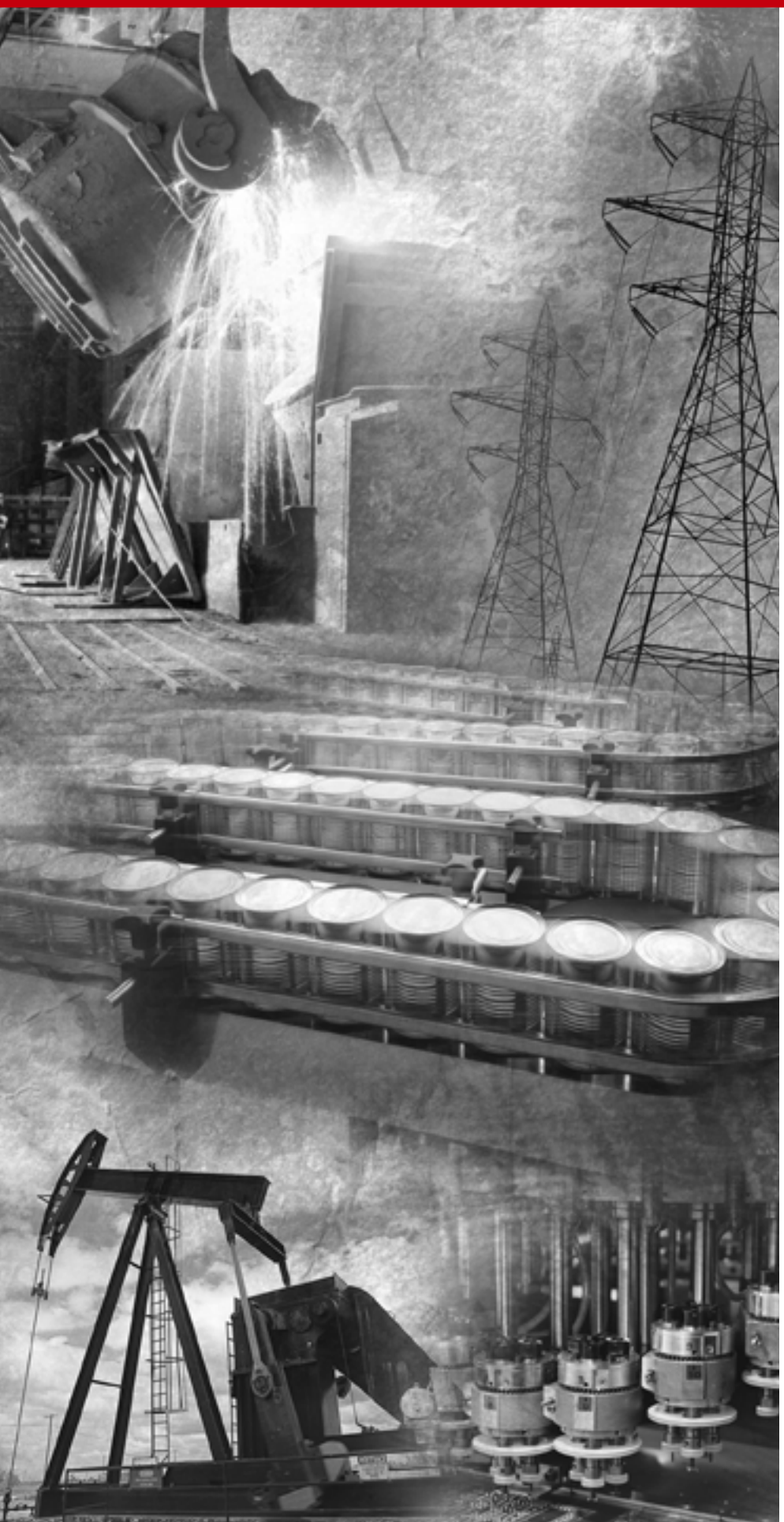


Allen-Bradley

ControlNet Scanner Module

1747-SCNR

Reference Manual

Rockwell Automation

Important User Information

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

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, 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.

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 a hazard
- recognize the consequences

IMPORTANT

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

European Communities (EC) Directive Compliance

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 the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — 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. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1.

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

Introduction

Use this manual to install, configure, and apply the features of the 1747-SCNR Scanner.

Contents

In this manual you will learn how:

- the 1747-SCNR Scanner communicates with an SLC™ processor and ControlNet™ devices
- to map I/O data using the **RS**NetWorx for ControlNet™
- to configure your 1747-SCNR Scanner

For information about	See
installing and connecting the scanner module	Chapter 1
preparing to use the ControlNet scanner module	Chapter 2
configuring and mapping scheduled data exchange using **RS**NetWorx for ControlNet	Chapter 3
troubleshooting	Chapter 4
local database access using PLC-5 MSG instructions	Appendix A
CIP client management	Appendix B
reset bit management	Appendix C
local database and ControlNet data files access using CIP messaging	Appendix D
application examples	Appendix E

Audience

This manual is intended for engineers and technicians who are installing, programming, and maintaining a control system that includes an SLC 500 communicating on a ControlNet network with a 1747-SCNR Scanner.

What We assume

We assume you:

- are developing a ControlNet network using an SLC processor in conjunction with a 1747-SCNR Scanner
- know each of your device's I/O parameters and requirements
- understand SLC processor programming and operation
- are familiar with **RS**NetWorx for ControlNet
- are familiar with the Microsoft® Windows® environment

Terminology

The following list contains ControlNet network terms used in this manual.

Term	Definition
Actual Packet Interval (API)	The measure of how frequently a specific connection produces its data.
Big-endian	A computer architecture in which, within a given multi-byte numeric representation, the most significant byte has the lowest address (the word is stored "big-end-first" - typically Motorola architecture).
Bit	A unit of information consisting of a 1 or a 0. This is the smallest data unit that can be transmitted.
Class	A set of objects all of which represent a similar system component. A class is a generalization of the object, a template for defining variables and methods. All objects in a class are identical in form and behavior, but they may contain different attribute values.
Client	1. An object that uses the services of another (server) object to perform a task. 2. An initiator of a message to which a server reacts.
Connection	A logical binding between two application objects. These application objects may be in the same or different devices.
Connection Path	The attribute is made up of a byte stream that defines the application object to which a connection instance applies.
Consume	The act of receiving data from a producer.
Consumer	A node that is receiving data from a producer.
Device	A physical hardware connection to the link. A device may contain more than one node.
Error	A discrepancy between a computed, observed, or measured value or condition and the specified or theoretically correct value or condition.
Frame	Single data transfer on a link.
Instance	The actual physical presentation of an object within a class. Identifies one of many objects within the same object class.
Link	A collection of nodes with unique MAC IDs. Segments connected by repeaters make up a link; links connected by routers make up a network.
Little-endian	A computer architecture in which, within a given multi-byte numeric representation, the least significant byte has the lowest address (the word is stored "little-end first" - typically Intel architecture).
Multicast Connection	A connection where one node produces data and multiple nodes consume that exact same data. Connections can be either point-to-point or multicast.
Network	A series of nodes connected by some type of communication medium. The connection paths between any pair of nodes can include repeaters, routers, and gateways.

Term	Definition
Network Access Port (NAP)	Physical Layer variant that allows a temporary node to be connected to the link by connection to the NAP of a permanent node.
Network Address or Node Address	A node's address on the link (also called MAC ID).
Network Status Indicators	Indicators on a node displaying the status of the Physical and Data Link Layers.
Network Update Interval (NUI)	A single occurrence of the ControlNet Network Update Time (NUT).
Network Update Time (NUT)	Repetitive time interval in which data can be sent on the link.
Node	A connection to a link that requires a single MAC ID.
Object	1. An abstract representation of a computer's capabilities. Objects can be composed of any or all of the following components: data (information which changes with time) configuration (parameters for behavior) methods (things that can be done using data and configuration) 2. A collection of related data (in the form of variables) and methods (procedures) for operating on that data that have clearly defined interface and behavior.
Originator	The client responsible for establishing a connection path to the target.
Point-To-Point Connection	A connection that exists between two nodes only. Connections can be either point-to-point or multicast.
Produce	Act of sending data to a consumer.
Producer	A node that is responsible for transmitting data.
Redundant Media	A system using more than one medium to help prevent communication failures.
Requested Packet Interval (RPI)	The measure of how frequently the originating application requires the transmission of data from the target application.
Scanner Configuration Tool (SCT)	Software tool that allows you to configure scheduled connections, map data for these connections, and monitor the status for the configured connections.
Scheduled	Data transfers that occur in a deterministic and repeatable manner on predefined NUTs.
Server	An object which provides services to another (client) object.
Service	Operation or function that an object performs upon request from another object.
Target	The end-node to which a connection is established.
Unscheduled	Data transfers that use the remaining time in the NUT after the scheduled transfers have been completed.

Acronyms

Acronym	Meaning
API	Actual Packet Interval.
BNC	A connector for coaxial cable having a bayonet-type shell with two small knobs on the female connector which lock into spiral slots in the male connector when it is twisted (refer to the illustration on page 1-1).
CIP	The control and information protocol defined by part 4 of the ControlNet standard. CIP includes both connected and unconnected messaging.
LED	Light Emitting Diode.
MAC ID	The address of a node.
NAP	Network Access Port.
NUI	Network Update Interval.
NUT	Network Update Time.
RPI	Requested Packet Interval.
SCT	Scanner Configuration Tool

Common Techniques Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists provide information, not procedural steps.
- Numbered lists provide sequential steps.
- Pictures of keys and/or screens represent the actual keys you press or the screens you use.
- "What's Happening" boxes appear in the appendices. These boxes give a step by step explanation of the process illustrated in the figure(s) that follow the What's Happening box. The figures have numbers in them that correspond to the What's Happening steps.

TIP

This symbol identifies helpful tips.

Rockwell Automation Support

Rockwell Automation offers support services worldwide, with over 75 sales/support offices, 512 authorized distributors, and 260 authorized systems integrators located throughout the United States alone, plus Rockwell Automation representatives in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

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

Technical Product Assistance

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

Your Questions or Comments about This Manual

If you find a problem with this manual, please notify us of it on the enclosed Publication Problem Report (at the back of this manual).

If you have any suggestions about how we can make this manual more useful to you, please contact us at the following address:

Rockwell Automation, Allen-Bradley Company, Inc.
Control and Information Group
Technical Communication
1 Allen-Bradley Drive
Mayfield Heights, OH 44124-6118

Notes:

Table of Contents

Chapter 1

Install and Connect the ControlNet Scanner Module

What This Chapter Contains 1-1
Identify Scanner Module Features 1-1
Prepare for Module Installation 1-2
Select the ControlNet Node Address. 1-3
Insert the 1747-SCNR Scanner Into the Chassis 1-3
Connect to a ControlNet Network 1-5
    Connect Programming Terminal to ControlNet Network 1-6
SLC 500 I/O Configuration for the 1747-SCNR Module 1-8

Chapter 2

Prepare to Use the ControlNet Scanner Module

What This Chapter Contains 2-1
What Your Scanner Does 2-1
Communicating with Your SLC Processor. 2-1
    Communicating with Your SLC processor Using M1 and M0 Files 2-2
Understand ControlNet Data transfer 2-3
    Scheduled Data Transfer Operations on a ControlNet Network 2-3
    Unscheduled Data Transfer Operations on a ControlNet Network 2-4
    Link Layer Services 2-4
Understand 1747-SCNR Mapping 2-5
    Discrete Input File 2-5
    1747-SCNR M1 File. 2-6
    Discrete Output File. 2-8
    1747-SCNR M0 File. 2-9
Communicating with Your Devices 2-9
    I/O Scheduled Data Transfer 2-9
    Unscheduled Data Server 2-10
    CIP Client Request Transfer 2-10

Chapter 3

Configure/Map Scheduled Data Exchange with RSNetWorx for ControlNet

What this chapter contains 3-1
Begin the Configuration Process 3-1
Questions to Ask. 3-1
Data Transfer Mapping 3-2

Chapter 4

Troubleshooting

What This Chapter Contains 4-1
Troubleshooting with the Status Indicators and Status Display 4-1
Apply Chassis Power. 4-2
Alphanumeric Display 4-2
OK Indicator and Display Mnemonics 4-3

Appendix A

Local Database Access Using PLC-5 MSG Instructions

What This Appendix Contains A-1
What We Assume A-1
Read and Write Access To
1747-SCNR Local Database Using PLC-5 MSG Instruction . . A-1

Appendix B

Local Database and ControlNet Data Files Access Using CIP Messaging

What This Appendix Contains B-1
What We Assume B-1
Read and Write Access to
1747-SCNR Data Files Using Assembly Object Services B-1
Assembly Object Instance Numbers Supported for Get and Set Member on Data Attribute B-2
1747-SCNR Memory Layout B-3

Appendix C

CIP Client Management

What This Appendix Contains C-1
What We Assume C-1
CIP Client Area C-1
Send a Get Attribute All Request to Node 14 Identity Object C-3
SLC 500 Processor: N7 Data File (hex) C-4
SLC 500 Ladder Program C-5
SLC 500 Processor: Data Files (hex). C-6
Send a Set Attribute Single Request C-7
SLC 500 Processor: N7 Data File (hex) C-8
Example: SLC 500 Ladder Program C-9
SLC 500 Processor: Target Input Data File (hex). C-10
Send a Set Member Request. C-11
SLC 500 Processor: N7 Data File (hex) C-12
Example: SLC 500 Ladder Program C-13
SLC 500 Processor: Target Input Data File (hex). C-14

Appendix D

Example of Reset Bit Management

What This Appendix Contains D-1
What We Assume D-1
Example D-1

Application Examples

Appendix E

What This Appendix Contains E-1
What We Assume E-1
Example 1: Configure the 1747-SCNR with the 1746-IV16 Input Module E-1
Hardware Setup E-1
Configure the ControlNet Network with RSNetWorx for ControlNet E-1
Example 2: Configure the 1747-SCNR with the 1746-NIO4V Analog Input/Output Module E-9
Hardware Setup E-9
Configure the ControlNet Network with RSNetWorx for ControlNet E-9
Configure a Module Connection E-16
Example 3: Configure the 1747-SCNR with the 1746-NI8 Analog Input Module E-19
Hardware Setup E-19
Configure the ControlNet Network with RSNetWorx for ControlNet E-19
Configure a Module Connection E-25
Example 4: Configure the 1747-SCNR with the 1746-BAS Series B Interface Module E-28
Hardware Setup E-28
Configure the ControlNet Network with RSNetWorx for ControlNet E-28
Configure a Module Connection E-34
Example 5: Configure the 1747-SCNR with the 1794-IE4XOE2 Analog Combo Module E-41
Hardware Setup E-42
Configure the ControlNet Network with RSNetWorx for ControlNet E-42
Configure a Module Connection E-48
Example 6: Creating Peer-to-Peer Scheduled Connections Between 1747-SCNR ControlNet Scanners E-51
Hardware Setup E-51
Configure the ControlNet Network with RSNetWorx for ControlNet E-52
Configure a Scheduled Connection Between ControlNet Scanners E-54

Install and Connect the ControlNet Scanner Module

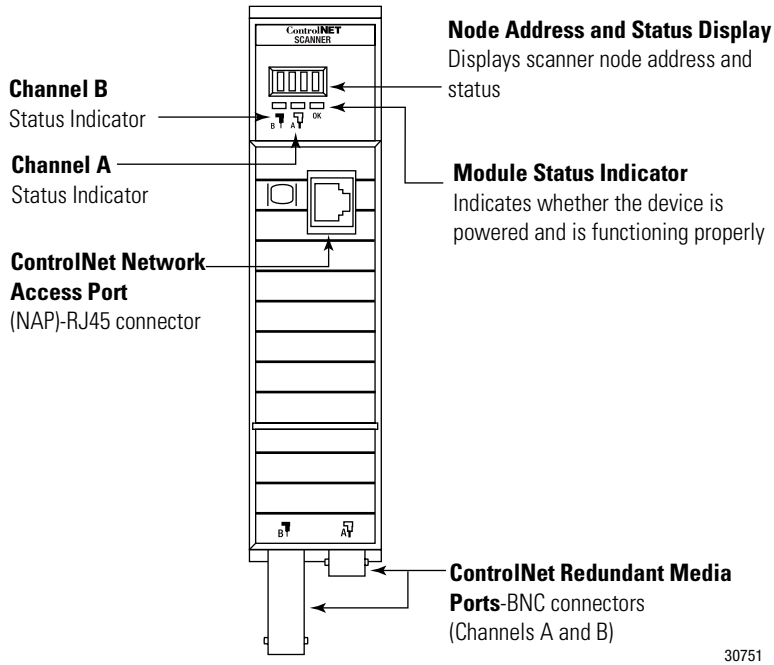
What This Chapter Contains

This chapter describes how to install and connect your ControlNet 1747-SCNR Scanner module. The following table describes what this chapter contains and where to find specific information.

For information about	See page
identifying scanner module features	1-1
preparing the module for installation	1-2
selecting the ControlNet node address	1-3
inserting the 1747-SCNR into an SLC chassis	1-3
connecting the 1747-SCNR to a ControlNet network	1-5
SLC 500 I/O configuration	1-8

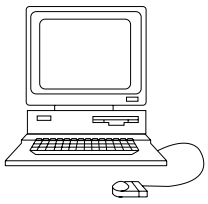
Identify Scanner Module Features

The following drawing identifies the features of the 1747-SCNR Scanner module.

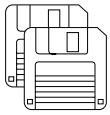


Prepare for Module Installation

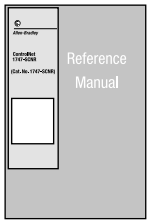
Before you install your module, you need the following items:



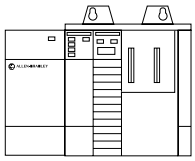
Personal Computer with Microsoft Windows



RSNetWorx for ControlNet, catalog number 9357-CNETL3



1747-SCNR Scanner Module Reference Manual, publication 1747-6.23 (this manual)



SLC 1746 chassis with SLC 5/02, 5/03, 5/04, or 5/05 processor and the appropriate programming software (**RS**Logix 500™)

ControlNet 1784-PCC (shown), or 1784-PCIC, or 1784-KTCX15, or 1770-KFC15

41523

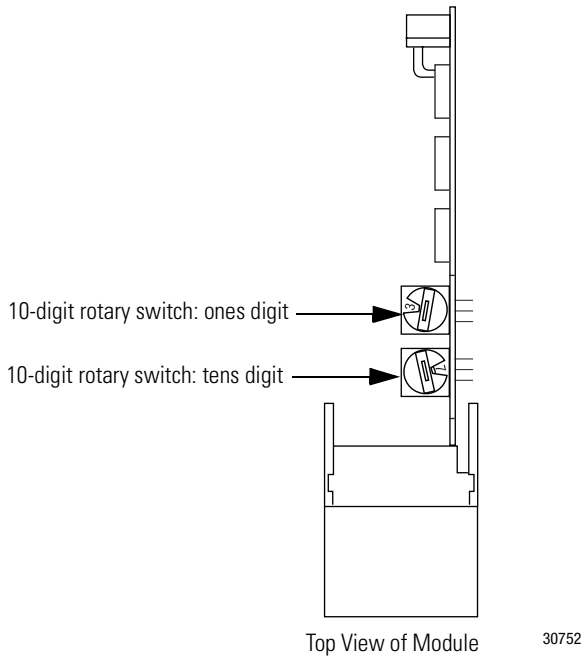
Before you install the module, you must know how to:

- program and operate an Allen-Bradley SLC 500 programmable controller
- install and configure the devices on your ControlNet network

The 1747-SCNR Scanner module fits in any slot of the chassis except for the left-most slot of the first chassis, which is reserved for the SLC 500 processor.

Select the ControlNet Node Address

Select the ControlNet node address of the 1747-SCNR by setting the two 10-digit rotary switches on the top of the scanner.



You can select a node address from 01 to 99 for a device on a ControlNet link. Zero (00) is **not** a valid node address.

Important: Since 00 is the default value from manufacturing, you must change the node address when using the scanner for the first time.

Insert the 1747-SCNR Scanner Into the Chassis

To insert the 1747-SCNR Scanner into the SLC chassis:

1. Turn off the SLC chassis power supply.

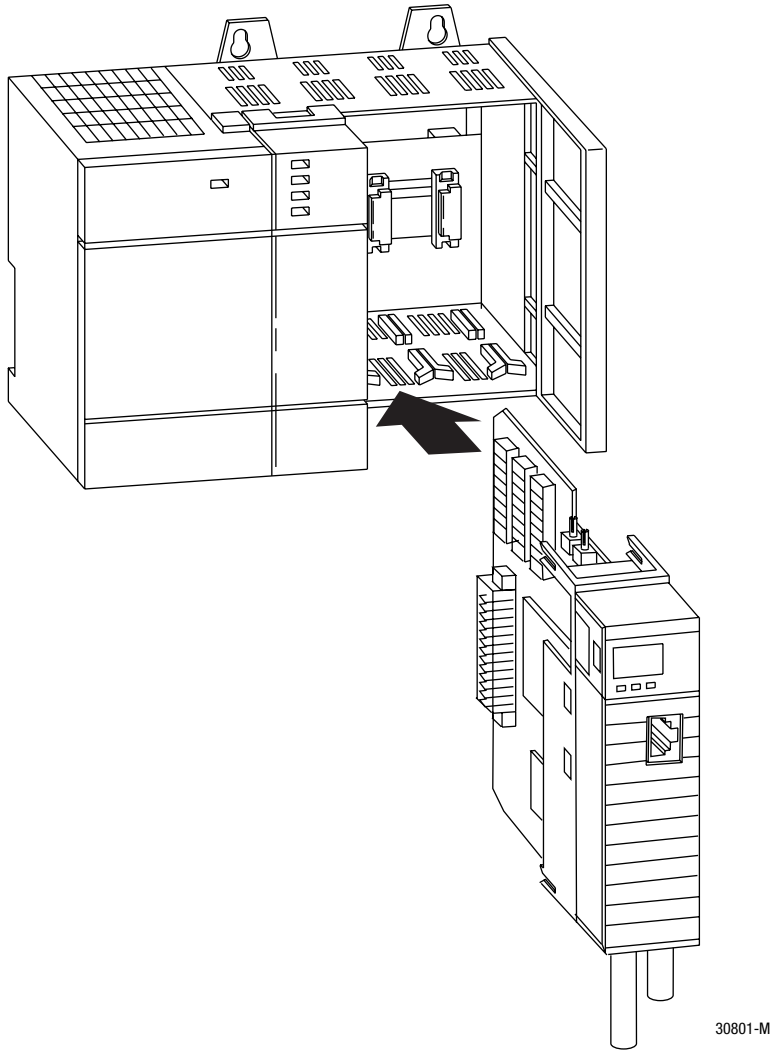
ATTENTION

Do not install the 1747-SCNR Scanner module with the chassis power supply on. Installing the module with the chassis power supply on may damage the module.

Important: If you disconnect the ac power, you lose the chassis ground. Electrostatic damage (ESD) protection is lost.

2. Select a slot for the module in the chassis. Choose any slot except the left-most slot of the first chassis, which is reserved for the SLC 500 processor.

3. Insert the module into the slot you have selected. We recommend that you insert the 1747-SCNR Scanner as close to the chassis power supply as possible.



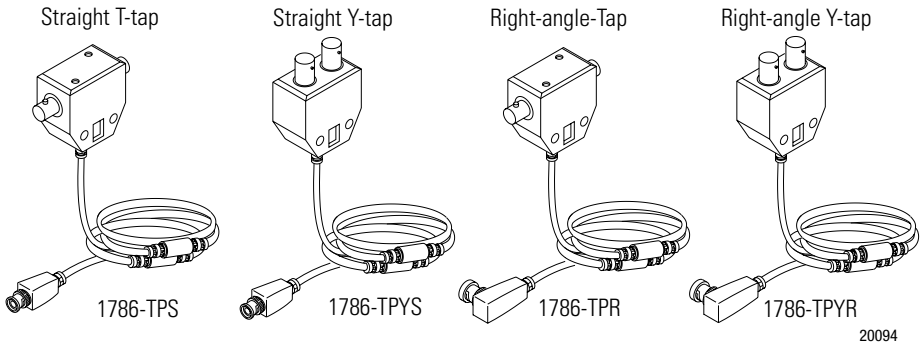
4. Apply firm, even pressure to seat the module in the I/O chassis backplane connectors.

5. Restore power to the SLC chassis.

Connect to a ControlNet Network

Connect the 1747-SCNR Scanner module to a ControlNet network via a tap with a 1m (39.4 in.) drop cable.

Four taps are available from Rockwell Automation.



TIP

We recommend that you use a tap with a straight connector—1786-TPS or 1786-TPYS—when you attach a ControlNet 1747-SCNR Scanner to a ControlNet network.

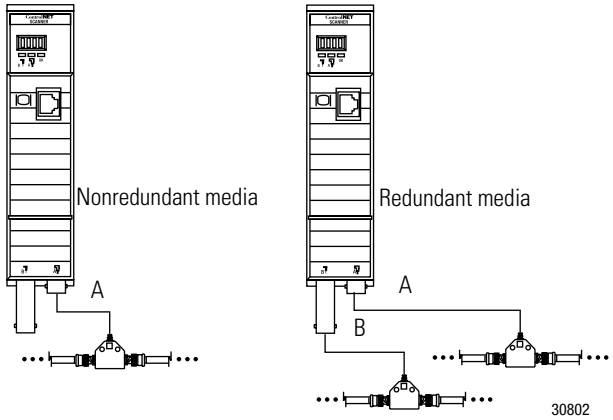
Important: Allen-Bradley ControlNet taps contain passive electronics and must be purchased from Rockwell Automation for the network to function properly.

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

Remove the tap's dust cap—located on the straight or right-angle connector—and set it aside.

If your network supports:	Connect the tap's straight or right-angle connector:
nonredundant media	to the channel A connector on the scanner—channel B is not used.[1]
redundant media	from the trunk-cable A to channel A on the scanner and from trunk-cable B to channel B on the scanner

1. Rockwell Automation recommends using channel A for nonredundant media.



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

Publication	Publication Number
ControlNet Coax Cable System Planning and Installation Manual	1786-6.2.1
ControlNet Media System Component List	AS-2.2
ControlNet Coax Tap Installation Instructions	1786-5.7
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
Terminating Your ControlNet Coaxial Cables	CNET-DM001A-EN-C

Connect Programming Terminal to ControlNet Network

You can connect the programming terminal to a ControlNet network through:

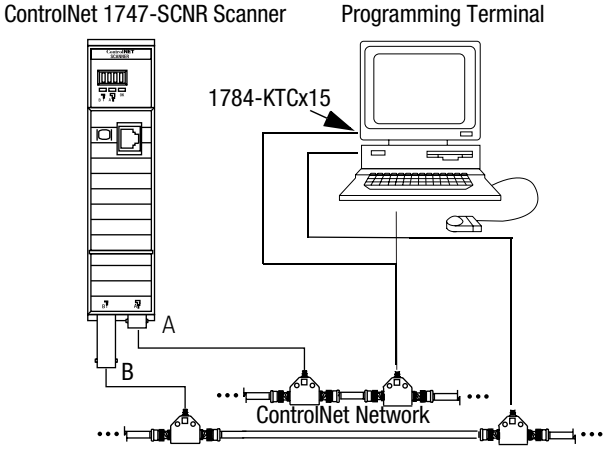
- a ControlNet product's NAP using a network access cable (1786-CP)
- a tap on a ControlNet network

ATTENTION

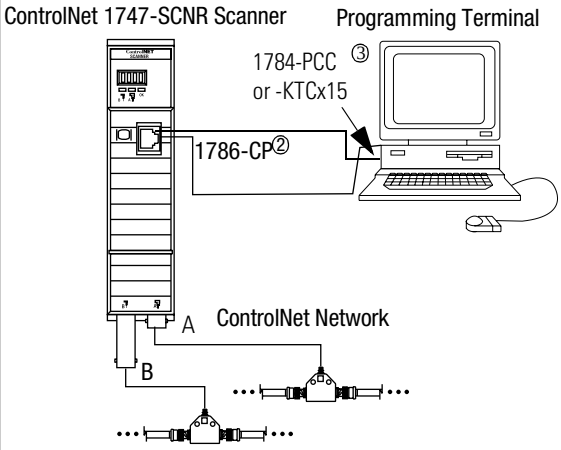
Do not connect the same communication card to both the NAP and a tap on the ControlNet network.

Please refer to the "SLC 500 ControlNet RS-232 Interface User Manual", publication number, 1747-5.34, for more information about connecting the programming terminal to the ControlNet network.

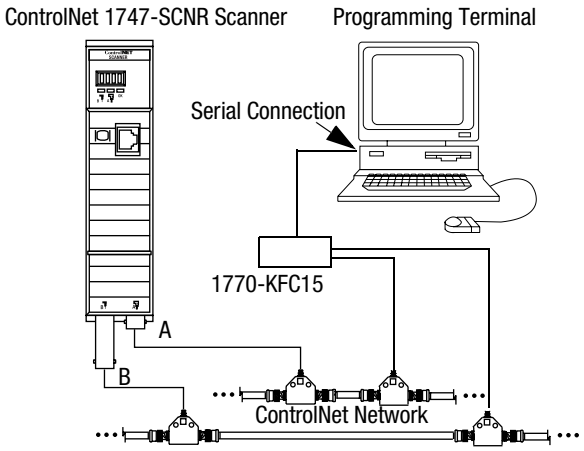
Using 1784-KTCx15 communication card on coax media ①



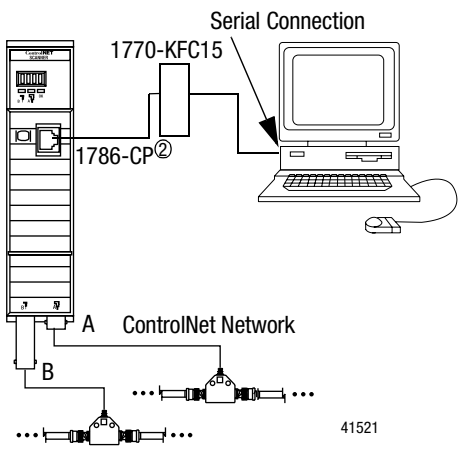
Using 1784-PCC or -KTCx15 communication card and NAP ①



Using 1770-KFC15 communication interface on coax media ①



Using 1770-KFC15 communication interface and NAP ①



① Shown with redundant media (redundant media is not required).
② The network access cable (1786-CP) 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.
③ The 1784-PCC ships with its own ControlNet cable (1784-PCC1).

ATTENTION

Use the 1786-CP cable when connecting a scanner to the network through a NAP. Using a commercially available RJ-style cable could result in network failure.

SLC 500 I/O Configuration for the 1747-SCNR Module

Select the I/O card. Or, if you do not have an I/O card, follow the procedure below.

Open **RS**Logix 500™ and follow the procedure below to configure the 1747-SCNR module.

In the **RS**Logix 500 project Window:

1. Open the **I/O Configuration** window.
2. Select the 1747-SCNR slot number.
3. Select the 1747-SCNR module from the current available cards list. If it is not available, perform the following steps:
   a. Choose the **other ..Requires I/O card type ID** line in the **Current cards available** list.
   b. In the **Other type I/O Card** window, type 13628.
   c. On the line associated with the scanner slot, the **I/O Configuration** window will report the following:

      OTHER I/O Module- ID Code = 13628

   d. Double click on the scanner module line to open the **Advanced I/O Configuration** window.
   e. Set **M0 Length** and **M1 Length** to 2000 (decimal).
4. Close the **I/O Configuration** and **Advanced I/O Configuration** windows.

Prepare to Use the ControlNet Scanner Module

What This Chapter Contains

Read this chapter to understand how to use your ControlNet 1747-SCNR Scanner module. The following table describes what this chapter contains and where to find specific information.

For information about	See page
what your scanner does	2-1
communicating with your SLC processor	2-1
understanding ControlNet data transfer	2-3
understanding 1747-SCNR mapping	2-5
communicating with your devices	2-9

What Your Scanner Does

In a typical configuration, the scanner acts as an interface between ControlNet devices and an SLC processor. The scanner communicates with ControlNet devices over the network to:

- read inputs from a device
- write outputs to a device
- issue native ControlNet requests to a remote node on the ControlNet link (CIP client)
- download configuration data

Communicating with Your SLC Processor

The scanner communicates with the processor in the form of M1/M0 File Transfers and/or Discrete I/O (DIO). Information exchanged includes:

- device I/O data
- status and control information
- CIP client requests and responses
- Local Database

An M1/M0 file transfer is a method of moving large amounts of data between an SLC 500 processor and its scanner.

Discrete input and output (DIO) is the transfer of one to 32 words between an SLC 500 processor and a scanner. All 32 words of input data and all 32 words of output data are updated on each SLC program scan.

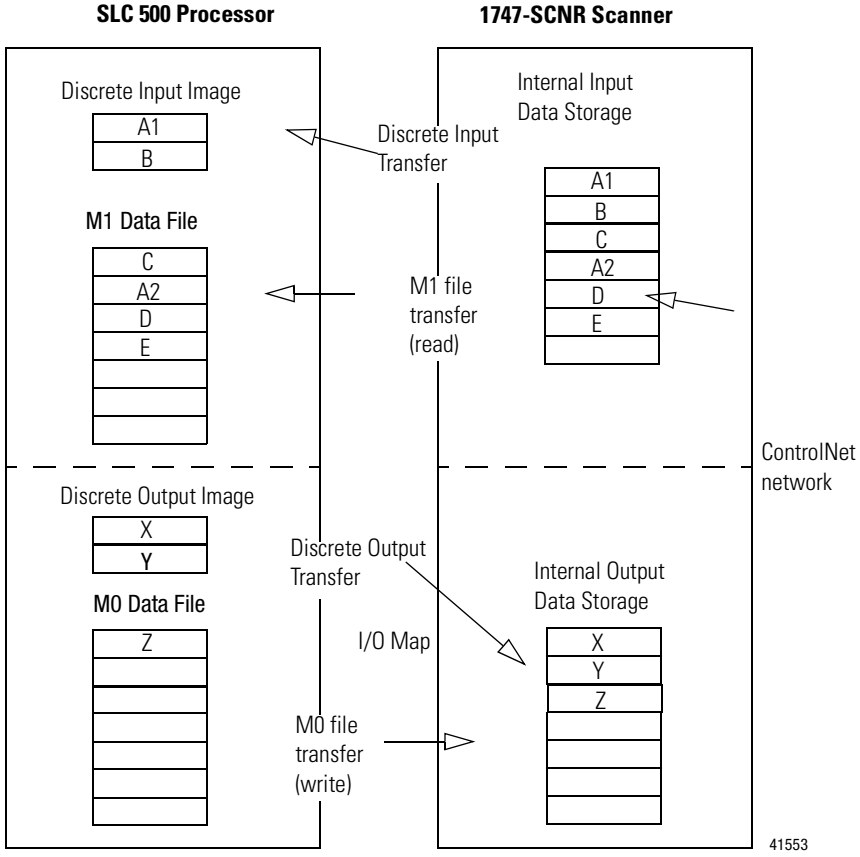
Communicating with Your SLC processor Using M1 and M0 Files

Your processor can communicate with the scanner via M1 file transfer reads and M0 file transfer writes.

The scanner does not send data to your processor. Data transfer between your scanner and the processor must be initiated by the processor. For example, data is sent, or "written", to the scanner by your processor by placing the data in the M0 file. This data is organized in the scanner and then, based on the area you updated, the appropriate action is initiated to send it on the ControlNet network.

An M1 file transfer is the transfer of data from the scanner to the processor. The scanner makes data collected from the network's devices available for the processor to "read".

An M0 file transfer is the transfer of data from the SLC 500 processor to the scanner. The processor "writes" data to the scanner's memory.



Understand ControlNet Data transfer

The ControlNet system is designed to:

- provide high-speed, repeatable, deterministic I/O transmission
- allow control and message information to co-exist on the same physical media
- make sure that I/O data transfers are not affected by:
  - programming-terminal activity
  - inter-scanner message activity on the network

Scheduled Data Transfer Operations on a ControlNet Network

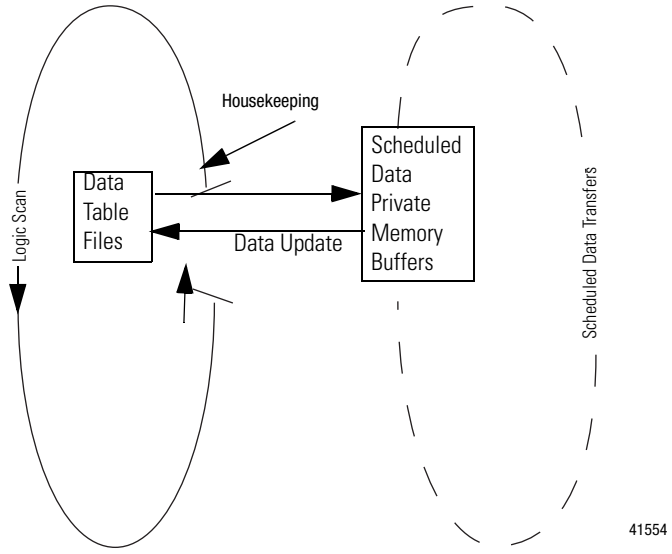
ControlNet scheduled data transfer on a 1747-SCNR Scanner:

- is continuous
- transmits on the network asynchronously to the ladder logic program scan
- occurs at the actual rate that is determined by **RS**NetWorx for ControlNet

For discrete I/O data transfer between logic scans (during "housekeeping"), the following updates occur:

- the gathered input image is moved from the scanner to the SLC processor's input image file for use during the next logic scan
- the 1747-SCNR output data is updated with data from the SLC processor output image file and is sent during the next scheduled communication

M0 and M1 files are data files that reside in the 1747-SCNR Scanner only. Data from these files will be available to the SLC processor using ladder instructions. Scheduled data update will be triggered by the Housekeeping period start, which occurs once per scan. This process is illustrated below.



SLC 500 Program Scan Data Tables Files Housekeeping 1747-SCNR Scheduled Data

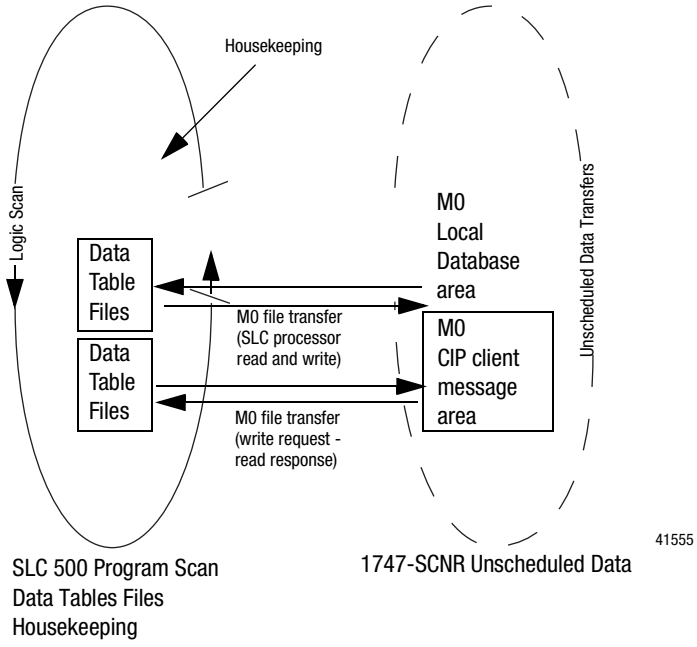
Unscheduled Data Transfer Operations on a ControlNet Network

The ControlNet network allows you to use unscheduled messaging in addition to deterministic delivery.

Unscheduled operations include:

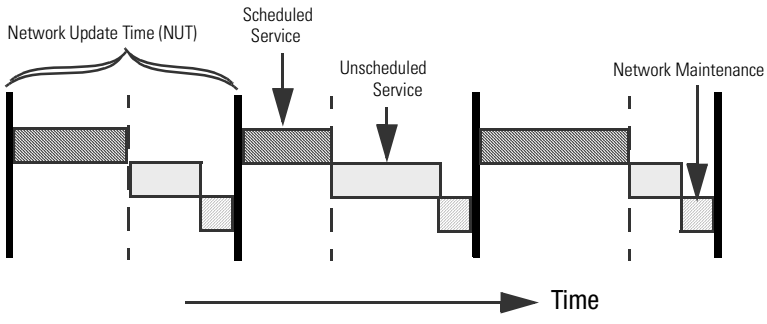
- peer-to-peer messaging
- messaging from any remote CIP client device
- messaging from programming devices
- CIP client message initiated by the SLC processor ladder program

This process is illustrated below.



Link Layer Services

The following figure illustrates link layer services.



The ControlNet system places your scheduled transfers in the first part of each Network Update Interval (NUI). Time is automatically reserved for network maintenance, and unscheduled transfers are performed during the remainder of the interval.

Unscheduled messaging on a ControlNet network is non-deterministic.Your application and your configuration (e.g., number of nodes, application program, NUT) determine how much time there is for unscheduled messaging.

Important: The ControlNet network reserves time for at least one unscheduled transfer per NUI.

Understand 1747-SCNR Mapping

The 1747-SCNR Scanner and the SLC processor exchange the following information through the backplane:

- Input data
- Output data
- Status data
- Command data
- CIP messages

The 1747-SCNR mapping is described below. Bit field descriptions follow each table.

Discrete Input File

Word Offsets	Word Size	ControlNet Transfer Mode	Contents	Description
0	1	N/A	Module Status (see the next section, "Module Status")	Bit field reporting general status information.
1-31	31	Scheduled	ControlNet Input Data	You can map up to 31 words of input data using **RS**NetWorx for ControlNet.

Module Status (I:e.0)

Bit 0	1747-SCNR Module Faulted
Bit 1	1747-SCNR Communication Module Fault The 1747-SCNR Scanner is not on line. See M1 word 2 (M1:e2) for the ControlNet network status.
Bit 2	1747-SCNR Connection Fault There is a fault in at least one scheduled connection.
Bit 3-7	Reserved.
Bit 8	Reset 1747-SCNR Module Acknowledge The 1747-SCNR Scanner will complement this bit each time the scanner is reset due to complementing the Reset module command bit (O:e.0/8 where e is the scanner slot number). See Appendix C "Example of Reset Bit Management."
Bit 9	Disable ControlNet Scheduled Connections Acknowledge The 1747-SCNR Scanner will set this bit when the Disable ControlNet Scheduled Connections Command bit is set (O:e.0/9) and all scheduled connections have been closed. The 1747-SCNR Scanner will clear this bit when the Disable ControlNet Scheduled Connections Command bit is cleared.
Bit 10	Scanner Mode The 1747-SCNR Scanner clears this bit when it is in idle mode. The 1747-SCNR Scanner sets this bit when it is in run mode.
Bit 11-15	Reserved

1747-SCNR M1 File

Word Offsets	Word Size	ControlNet Transfer Mode	Contents	Description
0	1	N/A	Reserved	Reserved for future use.
1	1	N/A	Module Status (See the next page "Module Status")	Value indicating the current operational status of the module. See the "Troubleshooting" section, chapter 4, for probable causes and recommended actions.
2	1	N/A	ControlNet Status (See the next page "ControlNet Status")	Value indicating the current channel LEDs.
3-255	253	Scheduled	ControlNet Input Data	You can map scheduled input data in this area using **RS**NetWorx for ControlNet.
256-599	344	N/A	Reserved	Reserved.
600-607	8	N/A	Connection Status	Bit field reporting scheduled connections status. Two consecutive bits per scheduled connection: Connection State (Even bit numbers) 1:connection opened 0:connection closed Remote Device Mode (Odd bit numbers) 1:remote device is in run mode 0:remote device is in idle mode

Module Status (M1:e.1)

See the "Troubleshooting" section, page 4-3, for probable causes and recommended actions.

Value	Description
0x20	The scanner is not configured.
0x21	The current configuration is not valid.
0x22	Connections are configured, but no connections are established.
0x23	Connections are configured, but only 25% are successfully established.
0x24	Connections are configured, but only 50% are successfully established.
0x25	Connections are configured, but only 75% are successfully established.
0x26	All configured connections are established.
0x42	The node address is set to 00. This caused the scanner to erase network and connection configuration stored in flash.
0x43	The scanner detected a network error due to a ControlNet cable problem or there are no other nodes on the network.
0x44	The scanner has the same ControlNet address as another device on the network.

ControlNet Status (M1:e.2)

The following table contains bit numbers and their descriptions.

Bit 0-2	Channel A status	
	Value	**LED State**
	000	Off
	001	Green
	010	Flashing green/off
	011	Flashing red/off
	100	Flashing red/green
	101	Alternating red/off
	110	Alternating red/green
	111	Red
Bit 3	Reserved	
Bit 4-6	Channel B status	
	Value	**LED State**
	000	Off
	001	Green
	010	Flashing green/off
	011	Flashing red/off
	100	Flashing red/green
	101	Alternating red/off
	110	Alternating red/green
	111	Red
Bit 7-15	Reserved	

Discrete Output File

Word Offsets	Word Size	ControlNet Transfer Mode	Contents	Description
0	1	N/A	Module Command (see the next section, "Module Command")	Bit field used to send commands to the 1747-SCNR Scanner.
1-31	31	Scheduled	ControlNet Output Data	You can map up to 31 words of output data using **RS**NetWorx for ControlNet.

Module Command (O:e.0)

Bit 0-7	Reserved
Bit 8	Reset Scanner Command By complementing this bit, you reset the 1747-SCNR Scanner (the reset occurs when the SLC slot is de-activated). **Important:** If you do not disable the slot while the scanner is resetting, the SLC will fault with the error code nn57h (i.e., specifically, I/O Module in slot nn did not respond to a lock shared memory command in the requested time limit) where nn is the slot number of the scanner. This is why the reset bit change is not taken into account until the slot is disabled.
Bit 9	Disable ControlNet Scheduled Connections Command When the bit value is 1, the 1747-SCNR Scanner will close all scheduled connections. When the bit value is 0, the 1747-SCNR Scanner will enable all scheduled connections.
Bit 10	Scanner Mode Command When the bit value is 0, the 1747-SCNR Scanner is forced to Idle mode. When the bit value is 1, the scanner's mode will be determined by the mode of the processor in slot 0.
Bit 11-15	Reserved

1747-SCNR M0 File

Word Offsets	Word Size	ControlNet Transfer Mode	Contents	Description
0-2	3	N/A	Reserved	Reserved.
3-255	253	Scheduled	ControlNet Output Data	Using the **RS**NetWorx for ControlNet, you can map scheduled output data in this area.
256-699	444	N/A	Reserved	Reserved.
700-955	256	Unscheduled	Local Database	Memory area used by remote devices to read or write data using CIP messaging.
1000-1650	651	Unscheduled	CIP Client Message Area	Memory used to send CIP client requests. These messages are then sent by the 1747-SCNR as unscheduled messaging.

Only Input and Output data (from Input file, Output file, M0 ControlNet Output data area, and M1 ControlNet Input data area) are exchanged during scheduled time.

Data transfer to the M0 Local Database is performed using Unscheduled messaging. Services available to read or write in this area are Set Attribute Single, Get Attribute Single, Set Member, and Get Member.

Communicating with Your Devices

The 1747-SCNR Scanner supports up to 64 simultaneous scheduled connections and up to 50 simultaneous unscheduled connections. The 1747-SCNR Scanner also supports up to 32 simultaneous incoming unconnected requests.

I/O Scheduled Data Transfer

Data received from the devices, or input data, is organized by the scanner and made available to your processor in the Input file or the M1 ControlNet data area.

Data received from your SLC processor, or output data, is stored within the Output file or M0 ControlNet data area. The 1747-SCNR Scanner can then send the data to your remote ControlNet devices.

All scheduled data transfer to Input, Output, M0 and M1 files must be mapped on a ControlNet network. You have to specify where I/O data is to be read from or written to – i.e., mapped. Data size and location within 1747-SCNR data files have to be configured for each connection you want to setup with a remote device. The configuration is performed using **RS**NetWorx for ControlNet.

Unscheduled Data Server

The scanner supports some CIP data server functionality on a specific local database of 256 words located in the M0 file. Any device on ControlNet can read or write in this database using the supported services as described in Appendix A, "Local Database Access Using PLC-5 MSG Instructions" and Appendix B, "Local Database and ControlNet Data Files Access Using CIP Messaging."

The SLC processor that has read and write access to this area is then able to receive or modify data into the database.

Using this Local Database:

- a device can send data to an SLC processor using unscheduled data transfer
- two devices can exchange unscheduled data by using this database as a proxy data storage
- a PLC can exchange data with the SLC processor by reading or writing in this area using MSG instructions

CIP Client Request Transfer

The scanner provides some limited CIP client messaging capability. Using ladder programming, you can manually build a message request for up to approximately 240 words of in and approximately 240 words of out data, to allow configuration and other limited messaging to remote devices.

The CIP client message management is detailed in Appendix B, "CIP Client Management."

Configure/Map Scheduled Data Exchange with RSNetWorx for ControlNet

What this chapter contains

This chapter provides information about the mapping of scheduled connections between 1747-SCNR remote devices. This chapter also contains questions you should ask before configuring your 1747-SCNR scanner. The following table describes what this chapter contains and its location.

For information about	See page
beginning the configuration process	3-1
questions to ask	3-1
data transfer mapping	3-2

Begin the Configuration Process

Planning before configuring your scanner helps make sure you can:

- use your memory bandwidth efficiently
- give attention to device-specific needs and requirements
- give priority to critical I/O transfers
- leave room for expansion

Questions to Ask

Some questions you should ask yourself before you begin configuring the 1747-SCNR scanner are:

- what is on your network?

  This is a very important question to answer. You should be familiar with each device's:

  - communication requirements
  - I/O importance and size
  - frequency of message delivery

- how might this network appear in the future?

  At this point in your planning, it is advantageous for you to have some idea of how the network could be expanded. When mapping your I/O, you have the opportunity to allow room for future I/O. Answering this question now can save time and effort in the future.

Data Transfer Mapping

You can use the configuration software (**RS**NetWorx for ControlNet) to select either Input or M1 files for input data and either Output or M0 files for output data. However, it is more appropriate to use Input and Output files for critical I/O data transfer and M1 and M0 for non-critical I/O data transfer.

Input and Output files contain 31 words each. These files are appropriate for discrete data. If you have more than 31 words to transfer, you have to map the remaining connections in M1 and M0 ControlNet data areas.

For input data, you can map your connections anywhere in Input and M1 ControlNet data areas. It is not possible to overlap the mapping of two independent input connections.

For output data, you can map your connections anywhere in Output and M1 ControlNet data areas (refer to chapter 2 for exact memory mapping.) The overlapping of two output connections is authorized.

Important: It is your responsibility to check that no unexpected overlapping has been configured.

Data exchanged through a single connection cannot be split between two distinct locations. This means that a 5 word connection cannot start at location I:29 and continue at another location in the M1 file. Likewise, you cannot configure this connection with two first words at address M1:e.4 and M1:e.5 and the rest between M1:10 and M1:12.

You access ControlNet data located in M1 and M0 files using the COP (copy) instruction in your ladder program. Since the maximum data length you can transfer with the COP instruction is 128 words, you need two instructions to copy the whole ControlNet area and control and status word in processor memory. If you have less than 128 words of data mapped in an M file, we recommend that you pack them together so that you can use a single copy instruction.

Important: To ensure data consistency at the connection level, be sure that, for all connections configured, data of a same connection are copied into processor memory using a single copy instruction.

When you are building your mapping, we recommend that you save free space between device connections if the size of these connections may increase in the future.

Troubleshooting

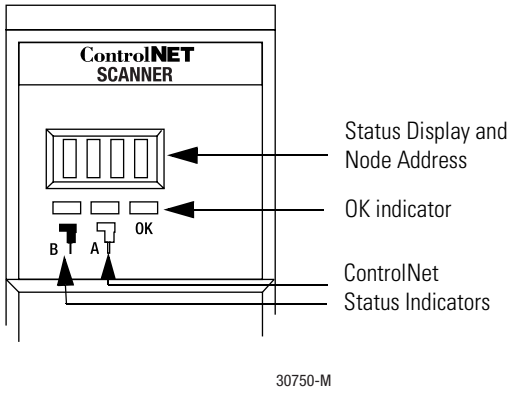
What This Chapter Contains

The following table describes what this chapter contains and its location.

For information about	See page
troubleshooting with the Status Indicators and Status Display	4-1
apply chassis power	4-2
alphanumeric display	4-2
OK indicator and display mnemonics	4-3

Troubleshooting with the Status Indicators and Status Display

The 1747-SCNR has indicators on the front plate, as shown below.



30750-M

These indicators are:

- an alphanumeric display (of status and node address)
- A and B status indicators
- OK

Use these indicators to troubleshoot the scanner.

Apply Chassis Power

When you apply chassis power, the module address and status display cycles through the following mnemonics:

1. **POST** - The 1747-SCNR runs Power On Self Test.
2. **1111, 2222, etc.** - The 1747-SCNR is executing its startup sequence.
3. **REV#, S/R, QXXX** - The 1747-SCNR firmware version temporarily displays after startup: (S = series, R = revision, and XXX = build number).
4. **A#nn** (where nn = ControlNet node address) then **I/O** or **I/OX** (based on the number of connections configured and established) then **IDLE** or **RUN** (based on the scanner mode).

Alphanumeric Display

The four character alphanumeric display provides you with additional visual information about the current operational status of the module.

The tables in the next section describes problems that may occur while using your 1747-SCNR, the probable causes, and the recommended action.

OK Indicator and Display Mnemonics

The OK indicator is handled consistently with the ControlNet specifications for the Identity object.

Sequence	OK Indicator	Alpanumeric Display	Module Status Word (M1 file)	Description	Probable Cause	Recommended Action
Startup	Alternating red/green	POST	N/A	The 1747-SCNR module is running Power On Self Test.	Power was applied to the module.	No action required.
		REV# S/R QXXX	N/A	1747-SCNR firmware revision: S=series, R=revision, XXX=build number. This is a temporary display after start up.	Power was applied to the module.	No action required.
Run time	Green	A#XX	N/A	ControlNet node address	None	No action required.
		I/O ■	0x26	All configured connections are established.	None	No action required.
		IDLE	N/A	The scanner is in idle mode.	The SLC processor in slot 0 is in program mode or the Scanner Mode Command bit of the Module Command word is clear (O:e.0/10 where e is the scanner slot number).	If you want to put the scanner into run mode, put the SLC processor in slot 0 into run mode and set the Scanner Mode Command bit of the Module Command word (O:e.0/10) using an unconditional OTE instruction.
		RUN	N/A	The scanner is in run mode.	The SLC processor in slot 0 is in run mode and the Scanner Mode Command bit of the Module Command word is set (O:e.0/10).	If you want to put the scanner into program mode, either put the SLC processor in slot 0 into program mode or clear the Scanner Mode Command bit of the Module Command word (O:e.0/10).
		EDIT	N/A	The scanlist in the 1747-SCNR is being modified.	Edits have been enabled with **RS**NetWorx for ControlNet. **Note:** Previously configured connections will be reestablished if lost. Newly configured or changed connections will not be established until edits are accepted.	Finish modifying the scanlist with **RS**NetWorx for ControlNet and then accept edits. Cancel edits with **RS**NetWorx for ControlNet.

Sequence	OK Indicator	Alpanumeric Display	Module Status Word (M1 file)	Description	Probable Cause	Recommended Action
Run time	Flashing Green	I/OX	0x20	The scanner is not configured.	Module is not configured.	Use **RS**NetWorx for ControlNet to download a new configuration.
			0x21	The current configuration is not valid. The scanner is not able to start any scheduled communication to remote devices. Only unscheduled communication is possible.	Module is not configured properly.	Use **RS**NetWorx for ControlNet to schedule the existing configuration.
						Use **RS**NetWorx for ControlNet to download a new configuration.
		I/O ☐	0x22	Connections are configured but no connections are established.	View the Connection Status screen in **RS**NetWorx for ControlNet to see why the connections are not established.	Check to see if the 1747-SCNR and the remote devices are correctly connected to the ControlNet network.
		I/O ▬	0x23	Connections are configured but only 25% are successfully established.	Module bandwidth is exceeded.	Reduce the number of scheduled connections by: - using a discrete rack connection instead of multiple discrete module connections - combining multiple I/O racks into a single I/O rack - combining multiple peer-to-peer messages into one message.
		I/O ▬	0x24	50%		
		I/O ▬	0x25	75%		
						Increase your Network Update Time and/or increase the Requested Packet Intervals for scheduled data transfers.
						Increase your SLC 500 ladder program scan by adding more logic.
Run time	Flashing Green	EDIT	N/A	The scanlist in the 1747-SCNR is being modified.	Edits have been enabled with **RS**NetWorx for ControlNet. **Note:** Previously configured connections will be reestablished if lost. Newly configured or changed connections will not be established until edits are accepted.	Finish modifying the scanlist with **RS**NetWorx for ControlNet and then accept edits.
						Cancel edits with **RS**NetWorx for ControlNet

Sequence	OK Indicator	Alpanumeric Display	Module Status Word (M1 file)	Description	Probable Cause	Recommended Action
Run time	Flashing Green	SIGM	N/A	A scanner signature mismatch has been detected. The 1747-SCNR scanner signature does not match the signature stored in the active keeper. The scanner is not able to start any scheduled communication to remote devices. Only unscheduled communication is possible.	Module is not configured properly.	Use **RS**NetWorx for ControlNet to schedule the existing configuration. Use **RS**NetWorx for ControlNet to download a new configuration.
Errors	Off	None	N/A	Module is not communicating.	Power supply fault.	Check power supply, cable connectors, and seat module firmly in chassis.
	Flashing Green	N/A	0x43	Network error.	Cable error or no other nodes on the network.	Verify network cabling.
	Red	(Scrolling display showing fault details)	N/A	Module faulted.	Internal error detected.	Record fault details and contact Rockwell Automation representative or distributor.
	Flashing Red	A#00 FLSH CFG ERAS	0x42	Module erased network and connection configuration stored in flash.	Network node address is set to 00.	Power down the module and change the address switches.
		DUPL A#XX	0x44	Duplicate node address.	Another device with the same ControlNet address is on the link.	Power down the 1747-SCNR module and change the network address switches to a correct node.

ControlNet Status Indicators may behave in three ways and display three additional color schemes as described below.

- 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 (i.e, 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 (i.e., in phase).

The following table describes how the status indicator is behaving, the cause of the behavior and the action you should take.

A and B	Probable Cause	Recommended Action
Off	No power	No action required or apply power.
Steady red	Faulty unit	Cycle power or reset unit. If fault persists, contact a Rockwell Automation representative or distributor.
Alternating red/green	Self-test	No action required.
Alternating red/off	Incorrect node configuration or duplicate ControlNet node address	Check network address and other ControlNet configuration parameters.
A or B	**Probable Cause**	**Recommended Action**
Off	Channel disabled	Program network for redundant media, if required.
Steady green	Normal operation	No action required.
Flashing green/off	Temporary network errors	• Check media for broken cables, loose connectors, missing terminators, etc. • If condition persists, refer to ContolNet Cable Planning and Installation Manual, publication 1786-6.2.1.
Flashing red/off	Media fault	• Check media for broken cables, loose connectors, missing terminators, etc. • If conditions persists, refer to ControlNet Cable Planning and Installation Manual, publication 1786-6.2.1.
	No other nodes present on the network	Add other nodes to the network.
Flashing red/green	Incorrect node address	Change 1747-SCNR node address so that it is less than or equal to SMAX[1].
	Incorrect network configuration	Reconfigure ControlNet network so that SMAX[1] is greater than or equal to 1747-SCNR node address.

1. SMAX is the highest node address on a ControlNet network that can transmit scheduled data.

Local Database Access Using PLC-5 MSG Instructions

What This Appendix Contains

This appendix describes how a PLC-5 reads or writes data in the 1747-SCNR module Local Database using the message (MSG) instruction.

What We Assume

We assume that you know how to use the PLC-5 Message ladder instruction.

Read and Write Access To 1747-SCNR Local Database Using PLC-5 MSG Instruction

The Local Database is used for direct read or write access from the network. A remote PLC-5 can access this database with MSG instruction as described below.

The PLC-5 can read or write data in the 1747-SCNR Local Database with the Message instruction. This instruction creates unscheduled message connections that are initiated by the PLC-5 processor and sent to the 1747-SCNR processor.

The 1747-SCNR Scanner supports up to 50 simultaneous unscheduled connections.

PLC-5 MSG instruction contains the following information:

- command – Only PLC-5 Typed Read, PLC-5 Typed Write, PLC-2 Unprotected Read, and PLC-2 Unprotected Write are supported by the 1747-SCNR
- data-table address in PLC-5 source processor
- size of message in elements
- network address of destination processor

- data-table address in destination processor - **The destination file must be N7, otherwise the request will be rejected**
  - PLC-5 Typed Read and PLC-5 Typed Write: N7:XX where XX is the zero-based element offset in the Local Database file
  - PLC-2 Unprotected Read, PLC-2 Unprotected Write: YY where YY is the octal zero-based element offset in the Local Database file
- Port number - set to 2 for the ControlNet network
- Flags:
  - .TO - forces a message to timeout
  - .EW - indicates that the message is waiting for an open connection
  - .CO - indicates that the message is sent
  - .ER - indicates that the message was terminated due to an error
  - .DN - indicates that the message was sent without error
  - .ST - indicates that the message was started
  - .EN - indicates that the message instruction is enabled
- Error code – indicates the error when the .ER is set

For each concurrently enabled MSG instruction, the PLC-5 opens an unscheduled connection.

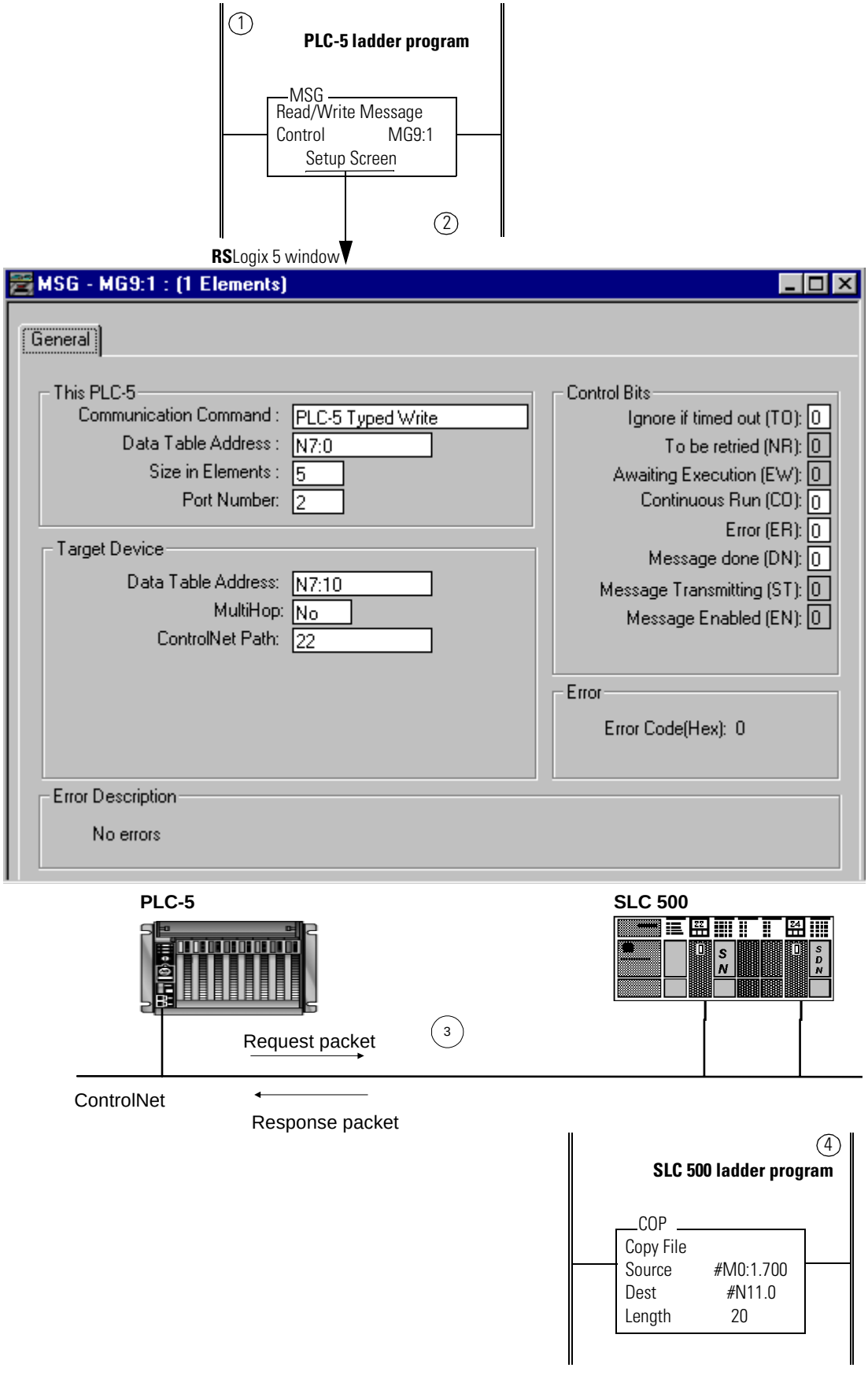
All messages sent over different connections to the 1747-SCNR Scanner have the same priority.

The following example illustrates how a PLC-5 ladder program can read or write the 1747-SCNR Local Database using the MSG instruction. The steps in the What's Happening box correspond to the steps in the illustrations following the What's Happening box.

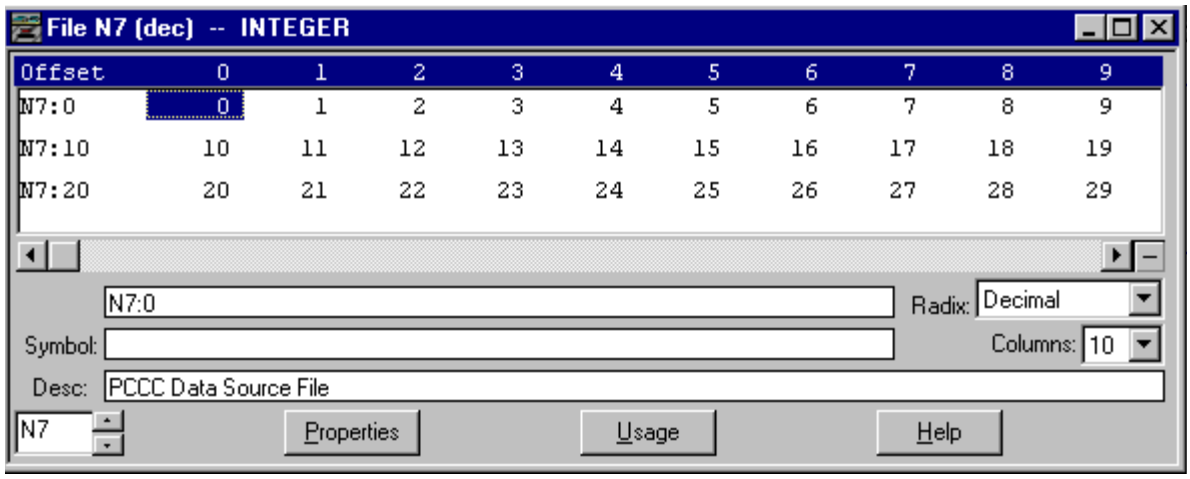
What's happening

1. The ladder programmer inserts a MSG instruction into the ladder program.
2. This message instruction sends five words from the PLC-5 N7 data file, starting at offset 0, to remote 1747-SCNR Local Database file offset 10 (N7:10). The destination node is 22.
3. The PLC-5 is put into RUN mode. Then the PLC-5 opens an unscheduled connection to the 1747-SCNR and messages are exchanged.
4. The SLC 500 ladder program reads 20 words of 1747-SCNR Local Database in slot 0 offset 700: #M0:1.700.
5. Elements from the PLC-5 N7 file are available in the SLC 500 N11 file, starting at address N11:10.

Important: When the #M0.e.yyyy address is used in ladder instructions, e is the 1747-SCNR slot number in the SLC rack. If you reuse this example, and your module is not in slot number one, update all instructions with the current appropriate number.

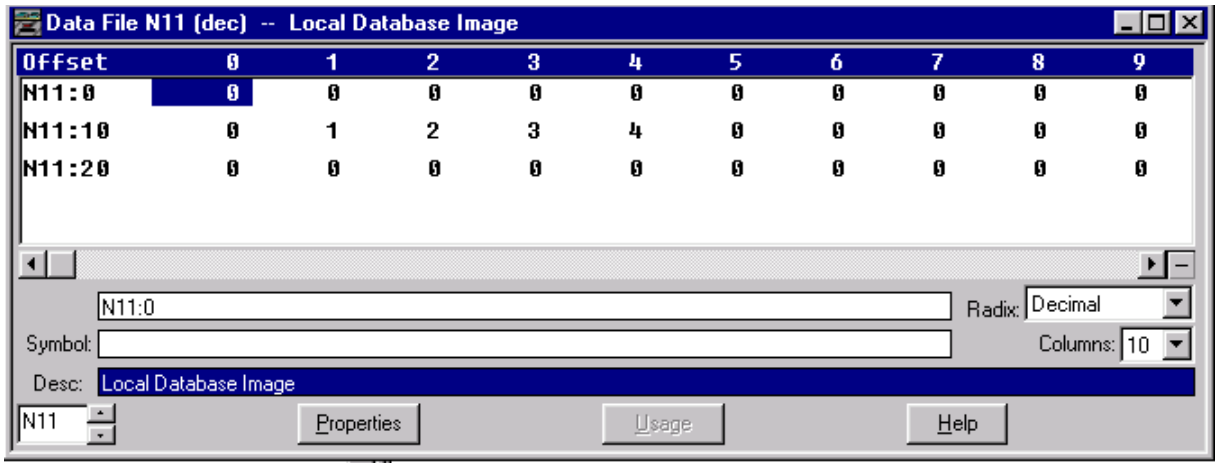

1
PLC-5 ladder program
MSG
Read/Write Message
Control MG9:1
Setup Screen
2
RSLogix 5 window
MSG - MG9:1 : (1 Elements)
General
This PLC-5
Communication Command : PLC-5 Typed Write
Data Table Address : N7:0
Size in Elements : 5
Port Number: 2
Target Device
Data Table Address: N7:10
MultiHop: No
ControlNet Path: 22
Control Bits
Ignore if timed out (TO): 0
To be retried (NR): 0
Awaiting Execution (EW): 0
Continuous Run (CO): 0
Error (ER): 0
Message done (DN): 0
Message Transmitting (ST): 0
Message Enabled (EN): 0
Error
Error Code(Hex): 0
Error Description
No errors
PLC-5
SLC 500
3
Request packet
ControlNet
Response packet
4
SLC 500 ladder program
COP
Copy File
Source #M0:1.700
Dest #N11.0
Length 20

⑤ PLC-5 Processor - Sources: N7 Data File



SLC 500 Processor - Destination: N11 Data File

RSLogix 500 window



Local Database and ControlNet Data Files Access Using CIP Messaging

What This Appendix Contains

This appendix provides a description of how a remote device can read or write the Local Database and ControlNet data areas of the 1747-SCNR by using Get Member and Set Member services. These data files are located in Input, Output, M0 and M1 memory files.

What We Assume

We assume that you are familiar with Object modeling and CIP protocol as described in the ControlNet Specification available from ControlNet International. You can contact ControlNet International at its website www.controlnet.org.

Read and Write Access to 1747-SCNR Data Files Using Assembly Object Services

The 1747-SCNR supports the following aspects of Assembly Object Services:

- The 1747-SCNR assembly object supports Get Member and Set Member services. The IOI of these requests must contain four logical segments: Class number, instance number, attribute number and member number.
- The member number is interpreted as the **one-based word offset** of the data transfer.
- The number of members (first word of the request field) is interpreted as **size in words** of the data transfer.

Assembly Object Instance Numbers Supported for Get and Set Member on Data Attribute

The following table lists assembly object instance numbers supported for Get and Set Member services.

SLC File	Word Offset	Contents	Assembly Object Instance Number	Member Number Range
Input	0-31	ControlNet Input Data	6	1-32
Output	0-31	ControlNet Output Data	5[1]	1-32
M1	0-607	ControlNet Input Data	8	1-608
M0	0-1650	ControlNet Output Data	7	1-1651

1. Instance 5 does not support Set Member service (no write access).

The following rules apply to all Set Member or Get Member services on the Assembly Object.

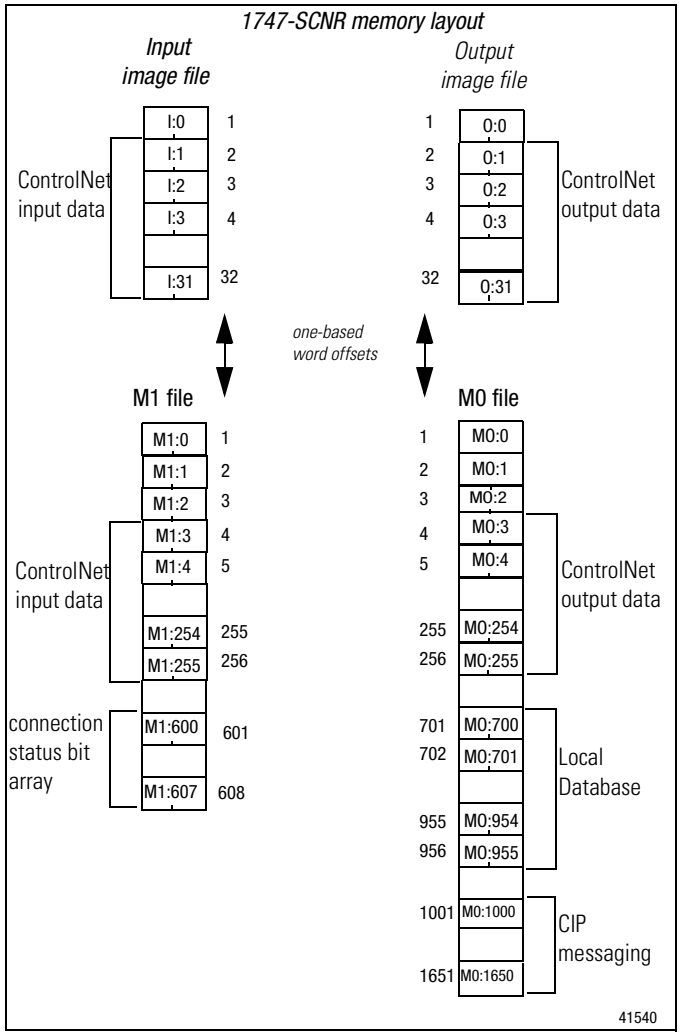
- Set Member and Set Attribute services on the discrete Input data file is rejected if the SLC processor is in RUN mode (no write access).
- Set Member and Set Attribute services on the discrete Output data file is always rejected (no write access).
- Set Member and Set Attribute services on the M0 and M1 files are always accepted (regardless of SLC processor mode).

The following table contains examples of valid and invalid range of values for Instance Number, Member Number, and Size Parameter.

		Get Member	Set Member
Valid	Instance Number = 0x08 Member Number = 0x01 Size Parameter = 0x01	The 1747-SCNR module returns the first word of the Local Database file [M0:0].	The 1747-SCNR module writes 1 word of data into the first word of the Local Database file [M0:0].
	Instance Number = 0x08 Member Number = 0x012D Size Parameter = 0x14	The 1747-SCNR Scanner returns 20 words of the Local Database file starting with one-based word offset of 301(dec) [M0:300].	The 1747-SCNR Scanner writes the 20 words of data into the Local Database file starting at the one-based word offset of 301(dec) [M0:300].
	Instance Number = 0x05 Member Number = 0x01 Size Parameter = 0x02	The 1747-SCNR Scanner returns 2 words of data starting from I:1.	The 1747-SCNR Scanner writes 2 words of data starting at I:1.
Invalid	Instance Number = Any Member Number = 0x00 Size Parameter = 0x02	0 is an invalid member number. Request rejected.	0 is an invalid member number. Request rejected.

1747-SCNR Memory Layout

The following illustration is an example of 1747-SCNR memory layout.



Notes

CIP Client Management

What This Appendix Contains

This appendix contains an example of how you can manage the CIP Client area to issue a CIP client request to a remote node on the ControlNet network.

What We Assume

We assume that you are familiar with:

- ladder programming
- object modeling as described in ControlNet specifications. You can contact ControlNet International at its website www.controlnet.org.

CIP Client Area

The 1747-SCNR M0 file contains a CIP client area that can be used to allow limited unconnected data exchange with a remote node on the local ControlNet link. **These messages are initiated by the SLC processor**.

The message is built by ladder programming using the structure described in the table below.

M0 File Word Offsets	Word Size	Contents	Description
1000	1	CIP Message Control	These bits are similar to the MSG bits from the SLC 500 instruction set. Bit 0-7: Reserved Bit 8: TO -Timeout on message sent Bit 9: unused (NR) Bit 10: EW -Message taken into account by 1747-SCNR, waiting for a response Bit 11: CO -Continuous mode Bit 12: ER -Error returned by the 1747-SCNR Bit 13: DN -Response received Bit 14: unused (ST) Bit 15: EN -Message enable.

M0 File Word Offsets	Word Size	Contents	Description
1001	1	Target MAC ID	Destination node address.
1002	1	Timeout	The scanner will wait this number of ms for a response. Must be nonzero, typical range 200-500 ms.
1003	1	Complex IOI size	The number of words from Complex IOI Buffer to be sent in the CIP message. If null, a default IOI is built from words 1004 through 1008. If non-null, this many words from 1050 through 1099 will be used for the IOI.
1004	1	UCMM service code	Any value in the 0x01 to 0x7F range will be sent by the 1747-SCNR Scanner as a valid service code. If the Object attribute code is non-null, the IOI will contain the class and instance logical segments. If the attribute code is non-null, the IOI will also contain the attribute logical segment. Any other value will generate an error and no service will be sent on the wire. Refer to the ControlNet International Specification for valid service codes.[1]
1005	1	Object class code	Destination object class number. First IOI logical segment. This field must be non-null.
1006	1	Object instance code	Destination object instance number.
1007	1	Object attribute code	Destination object attribute number. Can be null if attribute logical segment is not required.
1008	1	Object member code	Destination object member number. Can be null if member logical segment is not required.
1009	1	Size of command data	Size in words of command data in the following area. This field must be null when no command data are sent.
1010-1019	1	Reserved	Must be set to zero or undefined behavior may result.
1020	1	Request message status	Request status message value generated by destination response status node.
1021	1	General status response	Status returned by CIP response message (0 means no error). 1747-SCNR specific error codes: 0x201:Invalid command data size in word 1009 0x202:Internal fault 0x204:Invalid service code in word 1004 0x205:Invalid IOI data size in word 1003 0x206:Invalid CIP request block contents 0x207:CIP message request timeout 0x208:CIP timeout value too small in word 1002

1. You can purchase the ControlNet International Specification from ControlNet International.

M0 File Word Offsets	Word Size	Contents	Description
1022	1	Extended status size	Extended status size in the following response area. This value is zero, if unused.
1023	1	Size of response and status	Size in words of the response returned by the 1747-SCNR Scanner in the Extended status and Response data area.
1024-1049	1	Reserved	Must be set to zero or undefined behavior may result.
1050-1099	50	Complex IOI buffer	Data values are copied into a CIP message path segments.
1100-1349	250	Command data	Request data.
1350-1600	251	Extended status + Response data	Response data.

Send a Get Attribute All Request to Node 14 Identity Object

In this example, a 1747-SCNR module with MAC ID 11 is located in slot 1 of the SLC rack. It sends a Get Attribute All request to the Identity object of a remote 1794-ACNR15 Flex I/O device at MAC ID 14 on the ControlNet network. This request is triggered by the ladder program using the CIP Client feature provided by the 1747-SCNR module.

This process is illustrated in the following example. The steps in the What's Happening box correspond to the steps in the illustrations following the What's Happening box.

What's happening

1. The CIP message control image is updated on a regular basis.

2. The message and its data are prepared in the SLC N7 file to be copied in M0 using a single COP (copy) instruction. To send the message, first clear the CIP message control image area in the SLC 500 N7 data file. No command data is needed for a Get Attribute Single request. Initialize the local CIP control words and data size. Set the EN bit and then copy the control data.

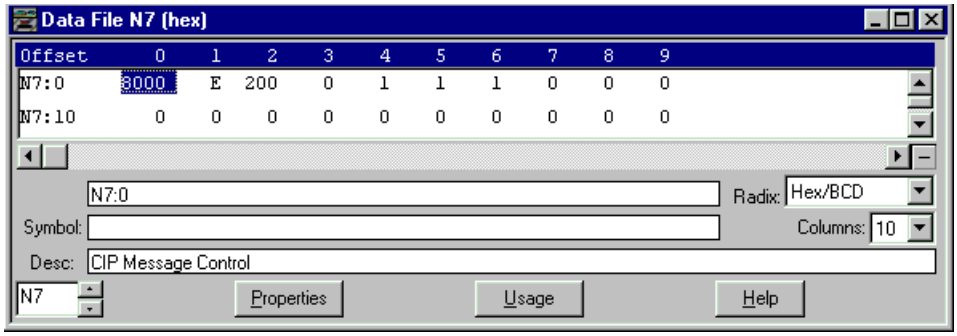
3. Request and response are exchanged on the wire.

4. When the DN bit is set without errors or timeout, copy the response data into an intermediate file and unlatch the DN bit.

5. The response is available in an SLC internal data file.

① SLC 500 Processor: N7 Data File (hex)

RSLogix 500 window

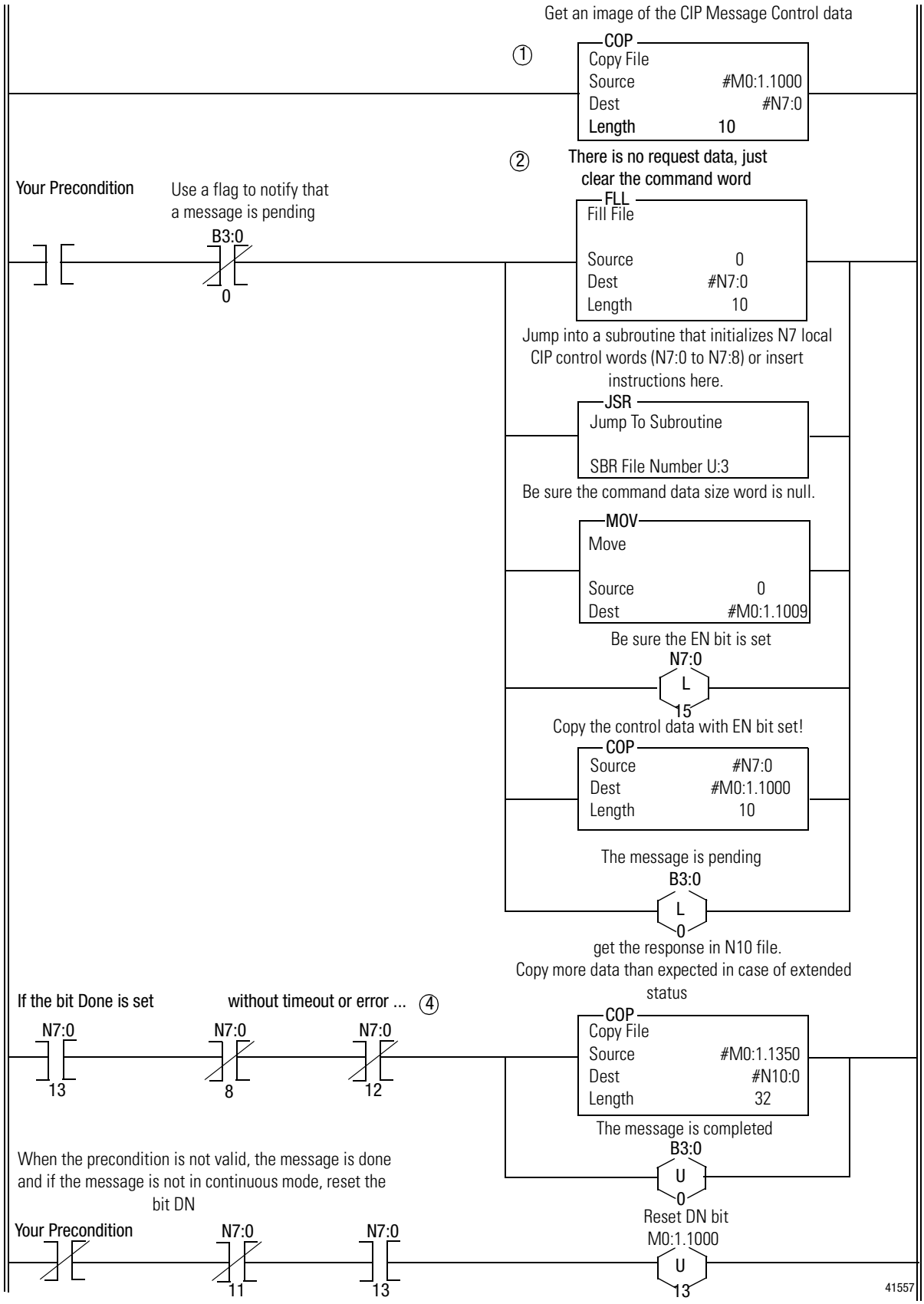


Detail:

N7:0 = 0x8000:Control word with EN bit set
N7:1 = 0x0E:Target MAC ID - Node 14
N7:2 = 0x200:Timeout 512 ms
N7:3 = 0x0:Complex IOI size - Not used
N7:4 = 0x01:Get Attribute All service code
N7:5 = 0x01:Target Class code - Identity object class
N7:6 = 0x01:Target Instance number - Instance number 1
N7:7 = 0x00:Target Attribute number - Not used
N7:8 = 0x00:Target Member number - Not used
N7:9 = 0x00:Command Data Size - No data used

In the ladder example on the next page:
M0:1.1100 = 0x00:Not used

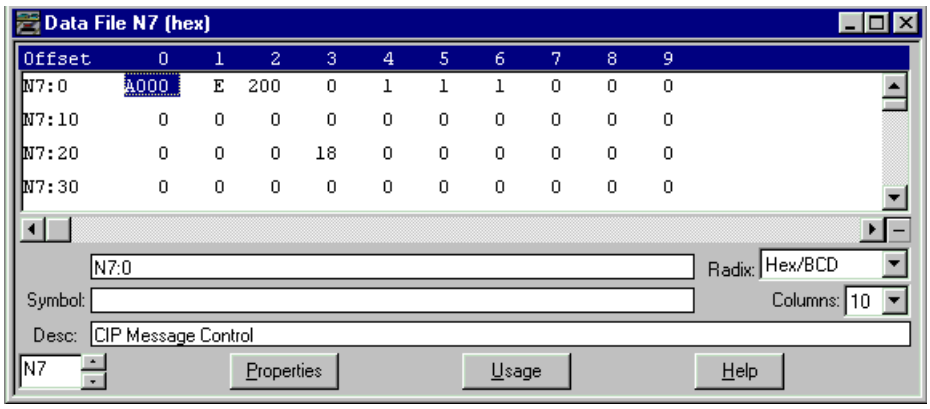
SLC 500 Ladder Program



⑤ SLC 500 Processor: Data Files (hex)

N7:Message control image

RSLogix 500 window

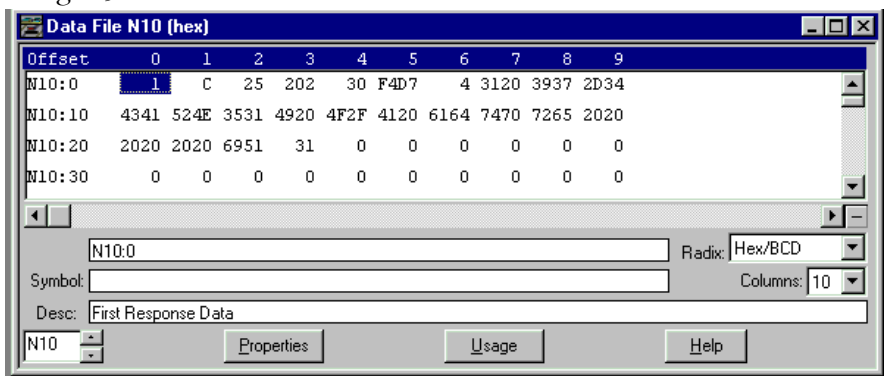


Detail:

N7:0 = 0xA000:Control word with bits EN and DN set - Response received
N7:23 = 0x18:Response length - 24 words

N10:Response data

RSLogix 500 window



Detail:

N10:0 to N10:23:Response data

Important: The data format on the wire is Little Endian. RSLogix 500 displays words so byte order is inverted on the screen.

Send a Set Attribute Single Request

This process is illustrated in the following example. The steps in the What's Happening box correspond to the steps in the illustrations following the What's Happening box.

What's happening

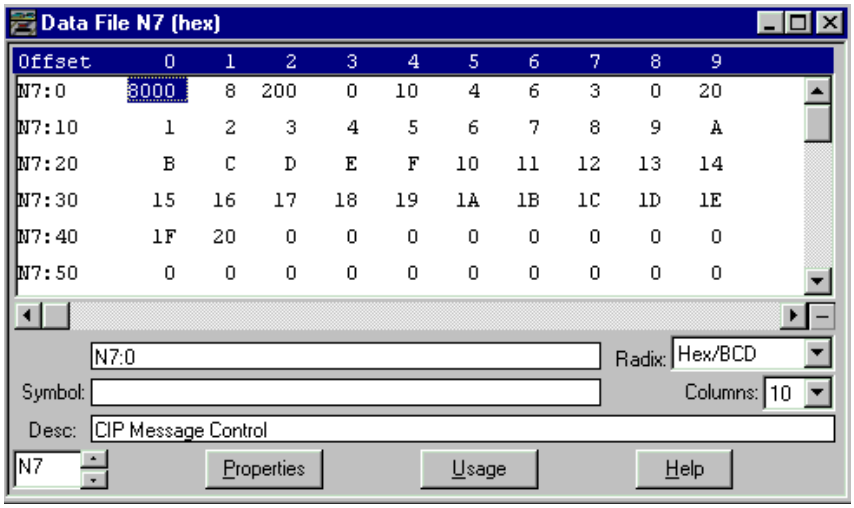
1. The CIP message control image is updated on a regular base.
2. You want to send a Set Attribute Single to **Data Attribute (Attribute number 3**) of assembly instance 6 (Input file words 1 to 32). The CIP message control area and command data are initialized in an internal data file. The command data is copied in M0 first, then the command word is cleared and, as a last step, the message control area is copied into M0 with the EN bit set to what will send the message on the wire.
3. Request and response are exchanged on the wire.
4. When the bit DN is set without an error or timeout, nlatch the DN bit. No response data is expected in case of a successful response.
5. The response is available in an SLC internal data file.

See the following list for assembly object instance numbers supported by the Get and Set Attribute Single services on Data attribute.

Instance 5 : Output file words 1 to 32
Instance 6 : Input file words 1 to 32

SLC 500 Processor: N7 Data File (hex)

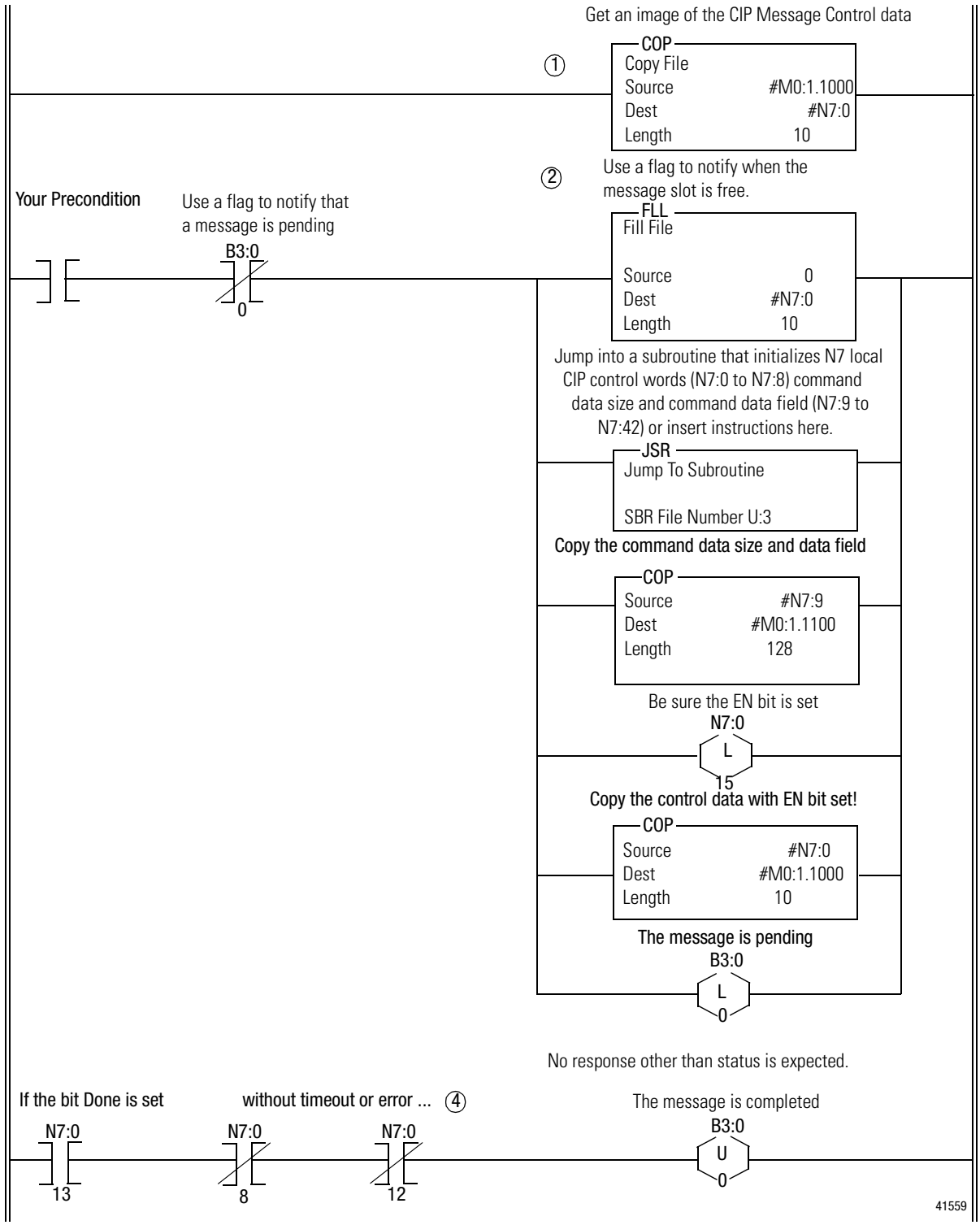
RSLogix 500



Detail:

N7:0 = 0x8000:Control word with bit EN set
N7:1 = 0x08:Target MAC ID - Node 8
N7:2 = 0x200:Timeout 512 ms
N7:3 = 0x0:Complex IOI size - Not used
N7:4 = 0x10:Set Attribute Single service code
N7:5 = 0x04:Target Class code - Assembly object class
N7:6 = 0x06:Target Instance number - Instance 6: Input File
N7:7 = 0x03:Target Attribute number - Data Attribute
N7:8 = 0x00:Target Member number - Not used
N7:9 = 0x20:Command Data size - 32 words of data at M0:1.1000
N7:10 to N10:40:Data - Copy 32 words of data to M0:1.1000

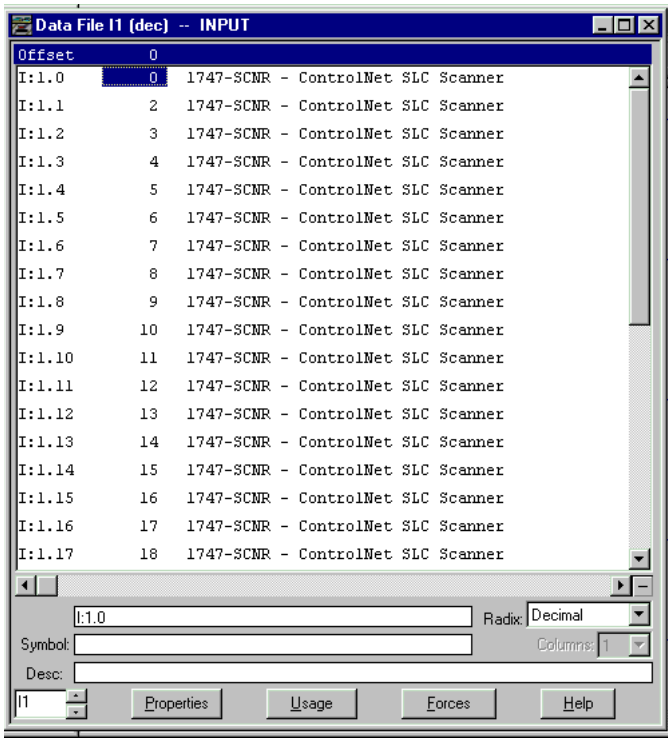
Example: SLC 500 Ladder Program



Important: When the #M0.e.yyyy address is used in ladder instructions, e is the 1747-SCNR slot number in the SLC rack. If you reuse this example, and your module is not in slot number one, update all instructions with the current appropriate number.

⑤ SLC 500 Processor: Target Input Data File (hex)

RSLogix 500



I:1 file is the image of target node 8 Input file.

The 1747-SCNR at MAC ID 11 wrote 32 words into the input data file of 1747-SCNR at MAC ID 8.

Note: The 1747-SCNR at MAC ID 8 must be in program mode to write to the input data file.

Send a Set Member Request

This process is illustrated in the following example. The steps in the What's Happening box correspond to the steps in the illustrations following the What's Happening box.

What's happening

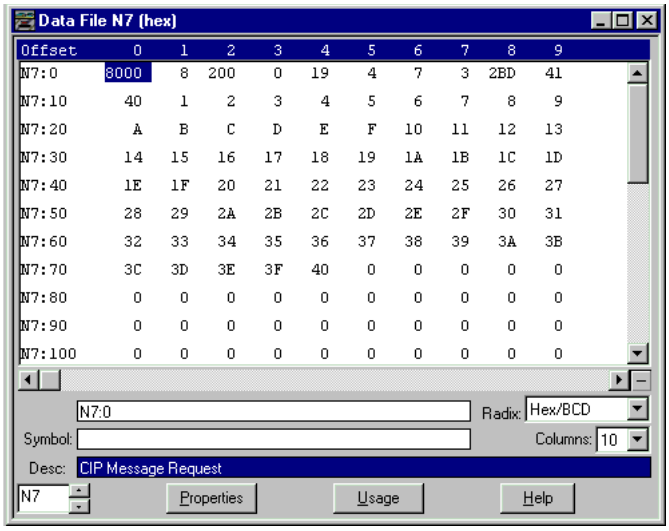
1. The CIP message control image is updated on a regular base.
2. You want to send a Set Member to **Data Attribute (Attribute number 3**) of assembly instance 7 (Local Database at words M0:701 to M0:956). The CIP message control area and command data are initialized in an internal data file. The command data is copied in M0 first, then the command word is cleared and, as a last step, the message control area is copied into M0 with the EN bit set to what will send the message on the wire.
3. Request and response are exchanged on the wire.
4. When the bit DN is set without an error or timeout, nlatch the DN bit. No response data is expected in case of a successful response.
5. The response is available in an SLC internal data file.

See the following list for assembly object instance numbers supported by the Get and Set Attribute Single services on Data attribute.

Instance 5 : Output file words 1 to 31
Instance 6 : Input file words 1 to 31
Instance 7 : M0, ControlNet Data area words 0 to 1650
Instance 8 : M1, ControlNet Data area words 0 to 607

SLC 500 Processor: N7 Data File (hex)

RSLogix 500



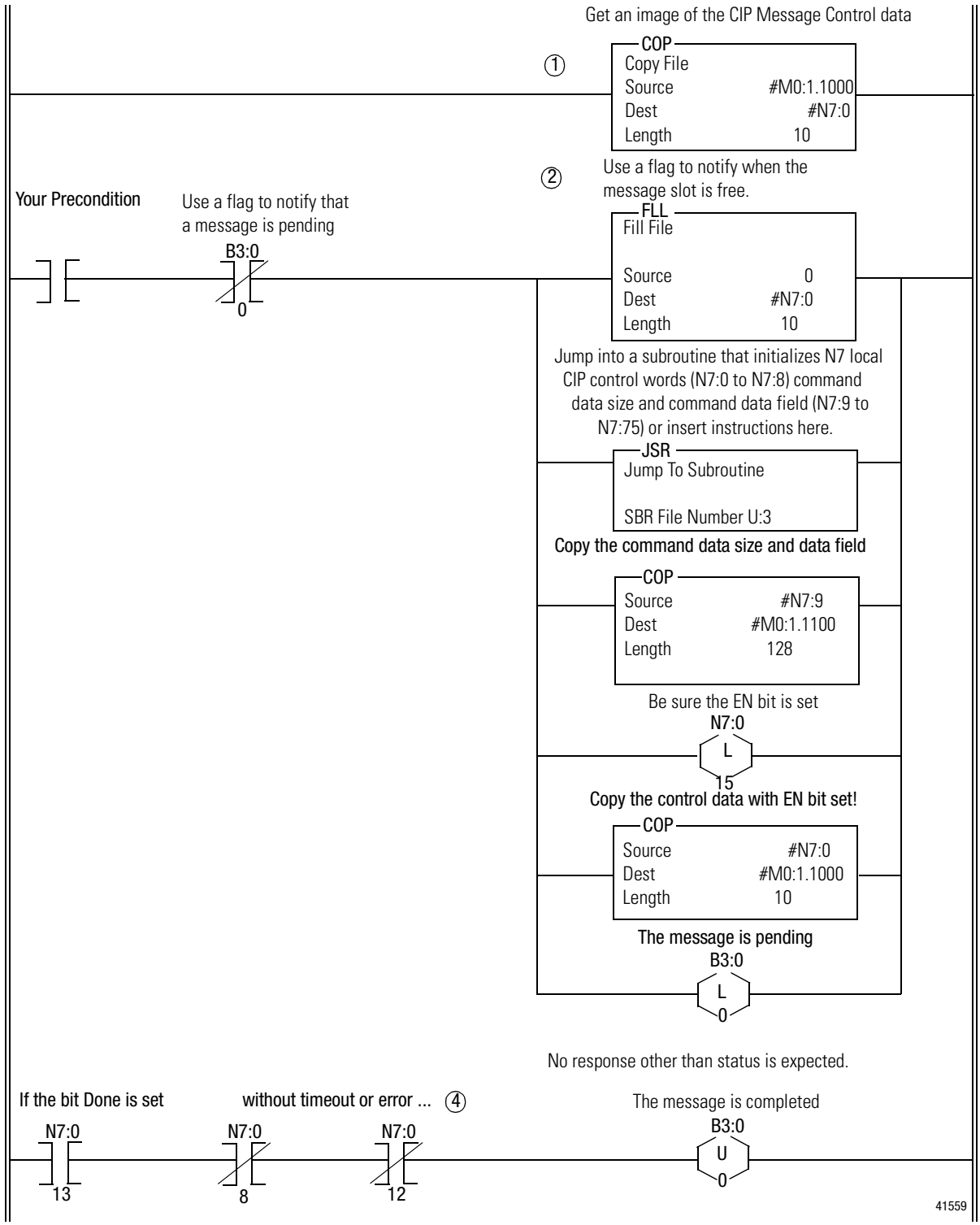
Detail:

N7:0 = 0x8000:Control word with bit EN set
N7:1 = 0x08:Target MAC ID - Node 8
N7:2 = 0x200:Timeout 512 ms
N7:3 = 0x0:Complex IOI size - Not used
N7:4 = 0x19:Set Member service code
N7:5 = 0x04:Target Class code - Identity object class
N7:6 = 0x07:Target Instance number - Instance 7: M0 File
N7:7 = 0x03:Target Attribute number - Data
N7:8 = 0x2BD:Target Member number - 701, one based offset, M0 File Local Database word 700
N7:9 = 0x41:Command Data size - 65 = 1 data length word + 64 words of actual data, copy to M0:1.1100
N7:10 to N7:75:Data copied to M0:1.1100

Note: The set member service contains the amount of data to be written in N7:10, followed by the actual data values.

The length contained in N7:9 includes the size word of N7:10, plus the number of data words to be sent.

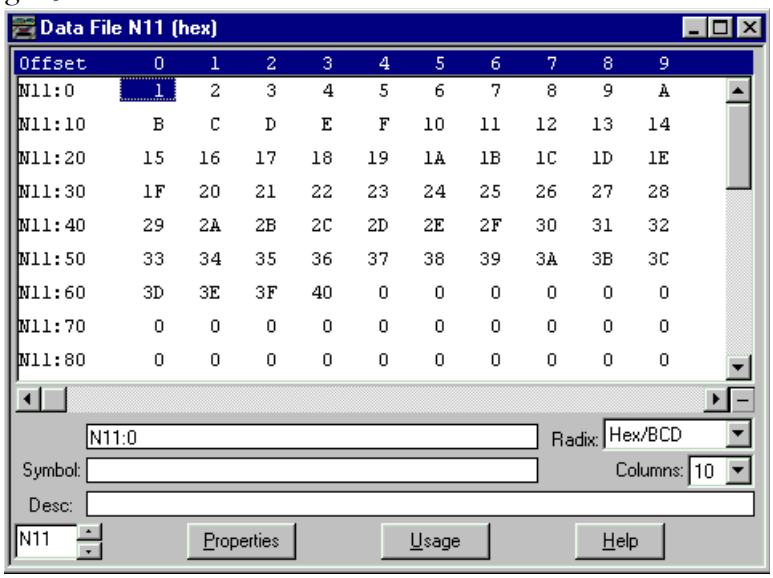
Example: SLC 500 Ladder Program



Important: When the #M0.e.yyyy address is used in ladder instructions, e is the 1747-SCNR slot number in the SLC rack. If you reuse this example, and your module is not in slot number one, update all instructions with the current appropriate number.

SLC 500 Processor: Target Input Data File (hex)

RSLogix 500



N11 file is the image of target node 8 Local Database.

The 1747-SCNR at MAC ID 11 wrote 64 words into the Local Database of 1747-SCNR at MAC ID 8.

Example of Reset Bit Management

What This Appendix Contains

This appendix contains an example of how you can use the ladder program to reset a 1747-SCNR module located in the SLC 500 rack.

What We Assume

We assume that you are familiar with ladder programming.

Example

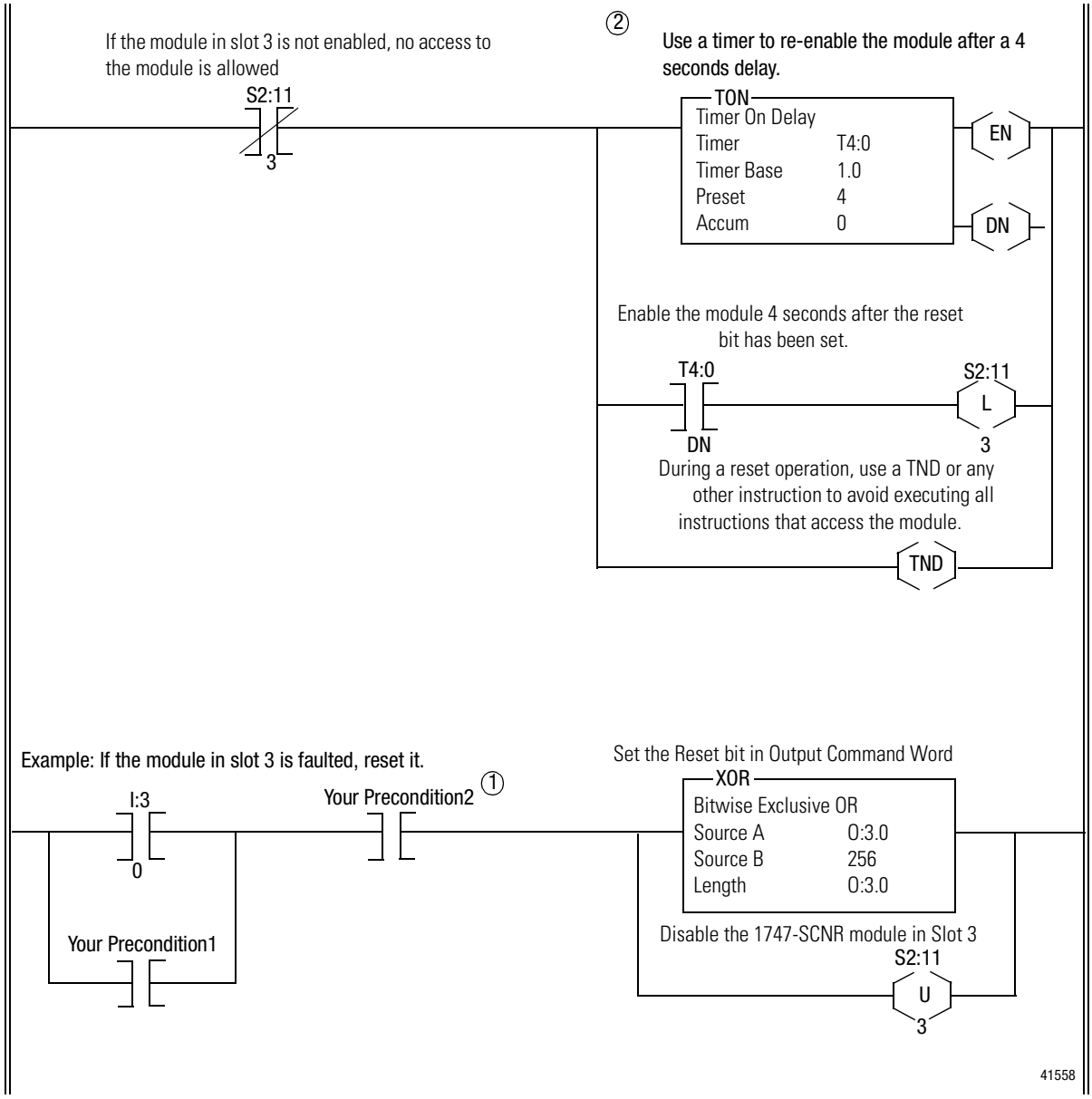
Reset bit management is illustrated in the following example. The steps in the What's Happening box correspond to the steps in the illustration following the What's Happening box.

What's happening

1. In this example, we reset the scanner when it is faulted. When the 1747-SCNR sets its fault bit, the scanner slot (slot 3) is disabled and the Output Command word Reset bit is set (O:3.0/8).

2. When the slot is disabled, a timer is started and four seconds later the scanner is enabled. During these four seconds, you must avoid any access to the scanner in reset. This is why the rung with the TND instruction has to be executed first.

Important: If you do not disable the slot while the scanner is resetting, the SLC will fault with the error code nn57h (i.e., speciality, I/O Module in slot nn has not responded to a lock shared memory command in the requested time limit) where nn is the slot number of the scanner. This is why the reset bit change is not taken into account until the slot is disabled.



Important: In this ladder example, when S2:11\e, I:e\0 or O:e.0 are used, e is the 1747-SCNR slot number in the SLC rack. If you reuse this example and your module is not in slot 3, update all instructions with the current appropriate number.

Application Examples

What This Appendix Contains

This appendix provides examples of five applications and their use with the 1747-SCNR controlling discrete and analog data on ControlNet via a 1747-ACNR15 and a 1794-ACNR15 ControlNet adapter. Also included in this appendix is an example of how to create peer-to-peer scheduled connections between 1747-SCNR ControlNet scanners.

What We Assume

We assume that you are familiar with setting up a network and working with **RS**Logix500, **RS**Linx, and **RS**NetWorx for ControlNet software and the 1784-KTCX15 interface card.

Example 1: Configure the 1747-SCNR with the 1746-IV16 Input Module

The following example discusses how to configure the 1747-SCNR scanner with the 1746-IV16 input module.

Hardware Setup

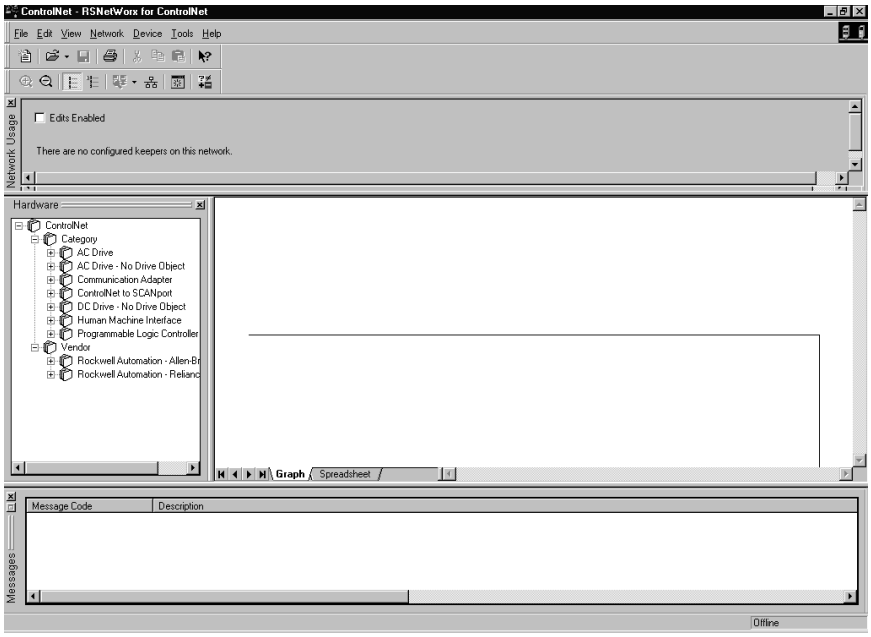
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes a 1747-ACNR15 in slot 0, 1746-IA16 in slot 1, 1746-OB16 in slot 2, and 1746-IV16 in slot 3.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

You see this screen:



At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

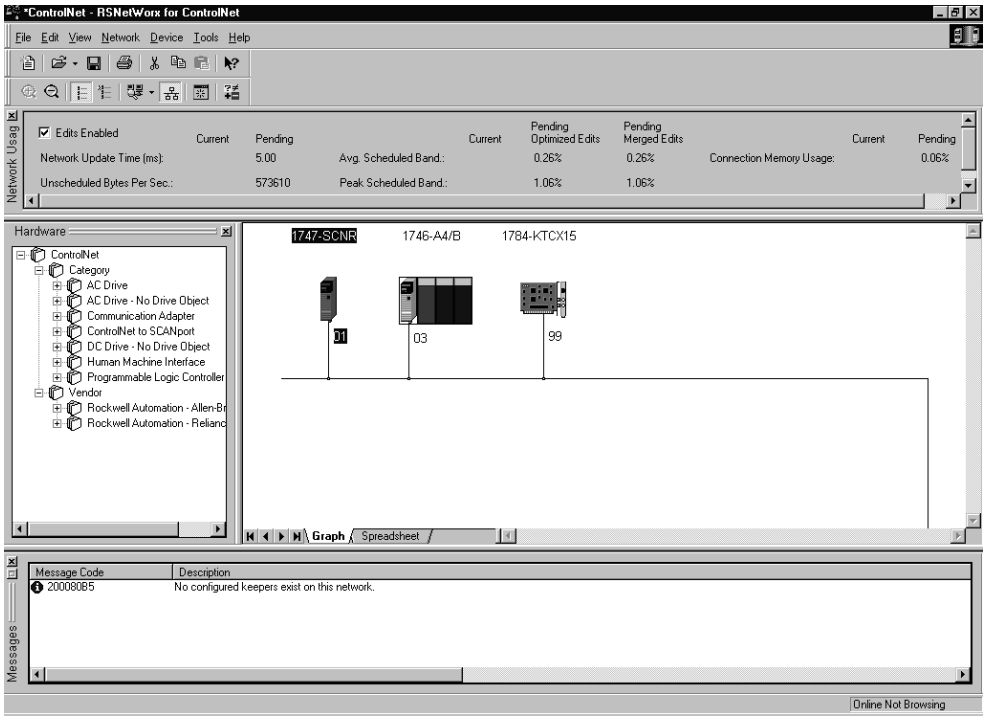
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

You see the "Browse for Network" window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



Node 1 is the 1747-SCNR and node 3 is the 1747-ACNR15. The 1747-ACNR15 resides in slot 0 of its chassis, while slot 1 contains a 1746-IA16, slot 2 contains a 1746-OB16, and slot 3 contains a 1746-IV16. For this example, a single 16-bit rack connection will be configured to read/write the three discrete I/O modules. Before we create this connection, we should verify the chassis configuration for the 1747-ACNR15. To do this:

5. Click the right mouse button on the 1747-ACNR15.

6. Choose **Edit Chassis** and verify that the chassis configuration is as follows:
   - slot 0: 1747-ACNR15
   - slot 1: 1746-IA16
   - slot 2: 1746-OB16
   - slot 3: 1746-IV16

   If the chassis is not already configured, manually configure it by dragging the appropriate modules from the list on the right to the proper slot on the left of the chassis configuration screen. When this is complete, click APPLY and then OK.

Configure a Rack Connection

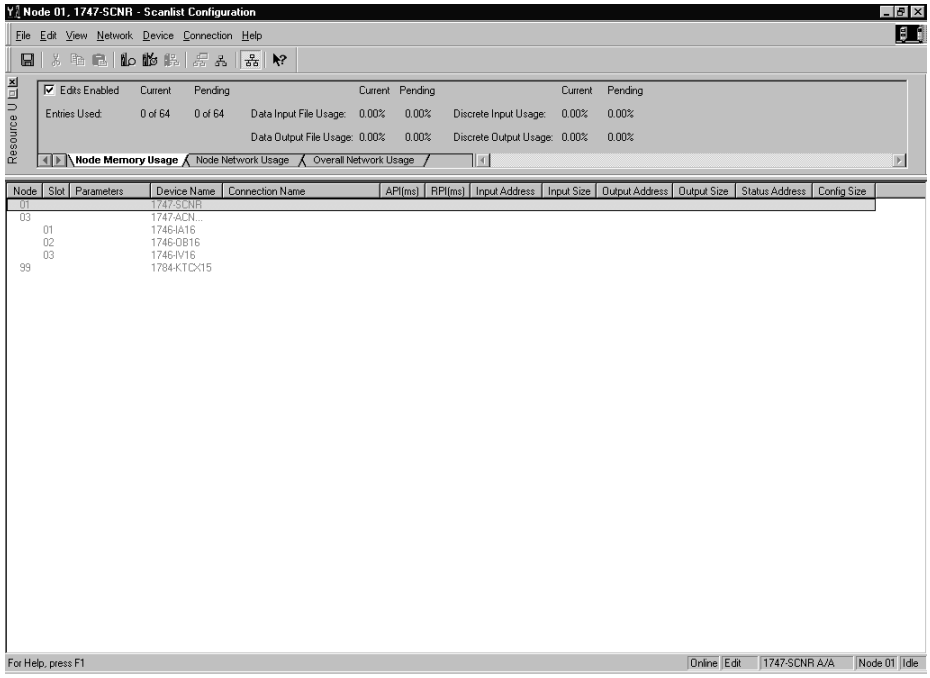
We are now ready to configure the necessary ControlNet connection so we can read/write data from the SLC processor to the remote discrete I/O modules.

1. Click with the right mouse button on the 1747-SCNR and choose **Scanlist Configuration**.

   You will be prompted to enter the edit mode.

2. Click YES.

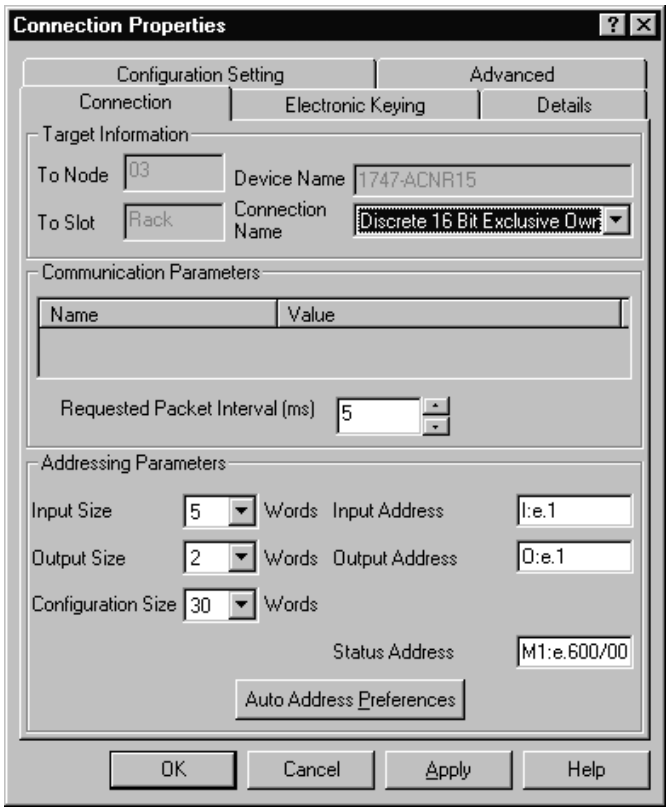
   You see the following screen:



   The 1747-SCNR and 1747-ACNR15 are shown as nodes 1 and 3, respectively. The three I/O modules are under the 1747-ACNR15 in slots 1 through 3 of the 1747-ACNR15 chassis.

3. In order to establish a 16-bit rack connection to the 1747-ACNR15 chassis, click with the right mouse button on the 1747-ACNR15 and choose **Insert Connection**.

You see the following window.



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

The Connection Name by default is Discrete 16 Bit Exclusive Owner. This is the 16-bit rack connection we want. The first available I/O addresses are I:3.1 and O:3.1, where the 1747-SCNR is in slot 3 of the processor chassis. The first available starting I/O addresses have been placed into the Input Address and Output Address fields, because automatic addressing was previously selected in the "Auto Address Preference" screen.

Words I:3.0 and O:3.0 are reserved. Note that the input data from the 1746-IA16 will be found in the processor's input image word I:3.3, the output data written to the 1746-OB16 module will be from the processor's output image word O:3.2, and the input data from the 1746-IV16 will be in the processor's input image word I:3.5.

Important: There is a two word offset for input data for rack connections. Therefore, for this example, the input data for the input module in slot 1 of the remote 1747-ACNR15 chassis will be written to I:3.3 in the SLC processor's input image and the input module in slot 3 will be written to I:3.5.

The starting input address configured in **RS**NetWorx for ControlNet for this rack connection was I:3.1, but I:3.1 and I:3.2 are used for status information. Hence the Input Size of 5 is shown in the "Connection Properties" screen.

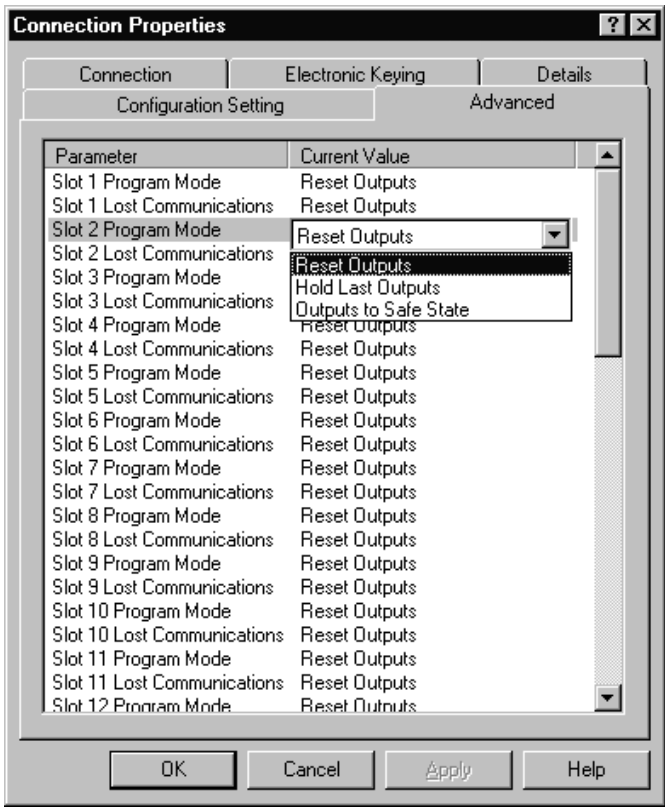
The actual input data begins after the two words of status information. I:3.4 is not used in this example because an output module resides in slot 2. Also, note that there is no offset for the outputs in a rack connection. O:3.2 is the output image word written to the output module located in slot 2 of the 1747-ACNR15 chassis. O:3.1 is also not used in this example because an input card is in slot 1.

You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor. The starting bit address for this field must be an even number, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the address chosen is the first available bit pair, M1:3.600/00.

You have successfully configured a rack connection to the remote chassis to communicate with the discrete I/O modules. At this point, you may also configure the state of the outputs in the remote ControlNet Chassis when the processor is placed into the Program Mode or if communications is lost to the remote chassis. This is optional. The default is to turn all outputs off when one of the two conditions occur. To select other options:

a. Click on the Advanced tab in the "Connection Properties" window.

You see the following window.



By default for rack connections, outputs in all slots in the remote chassis are reset if the processor is placed into the Program mode or if communications is lost for any reason. Two other choices are offered:

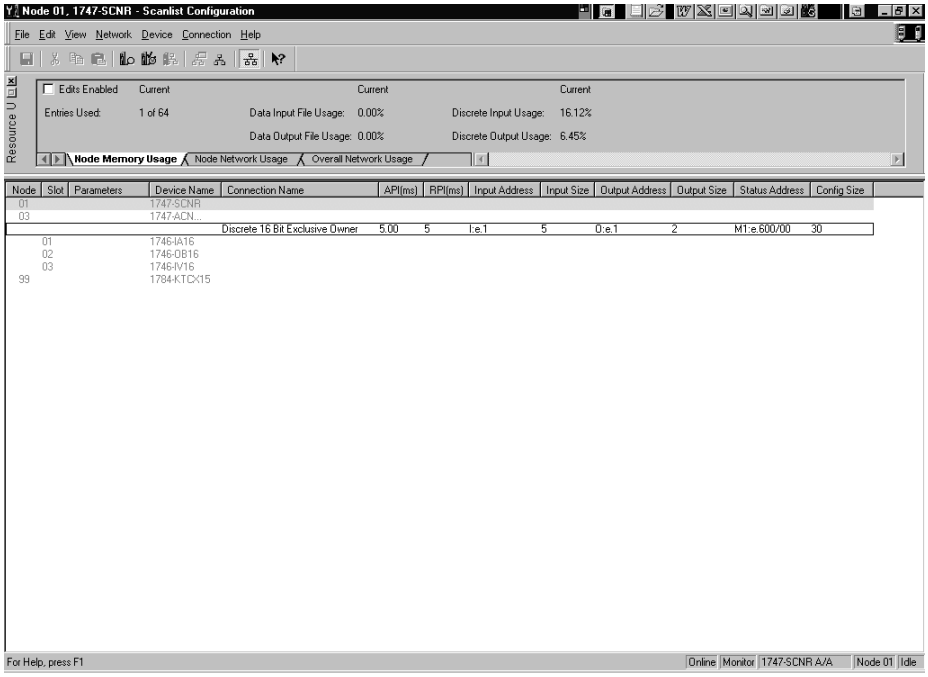
- Hold Last State - all outputs will remain in their last state if one of the two conditions occur
- Safe State - allows you to choose exactly the state of each output

If Safe State is selected, you must click on the Configuration Settings tab and enter your Safe State data for each output word in decimal. Then, whenever the SLC processor is placed into the Program Mode or if communications is lost to the 1747-ACNR15 adapter, the outputs will revert to the Safe State data you entered for each output word.

b. Click APPLY.

c. Click OK.

The “Connection Properties” window closes and the “Scanlist Configuration” window should look like the following:



You have now successfully configured a rack connection to read/write data between the SLC processor and the remote ControlNet chassis. All that remains is to save the configuration to the network keeper, which in this case is the 1747-SCNR.

1. Click on the Save icon or click on the **File** menu and then **Save**.

   You will be prompted to “Optimize and re-write schedule for all connections”.

2. Click OK.

3. Click YES.

   Your network configuration information will now be written to the network keeper.

   The display on the front of your 1747-SCNR should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs should be solid green and the B LED should be off, unless you are using the redundant media option, which is not being used in this example. The 1747-ACNR15 should be displaying that it is active (ACTV) and its LEDs should be solid green for A and OK and the B LED should be off.

Creating a Ladder Program

The final step is to write a ladder program for the SLC processor, including configuring the 1747-SCNR for slot 3 of the processor's chassis.

1. After downloading the program to your processor, place it into the Run mode.

2. Set the Run/Idle bit (O;e.0/10, where e=slot number of your 1747-SCNR) to a 1.

   Your program should now be able to read data from the 1746-IA16 in word I:3.3, write to the 1746-OB16 in word O:3.2 and read data from the 1746-IV16 in word I:3.5.

Example 2: Configure the 1747-SCNR with the 1746-NIO4V Analog Input/ Output Module

The following example discusses how to configure the 1747-SCNR scanner with the 1746-NIO4V combination analog input/output module.

Hardware Setup

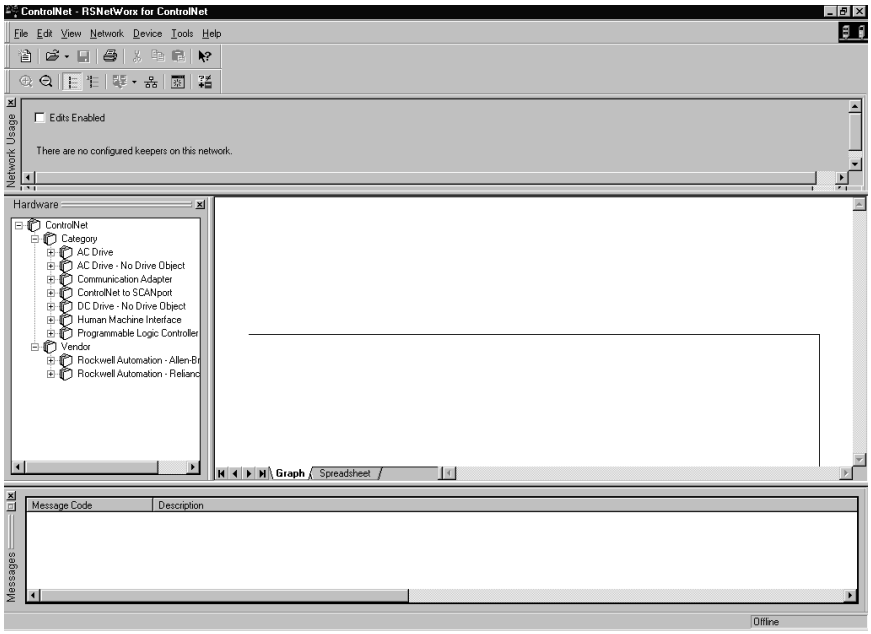
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes a 1747-ACNR15 in slot 0, 1746-IA16 in slot 1, 1746-OB16 in slot 2, and 1746-NIO4V in slot 3.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

You see this screen:



At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

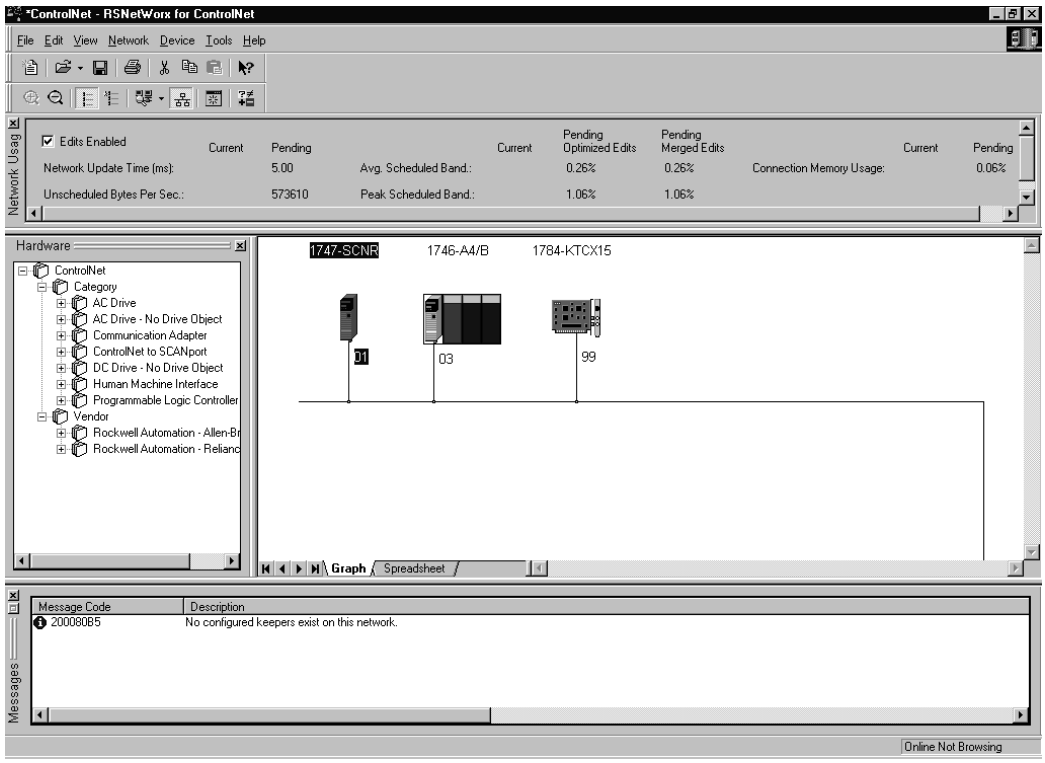
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

You see the "Browse for Network" window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



Node 1 is the 1747-SCNR and node 3 is the 1747-ACNR15. The 1747-ACNR15 resides in slot 0 of its chassis, while slot 1 contains a 1746-IA16, slot 2 contains a 1746-OB16, and slot 3 contains a 1746-NIO4V. For this example, two separate ControlNet connections will be configured. The first will be a Discrete 16 Bit Exclusive Owner rack connection for the two discrete I/O modules. The second will be a Module Connection to the 1746-NIO4V 2 input/2 output analog module. Before we create this connection, we should verify the chassis configuration for the 1747-ACNR15. To do this:

5. Click the right mouse button on the 1747-ACNR15.

6. Choose **Edit Chassis** and verify that the chassis configuration is as follows:
   - slot 0: 1747-ACNR15
   - slot 1: 1746-IA16
   - slot 2: 1746-OB16
   - slot 3: 1746-NIO4V

If the chassis is not already configured, manually configure it by dragging the appropriate modules from the list on the right to the proper slot on the left of the chassis configuration screen. When this is complete, click APPLY and then OK.

Configure a Rack Connection

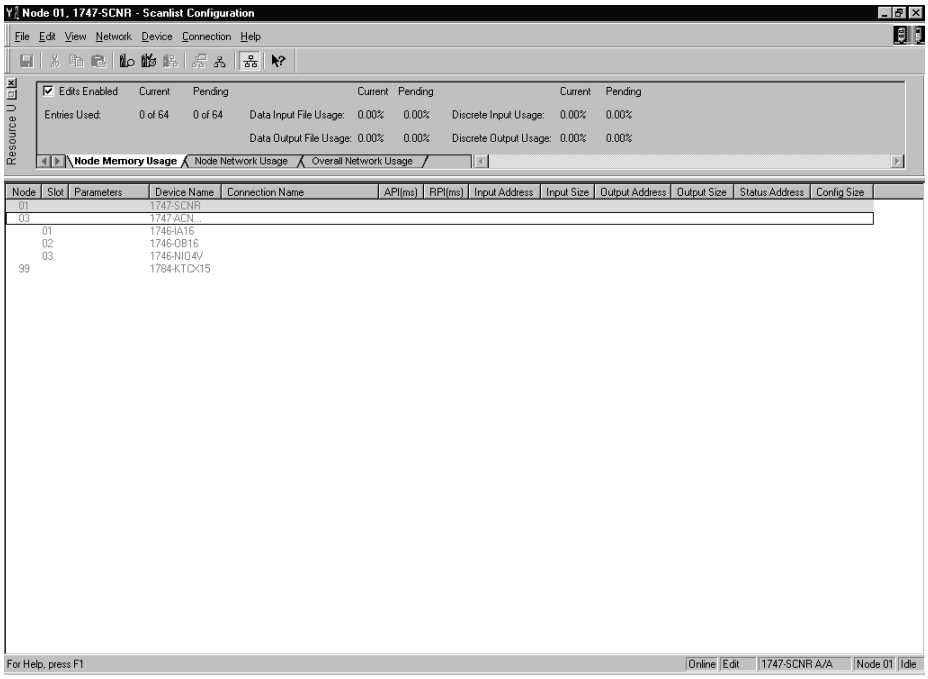
We are now ready to configure the necessary ControlNet connection so we can read/write data from the SLC processor to the discrete I/O modules and to the analog I/O module.

1. Click with the right mouse button on the 1747-SCNR and choose **Scanlist Configuration**.

   You will be prompted to enter the edit mode.

2. Click YES.

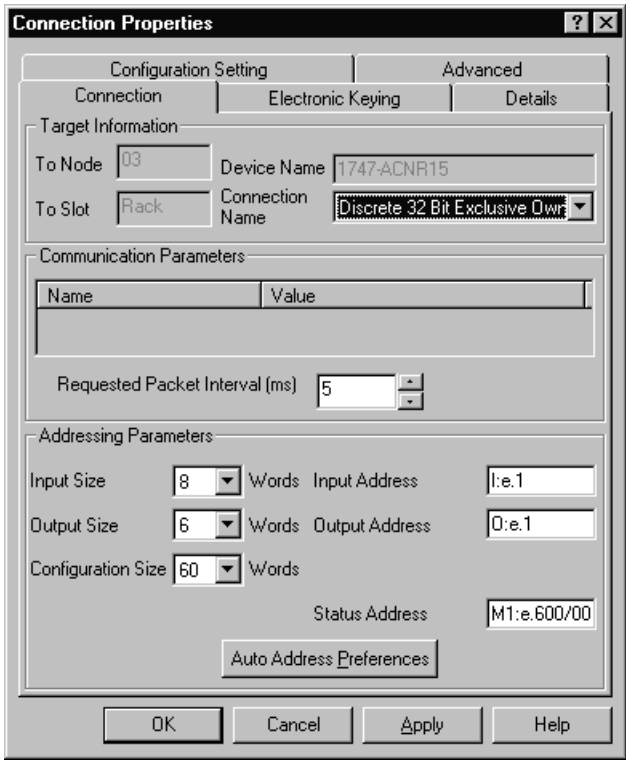
   You see the following screen:



The 1747-SCNR and 1747-ACNR15 are shown as nodes 1 and 3, respectively. The three I/O modules are under the 1747-ACNR15 in slots 1 through 3 of the 1747-ACNR15 chassis.

3. In order to establish a 16-bit rack connection to the 1747-ACNR15 chassis, click with the right mouse button on the 1747-ACNR15 and choose **Insert Connection**.

You see the following window.



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

The Connection Name by default is Discrete 16 Bit Exclusive Owner. This is the 16-bit rack connection we want. The first available I/O addresses are I:3.1 and O:3.1, where the 1747-SCNR is in slot 3 of the processor chassis. The first available starting I/O addresses have been placed into the Input Address and Output Address fields, because automatic addressing was previously selected in the "Auto Address Preference" screen.

Words I:3.0 and O:3.0 are reserved. Note that the input data from the 1746-IA16 will be found in the processor's input image word I:3.3, the output data written to the 1746-OB16 module will be from the processor's output image word O:3.2.

Important: There is a two word offset for input data for rack connections. Therefore, for this example, the input data for the input module in slot 1 of the remote 1747-ACNR15 chassis will be written to I:3.3 in the SLC processor's input image.

The starting input address configured in **RS**NetWorx for ControlNet for this rack connection was I:3.1, but I:3.1 and I:3.2 are used for status information. Therefore, the actual input data begins after the two words of status information. I:3.4 is not used in this example because an output module resides in slot 2.

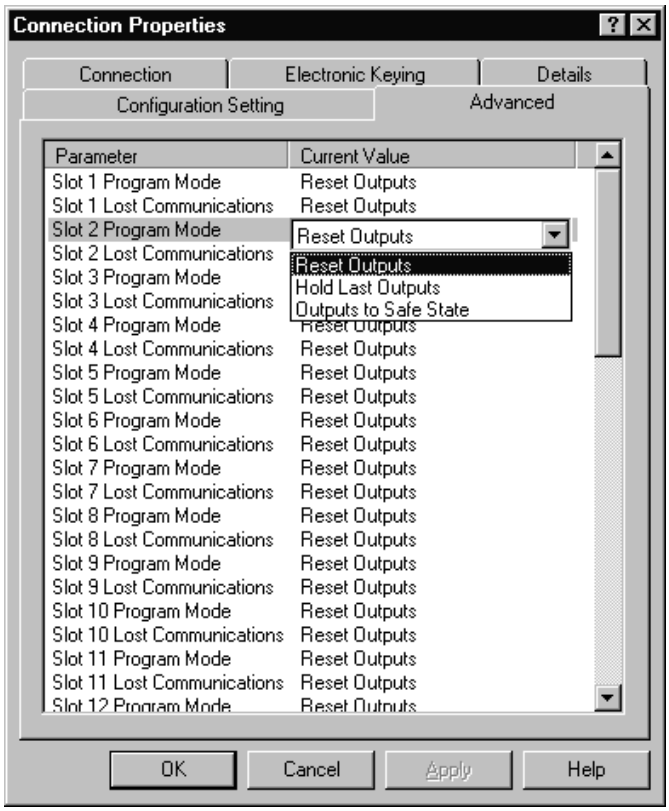
Also, note that there is no offset for the outputs in a rack connection. O:3.2 is the output image word written to the output module located in slot 2 or the 1747-ACNR15 chassis. In addition, no offset applies to module connections at all. For this example, the input and output data for the 1746-NIO4V is located in M1:3.3, M1:3.4, M0:3.3, and MO:3.4. M1:3.3 and MO:3.3 are the starting addresses entered in **RS**NetWorx for ControlNet for the module connection.

You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor for each unique connection. The bit address for this field must be an even number, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the starting address chosen is the first available bit, M1:3.600/00.

You have successfully configured a rack connection to the remote chassis to communicate with the two discrete I/O modules. At this point, you may also configure the state of the outputs in the remote ControlNet Chassis when the processor is placed into the Program Mode or if communications is lost to the remote chassis. This is optional. The default is to turn all outputs off when one of the two conditions occur. To select other options:

a. Click on the Advanced tab in the "Connection Properties" window.

You see the following window.



By default, outputs in all slots in the remote chassis are reset if the processor is placed into the Program mode or if communications is lost for any reason. Two other choices are offered:

- Hold Last State - all outputs will remain in their last state if one of the two conditions occur
- Safe State - allows you to choose the state of each output

If Safe State is selected, you must click on the Configuration Settings tab and enter your Safe State data for each output word in decimal. Then, whenever the SLC processor is placed into the Program Mode or if communications is lost to the 1747-ACNR15 adapter, the outputs will revert to the Safe State data you entered for each output word.

b. Click APPLY.

c. Click OK to return to the “Scanlist Configuration” screen.

Configure a Module Connection

Next, we need to configure a module connection for the 1746-NIO4V, 2 input/2 output module.

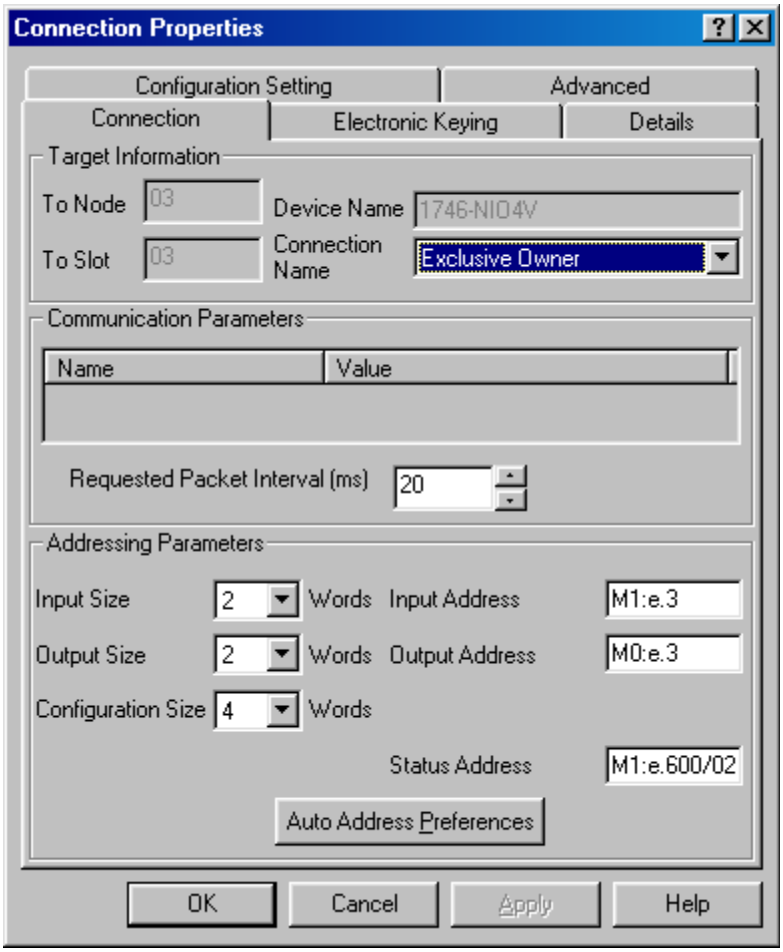
1. Click with the right mouse button on the 1746-NIO4V module in the "Scanlist Configuration" window.

2. Select **Insert Connection**.

   A Connection Properties window appears.

3. Choose Exclusive Owner for the connection name.

   For this example, we must choose M-file addresses for our 2 input/2 output analog module. The first available M-file addresses are M1:3.3 and M0:3.3. Words 0 through 2 are reserved. The next available Status Address is M1:3.600/02, since bits 0 and 1 are used for the rack connection. The Connection Properties window for the module connection should look like the following:

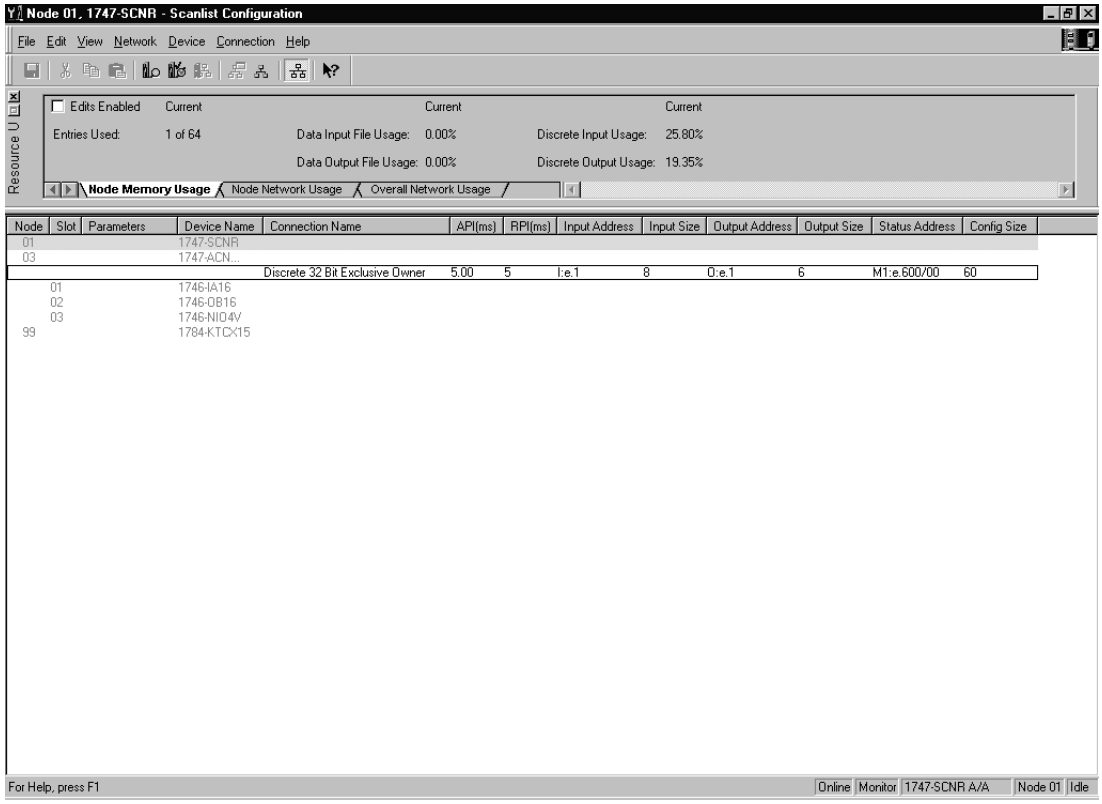


At this point, the state of the two analog outputs should be determined and set in the Advanced and Configuration Settings tabs in the "Connection Properties" window for this module connection, provided you do not want the default settings of 0 decimal. This is the same as we did for discrete outputs for the rack connection. This merely determines the state of the two analog outputs when the SLC processor is placed in the Program mode or if communications is lost to the 1747-ACNR15.

4. Click APPLY.

5. Click OK.

   The "Connection Properties" window closes and the "Scanlist Configuration" window appears and looks like the following.



You have successfully configured your two connections to read/write data between the SLC processor and the remote ControlNet chassis. All that remains is to save the configuration to the network keeper, which in this case is the 1747-SCNR.

1. Click on the Save icon or click the **File** menu and choose **Save.**

   You will be prompted to "Optimize and re-write schedule for all connections".

2. Click OK.

3. Click YES.

   Your network configuration information will now be written to the network keeper.

   The display on the front of your 1747-SCNR should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs should be solid green and the B LED should be off, unless you are using the redundant media option, which is not being used in this example. The 1747-ACNR15 should be displaying that it is active (ACTV) and its LEDs should be solid green for A and OK and the B LED should be off.

Creating a Ladder Program

The final step is to write a ladder program for the SLC processor, including configuring the 1747-SCNR for slot 3 of the processor's chassis.

1. After downloading the program to your processor, place it into the Run mode.

   Your program should now be able to read data from the 1746-IA16 in word I:3.3 and write to the 1746-OB16 in word O:3.2. The analog input data will reside in words M1:3.3 and M1:3.4, while the analog output data must be placed in words M0:3.3 and M0:3.4.

   Note that your ladder program should also contain an unconditional rung with an OTE instruction addressed to the 1747-SCNR scanner's Run/Idle bit, O:3.0/10 for this example. When the SLC processor is placed into the Run mode, this rung will set the 1747-SCNR scanner's Run/Idle bit and place the scanner into the Run mode as well. The scanner will begin executing the configured connections when the Run/Idle bit is set.

Example 3: Configure the 1747-SCNR with the 1746-NI8 Analog Input Module

The following example discusses how to configure the 1747-SCNR scanner with the 1746-NI8 analog input module.

Hardware Setup

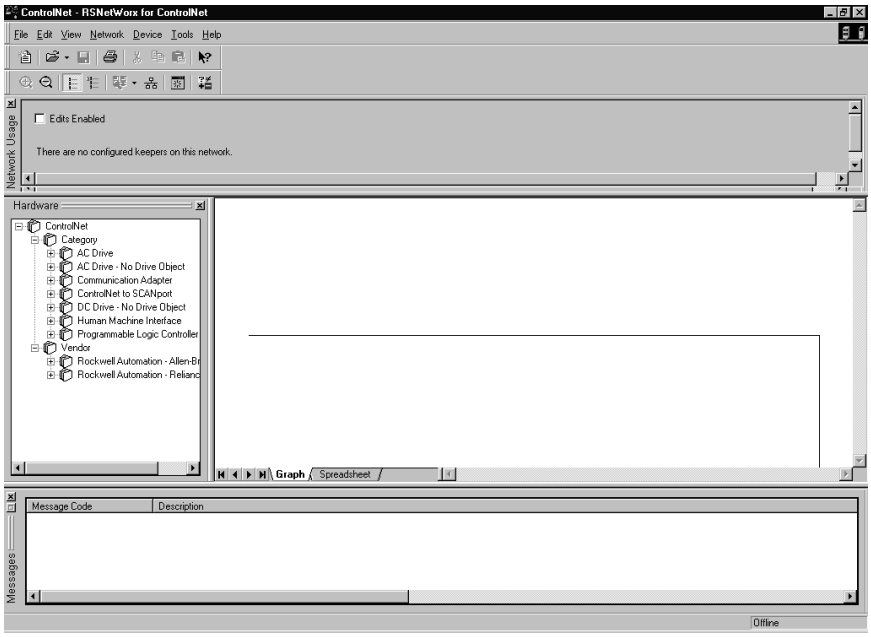
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes a 1747-ACNR15 in slot 0, 1746-IA16 in slot 1, 1746-OB16 in slot 2, and 1746-NI8 in slot 3.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

   You see this screen:



   At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

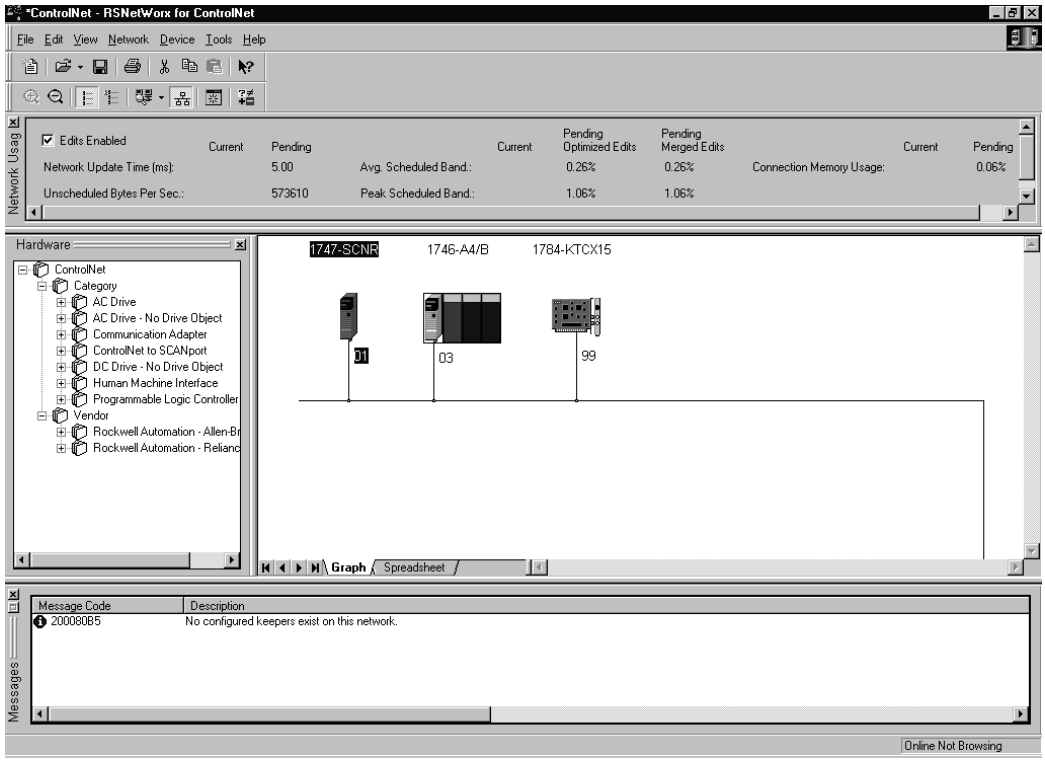
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

You see the “Browse for Network” window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



Node 1 is the 1747-SCNR and node 3 is the 1747-ACNR15. The 1747-ACNR15 resides in slot 0 of its chassis, while slot 1 contains a 1746-IA16, slot 2 contains a 1746-OB16, and slot 3 contains a 1746-NI8. For this example, two separate ControlNet connections will be configured. The first will be a Discrete 16 Bit Exclusive Owner rack connection for the two discrete I/O modules. The second will be a Module Connection to the 1746-NI8 8 input analog module. Before we create this connection, we should verify the chassis configuration for the 1747-ACNR15. To do this:

5. Click the right mouse button on the 1747-ACNR15.

6. Choose **Edit Chassis** and verify that the chassis configuration is as follows:
   - slot 0: 1747-ACNR15
   - slot 1: 1746-IA16
   - slot 2: 1746-OB16
   - slot 3: 1746-NI8

   If the chassis is not already configured, manually configure it by dragging the appropriate modules from the list on the right to the proper slot on the left of the chassis configuration screen. When this is complete, click APPLY and then OK.

Configure a Rack Connection

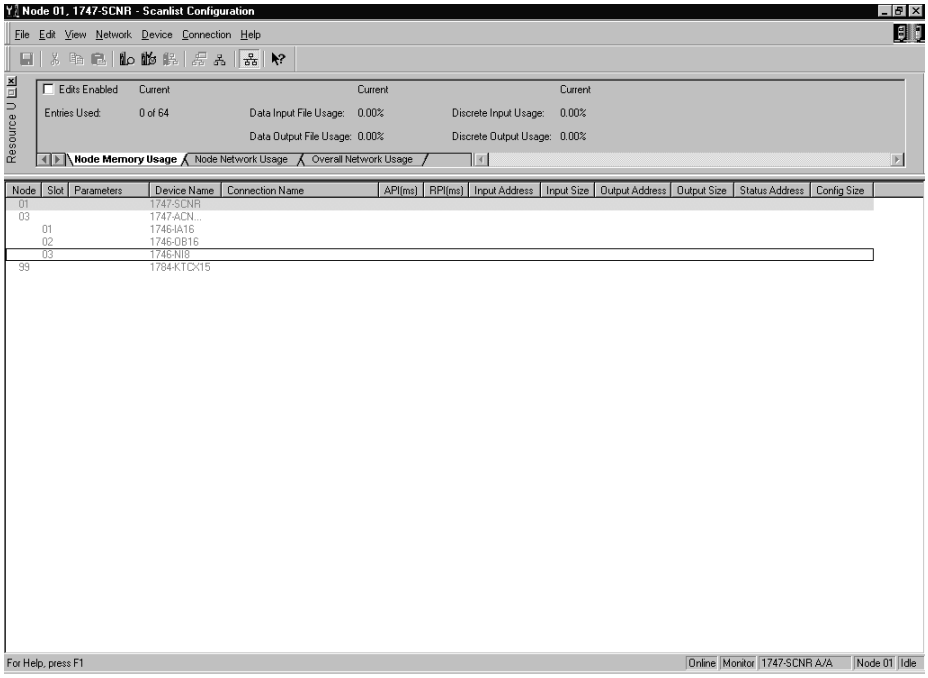
We are now ready to configure the necessary ControlNet connections so we can read/write data from the SLC processor to the discrete I/O modules and to the analog I/O module.

1. Click with the right mouse button on the 1747-SCNR and choose **Scanlist Configuration**.

   You will be prompted to enter the edit mode.

2. Click YES.

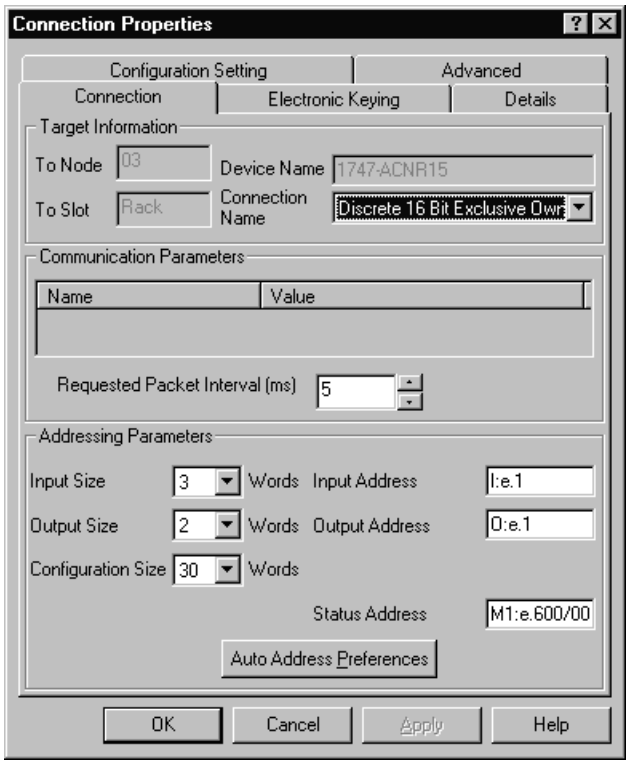
   You see the following screen:



The 1747-SCNR and 1747-ACNR15 are shown as nodes 1 and 3, respectively. The three I/O modules are under the 1747-ACNR15 in slots 1 through 3 of the 1747-ACNR15 chassis.

3. In order to establish a 16-bit rack connection to the 1747-ACNR15 chassis, click with the right mouse button on the 1747-ACNR15 and choose **ControlNet Configuration**.

You see the following window.



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

The Connection Name by default is Discrete 16 Bit Exclusive Owner. This is the 16-bit rack connection we want. The first available I/O addresses are I:3.1 and O:3.1, where the 1747-SCNR is in slot 3 of the processor chassis. The first available starting I/O addresses have been placed into the Input Address and Output Address fields, because automatic addressing was previously selected in the "Auto Address Preference" screen.

Words I:3.0 and O:3.0 are reserved. Note that the input data from the 1746-IA16 will be found in the processor's input image word I:3.3. The output data written to the 1746-OB16 module will be from the processor's output image word O:3.2.

Important: There is a two word offset for input data for rack connections. Therefore, for this example, the input data for the input module in slot 1 of the remote 1747-ACNR15 chassis will be written to I:3.3 in the SLC processor's input image.

The starting input address configured in **RS**NetWorx for ControlNet for this rack connection was I:3.1, but I:3.1 and I:3.2 are used for status information. Therefore, the actual input data begins after the two words of status information. I:3.4 and I:3.5 are not used in this example because an output module resides in slot 2 and an analog module resides in slot 3.

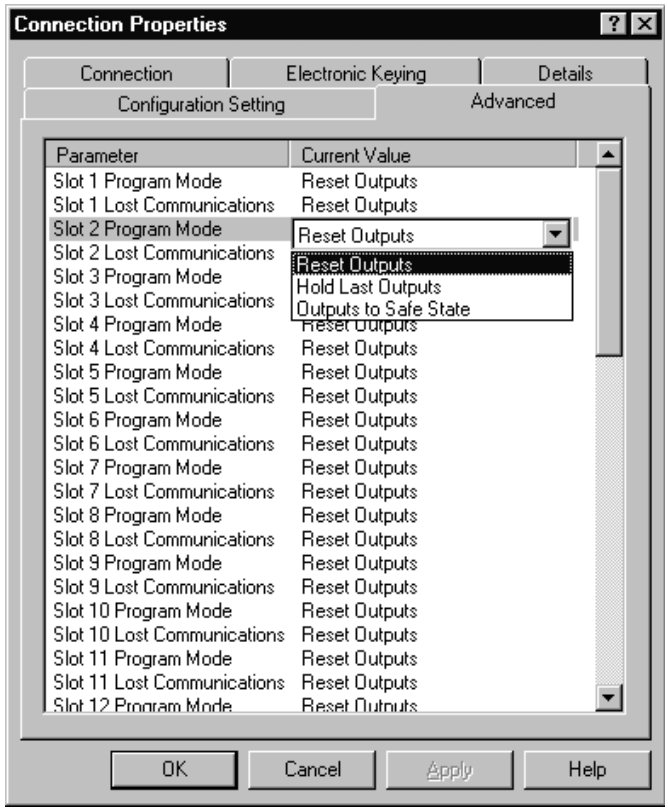
Also, note that there is no offset for the outputs in a rack connection. O:3.2 is the output image word written to the output module located in slot 2 of the 1747-ACNR15 chassis. In addition, no offset applies to module connections at all.

You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor for each unique connection. The bit address for this field must be an even number, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the starting address chosen is the first available bit pair, M1:3.600/00.

You have successfully configured a rack connection to the remote chassis to communicate with the two discrete I/O modules. At this point, you may also configure the state of the outputs in the remote ControlNet Chassis when the processor is placed into the Program Mode or if communications is lost to the remote chassis. This is optional. The default is to turn all outputs off when one of the two conditions occur. To select other options:

1. Click on the Advanced tab in the "Connection Properties" window.

   You see the following window:



   By default, outputs in all slots in the remote chassis are reset if the processor is placed into the Program mode or if communications is lost for any reason. Two other choices are offered:

- Hold Last State - all outputs will remain in their last state if one of the two conditions occur
- Safe State - allows you to choose exactly the state of each output

If Safe State is selected, you must click on the Configuration Settings tab and enter your Safe State data for each output word in decimal. Then, whenever the SLC processor is placed into the Program Mode or if communications is lost to the 1747-ACNR15 adapter, the outputs will revert to the Safe State data you entered for each output word.

2. Click APPLY.

3. Click OK to accept the rack connection.

Configure a Module Connection

Next, we need to configure a module connection for the 1746-NI8 input analog module.

1. Click with the right mouse button on the 1746-NI8 module in the "Scanlist Configuration" window.

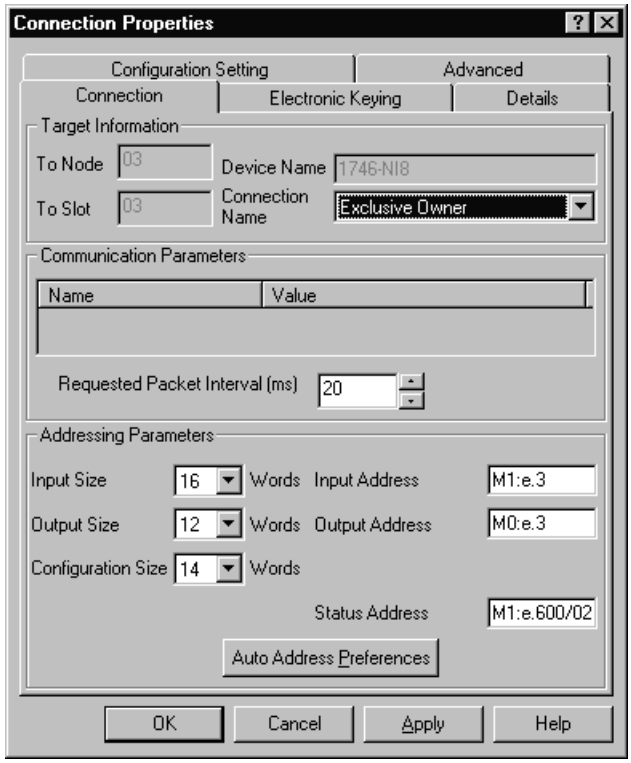
2. Select **Insert Connection**.

   A Connection Properties window appears.

3. Choose Exclusive Owner for the connection name.

   For this example, we must choose M-file addresses for our 8 input analog module. The 1746-NI8 module must use Class 3 operation in a 1747-ACNR15 chassis. It requires 12 output words and 16 input words. M-file words will be used for this in the 1747-SCNR. M0:3.3 through M0:3.14 will be used for the 12 output words used to configure the module and M1:3.3 through M1:3.18 are used for the input information, including actual analog data and analog channel status. Please refer to the SLC 500™ Analog Input Module User Manual, publication number 1746-6-8 for additional information on this module. M-file words M1:3.0, M1:3.1, M1:3.2, M0:3.0, M0:3.1, and M0:3.2 are reserved. The next available status address is M1:3.600/02, since bits 0 and 1 are used for the rack connection.

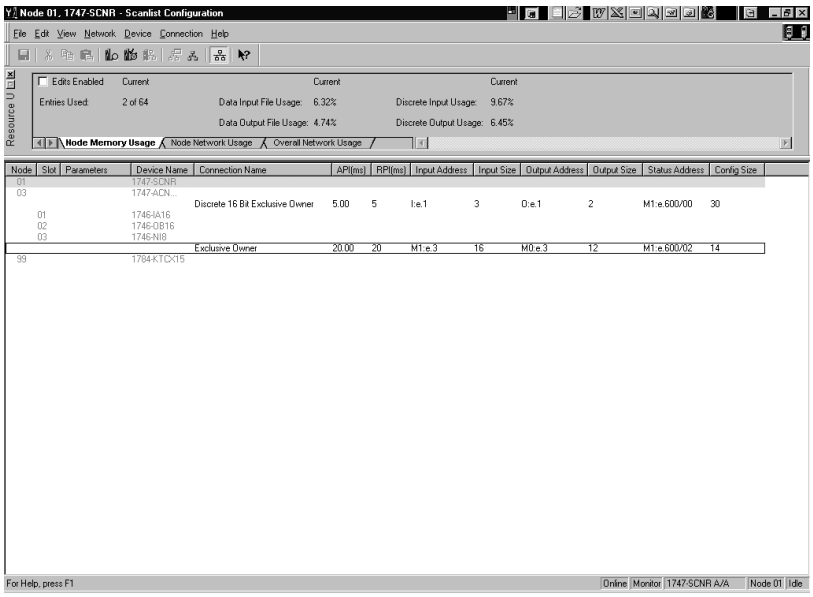
The Connection Properties window for the module connection should look as follows:



4. Click APPLY.

5. Click OK.

The "Connection Properties" window closes and the "Scanlist Configuration" window appears and looks as follows:



You have successfully configured your two connections to read/write data between the SLC processor and the remote ControlNet chassis. All that remains is to save the configuration to the network keeper, which in this case is the 1747-SCNR.

1. Click on the Save icon or choose the **File** menu and then **Save**.

   You will be prompted to "Optimize and re-write schedule for all connections".

2. Click OK.

3. Click YES to the warning message.

   Your network configuration information will now be written to the network keeper.

   The display on the front of your 1747-SCNR should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs are solid green and the B LED are off, unless you are using the redundant media option, which is not being used in this example. The 1747-ACNR15 is displaying that it is active (ACTV) and its LEDs are solid green for A and OK and the B LED is off.

Creating a Ladder Program

The final step is to write a ladder program for the SLC processor, including configuring the 1747-SCNR for slot 3 of the processor's chassis.

- After downloading the program to your processor, place it into the Run mode.

  Your program should now be able to read data from the 1746-IA16 in word I:3.3 and write to the 1746-OB16 in word O:3.2. The analog input data and channel status will reside in words M1:3.3 and M1:3.18, while the analog module configuration data must be placed in words M0:3.3 and M0:3.14.

  Note that your ladder program should also contain an unconditional rung with an OTE instruction addressed to the 1747-SCNR scanner's Run/Idle bit, O:3.0/10 for this example. When the SLC processor is placed into the Run mode, this rung will set the 1747-SCNR scanner's Run/Idle bit and place the scanner into the Run mode as well. The scanner will begin executing the configured connections when the Run/Idle bit is set.

Example 4: Configure the 1747-SCNR with the 1746-BAS Series B Interface Module

The following example discusses how to configure the 1747-SCNR scanner with the 1746-BAS Series B interface module.

Hardware Setup

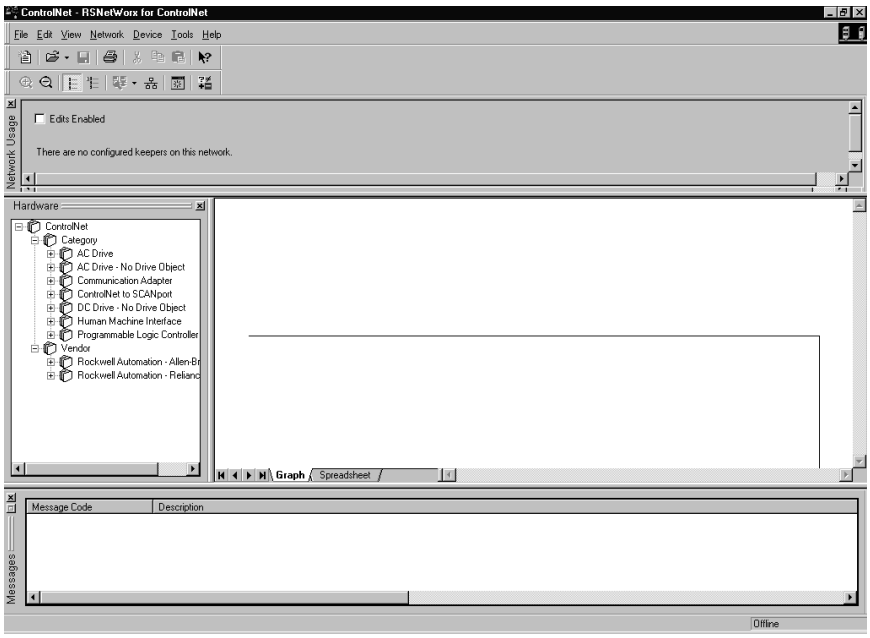
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes a 1747-ACNR15 in slot 0, 1746-IA16 in slot 1, 1746-OB16 in slot 2, and 1746-BAS in slot 3.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

   You see this screen:



   At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

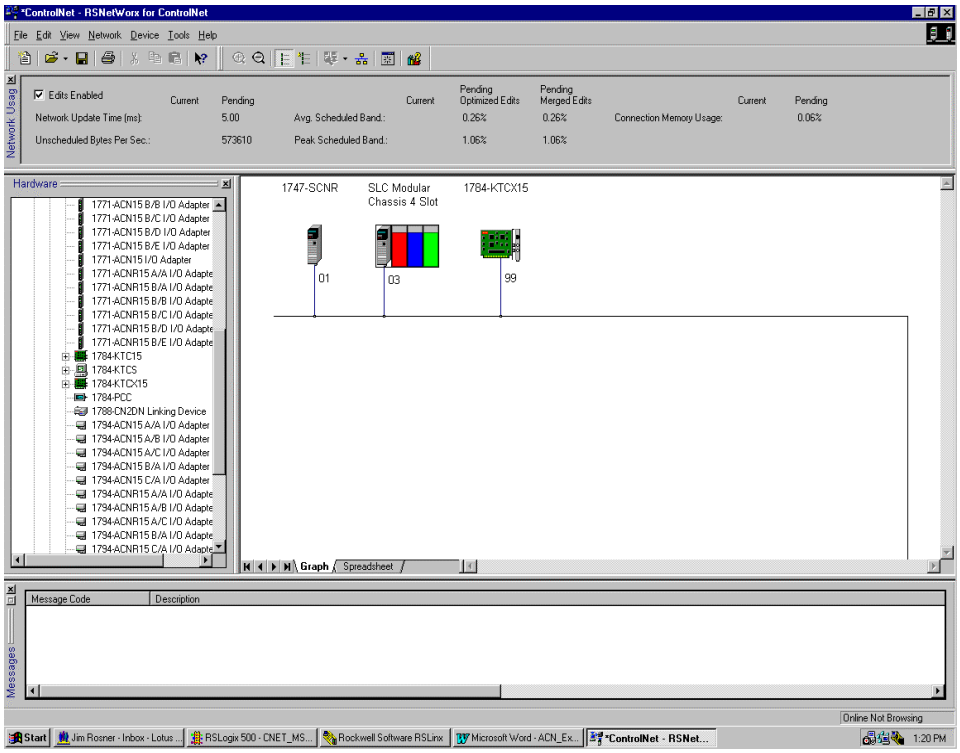
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

   You see the "Browse for Network" window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

   The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



   Node 1 is the 1747-SCNR and node 3 is the 1747-ACNR15. The 1747-ACNR15 resides in slot 0 of its chassis, while slot 1 contains a 1746-IA16, slot 2 contains a 1746-OB16, and slot 3 contains a 1746-BAS. For this example, two separate ControlNet connection will be configured. The first will be a Discrete 16 Bit Exclusive Owner rack connection for the two discrete I/O modules. The second will be an Exclusive Owner - Advanced Module Connection to the 1746-BAS module. Before we create these connections, we should verify the chassis configuration for the 1747-ACNR15.

To do this:

5. Click the right mouse button on the 1747-ACNR15.

6. Choose **Edit Chassis** and verify that the chassis configuration is as follows:
   - slot 0: 1747-ACNR15
   - slot 1: 1746-IA16
   - slot 2: 1746-OB16
   - slot 3: 1746-BAS

   If the chassis is not already configured, manually configure it by dragging the appropriate modules from the list on the right to the proper slot on the left of the chassis configuration screen. When online, the software reads the module types for you. When this is complete, click APPLY and then OK.

Configure a Rack Connection

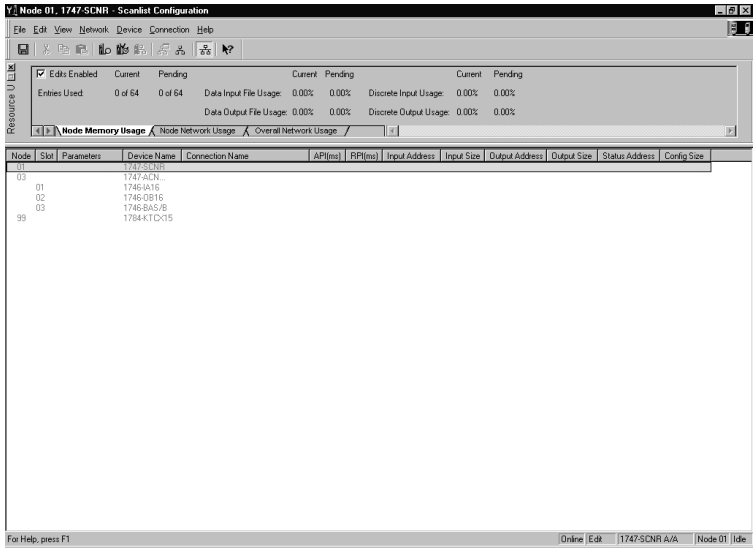
We are now ready to configure the necessary ControlNet connection so we can read/write data from the SLC processor to the discrete I/O modules and to the analog I/O module.

1. Click with the right mouse button on the 1747-SCNR and choose **Scanlist Configuration**.

   You will be prompted to enter the edit mode.

2. Click YES.

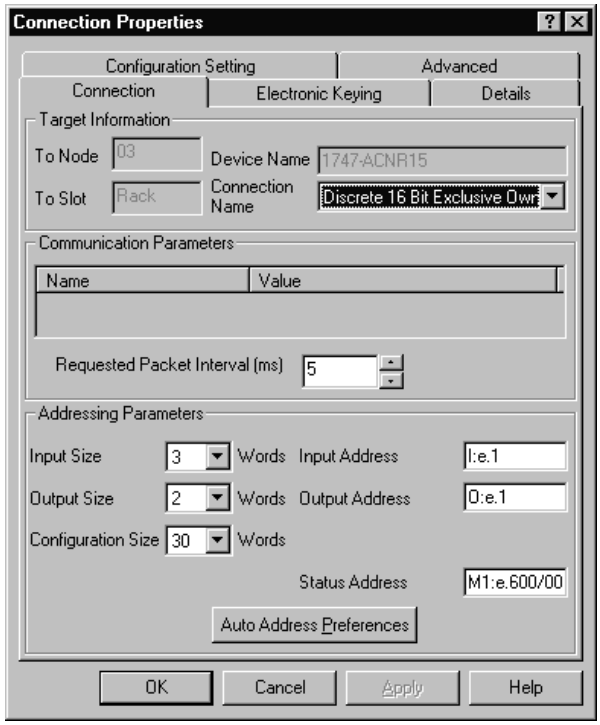
   You see the following screen:



The 1747-SCNR and 1747-ACNR15 are shown as nodes 1 and 3, respectively. The three I/O modules are under the 1747-ACNR15 in slots 1 through 3 of the 1747-ACNR15 chassis.

3. In order to establish a 16-bit rack connection to the 1747-ACNR15 chassis, click with the right mouse button on the 1747-ACNR15 and choose **Insert Connection**.

You see the following window:



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

The Connection Name by default is Discrete 16 Bit Exclusive Owner. This is the 16-bit rack connection we want. The first available I/O addresses are I:3.1 and O:3.1, where the 1747-SCNR is in slot 3 of the processor chassis. The first available starting I/O addresses have been placed into the Input Address and Output Address fields by **RS**NetWorx for ControlNet, because automatic addressing was previously selected in the "Auto Address Preference" screen.

Words I:3.0 and O:3.0 are reserved. Note that the input data from the 1746-IA16 will be found in the processor's input image word I:3.3, the output data written to the 1746-OB16 module will be from the processor's output image word O:3.2.

Important: There is a two word offset for input data for rack connections. Therefore, for this example, the input data for the input module in slot 1 of the remote 1747-ACNR15 chassis will be written to I:3.3 in the SLC processor's input image.

The starting input address configured in **RS**NetWorx for ControlNet for this rack connection was I:3.1, but I:3.1 and I:3.2 are used for status information. Therefore, the actual input data begins after the two words of status information. I:3.4 is not used in this example because an output module resides in slot 2.

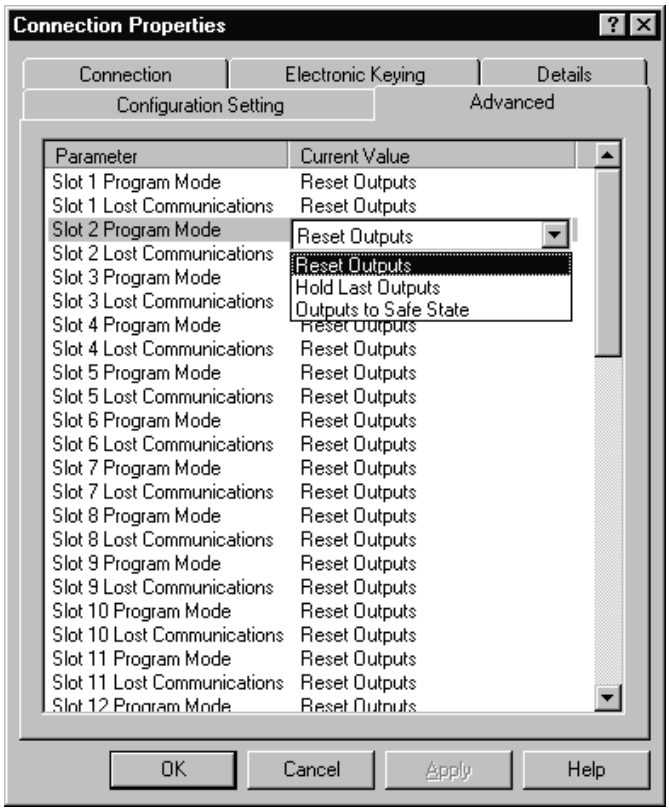
Also, note that there is no offset for the outputs in a rack connection. O:3.2 is the output image word written to the output module located in slot 2 of the 1747-ACNR15 chassis. In addition, no offset applies to module connections at all.

You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor for each unique connection. The bit addresses for this field must be even numbers, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the starting address chosen is the first available bit pair, M1:3.600/00.

You have successfully configured a rack connection to the remote chassis to communicate with the two discrete I/O modules. At this point, you may also configure the state of the outputs in the remote ControlNet chassis when the processor is placed into the Program Mode or if communications is lost to the remote chassis. This is optional. The default is to turn all outputs off when one of the two conditions occur. To select other options:

1. Click on the Advanced tab in the "Connection Properties" window.

You see the following window.



By default, outputs in all slots in the remote chassis are reset if the processor is placed into the Program mode or if communications is lost for any reason. Two other choices are offered:

- Hold Last State - all outputs will remain in their last state if one of the two conditions occur
- Safe State - allows you to choose exactly the state of each output

If Safe State is selected, you must click on the Configuration Settings tab and enter your Safe State data for each output word in decimal. Then, whenever the SLC processor is placed into the Program Mode or if communications is lost to the 1747-ACNR15 adapter, the outputs will revert to the Safe State data you entered for each output word.

2. Click APPLY.

3. Click OK to accept the rack connection.

Configure a Module Connection

Next, we need to configure a module connection for the 1746-BAS module.

1. Click with the right mouse button on the 1746-BAS module in the "Scanlist Configuration" window.

2. Select **Insert Connection**.

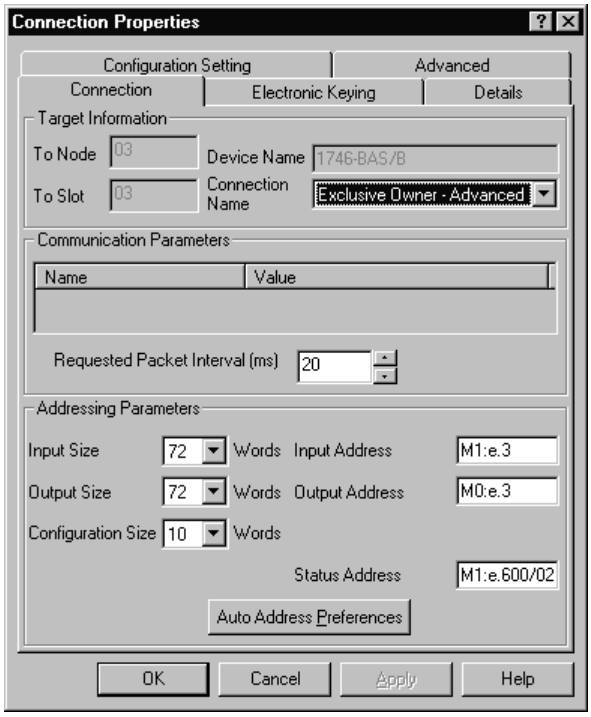
   A "Connection Properties" window appears.

3. Choose Exclusive Owner - Advanced for the connection name.

   For this example, we must choose M-file addresses for this type of connection. The series B module communicates via eight I/O words and 64 M1 and 64 M0 file words. These Basic module M-file words are independent of the 72 M-file words transferred to and from the Basic module. These 72 M0 and 72 M1 file words reside in the 1747-SCNR and are used to store the data sent to the 1747-ACNR15 from the SLC-5/04 processor and to store the data received from the 1747-ACNR15 for the SLC-5/04 processor.

   The M0-file words in the 1747-SCNR, which are assigned in the "Connection Properties" screen, are M0:3.3 through M0:3.74. These are the 72 words sent from the SLC-5/04 processor to the 1747-SCNR. Words M1:3.3 through M1:3.74 are the 72 words received from the 1747-ACNR15. M-file words M1:3.0 through M1:3.2 and M0:3.0 through M0:3.2 are reserved (please refer to Chapter 2 of this manual for details). The next available Status Address is M1:3.600/02, since bits 0 and 1 are used for the rack connection.

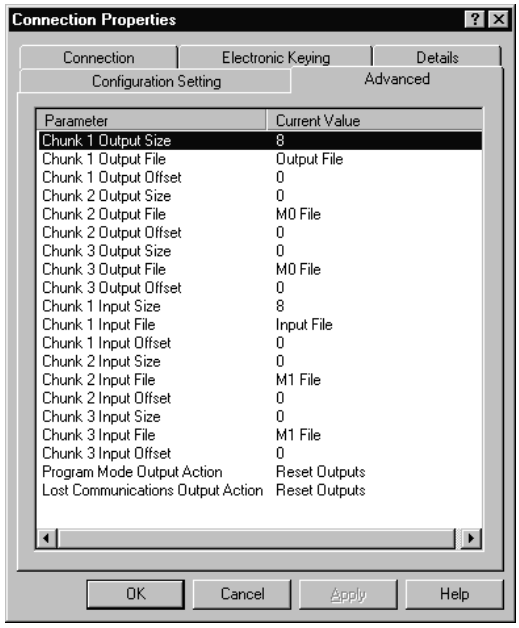
The “Connection Properties” window for the module connection should look like the following:



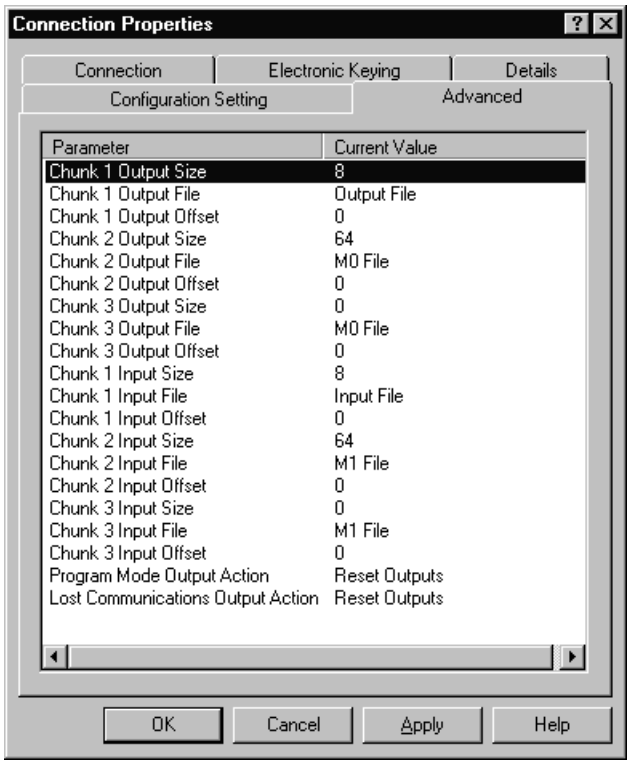
We now have to configure this connection for the eight I/O words and the 64 M0/M1 file words.

4. Click on the **Advanced** tab in the “Connection Properties” window.

You see this screen:



By default, the Chunk 1 Output File is the output image file for the Basic module and the Chunk 1 Input File is the input image file for the Basic module. We must then assign the Chunk 2 Output File as the Basic module's M0 file and the Chunk 2 Input File as the Basic module's M1 file. The size for each of these files is 64 words. The total number of words transferred bi-directional between the SLC processor and the Basic module will be 72. The first eight will be the Basic module's I/O image and the last 64 words will be the Basic module's M-file words. This order is determined by the Chunk numbers. This "Advanced" screen should then look as follows:

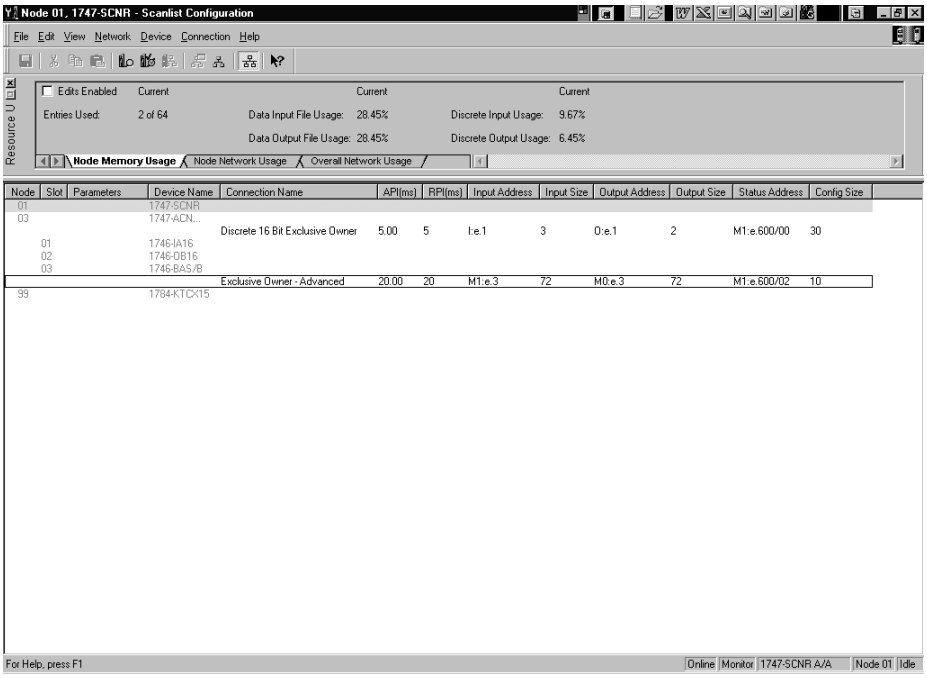


Safe State data is available under the Configuration Settings tab. For 1747-BAS module connections, it is recommended that outputs be reset to 0 when the SLC processor is placed into the Program mode or if communications is lost to the 1747-ACNR15. The Hold Last State option is not available for the 1747-BAS.

5. Click APPLY.

6. Click OK.

The “Connection Properties” window will close and the “Scanlist Configuration” window appears and looks as follows:.



You have successfully configured your two connections to read/write data between the SLC processor and the remote ControlNet chassis. All that remains is to save the configuration to the network keeper, which in this case is the 1747-SCNR.

1. Click on the Save icon or click on the **File** menu and then **Save**.

   You are prompted to “Optimize and re-write schedule for all connections”.

2. Click OK.

3. Click YES to the warning message.

   Your network configuration information is written to the network keeper.

   The display on the front of your 1747-SCNR should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs should be solid green and the B LED should be off, unless you are using the redundant media option, which is not being used in this example. The 1747-ACNR15 should be displaying that it is active (ACTV) and its LEDs should be solid green for A and OK and the B LED should be off.

Creating Ladder Logic and Basic Module Program

The final step is to write a ladder program for the SLC processor and a Basic program for the Basic module. After downloading the program to your processor and to your basic module, place the processor into the Run mode and run your Basic program as well. Your programs should now be able to read data from the 1746-IA16 in word I:3.3 and write to the 1746-OB16 in word O:3.2.

The attached basic program contains a CALL 23 interrupt CALL for PRT1 and a CALL 22 interrupt CALL for PRT2. The CALL 23 sends data out PRT1 when data is received from the SLC processor and CALL 22 transfers data sent in PRT2 to the SLC. Remember, the first eight words beginning with M1:3.3 and M0:3.3 are from the Basic module's Input and Output image. The following 64 words are from the Basic module's M1 and M0 files.

The handshaking required between the SLC processor and the Basic module to transfer data, is shown in the ladder logic program to follow. Refer to the 1746-BAS Module Floating Point Conversion Document Update, publication 1746-6.3 for a complete description of CALL 22 and 23, as well as the required handshaking. The only difference in the handshake logic when using these Basic module CALLs is that the I/O image words used for the handshaking are stored in the 1747-SCNR's M-files, so they appear as M-file addresses in the ladder logic instead of I/O addresses.

Connect an **RS**-232 cable between PRT1 and PRT2 on the Basic module. A 1747-CP3 cable will work for this purpose. When up to 64 words of data are placed into SLC processor's data table beginning at N12:0, it will be sent to the 1747-SCNR, then to the Basic module via ControlNet and the 1747-ACNR15 and will ultimately be sent out PRT1 of the BAS module. If you used a cable to loop the data back in PRT2, this data will be sent to the 1747-SCNR via ControlNet and will ultimately appear in the SLC processor's data table beginning with address N13:0.

Note that your ladder program should also contain an unconditional rung with an OTE instruction addressed to the 1747-SCNR scanner's Run/Idle bit, O:3.0/10 for this example. When the SLC processor is placed into the Run mode, this rung will set the 1747-SCNR scanner's Run/Idle bit and place the scanner into the Run mode as well. The scanner will begin executing the configured connections when the Run/Idle bit is set.

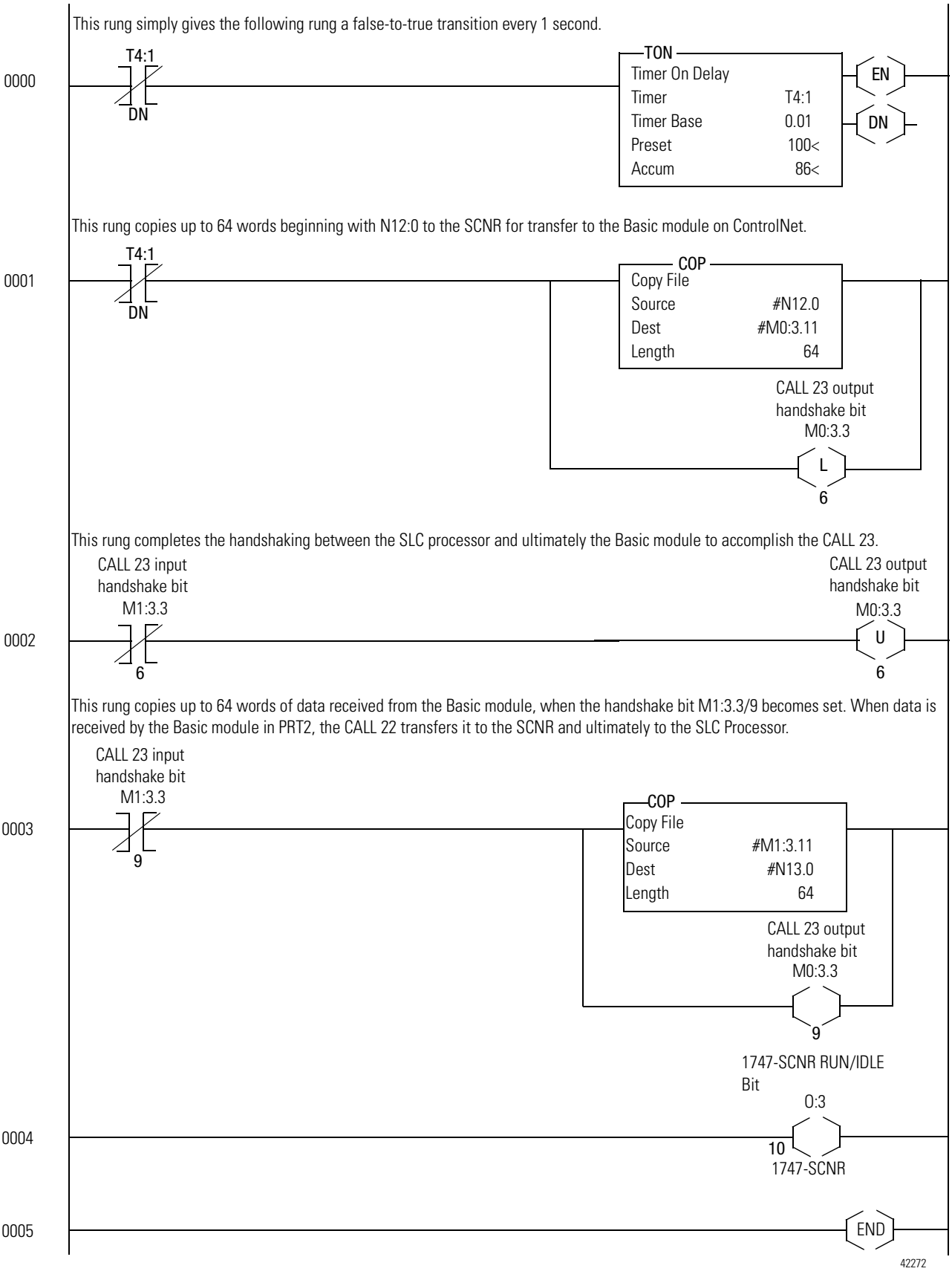
A sample Basic module program using CALL 23 for PT1 and CALL 22 for PRT2 follows, along with the necessary ladder logic to handshake with the module for these CALLs. When the SLC processor is placed into the Run mode, it will in turn place the 1747-SCNR into the Run mode as well by virtue of the unconditional OTE rung described above. When the Basic module is also placed into the Run mode, any data placed into the SLC processor's data table beginning with N12:0 will be sent to the 1747-SCNR, which will send it to the 1747-ACNR15 via ControlNet and then to the Basic module. The Basic module will send the data out PRT1 and this data will be looped right back in the Basic module's PRT2. The module will send the data to the 1747-ACNR15, which will send it to the 1747-SCNR via ControlNet. The SLC processor will then retrieve this data and place it into its data table beginning at N13:0.

Example of Basic Module Program

```
0 REM BTRAN V1.03, C:\ABBASIC\BDS\CNET_TST.BDL, 11-22-99
02:52pm
10 REM Test Program for CNET
20 MODE(PRT1,9600,N,8,1,N,R)
30 MODE(PRT2,9600,N,8,1,N,R)
40 PUSH 2
50 CALL 37
60 PUSH 2
70 CALL 96
80 REM CALL 23 for PRT1
90 PUSH 2
100 REM SEND DATA OUT PRT1
110 PUSH 1
120 REM GET DATA FROM M0 FILE
130 PUSH 0
140 REM NO OFFSET
150 PUSH 0
160 REM NO STRING USED
170 PUSH 1
180 REM ENABLE BYTE SWAPPING
190 CALL 23
200 POP S1
210 REM STATUS OF CALL 23 SETUP
220 IF (S1<>0) THEN P. "UNSUCCESSFUL CALL 23 SETUP"
230 REM CALL 22 FOR PRT2
240 PUSH 2
250 REM GET DATA FROM PRT2
260 PUSH 126
270 REM MAXIMUM OF 126 CHARACTERS PER TRANSFER
280 PUSH 13
290 REM CR TERMINATION CHARACTER
300 PUSH 1
```

```
310 REM SEND DATA TO M1 FILE
320 PUSH 0
330 REM NO OFFSET
340 PUSH O
350 REM NO STRING
360 PUSH 1
370 REM ENABLE BYTE SWAPPING
380 CALL 22
390 POP S2
400 REM CALL 22 SETUP STATUS
410 IF (S2<>0) THEN P. "UNSUCCESSFUL CALL 22 SETUP"
420 GOTO 420
```

The next page contains ladder logic to handshake with the module for CALLs 23 and 22.


This rung simply gives the following rung a false-to-true transition every 1 second.
0000
T4:1
DN
TON
Timer On Delay
Timer T4:1
Timer Base 0.01
Preset 100<
Accum 86<
EN
DN
This rung copies up to 64 words beginning with N12:0 to the SCNR for transfer to the Basic module on ControlNet.
0001
T4:1
DN
COP
Copy File
Source #N12.0
Dest #M0:3.11
Length 64
CALL 23 output handshake bit
M0:3.3
L
6
This rung completes the handshaking between the SLC processor and ultimately the Basic module to accomplish the CALL 23.
0002
CALL 23 input handshake bit
M1:3.3
6
CALL 23 output handshake bit
M0:3.3
U
6
This rung copies up to 64 words of data received from the Basic module, when the handshake bit M1:3.3/9 becomes set. When data is received by the Basic module in PRT2, the CALL 22 transfers it to the SCNR and ultimately to the SLC Processor.
0003
CALL 23 input handshake bit
M1:3.3
9
COP
Copy File
Source #M1:3.11
Dest #N13.0
Length 64
CALL 23 output handshake bit
M0:3.3
9
1747-SCNR RUN/IDLE Bit
O:3
10
1747-SCNR
0004
0005
END
42272

Example 5: Configure the 1747-SCNR with the 1794-IE4XOE2 Analog Combo Module

The following example discusses how to configure the 1747-SCNR scanner with the 1794-IE4XOE2 analog combo module.

Hardware Setup

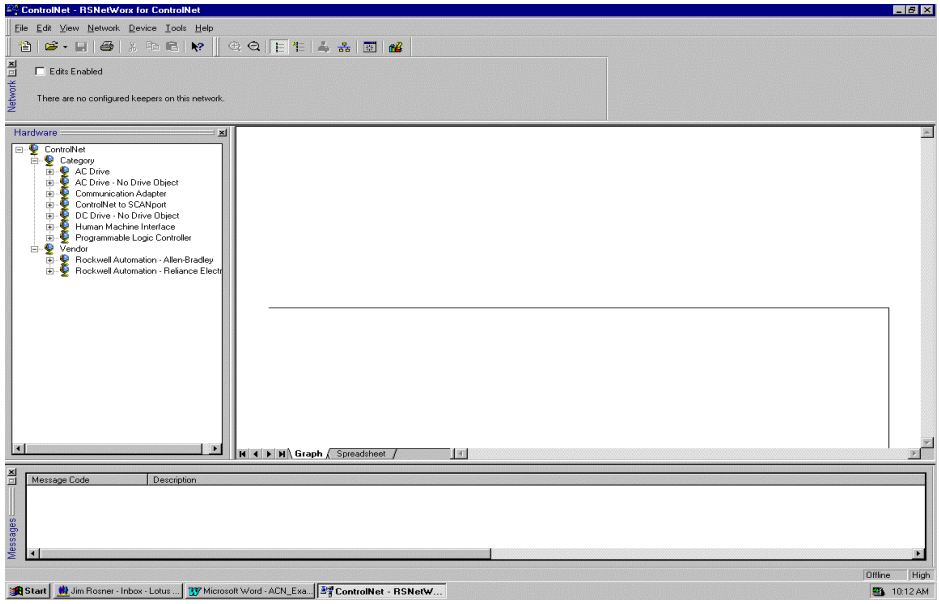
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes a 1794-ACNR15, a 1794-IB16 in slot 0, 1794-OB16 in slot 1, and 1794-IE4XOE2 in slot 2.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

   You see this screen:



At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

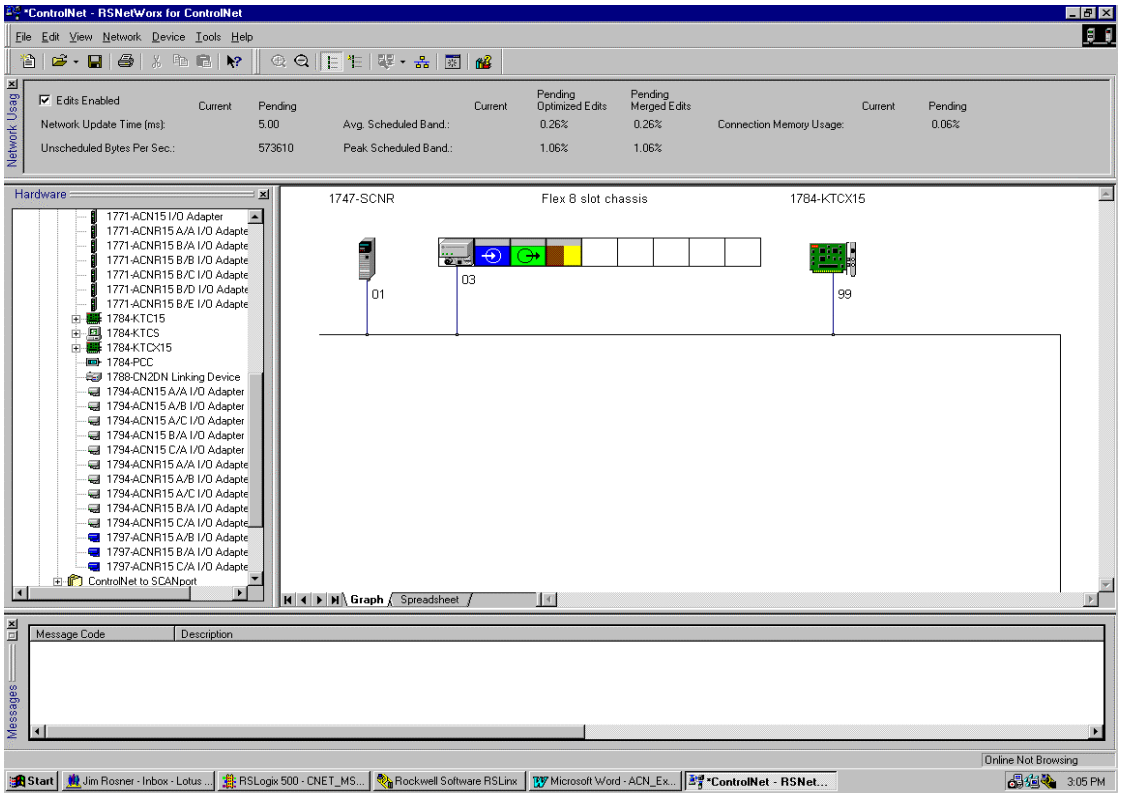
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

You see the "Browse for Network" window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



Node 1 is the 1747-SCNR and node 3 is the 1794-ACNR15. Slot 0 contains a 1794-IB16, slot 1 contains a 1794-OB16 and slot 2 contains a 1794-IE4XOE2. For this example, two separate ControlNet connection will be configured. The first will be a Discrete Exclusive Owner rack connection for the two discrete I/O modules. The second will be a Module Connection to the 1794-IE4XOE2 4 input/2 output analog module. Before we create these connections, we should verify the chassis configuration for the 1794-ACNR15. To do this:

5. Click the right mouse button on the 1794-ACNR15.

6. Choose **Edit Chassis** and verify that the chassis configuration is as follows:
   - : 1794-ACNR15
   - slot 0: 1794-IB16
   - slot 1: 1794-OB16
   - slot 2: 1794-IE4XOE2

   If the chassis is not already configured, manually configure it by dragging the appropriate modules from the list on the right to the proper slot on the left of the chassis configuration screen. When this is complete, click APPLY and then OK.

Configure a Rack Connection

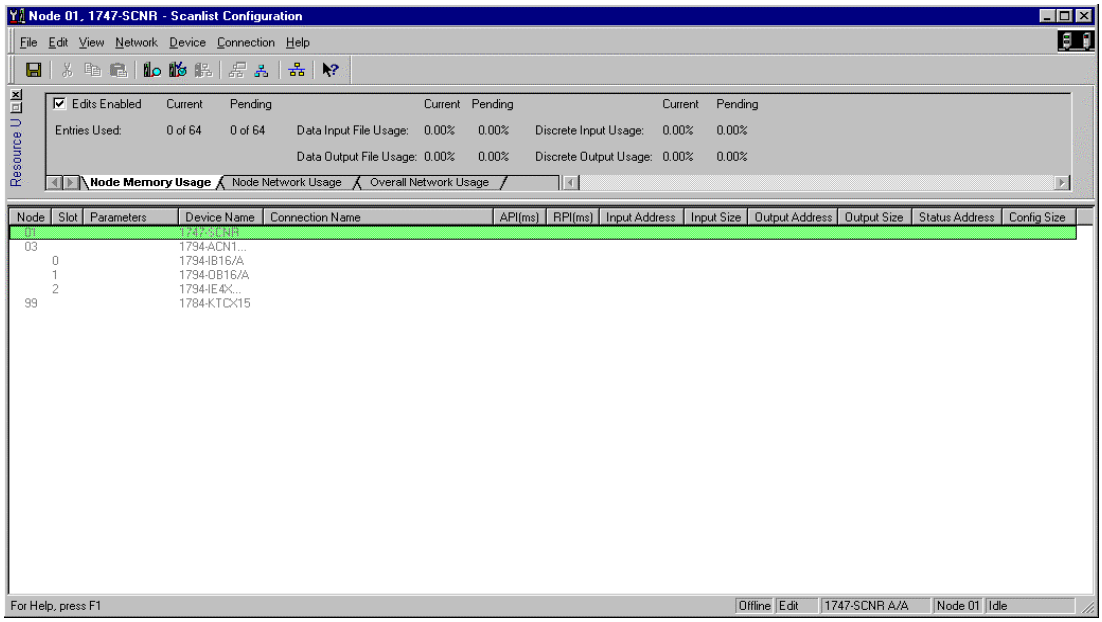
We are now ready to configure the necessary ControlNet connection so we can read/write data from the SLC processor to the discrete I/O modules and to the analog I/O module.

1. Click with the right mouse button on the 1747-SCNR and choose **Scanlist Configuration**.

   You will be prompted to enter the edit mode.

2. Click YES.

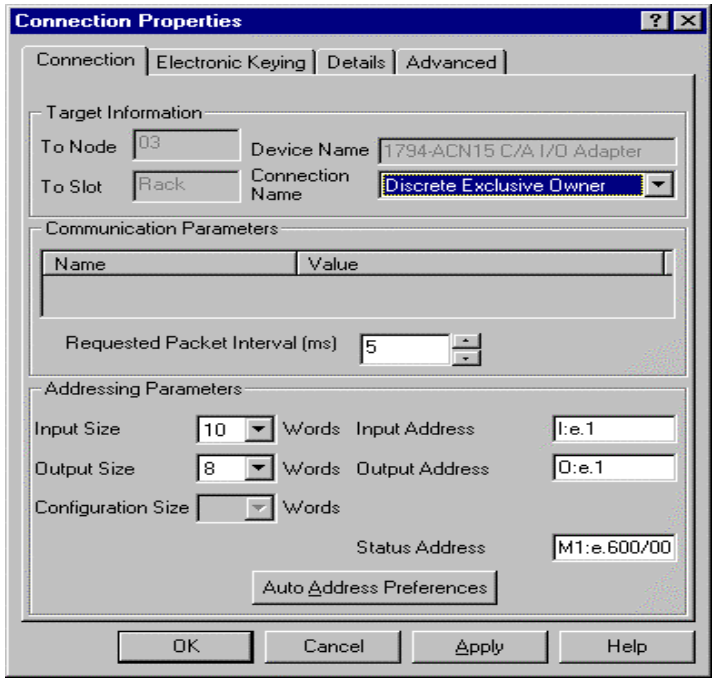
You see the following screen:



The 1747-SCNR and 1794-ACNR15 are shown as nodes 1 and 3, respectively. The three I/O modules are under the 1794-ACNR15 in slots 0 and 2 of the 1794-ACNR15 system.

3. In order to establish a 16-bit rack connection to the 1794-ACN515 chassis, click with the right mouse button on the 1794-ACNR15 and choose **Insert Connection**.

You see the following window.



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

The Connection Name by default is Discrete Exclusive Owner. This is the rack connection we want. The first available I/O addresses are I:3.1 and O:3.1, where the 1747-SCNR is in slot 3 of the processor chassis. The first available starting I/O addresses have been placed into the Input Address and Output Address fields by **RS**NetWorx for ControlNet, because automatic addressing was previously selected in the "Auto Address Preference" screen.

Words I:3.0 and O:3.0 are reserved. Note that the input data from the 1794-IB16 will be found in the processor's input image word I:3.3, the output data written to the 1794-OB16 module will be from the processor's output image word O:3.2.

Important: There is a two word offset for input data for rack connections and module connections when working with a 1794 Flex ControlNet adapter. Therefore, for this example, the input data for the input module in slot 0 of the remote 1794-ACNR15 system will be written to I:3.3 in the SLC processor's input image.

The starting input address configured in **RS**NetWorx for ControlNet for this rack connection was I:3.1, but I:3.1 and I:3.2 are used for status information. Therefore, the actual input data begins after the two words of status information. I:3.4 is not used in this example because an output module resides in slot 2.

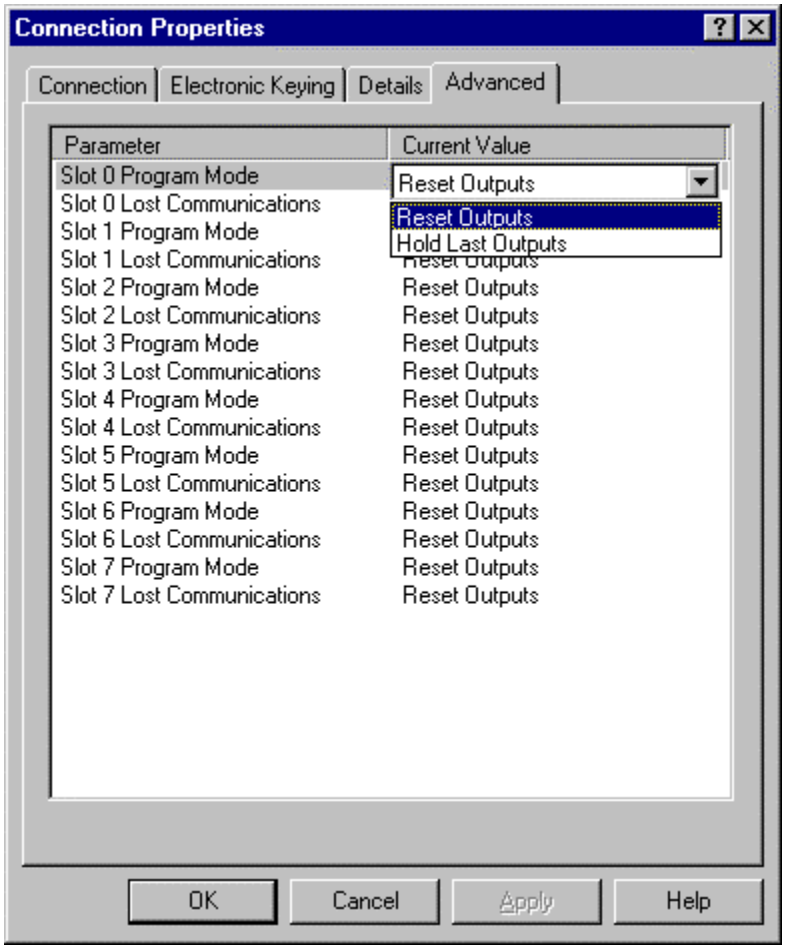
Also, note that there is no offset for the outputs in a rack connection. O:3.2 is the output image word written to the output module located in slot 1 of the 1794-ACNR15 chassis. In addition, this same offset scheme applies to module connections for Flex I/O on ControlNet. For this example, the input and output data for the 1794-IE4XOE2 is located in M1:3.5 through M1:3.8 and M0:3.3 and M0:3.4.

You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor for each unique connection. The bit addresses for this field must be an even number, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the starting address chosen is the first available bit pair, M1:3.600/00.

You have successfully configured a rack connection to the remote Flex adapter to communicate with the two discrete I/O modules. At this point, you may also configure the state of the outputs in the remote ControlNet chassis when the processor is placed into the Program Mode or if communications is lost to the remote chassis. This is optional. The default is to turn all outputs off when one of the two conditions occur. To select other options:

1. Click on the Advanced tab in the "Connection Properties" window.

   You see the following window.



By default, outputs in all slots in the remote chassis are reset if the processor is placed into the Program mode or if communications is lost for any reason. The other choice offered is Hold Last State, which means all outputs will remain in their state should one of the two conditions occur.

2. Click APPLY.

3. Click OK to return to the "Scanlist Configuration" screen.

Configure a Module Connection

Next, we need to configure a module connection for the 1794-IE4XOE2 4-input/2-output analog module.

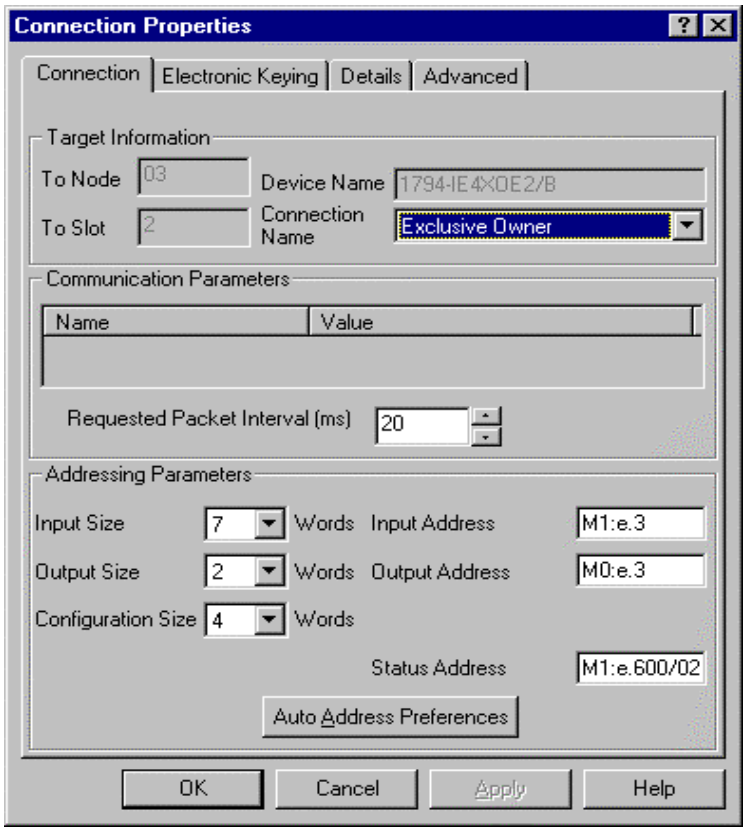
1. Click with the right mouse button on the 1794-IE4XOE2 module in the "Scanlist Configuration" window.

2. Select **Insert Connection**.

   A "Connection Properties" window appears.

3. Choose Exclusive Owner for the connection name.

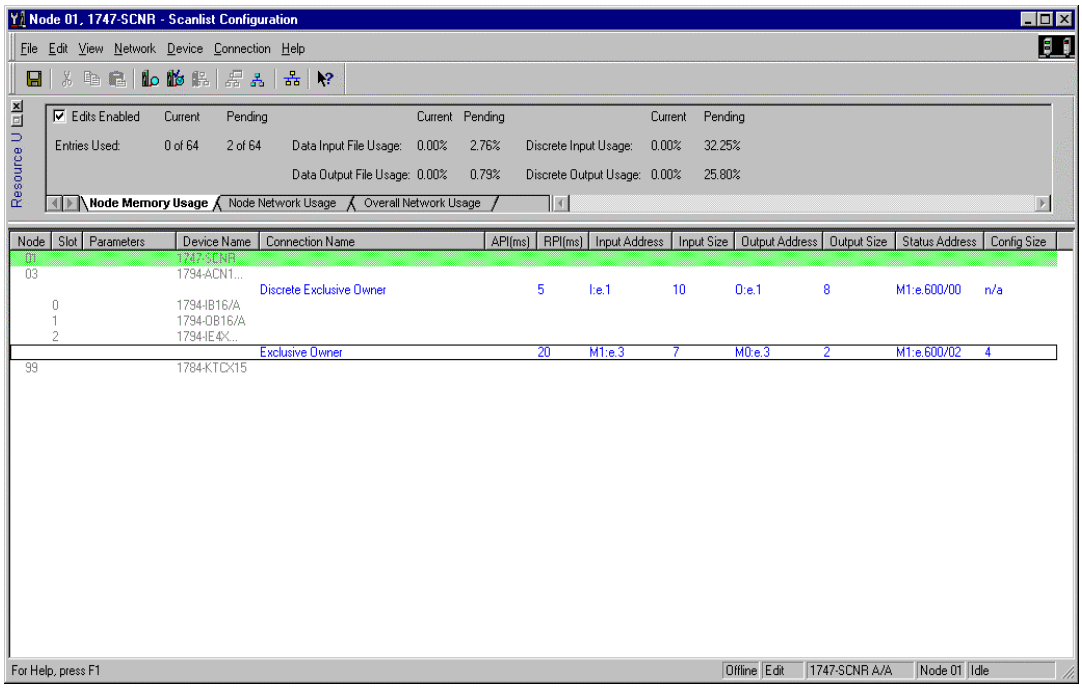
   For this example, we must choose M-file addresses for our 4 input/2 output analog module. The first available M-file addresses are M1:3.3 and M0:3.3. Words 0 through 2 are reserved. The analog input data for the four analog inputs will actually begin at M1:3.5, because the 1794-ACNR15 sends two words of status information ahead of the actual data. The output data for the two analog outputs does begin at address M0:3.3. The next available Status Address is M1:3.600/02, since bits 0 and 1 are used for the rack connection. The "Connection Properties" window for the module connection should look as follows:



At this point, the state of the two analog outputs should be determined for the times when the SLC processor is placed into the Program mode or in the event that communications is lost to the 1794-ACNR15. Set this state in the **Advanced** tab of the "Connection Properties" window for this module connection, provided you do not want the default settings of 0 decimal, which is the most common choice. This is the same procedure we performed for discrete outputs for the rack connection. The 1794-ACNR15 only supports outputs set to 0 or Hold Last State if one of the two conditions occur.

4. Click **APPLY**.

5. Click OK. The “Connection Properties” window closes and the “Scanlist Configuration” window appears and looks as follows:



You have successfully configured your two connections to read/write data between the SLC processor and the Flex I/O on ControlNet. All that remains is to save the configuration to the network keeper, which in this case is the 1747-SCNR.

1. Click on the Save icon or click on the **File** menu and then **Save**.

   You will be prompted to “Optimize and re-write schedule for all connections”.

2. Click OK.

3. Click YES to the warning message.

   Your network configuration information will now be written to the network keeper.

   The display on the front of your 1747-SCNR should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs should be solid green and the B LED should be off, unless you are using the redundant media option, which is not being used in this example. The 1794-ACNR15 should be displaying a green COMM A and STATUS LED, while COMM B should be off.

Creating Ladder Logic and Basic Module Program

The final step is to write a ladder program for the SLC processor, including the 1747-SCNR for slot 3 of the processor's chassis. After downloading the program to your processor, place the processor into the Run mode. Your programs should now be able to read data from the 1794-IB16 in word I:3.3 and write to the 1794-OB16 in word O:3.2.

The analog input data will reside in words M1:3.5 through M1:3.8, while the analog output data must be placed in words M0:3.3 and M0:3.4. M1:3.9 is the seventh word received from the analog module. It contains status bits for the analog I/O channels. Please refer to your 1794-IE4XOE2 analog combo module documentation for additional details.

Example 6: Creating Peer-to-Peer Scheduled Connections Between 1747-SCNR ControlNet Scanners

The following example discusses how to create peer-to-peer scheduled connections between 1747-SCNR ControlNet scanners.

Hardware Setup

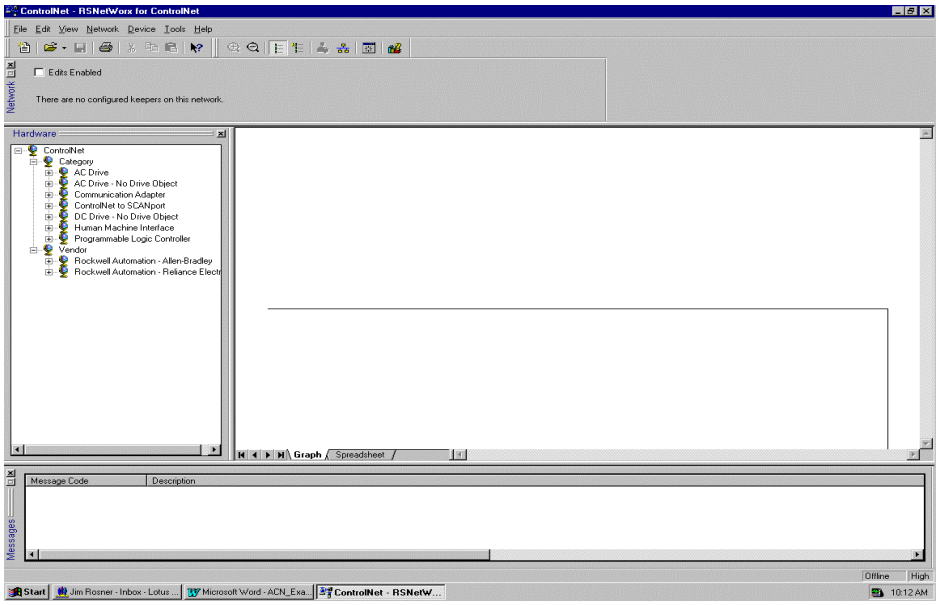
The hardware setup for this examples includes a computer with **RS**Logix500, **RS**Linx, **RS**NetWorx for ControlNet, and a 1784-KTCX15 interface card. The chassis configuration includes an SLC-5/05 in slot 0, a 1747-SCNR in slot 1, 1746-OB16 in slot 2, and 1746-IV16 in slot 3.

Configure the ControlNet Network with RSNetWorx for ControlNet

Follow the procedure below to configure the ControlNet network using **RS**NetWorx for ControlNet.

1. Start **RS**NetWorx for ControlNet by double clicking on its icon.

   You see this screen:



   At this time, you can configure your ControlNet network offline and then download it to the network. But in this example, we will go online and configure the network.

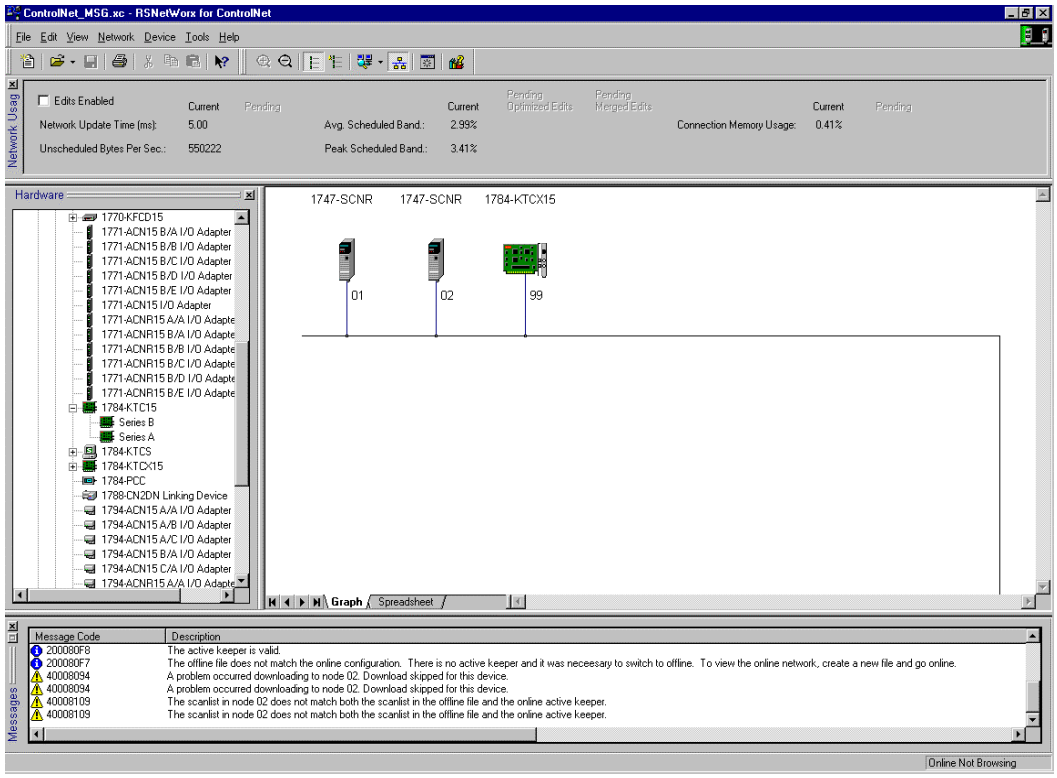
2. Go online by clicking on the Online icon or by clicking on the **Network** menu and selecting **Online**.

   You see the "Browse for Network" window. In this window, you must select the communication path previously configured in **RS**Linx for communicating with your ControlNet network. For this example, a 1784-KTCX15 ControlNet PC card is used.

3. Click on the 1784-KTCX15 card to select it.

4. Click OK.

The software will attempt to communicate with all possible node numbers on the network, from 1 to 99. The online network screen appears. For this example, the screen should show node 99 as the programming terminal as shown below.



The two 1747-SCNR scanner modules are nodes 1 and 2 on the ControlNet network. For this example, a scheduled connection will be configured for the 1747-SCNR at node 1 to write 50 words to the 1747-SCNR at node 2 and the 1747-SCNR at node 2 will write 60 words to the 1747-SCNR at node 1 with another scheduled connection. In other words, the 1747-SCNR at node 1 will produce 50 words of data, received from the SLC processor in its chassis and this data will be consumed by the 1747-SCNR at node 2. Also, the 1747-SCNR at node 2 will produce 60 words of data received from its processor and that data will be consumed by the 1747-SCNR at node 1. This producer/consumer model will become more apparent when we actually create the necessary scheduled connections.

Configure a Scheduled Connection Between ControlNet Scanners

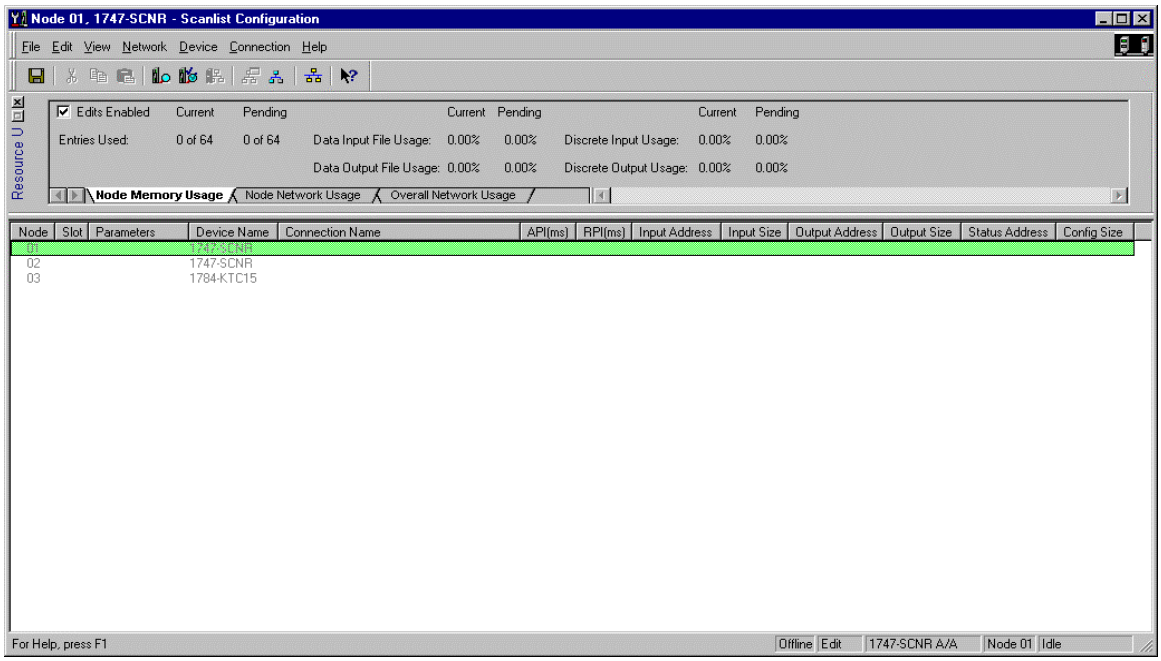
We are now ready to configure the necessary ControlNet connections to effectively transfer data between two SLC processors on ControlNet. These connections will be scheduled connections, meaning that their throughput will be deterministic and repeatable. If such data transfers between SLC processors on ControlNet do not require this type of determinism, then 1747-KFC15 modules may be used to allow SLC processors to send unscheduled messages on ControlNet.

1. Click the right mouse button on the 1747-SCNR at node 1.

2. Choose **Scanlist Configuration**. You will be prompted to enter the edit mode.

3. Click YES.

   You see the following screen:

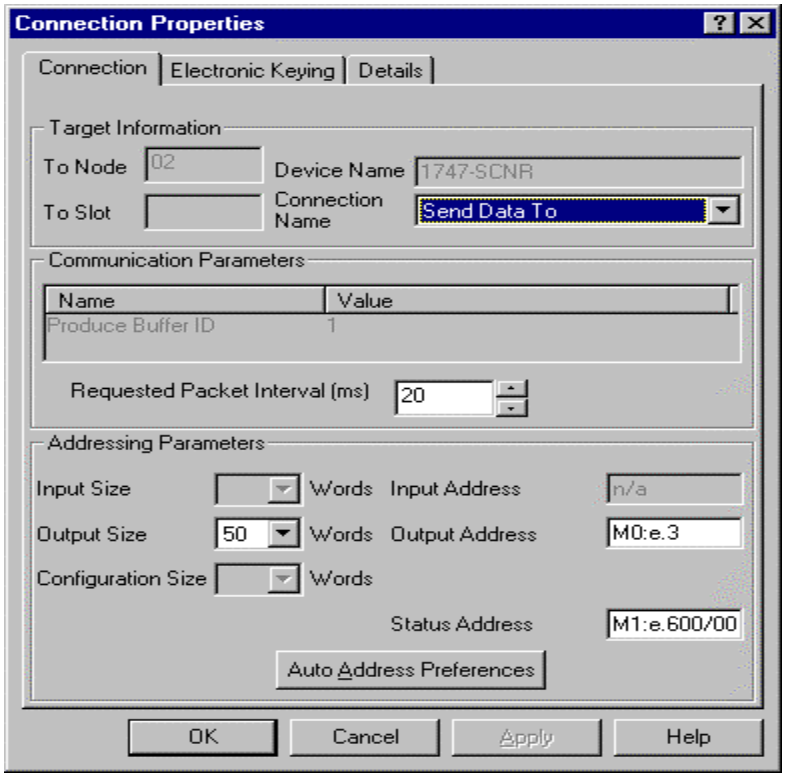


   As you can see, the two 1747-SCNR ControlNet scanners are shown as nodes 1 and 2. In order to establish a scheduled peer-to-peer connection so node 1 can send/produce 50 words of data for node 2:

4. Click the right mouse button on the 1747-SCNR at node 2.

5. Choose **Insert Connection**.

You see the following window:



Note that addresses in the "Connection Properties" window are already displayed in the fields. To have **RS**NetWorx for ControlNet choose the next available, valid I/O or M-file addresses for all connections:

a. Click on the Auto Address Preferences button.
b. Click on the box next to Enable Automatic Addressing on Insert so that a check mark appears in the box.
c. Click OK.

In general, we always recommended that you create connections for a particular device in its own Scanlist, but under the other devices in that Scanlist. Then, **RS**NetWorx for ControlNet knows enough about that connection to create the other matching connection in the other device's Scanlist.

For this example, we create a connection in the node 1 scanner's Scanlist to send/produce 50 words of data to the scanner at node 2 by entering this connection under node 2 in the Scanlist for node 1. **RS**NetWorx for ControlNet will automatically create a receive/consumer data connection for 50 words under node 2 in the node 2 Scanlist. Everything in the Scanlist for node 1 is with respect to node 1. Therefore, if a connection to Send Data To is configured under node 2 in the node 1 Scanlist, this means that node 1 will send/produce data to node 2.

We do not recommended that you create connections, for example, under node 1 in its own Scanlist. **RS**NetWorx for ControlNet will not know which node will consume the data it produces and will therefore not be able to create the other necessary connection. Making that connection would then become your responsibility.

In this example, we want the 1747-SCNR at node 1 to send/produce 50 words of data to the 1747-SCNR at node 2. The connection name must be Send Data To. The number of words in this case is 50, but the valid range is between 1 and 240 words. The first available output address is M0:e.3, where e is the slot number of the 1747-SCNR at node 1.

For this example, the 1747-SCNR at node 1 will take 50 words of data copied to its M0 file by the SLC processor and will send/produce this data on the ControlNet network for the 1747-SCNR at node 2 to receive/consume. The SLC processor in the same chassis as the node 1 scanner will then need to copy 50 words of data to M0:3.3. The SLC processor in the same chassis as the node 2 scanner will need to copy 50 words from M1:1.3. Please refer to the Hardware Setup section at the beginning of this application example to match the slot numbers in the M-file addresses to the slot numbers of the scanners in their respective chassis.

When you are finished configuring the connection in the Connection Properties screen:

6. Click APPLY.

7. Click OK.

   You must also enter a value in the Status Address field. This field supplies Connection Status information to the processor. The starting bit addresses for this field must be an even number, because two consecutive bits are used as status for each connection. The even numbered bit indicates whether the connection is open or closed and the odd numbered bit indicates whether the connection is in normal operation or Idle mode. In this example, the address chosen for the first connection is the first available bit pair, M1:3.600/00. The next connection automatically created by **RS**NetWorx for ControlNet will use M1:3.600/02.

   You must now save your Scanlist for node 1 to the network keeper.

8. Click on the Save icon or click on the **File** menu and then **Save**.

You will be prompted to “Optimize and re-write schedule for all connections”.

9. Click OK.

10. Click YES to the warning message.

To create a connection to have node 2 send 60 words of data to node 1, enter the Scanlist for node 2 and create a Send Data To connection under node 1. **RS**Networx for ControlNet will then automatically create a Receive Data connection under node 1 in the node 1 scanner’s Scanlist. The SLC processor in the same chassis with the node 2 scanner will then need to copy 60 words of data to M0:1.3. The SLC processor in the same chassis with the node 1 scanner will then need to copy 60 words of data from M1:3.3. Please refer to the Hardware Setup section at the beginning of this application example to match the slot numbers in the M-file addresses to the slot numbers of the scanners in their respective chassis. The starting Status Addresses for these connections will be M1:1.600/00 and M1:1.600/02.

You must now save your Scanlist for node 2 to the network keeper.

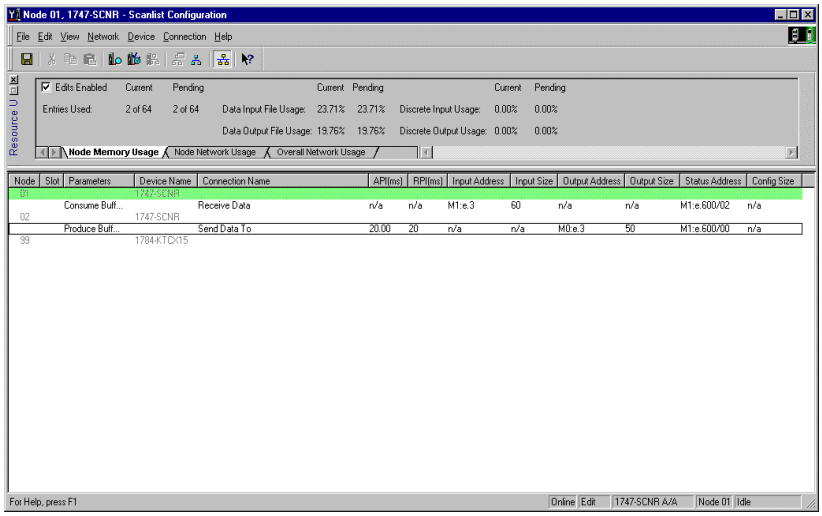
11. Click on the Save icon or click on the **File** menu and then **Save**.

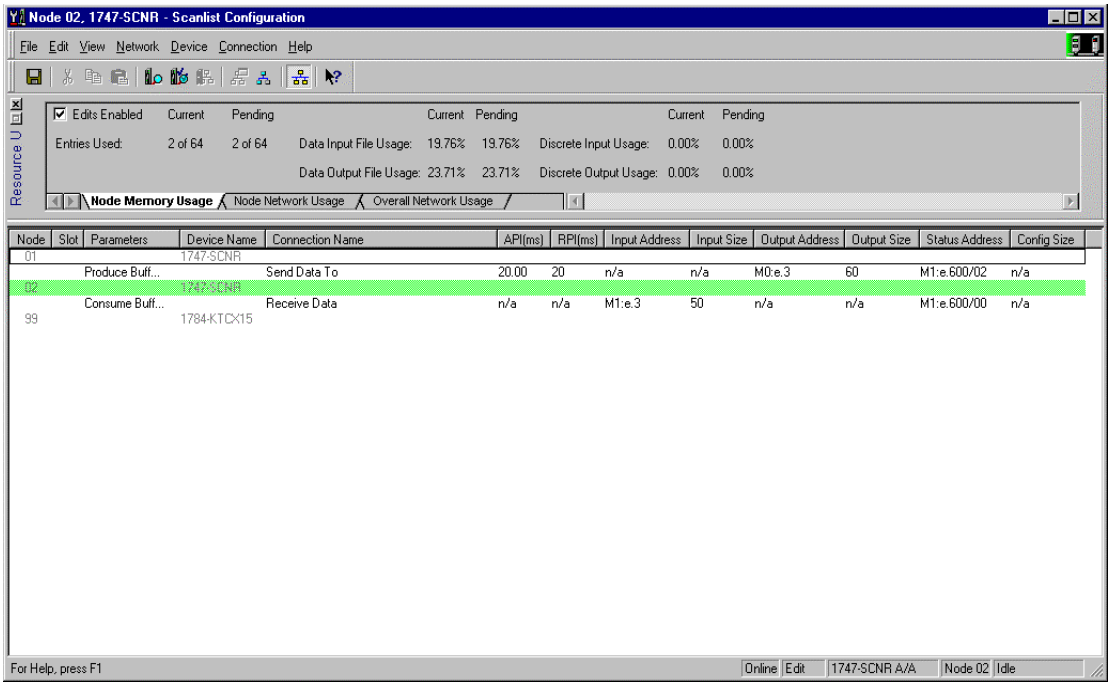
You will be prompted to “Optimize and re-write schedule for all connections”.

12. Click OK.

13. Click YES to the warning message

The Scanlist Configuration screens for nodes 1 and 2 should look as follows:





You have successfully configured peer-to-peer scheduled connections between two 1747-SCNR scanners. You have also saved this information to the active keeper on the network. If your ladder programs in the two SLC processors are correctly copying data to and from the M-files of each 1747-SCNR and have an unconditional rung with an OTE instruction addressed to the Run/Idle bit for each scanner (bit 10 of the first output image word for the scanners, i.e., O:3.0/10 for scanner node 1 and O:1.0/10 for scanner node 2), data transfers will begin when the two processors are placed into the Run mode. When each SLC processor is placed into the Run mode, the 1747-SCNR scanner's Run/Idle bit must be set to a logical 1 to place each scanner into the Run mode to begin executing the configured connections.

The display on the front of your 1747-SCNR scanners should show an image of a full glass next to the word I/O. This indicates that all configured connections have been successfully downloaded to the scanner. In addition, the A and OK LEDs should be solid green and the B LED should be off, unless you are using the redundant media option, which is not being used in this example.

Numbers

1747-SCNR
communicating with your SLC processor 2-2, 4-2
M0 file 2-9
M1 file 2-6
understanding ControlNet data transfer 2-3
understanding mapping 2-5
what it does 2-1
1747-SCNR mapping
discrete input file 2-5
discrete output file 2-8
M0 file 2-9
M1 file 2-6

A

alphanumeric display
troubleshooting 4-2
application examples
configure the 1747-SCNR with the 1746-BAS interface module E-28
configure the 1747-SCNR with the 1746-IV16 input module E-1
configure the 1747-SCNR with the 1746-N18 analog input module E-19
configure the 1747-SCNR with the 1746-NIO4V input/output module E-9
configure the 1747-SCNR with the 1794-IE4XOE2 I/O analog combo module E-42
creating peer-to-peer scheduled connections between 1747-SCNR ControlNet scanners E-51
apply chassis power
troubleshooting 4-2

C

CIP client
management C-1
send a get attribute all request to node 14 identity object C-3
send a set attribute single request C-7
SLC 500 ladder program example C-9, C-13
SLC 500 processor target data file (hex) C-10, C-14
SLC 500 ladder program C-5
SLC 500 processor data files (hex) C-6
request transfer 2-10
communicating with your devices 2-9
CIP client request transfer 2-10
CIP unscheduled data server 2-10
I/O scheduled data transfer 2-9
communicating with your SLC processor 2-2, 4-2
configure scheduled data exchange
data transfer mapping 3-2
questions to ask 3-1
ControlNet data transfer
link layer services 2-4
scheduled data transfer operations on a ControlNet network 2-3
understanding 2-3
unscheduled data transfer operations on a ControlNet network 2-4

D

discrete output file 2-8
display mnemonics
troublshooting 4-3

E

examples
application E-1
reset bit management D-1

G

get attribute
send an all request to node 14 identity object C-3

I

I/O scheduled data transfer 2-9
installing
connecting to network 1-5
inserting into SLC chassis 1-3
module features 1-1
selecting node address 1-3
SLC 500 I/O configuration 1-8

L

link layer services 2-4
local database
access using PLC-5 MSG instructions A-1
read and write access to 1747-SCNR A-1
ControlNet data files access using CIP messaging B-1
read and write access to 1747-SCNR B-1

M

M0 file mapping 2-9
M1 file mapping 2-6
mapping
understanding 2-5
MSG instructions
read and write access to 1747-SCNR local database A-1

O

OK indicator
troubleshooting 4-3

P

purpose of 1747-SCNR scanner 2-1

R

reset bit management example D-1

S

scheduled data transfer operations on a ControlNet network 2-3
set attribute
send a single request C-7
SLC 500 ladder program C-5
SLC 500 processor data files (hex) C-6
status indicators and status display
troubleshooting 4-1

T

troubleshooting 4-1
alphanumeric display 4-2
apply chassis power 4-2
OK indicator and display mnemonics 4-3
with status indicators and status display 4-1

U

unscheduled data transfer operations on a ControlNet network 2-4

Allen-Bradley
Publication Problem Report

If you find a problem with our documentation, please complete and return this form.

Pub. Title/Type ControlNet Scanner Module Reference Manual

Cat. No. 1747-SCNR Pub. No. 1747-RM623B-EN-P Pub. Date November 2000 Part No. 957445.90

Check Problem(s) Type:	Describe Problem(s)			Internal Use Only
☐ Technical Accuracy	☐ text		☐ illustration	
☐ Completeness	☐ procedure/step	☐ illustration	☐ definition	☐ info in manual
What information is missing?	☐ example	☐ guideline	☐ feature	(accessibility)
	☐ explanation	☐ other		☐ info not in manual
☐ Clarity				
What is unclear?				
☐ Sequence				
What is not in the right order?				
☐ Other Comments				
Use back for more comments.				

Your Name _____ Location/Phone _____

~~Return to: Marke~~ting Communications, Allen-Bradley., 1 Allen-Bradley Drive, Mayfield Hts., OH 44124-6118Phone:(440) 646-3176
FAX:(440) 646-4320

PLEASE FASTEN HERE (DO NOT STAPLE)

Other Comments

PLEASE FOLD HERE

PLEASE REMOVE

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 18235 CLEVELAND OH

POSTAGE WILL BE PAID BY THE ADDRESSEE

Allen-Bradley
RELIANCE ELECTRIC
DODGE
ROCKWELL SOFTWARE
Rockwell Automation

1 ALLEN-BRADLEY DR
MAYFIELD HEIGHTS OH 44124-9705

Reach us now at www.rockwellautomation.com

Wherever you need us, Rockwell Automation brings together leading brands in industrial automation including Allen-Bradley controls, Reliance Electric power transmission products, Dodge mechanical power transmission components, and Rockwell Software. Rockwell Automation's unique, flexible approach to helping customers achieve a competitive advantage is supported by thousands of authorized partners, distributors and system integrators around the world.

Americas Headquarters, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444
European Headquarters SA/NV, avenue Herrmann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1747-RM623B-EN-P - November 2000

PN 957445.90