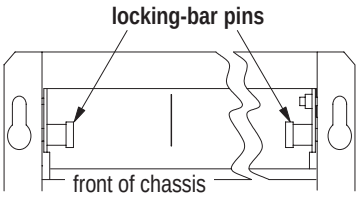


Once you've determined the power requirements and keying for your adapter module, and have set the appropriate switch assemblies, you can use the following procedure to install it.

Refer to the Industrial Controller Wiring and Grounding Guidelines (publication 1770-4.1) for proper grounding and wiring methods to use when installing your module.



ATTENTION: Remove system power before removing or installing your module in the I/O chassis. Failure to observe this warning could damage module circuitry and injure people.



12453-I

1. Remove power from the I/O chassis before inserting (or removing) the module.
2. On chassis equipped with a chassis locking bar, pull the locking-bar pins to release the locking bar and swing it up. If installing in an earlier chassis, lift the module locking latch up.
3. Place the module in the plastic tracks on the top and bottom of the leftmost slot. These tracks guide the module into position.
4. Press firmly and evenly to seat the module in its backplane connectors.

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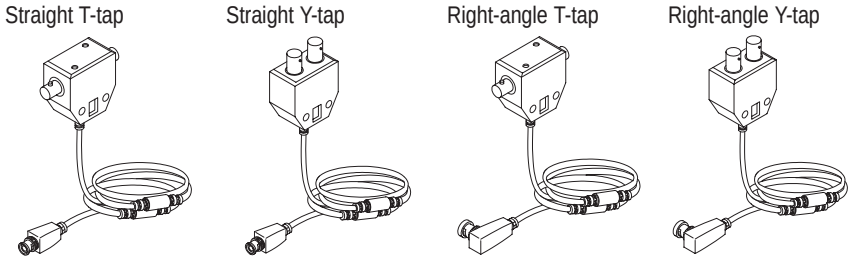
ATTENTION: Do not force the module into the backplane connector. If you cannot seat the module with firm pressure, check the alignment and keying. Forcing the module can damage the backplane connector or the module.

5. Snap the chassis locking bar (or locking latch on earlier chassis) over the top of the module to secure it. Make sure the locking pins on the locking bar are fully engaged.

   Note: The chassis locking bar will not close if all modules are not properly seated.

Connecting Your Adapter to the ControlNet Network

You connect your 1771-ACN15 or -ACNR15 adapter module to a ControlNet network via taps. These taps are available:



Important: Taps contain passive electronics and must be purchased from Allen-Bradley for the network to function properly.

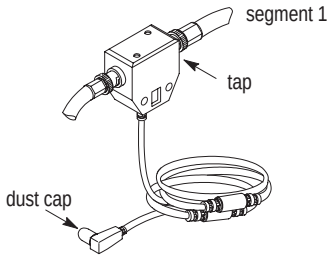
1. Remove the tap's dust cap (located on the straight or right angle connector).

If your node supports:	Connect the tap's straight or right angle connector:
Non-redundant media	to the **channel A** connector on the 1771-ACN15 or 1771-ACNR15 (channel B on the 1771-ACNR15 is not used)①
Redundant media	• from **trunkline A to channel A** on the 1771-ACNR15 • from **trunkline B to channel B** on the 1771-ACNR15

① While both channels are active, Allen-Bradley recommends using channel A for non-redundant media.

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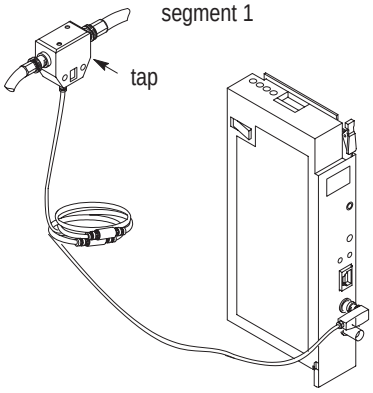
ATTENTION: Do not allow any metal portions of the tap to contact any conductive material. If you disconnect the tap from the adapter, place the dust cap back on the straight or right angle connector to prevent the connector from accidentally contacting a metallic grounded surface.



20093-I

2. Remove and discard the dust caps from the adapter BNC jacks.

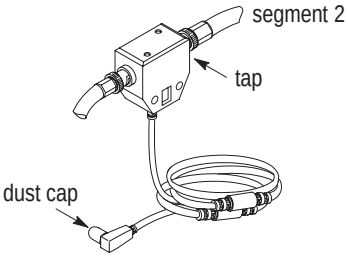
3. Connect this tap's straight or right angle connector to the **A** BNC connector on the adapter.



Important: To prevent inadvertent reversal of the tap connections (resulting in incorrect LED displays and troubleshooting), check the tap drop cable for a label indicating the attached segment before making your connection.

20093-I

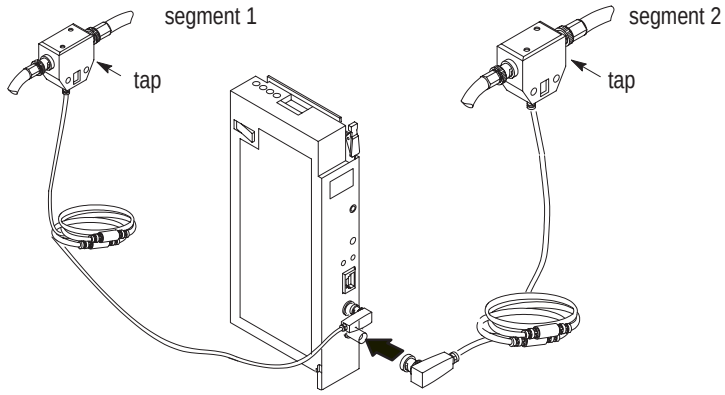
4. For redundant adapters (1771-ACNR15), remove (and save) the dust cap located on the straight or right angle connector of the designated tap on the second segment (segment 2).



20093-I

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5. Connect this tap's straight or right angle connector to the BNC connector on the adapter.



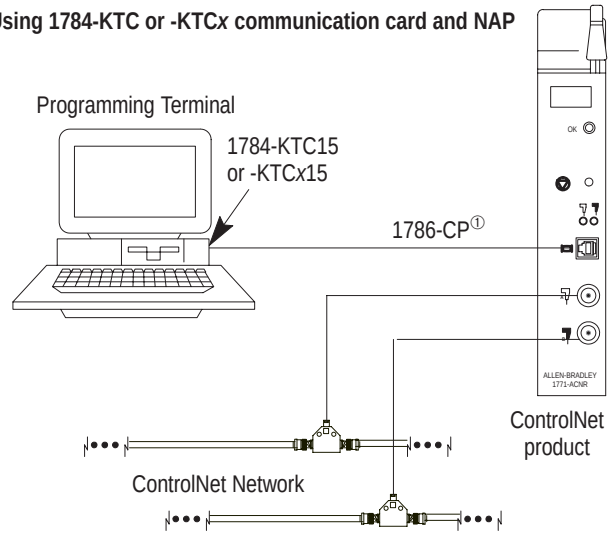
20093-I

After terminating your segments, you connect your node to the network.

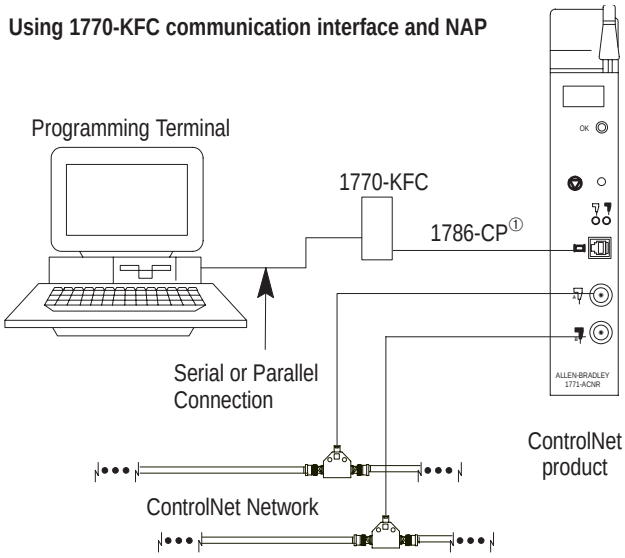
Connecting Programming Terminals to the Network via the NAP

You can connect programming terminals to the ControlNet network by connecting to the network access port (NAP). Two methods are shown below.

Using 1784-KTC or -KTC*x* communication card and NAP



Using 1770-KFC communication interface and NAP



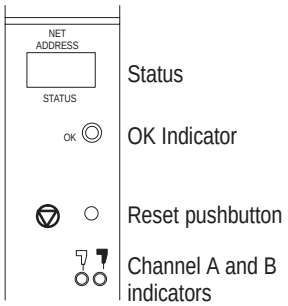
① The 1786-CP cable can be plugged into any ControlNet product's NAP to provide programming capability on the ControlNet network. A programming terminal connected through this cable is counted as a node and must have a unique address.

ATTENTION: Use the **1786-CP** cable when connecting a programming terminal to the network through NAPs. Using a commercially available RJ-style cable could result in possible network failures.

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Powerup Sequence

Look carefully at the status display and OK indicator when powering up the module. These indicators provide meaningful information on proper module operation.



1. Apply power to the chassis – the OK indicator should not light.
2. The module runs a power on self test (POST). During this test, the status displays 0000 through 8888.
3. If the OK indicator is red, and the display shows POST-RSET, then POST has failed.
   a. Press the reset pushbutton to reset.

      The module reruns the POST program. If POST-RPLC appears on the status display again, POST has failed again.

   b. Replace the module.
4. If:
   a. the OK indicator begins to blink green, and
   b. the series/revision level of the module is displayed in the status window (e.g. A/A, A/B, etc.), and
   c. the channel A and B indicators blink alternately, the module has passed POST.

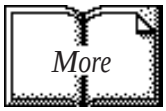
If the indications are neither of those indicated in 3 or 4, refer to chapter 5, “Troubleshooting.”

INIT A#nn

5. The module status displays INIT-A#nn (where nn is the node number of module).
6. The channel indicators indicate network condition as shown in the indicator table in chapter 5.

IDLE A#nn

7. Then the display shows IDLE-A#nn (where nn is the node number of module), indicating a successful configuration by the ControlNet Configuration Manager.



For detailed information on planning and installing your ControlNet system, see the following publications:

Publication	Publication Number
ControlNet Cable System Component List	AG-2.2
ControlNet Cable System Planning and Installation Manual	1786-6.2.1
ControlNet Coax Tap Installation Instructions	1786-2.3
ControlNet Network Access Cable Installation Instructions	1786-2.6
ControlNet Repeater Installation Instructions	1786-2.7
Industrial Automation Wiring and Grounding Guidelines	1770-4.1

Chapter Summary

In this chapter you learned how to install your adapter module. Chapter 3 tells you how to address your I/O.

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Addressing Modes for Your I/O

Chapter Objectives

In this chapter, you will learn:

- addressing your I/O
- using 2-slot addressing, including:
  - I/O module combinations
  - using standard-density I/O (8 point) modules
  - using high-density (16 point) I/O modules
- using 1-slot addressing, including:
  - I/O module combinations
- using 1/2- slot addressing
- addressing summary

Addressing Your I/O

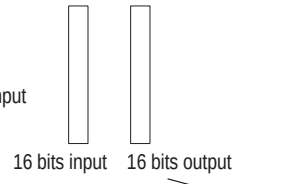
Programmable controllers that use the ControlNet adapter module can address their I/O in 2-slot, 1-slot or 1/2 slot I/O groups. These three addressing methods are referred to as 2-slot addressing, 1-slot addressing and 1/2-slot addressing.

You select the addressing method with switch 5 and 6 in the I/O chassis backplane switch assembly. You make this selection for each chassis independently with only one method of addressing for each chassis.

For each I/O chassis in your system, you must define how many I/O chassis slots make up an I/O group (1 word each in the input image table and output image table); this choice is the chassis' addressing mode. Choose from among these available modes:

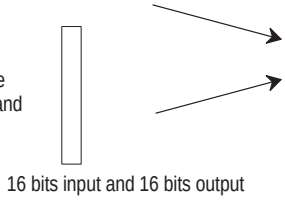
- **2-slot addressing**

  2 I/O chassis slots = 1 I/O group = 1 input image word and 1 output image word = 16 input bits and 16 output bits.



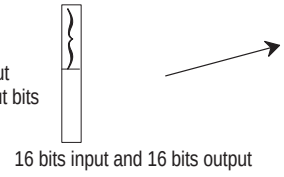
- **1-slot addressing**

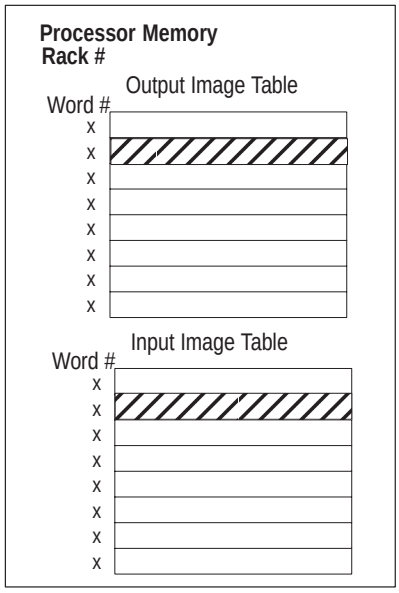
  1 I/O chassis slot = 1 I/O group = 1 input image word and 1 output image word = 16 input bits and 16 output bits.



- **1/2-slot addressing**

  1/2 of an I/O chassis slot = 1 I/O group = 1 input image word and 1 output image word = 16 input bits and 16 output bits.

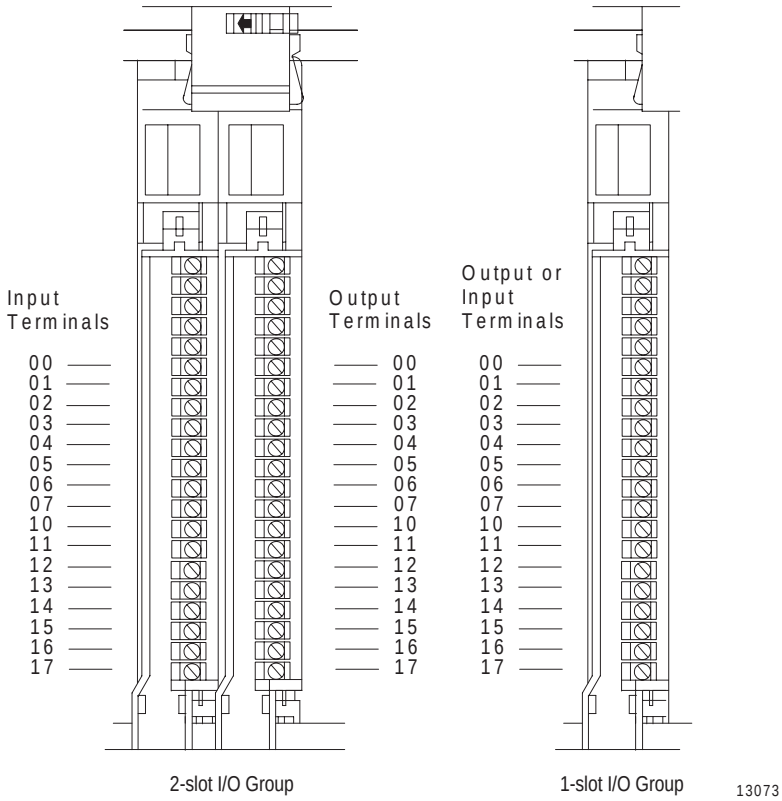




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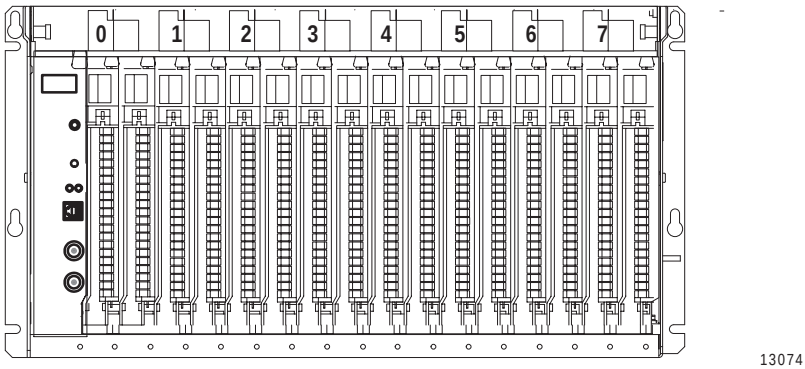
I/O groups are made up of I/O terminals (Figure 3.1). An I/O group is an addressing unit that can contain up to 16 input terminals and 16 output terminals. You select an I/O chassis to have either 2-slot, 1-slot or 1/2-slot I/O groups.

Figure 3.1
An I/O Group - Up to 16 Input Terminals and 16 Output Terminals



I/O racks are made up of I/O groups (Figure 3.2). An I/O rack is an addressing unit that can contain up to eight I/O groups.

Figure 3.2
An I/O Rack - Up to Eight I/O Groups



Power Source Not Indicated

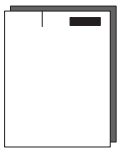
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Using 2-Slot Addressing

Definition: The processor addresses two I/O module slots as one I/O group.

Concept: Each physical 2-slot I/O group is represented by a word in the input image table and a word in the output image table. Each input terminal corresponds to a bit in the input image table word and each output terminal corresponds to a bit in the output image table word.

The maximum number of bits available for one 2-slot I/O group is 32: 16 bits in the input image table and 16 bits in the output image table. The type of module you install (either 8 or 16-point I/O) determines the number of bits in the words that are used.



You select 2-slot addressing by setting switches 5 and 6 of the I/O chassis backplane switch assembly to the OFF position as shown in Chapter 2.

I/O Module Combinations

The combination of I/O modules you can use depends on the addressing method and I/O chassis you select.

Table 3.A lists acceptable I/O module combinations with 2-slot addressing.

Table 3.A
I/O Module Combinations With 2-slot Addressing

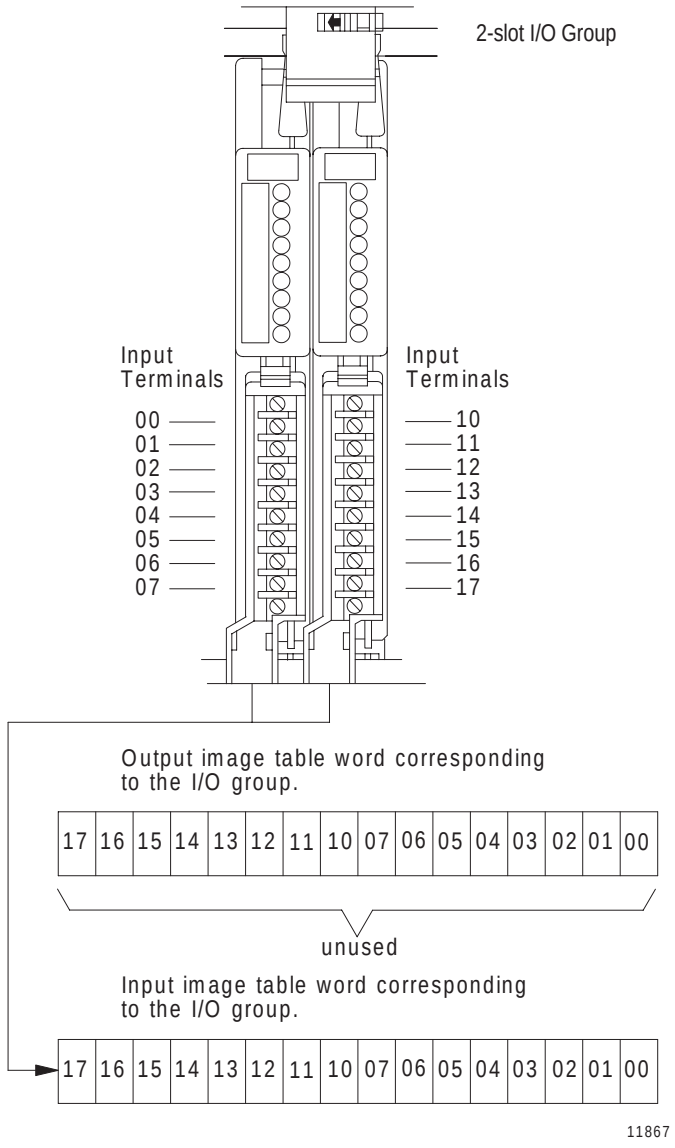
I/O Chassis Series	I/O Module Combinations Per I/O Group	Data Table Bits Used	
		Input Image Table	Output Image Table
A, B	2 8-point input modules	16	0
	2 8-point output modules	0	16
	1 8-point input and output module	8	8
	1 8-point input and 1 nondiscrete module	16	8
	1 nondiscrete and 1 8-point output module	8	16
	2 nondiscrete modules	16	16
B or later only	1 16-point input and output module	16	16
	1 16-point input and 1 8-point output module	16	8
	1 8-point input and 1 16-point output module	8	16

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Using Standard-density I/O (8 point) Modules

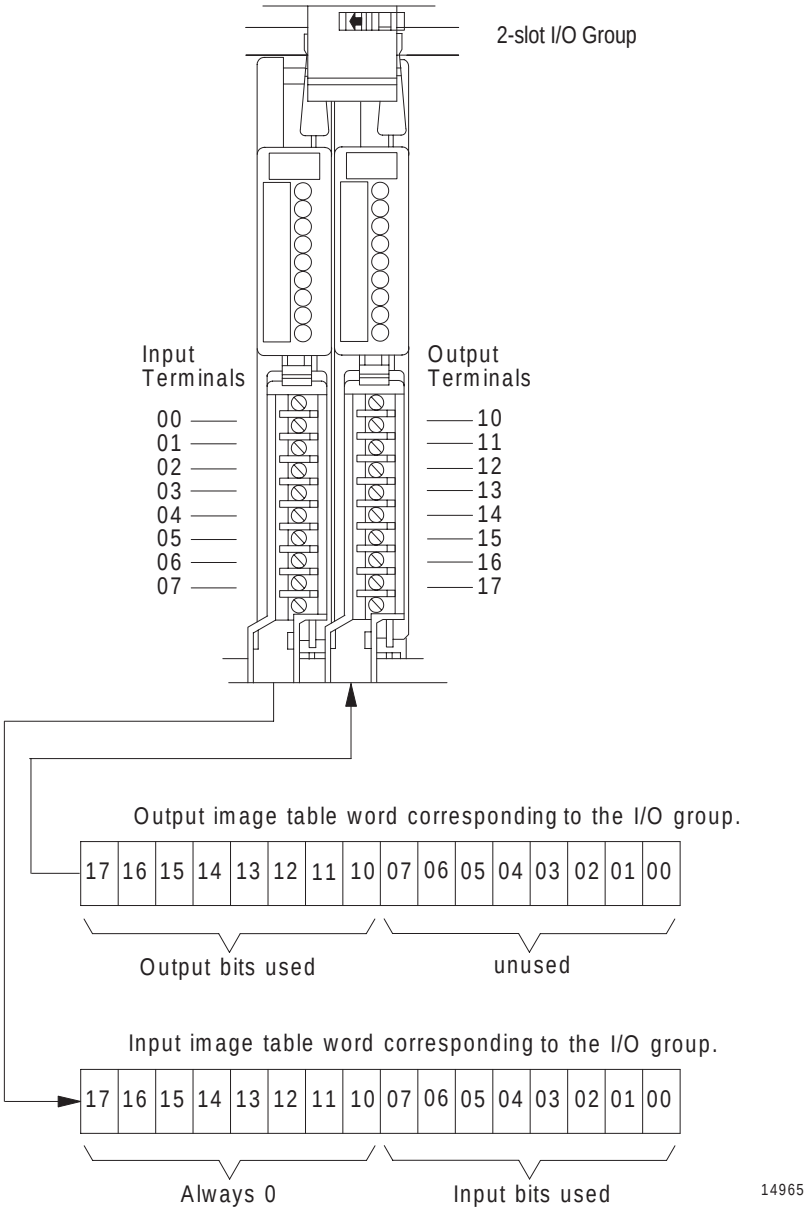
Standard-density I/O modules provide eight input terminals or eight output terminals. Figure 3.3 illustrates the 2-slot I/O group concept with two 8-point input modules. Figure 3.4 shows an 8-point input module and an 8-point output module in a 2-slot I/O group.

Figure 3.3
Two 8-point Input Modules Using One Word of the Input Image Table



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Figure 3.4
8-point Input and Output Modules Using Eight Bits of the Input Image Table Word and Eight Bits of the Output Image Table Word

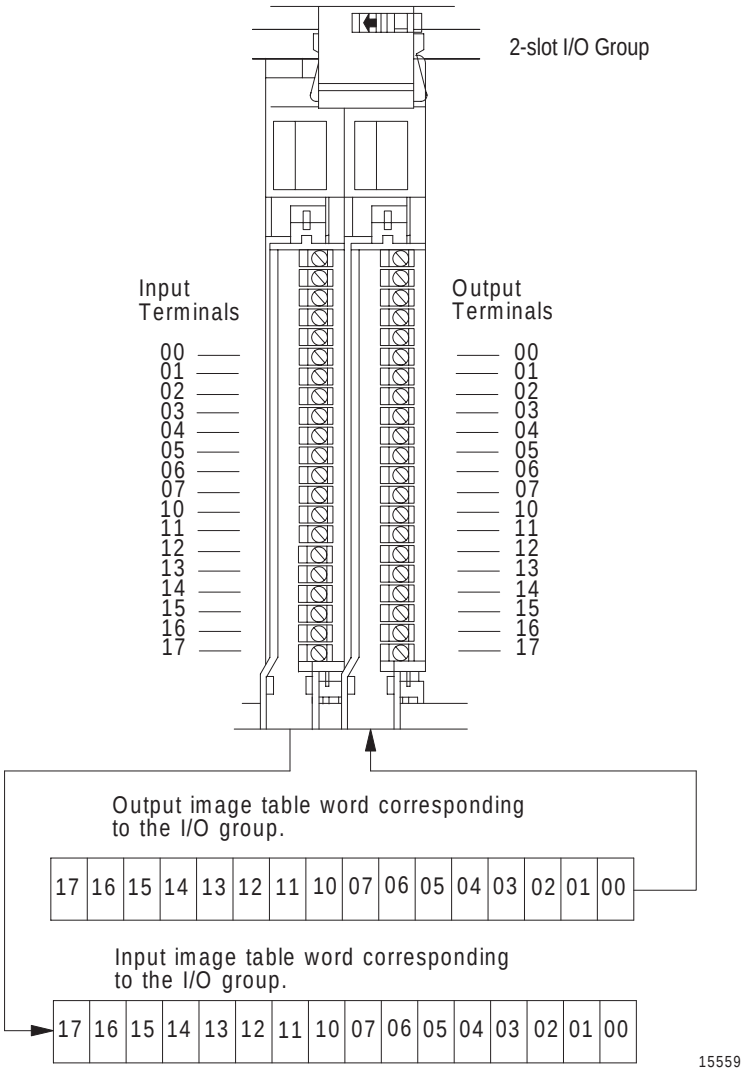


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Using High-density (16 point) I/O Modules

16-point I/O modules provide 16 input terminals or 16 output terminals. 16-point I/O modules use a full word in the input or output image table when they are addressed as a 2-slot I/O group (Figure 3.5). Two 16-point modules (one input and one output) can be used in a 2-slot I/O group.

Figure 3.5
16-point Input and Output Modules Using Two Words of the Image Table



Because these modules use a full word in the image table, the only type of module you can use in a 2-slot I/O group with a 16-point module is one that performs the opposite (complementary) function; an input module complements an output module and vice-versa.

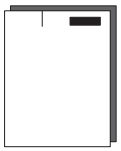
You can use an 8-point module with a 16-point module in a 2-slot group; it must perform the opposite function. However, eight bits in the I/O image table are unused.

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Using 1-Slot Addressing

Definition: The processor addresses one I/O module slot as one I/O group.

Concept: The physical address of each I/O group corresponds to an input and output image table word. The type of module you install (8, 16, or 32-point) determines the number of bits in these words that are used.



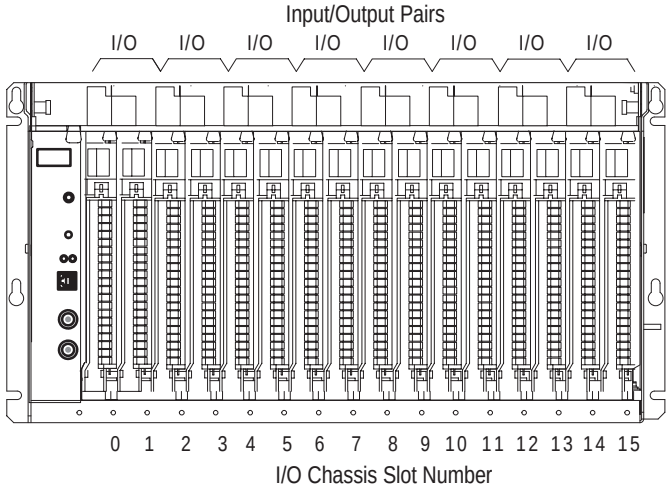
You select 1-slot addressing by setting switches 5 and 6 of the I/O chassis backplane switch assembly as shown in Chapter 2:

- switch 5 to the ON position
- switch 6 to the OFF position

With 1-slot addressing, because 16 input AND 16 output bits are available in the processor's image table for each I/O slot, you can use any mix of 8-point, 16-point or nondiscrete I/O modules in the I/O chassis.

To use 32-point I/O modules with 1-slot addressing, you must install, as a pair, an input module and an output module in 2 adjacent slots of the I/O chassis beginning with I/O slot 0 (Figure 3.6). If you cannot pair the modules in this way, one of the two slots of the pair must be empty. For example, if I/O slot 0 holds a 32-point input module, I/O slot 1 can hold an 8, 16, or 32-point output module (or a module that uses the backplane for power only); otherwise, it must be empty.

Figure 3.6
Using 32-point I/O Modules with 1-slot Addressing



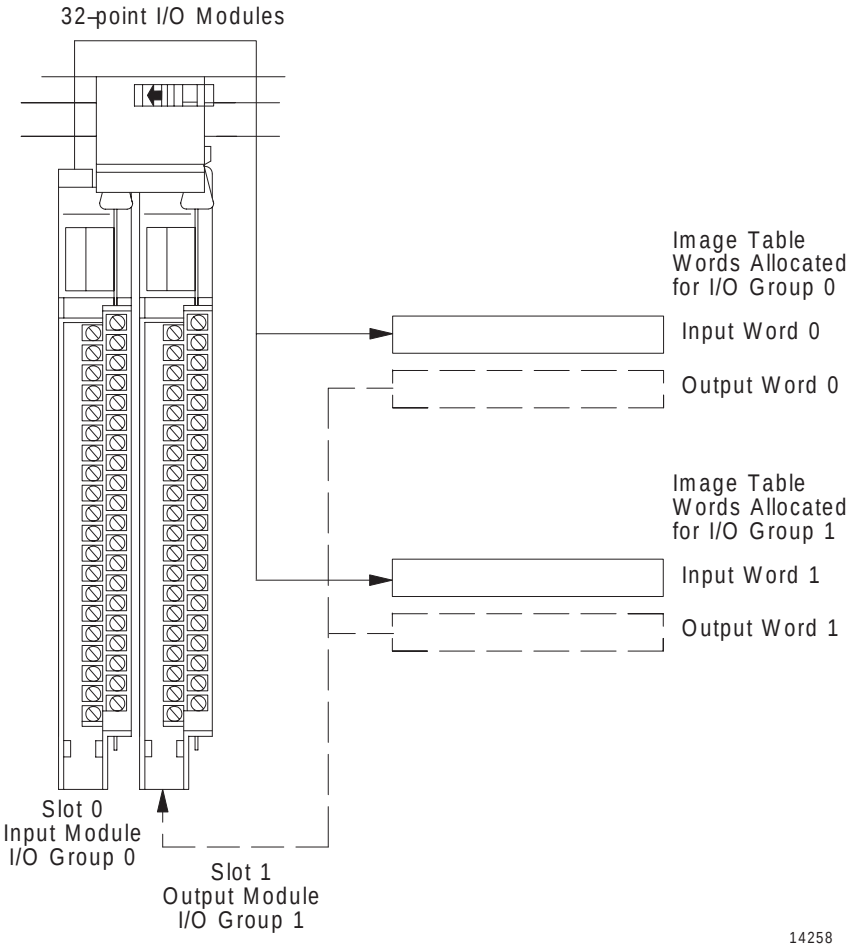
Thirty-two-point I/O modules need 32 input or 32 output bits in the processor's image table. Because only 16 input and 16 output bits are available for each I/O group, to address a 32-point I/O module, the ControlNet adapter module uses the unused input or output word associated with the adjacent I/O slot.

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When the 1771-ACN15/ACNR15 ControlNet adapter module addresses a 1-slot I/O group containing a 32-point I/O module, the adapter module uses the unused word assigned to the adjacent I/O module slot. For example, the adapter module uses the unused input word associated with I/O slot 1 (because that slot must hold an output module and does not use its input word).

Figure 3.7 illustrates the concept of 1-slot addressing with two 32-point I/O modules.

Figure 3.7
1-slot I/O Group Concept With 32-point I/O Modules



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I/O Module Combinations

The combination of I/O modules you can use depends on the addressing method and I/O chassis you select.

The table below lists acceptable I/O module combinations with 1-slot addressing.

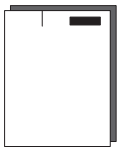
Table 3.B
I/O Module Combinations With 1-slot Addressing

I/O Chassis Series	I/O Module Combinations Per I/O Group	Data Table Bits Used	
		Input Image Table	Output Image Table
A, B	1 8-point input module	8	0
	1 8-point output module	0	8
	1 8-point input and output module	8	8
	1 8-point input and 1 nondiscrete output module	16	8
	1 nondiscrete input and 1 8-point output module	8	16
	1 nondiscrete module	8	8
B or later only	any mix of 8, 16 and 32-point input and output modules (when using 32 point modules, install in pairs – input and output in each group)	16	16
	any mix of 8 and 16-point modules, and nondiscrete or intelligent modules	16	16

Using 1/2- Slot Addressing

Definition: The processor addresses one-half of an I/O module slot as one I/O group.

Concept: The physical address of each I/O slot corresponds to two input and two output image table words. The type of module you install (8-, 16-, or 32-point) determines the number of bits in these words that are used.



You select 1/2-slot addressing by setting switches 5 and 6 of the I/O chassis backplane switch assembly as shown in Chapter 2:

- switch 5 to the OFF position
- switch 6 to the ON position

With 1/2-slot addressing, since 32 inputs bits AND 32 output bits are available in the processor's image table for each I/O group, you can mix 8-point, 16-point, 32-point and nondiscrete modules in any order in the I/O chassis.

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Figure 3.8 illustrates the 1/2-slot addressing concept with a 32-point I/O module. A 32-point I/O module (with 1/2-slot I/O groups) uses two words of the image table. When you use 8 and 16-point I/O modules with 1/2-slot addressing, you get fewer total I/O points.

Figure 3.8
1/2-slot Addressing Concept

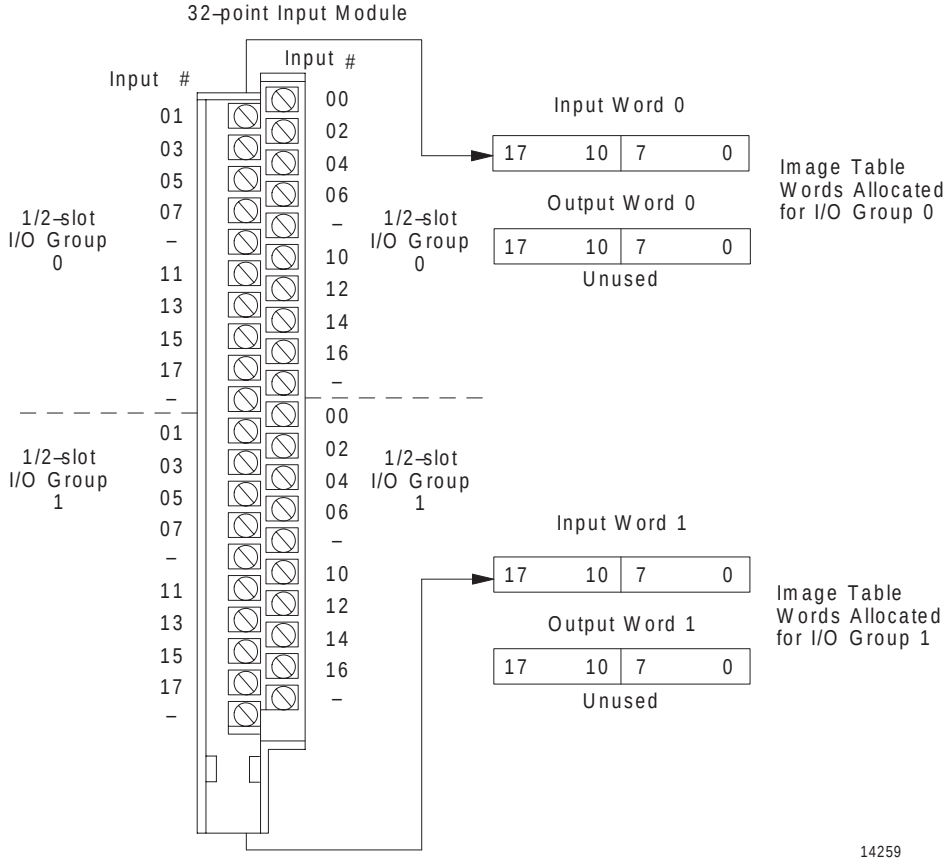


Table 3.C
I/O Module Combinations With 1/2-slot Addressing

I/O Chassis Series	I/O Module Combinations Per I/O Group	Data Table Bits Used	
		Input Image Table	Output Image Table
A, B	1 8-point input module	8	0
	1 8-point output module	0	8
	1 8-point input and output module	8	8
	1 8-point input and 1 nondiscrete output module	16	8
	1 nondiscrete input and 1 8-point output module	8	16
	1 nondiscrete module	8	8
B or later only	any mix of 8, 16 and 32-point input and output modules, nondiscrete modules, and intelligent modules	16	16

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Addressing Summary

Use this table as a quick reference for addressing.

Addressing Mode	Guidelines
2-slot	• Two I/O module slots = 1 group • Each physical 2-slot I/O group corresponds to one word (16 bits) in the input image table and one word (16 bits) in the output image table • When you use 16-point I/O modules, you must install as a pair an input module and an output module in an I/O group; if you use an input module in slot 0, you must use an output module in slot 1 (or it must be empty). This configuration gives you the maximum use of I/O. • You cannot use a nondiscrete module and a 16-point module in the same I/O group because nondiscrete modules use 8 bits in both the input and output table. Therefore, 8 bits of the 16-point module would conflict with the nondiscrete module. • You cannot use 32-point I/O modules.
1-slot	• One I/O module slot = 1 group • Each physical slot in the chassis corresponds to one word (16 bits) in the input image table and one word (16 bits) in the output image table • When you use 32-point I/O modules, you must install as a pair an input module and an output module in an even/odd pair of adjacent I/O group; if you use an input module in slot 0, you must use an output module in slot 1 (or it must be empty). This configuration gives you the maximum usage of I/O. • Use any mix of 8- and 16-point I/O modules, nondiscrete or intelligent modules in a single I/O chassis. Using 8-point modules results in fewer total I/O.
1/2-slot	• One half of an I/O module slot = 1 group • Each physical slot in the chassis corresponds to two words (32 bits) in the input image table and two words (32 bits) in the output image table • Use any mix of 8-, 16-, and 32-point I/O or nondiscrete and intelligent modules. Using 8-point and 16-point I/O modules results in fewer total I/O. • With the processor-resident local rack set for 1/2-slot addressing, you cannot force the input bits for the upper word of any slot that is empty or that has an 8-point or 16-point I/O module. For example, if your have an 8-point or a 16-point I/O module in the first slot of your local rack (words 0 and 1 of the I/O image table, 1/2-slot addressing), you cannot force the input bits for word 1 (I:001) on or off. However, in a remote chassis using a 1771-ACN15 or -ACNR15 adapter, all points can be forced, including those not physically present. In the example above, chassis word I:001 can be forced on or off.

Chapter Summary

In this chapter we discussed how to address your hardware and the various remote I/O configurations and options you can use in your remote system.

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Planning to Use Your ControlNet Adapter Module

Chapter Objectives

This chapter explains how the adapter operates on ControlNet and provides information to assist in configuring your system. This includes:

- overview of adapter operation
- discrete I/O data transfer
- configuring discrete I/O data transfers
- nondiscrete I/O data transfers
- using ControlNet I/O (CIO) instructions
- mapping directly into processor memory, including examples of nondiscrete input module and output module communication
- configuring nondiscrete I/O data transfers

Overview of Adapter Operation

The controlling processor (network address 01) on ControlNet contains an I/O map table. This map table stores the information necessary for communications to be established. Each map table entry corresponds to 1 transfer of data between the processor and an I/O rack, or between the processor and another ControlNet processor. The information in each map table is used to open a logical "connection" between 2 devices.

Connections are established between the processor and each adapter to exchange input and output data on the network. Status information is transferred along with the I/O data and is stored in a separate status file in the specified processor. Refer to the *ControlNet PLC–5 Programmable Controller (Phase 1.5) User Manual*, publication 1784-6.5.22, for more on status information available.

Important: The processor compares the specified module type (in the map table) with the device with which communication is being attempted. Therefore, when changing from a 1771-ACN15 to a 1771-ACNR15, or vice versa, you must specify the new module type in the map table.

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Discrete I/O Data Transfer

All 1771 discrete I/O data is mapped into the processor's I/O image table according to the user-configurable I/O map table stored in the processor. This image table location is specified on the ControlNet configuration screen.

Configuring Discrete I/O Data Transfers

ControlNet provides significant flexibility when configuring discrete I/O data transfers. The following are important factors to consider as you plan and configure your system.

- I/O is **not** automatically mapped into the processor's I/O image file based on the network address of the adapter. If you manually configure your system, I/O from an adapter is mapped into the I/O image file based on the I/O image file address that you enter into your configuration. If you automap your system, I/O is mapped into the first available I/O image space outside of the local rack image space.

  For example, if your local chassis is 12 slots and is using 1-slot addressing mode, it will use rack numbers 0 and 1. ControlNet I/O mapping would then start with rack 2. Note that even though the local chassis only used 1/2 of rack 1, ControlNet I/O cannot map into any rack number used by the local chassis.

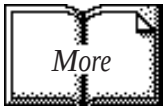
- Always configure your remote I/O system first. Remote I/O devices must use the I/O image space which corresponds to their rack number and size. A conflict could occur if you automap ControlNet first, and it uses I/O image space which matches a rack number on the remote I/O. Automap remote I/O first, and then automap ControlNet, since ControlNet can use any unused I/O image space.
- I/O image space for a given ControlNet connection must be contiguous. ControlNet software cannot break up a map entry into multiple I/O image file locations.

  For example, if you automap a device which requires 4 words of I/O image table, it will map into the first available 4 word block in the I/O image table, even if there are several 2 word blocks available prior to the 4 block area.

- All 1771 I/O placement rules for discrete I/O module (8, 16 and 32 point) addressing still apply.
- You can configure the adapter to scan a minimum of 0 input words to a maximum of 32 input words in the physical rack. Data from input modules in the chassis beyond the configured rack size will not be sent to the processor.
- You can configure the adapter to write to a minimum of 0 output words to the maximum number of words in the the physical rack (up to 32 maximum). Modules in the chassis beyond the configured rack size will not receive outputs from the processor, and will respond as if they were receiving all zeroes.

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- The number of input words and output words do not have be the same for an adapter.
- Update times (Expected Network Packet Times) are not required to be the same for all remote racks in the system. Update times can be selected based on your application requirements.



Refer to the PLC-5 ControlNet programmable controller manual or 6200 Software manuals for more information on the ControlNet configuration screens.

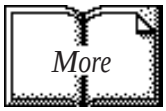
Nondiscrete I/O Data Transfers

There are 2 methods for data transfer to and from 1771 nondiscrete I/O modules on ControlNet:

- ControlNet I/O (CIO) instructions
- mapping directly into the processor's memory

Using ControlNet I/O (CIO) Instructions

By programming CIO instructions into your ladder logic, you can either read or write data to or from a module. The CIO instruction is only active when the processor is in the RUN mode. This method uses the unscheduled portion of the Network Update Interval (NUI) to complete the transfers.



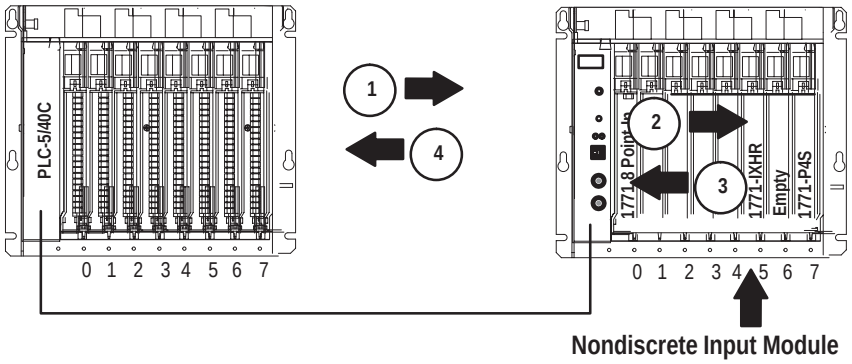
Refer to the *ControlNet PLC–5 Programmable Controller (Phase 1.5) User Manual*, publication 1784-6.5.22, for more information on CIO instructions.

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Mapping Directly Into Processor Memory

ControlNet also allows mapping 1771 nondiscrete I/O modules directly into processor memory. This eliminates the need for programming CIO or other transfer instructions in your ladder program. When you map a nondiscrete I/O module, the processor opens a connection to the adapter. Data is produced and/or consumed over the network, continuously and asynchronous to the ladder logic program scan. At the adapter, nondiscrete transfers are initiated to the module in its resident chassis asynchronous to the network activity. Once configured, these data transfers are active in all processor modes (RUN, PROG, and TEST).

Example: Nondiscrete Input Module Communications

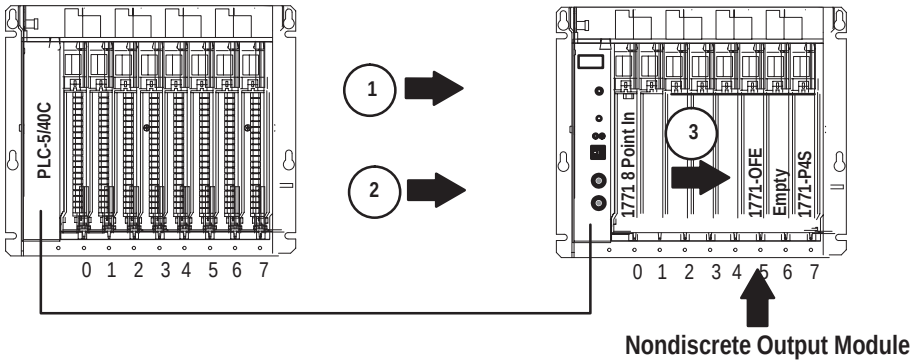


1. The processor opens a connection to the adapter for consuming the data from the nondiscrete module. The processor requests the adapter to produce the module's data at the Actual Network Packet Time shown in the configuration.
2. Upon receiving the request, the adapter starts initiating continuous read requests to the module. This occurs asynchronous to any activity on the network.
3. The module processes the read requests and responds to the adapter as fast as it can.
4. The adapter produces the most recently received copy of the module's data on the network at the Actual Network Packet Time.

Note: If the nondiscrete input module can only respond to read requests every 50ms, and you set your update time to 10ms, the adapter will be sending 5 copies of each data block.

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Example: Nondiscrete Output Module Communications



1. The processor opens a connection to the adapter for producing the data for the nondiscrete module.
2. The processor produces the most recent copy of the designated data table value you specified in your configuration onto the network at the Actual Network Packet Time.
3. The adapter consumes the packet from the processor, and initiates a nondiscrete write transfer to the output module. Only 1 nondiscrete write transfer is active to any module at a time.

Nondiscrete I/O data is stored in integer files that you specify in your ControlNet configuration screen. Each map entry for a nondiscrete I/O data transfer defines an offset into the Data Input File (DIF) or Data Output File (DOF) where data is stored.

Using separate data table files for nondiscrete I/O data transfer allows the processor to present nondiscrete I/O data in the same manner as discrete I/O data – continuously transmitted and asynchronous to the ladder logic program scan.

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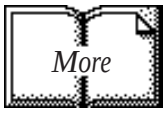
Configuring Nondiscrete I/O Data Transfers

The following are important factors to consider when planning and configuring nondiscrete I/O modules:

- You can communicate with nondiscrete I/O modules anywhere in the rack, including slots that are not mapped into the discrete I/O image files. Note that nondiscrete I/O modules can be placed so no I/O image space is used.

  For example, in an 8-slot chassis with 1-slot addressing, you can place discrete modules in the first 4 slots and only map 4 words of I/O image table. You could then place nondiscrete modules in the last 4 slots without using more I/O image space.

- Slots in the adapter are physically referenced starting at 0 and continuing by 1 up to a maximum of 15 (depending on the size of your chassis) regardless of the addressing mode (2, 1, or 1/2) used within the chassis.
- The explicit ControlNet I/O transfer instruction (CIO) can also be included in your ladder logic program to communicate with nondiscrete I/O modules.
- One or more connections are required per module, depending on the type of module. A separate connection is used for a read or write.
- Modules accommodated by the processor's nondiscrete I/O data transfer mechanism are typically those that require a one-time configuration and are continuously read from or written to.



Refer to the *ControlNet PLC–5 Programmable Controller (Phase 1.5) User Manual*, publication 1784-6.5.22, for more information on supported nondiscrete I/O modules.

Configuring Your ControlNet System

Use the following software packages to configure your ControlNet system.

Use	To
RSNetworx	define network parameters, such as: • network update time • media redundancy • physical media configuration • maximum scheduled nodes • maximum unscheduled nodes
RSLogix5	enter channel 2 ControlNet configuration

Chapter Summary

In this chapter, you learned about adapter operation, discrete I/O data transfer, configuring discrete I/O data transfer, nondiscrete I/O data transfer, and configuring nondiscrete I/O data transfer. In addition, you learned some important factors about nondiscrete I/O data transfers.

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Troubleshooting

Chapter Objectives

In this chapter, you will learn how to use the indicators on the module frontplate for troubleshooting the module. This includes:

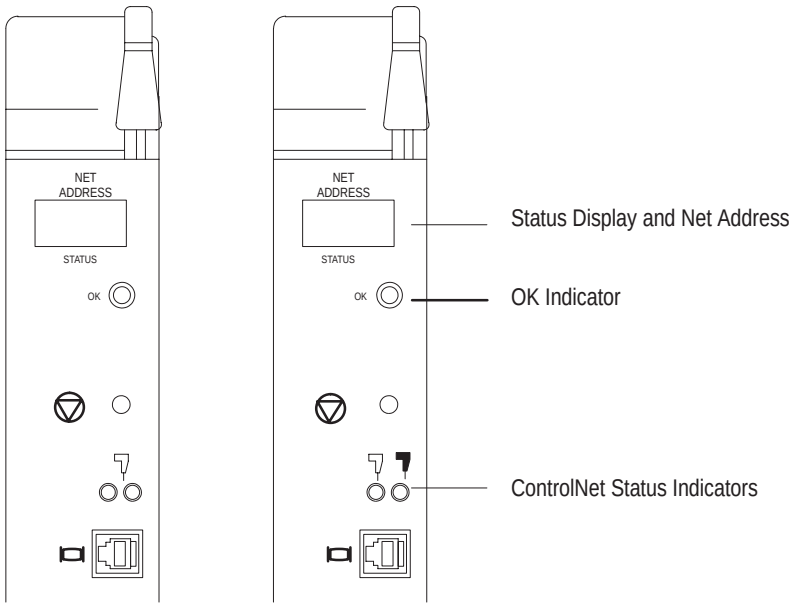
- troubleshooting with the status indicators and status display, including:
  - OK indicator and display mnemonics
  - ControlNet status indicators

Troubleshooting With the Status Indicators and Status Display

The module has indicators on the front plate, as shown below. These indicators consist of:

- OK indicator
- status indicators
- display of status and address

Use these indicators for troubleshooting the module.



The following tables describe problems that may occur, probable causes, and recommended courses of action.

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OK Indicator and Display Mnemonics

OK Indicator OK Red/ Green	Display Mnemonic NET ADDRESS STATUS	Description	Probable Cause	Recommended Action
Off Off	None	Module not communicating	Power supply fault	Check power supply, cable connectors, and seat adapter firmly in chassis.
			Defective adapter	Contact Allen-Bradley service.
	POST	Adapter is running Power On Self Test	None	None
	CODE UPDT	Firmware update mode.	Adapter firmware is being updated via A-B Flash Update Utility.	None
Blinking Red	POST RSET	Module failed Power On Self Test	RAM or FLASH test failed. Processor fault or watchdog timeout.	Push the reset pushbutton on the front of the module.
	A#00 ERR	Illegal ControlNet address.	Network address set to 00.	Power down the adapter and change the network address switches.
	MOD ERR	I/O module placement error.	Incorrect I/O module density for addressing mode used.	Place I/O module in correct slot in chassis.
	RACK ERR	Illegal backplane switch settings.	Illegal addressing mode selected.	Power down the adapter and change the backplane switches.
	PRL	Adapter in processor restart lockout mode. (Adapter to processor link is normal.)	Processor restart lockout switch on chassis backplane in on position.	Depress reset button on module to clear lockout feature, or cycle power.
	SHRT BP	Communication on link. Excessive noise on backplane or possible shorted backplane	I/O module or chassis backplane bad.	Replace module or chassis as necessary.
	DUPL NODE	Duplicate node.	Another adapter with the same ControlNet address is on the link.	Power down the adapter and change the network address switches to correct node.
	SW ERR	Switch error.	Network address switches have been changed since module powerup.	Set network address switches to correct address and cycle power to the adapter.
Red	RPLC	Fatal Power On Self Test failure.	RAM or FLASH test failed. Processor fault or watchdog timeout.	Contact Allen-Bradley service.
	None	Hardware fault.	Defective hardware.	
Blinking Green	INIT	Requires ControlNet configuration.	No communication with ControlNet Configuration Manager node.	Verify Configuration Manager node is operating.
	IDLE	Processor not actively controlling I/O.	Adapter not mapped.	Verify mapping of adapter in processor.
	NET ERR	Nework error.	Cable error or no other nodes on network.	Verify network cabling.

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OK Indicator (OK Red/Green)	Display Mnemonic (NET ADDRESS / STATUS)	Description	Probable Cause	Recommended Action
Green	RUN	Normal indication – processor is in RUN mode.	None	None
	PRGM	Normal indication – processor is in program or test mode.	None	None
Blinking alternately red and green	BOOT	Running boot code.	Adapter has corrupted firmware.	Update adapter firmware with A-B Flash Update Utility.

ControlNet Status Indicators

- steady – indicator is on continuously in the defined state.
- alternating – the two indicators alternate between the two defined states at the same time (applies to both indicators *viewed together*). The two indicators are always in opposite states, out of phase.
- flashing – the indicator alternates between the two defined states (applies to each indicator *viewed independent* of the other). If both indicators are flashing, they must flash together, in phase.

A and B	Cause	Action
Off	No power	None or power up
Steady red	Faulted unit	Cycle power or reset unit If fault persists, contact A-B representative or distributor.
Alternating red/green	Self-test	None
Alternating red/off	Incorrect node configuration	Check network address and other ControlNet configuration parameters
A or B	**Cause**	**Action**
Off	Channel disabled	Program network for redundant media, if required
Steady green	Normal operation	None
Flashing green/off	Temporary errors	None; unit will self-correct
	Node is not configured to go on line	Make sure the configuration manager node is present and working①
Flashing red/off	Media fault	Check media for broken cables, loose connectors, missing terminators, etc.
	No other nodes present on network	Add other nodes to the network
Flashing red/green	Incorrect network configuration	Cycle power or reset unit If fault persists, contact A-B representative or distributor.

① The configuration manager node is the node responsible for distributing ControlNet configuration data to all nodes on the network.

Chapter Summary

In this chapter you learned how to use the indicators on the front of the module to troubleshoot your module.

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Specifications

Module Location	1771 I/O chassis, leftmost slot
Interconnect Cable	Quad shield RG-6 coaxial cable – Refer to the ControlNet Cable System manual (pub. no. 1786-6.2.1) for more information
Power Dissipation	5 Watts
Thermal Dissipation	17.06 BTU/hr
Backplane Current	1.0A @ 5V
Keying	Upper connector: between 54 and 56 Lower connector: between 16 and 18
Environmental Conditions Operational Temperature Storage Temperature Relative Humidity	 0^{o} to 60^{o}C (32^{o} to 140^{o}F) -40^{o} to 85^{o}C (-40^{o} to 185^{o}F) 5% to 95% (without condensation)

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Publication 1771-6.5.124 – August 1997

PN955129–61

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