Modicon Quantum with Unity Ethernet Network Modules User Manual

UNY USE 100 10 V20E

September 2004

33002479 01

Document Set

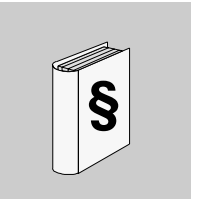
Presentation

This package contains the following manuals:

- Quantum and Premium Communication Architecture Reference Manual
- Quantum TCPIP/IP Configuration User Manual
- Quantum Modbus Plus Network Modules
- Quantum Ethernet Network Modules User Manual
- 140 ESI 062 10 Quantum ASCII Interface Module User Manual

Table of Contents

Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death, serious injury, or equipment damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

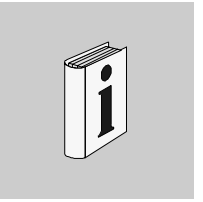
⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

About the Book



At a Glance

Document Scope

This documentation describes the functionality of the Modicon Quantum Ethernet modules, the NOE 771 xx and 140 NWM 100 00 and the Ethernet port of the 140 CPU 651 x0 modules.

Model Numbers
140 NOE 771 00
140 NOE 771 01
140 NOE 771 10
140 NOE 771 11
140 NWM 100 00
140 CPU 651 50
140 CPU 651 60

This documentation should provide you with the knowledge to begin using a Modicon Quantum Ethernet module and Ethernet equipped controller to communicate with devices over an Ethernet network. This documentation includes information about:

- Hardware architecture of a Modicon Quantum Ethernet TCP/IP module designed to fit into a single slot on the standard Modicon Quantum backplane
- Capabilities of the NOE 771 xx and NWM 100 00 modules
- Capabilities of the Ethernet port of the 140 CPU 651 x0 CPU modules
- Installation of the NOE 771 xx and NWM 100 00 modules onto a Modicon Quantum backplane

This documentation describes the procedures for:

- Setting up the modules to transfer data using one of two methods:
  - Global Data (Publish / Subscribe) Utility
    The Global Data modules (NOE 771 01 and NOE 771 11)
  - I/O Scanner
    The I/O scanner modules
    (NOE 771 -00, -01, -11 only and 140 CPU 651 -50, -60)
- Using an embedded Web server to access diagnostics and online configurations for the module and its associated controller
- Using the FatoryCast Web server to customize your configuration via embedded Web pages (140 NOE 771 -10, -11 and 140 NWM 100 00)
- Using the NOE in a Hot Standby solution that provides fault tolerance for the remote I/O and communications

Nomenclature

The following table describes the naming scheme for

140 NOE 771		**Model Numbers**
xx	refers to	-00, -01, -10, -11
x0	refers to	-00, -10
x1	refers to	-01, -11
0x	refers to	-00, -01
1x	refers to	-10, -11

The following table describes the naming scheme for

140 CPU 651		**Model Numbers**
xx	refers to	-50 and -60

Note: Who Should Use This Documentation?
This documentation is intended to support anyone using a Quantum PLC that needs to communicate with devices over an Ethernet network. You are expected to have some knowledge about the use of PLC systems and possess of a working knowledge of either the Modsoft, Concept, ProWORX, or Unity Pro programming tools. You also need to understand the use of an Ethernet network and TCP/IP.

Note: Adding Ethernet Nodes
Before adding a node to an existing corporate network, consult with your information technology (IT) department about any possible consequences.

This documentation is valid for Unity Pro version 2.0 and higher.

Validity Note

The data and illustrations found in this documentation 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.

Related Documents

Title of Documentation	Reference Number
Quantum Hardware Reference Manual	UNYUSE10010V20E
Quantum Discrete and Analog I/O Reference Manual	UNYUSE10010V20E
Quantum Experts and Communication Reference Manual	UNYUSE10010V20E
Grounding and Electromagnetic Compatibility of PLC Systems User Manual	UNYUSE10010V20E
Quantum and Premium Communication Architecture Reference Manual	Part of this package
Schneider Automation BooTP Lite Ethernet IP Address Download Utility for Schneider Automation Ethernet Products Instruction Sheet	31002087
FactoryCast for Quantum, Premium and Micro User Guide	31001229
Modicon Quantum Hot Standby with Unity User Manual	UNYUSE10710V20E
MODBUS Protocol Reference Guide	PI-MBUS-300
Open MODBUS Specification	http:// www.modbus.org/
Factory Cast HMI 140 NWM 100 00 User Guide	890USE15200

Note: Some of the preceding documents are available only in online form at this time.

Product Related Warnings

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.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

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

When controllers are used for applications with technical safety requirements, please follow the relevant instructions.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this product related warning can result in injury or equipment damage.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Modicon Quantum with Unity Ethernet Products

I

At a Glance

Purpose

This part introduces the Modicon Quantum with Unity products used for Ethernet communication.

What's in this Part?

This part contains the following chapters:

Product Description

1

At a Glance

Introduction

This chapter provides product overviews of the Quantum modules for Ethernet communication. It covers the 140 NOE 771 xx modules, the 140 NWM 100 00 module, and the built-in Ethernet port of the 140 CPU 651 x0 modules.

What's in this Chapter?

This chapter contains the following sections:

1.1 Module Description 140 CPU 651 x0

Introduction

Overview

This section contains the module descriptions for the 140 CPU 651 x0.

What's in this Section?

This section contains the following topics:

140 CPU 651 x0 Product Overview

Overview

The following information is an overview about the Quantum Processor Modules 140 CPU 651 x0.

General Description

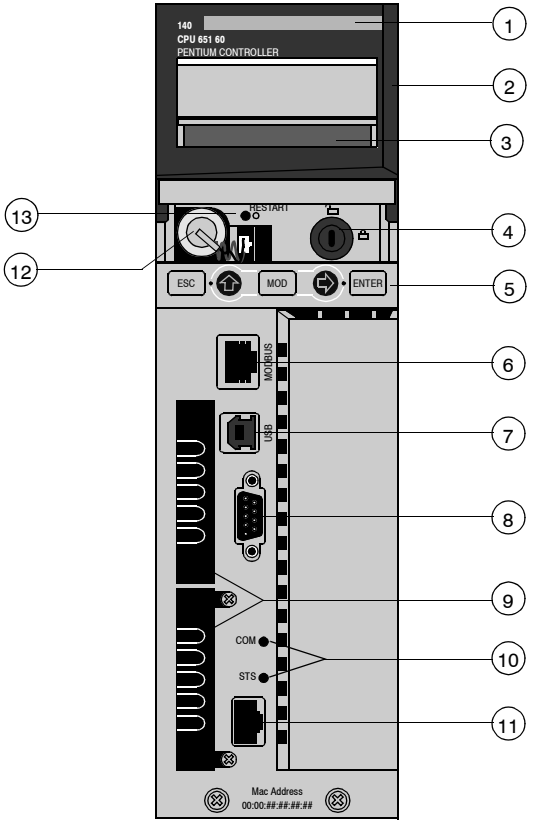
The Quantum-140 CPU 651 x0 module shown below, is one of the newest models in a series of Quantum processor modules. It unites the standard functions of the PLC and the diagnostic possibilities of a Web server. The 140 CPU 651 x0 communicates using an RJ-45 connection.
The 140 CPU 651 x0 module is in a double-width standard Quantum housing, which requires 2 sequential slots in a Quantum rack.
The Modicon Quantum processor 140 CPU 651 x0 Web server functions are diagnostic only. Therefore, use the software to configure services.
The 140 NOE 771 xx modules offer embedded Web pages that enable you to both configure and diagnose services.
The table shows the diagnosis possibilities implemented:

Service	**140 CPU 651 x0**
HTTP Server	x
FTP Server	x
Flash File System	x
BOOTP Client	x
Address Server	x
SNMP V2 Agent (Network Management Service)	x
Modbus Messaging	x
I/O Scanner	x
Hot Standby	
Global Data - Publish / Subscribe	x
Bandwidth Monitoring	x
Faulty Device Replacement (Server)	x
Enhanced Web Diagnosis	x
Schneider Private MIB	x
FactoryCast Application	
User-programmed Web pages	
RJ-45 Connection	x
Fiber Optic Connection	
Time Synchronization Service	X
Electronic Mail Notification Service	

Presentation

Illustration

The following figure shows the High End CPU Module and its components.



1 Model Number, Module Description, Color Code
2 Lens Cover (open)
3 LCD Display (here covered by the Lens Cover)
4 Key Switch
5 Keypad
6 Modbus port
7 USB port
8 Modbus Plus port
9 PCMCIA Slots (Type II, Type III)
10 Indicators for Ethernet communication
11 Ethernet port
12 Battery
13 Reset Button

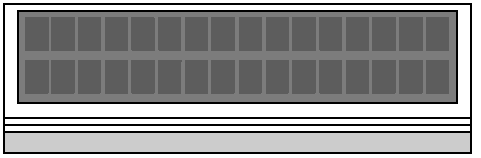
Lens Cover

The Lens Cover serves as a protection, which can be opened by sliding upwards. With the Lens Cover open you have access to the following items:

- Key Switch
- Battery
- Reset Button

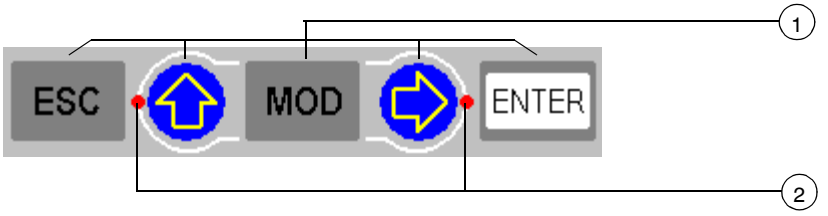
LCD Display

The Modicon Quantum High End CPU with Unity has a standard 2 line by 16 character LCD display with changeable backlight state and contrast. The backlight handling is entirely automated to save the life of the LEDs in the LCD.
The backlight turns on when the keypad driver detects a key press, the key switch state is changed, or when an error message is displayed on the LCD. The backlight automatically turns off after 5 minutes if there has been no key switch or keypad activity during that time period. The backlight will stay on for error messages as long as the error message is displayed on the LCD screen.
2 Line by 16 character LCD



Keypad

The Modicon Quantum High End with Unity keypad consists of five keys that are mapped to a hardware address. On each of the two arrow keys there is an LED.
5 key keypad with 2 LEDs

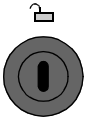
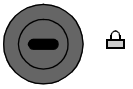


1 5 keys

2 2 LEDs

Key Switch

The key switch is used as an authorization level security feature and Memory Protection switch. The key switch has two positions: Locked and Unlocked. The key switch will only be read and deciphered by the PLC OS (Executive) portion of the firmware and not by the OS Loader portion.
The Modicon Quantum High End CPU has a set of system menus, which enable the operator to perform PLC operations (i.e. Start PLC, Stop PLC) and display module parameters (i.e. Communications parameters).
PLC operations depending on the key position

Key position	PLC operation
unlocked 	• all system menu operations are able to be invoked and all changeable module parameters are able to be modified by the operator via the LCD and keypad. • memory protection is off
locked 	• no system menu operations are able to be invoked and all module parameters are read only. • memory protection is ON
Switching the key switch position from locked to unlocked or vice versa will turn on the LCD's backlight.	

Reset Button

When pressed, this button forces a cold start of the PLC.

Keypad Operation

Function

Table of function

Key	Function	
ESC	To cancel an entry, or suspend or stop an action in progress To display the preceding screens successively (step up the menu tree)	
ENTER	To confirm a selection or an entry	
MOD	To set a field on the display into modify mode	
	LED: on	key active ● To scroll through menu options ● To scroll through modify mode field options
	LED: flashing	key active ● Field in modify mode has options to scroll through
	LED: off	key inactive ● No menu options, no field options
	LED on	key active ● To move around in a screen, field to field ● To go to the sub-menu
	LED flashing	key active ● To move around in a field that is in modify mode, digit to digit
	LED off	key inactive ● No sub-menu for menu option ● No moving around in a screen ● No moving around in a field

Contrast Adjustment

The contrast is adjustable from the keypad when the Default screen is displayed as follows:

Step	Action
1	Press the MOD key: 
2	To adjust the contrast darker press: 
3	To adjust the contrast lighter press: 
4	To confirm the setting press: 

Backlight

Pressing a key will turn on the LCD backlight (if it was off). When there is no activity from the keypad for 30 minutes the Default Screen will return to the display. When the user presses the < ESC > key and the LCD backlight was off, the LCD backlight will turn on and the Default Screen will stay as the displayed screen.
If at any time the executive detects an error in the CPU it will display an error message to the LCD and the LCD's backlight will turn on until the error condition disappears

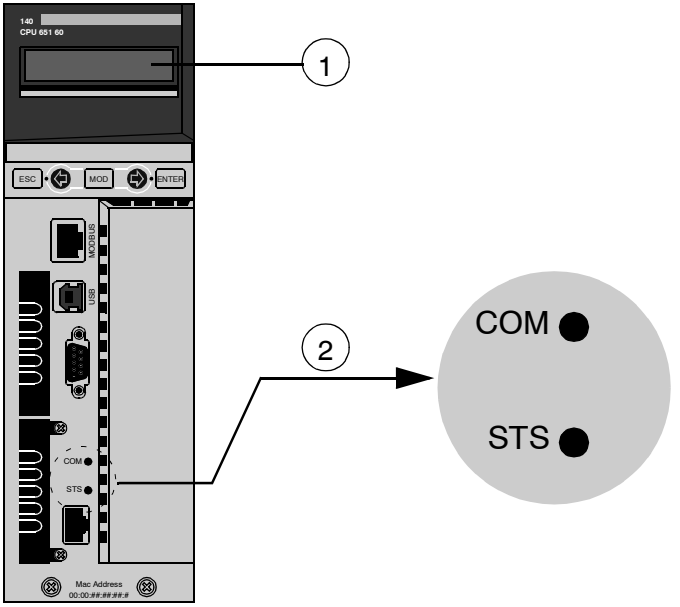
Indicators

Overview

The High End CPU uses two types of indicators:

1. *LCD Display, p. 23*:
   The *Understanding the Default Screen, p. 31* serves as a Controller status screen
2. LED Indicators:
   For the function refer to *LED Description, p. 28*

The following figure shows the two types of indicators.



1 LCD Display (lens cover closed)

2 LED Indicators

LED Description

The following table shows the description for the LED indicators of the different High End CPU modules.

LEDs	Color	Indication	
		CPU 651 50 and CPU 651 60	
COM	Green	Controlled by the Coprocessor hardware ● Indicates Ethernet activity	
STS	Red	Controlled by the Coprocessor software	
		ON	all is OK
		OFF	abnormal end of copro boot; possible hardware problem
		Flashing:	
		1 Flash	Configuration in progress Temporary situation
		2 Flashes	Invalid MAC address
		3 Flashes	Link not connected
		4 Flashes	Duplicate IP Address
		5 Flashes	Waiting for a served IP Address
		7 Flashes	Firmware incompatibility exists between PLC OS and Copro firmware

Using the Modicon Quantum Hot Standby with Unity 140 CPU 671 60 LCD Display Screens

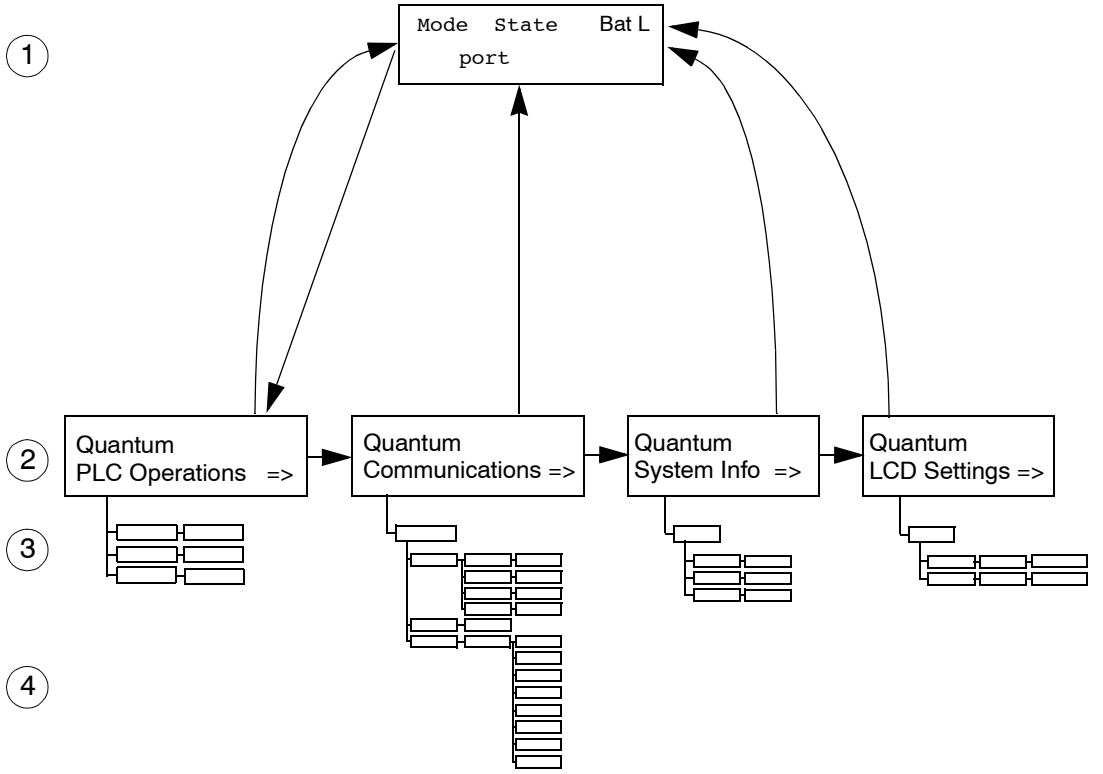
Overview

The controller's LCD displays messages. These messages indicate the controller's status. There ae four levels of menus and submenus. All menus are accessed using the keypad on the front of the controller.

For detailed information about the menus and submenus see:

- *Using the PLC Operations Menus and Submenus, p. 32*
- *Using the Communications Menus and Submenus, p. 33*
- *Using the System Info Menus and Submenus, p. 36*
- *Using the LCD Settings Menus and Submenus, p. 37*

Structure: LCD display menus and submenus



1 Default Screen

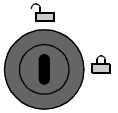
2 System Menus

3 Sub Menus

4 Sub Screens

Accessing the Screens

Use the keys on the keypad to access the system menus and submenus.

Step	Action
1	To access the screens, ensure that the key switch is in the unlocked position . 
2	To step down to a lower menu, operate one of the following keys: 
3	To return to the previous menu, press: 

Understanding the Default Screen

Default screen displays the following information

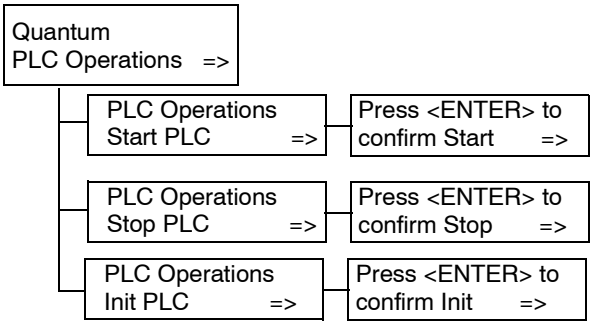
```
Mode  State   Bat L
   port   PCM
```

The default screen is read only.

Default Screen Displays	Fields Available		Options Available	Description
Default	State		RUN	Application program is running
				RUN Primary
				RUN Standby
				RUN Offline
			STOP	Application program is NOT running
				STOP Offline
			No Conf	CPU has no application program
	BatL			Indicates health of battery • Steady = Battery is low • No message = Battery is OK
	Port	USB		Indicates that port has activity
		Modbus Plus	MB+	Indicates Modbus Plus activity
			mb+	No activity
		Modbus	232	Serial port activity for RS-232
			485	Serial port activity for RS-485
		PCM	1	Indicates the card in slot 1 is being accessed The status displayed indicates the health of the battery • Steady = Battery is OK • No message = Batery is low
			2	Blinks, when the card in slot 2 is being accessed The status displayed indicates the health of the battery • Steady = Battery is OK • No message = Batery is low

Using the PLC Operations Menus and Submenus

Structure: PLC Operations menu and submenus

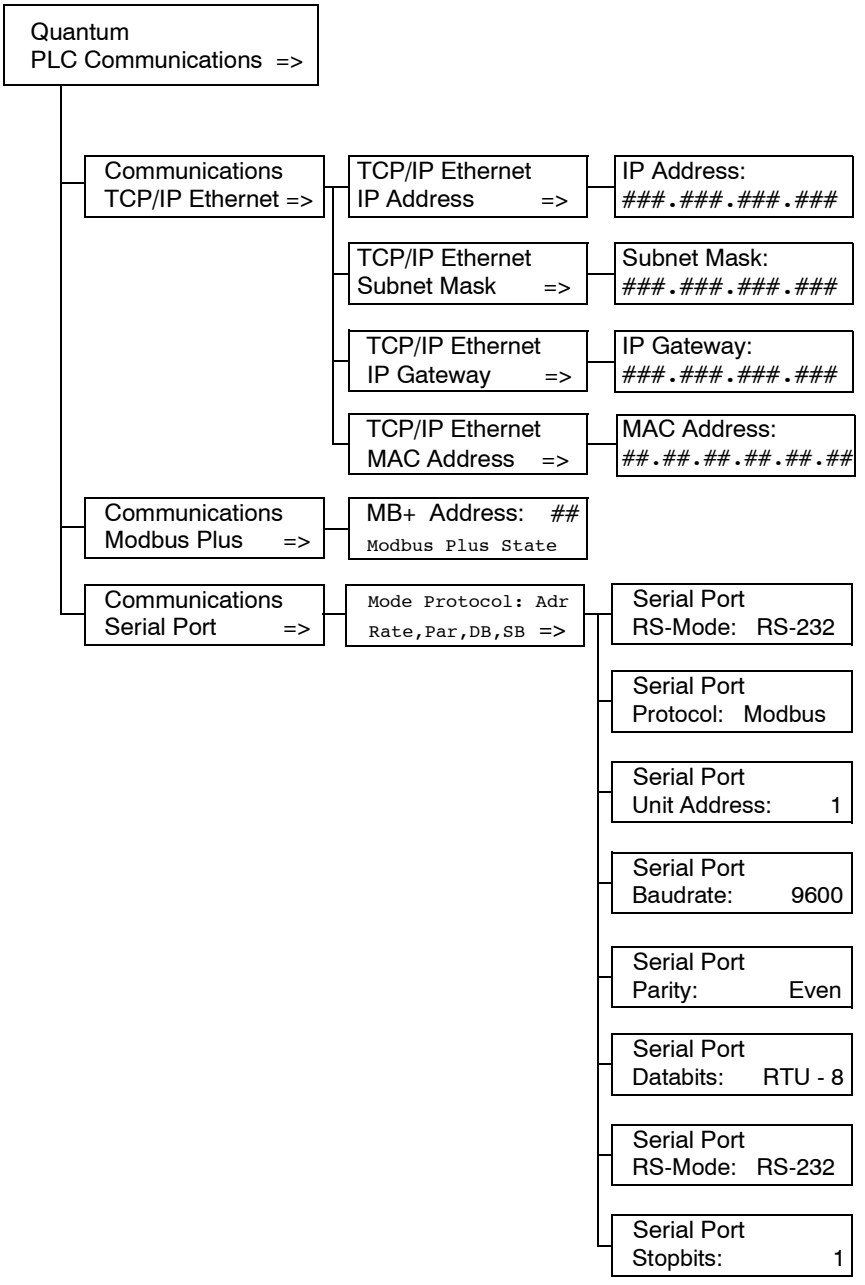


Submenu: PLC Operations: Start, Stop, Init

Start, Stop, Init Screens Display	Fields Available	Description
Start PLC	Press <ENTER> to confirm Start	Pressing <ENTER> starts the controller
Stop PLC	Press <ENTER> to confirm Stop	Pressing <ENTER> stops the controller
Init PLC	Press <ENTER> to confirm Init	Pressing <ENTER> initializes the controller

Using the Communications Menus and Submenus

Structure: Communications menu and submenus structure



Submenu: PLC Communications: TCP/IP Ethernet

TCP/IP Ethernet Screen Displays	Fields Available	Options Available	Description
TCP/IP Ethernet IP Address[1,2]	###.###.###.### (not modifiable)	decimal numbers	displays IP address
TCP/IP Ethernet Subnet Mask[1]	###.###.###.### (not modifiable)	decimal numbers	displays Subnet Mask address
TCP/IP Ethernet IP Gateway[1]	###.###.###.### (not modifiable)	decimal numbers	displays Ethernet IP Gateway address
TCP/IP Ethernet MAC Address	##.##.##.##.##.## (read only)	hexadecimal numbers	displays MAC (Medium Access Control) address

Submenu: PLC Communications: Modbus Plus

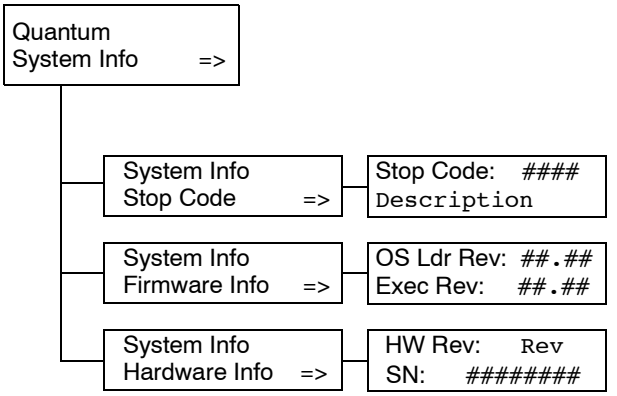
Modbus Plus Screen Displays	Fields Available	Options Available	Description
Modbus Plus Address	## (modifiable only if the key switch is in the unlocked position)	1-64	to enter a valid Modbus Plus address
	Modbus Plus State	Monitor Link	Modbus Plus State
		Normal Link	
		Sole Station	
		Duplicate address	
		No Token	

Submenu: PLC Communications: Serial Port

Seriial Port Screen Displays	Fields Available*	Options Available	Description
Serial Port	Mode	232	RS mode
		485	
	Protocol	ASCII	Protocols available
		RTU	
	Adr	1 - 247	Unit address
		for Modbus switchover Primary 1-119 Standby 129 - 247	
	Rate	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 3600. 4800, 7200, 9600, 19200 bits/s	Baud rate
	Par	NONE	Parity
		ODD	
		EVEN	
	DB	7,8	Databits: if Protocol is Modbus then RTU-8 or ASCII-7
	SB	1,2	Stopbits
	* If the key switch is in the unlocked position, all fields are modifiable.		

Using the System Info Menus and Submenus

Structure: System Info menus and submenus

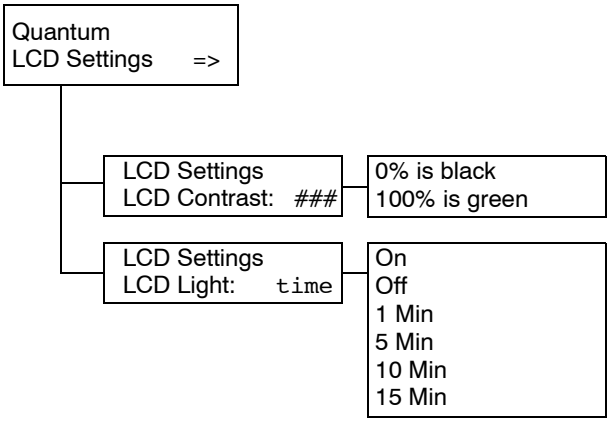


Submenu: PLC Communications: System Info

System Info Screen Displays	Fields Available*	Option Available	Description
Stop Code	####		shows the machine stop code
	Description		shows the description to the machine stop code
Firmware Info	##.##		shows the number of OS Loader Revision
	##.##		shows the number of Exec Revision
Hardware Info	Rev		shows the number of Hardware Revision
	########		shows the serial number of Hardware
	* All fields are read only.		

Using the LCD Settings Menus and Submenus

Structure: LCD Settings menus and submenus



Submenu: LCD Settings: LCD Contrast

LCD Screen Contrast Screen Displays	Fields Available	Description
LCD Contrast:	####	A lower percent is darker. A higher percent is brighter. Use the arrow keys to adjust the setting. • Up arrow increases percent • Down arrow decreases percent

Submenu: LCD Settings: LCD Light

Screen Displays	Fields Available	Description
LCD Light:	On	LCD light remains on permanently or until changed
	Off	LCD light remains off permanently or until changed
	1 Min	LCD light remains on for one minute
	5 Min	LCD light remains on for five minutes
	10 Min	LCD light remains on for ten minutes
	15 Min	LCD light remains on for fifteen minutes

1.2 Module Description 140 NOE 771 xx and 140 NWM 100 00

Introduction

Overview

This section contains the module descriptions for 140 NOE 771 xx and 140 NWM 100 00.

What's in this Section?

This section contains the following topics:

Modicon Quantum Ethernet Modules Overview

Overview

The following information provides overviews of all Modicon Quantum Ethernet modules.

General Description

The Modicon Quantum Ethernet module, shown below, is one of the latest models in a line of Modicon Quantum Ethernet TCP/IP modules designed to make it possible for a Modicon Quantum Programmable Logic Controller (PLC) to communicate with devices over an Ethernet network. The electronics for the Ethernet modules are contained in a standard Modicon Quantum single width case that takes up one slot in a Modicon Quantum backplane. The module, which is capable of being hot swapped, can be plugged into any available slot in the backplane.

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.

NOEs in a Rack

The following table summarizes the total number of NOE modules per CPU.

Modicon Quantum CPU Type	Supports NOEs
140 CPU 311 10	2
140 CPU 434 12A	6
140 CPU 534 14A	6
140 CPU 651 50	6
140 CPU 651 60	6
140 CPU 671 60	6

Key Features

The following table shows the different feature of the 140 NOE 771 xx and 140 NWM 100 00 Ethernet modules.
The key features of the **140 NOE 771 (-00, -01, -10, -11) and 140 NWM 100 00** models are listed below:

Service	**-00**	**-01**	**-10**	**-11**	**NWM**
HTTP Server	X	X	X	X	X
FTP Server	X	X	X	X	X
Flash File System	X	X	X	X	X
BOOTP Client	X	X	X	X	X
Address Server	X	X	X	X	
SNMP V2 Agent (Network Management Service)	X	X	X	X	X
MODBUS Messaging	X	X	X	X	X
I/O Scanner	X	X		X	
Hot Standby		X		X	
Global Data - Publish / Subscribe		X		X	
Bandwidth Monitoring		X		X	
Faulty Device Replacement (Server)		X		X	
Enhanced Web Diagnostics		X		X	X
Schneider Private MIB		X		X	X
FactoryCast Application			X	X	X
User-programmed Web pages			X	X	X
JAVA Virtual Machine					X
Fiber optic connection	X	X	X	X	
RJ-45 connection	X	X	X	X	
Time Synchronization Service				X	
Electronic Mail Notification Service		X		X	

Note: In the detailed description of the key features, only the modules of the NOE family are named. The features are also available for the 140 NWM 100 00 module. This applies depending on the listed properties in the table shown above.

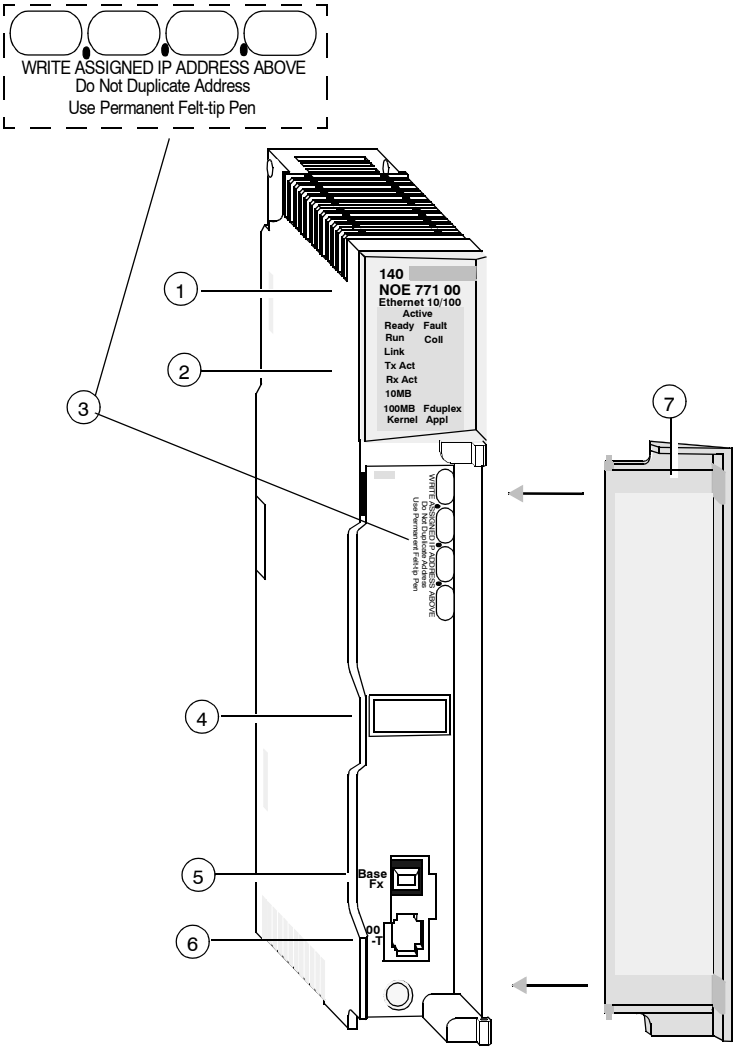
Front Panel Components

The front panel of the Ethernet modules contain identification markings, color codes, and LED displays. A writable area for an IP address, a global address label, and two Ethernet cable connectors is located behind the removable front panel door.
The following table provides a description of the front panel components which are shown in front view figure.

Component	Description
LED indicator Panel	Indicates the operating status of the module, and the fiber optic or Ethernet communications network it is connected to. (See LED Indicators in this chapter.)
IP Address 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 socket for connection to a 100 megabit fiber optic Ethernet cable.
10/100BASE-T Connector	Provides an RJ-45 socket for connection to a shielded, twisted pair Ethernet cable.

Front View

The following figure shows the front of the NOE 771 00 Ethernet module as an example for all Ethernet modules.

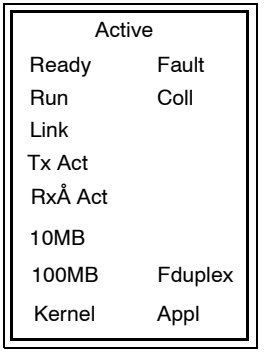


1 Model number, module description, color code
2 LED display
3 IP Address writable area
4 Global address label
5 100 Base Fx MT-RJ cable connector
6 10/100 Base-T RJ-45 cable connector
7 Removable door

Indicators

Illustration

The following figure shows the NOE 771 00 LED indicators as a place holder for all other Ethernet modules.



Description

The following table shows the LED descriptions.

LED	Color	Description
Active	Green	Indicates the backplane is configured.
Ready	Green	Indicates module is healthy.
Fault	Red	Flashes when the NOE is in 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.
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.
Kernel	Amber	On when in Kernel Mode. Flashing while in download 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 it 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 (140 NWM 100 00 only)	Invalid IP configuration (Likely cause: Default gateway is not on the same subnet mask.)
nine (140 NWM 100 00 only)	Flash file system inoperative.

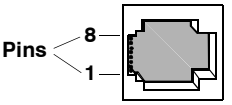
Connectors and Cabling

Overview

The following information describes the 10/100 BASE-T and 100 BASE-FX connectors.

10/100 BASE-T Twisted Pair Connector

The NOE 771 xx, NWM 100 00, and CPU 651 x0 modules' 10/100 BASE-T connector (shown below) is a standard RJ-45 twisted pair socket.
The following figure shows the 10/100 BASE-T connector.



Schneider Electric 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 xx, NWM 100 00, and CPU 651 60 modules' 100 BASE-FX connector is a MT-RJ socket or a mating fiber optic cable connector. (See the figure in the block *Front View, p. 42*).
For the NOE 771 xx and NWM 100 00, you may need an MT-RJ to SC (Duplex) multimode fiber optic cable assembly 62.5/125mm. Schneider Electric recommends cable number 490NOC00005 to connect to fiber hubs/switches.

Note: The NOE 771 xx and NWM 100 00 is an 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 over both at the same time.

1.3 Installing the Module

Overview

Introduction

This section contains installation and configuration information for the Ethernet modules.

What's in this Section?

This section contains the following topics:

Before You Begin

Overview

The following information describes how to install the NOE 771 xx module.

Initial Checks

Before you install your module, you need to complete the following checks.

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

CAUTION

UNINTENTIONAL OPERATION

If you do not enter the correct address pairs into the BOOTP server, you could communicate to the wrong device.

- Ensure the MAC address matches the intended IP address in your BOOTP server.

Having two or more devices with the same IP address can cause unpredictable operation of your network.

- Ensure that your Ethernet module receives a unique IP address.

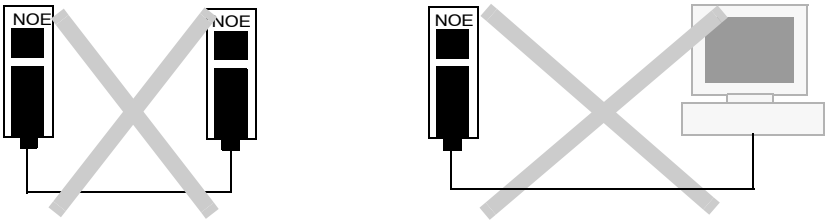
Failure to follow this precaution can result in injury or equipment damage.

Determining the Appropriate Ethernet Address Parameters

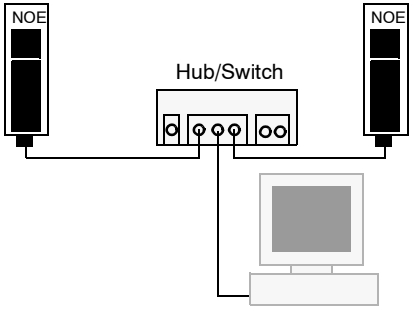
Consult your system administrator to determine if you must configure a new IP address and appropriate gateway and subnet mask addresses, or whether the module will obtain its Ethernet address parameters from a BOOTP server. If the administrator assigns new address parameters, you will need to configure the module from your programming panel. Follow the directions in the *Configuring the Module with Concept* chapter.

Verifying the Network Topology

You should not use a standard cable to connect an Ethernet Web embedded server module directly to another device, you have to use a cross link cable. For the network to operate properly, you must route the cable for each device through an Ethernet hub/swit
The following figure shows two incorrect network topologies.



The following figure shows a correct network topology.



Cabling Schemes

Overview

The following information describes how to connect devices in a standard Ethernet cabling.

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 purpose of the following table is to show that the maximum length of cable between devices depends on the type of device.

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

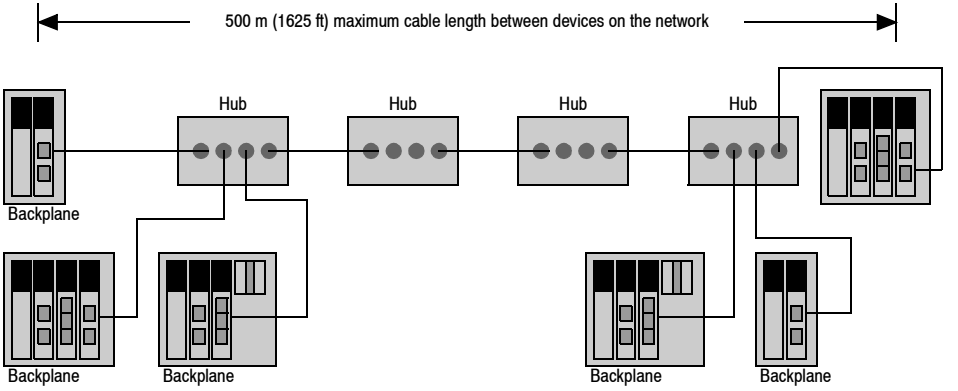
For Fast Ethernet (100 Base-T) specifications, please refer to the IEEE 802.3u Standard available from the IEEE (*www.IEEE.org*).

Cabling with Conventional Hubs

The figures and tables that follow show the maximum number of hubs and the maximum cable length between devices allowed if using hubs.

10 BASE-T Cable Distances

The following figure 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 provides information about 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)

100 BASE-FX Cable Distances

The 100 BASE-FX cabling allows for two hubs with a link maximum distance of 412 m (1339 ft), and a total network diameter of 205 m (665 ft).
The following table provides information about 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

The following information describes firewalls. A firewall is a gateway that controls access to your network. To restrict access to your Ethernet controller and I/O network, you may want to consider a firewall.

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 the information in this table to your system administrator so that the firewall configuration will allow access to your PLC from outside of your facility.

Installing the Module

Overview

The following information describes how to install the NOE 771 xx module.

Before You Begin

Locate the backplane in which you will mount the NOE 771 xx module. Ensure that an open slot is available in which to mount the module.

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

Note: Power requirements
- Ensure when installing the NOE that it does not exceed the Quantum backplane requirements.

Backplane Slot Placement

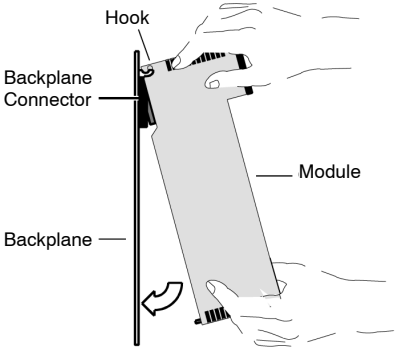
The modules may be placed in any slot on the backplane. They do not have to be placed next to each other.

Tools Required

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

Mounting the Module in the Backplane

Perform the following steps to mount the NOE 771 xx module on to a Quantum backplane.

Step	Action
1	Holding the module at an angle, mount it on the two hooks located near the top of the backplane. The following figure shows the correct way to hold the module. 
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 or between .22 and .45 Newton meters of torque.

Connecting the Cable

Overview

The following information pertains to cabling.

Note: The 140 NOE 771 xx 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.

Accessories

The following are switches that are sold by Schneider Electric.

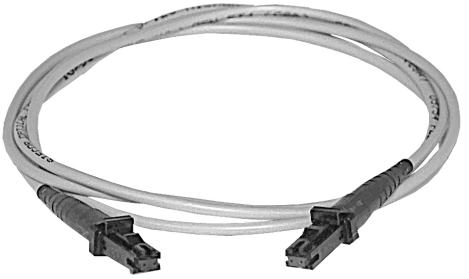
Hub or Switch	Description
499NEH10410	Hub with 4 ports 10BASE-T
499NOH10510	Hub with 3 ports 10BASE-T and 2 ports 10BASE-FL
499NTR10010	Transceiver 10BASE-T / 10BASE-FL
499NEH14100	Hub with 4 ports 100BASE-TX
499NTR10100	Transceiver 100BASE-TX
499NES18100	Switch with 8 ports 10/100BASE-TX
499NES17100	Managed Switch with 7 ports 10/100BASE-TX
499NOS17100	Managed Switch with 5 ports 10/100BASE-TX and 2 ports 100BASE-FX

The following are Schneider Electric cables that support Multicast Filtering

Cable	Description
490NTW000 02/05/12/40/80 U	StraightThru cable
490NTC000 05/15/40/80 U	Crossover cable

Fiber Optic

Remove the protective cap 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 (as shown in the following figure). Note the plug only fits to the socket in one way. It should snap into place.
The following figure shows MT-RJ fiber optic cable.



Assigning Ethernet Address Parameters

Overview

The following information describes how to assign IP address parameters.
As shipped from the factory, the NOE 771 xx module does not contain an IP address. If you have not programmed the unit with an Ethernet configuration extension, the module does not contain an IP address. When the module starts up without an IP address, the module will attempt to obtain an IP address from the network's BOOTP server.
You can assign IP address parameters using the BOOTP Lite software utility.

Note: You can configure the IP address using Web pages on the modules NOE 771 01, -11 and NWM 100 00.

CAUTION

UNINTENTIONAL OPERATION

If you do not enter the correct address pairs into the BOOTP server, you could communicate to the wrong device.

- Ensure the MAC address matches the intended IP address in your BOOTP server.

Having two or more devices with the same IP address can cause unpredictable operation of your network.

- Ensure that your Ethernet module receives a unique IP address.

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

Using a BOOTP Server

A BOOTP server is a program that 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.
See *Using "BOOTP Lite" to Assign Address Parameters, p. 64*.

How an Unconfigured ("as shipped") Module Obtains an IP Address

On startup, an unconfigured NOE 771 xx module will attempt to obtain an IP address by issuing BOOTP requests. When a response from a BOOTP server is obtained, that IP address is used. If no BOOTP response is received within two minutes, the module uses the default IP address derived from its 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.

Connecting to the Default IP Address

To connect to the default IP address with your PC, set up an active route from your PC. To do this with either Windows 95/98/ME/NT/2000 or Windows XP, use the following procedure. You can use the routes for connecting Ethernet components with other address ranges.

Step	Action
1	Be sure the NOE module is running.
2	Obtain the default IP address of the NOE derived from its MAC address (e.g. 84.0.0.2).
3	Open an MS-DOS Window.

4	Add an active route for the local NOE by typing
	`C:\>ROUTE ADD <target> MASK <mask> <gateway>`
	e.g.
	`C:\>ROUTE ADD 84.0.0.0 MASK 255.0.0.0 205.217.193.205`
	Use the default IP address of the NOE module as target address. Use class A subnet mask for connecting to every 84.0.0.0 address. The gateway address is the IP of your PC. The result is that MS Windows 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.

5	Confirm that there is a new entry in the active route table by typing `C:\>route print`: The following figure confirms that the new entry was added to the active route table. Active Routes: Network Address Netmask Gateway Address Interface Metric 0.0.0.0 0.0.0.0 205.217.193.205 205.217.193.205 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
6	Verify that a connection is made by typing `C:\>ping 84.0.0.2` The following figure shows that the connection is verified. Reply from 84.0.0.2: bytes=32 time<10ms TTL=32 Reply from 84.0.0.2: bytes=32 time<10ms TTL=32 Reply from 84.0.0.2: bytes=32 time<10ms TTL=32 Reply from 84.0.0.2: bytes=32 time<10ms TTL=32

Specifying Address Parameters	Consult your system administrator to obtain a valid IP address and an appropriate gateway and a subnet mask, if required. Then follow the instructions in the section, *Configuring the Ethernet Address Parameters*.
If BOOTP Server Responds	If the server responds with address parameters, the NOE 771 xx module will use those parameters as long as power remains applied to the module. If the server does not respond, the module will retry its request for two minutes.
If BOOTP Server Does Not Respond	If no BOOTP response is received, the NOE 771 xx module will use the default IP Address. During this time the Run indicator will display a pattern of five flashes for a BOOTP attempt and six flashes for using the default IP.
NOE 771 xx Duplicate IP Address Test	In all cases, when the NOE 771 xx 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 xx will stay off-line to avoid a network disruption. It will display a pattern of four flashes to indicate a Duplicate IP Address detection.
Automatic ARP	If there are no replies to its requests, the NOE 771 xx will send automatic ARP three times at 2 second intervals to announce its presence on the network.

Establishing the FTP Password

Overview

The following information describes how to set the FTP Password.

Establishing the FTP Password

The FTP Password is established using the Embedded Web Server. This section contains information about 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 contains information on how to access the web server for purposes of changing the FTP and HTTP passwords. See the chapter *Embedded Web Pages* for detailed information about the web server pages and their functionality.

Introduction to Accessing the Web Server

Each Quantum 140 NOE 771 xx module contains an embedded Web server, which allows you to access diagnostics and online configurations for the module and its associated controller (PLC).
The web pages can only be viewed across the World Wide Web using version 4.0 or higher of either Netscape Navigator or Internet Explorer, both of which support JDK 1.1.4 or higher.
For information about the additional functionality provided by the FactoryCast system in the 140 NOE 771 1x modules, see the *FactoryCast Manual*.

How to Access the Web Server

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.)
After you do this, the Schneider Electric Web Utility home page displays.

Schneider Web Utility Home Page

The following figure shows the Schneider Electric Web Utility home page

Schneider Automation Web Server

Diagnostics and Online Configurations

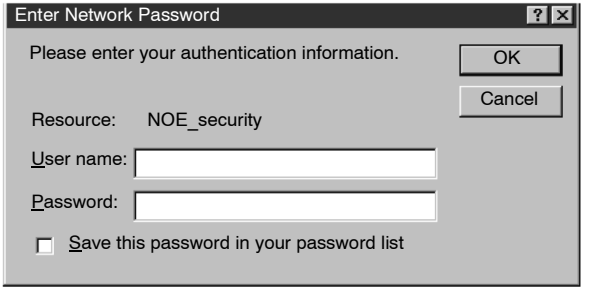
French **German** **Italian** **Spanish**

From this page, you can access the following pages.

- 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 *Embedded Web Pages, p. 217* for further information.

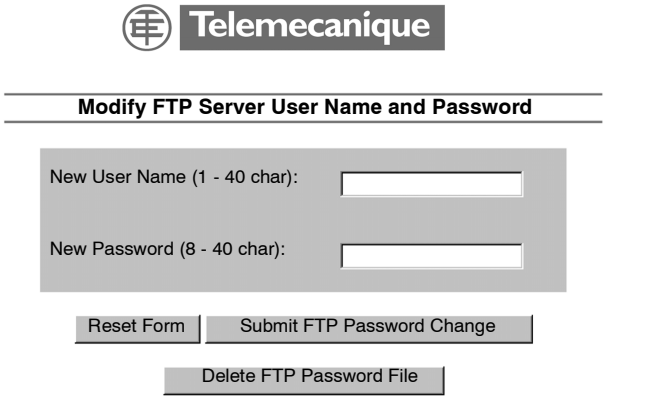
Modifying the FTP Server Password

The following steps detail how to link to the correct web page for modifying the FTP Password

Step	Action
1	Enter the URL, for example, *http://hostname/secure/embedded/ftp_passwd_config.htm*
2	The result of step 1 is that the user is requested to supply a user name and password, as shown in the figure that follows. The following figure shows the Enter Network Password dialog box. 
3	Upon supplying the user name, password, and clicking the <OK> button, the Modify FTP Server User Name and Password Page displays. **NOTE:** The default User Name is USER, and the default Password is USERUSER. Both should be changed by the system administrator during module installation.

FTP Username and Password Modify Page Overview

The following figure shows the page 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 following steps should be used.

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.

Modify FTP Server User Name and Password Message

The following figure shows the message that is generated if you click on the Submit FTP Password Change button

Ethernet Configuration

Successfully changed User Name and Password

Please click Reboot Device button to use the new password

Reboot Device

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

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

Note: The Reboot requires about 40 seconds (with large applications reboot may require up to one (1) minute).
During the reboot all services provided by the NOE 771 xx are not available.

Establishing the HTTP Password

Overview

The following information describes how to set the HTTP Password for the NOE 771 0x only.

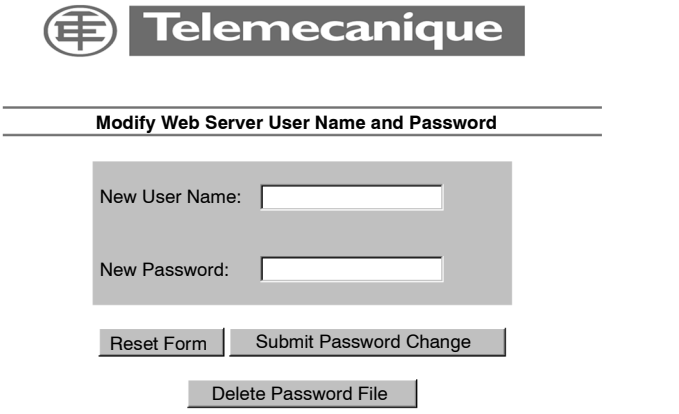
Modifying the HTTP Password

The following steps detail how to link to the correct Web page for modifying the HTTP Password

Step	Action
1	Enter the URL, for example, http://hostname/secure/embedded/http_passwd_config.htm
2	When you enter the URL, you will be requested to supply a user name and password. The following figure displays the **Enter Network Password** dialog box. 
3	Upon supplying the user name, password, and clicking the **OK** button, the **Modify HTTP Server User Name and Password** page displays. **NOTE:** The default User Name is USER, and the default Password is USER. Both should be changed by the system administrator during module installation.

Modify Web Server User Name and Password Page Overview

The following figure shows the Schneider Electric Web page used to modify the HTTP user name and password.



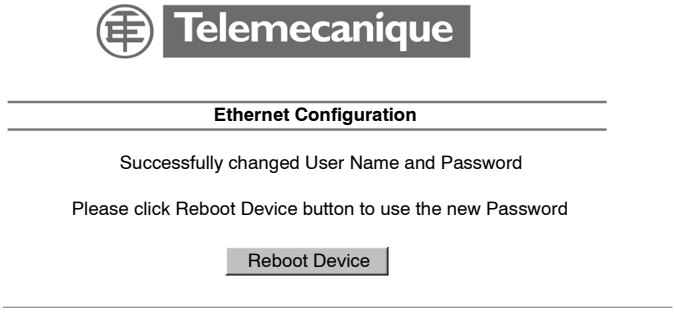
Change the Username and Password

At this point, the system administrator should change the Username and Password to restrict future access to the system. The following steps should be used.

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.

Modify Web Server User Name and Password Message

The following figure shows the message that is generated if you click on the **Submit Password Change** button.



Clicking the **Reboot Device** button will reset the Username and Password for the NOE 771 0x board.

Note: The Reboot will take about 40 seconds (with large applications reboot may require one (1) minute).
During the reboot all services provided by the NOE 771 0x are not available.

Using "BOOTP Lite" to Assign Address Parameters

Overview

The following information describes how to use the BOOTP Lite utility software.

CAUTION

UNINTENIONAL OPERATION

If you do not enter the correct address pairs into the BOOTP server, you could communicate to the wrong device.

- Ensure the MAC address matches the intended IP address in your BOOTP server.

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

BOOTP Lite Utility

Instead of a BOOTP server, Schneider Electric's *BOOTP Lite Server Software* utility can be used to provide the IP address, subnet mask, and default gateway to the NOE 771 xx module.
Refer to the BOOTP Lite Server Software user documentation for instructions

Note: BOOTP Lite Server Software and user documentation are available for download at www.modicon.com.

1.4 Customer Support

Customer Support

Customer Support

If you have any problems, please first consult the documentation listed above or the MS-Windows documentation.
Please find the nearest Schneider Electric sales office by visiting `http://www.schneider-electric.com`. Select your country in the drop-down menu to find customer support closest to you.
For the most up-to-date NOE Ethernet controller information, please

Step	Action
1	Access the Schneider Electric Web site.
2	Search technical information.
3	Select Quantum from the list of cross-product families.
4	Access either • resolutions for resolutions to product issues • product manuals for the most recently published user documentation • product announcements

Provided Ethernet Services

2

At a Glance

Introduction

This chapter describes the Ethernet services available on NOE 771 x1 and CPU 651 x0.

What's in this Chapter?

This chapter contains the following topics:

Modicon Quantum with Unity Ethernet Services

Table of Ethernet Services

The Ethernet services add functionality to the system. Some services can be configured, others require no configuration. Some services provide diagnostic information. Access to the services is through either a Web page or the Unity Pro application.

		NOE 771 01	NOE 771 11	CPU 651 x0
Service				
Address Server	Configure	Web Unity Pro	Web Unity Pro	Web Unity Pro
	Diagnostic	NA	NA	NA
BOOTP Client	Configure	Unity Pro	Unity Pro	Unity Pro
	Diagnostic	NA	NA	NA
Network Management Service (SNMP V2 Agent)	Configure	Web	Web	Unity Pro
	Diagnostic	NA	NA	NA
Schneider Private MIB	Configure	NA	NA	NA
	Diagnostic	NA	NA	NA
Modbus Messaging	Configure	Unity Pro	Unity Pro	Unity Pro
	Diagnostic	Web Unity Pro	Web Unity Pro	Web Unity Pro
I/O Scanner	Configure	Unity Pro	Unity Pro	Unity Pro
	Diagnostic	Web Unity Pro	Web Unity Pro	Web Unity Pro
Global Data (Pub / Sub)	Configure	Web Unity Pro	Web Unity Pro	Unity Pro
	Diagnostic	Web Unity Pro	Web Unity Pro	Web Unity Pro
Time Synchronization Service	Configure	NA	Web	NA
	Diagnostic	NA	Web Unity Pro	NA
Electronic Mail Notification Service	Configure	Web	Web	Web
	Diagnostic	Web	Web	Web
Bandwidth Monitoring	Configure	Unity Pro	Unity Pro	Unity Pro
	Diagnostic	Web Unity Pro	Web Unity Pro	Web Unity Pro
FTP Server	Configure	NA	NA	NA
	Diagnostic	NA	NA	NA

		NOE 771 01	NOE 771 11	CPU 651 x0
Service				
HTTP Server	Configure	NA	NA	NA
	Diagnostic	NA	NA	NA
Faulty Device Replacement (Server)	Configure	Web Unity Pro	Web Unity Pro	Unity Pro
	Diagnostic	NA	NA	NA
Hot Standby	Configure	NA	NA	NA
	Diagnostic	NA	NA	NA
Flash File system	Configure	NA	NA	NA
	Diagnostic	NA	NA	NA
FactoryCast Application	Configure	NA	Web	NA
	Diagnostic	NA	Web	NA

Address Server

Overview

The following information describes the services provided by the Address Server.

- BOOTP Server
- DHCP Server

The DHCP server responds to both a DHCP and a BOOTP server

BOOTP Server

Note: The BOOTP Server is available on the 140 NOE 771 xx 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 771 xx 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 xx. Providing a BOOTP Server that is built into your NOE 771 xx module eliminates the need for an external BOOTP server.

Note: The NOE 771 xx's BOOTP Server cannot be used to provide its own IP address.

You can configure your NOE 771 xx's BOOTP Server from the module's HTTP Web page. Configure a 140 CPU 651 x0 using the Unity Pro editors. Configuring allows you to add to, remove from, and edit devices in the BOOTP Server's database, which is maintained in the module's non-volatile memory.

DHCP Server

Note: The DHCP Server is available on the 140 NOE 771 x1 models.

Dynamic Host Configuration Protocol (DHCP) is a superset of the BOOTP Protocol. Your 140 NOE 771 x1 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 for details on configuring your NOE's address Server.
If you are migrating a BOOTP configuration from a 140 NOE 771 x0 module to the new 140 NOE 771 x1 module, see the *Address Server Configuration / Faulty Device Replacement* chapter 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 Electric 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.

SNMP and Schneider Private MIB Overview

Overview

Simple Network Management Protocol (SNMP) is configured on your NOE.

Introduction

Network management software allows a network manager to

- Monitor and control network components
- Isolate problems and find their causes
- Query devices such as a host computer, routers, switches, and bridges to determine their status
- Obtain statistics about the networks to which they attach

Simple Network Management Protocol

Your NOE module is configured with the Simple Network Management Protocol (SNMP), which is the standard protocol used to manage a local area network (LAN). SNMP defines exactly how a *manager* communicates with an *agent*.
The SNMP defines 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. Both the manager and agent programs must agree on the names and the meanings of the fetch and store operations. The set of all objects SNMP can access is known as a *Management Information Base (MIB*).

The Private MIB

Schneider obtained a private MIB, Groupe_Schneider (3833). Under the Groupe Schneider private MIB is a Transparent Factory Ethernet (TFE) private MIB. The Transparent Factory SNMP embedded component controls the Schneider private MIB function.

MODBUS Messaging

Overview

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

Introduction - Client

All Modicon Quantum Ethernet modules provide the user with the capability of transferring data to and from nodes on a TCP/IP network using a communication instruction. All PLCs that support networking communication capabilities over Ethernet can use either the MSTR Ladder Logic instruction to read or write controller information or IEC communication blocks.

Introduction - Server

Using the standard MODBUS/TCP protocol, all Modicon Quantum Ethernet modules provide access to controller data. 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 Ethernet module supports up to 64 simultaneous MODBUS/TCP server connections. To guarantee consistency of changes to the controller configuration, the Ethernet module allows only one Programming Panel to be logged in at a time. The following MODBUS/TCP commands are supported by the Ethernet module:

- 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 Ethernet module's MODBUS/TCP Server.

Parameter	Value
Typical Response Time (ms)	0.6
Number of MODBUS connections (Client and Server)	64 (NOE 771 x1, NWM 100 00, HE CPU 651 x0) 16 Client (NOE 771 x0) 32 Server (NOE 771 x0)
Number of simultaneous login channels	1

Note: Ethernet module's MODBUS/TCP performance measurements are made with a Modicon Quantum 140 CPU 534 14 PLC.

I/O Scanner

Introduction

The functionality of your Ethernet module is further enhanced by the addition of an I/O Scanner, which you can configure with either the Schneider Electric programming panels or on the Ethernet module's embedded Web page.

I/O Scanner Features

In 2004 Schneider Electric enhanced the I/O scanner capabilities by offering:

Feature	Availability	Improvement	Description
Improved Timeout and Retry Transmission algorithm	Unity Concept ProWORX	Improves TCP connection management	2004 version uses a variable timeout. Older versions used a fixed timeout. Difference: Faster retransmission rates
Enable/Disable I/O Scanner entry	Unity Concept	Reduces network traffic volume	Use the 'Device Control Block' • Set = 0 Enable channel for normal data exchange • Set = 1 Disable channel Note: Concept Users Concept uses diagnostic words. Set = FF Disable channel
Send Modbus requests across a router	Unity Concept ProWORX	Allows routers to connect remote I/O devices to a controller	Automatic
Dynamic TCP port allocation	Unity Concept ProWORX	Improves connection/ disconnection performance	Reserves TCP client ports 3072 (0xC00) through 4992 (0x1380) Allocates ports dynamically
Repetition rate display	Unity	Check status using GUI	Status displays in I/O Scanning tab of module editor

I/O Scanner Parameters

Functionality of the I/O Scanner.

Parameter	Value
Max. No. of Devices	64: 140 NOE 771 00 (Version 2.2 or earlier) 128: 140 NOE 771 00 (Version 3.0 or later), 140 NOE 771 01, and 140 NOE 771 11 only 128: HE CPU 651 x0
Max. No. of Input Words	4000
Max. No. of Output Words	4000
Health Timeout Value	User configured (1 ms to 2 s in 1 ms increments)
Last Value (Input)	User configured (Zero or Hold)
IP Address	User configured IP address of scanned device (Slave IP)
Local and Remote Register Reference	User configured
Repetition Rate	User configured
Unit ID	User configured Configure ID only if using a bridge
Operation through a bridge	Modbus bridge: Supported
	Modbus Plus bridge: Supported

Refer to the section *I/O Scanner Concepts, p. 166* to learn how to configure the MODBUS I/O Scanner.

Performance

Refer to the appendix for detailed performance data.

Global Data

Overview

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 %MW words (4x registers) 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 %MW words (4x registers)
- A device can subscribe to several network variables of up to 2048 %MW words (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

Time Synchronization Service

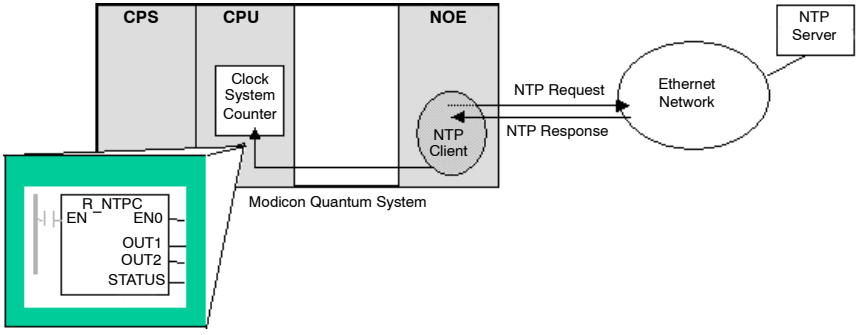
General

The time service synchronizes computer clocks over the Internet. For example, the time of one client is synchronized either with another server or to a referenced time source like a radio or satellite receiver.
Typical time service configurations utilize multiple redundant servers and diverse network paths to achieve high accuracy and reliability. Time service accuracy can be within a millisecond on LANs and up to a few tens of milliseconds on WANs.
Use the time service for

- event recording—sequence events
- event synchronization—trigger simultaneous events
- alarm and I/O synchronization—time stamp alarms

Time Synchronization and Time Stamps

On an Ethernet network, all controllers should be synchronized with the same clock time, which is provided by an NTP server. In each application program, events or application data (IO values for example) can be time stamped using the application stacks.
The Modicon Quantum Ethernet interface module, a NOE 771 11, connects to an NTP time server and provides the source-time synchronization signal, which is sent to the CPU.
To read the clock, a function block is used in the controller's project (application program).



Electronic Mail Notification Service

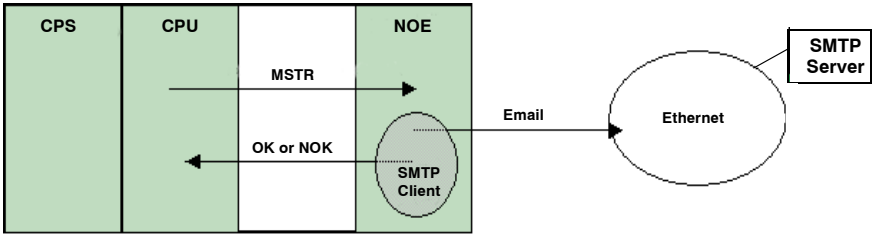
General

The electronic mail notification service allows controller-based projects to report alarms or events. The automation controller monitors the system and can automatically create an electronic mail message alert with data, alarms, and/or events. Mail recipients can be either local or remote.

- Based on predefined events or conditions, messages are created using the MSTR function block.
- The email message is constructed from predefined headers plus variables and text (a maximum of 238 bytes). This message is sent directly from the automation system to the local email server.
- Mail headers contain common predefined items—recipient list, sender name, and subject. These items can be updated by an authorized administrator.

Mail Service Client

The NOE and 140 CPU 651 x0 modules include an SMTP client. When the module receives a specific request from the controller, the module sends an email message to the mail server.



Bandwidth Monitoring

Overview

Bandwidth Monitoring allows the user 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 the user want to use Bandwidth Monitoring, he 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, the user should ensure that the controller scan time is set to the expected scan time for the application being modelled.

FTP Server

Overview

The following information describes the services provided by the File Transfer Protocol (FTP) Server. The FTP server is available on all NOE 771 xx and CPU 651 x0 modules.

FTP Server

The NOE 771 xx's and CPU 651 x0's FTP Server is available as soon as the module receives an IP address. Any FTP client can log on to the module, which requires the client use 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

Note: Only one FTP client per module.

The FTP Server is protected with a default user name and password.

Default user name	USER Case sensitive
Default password	USERUSER Case sensitive
Refer to *Establishing the FTP Password, p. 57* for instructions about how to change the password, and how to add or delete user names to the FTP Server.	

Embedded Web Pages—HTTP Server, Web Configuration and Diagnostics

HTTP Server

The Modicon Quantum with Unity Ethernet modules' Hypertext Transport Protocol (HTTP) server is available as soon as the module receives an IP address.
Use the HTTP Server

1. with Internet Explorer version 4.0 or higher
2. to view:
   - Module's Ethernet statistics
   - Controller and I/O information
   - BOOTP/DHCP/FDR (Faulty Device Replacement) server information
   - Global Data (Publish / Subscribe) information
3. to configure the module's BOOTP/DHCP/FDR server and SNMP agent

Note: JRE 1.4.2_04 or higher plug-in required with Internet Explorer

The HTTP server is protected with a default user name and password.

Default user name	USER Case sensitive
Default password	USER Case sensitive
Change either user name or password via the Configuration page on the Ethernet modules' Web Embedded Pages. (See *Establishing the HTTP Password, p. 61*) For the NOE 771 11 modules, user name and passwords can be changed via the FactoryCast Configurator.	

Note: CONNECTIONS
The NOE 771 xx and CPU 651 xx support a maximum of 32 HTTP simultaneous connections.
Browsers may open multiple connections so 32 HTTP connections does not indicate 32 simultaneous users.

Note: DOWNLOADED WEB PAGES
The NOE 771 00 and NOE 771 01 modules do not support user downloaded Web pages. You will need to purchase either the NOE 771 10, NOE 771 11, or the NWM 100 00 module to support user downloaded Web pages.

Web Configuration

The embedded Web server provides Web pages to configure the following Transparent Factory / Real Time services.

Service	Description
Global Data diagnostics	• status of all global data services • status of all subscribed and published variables • publication/subscription rate
I/O Scanning diagnostics	• status of all I/O scanning services • status of individual scanned devices • actual I/O scanning rate
Messaging diagnostics	diagnostic information for port 502 messaging
Time Synchronization diagnostic	• status of client and link to the server • date and time • status of daylight savings time (DST) option
Electronic Mail Notification diagnostic	• status of SMTP server • track messages sent and received • track errors
Bandwidth Monitoring	throughput measure of NOE by service

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

Further Information

Hot Standby

The Ethernet Hot Standby system consists of two identical Modicon Quantum systems each containing a Modicon Quantum Hot Standby with Unity controller (140 CPU 671 x0), a remote I/O head, no more than six NOE771 xx's, and a power supply. The Hot Standby modules are connected to each other via a fiber optic cable. Both remote I/O heads are connected to the remote I/O network and to each other.

Schneider Electric recommends

1. remote I/O network use redundant cables
   - drops are not redundant
2. switch connects the NOEs to the network
   switches available
   - 499NES17100
   - 499NOS17100

FactoryCast and User Customizable Web Pages

FactoryCast is a software package that you use to customize a Web site on the embedded Web server module. The site can be accessed via a browser to view and modify data from a Modicon Quantum with Unity controller (PLC).

FactoryCast provides all the Web pages and Java applets you need to view run-time data from your controller. You can use the FactoryCast default Web site simply by configuring the module and accessing it with a browser over an intranet.

The NOE 771 10, -11 and 140 NWM 100 00 modules provide the possibility to add your own Web pages to the site.

Flash File System

The NOE 771 xx modules are equipped with a Flash File System, which allows changing or updating the executive, kernel, and Web site files by an upload.

Modicon Quantum with Unity Ethernet Modules Services

II

At a Glance

Purpose

This part introduces the Ethernet services available with Modicon Quantum with Unity Ethernet modules.

What's in this Part?

This part contains the following chapters:

Start Communication with Unity Pro

3

At a Glance

Introduction

This chapter presents how to start the configuration of an Ethernet network within Unity Pro.

What's in this Chapter?

This chapter contains the following sections:

3.1 How to Configure the Communication

Overview

Overview

This section describes how to configure the communication.

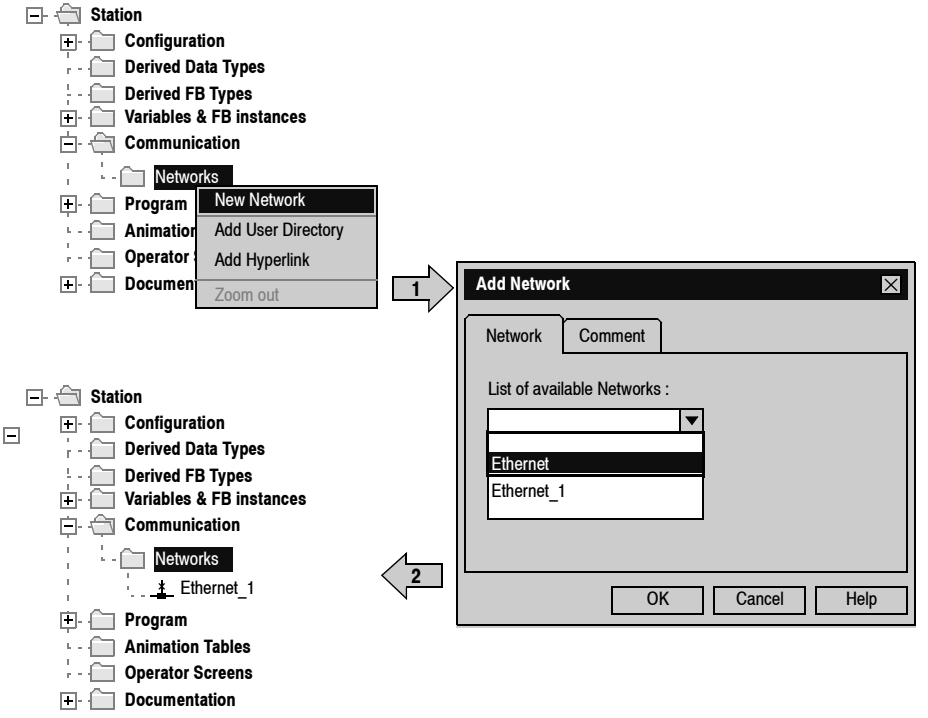
What's in this Section?

This section contains the following topics:

Add a New Network to the Communication Folder

Add a New Network to the Communication Folder

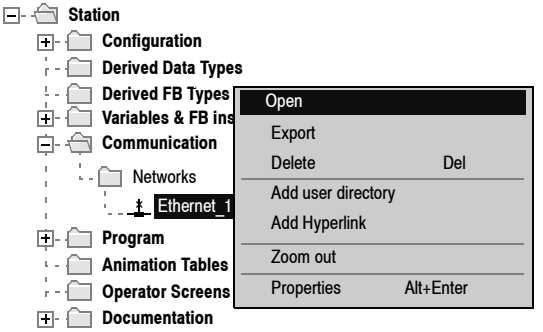
After starting a new application, the Communication folder under Station tree branches the Network folder and the Routing table folder (only on Premium platform). These two folders are empty. Under the Network folder, the user can insert the networks by menu. A click on the right mouse-button above Network pops up a contextual menu. The user selects the type of network he wants to add. For easier use, a network name will be suggested with the prefix of the network type (Ethernet_1 or Modbus+_1). By choosing a new network the next available number for the network is chosen automatically like e.g. Ethernet_1 then Ethernet_2 and so on. At any moment, the user may rename any NetLink.
The user can also attach a comment that describes each configured network. The OK button adds the network as subfolder.
The names of network nodes are also called NetLink. These are the names of logical networks.



Configure Network

Configure Network

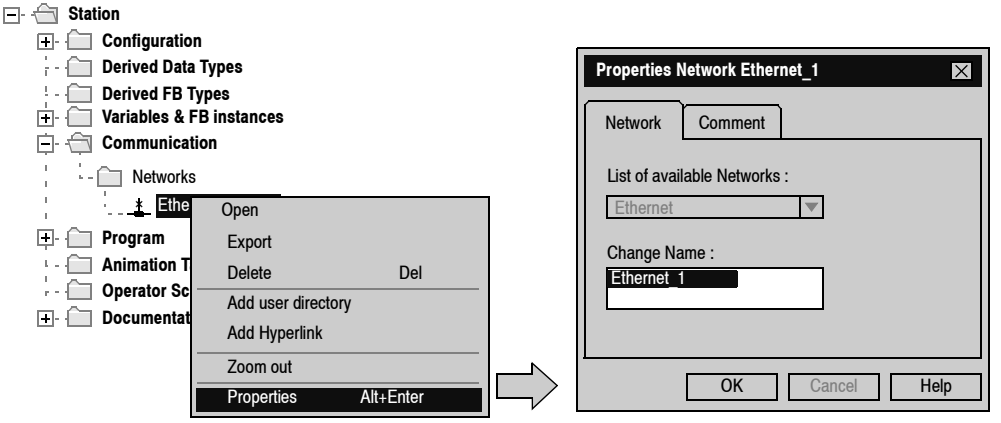
On the network folder, by a double-clicking action or by the Open item on contextual menu, the editor of the corresponding communication screen is opened in order to set the specific network services.
The figure shows the contextual menu to start network properties



Properties of a Network

Properties of a Network

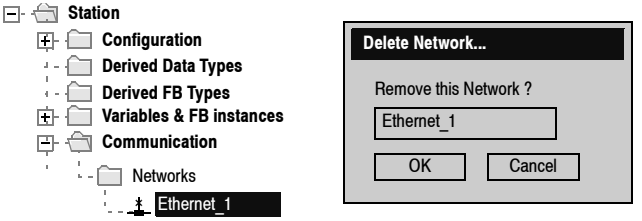
The contextual menu proposes the user to see again the properties of a configured network. Here, the user can change the NetLink name and the associated comment. The figure shows the Ethernet property window



Delete an Existing Network Folder

Delete an Existing Network Folder

With a right-mouse-click above the network folder, a contextual menu appears. Here the user is able to delete the network configuration. In this case, the subfolder of the network will also be removed in application browser.



Note: If this removed network was previously attached to a communication module, this module loses its link and it will work with its default parameters.

3.2 Unity Soft Communication Links

At a Glance

Overview

This section presents the principle of communication implementation and describes the relationship between software configuration of networks and the hardware configuration of the network controllers.

What's in this Section?

This section contains the following topics:

Communication Configuration Principle

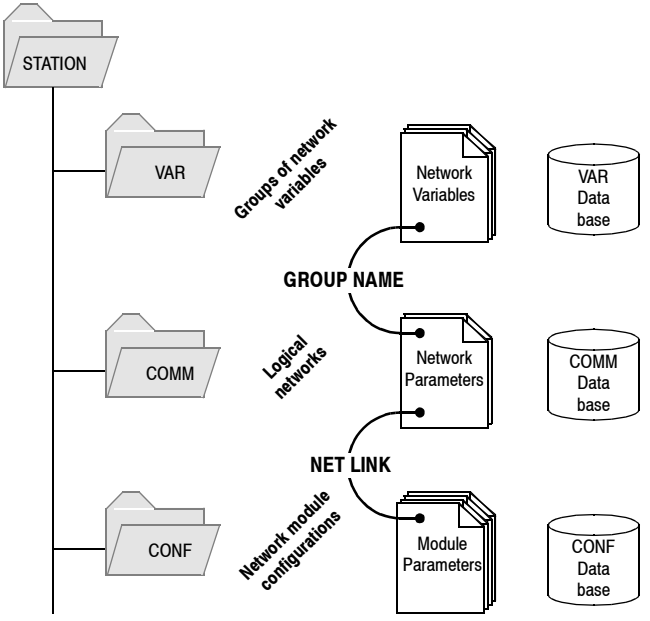
Introduction

The configuration of communication links between different devices with Unity Soft includes three different configuration parts.

- Configuration of the Network Controller
- Configuration of the Logical Network
- Configuration of Network Variables

Configuration

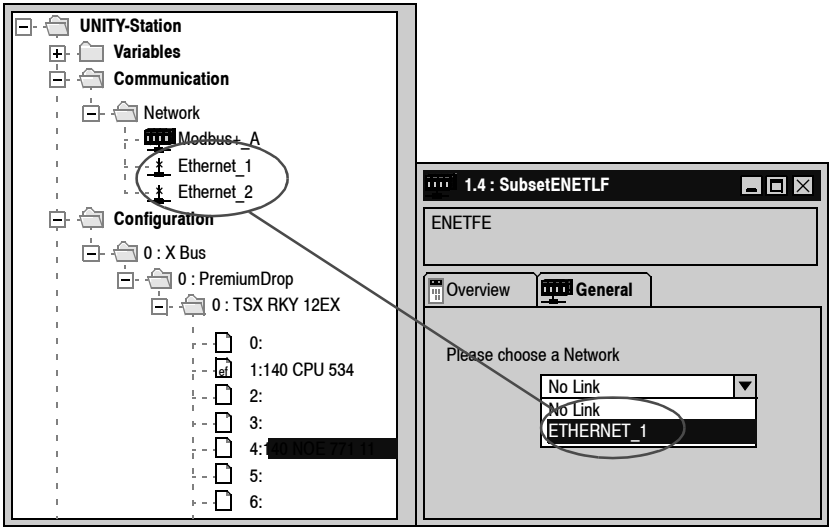
The Communication Configuration supports the "Free Mode" of Unity Soft. That means the user can first configure the module and then the Communication or the user can configure the communication and then the module.
This will be provided through a NetLink that must be selected in the module configuration. The network variables including in the VAR folder are linked with a group name that defines an IP domain over Internet network.
The illustration shows the three parts involved in communication configuration:



Link between Configuration and Communication

NetLinks

During Unity Pro application design, the NetLinks are created and inserted on sub-folder Communication under Network. These are the names of logical networks. Under configuration folder, on the communication module node included in the current station, the list of existing NetLinks is proposed to select and attach one network to one module. Only the NetLink that can be managed by this module, are displayed in the list box on module configuration screen. No NetLink can be edited and created here (no edit box), but this list contains at least the No_Link field.
The following figure shows the window for the Ethernet link for the Quantum NOE module.



Attaching a NetLink to a Module

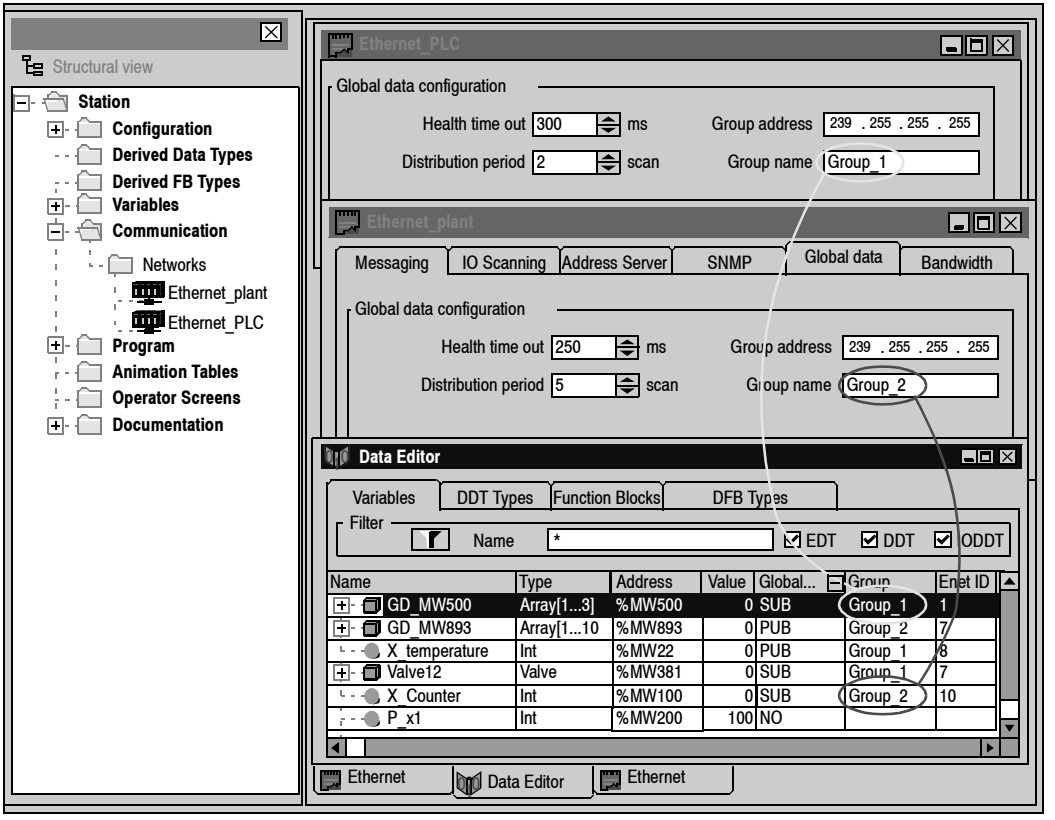
When a network is attached to a module, the icon of the corresponding node is changed and the network editor displays the address of the module in the rack . The Icon in the Network folder indicates whether the link is attached to a module or not:

	Icon when no communication module is attached to the NetLink
	Icon when a communication module has been attached to the NetLink

Link between Data and Communication

Network Variables and Groups

The groups of Ethernet network variables are created in the Ethernet network communication folders. An IP domain determines a group. In Unity Pro, one network can support only one group.
In Data Editor, the list of all current groups is provided to select in which group each Ethernet network variables is included. Nevertheless, the group field is also a free entry editing box, in order to give a group name not yet defined in communication folder. The build step checks this link.
The illustration shows corresponding fields in Communication configuration and the Data Editor:



3.3 Selecting the Ethernet Module

At a Glance

Introduction

This chapter contains the software page Selecting the Quantum NOE/NWM Ethernet Module.
The module families are the communication modules 140 NOE 771 xx, 140 NWM 100 00 and the processor module CPU 651 x0.

Note: The webpage settings described only apply to the communication modules. The processor modules only offer the possibility for diagnostics via the web.

What's in this Section?

This section contains the following topics:

Selecting the Quantum NOE Ethernet Module

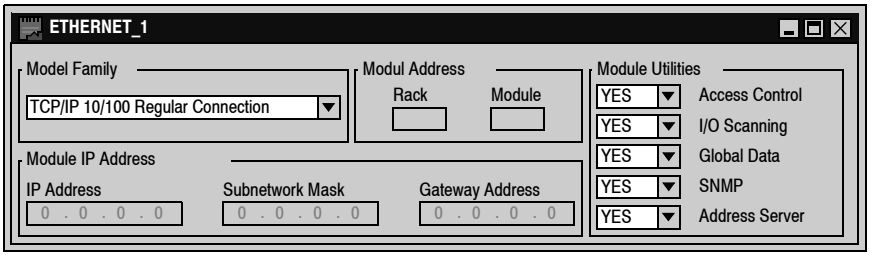
General Description

After configuring Ethernet communication (see: *Add a new network to the Communication folder, p. 89*) the Ethernet module parameters can be configured. When you select the model family, all the corresponding communication module configuration options are displayed automatically. The module services allow the following settings to be made.
Table of module service configuration options:

Setting	Description
No	Setting deactivated
Yes	Setting activated. Parameters are set using the Unity Pro menu window.
Web	Setting activated. Parameters are set using the configured NOE Web pages. Unity Pro menu window deactivated. Not available for every model family.

Note: The availability of the displayed settings depends on the selected model family and can vary.

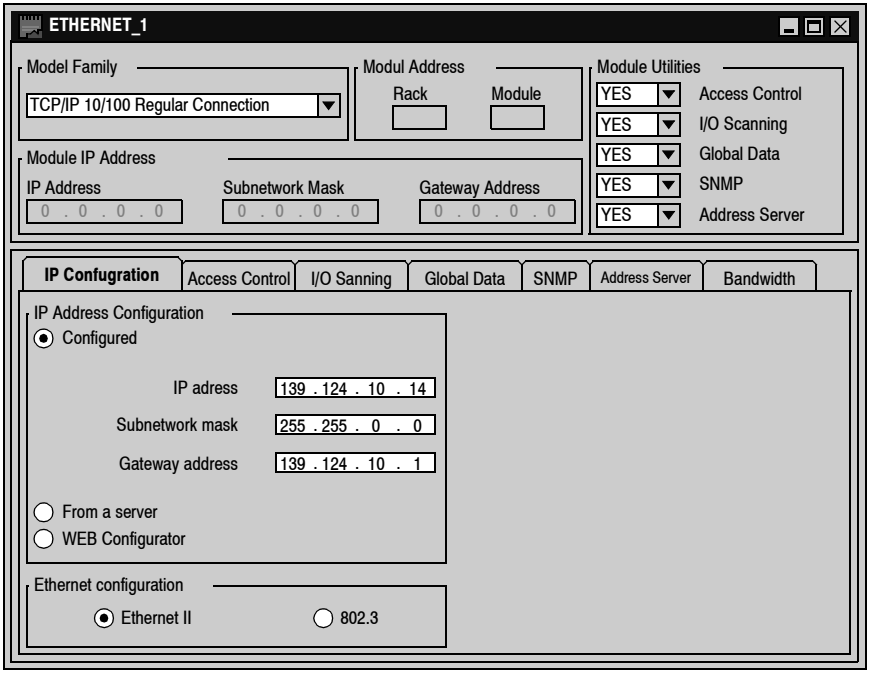
The screen shot shows an example of the menu window of the Ethernet module NOE 771 x1 (TCP/IP 10/100 Regular connection).



Parameter description

Parameter	Description
Model family	Quantum NOE Ethernet Module settings
Slot	Not used
Module services	For module service configuration options, see above.
IP address of the module	Overview of the IP address parameter set.

After selecting the model family **TCP/IP 10/100 Regular Connection,** the following mask appears. The image also displays the activated module services.



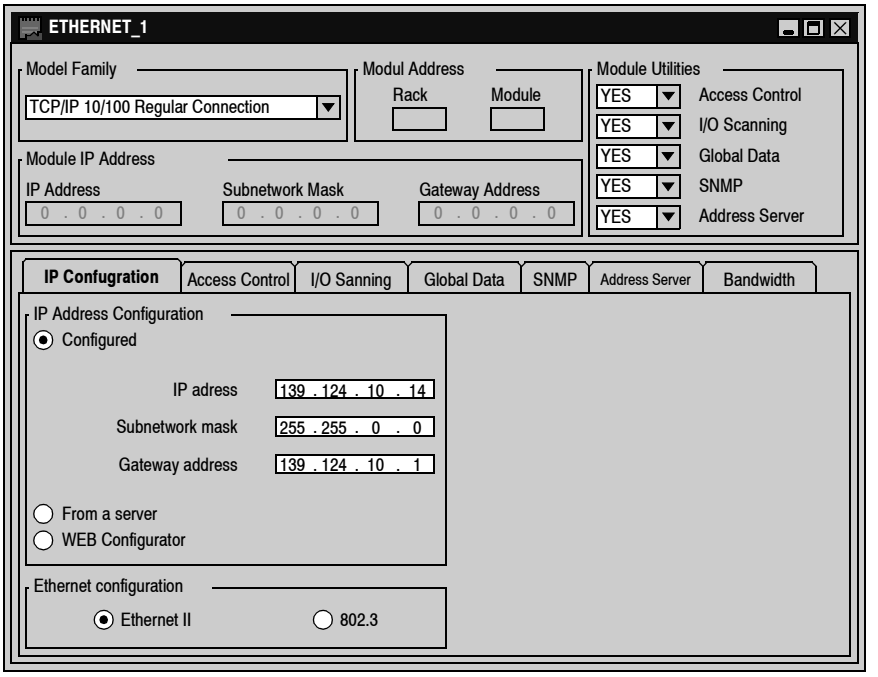
Note: The availability of the displayed register depends on the selected model family and can vary.

After selecting the **Yes** option in module services, the tab corresponding to the module is activated.

IP Configuration

General Description

The **IP configuration** tab enables you to configure the IP address settings. The settings are activated after the connection to the hardware and the configuration is downloaded to the PLC in the Quantum NOE Ethernet module.
The diagram shows the IP configuration for the Quantum NOE Ethernet model family.



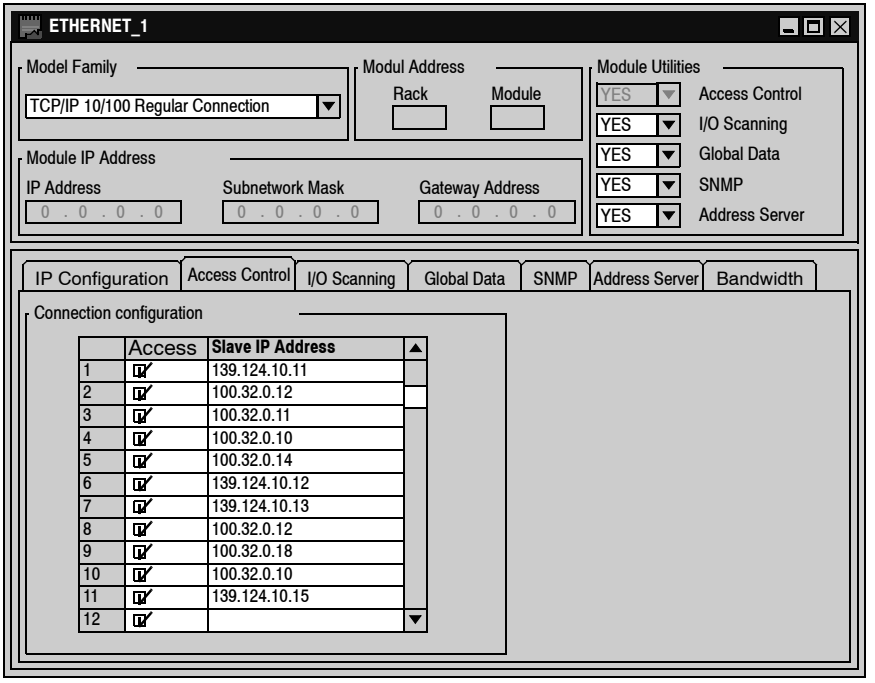
Description of the selection properties

Selection	Description
Configured	Activate the IP address, Subnet mask and Gateway address. The data is activated after the configuration is downloaded to the PLC.
Client / **Server**	The Quantum NOE Ethernet module receives its IP address parameter through a BOOTP server on startup.
Web configuration	The IP address parameter settings are made on the embedded Web page of the Quantum NOE Ethernet module.
Ethernet configuration	Select the default protocol as Ethernet or 802.3.

Quantum NOE Ethernet Messaging Configuration

Introduction

Ethernet Messaging gives the user the opportunity to send and receive Ethernet messages. Data traffic is handled by the Client / Server procedure.
The illustration shows the Ethernet Messaging dialog box.



Parameter description

Setting	Description
Connection configuration	Activates general data transfer
Access	Activates data transfer between specific nodes.
Slave IP address	Defines the node for the Ethernet Messaging procedure.

3.4 Selecting the Ethernet Coprocessor

At a Glance

Introduction

This section describes configuring the Modicon Quantum with Unity coprocessor, 140 CPU 651 x0.

What's in this Section?

This section contains the following topics:

Selecting the Modicon Quantum with Unity Ethernet Controller

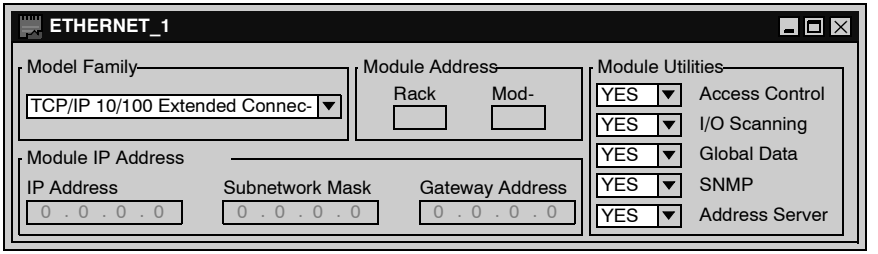
General Description

After configuring Ethernet communication (See *Add a new network to the Communication folder, p. 89*), configure the Ethernet module parameters.
When you select the model family, all the corresponding communication-module configuration options display automatically. The module services allow the following settings to be made.

Setting	Description
No	Setting deactivated
Yes	Setting activated. Parameters are set using the Unity Pro menu window.

Note: The availability of the displayed settings varies and depends on the selected model family.

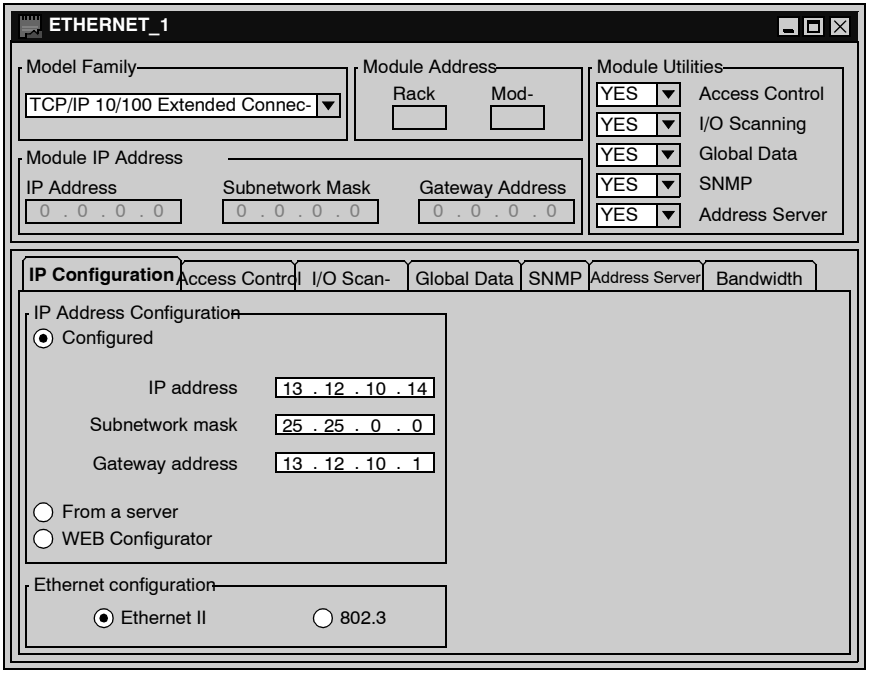
The screen shot shows an example of the menu window of the Ethernet module CPU 651 x0 (TCP/IP 10/100 Extended connection).



Parameter description

Parameter	Description
Model family	Modicon Quantum with Unity Ethernet module settings
Slot	Not used
Module services	For module service configuration options, see above.
IP address of the module	Overview of the IP address parameter set.

After selecting the model family **TCP/IP 10/100 Extended Connection,** the following mask appears. The image also displays the activated module services.



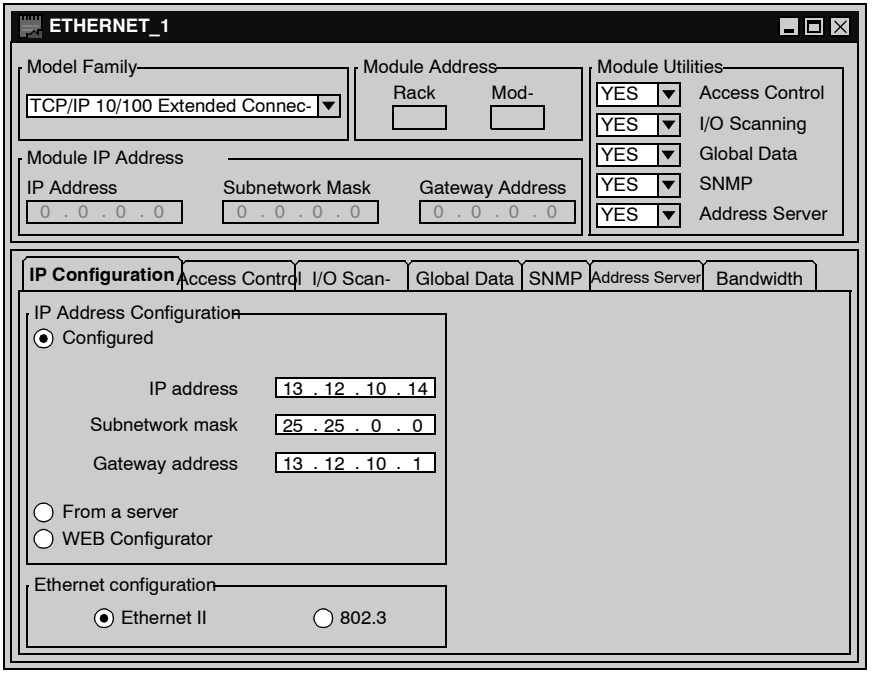
Note: The availability of the displayed register depends on the selected model family and can vary.

After selecting the **Yes** option in module services, the tab corresponding to the module is activated.

Configuring the IP Address of the Ethernet Controller

General Description

The **IP configuration** tab enables you to configure the IP address settings. The settings are activated after the connection to the hardware and the configuration is downloaded to the Modicon Quantum with Unity Ethernet controller, 140 CPU 651 x0.
The diagram shows the IP configuration for the Modicon Quantum with Unity Ethernet controller, 140 CPU 651 x0.



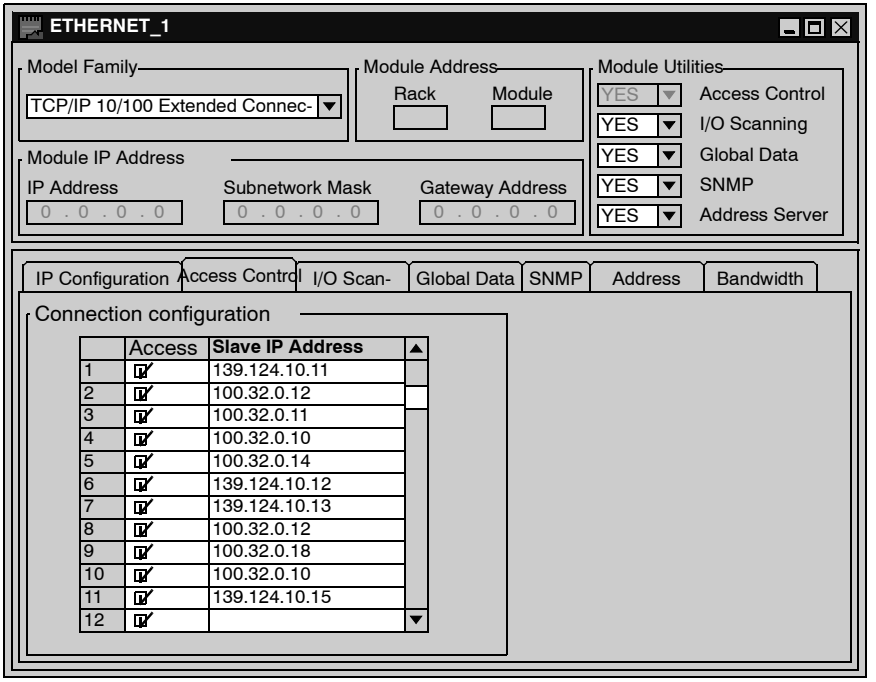
Description of the selection properties

Selection	Description
Configured	Activate the IP address, Subnet mask and Gateway address. The data is activated after the configuration is downloaded to the controller.
Client / **Server**	The Modicon Quantum with Unity Ethernet controller receives its IP address parameter through a BOOTP server on startup.
Web configuration	The IP address parameter settings are made on the embedded Web page of the Modicon Quantum with Unity Ethernet controller.

Modicon Quantum with Unity Ethernet Controller Messaging Configuration

Introduction

Send and receive messages though the Ethernet. Data traffic is handled by the Client / Server procedure.
The illustration shows the Ethernet Messaging dialog box.



Parameter description

Setting	Description
Connection configuration	Activates general data transfer
Access	Activates data transfer between specific nodes.
Slave IP address	Defines the node for the Ethernet Messaging procedure.

Using the Modicon Quantum with Unity Ethernet Services

III

At a Glance

Purpose

This part describes how to use the Ethernet services available on Modicon Quantum with Unity Ethernet modules.

What's in this Part?

This part contains the following chapters:

Transferring Data using Communication Blocks

4

At a Glance

Introduction

This chapter describes how to transfer data to and from nodes on a TCP/IP network using communication blocks. You transfer the data using either a special MSTR instruction (the Master instruction of the 984 Ladder Logic instruction set) or an IEC Logic function. 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:

CREAD_REG

Function Description

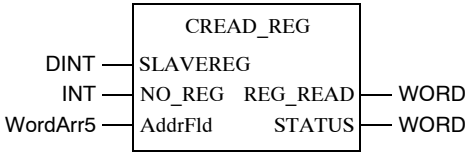
This Function block reads the register area continuously. It reads data from an addressed node via TCP/IP-Ethernet.
EN and ENO can be projected as additional parameters.

Note: When programming a CREAD_REG function, you must be familiar with the routing procedures used by your network.

Note: For technical reasons, this function block does not allow the use of programming languages ST and IL.

Representation

Block Representation



Parameter Description

Description of Parameters

Parameter	Data Type	Meaning
SLAVEREG	DINT	Offset address of the first 4x register in the slave to be read from
NO_REG	INT	Number of registers to be read from slave
AddrFld	WordArr5	Data structure describing the TCI/IP address
REG_READ	WORD	First 4x area register for read values
STATUS	WORD	Error code, see Runtime errors

Elementary Description for WordArr5 with TCP/IP Ethernet

Elementary description for WordArr5 with TCP/IP Ethernet

Element	Data Type	Meaning
WordArr5[1]	WORD	Low value byte: MBP on Ethernet Transporter (MET) mapping index High value byte: Slot of the NOE module
WordArr5[2]	WORD	Byte 4 (MSB) of the 32-bit destination IP address
WordArr5[3]	WORD	Byte 3 of the 32-bit destination IP address
WordArr5[4]	WORD	Byte 2 of the 32-bit destination IP address
WordArr5[5]	WORD	Byte 1 (LSB) of the 32-bit destination IP address

Function Mode of the CREAD_REG Block

Although a large number of CREAD_REG function blocks can be programmed, only sixteen read operations may be active at the same time. In such a case it is insignificant whether they are the result of this function block or others (e.g. MBP_MSTR, MSTR, READ_REG). All function blocks use one data transaction path and require multiple cycles to complete a job.

Note: A TCP/IP communication between a Quantum PLC (NOE 771 xx) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

Note: A TCP/IP communication between a Quantum PLC (NOE 211 00) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

The entire routing information is contained in data structure WordArr5 of input AddrFld. The type of function block connected to this input and thus the contents of the data structure depends on the network used.
Please use:

- TCP/IP EtherNet the function block TCP_IP_ADDR

Note: For experts: The WordArr5 data structure can be used with constants as well.

Note: This function block puts a heavy load on the network; therefore the network load must be carefully monitored. If the network load is too high, the program logic should be reorganized in order to work with the READ_REG function block, a variation of this function block that does not operate in a continuous mode, but under command control.

SLAVEREG	Start of the area in the addressed slave from which the source data is read. The source area always resides within the 4x register area. SLAVEREG expects the source reference as offset within the 4x area. The leading "4" must be omitted (e.g. 59 (contents of the variables or value of the literal) = 40059). The parameter can be specified as direct address, located variable, unlocated variable, or literal.
NO_REG	Number of registers to be read from the addressed slave (1 ... 100). The parameter can be entered as a Direct address, Located variable, Unlocated variable, or Literal.
REG_READ	This word parameter addresses the first register in a series of NO_REG registers, listed one after the other, which are used as a destination data area. The parameter must be entered as a Direct address or located Variable.
STATUS	Error code, see Runtime errors. The parameter can be specified as direct address, located variable or unlocated variable.

CWRITE_REG

Function Description

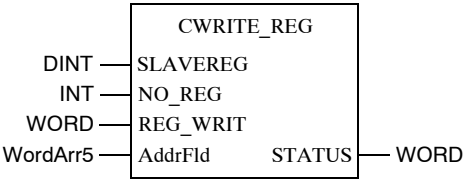
The purpose of this Function block is to write the register area continuously. It transfers data from the PLC via TCP/IP Ethernet to an addressed slave.
EN and ENO can be configured as additional parameters.

Note: You must be familiar with the routing procedures of the network when programming a CWRITE_REG function.

Note: For technical reasons, this function block does not allow the use of ST and IL programming languages.

Symbol

Block Representation



Parameter Description

Description of Parameters

Parameter	Data Type	Meaning
SLAVEREG	DINT	Offset address of the first 4x register in the slave to be written to
NO_REG	INT	Number of registers to be written to slave
REG_WRIT	WORD	First 4x register of the source data area
AddrFld	WordArr5	Data structure for transferring the TCI/IP address
STATUS	WORD	MSTR error code, see Runtime errors

Elementary Description for WordArr5 with TCP/IP Ethernet

Elementary description for WordArr5 with TCP/IP Ethernet

Element	Data Type	Meaning
WordArr5[1]	WORD	Low value byte: MBP on Ethernet Transporter (MET) mapping index High value byte: Slots of the NOE module
WordArr5[2]	WORD	Byte 4 (MSB) of the 32-bit destination IP address
WordArr5[3]	WORD	Byte 3 of the 32-bit destination IP address
WordArr5[4]	WORD	Byte 2 of the 32-bit destination IP address
WordArr5[5]	WORD	Byte 1 (LSB) of the 32-bit destination IP address

CWRITE_REG Block Function Mode

Although a large number of CWRITE_REG function blocks can be programmed, only sixteen write operations may be active at the same time. It makes no difference whether these operations are performed using this function block or others (e.g. MBP_MSTR, MSTR, WRITE_REG). All function blocks use one data transaction path and require multiple cycles to complete a job.
If several CWRITE_REG function blocks are used within an application, they must at least differ in the values of their NO_REG or REG_WRITE parameters.

Note: A TCP/IP communication between a Quantum PLC (NOE 771 xx) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

The entire routing information is contained in data structure WordArr5 of input AddrFld. The type of function block connected to this input and thus the contents of the data structure depend on the network used.
Please use:

- TCP/IP Ethernet: the function block TCP_IP_ADDR

Note: For experts: The WordArr5 data structure can also be used with constants.

Note: This function block puts a heavy load on the network. The network load must therefore be carefully monitored. If the network load is too high, the program logic should be reorganized to work with the WRITE_REG function block, which is a variant of this function block that does not operate in continuous mode but is command driven.

SLAVEREG	Start of the area in the addressed slave to which the source data are written. The destination area always resides within the 4x register area. SLAVEREG expects the destination address as offset within the 4x area. The initial "4" must be omitted (e.g. 59 (contents of the variables or value of the literal) = 40059). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
NO_REG	Number of registers to be written to slave processor (1 ... 100). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
STATUS	Error code, see Runtime errors. The parameter can be specified as direct address, located variable or unlocated variable.
REG_WRIT	This word parameter addresses the first register in a series of NO_REG Successive registers used as source data area. The parameter must be entered as a direct address or located variable.

READ_REG

Function Description

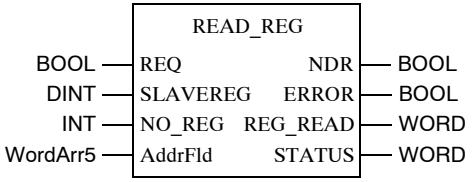
If requested, this function block will read a register area once (rising edge of the REQ input). It reads data from an addressed slave via TCP/IP-Ethernet.
EN and ENO can be projected as additional parameters.

Note: You must be familiar with the routing procedures of your network when programming a READ_REG function.

Note: Note: For technical reasons, this function block does not allow use of the programming languages ST and IL.

Symbol

Block Representation



Parameter Description

Description of Block Parameters

Parameter	Data Type	Meaning
REQ	BOOL	Start read operation once
SLAVEREG	DINT	Offset address of the first 4x register in the slave to be read from
NO_REG	INT	Number of registers to be read from slave
AddrFld	WordArr5	Data structure describing the TCP/IP address
NDR	BOOL	Set to "1" for one cycle after reading new data
ERROR	BOOL	Set to "1" for one scan in case of error
STATUS	WORD	Error code, see Runtime errors
REG_READ	WORD	First 4x area register for read values

Elementary Description for WordArr5 with TCP/IP Ethernet

Elementary description for WordArr5 with TCP/IP Ethernet

Element	Data Type	Meaning
WordArr5[1]	WORD	Low value byte: MBP on Ethernet Transporter (MET) mapping index High value byte: Slot of the NOE module
WordArr5[2]	WORD	Byte 4 (MSB) of the 32-bit destination IP address
WordArr5[3]	WORD	Byte 3 of the 32-bit destination IP address
WordArr5[4]	WORD	Byte 2 of the 32-bit destination IP address
WordArr5[5]	WORD	Byte 1 (LSB) of the 32-bit destination IP address

Function Mode of READ_REG Blocks

Although a large number of READ_REG function blocks can be programmed, only sixteen read operations may be active at the same time. In such a case it is insignificant whether they are the result of this function block or of other read operations (e.g. MBP_MSTR, MSTR, CREAD_REG). All function blocks use one data transaction path and require multiple cycles to complete a job.

Note: A TCP/IP communication between a Quantum PLC (NOE 771 xx) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

The entire routing information is contained in data structure WordArr5 of input AddrFld. The type of function block connected to this input and thus the contents of the data structure depends on the network used.
Please use:

- TCP/IP EtherNet the function block TCP_IP_ADDR

Note: For experts: The WordArr5 data structure can be used with constants as well.

REQ

A rising edge triggers the read transaction.
The parameter can be specified as direct address, located variable, unlocated variable, or Literal.

SLAVEREG	Start of the area in the addressed slave from which the source data is read. The source area always resides within the 4x register area. SLAVEREG expects the source reference as offset within the 4x area. The leading "4" must be omitted (e.g. 59 (contents of the variables or value of the literal) = 40059). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
NO_REG	Number of registers to be read from the addressed slave (1 ... 100). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
NDR	Transition to ON state for one program cycle signifies receipt of new data ready to be processed. The parameter can be specified as direct address, located variable, or unlocated variable.
ERROR	Transition to ON state for one program cycle signifies detection of a new error. The parameter can be specified as direct address, located variable, or unlocated variable.
REG_READ	This word parameter addresses the first register in a series of NO_REG registers lying in series used as destination data area. The parameter must be entered as a direct address or located variable.
STATUS	Error code, see Runtime errors. The parameter can be specified as direct address, located variable or unlocated variable.

WRITE_REG

Function Description

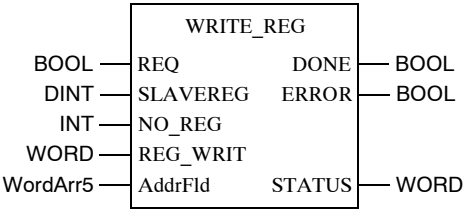
If requested, this Function block will write a register area once (rising edge of the REQ input). It transfers data from the PLC via TCP/IP Ethernet to an addressed slave.
EN and ENO can be configured as additional parameters.

Note: You must be familiar with the routing procedures of your network when programming a WRITE_REG function.

Note: For technical reasons, this function block does not allow the use of ST and IL programming languages.

Symbol

Block Representation



Parameter Description

Description of Parameters

Parameter	Data Type	Meaning
REQ	BOOL	Start write operation once
SLAVEREG	DINT	Offset address of the first 4x register in the slave to be written to
NO_REG	INT	Number of registers to be written from slave
AddrFld	WordArr5	Data structure transferring the TCP/IP address
REG_WRIT	WORD	First 4x register of the source data area
DONE	BOOL	Set to "1" for one scan after writing data
ERROR	BOOL	Set to "1" for one scan in case of error
STATUS	WORD	Error code, see Runtime errors

Elementary Description for WordArr5 with TCP/IP Ethernet

Elementary description for WordArr5 with TCP/IP Ethernet

Element	Data Type	Meaning
WordArr5[1]	WORD	High value byte: Slot of the NOE module Low value byte: MBP on Ethernet Transporter (MET) mapping index
WordArr5[2]	WORD	Byte 4 (MSB) of the 32-bit destination IP address
WordArr5[3]	WORD	Byte 3 of the 32-bit destination IP address
WordArr5[4]	WORD	Byte 2 of the 32-bit destination IP address
WordArr5[5]	WORD	Byte 1 (LSB) of the 32-bit destination IP address

Function Mode of the WRITE_REG Module

Although a large number of WRITE_REG function blocks can be programmed, only sixteen write operations may be active at the same time. In such a case it is insignificant whether they are the result of this function block or of other write operations (e.g. MBP_MSTR, MSTR, CWRITE_REG). All function blocks use one data transaction path and require multiple cycles to complete a job.
If several WRITE_REG function blocks are used within an application, they must at least differ in the values of their NO_REG or REG_WRITE parameters.

Note: A TCP/IP communication between a Quantum PLC (NOE 771 xx) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

The status signals DONE and ERROR report the function block state to the user program.
The entire routing information is contained in data structure WordArr5 of input AddrFld. The type of function block connected to this input and thus the contents of the data structure depend on the network used.
Please use:

- TCP/IP Ethernet: the function block TCP_IP_ADDR

Note: For experts: The WordArr5 data structure can also be used with constants.

REQ

A rising edge triggers the read transaction.
The parameter can be specified as direct address, located variable or unlocated variable.

SLAVEREG	Start of the area in the addressed slave from which the source data is read. The source area always resides within the 4x register area. SLAVEREG expects the source reference as offset within the 4x area. The leading "4" must be omitted (e.g. 59 (contents of the variables or value of the literal) = 40059). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
NO_REG	Number of registers to be read from the addressed slave (1 ... 100). The parameter can be specified as direct address, located variable, unlocated variable, or Literal.
REG_WRIT	This word parameter addresses the first register in a series of NO_REG registers used as source data area. The parameter must be entered as a direct address or located variable.
DONE	Transition to ON state for one program scan signifies data have been transferred. The parameter can be specified as direct address, located variable or unlocated variable.
ERROR	Transition to ON state for one program scan signifies detection of a new error. The parameter can be specified as direct address, located variable or unlocated variable.
STATUS	Error code, see Runtime errors. The parameter can be specified as direct address, located variable, or unlocated variable.

TCP_IP_ADDR

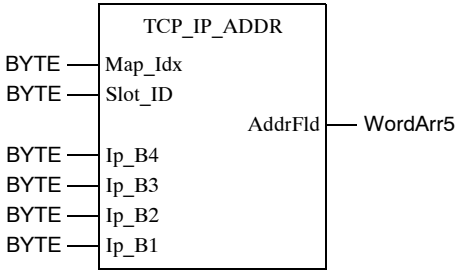
Function Description

This Function Block enables the input of TCP/IP addresses for the READ_REG, CREAD_REG, WRITE_REG and CWRITE_REG Function Blocks. The address is transferred in the form of a data structure.
The parameters EN and ENO can additionally be projected.

Note: You must be familiar with your network when programming the TCP_IP_ADDR Function Block.

Symbol

Block representation



Parameter Description

Description of Parameters

Parameter	Data Type	Meaning
Map_Idx	BYTE	Map-Index MBP on Ethernet Transporter (MET) mapping index
Slot_ID	BYTE	Slot ID Slot of the NOE module
Ip_B4	BYTE	Byte 4 (MSB) of the 32-bit destination IP address
Ip_B3	BYTE	Byte 3 of the 32-bit destination IP address
Ip_B2	BYTE	Byte 2 of the 32-bit destination IP address
Ip_B1	BYTE	Byte 1 (LSB) of the 32-bit destination IP address
AddrFld	WordArr5	Data structure used to transfer the TCP/IP address

Elementary Description for WordArr5

Elementary description for WordArr5

Element	Data Type	Meaning
WordArr5[1]	WORD	High value byte: Slot of the NOE module Low value byte: MBP on Ethernet Transporter (MET) mapping index
WordArr5[2]	WORD	Byte 4 (MSB) of the 32-bit destination IP address
WordArr5[3]	WORD	Byte 3 of the 32-bit destination IP address
WordArr5[4]	WORD	Byte 2 of the 32-bit destination IP address
WordArr5[5]	WORD	Byte 1 (LSB) of the 32-bit destination IP address

Map_Idx

The MBP on Ethernet Transporter (MET) mapping index is given at the Map_Idx input, i.e. if MET is 6, the value appears as follows:

0	0	0	0	0	1	1	0

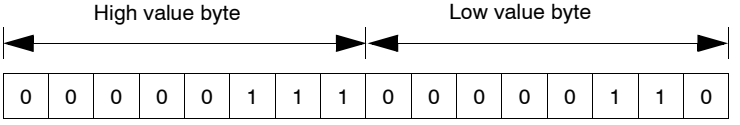
Slot_ID

If an NOE in the rack of a Quantum controller is addressed as destination node, the value at the Slot_ID input represents the physical NOE slot, i.e. if the NOE is plugged in at Slot 7 of the rack, the value appears as follows:

0	0	0	0	0	1	1	1

AddrFld

If an NOE in the rack of a Quantum controller is addressed as a destination node, the value in the High value byte represents the physical slot of the NOE and the Low value byte represents the MBP on Ethernet Transporter (MET) mapping index, i.e. if the NOE is inserted in slot 7 of the rack and the MET mapping index is 6, the first element of the data structure looks as follows:



High value byte Slots 1 ... 16
Low value byte MBP on Ethernet Transporter (MET) mapping index

MBP_MSTR

Function Block

With this Function block, it is possible to select one of 12 available network communication operations.
Although a large number of MBP_MSTR function blocks can be programmed, only sixteen of them can be active at the same time. All function blocks use one data transaction path and require multiple cycles to complete a job.

Note: A TCP/IP communication between a Quantum PLC (NOE 771 xx) and a Momentum PLC (all TCP/IP CPUs and all TCP/IP I/O modules) is only possible, when only one read or write job is carried out in every cycle. If several jobs are sent per PLC cycle, the communication stops without generating an error message in the status register of the function block.

Note: In FBD and LD sections, the function block can only be used on the program level, i.e. not in Derived Function Blocks (DFBs).

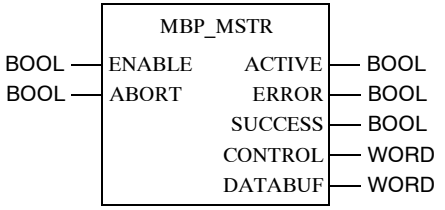
Note: For technical reasons, this function block does not allow the use of programming languages ST and IL.

EN and ENO can be configured as additional parameters.

Note: You must be familiar with the routing procedures of your network when programming an MSTR function.

Symbol

Block representation



Parameter Description

Description of parameters

Parameter	Data Type	Meaning
ENABLE	BOOL	Enable MSTR function
ABORT	BOOL	Cancel active MSTR operation
ACTIVE	BOOL	Operation is active
ERROR	BOOL	Faulty operation
SUCCESS	BOOL	Operation completed successfully
CONTROL	WORD	First 4x register of the MSTR control block
DATABUF	WORD	First 4x register of the data field

Function Mode of MBP_MSTR Blocks

Using the MBP_MSTR block, one of 12 available network communication operations can be triggered via the network. Each operation receives a code. Whether the operations are available depends on the type of network used.

Valid Function Codes

Valid function codes:

Code	Function	TCP/IP Ethernet
1	Write Data	X
2	Read Data	X
3	Get Local Statistics	X
4	Clear Local Statistics	X
5	Write Global Data	-
6	Read Global Data	-
7	Get Remote Statistics	X
8	Clear Remote Statistics	X
9	Peer Cop Status (Peer Cop Health)	-
10	Reset optional module	X
11	Read CTE (Config extension)	X
12	Write CTE (Config extension)	X
13	Send email	X

Legend:

X	Yes
-	No

ENABLE When ON, the operation specified in the first CONTROL register is enabled.

ABORT When ON, the currently active operation is aborted.

ACTIVE ON, if the operation is active.

ERROR ON, if the operation was aborted without success.

SUCCESS ON, if the operation concluded successfully.

DATABUF The 4x register specified is the first in a group of successive output/marker words, making up the data field. For operations providing data, e.g. the write operation, the data field is the data source. For operations receiving data, e.g. the read operation, the data field is the data sink.
In the case of Ethernet CTE Read and Write operations, the middle input stores the contents of the Ethernet configuration extension table in a series of registers.

CONTROL This word parameter addresses the first of several successive 4x registers. The control block is contained in these registers. The first register displayed contains a number from 1 to 12, which provides the operation code of the MODBUS operation to be performed. The contents of the sequence registers are determined by the operation.
The structure of the control block differs according to the network used:

- TCP/IP Ethernet

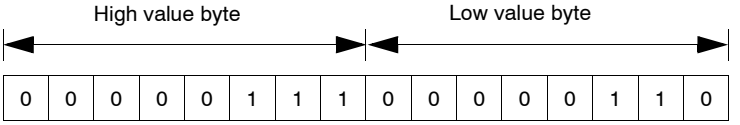
Control Block for TCP/IP Ethernet

Control block for TCP/IP Ethernet

Register	Contents
4x	Indicates one of the Operations which are valid for TCP/IP
4x + 1	Indicates the Error status
4x + 2	Indicates the length (number of registers transferred)
4x + 3	Indicates MSTR operation-dependent information
4x + 4	Routing register Low value byte: MBP on Ethernet Transporter (MET) mapping index High value byte: Slot of the NOE module
4x + 5	Byte 4 (MSB) of the 32-bit destination IP address
4x + 6	Byte 3 of the 32-bit destination IP address
4x + 7	Byte 2 of the 32-bit destination IP address
4x + 8	Byte 1 (LSB) of the 32-bit destination IP address

Routing Register (4x + 4) in TCP/IP Ethernet

If a NOE in the rack of a Quantum controller is addressed as destination node, the value in the high value byte represents the physical NOE slot and the value in the low value byte represents the MBP on Ethernet (MET) mapping index, i.e. if the NOE is plugged in at Slot 7 of the rack and the MET mapping index is 6, the first element of the data structure appears as follows:



High value byte Slots 1 to 16
Low value byte MBP on Ethernet Transporter (MET) mapping index

MSTR Function Error Codes

Overview

The following information describes the error codes for MSTR operations.

Where Displayed

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

TCP/IP Ethernet Error Codes

The following table describes the errors that can occur in the MSTR *control block* if the MSTR routine runs over TCP/IP Ethernet.

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.
2008	Invalid slave device network routing
3000	Generic MODBUS fail code.
30ss*	MODBUS slave exception response.
4001	Inconsistent MODBUS slave response.
F001	Option Module not responding
F002	Module not fully initialized
* ss = subfield	

The following table lists the ss subfield values in error code 30ss.

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	Reserved
05	Slave has accepted long-duration program command.
06	Function cannot be performed now; a long-duration command is in effect.
07	Slave rejected long-duration program command.

TCP/IP Ethernet Network Errors

The following table describes the errors that can occur in the MSTR *control block* as a result of an error on the TCP/IP Ethernet network.

Hex Error Code	Meaning
5004	Interrupted system call
5005	I/O error
5006	No such address
5009	The socket descriptor is invalid
500C	Not enough memory
500D	Permission denied
5011	Entry exists
5016	An argument is invalid
5017	An internal table has run out of space
5020	The connection is broken
5028	Destination address required
5029	Protocol wrong type for socket
502A	Protocol not available
502B	Protocol not supported
502C	Socket type not supported
502D	Operation not supported on a socket
502E	Protocol family not supported
502F	Address family not supported
5030	Address already in use
5031	Cannot assign requested address
5032	Socket operation on a non-socket
5033	Network is unreachable
5034	Network dropped connection on reset
5035	Network caused connection abort
5036	Connection reset by peer
5037	No buffer space available
5038	Socket is already connected
5039	Socket is not connected
503A	Cannot send after socket shutdown
503B	Too many references, cannot splice
503C	Connection timed-out (See note below.)

503D	Connection refused
503E	Network is down
503F	Text file busy
5040	Too many levels of links
5041	No route to host
5042	Block device required
5043	Host is down
5044	Operation now in progress
5045	Operation already in progress
5046	Operation would block
5047	Function not implemented
5048	Hardware length is invalid
5049	Route specified cannot be found
504A	Collision in select call: these conditions have already been selected by another task.
504B	Task ID is invalid
5050	No Network Resource
5051	Length Error
5052	Addressing Error
5053	Application Error
5054	Client in Bad State for Request
5055	No Remote Resource (Note: May indicate no path to Remote Device) (See note below.)
5056	Nonoperational TCP Connection
5057	Incoherent Configuration

Note: Error Codes 503C and 5055
- Error 5055 can occur before a 503C error.

No remote device takes precedence over a timeout.

CTE Error Codes

The following table lists the error codes that 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

Overview

This section describes the MSTR Read and Write 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 following table describes the registers in the MSTR *control block* (the top node) that contain the Read or Write information,

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	
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.	

Read/Write MSTR Operation (FC 23)

Overview

This section describes the MSTR Read/Write operation, Function Code (FC) 23.

Introduction

In a single transaction, the MSTR read and write operation transfers data from a master source device to a specified stave destination device and then transfers data from this specified slave source to the master.

Note: FC 23 can only be used with these two models:
- NOE 771 **01**, version 2.0 and higher
- NOE 771 **11**, version 2.0 and higher

Control Block Utilization

The following table describes the registers in the MSTR control block (the top node), registers that contain the Read or Write information.

Register	Function	Content
Displayed	Operation Type	23 = Read/Write
1st Implied	Error Status	Displays a hex value indicating a MSTR error
2nd Implied	Write Length	Number of registers to be sent to slave
3rd Implied	Slave device writes data area	Specifies starting 4x register in the slave to be written to (1 = 400001, 49 = 40049)
4th Implied	Slot ID	Slot where the NOE is located
5th Implied	IP - 34	Byte 4 (MSB) of the 32 bit destination IP address
6th Implied	IP - 33	Byte 3 of the 32 bit destination IP address
7th Implied	IP - 32	Byte 2 of the 32 bit destination IP address
8th Implied	IP - 31	Byte 1 (LSB) of the 32 bit destination IP address
9th Implied	Read Length	Number of registers to be read from slave
10th Implied	Slave device reads data area	Specifies starting 4x register in the slave to be read to

Get Local Statistics MSTR Operation

Overview

This section describes the Get Local Statistics 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 *TCP/IP Ethernet Statistics, p. 146*.)

Control Block Utilization

The following table describes the registers in the MSTR *control block* (the top node). These registers contain the Get Local Statistics information.

Register	Function	Content
Displayed	Operation Type	3
First implied	Error status	Displays a hex value indicating an MSTR error, if 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

Overview

The following information describes the Local Statistics operation.

Introduction

The Clear Local Statistics 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 following table describes the registers in the MSTR *control block* (the top node). These registers contain the Clear Local Statistics information.

Register	Function	Content
Displayed	Operation Type	4
First implied	Error status	Displays a hex value indicating an MSTR error, if 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

Overview

The following information describes the Get Remote Statistics 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 *TCP/IP Ethernet Statistics, p. 146*.)
The remote Ethernet module always returns its complete statistics table if 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 4x registers.

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

Control Block Utilization

The following table describes the registers in the MSTR *control block* (the top node). These registers contain the Get Remote Statistics information.

Register	Function	Content
Displayed	Operation Type	7
First implied	Error status	Displays a hex value indicating an MSTR error, if 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

Overview

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

Register	Function	Content
Displayed	Operation Type	8
First implied	Error status	Displays a hex value indicating an MSTR error, if 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

Overview

The following information describes the Peer Cop Health 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 4x registers in state RAM. The Peer Cop communications health table is 12 words long, and the words are indexed via this MSTR operation as words 0 ... 11.

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

Control Block Utilization

The following table describes the registers in the MSTR control block (the top node). These registers contain information for a Peer Cop Health operation.

Register	Function	Content
Displayed	Operation Type	9
First implied	Error status	Displays a hex value indicating an MSTR error, if 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.

Peer Cop Communications Health Status Information

The following information describes the structure of the Peer Cop health table: Each bit in each table word 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.

The following table shows the 12 contiguous registers used by the health table and the words to which they are indexed. Each row that is configured is mapped to a bit position.

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

Peer Cop Communications Health Bit State

The state of a Peer Cop health bit reflects the current communication status of its associated node. The following list provides more detailed information:

- A health bit is set if data is successfully exchanged with its corresponding node.
- A health bit is cleared if 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 if its associated Peer Cop entry is null.
- All global health bits are always reported as zero.

Reset Option Module MSTR Operation

Overview

The following information describes the Reset Option Module 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 following table describes the registers in the MSTR *control block* (the top node). These registers contain the Reset Option Module information.

Register	Function	Content
Displayed	Operation Type	10
First implied	Error status	Displays a hex value indicating an MSTR error, if 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

Overview

The following information describes the Read CTE 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 following table describes the registers in the MSTR *control block* (the top node). These registers contain the Read CTE information.

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 ... Eighth implied	Not applicable	

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 4x registers.

The following table describes the CTE data contained in the registers.

Parameter	Register	Content	
Frame type	Displayed	1 = 802.3	
		2 = Ethernet	
IP Address	First implied	Byte 4 (MSB) of the 32-bit IP address	
	Second implied	Byte 3 of the 32-bit IP address	
	Third implied	Byte 2 of the 32-bit IP address	
	Fourth implied	Byte 1 (LSB) of the 32-bit IP address	
Subnetwork mask	Fifth implied	Hi word	
	Sixth implied	Low word	
Gateway	Seventh implied	Byte 4 (MSB) of the 32-bit gateway address	
	Eighth implied	Byte 3 of the 32-bit gateway address	
	Ninth implied	Byte 2 of the 32-bit gateway address	
	Tenth implied	Byte 1 (LSB) of the 32-bit gateway address	
	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 5 = NOE77101 6 = NOE77111	IP Address Algorithm 0: Take IP Address from above definition (default) (All modules support this functionality) 1: Always take IP Address from BOOTP Server (M1 and NOE 771 x0 support this functionality) 2: Disable Ethernet functionality (M1 only)

Note: Module type only used by the p-unit during an upload to determine module.

Write CTE (Config Extension Table) MSTR Operation

Overview

The following information describes the Write CTE 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 describes the registers in the MSTR *control block* (the top node). These registers contain the Write CTE information.

Register	Function	Content
Displayed	Operation Type	12
First implied	Error status	Displays a hex value indicating an MSTR error, if relevant.
Second implied	Not applicable	
Third implied		
Fourth implied	Low byte	Either a value displayed in the high byte of the register or not used.
	Slot Index	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	

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 if a Write CTE operation is implemented. The middle node contains the first of 11 contiguous 4x registers.

The following table describes the CTE data contained in the registers.

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 = NOE771 00 3 = NOE771 10 4 = M1 5 = 140 NOE 771 01 6 = 140 NOE 771 11	IP Address Algorithm 0: Take IP Address from above definition (default) (All modules support this functionality) 1: Always take IP Address from BOOTP Server (M1 and NOE 771 x0 support this functionality) 2: Disable Ethernet functionality (M1 only)

TCP/IP Ethernet Statistics

Overview

The following information describes the available TCP/IP Ethernet Statistics.

Introduction

A TCP/IP Ethernet board responds to the "Get Local Statistics" and "Set Local Statistics" commands with the following information.

Word	Meaning
00 ... 02	MAC address
03	Board Status (see the Board Status Bit Definition table in this map)
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 buffer error
28 and 29	Transmit silo underflow
30 and 31	Late collision
32 and 33	Lost carrier
34 and 35	Number of retries
36 and 37	IP address

Board Status Word Bit Definition

The following table describes the word bit definitions for Board Status.

Bit #	Definition
15 ... 12	Module Type (See Module type table below)
11	(Reserved)
10	0 = half duplex 1 = full duplex
9	0 = not configured 1 = configured
8	0 = PLC not running 1 = PLC/NOE running
7	0 = Link LED off 1 = Link LED on
6	0 = Appl LED off 1 = Appl LED on
5	0 = twisted pair 1 = fiber
4	0 = 10 Mbit 1 = 100 Mbit
3 ... 0	(Reserved)

Board Status Word Bit Definition by Module Type

The following table describes the values of the Module Types.

Value of Bits 15 ... 12	Module Type
0	NOE 2x1
1	ENT
2	M1E
3	NOE 771 00
4	ETY
5	CIP
6	(Reserved)
7	(Reserved)
8	(Reserved)
9	(Reserved)
10	NOE 771 10
11	NOE 771 01
12	NOE 771 11
13 ... 15	(Reserved)

For bit level detail for the Momentum 170ENT1101 and Momentum 170ENT11000 see the *Momentum Ethernet Communication Adapter 170ENT11001 and 170ENT11000 User Guide*, 870USE11400.
For bit level detail for the 140NOE211xx see the *TCP/IP Module User Guide*, 840USE10700.

Global Data (Publish / Subscribe) Utility

5

At a Glance

Introduction

The material in this section presents the Global Data (Publish / Subscribe) utility available on the following modules.

- 140 NOE 771 01
- 140 NOE 771 11
- HE CPU 651 x0

For more information on the publish-subscribe model, go to this URL:
`http://www.isa.org/journals/intech/feature/printable/1,1171,596,00.html`

What's in this Chapter?

This chapter contains the following topics:

Planning the Global Data (Publish / Subscribe) System

Overview

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 **Global Data Configuration** Web 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 %MW (4x registers) 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 %MW words (4x registers)
- A device can subscribe of up to 64 network variables of up to 2048 %MW words (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
- A 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

Planning Your System Configuration

The Global Data (Publish / Subscribe) utility is a powerful function incorporated into the NOE product line. Implementing Global Data requires a configuration that spans many PLCs throughout the system. Therefore, we recommend preplanning your installation before implementation. Work spent on preplanning saves time and money by reducing errors and unnecessary debugging time. Preplanning also serves as an aid to ensuring consistency throughout the system.

Go to paper before computer.

We offer the following table to help with your system planning. The table below is a graphic representation of a recommended configuration table for system planning, which we call the **Global Data Planning Spreadsheet**. You may create your own table using the format below or you may download a Microsoft *Excel*™ spreadsheet template which is available on the Schneider public Web site.

Here is the graphic representation of the **Global Data Planning Spreadsheet**.

Parameter Checking	**Variable ID**	**Symbol** [1.]	**Length (Registers)**	**Device Number**				**Variable Public. Status**
				1	2	...	3	
	1	*VALVE_STATUS*	*20*	*PUB*	*SUB*		*NONE*	OK
	2	*VALVE_CONTROL*	*10*	*SUB*	*NONE*		*PUB*	OK
	...							
	64	*PUMP_CONTROL*	*50*	*SUB*	*PUB*		*NONE*	OK
			Device Publication Status:	OK	OK		OK	
			Total Publication Size per Node:	20	50		10	
			Total Subscription Size per Node:	60	20		0	

Group IP Address	*239.255.255.0*
Multicast Filtering Enabled	*OFF*
Default 4x Address for Health	*400100*
Distribution Period	*10*
Health Timeout	*1000*
Data Zone	*400200*

1. Entries or changes to the symbol (description) do NOT affect or change a variable or the system. The Symbol used in the Quantum product line has no relation to the Concept / Unity product line symbol.

Table of **Global Data Limits**

Parameter	Limit
Maximum number of publish variables per device	1
Maximum size for the publish variable	512 Registers = 512 Words (16 bits) = 1024 Bytes
Maximum number of subscription variables per device	64 (63 if this device is publishing)
Maximum size for the subscripe variables per device	2048 registers = 2048 Words (16 bits) = 4096 Bytes

Note: We recommend that you consider the following when planning.

- 10 to 20% Increase margin for growth
  We suggest that you allow for a percentage increase in growth of any variable, a 10 to 20% increase allowance should be sufficient.
- Add at end
  We recommend that you add variables at the end of the configuration because variables added at the end of the configuration do not affect the existing application address. Therefore, you avoid changing the existing addresses in your configuration, which can be a time consuming process.

Table of **Global Data Planning Spreadsheet**

Parameter	Description
Parameter Checking	Reserved
Variable Id	Represents the Data ID on the NOE's **Global Data Configuration** Web page
Symbol	Symbolic name for Global Data exchange.
Length Words (Registers)	Length of Global Data information. Number of %MW words (4x registers).
Device Number	Number of devices for the Global Data network. Of up to 64.
Variable Public. Status	Automatic information of the correct publication status of the Global Data network. Only by using the Microsoft *Excel*™ spreadsheet. Information per symbol.
Device Publication Status	Automatic information of the correct publication status of the Global Data network. Only by using the Microsoft *Excel*™ spreadsheet. Information per device.
Total Publication Size per Node	Publication size for the specific node. The maximum publication size is 512 words (registers) per node
Total Subscription Size per Node	Subscription size for the specific node. The maximum subscription size is 2048 words (registers) per node
Group IP Address Enabled	IP address for multicast networking. Identifies the stations distribution group. The address range is from 224.0.0.0 to 239.255.255.255
Multicast Filtering Enabled	A check box for Ethernet switches that support multicast filtering.
Default Address for Health%MW (4x register)	%MW (4x register) address for the Health bits. This is the memory area where the Health bits are stored. It has the size of 4 words (registers).
Distribution Period	Is the minimum number of controller scan times before an update will occur.
Health Timeout	Is the maximum time between received subscriptions before a subscription is declared unhealthy (faulty). The value is measured in milliseconds and can be set to a value that ranges from 50 through 10000 ms (increase in units of 50 ms)
Data Zone	The starting address for the data. This are the registers where the data information are stored.

Multicast Filtering

Overview

Your NOE may offer the multicast filtering functionality.
The global data service synchronizes several stations located in a distribution group. A distribution group is a set of stations identified by using the same IP multicast address for all stations in the group. By using the same IP address for multiple devices, multicast exchanges can be used to distribute global data. Several independent distribution groups can coexist on the same sub-network. Each distribution group posses its own unique IP multicast address.
Early versions of Switches treat multicast packets as a broadcast. Therefore, transmitting broadcasts to all nodes, and thereby suppressing all benefits of both switching and multicasting. Newer version of switches provide automatic Multicast Filtering, and consequently only forward multicast traffic to the ports that are connected to registered end-stations.
Multicast Filtering uses the GARP Multicast Registration Protocol (GMRP) to inform a switch which IP Multicast Addresses are of interest to the attached device GMRP is defined in the IEEE 802.1D-1998 Standard, which is available as a free download at: http://IEEE802.org.
In order to use Multicast Filtering, you need to:

1. Ensure that your Switch supports IEEE 802.1D - 1998
2. Click the **Multicast filtering** check box on the **Global Data Configuration** area on the Web page.

Reducing Traffic

Multicast Filtering helps to reduce the traffic on a network, because broadcasts are sent only to interested, or subscribed, devices.
For distributed applications and one to many communications multicast affords advantages over unicast:

- Utilizes the network bandwidth more efficiently
- Sends a single transmission instead of multiple transmissions.
- Reduces collisions
- Optimizes the performance of Ethernet module processing

Using Multicast Filtering

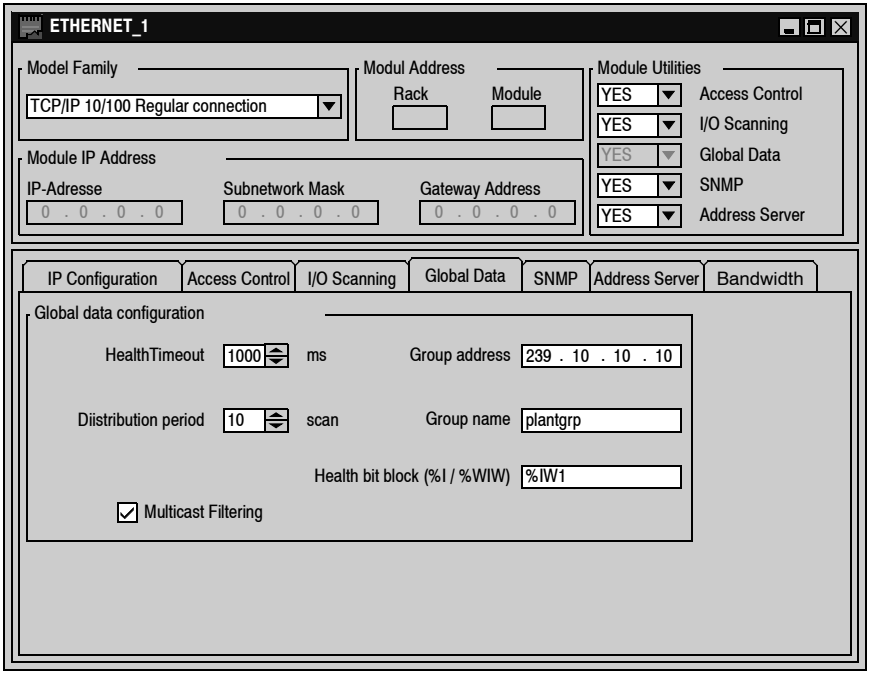
These ConneXium switches support multicast filtering. Other switches from alternate vendors also support multicast filtering.

Switch	Description
499NES17100	Managed Switch with 7 ports 10/100BASE-TX
499NOS17100	Managed Switch with 5 ports 10/100BASE-TX and 2 ports 100BASE-FX

Quantum NOE Global Data Configuration

Introduction

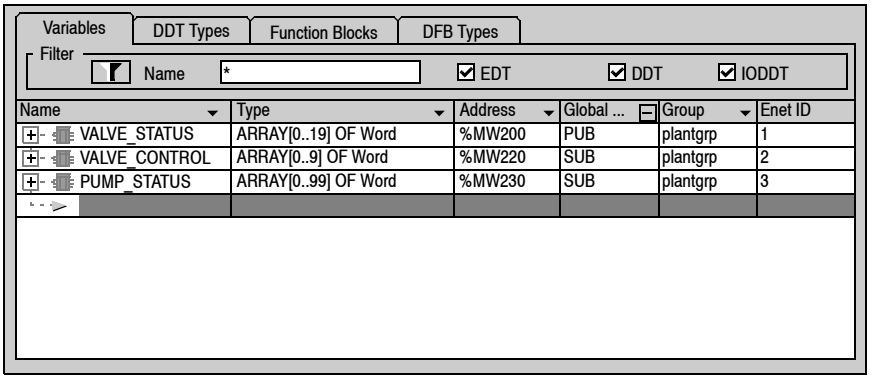
Global data configuration is carried out in the network configuration as well as the data editor.
The variables for the Publish/Subscribe procedure are configured in the data editor.
The screen shot shows the network configuration Global data configuration settings.



Parameter description

Parameter	Description
Health timeout	After this time period has run out, the data received becomes invalid.
Group address	Class D Multicast IP address. All nodes in the global data procedure use the same Multicast address for distributing or receiving data. The address range is: 224.0.0.0 to 239.255.255.255.
Distribution time	Time after which the data is received or sent. Minimum scan time of the PLC.
Group name	Logical name. Defines the varibale allocation to different communication configurations in the variablen editor.
Status bit block	Address for retrieving the status information of the global data procedure.
Multicast filtering	Activates an Ethernet switch on connection that supports Multicast filtering.

The screen shot shows an image of the data editor.



Parameter description

Parameter	Description
Name	Variables ID
Type	Variable type
Address	Variable address
Enet	Type of Global Data Variable. Options: No/Publish/Subscribe
Group	Group name for allocating the variables of the existing network description. When creating the different Ethernet networks, a logical connection is arranged here between the network and the variable declaration.
Enet ID	Ethernet ID. Representation of the administrative order.

Configuration of Global Data (Publish / Subscribe) by the Web for NOE 771 x1

Modeling the System Configuration

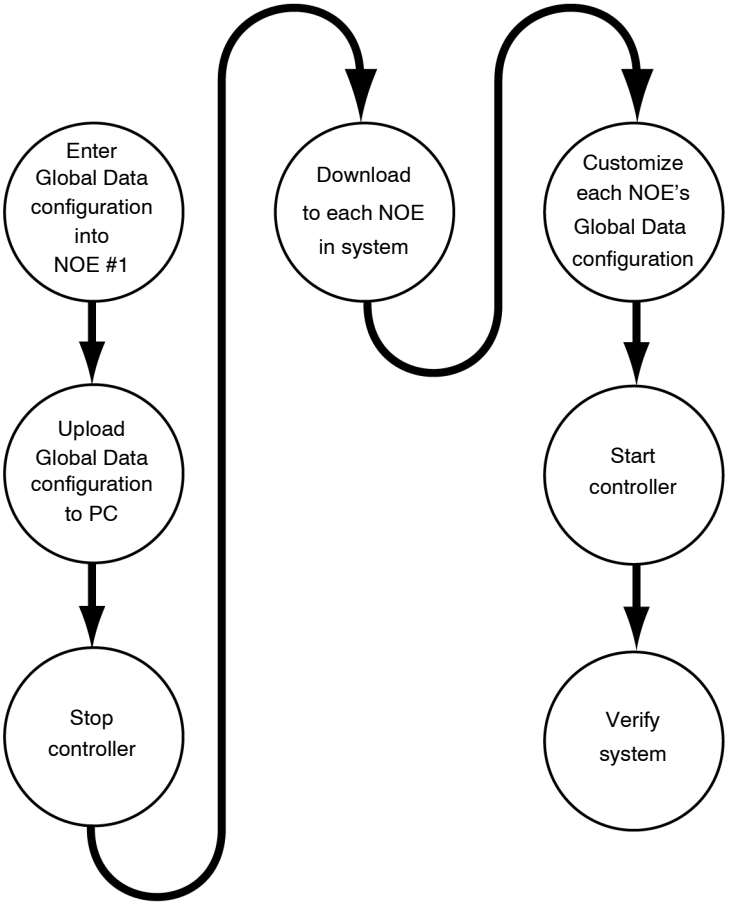
There are two methods of configuring a system.

- **Configure Each Device Separately**
  Using this method you configure devices via the **Global Data Configuration** Web page for each device. Repeat for each device in the system. We suggest that you do not use this method because entry errors may occur due to the fact that the same information must be reentered on each and every device, possibly as much as 64 times.
- **Copy Configuration**
  You configure all variable IDs, symbols (descriptions), and lengths on one NOE, then upload to your PC, and download the same configuration to all devices, and finish with a small customization to each node.

Note: We recommend that you use the **Copy Configuration** method to configure all variable IDs, symbols (description), and lengths.
Choosing this method reduces entry errors, allows for verifying the configuration, and permits you to determine if the system is satisfactory for your needs before implementing the configuration system wide.
By using this method you enter the variable ID, symbol (description), and length only once thus ensuring consistency.

When your planning is complete, follow the *Configuring Your NOE* steps below. We present these steps both as a picture and as instructions.

These are the *Configuring Your NOE* steps displayed as a picture



These are the *Configuring Your NOE* steps written as instructions.

Step	Action
1	Select one NOE.
2	Using your browser, navigate to that NOE's **Global Data Configuration** page. Follow these links:| **Diagnostics and Online Configuration** | **Configure NOE** | **Configure Global Data** | **Global Data Configuration** |
3	Enter the configuration's variable IDs, symbols (description), and lengths.
4	Click the **Update Global Data Configuration** button to update the file. This creates the file `glbdata.ini`. Full path follows: `ftp://NOE_IP_ADDRESS/wwwroot/conf/glbdata/glbdata.ini` Note: You substitute `NOE_IP_ADDRESS` with an address like 192.168.000.010. Please check the address with your system administrator.
5	Using the FTP process, upload the `glbdata.ini` file to a PC. See the section below, **Uploading a glbdata.ini file**.
6	Stop each controller before you do the customization.
7	Using the same path, download the `glbdata.ini` file to the other devices. See the section below, **Downloading a glbdata.ini file**.
8	Connect your Web browser to each device to customize start address and the Publish / Subscribe setting.

Note: The Global Data Configuration page is populated with data which comes from the `glbdata.ini` configuration file.

Uploading a glbdat.ini File

The following procedure describes the steps to upload the glbdata.ini file.

Step	Action
1	At the DOS prompt type **FTP** followed by the IP address and press **Enter**.
2	At the User prompt type **FTP** Username and press **Enter**.
3	At the password prompt enter your FTP Password and press **Enter**.
4	At the FTP prompt type **cd wwwroot/conf/glbdata** and press **Enter**.
5	At the FTP prompt type **get** and press **Enter**.
6	At the local file prompt type **glbdata.ini** and press **Enter**.
7	At the remote file prompt type **glbdata.ini** and press **Enter**.

Downloading a glbdat.ini File

The following procedure describes the steps to download the glbdata.ini file.

Step	Action
1	At the DOS prompt type **FTP** followed by the IP address and press **Enter**.
2	At the User prompt type the FTP username and press **Enter**.
3	At the password prompt enter your FTP Password and press **Enter**.
4	At the FTP prompt type **cd wwwroot/conf/glbdata** and press **Enter**.
5	At the FTP prompt type **put** and press **Enter**.
6	At the local file prompt type **glbdata.ini** and press **Enter**.
7	At the remote file prompt type **glbdata.ini** and press **Enter**.

Verifying System Operation

To ensure that the system is operational, do the following:

Step	Action
1	Verify all controllers are running.
2	Look at the health of all variables using the **Global Data Diagnostic** page. Follow these links:| **Diagnostics and Online Configuration** | **NOE Diagnostics** | **Global Data**

Configuring the Global Data (Publish / Subscribe) Utility

Overview

Whether you use the Configure Each Device Separately or the Copy Configuration method, the procedure to configure individual parameters is the same. Therefore, in order to use the Global Data (Publish / Subscribe) utility in the NOE, you need to configure the Global Data parameters including:

- Distribution period
- Multicast filtering
- Health bit location
- Global Data base address
- Group IP address

The following sections describe in detail the exact steps to configure each parameter via the **Global Data Configuration** page.

Accessing the Global Data Utility

You access the Global Data utility through the **Global Data Configuration** page.

Step	Action
1	On your screen click the **Diagnostics and Online Configurations** link.  **Schneider Automation Web Server** Diagnostics and Online Configurations **French** **German** **Italian** **Spanish** Copyright © 1998 - 2003 Schneider Automation, All rights reserved.
2	When you click the **Diagnostics and Online Configurations** link, you are requested to enter user name and password.
3	Enter your user name and password. The **Configure NOE** page appears.
4	Click the **Configure NOE** link. The **Configure NOE** page appears.

Step	Action
5	Click the **Configure Global Data** link.  **Configure NOE** **Configure SNMP** **Configure Address Server** **Configure Global Data** **Configure NTP** **Configure Email** Home | NOE Proper- | NOE Diagnos- | Support
6	The **Global Data Configuration** page appears.  **Global Data Configuration** Gro 23 . 20 . 25 . 25 Multicast Distribu- 5 sca Health 100 m Healt %M 4 to 7 Data %M 0 to 5 Update Global Data Configu- **Variable Table** Dat | Type | Symbol | Address | Lenght 1 | SU | var_01 | %M 48 | 2 2 | PU | var_02 | %M 60 | 2 3 | SU | var_03 | %M 44 | 2 4 | NO | | %M | 5 | NO | | %M | 6 | NO | | %M | 7 | NO | | %M | 8 | NO | | %M | 9 | NO | | %M | In this screen you may make changes to the configuration.

Configuring Global Data

After you have completed the Modelling System Configuration process using the second method, Copy Configuration, then you modify the following parameters:

- Distribution period
- Health Time Out
- Health Bits location
- Start address
- Type: Pub / Sub / None

Please do NOT change Symbol (description), and Length.

To change the Global Data variables of the group box on the **Global Data Configuration** page, follow the instructions below.

Step	Action
1	Adjust the **Distribution Period Cycle**. Enter a value from 1 through 50. **Note: Distribution period** is the minimum number of controller scan times before an update will occur.
2	Before entering a value in the **Group address** field, identify the station's distribution group. The **Group address** entry will be an IP address from **224.0.0.0** through **239.255.255.255**. **Group address:** the Class D Multicast IP address used for a distribution group. All members of this distribution group are configured to use the same group address, and therefore, all members can communicate with each other using Global Data.
3	Set the timeout in the **Health Time Out** field. This value is measured in milliseconds and can be set to a value that ranges from 50 through 10,000 ms (increase in units of 50ms). **Note: Validity Time** is the maximum time between received subscriptions before a subscription is declared unhealthy (faulty).
4	In the **Data Zone %MW** field set the **Data Zone** variable.
5	If you are connected to an Ethernet switch that supports multicast filtering, click the **Multicast filtering** check box.
6	Enter 4x Register Location for the Health Bits. This is the register where the health bit will be stored

Note: Health bits run in different directions.

- I/O scanner health bits run left to right.
- Global Data health bits run right to left.

Changing Global Data Variables

To change the Global Data variables that appear in the **Variable Table** area, follow the instructions below.

Step	Action
1	Highlight the identification number in the **Data ID** column.
2	In the Type column select the publish / subscribe variable type from the drop down list. Three options are available publish, subscribe, or none. These options display on the screen as follows: • **NONE** • **SUB** • **PUB**
3	In the **Symbol** column you may enter text to describe the variable.
4	In the **Address** column you see the application address for this variable. **Note:** This is a read only field.
5	In the Length column for each row, type a value, which represents the number of %MW words. The ending %MW word field is automatically updated. If you are using the second method, **Copy Configuration**, you update **Length** the first time only.
6	When you are finished, click the **Update Global Data Configuration** button.

Verifying System Operation

To ensure that the system is operational, do the following:

Step	Action
1	Verify all controllers are running.
2	Look at the health of all variables using the **Global Data Diagnostics** page. Follow these links:| **Diagnostics and Online Configuration** | **NOE Diagnostics** | **Global Data**

I/O Scanner

6

At a Glance

Introduction

This chapter discusses the Ethernet modules' I/O scanner capabilities.

What's in this Chapter?

This chapter contains the following topics:

I/O Scanner Concepts

Overview

The following information describes how to configure the I/O scanner.

Introduction

The I/O Scanner is a feature that resides in an Ethernet (NOE 771 00, -01, -11, and CPU 651 x0 modules). The I/O Scanner allows, through a controller, repeated reading from and/or writing to scanned devices.
Configure the I/O Scanner with Schneider Electric's programming package Unity Pro. Use the I/O scanner to transfer data between network devices.

I/O Scan List

The I/O scan list is a configuration table that identifies the targets with which repetitive communication is authorized. While the controller is running, the Ethernet module transfers data to and from the controller's registers as indicated by the I/O scan list.

Health Block Bits

Each bit corresponds to an entry in the I/O Scanner table. (See *Modicon Quantum with Unity I/O Scanner Configuration, p. 169*) Each entry in the table represents one logical device.
The bits contain the health status for the Modicon Quantum I/O Scanner.

I/O Scanner Parameters

Functionality of the I/O Scanner.

Parameter	Value
Max. No. of Devices	64: 140 NOE 771 00 (Version 2.2 or earlier) 128: 140 NOE 771 00 (Version 3.0 or later), 140 NOE 771 01, and 140 NOE 771 11 only 128: HE CPU 651 x0
Max. No. of Input Words	4000
Max. No. of Output Words	4000
Health Timeout Value	User configured (1 ms to 2 s in 1 ms increments)
Last Value (Input)	User configured (Zero or Hold)
IP Address	User configured IP address of scanned device (Slave IP)
Local and Remote Register Reference	User configured
Repetition Rate	User configured
Unit ID	User configured Configure ID only if using a bridge
Operation through a bridge	Modbus bridge: Supported
	Modbus Plus bridge: Supported

To configure the I/O Scanner, refer to the section *Modicon Quantum with Unity I/O Scanner Configuration, p. 169*.

Using the I/O Scanner across a Router

Note: I/O Scanner in the 771 x1 and HE CPU 651 x0
The I/O scanner can scan devices through an IP router with a TTL of 10.

Device Control Block

Important information about using the Device Control Block:

1	Registers	The Device Control Block consists of registers either eight (8) words or four (4) double words. Contents of the registers are mapped in the controller's memory. Each bit corresponds to an entry in the table.
2	Disabling Devices	Each I/O Scanner device can be disabled. To disable individual devices: **1.** Select the Device Control Block option. (Insert a check mark in the box.) **2.** Set the associated bit = 1. (For example, %MD2:4)
3	Mapping Device Control Block Bits to I/O Scanner Entry Numbers (#)	See the table for mapping entry numbers to bits. Each entry number represents a logical device on the network.
4	Setting Bits	If Device Control Block bit is set to • 0 = Device is enabled • 1 = Device is disabled

Note: Concept Users
Use diagnostic words instead of "Device Control Block."

Mapping Device Control Block Bits to I/O Scanner Entry Numbers (#)

Register																	**Register**
Word 1	Table Entry #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Double Word
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Word 2	Table Entry #	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
							Word 3 through Word 7											
Word 8	Table Entry #	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Modicon Quantum with Unity I/O Scanner Configuration

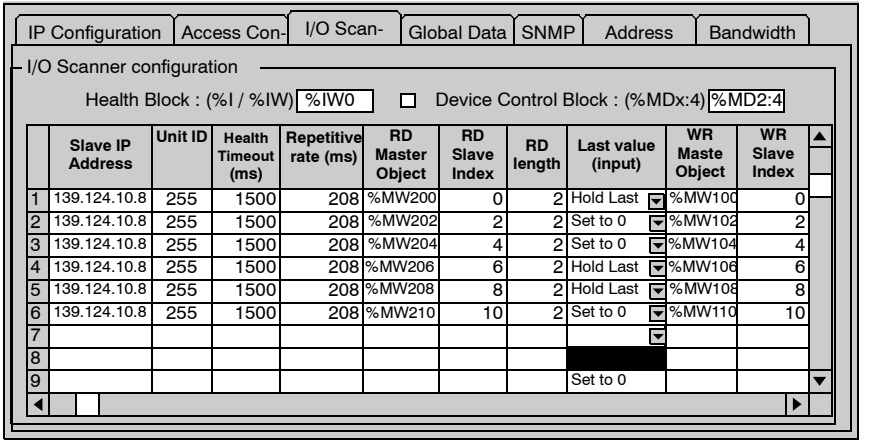
Introduction

Use the I/O scanner to transfer data between master devices and slave devices.

Note: Important Information: Enable/Disable Device Control Block
If you enable the Device Control Block, you must have
1. Unity Pro V2.0 or higher
2. NOE 771 01 and NOE 771 11: version 3.5 or higher
3. 140 CPU 651x0: version 2.0 or higher
Enabling the Device Control Block with outdated versions of the firmware, causes the I/O scanner to NOT work.

I/O Scanner Configuration Dialog

The I/O scanner tab displays the I/O Scanner configuration dialog. Use for configuring a NOE 771 00, -01, or -11. Note: the dialog for the CPU 651 x0 does NOT have a Health Block field.



I/O Scanner Configuration Parameters

Set configuration parameters in the I/O Scanner configuration dialog. Enter data in appropriate fields.

Parameter/Field	Description
Health Block: (%I/%IW)	Length of the table: 8 words (%IW) or 128 bits (%I). Each bit represents the status of the corresponding slaves. **Note**: Health Block field is available only on NOE 771 00, -01, and -11. Health Block field is NOT available on CPU 651 x0.
Device Control Block Check Box	If the option is selected (check mark appears in box), ● enabled User allows master to send requests to slave. If the option is NOT selected (check mark does NOT appear in box), ● disabled No requests sent from master to slave.
Device Control Block: (%MDx:4)	**Note**: If the Device Control Block parameter is disabled (check mark does NOT appear), the I/O Scanner closes the connection and sets the Health Bit to an unhealthy state (Health Bit set = 1).
Entry #	Entries available: 1 -128 Each entry represents a logical device on the network.
Slave IP Address	IP address of the scanned Ethernet device
Unit ID	Specific ID of the device on the Modbus/Modbus Plus network The device connects to the Ethernet through a bridge.
Health Timeout (ms)	Timeout period specified in milliseconds
Repetitive rate (ms)	Rate at which the data will be scanned
RD Master Object	Destination address in the controller for reads
RD Slave Index	Source address of the input/output module for the read period
RD length	Number of words to read
Last value (Input)	Status of the inputs in the event of an error
WR Master Object	Source address of the controller for writes The write is carried out in words.
WR Slave Object	Destination address of the slave for writes
WR length	Number of words to write
Description	Information

Health Block

Coordination of the bits to the different data types

Bit	Data Type	
	%I	**%IW**
1	%I1	%IW1.0
16	%I16	%IW1.15
17	%I17	%IW2.0

Address Server Configuration / Faulty Device Replacement

7

At a Glance

Introduction

This section covers the Address Server Configuration / Faulty Device Replacement service available only on the NOE 771 -01 and -11, Transparent Factory / Real Time modules. The Faulty Device Replacement service offers you a method of handling device replacement without disrupting the system nor interrupting service.

What's in this Chapter?

This chapter contains the following topics:

Address Server Configuration / Faulty Device Replacement

Overview

The Address Server provides 2 capabilities:

1. Standard BOOTP Server Behavior
   Enter the MAC Address and IP Configuration. The NOE BOOTP server will provide the IP configuration when the device sends a BOOTP request.
2. Faulty Device Replacement (FDR) Behavior
   Enter the Role Name or the MAC Address of the device. The device will send its Role Name or the MAC Address with its DHCP request. With the DHCP response from the NOE, the device will receive its IP Configuration, plus the name and location of a configuration file.
   The next step for a FDR-compliant device is to download its configuration from the NOE.
   Consult your Schneider Electric Sales Representative for the current list of FDR-Compliant devices.

The Address Server in the NOE supports both modes at the same time. You select a mode by entering either the MAC Address or the Role Name in the **Address Server Node Configuration** page. You may enter only one or the other, but not both.

The Faulty Device Replacement capability allows automatic configuration of FDR-compliant devices.

Identifying a Role Name

Inherent in the discussion of Faulty Device Replacement is the idea of a Role Name. A Role Name is a logical name that the user assigns to a device, a logical name that has a meaning within the application.

Some examples of a Role Name might be:

- **ENT_6** (6th Momentum ENT in your application)
- **OUTPUT_VALVE_2** (2nd Output Valve in your application)

Role Names are case sensitive.

Faulty Device Replacement

The Faulty Device Replacement service offers a method of handling device replacement without disrupting the system nor interrupting service. Should a device fail, replacing that device is easy. When the new device is physically connected to the network, the system (including the new device) is able to

- Provide the replacement device with the IP address of the previous device
- Ensure that new device is working in the same manner as the previous device
- Restore the I/O device application parameters in order to restart the device with the same configuration as before the failure

Faulty Device Replacement enables you to avoid configuring a new device when a faulty device is replaced: You enter the device name in the new device, and the task is completed. You have a new configuration scheme for I/O and smart devices, which allows:

- Creating an automatic network configuration
- Managing automatic application parameters

Faulty Device Replacement is implemented using the combination of DHCP and FTP/TFTP standard protocols. The device implements a DHCP client and an FTP or TFTP client. Choosing between FTP and TFTP has no direct impact on your system. The choice depends only on device memory footprint: TFTP is much smaller than FTP.

Faulty Device Replacement offers the following functionality

- FDR Manager
- FDR Agent

Faulty Device Replacement management is based on three entities:

- Agent device embedding the DHCP client and FTP/TFTP client
- DHCP server
- FTP/TFTP server

Role Name

The logical Role Name should be written on devices. The technician can get the new device from stores, enter the corresponding Role Name into the device, and place the device in the system. The device automatically gets its configuration and starts running with no further input from the technician. This process is designed to get your machine up and running quickly. All the technician has to do for any FDR compliant device is to enter the Role Name into the new device.

Address Server Limits

This table displays the parameters and limits of the Address Server.

Parameter	Limit
Maximum number of Address Server entries	128
Maximum size of the configuration file per device	4K bytes
Total size of Faulty Device Replacement storage	512K bytes
Maximum Role Name size	16 Characters

Note: For the DHCP Server to work correctly the following must be observed:
- Address class and subnet class configured for the devices has to match
- Address class of the NOE and of the devices has to be the same

Operating on a Corporate Network

Note: Operating on a corporate network

- Before placing the NOE on a corporate network, Schneider Electric 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 have to 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.

Available FDR Agents

Three FDR agents are available
- Momentum ENT
- Micro ETZ
- ATV58*

*Available 2002

The `role-name.prm` configuration files are stored in the NOE in non-volatile memory. Therefore, after a power failure all configurations will be available.

BOOTP and DHCP Compatible Devices

Use either the MAC Address or the Role Name to assign IP addresses. Therefore, you may use the DHCP server with devices that support BOOTP only, such as Momentum ENT v1.

Understanding Faulty Device Replacement

Understanding Confirmation and Error Messages

In addition to highlighting errors the system provides confirming information and error messages.

Confirmation Message If you successfully added, modified, or removed and entry, the following alert message appears.

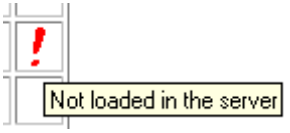
Error Messages Error messages, appearing as an icon in the seventh column, display on the Address Server Configuration page, or they appear as dialog box.

Error Icon If an entry is not loaded in the DHCP server or loaded with a different configuration, an icon of an exclamation point displays in the seventh column. The icon informs you of the difference between the current and stored information.

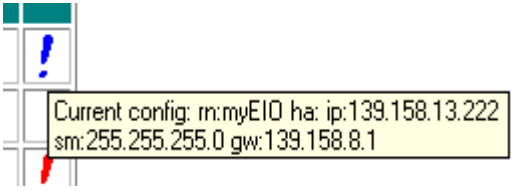
- Not Loaded in Server: A red icon displays.
- Duplicate Configuration: A blue icon displays.

Place the pointer over the icon and a pop-up window appears and displays a message

- Not Loaded in Server:



- Present Configuration:



Error Dialog Box If you entered an existing role name or MAC address, you will receive an alert message asking you to correct the entry.

Modifying the Database

If you need to add or modify an entry in the database, use the **Address Server Node Configuration** page. Three fields must be filled in **Device IP address**, **Subnet Mask**, and **Gateway**.

Choose either the **Role Name** or **Device MAC address** field. When one field is selected, the other is made unavailable.

Adding Entries If you are adding a device, the page appears with values. You need to enter either a Role Name or a MAC Address.

If you are adding an entry, submit your selection using the **Add the Entry** button.

Modifying Entries If you are modifying an entry, the **Device IP address**, **Subnet Mask**, and **Gateway** fields display with the current configuration.

If you are modifying an entry, submit your selection using the **Reset the Form** button.

Each field of the **Address Server Node Configuration** page has restrictions, which are detailed below.

- **Role Name**
  Each role name must be unique. Only letters, numerals, and underscores are allowed. No more than 16 characters are allowed, and no spaces are allowed.
- **Device MAC Address**
  This address must be in hexadecimaL format and six (6) bytes long (6x2 characters). The MAC address can be entered with or without a delimiting character between each pair of lower or upper case hexadecimal characters. The delimiting characters improve readability. There are three choices for a delimiting character:
  - Space " "
    Use the spacebar to create the space.
  - Colon ":"
  - Hyphen "-"
- **Device IP address**
  The IP address must use the standard numeric Internet Protocol address that uniquely identifies each computer on the network. The IP address is a 32-bit identifier made up of four groups of numbers (from 0 through 255), each number separated by a period, for example `123.456.78.9`.
- **Subnet Mask**
  The subnet mask must be entered in IP address format.
- **Gateway**
  The gateway must be entered in IP address format. The gateway must be on the same subnet as the device.

Configuring Faulty Device Replacement

Configuring the Address Server

To configure the Address Server you use Web pages generated by the embedded Web server. The first page that appears is the **Address Server Configuration** page. The first column contains buttons used for selecting devices. The **Address Server Configuration** page displays configuration information for each device in the system and has seven columns in the table.
Displayed on this page is information about:

- Role Name
- Mac Address
- IP Address
- Subnet Mask
- Gateway

A additional, unnamed column indicates if there is a difference between the current and the stored configuration. If a difference exists, an exclamation point is displayed. This is the **Address Server Configuration** page. All devices are compatible.

Address Server Configuration

	Role Name	MAC Address	IP Address	Subnet Mask	Gateway	
○	myNIP		192.168.3.11	255.255.255.0	192.168.3.11	
○	ENT_1st_floor		192.168.5.14	255.255.0.0	192.168.2.1	

Refresh Address Server Database Table

Add a New Entry | Change an Entry | Delete an Entry

Hom | Configure | NOE Prop- | NOE Diag- | Sup-

On the Address Server Configuration page you can:

- Add a New Entry
- Change an Entry
- Delete an Entry

Choosing Options

The Address Server Configuration page allows you to choose different options for adding or altering the configurations of your NOE. The options available to you are:

- Selecting an entry
- Adding an entry
- Changing an entry
- Deleting an entry

Below we describe the method and options chosen to perform any of the four options listed above. Screen shots are presented to accompany the *Adding an entry* section.

Selecting an Entry When the page displays, by default no entries are selected. Use the radio buttons in the first column to select an entry. Only one entry may be selected at a time.

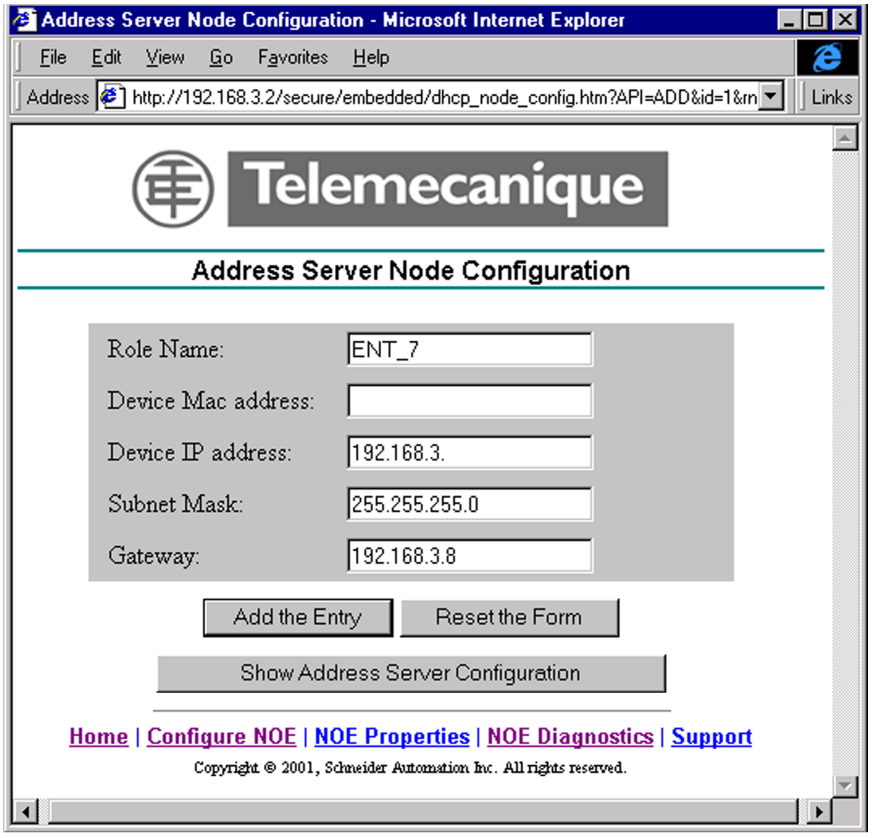
Adding an Entry When the **Add a New Entry** button is selected, the **Address Server Node Configuration** page appears. This page displays information about a device.

If you selected a device, this page displays the device's configuration. Configuration information displays in four of the five fields of the dialog box. Only the Role information field is blank. You should enter a Role name, for example *ENT_7*.

If no device is selected, default values appear in all the fields.

Changing an Entry Before using this button, you must select an entry in the database by choosing one of the radio buttons in the first column. If you fail to choose an entry, an error message appears.

When the **Change an Entry** button is selected, the **Address Server Node Configuration** page appears. The information displayed is for the device selected.



Deleting an Entry Before using this button, you must select an entry in the database by choosing one of the radio buttons in the first column. If you fail to choose an entry, an error message appears.
The entry selected will be removed from the database. Before completely deleting an entry, a warning message appears. Click **Yes** if you want to delete the entry, no if you don't.

If you click **Yes**, a dialog box appears.

Click OK. Another dialog box appears notifying you that the deletion was successful.

Highlighting Errors

If there are problems with the configuration parameter information entered, the system indicates problems using a highlighting mechanism. All the configurations appear in purple and italic, and the device with configuration problems appears in red and bold.

The system detects the following errors:

- Bad **Role Name**
  The valid **Role Name** characters are:
  - a through z (lower case)
  - A through Z (upper case)
  - "_" (underscore)
- Bad **MAC Address**
  The valid **MAC Address** characters are:
  - 0 through 9
  - A through F
- Wrong **IP Address**
- Wrong **Subnet Mask**
- Wrong **Gateway**
- Double Entry
  Each entry must have a unique **Role Name** or **MAC Address**. If a duplicate **Role Name** or **MAC Address** is entered, the system highlights the error.

Erroneous errors are not loaded into the DHCP server. Therefore, errors must be corrected before loading. There are two ways of correcting the error.

Correcting through Web page Make the changes on the Web page and submit the change.

Correcting through the Address Server configuration file Make the changes in the file and reboot the server.

Network Management Service (SNMP)

8

At a Glance

Introduction

The following material describes the Simple Network Management Protocol (SNMP) and the Schneider private MIB. Under the Schneider private MIB is the Transparent Factory Ethernet private MIB.

What's in this Chapter?

This chapter contains the following topics:

SNMP

Overview

This following information describes the Simple Network Management Protocol (SNMP), which is configured on your NOE or 140 CPU 651 x0.

Introduction

Network management software allows a network manager to

- Monitor and control network components
- Isolate problems and find their causes
- Query devices such as a host computer, routers, switches, and bridges to determine their status
- 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 following 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. Managers and agents then exchange requests and responses according to the network management protocol.

Simple Network Management Protocol

Your NOE module is configured with the Simple Network Management Protocol (SNMP), which is the standard protocol used to manage a local area network (LAN). SNMP defines exactly how a *manager* communicates with an *agent*.
The SNMP defines 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 SNMP has access to has to be defined and given a unique name. Both the manager and agent program must agree on the names and the meanings of the fetch and store operations. The set of all objects SNMP can access is known as a *Management Information Base (MIB*).

The Private MIB

Schneider obtained a private MIB, Groupe_Schneider (3833). Under the Groupe Schneider private MIB is a Transparent Factory Ethernet (TFE) private MIB. The Transparent Factory SNMP embedded component controls the Schneider private MIB function.

Choosing a SNMP Manager

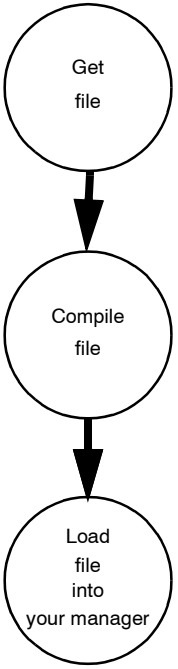
If you have a SNMP Manager already working, you may continue to use that SNMP Manager. If you are selecting a SNMP Manager, there are many SNMP Managers on the market, and you may use any of these managers. You must use a SNMP Version 1 compliant manager.
If you do not currently use a SNMP Manager in your organization and are evaluating SNMP Managers for purchase, then we recommend that you consider the HiVision, with the ConnexView Add-On developed for use with Schneider Automation PLCs. Please contact your Schneider Electric sales office for availability and pricing of HiVision, and ConnexView,.

Using a SNMP Manager

The process for obtaining a SNMP Manager

Step	Action
1	Get Schneider `.mib` file from the NOE Web page. You are going to find the `.mib` file as a packed file under /**wwwroot**/ **SchneiderTFE.zip** on your NOE module.
2	Compile `.mib` file in the compiler that comes with the NOE.
3	Load compiled `.mib` file to the SNMP manager.
4	When you are done, you will see the Schneider private MIB manager in your manager.

The process is simple.



More SNMP Information

SNMP and related subjects are well documented on Web sites and in many books

- As of this writing, a useful description appears on Microsoft's *Technet* pages. Browse to *http://www.microsoft.com/technet*. Use the **Search** function to find "Network Management for Microsoft Networks Using SNMP."
- Use an Internet search engine to search for a SNMP introduction, a SNMP tutorial, and other topics on SNMP.
- The SNMP FAQ from the news group `comp.protocols.snmp` appear on many `.com` and `.org` Web pages. Search for the combination of "`comp.protocols.snmp`" and "`FAQ`."
- A list of print books about SNMP appears in the SNMP FAQs. In addition, a search of most online retail book sites will yield a substantial list of titles.

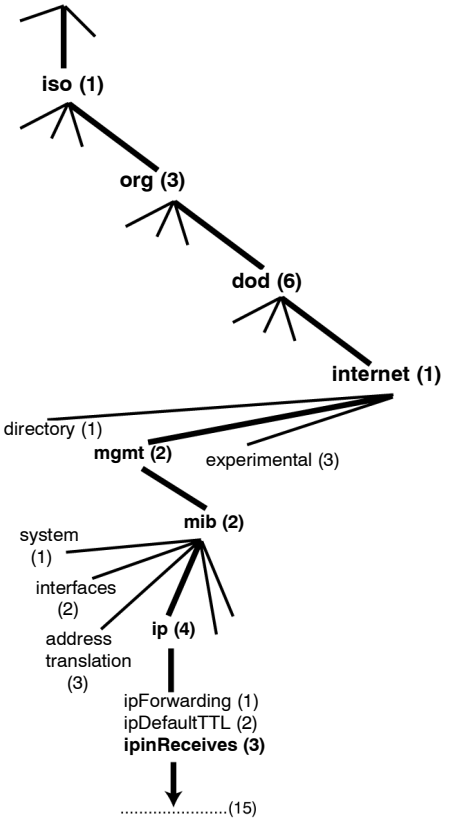
ASN.1 Naming Scheme

ASN.1 Overview

Abstract Syntax Notation One (ASN.1) is a formal language for abstractly describing messages to be exchanged between distributed computer systems.

An Example

Objects in a MIB are defined with the ASN.1 naming scheme that assigns each object a long prefix that guarantees that the name will be unique. For example, an integer that counts the number of IP datagrams that a device has received is named: *iso.org.dod.internet.mgmt.mib.ip.ipinReceives*.
The following figure depicts the ASN.1 Naming Scheme example.



This object name is represented in an SNMP message by assigning each part an integer. So, the above message would appear as 1.3.6.1.2.2.4.3.
Each integer has 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
- 2 = mib-2(1) group of managed objects
- 4 = ip — the mib-2(1) IP group (one of 11)
- 3 = ipinReceives — the MIB object

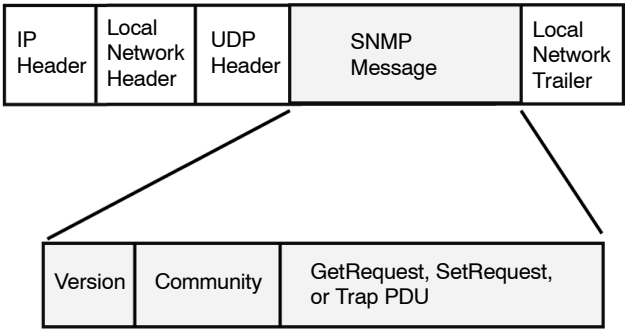
Configuring a NOE with SNMP

The Object Identifier (OID)

In the ASN.1 Naming Scheme example, the MIB object identified by the notation 1.3.6.1.2.2.4.3 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.

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 module uses the following 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.

Version & Community Identifiers

The version identifies the version number of the SNMP software being used by the manager and the agent. Your NOE supports Version 1 of the SNMP. The community is an identifier that you assign to your SNMP network. If community names for the manager and the agent do not 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 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 SysContact and SysLocation via the configuration page in the module's Embedded Web pages. After making changes in the SNMP Configuration Web page and to set those changes, reboot the module using hot swap.

Configuring a NOE with TFE Private MIB

Introduction

A MIB, a Management Information Base, is an element used in network management. Network management services are based on the need to monitor and to manage:

- Performance
- Fault occurrences
- Security

Each MIB contains a finite number of objects. Manage your MIB with a management station running an SNMP management application. The management application uses **GETs** and **SETs** to retrieve system information and to set system environment variables.

Schneider Private MIB

Schneider Electric obtained a Private Enterprise Number (PEN) from the Internet Assigned Numbers Authority (IANA). That number represents a subtree in the SNMP MIB, a number that is a unique identifier used for Groupe Schneider.
The object identifier for the root of the Groupe Schneider subtree is **`1.3.6.1.4.1.3833`** and represents a path to the subtree as follows:

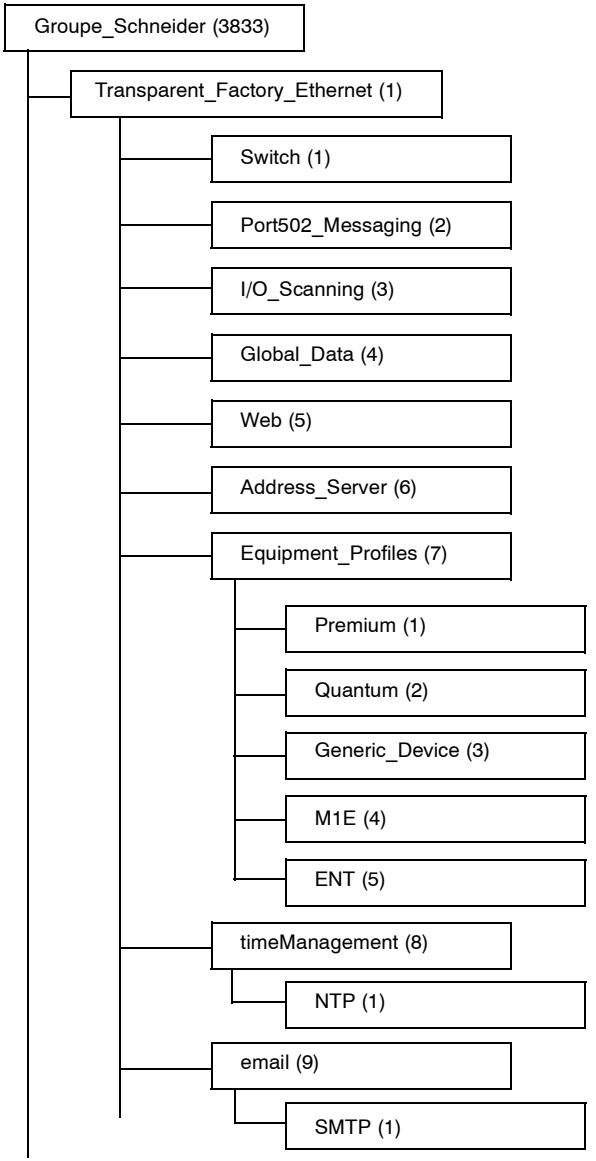
```
iso(1)
        org(3)
                dod(6)
                        internet(1)
                                private(4)
                                        enterprise(1)
                                                GroupeSchneider(3833)
                                                        Transparent_Factory_Ethernet(1)
```

Under the GroupeSchneider private MIB is a Transparent Factory Ethernet (TFE) private MIB, **Transparent_Factory_Ethernet(1)**.

TFE Private MIB

The Transparent Factory SNMP-embedded component controls the Schneider private MIB function. The Schneider private MIB, and associated services, perform Network Management on all components of the system. The Transparent Factory private MIB provides the data to manage the main Transparent Factory communication services for all the communication components of the Transparent Factory architecture (ETYs, NOEs, third party toolkit, ENTs, M1Es). The Transparent Factory private MIB does not define the specific management applications and policies.

The diagram following illustrates the Schneider Electric (Groupe_Schneider (3833) private enterprise MIB subtree.



The **Groupe_Schneider (3833)** subtree is the root of Groupe Schneider's private MIB in the Structure of Management Information (SMI) used by SNMP and defined in RFC-1155, which is a specification that defines the structure and identification of management information for TCP/IP-based networks.

Transparent Factory Ethernet Subtree

The **Transparent_Factory_Ethernet (1)** subtree defines groups that support the Transparent Factory Ethernet services and devices.

Service	Description
Switch(1)	Subtree defines a brand of switches labeled: ConneXium switches private MIB
Port502_Messaging(2)	Subtree defines objects for managing explicit client / server communications supporting applications, such as HMI, SCADA, or programming tools
I/O_Scanning(3)	Subtree defines objects for managing I/O device communications that use the I/O Scanner mechanism with the MB/TCP protocol
Global_Data(4)	Subtree defines objects for managing the application coordination service using a publish / subscribe protocol
Web(5)	Subtree defines objects for managing the activity of the embedded Web servers
Address_Server(6)	Subtree defines objects for managing the activity of the BOOTP and (or) DHCP servers
Equipment_Profiles(7)	Subtree defines objects for each type of device in Transparent Factory Ethernet's product portfolio
timeManagement(8)	Subtree defines objects for managing the UTC time stamp service
email(9)	Subtree defines objects for managing the mail service

Device subtrees, or groups, will be defined for the following devices:

- **Premium(1)**
- **Quantum(2)**
- **Generic_Device(3)**
- **M1E(4)**
- **ENT(5)**

As devices are added to Schneider's catalog, Schneider's private MIB will be extended in the following manner:

- If needed, a Transparent Factory, communication-service object will be added for the new device in the corresponding **Equipment_Profiles(7)** subtree. As many objects as needed can be added to this subtree.
- If needed, a new branch will be added at the same level as **Transparent_Factory_Ethernet(1)**. This subtree will be created for product-specific objects (such as the ATV58 object under the **IndustrialControl-Products (3) subtree)**.

When a new device is created, a corresponding object description is created in the ASN.1 format. The ASN.1 file(s) are then given to producers of SNMP manager software for inclusion in their products.

Port502 Messaging Subtree

The Port502_Messaging (2) subtree, or group, provides connection management and data flow services. The following list describes the function of each object.

Service	Description
port502Status(1)	Indicates the status of the service (Idle, Operational)
port502SupportedProtocol(2)	Indicates the supported protocols (MODBUS, Xway)
port502IpSecurity(3):	Indicates the status of the Port502 IP Security service (enabled/disabled)
port502MaxConn(4)	Indicates the maximum TCP connection number supported by the Port502 entity
port502LocalConn(5)	Indicates the TCP connection number currently opened by the local Port502 entity
port502RemConn(6)	Indicates the TCP connection number currently opened by the remote entity to the local Port502 entity
port502IpSecurityTable(7)	Indicates a table containing the number of unsuccessful TCP connection open tries from a remote TCP entity
port502ConnTable(8)	Indicates a table containing Port502 TCP specific information (MsgIn, MsgOut)
port502MsgIn(9)	Indicates the total number of Port502 messages received from the network
port502MsgOut(10)	Indicates the total number of Port502 messages sent from the network
port502MsgOutErr(11)	Indicates the total number of error messages built by the Port502 messaging entity and sent to the network
port502AddStackStat(12)	Indicates the support of additional port502 stack statistics 1 - Disabled 2 - Enabled
port502AddStackStatTable(13)	Indicates additional stack statistics for Port502 (optional)

I/O Scanning Subtree

The I/O_Scanning (3) subtree, or group, contains the objects related to I/O Scanning device management and associated MODBUS communications on Port502.

Service	Description
ioScanStatus(1)	Indicates the global status of the I/O Scanning service 1 - Idle 2 - Operational 3 - Stopped
ioScanMaxDevice(2)	Indicates the maximum number of devices supported by the I/O Scanning entity
ioScanPolledDevice(3)	Indicates the number of devices currently polled by the I/O Scanning entity
ioScanTransSend(4)	Indicates the total number of transactions sent by the I/O Scanning entity
ioScanGlbHealth(5)	Indicates the global status of health for the I/O Scanning service 2 - OK: Every remote I/O device is responding 4- Warning: At least one remote I/O device is not responding
ioScanDeviceTable(6)	Displays a table containing information on each remote devices polled by the I/O Scanning entity

Global Data Subtree

The Global_Data (4) subtree, or group, contains the objects related to the Global Data service.

Service	Description
glbDataStatus(1)	Indicates the global status of the Global Data service 1 - Idle 2 - Operational 3 - Stopped
glbDataMaxPub(2)	Indicates the maximum number of published variables configured by the Global Data entity
glbDataMaxSub(3)	Indicates the maximum number of subscribed variables configured by the Global Data entity
glbDataPub(4)	Indicates the total number of publications sent to the network
glbDataSub(5)	Indicates the total number of subscriptions received from the network
glbDataPubErr(6)	Indicates the total number of publication errors detected by the local entity
glbDataSubErr(7)	Indicates the total number of subscription errors detected by the local entity
glbDataGlbSubHealth(8)	Indicates the global status of health for the Global Data subscribed variables 2 - OK: The health status of all subscribed variables are OK 4 - Warning: At least one subscribed variable has a health fault
glbDataPubTable(9)	Displays a table containing information on each published variable (the number of publications, the source IP address, the number of errors)
glbDataSubTable(10)	Displays a table containing information on each subscribed variable (the number of subscriptions, the source IP address, the number of errors, Health)

Web Subtree

The Web (5) subtree, or group, contains the objects related to the Web server service.

Service	Description
webStatus(1)	Indicates the global status of the Web service 1 - Idle 2 - Operational
webPassword (2)	Indicates a switch to enable or disable the use of Web passwords 1 - Disabled 2 - Enabled
webSuccessfullAccess (3)	Indicates the total number of successful accesses to the Web site
webFailedAttempts (4)	Indicates the total number of unsuccessful accesses to the Web site

Address Server Subtree

The Address_Server (6) subtree, or group, contains the objects related to the Address Server service. The Address Server can be either a BOOTP server or a DHCP server.

Service	Description
addressServerStatus(1)	Indicates the global status of the address server service 1 - Idle 2 - Operational

Equipment Profile Subtree

The Equipment_Profiles (7) subtree contains a set of common objects.

Service	Description
profileProductName(1)	Displays the commercial name of the communication product in a string form (for example: 140 NOE 771 11)
profileVersion(2)	Displays the software version of the communication product in a string form (for example: Vx.y or V1.1)
profileCommunicationServices(3)	Displays a list of the communication services supported by the profile (Port502Messaging, I/O scanning Messaging, Global Data, Web, and Address Server)
profileGlobalStatus(4)	Indicates the global status of the communication module 1 - NOK 2 - OK

Service	Description
profileConfigMode(5)	Indicates the IP configuration mode of the communication module 1 - Local: The IP configuration is created locally 2 - dhcpServed: The IP configuration is created by a remote DHCP server
profileRoleName(6)	Indicates the role name for the IP address management if it exists (Empty string if there is none)
profileBandwidthMgt(7)	Indicates the status of Bandwidth Management 1 - Disabled 2 - Enabled
profileBandwidthDistTable(8)	Indicates the CPU time distribution between Global Data, Port502 Messaging, I/O Scanning
profileLedDisplayTable(9)	Displays a table giving the name and the state of each module's LEDs
profileSlot(10)	Indicates the position of the communication module inside the rack if there is one. If there is no rack, the profileSlot value will be zero
profileCPUType(11)	Indicates that if the CPU type exists, this variable identifies the host for which that communication module is a part. If there is no host, the string is empty
profileTrapTableEntriesMax(12)	Indicates the maximum numbers of entries in the Trap Table. This entry equals the number of possible remote managers
profileTrapTable(13)	Displays a table allowing you to enable or disable the private traps for each of the communication services
profileSpecificId(14)	Indicates a unique Profile Specific Identification inside the equipmentProfile object of the Schneider Transparent Factory MIB. (For example the PLC Premium family is 100)
profileIpAddress(15)	Indicates the IP address of the SNMP agent
profileIpNetMask(16)	Indicates the subnet mask associated with the IP address of the SNMP agent. The value of the mask is an IP address with all the network bits set to 1 and all the host bits set to 0
profileIpGateway(17)	Indicates the default Gateway IP address of the SNMP agent
profileMacAddress(18)	Indicates the Ethernet media-dependent address of the SNMP agent

NTP Subtree

The NTP (1) subtree contains a set of common objects.

Service	Description
ntpStatus(1)	Status of NTP service (not server) **1.** 1 = Idle no configuration **2.** 2 = Operational
ntpSrvAddr(2)	IP address of NTP server in dot notation format
ntpLnkSrvStatus(3)	Status of link between module and NTP server **1.** 1 = NOK module can not reach NTP server **2.** 2 = OK
ntpReqCnt(4)	Number of requests sent to NTP server
ntpRespCnt(5)	Number of responses received from NTP server
ntpErrCnt(6)	Total number of communication errors
ntpDate(7)	Date of the day
ntpTime(8)	Time of the day
ntpTimeZone(9)	Current time zone
ntpDSTStatus(10)	Daylight Saving Time status **1.** 1 = ON Daylight Saving Time **2.** 2 = OFF Standard Time
ntpLastErr(11)	Last error code generated by system

SMTP Subtree

The SMTP (1) subtree contains a set of common objects.

Service	Description
smtpStatus(1)	Status of SMTP service (not server) **1.** 1 = Idle no configuration **2.** 2 = Operational
smtpSrvAddr(2)	IP address of SMTP server in dot notation format
smtpLnkSrvStatus(3)	Status of link with SMTP server **1.** 1 = NOK link is down; module failed to contact SMTP server **2.** 2 = OK
smtpEmailSentCnt(4)	Total number of email messages sent to network
smtpSrvRspCnt(5)	Total number of responses from SMTP server
smtpErrCnt(6)	Total umber of email messages that could not be sent because of an error
smtpLastErr(7)	Error code of the last error that occurred while trying to send an email message to the network
smtpLastHdrUsed(8)	Mail header used in the last email message sent successfully on the network **1.** None(0) no email messages sent **2.** Mail header 1(1) **3.** Mail header 2(2) **4.** Mail header 3(3)
smtpLastMailCnt(9)	Number of seconds elapsed since the last successful email message sent
smtpSrvChkFailCnt(10)	Number of times that the link to SMTP server detected as ‘down’

Private Traps and MIB Files

Traps are used to signal status changes to the manager. Using traps helps to avoid adding traffic.

The status changes signaled by the trap are for the:

- LEDs
- Communication Ports
- I/O Scanning Health Values
- Global Data Health
- NTP service
- SMTP service

The following list describes the characteristics of private traps, which means that they can:

- Send messages to the two managers whose IP addresses are configured in the SNMP configuration (either the PL7 or the Web page)
- Use the community name given to this configuration
- Enable or disable each of the Transparent Factory Ethernet Private MIB groups: Switch (1), Port502_Messaging (2), I/O_Scanning (3), Global_Data (4), Web (5), Address_Server (6), Equipment_Profiles (7), NTP (8), and SMTP (9)

Private traps are described in the MIB ASN.1 description, which is contained in a **`.mib`** text file.

NTP Traps

1. DST Change Trap
   Trap notifies the manager that the NTP server time has changed either from (a) standard time to daylight saving time or (b) daylight saving time to standard time
2. NTP Status Change Trap
   Trap sent when the NTP component status changes (ntpStatus(1))
3. Leap Second Trap
   Trap sent when leap seconds are inserted

SMTP Traps

1. SMTP Status Change Trap
   Trap is sent when SMTPStatus changes
2. SMTP Link to Server Status Change
   Trap is sent when tSMTPLnkSrvStatus changes. Trap is sent when service tries to send an email. Every 30 minutes a periodic test checks the connection to the SMTP server.

Time Synchronization Service

9

At a Glance

Introduction

This chapter describes the time synchronization service, which provides an accurate local clock by using Network Time Protocol (NTP).

What's in this Chapter?

This chapter contains the following topics:

Introducing the Time Synchronization Service

General

The time service synchronizes computer clocks over the Internet. For example, the time of one client is synchronized either with another server or to a referenced time source like a radio or satellite receiver.
Typical time service configurations utilize redundant servers and diverse network paths to achieve high accuracy and reliability. Time service accuracy can be within a millisecond on LANs and up to a few tens of milliseconds on WANs.
Use the time service for

- event recording—sequence events
- event synchronization—trigger simultaneous events
- alarm and I/O synchronization—time stamp alarms

Features of the Time Service

- Periodic time correction obtained from the reference-standard time server
- Automatic switch over to a backup time server if a problem occurs with the normal time server system
- Controller projects use a function block to read the accurate clock, a feature that allows project events or variables to be time stamped
- Estimated time stamping accuracy of
  - 5 mSec for 140 CPU 651 x0's and higher
  - 10 mSec for other CPUs
- Local time zone is configurable and customizable including daylight savings time
- Web page diagnostics for the time synchronization service

Time Synchronization and Time Stamps

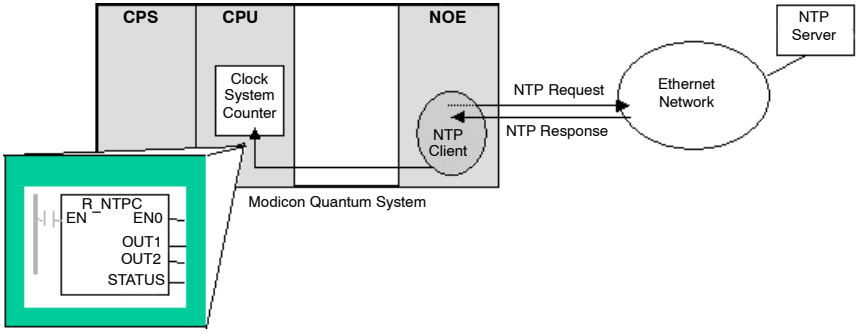
The Schneider Electric Ethernet interface modules, NOEs, provide the source time-synchronization signal sent to a controller. The Ethernet module's firmware includes an NTP client, which provides time synchronization.

Action	Result
NTP Client requests a time synchronization signal from an NTP server. Request is sent over an Ethernet network.	NTP Server responds with a signal.
NTP Client stores the time.	
NTP Client sends a message to the controller's clock system counter.	The controller updates its internal clock with the following granularity: • 1 ms

To read the clock from the PLC application,

- Use the R_NTPC function block in either MAST, FAST, or Interrupt sections.

On an Ethernet network, all controllers should be synchronized with the same NTP server.



Time Synchronization Definitions

Terms related to the time synchronization service

Term	Description of Service
Local clock offset	Accurate local time is maintained by adjusting the time by using a local clock offset. The local clock offset is calculated by the following formula. `( (T4 - T1) + (T3 - T2) )  / 2` ● T1 = Time when NTP request is transmitted from the module ● T2 = Time when NTP Server receives the request (provided by the module in response) ● T3 = Time when the NTP Server transmits the response (provided to the module in the response) ● T4 = Time when NTP Response is received by the module
Time accuracy	Local Time error is < 10 ms compared to the reference NTP server. ● Typical: under 5 ms ● Worst case: <10 ms Note: **1.** Settling Time: The maximum accuracy is obtained after 2 updates from the NTP server. **2.** Polling Period Dependency: The accuracy is dependent upon the polling period. Less than 10 mSec of error is guaranteed for polling periods of 120 seconds or less. To obtain the best possible accuracy and if your network bandwidth will allow, reduce the polling period to a small value. **3.** For example, choosing a polling time of 5 seconds provides better accuracy than a time of 30 seconds.
Time zone	Default format: Universal Time, Coordinated (UTC) Optional: Configure the service to use a local time zone. For example, GMT+1 for Barcelona or Paris
Daylight saving time	Automatic: module adjusts time in spring and fall
Leap Second	Automatic: module inserts or deletes a second Note: **1.** To compensate for the deceleration of the earth's rotation, a leap second is inserted in the UTC time every 18 months by an INTERNATIONAL EARTH ROTATION SERVICE (IERS). **2.** Leap seconds will be inserted automatically as needed. If needed, leap seconds are inserted at the end of the last minute in June or December, as commanded by the NTP server.

Using the Time Synchronization Service

Introduction

This material describes special operating conditions related to
- powering up
- Stop or Run PLC
- downloading applications
- configuring the time service

Power Up

On Power-up, to establish accurate system Ethernet network time, the system
- requires the Ethernet module to boot
- uses the Ethernet module to obtain the time from the NTP server
- requires a predefined interval until time is accurate; user's configuration determines how long before time is accurate
- may require several updates to achieve peak accuracy

Once an accurate time is received, the service sets the STATUS in the associated time service register.
The time-service clock value starts at 0 until fully updated from the module.

Model	Starting Date
Modicon Quantum with Unity	January 1st 1980 00:00:00.00

Stop or Run PLC

- Stop and Run have no effect on the accuracy of the clock.
- Stop and Run have no effect on the update of the clock.
- A transition from one mode to the other has no effect on the accuracy of the system Ethernet network time.

Download Application

After a download application or an NTP server swap occurs, the status clock value associated with the time service register in the CPU is reinitialized.
There will be two polling periods before the time is accurate.

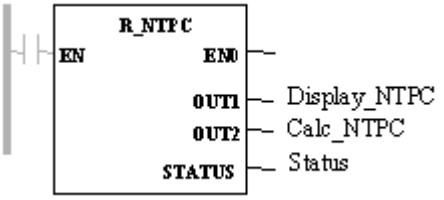
NTP Configuration

(See *Configuring the Time Synchronization Service, p. 244*)

Using the R_NTPC Block for Time Synchronization

R_NTPC Representation

The block reads the Ethernet network system time and transfers the time into specified parameters: The additional parameter EN should be configured.



R_NTPC block has a 16-bit status word.

R_NTPC Parameter Description

Description of parameters

Parameter	Data Type	Description
Display_NTPC (OUT1)	DT + INT	NTP clock value displayed in • Year, month, day, hours, minutes, and seconds using the DT format • Milliseconds as an INT
Calc_NTPC (OUT2)	UDINT+INT	NTP clock value displayed in • Seconds as an UDINT • Fractions of a second as an INT

STATUS Low Byte	INT	Low byte is managed by the controller
		• Set = 0
		  • Clock value NOT available
		  • Date/time NOT updated within last two minutes
		• Set = 1
		  • Date/time updated within the last two minutes
		  • Date/time acceptable

STATUS High Byte	INT	High byte is managed by the NOE
		• Set = 0
		  • Clock value transferred to CPU not acceptable
		• Set = 1
		Updated date/time received from server and sent to module
		  • within two minute time interval
		  • acceptable (10 ms or less error)

Note: For valid time in CPU • STATUS Low Byte = 1 • STATUS High Byte = 1		

Electronic Mail Notification Service

10

At a Glance

Introduction

This chapter describes the electronic mail notification service, which uses the simple mail transport protocol (SMTP) to allow the controller's project to send e-mail messages.

What's in this Chapter?

This chapter contains the following topics:

Introducing the Electronic Mail Notification Service

General

The electronic mail notification service allows controller-based projects to report alarms or events. The controller monitors the system and dynamically creates an electronic mail message, which alerts local or remote users.

Mail System Types

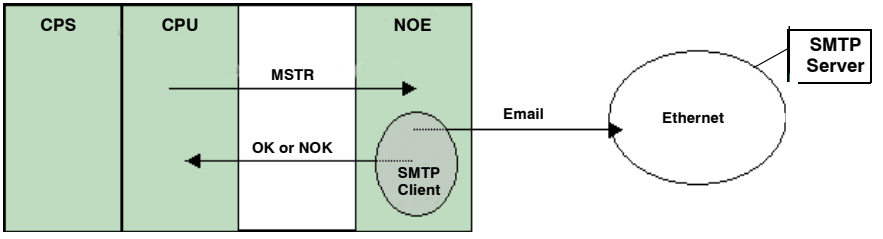
The simple mail transfer protocol provides two mechanisms for the transmission of email messages:

- direct connection
- relay system

Mechanism	Condition	Result
Direct connection	sender and receiver are connected to the same transport service	Email messages are sent to host
Relay system	sender and receiver are NOT connected to the same transport service	Email messages are relayed from one server to another server To relay messages, the SMTP server must be supplied with the address of the • destination host • destination mailbox

Mail Service Client

The NOE and 140 CPU 651 x0 modules include an SMTP client. When the module receives a specific request from the project, the module sends an email message to the mail server.



Operating Modes and Sending Requests

Because the project sends the email request, a controller cannot send an email message either while in the stopped mode or while downloading a project. As soon as the controller is in RUN mode, the function block sends a request during the first project scan.

Diagnostic counters are reset to 0 after either a power-up, a project download, or a reconfiguration of the mail service.

Using the Mail Service

Configuring the Mail Service

As an authorized administrator, use the SMTP Configuration Web page to
- configure the service
- set the IP address of the mail server

> **Note:** Default TCP Port
> The default TCP port number for SMTP is 25. Ensure that you configure the port specified by your local mail server.

(See *Configuring the Mail Service with the Email Configuration Page, p. 249*)

Message Creation and Delivery

A user-defined event or condition triggers the MSTR block to create a message. Each message uses one of three user-defined headers. Each message sent from the controller can contain text and variable information (with a maximum of 238 bytes).
The project selects the appropriate header. Each header contains
- sender name
- list of recipients
- subject

Header Examples

The text and variable information can be defined and updated by an authorized administrator using an embedded Web page (SMTP Configuration page). Define mail headers to indicate different levels of importance. For example,
- Header 1 could be "Urgent problem reported by PLC 10"
- Header 2 could be "NOTIFICATION from substation 10"
- Header 3 could be "INFO message from water system"

Listing different recipients in each of the three headers ensures that the right information quickly flows to the right recipients. The project adds pertinent information such as the specific device, process, or location. This pertinent information is added to the body of the mail message. Then the complete message is sent to an electronic mail server for distribution to recipients. These recipients could be engineers, managers, or process owners.

Security (Authentication)

An optional login (system ID) and password can be used to authenticate the connection to the SMTP mail server. The SMTP-supported authentication method is LOGIN.

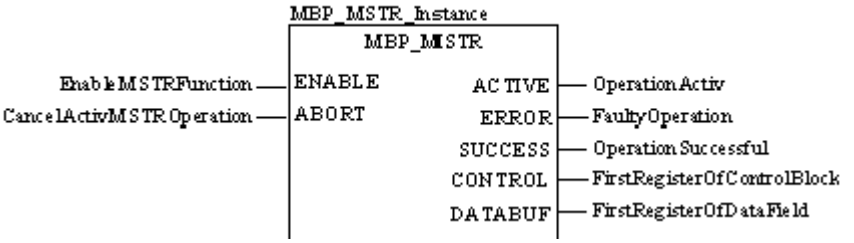
System Diagnostics

The SMTP Diagnostic Web page displays the status of the service. Diagnostic information is also available for remote management using the SNMP network management standard.

Using the MSTR Block for Mail Service Communication

MSTR Representation

Each operation is designated by a code. To send an email message, use the MSTR block with Function Code 13.



MSTR Parameter Description

Description of parameters

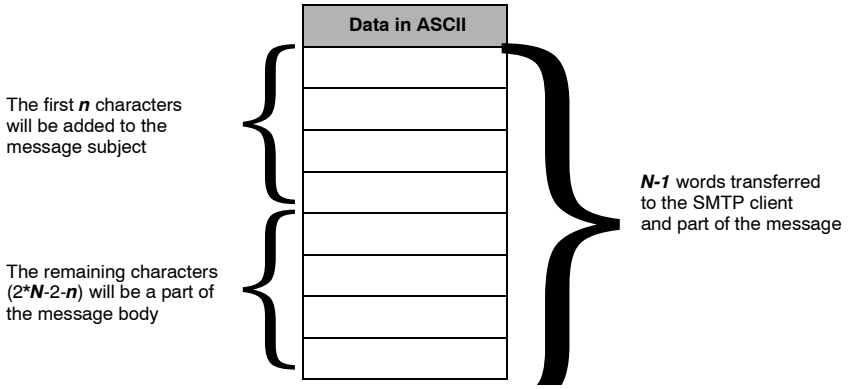
Parameter	Data Type	Description	
ENABLE	None	ON = enables selected MSTR operation	
ABORT	None	ON = terminates active MSTR operation	
ACTIVE	None	ON while the instruction is active	
ERROR	None	ON if the MSTR operation is terminated prior to completion	
SUCCESS	None	ON = operation successful	
CONTROL	INT, UINT	Control block is the first of several network-dependant, contiguous, holding words, and the first of nine contiguous words entered in the top node. The remaining eight words are:	
		Displayed: Identifies one of the MSTR = **13**	
		First implied	Displays error status (See *Mail Service Error Codes, p. 215*)
		Second implied	Displays length (number of words transferred)
		Third implied	Not used
		Fourth implied	High byte: slot address of the NOE module or 0xFE for the 140 CPU 651 x0
			Low byte: 0 (Not used)
		Fifth implied	(Not used)
		Sixth implied	(Not used)
		Seventh implied	(Not used)
		Eighth implied	(Not used)
DATABUF	INT, UINT	The DATABUF parameter is the address of the buffer including the data inserted into the body of the email message. The data should be in ASCII format starting at the second word. Note: **1.** Least significant byte of the first word Contains a valid (configured) mail header (should be of value 1, 2, or 3). **2.** Most significant byte of the first word Contains the length of the dynamic part of the message's subject field. The length must be between 0 and 238 characters.	

DATABUF Parameter Description

The first word of the DATABUF parameter contains the following information:

Byte Number		Value
1 Least significant byte	Mail header	{1,2,3}
2 Most significant byte	Nb **n** of extra characters in subject	User defined (between 0 and 238)

The second and subsequent words (maximum 119) contain the data (ASCII format) that will be copied into the email message. The first ***n*** characters will be added to the configured email subject. The remaining characters (2***N***-2-***n***) will be part of the message body. ***N*** represents the number of words transferred.



Mail Service Error Codes

Error Codes

The electronic mail notification service supports the following error codes

Hex. Error Code	Description
5100	Internal error
5101	SMTP component not operational
5102	Mail Header not configured
5103	Invalid Mail Header value (should be 1, 2 or 3)
5104	Cannot connect to SMTP server
5105	Error in transmitting content of email body to SMTP server
5106	Closing SMTP connection with the server returned an error
5107	SMTP HELO request failed
5108	SMTP MAIL request failed. SMTP server may require authentication
5109	SMTP RCPT request failed
510A	No recipient has been accepted by the SMTP server
510B	SMTP DATA request failed
510C	Send email request contains an invalid length
510D	Authentication failed
510E	A Reset component request has been received while the connection was open

Embedded Web Pages

11

At a Glance

Introduction

This chapter presents the contents of the embedded Web pages contained in the Quantum 140 NOE 771 xx modules. 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

Overview

The following information describes how to access the Web utility home page to perform diagnostics and online configuration on the Modicon Quantum 10/100 Megabit Ethernet module.

Introduction

Each Modicon Quantum 10/100 Megabit Ethernet module contains an embedded Web server that allows you to access diagnostics and online configurations for the module and its associated controller (PLC).
Pages on the embedded Web site display the following information:

Configurable menus of the Address Server both BOOTP and DHCP and for SNMP
Ethernet statistics for the node
Controller's configuration (Controller Status on menu)
Controller's register values
Remote I/O status and configuration
Remote I/O register values
Remote I/O distributed values

The FactoryCast / Real Time modules offer these additional pages:
- Configuration and status for Global Data (Publish / Subscribe)
- Bandwidth monitoring
- I/O Scanner status
- MODBUS Messaging status
- NTP configuration and status
- SMTP configuration and status

The Web pages can be viewed using either Netscape Navigator or Internet Explorer version 4.0 or higher. Either browser supports JRE 1.4.2_04 or higher.
For information about the additional functionality provided by the FactoryCast system in the Ethernet modules, see the *FactoryCast Manual*.

Accessing the Module's Home Page

Do the following.

Step	Action
1	Obtain the full IP address or URL from your system administrator.
2	Type the address or URL in the address or location box in the browser window. The Schneider Electric Web Utility home page displays.
3	Refer to the following figure, and click **Diagnostics and Online Configurations**. 
4	You will be requested to supply a user name and password.
5	After supplying the user name, password, and clicking **OK**, the Quantum Welcome Page appears. The Quantum Welcome Page provides the links to all the Quantum configuration and diagnostic pages and to the **Data Editor** / **Data Monitor**. **NOTE:** The default User Name is USER, and the default password is USER. Both should be changed by the system administrator during module installation.

Quantum Welcome Page

Overview

The following information describes the Quantum Welcome Page.

Quantum Welcome Page Overview and Links

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

FactoryCast Web Server

for Quantum

Home
Configured Local Rack
Controller Status
Ethernet Statistics
RIO Status
Graphic Editor
Data Editor

Configure NOE
NOE Properties
NOE Diagnostics
Support

The following table details the links on the Quantum Welcome Page. To view the pages related to a particular topic, click the link for that topic.

Link	**Results**
Home	Return to the home 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
Graphic Editor	Displays the Graphic tool for creating input / output user screens (only with FactoryCast) Only available on • NOE 771 10 • NOE 771 11 • NWM 100 00
Data Monitor / Data Editor	Allows access to the Quantum PLC Data
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration page
NOE Properties	Provides information about 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

Configured Local Rack Page

Configured Local Rack Page Overview

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

The following table details the links on the Configured Local Rack Page. To view the pages related to each of these topics, click on the topic.

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
Graphic Editor	Displays the Graphic tool for creating input / output user screens (only with FactoryCast) Only available on • NOE 771 10 • NOE 771 11 • NWM 100 00
Data Monitor / Data Editor	Allows access to the Quantum PLC Data with editing capabilities

CPU Configuration Screen Page

Overview

The following information describes the CPU Configuration Screen Page.

Introduction to the CPU Configuration Screen Page

In the following figure, the top eight fields identify the CPU Configuration. More information about these fields follows.

CPU CONFIGURATION SCREEN

Status:	Stopped	Reference:	140-CPU-651-50
Battery:	OK	Product Type:	Quantum
Rack:	1	Exec ID:	871
Slot:	3	Logged In:	No

DESCRIPTION		REGISTERS		ASCII	
System Memory[Kb]	8 Kb	0xxxxx (%M)	000001-001536	Total Words	0
Extended Memory[Kb]	0	1xxxxx (%I)	100001-100512	Total Messages	0
Total Memory [Bytes]	8192	3xxxxx (%IW)	300001-300048	Words Used	0
I/O Map Words	512	4xxxxx (%MW)	400001-401872	Messages Used	0
Segments	1	6xxxxx	None	Available Words	0
DCP Drop ID	0	Battery Coil	0-----	Available Messages	0
Memory Protect	Off	Timer Register	4-----	# ASCII Ports	0
Constant Sweep	Off	Time of Day Clock	4-----	ASCII Inputs	4-----
Optimize	No	Stopped Codes	0x0200	ASCII Outputs	4-----

Home | Configured Local Rack | Ethernet Statistics | RIO Status | Data Monitor

Description Fields

The following table describes the Description fields on the CPU Configuration Screen Page.

Field	Information Supplied
System Memory [Kb]	Amount of system memory used
Extended Memory [Kb]	Amount of Extended Memory used
Number of I/O words mapped.	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

Word Fields

The following table describes the Word fields on the CPU Configuration Screen Page.

Field	Information Supplied
%M	Valid Address of %M
%I	Valid Address of %I
%IW	Valid Address of %IW
%MW	Valid Address of %MW
Battery Bit	Address of Battery Bit
Timer Word	Address of Timer Word
Time of Day Clock	Address of Timer of Day Clock
Stopped Codes	Reason for controlled stopping

ASCII Fields

The column headed ASCII fields on the CPU Configuration Screen contains information concerning the ASCII fields.

CPU Configuration Screen Page Links

The following table describes 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
Graphic Editor	Displays the Graphic tool for creating input / output user screens (only with FactoryCast) Only available on • NOE 771 10 • NOE 771 11 • NWM 100 00
Data Monitor	Allows access to the Quantum PLC Data with editing capabilities

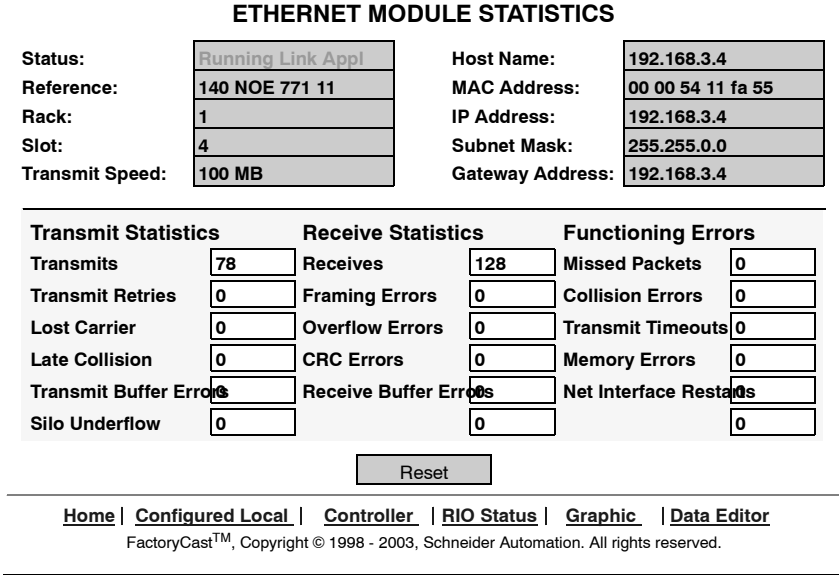
Ethernet Module Statistics Page

Overview

The following information describes the Ethernet Module Statistics Page.

Introduction to the Ethernet Module Statistics Page

The statistics on Ethernet Module Statistics Page are "information only". To retain any of the information appearing on the Ethernet Module Statistics Page, you must copy it offline (for example, to your hard drive).
The following figure shows the Ethernet Module Statistics Page. The counters may be reset to zero by clicking the Reset Counter button.



ETHERNET MODULE STATISTICS

Status:	Running Link Appl	Host Name:	192.168.3.4
Reference:	140 NOE 771 11	MAC Address:	00 00 54 11 fa 55
Rack:	1	IP Address:	192.168.3.4
Slot:	4	Subnet Mask:	255.255.0.0
Transmit Speed:	100 MB	Gateway Address:	192.168.3.4

Transmit Statistics		Receive Statistics		Functioning Errors	
Transmits	78	Receives	128	Missed Packets	0
Transmit Retries	0	Framing Errors	0	Collision Errors	0
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	Net Interface Restarts	0
Silo Underflow	0		0		0

Reset

Home | Configured Local | Controller | RIO Status | Graphic | Data Editor

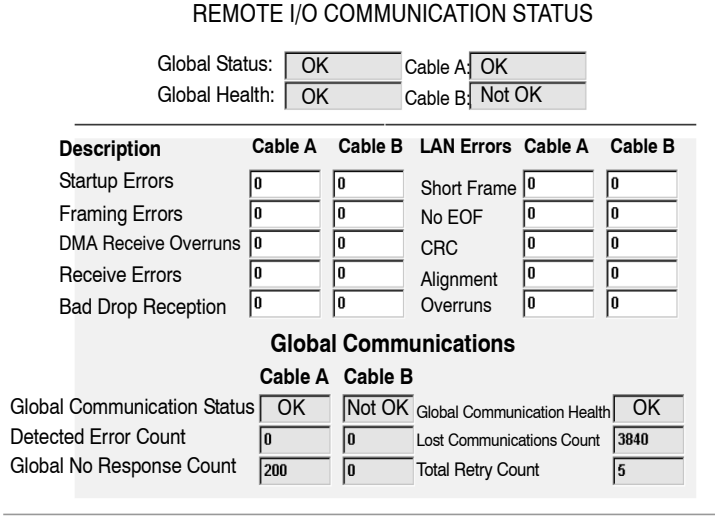
Remote I/O Communication Status Page

Overview

The following information describes the Remote I/O Communication Status Page.

Introduction to the Remote I/O Communications Status Page

In the following figure, the fields are "information only". You cannot change the fields.



Note: The Graphic Editor Link is available only on the 140 NOE 771 1x, the FactoryCast Web server.

For more information about the Remote I/O Communications Status, see the RIO Manual.

Remote I/O Communications Status Page Links

The following table describes the information that is available for each cable, using the links on the Remote I/O Communication Status Page.

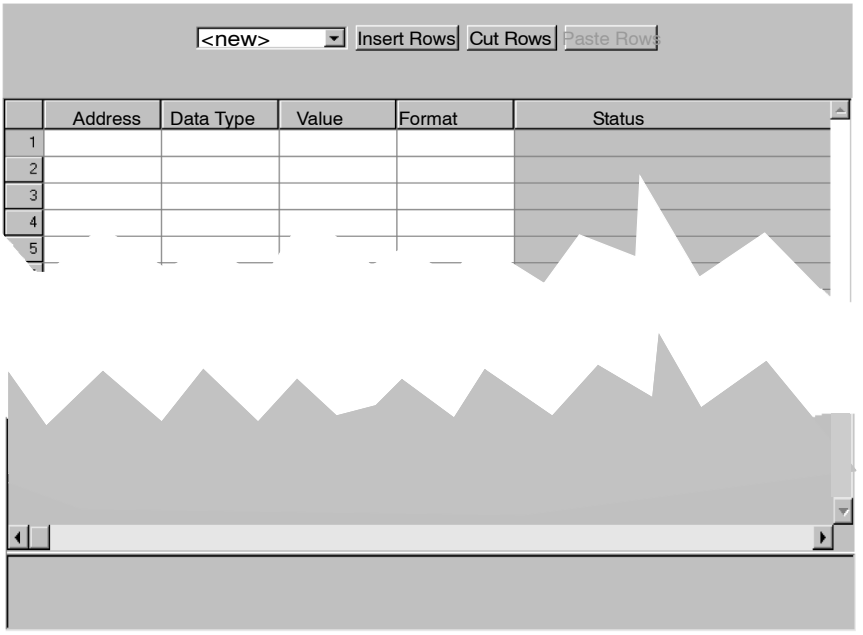
Link	Results
Home	Displays the Quantum Welcome Page
Configured Local Rack	Displays the Quantum Local Rack with NOE and CPU
Controller Status	Displays the CPU Configuration
RIO Status	Displays the Ethernet Module Statistics with the Reset Counters link
Data Monitor	Allows access to the Quantum PLC Data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

Quantum PLC Data Monitor Page

Introduction to the PLC Data Monitor Page

The following figure shows the web page that allows you to display Quantum PLC data.

Quantum PLC Data Monitor



Home | Configured Local Rack | Controller Status | Ethernet Statistics | RIO Status

You can add, delete, and copy Quantum PLC data as described in the following list:

- 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.

PLC Data Monitor Page Links

The following table describes 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
RIO Status	Displays the Remote I/O Communications Status
Graphic Editor	Displays the Graphic tool for creating input / output user screens (only with FactoryCast) Only available on • NOE 771 10 • NOE 771 11 • NWM 100 00

Configure NOE Page

Overview

The following information describes the **Configure NOE** page and the links on that page.

Introduction to the NOE Configuration Pages

The following figure shows the **Configure NOE** page, which provides links to the individual configuration pages for the NOE.

Configure NOE

Configure SNMP

Configure Address Server

Configure Global Data

Configure NTP

Configure Email

Home | **NOE Properties** | **NOE Diagnostics** | **Support**

NOE Configuration Page Links

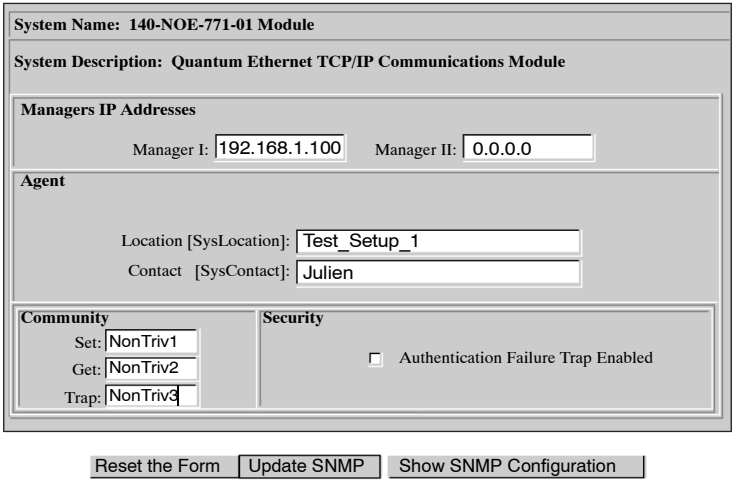
The following table describes the links on the **Configure NOE** page.

Link	**Result**s
Configure SNMP	Provides the ability to configure the SNMP Agent in the NOE
Configure Address Server	Configure the BOOTP IP assignments, including showing the BOOTP and DHCP database
Configure Global Data	Displays the Global Data Configuration page. Configure the Group Address, Multicast filtering, Distribution period, Health Time Out, Health Bits, and Data Zones. The Global Data Configuration page also displays a Variable Table.
Configure NTP	Configure the IP address of the primary and secondary NTP server. Set a polling period. Select a time zone from the drop-down list, and automatic adjustment for daylight savings time.
Configure Email	Configure the email server's IP and Port (default port is 25). If security required, select Enable and set a Login and Password. Create three mail headers.
Home	Returns you to the Quantum Welcome Page
NOE Properties	Provides information about 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

Introduction to the Configure SNMP Page

SNMP may already be configured on your NOE 771 xx. If it is not, complete the SNMP Configuration form, which is shown in the following figure.



The following table shows how to enter the required information for configuring SNMP on your NOE 771 xx.

Task	How To
To display the current SNMP configuration	Click **Show SNMP Configuration**
To clear the fields	Click **Reset the Form**
To change the SNMP configuration	Change the information on the page and click **Update SNMP**

SNMP Page Fields

The following table describes the specific SNMP fields that you can modify.

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 describes the links on the Configure SNMP Page.

Link	Results
Home	Returns you to the Modicon Quantum Welcome Page.
Configure NOE	Provides the ability to configure and change the NOE through the Ethernet Configuration Page.
NOE Properties	Provides information about 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

Completion Message

Clicking on the **Update SNMP** button displays a new page containing the message "Successfully updated SNMP database". Note that this page contains the same links as those on the Configure SNMP Page.

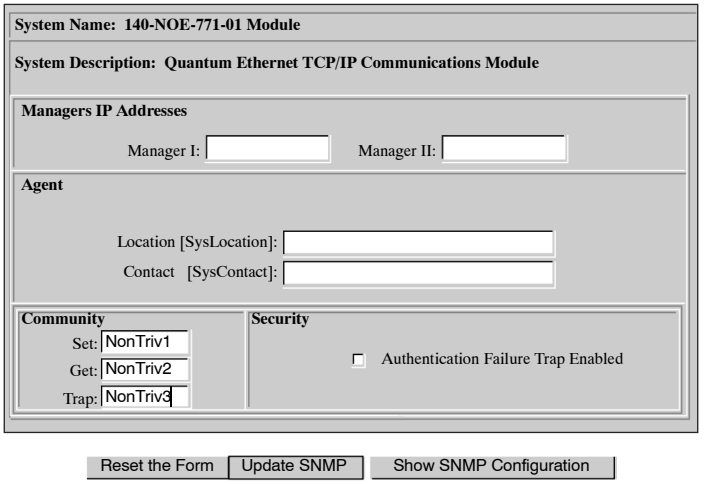
Note: The NOE module has to be reset for the changes to take effect.

SNMP Community Strings

Use strings to restrict access to the SNMP Agent. These strings should be set to Non-Trivial names during module installation.

Modifying the SNMP Community Strings

The following steps should be used to establish the SNMP Community Strings:

Step	Action
1	Enter the URL into your browser: **http://hostname/secure/embedded/builtin?submit=Configure+SNMP** or navigate to the **SNMP Configuration** Web page
2	Enter the **Community** names for **Set**, **Get**, and **Trap** into the **SNMP Configuration** Web page as shown below. 
3	Click **Update SNMP**.
4	After making changes in the **SNMP Configuration** Web page and to set those changes, reboot the module using hot swap.

Configuring the Global Data (Publish / Subscribe) Utility

Overview

Whether you use the Configure Each Device Separately or the Copy Configuration method, the procedure to configure individual parameters is the same. Therefore, in order to use the Global Data (Publish / Subscribe) utility in the NOE, you need to configure the Global Data parameters including:

- Distribution period
- Multicast filtering
- Health bit location
- Global Data base address
- Group IP address

The following sections describe in detail the exact steps to configure each parameter via the **Global Data Configuration** page.

Accessing the Global Data Utility

You access the Global Data utility through the **Global Data Configuration** page.

Step	Action
1	On your screen click the **Diagnostics and Online Configurations** link. 
2	When you click the **Diagnostics and Online Configurations** link, you are requested to enter user name and password
3	Enter your user name and password. The **Configure NOE** page appears.
4	Click the **Configure NOE** link. The **Configure NOE** page appears.

Step	Action
5	Click the **Configure Global Data** link.  **Configure NOE** **Configure SNMP** **Configure Address Server** **Configure Global Data** **Configure NTP** **Configure Email** Home | NOE Properties | NOE Diagnostics | Support Copyright © 1998 - 2003 Schneider Automation, All rights reserved.
6	The **Global Data Configuration** page appears.  **Global Data Configuration** Group 239 . 200 . 255 . 255 ☑ Multicast filtering Distribution 5 scan Health 100 m Health %M 4 to 7 Data %M 0 to 5 Update Global Data Configuration **Variable Table** In this screen you may make changes to the configuration.

Data	Type	Symbol	Address	Lenght
1	SU	var_01	%M 48	2
2	PU	var_02	%M 60	2
3	SU	var_03	%M 44	2
4	NO		%M	
5	NO		%M	
6	NO		%M	
7	NO		%M	
8	NO		%M	
9	NO		%M	

Configuring Global Data

After you have completed the Modelling System Configuration process using the second method, Copy Configuration, then you modify the following parameters:

- Distribution period
- Health Time Out
- Health Bits location
- Start address
- Type: Pub / Sub / None

Please do NOT change Symbol (description), and Length.

To change the Global Data variables of the group box on the **Global Data Configuration** page, follow the instructions below.

Step	Action
1	Adjust the **Distribution Period Cycle**. Enter a value from 1 through 50. **Note: Distribution period** is the minimum number of controller scan times before an update will occur.
2	Before entering a value in the **Group address** field, identify the station's distribution group. The **Group address** entry will be an IP address from **224.0.0.0** through **239.255.255.255**. **Group address:** the Class D Multicast IP address used for a distribution group. All members of this distribution group are configured to use the same group address, and therefore, all members can communicate with each other using Global Data.
3	Set the timeout in the **Health Time Out** field. This value is measured in milliseconds and can be set to a value that ranges from 50 through 1000 ms (increase in units of 50ms). **Note: Validity Time** is the maximum time between received subscriptions before a subscription is declared unhealthy (faulty).
4	In the **4x Starting Address** set the **Data Zone** field.
5	If you are connected to an Ethernet switch that supports multicast filtering, click the **Multicast filtering** check box.
6	Enter 4x Register Location for the Health Bits. This is the register where the health bit will be stored

Note: Health bits run in different directions.

- I/O scanner health bits run left to right.
- Global Data health bits run right to left.

Changing Global Data Variables

To change the Global Data variables that appear in the **Variable Table** area, follow the instructions below.

Step	Action
1	Highlight the identification number in the **Data ID** column.
2	In the Type column select the publish / subscribe variable type from the drop down list. Three options are available publish, subscribe, or none. These options display on the screen as follows: • **NONE** • **SUB** • **PUB**
3	In the **Symbol** column you may enter text to describe the variable.
4	In the **Address** column you see the application address for this variable. **Note:** This is a read only field.
5	In the Length column for each row, type a value, which represents the number of 4x registers. The ending 4x register field is automatically updated. If you are using the second method, **Copy Configuration**, you update **Length** the first time only.
6	When you are finished, click the **Update Global Data Configuration** button.

Verifying System Operation

To ensure that the system is operational, do the following:

Step	Action
1	Verify all controllers are running.
2	Look at the health of all variables using the **Global Data Diagnostics** page. Follow these links:| **Diagnostics and Online Configuration** | **NOE Diagnostics** | **Global Data**

Configure Address Server Page

Overview

The following information describes how to configure the Address Server for the Transparent Factory Ethernet modules.

> **Note:** For information describing how to configure the Address Server for the 140 NOE 771 x1, FactoryCast Web server modules, see the chapter entitled *Address Server Configuration / Faulty Device Replacement*. That chapter describes the BOOTP process.

Introduction to the Configure BOOTP Initial Page

The BOOTP Database File does not exist. Therefore, you need to create the database. Use the Ethernet Configuration page to create a BOOTP database file. Select Configure Bootp Entry.

Ethernet Configuration

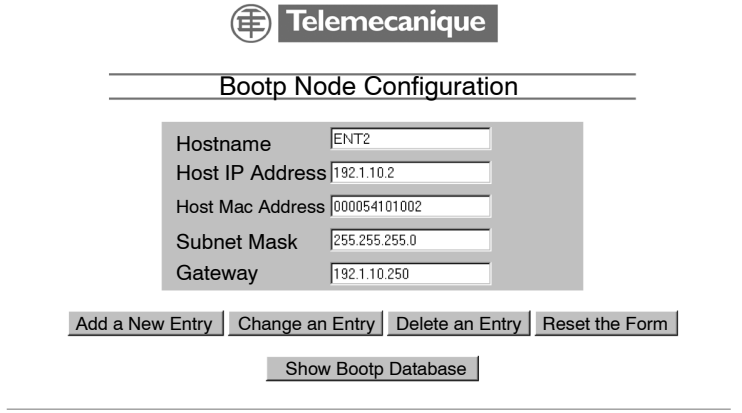
No Bootp Database File Exists. Please click button to configure it.

Configure Bootp Entry

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

Displaying the Bootp Node Configuration Form Page

The following information describes how to complete the **Bootp Node Configuration** page.

Step	Action
1	Click the **Configure Bootp Entry** button on the **Ethernet Configuration** page to configure a BOOTP Database File. **Result**: As the following figure shows, the **Bootp Node Configuration** page appears. 
2	If this is an initial BOOTP configuration, fill in the fields on the **Bootp Node Configuration** page and click the **Add a New Entry** button.

Initial Configuration

The following table describes the fields to complete on the BOOTP configuration form.

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 administrator and configured on the server by the system administrator
Gateway	Define the address of route to use to access nodes off the devices subnet

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

The following steps describe how 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 the Configure NOE page.
4	Click on **Configure BOOTP.**
5	Enter the information to be old information.
6	Click on **Delete an Entry.**

Deleting the BOOTP Database File

The following steps describe how to delete an entry in the BOOTP Database File.

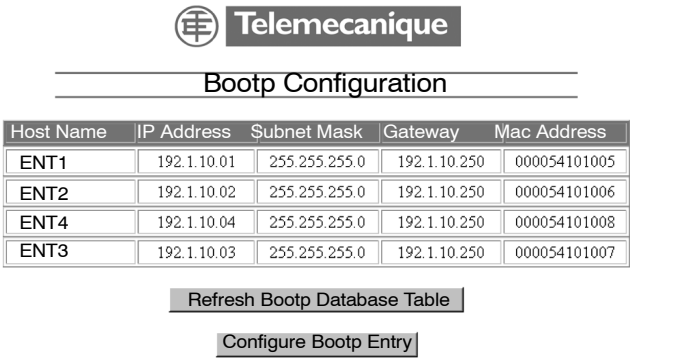
Step	Action
1	Enter the new information for the item to be deleted.
2	Click on the **Delete an Entry** button. **Result:** A delete successful message is displayed.
3	Click on **Configure NOE** to return to Configure NOE page.
4	Click on **Configure BOOTP.**
5	Click on **Refresh Bootp Database Table**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

Resetting the Form

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

Displaying the BOOTP Database File

The following figure shows a sample current BOOTP Database File. To display the current BOOTP Database File, press the **Show Bootp Database** button.



Configure BOOTP Page Links

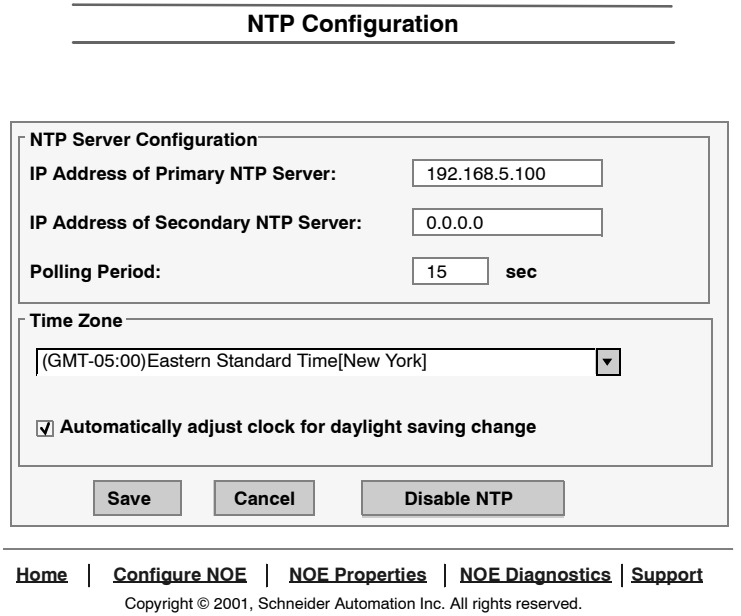
The following table describes the links on the **Bootp Node Configuration** page Page.

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 about 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.

Configuring the Time Synchronization Service

Configuring the Time Service with the NTP Configuration Page

You must use the module's embedded Web page to configure the time service. No other method is available.



Time Service Command Buttons

Execute the following commands

Command Button	Description
Save	Stores new NTP (time service) configuration. Previous configuration is no longer valid.
Cancel	Cancels new NTP (time service) configuration. Previous configuration is valid
Disable NTP	IP of Primary and Standby set = 0. NTP server not polled Time in controller not updated.

Configurable Time Service Parameters

Configure or change the following parameters on the NTP Configuration page.

1. IP address of primary NTP server
   - Enter a valid IP address
2. IP address of secondary NTP server
   - Enter a valid IP address
3. Polling Period (in seconds)
   Enter a value
   - min = 1sec
   - max = 120sec
   - default = 5 sec
4. Time Zone
   - Select from drop-down menu
     Universal Time, Coordinated (GMT) = default
   - Custom time zone
5. Automatically adjust clock for daylight saving change
   - Parameter is selected by default (check mark appears) if daylight saving time is chosen.

Changing Time Service Parameters

To make any changes to the time synchronization service,

Step	Action
1	Enter changes in the appropriate field on the NTP Configuration page for one or all of the configurable parameters.
2	Click Save.

Important Information about the Time Service

Note: About the Time Service

1. Enable/Disable Daylight Savings Time parameter
   If the Enable/Disable check box is selected, the module automatically corrects the local time to account for daylight savings time. Therefore, requiring no action, as the daylight savings time start and end are automatically changed each year.
2. Polling Time Parameter
   The time (in seconds) is the time between time updates from the NTP server. The default is 5 Seconds.
3. Storing the Time Service Configuration
   The last time service configuration is saved internally in the Ethernet module.
4. Replacing the Ethernet Module
   If the Ethernet module has to be replaced, the stored configuration is lost, and the system returns to the default configuration.

Customizing Time Zone Parameters

If you want a time zone not listed in the time zone table,

Step	Action	Comment
1	Write the text rules for the custom time zone.	
2	Using an FTP client, store your rules in the file: /FLASH0/wwwroot/conf/NTP/customrules user ID: ntpupdate password: ntpupdate	Root directory to store 'customrules' is set by the FTP server as /FLASH0/wwwroot/conf/NTP
3	When the rules are written, choose the drop down menu on the NTP Configuration web page, and configure (or reboot) the module by selecting Time Zone = Custom	The NTP component looks for customrules, calls the tz compiler and generates a new file called 'tz_custom'. This file is binary file and should not be edited. If the tz compiler detects a syntax error in customrules, the error is logged in the file: /FLASH0/wwwroot/conf/NTP/error.log **1.** NTP component is not launched **2.** NTP Status field in diagnostic web page displays NOT OK.
4	If you want more information, the syntax to write those rules along with a few examples are found in the module in /FLASH0/wwwroot/conf/NTP/instructions.txt	

Time Zone Parameters

Select one from drop-down menu.

Time Zone	Description	DST Available
Custom		Yes
(GMT-12:00)	Dateline Standard Time [Eniwetok Kwajalein]	No
(GMT-11:00)	Samoa Standard Time [Midway Is Samoa]	No
(GMT-10:00)	Hawaiian Standard Time [Hawaii Honolulu]	No
(GMT-09:00)	Alaskan Standard Time [Anchorage]	Yes
(GMT-08:00)	Pacific Standard Time [Los Angeles Tijuana]	Yes
(GMT-07:00)	Mexican Standard Time [Chihuahua La Paz Mazatlan]	Yes
(GMT-07:00)	Mountain Standard Time [Arizona Phoenix]	No
(GMT-07:00)	Mountain Standard Time [Denver]	Yes
(GMT-06:00)	Central Standard Time [Chicago]	Yes
(GMT-06:00)	Mexico Standard Time [Tegucigalpa]	No
(GMT-06:00)	Canada Central Standard Time [Saskatchewan Regina]	No

Time Zone	Description	DST Available
(GMT-06:00)	Central America Standard Time [Mexico_city]	Yes
(GMT-05:00)	SA Pacific Standard Time [Bogota Lima Quito]	No
(GMT-05:00)	Eastern Standard Time [New York]	Yes
(GMT-05:00)	Eastern Standard Time [Indiana (East)] [Indianapolis]	No
(GMT-04:00)	SA Western Standard Time [Caracas La Paz]	No
(GMT-04:00)	Pacific SA Standard Time [Santiago]	Yes
(GMT-03:30)	Newfoundland Standard Time [Newfoundland St Johns]	Yes
(GMT-03:00)	E. South America Standard Time [Brasilia Sao_Paulo]	Yes
(GMT-03:00)	SA Eastern Standard Time [Buenos Aires Georgetown]	No
(GMT-02:00)	Mid-Atlantic Standard Time [South_Georgia]	No
(GMT-01:00)	Azores Standard Time [Azores Cape Verde Island]	Yes
(GMT)	Universal Coordinated Time [Casablanca, Monrovia]	No
(GMT0)	Greenwich Mean Time [Dublin Edinburgh Lisbon London]	Yes
(GMT+01:00)	Romance Standard Time [Amsterdam CopenHagen Madrid Paris Vilnius]	Yes
(GMT+01:00)	Central European Standard Time [Belgrade Sarajevo Skopje Sofija Zagreb]	Yes
(GMT+01:00)	Central Europe Standard Time [Bratislava Budapest Ljubljana Prague Warsaw]	Yes
(GMT+01:00)	W. Europe Standard Time [Brussels Berlin Bern Rome Stockholm Vienna]	Yes
(GMT+02:00)	GTB Standard Time [Athens Istanbul Minsk]	Yes
(GMT+02:00)	E. Europe Standard Time [Bucharest]	Yes
(GMT+02:00)	Egypt Standard Time [Cairo]	Yes
(GMT+02:00)	South Africa Standard Time [Johannesburg Harare Pretoria]	No
(GMT+02:00)	FLE Standard Time [Helsinki Riga Tallinn]	Yes
(GMT+02:00)	Israel Standard Time [Israel Jerusalem]	Yes
(GMT+03:00)	Arabic Standard Time [Baghdad]	Yes
(GMT+03:00)	Arab Standard Time [Kuwait Riyadh]	No
(GMT+03:00)	Russian Standard Time [Moscow St. Petersburg Volgograd]	Yes
(GMT+03:00)	E. Africa Standard Time [Nairobi]	No
(GMT+03:30)	Iran Standard Time [Tehran]	Yes
(GMT+04:00)	Arabian Standard Time [Abu Dhabi Muscat]	No
(GMT+04:00)	Caucasus Standard Time [Baku Tbilisi]	Yes

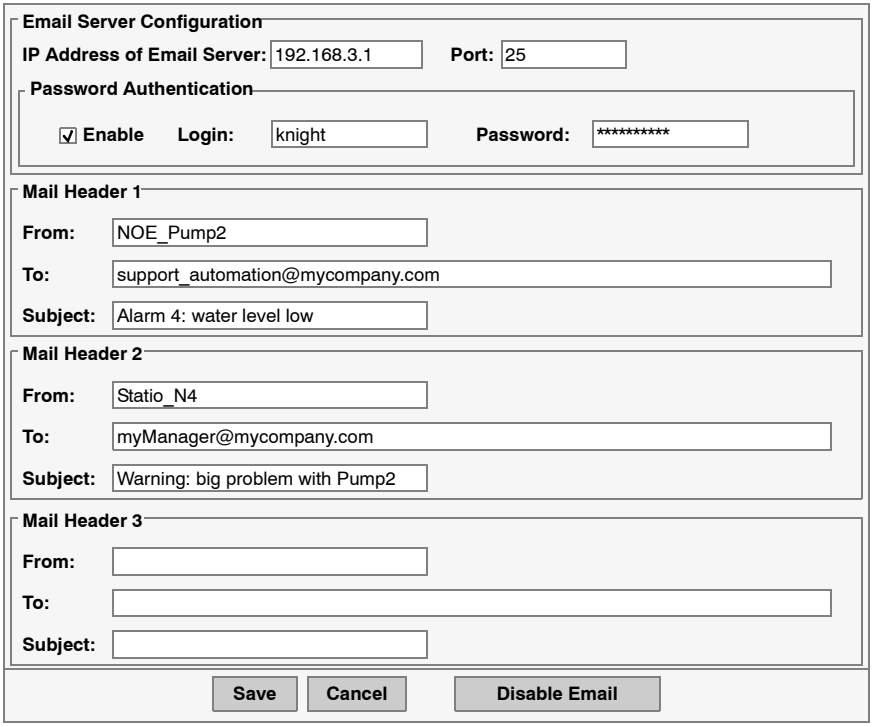
Time Zone	Description	DST Available
(GMT+04:00)	Afghanistan Standard Time [Kabul]	No
(GMT+05:00)	Ekaterinburg Standard Time [Ekaterinburg]	Yes
(GMT+05:00)	West Asia Standard Time [Islamabad Karachi Tashkent]	No
(GMT+05:30)	India Standard Time [Bombay Calcutta Madras New Delhi]	No
(GMT+06:00)	Central Asia Standard Time [Almaty Dhaka]	Yes
(GMT+06:00)	Sri Lanka Standard Time [Columbo]	No
(GMT+07:00)	SE Asia Standard Time [Bangkok Hanoi Jakarta]	No
(GMT+08:00)	China Standard Time [Beijing Chongqing Hong Kong Urumqi]	No
(GMT+08:00)	W. Australia Standard Time [Perth]	No
(GMT+08:00)	Singapore Standard Time [Singapore]	No
(GMT+08:00)	Taipei Standard Time [Taipei]	No
(GMT+09:00)	Tokyo Standard Time [Osako Sapporo Tokyo]	No
(GMT+09:00)	Korea Standard Time [Seoul]	No
(GMT+09:00)	Yakutsk Standard Time [Yakutsk]	Yes
(GMT+09:30)	Cen. Australia Standard Time [Adelaide]	Yes
(GMT+09:30)	AUS Central Standard Time [Darwin]	No
(GMT+10:00)	E. Australia Standard Time [Brisbane]	No
(GMT+10:00)	AUS Eastern Standard Time [Canberra Melbourne Sydney]	Yes
(GMT+10:00)	West Pacific Standard Time [Guam Port Moresby]	No
(GMT+10:00)	Tasmania Standard Time [Hobart]	Yes
(GMT+10:00)	Vladivostok Standard Time [Vladivostok]	Yes
(GMT+11:00)	Central Pacific Standard Time [Magadan Solomon Is New Caledonia]	Yes
(GMT+12:00)	New Zealand Standard Time [Auckland Wellington]	Yes
(GMT+12:00)	Fiji Standard Time [Fiji Kamchatka Marshall Is]	No

Configuring the Electronic Mail Notification Service

Configuring the Mail Service with the Email Configuration Page

You must use the module's embedded Web page to configure the electronic mail notification service. No other method is available.

Email Configuration



Mail Service Command Buttons

Mail service configuration buttons

Command Button	Description
Save	Saves the new Email configuration. Note: Previous configuration is not valid. Previous configuration is not stored.
Cancel	Cancels the entries in the fields. Previous configuration is valid.
Disable Email	Clears the stored configuration, and disables the email service. Note: Next time the service is enabled, a new configuration is required.

Configurable Mail Service Parameters

Configure the following parameters.

Parameter	Description
IP address of Email	Enter a valid IP address This parameter identifies SMTP server.
Port	Default = 25 If needed, enter a new value.

Password Authentication	If security is needed, enable Password Authentication.
	To enable, enter a check mark in the box.
	Enter values for
	● Login
	  ● Any printable character allowed
	  ● 12 character maximum
	● Password
	  ● Any printable character allowed
	  ● 12 character maximum

3 mail headers	Each header must contain
	1. sender's ID in the "From:" field
	  ● 32 character maximum; no spaces
	2. list of recipients in the "To:" field
	  ● Separate each email address with a comma.
	  ● 128 character maximum
	3. fixed part of message in the "Subject:" field[1].
	  ● (32 character maximum)

1. Subject field consists of two parts: **1.** Fixed ● 32 character maximum **2.** Dynamic ● 206 character maximum (See *DATABUF Parameter Description, p. 214*)	

Extended Web Diagnostics Pages

Overview

The 140 NOE 771 x1 embedded Web server provides Web pages that you may use to diagnose Transparent Factory / Real Time services. Those services are listed below:

- Global Data Diagnostics
  - Status of all Global Data services
  - Status of all subscribed and published variables
  - Publication / Subscription rate
- I/O Scanning Diagnostics
  - Status of all I/O Scanning services
  - Status of individual scanned devices
  - Actual I/O scanning rate
- Messaging Diagnostic
  - Diagnostic information for Modbus (port 502) messaging
- Bandwidth Monitoring
  - Throughput measurement of NOE by service
- Time Synchronization Service
  - Status of NTP server
  - Date and time
  - Status of daylight savings time option (DST)
- Electronic Mail Notification Service
  - Status of SMTP server
  - Track messages sent and received
  - Track errors

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

Accessing Web Diagnostics

You access the diagnostic Web pages through the **Web Server for Quantum** page.

FactoryCast Web Server

for Quantum

Home
Configured Local Rack
Controller Status
Ethernet Statistics
RIO Status
Graphic Editor
Data Editor

Configure NOE
NOE Properties
NOE Diagnostics
Support

On this page select the **NOE Diagnostics** link, which opens the **NOE Diagnostics** page.

On the **NOE Diagnostics** page select the desired service by clicking the appropriate link.

NOE Diagnostics

Global Data
I/O Scanning
Messaging
Bandwidth Monitoring

Ethernet Statistics

NTP Diagnostics

Email Diagnostic

Upload MIB File
Crash Log File

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

The first four links are the diagnostics.

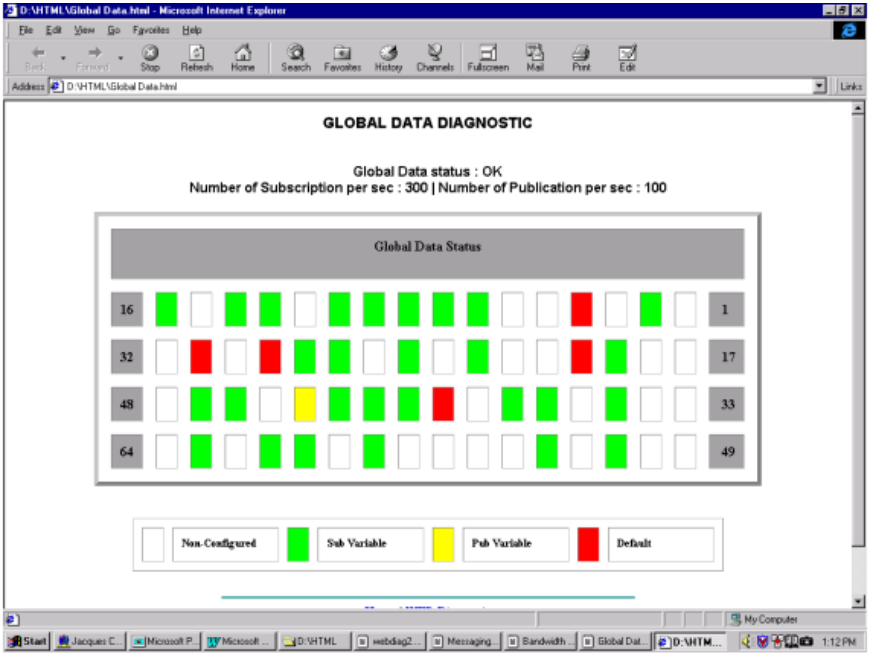
- Global Data
- IO Scanning
- Messaging
- Bandwidth Monitoring

The last five links access other functions.

- Ethernet Statistics
- NTP Diagnostics
- Email Diagnostics
- Upload MIB File
- Crash Log File

Global Data Diagnostics Page

This is the **Global Data Diagnostics** page.



This page displays information generated by the Global Data service. At the top of the page the following three items appear:

- Global Data status
- Number of subscriptions per second
- Number of publications per second

The above information is displayed both as text and as a graphic.

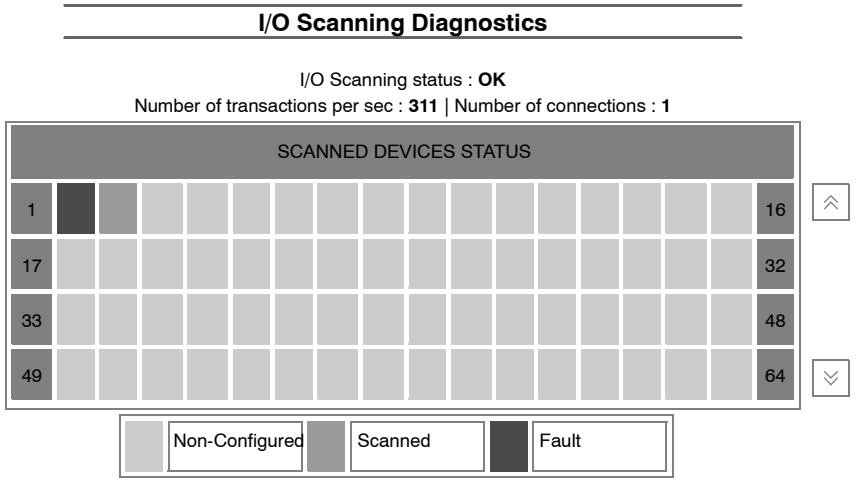
This page also displays the complete status for all variables published and subscribed within the same distribution group. Every variable is identified by its data ID. At the bottom of the page four boxes display indicating the status of the variables. Those boxes are color coded.

- White for all non configured variables
- Green for the healthy subscribed variables
- Black for the healthy published variables
- Red for a communication fault

If Red displays in the **Fault** variable box, you should check the system for problems. The **Global Data status** indicator displays **OK**, even if there are unhealthy variables.

I/O Scanning Diagnostic Page

This page displays information generated by the I/O Scanning service.



At the top of the page the following three items appear:

- I/O Scanning status
- Number of transactions per second
- Number of connections

The above information is displayed both as text and as a graphic.

At the bottom of the page four boxes display indicating the status of the devices. Those boxes are color coded.

- White for all non configured devices
- Green for all scanned devices
- Black for all temporary unscanned devices
- Red for all devices in a default state

If Red displays in the **Fault** variable box, you should check the system for problems

Messaging Diagnostic Page

This page provides information concerning current open TCP connections on Port 502. The total number of messages sent and received on Port 502 displays on the top of this page.

Note: Please note the following.
- After a port 502 connection is closed, the connection will remain on the list for several minutes.
- The total message counter is not reset after a port 502 connection is closed.
- The I/O status indicator displays OK, even if there are unhealthy faulted scanned devices.

The **Messaging Diagnostic** page:

Modbus Messaging Diagnostics

Number of Messages sent : **21634** | Number of Messages received : **21651**

Conn.	Remote address	Remote port	Local port	Mess. Sent	Mess. Received	Error Sent
1	**192.168.3.1**	4524	502	9143	9144	0
2	**192.168.3.1**	4563	502	13	13	0

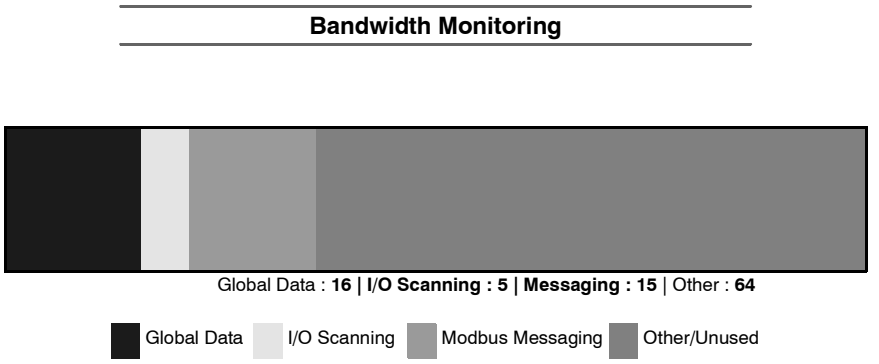
Home | Configure NOE | NOE Properties | NOE Diagnostics | Support

For each connection (numbered from 1 to 64) the following information is given:
- Remote address (IP address)
- Remote port (TCP)
- Local port (TCP)
- Number of messages sent (**Mess. Sent**) on this connection
- Number of messages received (**Mess. Received**) on this connection
- Number of errors (**Error Sent**) on this connection

Bandwidth Monitoring Page

The Bandwidth Monitoring page indicates how the NOE's CPU is shared between the Global Data service, the I/O Scanner service, and the Messaging service. The information generated by this service displays both as a graphic and as text. The information generated gives you a view of the allocation of service usage. Knowing the allocation of services can help you to determine the number of and the distribution of NOEs on your system.

The **Bandwidth Monitoring** page:



The page reports four statistics one each for the three services and one for "other."

- Blue: Global Data (usage expressed as a % of maximum number of messages/second)
- Yellow: I/O Scanner (usage expressed as a % of maximum number of messages/second)
- Green: Modbus Messaging (usage expressed as a % of maximum number of messages/second)
- Gray: Other/Unused (usage expressed as a % of maximum number of messages/second.)

Percentages add to 100%.

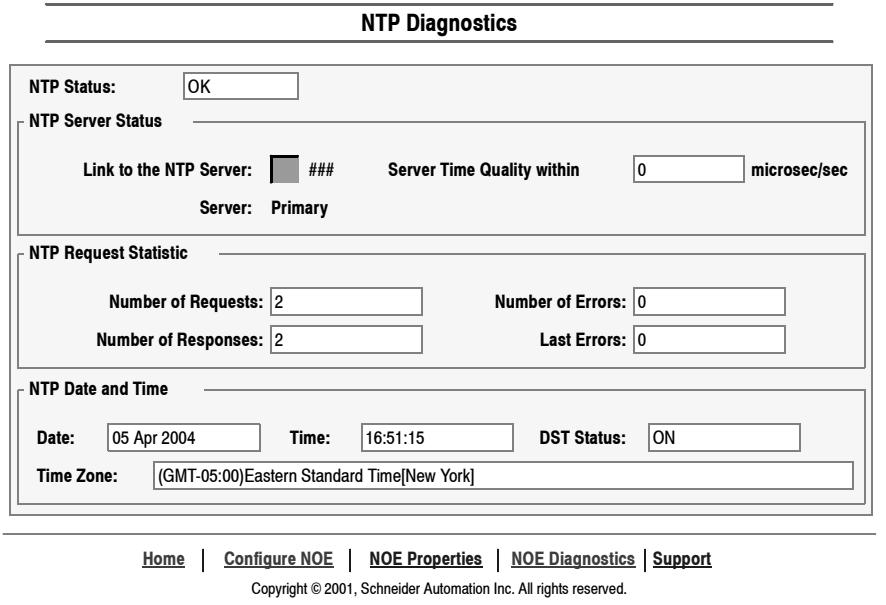
NTP Diagnostics Page

NTP Diagnostic Dialog

Time synchronization service parameters:

Parameter	Description
NTP status	Service is correctly configured (OK)
NTP server status	NTP client is connected to the NTP server, and if the server is Primary or Standby
NTP requests	Total number of client requests sent to the NTP server
NTP responses	Total number of server responses sent from the NTP server
Number of errors	Total number of unanswered NTP requests
Last error code	Last error code received from the NTP client
Date	Date in d/m/y format
Time	Time
Time zone	Time zone plus or minus Universal Time, Coordinated (UTC)
DST	Daylight saving time (DST) parameter is either **1.** on (enabled) **2.** off (disabled)

The dialog:



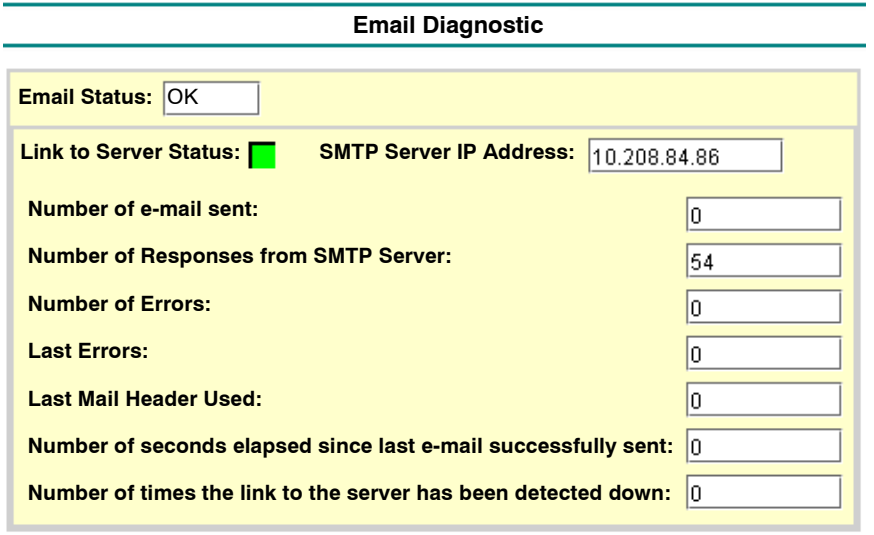
Last Error Field Last Error field displays values, which indicate the type of error.

Type of Error	Value
Component OK and running	0
Excessive network traffic or server overload	1
Bad parameters in the configuration	3
Component is disabled	4
Incorrect IP	9
Time zone file absent	14
Syntax error in the customrules file	15

Email Diagnostics Page

Email Diagnostics

The dialog



Electronic mail notification service parameters

Parameter	Description
Email status	Email service is correctly configured (OK).
Link to Server Status	Ethernet module is connected to the SMTP server Status is checked at start-up and at least every 30 minutes after start-up ● Green = module connected to server ● Red = module NOT connected to server
SMTP Server IP Address	IP address of the SMTP server
Number of e-mails sent	Total number of emails sent successfully
Number of Responses from SMTP Server	Total number of SMTP messages received from the SMTP server
Number of Errors	Total number of e-mails NOT sent because of an error
Last Errors	Reason for the last error with a code in hexadecimal. 0 displays if no error occurs
Last Mail Header Used	Last header used by giving the number.
Number of seconds elapsed since last e-mail successfully sent	Counts the number of seconds since the last email was successfully sent.
Number of times the link to the server has been detected down	Number of times the SMTP server could not be reached. (Link checked every 30 minutes.)

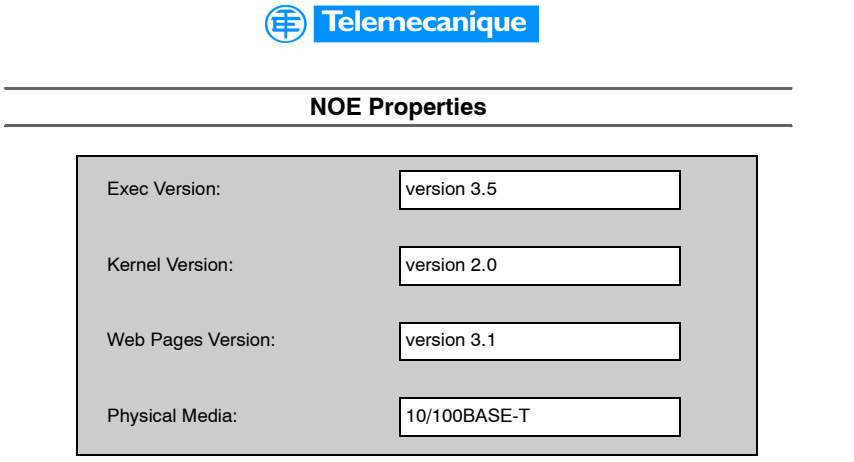
NOE Properties Page

Overview

The following information describes the NOE Properties Page.

Introduction to the NOE Properties Page

The following figure shows the NOE Properties Page, which displays the Exec, Kernel, Web Pages versions, and the Physical Media being used.



Note: The NOE Properties Page is "information only." The fields cannot be changed.

NOE Properties Page Links

The following table describes 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

Crash Log Diagnostics

Introduction to the Crash Log Diagnostics Page

The Crash Diagnostics Page displays a crash log file when a crash has occurred, and a status message when no crash has occurred.
Press **Clear Crash Log File** to clear the file.

Crash Log Diagnostics Links

The following table describes 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 about 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 Electric Page

Overview

The following information describes the Contacting Schneider Electric Page.

Introduction to the Contacting Schneider Electric Page

The following figure shows the Contacting Schneider Electric Page, which contains information about how to obtain support for the NOE 771 xx modules.

Contacting Schneider Electric

Technical Information
Click here to go to the Schneider Electric Automation web site.

Contact Us
Click here to contact Schneider Electric in your country.

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

Hot Standby

12

At a Glance

Introduction

The NOE 771 x0 modules offer a Hot Standby configuration available for Quantum controllers.

Note: Hot Standby Availability and Unity
The 140 CPU 671 60 Hot Standby controller and the Hot Standby functionality will be available only in Unity V2.0 and higher.

What's in this Chapter?

This chapter contains the following topics:

Overview of Modicon Quantum Hot Standby with Unity Solution for NOEs

Please Note

The Modicon Quantum Hot Standby with Unity system supports up to six NOE 771 Ethernet adapters on bus controllers.

Description of the Hot Standby Solution

The NOE Hot Standby allows automatic IP Address swap. Both controllers are configured identically. One controller is the Primary NOE; the other controller, the Secondary NOE. In case of a failure, the controllers switchover and the system recovers.
The NOEs coordinate the swapping of IP addresses. After closing both the client and the server connections, each NOE sends a swap UDP message to its peer NOE. The sending NOE then waits a specified timeout (500 ms) for the peer swap of UDP messages. Either after receiving the messages or after a timeout, the NOE changes its IP address.

Note: NOEs must communicate with each other in order to swap IP Addresses. Schneider Electric recommends that you connect the primary and Secondary NOEs to the same switch because

- Communication failures between the NOEs increases the time to swap
- Connecting two NOEs to the same switch, minimizes the probability of a communication failure

Note: Schneider Electric recommends that a switch (not a hub) is used to connect the NOEs to each other or to the network. Schneider Electric offers switches; please contact a local sales office for more information.

The NOE waits for either a change in the controller's Hot Standby state or the swap of UDP messages. Then the NOE performs one of two Hot Standby actions.
If the NOE:

1. Detects that the new Hot Standby state is either primary or standby:
   The NOE changes the IP address
2. Receives a swap UDP message:
   The NOE transmits a Swap UDP message and swaps the IP address

All client/server services (I/O Scanner, Global Data, Messaging, FTP, SNMP, and HTTP) continue to run after the switchover from the old to the new Primary NOE.

Note: Failure of an NOE module is not a condition for the primary system to leave the primary state.

Hot Standby and NOE Module Functionality

The NOE 771 family provides different Ethernet services. Some services are enabled or disabled in a Modicon Quantum Hot Standby with Unity system. The following table shows which services are enabled and disabled.

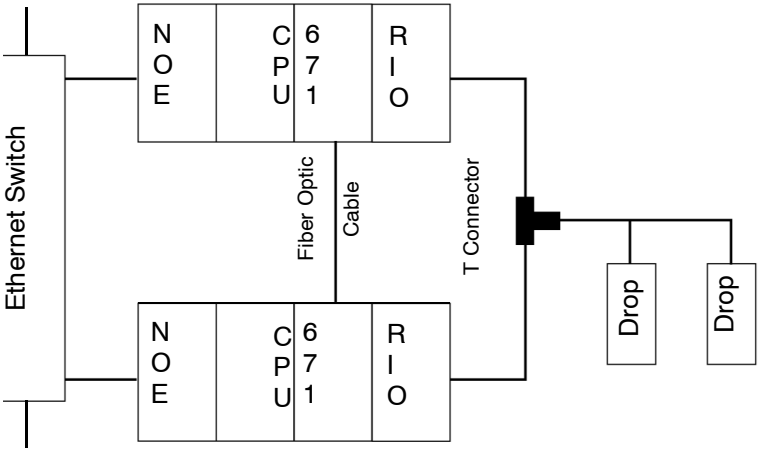
Service	NOE 771 x1
I/O Scanning	Enabled
Global Data	Enabled
Modbus Messaging	Enabled
FTP/TFTP	Enabled
SNMP	Enabled
HTTP Server	Enabled
DHCP	Disabled

Note: Only the 140 NOE 771 01 or 140 NOE 771 11 (TCP/IP Ethernet Modules) support a Modicon Quantum Hot Standby with Unity V2.0 system.

Hot Standby Topology

Hot Standby Interconnection

The following diagram shows a Hot Standby system and the relationship between the two redundant systems.Two 140 CPU 671 60 controllers are connected via a link created with fiber optic cable. The RIOs are connected both to each other (through the fiber optic cable) and to the RIO Drops.



Note: The following three items are required.
1. Two identical systems
2. Identical order of modules in each rack
3. Identical software revisions

In the preceding diagram the NOEs are connected to the same switch. Connecting to the same switch is recommended but not required. Connecting to the same switch is recommended because the NOEs communicate with each other in order to swap the IP address.

There are two reasons for connecting to the same switch:

- If a failure to communicate between the NOEs occurs, the time to swap increases.
- Therefore to minimize the probability of a failure, connect the two NOEs to the same switch.

The other requirement for the switches is that they are on the same sub network.

NOE Configuration and Hot Standby

TCP/IP Configuration

When an NOE goes into service the first time, the NOE attempts to get its IP Address from a BOOTP server. If no BOOTP server is available, the NOE derives its IP Address from its MAC address. Connecting to a BOOTP server or deriving the IP Address from a MAC address allows you a connection to the NOE, that enables you to download a project to the PLC.
All standard rules apply to IP addressing with the additional restriction that the IP address cannot be greater than 253 or broadcast address minus 2. Also, no other device can be assigned the configured IP + 1 address.

IP Address Assignment

Configuring the NOE

The NOE can be configured to work in conjunction with the Modicon Quantum Hot Standby with Unity controller. Since the Primary and Secondary controllers must have an identical configuration, the configured IP Addresses will be the same. The NOE's IP Address is either the configured IP Address or the configured IP Address +1. The IP Address is determined by the current local Hot Standby state.
In the Offline state, the IP Address is determined by whether or not the other controller is in transition to the Primary state.

Note: For a Modicon Quantum Hot Standby with Unity system, the two IP Addresses will be consecutive.

The following table shows the IP Address assignments.

Hot Standby State	IP Address
Primary	Configured IP Address
Standby	Configured IP Address + 1
Transition from Primary to Offline	Configured IP Address, if peer controller **does not** go to Primary
Transition from Standby to Offline	Configured IP Address + 1

Note: Offline - Results depend on whether or not the other controller is detected as in transition into the primary state. If Current IP is the configured IP Address, then change the IP Address to the configured IP Address + 1.

IP Address Restriction

Note: Configuring NOE
Do not use either broadcast IP Address or broadcast IP Address - 2 to configure a NOE.

IP Address Transparency

For continued Ethernet communication, the new Primary NOE must have the same IP Address as the former Primary NOE. The IP Address in the Secondary NOE (an NOE in the secondary state) is IP Address + 1.
The NOEs integrated into the Modicon Quantum Hot Standby with Unity configuration coordinate this swapping IP Address with the management of Ethernet services used.

Note: Do not use the address IP + 1. For a Modicon Quantum Hot Standby with Unity system, do not use consecutive addresses of the configured IP Address. If you configure the last IP Address (255), NOE returns diagnostic code "Bad IP configuration".

NOE Operating Modes and Modicon Quantum Hot Standby with Unity

The NOE Modes

The NOE modes are

- **Primary Mode**
  The Hot Standby state is primary, and all client/server services are active.
- **Secondary Mode**
  The Hot Standby state is standby, and all server services are active except DHCP.
- **Standalone Mode**
  Occurs when NOE is in a nonredundant system, or if the HE CPU module is not present or is not healthy.
- **Offline Mode**
  CPU is stopped.
  CPU module is in Offline mode.

The Modicon Quantum Hot Standby with Unity and the NOE operating modes are synchronized by the conditions described in the following table.

HE CPU Module Status	HSBY State	NOE Operating Mode
Present and Healthy	Primary	Primary
Present and Healthy	Standby	Secondary
Present and Healthy	Offline	Offline
Present and Healthy	Unassigned	Standalone
Not present or unhealthy	N/A	Standalone

Any one of four events will affect the NOE operating mode. These four events occur when the NOE is powered-up, when an NOE executes a Hot Standby switchover, when an NOE goes to offline mode, or when a new application is downloaded to the NOE.

Power-Up and IP Address Assignment

An NOE obtains its IP Address assignment at power-up as follows:

If the HSBY state is ...	Then the IP Address assigned is ...
Unassigned	Configured IP Address
Primary	Configured IP Address
Secondary	Configured IP Address + 1
Unassigned to Offline	See the *Offline Mode at Power-up Sequence* table following

If two NOEs power-up simultaneously, a "resolution algorithm" determines the Primary NOE, and after determining the Primary NOE, the "resolution algorithm" assigns the configured IP Address to the Primary NOE and then assigns the configured IP Address + 1 to the Secondary NOE.
Offline Mode at Power-up Sequence table:

Offline Mode at Power-up Sequence	Result
Controller A powers-up before controller B	• IP Address of controller A is configured IP Address • IP Address of controller B is the configured IP Address + 1
Both controller A and controller B power-up a the same time	The resolution algorithm will assign controller A the configured IP address and will assign controller B the configured IP address + 1.

The NOE performs a "duplicate IP" test by issuing an ARP request to the configured IP Address. If a response is received within 3 seconds, the IP Address remains at the Default IP and blinks a diagnostic code.
If no IP configuration exists, the NOE remains in standalone mode, and the IP Address must be obtained from either a BOOTP server or from a MAC address.

Power-Up and Ethernet Services

The following table shows how the status of an NOE service is affected by the Modicon Quantum Hot Standby with Unity HSBY state.

HSBY State	Status of NOE Services					
	Client Services		Client/Server Services	Server Services		
	I/O Scanner	Global Data	Modbus Messaging	FTP	SNMP	HTTP
Unassigned	Run	Run	Run	Run	Run	Run
Primary	Run	Run	Run	Run	Run	Run
Secondary	Stop	Stop	Run	Run	Run	Run
Offline	Stop	Stop	Run	Run	Run	Run

Hot Standby Switchover

The following steps describe how NOEs coordinate the Hot Standby switchover.

Step	Action
1	NOE A (installed in a HSBY rack) detects that its local controller changed from Primary to Offline.
2	NOE A changes its HSBY state from Primary to Offline with the same Ethernet services running, starts its watch-dog timer (with 500 ms timeout setting), and expects from its peer NOE a UDP request to swap the IP Address.
3	NOE B (installed in peer HSBY rack) detects that its local controller changed state from Secondary to Primary.
4	NOE B stops all Ethernet services, sends a UDP request to its peer NOE (NOE A) for the synchronization of the IP Address swap, starts its watch-dog timer (with 500 ms timeout setting), and then waits for an UDP response from its peer NOE.
5	Once NOE A receives the UDP request from NOE B (or after its watch-dog timer times out), it stops all Ethernet services, sends a UDP response to NOE B (no UDP response is sent to NOE B for watch-dog timeout case), swaps IP Address as Secondary, and starts Secondary services.
6	As soon as NOE B receives the UDP response from NOE A (or after its watch-dog timer times out), it swaps IP Addresses and starts Ethernet services as Primary.
7	After NOE A senses that its local controller changes state from Offline to Standby, it changes to Secondary accordingly.
8	The Secondary NOE now becomes the Primary NOE.
9	Primary NOE opens all client connections and listens for all server connections and re-establishes those connections.
10	Simultaneously, Secondary NOE listens for all server connections and re-establishes those connections.

Going to Offline

When either the CPU stops or the Hot Standby state goes to offline mode, two events occur:

1. NOE mode goes to Offline

2. NOE uses the IP Address of the present configuration

IP Address Assignment and Going Offline

HSBY State	IP Address Assigned Is ...
Primary to Offline	Configured IP Address, if other controller **does not** go to Primary
Standby to Offline	Configured IP Address + 1

Address Swap Times

Description

The following table details what the "time for an Address swap" comprises, such as the time to close connections, time to swap IP addresses, or time to establish connections.
The following table shows the swap time for each of the Ethernet services.

Service	Typical Swap Time	Maximum Swap Time
Swap IP Addresses	6 ms	500 ms
I/O Scanning	1 initial cycle of I/O Scanning	500 ms + 1 initial cycle of I/O scanning
Global Data	For swap times, please see the 840USE11600, *Quantum NOE 771 xx Ethernet Modules User Guide*	500 ms + 1 CPU scan
Client Messaging	1 CPU scan	500 ms + 1 CPU scan
Server Messaging	1 CPU scan + the time of the client reestablishment connection	500 ms + the time of the client reestablishment connection
FTP/TFTP Server	The time of the client reestablishment connection	500 ms + the time of the client reestablishment connection
SNMP	1 CPU scan	500 ms + 1 CPU scan
HTTP Server	The time of the client reestablishment connection	500 ms + the time of the client reestablishment connection

Network Effects of Modicon Quantum Hot Standby with Unity Solution

Overview

The Modicon Quantum Hot Standby with Unity solution is a powerful feature of NOEs, a feature that increases the reliability of your installation. Hot Standby uses a network, and using the Hot Standby feature over a network can affect the behavior of

- Browsers
- Remote and Local clients
- I/O Scanning service
- Global Data service
- FTP/TFTP server

The following are factors you may encounter while using the Modicon Quantum Hot Standby with Unity solution.

Browsers

Note: In Modicon Quantum Hot Standby with Unity configuration the NOE's I/O scanner is enabled.

If a browser requests a page and during the process of downloading that page an IP Address swap occurs, the browser will either hang or time out. Click the **Refresh** or **Reload** button.

Remote Clients

Hot Standby swaps affect remote clients.
An NOE will reset under the following conditions:

- **Remote Connection Request during Hot Standby Swap**
  If a remote client establishes a TCP/IP connection during a Hot Standby swap, the server closes the connection using a TCP/IP reset.
- **Hot Standby Swap during Remote Connection Request**
  If a remote client makes a connection request and a Hot Standby swap occurs during the connection request, the sever rejects the TCP/IP connection by sending a reset.
- **Outstanding Requests**
  If there is an outstanding request, the NOE will not respond to the request, but the NOE will reset the connection.

The NOE will do a Modbus logout if any connection has logged in.

Local Clients

During a swap, the NOE will reset all client connections using a TCP/IP reset.

I/O Scanning Service

The I/O Scanning provides the repetitive exchange of data with remote TCP/IP nodes I/O devices. While the PLC is running the Primary NOE sends Modbus Read/Write, read or write request to remote I/O devices, and transfer data to and from the PLC memory. In the secondary controller, the I/O scanning service is stopped. When the Hot Standby swap occurs, the Primary NOE closes all connections with I/O devices by sending a TCP/IP reset. The I/O scanning service in this NOE is standby.

After the swap, the new Primary NOE re-establishes the connection with each I/O devices. It restarts the repetitive exchange of data with these re-connections.

The NOE 771 01 and 11 provides the I/O scanning feature. Configure using either

- Unity Pro software
- Internal I/O Scanner Web page

Using either method, the configuration and transfer of data between network addresses can be done without using the MSTR/IEC function block.

Note: I/O SCANNING AND SWITCHOVER WITH CRITICAL APPLICATIONS
Account for the following Ethernet I/O scanning considerations during a switchover.

- If MSTR/IEC function block is used for TCP/IP, only some of the Op Code will be used. Therefore, the block will not complete its transaction and returns error code 0x8000.
- While the NOE is in the process of performing the transaction, a new MSTR/IEC function block may become active.
- The output states of the scanned I/Os will follow the state defined in the last value option configured in the I/O scanning table of the NOE module (in Unity Pro software).
  These two states are either
  1. set to 0
  2. Hold last

With the above considerations, Schneider Electric recommends using switchover with Ethernet I/O scanning for less critical applications.

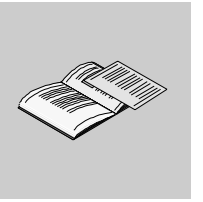
Global Data (Publish/ Subscribe) Service

The Hot Standby NOE is one station within a distribution group. Distribution groups exchange application variables. Exchanging application variables allows the system to coordinate all the stations in the distribution group. Every station publishes local application variable in a distribution group for all other stations and can subscribe to remote application variables independent of the location of the producer.
The communication port has only one multicast address.
In this network service, the Modicon Quantum Hot Standby with Unity controllers are viewed like only one station. The Primary NOE publishes the Hot Standby application variables and receives the subscription variables. The Secondary NOE global data service is in a stopped state.
When the Hot Standby swap occurs, the Primary NOE stops the Global Data service. The NOE does not publish the local variable during a swap. And after the swap, the new Primary NOE starts to publish application variables and to receive the subscription variables.

FTP/TFTP Server

The File Transfer Protocol/Trivial File Transfer Protocol (FTP/TFTP) server is available as soon as the module receives an IP address. Any FTP/TFTP client can logon to the module. Access requires the correct user name and password. Modicon Quantum Hot Standby with Unity allows only one active FTP/TFTP client session per NOE module.
When the Hot Standby swap occurs, the Primary and Secondary NOEs close the FTP/TFTP connection. If a user sends an FTP/TFTP request during the swap, the communication is closed.
Whenever you re-open communication, you must re-enter a user name and a password.

Appendices



At a Glance

Introduction

The appendices provide supplementary reference information for the Quantum 140 NOE 771 •• series of modules and the 140 NWM 100 00 module.

What's in this Appendix?

The appendix contains the following chapters:

Maintenance

A

At a Glance

Introduction

This chapter details information about 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:

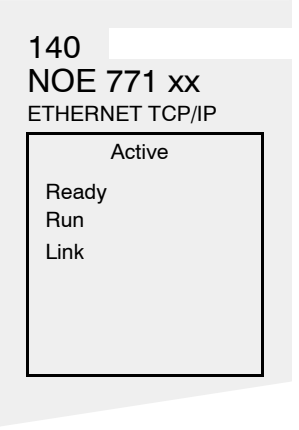
Responding to Errors

Overview

The following information describes how to respond to errors on the NOE 771 x0.

Detecting Errors

When faults occur, the NOE 771 xx LED display can help you determine what went wrong. The following figure shows the pattern that the LEDs should display during normal operation.



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 occurs, 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.

Procedure for Responding to an Active LED Error Indicator

If the Active LED fails to light, the NOE 771 00 module is not communicating with the backplane. The following procedure describes the steps to perform to respond to an Active LED error.

Step	Action
1	Make sure the NOE 771 module and the controller are installed properly.
2	Verify that the controller is working; if it is not, replace it.
3	If neither the new controller nor the NOE 771 module functions, replace the backplane.
4	Make sure that no more than two network option modules -- including NOE, NWM, NOM, NOP, and CRP 811 modules -- have been installed in the backplane with a 140 CPU 311 10; not more than six network option modules with a 140 CPU 434 12A or 140 CPU 534 14A.
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 out ok, replace the NOE 771 module.

Procedure for Responding to a Ready LED Error Indicator

If the **Ready** LED fails to light, the NOE 771 module has failed internal diagnostic tests. The following procedure describes the steps to perform.

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

Procedure for Responding to a Link LED Error Indicator

If the **Link** LED fails to light, the NOE 771 module is not communicating with the Ethernet hub/switch. The following procedure describes the steps to perform to respond to a **Link** LED error.

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 check ok, replace the NOE 771 module.

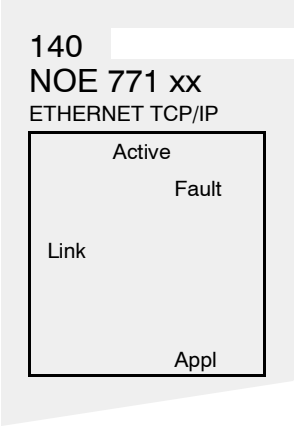
Kernel LED Error

The following table describes the **Kernel** LED errors that may occur and how to respond to them.

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 exists.	download a new NOE Exec see .

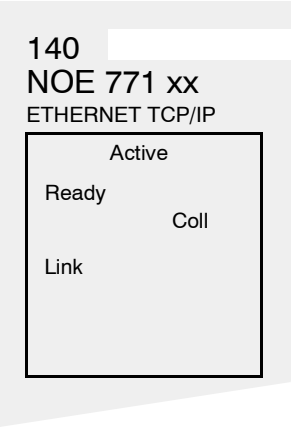
Fault LED

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



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.)
The following figure shows the Collision LED.



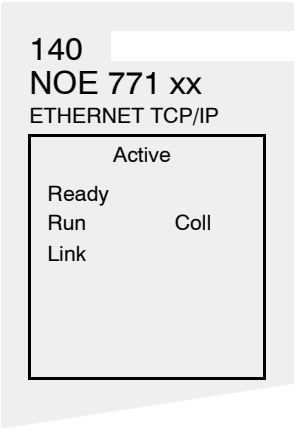
Procedure for Responding to a Collision LED Error

If the Collision LED fails to light, use the following procedure.

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

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.
The following figure shows the Collision LED under normal conditions.



Run LED

The following table describes 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 *Reading and Clearing the Crash Log, p. 287*.

Reading and Clearing the Crash Log

Overview

The following information describes 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 on, 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 *Embedded Web Pages, p. 217*) or via FTP.

Procedure for Reading the Crash Log via FTP

The following procedure describes the steps to perform 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 file: `get crash.log`

Clearing the Crash Log

The crash log can be cleared from the Embedded Web Pages (see *Embedded Web Pages, p. 217*) or via FTP.

Procedure for Clearing the Crash Log via FTP

The following procedure describes the steps to perform 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 delete the crash log file: `rm crash.log`

Downloading a New NOE Exec

Introduction

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

- Schneider Electric programming packages (see corresponding manuals)
- FTP

Downloading a New NOE Exec via FTP

Exec Version

Please check the current NOE Exec file version on the **NOE Properties** Web page. Follow these links:| **Web Server** | **Diagnostics and Online Configuration** | **NOE Properties** |

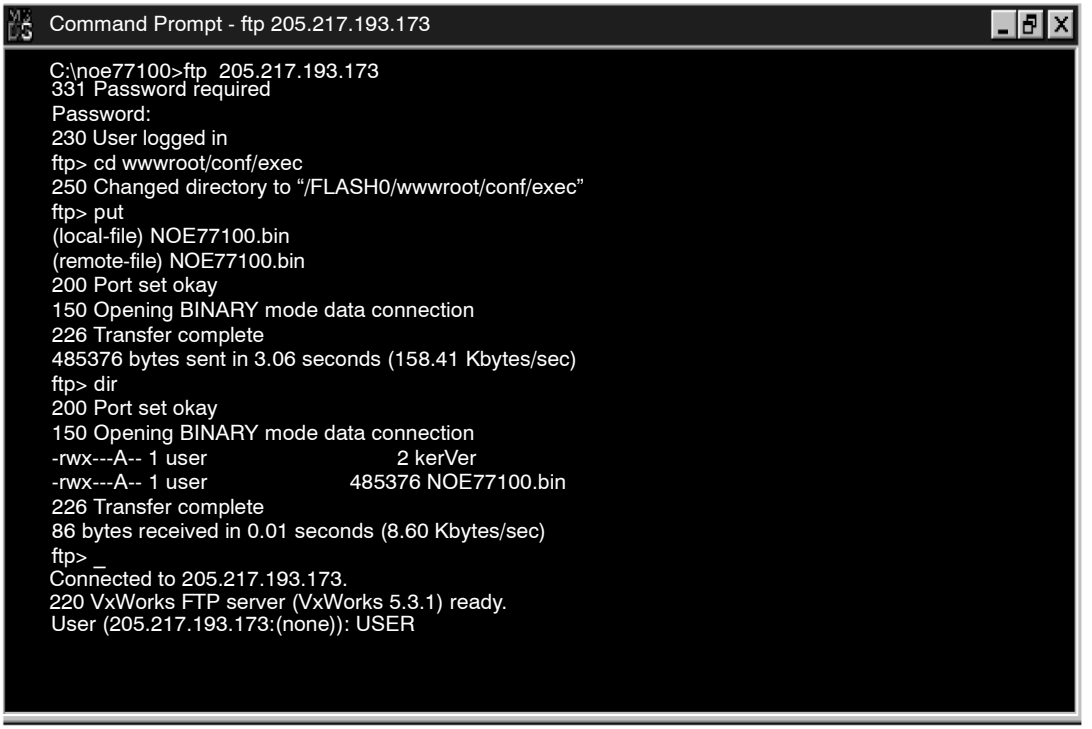
Procedure

The following procedure describes the steps to use to download a new NOE Exec via FTP. An example follows the procedure.

Step	Action
1	At the DOS prompt, type `FTP`, followed by the IP Address and press **Enter**.
2	At the User prompt, type: `USER` and press **Enter**.
3	At the password prompt, enter your FTP Password and press **Enter**.
4	At the FTP prompt, type `cd wwwroot/conf/exec` and press **Enter**.
5	At the FTP prompt, type `put` and press **Enter**. **Note:** Pay attention that the NOE771xx.bin has to be to the local path on your PC (default path: `c:\`).
6	At the local file prompt, type `NOE771xx.bin` and press **Enter**.
7	At the remote file prompt, type `NOE771xx.bin` and press **Enter**.
8	After the transfer is complete you must reboot the NOE to allow the new EXEC to become operational. **Note:** The file name is case sensitive and must be entered with the name in uppercase and the extenion in lowercase as shown in the figure below. For example: `NOE771xx.bin`

Sample FTP Session

The following FTP session was used to download an NOE Exec.



Note: The NOE Kernel can not be downloaded via FTP.

Reboot Information after FTP

Note: After downloading by FTP, reboot the module.
Perform a download or a reboot when your system can tolerate these actions.

Downloading a New NOE Kernel

Procedure

The NOE Executive (Exec) adds a new feature that allows updating of the low level Kernel within the NOE 771 xx's firmware. For the proper installation of new kernel firmware, use the following procedure.

Step	Action
1	Check the current version of the NOE's Executive firmware (Exec file).
2	If the Exec is not the appropriate version, the Exec must be updated before updating the Kernel.
3	Use the EXECLoader to load the latest version of the EXEC.
4	After loading the new Exec and before loading the Kernel, make sure to cycle power to the NOE.
5	Load the Kernel using the EXECLoader.
6	After the transfer displays as Successful, the NOE needs approximately 1 minute to burn the new Kernel into the NOE's FLASH.
7	The NOE goes go through a reboot sequence.

Kernel Version

Note: The NOE Kernel can not be downloaded via FTP.

Please check the current NOE Kernel version on the **NOE Properties** Web page. Follow these links:| **Web Server** | **Diagnostics and Online Configuration** | **NOE Properties** |

Note: NOE Operation
Failure to perform the preceding update procedure will render the NOE inoperable.

Specifications

B

Specifications

Overview

The following information describes the main specifications for the Quantum 140 NOE 771 xx and 140 NWM 100 00 Ethernet Module.

140 NOE 771 •• Specification Table

The main specifications for the Quantum 140 NOE 771 xx 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
	Unity Pro, Ver. 1.0, 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

140 NWM 100 00 Specification Table

The main specifications for the Quantum 140 NWM 100 00 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	900 mA
Power Dissipation	4.5 W
Fuse	None
Programming Software	
Type and version	Concept, Ver. 2.6, or higher
	Unity Pro, Ver. 1.0, or higher
Firmware	
CPU Type and version	Quantum Executive, Ver. 2.6, 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
Immunity	
International Standard	ISO/IEC 802-3 ANSI/IEEE Std 802.3 2000 Edition
US Standard	UL508, CEI 1131-2 for Immunity and 50081-2 for Emissions.
European Standard	CSA C22.2 / 142
Canadian Standard	Conformity to FCC-B for Emission (50082-1 CE Marketing Conformance to Marine Standards for the Principal European Organizations V, DNV, GL, LROS, RINA IEC 61131-2, EN66631-2
Agency Approvals	
	UL 508, 94 Specifications CSA 22.2-142 IEC 1131 CE Factory Mutual Class 1 Division 2 Maritime Certifications

Quantum Ethernet TCP/IP Modbus Application Protocol

C

At a Glance

Introduction

This chapter describes the Quantum Ethernet TCP/IP Modbus Application Protocol.

What's in this Chapter?

This chapter contains the following topics:

Overview

Introduction

The following information describes the Modbus Application Protocol (MBAP).
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*.

Modbus Application Protocol PDU

Overview

The following information describes the structure and content of the Modbus Application Protocol PDU.

Description

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 fields listed in the following table:

Field	Description
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 it includes the dst_id and data fields

The remainder of the pdu includes two fields:

Field	Description
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 it is defined below

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

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

The following table describes the fields in mb_pdu.:

Field	Description
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.

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`
The following table shows the structure and content for this example:

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 PIC'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

Oveview

The following information provides an analysis of the Modbus Application Protocol.

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 octets802.2_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.

Structure and Content

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
serviceslen[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 codedata[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

Overview	The following information describes some 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

Overview

The following information provides a list of reference documents that you may find helpful.

Introduction

Following is a list of related documentation.

- ANSI/IEEE Std 802.3-1985, ISO DIS 8802/3, ISBN - 0-471-82749-5, May 1988
- ANSI/IEEE Std 802.2-1985, ISO DIS 8802/2, ISBN 0-471-82748-7, Feb 1988
- RFC793, TCP (Transmission Control Protocol) DARPA Internet Program Protocol Specification, Sep 1981
- RFC 791, IP (Internet Protocol) DARPA Internet Protocol Specification, Sep 1981
- RFC826, An Ethernet Address Resolution Protocol (ARP), David Plummer, NIC Sep 1982
- RFC1042, A Standard for the Transmission of IP Datagrams over IEEE 802.2 Networks, Postel & Reynolds, ISI, Feb 1988
- RFC 792, ICMP (Internet Control Message Protocol) DARPA Internet C Control Message Protocol Specification, Jon Postel, Sep 1981
- RFC951, BOOTSTRAP PROTOCOL (BOOTP), Bill Croft and John Gilmore, September 1985
- RFC783, The Trivial File Transfer Protocol (TFTP) rev 2, K.R. Solons MIT, June 1981

Errata

D

At a Glance

Overview

A table of errors in the manual is presented. A table describing the electonic mail notification service objects is also provided.

What's in this Chapter?

This chapter contains the following topics:

User Manual Errata Sheet

Summary The following technical and typographical errors have been identified in this manual:

Location in the Manual	on Page ...	Original Content	is replaced with ...
About the Book:	14: second bullet	*The Global Data modules (NOE 771 01 and NOE 771 11)*	*The Global Data modules (NOE 771 01, NOE 771 11 and 140 CPU 651 x0*)
Section 4. 8: 140 CPU 651 x0 Product Overview	21: table, 19th row, first and second columns	*Time Synchronization Service X*	*Remove X—the 140 CPU 651 x0 does not support the time synchronization service.*
Section 4.8: 140 CPU 651 x0 Product Overview	21: table, 20th row, first and second columns	*Electronic Mail Notification Service*	*Insert X—the 140 CPU 651 x0 supports the electronic mail notification service.*
Chapter 1.2.2: Run LED Status	44: table, eleventh row, first column	*eight (140 NWM 100 00 only)*	*eight (140 NWM 100 00 only) (140 NOE 771 x1 only)*
Section 1.3.7: Establishing the FTP Password, Introduction to Accessing the Web Server	57: second paragraph	*The web pages can only be viewed across the World Wide Web using version 4.0 or higher of either Netscape Navigator or Internet Explorer, both of which support JDK 1.1.4 or higher.*	*The web pages can be viewed using Internet Explorer 4.0 or higher supporting JRE 1.4.2_04 or higher.*
Chapter 2.1: Modicon Quantum with Unity Ethernet Services	68: table, tenth row, fourth column	*Web Unity Pro*	*Web* Note: The 140 NOE 771 11 time synchronization diagnostics are available only through the web.
Chapter 2.1: Modicon Quantum with Unity Ethernet Services	68: table, third row, fifth column	*Web Unity Pro*	*Unity Pro* Note: The 140 CPU 651 x0 address server is configured through Unity Pro only.
Chapter 2.3: SNMP and Schneider Private MIB Overview	72, first line	*Simple Network Management Protocol (SNMP) is configured on your NOE.*	*Simple Network Management Protocol (SNMP) is configured on your NOE or 140 CPU 651 x0.*
Chapter 2.3: SNMP and Schneider Private MIB Overview, Simple Network Management Protocol	72, first and second lines	*Your NOE module is configured with the Simple Network Management Protocol (SNMP), which is the standard protocol used to manage a local area network (LAN).*	*Your NOE module or 140 CPU 651 x0 controller supports the Simple Network Management Protocol (SNMP), which is the standard protocol used to manage a local area network (LAN).*
Chapter 2.5: I/O Scanner Parameters	75, table, fifth row, Health Timeout Value	*User configured (1 ms to 2 s in 1 ms increments)*	*User configured (1 ms to 50000 ms in 1 ms increments) (50000 ms = 50 seconds)*

Location in the Manual	on Page ...	Original Content	is replaced with ...
Chapter 2.11: Embedded Web Pages-HTTP Server, Web Configuration and Diagnostics	81: second table, step 4	*Use the HTTP Server:* *1. with Internet Explorer version 4.0 or higher* *2. to view:* ● *Module's Ethernet statistics* ● *Controller and I/O information* ● *BOOTP/DHCP/FDR (Faulty Device Replacement) server information* ● *Global Data (Publish / Subscribe) information* 3. *to configure the module's BOOTP/DHCP/FDR server and SNMP agent*	*Use the HTTP server to:* *1. view:* ● *module's Ethernet statistics* ● *controller and I/O information* ● *server information (BOOTP/ DHCP/FDR)* ● *diagnostic information for some Ethernet services* *2. configure module's Ethernet services* *Use Internet Explorer version 4.0 or higher.* *For a complete list of services, see the Key Features table in Chapter 1.2.*
Chapter 2.11: Web Configuration	82	*Page displays only content related to web diagnostics pages, although page implies that content for both web configuration and diagnostics are displayed.*	*Refer to Chapter 11 for a description of the web configuration pages.*
Chapter 4.18: Board Status Word Bit, Definition by Module Type	147: second table, ninth row, first and second columns	7 (*Reserved)*	*7 140 CPU 651 x0* Note: Bit 7 is used by 140 CPU 651 x0.
Chapter 5.1: Table of Global Data Planning Spreadsheet	153: table, 15th row, second column	*The value is measured in milliseconds and can be set to a value that ranges from 50 through 10000 ms (increase in units of 50 ms)*	*The value is measured in milliseconds and can be set from 50 to 15000 ms in 50 ms increments.*
Chapter 5.3: Configuring Global Data	156: table, second row, second column	*Variable ID*	*Variable Symbols*
Chapter 5.3: Configuring Global Data	156: table, fifth row, first column	*Enet*	*Global Data*
Chapter 5.3: Configuring Global Data	156: table, seventh row, first and second columns	*Enet ID. Ethernet ID. Representation of the administrative order.*	*Variable ID*
Chapter 5.5: Configuring Global Data	163: table, step 3	*The value is measured in milliseconds and can be set to a value that ranges from 50 through 10000 ms (increase in units of 50 ms)*	*The value is measured in milliseconds and can be set from 50 ms to 15000 ms in 50 ms increments.*

Location in the Manual	on Page ...	Original Content	is replaced with ...
Section 6.1: I/O Scanner Concepts	166	No discussion of Device Control Block.	*Device Control Block Used to individually disable an entry/ device in the I/O Scanner table by checking the box (check mark appears in the box) and setting the associated bit in Device Control Block to 1.*
Chapter 6.1: I/O Scanner Parameters	167: table, fifth row, second column	*User configured (1 ms to 2 s in 1 ms increments)*	*User configured (1 ms to 50000 ms in 1 ms increments)*
Chapter 6.1: I/O Scanner Configuration Parameters	168: table, second step, third column, second item	*(For example, %MD2:4)*	Note: IEC notation removed.
Chapter 6.1: I/O Scanner Configuration Parameters	170: table, third row, second column	*If the option is selected (check mark appears in box),* ● *enabled* *User allows master to send requests to slave.* *If the option is NOT selected (check mark does NOT appear in box),* ● *disabled* *No requests sent from master to slave*	*If the option is selected (check mark appears in box), the IO scanner service can be disabled. Entries represent the scanned devices. You may individually disable the entries in the I/O scanner table by setting the associated bit in the Device Control Block to 1.* *If the option is not selected (check mark does not appear in box), the I/O scanner service is enabled. Module sends request to the scanned devices. You cannot individually disable the entries in the I/O scanner table.*
Chapter 6.1: I/O Scanner Configuration Parameters	170: table, fourth row, second column	*Note: If the Device Control Block parameter is disabled (check mark does NOT appear), the I/O Scanner closes the connection and sets the Health Bit to an unhealthy state (Health Bit set = 1).*	*Note: If the Device Control Block is checked (check mark appears in the box), you can disable any scanned device by setting its associated bit in Device Control Block to 1. Then, the I/O scanner closes the connection and sets the Health Bit to 0 (unhealthy state).*
Chapter 7.1: Address Server Configuration / Faulty Device Replacement	171: first paragraph	*This section covers the Address Server Configuration / Faulty Device Replacement service available only on the NOE 771 01 and -11, Transparent Factory / Real Time modules.*	*This section covers the Address Server Configuration / Faulty Device Replacement service available on the NOE 771 01 and -11 (Transparent Factory / Real Time modules) and HE CPU modules.*

Location in the Manual	on Page ...	Original Content	is replaced with ...
Chapter 7: SMTP Subtree	200: table	*List of Subtrees changed from published list.*	*See the Electronic Mail Notification Service* subtree table (see *p. 312*). Note: A diagram of the Schneider Electric (Groupe_Schneider (3833)) private enterprise MIB subtree appears in Chapter 8.
Chapter 11.1: Accessing the Web Utility Home Page	219: fourth and last paragraphs	*The Web pages can be viewed using either Netscape Navigator or Internet Explorer.*	*The web pages can be viewed using Internet Explorer 4.0 or higher.*
Chapter 12: Hot Standby, Introduction	265: first sentence	*The NOE 771 x0 modules offer a Hot Standby configuration available for Quantum controllers.*	*The NOE 771 x1 modules offer a Hot Standby configuration available for Quantum controllers.* Note: The x1 modules offer the Hot Standby capability
Chapter 12.7: I/O Scanning Device	277: second paragraph	*The NOE 771 01 and 11 provides the I/O scanning feature. Configure using either* • *Unity Pro software* • *Internal I/O Scanner Web page*	*The NOE 771 x1 modules provide the I/O scanning feature. Configure using the Unity Pro software.*
Appendix A: Downloading a New NOE Exec	288: first paragraph	No content about OS loader	*Use the OS loader to update the NOE Executive and web pages.* Note: Refer to the Unity Pro documentation.

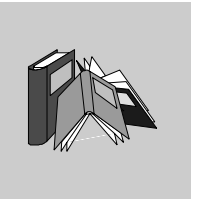
Electronic Mail Notification Service Subtree

Summary

The electronic mail delivery service subtree contains the following objects:

Service	Description
emailIndex (1)	index value in the email service table
smtpStatus (2)	global status of the SMTP service: ● idle(1): no configuration ● operational(2): operational and running ● stopped(3): stopped
smtpSrvAddr (3)	IP address of the remote SMTP server
smtpMailSentCnt (4)	total number of emails sent to the network and successfully acknowledged by server
smtpErrCnt (5)	total number of emails: ● not sent to the network ● sent but not successfully acknowledged by server (The smtpLastErr (6) object details the errors.)
smtpLastErr (6)	last error code (see Chapter 10 for details)
smtpLastMailElapsedTime (7)	number of seconds elapsed since last successful email sent
smtpLnkSrvStatus (8)	status of link between communication module and remote SMTP server: ● NOK (1) = SMTP server can NOT be reached ● OK (2) = SMTP server can be reached
smtpSrvChkFailCnt (9)	number of times link to SMTP server has been detected as down

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.

ASN.1 Abstract Syntax Notation. Grammar used to define a protocol (OSI scope)

B

Backplane A metal plate with a bus-bar and couplers. Use the backplane to attach a module and make a PLC bus connection.

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.

bps Bits per second.

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.
Cyclic Data Exchange	Provides data transfer between two or more NOE 771 xx 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.
DHCP	Dynamic Host Configuration Protocol. An improved version of BOOTP.
DHCP Client	Host on the network obtaining its configuration from a DHCP Server.
DHCP Server	Server providing configuration parameters to a DHCP Client.
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 the user customizes, 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. The protocol (over TCP) used to read or write a file into a remote station (the FTP server side).

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.

Global Data (Publish / Subscribe) Service of inter PLC synchronization (shared databases).

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

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

I

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

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.

I/O scanner Software component which is in charge of scanning Ethernet based Momentum IO in order to get inputs and set outputs.

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.

L

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

Legacy In the sense of network communication: Existing Components (PLC products etc.) that do not provide special (hardware) support for Control Intranet.

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

MIB Management Information Base. Database that holds the configuration of a SNMP enabled device.

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

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

N

NACK Negative acknowledgment indicating an error.

NDDS Network Data Delivery Services.

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

node An addressable device on a communications network.

NTP Network Time Protocol. A protocol used to synchronize the time of a client or server to the time of another server or referenced source like a satellite receiver.

O

OIT / **OID** Object Information True / Object ID (identify OIT) Contain databases managing SNMP (MIBs)

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.

PLC Programmable Logic Controller

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.

R

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

RFC Request For Comment. Paper identified by a number in Internet world. They define the state of art regarding Internet protocols (ruled by IETF = Internet Engineering Task Force) http://www.ietf.org

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.

SMTP Simple Mail Transfer Protocol. A common protocol used to transfer e-mail messages.

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 A bit mask used to identify or determine which bits in an IP address correspond to the network address and which bits correspond to the subnet portions of the address. The subnet mask is the network address plus the bits reserved for identifying the subnetwork.

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.

U

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

Uni-Te Télémecanique unified application protocol (used in S7, Premium, and Micro PLC ranges).

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

Web Worldwide interconnection of stations based on Internet protocols. The most famous one is HTTP (Web server).

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

Index

Numerics

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W