Quantum Ethernet Modules

13

At a Glance

Introduction

This chapter provides information on the NOE2X1 TCP/IP, NOE3X1 SY/MAX, NOE5X100 MMS, and NOE771xx Ethernet modules.

What's in this Chapter?

This chapter contains the following topics:

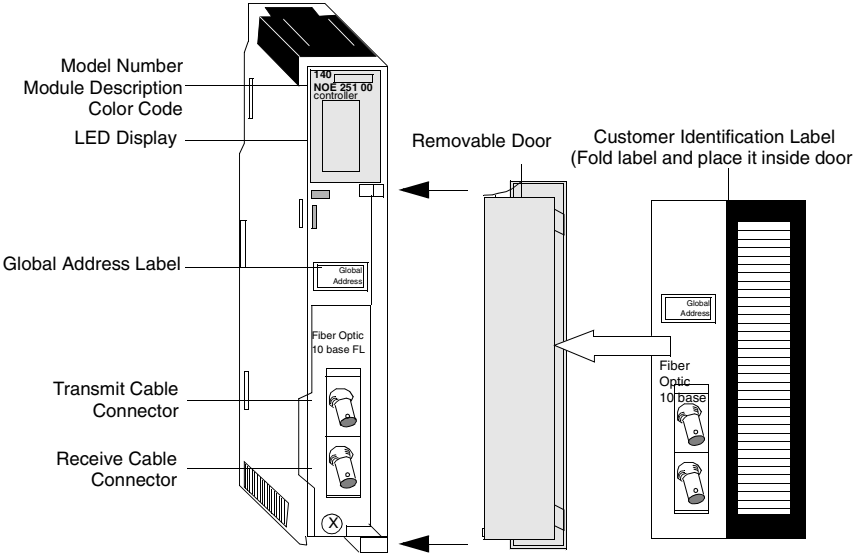
140NOE2X100 Quantum Ethernet TCP/IP Module

Overview

The Quantum NOE2X1TCP/IP is described in this section. This includes specifications for the NOE21100 and NOE25100 modules.

Ethernet TCP/IP Module

The following figure shows the Ethernet TCP/IP NOE2X100 module.



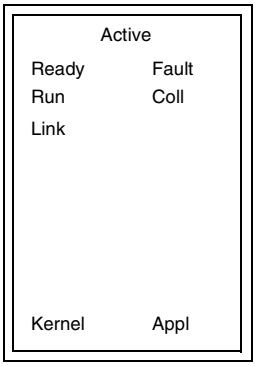
Specifications

The Ethernet TCP/IP modules for twisted pair and fiber optic cabling provide an interface to Ethernet networks for the Quantum Automation Series system.

Specifications	
Communication Ports	
Ethernet ports transmit and receive Modbus commands encapsulated in TCP/IP protocol: NOE 211 00 1, 10BASE-T Ethernet network (RJ-45) port. NOE 251 00 1, 10BASE-FL Ethernet network (ST-style) port	
Data Transfer Frequency	10 mb
Power Dissipation	5 W
Bus Current Required	1 A
Compatibility	
Programming Software	Modsoft V2.32 or Concept 2.0 at a minimum
Quantum Controllers	All, V2.0 at a minimum

LED Indicators and Descriptions

The following figure shows the NOE2X100 LED indicators.



The following table describes the meaning of each NOE2X100 LED indicator.

LED Descriptions		
LEDs	**Color**	**Indication when On**
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet link to hub is ok.
Kernel	Amber	If steady, module is operating in kernel mode. If flashing, module is waiting for download.
Fault	Red	An error has been detected, a download has failed or a reset is in process.
Coll	Red	If steady, cable is not connected. If flashing, Ethernet collisions are occurring.
Appl	Amber	Entry exists in crash log.

Installing the NOE Module

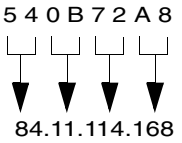
Quantum Ethernet TCP/IP modules come fully configured. However, before installing your module, you should make sure the default configuration is appropriate for your network.

If the module will be communicating on an open network, consult your network administrator to obtain a unique IP network address. You must enter this address in the Modsoft Ethernet TCP/IP configuration extension screen before installing the module.

If the module will be communicating on a local network, make sure the default IP network address is not already in use on that network. To determine the default IP network address, locate the global address label on the front panel of the module. Convert the rightmost eight digits from hexadecimal to decimal. The result should be a decimal number in the form, 84.xxx.xxx.xxx, where each group of xxx is a number from 0 to 255. This is the default IP network address.

Installation Example: Discovering the Default IP Network Address

The following example shows the steps for discovering the default IP network address.

Step	Action
1	Locate the global address label on the front panel of the module. **IEEE GLOBAL ADDRESS** 0000540B72A8
2	Note the rightmost eight digits. 
3	Convert them from hexadecimal to decimal. Each pair of hexadecimal numbers will result in a decimal number between 0 and 255. This is the default IP address.
4	If you use the default IP network address and if your network uses Ethernet II framing and if you do not need to specify the default gateway or a subnet mask, then you may install the module without changing the default configuration.

CAUTION

System Error

Do not connect this module to your network until you have ensured that its IP address will be unique on the network.

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

CAUTION

Hardware Restrictions

The cable for an Ethernet module must be routed through an Ethernet hub for the network to function properly. Do not connect the module directly to another device.

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

140NOE3X100 Quantum Ethernet SY/MAX Modules

Overview

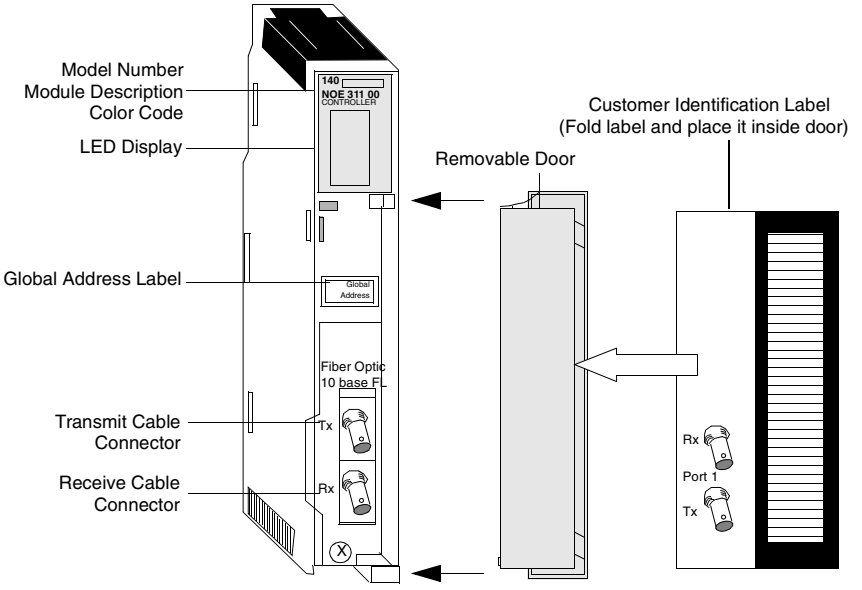
This section includes information for the NOE31100 and 35100 SY/MAX Ethernet modules. The Quantum SY/MAX Ethernet modules for twisted pair and fiber optic cabling provide an interface for the Quantum Automation Series system to SY/MAX devices via Ethernet.

Related Documentation

For more detailed information, see *Quantum-SY/MAX-Ethernet Module User Guide*, 840USE11100, Version 1.0.

Ethernet SY/MAX Module

The following figure shows the NOE3X100 SY/MAX Ethernet modules.



Note: The NOE31100 is equipped with one RJ-45 connector instead of the fiber optic connectors (as shown above on the NOE35100).

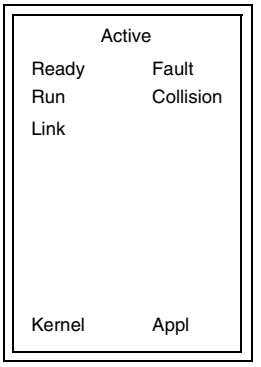
Specifications

The following table shows the specifications for the SY/MAX Ethernet modules NOE31100 and 35100.

Specifications	
Communication Ports	
NOE31100	1 10BASE-T Ethernet network (RJ-45) port
NOE35100	2 10BASE-FL Ethernet network (ST-style) ports
Cable Type	
10Base-2 or ThinWire Ethernet	2, 3, 4, or 6 twisted pairs with a solid copper core
10Base-T (twisted pair)	RG58a/u or RG58C/U coaxial (Belden 9907/82907 or equivalent)
Wire Size	
10Base-2 or ThinWire Ethernet	20 AWG
10Base-T (twisted pair)	22, 24, 26 AWG
Topology	
10Base-2 or ThinWire Ethernet	Bus
10Base-T (twisted pair)	Star
Connector	
10Base-2 or ThinWire Ethernet	BNC (UG-274)
10Base-T (twisted pair)	Modular RJ-45 (4 pins of 8 are used by 10Base-T)
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Compatible SY/MAX 802.3 Devices and Software	Model 450 Model 650 SFI160 SFW390-VAX Streamline Version 1.3
Bus Current Required	1 A

LED Indicators and Descriptions

The following figure shows the NOE3X100 LED indicators.



The following table describes the meaning of each NOE3X100 indicator.

LED Descriptions		
LEDs	**Color**	**Indication when On**
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet connection is made.
Kernel	Amber	On during download.
Fault	Red	An error condition has occurred.
Collision	Red	If steady, an error condition exists. If flashing, packet collisions are occurring on the network during data transmission.
Appl	Amber	A fatal error has occurred.

SY/MAX Addressing

Be sure that the module is assigned a unique SY/MAX drop number during configuration.

	**WARNING** **Personal injury or equipment damage** Failure to assign a unique SY/MAX drop number during configuration can cause severe personal injury or equipment damage. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

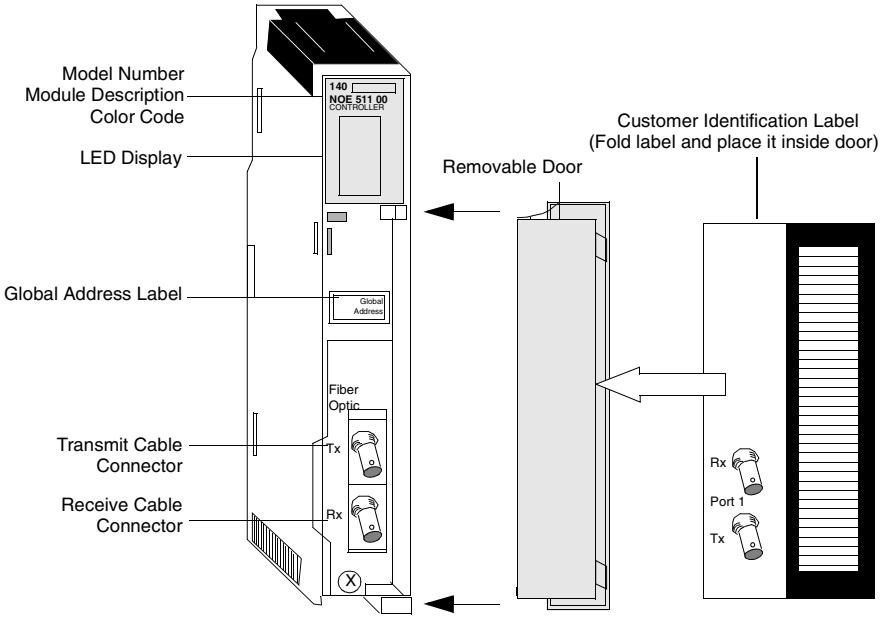
140NOE5X100 Quantum Ethernet MMS Modules

Overview

The section includes information for the NOE5X100 MMS Ethernet modules, NOE51100 and NOE55100. The Quantum MMS Ethernet modules for twisted pair and fiber optic cabling provide an interface for the Quantum Automation Series system to MMS devices via Ethernet.

Ethernet MMS Module

The following figure shows the NOE5X100 MMS Ethernet modules.



Note: The NOE51100 is equipped with one RJ45 connector instead of the fiber optic connectors (as shown above on the NOE55100).

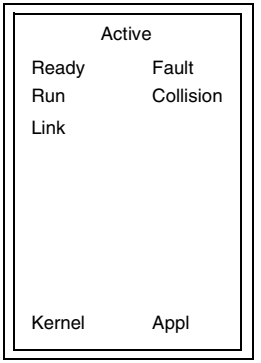
Specifications

The following table shows the MMS Ethernet specifications.

Specifications	
Communication Ports	
NOE51100	1 10BASE-T Ethernet network (RJ-45) port
NOE55100	2 10BASE-FL Ethernet network (ST-style) ports
Cable Type	
10Base-2 or ThinWire Ethernet	2, 3, 4, or 6 twisted pairs with a solid copper core
10Base-T (twisted pair)	RG58a/u or RG58C/U coaxial (Belden 9907/82907 or equivalent)
Wire Size	
10Base-2 or ThinWire Ethernet	20 AWG
10Base-T (twisted pair)	22, 24, 26 AWG
Topology	
10Base-2 or ThinWire Ethernet	Bus
10Base-T (twisted pair)	Star
Connector	
10Base-2 or ThinWire Ethernet	BNC (UG-274)
10Base-T (twisted pair)	Modular RJ-45 (4 pins of 8 are used by 10Base-T)
Backplane Compatibility (Requires Quantum CPU)	3, 4, 6, 10, and 16 position backplanes
Data Transfer Frequency	10 mb
Bus Current Required	1 A

LED Indicators and Descriptions

The following table shows the NOE5X100 LED indicators.



The following table describes the meaning of each NOE5X100 indicator.

LED Descriptions		
LEDs	**Color**	**Indication when On**
Active	Green	Module is communicating with backplane.
Ready	Green	Module has passed internal diagnostic tests.
Run	Green	Flashes during normal operation.
Link	Green	Ethernet connection is made.
Kernel	Amber	On during download.
Fault	Red	An error condition has occurred.
Collision	Red	If steady, an error condition exists. If flashing, packet collisions are occurring on the network during data transmission.
Appl	Amber	A fatal error has occurred.

140NOE771xx Ethernet Modules

Overview

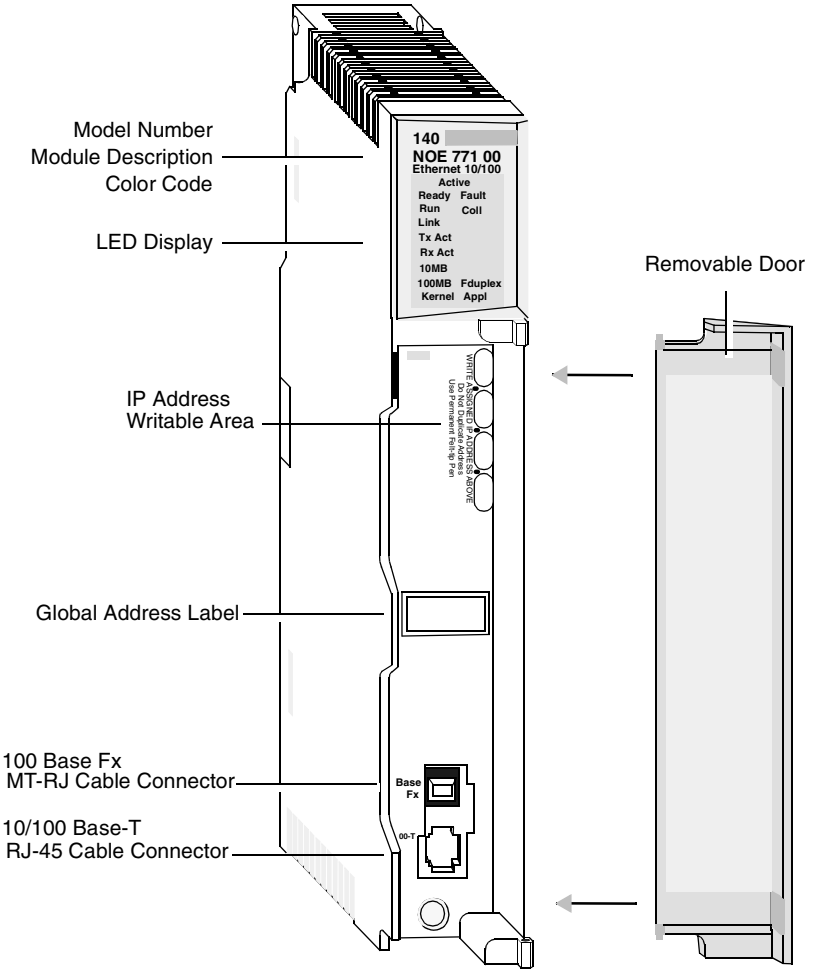
The following provides information on the Quantum ethernet modules 140NOE77100, 140NOE77101, 140NOE77110, and 140NOE77111.

Related Documentation

Refer to *Quantum NOE 771 xx Ethernet Modules User Guide*, 840USE11600 for more detailed information on the installation and use of Quantum ethernet modules.

Ethernet Module

The following figure shows the NOE77100 Ethernet module. The other NOE771xx Ethernet modules are the same in appearance except for the model number.



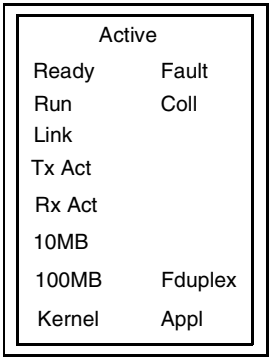
Specifications

The main specifications for the Quantum 140NOE771xx Ethernet Modules are described in the following table

Specifications	
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. Only one port can be used at a time.
Bus Current Required	750 mA
Power Dissipation	3.8 W
Fuse	None
Programming Software	
Type and version	Concept, Ver. 2.2 or higher (NOE77100/10)
	Concept, Ver 2.5 or higher (NOE77101/11)
	Modsoft, Ver. 2.6 or higher (NOE77100/10)
	ProWORX NxT, Ver 2.1 or higher (NOE77100/10)
	ProWORX NxT, Ver 2.2 or higher (NOE77101/11)
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

LED Indicators and Descriptions

The following figure shows the NOE771xx LED indicators.



The following table describes the meaning of each NOE771xx LED indicator.

LED Descriptions		
LED	**Color**	**Description**
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	During a crash while going through a reset. If Duplicate IP address is detected. If no link is available. While going through BOOTP sequence.
Run	Green	Flashes to indicate diagnostic code, as described in "Run LED Status" (following table).
Coll.	Red	Flashes when Ethernet collisions occur.
Link	Green	On when Ethernet link is active.
TxAct	Green	Flashes to indicate Ethernet transmission.
RxAct	Green	Flashes to indicate Ethernet reception.
Kernel	Amber	On when in Kernel Mode. Flashing while in download 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.

Run LED Status

The following table lists each available state of the Run LED indicator and provides diagnostic information for that state

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
eight	Invalid IP configuration. Likely cause: Default gateway is not on the same subnet mask as the NOE>

Key Features

The key features of the **140 NOE 771 (-00, -01, -10, -11)** models are listed below:

	-00	-01	-10	-11
HTTP Server	X	X	X	X
FTP Server	X	X	X	X
Flash File System	X	X	X	X
BOOTP Client	X	X	X	X
BOOTP Server	X	X	X	X
SNMP V2 Agent	X	X	X	X
MODBUS Messaging	X	X	X	X
I/O Scanner	X	X		X
Hot Standby	X	In Version 2.0	X	In Version 2.0
Global Data - Publish / Subscribe		X		X
Bandwidth Monitoring		X		X
Faulty Device Replacement (DHCP Server)		X		X
Enhanced Web Diagnostics		X		X
Schneider Private MIB		X		X
FactoryCast Application			X	X
User Programmable Web Pages			X	X

MODBUS I/O Scanner

The functionality of the NOE771xx module is further enhanced by the addition of a MODBUS I/O Scanner that can be configured with either the Modsoft, Concept, or ProWorx programming panel. This allows the user a means to transfer data between network nodes without using the MSTR instruction.

The NOE771 MODBUS I/O Scanner can be configured by either of the following two methods:

- Peer Cop (Available on NOE77100 only)
- 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 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 following table lists the characteristics of the Peer Cop based MODBUS I/O Scanner, which is available only on the NOE77100.

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

Enhanced Modbus I/O Scanner

The following table lists the characteristics of the Enhanced based MODBUS I/O Scanner, which is available on the NOE77100, NOE77101, and NOE77111.

Parameter	Value
Max. No. of Devices	128: NOE77100, NOE77101 and NOE77111.
Max. No. of Input Words	4000
Max. No. of Output Words	4000
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 the *Quantum NOE 771 xx Ethernet Modules User Guide*, 840USE11600 to learn how to configure the MODBUS I/O Scanner.

MODBUS/TCP Server

The following information describes the functionality of the MODBUS/TCP Server.

Introduction – Client

All NOE771xx 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 communication instruction. All PLCs that support networking communication capabilities over Ethernet can use the MSTR Ladder Logic instruction to read or write controller information or can also use IEC communication blocks.

Introduction – Server

All NOE771xx 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 log into the controller over Ethernet.

Limitations

The NOE771xx supports up to 64 simultaneous MODBUS/TCP Server connections. The NOE771xx 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 following table shows the performance characteristics of the NOE771xx's MODBUS/TCP Server.

Parameter	Value
Typical Response Time (ms)	0.6
Number of MODBUS connections (Client and Server)	64 (-01, -11) 16 (Client -00) 32 (Server -10)
Number of simultaneous login channels	1

Note: NOE771xx MODBUS/TCP performance measurements are made with Quantum 140CPU53414 PLC.

FTP and HTTP Server

The following information describes services provided by the FTP and HTTP servers.

FTP Server

The NOE771xx's File Transfer Protocol (FTP) Server is available as soon as the module receives an IP address. Any FTP client can log on to the module, if the client uses the correct user name and password.

The FTP Server provides the following services:

- Update the NOE's firmware by downloading a new Exec
- Provides 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 the *Quantum NOE 771 xx Ethernet Modules User Guide* for instructions about how to change the password, and how to add or delete user names to the FTP Server.

There should be only one FTP client per module.

HTTP Server

The NOE771xx's HyperText Transport Protocol (HTTP) Server is available as soon as the module receives an IP address. It can be used with version 4.0 or greater of either the Internet Explorer or Netscape browser.

The NOE771xx's HyperText Transport Protocol (HTTP) Server allows you to view the following information:

- Module's Ethernet statistics
- Controller and I/O information
- BOOTP/DHCP/FDR (Faulty Device Replacement) Server information
- Global Data (Publish / Subscribe)

The HTTP Server's HTML pages allow you to configure the module's BOOTP/ DHCP/FDR 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 0x's Web Embedded Pages (see the *Installing the Module* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide*).

For the NOE7711x modules, they can be changed via the FactoryCast Configurator.

The NOE771xx supports a maximum of 32 HTTP simultaneous connections.

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

Note: The NOE7710x module does not support user downloaded Web pages. You will need to purchase the 140NOE7711x module to support that requirement.

Address Servers

The following information describes the services provided by the Address Servers:

- BOOTP Server
- DHCP Server

BOOTP Server

Note: The BOOTP Server is available on the 140NOE771 -00 and -10 models.

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 request 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 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 NOE771x0. Providing a BOOTP Server that is built into your NOE771x0 module eliminates the need for you to have a dedicated PC on your I/O network acting as a BOOTP Server.

Note: The NOE771x0's BOOTP Server cannot be used to provide its own IP address.

You can configure your NOE771x0'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 modules non-volatile memory.

DHCP Server

Note: The DHCP Server is available on the 140NOE771x1 models.

Dynamic Host Configuration Protocol (DHCP) is a superset of the BOOTP Protocol. Your 140NOE771x1 has a DHCP Server. The DHCP Server is compliant with RFC 1531. The DHCP Server can be used to provide the IP configuration to devices using BOOTP or devices using DHCP.

The DHCP Server has entries that use the MAC address to serve the IP configuration and entries in the Server that use the role name to serve the IP configuration. See the *Address Server Configuration/Faulty Device Replacement* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide* for details on configuring your NOE's address Server.

If you are migrating a BOOTP configuration from a 140NOE771x0 module to the new 140 NOE 771 x1 module, see the *Address Server Configuration/Faulty Device Replacement* chapter in the *Quantum NOE 771 xx Ethernet Modules User Guide* for details on automatic upgrade of your configuration for the new DHCP Server.

Note: OPERATING ON A CORPORATE NETWORK

Before placing the NOE on a corporate network, Schneider Automation recommends that you discuss the installation with your MIS department. It is likely that your company's corporate network has at least one DHCP Server running already. If the NOE's DHCP Server is running on the same network, it may disturb the network.

To avoid any possible problem related to the NOE's DHCP Server on the corporate network, you must ensure that the DHCP Server is not running in the NOE by not having address entries in the configuration. If there are no configured devices in the address Server configuration page, then the NOE will not start the DHCP Server.

Global Data

Global Data service is a real time Publisher/Subscriber mechanism providing the most efficient data exchange for PLC application coordination.

Devices supporting Global Data are arranged in a distribution group for the purpose of application variable exchange and synchronization. Each Global Data device can publish up to one network (application) variable and subscribe up to 64 network (application) variables.

The Quantum NOE's embedded **Web Global Data Configuration Page** provides a configuration screen to determine which and how many application variables are exchanged with this service. After configuration, the exchanges between all stations belonging to the same distribution group are done automatically.

The Global Data service uses the 4x register space for Global Data exchanges.

Key Features of Global Data

The main features for Global Data are:

- One Publisher and many Subscribers
- A device can publish one network variable of up to 512 registers
- A device can subscribe to several network variables of up to 2048 4x registers
- A device subscribes to the complete network variable
- One distribution group per network IP address
- Application defined publication rate
- Up to 64 Global Data network variables (numbered from 1 to 64) can be part of the data distribution group
- An NOE has only one multicast address; consequently, it can only publish and subscribe inside the group
- A device can participate in several distribution groups by using multiple NOEs in the rack

Global Data has an advantage over Client/Server services when more than one Subscriber is receiving the same data since only one transaction is necessary for all Subscribers to receive the data.

This advantage offers two benefits:

- Reduce overall network traffic
- Ensure tighter synchronization of multiple subscribers

Bandwith Monitoring

Bandwidth Monitoring allows you to monitor the NOE's CPU allocation for each of the following services: Global Data, I/O Scanning, and Messaging. The Bandwidth Monitoring service retrieves workload data and returns one of two pieces of information: whether the module has free resources or whether the module is working at capacity. Knowing the resource allocation helps you:

- Decide about allocating your resources
- Determine the number of NOEs needed in a system

Available Services

The services accessed and monitored are:

- Global Data
- I/O Scanner
- Modbus Messaging

If you use Bandwidth Monitoring, you do not need to develop a new set of access functions. The actual NOE CPU load is computed each second.

Bandwidth Monitoring Load Rates

The Bandwidth Monitoring service checks once a second and computes four (4) values in private data:

- Percentage of NOE's CPU allocated to **Global Data**
- Percentage of NOE's CPU allocated to the **I/O Scanner**
- Percentage of NOE's CPU allocated to **Messaging**
- Percentage of NOE's CPU allocated to other services and idle

Results are returned as percentages. CPU time spent in other services is shown as "Other" or "Free." Bandwidth Monitoring uses the same functions as used by SNMP.

The three service rates, Global Data, I/O Scanner, and Messaging, are computed using the following formula:

```
(Current load * 100) / Maximum Load
```

Table of **Maximum Load Rates**

Diagnostic Service	Workload Data Returned	Maximum load for NOE 771 x1
Global Data	Number of published variables per second	800
I/O Scanner	Number of transactions per second	4200
Messaging	Number of messages treated per second	410

The current load is computed dynamically.

Note: The loads are dependent on controller scan time. Each application has an expected scan time. Therefore, when evaluating the loads, you should ensure that the controller scan time is set to the expected scan time for the application being modelled.

Enhanced Web Diagnostics

Note: These services are available on the 140NOE771x1 modules.

The embedded Web server provides Web pages that you may use to diagnose Transparent Factory / Real Time services.

Those diagnostic services are listed below:

1. Global Data diagnostics
   - Status of all Global Data services
   - Status of all subscribed and published variables
   - Publication / Subscription rate
2. I/O Scanning diagnostics
   - Status of all I/O Scanning services
   - Status of individual scanned devices
   - Actual I/O scanning rate
3. Messaging diagnostics
   - Diagnostic information for Port 502 messaging
4. Bandwidth Monitoring
   - Throughput measurement of NOE by service

Note: All these pages are protected by the general HTTP password.