Quantum
NOE 771 x0 Ethernet Modules
User Guide

840 USE 116 00 Version 1.0

October 1999

Schneider Electric

Preface

The data and illustrations found in this book are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

Schneider Electric assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

CAUTION!

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to assure compliance with documented system data, repairs to components should be performed only by the manufacturer.

Failure to observe this precaution can result in injury or equipment damage.

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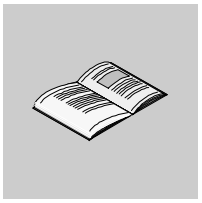
Contents



Introduction

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At a Glance

Introduction

This chapter contains general information about the manual

What's in this Chapter

This chapter contains the following topics.

About this Manual

Document Scope

This manual describes all the features of the Quantum 140 NOE 771 00,10/100 Megabit Ethernet module and the Quantum 140 NOE 771 10 Factory/Cast module. It should provide you with the knowledge to begin using a Quantum Programmable Logic Controller (PLC) to communicate with devices over an Ethernet network. The manual covers:

- The hardware architecture of a Quantum Ethernet TCP/IP module designed to fit into a single slot on the standard Quantum backplane.
- The capabilities of the NOE 771 x0 modules.
- The installation of the NOE 771 x0 module on a Quantum backplane.
- Instructions on configuring the module from your programming panel using Concept.
- Instructions on setting up the module for I/O scanner capabilities (-00 only), including procedures for configuring the I/O scan list using Concept, ProWORX NxT, and Modsoft.
- Instructions on how to set up the modules to transfer data to and from nodes on a TCP/IP network through the use of a special master instruction (MSTR).
- How to use a World Wide Web embedded server to access diagnostics and online configurations for the module and its associated controller (PLC).
- How to use the FactoryCast web server to customize your configuration via embedded web pages (-10 module only)
- Instructions on using the Network Options Ethernet Tester with a Windows based PC to monitor the network.

Note: NOE 771 x0 is used in this manual when the information applies to both the NOE 771 00 and NOE 771 10 modules.

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About this Manual, continued

Who Should Use this Manual

This manual is intended to support anyone using a Quantum Programmable Logic Controller that needs to communicate with devices over an Ethernet network. You are expected to have a knowledge of the use of Programmable Logic Controller systems and possess of a working knowledge of either the Concept, ProWORX NxT, or Modsoft programming tools. You also need to understand the use of an Ethernet network and TCP/IP.

Continued on next page

About this Manual, continued

How this Manual is Organized

This manual is organized as follows:

Chapter	Description
Chapter 1 I*ntroduction*	Presents an introduction to this manual--its scope, who should use it, how it is organized, and a listing of related publications.
Chapter 2 *Product Description*	Describes the hardware makeup of the NOE 771 x0, 10/100 Megabit Ethernet Module, and discusses the capabilities of the features.
Chapter 3 *Installing the Module*	Describes how to physically install the NOE 771 x0 module into a Quantum backplane, and how to configure its IP parameters, SNMP agent, and BOOTP server.
Chapter 4 *Configuring the Module with Concept*	Describes how to configure the NOE 771 module from your programming panel using Concept 2.2 or later.
Chapter 5 *Transferring Data with the I/O Scanner*	Discusses the NOE 771 00 module's I/O scanner capabilities and includes procedures for configuring the I/O scan list using Concept, ProWORX NxT, and Modsoft. Module configuration with ProWORX NxT and Modsoft is also described here.
Chapter 6 *Transferring Data with the MSTR Instruction*	Describes how to transfer data to and from nodes on a TCP/IP network through the use of a special MSTR (master instruction). The operational statistics and error codes for reading and writing the controller information are also included.
Chapter 7 *Embedding Web Pages*	Discusses how to use an embedded web server to access diagnostics and through embedded web pages view and change configurations of the module and its associated controller (PLC).
Chapter 8 *Using the Network Options Ethernet Tester*	Describes how to use the Network Options Ethernet Tester with a Windows based PC to monitor the network by supplying you with operational statistics and providing the capability of reading and writing PLC registers.
Chapter 9 *Maintenance*	Describes how to obtain information for system maintenance including accessing and clearing the crash log and downloading the new NOE Exec.

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About this Manual, continued

Appendices

The manual contains the following Appendices:

Appendix	Description
Appendix A *NOE 771 x0 Module Specifications*	Describes the main specifications for the Quantum 140 NOE 771 Ethernet Module.
Appendix B *Ethernet Developers Guide*	Describes a sample TCP/IP application named Network Options Ethernet Tester (NOET) used to verify the installation of the Quantum Ethernet TCP/IP modules and serves as a sample application for developers.
Appendix C *Quantum Ethernet TCP/IP Modbus Application Protocol*	Describes the Modbus Application Protocol used to transport Modbus Application Protocol PDUs over TCP/IP.
Appendix D *NOE 771 00 Module I/O Scanner Performance Statistics*	Provides graphs of performance statistics for the I/O Scanner used with various CPUs.

System Requirements

Minimum System Requirements

The following table details the minimum versions for systems used with the NOE 771 x0 modules:

System	Minimum Version Number
Quantum Executive	2.0
Concept	2.2
Modlink	2.0
Modsoft	2.6
ProWORX NxT	2.0 IP Address Configuration 2.1 I/O Scanning

Related Documentation and Customer Support

Related Paper Documentation

In addition to the manual, the following documents may prove helpful to you:

- *Concept 2.2 User's Manual*, 840 USE 483 00
- *BOOTP Lite User Documentation*, 31002087
- *FactoryCast User Guide*, 890 USE 152 00
- *Ladder Logic Library User Guide*, 890 USE 100 00
- *Modbus Protocol Reference Guide*, PI-MBUS-300
- *Open Modbus Specification*, www.modicon.com/openmbus
- *ProWORX NxT User Guide*, 372 SPU 680 01 NMAN
- *RIO Manual*, 890 USE 101 00

Related Electronic Documentation

The NOE 771 x0 contains an embedded web server to provide online diagnostics, configuration, and support. The NOE 77710 module has additional functionality provided by the FactoryCast module.

Customer Support

If you have any problems, please consult the documentation listed above or MS-Windows documentation first. If you still have a question or need assistance, help is available from our Schneider hotline:

- Tel: USA and Canada 800-468-5342
- Tel: International 978-975-9557
- Fax: All 978-975-9301
- BBS: Bulletin Board 978-975-9779

When calling the Schneider 800 telephone number, you will get a recording asking you to enter a one-digit code for the type of service you request, provided you use a touch tone telephone.

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Related Documentation and Customer Support, continued

Customer Support, continued

Visit Our Web Site: Please access the Schneider web site, www.modicon.com or schneider.com for the most up-to-date NOE Ethernet Controller information, such as resolutions to product issues, and product announcements. When you access the web site, look under technical information, and choose Quantum from the list of cross-product families. Then access Resolutions for resolutions to product issues, Product Manuals for the most recently published user documentation, and so on.

Product Description

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At a Glance

Introduction

This chapter presents a product overview of the Quantum 140 NOE 771 00 10/100 Megabit Ethernet Module and the Quantum 140 NOE 771 10 FactoryCast Module.

What's in this Chapter

This chapter contains the following topics.

NOE 771 x0 Module Overview

General Description

The Quantum 140 NOE 771 00,10/100 Ethernet module, shown below, is the latest model in a line of Quantum Ethernet TCP/IP modules designed to make it possible for a Quantum Programmable Logic Controller (PLC) to communicate with devices over an Ethernet network. The NOE 771 x0 module's electronics are contained in a standard Quantum single width housing that takes up one slot in a Quantum backplane. The module can be plugged into any available slot in the backplane and is capable of being hot swapped.

The NOE 771 00 provides real-time peer-to-peer communications, as well as, I/O scanning, and a Modbus/TCP server. The included HTTP services provide maintenance and configuration utilities to the module.

The NOE 771 10 provides all the services of the -00 except the I/O Scanner. It also has the following additional features:

- user programmable web pages
- the FactoryCast application, including:
  - creating and viewing of graphic real-time templates using Java beans
  - creating and viewing of text real-time templates in spreadsheet format
  - use of Concept symbols or direct addresses.

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NOE 771 x0 Module Overview, continued

Key Features

The NOE 771 x0 module provides the following key features:

- Integrated 10/100BASE-TX, full duplex capable, shielded twisted pair port
- Integrated 100BASE-FX multimode, full duplex capable, fiber optic port
- Embedded HTTP server
- BOOTP client and server
- SNMP V2 agent
- Flash file system
- Modbus I/O scanner (-00 only)
- Field upgradeable software over TCP/IP
- Modbus/TCP client
- Modbus/TCP server
- User Programmable Web Pages (-10 only)
- FactoryCast Application (-10 only)

Front Panel Components

The front panel of NOE 771 x0 module contains identification marking, color code, and LED display. A writable area for an Internet Protocol (IP) address, a global address label, and two Ethernet cable connectors are located behind the removable front panel door. The following table provides a description of the front panel components which are shown on the opposite page.

Component	Description
LED indicator Panel	Indicates the operating status of the module, and the fiber optic and Modbus communications networks it is connected to. (See *LED Indicators* in this chapter.)
IP Address Writable Area	Provides a writable area to record the module's assigned IP address.
Global Address Label	Indicates the module's global Ethernet MAC address assigned at the factory.
100 BASE-FX Connector	Provides an MT-RJ receptacle for connection to a 100 megabit fiber optic Ethernet cable.
10/100BASE-T Connector	Provides an RJ-45 receptacle for connection to a shielded, twisted pair Ethernet cable.

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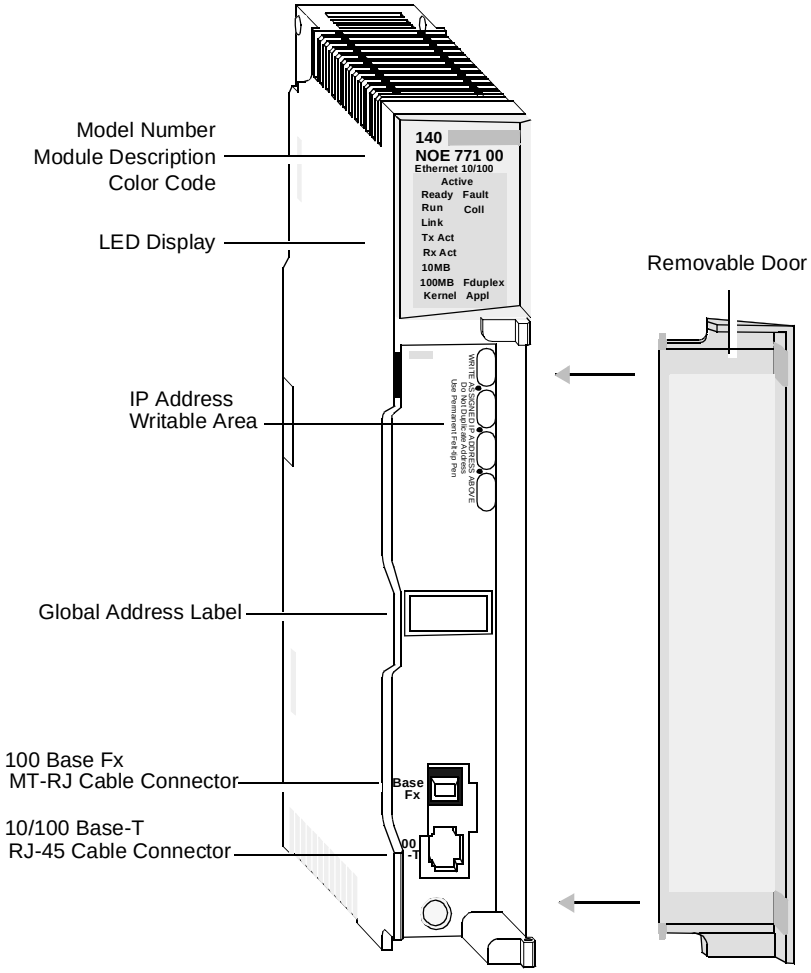
NOE 771 x0 Module Overview, continued

Front View

The front of the NOE 771 00 Ethernet module is shown below. The 140 NOE 771 10 is identical, with the exception of the Module Description, which reads 140 NOE 771 10 FactoryCast.

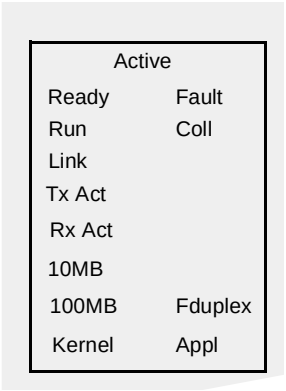


LED Indicators

LED Indicator Panel

The LED indicator panel, shown below, provides continuous operating information about the NOE 771 x0 module and its connection to the network. The functions of the LED indicators are described in the following table

LED	Color	Description
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	Indicates when the NOE is in a crash state
Run	Green	Flashes to indicate diagnostic code, as described in “Run LED Status” (below).
Coll.	Red	Flashes when Ethernet collisions occur.
Link	Green	On when Ethernet link is active.
Tx Act	Green	Flashes to indicate Ethernet transmission.
Rx Act	Green	Flashes to indicate Ethernet reception.
Kernel	Amber	On when in Kernel Mode.
10MB	Green	On when the module is connected to a 10 Megabit network.
100MB	Green	On when the module is connected to a 100 Megabit network.
Fduplex		On when Ethernet is operating in the full duplex mode.
Appl	Green	On when crash log entry exists.



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LED Indicators, continued

Run LED Status

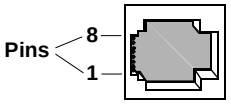
The state of the Run LED indicator provides the following diagnostic information:

Indicator State	Status
On (steady)	Normal operation: The NOE module is ready for network communication.
Number of flashes in sequence	
one	Not used
two	Not used
three	No Link: the network cable is not connected or is defective
four	Duplicate IP address: The module will stay off-line.
five	No IP address: The module is attempting to obtain an IP address from a BOOTP server.
six	Using default IP address
seven	No valid executive NOE present

Connectors and Cabling

10/100 BASE-T Twisted Pair Connector

The NOE 771 x0 module's 10/100 BASE-T connector (shown below) is a standard RJ-45 twisted pair receptacle.



Schneider Automation recommends that you use Category 5 STP cabling, which is rated to 100 Mbps, with an RJ-45 connector.

The eight pins are arranged vertically and numbered in order from the bottom to the top. The RJ-45 pinout used by this module is:

- Receive Data (+) 3
- Receive Data (-) 6
- Transmit Data (+) 1
- Transmit Data (-) 2

100 BASE-FX

The NOE 771 x0 module's 100 BASE-FX connector is a MT-RJ receptacle with it's mating fiber optic cable connector (see figure on page 4).

For the NOE 771 x0, you may need an MT-RJ to SC (Duplex) Multimode fiber optic cable assembly 62.5/125µm. Schneider Electric recommends Cable Number 490NOC00005 to connect to fiber hubs/switches.

Note: The NOE 771 x0 is a one channel device. It is capable of communicating over either a 10/100BASE-T or a 100BASE-FX Ethernet network at any given time, but not both at the same time.

I/O Scanner (140 NOE 771 00 only)

Introduction

The functionality of your NOE 771 00 module is further enhanced by the addition of a Modbus I/O Scanner which you can configure with either the Modsoft or Concept programming panel. This allows you a way to transfer data between network nodes without using the MSTR instruction.

You can configure the NOE 771 Modbus I/O Scanner by either of two methods:

- Peer Cop
- Ethernet I/O Scanner

Note: It is recommended that the enhanced Modbus I/O Scanner be used for all new installations. Peer Cop functionality is provided only on as an easy migration path for an existing installation. The enhanced Modbus I/O Scanner provides greater functionality than the Peer Cop based I/O scanner.

Peer Cop Based I/O Scanner

The Peer Cop based Modbus I/O Scanner has the following characteristics:

Parameter	Value
Max. No. of Devices	64
Max. No. of Input Words	500
Max. No. of Output Words	500
HealthTimeout Value	Global Setting (20 Msec to 2 Secs in 20 mSec increments)
Input TimeOutState	Global Setting (Zero or Hold)
IP Address	Derived from Modbus Address (must be on NOE's Subnet)
Remote Register Reference	Not configurable - 400001 is used

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I/O Scanner (140 NOE 771 00 only), continued

Enhanced Modbus I/O Scanner

The Enhanced based Modbus I/O Scanner has the following characteristics

Parameter	Value
Max. No. of Devices	64
Max. No. of Input Words	4,000
Max. No. of Output Words	4,000
HealthTimeout Value	Individual Setting (1 Msec to 2 Secs in 1 mSec increments)
Input TimeOutState	Individually Settable
IP Address	Individually Settable
Remote Register Reference	Configurable
Min. Update Rate	Settable

Refer to Chapter 5 to learn how to configure the Modbus I/O Scanner.
Refer to Appendix D for detailed performance data.

Performance

Refer to Appendix D for detailed performance data.

Peer-to-Peer Communications

Introduction

All NOE 771 x0 Quantum Ethernet TCP/IP modules provide the user with the capability of transferring data to and from nodes on a TCP/IP network through the use of a special MSTR (master instruction). All PLCs that support networking communication capabilities over Ethernet can use the MSTR ladder logic instruction to read or write controller information.

MSTR Operations

The MSTR instruction allows you to initiate one of 12 possible network communications operations over the network. Each operation is designated by a code. The following table lists the 12 operations and indicates those that are supported on an Ethernet TCP/IP network.

MSTR Operation	Code	TCP/IP Ethernet Support
Write data	1	supported
Read Data	2	supported
Get local statistics	3	supported
Clear local statistics	4	supported
Write global database	5	not supported
Read global database	6	not supported
Get remote statistics	7	supported
Clear remote statistics	8	supported
Peer Cop health	9	supported
Reset Option Module	10	supported
Read CTE(config extension)	11	supported
Write CTE (config extension)	12	supported

Performance

Performance information to be inclused in manual revision 1.1.

Refer to Chapter 6 for the Number of MSTR Instructions allowed.

Modbus/TCP Server

Introduction

All NOE 771 x0 Quantum Ethernet TCP/IP modules provide the user with the ability to access data from the controller using the standard Modbus/TCP protocol. Any device: PC, HMI package, another PLC, or any Modbus/TCP compliant device can access data from the PLC. The Modbus/TCP Server also allows Programming Panels to login into the controller over Ethernet.

Limitations

The NOE 771 x0 supports up to 32 simultaneous Modbus/TCP Server connections. The NOE 771 x0 allows only one Programming Panel to be logged in at a time to guarantee consistency of changes to the controller configuration.

The following Modbus/TCP commands are supported by the NOE:

- Read Data
- Write Data
- Read/Write Data
- Get Remote Statistics
- Clear Remote Statistics
- Modbus 125 Commands (used by Programming Panels to download a new Exec to the NOE)

Performance

The NOE 771 x0's Modbus/TCP Server has the following performance characteristics:

Parameter	Value
Typical Response Time (mSec)	0.6
Number of Modbus/TCP Server Connections	32
Number of Simultaneous Login Channels	1

Note: NOE 771 x0 Modbus/TCP performance measurements made with 140 CPU 534 14.

FTP and HTTP Services

FTP Server

The NOE 771 x0's File Transfer Protoc Protocol (FTP) server is available as soon as the module has received an IP address. Any FTP client can logon to the module if it has the correct user name and password. The FTP server provides the following services:

- update the NOE's firmware by downloading a new Exec
- error log visibility by uploading error log files
- upload/download BOOTP server and SNMP configuration files

The default user name is USER, and the default password is USERUSER. Both the user name and password are case sensitive. Refer to Chapter 3 for instructions on how to change the password, and add or delete user names to the FTP server.

There should be only one FTP client per module.

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FTP and HTTP Services, continued

HTTP Server

The NOE 771 x0's HyperText Transport Protocol (HTTP) server is available as soon as the module has received an IP address. It can be used with version 4.0 or greater, of either the Internet Explorer or Netscape browsers, and allows you to see:

- module Ethernet statistics
- controller and I/O information
- BOOTP server information

The HTTP server's HTML pages allow you to configure the module's BOOT server and SNMP Agent.

The HTTP server is protected with a default name and password. The default name and password are both USER, and both are case sensitive. They can both be changed via the Configuration page on the NOE 771 x0's Web Embedded Pages (see Chapter 3).

The NOE 771 x0 supports a maximum of 32 HTTP instantaneous connections.

Note: Browsers may open multiple connections so 32 HTTP connections does not indicate 32 simultaneous users.

Note: The NOE 771 00 module does not support user downloaded Web pages. You will need to purchase the 140 NOE 771 10 module in order to support that requirement.

BOOTP Server

Introduction

The BOOTstrap Protocol (BOOTP) software, compliant with RFC 951, is used to assign IP addresses to nodes on an Ethernet network. Devices (hosts) on the network issue BOOTP requests during their initialization sequence and a BOOTP server that receives the requests will extract the required IP address information from its database and place it in BOOTP response messages to the requesting devices. The devices will use the assigned IP addresses, received from the BOOTP server, for all communication occurring on the network.

Your NOE BOOTP Server

Your NOE 771 x0 module comes supplied with a BOOTP server. This feature allows you to provide IP addresses to all the I/O devices being serviced by the NOE 771 00. Providing a BOOTP server that is built into your NOE 771 x0 module, eliminates the need for you to have a dedicated PC on your IO network acting as a BOOTP server.

Note: The NOE 771 x0's BOOTP server cannot be used to provide it's own IP address.

You can configure your NOE 771 x0's BOOTP server from the module's HTTP web page. Using this feature allows you to add, remove, and edit devices to the BOOTP server's database which is maintained on the module's non-volatile memory. Refer to Chapter 7 to learn how to configure the BOOTP server's database.

SNMP

Introduction

Network management software allows a network manager to monitor and control network components and thus make it possible to isolate problems and find their causes. It allows a manager to:

- interrogate devices such as host computer, routers, switches, and bridges to determine their status, and
- obtain statistics about the networks to which they attach.

Manager/Agent Paradigm

Network management software follows the conventional client-server model. To avoid confusion with other network communication protocols that use the client/ server terminology, network management software uses the terms;

- *manager* for the client application that runs on the manager's computer
- *agent* for the application that runs on a network device.

The manager uses conventional transport protocols (e.g., TCP or UDP) to establish communication with the agent and they then exchange request and responses according to the network management protocol.

Simple Network Management Protocol

Your NOE 771 x0 module is configured with the Simple Network Management Protocol (SNMP) which is the standard protocol used to manage a local area network (LAN). It defines exactly how a manager communicates with an agent, (i.e., the format of the requests that a manager sends to an agent and the format of the replies that the agent returns to the manager).

The MIB

Each object to which SNMP has access must be defined and given a unique name. Also, both the manager and agent programs must agree on the names and the meanings of fetch and store operations. The set of all objects SNMP can access is known as a *Management Information Base (MIB)*.

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SNMP, continued

ASN.1 Naming Scheme

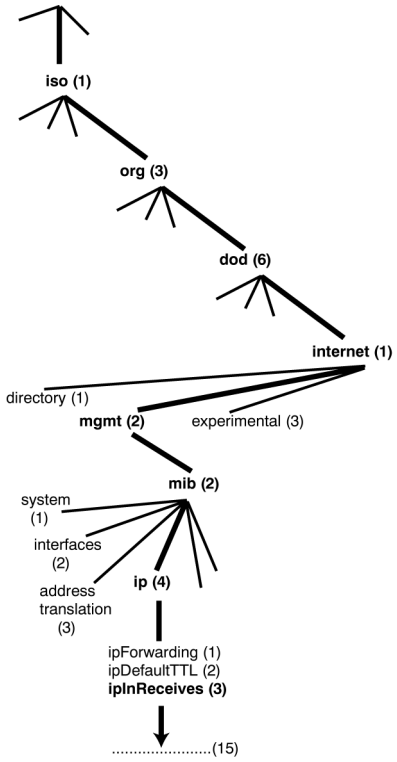
Objects in a MIB are defined with the ASN.1 naming scheme, which assigns each object a long prefix that guarantees the name will be unique. For example, an integer that counts the number or IP datagrams a device has received is named:

iso.org.dod.internet.mgmt.mib.ipIn-Receives

This object name is represented in an SNMP message by assigning each part an integer. So, the above message would appear as follows:

1.3.6.1.2.1.4.3

with each integer having the following meaning:



1 = ISO (International Organization for Standardization
3 = identified organization — one of branches under the ISO root
6 = U. S. Department of Defense (DOD) — one of the children under branch1.3
1 = the Internet subtree under 1.3.6
2 = the mgm branch — (one of seven) of the Internet subtree. It is managed by the Internet Assigned Numbers Authority, and includes the standard MIBs.
1 = mib-2(1) group of managed objects
4 = ip — the mib-2(1) IP group (one of 11)
3 = ipinReceivers — the MIB object

The Object Identifier (OID)

In the above example, the MIB object identified by the notation 1.3.6.1.2.1.4.3 is referred to as the Object Identifier or OID. All OIDs can be envisioned as part of a tree structure which begins at the root (ISO) and branches out with each subtree identified by an integer.

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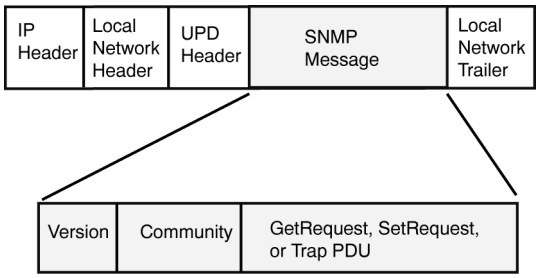
SNMP, continued

SNMP Protocol Data Units

SNMP uses Protocol Data Units (PDUs) to carry the requests and responses, between the manager and the agents, for the information contained in an OID. As the following figure shows, the SNMP message is the innermost part of a typical network transmission frame.



The PDUs within the SNMP initiate the communication between the manager and the agents. The SNMP installed on your NOE 771 00 module uses three PDUs:

- GetRequest
- SetRequest
- Trap

GetRequest PDU

The GetRequest (shortened to Get) PDU is used by the SNMP manager to retrieve the value of one or more objects (OIDs) from an agent.

SetRequest PDU

The SetRequest (shortened to Set) PDU is used by the SNMP manager to assign a value to one or more objects (OIDs) residing in an agent.

Trap PDU

The Trap PDU is used by the agent to alert the manager that a predefined event has occurred.

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SNMP, continued

Version & Community Identifiers

The version identifies the version number of the SNMP software being used by the manager and the agent. Your NOE 771 x0 supports Version 2 of the SNMP. The community is an identifier that you assign to your SNMP network. If community names for the manager and the agent don't agree, the agent will send an authentication failure trap message to the manager. If the community names and version number agree, the SNMP PDU will be processed.

What can be Configured

Your NOE 771 x0 module can be configured to send an authentication trap to two SNMP managers if it receives a community name in a Get/Set request that does not match the configured name. Also, you can configure the Sys Contact and Sys Location via the configuration page in the module's Embedded Web pages. Please refer to Chapter 7 to learn how to configure the NOE 771 x0 SNMP.

Installing the Module

3

At a Glance

Introduction

This chapter describes how to physically install the NOE 771 x0 module into a Quantum backplane, and configure its IP parameters, SNMP agent, and BOOTP server.

What's in this Chapter

This chapter contains the following topics.

Before You Begin

Initial Checks

Before you install your module, you need to:

- determine how the NOE 771 x0 module will be assigned its Ethernet address parameters (the default method is BOOTP)
- verify that your Ethernet network is properly constructed

CAUTION

DUPLICATE ADDRESS HAZARD

Do not connect the module to your network until you have ensured that its IP address will be unique on the network. Having two devices with the same IP address can cause unpredictable operation of your network.

Failure to observe this precaution can result in network disruption leading to possible injury or equipment damage.

Determining the Appropriate Ethernet Address Parameters

Consult your system administrator to determine if you must configure a new IP address and appropriate gateway and subnet mask addresses, or whether the module will obtain its Ethernet address parameters from a BOOTP server. If the administrator assigns new address parameters, follow the directions in Chapter 4 to configure the module from your programming panel.

Note: If you will be changing the default configuration, you should stop the controller, then install the module, then change the configuration before starting the controller again.

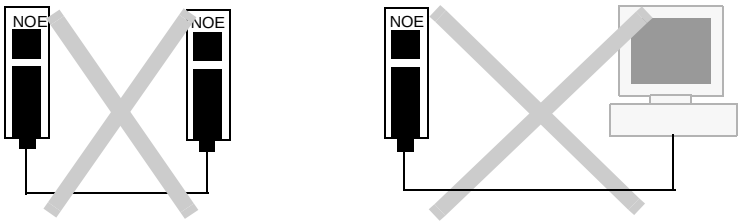
The NOE 771 x0 module only reads its configuration data at power-up and when it is reset. Whenever the configuration data is changed, the module must be reset, either by hot swapping or through a reset command in the MSTR block (see Reset Option Module MSTR Operation section in Chapter 6). Once the module is installed, stopping and restarting the controller will not reset it.

Continued on next page

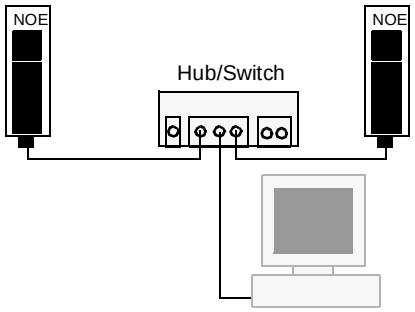
Before You Begin, continued

Verifying the Network Topology

You should not connect an Ethernet web embedded server module directly to another device with a length of cable. For the network to operate properly, you must route the cable for each device through an Ethernet hub/switch. Hubs/switches are widely available and can be purchased from many suppliers.



Improper Network Topologies



Proper Network Topology

Cabling Schemes

Introduction

In a standard Ethernet cabling scheme, each device connects via a cable to a port on a central Ethernet hub/switch.

Twisted Pair Length

The maximum length of cable between devices depends on the type of device used, as shown in the following table:

Type of Device	Max. Cable from Device to Hub	Max. Hubs Between Any Two Nodes	Max. Cable Between Most Distant Nodes on Network
Hub	100 m	4	500 m
Switch	100 m	Unlimited	Unlimited

For Fast Ethernet (100 Base-T) specifications, please refer to the IEEE 802.3u Standard available from the IEEE (www.IEEE.org).

Continued on next page

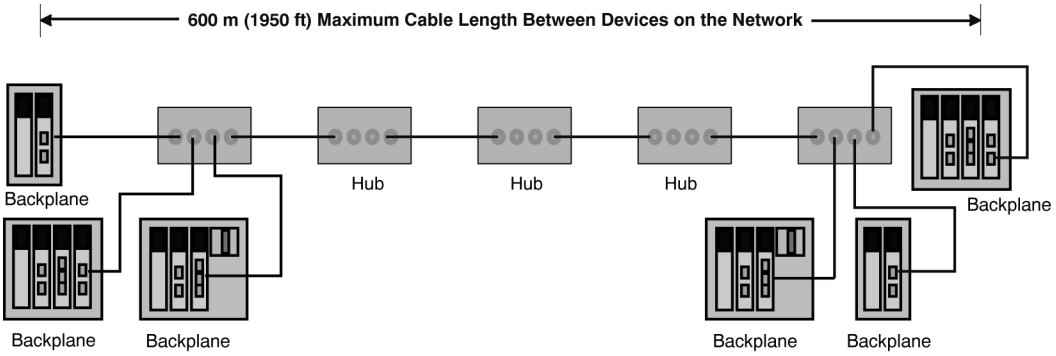
Cabling Schemes, continued

Cabling with Traditional Hubs

The following illustration and tables show the maximum number of hubs and the maximum cable length between devices when using hubs.

10 BASE-T Cable Distances

The illustration below is for 10 BASE-T cable:



100 BASE-T Cable Distances

The 100 BASE-T cabling allows for two hubs with a link maximum distance of 100 m (325 ft), and a total network diameter of 205 m (665 ft).

The following table details the maximum distance parameters with 100 BASE-T:

Model	Length max. in Twisted pair TX-T2-T4
DTE-DTE (no repeater)	100 m (325 ft)
One Class I repeater	200 m (650 ft)
One Class II repeater	200 m (650 ft)
Two Class II repeaters	205 m (665 ft)

Continued on next page

Cabling Schemes, continued

100 BASE-FX Cable Distances

The 100 BASE-FX cabling allows for two hubs with a link maximum distance of 412 m (1339 ft).

The following table details the maximum distance parameters with 100 BASE-FX and 100 BASE TX-FX:

Model	Length max. Twisted pair TX and Fiber FX	Length max. Fiber FX
DTE-DTE (no repeater)	n.a.	412 m (1339 ft)
One Class I repeater	260.8 m *(1)*	272 m (884 ft)
One Class II repeater	308.8 m *(1)*	320 m (1040 ft)
Two Class II repeaters	216.2 m *(2)*	228 m (741 ft)

(1) Mixed twisted pairs and fiber assumes a 100 m (325 ft) twisted pair links

(2) Mixed twisted pairs and fiber assumes a 105 m (340 ft) twisted pair links

Fiber Length

The maximum length for 850 nm/Multimode cable is 2 KM.

Security

Overview

To restrict access to your Ethernet controller and I/O network, you may want to consider a firewall. A firewall is a gateway which controls access to your network.

Types of Firewalls

There are two types of firewalls:

- Network-level firewalls
- Application-level firewalls

Network-Level Firewalls

Network-level firewalls are frequently installed between the Internet and a single point of entry to an internal, protected network.

Application-Level Firewalls

An application-level firewall acts on behalf of an application. It intercepts all traffic destined for that application and decides whether to forward that traffic to the application. Application-level firewalls reside on individual host computers.

Port Numbers Used by NOE

The following table contains the port numbers used by NOE.

Protocol	Port Number
Modbus/TCP	TCP 502
HTTP	TCP 80
SNMP	UDP 61
FTP	TCP 21

You may need to provide this information to your system administrator to configure the firewall to allow access to your PLC from outside of your facility.

Installing the Module

Before You Begin

Locate the backplane that the NOE 771 module will be mounted in. Ensure that an open slot is available to mount the module in.

Note: The NOE 771 x0 module can only be installed in a local backplane.

Backplane Slot Placement

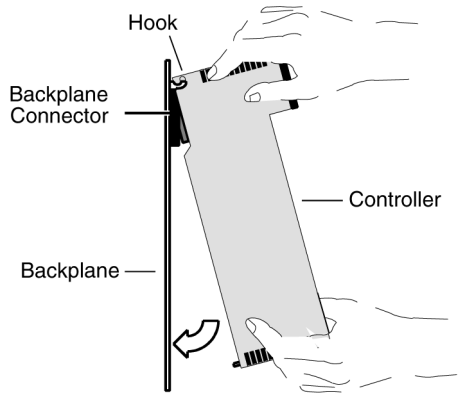
The modules may be placed in any slot in the backplane. They do not have to be placed next to each other.

Tools Required

You will need one Phillips head screw driver-medium size.

Mounting the Module in the Backplane

Perform the following steps to mount the NOE 771 x0 module in a Quantum backplane..

Step	Action
1	Holding the module at an angle, mount it on to the two hooks located near the top of the backplane. 
2	Swing the module down so its connector engages the backplane connector.
3	Using a Phillips head screw driver, tighten the screw at the bottom of the module between 2 and 4 in-lbs of torque.

Connecting the Cable

Note: The 140 NOE 771 x0 is capable of communicating over either a 10/100BASE-T or a 100BASE-FX Ethernet network at any given time, but not both at the same time

Shielded Twisted Pair

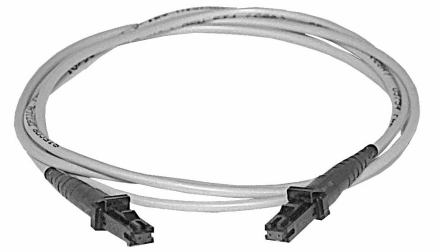
If you are using shielded twisted pair cable, Schneider Electric recommends Category 5, which is rated to 100 Mbps. The following table specifies the Schneider Electric part numbers:

Purpose/Description	Part Number	Available Lengths in meters
Connection of a device to an Ethernet hub/switch		
Shielded Twisted Pair Cable (SFTP, Cat 5, RJ-45, Low Smoke Free Halogen)	490NTW000*nn* *(where nn is the length in meters)*	02, 05, 12, 40, 80
Connection of the Ethernet hub/switch together		
Shielded Twisted Pair crossed Cable (SFTP, Cat 5, RJ-45, Low Smoke Free Halogen)	490NTC000*nn* *(where nn is the length in meters)*	05,15,40, 80

Use RJ-45 connectors. Slip the connector into the port. It should snap into place.

Fiber Optic

Remove the protective plug from the module's MT-RJ connector port and the protective cap from the tip of the black connector on the MT-RJ fiber optic cable (see figure below). Note the position of the keyway on the module's connector port and the matching key on the cable connector, and then insert the connector into the port. It should snap into place.



Assigning Ethernet Address Parameters

Overview

As shipped from the factory, the NOE 771 x0 module does not contain an IP address. This is also true if you have not programmed the unit with an Ethernet configuration extension. In this condition, when the module starts up, it will attempt to obtain an IP address from the network's BOOTP server.

You can use Concept to assign an IP address, default gateway and sub network mask. See Configuring the Ethernet Address Parameters in Chapter 4.

You can also assign IP address parameters using the BOOTP Lite software utility. See Using BOOTP Lite to Assign Address Parameters in this chapter.

CAUTION

DUPLICATE ADDRESS HAZARD

Be sure that your NOE 771 x0 module will receive a unique IP address. Having two or more devices with the same IP address can cause unpredictable operation of your network.

Failure to observe this precaution can result in injury or equipment damage.

Using a BOOTP Server

A BOOTP server is a program which manages the IP addresses assigned to devices on the network. Your system administrator can confirm whether a BOOTP server exists on your network and can help you use the server to maintain the adapter's IP address.

How an unconfigured ("as shipped") module obtains an IP address

On startup, an unconfigured NOE 771 x0 module will attempt to obtain an IP address by issuing BOOTP requests. When a response from a BOOTP server is obtained, that IP address will be used. If there is no BOOTP response received in two minutes, the module will use the default IP Address.

Continued on next page

Assigning Ethernet Address Parameters, continued

Using the Default IP Address

To use the default IP address with your PC, set up an active route from your PC. To do this with either Windows 95 or Windows NT, use the following procedure.

Step	Action
1	Be sure the NOE module is running
2	Obtain the default IP address of the NOE
3	Open an MS-DOS Window
4	Print the current active routes by typing: C:\>route print Active Routes: Network Address Netmask Gateway Address Interface Metric 0.0.0.0 0.0.0.0 205.217.193.250 205.217.193.205 1 84.0.0.0 255.0.0.0 205.217.193.205 205.217.193.205 1 127.0.0.0 255.0.0.0 127.0.0.1 127.0.0.1 1
5	Add an active route for the local NOE by typing: C:\>route add 84.0.0.0 mask 255.0.0.0 205.217.193.205 The result is that Windows 95/98/ NT will now talk to any address that starts with an 84 that is directly connected to a hub or switch directly accessible to your machine, or that can be seen by the route/gateway specified.

Continued on next page

Assigning Ethernet Address Parameters, continued

Using the Default IP Address, continued

Step	Action
6	Confirm that there is a new entry in the active route table by typing: C:>route print Active Routes: Network Address Netmask Gateway Address Interface Metric 0.0.0.0 0.0.0.0 205.217.193.250 205.217.193.205 1 84.0.0.0 255.0.0.0 205.217.193.205 205.217.193.205 1 127.0.0.0 255.0.0.0 127.0.0.1 127.0.0.1 1
7	Verify that a connection is made by typing C:\>ping 84.0.0.2 Reply from 84.0.0.2: bytes = 32 time = 1ms TTL=32 Reply from 84.0.0.2: bytes = 32 time = 1ms TTL=32 Reply from 84.0.0.2: bytes = 32 time = 1ms TTL=32 Reply from 84.0.0.2: bytes = 32 time = 1ms TTL=32

Specifying Address Parameters

Consult your system administrator to obtain a valid IP address and appropriate gateway and subnet mask, if required. Then follow the instructions in Configuring the Ethernet Address Parameters in Chapter 4.

Continued on next page

Assigning Ethernet Address Parameters, continued

Assigning an IP address Via Concept's "Specify IP Address" option.

You can select the NOE 771 x0 module's "Specify IP Address" mode via Concept to assign an IP address (as well as default gateway and sub network mask) to the module.

Assigning an IP address Via Concept's "Use Bootp Server" option

You can select the NOE 771 x0 module's "Use Bootp Server" mode via Concept to instruct the module to obtain its IP address from a network BOOTP server. In this mode, only an address obtained from a BOOTP server will be accepted by the module.

If BOOTP Server Responds

If the server responds with address parameters, the NOE 771 x0 module will use those parameters as long as power remains applied to the module.

If the server doesn't respond, the module will retry its request for two minutes.

If BOOTP Server Doesn't Respond

If no BOOTP response is received, the NOE 771 x0 module will use the default IP Address.

During this time the Run indicator will display a pattern of three flashes.

Assigning Ethernet Address Parameters, continued

NOE 771 00 Duplicate IP Address Test

In all cases, when the NOE 771 x0 module receives an IP address, it will test for duplicate addresses by sending broadcast ARP requests three times at 5 second intervals.

If a Duplicate IP Address is found on the network, the NOE 771 x0 will stay off-line to avoid a network disruption. It will display a pattern of four flashes to indicate a Duplicate IP Address detection.

Gratuitous ARP

If there are no replies to its requests, it will send gratuitous ARP three times at 2 second intervals to announce its presence on the network.

Establishing the FTP Password

Establishing the FTP Password

The FTP Password is established using the Embedded Web Server. This section contains information on initially accessing the web server. The first thing the system administrator should do upon accessing the web server is change the FTP password. Doing this restricts access to the web server functionality to the system administrator.

This section contain information on how to access the web server for purposes of changing the FTP and HTTP passwords. Chapter 7 contains detailed information on the web server pages and their functionality.

Introduction to Accessing the Web Server

Each Quantum 140 NOE 771 x0 10/100 Megabit Ethernet module contains a World Wide Web embedded server that allows you to access diagnostics and online configurations for the module and it's associated controller (PLC).

The web pages can only be viewed across the World Wide Web using version 4.0 or greater of either Netscape Navigator or Internet Explorer, both of which support JDK 1.1.4 or higher.

For information on the additional functionality provided by the FactoryCast system in the 140 NOE 771 10 module, see the *FactoryCast Manua*l, 890 USE 152 00.

How to Access It

Before you can access the module's home page, you must enter the full IP address or URL in the Address or Location box in the browser window.

For example: http://*hostname* *(hostname* is full IP address or DNS host name.)

Once you do this the Schneider Automation Web Utility home page will appear.

Continued on next page

Establishing the FTP Password, continued

Schneider Web Utility Home Page

Schneider Automation Web Server

Diagnostics and Online Configurations

Operating System: Windows 95
Screen Resolution: 1280 x 1024
Browser: Microsoft Internet Explorer 4

From this page you can do the following:

- Access the pages to change the FTP password
- Access the pages to change the HTTP password
- Access the pages for diagnostic and configuration information, see Chapter 7 Embedded Web Pages for further information.

Continued on next page

Establishing the FTP Password, continued

Modifying the FTP Server Password

The following step details how to link to the web page that allows the modifying of the FTP Password:

Step	Action
1	Enter the URL, for example: http://*hostname*/secure/embedded/ftp_passwd_config.htm

Result: The user is requested to supply a user name and password.

Upon supplying the user name, password, and clicking the **<OK>** button, the Modify FTP Server User Name and Password Page appears.

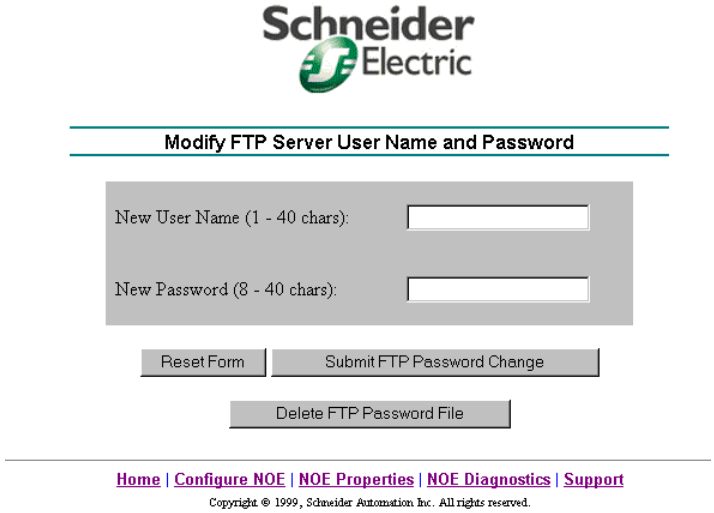
Note: The default User Name is USER, and the default Password is USERUSER. Both should be changed by the system administrator during module installation.

Continued on next page

Establishing the FTP Password, continued

FTP Username and Password Modify Page Overview

This page is used for modifying the FTP user name and password.



Change the Username and Password

At this point the system administrator should change the Username and Password to restrict future access to the system. The steps to do this are:

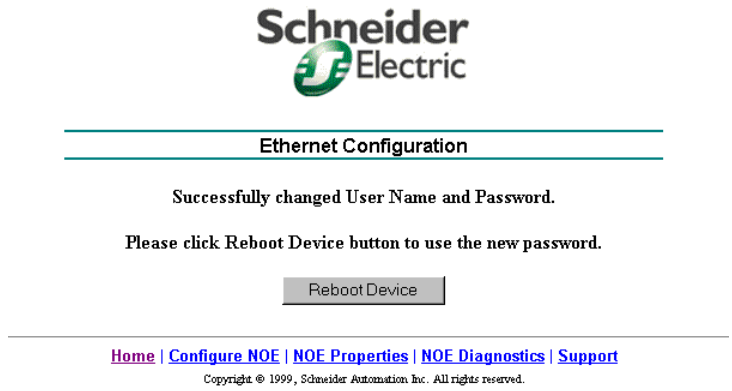
Step	Action
1	Type in the new Username in the New User Name block
2	Type in the new Password in the New Password block
3	Click on the Submit FTP Password Change button

Continued on next page

Establishing the FTP Password, continued

Modify FTP Server User Name and Password Message

The following message is generated when you click on the Submit FTP Password Change button:



Clicking the Reboot Device button will reset the Username and Password for the NOE 771 x0 board.

Note: The Reboot will take approximately 40 seconds.

Establishing the HTTP Password

Modifying the HTTP Password

The following step details how to link to the web page that allows the modifying of the HTTP Password:

Step	Action
1	Enter the URL, for example: http://*hostname*/secure/embedded/http_passwd_config.htm

Result: The user is requested to supply a user name and password.

Upon supplying the user name, password, and clicking the **<OK>** button, the Modify HTTP Server User Name and Password Page appears.

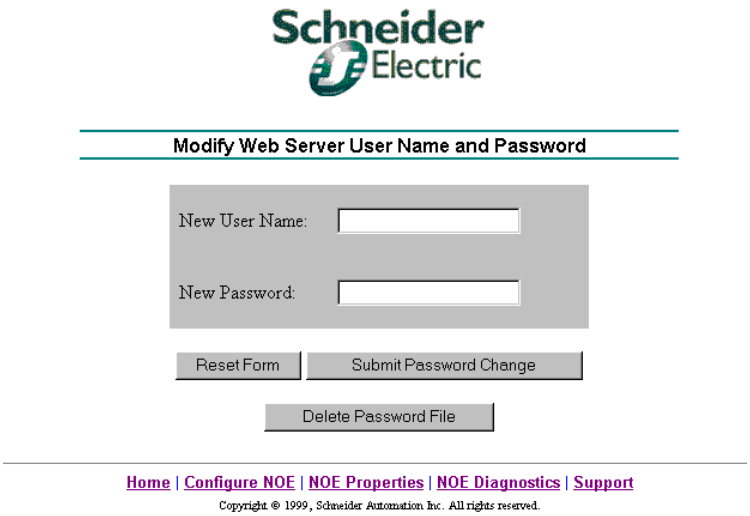
Note: The default User Name is USER. and the default Password is USER. Both should be changed by the system administrator during module installation.

Continued on next page

Establishing the HTTP Password, continued

Modify Web Server User Name and Password Page Overview

This page is used for modifying the HTTP user name and password.



Change the Username and Password

At this point the system administrator should change the Username and Password to restrict future access to the system. The steps to do this are:

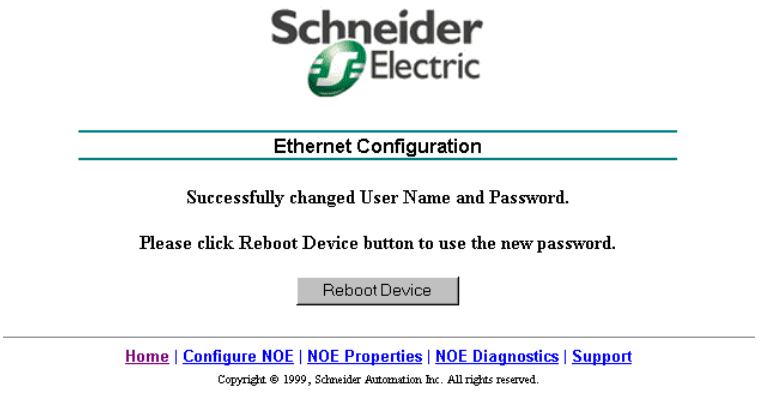
Step	Action
1	Type in the new Username in the New User Name block
2	Type in the new Password in the New Password block
3	Click on the Submit Password Change button

Continued on next page

Establishing the HTTP Password, continued

Modify Web Server Username and Password Page Message

The following message is generated when you click the Submit Password Change button:



Clicking the Reboot Device button will reset the Username and Password for the NOE 771 x0 board.

Note: The Reboot will take approximately 40 seconds.

Using BOOTP Lite to Assign Address Parameters

CAUTION

INCORRECT MAC ADDRESS HAZARD

Be sure to verify the MAC address of the target device before invoking BOOTP Lite. If you do not enter the correct parameters of the target controller, it will run in its old configuration. An incorrect MAC address may also result in an unwanted change to another device and cause unexpected results.

Failure to observe this precaution can result in injury or equipment damage.

BOOTP Lite Utility

Instead of a BOOTP server, Schneider Electric's BOOTP Lite utility software can be used to provide the IP address, subnet mask and default gateway to the NOE 771 x0 module.

Refer to the BOOTP Lite user documentation for instructions.

Note: BOOTP Lite and the user document are available for download at www.modicon.com.

Configuring the Module with Concept

4

At a Glance

Introduction

This chapter describes how to configure the NOE 771 module from your programming panel using Concept 2.2 or later. This is used to configure the module's IP parameters using Concept. The module can function as a network interface to the CPU without I/O services, as long as the IP parameters are provided by a BOOTP server, or with the module's default IP address.

What's in this Chapter

This chapter contains the following topics.

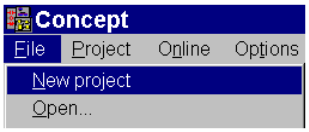
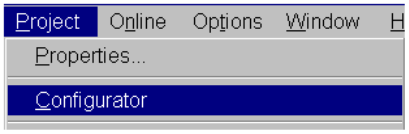
Selecting Your PLC

Procedure

Once the NOE 771 module has been installed in a Quantum backplane (refer to Chapter 3), you can begin to configure it using Concept 2.2. You start by selecting your CPU (PLC).

Note: For complete details on the use of Concept, refer to the set of manuals shipped with the software.

Perform the following steps to select a CPU.

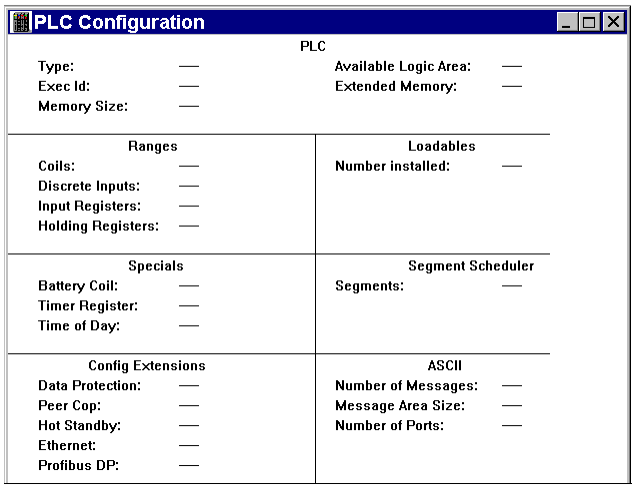
Step	Action
1	Open Concept 2.2 on your programming panel (PC)
2	From the File menu, select **New project**.  **Result:** A new project is opened and the file name (untitled) appears over the menu bar. 
3	From the Project menu, select **Configurator**. 

Continued on next page

Selecting Your PLC, continued

Procedure, continued

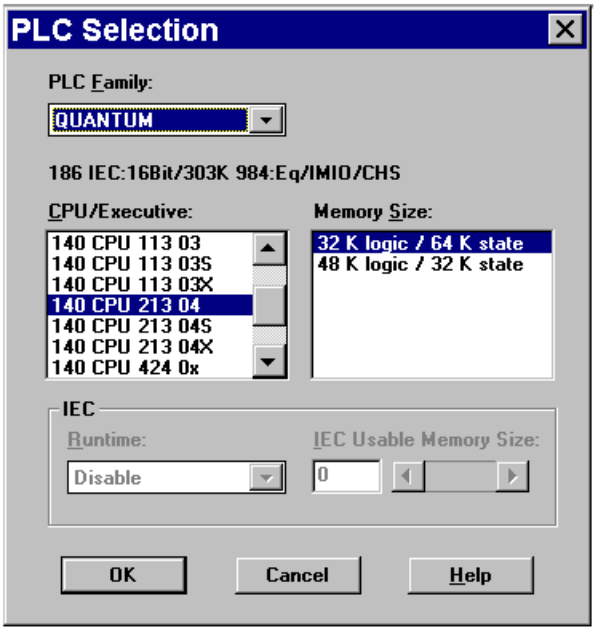
Step	Action
3, (con't)	**Result:** The PLC Configuration screen appears.



Continued on next page

Selecting Your PLC, continued

Procedure, continued

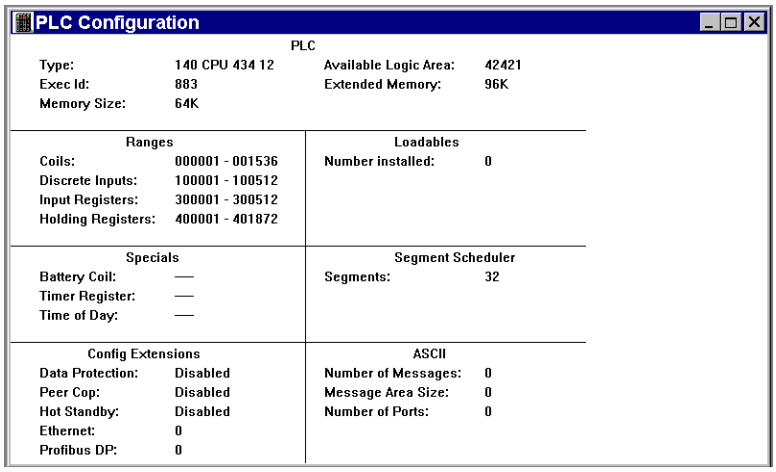
Step	Action
4	Double click on the **Type** field in the PLC section of the Configure menu. **Result:** The PLC Selection dialog box appears. The default selection is Quantum. 
5	From the **CPU/Executive** scroll box, select the CPU that is installed in your Quantum backplane **Note:** Depending on the CPU selected, you may need to select the correct memory size applicable to it in the **Memory Size** dialog Box.

Continued on next page

Selecting Your PLC, continued

Initial Setup Procedure, continued

Step	Action
6	Click the **<OK>** button. **Result:** Your PLC type and default configuration parameters are displayed in the PLC Configuration screen.



Next

Next, you must configure the number of Ethernet modules that your system will contain.

Setting the Number of NOEs

Introduction

You may configure from two to six Ethernet modules in a single controller, depending on the model. A 140 CPU 113 or 213 will accept a total of two network option modules, including NOE, NOM, NOP, and CRP 811. A 140 CPU 424, 434 or 534 will accept six. Refer to the table in the I/O Scanner Concepts section in Chapter 5 regarding the mix of I/O scanners and NOE modules per CPU.

Memory Requirements

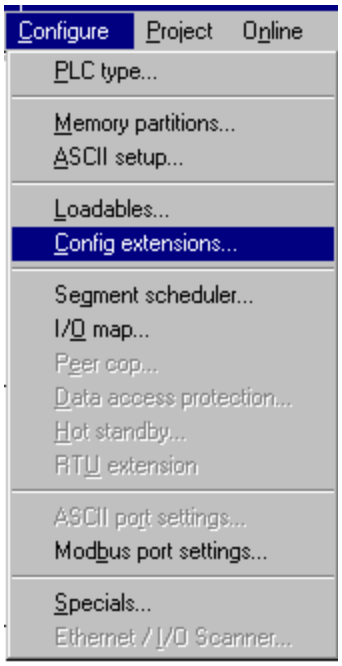
The first Ethernet TCP/IP module configured requires 20 words of memory. Each additional module requires an additional 16 words of memory.

Continued on next page

Setting the Number of NOEs, continued

Procedure

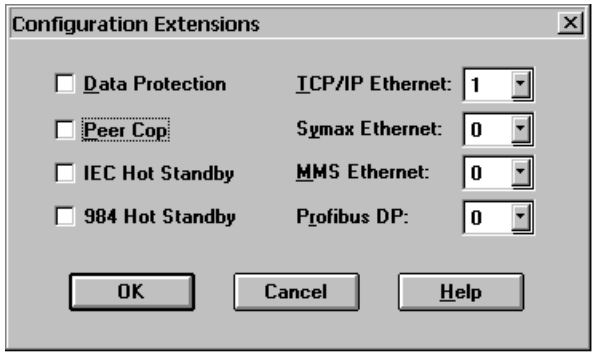
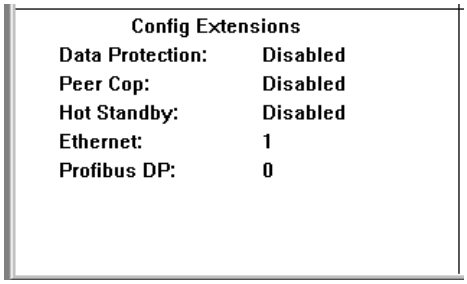
From the PLC Configuration screen, follow the steps below to select the number of NOE modules.

Step	Action
1	From the Configure menu, select **Config extensions** or, double-click anywhere in the Config Extensions region of the screen.  Result: The Configuration Extension dialog box appears (next page).

Continued on next page

Setting the Number of NOEs, continued

Procedure, continued

Step	Action
2	In the TCP/IP Ethernet scroll box, select the number of NOE modules to be configured. 
3	Click on the **<OK>** button. **Result:** The Ethernet status changes from 0 to the number selected in Step 2. 

Next

Next, you need to create an I/O map for the NOEs in your configuration.

Accessing and Editing the I/O Map

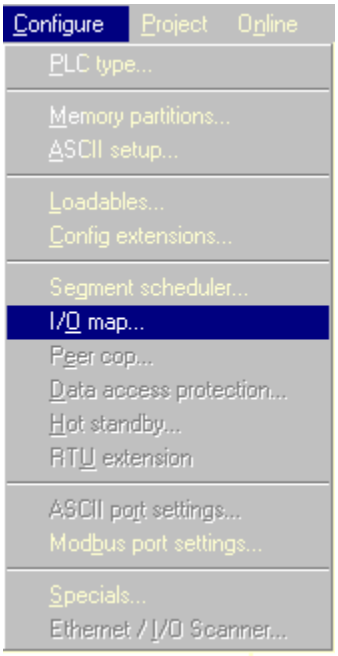
Introduction

This procedure is required to determine the number of NOEs in the system and their slot numbers.

As part of the configuration process, you need to create an I/O Map for the local backplane including the NOE 771 x0 module. This step is required to determine the number of NOEs in the system and their slot locations.

Procedure

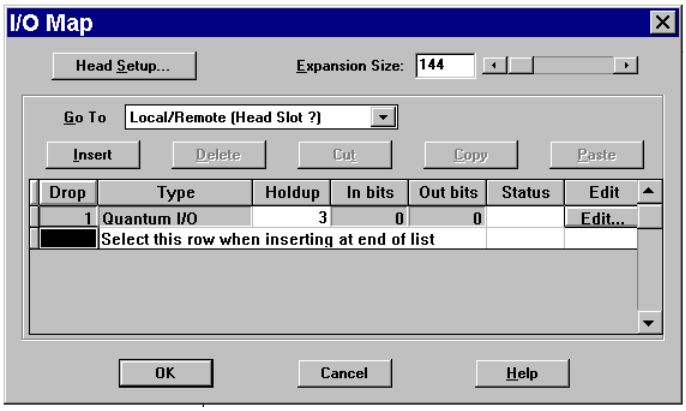
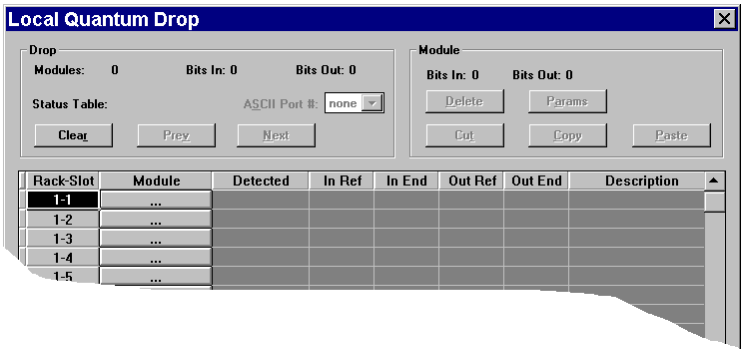
Perform the following steps to access and edit an I/O Map from the PLC Configuration screen.

Step	Action
1	From the Configure menu, select I/O map. 

Continued on next page

Accessing and Editing the I/O Map, continued

Procedure, continued

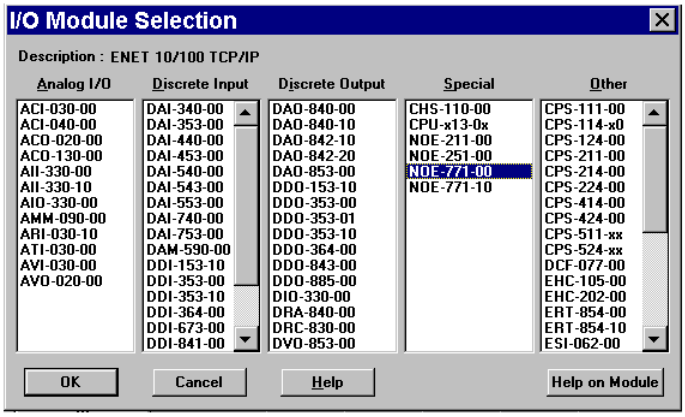
Step	Action
1, (con't)	**Result:** The I/O Map dialog box appears: 
2	Click the **<Edit>** button at the end of the Quantum I/O row. **Result:** The Local Quantum Drop I/O dialog box appears. 

Continued on next page

Accessing and Editing the I/O Map, continued

Procedure, continued

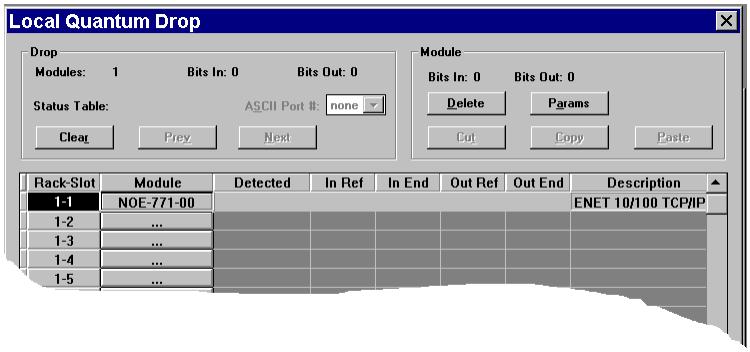
Step	Action
3	Click on the **...** button under **Module.** **Result:** The I/O Module Selection dropdown menu appears.



Continued on next page

Accessing and Editing the I/O Map, continued

Procedure, continued

Step	Action
4	Click on **NOE-771-00** that appears in the Special column and then click on the **<OK>** button**.** **Result:** The Local Quantum Drop I/O dialog box reappears and the **NOE-771-00** is now listed under Module and is described in the Description column 
5	Repeat Steps 3 and 4 if other modules need to be added to the I/O map.
6	Click the <OK> buttons to return to the PLC Configuration screen.

Next

Next, you will configure the Ethernet address parameters from the Ethernet/ I/O Scanner screen.

Configuring the Ethernet Address Parameters

Introduction

The NOE 771 x0 module's Ethernet address parameters, consisting of Internet, Subnet mask, and Gateway addresses, are accessible from the Ethernet/ I/O Scanner dialog box. Prior to performing the following procedure, consult your system administrator to determine if you must configure new Ethernet address parameters, or whether the module will obtain them from the BOOTP server.

CAUTION

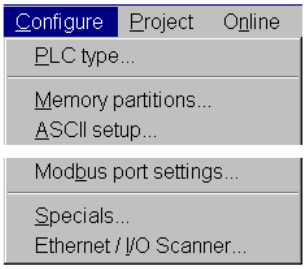
DUPLICATE ADDRESS HAZARD

Always obtain your IP addresses from your system administrator to avoid the possibility of duplicate addresses. Having two devices with the same IP address can cause unpredictable operation of your network.

Failure to observe this precaution can result in network disruption leading to possible injury or equipment damage.

Procedure

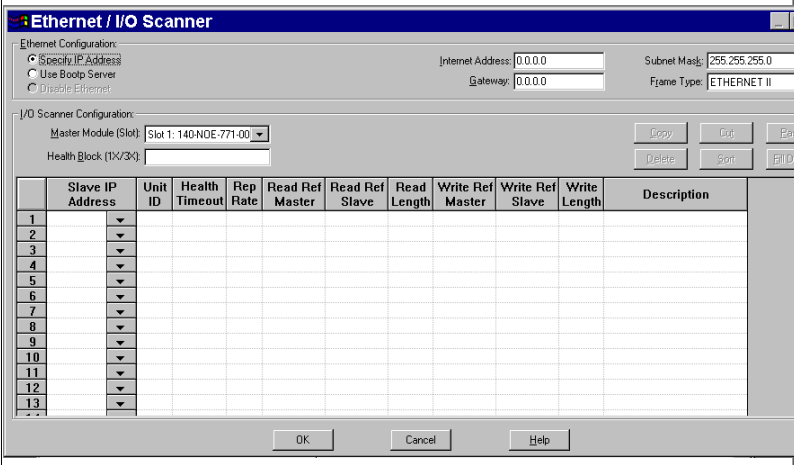
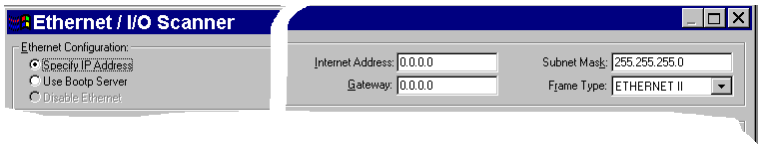
Perform the following steps to configure the Ethernet Address Parameters.

Step	Action
1	From the Configure menu, select **Ethernet/ I/O Scanner** 

Continued on next page

Configuring the Ethernet Address Parameters, continued

Procedure, continued

Step	Action
1, (con't)	**Result:** The Ethernet/ I/O Scanner dialog box appears. 
2	To configure new Ethernet address parameters, click on the **Specify IP Address** radio button. 
3	Type in the new IP, Subnet Mask, and Gateway addresses in the applicable text boxes.
4	Select the correct Internet frame type from the **Frame Type** scroll box.

Continued on next page

Configuring the Ethernet Address Parameters, continued

Procedure, continued

Step	Action
5	If the Ethernet address parameters are to be assigned by the module's BOOTP server, click on the Use Bootp Server radio button **Note**: If you select this option, the address parameter text boxes will be grayed out and will not display the addresses. 

How the Module Derives It's IP Address

During initialization, the NOE 771 module attempts to read the address parameter information from the PLC and determines it's IP Address in the following fashion:

- If the PLC has the IP Address and the BOOTP server is not selected, the module will use the configured IP address that you assigned in Step 2 of the above procedure.
- If the BOOTP server was selected in Step 5 of the above procedure, the module will send BOOTP requests to receive it's IP Address.
- If no Configuration Extension exists, the NOE sends out BOOTP requests. If the module does not receive it's IP Address from the BOOTP server after 2 minutes, it will then use the IP Address derived from it's MAC address.

Note: The MAC address is assigned at the factory and is recorded on a label on the front panel, above the cable connector. This is a unique 48-bit global assigned address. It is set in PROM. The Ethernet address is recorded on the label in hexadecimal, in the form 00.00.54.xx.xx.xx

Transferring Data with the I/O Scanner 140 NOE 771 00 only

5

At a Glance

Introduction

This chapter discusses the NOE 771 00 module's I/O scanner capabilities and includes procedures for configuring the I/O scan list using Concept 2.2, ProWORX NxT 2.1, and Modsoft.

What's in this Chapter

This chapter contains the following topics.

I/O Scanner Concepts

Introduction

All NOE 771 00 modules provide an I/O scanner which the user configures with the Concept 2.2, ProWORX NxT 2.1, or Modsoft programming panel. This allows the user a way to configure data and transfer it between network nodes without using the MSTR instruction.

I/O Scan List

The I/O Scanner is a feature of the NOE module, which allows the reading and/or writing to Input/Output devices repetitively.

The I/O scan list is a configuration table which identifies the targets with which repetitive communication is authorized. The list contains enough information for each target to construct the Modbus message addressed to that particular remote device and to designate where on the local controller the input and output data is to be mapped at the end of the scan. While the controller is running the NOE module transfer data to and from the controller's registers and coils as indicated by the I/O scan list.

The user configures the I/O scan list with the Concept, ProWORX NxT, or Modsoft programming panel. There can be multiple instances of the I/O scan list (Peer Coop restrictions apply). The individual scan lists for each module are identified by the Quantum backplane slot number where the NOE is installed.

Continued on next page

I/O Scanner Concepts, continued

I/O Scanner Definitions

The following defined terms are used to describe the I/O Scanner operation.

Term	Definition
Scan List	The list of input and/or output devices which the NOE module is configured to scan.
Specific Input	Input to the controller, on the backplane where the NOE resides.
Specific Output	Output from the controller, on the backplane where the NOE resides.
Peer Cop	Legacy I/O Scanner support to upgrade Modbus Plus I/O applications to Ethernet.
Ethernet I/O Scanner	Provides high performance cyclic communication service to the controller.

Peer Cop and Enhanced Modbus/TCP Scanners

The NOE 771 00 module's design provides you with the ability to configure it's Modbus I/O Scanner as either a Peer Cop or Enhanced Modbus scanner. The determination as to which scanner is used depends on the programming package that is installed on your system. If you presently are using Modsoft, than you must configure the I/O Scanner for Peer Cop operation. If your are presently using Concept 2.2 or ProWORX NxT 2.1, than you can configure the I/O Scanner for either Peer Cop or enhanced Modbus/TCP operation.

Continued on next page

I/O Scanner Concepts, continued

Peer Cop I/O Scanner Features

The Peer Cop based Modbus I/O Scanner has the following characteristics:

Parameter	Value
Max. No. of Devices	64
Max. No. of Input Words	500
Max. No. of Output Words	500
Timeout Value	Global Setting (20 Msec to 2 Secs in 20 mSec increments)
Input TimeOutState	Global Setting (Zero or Hold)
IP Address	Derived from Modbus Address (must be on NOE's Subnet)
Remote Register Reference	Not configurable - 400001 is used
Destination ID	Not settable, set to 0
Operation thru a Modbus Plus to Ethernet bridge	Not supported

Enhanced Modbus I/O Scanner Features

The Enhanced Modbus I/O Scanner has the following characteristics

Parameter	Value
Max. No. of Devices	64
Max. No. of Input Words	4,000
Max. No. of Output Words	4,000
Timeout Value	Individual Setting (1 Msec to 2 Secs in 1 mSec increments)
Input TimeOutState	Global set to zero. Individual set table with Concept 2.5.
IP Address	Individually Settable
Remote Register Reference	Configurable
Min. Update Rate	Settable
Destination ID	Not settable, set to 0
Operation thru a Modbus Plus to Ethernet bridge	Not supported

Continued on next page

I/O Scanner Concepts, continued

I/O Scanner Support

A maximum of two NOE modules can be configured as I/O scanners per controller. The mix of I/O scanners and NOE modules per CPU is summarized in the following table.

Quantum CPU Type	No. of NOEs Supported	Max No. of NOEs Configured as Peer Cop I/O Scanners	Max No. of NOEs Configured as Ethernet I/O Scanners
140 CPU 113 02	2	2	2
140 CPU 113 03	2	2	2
140 CPU 213 04	2	2	2
140 CPU 424 02	6	2	6
140 CPU 434 12	6	2	6
140 CPU 534 14	6	2	6

Configuring the I/O Scan List Using Concept

Introduction

Once the NOE 771 00 has been configured using Concept (see Chapter 4), you can assign parameters for I/O scanning. This involves creating the I/O scan list containing all the input and output devices that the NOE module will scan.

IP Address

Type the IP address of the slave module in the IP address column. This address will be stored in a pulldown menu, so that you may use it in another row by clicking on the down arrow and selecting it, as shown:

Unit ID

If the slave module is an I/O device attached to the specified slave module, use the Unit ID column to indicate the device number. The Unit ID is used with the Modbus Plus to Ethernet bridge to route to Modbus Plus networks.

Health Timeout

The Health Timeout is used for setting the health bit. If the response arrives before the HealthTimeout, the health bit is set, otherwise it is cleared. If the Health Timeout is zero, the health bit is set true once communications is established, and it is never cleared.

Continued on next page

Configuring the I/O Scan List Using Concept, continued

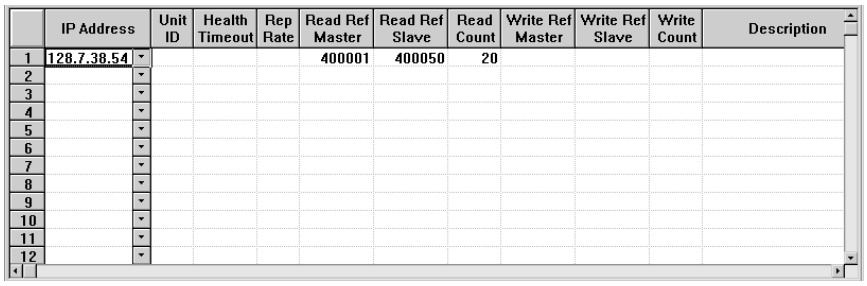
Rep Rate

Use this column to specify the lower bound in milliseconds (ms) between transactions to this node. Valid values are 0 ... 65,000 ms (1 min). The NOE module takes this value and rounds up to a multiple of 17 ms. Since the update of I/O is synchronized to the CPU scan, if the CPU scan is greater than the configured lower bound, then the actual update rate will be at the rate of the CPU scan. To obtain the maximum rate specify a zero.

For example, if a user specifies 10 ms, then it is rounded up to 17 ms. If the controller's scan time is 5 ms, then the time between transactions must be greater than or equal to 17 ms. On the other hand, if the controller's scan time is 200 ms, the time between transactions must be greater than or equal to 200 ms.

Read

Use the read function to read data from the remote node. The Read Ref Slave column specifies the first 4x register of the remote node to be read. The Read Count column specifies the number of registers to read. The Read Ref Master column specifies the local address for the read response.



	IP Address	Unit ID	Health Timeout	Rep Rate	Read Ref Master	Read Ref Slave	Read Count	Write Ref Master	Write Ref Slave	Write Count	Description
1	128.7.38.54				400001	400050	20				
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

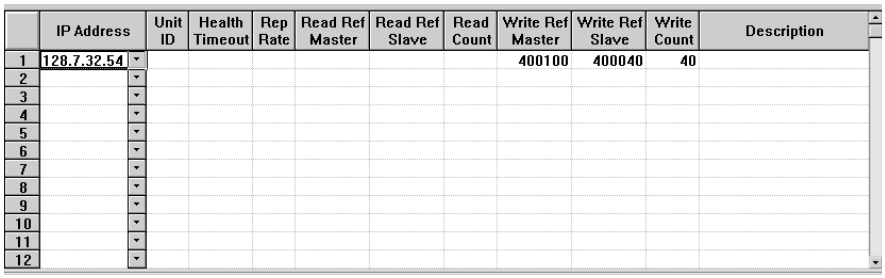
Continued on next page

Configuring the I/O Scan List Using Concept, continued

Write

Use the write function to write data to the remote node. The Write Ref Master column specifies the local address of the write data. The Write Count column specifies the number of registers to write. The Write Ref Slave column specifies the first 4x register to be written to the remote node

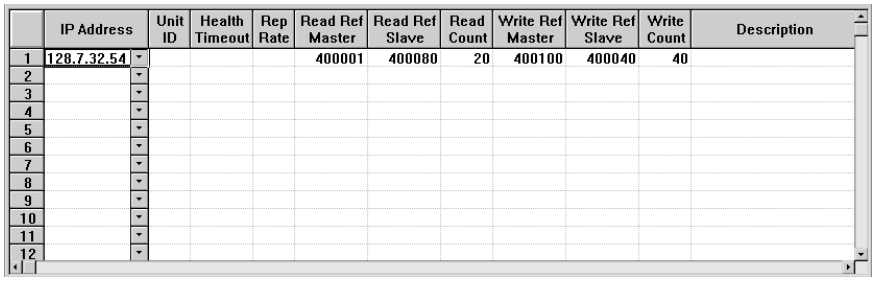
.



	IP Address	Unit ID	Health Timeout	Rep Rate	Read Ref Master	Read Ref Slave	Read Count	Write Ref Master	Write Ref Slave	Write Count	Description
1	128.7.32.54							400100	400040	40	
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Read and Write

You may include read and write commands on the same line, as shown:



	IP Address	Unit ID	Health Timeout	Rep Rate	Read Ref Master	Read Ref Slave	Read Count	Write Ref Master	Write Ref Slave	Write Count	Description
1	128.7.32.54				400001	400080	20	400100	400040	40	
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Description

You can type a brief description (up to 32 characters) of the transaction in the Description column.

Continued on next page

Configuring the I/O Scan List Using Concept, continued

Configuring the Health Block

The Health Block is located at a block of 3x registers or 1x coils. For 1x coils it must start on a 16-bit boundary. Each device that is configured has a corresponding health bit in the Health Block. If the health bit is one, the remote device is healthy. It the health bit is 0 (zero), the remote device is unhealthy.

Each row that is configured is mapped to a bit position as shown below.

Word 1 Bit Positions

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Word 2 Bit Positions

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Word 3 Bit Positions

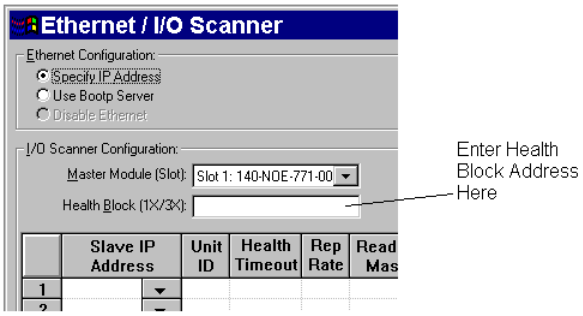
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48

Word 4 Bit Positions

49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64

Starting Location of Health Block

To specify the starting 1x/3x location of the Health Block, enter the desired address into the Health Block text box as shown below.



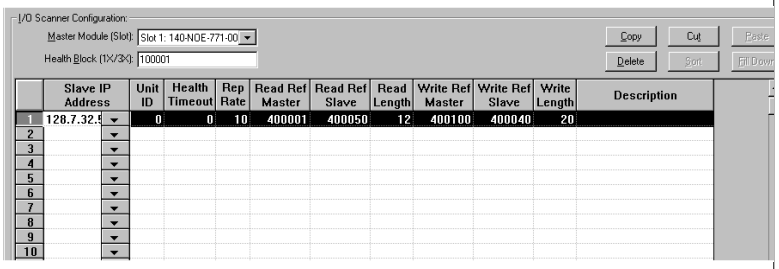
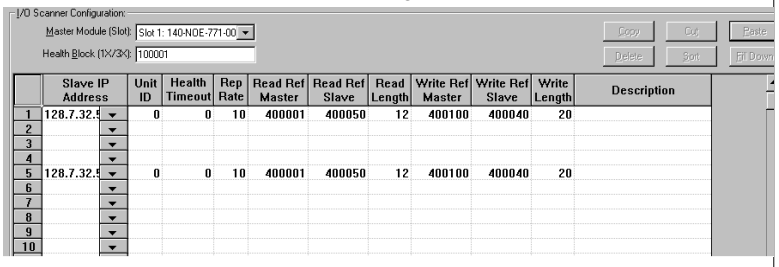
Completing the I/O Configuration

Introduction

This section describes how to complete your Ethernet I/O configuration using the Copy, Cut, Paste, Delete, Sort, and Fill Down buttons.

Copy and Paste

To save time when typing similar read and write commands, you may copy and paste entire rows within your configuration. Follow the steps in the table below:

Step	Action
1	Select the row you want to copy by clicking on the row number at the far left. 
2	Click the **Copy** button above the I/O configuration list.
3	Select the row where you would like to paste the data (by clicking on the row number at the far left).
4	Click the **Paste** button above the I/O configuration list. 

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Completing the I/O Configuration, continued

Cut and Paste

To move a row within the configuration list, follow the directions for copying, only use the Cut button instead of the Copy button.

Delete

To delete a row from the configuration list, select the row by clicking on the row number at the far left. Then click the **Delete** button.

Sort

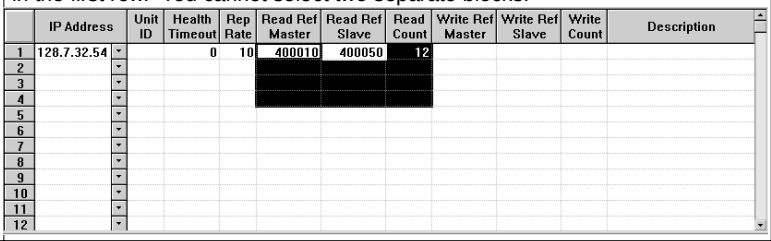
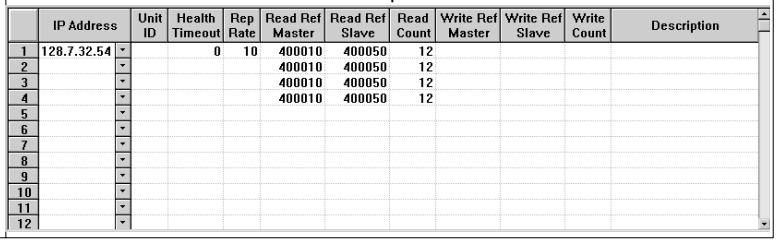
To sort the I/O configuration list, select a column by clicking on the column heading (i.e.. Read Ref Master). Then click the **Sort** button.

Continued on next page

Completing the I/O Configuration, continued

Fill Down

To copy part of any row to the next row or to a series of adjoining rows, use the Fill Down button, following the steps in the table below:

Step	Action
1	Use your mouse to select the data you would like to copy and the cells you would like to copy it to. **Note:** You must select one contiguous block of cells, with the data to be copied in the first row. You cannot select two separate blocks. 
2	Click the **Fill Down** button. **Result:** The data from the first row is copied to the selected cells below. 

Configuring the I/O Scan List Using ProWORX NxT

Introduction

This section discusses how to configure the NOE 771 module from your programming panel using ProWORX NxT program. This process assumes you have switched to an Ethernet network so you can choose I/O Scanner instead of the Peer Cop. This allows you to configure data blocks to be transferred between controllers on a TCP/IP network.

There are three procedures to the configuration process:

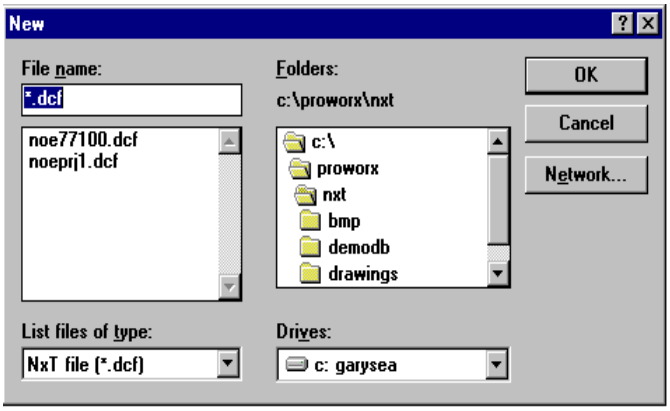
- Selecting Your PLC
- Accessing and Editing the Traffic Cop
- Setting the Number of NOE's and Configuring the Ethernet Address Parameters

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Selecting Your PLC

Perform the following steps to select a CPU.

Step	Action
1	Open ProWORX NxT on your programming panel (PC). **Result:** ProWORX NxT initial screen will appear. 
2	From the File menu, select **New.** **Result:** The New dialogue box appears. 

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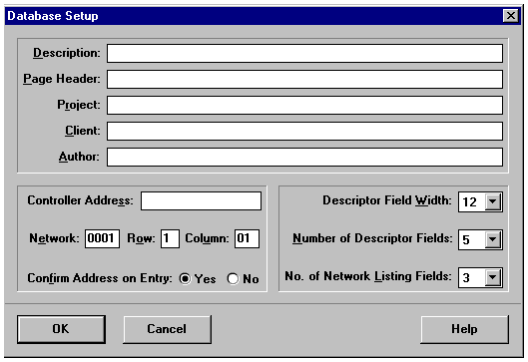
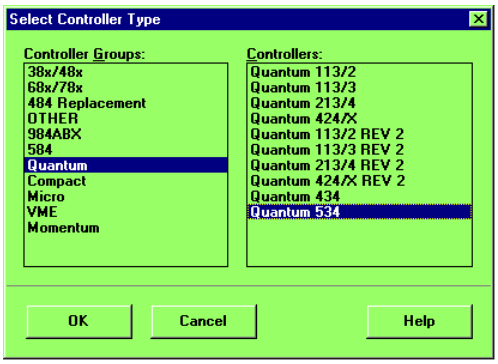
Configuring the I/O Scan List Using ProWORX NxT, continued

Selecting Your PLC
continued

Step	Action
3	Type a file name in the **File Name** text box. Select the drive from the drop down box labeled “Drivers” . Select the file folder where you want to save the new database labeled “Folders”. Press the **<OK>** button **Result:** The Database Setup screen appears. 
4	Fill in the text boxes as you require. Press the **<OK>** button. **Result:** The Select Controller Type dialog box appears. 

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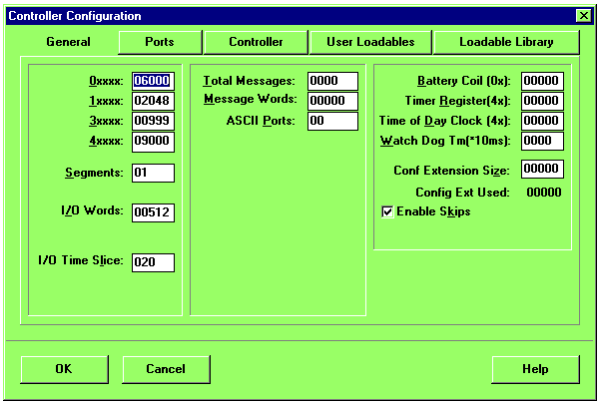
Configuring the I/O Scan List Using ProWORX NxT, continued

Selecting Your PLC
continued

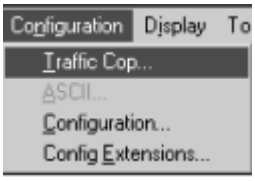
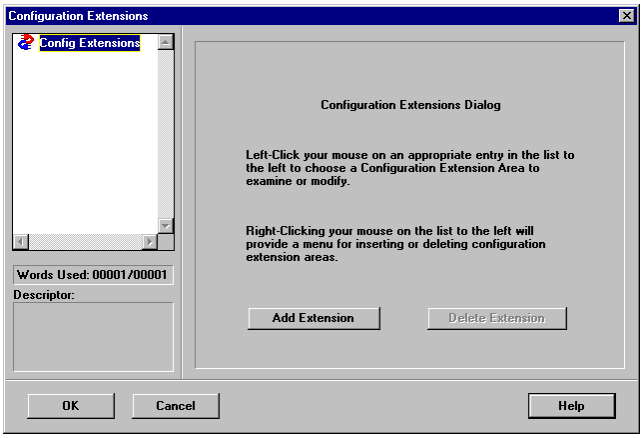
Step	Action
5	From the **Controller Groups** list box on the left, select the Quantum group. From the **Controllers** list box on the right, select the CPU that is installed in your Quantum backplane. Click the **<OK>** button. **Result:** The Controller Configuration screen appears. 
6	You must define a value in the **Conf Extension Size** on the right side of the Controller Configuration screen. This value is the amount of memory you require. Press the **<OK>** button.

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Accessing and Editing the Traffic Cop

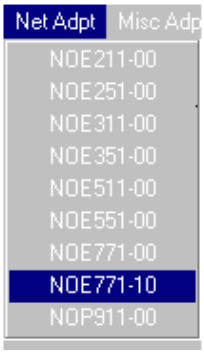
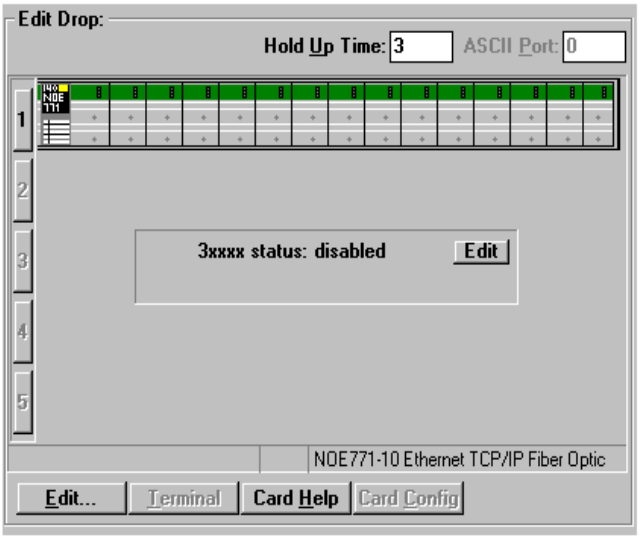
Perform the following steps to access and edit the Traffic Cop.

Step	Action
1	From the Configuration menu, select **Traffic Cop**.  **Result:** the Traffic Cop screen appears. 
2	From the Quantum Traffic Cop menu on the left, click the “+” sign to expand the Traffic Cop tree. Choose the Rack and Slot where you want the NOE 771 module inserted.

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Accessing and Editing the Traffic Cop continued

Step	Action
3	From the Net Adpt menu of the Traffic Cop screen, select NOE 771,  **Result:** The NOE 771 module is inserted into the specified location, within the Edit Drop field of the Traffic Cop screen. 
4	Press the **<OK>** button.

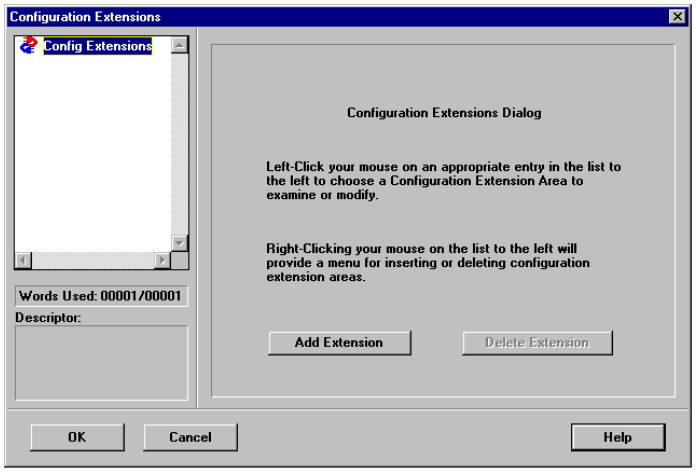
Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Setting the Number of NOE's and Configuring the Ethernet Address Parameters

From the Configuration Expansion screen, follow the steps below to do the following:

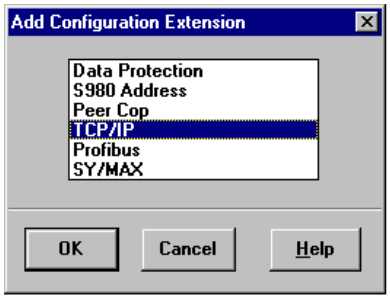
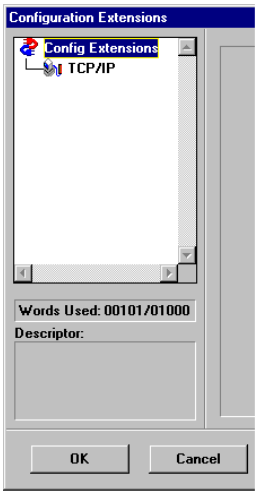
- Select the number of NOE 771 modules
- Configure the Ethernet Address Parameters, TCP/IP

Step	Action
1	From the Configuration menu, select **Config Extensions**.  **Result:** The Config Extension screen appears. 

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Setting the Number of NOE's and Configuring the Ethernet Address Parameters continued

Step	Action
2	Click the **Add Extension** button. Result: The Add Configuration Extension dialog box appears. 
3	Select **TCP/IP** from the list and click the **<OK>** button. **Result:** The TCP/IP Configuration Extension is added to the left menu of the Configuration Extensions screen. 

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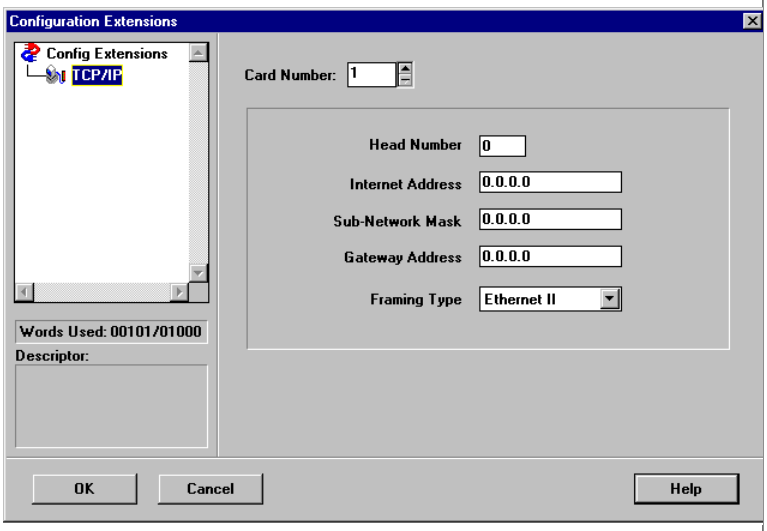
Configuring the I/O Scan List Using ProWORX NxT, continued

Setting the Number of NOE's and Configuring the Ethernet Address Parameters continued

Step	Action
4	Click the **TCP/IP Config Extension** in the left menu. **Result:** The details of the TCP/IP configuration appear on the right of the Configuration Extension screen. 
5	Select the Card Number (Rack Number) by pressing the  button in the Card Number combo box.
6	Complete the fields for each Card Number. The Head Number text box represents the Rack in which the NOE 771 module is located. Click the **<OK>** button when complete.

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Setting Up the I/O Scanner Using ProWORX NxT

At this point you are ready to set up the I/O Scanner. The I/O Scanner provides data transfer between two or more NOE 771 00 and other Modbus or TCP/IP devices. It allows you to simultaneously configure up to 64 connections. To configure the I/O Scanner, follow the steps below to do the following:

- Specify the specific I/O groups to be scanned
- Configure the transaction parameters
- Set the hardware clock for when the data is to be collected

Specify the Specific I/O Groups to be Scanned

Follow the steps below to specify the I/O groups to be scanned:

Step	Action
1	From the Network Editor, on the **Configuration** menu, click **Config Extensions**. The Configurations Extensions dialog box appears.
2	In the Config Extensions tree, right-click on **Config Extensions** and select **Add Extension**.
3	Select **Ethernet I/O Scanner**. The parameters for the CDE appear in the details area.
4	In the Health Block field, type a 1xxxxx or 3xxxxx address. **Note:** All 1xxxxx addresses are based on a 16-bit boundary. For example: 100001, 100017, 100033, etc.
5	Double-click on an empty transaction to add a new transaction or double-click on an existing transaction to edit it. The Transaction dialog box appears.

Continued on next page

Configuring the I/O Scan List Using ProWORX NxT, continued

Configure the Transaction Parameters

Follow the steps below to configure the transaction parameters:

Step	Action
1	Double-click on an empty transaction to add a new transaction or double-click on an existing transaction to edit it. The Transaction dialog box appears.
2	Configure the transaction parameters.

Establishing Configuration Extension Memory for Peer Cop

Introduction

By default, the Peer Cop capability is disabled. If you want to use Peer Cop to handle Modbus Plus communications, you need to enable this capability and adjust the amount of configuration extension memory.

Note: If you are upgrading your network to Ethernet, you should consider the option of ignoring Peer Cop and instead, configuring extension memory to use the enhanced Modbus/TCP IO Scanner feature of your NOE 771 00 module. (See Chapter 6.)

How Much Memory?

The minimum Peer Cop memory requirement is 20 words; the maximum is 1366 words.

Follow these guidelines for estimating the amount of extension memory you will need for your Peer Cop database:

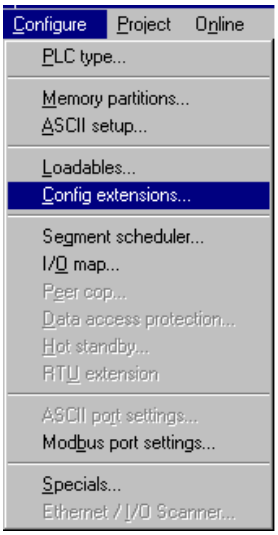
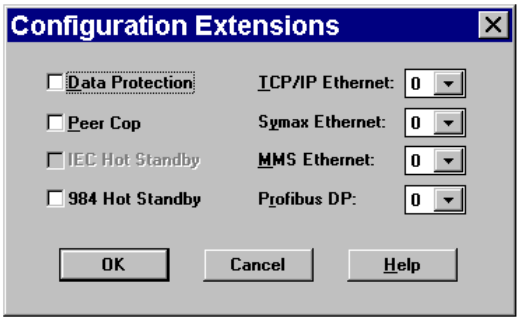
For...	Add...	Up to a maximum of...
Overhead	9 words	--
Global output	5 words	--
Global input	number of words= number of devices x (1 + 2 x number of device subentries)	1088 words
Specific output	2 words for every device entry in Peer Cop	128 words
Specific input	2 words for every device entry in Peer Cop	128 words

Continued on next page

Establishing Configuration Extension Memory for Peer Cop, continued

Procedure

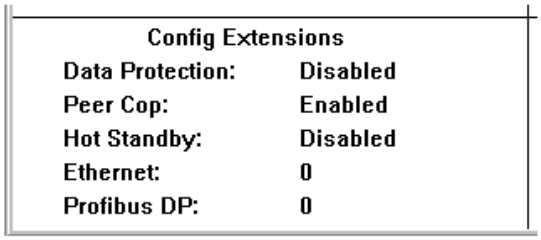
From the PLC Configuration screen, follow the steps below to enable Peer Cop and adjust the amount of Configuration Extension memory.

Step	Action
1	From the Configure menu, select **Config extensions** or, double-click anywhere in the Config Extensions region of the screen.  **Result:** The Configuration Extension dialog box appears. 

Continued on next page

Establishing Configuration Extension Memory for Peer Cop, continued

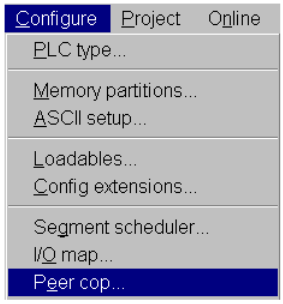
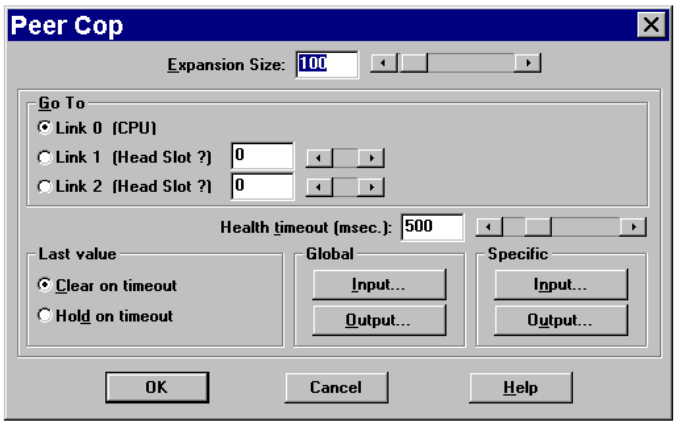
Procedure, continued

Step	Action
2	Click on the check box next to **Peer Cop**, then click the **<OK>** button. **Result:** Peer Cop status changes from Disabled to Enabled in the PLC Configuration screen. 

Continued on next page

Establishing Configuration Extension Memory for Peer Cop, continued

Procedure, Continued

Step	Action
3	From the Configure menu, select **Peer Cop**.  **Result:** The Peer Cop dialog box appears. 
4	Modify the amount of configuration extension memory allocated to Peer Cop by typing a new value in the **Expansion Size** field or, by adjusting the sliding scale next to the field.
5	Click the **<OK>** button.

Configuring the I/O Scan List Using Modsoft

Introduction

The Peer Cop input screens in the Modsoft program will be used to configure the I/O scan list.

The Peer Cop configuration extension allows you to configure certain continuous, fixed format communications between the controller (in which its is defined) and all other nodes on the same subnet.

Each Peer Cop configured communication specifies a source data block. The source data block is of fixed location and length and is continuously moved, to a fixed destination data block. This data transfer type is useful for transferring state information between controllers and for communicating with slave devices on the Ethernet.

Peer Cop communication is not appropriate for sequence dependent communication that must be performed exactly once. The standard MSTR element is used for those logic dependent requirements with certain restrictions.

Like the I/O Map, the Peer Cop can only be configured with the controller stopped. Once the PLC is configured and started, the transfers are performed automatically.

A menu item in the Peer Cop is available to delete the current node on the screen. A warning is given and the node is deleted if (Y) is answered. If the last node is deleted, a window opens to allow entry of a node. This condition is identical to the initial screen of an empty Peer Cop.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

Current Limitations

The following table describe the limitations of the operating parameters, as well as, the recommended settings for other parameters.

Parameter	Limitation/Special Recommendation
Maximum Input Length	32 Words
Maximum Output Length	32 Words
Total I/O Scan Data Length	500 Words
IP Address	An I/O device is currently limited to having an IP address in the form of AAA.BBB.CCC.DDD, where AAA.BBB.CCC are the same as the NOE's IP address and the subnet address of DDD is limited to 1 ... 64
Operation thru a Modbus Plus to Ethernet bridge	Not supported
Destination ID	Not user supportable; fixed at 0

Storage Requirements

Before selecting Peer Cop from the Cfg Ext pulldown list, you must use ExtSize to set the memory storage requirements.

Note: The remainder of the CfgExt pulldown functions remain disabled until the ExtSize is set.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

Storage Requirements, continued

- There are four types of Peer Cop requests:
- Global data input (not supported)
- Global data output (not supported)
- Specific data input
- Specific data output

CAUTION

GLOBAL DATA EXTENSION HAZARD

For the Ethernet TCP/IP network operations, only the specific data input and output are supported. Do not fill in the Global input or Global output. The NOE ignores global data configuration.

Failure to observe this precaution can result in injury or equipment damage.

Depending on your requirements you can estimate the memory needed where:

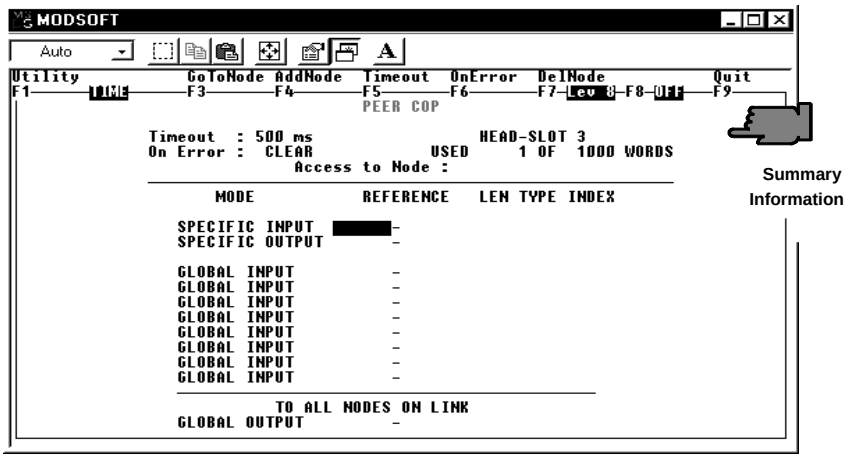
- If Specific Output is configured, then add 2 words for each device entry (64 maximum. Maximum is 64 x 2 = 128 words
- If Specific Input is configured, then add 2 words for each device entry (64 maximum). Maximum is 64 x 2 = 128 words. Based on the above, the minimum size Peer Cop could be 20 words while the maximum could be 1366 words for each of up to 3 links.

Specific Input/Output Configuration

The default screen for Peer Cop entry is labeled “Peer Cop” (see figure on next page). The screen is a data entry template comprising all four data types and providing a summary of settings that apply to the specific link/node as well as timeout, error handling and statement of memory words used.

Configuring the I/O Scan List Using Modsoft, continued

Specific Input/Output Configuration, continued



The cursor is initially in the Head Slot field. If you are not editing an initial template you may press the Esc key which re-positions the cursor to the SPECIFIC INPUT field. To traverse the Heads and Nodes you can re-display the Add Node select box from the main Menu line.

Specific Output

Specific output comes from the Controller, located in the same rack, where the NOE resides. Specific out data can be set from the NOE to the remote node on the subnet by a Modbus Write. The source of each specific output block is a contiguous region of 0x, 1x, 3x or 4x state RAM, which varies from 1 to 32 words in length. If discretes are used, they must start on a word boundary (00001, 00017, 00033, etc.).

The Type default (BIN or BCD) is put in by the controller. Where different types can be specified, you make the entry from a display list displayed by keying the return key while the cursor is on the TYPE field.

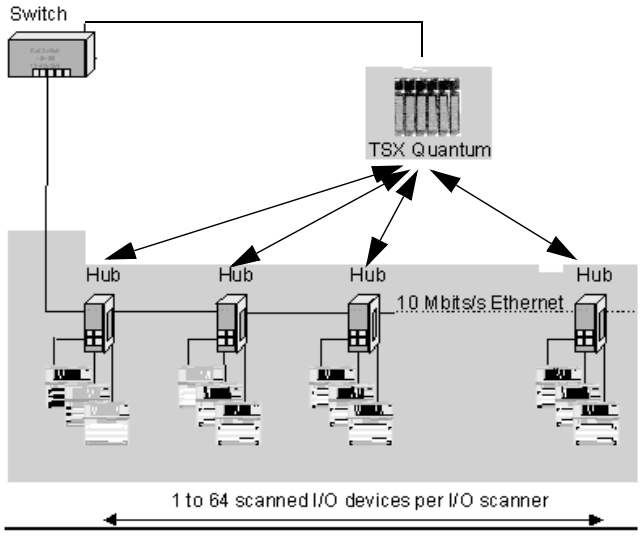
Note: The NOE 771 00 ignores the BIN BCDs setting and always uses a BIN format.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

Specific Input

Specific input goes to the Controller in which the NOE resides. NOE obtains specific input data from a remote node on the subnet with a Modbus read. You can specify all Specific Input blocks, sent to this controller, from the specified other stations on the node. The destination of each block of specific input is a contiguous region of 0x, 1x, 3x or 4x state RAM, which varies from 1 to 32 words in length. If discretes are used, they must start on a word boundary (00001, 00017, 00033, etc.).



In the above figure, the Quantum NOE is configured to write 1 word from 400050, to the Momentum EIO at IP Address 198.202.137.2, and read 1 word from the EIO into register 400100.

The Modsoft menu that reflects the above situation, is shown on the figure appearing on the next page. It provides an example of the Length, Source and Type data fields and illustrates the above example completely filling in the template fields.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

Specific Input, continued

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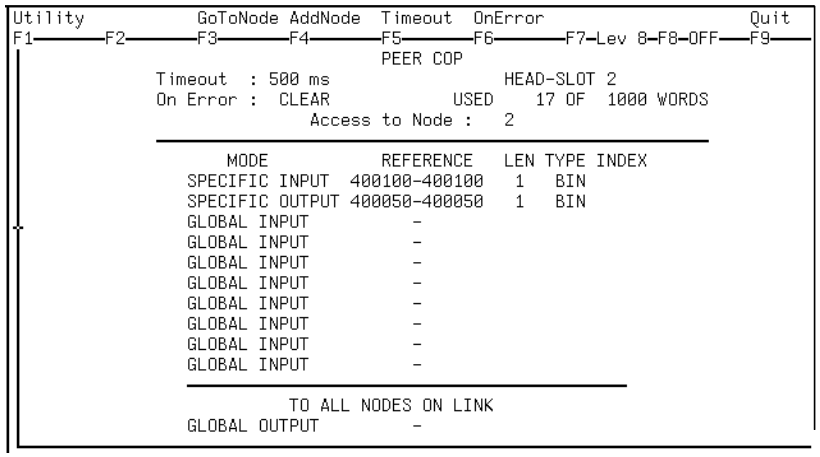


Specific Input/ Output Summary

Given the proper configuration, if you complete the above template for node 2 with a specific input of length of 1 and Specific output Length of 1 will result in:

- reading of 1 word from node 2, destination of data is 400100
- writing of 1 word to node 2, source of data is 400050

Other Menu Selectable Support Functions

In addition to the Standard Utility Menu line entry, you have Peer Cop related functions available from the `GoToNode`, `AddNode`, `Timeout` and `OnError` entries.

The GoToNode Function

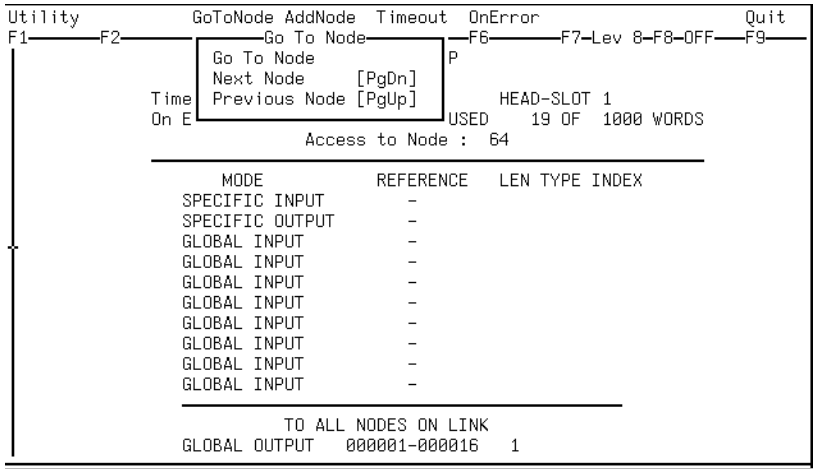
`GoToNode` - Displays the Peer Cop menu that allows you to configure that node.

This function has a pulldown as shown in the figure on the following page.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

The GoToNode Function, continued



If you select GoToNode and the node number you enter is not found you are asked if it should be created for you. You can also transverse the node structure using the PgUp and Pg dn keys.

The AddNode Function

This is very similar to GoToNode in that you select the Link and Node number that you want to add parameters for.

The Timeout Function

This field allows you to specify a value for the Health Time–out interval. The default value is 500 Milliseconds. You can change it to any value in the range of 60ms. to 2 seconds. The value you use specifies the minimum time period that a Peer Cop configured communication must fail before the associated health bit is cleared. You should choose values in 20 ms. increments to account for implementation latency i.e., the configured time plus the time to assure the health bit is cleared.

For example, if your choice is 60 ms. the health bit is cleared no sooner than 60 ms. and no later than 79 ms. after communication has been lost.

Continued on next page

Configuring the I/O Scan List Using Modsoft, continued

Health Bits

There is a health bit for each Peer Copped node. If Peer Cop Data is successfully communicated within the set timeout, the associated bit is set to 1. Otherwise, it is set to 0 and all data associated with that group is cleared (to 0). You must use the MSTR element with proper sub-function code (0009) to retrieve the peer cop health information. (See Peer Cop Health MSTR Operation in Chapter 6.)

Note: All configured Specific output health bits are initialized to 1 for the first few scans to allow complete synchronization between controller, health bit time factor and line latency

OnError Function

You have the choice of Clearing (CLEAR) the last set of received values or retaining the last set of received values (HOLD) if any error is detected.

- DelNode - Once Deleted, you can re-enter node information, or you can exit. Exit with the node deleted removes it. When the `DelNode` is selected, and the Key Verification UPF entry is selected, you are prompted to confirm the intent to clear the node. The default will be "N" for NO. Pressing "Y" for YES and `Enter` will perform the clear

Device IP Address Generation

The IP addresses of the I/O devices in the Scan Table are calculated from the Modbus Address entered in the Peer Cop Configuration Extension, as well as, the IP address of the NOE. Currently, the I/O devices are required to be on the same subnet as the NOE. The device's IP address is calculated by AND'ing the NOE's IP address with the NOE's subnet mask, and then OR'ing the result with the devices's MB address from the configuration extension table.

The following example illustrates the device IP generation.

NOE IP Address:	AAA.BBB.CCC.DDD
Subnet Mask:	255.255.255.0
Device's Modbus Address from Configuration Extension (Range of 1 ... 64):	MB
Resulting Device IP Address:	AAA.BBB.CCC.MB

Transferring Data with the MSTR Instruction

6

At a Glance

Introduction

This chapter describes how to transfer data to and from nodes on a TCP/IP network through the use of a special MSTR (master instruction). Included in this chapter are the operational statistics and error codes for reading and writing the controller information.

What's in this Chapter

This chapter contains the following topics.

MSTR Description

Introduction

All NOE 771 x0 Quantum Ethernet TCP/IP modules provide the user with the capability of transferring data to and from nodes on a TCP/IP network through the use of a special MSTR (master instruction). All PLCs that support networking communication capabilities over Modbus Plus and Ethernet can use the MSTR ladder logic instruction to read or write controller information.

MSTR Operations

The MSTR instruction allows you to initiate one of 12 possible network communications operations over the network. Each operation is designated by a code. The following table lists the 12 operations and indicates those that are supported on an Ethernet TCP/IP network.

MSTR Operation	Operation Type	TCP/IP Ethernet Support
Write data	1	supported
Read Data	2	supported
Get local statistics	3	supported
Clear local statistics	4	supported
Write global database	5	not supported
Read global database	6	not supported
Get remote statistics	7	supported
Clear remote statistics	8	supported
Peer Cop health	9	supported
Reset Option Module	10	supported
Read CTE(config extension)	11	supported
Write CTE (config extension)	12	supported

No. of MSTR Instructions Allowed

Up to16 MSTR instructions can be simultaneously serviced in a ladder logic program per NOE. More than 16 MSTRs may be programmed to be enabled by the logic flow as one active MSTR block releases the resources it has been using and becomes deactivated, the next MSTR operation encountered in logic can be activated.

MSTR Characteristics

MSTR Characteristics

The characteristics of the MSTR instruction are described below.

Size: Three nodes high

PLC Compatibility:

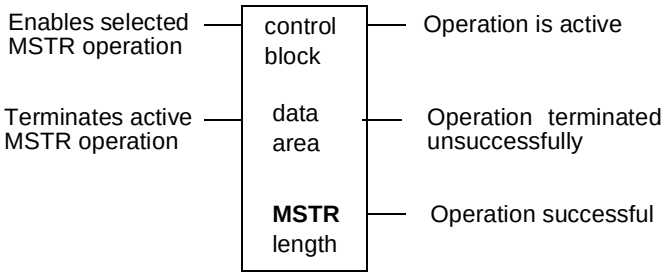
- Standard in PLCs that have built-in Modbus Plus capabilities (Modbus Plus functionality only)
- Standard in all Quantum PLCs with Modbus Plus functionality and/or TCP/IP Ethernet option modules
- Available as a loadable in chassis mount PLCs (Modbus Plus functionality only)

Opcode: BF hex

MSTR Ladder Logic Representation

Ladder Logic Diagram

The MSTR Block is represented in Ladder Logic diagrams as shown in the figure below and described the in the paragraphs that follow the figure.



Inputs

The MSTR instruction has two control inputs:

- the input to the top node enables the instruction when it is ON
- the input to the middle node terminates the active operation when it is ON

Outputs

The MSTR instruction can produce three possible outputs:

- the output from the top node echoes the state of the top input - it goes ON while the instruction is active
- the output from the middle node echoes the state of the middle input - it goes ON if the MSTR operation is terminated prior to completion or if an error occurs in completing the operation
- the output from the bottom node goes ON when an MSTR operation has been completed successfully

All outputs are zero is an indication that four MSTR instructions are already in progress.

Continued on next page

MSTR Ladder Logic Representation, continued

Top Node Content

The 4*x* register entered in the top node is the first of several (network dependent) holding registers that comprise the network *control block*. The control block structure differs according to the network in use. For the TCP/IP Ethernet network the control block structure is as follows:

Register	Content
Displayed	Identifies one of ten MSTR operations legal for TCP/IP (1 ... 4 and 7 ... 12).
First implied	Displays error status.
Second implied	Displays length (number of registers transferred).
Third implied	Displays MSTR operation-dependent information.
Fourth implied	High byte: Destination index. Low byte: Quantum backplane slot address of the NOE module.
Fifth implied	Byte 4 of the 32-bit destination IP Address.
Sixth implied	Byte 3 of the 32-bit destination IP Address.
Seventh implied	Byte 2 of the 32-bit destination IP Address.
Eight implied	Byte 1 of the 32-bit destination IP Address.

Middle Node Content

The 4x register entered in the middle node is the first in a group of contiguous holding registers that comprise the *data area*. For operations that provide the communication processor with data such as a Write operation, the *data area* is the source of the data. For operations that acquire data from the communication processor, such as a Read operation, the *data area* is the destination for the data.

In the case of the Ethernet Read and Write CTE operations (see pages 121 and 123), the middle node stores the contents of the Ethernet configuration extension table in a series of registers.

Bottom Node Content

The integer value entered in the bottom node specifies the *length* - the maximum number of registers in the *data area*. The *length* must be in the range 1 ... 100.

MSTR Function Error Codes

Where Displayed

If an error occurs during an MSTR operation, a hexadecimal error code will be displayed in the first implied register in the *control block* (the top node). Function error codes are network-specific.

TCP/IP Ethernet Error Codes

An error in an MSTR routine over TCP/IP Ethernet may produce one of the following errors in the MSTR *control block*:

Hex Error Code	Meaning
1001	User has aborted the MSTR element.
2001	An unsupported operation type has been specified in the *control block*.
2002	One or more *control block* parameters has been changed while the MSTR element is active (applies only to operations that take multiple scans to complete). *Control block* parameters may be changed only when the MSTR element is not active.
2003	Invalid value in the length field of the *control block*.
2004	Invalid value in the offset field of the *control block*.
2005	Invalid values in the length and offset fields of the *control block*.
2006	Invalid slave device data area.
3000	Generic Modbus fail code.
30ss*	Modbus slave exception response.
4001	Inconsistent Modbus slave response.
F001	Option Module not responding

* The ss subfield in error code 30ss is shown in the following table.

ss Hex value	Meaning
01	Slave device does not support the requested operation.
02	Nonexistent slave device registers requested.
03	Invalid data value requested.
04	
05	Slave has accepted long-duration program command.
06	Function can't be performed now; a long-duration command is in effect.
07	Slave rejected long-duration program command.

Continued on next page

MSTR Function Error Codes, continued

TCP/IP Ethernet Network Errors

An error on the TCP/IP Ethernet network itself may produce one of the following errors in the MSTR *control block*:

Hex Error Code	Meaning
04	Interrupted system call.
05	I/O error.
06	No such address.
09	The socket descriptor is invalid.
0C	Not enough memory.
0D	Permission denied.
11	Entry exists.
16	An argument is invalid.
17	An internal table has run out of space.
20	The connection is broken.
28	Destination address required
29	Protocol wrong type for socket
2A	Protocol not available
2B	Protocol not supported
2C	Socket type not supported
2D	Operation not supported on a socket
2E	Protocol family not supported
2F	Address family not supported
30	Address already in use
31	Can’t assign requested address
32	Socket operation on a non-socket
33	Network is unreachable
34	Network dropped connection on reset
35	Network caused connection abort
36	Connection reset by peer
37	No buffer space available

Continued on next page

MSTR Function Error Codes, continued

TCP/IP Ethernet Network Errors, continued

Hex Error Code	Meaning
38	Socket is already connected
39	Socket is not connected
3A	Can't send after socket shutdown
3B	Too many references, can't splice
3C	Connection timed-out
3D	Connection refused
3E	Network is down
3F	Text file busy
40	Too many levels of links
41	No route to host
42	Block device required
43	Host is down
44	Operation now in progress
45	Operation already in progress
46	Operation would block
47	Function not implemented

CTE Error Codes

The following error codes are returned if there is a problem with the Ethernet configuration extension table (CTE) in your program configuration.

Hex Error Code	Meaning
7001	There is no Ethernet configuration extension.
7002	The CTE is not available for access.
7003	The offset is invalid.
7004	The offset + length is invalid.
7005	Bad data field in the CTE.

Read and Write MSTR Operations

Introduction

An MSTR Write operation (operation type 1 in the displayed register of the top node) transfers data from a master source device to a specified slave destination device on the network. An MSTR Read operation (operation type 2 in the displayed register of the top node) transfers data from a specified slave source device to a master destination device on the network. Read and Write use one data master transaction path and may be completed over multiple scans

Note: TCP/IP Ethernet routing must be accomplished via standard third-party Ethernet IP router products.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Read or Write information as described in the following table:

Register	Function	Content	
Displayed	Operation Type	1 = Write, 2 = Read.	
First Implied	Error status	Displays a hex value indicating an MSTR error.	
		Exception response, where response size is incorrect.	Exception code + 3000
		Exception response where response size is incorrect.	4001
		Read Write	
Register	Function	Content	
Second implied	Length	Write = number of registers to be sent to slave. Read = number of registers to be read from slave.	
Third implied	Slave device data area	Specifies starting 4x register in the slave to be read from or written to (1 = 4001, 49 =40049).	
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.	
Fifth ... eighth implied	Destination	Each register contains one byte of the 32-bit IP address.	

Get Local Statistics MSTR Operation

Introduction

The Get Local Statistics operation (operation type 3 in the display register of the top node) obtains information related to the local node where the MSTR has been programmed. (See page 125 for a listing of the TCP/IP Ethernet Network Statistics).

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Get Local Statistics information as described in the following table

Register	Function	Content
Displayed	Operation Type	3
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Length	Starting from *offset*, the number of words of statistics from the local processor's statistics table; the *length* must be > 0 ≤ *data area*.
Third implied	Offset	An offset value relative to the first available word in the local processor's statistics table. If the offset is specified as 1, the function obtains statistics starting with the second word in the table.
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.
Fifth .. Eighth implied	Not applicable	

Clear Local Statistics MSTR Operation

Introduction

The Clear LocalStatistics operation (operation type 4 in the displayed register of the top node) clears statistics relative to the local node where the MSTR has been programmed.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Clear Local Statistics information as described in the following table

Register	Function	Content
Displayed	Operation Type	4
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Not applicable	
Third implied	Not applicable	
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.
Fifth ... Eighth implied	Not applicable	

Get Remote Statistics MSTR Operation

Introduction

The Get Remote Statistics operation (operation type 7 in the displayed register of the top node) obtains information relative to remote nodes on the network. This operation may require multiple scans to complete and does not require a master data transaction path. (See page 125 for a listing of the TCP/IP Ethernet Network Statistics).

The remote Ethernet module always returns its complete statistics table when a request is made, even if the request is for less than the full table. The MSTR instruction then copies only the amount of words you have requested to the designated 4*x* registers.

Note: TCP/IP Ethernet routing must be accomplished via standard third-party Ethernet IP router products.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Get Remote Statistics information as described in the following table:

Register	Function	Content
Displayed	Operation Type	7
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Length	Starting from an *offset*, the number of words of statistics from the local processor's statistics table. The length must be > 0 ≤ *data area*.
Third implied	Offset	Specifies an offset value relative to the first available word in the local processor's statistics table. If the offset is specified as 1, the function obtains statistics starting with the second word in the table.
Fourth implied	High byte	Destination index.
Fifth ... Eighth implied	Destination	Each register contains one byte of the 32-bit IP address.

Clear Remote Statistics MSTR Operation

Introduction

The Clear Remote Statistics operation (operation type 8 in the displayed register of the top node) clears statistics relative to a remote network node from the *data area* in the local node. This operation may require multiple scans to complete and uses a single data master transaction path.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Clear Remote Statistics information as described in the following table.

Register	Function	Content
Displayed	Operation Type	8
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Not applicable	
Third implied	Not applicable	
Fourth implied	High byte	Destination index.
Fifth ... Eighth implied	Destination	Each register contains one byte of the 32-bit IP address.

Peer Cop Health MSTR Operation

Introduction

The Peer Cop Health operation (operation type 9 in the displayed register of the top node) reads selected data from the peer cop communications health table and loads that data to specified 4*x* registers in state RAM. The Peer Cop communications health table is12 words long, and the words are indexed via this MSTR operation as words 0 ... 11.

Note: The Peer Cop Health MSTR block is only operational when a Peer Cop based I/O Scanner has been configured.

Control Block Utilization

The registers in the MSTR control block (the top node) contain information for a Peer Cop Health operation as described in the following table:

Register	Function	Content
Displayed	Operation Type	9
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Data Size	Number of words requested from Peer Cop table (range 1 ... 12).
Third implied	Index	First word from the table to be read (range 0 ... 11, where 0 = the first word in the Peer Cop table and 11 = the last word in the table).
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.
Fifth ... Eighth implied	Destination	Each register contains one byte of the 32-bit IP address.

Continued on next page

Peer Cop Health MSTR Operation, continued

Peer Cop Communications Health Status Information

The Peer Cop communications health table (shown on next page) comprises 12 contiguous register that can be indexed in an MSTR operation as words 0 ... 11. Each bit in each of the table words is used to represent an aspect of communications health relative to a specific node on the TCP/IP network:

- The bits in words 0 ... 3 represent the health of the global input communication expected from nodes 1 ... 64. Since global input is not supported these bits are set to zero.
- The bits in words 4 ... 7 represent the health of the output from a specific node.
- The bits in words 8 ... 11 represent the health of the input to a specific node.

Continued on next page

Peer Cop Health MSTR Operation, continued

Peer Cop Communications Health Status Information, continued

Type of Status	Word Index	Bit-To-Network Node Relationship
Global Input	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	3	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Specific Output	4	16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
	5	32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17
	6	48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33
	7	64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49
Specific Input	8	16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
	9	32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17
	10	48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33
	11	64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49

Continued on next page

Peer Cop Health MSTR Operation, continued

Peer Cop Communications Health Bit State

The state of a Peer Cop health bit reflects the current communication status of its associated node:

- A health bit is set when data is successfully exchanged with its corresponding node.
- A health bit is cleared when no communication has occurred with the corresponding node within the configured Peer Cop health time-out period.
- All health bits are cleared at PLC start time. The health bit for a given node is always zero when its associated Peer Cop entry is null.
- All global health bits are always reported as zero.

Reset Option Module MSTR Operation

Introduction

The Reset Option Module operation (operation type 10 in the displayed register of the top node) causes a Quantum NOE option module to enter a reset cycle to reset its operational environment.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Reset Option Module information as described in the following table:

Register	Function	Content
Displayed	Operation Type	10
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Not applicable	
Third implied	Not applicable	
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.
Fifth ... Eighth implied	Not applicable	

Read CTE (Config Extension Table) MSTR Operation

Introduction

The Read CTE operation (operation type 11 in the displayed register of the top node) reads a given number of bytes from the Ethernet configuration extension table to the indicated buffer in PLC memory. The bytes to be read begin at a byte offset from the beginning of the CTE. The content of the Ethernet CTE table is displayed in the middle node of the MSTR block.

Control Block Utilization

The registers in the MSTR *control block* (the top node) contain the Read CTE information as described in the following table:

Register	Function	Content
Displayed	Operation Type	11
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant.
Second implied	Not applicable	
Third implied	Not applicable	
Fourth implied	Low byte	Quantum backplane slot address of the NOE module.
Fifth ... Eight implied	Not applicable	

Continued on next page

Read CTE (Config Extension Table) MSTR Operation, continued

CTE Display Implementation

The values in the Ethernet configuration extension table (CTE) are displayed in a series of registers in the middle node of the MSTR instruction when a Read CTE operation is implemented. The middle node contains the first of 11 contiguous 4*x* registers. The registers display the following CTE data:

Parameter	Register	Content	
Frame type	Displayed	1 = 802.3	
		2 = Ethernet	
IP Address	First implied	First byte of the IP address	
	Second implied	Second byte of the IP address	
	Third implied	Third byte of the IP address	
	Fourth implied	Fourth byte of the IP address	
Subnetwork mask	Fifth implied	Hi word	
	Sixth implied	Low word	
Gateway	Seventh implied	First byte of the gateway	
	Eighth implied	Second byte of the gateway	
	Ninth implied	Third byte of the gateway	
	Tenth implied	Fourth byte of the gateway	
	Eleventh implied	**High byte**	**Low byte**
		Software defined Module Type (Ignored by M1 and NOE modules) 0 = NOE211 1 = NOE251 2 = NOE77100 3 = NOE77110 4 = M1	IP Address Algorithm **0:** Take IP Address from above definition (default) (All modules support this) **1:** Always take IP Address from BOOTP Server (M1 and NOE 771 x0 support this) **2:** Disable Ethernet functionality (M1 only)

Write CTE (Config Extension Table) MSTR Operation

CTE Write Implementation

The Write CTE operation writes an indicated number of bytes from PLC memory, starting at a specified byte address, to an indicated Ethernet configuration extension table at a specified offset. The content of the Ethernet CTE table is contained in the middle node of the MSTR block.

Network Implementation

The Write CTE operation (type 12 in the displayed register of the top node) can be implemented for TCP/IP Ethernet networks, via the appropriate network adapter.

Note: Modbus Plus networks do not use this operation.

Control Block Utilization

In a Write CTE operation, the registers in the MSTR control block (the top node) differ according to the network in user. The following table displayed the registers in the Control Block for TCP/IP Ethernet:

Register	Function	Content
Displayed	Operation type	12
First implied	Error status	Displays a hex value indicating an MSTR error, when relevant
Second implied	Not applicable	
Third implied		
Fourth implied	Map index	Either a value displayed in the high byte of the register or not used
	Slot ID	Number displayed in the low byte, in a range 1 ... 16 indicating the slot in the local backplane where the option resides.
Fifth ... Eighth implied	Not applicable	

Continued on next page

Write CTE (Config Extension Table) MSTR Operation, continued

CTE Display Implementation

The values in the Ethernet configuration extension table (CTE) are displayed in a series of registers in the middle node of the MSTR instruction when a Write CTE operation is implemented. The middle node contains the first of 11 contiguous 4*x* registers. The registers display the following CTE data:

Parameter	Register	Content	
Frame type	Displayed	1 = 802.3	
		2 = Ethernet	
IP Address	First implied	First byte of the IP address	
	Second implied	Second byte of the IP address	
	Third implied	Third byte of the IP address	
	Fourth implied	Fourth byte of the IP address	
Subnetwork mask	Fifth implied	Hi word	
	Sixth implied	Low word	
Gateway	Seventh implied	First byte of the gateway	
	Eighth implied	Second byte of the gateway	
	Ninth implied	Third byte of the gateway	
	Tenth implied	Fourth byte of the gateway	
	Eleventh implied	**High byte**	**Low byte**
		Software defined Module Type (Ignored by M1 and NOE modules) 0 = NOE211 1 = NOE251 2 = NOE77100 3 = NOE77110 4 = M1	IP Address Algorithm **0:** Take IP Address from above definition (default) (All modules support this) **1:** Always take IP Address from BOOTP Server (M1 and NOE 771 x0 support this) **2:** Disable Ethernet functionality (M1 only)

TCP/IP Ethernet Statistics

Introduction

A TCP/IP Ethernet board responds to “Get Local Statistics” and “Set Local Statistics” commands with the following information:

Word	Meaning
00 ... 02	MAC address
03	Board Status (see following table for Board Status Bit Definition)
04 and 05	Number of receiver interrupts
06 and 07	Number of transmitter interrupts
08 and 09	Transmit _ timeout error count
10 and 11	Collision_detect error count
12 and 13	Missed packets
14 and 15	Memory error
16 and 17	Number of times driver has restarted
18 and 19	Receive framing error
20 and 21	Receiver overflow error
22 and 23	Receive CRC error
24 and 25	Receive buffer error
26 and 27	Transmit silo underflow
28 and 29	Late collision
30 and 31	Lost carrier
32 and 33	Number of retries
34 and 35	IP address

Continued on next page

TCP/IP Ethernet Statistics, continued

Board Status Word Bit Definition

The following table details the word bit definitions for the Board Status

Bit #	Definition
15	0 = 10 Mbit, 1 = 100 Mbit
14	0 = Twisted Pair, 1 = Fiber
13	0 = APPL LED off, 1 = APPL LED on
12	0 = Link LED off, 1 = Link LED on
11 ... 4	Module Type (See Module Type table below.)
3	0 = CPU Stopped, 1 = CPU Running
2	0 = PLC Not Configured, 1 = PLC Configured
1 ... 0	Reserved

Board Status Word Bit Definition by Module Type

The following table defines the values of the Module Types:

Value of Bits 11...4	Module Type
0	NOE 2x1
1	ENT
2	M1E
3	NOE 771 00
4	ETY 410
5 ... 9	Currently Reserved
10	NOE 771 10

Embedded Web Pages

7

At a Glance

Introduction

This chapter presents the contents of the embedded web pages contained in the Quantum 140 NOE 771 x0. These web pages enable you to access diagnostic information, view configuration information, and change the online configurations for the module.

What's in this Chapter

This chapter contains the following topics:

Accessing the Web Utility Home Page

Introduction

Each Quantum 140 NOE 771 x0 10/100 Megabit Ethernet module contains a World Wide Web embedded server that allows you to access diagnostics and online configurations for the module and it's associated controller (PLC). Pages on the embedded web site display:

- configurable menus for the BOOTP server and SNMP
- the Ethernet statistics for the node
- crash file log statistics
- the controller's configuration (Controller Status on menu)
- the controller's register values
- the status, configuration and register values of remote I/O
- the status, configuration and register values of distributed I/O

The web pages can only be viewed across the World Wide Web using version 4.0 or greater of either Netscape Navigator or Internet Explorer, both of which support JDK 1.1.4 or higher.

For information on the additional functionality provided by the FactoryCast system in the 140 NOE 771 10 module, see the *FactoryCast Manual*, 890 USE 152 00.

How to Access It

Before you can access the module's home page, you must learn its full IP address or URL from your system administrator. Type the address or URL in the Address or Location box in the browser window. Once you do this the Schneider Automation Web Utility home page will appear (see next page).

Continued on next page

Accessing the Web Utility Home Page, continued

Schneider Web Utility Home Page

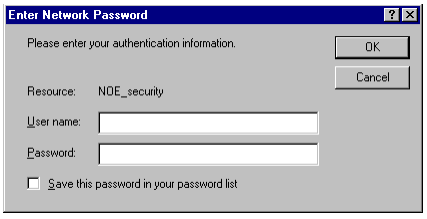
Schneider Automation Web Server

Diagnostics and Online Configurations

Operating System: Windows 95
Screen Resolution: 1280 x 1024
Browser: Microsoft Internet Explorer 4

Click on the “Diagnostics and Online Configuration”.

Result: The user is requested to supply a user name and password.



Upon supplying the user name, password, and clicking the **<OK>** button, the Quantum Welcome Page appears.

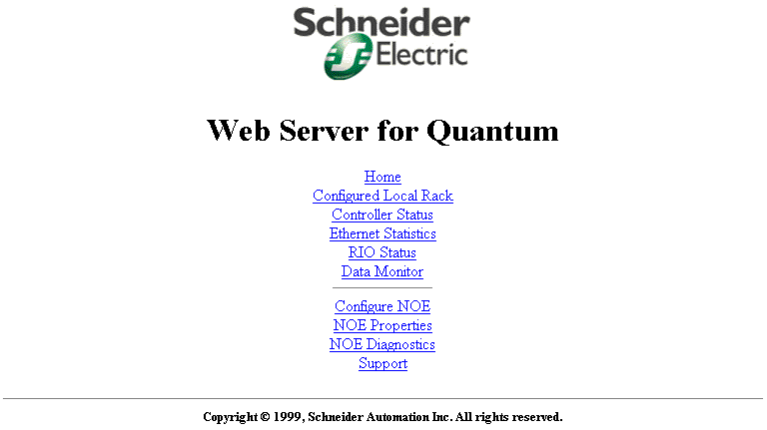
Note: The default User Name is USER. and the default Password is USER. Both may be changed.

Result: The Quantum Welcome Page which provides the links to all the Quantum Configuration and Diagnostic Pages and to the Run-Time Data Editor.

Quantum Welcome Page

Quantum Welcome Page Overview

The Quantum Welcome Page provides links to all the Configuration and Diagnostic Pages and to the Run-Time Data Editor.



Continued on next page

Quantum Welcome Page, continued

Quantum Welcome Page Links

The following table details the links on the Quantum Welcome Page :

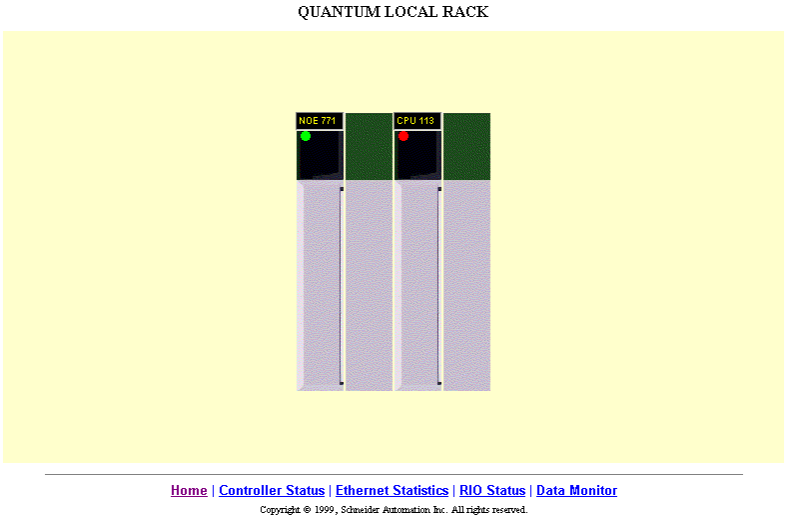
Link	Results
Home	Restarts the process
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Controller Status	Displays the CPU Configuration.
Ethernet Statistics	Displays the Ethernet Module Statistics with the Reset Counters link
RIO Status	Displays the Remote I/O Communications Status
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities.
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration page
NOE Properties	Provides information on the NOE properties
NOE Diagnostics	Displays the links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Displays contact information for technical assistance, sales, and feedback

To view the pages related to each of these topics, click on the topic.

Quantum Local Rack Page

Quantum Local Rack Page Overview

The Quantum Local Rack page displays a visual of the current configuration.



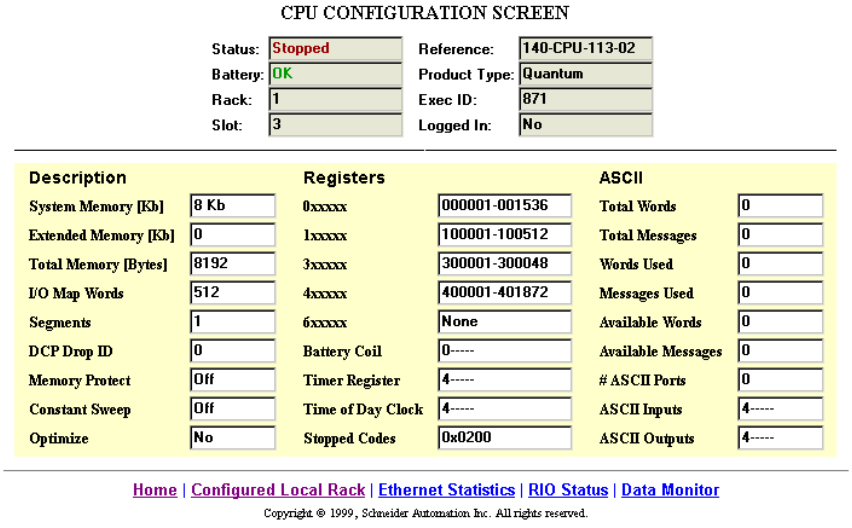
Quantum Local Rack Page Links

The following table details the links on the Quantum Local Rack Page:

Link	Results
Home	Displays the Quantum Welcome Page
Controller Status	Displays the CPU Configuration
Ethernet Statistics	Displays the Ethernet Module Statistics with the Reset Counters link
RIO Status	Displays the Remote I/O Communications Status
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities

CPU Configuration Screen Page

CPU Configuration Screen Page Overview



The top eight fields identify the CPU Configuration. See the following tables for further information on the content of the other fields.

Continued on next page

CPU Configuration Screen Page, continued

Description Fields

Field	Information Supplied
System Memory [Kb]	Amount of system memory used
Extended Memory [Kb]	Amount of Extended Memory used
Total Memory (Bytes)	Total memory used in bytes
I/O Map Words	Number of I/O words mapped.
Segments	Number of segments
DCP Drop ID	Drop number for Distributed Control
Memory Protect	Position of the Memory Protect Switch
Constant Sweep	Current status of Constant Sweep
Optimize	Current status of Optimization

Register Fields

Field	Information Supplied
0xxxxx	Valid Address of 0x
1xxxxx	Valid Address of 1x
3xxxxx	Valid Address of 3x
4xxxxx	Valid Address of 4x
6xxxxx	Valid Addres of 6x
Battery Coil	Address of Battery Coil
Timer Register	Address of Timer Register
Time of Day Clock	Address of Time of Day Clock
Stopped Codes	Reason for controlled stopping

ASCII Fields

This column contains information concerning the ASCII fields.

Continued on next page

CPU Configuration Screen Page, continued

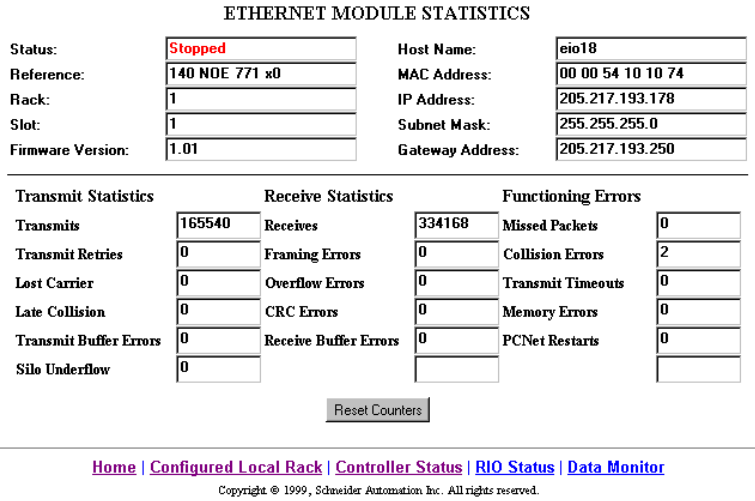
CPU Configuration Screen Page Links

The following table details the links on the CPU Configuration Screen Page

Link	Results
Home	Displays the Quantum Welcome Page
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Ethernet Statistics	Displays the Ethernet Module Statistics with the Reset Counters link
RIO Status	Displays the Remote I/O Communications Status
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities

Ethernet Module Statistics Page

Ethernet Module Statistics Page Overview



ETHERNET MODULE STATISTICS

Status:	Stopped	Host Name:	eio18
Reference:	140 NOE 771 x0	MAC Address:	00 00 54 10 10 74
Rack:	1	IP Address:	205.217.193.178
Slot:	1	Subnet Mask:	255.255.255.0
Firmware Version:	1.01	Gateway Address:	205.217.193.250

Transmit Statistics		Receive Statistics		Functioning Errors	
Transmits	165540	Receives	334168	Missed Packets	0
Transmit Retries	0	Framing Errors	0	Collision Errors	2
Lost Carrier	0	Overflow Errors	0	Transmit Timeouts	0
Late Collision	0	CRC Errors	0	Memory Errors	0
Transmit Buffer Errors	0	Receive Buffer Errors	0	PCNet Restarts	0
Silo Underflow	0				

Reset Counters

Home | Configured Local Rack | Controller Status | RIO Status | Data Monitor

These statistics are for information only. If you wish to retain the information, you must copy it offline. The counters may be reset to zero by clicking the Reset Counter button.

Continued on next page

Ethernet Module Statistics Page, continued

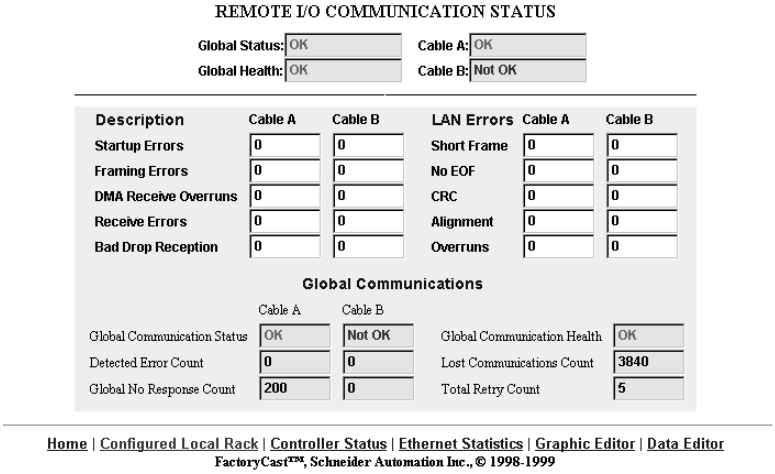
Ethernet Module Statistics Page Links

The following table details the links on the Ethernet Module Statistics Page:

Link	Results
Home	Displays the Quantum Welcome Page
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Controller Status	Displays the CPU Configuration
RIO Status	Displays the Remote I/O Communications Status
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities

Remote I/O Communication Status Page

Remote I/O Communication Status Page Overview



Note: The Graphic Editor Link is only available on the 140 NOE 771 10.

This page is for information only. There are no fields you can change. The following tables discuss the information supplied for each cable.

For more information concerning the Remote I/O Communications Status, see the *RIO Manual*, 890 USE 101 00.

Remote I/O Communication Status Page, continued

Remote I/O Communications Status Page Links

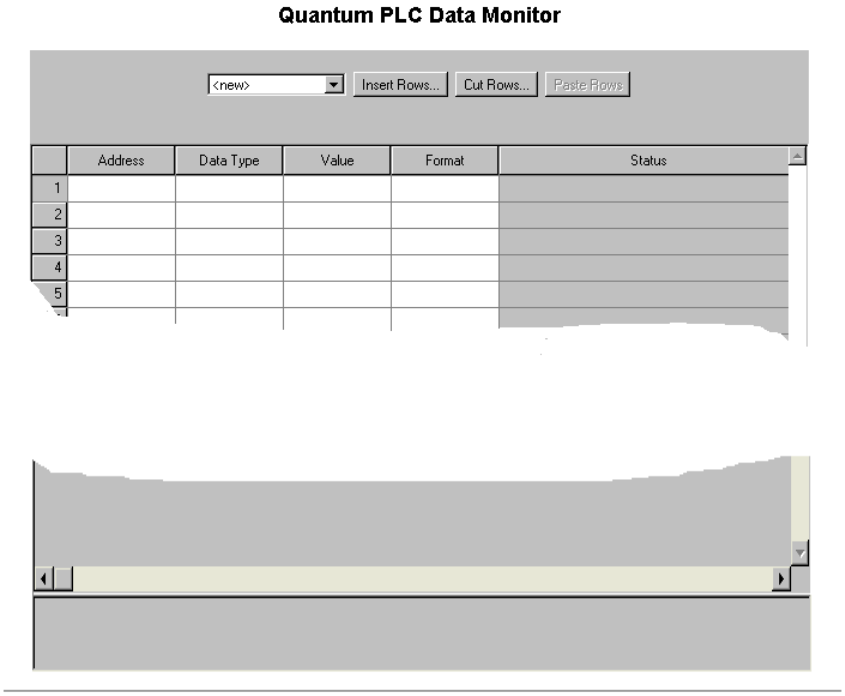
The following table details the links on the Remote I/O Communication Status Page:

Link	Results
Home	Displays the Quantum Welcome Page
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Controller Status	Displays the CPU Configuration
Ethernet Statistics	Displays the Ethernet Module Statistics with the Reset Counters link
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities

Quantum PLC Data Monitor Page

Quantum PLC Data Monitor Page Overview

This is the web page that allows you to alter the displayed Quantum PLC data.



You can insert additional rows of data by clicking on the Insert Rows button.

You can delete specific rows of data by clicking on the Cut Rows button.

You can copy in rows of data by clicking on the Paste Rows button.

Continued on next page

Quantum PLC Data Monitor Page, continued

Quantum PLC Data Monitor Page Links

The following table details the links on the Quantum PLC Data Monitor Page:

Link	Results
Home	Displays the Quantum Welcome Page
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Controller Status	Displays the CPU Configuration
Ethernet Statistics	Displays the Ethernet Module Statistics with the Reset Counters link
RIO Status	Displays the Remote I/O Communications Status

Configure NOE Page

Configure NOE Page Overview

This page provides links to individual configuration pages for the NOE.

Configure NOE

Configure SNMP

Configure BOOTP

Home | NOE Properties | NOE Diagnostics | Support

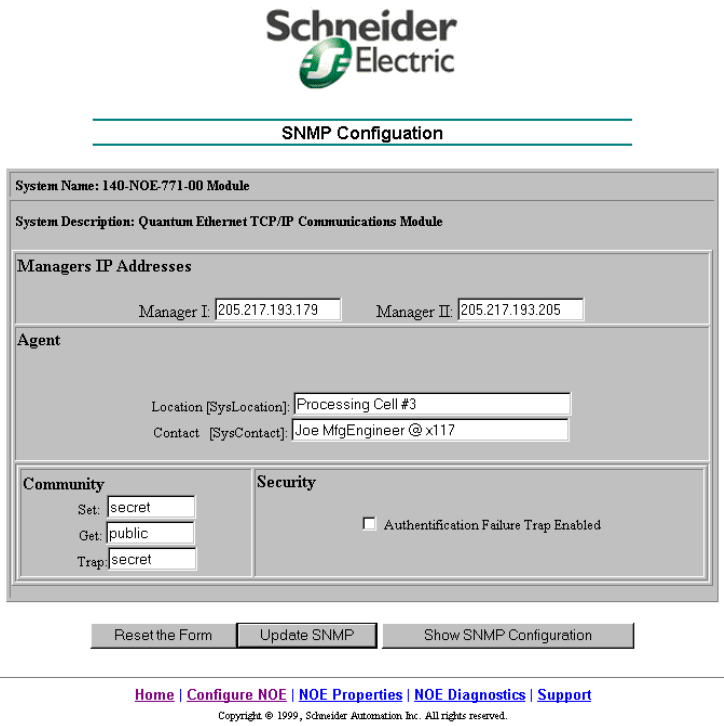
Configure NOE Page Links

The following table details the links on the Configure NOE Page:

Link	Results
Configure SNMP	Provides the ability to configure the SNMP Agent in the NOE
Configure BOOTP	Provides the ability to configure the BOOTP IP assignments including showing the BOOTP database
Home	Returns you to the Quantum Welcome Page
NOE Properties	Provides information on NOE properties
NOE Diagnostics	Displays links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Provides you with contact information for technical assistance, sales, and feedback

Configure SNMP Page

Configure SNMP Page Overview



If the SNMP is not configured, enter the appropriate information in the fields.

To display the current SNMP configuration, click on Show SNMP Configuration.

To change the SNMP configuration, change the information on the page and click on Update SNMP. The NOE must also be reset for the change to take affect, see the Successful Update Message Screen.

To clear the fields, click on Reset the Form.

Continued on next page

Configure SNMP Page, continued

SNMP Page Fields

The following SNMP configuration fields can be changed on the Configure SNMP Page:

Field	Information to be Supplied
Manager I	IP Address of first SNMP Manager
Manager II	IP Address of second SNMP Manager
Location [SysLocation]	Location of the module
Contact [SysContact]	Name of the responsible systems engineer
Set	Designation of level of user who can set the configuration
Get	Designation of level of user who can view the configuration
Trap	Designation of level of user who can capture information
Authentication Failure Trap Enabled	Turns on Community Name Checking

Configure SNMP Page Links

The following table details the links on the Configure SNMP Page:

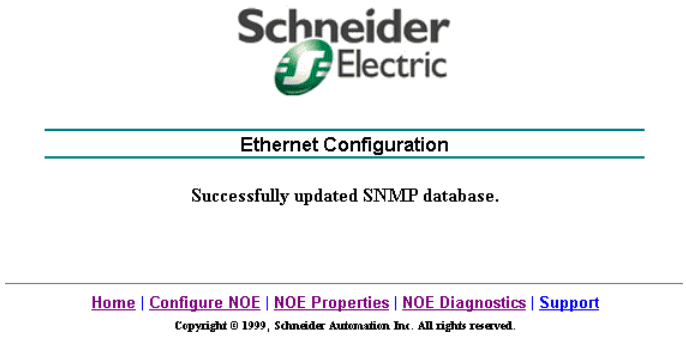
Link	Results
Home	Returns you to the Quantum Welcome Page
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page
NOE Properties	Provides information on NOE properties
NOE Diagnostics	Displays links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Provides you with contact information for technical assistance, sales, and feedback

Continued on next page

Configure SNMP Page, continued

Completion Message

Clicking on the Update SNMP button results in a new page with the following message:



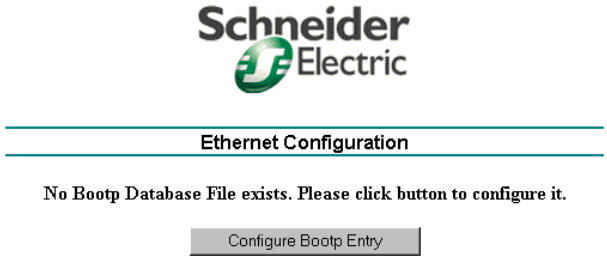
The NOE module has to be reset for the changes to take effect.

This page contains the same links as the Configure SNMP Page.

Configure BOOTP Process

Configure BOOTP Initial Page

he BOOTP Database File does not exist, this page will display so a BOOTP Database File can be created.



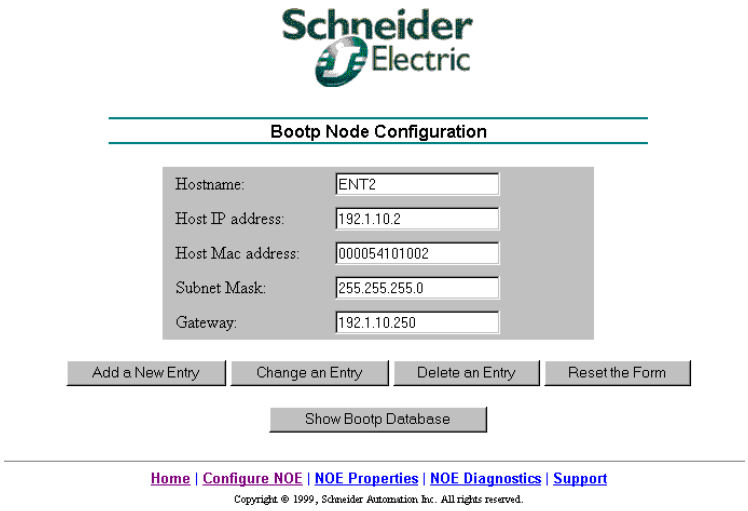
Press the Configure Bootp Entry button to configure a BOOTP Database File.

The result will be the Bootp Node Configuration Form Page.

Continued on next page

Configure BOOTP Process, continued

Bootp Node Configuration Form Page



Initial Configuration

If this is an initial BOOTP configuration fill in the fields on the Bootp Node Configuration Form and press the Add a New Entry.

Field	Information to be Supplied
Hostname	Text to identify device
Host IP address	IP Address from System Administrator - read from sticker on device
Host Mac Address	IEEE Global Address
Subnet Mask	Supplied by system
Gateway	Define the address of route to access nodes off the devices subnet

Continued on next page

Configure BOOTP Process, continued

Adding to the BOOTP Database File

If you want to add an entry to the BOOTP Database File, complete the fields on the form, and press the Add a New Entry button.

Changing the BOOTP Database File

Use the following steps to change an entry in the BOOTP Database File:

Step	Action
1	Enter the new information on the Bootp Node Configuration Page
2	Click on the Change an Entry button **Result:** The a new entry will be made at the bottom of the Database Table and you will get a successful entry message.
3	Click on Configure NOE to return to Configure NOE page
4	Click on Configure BOOTP
5	Enter the information to be old information
6	Click on Delete an Entry

Deleting from the BOOTP Database File

Use the following steps to delete an entry on the BOOTP Database File:

Step	Action
1	Enter the information for the item to be deleted
2	Click on the Delete an Entry button **Result:** A delete successful message.
3	Click on Configure NOE
4	Click on Configure BOOTP
5	Click on Refresh Bootp Database Table to view revised Database file.

Continued on next page

Configure BOOTP Process, continued

Resetting the Form

To clear the fields in the Bootp Node Configuration Form, press the Reset the Form button. You will then be able to fill in the information of Database File entries to be added, changed, or deleted.

Displaying the BOOTP Database File

To display the current BOOTP Database File, press the Show Bootp Database button.

Bootp Configuration

Host Name	IP Address	Subnet Mask	Gateway	Mac Address
ENT1	192.1.10.01	255.255.255.0	192.1.10.250	000054101005
ENT2	192.1.10.02	255.255.255.0	192.1.10.250	000054101006
ENT4	192.1.10.04	255.255.255.0	192.1.10.250	000054101008
ENT3	192.1.10.03	255.255.255.0	192.1.10.250	000054101007

Refresh Bootp Database Table

Configure Bootp Entry

Home | Configure NOE | NOE Properties | NOE Diagnostics | Support

Continued on next page

Configure BOOTP PROCESS, continued

Bootp Node Configuration Form Links

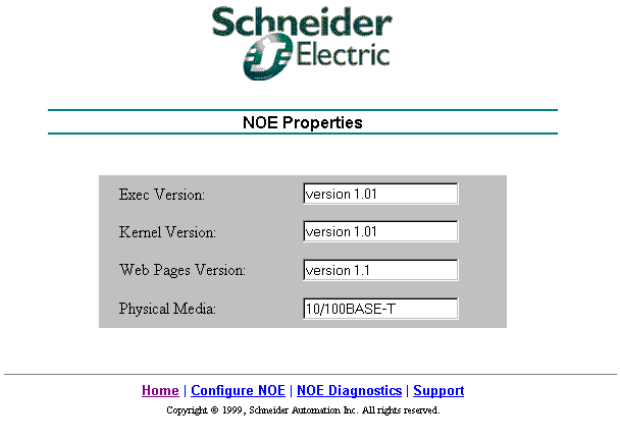
The following table details the links on the Bootp Node Configuration Form Page:

Link	Results
Home	Returns you to the Quantum Welcome Page
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page
NOE Properties	Provides information on NOE properties
NOE Diagnostics	Displays links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Provides you with contact information for technical assistance, sales, and feedback

NOE Properties Page

NOE Properties Page Overview

The NOE Properties Page displays the Exec, Kernel, Web Pages versions being used, and the Physical Media in use.



This is for information only. The fields cannot be changed.

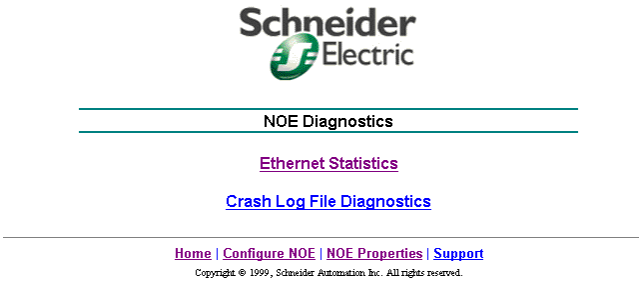
NOE Properties Page Links

The following table details the links on the NOE Properties Page:

Link	Results
Home	Returns you to the Quantum Welcome Page
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page
NOE Diagnostics	Displays links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Provides you with contact information for technical assistance, sales, and feedback

NOE Diagnostics Page

NOE Diagnostics Page Overview



NOE Diagnostics Page Links

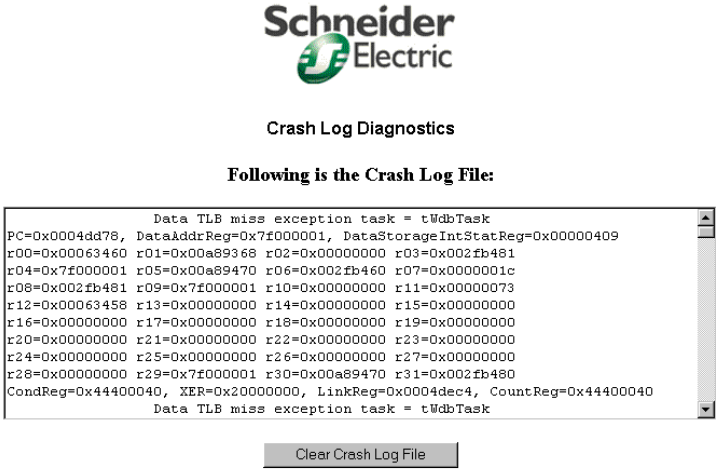
The following table details the links on the NOE Diagnostics Page:

Link	Results
Ethernet Statistics	Displays the Ethernet Module Statistics Page where you can display the Ethernet statistics and reset the counters.
Crash Log File Diagnostics	Displays the Crash Log entries for use in diagnosing the cause of crashes.
Home	Returns you to the Quantum Welcome Page
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page
NOE Properties	Provides information on NOE properties
Support	Provides you with contact information for technical assistance, sales, and feedback

Crash Log Diagnostics

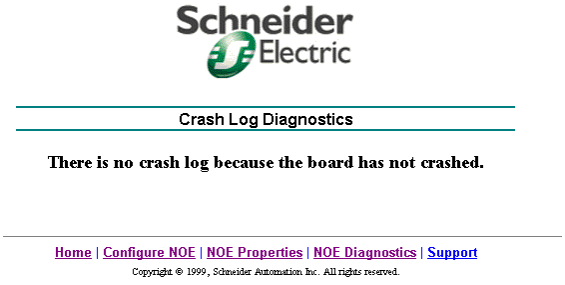
Crash Log Diagnostics Page

Following is an example of a Crash Diagnostics Page:



Press Clear Crash Log File to clear the file.

If there have been no crashes, the following message displays.



Continued on next page

Crash Log Diagnostics, continued

Crash Log Diagnostics Links

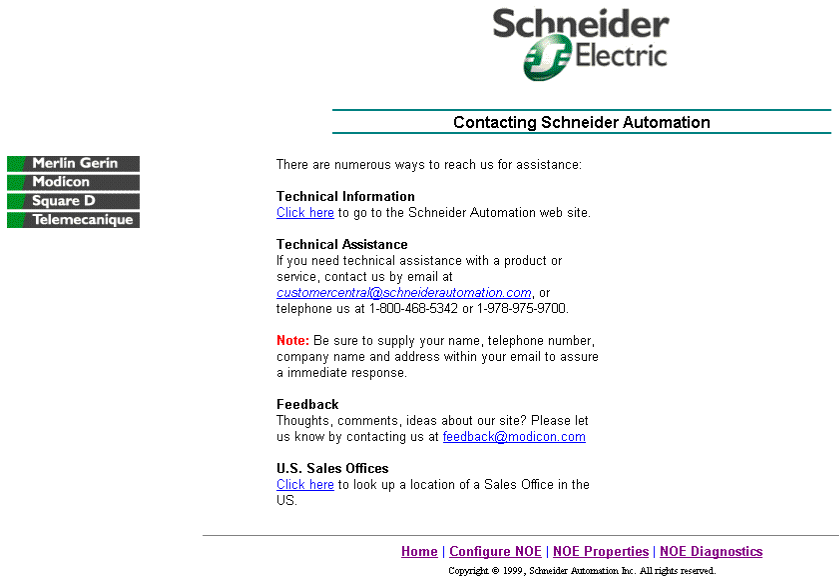
The following table details the links on the Crash Log Diagnostics Page:

Link	Results
Home	Returns you to the Quantum Welcome Page
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page
NOE Properties	Provides information on NOE properties
NOE Diagnostics	Displays links to Ethernet Statistics and the Crash Log File Diagnostics
Support	Provides you with contact information for technical assistance, sales, and feedback

Contacting Schneider Automation Page

Contacting Schneider Automation Page Overview

The Contacting Schneider Automation Page contains information on how to obtain support for the NOE 771 x0 modules.



Using the Network Options Ethernet Tester

8

At a Glance

Introduction

This chapter describes how to use the Network Options Ethernet Tester with a Windows based PC to monitor the network by supplying you with operational statistics and to provide the capability of reading and writing PLC registers.

What's in this Chapter

This chapter contains the following topics.

Installing the Network Options Ethernet Tester

Introduction

An Ethernet module may act as a client or as a server.

If it will be acting as a client -- that is, initiating transactions on the network for its Quantum controller -- then you must program an MSTR block in ladder logic. For details about the MSTR block, please refer to Chapter 6.

The Ethernet module may also act as a server, responding to requests and commands from devices on the network for its Quantum controller.

The Network Options Ethernet Tester utility allows you to get and clear statistics and to read and write registers over the network, using a Windows-based PC.

You may also create your own program using the Ethernet module as a server. For guidance in creating your own program, refer to Appendix B.

Note: In its capacity as server, the Ethernet module can only accept 32 connections at any one time. If a new connection is attempted and the server has already reached its limit, it will terminate the least used connection in order to make room for the new one.

Installation Procedure

The Network Options Ethernet Tester is supplied to you on a utility diskette. To install the tester on your PC perform the following steps:

Step	Action
1	Insert the Network Options Ethernet Tester utility disk into drive A:
2	Select **Run** from the Program Manager file menu.
3	Type `A:\SETUP` and click on the **OK** button–the Welcome dialog will appear.
4	Click on the **Next** button and follow the instructions that appear in each of the dialogs to complete the installation.  **Note:** Each installation dialog has Back and Next buttons that allow you to move back to the previous dialog or move forward to the next dialog.

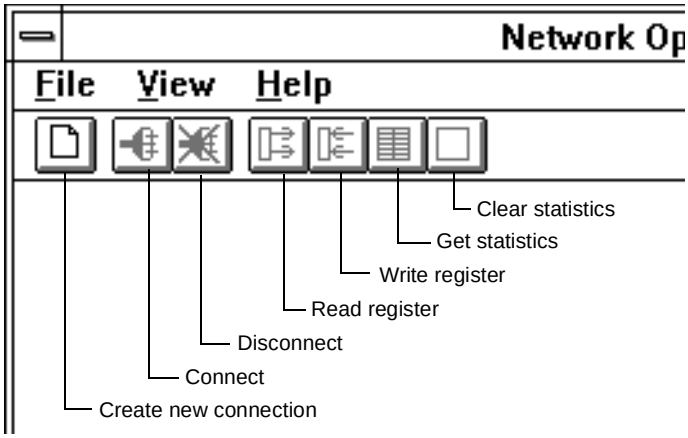
Establishing a Connection with an Ethernet Module

What You Must Know

To establish a connection with an Ethernet module using the Network Options Ethernet Tester, you must know the module's IP network address or host name.

Procedure

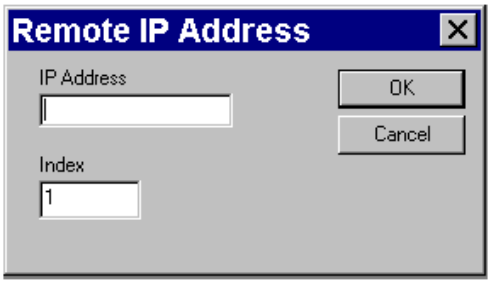
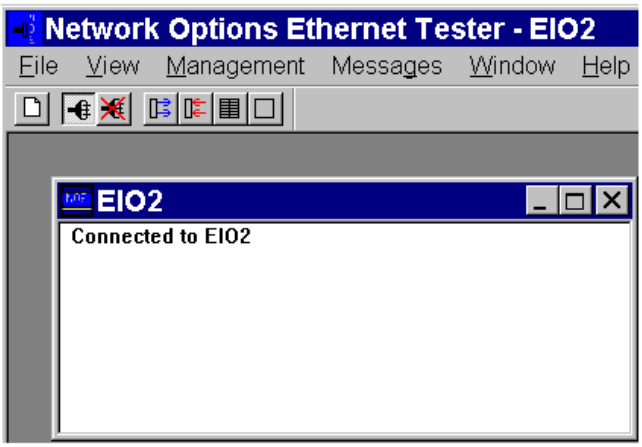
Perform the following steps to establish a connection with an Ethernet module using the Network Options Ethernet Tester:

Step	Action
1	From the initial menu, select **File** and choose **New** from the options in the pulldown menu  *or* click on the new connection button in the toolbar.  This will bring up the Remote IP Address dialog box.

Continued on next page

Establishing a Connection with an Ethernet Module, continued

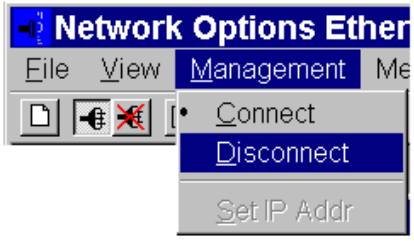
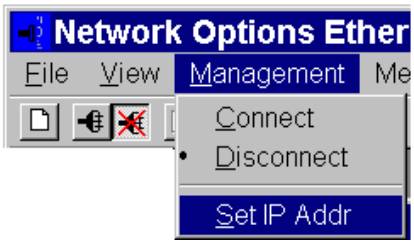
Procedure,
continued

Step	Action
2	Type the module's IP network address or host name in the **IP Address** box.  Click on the **OK** button. This dedicates a connection from your PC to the designated Ethernet module and brings you to the main menu. 
3	You may establish several connections with the same module or with other modules by repeating step 2 for each new connection.

Continued on next page

Establishing a Connection with an Ethernet Module, continued

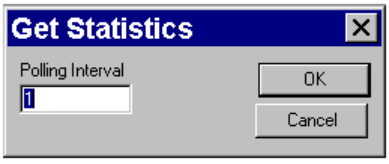
Procedure, continued

Step	Action
4	When you are ready to disconnect, select **Management** and choose **Disconnect** from the pulldown menu:  *or* click on the disconnect button in the toolbar.
5	After disconnecting from one module, you may reassign its dedicated connection by selecting **Management** and choosing **Set IP Addr** from the pulldown menu.  Type the new IP network address or host name in the box provided.

Getting and Clearing Statistics

Procedure

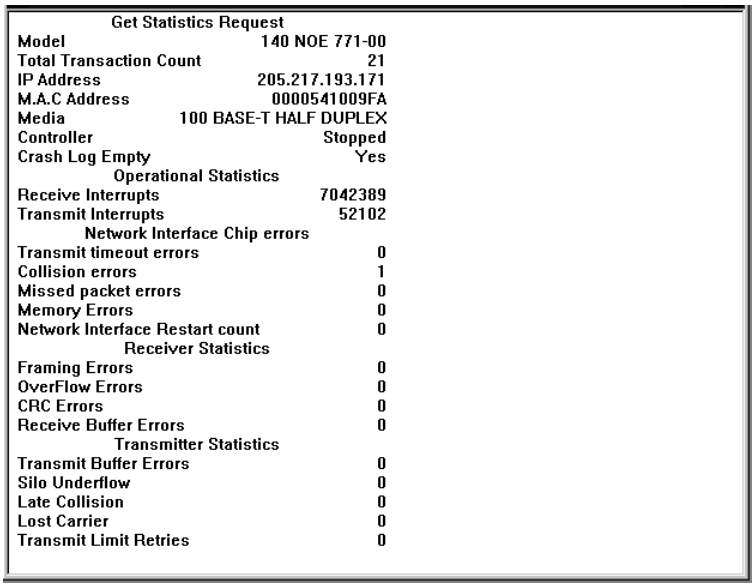
To get statistics from the Ethernet module using your Network Options Ethernet Tester, perform the following steps:

Step	Action
1	Establish a connection with the Ethernet module (see previous procedure).
2	Select **Messages** from the main menu and choose **Get Stats** from the pulldown menu:  or click on the get statistics button in the toolbar. The Get Statistics dialog box will appear.
3	Type a polling interval (the number of seconds between transactions) in the box provided and click on the **OK** button. 

Continued on next page

Getting and Clearing Statistics, continued

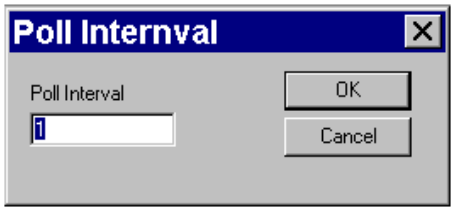
Procedure, continued

Step	Action
4	Complete statistics for the module will be printed in the window for this connection. 
5	To change the polling interval without interrupting communication with the Ethernet module, select **Messages** and choose **Poll Interval.** 

Continued on next page

Getting and Clearing Statistics, continued

Procedure, continued

Step	Action
6	Type the new polling interval in the box provided, and click on the **OK** button. 
7	To clear statistics, select **Messages** and choose **Clear Stats** from the pulldown menu:  *or* click on the clear statistics button in the toolbar.

Continued on next page

Getting and Clearing Statistics, continued

Procedure,
continued

Step	Action
8	When the Clear Statistics dialog box appears,  click on the **OK** button. This will bring up the Clear Statistics Request for the connection. 

Statistics

Statistics Description

The Network Options Ethernet Tester will provide the following statistics:

- Total Transaction Count. How many transactions have been completed.
- IP Address.
- Status Information in the following form:

Parameter	Information	
Model:	Model number	
Media:	10 BASE-T 100 BASE-T 100 BASE-FX	HALF DUPLEX DUPLEX
Controller:	Running Stopped	
Crash Log Empty?	Yes No - there is a crash log entry present	

- Receive Interrupts and Transmit Interrupts. The number of times the PCNET controller chip has generated interrupts.
- Transmit timeout errors. The number of times the transmitter has been on the channel longer than the interval required to send the maximum length frame of 1519 bytes. This is also known as a babble error.
- Collision errors. The number of collisions detected by the Ethernet chip.
- Missed packet errors. The number of times a received frame was dropped because a receive descriptor was not available.
- Memory errors. The number of times an Ethernet controller chip experienced an error accessing shared RAM. A memory error will cause a restart.
- Restart count. The number of times the Ethernet controller chip was restarted due to fatal runtime errors, including memory errors, transmit buffer errors and transmit underflow.
- Framing error. The number of times an incoming frame contained a non-integer multiple of eight bits.
- Overflow errors. The number of times the receiver has lost part or all of an incoming frame, due to an inability to store the frame in memory before the internal FIFO overflowed.
- CRC errors. The number of times a CRC (FCS) error was detected on an incoming frame.

Continued on next page

Statistics, continued

Statistics, continued

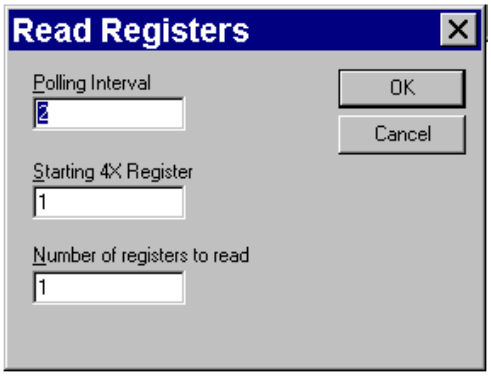
- Receive buffer errors. The number of times a receive buffer was not available while data chaining a received frame.
- Transmit buffer errors. The number of times the end packet flag on the current buffer was not set and the Ethernet controller did not own the next buffer. A transmit buffer error causes a restart.
- Silo Underflow. The number of times a packet was truncated due to data late from memory. A Silo Underflow will cause a restart.
- Late Collision. The number of times a collision was detected after the slot time of the channel had elapsed.
- Lost Carrier. The number of times a carrier was lost during a transmission.
- Transmit retries. The number of times the transmitter has failed after 16 attempts to transmit a message, due to repeated collisions.

These statistics also may be obtained from the MSTR block. Refer to the *Ladder Logic Block Library User Guide,* 890 USE 100 00 for details.

Reading Registers

Reading Registers Procedure

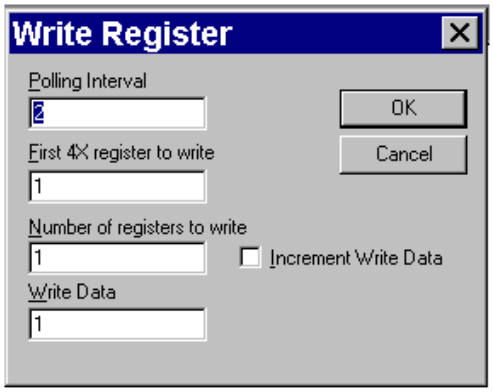
To read registers from the Ethernet module using your Network Options Ethernet Tester, perform the following steps:

Step	Action
1	Establish a connection with the Ethernet module (see procedure on page __).
2	Select **Messages** from the main menu.
3	Choose **Read Register** from the pulldown menu:  or click on the read register button in the toolbar. The Read Register dialog box will appear.
4	Type in a polling interval (the number of seconds between transactions) in the **Polling Interval** box. 
5	Type in the number of the first 4x register you want to read in the **Starting 4x Register** box. When typing the 4*x* register number, omit the leading 40 or 400, as shown in the figure above.
6	Type in the number of register to read in the **Number of registers to read** box.
7	Click on the <**OK>** button. The register values will be displayed in the window for this connection. Five values will be listed in each row, with the number of the first register at the beginning of the row.

Writing Registers

Writing Registers Procedure

To write registers from the Ethernet module using your Network Options Ethernet Tester, perform the following steps:

Step	Action
1	Establish a connection with the Ethernet module (see procedure on page __).
2	Select **Messages** from the main menu.
3	Choose **Write Register** from the pulldown menu:  or click on the write register button in the toolbar. The Write Register dialog box will appear.
4	Type in a polling interval (the number of seconds between transactions) in the **Polling Interval** box. 
5	Type in the number of the first 4x register you want to write in the **First 4x register to write** box. When typing the 4*x* register number, omit the leading 40 or 400, as shown in the figure above.
6	Type in the number of register to write in the **Number of registers to write** box.

Continued on next page

Writing Registers, continued

Writing Registers Procedure, continued

Step	Action
7	Type in the data to be written to those registers in the **Write Data** box.
8	Click on the **Increment Write Data** box if you want the data you have entered to be increased by one with each transaction.
9	Click on the **OK** button. The register values will be displayed in the window for this connection.

Read or Write Request Error.

If you try to read or write registers and an error occurs, the NOE Tester will display a Read Request Error or Write Request Error. The error codes correspond with MSTR block error codes. For more information, refer to the *Ladder Logic Block Library User Guide,* 890 USE 100 00.

Maintenance

9

At a Glance

Introduction

This chapter details information on system maintenance including accessing and clearing the Crash Log and downloading the new NOE Exec.

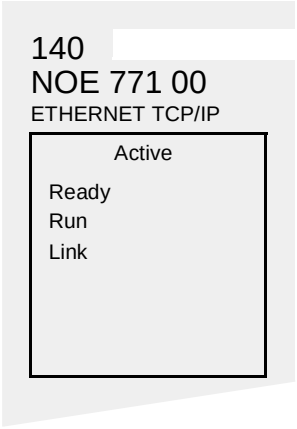
What's in this Chapter

This chapter contains the following topics.

Responding to Errors

Detecting Errors

When faults occur, the NOE 771 x0 LED display can help you determine what went wrong. During normal operation, the LEDs should display the following pattern:



The **Run** indicator will be solid. The **Coll** LED may flash, indicating that collisions are occurring on the Ethernet network. Such collisions are normal.

If a fault has occurred, the normal LEDs may be extinguished or other indicators may light. This section will discuss errors reported by the **Active, Ready, Coll, Link, Kernel, Appl** and **Fault** indicators.

For each type of error, try the suggested remedies in the order given. If no remedy suggested here overcomes the error, call your local service representative or call Schneider Electric customer service at 1-800-468-5342 for further directions.

Certain error codes are recorded in the MSTR block. For instructions on how to read and interpret those codes through ProWORX NxT, Modsoft, or Concept, please refer to *MSTR Function Error Codes* on page 108.

Active LED Error

When the Active LED fails to light, then the NOE 771 00 module is not communicating with with the backplane. Perform the following checks:

Step	Action
1	Make sure the NOE 771 module and the controller are installed properly.
2	Verify that the controller is functioning. If it isn't, replace it.
3	If neither the new controller nor the NOE 771 module will function, replace the backplane.

Continued on next page

Responding to Errors, continued

Active LED Error, continued

Step	Action
4	Make sure that no more than two network option modules -- including NOE, NOM, NOP and CRP 811 modules -- have been installed in the backplane with a 140 CPU 113 or 213; no more than six network option modules with a 140 CPU 424 or 534.
5	Check the version of the controller executive. You must have version 2.0 or greater to support the Ethernet module. Earlier versions do not recognize the module.
6	If steps 4 and 5 above check ok, replace the NOE 771 module.

Ready LED Error

The **Ready** LED fails to light, the NOE 771 module has failed internal diagnostic tests. Perform the following checks:

Step	Action
1	Make sure that power has been applied to the backplane.
2	If step 1 checks ok, replace the NOE 771 module.

Link LED Error

If the **Link** LED fails to light, the NOE 771 module is not communicating with the Ethernet hub/switch. Perform the following checks:

Step	Action
1	Make sure that the cable has been installed correctly and the module is functioning properly.
2	Verify that the hub/switch is working properly.
3	If steps 1 and 2 above check ok , replace the NOE 771 module.

Continued on next page

Responding to Errors, continued

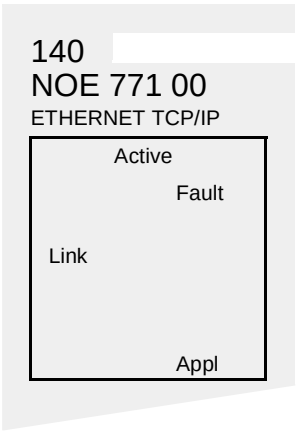
Kernel LED Error

Check for the following **Kernel** LED error conditions:

If	**Then**
The **Ready** LED is on and the **Kernel** LED is flashing,	the module has detected an invalid software image.
The **Ready** LED is on and the **Kernel** LED is shining steadily,	an attempt to download a software image has failed and the module is in kernel mode.
Either of the above conditions exist,	download a new NOE Exec (see page 179).

Fault LED

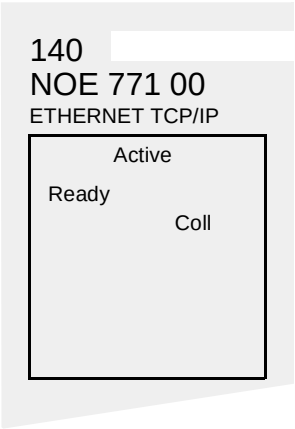
The **Fault** LED will flash briefly following an error as the module attempts to recover.



Responding to Errors, continued

Collision LED Error

If the twisted pair cable has not been connected properly, the **Coll** LED will shine steadily and the **Link** LED will be extinguished. (This condition does not occur with fiber optic modules.)



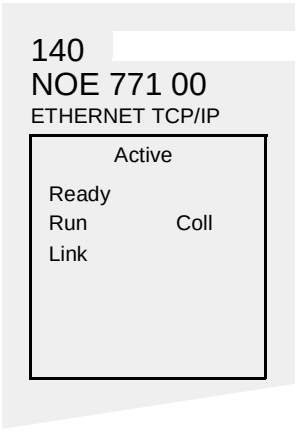
Perform the following checks:

Step	Action
1	Make sure the cable has been installed properly and is working properly.
2	Verify that the Ethernet hub/switch is functioning properly.

Continued on next page

Responding to Errors, continued

Collision LED, Normal Condition



If the **Coll** LED is flashing, the module is reporting collisions on the Ethernet network. While such collisions are normal, the frequency of the flashes is an indication of the volume of traffic on the network. The flashes may be so frequent that the LED appears to be shining steadily. Heavy traffic will slow communications. If response time is important to your application, you should consider segmenting your network to reduce the frequency of collisions.

Run LED

The following table indicates the action to be taken if the **Run** LED is flashing. The action depends on the number of flashes in sequence.

# of Flashes in Sequence	Action
Three	Check Ethernet connection
Four	Change IP address
Five	Provide IP address
Six	Connect using default IP address and configure
Seven	Download NOE Executive

Application LED

If the module crashes, it will note the reason in a log. If the module is able to recover, the **Appl** LED will light, indicating that an entry has been made in the crash log. To learn how to read and clear the crash log, refer to the section below.

Reading and Clearing the Crash Log

Introduction

The crash log provides you with the ability to capture conditions that lead to an anomalous condition. By providing the crash log to Schneider Electric technical support, you can facilitate their assistance in resolving your problems.

Note: The crash log is provided with the understanding that with a complex product in thousands of customer applications, there may be conditions that require advance diagnostics. The crash log is one of the tools used to solve complex problems.

The Crash Log

If the **Appl** indicator is lit, entries have been made in the crash log. The log may hold up to 64K of entries.

Reading the Crash Log

The crash log can be read from the Embedded Web Pages (see Chapter 7) or via FTP.

Reading the Crash Log via FTP

Perform the following steps to access the crash log via FTP.

Step	Action
1	Log into the module's FTP Server
2	Change the directory to wwwroot/conf/diag
3	Perform an FTP to get the crash log: get crash log

Continued on next page

Reading and Clearing the Crash Log, continued

Clearing the Crash Log

The crash log can be cleared from the Embedded Web Pages (see Chapter 7) or via FTP

Clearing the Crash Log via FTP

Perform the following steps to clear the crash log via FTP.

Step	Action
1	Log into the module's FTP Server
2	Change the directory to wwwroot/conf/diag
3	Perform an FTP rm crash.log to delete the crash log file

Downloading a New NOE Exec

Introduction

The following tools can be used to download of new NOE Exec:

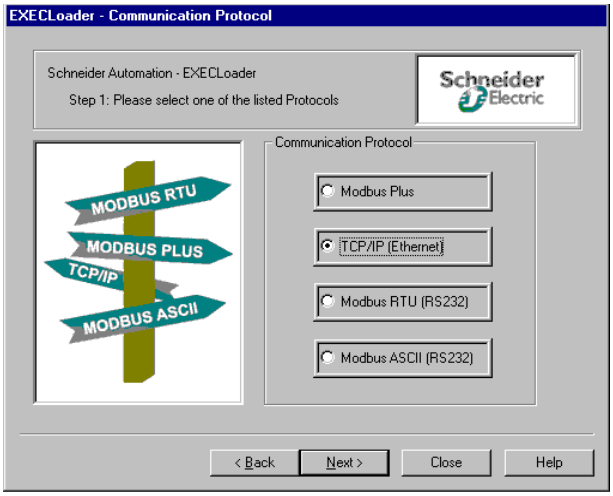
- Concept Exec Loader
- FTP

These tools provide you with the ability to download a new NOE Exec.

The Concept Exec Loader

Process

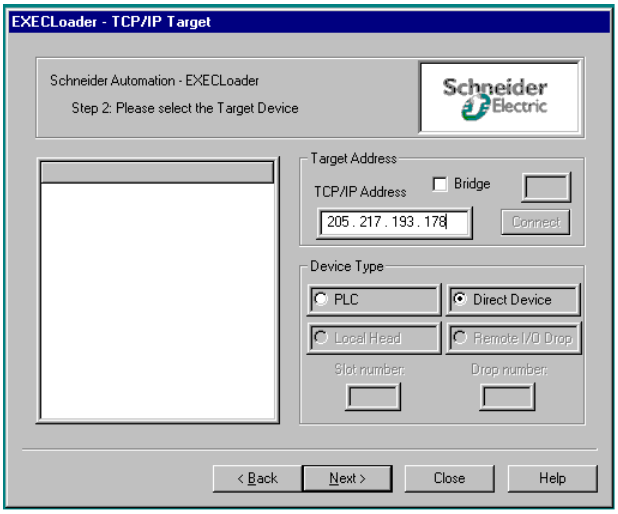
The following steps detail downloading a new NOE Exec using the Concept Exec Loader.

Step	Action
1	Activate the Exec Loader program.
2	Click on the Next button to start the Exec Loader process **Result:** The EXECLoader - Communication Protocol screen is displayed.  Click on TCP/IP [Ethernet}

Continued on next page

The Concept Exec Loader, continued

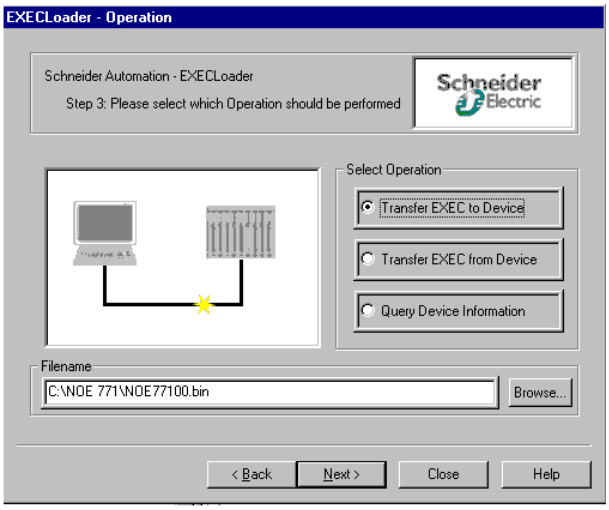
Process, continued

Step	Action
3	Click on the Next button **Result:** The EXECLoader - TCP/IP Target screen is displayed.  Click on Direct Device

Continued on next page

The Concept Exec Loader, continued

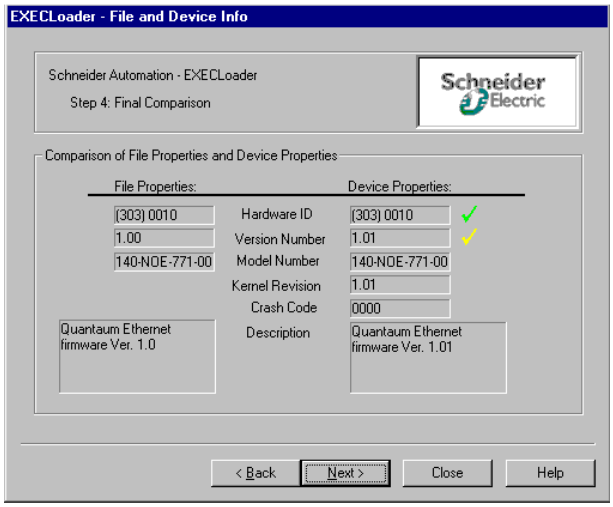
Process, continued

Step	Action
4	Click on the Next button **Result:** The EXECLoader - Operation screen is displayed.  Click on Transfer EXEC to Device
5	Use Browser to select the file name.

Continued on next page

The Concept Exec Loader, continued

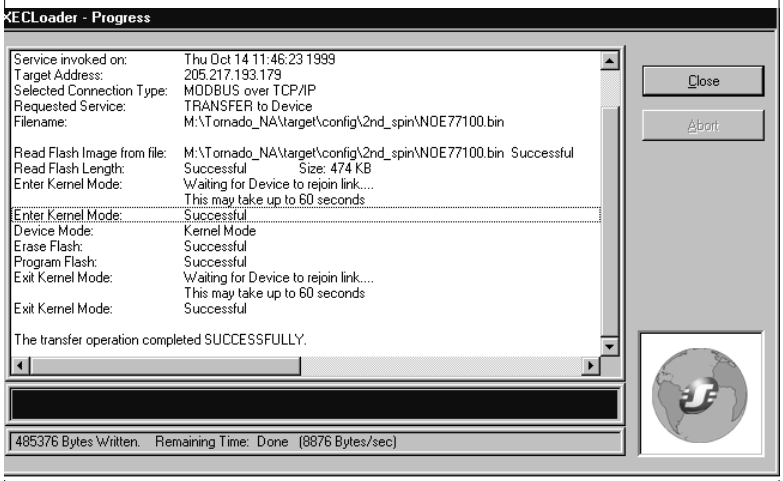
Process,

Step	Action
6	Click on the Next button **Result:** The EXECLoader - File and Device Info screen is displayed. 

Continued on next page

The Concept Exec Loader, continued

Process, continued

Step	Action
7	Click on the Next button **Result:** The EXECLoader - Progress screen is displayed.  When the process is completed, you can click on the Close button.

Continued on next page

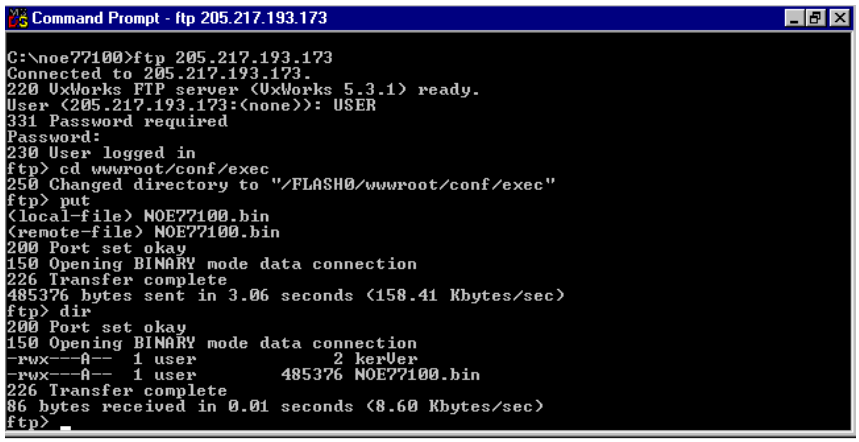
Downloading a new NOE Exec via FTP

Procedure

Use the following steps to download a new NOE Exec via FTP:

Step	Action
1	FTP IP Address
2	: USER
3	FTP Password
4	cd wwwroot/conf/exec
5	put
6	<local file> NOE 77100.bin
7	<remote file> NOE 77100.bin

Following is an example:



NOE 771 00 Module Specifications

A

At a Glance

What's in this Appendix

This appendix covers the following topics.

Specifications

Specification Table

The main specifications for the Quantum 140 NOE 771 x0 Ethernet Module are described in the following table.

Communication Ports	One auto-sensing 10/100Base-T shielded twisted pair (RJ-45 connector) port and one 100Base-FX (MT-RJ connector) port. Both ports transmit and receive Modbus commands encapsulated in TCP/IP protocol.
Bus Current Required	750 mA
Power Dissipation	3.8 W
Fuse	None
Programming Software	
Type and version	Concept, Ver. 2.2, or higher Modlink, Ver. 2.0, or higher Modsoft, Ver. 2.6, or higher ProWORX NxT, Ver. 2.1, or higher
Firmware	
CPU Type and version	Quantum Executive, Ver. 2.0, or higher
NOE Upgradeable	Field Upgradeable via FTP or Programming Panel.
Operating Conditions	
Temperature	0 to +60° C
Humidity	0 to 95% Rh non condensing @ 60° C
Altitude	15,000 ft (4500 m)
Vibration	10-57 Hz @ 0.0075 mm d.a. 57-150 Hz @ 1 g
Storage Conditions	
Temperature	-40 to +85°C
Humidity	0 to 95% Rh non condensing @ 60°C
Free Fall	1 m unpackaged
Shock	3 shocks / axis, 15 g, 11 ms

Ethernet Developers Guide

B

At a Glance

What's in this Appendix

This appendix covers the following topics.

Overview

Introduction

This appendix describes the design of the sample TCP/IP application named Network Options Ethernet Tester (NOET). The NOET application is a multiple document interface windows application that verifies the installation of the Quantum Ethernet TCP/IP module and also serves as a sample application for developers.

TCP/UDP system port number 502 is used with ASA protocol_id of 0.

References

Inside Visual C++, Second Edition, David J. Kruglinski

Window Sockets, An Open Interface for Network Programming under Microsoft® Windows Version 1.1

What the Sample Application Does

The sample application performs the following steps:

- Calls the window socket function **socket** to create a socket.
- Calls the window socket function **setsockopt** to set the socket attributes.
- Calls the window socket function **connect** to establish a connection.
- Encodes the request. The request consists of a header followed by a Modbus message. The header contains an invoke identifier, a protocol type, the command length, and a destination identifier
- .

Invoke Identifier	Protocol Type	Command Length	Destination ID	Modbus Message

- Calls the window socket function **send** to transmit the request to the remote node.
- Calls the window socket function **recv** to receive the response from the remote node.
- Calls the window socket function **closesocket** to close the connection and release the socket.

The winsock.lib import library provided by the installation is used to link the window socket calls.

Continued on next page

Overview, continued

Development Environment

The sample application was developed with Microsoft Visual C++, version 1.52. The sample application uses Microsoft Foundation Class. The initial application was generated by the Visual C++ application wizard.

Class Descriptions

List of Classes

6. **CSample_app.** The Csample_app is the application class. This application was generated by the application wizard, and the source is in the file sam_app.cpp. The class declaration is in sam_app.h.
7. **CMainFrame.** The CMainFrame is derived from the MFC class CMDI-FrameWnd and is the application's main window frame. The source for CMainFrame is in mainfrm.cpp, and the declaration is in mainfrm.h. The code for CMainFrame was initially generated by the application wizard, and was modified to process window timer messages.
8. **CSample_doc.** The CSample_doc is the document class. The declaration is in sam_doc.h and the implementation is in sam_doc.cpp.
9. **CSample_View.** The CSample_View is the view of the document. It is derived from the CScrollView class. The declaration is in the sam_vw.h class, and it is implemented in the sam_vw.cpp, disp.cpp, tcp_hlp.cpp, and the tx_rx.cpp files.
10. **CIP_dig.** The CIP_dlg class is the dialog class for getting the IP address. It is derived from the CDialog class. The declaration is in the cip_dlg.h file and the implementation is in the cip_dlg.cpp file. Both of these files were generated by The Visual C++ class wizard.
11. **ClrStatsDlg.** The ClrStatsDlg class is the dialog class for clearing statistics. It is derived from the CDialog class. The declaration is in the cstatdlg.h file and the implementation is in the cstatdlg.cpp. Both of these files were generated by The Visual C++ class wizard.
12. **GetStatsDlg.** The GetStatsDlg class is the dialog class for get statistics. It is derived from the CDialog class. The declaration is in the gstatdlg.h file and the implementation is in the gstatdlg.cpp file. Both of these files were generated by The Visual C++ class wizard.
13. **CPollDlg.** The CPollDlg class is the dialog class for determining the poll period. It is derived from the CDialog class. The declaration is in the polldlg.h file, and the implementation is in the polldlg.cpp file. Both of these files were generated by The Visual C++ class wizard.

Continued on next page

Class Descriptions, continued

List of Classes, continued

14. **CReadDlg.** The CReadDlg class is the dialog class for determining the registers to read. It is derived from the CDialog class. The declaration is in the readdlg.h file, and the implementation is in the readdlg.cpp file. Both of these files were generated by The Visual C++ class wizard.
15. **CWriteDlg.** The CWriteDlg class is the dialog class for determining the registers to write and the write data. It is derived from the Cdialog class. The declaration is in the writedlg.h and the implementation is in the writedlg.cpp file. Both of these files were generated by The Visual C++ class wizard.
16. **CAboutDlg.** The CAboutDlg class is the dialog class for **about**. Both the declaration and its implementation are in the sam_app.cpp file.

The CSample_doc Class

Description

The CSample_doc (the document class) contains the user data used by the CSample_View class. The user data consists of the remote node's IP address, the transaction type and its associated values. The different transaction types are read register, write register, clear statistics, and get statistics. In addition to the transaction type and the associated values, the document class also contains the poll interval.

A user modifies the user data via a menu or tool bar. The CSample_doc processes the menu or tool bar window command message by invoking the corresponding dialog. The state of the various menu items and tool bar buttons depends on the connection state between the application and the remote node. The CSample_View class maintains the connection state, and hence sets the state of the menu items and tool bar buttons.

The CSample_View Class

What it Does

The CSample_View class manages the TCP/IP connection, sends requests to remote nodes, and displays either connection state, or the results of a transaction. In addition it sets the states of the tool bar buttons and menu items.

Accessing TCP/IP

The CSample_View interfaces with window sockets via its application programming interface, and via messages sent by the window sockets DLL to the CSample_View window. The reference for the window socket API is given above. The first call made to the window sockets DLL must be WSAStartup. This call is made by InitInstance member function of the CSample_app class. The last call to the window socket DLL must be WSACleanup. This call is made by the ExitInstance member function of the Csample_app class.

The CSample_View allocates and sets the socket attributes. The attributes it sets are:

- Set Linger to cause a hard close
- Receive out of band data in the normal data stream
- Disable Nagel algorithm for send coalescing

When the Nagel algorithm is disabled, if the stack receives an application message, it will immediately pass the message to the application and will send a TCP/IP acknowledgment message. Although this can generate more traffic, the application receives the message sooner then if Nagel algorithm is enabled. The member function tcpip_setsocket_options sets the socket attributes.

The window socket interface provides the WSAAsyncSelect function which notifies the window of network events. The member function tcpip_setsocket_options calls WSAAsyncSelect function. The different events are given by the following table

Event	Description
FD_READ	A socket can read data
FD_WRITE	A socket can write data
FD_OOB	A socket can read out of band data
FD_CONNECT	A connect response has been received
FD_CLOSE	The connection has been closed

Continued on next page

The CSample_View Class, continued

Accessing TCP/ IP, continued

One of the parameters to the WSAAsyncSelect is a user defined message the window socket DLL sends to the window. The sample application user message is WM_TCPIP_EVENT and is defined in the file wn_msh.h. MFC architectural framework calls the CSample_View tcpip_event member function to process this message. Like all functions which process messages, tcpip_event parameters are a word and a long word. The word parameter is the socket, and the long word parameter contains the network event , and an error code. Tcpip_event examines the network event and calls the member function indicated in the following table.

Network Event	Member Function
FD_READ	OnTcpIpRead()
FD_WRITE	OnTcpIpWrite()
FD_OOB	OnTcpIpOob()
FD_CONNECT	⁄OnTcpIpConnect
FD_CLOSE	OnTcpIpClose()

Application Message Format

TCP/IP transmits a message as a stream. There is no indication of the start of a message nor the end of the message. The NOE option module adds a header to determine the message boundaries. The message is a Modbus message. The header contains the following fields.

- Invoke Identifier. This two byte field associates a request with the response. The client application picks the invoke identifier, and server returns the same invoke identifier in the response.
- Protocol Type. This two byte field identifies the protocol type. Currently, the only protocol supported is Modbus.
- Command Length. This two byte field is the size of the rest of the message.
- Destination Identifier. This one byte field is reserved for future use.

The Modbus message follows the header. The message does not contain the address field, instead, the first byte is the Modbus function code.

The data structure for the header is declared in modbus.h and the CSample_View encode_header function encodes the header. The member functions encode_clear_stats, encode_read_stats, encode

Timers and Transaction Processing

Timers

CSample_View requires to periodically receive a timer message. This message triggers the CSample_View to transmit a message. Since window timers are a limited resource, the window associated with CMainFrame class receives the timer messages. CMainFrame member AddTimerList function will place a window on its timer list. When CMainFrame processes the WM_TIMER message, it sends each window on its time list the user defined WM_POLL_INTERVAL message.

MFC calls CSample_View member OnInitalUpdate function when it is first being created. OnInitialUpdate calls CMainFrameís AddTimerList in order to receive the WM_POLL_INTERVAL message. MFC architectural framework calls CSample_View OnPollInterval member function to process this message.

Transaction Processing

CSample_View transaction processing consists of establishing a connection, transmitting the request, receiving the response, and displaying the response. CSample_View uses both a transmit and a receive state machine to advance a transaction.

Transmit State Machine

Description

The transmit state machine establishes a connection, and periodically transmits a request. The different states for the transmit state machine are as follows.

- IDLE. In the IDLE state, there is no connection.
- RESOLVING_NAME. In the RESOLVING_NAME state, CSample_View is waiting for the window socket DLL to convert a node's name into an IP address.
- CONNECTING. In the CONNECTING state, CSample_View is waiting for the window socket DLL to generate the FD_CONNECT event. This event indicates if the attempt to establish a connection succeeded or failed.
- CONNECTED. The CONNECTED state indicates that a connection has been successfully established.
- WAIT_TO_TX. In the WAIT_TO_TX state, CSample_View is waiting to transmit the message. It transmits the message, when the time from the last transmit exceeds the specified poll interval.
- BLOCKED. When CSample_View attempts to send a message, the window socket DLL may not be able to transmit the complete message. This is a flow control condition, and CSample_View enters the BLOCKED state. The window socket DLL generates the FD_WRITE event when it can send more data.
- TX_DONE. CSample_View enters the TX_DONE when it has completed transmitting the request.

If the CSample_View is in the IDLE state, and user selects either the connect menu item, or the connect tool bar button, CSample_View OnManagConnect function attempts to establish connect with its tcpip_initate_connection function. This function examines the remote destination and determines if it's a name or an IP address. If it's a name, OnManagConnect changes the transmit state to RESOLVING_NAME, and it invokes the window sockets DLL WSAAsyncGetHostByName function to resolve the name. Window sockets DLL will generate the user defined WM_TCPIP_NAME_RESOLVED message which indicates if the name has been resolved. The OnTcpIpNameResolved member function process the WM_TCPIP_NAME_RESOLVED message. If the name is not resolved, OnTcpIpNameResolved changes the transmit state back to IDLE.

Continued on next page

Transmit State Machine, continued

Description, continued

If the remote node is an IP address, or if it's a name that has been resolved, then CSample_View tcpip_connect_rq function is called to initiate a connect request to the remote node. The listen port for the connect request is five hundred and two, and is defined by the constant MBAP_LISTEN_PORT in modbus.h. If tcpip_connect_rq succeeded in initiating a connect request, then tcpip_connect_rq changes the transmit state to CONNECTING, otherwise it changes the transmit state to IDLE.

The window sockets DLL generates a FD_CONNECT event which indicates if the connect request succeeded or failed. CSample_View OnTcpIpConnect function processes the FD_CONNECT event. If the connect request succeeded, OnTcpIpConnect changes the transmit state to CONNECTED, otherwise it changes the state to IDLE.

Recall that MFC architectural framework calls CSample_View OnPollInterval member function to processes WM_POLL_INTERVAL message sent as result of CMainFrame class processing a WM_TIMER message. OnPollInterval examines the transmit state. If the transmit state is CONNECTED, and the user has selected a transaction type, then OnPollInterval calls CSample_View TransmitUserRequest function.

TransmitUserRequest encodes a request based on the transaction type, saves the current time, and calls CSample_View TransmitMessage function. OnPollInterval uses the saved time to determine when to transmit the next request. TransmitMessage attempts to send a message to the remote side. To send the message, TransmitMessage enters a loop. In the body of the loop transmit message calls the window socket DLL send function. The following lists the outcomes of the send function and the actions taken.

- The message was sent successfully. TransmitMessage changes the transmit state to TX_DONE and exits the loop.
- Only part of the message was sent. TransmitMessage reenters the loop.
- Send function returns an error indicating there is no buffer space within the transport system. TransmitMessage changes the transmit state to BLOCKED and exists the loop.
- Send function returns some other error. TransmitMessage closes the connection, changes the transmit state to IDLE, and exits the loop.

Continued on next page

Transmit State Machine, continued

Description, continued

When buffer space within the transport system becomes available to transmit messages, the window socket DLL generates a FD_WRITE event. CSample_View OnTcpWrite function processes the FD_WRITE function by calling TransmitMessage.

The receive state machine (which is described below) processes the response to a request. When the receive state machine has completed receiving the response, it changes the transmit state machine from the TX_DONE state to the WAIT_TO_TX state.

Recall that the TransmitUserRequest saves the time. CSample_View OnPollInterval uses this saved time to determine if a new request needs to be transmitted. OnPollInterval is called by MFC architectural framework to process the WM_POLL_INTERVAL sent when CMainFram class processes the window timer message, WM_TIMER. OnPollInterval examines the transmit state. If the transmit state is WAIT_TO_TX, and the elapsed time from the previous transmit request exceeds the poll interval, then OnPollInterval calls TransmitUserRequest to start another transaction.

Receive State Machine

Description

The receive state machine receives a response to a transaction by first reading the header, determining the size of the rest of the message, and then reading the body of the message. The different states of the receive state machine are as follows.

- RX_HEADER. In the RX_HEADER state, the receive machine is receiving the message header.
- RX_BODY. In the RX_HEADER state, the receive machine is receiving the response message associated to the requested transaction.
- DUMP_BODY. In the DUMP_BODY state, the receive message is receiving a message, but there is no associated transaction with respect to this message.

The window socket DLL generates the FD_READ event whenever there is data to be read. If only part of the data is read, it generates another event. CSample_View OnTcpIpRead function processes the FD_READ event, and drives the receive state machine.

When a FD_READ event is generated it is possible that the complete message is not present. The remote node may have attempted to send a 100 byte response, but the transport system may have only had buffer space to transmit three bytes. The receiver will get a FD_READ for the three bytes. OnTcpIpRead calls CSample_View rx_msg to read the receive data into the buffer. There are three parameters to rx_msg. The first parameter is a pointer to a receive buffer. The second input parameter is the receive size. The third parameter is both an input and output parameter. On both input and output the third parameter is the number of bytes read. These parameters allow the processing of a partially received message.

The receive state machine maintains a variable which is the number of bytes received. Initially the receive state machine is in the RX_HEADER state, and the number of bytes received is zero.

When OnTcpIpRead is called and the receive state is RX_HEADER OnTcpIpRead calls rx_msg with receive size equal to the header size. On return OnTcpIpRead examines the number of bytes received. If the number of bytes received is not equal to the header size, then receive machine remains in the RX_HEADER state, and OnTcpIpRead returns.

Receive State Machine, continued

Description, continued

If upon return, the number of bytes received is the same size as the header size, then the header has been received. OnTcpIpRead sets the number of bytes received to zero, and the receive size is obtained from the header. These two values will be used the next time rx_msg is called. OnTcpIpRead also obtains the transaction identifier and the protocol type from the header. If the transaction identifier matches the transmit request identifier and the protocol type is MODBUS, then OnTcpIpRead changes the receive state to RX_BODY. However if either transaction identifier does not match or the protocol is not MODBUS, then OnTcpIpRead changes the receive state to DUMP_BODY.

When OnTcpIpRead is called and the receive state is RX_BODY, OnTcpIpRead calls rx_msg with receive size equal to the value obtained from the header. On return OnTcpIpRead examines the number of bytes received. If the number of bytes received is not equal to the receive size, then the receive machine remains in the RX_HEADER state, and OnTcpIpRead returns.

If upon return the number of bytes received is the same as the receive size, then OnTcpIpRead has read the response to a transaction. OnTcpIpRead saves the results and invalidates the client area which causes the results to be display. OnTcpIpRead also changes the transmit state to WAIT_TO_TX, and resets the state receive state machine by setting the state to RX_HEADER and the number of bytes received to zero. It then returns.

When OnTcpIpRead is called and the receive state is DUMP_BODY, OnTcpIpRead calls rx_msg with receive size equal to the value obtained from the header. On return OnTcpIpRead examines the number of bytes received. If the number of bytes received is not equal to the receive size, then the receive machine remains in the RX_HEADER state, and OnTcpIpRead returns.

If upon return the number of bytes received is the same as the receive size, the OnTcpIpRead has completed reading the message. Since this message does not correspond to an transaction, the only processing OnTcIpRead performs is resetting the receive state machine.

The member function rx_msg calls the window socket recv function to read data. The recv function either returns a non negative number that is the number of bytes read or it returns an error. If the number bytes read is zero, then the connection no longer exits, and rx_msg closes the socket, and sets the transmit state to IDLE. If the recv function returns the error indicating that no receive data is available, then rx_msg just returns. For any other recv function error, rx_msg closes the socket, and sets the transmit state to IDLE.

Displaying on the Screen

Description

CSample_View m_display member indicates the display type. The different types of the displays and the CSample_View member functions for showing the display are as follows.

1 . Displaying the connection state. The different connection states displayed are IDLE, RESOLVING NAME, and CONNECTING. ConnPaint member function displays the connection state.

2. GetStatsPaint member function displays the results of a get statistics request.

3. ClearStatsPaint member function displays the results of a clear statistics request.

4. ReadRegPaint member function displays the results of a read register request.

5. WriteRegPaint member function displays the results of a write register request.

MFC architectural framework calls CSample_View OnDraw member function to process the window WM_PAINT message. OnDraw examines m_display member variable and calls the corresponding member function described in the previous paragraph. Whenever CSample_View needs to display a result, it calls Cview Invalidate function which causes a WM_PAINT message.

CSample_View is derived from MFC CScrollView class. This class handles the scroll logic. To perform the scroll logic, CScrollView requires the size of the document. It is informed of the document size via its SetScrollSizes member function.

CSample_View UpdateScrollSizes member function based on the display type calculates the document size, and then calls SetScrollSizes. CSample_View calls UpdateScrollSizes when the display type changes or when the user changes the window size.

Quantum Ethernet TCP/IP Modbus Application Protocol

C

At a Glance

What's in this Appendix

This appendix covers the following topics.

Overview

Introduction

The Modbus Application Protocol (MBAP) is a layer-7 protocol providing peer-to-peer communication between programmable logic controllers (PLCs) and other host-based nodes on a LAN. Collectively these nodes implement all or part of a control application used for industrial automation applications in the automotive, tire and rubber, food and beverage, and utilities industries, to name a few.

Modbus protocol transactions are typical request-response message pairs. Modbus requests contain function codes representing several classes of service including data access, online programming, and program download and upload classes. Modbus responses can be ACKs with and without data, or NACKs with error information.

The Modbus Application Protocol can be transmitted over any communication system that supports messaging services. However, the current Quantum implementation transports Modbus Application Protocol PDUs over TCP/IP. Both Ethernet II and IEEE 802.3 framing are accommodated, although Ethernet II framing is the default.

For more information, consult the *Modbus Protocol Reference Guide* (PI-MBUS-300).

Modbus Application Protocol PDU

The Modbus Application Protocol PDU, mbap_pdu, is received at TCP port number 502. The current maximum size of the mbap_pdu for this class of services is 256 bytes. The structure and content of the mbap_pdu is defined to be:

mbap_pdu ::={ inv_id[2], proto_id[2], len[2],dst_idx[1], data=mb_pdu }

The header is seven bytes long and includes the following fields:

inv_id	[2 bytes] invocation id used for transaction pairing
proto_id	[2 bytes] used for intra-system multiplexing, default is 0 for Modbus services
len	[2 bytes] the len field is a byte count of the remaining fields and includes the dst_id and data fields

The remainder of the pdu includes two fields:

dst_idx	[1 byte] destination index is used for intra-system routing of packets (currently not implemented)
data	[n bytes] this is the service portion of the Modbus pdu, mb_pdu and is defined below

The service portion of the Modbus Application Protocol, called mb_pdu, contains two fields:

mb_pdu ::={ func_code[1], data[n] }

func_code	[1 byte] Modbus function code
data	[n bytes] this field is function code dependent and usually contains information such as variable references, variable counts and data offsets

The size and content of the data field are dependent on the value of the function code.

Continued on next page

Modbus Application Protocol PDU, continued

Example

Here are the values for a sample mbap_pdu for reading a register:

00 01 00 00 00 06 01 03 00 00 00 01

This example has the folowing structure and content:

inv_id	00 01	
	proto_id	00 00
	len	00 00
	dst_idx	01
	func_code	03
	data	00 00 00 01

Modbus Application Protocol Service Classes

Introduction	There are several classes of service that are part of the Modbus Application Protocol. Each of these classes is described below.
Data Access	Read/write both discrete and analog data values from PLC register files.
Online Programming	Services make relatively minor alterations to ladder logic programs with a highly controlled introduction of these changes into the executing program.
Image Download/ Upload	Image download services support the downloading of a ladder logic control program to the PLC. Image upload services support the uploading of a ladder logic control program from a PLC to PC host for archival/backup purposes.
Configuration	Configuration services allow the user to define parameter values which affect the PLC's register files, I/O map, communication port configuration and scan attributes, to name a few.
Device Execution State Control	The class of service allows the user to start/stop the PLC scan execution. These services require the user to be in an application login context which is obtained through other Modbus services.

Modbus Application Protocol PDU Analysis

Introduction

An analysis of the Modbus Application Protocol is described in the following paragraphs

Analysis

The Modbus Application Protocol PDU is transmitted over a TCP/IP Ethernet stack. Both Ethernet II and IEEE 802.3 framing will be accommodated. Ethernet II framing is the default.

. . . from the wire in for IEEE 802.3 framing . . .
. . . is IEEE 802.3 framing if length <=1500 . . .

802.3_pdu ::= {dst_addr[6], src_addr[6], length[2], data=802.2_pdu}

*an IEEE 802.3 PDU has a maxFrameSize of 1518 octets
*an IEEE 802.3 PDU has a minFrameSize of 64 octets

802.2_pdu : {dsap[1], ssap[1], frm_cntrl[1], snap_hdr[5], data=ip_pdu}

*the snap_hdr is associated with a “well-known” 802.2 sap snap_hdr ::={org_code[3], ethertype[2] }

*the snap hdr (sub network access protocol) allows the older style Ethernet protocols to run on the newer IEEE 802.2 interface. The ethertype parameter indicates the service, ex. ip or arp. IP has a value 0x800.

. . . from the wire in for Ethernet II framing . . .
. . . is Ethernet II framing if length >1500 . . .

802.3_pdu ::= {dst_addr[6], src_addr[6], length[2], data=ip_pdu}

. . . the common part of the packet begins here . . .

ip_pdu ::= {ip_hdr[20], data=tcp_pdu}

tcp_pdu ::= {tcp_hdr[24], data=appl_pdu=mbap_pdu}

The mbap_pdu is the Modbus Application Protocol whose messages are received at a well-known port. The current maximum size of the mbap_pdu for this class of services in 256 bytes.

Continued on next page

Modbus Application Protocol PDU Analysis, continued

Analysis, continued

The structure and content of the mbap_pdu is defined to be:

mbap_pdu ::={ inv_id[2], proto_id[2], len[2], dst_idx[1], data=mb_pdu }The header is 7 bytes long, and includes the following fields:

inv_id[2 bytes] invocation id used for transaction pairing

proto_id[2 bytes] used for intra-system multiplexing,default is 0 for Modbus services

len[2 bytes] the len field is a byte count of the remaining fields and includes the dst_id and data fields.

The remainder of the pdu includes two fields:

dst_idx[1 byte] destination index is used for intra-system routing of packets. (currently not implemented)

data[n bytes] this is the service portion of the Modbus pdu, mb_pdu, and is defined below

The service portion of the Modbus Application Protocol, called mb_pdu, contains 2 fields:

mb_pdu ::= { func_code[1], data[n] }

func_code[1 byte] MB function code

data[n bytes] this field is function code dependent and usually contains information such as variable references, variable counts, and data offsets.

The size and content of the data field are dependent on the value of the function code.

TCP/IP Specific Issues

Broadcast/ Multicast

Although broadcast and/or multicast are supported by both IP network address and IEEE 802.3 MAC address, the Modbus Application Protocol does not support either broadcast or multicast at the application layer.

Schneider Electric's Quantum PLCs use broadcast addressing because they use ARP as the means of locating the destination node. The client interface to the Modbus Application Protocol service on the PLC, the MSTR block, requires the user to provide the destination IP address. Also the embedded stack does use a pre-configured default gateway IP address in the case where ARP does not succeed.

TCP Port Number

Schneider Electric has obtained a well-known system port from an Internet Authority. Schneider Electric's well-known system port number is 502. The Internet Authority assigned the system port number 502 to asa-appl-proto with Dennis Dubé as the company point of contact.

This port number allows Schneider Electric to transport various application protocols over with TCP or UDP. The particular protocol is indicated by the value of the proto_id parameter in the mbap_pdu. Currently the only assignment is 0 meaning Modbus Application Protocol.

Reference Documents

Introduction

The following reference documents may prove helpful to you.

[1] ANSI/IEEE Std 802.3-1985, ISO DIS 8802/3, ISBN - 0-471-82749-5, May 1988

[2] ANSI/IEEE Std 802.2-1985, ISO DIS 8802/2, ISBN 0-471-82748-7, Feb 1988

[3] RFC793, TCP (Transmission Control Protocol) DARPA Internet Program Protocol Specification, Sep 1981

[4] RFC 791, IP (Internet Protocol) DARPA Internet Protocol Specification, Sep 1981

[5] RFC826, An Ethernet Address Resolution Protocol (ARP), David Plummer, NIC Sep 1982

[6] RFC1042, A Standard for the Transmission of IP Datagrams over IEEE 802.2 Networks, Postel & Reynolds, ISI, Feb 1988

[7] RFC 792, ICMP (Internet Control Message Protocol) DARPA Internet C Control Message Protocol Specification, Jon Postel, Sep 1981

[8] RFC951, BOOTSTRAP PROTOCOL (BOOTP), Bill Croft and John Gilmore , September 1985

[9] RFC783, The Trivial File Transfer Protocol (TFTP) rev 2, K.R. Sollins MIT, June 1981

NOE 771 00 Module I/O Scanner Performance Statistics

D

At a Glance

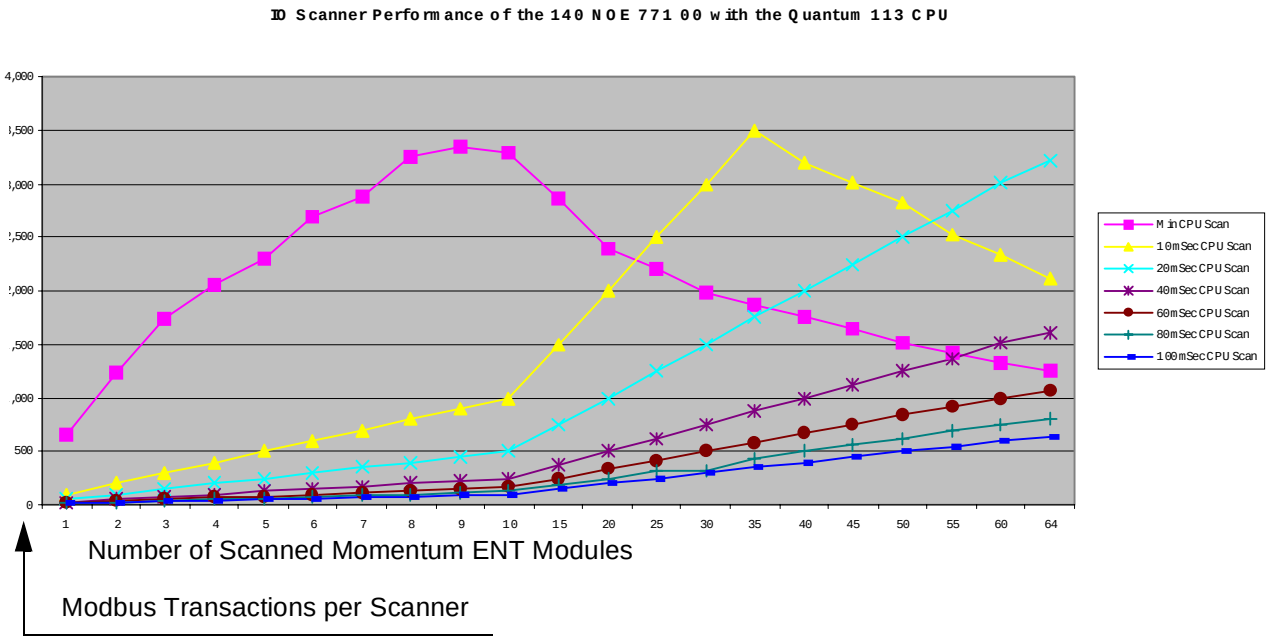
What's in this Appendix

This appendix covers the following topics.

140 NOE 771 00 I/O Scanner Performance

Quantum 113 CPU

Following is the performance graph for the I/O Scanner of the 140 NOE 771 00 with the Quantum 113 CPU.



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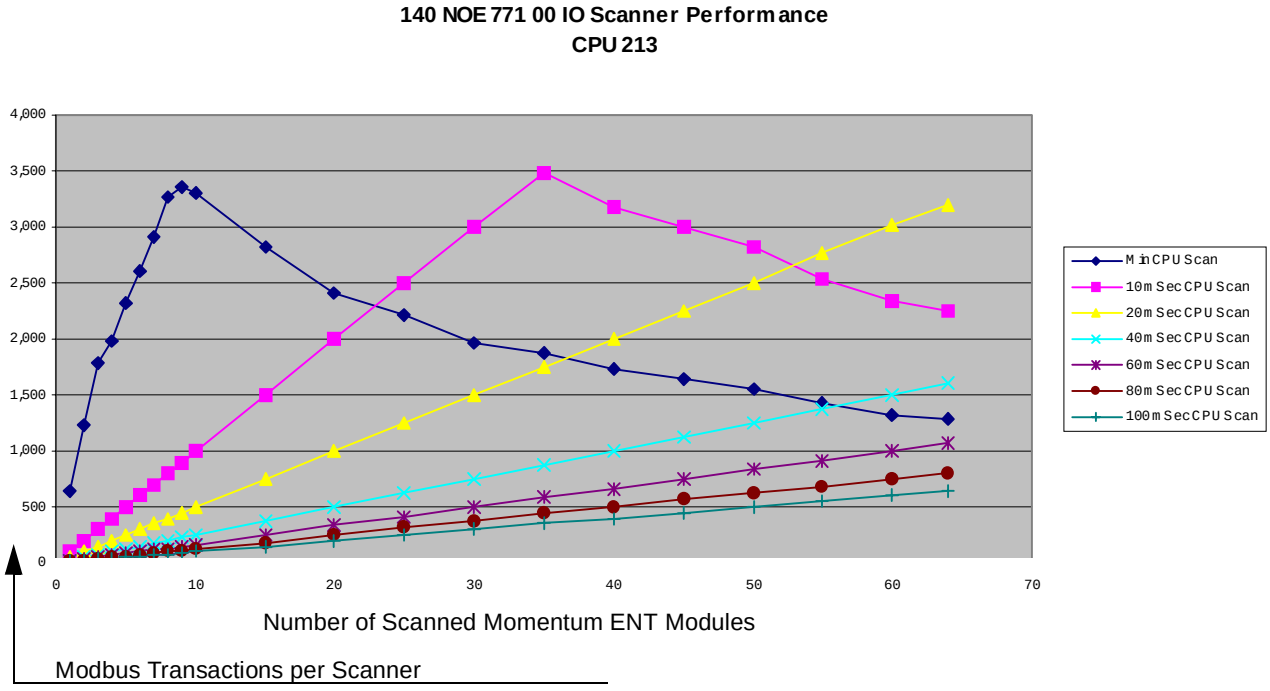
140 NOE 771 00 I/O Scanner Performance, continued

Quantum 213 CPU

Following is the performance graph for the I/O Scanner of the 140 NOE 771 00 with the Quantum 213 CPU.



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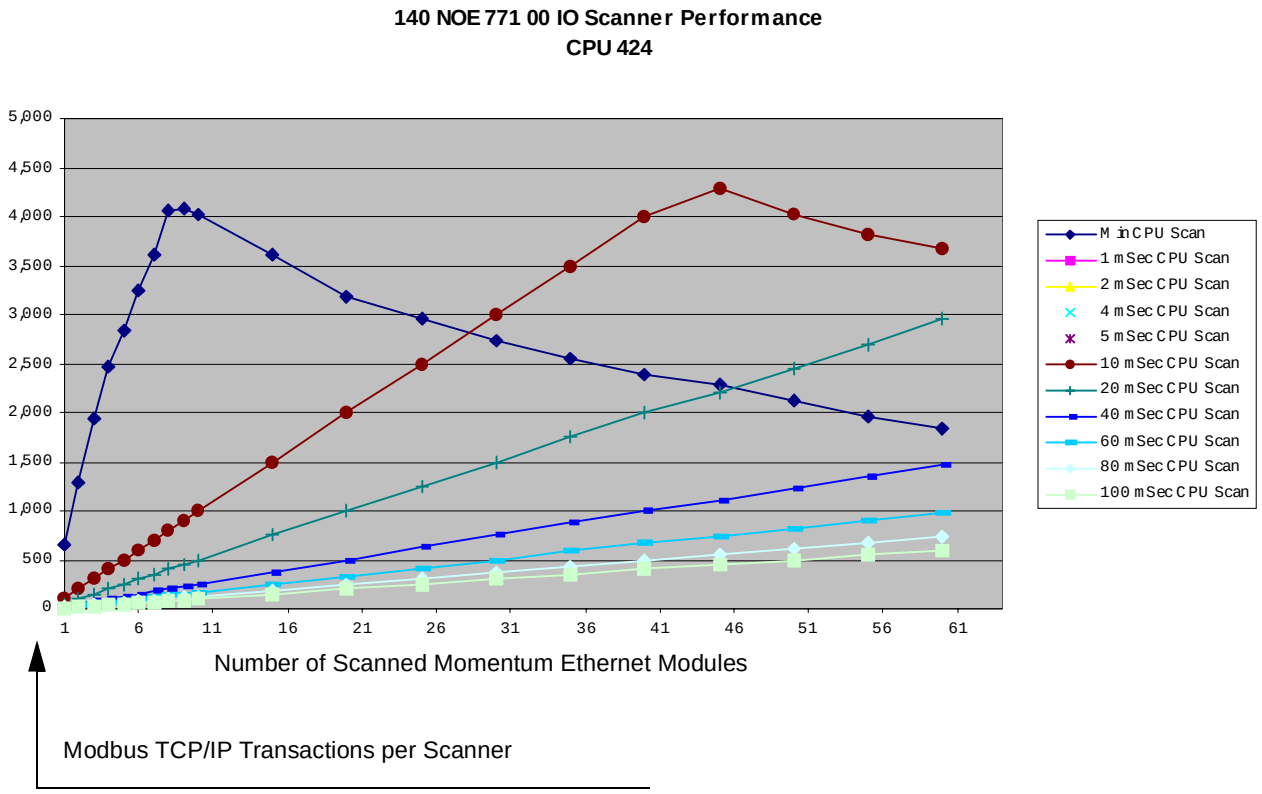
140 NOE 771 00 I/O Scanner Performance, continued

Quantum 424 CPU

Following is the performance graph for the I/O Scanner of the 140 NOE 771 00 with the Quantum 424 CPU.



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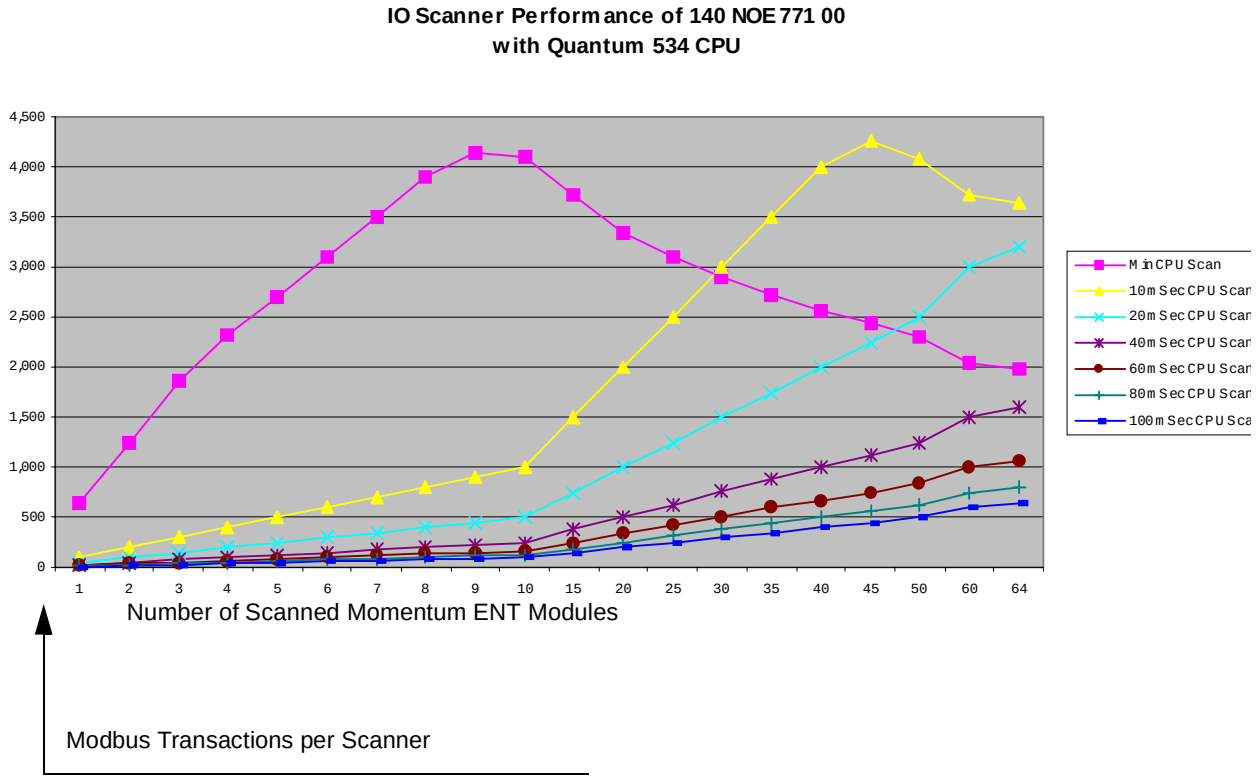
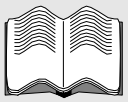
140 NOE 771 00 I/O Scanner Performance, continued

Quantum 534 CPU

Following is the performance graph for the I/O Scanner of the 140 NOE 771 00 with the Quantum 534 CPU.



Glossary



A

ACK Acknowledgement

address On a network, the identification of a station. In a frame, a grouping of bits that identifies the frame's source or destination.

API Application Program Interface. The specification of functions and data used by one program module to access another; the programming interface that corresponds to the boundary between protocol layers.

ARP Address Resolution Protocol. A network layer protocol used to determine the physical address which corresponds to the IP address for a host on the network. ARP is a sub-protocol which operates under TCP/IP.

B

bps Bits per second.

BOOTP BOOTstrap Protocol. A protocol used at power-up in order to get an IP address which is provided by a BOOTP server and is based on the module's MAC address.

bridge A device that connects two or more physical networks which use the same protocol. Bridges read frames and decide whether to transmit or block them based on their destination address.

BSP Board Support Package. A software package that maps a specific real-time operating system (RTOS0 onto a specific hardware.

C

client A computer process requesting service from other computer processes.

Concept A software package that facilitates controller configuration.

Cyclic Data Exchange Provides data transfer between two or more NOE 771 x0 controllers on a TCP/IP network.

D

default gateway The IP address of the network or host to which all packets addressed to an unknown network or host are sent. The default gateway is typically a router or other device.

DNS Domain Name System. A protocol within TCP/IP used to find IP addresses based on host names.

F

FactoryCast An embedded web server which is user customizable, permitting user access to controller diagnostics and Ethernet configuration.

field A logical grouping of contiguous bits that convey one kind of information, such as the start or end of a message, an address, data or an error check.

firewall A gateway that controls access to a network or an application.

frame A group of bits which form a discrete block of information. Frames contain network control information or data. The size and composition of a frame is determined by the network technology being used.

framing types Two common framing types are Ethernet II and IEEE 802.3.

FTP File Transfer Protocol. A networking protocol used to exchange files between stations on a network or over the Internet.

full duplex (FDX) A method of communication in which data is transmitted in two directions at the same time.

G

gateway A device which connects networks with dissimilar network architectures and which operates at the Application Layer. This term may refer to a router.

H

half duplex (HDX) A method of data transmission capable of communication in two directions, but only one direction at a time.

host A node on a network.

hostname A domain name given to a specific computer on a network and used to address that computer.

HTTP Hyper Text Transport Protocol. A protocol used to deliver hypertext documents over the WEB.

hub A device which connects a series of flexible and centralized modules to create a network.

I

ICMP Internet Control Message Protocol. A protocol within TCP/IP used to report errors in datagram transmission.

Internet The global interconnection of TCP/IP based computer communication networks.

IP Internet Protocol. A common network layer protocol. IP is most often used with TCP.

IP Address Internet Protocol Address. A 32-bit address assigned to hosts using TCP/IP.

IO Map An area in the controller configuration memory used to map input and output points. Previously called traffic cop.

I/O Drop One or two (depending on the system type) Remote I/O Channels consisting of a fixed number of I/O points.

I/O Scan A procedure the processor follows to monitor inputs and control outputs.

I/O Scan List A configuration table which identifies the targets with which repetitive communication is authorized.

L

layer In the OSI model, a portion of the structure of a device which provides defined services for the transfer of information.

M

MAC Address Media Access Control address. The hardware address of a device. A MAC address is assigned to an Ethernet TCP/IP module in the factory.

MBAP Modbus Application Protocol

Modbus A communication system that links Modicon controllers with intelligent terminals and computers over common carrier or dedicated lines.

Modsoft A software package that facilitates programming the NOE module.

MSTR A special master instruction which uses ladder logic to read and write controller information.

N

NACK Negative acknowledgment indicating an error.

network Interconnected devices sharing a common data path and protocol for communication.

node An addressable device on a communications network.

NOET Network Options Ethernet Tester

O

OSI model Open System Interconnection model. A reference standard describing the required performance of devices for data communication. Produced by the International Standards Organization.

P

packet The unit of data sent across a network.

Peer Cop Software that allows you to configure data blocks to be transferred between controllers on a Modbus Plus network.

PING Packet Internet Groper. A program used to test whether a destination on a network can be reached.

port An access point for data entry or exit within a host using TCP services.

protocol Describes message formats and a set of rules used by two or more devices to communicate using those formats.

PLC Programmable Logic Controller

ProWORX NxT A software package that facilitates the use of the I/O Scanner to configure data blocks to be transferred between controllers on a TCP/IP network.

R

repeater A device that connects two sections of a network and conveys signals between them without making routing decisions or filtering packets.

router A device that connects two or more sections of a network and allows information to flow between them. A router examines every packet it receives and decides whether to block the packet from the rest of the network or transmit it. The router will attempt to send the packet through the network by the most efficient path.

S

server Provides services to clients. This term may also refer to the computer on which the service is based.

SNMP Simple Network Management Protocol

socket The association of a port with an IP address, serving as an identification of sender or recipient.

stack The software code which implements the protocol being used. In the case of the NOE modules it is TCP/IP.

STP Shielded Twisted Pair. A type of cabling consisting of several strands of wire surrounded by foil shielding, twisted together.

subnet A physical or logical network within an IP network, which shares a network address with other portions of the network.

subnet mask Used to indicate which bits in an IP address identify a subnet.

switch A network device which connects two or more separate network segments and allows traffic to be passed between them. A switch determines whether a frame should be blocked or transmitted based on its destination address.

T

TCP Transmission Control Protocol.

TCP/IP A protocol suite consisting of the Transmission Control Protocol and the Internet Protocol; the suite of communications protocols on which the Internet is based.

Traffic Cop A Quantum software routine that facilitates the placement of an NOE 771 module into a specified location

U

UDP User Datagram Protocol. A protocol which transmits data over IP.

URL Uniform Resource Locator. The network address of a file.

UTP Unshielded Twisted Pair. A type of cabling consisting of insulated cable strands which are twisted together in pairs.

W

Winsock The Microsoft implementation of the Windows Sockets networking API based on the Berkeley UNIX Sockets interface for supporting TCP/IP.

WWW World Wide Web. A hypertext-based, distributed information system in which clients and servers are freely available.

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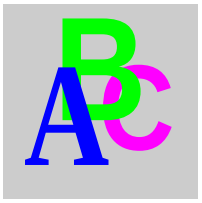

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