COMPAQ

Netelligent 2008/2016 10Base-T Repeater

User Guide

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Compaq Netelligent 2008/2016 10Base-T Repeater User Guide

Third Edition (August 1996)
Part Number 185814-003

Federal Communications Commission Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions in this manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Class A devices bear a label indicating the interference potential of the device as well as additional operating instructions for the user, such as the following: This device complies with Part 15 of the Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Department of Communications Radio Frequency Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numriques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministères des Communications du Canada.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Compaq Computer Corporation may void the user’s authority to operate the equipment.

Emissions

This equipment complies with EMC directive 89/336/EEC (ITE), which includes EN50081-1 CLASS 1: 1992 (EN55022/CISPR 22 for Class A ITE). It also complies with FCC Class A.

European Union Notice

Products with the CE (Community European) Marking comply with both the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European Norms:

- EN55022 (CISPR 22) - Electromagnetic Interference
- EN50082-1 (IEC801-2, IEC801-3, IEC801-4) - Electromagnetic Immunity
- EN60950 (IEC950) - Product Safety

Safety

This equipment complies with UL 1950, Second Edition; CAN/CSA C22.2 No. 950-93, 73/23/EEC Low Voltage Directive; TUV Rheinland EN60950, 1988; A1/1990, 1993; and A2/1992, 1992, 1993.

Immunity

This equipment complies with EMC directive 89/336/EEC (ITE), which includes EN 50082-1:

- IEC 801-2 (Electrostatic Discharge)
- IEC 801-3 (Radiated Immunity)
- IEC 801-4 (Electrical Fast Transient/Burst)
- EN55101-4 (Conducted Immunity) (not currently required)

Lithium Battery

The non-volatile RAM chip (Socket U8) on the repeater's motherboard contains a non-replaceable lithium battery. Only trained service personnel should dispose of this chip.

La puce mémoire non volatile (encoche U8) contient une pile au lithium non remplaçable. L'élimination de cette puce devrait être confiée à un personnel qualifié.

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Chapter 3
Installing the Repeater

Chapter 4
Administration and Management

Preface

This manual includes information about how to install, configure, and operate the Compaq Netelligent 2008/2016 10Base-T repeaters. We recommend that you read all chapters in this manual to become familiar with the repeater's features and to ensure a successful installation.

Intended Reader

This manual is written for network administrators and technicians responsible for hardware installation.

Organization of Contents

The contents of this guide are organized as follows:

Chapter 1 **—** Provides an overview of the repeater and describes the repeater's features.

Chapter 2 **—** Helps you plan the installation of the repeater.

Chapter 3 **—** Provides instructions for installing and powering up the repeater, installing an alternate media connector, and interconnecting and segmenting repeaters.

Chapter 4 **—** Provides information about repeater administration and management, including SNMP management, error and fault processing, and flash updates.

Appendix A **—** Includes the repeater's electrical, physical, and environmental specifications.

Glossary **—** Provides terms used throughout this guide, as well as general networking terms.

Chapter 1
Overview

The Compaq Netelligent 2008/2016 10Base-T repeater is the ideal connectivity solution for departmental Ethernet networks that contain 8 to 160 nodes. The repeater is available in a 16-port model and an 8-port model. The repeater is easy to configure, maintain, and expand. Each repeater is pre-configured with management capability and is fully manageable under SNMP management systems, such as Compaq Netelligent Management Software.

Features

Both repeater models include these features:

- RJ-45 ports (16 for the 16-port; 8 for the 8-port) to connect UTP or STP cabling to workstations and servers in a 10Base-T network
- Two repeater expansion ports (IN and OUT) that allow up to ten repeaters to be daisy-chained to accommodate network growth
- Extended Repeater Architecture (ERA) allows the combined cabling for all interconnected repeaters to extend up to 250 feet (76.22 meters). This makes repeaters perfect for network installations that require repeaters on multiple floors.
- Front-panel uplink switch that converts RJ-45 Port 16 on a 16-port repeater or Port 8 on an 8-port repeater to an uplinkable port so that the repeater can connect to another repeater in a star topology
- Serial port that supports out-of-band management and firmware upgrades using SLIP (Telnet and TFTP) or a serial connection (VT100 and XMODEM).
- In-band management and firmware upgrades using BOOTP/TFTP
- Segmentable on a per repeater basis
- LEDs that indicate power, segmentation, and collision status as well as port activity
- Full compatibility with the IEEE 802.3 10Base-T repeater specification

- SNMP agent that is fully compatible with the IEEE 802.3K specification and Novell's HMI specification.
- Maintains statistics at full Ethernet bandwidth
- Manageable with SNMP-based management software, such as Compaq Netelligent Management Software
- Standalone, stackable with other repeaters, or mountable in a standard 19-inch rack

The 10Base-T repeater also includes one Media Expansion Port (MEP) with slide-in connector that supports optional BNC (Thinnet), AUI (DB-15), and Fiber (10BASE-FL) Alternate Media Connectors (AMCs).

Figures 1-1 and 1-2 show the 16-port and 8-port repeater front panel. Figure 1-3 shows the back panel for both versions:

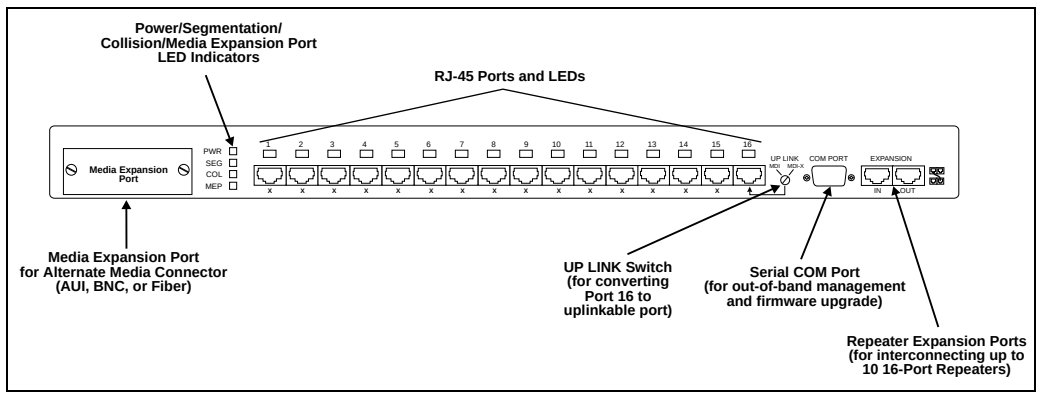


Figure 1-1. 16-Port Repeater Front Panel

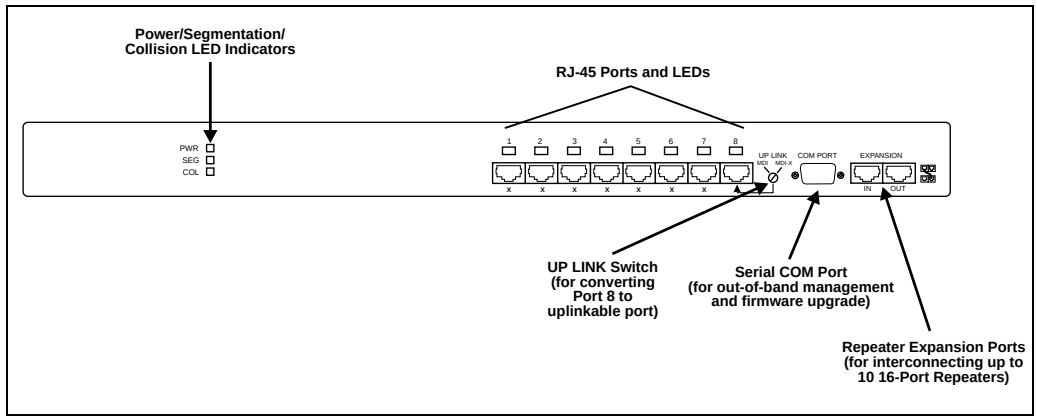


Figure 1-2. 8-Port Repeater Front Panel

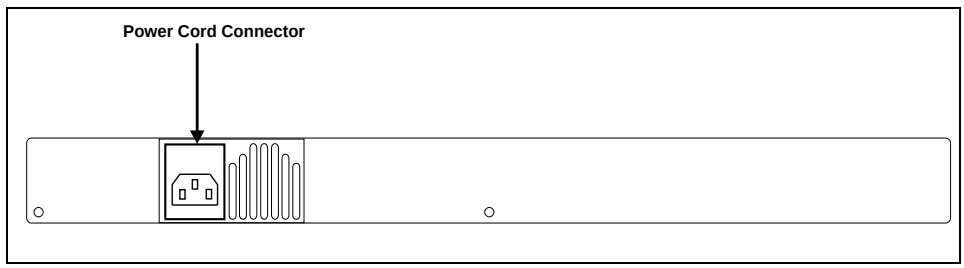


Figure 1-3. Repeater Back Panel

Repeater Components

This section provides an overview of the repeater's components including the LED indicators, connection ports, and uplink switch.

LED Indicators

The 10base-T repeater features several LED indicators that help you monitor and manage the repeater. The LEDs on the left side of the front panel provide the power, segmentation, and collision status of the repeater. The LEDs above the RJ-45 ports indicate activity at those ports. The repeater also provides an LED that indicates any activity on the Media Expansion Port (MEP).

The following table lists the possible colors and statuses of each LED and describes the meaning of each condition.

Table 1-1
LED Conditions and Descriptions

LED	Color	Description
PWR LED	Yellow	The repeater is booting up
	Flashing Yellow	There is some type of repeater failure
	Green	The repeater is operating
	OFF	The repeater is powered down.
SEG LED	Yellow	The repeater is segmented (isolated from the Ethernet backplane)
	Off	The repeater is unsegmented (connected to the Ethernet backplane).
COL LED	Flashing Yellow	Slow flashing indicates light collisions; fast flashing indicates heavy collisions
	OFF	No collisions are occurring

continued

MEP LED (16-Port Only)	Yellow	The port is in a partitioned state
	Green	The Fiber port is in a link OK state.
	Flashing Green	The port is in a receiving state.
	OFF	A link fail state occurred at the Fiber port or there is no connection at the Fiber port.
UTP Status LEDs	Yellow	The port is in a partitioned state.
	Green	The port is in a link OK state.
	Flashing Green	The port is in a receiving state.
	OFF	The port link state failed or there is no connection at the port.

NOTE: LEDs listed as yellow might appear orange on the repeater's front panel.

RJ-45 Ports

The 16-port repeater has 16 RJ-45 ports and the 8-port repeater has 8 RJ-45 ports. These ports let you connect UTP or STP cabling to workstations and servers in a 10Base-T network.

Media Expansion Port

The 10Base-T repeater has a Media Expansion Port (MEP) that lets you install one of the three optional Alternate Media Connectors (AMCs, sold separately) shown in Figure 1-4:

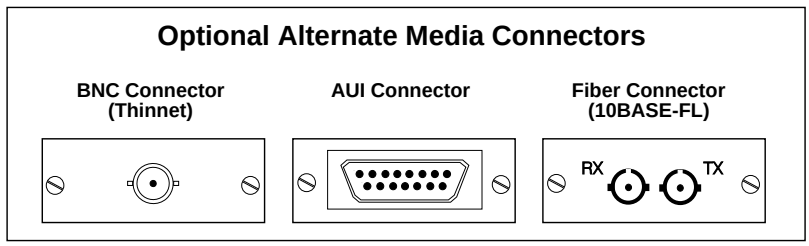


Figure 1-4. Alternate Media Connectors

- BNC for Thinnet (Part Number 267064-001)
- DB-15 for AUI wiring (Part Number 267063-001)
- Fiber (Part Number 267065-001)

NOTES:

— The MEP is the 17th logical port on the repeater.

— Link test is available for the fiber optic AMC (i.e., hardware is always enabled, but firmware can effectively disable link test). Link test is not available for AUI or BNC AMCs.

Repeater Expansion Ports

The Repeater Expansion Ports (REPs) let you interconnect up to 10 repeaters to form a single logical stack. Each REP consists of a standard RJ-45 connector.

The OUT REP of one repeater connects to the IN REP of the repeater located immediately above, using a standard 8-wire (four twisted pairs) UTP cable (Figure 1-5).

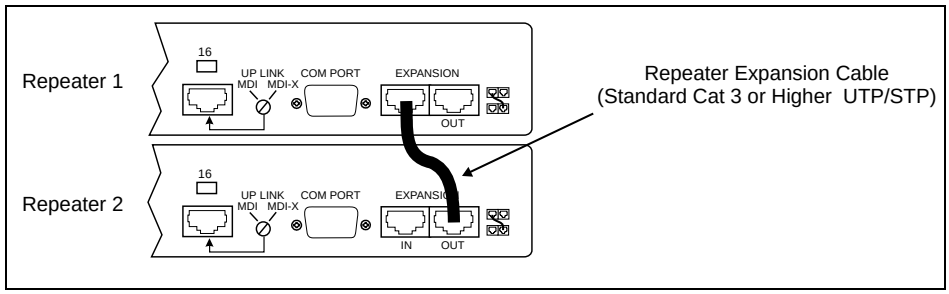


Figure 1-5. Repeater Expansion Ports

NOTE: The REPs on the 8-port repeater are compatible with the REPs on the 16-port repeater. This allows both types of repeaters to coexist in the same stack.

Serial COM Port

The repeater has a serial COM port that uses a 9-pin D male connector with a standard AT pinout. This port enables the following operations:

- XMODEM downloads of text configuration files
- XMODEM Flash downloads
- SLIP (Serial Line Internet Protocol) functions including remote (out-of-band) management and TFTP Flash downloads

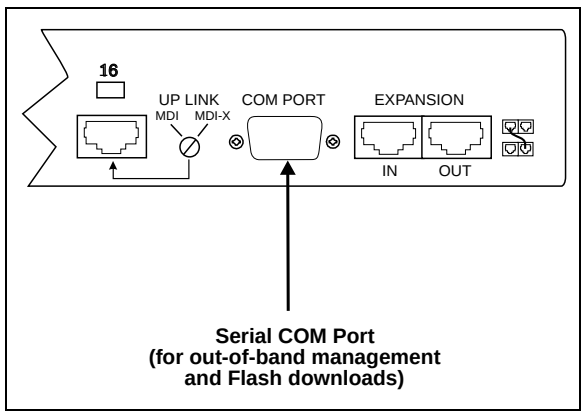
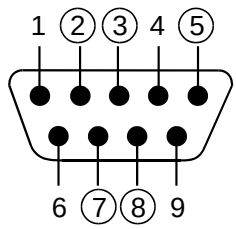


Figure 1-6. Serial COM Port

Serial Port Pinouts

The repeater uses five out of the nine available pins on the serial port DB-9 connector. The following illustration shows the used pin numbers (circled), the abbreviated names, and descriptions.

Serial Port (DB-9) Pinouts



Pin No.	Name	Description
1	DCD	Data carrier detect
②	RxD	Receive data
③	TxD	Transmit data
4	DTR	Data terminal ready
⑤	GND	Signal ground
6	DSR	Data set ready
⑦	RTS	Request to send
⑧	CTS	Clear to send
9	RI	Ring indicator

Figure 1-7: Serial Port Pinouts

NOTE: If you are using a modem, set it for DTR override. This ensures that the modem can accept data.

Uplink Switch

The uplink switch allows the eighth port on the 8-port repeater and the sixteenth port on the 16-port repeater to function as either a standard IN RJ-45 port or an uplinkable OUT RJ-45 port.

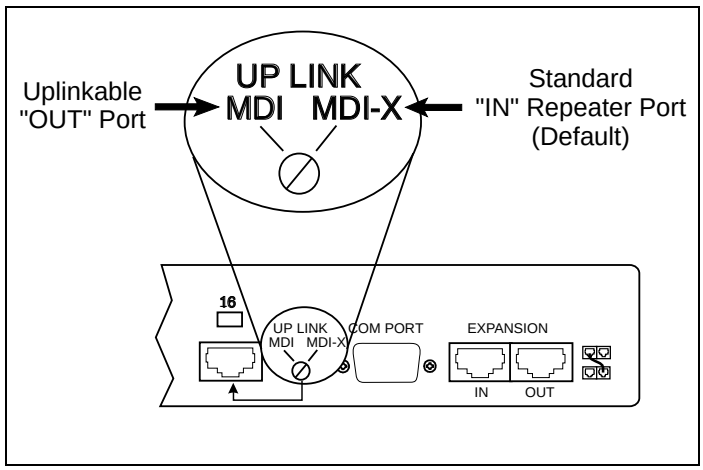


Figure 1-8. Uplink Switch

IN ports use an internal crossover of the receive and transmit lines, enabling the port to connect to a network interface card using standard 8-wire UTP cable. OUT ports use a straight-through (uncrossed) connection, enabling the port to connect to any IN port of another repeater located higher in the stack. This allows two isolated repeaters to be on the same segment.

Lithium Battery

For information about the lithium battery, see the “Notice” section at the front of this guide.

Chapter 2
Planning Repeater Installation

This chapter contains information to help you prepare for installing the Netelligent 2008 or 2016 repeater.

Before You Begin

Before you start to install the repeater, verify that this package contains the following items:

- Netelligent 2008 8-port or 2016 16-port 10Base-T repeater
- Shielded AC power cord
- One repeater expansion port cable (Category 3 UTP)
- Four adhesive-backed rubber feet

Installation Requirements

To help ensure a correct installation, read this section to determine the environmental, electrical, spatial, and cable requirements.

Environmental Requirements

Be sure the operating environment for the repeater is within the following ranges:

- Temperature: 32° to 120° F (0° to 49° C)
- Humidity: 5% to 95% (non-condensing)
- Altitude: 0 to 10,000 feet

Electrical Requirements

The electrical requirements for a repeater are as follows:

- Voltage: 100 to 240 VAC

- Frequency: 50 Hz 60 Hz
- Power: 0.25 A to 0.5 A maximum

> **CAUTION:** The power outlet must be a non-switched, three-pronged, grounded outlet. Do not use a three-to-two pronged adapter at the outlet. Doing so may result in electrical shock and/or damage to the repeater.

NOTE: If the supplied shielded power cord is lost or damaged, replace it with an identical shielded power cord set to ensure emissions compliance.

Spatial Requirements

The repeater's dimensions are 1.75 x 17.00 x 8.4 inches, 4.44 x 43.18 x 21.34 centimeters (HxWxD).

You can interconnect up to ten repeaters in one stack. If there is not enough space to mount the repeaters in a single rack or stack them on a single shelf, or if you want to place the repeaters in different locations, you can place them side by side on separate shelves or in separate racks. If this is necessary, you will need longer repeater expansion port cables to connect the repeaters. See the “Cable Requirements” section in this chapter for more information.

Be sure to allow at least 2 inches (5.1 centimeters) on each side of the repeater for proper air circulation and cable connections.

Twisted-Pair (UTP/STP) Wire Requirements

The twisted-pair wiring you use to connect the repeater's RJ-45 ports must meet the following minimum specifications and requirements to ensure long-term LAN reliability.

- The wiring must be shielded or unshielded twisted-pair (STP/UTP), Category 5.
- Two pairs of wiring are required.
- Depending on building codes, different insulation materials may be required. Plenum-rated or TEFLON-coated wiring may be required in some areas.
- The wire gauge should be between 18 and 26 AWG. (Most telephone installations use 24-gauge wiring.)
- UTP wire should meet the following requirements:
  - Solid copper
  - Nominal capacitance: less than 16 pF/ft
  - Nominal impedance: 100 Ohms
  - Nominal attenuation: less than 11.5 db

CAUTION: Never use gray satin station cable for connecting a repeater. This flat cable, typically used for connecting telephones to wall jacks, is incompatible with 10Base-TX systems.

Straight-through twisted-pair cable is typically used to connect a repeater to a server or workstation. In a straight-through connection, Pin 1 at the repeater connects to Pin 1 at the server, Pin 2 at the repeater connects to Pin 2 at the server, and so on. Figure 2-1 shows the locations of pins on a standard RJ-45 plug on a twisted-pair cable.

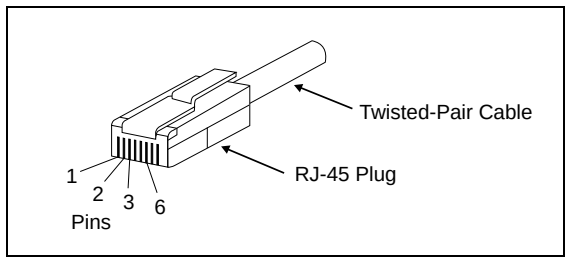


Figure 2-1. RJ-45 Plug Pin Locations

Table 2-1 shows the wiring in a straight-through and crossover twisted-pair cable. (Pins 4, 5, 7, and 8 are not used.)

Table 2-1
Straight-Through Twisted-Pair Wiring

Twisted Pair Number	Pin Number	Signal Description	To	Pin Number	Signal Description
1	1	TD+	→	1	TD+
	2	TD-	→	2	TD-
2	3	RD+	→	3	RD+
	6	RD-	→	6	RD-

Crossover Twisted-Pair Wiring

Twisted Pair Number	Pin Number	Signal Description	To	Pin Number	Signal Description
1	1	TD+	→	3	RD+
	2	TD-	→	6	RD-
2	3	RD+	→	1	TD+
	6	RD-	→	2	TD-

Repeater Expansion Port Cable

Standard 8-wire, Category 3, twisted-pair cable with straight-through wiring connects the OUT repeater expansion port of one repeater to the IN repeater expansion port of another repeater. Repeater expansion port cable has an RJ-45 plug at each end. Table 2-2 shows the correct wiring in a repeater expansion port cable.

Table 2-2
Expansion Cable Wiring

Twisted Pair Number	Pin Number	To	Pin Number
1	1	→	1
	2		2
2	3	→	3
	6		6
3	4	→	4
	5		5
4	7	→	7
	8		8

Stacks that contain only one repeater do not require a repeater expansion port cable. However, to connect the repeater to another repeater located directly above it, use the supplied 6-inch (15.24 cm) repeater expansion port cable.

If your repeater connections require a longer repeater expansion port cable, use a cable that meets the above requirements. The cable can be from 6 inches (15.24 cm) to 250 feet (76.2 m) long. The combined length of all repeater expansion port cables in a stack should not exceed 250 feet.

NOTE: Do not leave cables connected at only one end. Doing so reduces performance.

Media Expansion Port Cable

You can install any one of three different Alternate Media Connectors in the repeater's Media Expansion Port. The cable requirements for these modules are as follows:

Table 2-3
Media Expansion Port Cable

Alternate Media Module	Maximum Length
AUI	164 feet (50 meters)
BNC	607 feet (185 meters)
Fiber 10BASE	6562 feet (2000 meters)
Fiber FOIRL	3281 feet (1000 meters)

NOTE: Drive distances for fiber are based on 62.5/125 micrometer cable. Fiber AMCs also support 50/125 micrometer and 100/140 micrometer cable.

Modem Cable

You can use a standard EIA 232 cable to connect the serial COM port, located on the front panel of the repeater, to a modem. This lets you perform out-of-band management and Flash (firmware) downloads.

System Planning Charts

The charts in Figures 2-2 and 2-3 provide a convenient way of planning the connections for your repeater.

16-Port Repeater Setup and Cabling Chart

Date

Segment

Unit Number

Building

Location

Rack Mount ☐

Table Mount ☐

MAC Address

IP Address

Uplink Switch Setting

☐ MDI-X (default)

☐ MDI (uplinkable)

Installed Alternate Media Connector

☐ None

☐ AUI

☐ BNC

☐ Fiber

Port	Connects To
HEP IN OUT	
16	
15	
14	
13	
12	
11	
10	
9	
8	
7	
6	
5	
4	
3	
2	
1	
AMC	

Figure 2-2. Setup and Cabling Chart

Rack Inventory Chart

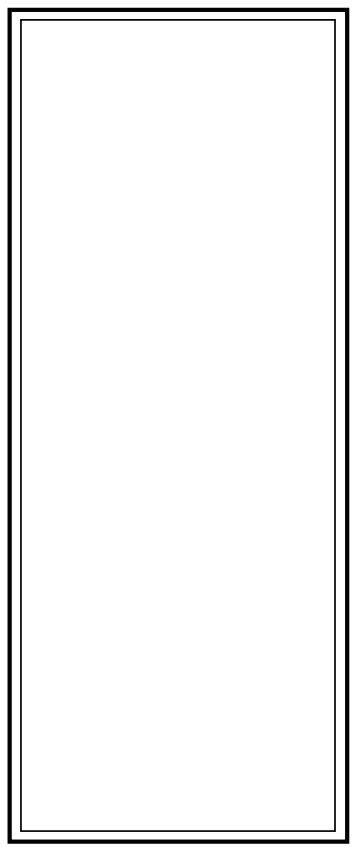
Date

Use this chart to record the components installed in a particular rack.

Wiring Closet Number

Rack Number

Installer



Example

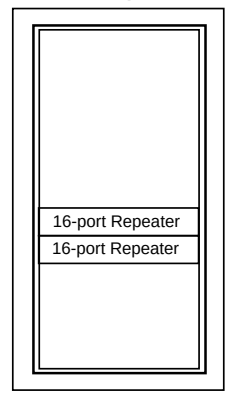


Figure 2-3. Rack Inventory Chart

Chapter 3
Installing the Repeater

This chapter explains how to mount the repeater, attach cables, install an Alternate Media Connector, and interconnect several repeaters. It also provides an overview of segmentation as it relates to the repeater.

Mounting the Repeater

You can place the repeater on a level surface (table top or shelf, for example) or mount it in a standard EIA 19-inch rack.

Attaching the Rubber Feet

To place the repeater on a table top or shelf, attach the supplied adhesive-backed rubber feet as described in the following steps.

1. Turn the repeater over so that its bottom side faces up.
2. Remove the four rubber feet from their packaging.
3. Peel the protective paper backing OFF the rubber feet. Then position the feet in the marked areas near the corners of the repeater and press the feet into place.
4. Turn the repeater to its upright position and place it on the mounting surface.

NOTE: Be sure you allow at least 2 inches (5.1 centimeters) on each side of the repeater for proper air flow.

Rack-Mounting the Repeater

To mount the repeater in a rack, use the supplied installation kit. This kit includes two side mounting brackets and eight screws to secure the brackets. To attach the brackets, position them as shown in Figure 3-1. Then secure the brackets with the screws supplied with the mounting kit.

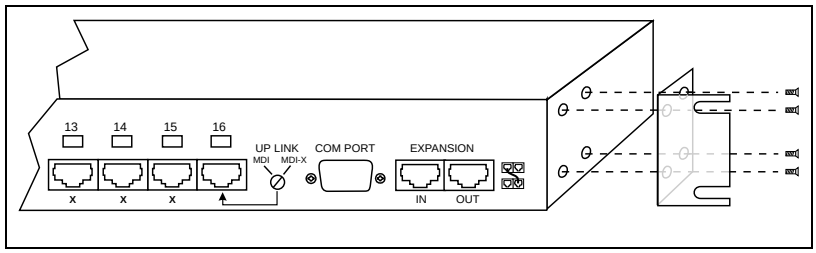


Figure 3-1. Attaching the Mounting Brackets

After you attach both mounting brackets, position the bracket slots over the desired holes on the rack (Figure 3-2). Then insert and tighten the mounting screws.

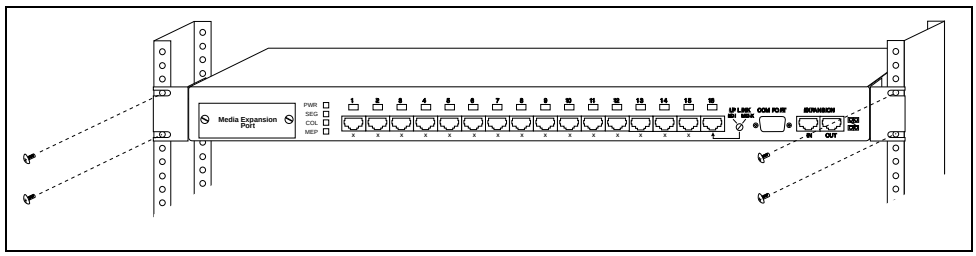


Figure 3-2. Positioning the Repeater in a Rack

Installing an Alternate Media Connector

The 10Base-T repeater has a Media Expansion Port (MEP) that lets you install one of the following three optional Alternate Media Connectors (AMCs, sold separately):

- BNC for connecting to a Thinnet backbone (Part No. 267064-001)
- AUI for connecting to a Thicknet backbone (Part No. 267263-001)
- Fiber for connecting to a 10Base-FL backbone (Part No. 267265-001)

NOTES:

— The MEP is the 17th logical port on the repeater.

— Link test is available for the fiber optic AMC (hardware is always enabled, but firmware can effectively disable link test), but not for the AUI or BNC AMCs.

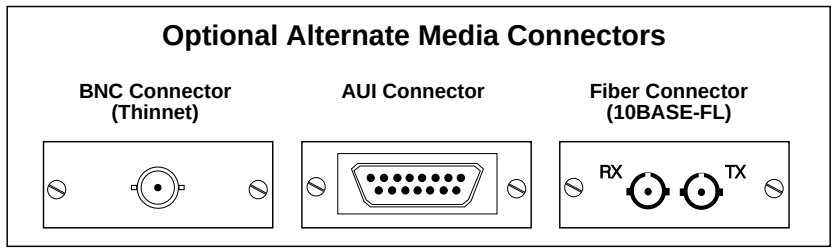


Figure 3-3. Optional Alternate Media Connectors

Setting Jumpers for a BNC AMC

If you install a BNC AMC, but do not connect a cable, you must set the connector board jumper to disable the port. You can also use an external terminator on this port. If you use a terminator, set the jumper to ON for future connections.

NOTE: If there is no connection or external terminator at the BNC port, the jumper must be set to OFF; otherwise, excessive collisions will occur and adversely affect network performance.

Figure 3-4 shows the AW1 jumper settings.

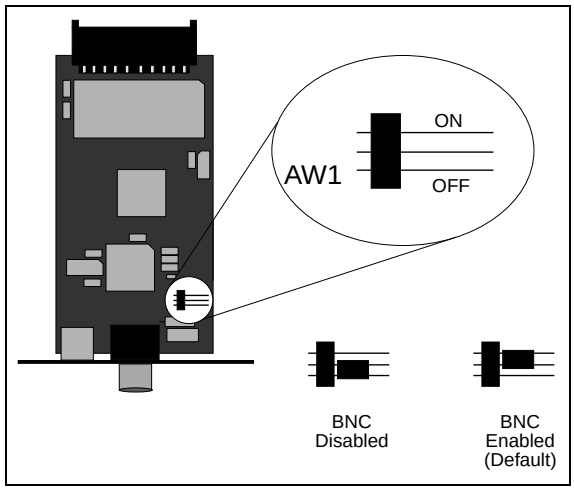


Figure 3-4. AW1 Jumper Settings for a BNC AMC

Inserting the AMC

To insert an AMC, follow these steps:

1. Disconnect the repeater from power.
2. Remove the cover plate from the Media Expansion Port on the repeater's front panel.
3. Insert the AMC through the Media Expansion Port hole and carefully push the 20-pin male connector into the MEP socket on the repeater motherboard until the AMC is secure.

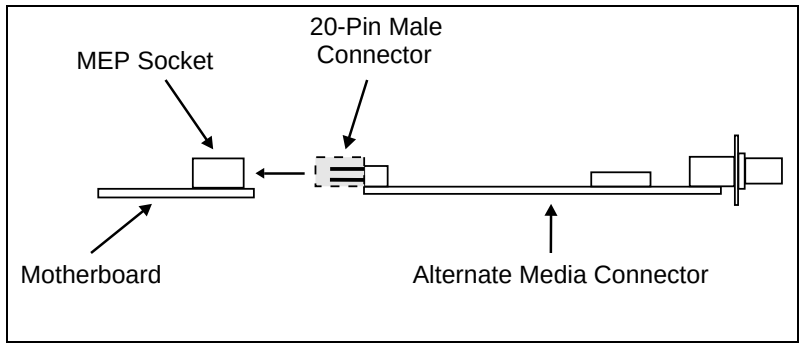


Figure 3-5. AMC Installation (Side View)

4. Tighten the screws on the AMC's faceplate.

Connecting Twisted-Pair Cable

Each 10Base-T port on the repeater can accept a standard 4-wire twisted-pair (UTP or STP) cable that ends with an RJ-45 connector. These ports can support cable lengths up to 100 meters (328 feet).

To attach twisted-pair cable, plug one of the RJ-45 connectors into the selected port on the repeater. Connect the other RJ-45 connector into a 10Base-T-equipped workstation.

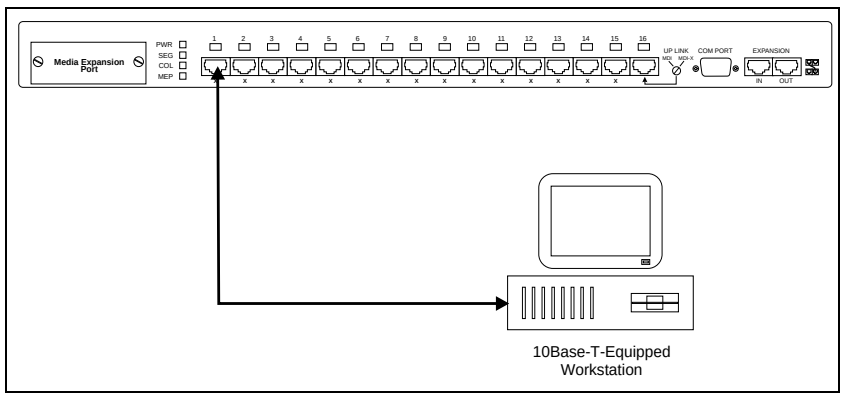


Figure 3-6. Connecting Twisted Pair Wiring

Interconnecting Repeaters

Up to ten repeaters can be interconnected to form one logical repeater that supports up to 80 Ethernet ports for the 8-port repeater and up to 160 Ethernet ports for the 16-port repeater. Each repeater can be isolated from the rest of the repeaters to reside on its own segment. See the “Segmenting Repeaters” section of this chapter.

Compaq's unique Extended Repeater Architecture (ERA) allows for greater distances between interconnected repeaters (up to 250 feet, 76.22 meters total). ERA provides both Ethernet connectivity and inter-repeater communication. Inter-repeater communication is a management protocol where data is transferred from one repeater to the next and then repeated until it reaches the destination repeater. This minimizes signal reflection at extended distances and also provides a stack order and status signal to indicate the physical bottom repeater in the stack. ERA also provides automatic detection of powered down repeaters so that signals will pass through (bypass) those repeaters.

Repeater Expansion Port

The repeater has two Repeater Expansion Ports: the IN port and the OUT port. Repeaters are interconnected via these ports using a standard, eight-wire (four twisted pair) Category 3 (or higher) UTP/STP repeater expansion cable that ends in standard RJ-45 plugs. One 6-inch (15 cm) Category 3 expansion cable is supplied with the repeater.

To connect one repeater to an adjacent repeater in the stack, connect the lower repeater's RJ-45 EXPANSION OUT port to the upper repeater's EXPANSION IN port, as show in Figure 3-7.

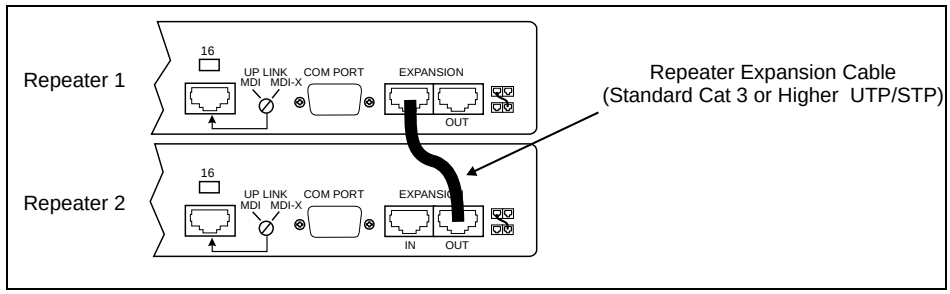


Figure 3-7. Connecting Repeaters via Repeater Expansion Ports

NOTE: When you add a repeater to a stack, connect the cable to the repeater you add before you connect it to the repeater in the existing stack. For example, if you add a repeater to the top of a stack, connect the cable to the IN port of the added repeater. Then connect the other end of the cable to the OUT port of the existing repeater in the stack. Do not leave cables connected at only one end. Doing so reduces performance. The pin-outs of the IN and OUT ports are shown below.

Table 3-1
IN Port Pinouts

Symbol	Pin No.	Function	Description
10B2_DATA	1	In/Out	10B2 Ethernet bus data
10B2_GND	2	In/Out	10B2 Ethernet bus ground
RXDB+	3	In/Out	Serial data negative lower repeater
SHARE_GND	4	Gnd	Shared ground
XDOWN	5	In	External bottom status indicator
RXDB	6	In/Out	Serial data positive lower repeater
SHARE+12	7	Pwr	Shared +12V
SHARE_GND	8	Gnd	Shared gnd

Table 3-2
OUT Port Pinouts

10B2_DATA	1	In/Out	10B2 Ethernet bus data
10B2_GND	2	In/Out	10B2 Ethernet bus gnd
TXDB+	3	In/Out	Serial data negative upper repeater
XUP	4	In	External top status indicator
SHARE+12	5	Pwr	Shared +12V
TXDB	6	In/Out	Serial data positive upper repeater
SHARE+12	7	Pwr	Shared +12V
SHARE_GND	8	Gnd	Shared ground

Multi-Floor Configuration

The expansion capability provided by Extended Repeater Architecture makes the repeater ideal for multi-floor network configurations that require repeaters on each floor (Figure 3-8).

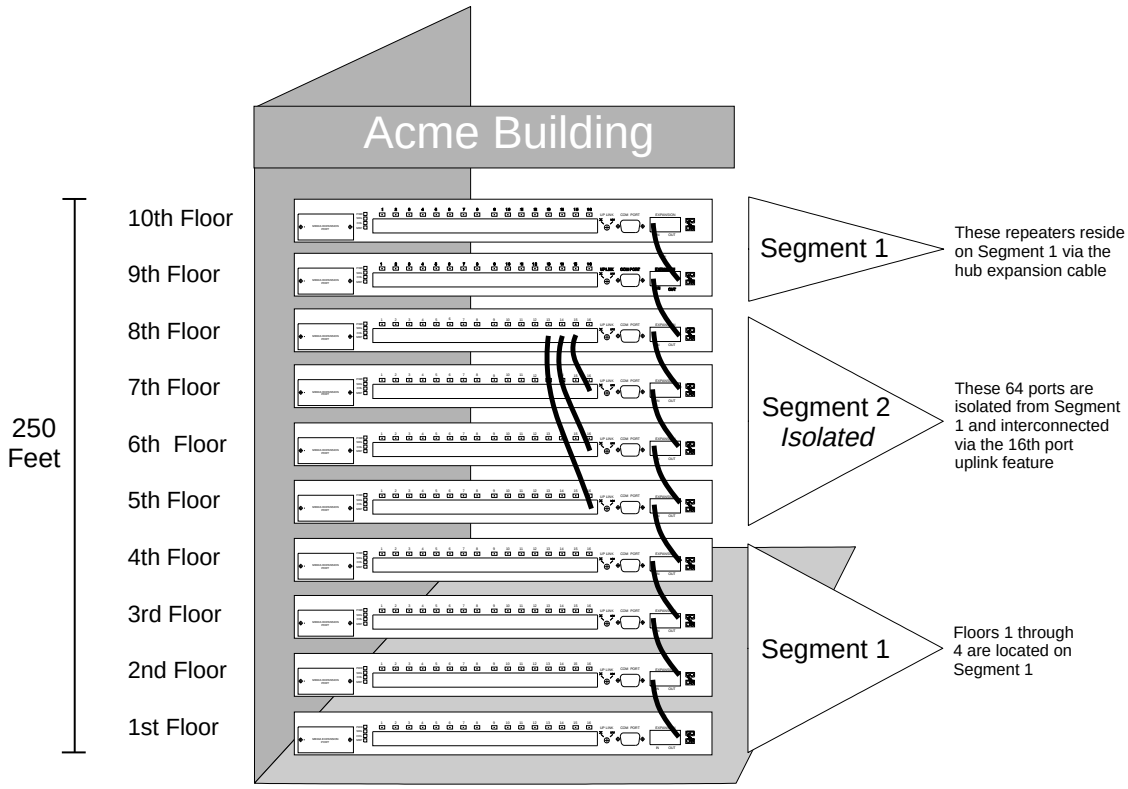


Figure 3-8. Multi-Floor Configuration

CAUTION: Avoid any large differences in AC grounding potentials between repeaters in the same stack (for example, interconnected repeaters installed in different buildings). To guarantee operation of the repeaters, AC power sources for the repeaters in the stack must meet the AC voltage differential of 1Vrms or less between chassis ground of any repeater in the stack. Large differences in grounding potentials can damage the repeaters and create a safety hazard.

Setting the Uplink Switch

The uplink switch lets you cascade repeaters by connecting the 16th RJ-45 port on one 16-port repeater (or the 8th RJ-45 port on one 8-port repeater) to any RJ-45 port on another repeater without the need for special crossover cables. The default setting for the switch is MDI-X (Media Dependent Interface-Reversed that is, standard repeater port). To change the position of the switch, use a small, slotted screwdriver, or a similar tool, to set the switch to the desired position.

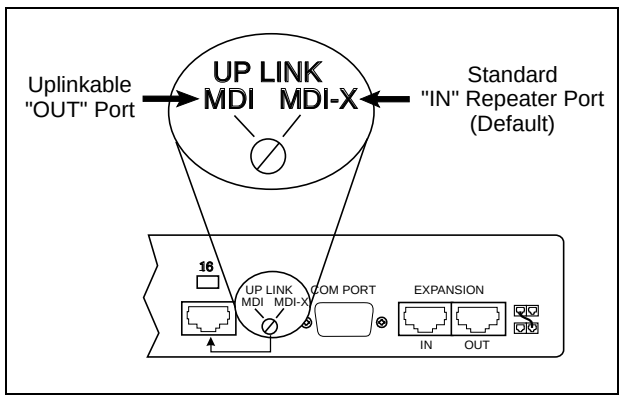


Figure 3-9. Uplink Switch

Segmenting Repeaters

Segmentation divides networks into *segments*, or smaller networks, of fewer users. These segments maintain separate *collision domains*, where fewer users compete for bandwidth, thereby reducing collisions and increasing network throughput.

Segmentation of repeaters is accomplished by internally *isolating* a repeater that is interconnected to other repeaters via the Repeater Expansion Ports. You can isolate any repeater in a stack by setting the SNMP variable that isolates a repeater (*nw2BkplNum=6*) or by using VT100. When you isolate a repeater, it occupies its own collision domain and is separate from the collision domain of the repeaters that are still connected to the backplane. Isolating repeaters lets you create up to 10 separate collision domains in a 10-repeater stack.

NOTE: You can view only the stack table for isolated repeaters. For complete management, you must use a router or bridge to ensure proper connectivity. See Chapter 4, "Administration and Management" for more information.

In Figure 3-10, Repeaters 1 through 3 are isolated from the other repeaters and form Collision Domain 1. They are also cascaded together via the uplink switch and standard twisted-pair cables. See the "Setting the Uplink Switch" section in this chapter. Repeaters 4 and 5 are not isolated and form Collision Domain 2.

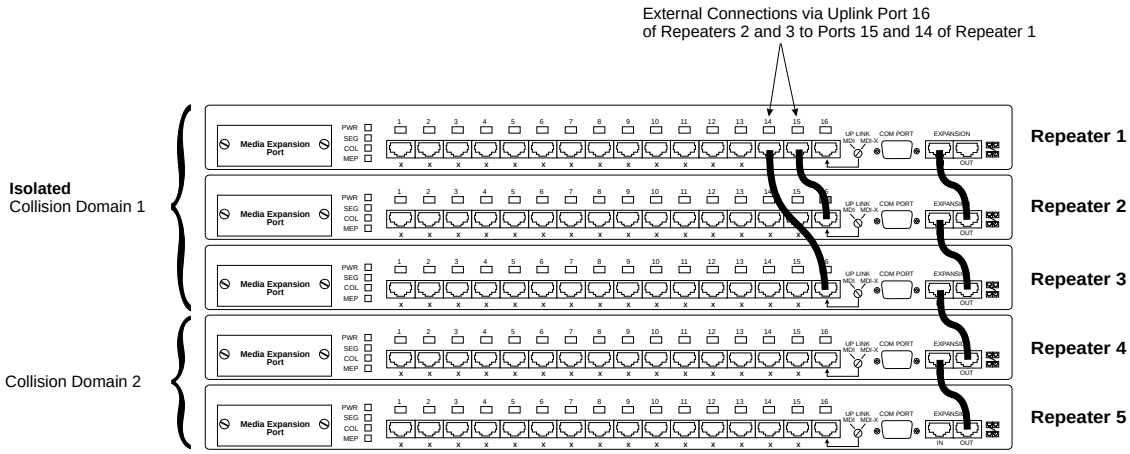


Figure 3-10. Example of Segmentation

NOTES:

— The repeaters do not need to be physically adjacent to one another to be in the same collision domain.

— If the combined length of the repeater expansion cables in a stack exceeds 150 feet (45.7 m), the stack is considered as two repeater hops. The IEEE 802.3 specification states four as the maximum number of repeater hops between stations on a network.

— If a repeater in a stack is powered off or hot-swapped, the remaining repeaters take a moment to merge together. During this time, an SNMP manager may see the stack as two or more substacks. When the bottom repeater of a stack or *substack* detects a change in the stack size, the repeater's SNMP agent issues a *group map change trap*. After the remaining repeaters merge, the SNMP manager sees the repeaters as a single stack.

Backup Port

Any port on the repeater can function as a backup port for another port on the same repeater. This feature is useful for mission-critical applications (for example, order-entry workstations connected to a file server). About every 5 seconds, the repeater monitors the status of the primary port. If the port has lost its link test or has been autopartitioned by the hardware, the repeater enables the backup port and sends a *health state trap* to each management station contained in its IP and IPX trap tables.

Figure 3-11 shows a file server with two network interface cards (NICs) connected to two ports on a repeater. In this example, Port 1 is the *primary* port and Port 2 is the *backup* port.

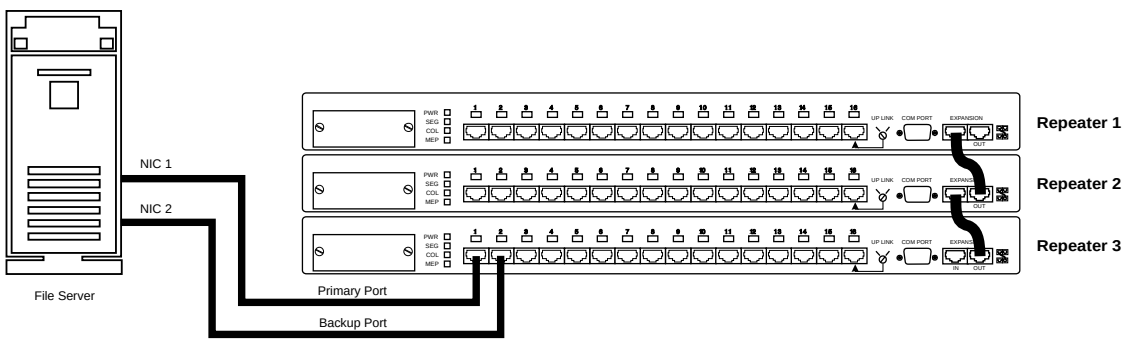


Figure 3-11. Backup Port Example

NOTES:

— If the backup port fails, the repeater does not re-enable the primary port.

— When the backup port is enabled, the repeater prevents the primary port from automatically being re-enabled. To re-enable the primary port, you must use an SNMP network manager to change the backup port status.

Connecting Power

Follow these steps to connect the repeater to power:

1. Plug the power cord into the power connector on the back of the repeater.
2. Insert the three-pronged plug on the power cord into a non-switched, grounded power outlet on a wall, a power strip, or a grounded extension cord.

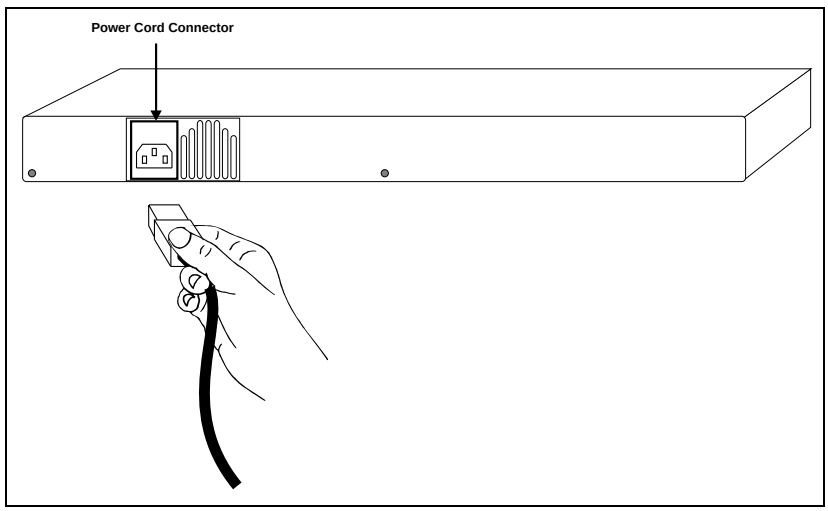


Figure 3-12. Connecting the Power Cord

NOTE: The power outlet should be near the repeater and easily accessible.

3. When you plug in the power cable, verify that the repeater performs the self test (described in the following section) to confirm that the repeater is operating correctly.

To power down the repeater, disconnect the male connector from the wall outlet or power strip. **Do not disconnect the female connector from the repeater to power down the repeater because it is not a tested disconnect.**

Power-On Self Test and Initialization

When power is applied to the repeater, it performs a Power-On Self Test (POST) and initialization. During the POST, the port status LEDs on the repeater display the following sequence:

- Odd-numbered LEDs flash green, even-numbered LEDs are OFF
- Even-numbered LEDs flash green, odd-numbered LEDs turn OFF
- Odd-numbered LEDs flash yellow, even-numbered LEDs turn OFF
- Even-numbered LEDs flash yellow, odd-numbered LEDs turn OFF

After the above sequence, the SEG, COL, and MEP LEDs flash green, then yellow, and then turn OFF. When the repeater successfully completes the POST, it performs the BOOT initialization followed by the Flash initialization.

The PWR LED shows the current Power/POST/initialization status as follows:

- **OFF** — No power to the repeater or a hardware failure
- **Yellow** — POST/initialization in progress or operating out of boot code
- **Flashing Yellow** — POST failed or the repeater is faulty
- **Green** — POST was successful and initialization is complete. repeater is operating out of Flash and is fully functional.

NOTE: The port activity LEDs do not function until the PWR LED turns green.

Non-Volatile Memory Check

A test is performed on the NVRAM during the initialization of the flash. If the test detects an error, the user is notified in the following ways:

- The PWR (power) LED toggles green, yellow, green, yellow (1 second on each color) and then lights steady green. (This occurs only during initialization.)
- A message is sent to the RS-232 port indicating an error condition. (This occurs only during initialization.)

- The MIB variable *nw2NVRAMStatus* is set to error(2).

These messages only indicate a NVRAM malfunction. The repeater and management functions are still operational. Only the configuration parameters in NVRAM are re-initialized to their defaults.

Chapter 4
Administration and Management

This chapter contains information about SNMP management, out-of-band management using SLIP, error and fault processing, Flash updates, and other information related to the firmware for the Netelligent 2008 and 2016 repeaters.

Boot and Runtime Overview

The Netelligent 2008/2016 repeater firmware is divided into two distinct firmware blocks:

- Boot
- Runtime

Boot

Boot provides these basic features:

- POST (Power On Self Test)
- BOOTP/TFTP
- Verification of valid Runtime
- Autopolarity Reversal for UTP ports
- XMODEM (Configuration File and Runtime upgrades)

NOTE: Boot cannot be upgraded via TFTP or XMODEM.

Runtime

Runtime is field upgradable via a firmware download using XMODEM or TFTP. Runtime provides these basic features:

- VT100 (Telnet and SLIP)

- In-band via Telnet
- Out-of-band via Telnet /SLIP
- Out-of-band via VT100; using ANSI terminal emulation

- SNMP
  - In-band via IP
  - In-band via IPX
  - Out-of-band via SLIP
- LED Management
- Backup Ports
- In-band management over IPX with SMMP and SNMP
- Intrusion detection with the option to configure security
- BOOTP/RARP
- InterHub Communication
- Autopolarity Reversal for standard UTP Ports
- Port Management

Configuring the Repeater During the Boot Process

You can configure the repeater during the boot process in the following three ways:

- Via an XMODEM text configuration file
- Via a BOOTP server
- Via a reverse ARP (RARP) server

XMODEM Text Configuration File

You can set the repeater IP address during the boot process by downloading a text configuration file using the XMODEM protocol. This requires a PC with a serial port, a text editor (to change the IP address), an XMODEM file transfer program, and a null modem cable. You can substitute a pair of modems with modem cables for the null modem cable if you want to set the IP address remotely.

The text configuration file is used in conjunction with a second binary Flash image file to update the Flash in the repeater (see the section “XMODEM Implementation” in this chapter). The text file uses acronyms to simplify the firmware parsing. The following example configuration file updates the repeater configuration parameters and prepares the repeater for a firmware download (i.e., erases the current Flash). This example assumes that the COM serial port is used for a SLIP connection. If not, the serial IP address and NetMask should be set to "0.0.0.0".

```
;SMM16/8 XMODEM Config
;Comment ";" in column 1; Max size=512
;
;"FL=yes" sets IP/NM/GW/WC/SI/SM; no skips
FL=yes
;IP Addr
IP=192.103.93.200
;Net Mask
NM=255.255.255.0
;Default Gateway
GW=192.103.93.139
;Write Community
WC=public
;SLIP IP
SI=192.103.83.200
;SLIP Mask
SM=255.255.255.0
;Flash Version; erases Flash!
FV=8NW1.30
;END
```

The valid values for each field are shown in the following table.

If you want to modify only the repeater configuration parameters (Items 2 to 7) and not the Flash sectors, comment out or delete Item 8. To comment out a line, place a semicolon (;) in Column 1. If FL=yes, Items 2 to 7 must be in the text configuration file.

To update the Flash without updating the repeater configuration parameters, set FL=no or delete/comment out Items 1 to 7 (i.e., have only the FV line in the text configuration file).

Item	Field	Meaning	Valid Values/Descriptions
1	FL	Update flag	"Yes" updates the repeater configuration for items 2 through 7 (all items must be present); "No" indicates no update.
2	IP	Repeater IP Address	Any valid IP address (cannot use 255.255.255.255 (broadcast IP)
3	NM	IP Net Mask	Any valid Net Mask (cannot be 0.0.0.0 or 255.255.255.255); must start with a "1" in the left bit position (e.g., 128.0.0.0); "1's" in Net Mask must be contiguous (i.e., proceeding from left to right, once a bit is set to "0", there can be no more "1" bits (e.g., 255.255.192.0 is contiguous; 255.255.160.0 is NOT contiguous))
4	GW	IP Default Gateway	Any valid IP Default Gateway address (cannot use 255.255.255.255)
5	WC	Write Community String	Up to 20 characters (alphanumeric, underscores, spaces); using more than 20 characters causes an error
6	SI	SLIP IP Address	Any valid IP address (cannot use 255.255.255.255, broadcast IP); if the COM serial port on this repeater is not used for a SLIP connection, set SI=0.0.0.0".
7	SM	SLIP Net Mask	Any valid NetMask (see Item 3)
8	FV	Firmware Version String	Non-null value indicates that the firmware will be updated (i.e., erased and downloaded); comment out (with a semi-colon, ";") or delete the FV field to update only the repeater configuration parameters. This field also indicates the type of repeater (2008 or 2016). For example, 8-port repeaters use 8NWx.xx and 16-port repeaters use NWVx.xx.

Text Configuration Field Values

The firmware parser ignores blank lines at the end of the text configuration file. If quotation marks enclose the write community string, the parser considers the marks part of the string. If spaces are embedded in the string, the parser accepts the first 19 characters, including spaces.

NOTE: If the text configuration file contains a valid "FV" line, the Flash is erased to prepare for a Flash Update. See the section "Updating Flash" later in this chapter.

Text Configuration File Rules:

- The configuration file can be composed with an ASCII text editor (each line must be terminated with either a "CR/LF" (0x0D/0x0A) pair, a "CR" or a "LF").
- The maximum file size is 512 bytes.
- The maximum line length is 132 bytes.
- Comments must start with a semicolon (;) in Column 1. The file can contain any number of comments as long as it does not exceed the maximum file size and line length.
- No spaces are allowed before or after the equal sign (=) in each line (except for a write community string that starts with a space).
- The acronyms, as well as the yes/no data, can be in upper or lower case letters.
- There must be a comment line (e.g., ";END") after the last valid non-comment line (e.g., "FV=8NW1.30"). Most XMODEM implementations "pad" out the last 128-byte transmit block. The final comment allows the parser to determine the precise end of the previous non-comment line (i.e., avoids confusion with the "pad" characters).
- The firmware version string indicates not only the version number but also the type of repeater. The 8-port 2008 repeater uses 8NWx.xx and the 16-port 2016 repeater uses NWVx.xx.

Certain combinations of IP addresses and Net Masks also cause configuration errors. When the IP address (IP) is logically ANDed with the Net Mask (NM) the result cannot be equal to the SLIP IP address (SI) logically ANDed with the SLIP Net Mask (SM).

The following combination is **invalid**:

IP =192.103.83.200	SI =192.103.83.201
NM =255.255.255.0	SM =255.255.255.0
==========	==========
AND=192.103.83.0	AND=192.103.83.0

The following combination is **valid**:

IP =192.103.93.200	SI =192.103.83.200
NM =255.255.255.0	SM =255.255.255.0
==========	==========
AND=192.103.93.0	AND=192.103.83.0

If there is any error at all (e.g., parsing error, invalid IP address, more than 20 characters in the write community string), the repeater configuration update stops without making any updates. Since the serial COM port uses the XMODEM protocol, it cannot indicate an error. Therefore, the UTP port status LED's provide error indications. If the configuration file update is successful, the status LED's flash green-off-green (0.5 second each). If an error is detected, the status LED's flash orange-off-orange (0.5 second each).

If there is an active SLIP session on the COM serial port, there is a 3-minute time-out before an XMODEM transfer can begin. When an XMODEM transfer starts, the repeater disables all interrupts except for the timer. The CPU polls the COM serial port for activity. Consequently, SNMP requests, as well as normal repeater processing (e.g., checking for backup ports, updating the status LEDs), are ignored during XMODEM transfers.

XMODEM Implementation

When the repeater (receiver) is ready to initiate an XMODEM transfer, it issues a synchronization byte at 10-second intervals to the workstation (sender) to inform it which type of block error checking method is used (CRC or checksum). Once the error checking type is established, the repeater uses the first XMODEM packet to synchronize the transfer and then discards the packet. This causes the repeater to retransmit the first packet. The retransmission is invisible to the user except in XMODEM applications that report block errors.

You can use a common terminal emulation program, such as Window's Terminal or Procomm, to perform XMODEM file transfers. If the program gives you a choice, use binary XMODEM transfers for both the text configuration file and the binary Flash image file.

To update either the text configuration file or the binary Flash image file, wait until a letter "C" appears on the terminal emulation screen before you select the Upload or Send menu. Otherwise, the terminal emulation screen is blocked and you cannot see the "C."

The following sequence of events can help you understand the XMODEM user interface. This sequence applies to both text configuration file and binary Flash image file transfers.

1. Determine if an XMODEM transfer is being initiated over a null modem cable at 9600 baud:

   - Repeater sends a letter "C" and waits 10 seconds for a response.
   - Repeater sends a NAK and waits 10 seconds for a response.
   - Repeater sends a letter "C" and waits 10 seconds for a response.
   - Repeater sends a NAK and waits 10 seconds for a response.

   When you see the letter "C" (that is, the repeater already sent the first sync byte that the sending program already missed), you have 30 seconds to start the file transfer. If the sending PC responds during this interval, the transfer proceeds.

   If no XMODEM transfer starts, the repeater attempts to find a modem at the following speeds:

   - Repeater sends a 9600 Baud modem initialization string and waits 10 seconds for a response.
   - Repeater sends a 2400 Baud modem initialization string and waits 10 seconds for a response.
   - Repeater sends a 1200 Baud modem initialization string and waits 10 seconds for a response.
   - Repeater sends a 300 Baud modem initialization string and waits 10 seconds for a response.

If the repeater receives a valid modem response, it knows that a modem is connected to the COM serial port. The repeater does not know if the modem is operating at its highest possible baud rate. For example, if the modem is plugged in just before the 300 Baud initialization string is issued, the modem remains at 300 Baud. (It is not recommended to transfer a 180KB Flash image file at 300 Baud if the modem supports a higher baud rate). Consequently, unless the modem is already connected at 9600 Baud, the repeater re-issues the 9600 Baud modem initialization string and then continues to search at each consecutively lower Baud rate until it detects the highest speed modem supported.

If the repeater does not receive a valid modem response, the connection algorithm restarts and the repeater firmware reattempts an XMODEM transfer (Step 1).

2. See if a modem is still attached:

   Once a modem connection is established, the repeater checks to see if the modem is still attached by sending an initialization string every minute. If the modem does not respond, the connection algorithm restarts, searching for a null modem cable XMODEM transfer (Step 1).

3. Wait for the modem to go off hook and initiate an XMODEM transfer: When the repeater's COM serial port modem answers the incoming call, its Carrier Detect (CD) line is asserted. After the repeater sees an active CD, it delays 30 seconds and then repeatedly sends the following sync bytes until an XMODEM transfer starts or CD goes inactive.

   - Repeater sends a C and waits 10 seconds for a response.
   - Repeater sends a NAK and waits 10 seconds for a response.

   If CD goes inactive, the repeater checks to see if the modem is still attached (Step 2).

If you update the repeater firmware with an XMODEM configuration file while the PWR LED is orange (i.e., while executing from Boot), the updates take effect when the firmware jumps from the boot sectors into the Flash sectors (i.e., they will be valid by the time the PWR LED turns green). If you update the firmware when the PWR LED is already green (i.e., executing from Flash) and only the configuration parameters are updated, the updates take effect immediately.

BOOTP Server

On IP networks, you can use a BOOTP server to set the repeater configuration parameters and download new Flash updates. (See “Updating Flash” in this chapter.) Every time the repeater initializes its BOOT, it makes a predetermined number of BOOTP/RARP requests, each of which contains the MAC address of the requesting repeater. (The number or requests is set in the nw2BootpRarpRetries MIB variable.) The repeater issues the BOOTP request simultaneously over both the ETHERNET_II and ETHERNET 802.2 SNAP frame types and waits a predetermined time interval (set in the nw2BootpRarpRetryInterval MIB variable) for a response.

If the BOOTP server is active and finds the repeater's MAC address in its database, it sends the repeater its IP address, IP net mask, and IP default gateway. If the BOOTP response is valid, the repeater makes no more BOOTP requests. The repeater uses the BOOTP response to determine the frame type to be used for IP communications. If the repeater receives no BOOTP response, the firmware performs the same sequence using RARP requests instead of BOOTP requests. Shown below is a sample USRBOOTP file. This sample file also updates the Flash program sectors.

```
global.dummy:\
        :sm=255.255.255.0:\
        :bf=c:\flash\nw8v101.img:

# Next, define different master entries for each subnet. . .
subnet105:\
        :tc=global.dummy:gw=192.103.93.139:

# The Hostname contains the firmware version followed by the entire
# MAC Address (including leading zeros).  Modify the appropriate entries
# as needed using the following legend:
#
#   ht = hardware type
#   ha = hardware address
#   ip = IP Address for the unit with the above "ha"
#   gw = Gateway IP Address
#   sm = Subnet Mask
#   bf = bootfile name (including path - must be << 64 characters)
#   hn = hostname (do not fill in).  This entry will cause the hostname
#        to be sent as part of the BOOTP Response.  This is necessary
#        for the unit to TFTP properly.  If no TFTP Flash update
#        is desired, then remove the "bf=..." and "hn:" lines and the
#        continuation slash from the preceding line.
#
#   Examples are shown below.  Each entry should have a unique hostname.
#   The hostname can only contain alphanumeric characters.

8NW110.00.00.79.58.00.22:\
        ht=ethernet:\
        ha=000079580022:\
        ip=192.103.93.10:\
        sm=255.255.255.0:\
        gw=192.103.93.139:\
        bf=c:\flash\8nwv110.img:\
        hn:

NWV101000079580026:\
        ht=ethernet:\
        ha=000079580026:\
        ip=192.103.93.11:\
        sm=255.255.255.0:\
        gw=192.103.93.139:\
        bf=c:\flash\nwv130.img:\
        hn:
```

NOTE: This USRBOOTP file is only an example. For information about the appropriate file for your specific BOOTP server, refer to the BOOTP server documentation.

If the repeater receives no response for any the BOOTP or RARP requests and if the repeater already has a valid IP address stored in NVRAM, the NVRAM IP address is used.

Once in Runtime, if there is not a valid IP address in NVRAM and the nw2BootpRarpRequests MIB variable is set to doBootpRarp(1), the firmware loops until it receives a valid IP address. The following information describes various repeater operations and limitations of the IP address search loop.

- Every 5 minutes, the repeater makes a BOOTP request. If the repeater does not receive a BOOTP response within 5 seconds, it makes a RARP request. If the repeater does not receive a RARP response within 5 seconds, it waits 5 minutes and then re-issues the BOOTP/RARP requests.
- The repeater can receive an IPX set request during the 5-minute interval when it is not making BOOTP/RARP requests. If an IPX set request occurs during the 10-second BOOTP/RARP period, the repeater ignores the request (i.e., the request times out).
- You can use SNMP over IPX to set the repeater's IP address during the 5-minute interval when the repeater is not making BOOTP/RARP requests If an SNMP over IPX set request occurs during the 10-second BOOTP/RARP period, the repeater ignores the request (i.e., the request times out).
- VT100 can be used at any time.

NOTE: The repeater may periodically disable SNMP requests during the BOOT/RARP request intervals, reducing network management performance for IPX-only networks. To prevent this from occurring, either assign an IP address to each repeater or set the nw2BootpRarpRequests MIB object to noBootpRarp(2), which disables the periodic BOOTP/RARP requests in Runtime and in Boot if you have Boot v1.30.

Reverse ARP Server

On IP networks, you can use a RARP (Reverse Address Resolution Protocol) server to set the repeater IP address. Every time the repeater completes its POST, it makes a predetermined number of BOOTP/RARP requests, each of which contains the MAC address of the requesting repeater. (The number or requests is set in the nw2BootpRarpRetries MIB variable.) The RARP request contains the MAC address of the requesting repeater. The repeater issues the RARP request simultaneously over both the ETHERNET_II and ETHERNET 802.2 SNAP frame types and waits a predetermined time interval (set in the nw2BootpRarpRetryInterval MIB variable) for a response. If the RARP server is active and finds the requesting repeater's MAC address in its database, it sends the repeater its IP address. The repeater uses the response to determine the frame type to be used for IP communications.

NVRAM Usage

The Netelligent 2008/2016 repeaters have nonvolatile RAM (NVRAM) that stores parameters that must survive a power failure or CPU reset. The NVRAM stores the following information:

- Backup port information (the backup port status is configured during boot; default = none)
  - primary port, backup port, and backup state
- Port names information
  - Supports port names up to 10 characters in length for each port (supports 17 ports).
- SNMP information
  - IP address (default = 0.0.0.0). If you set the IP address to 0.0.0.0, there is no valid IP address.
  - IP network mask (default = 0.0.0.0)
  - default gateway IP address
  - sysLocation (RFC1213)

- sysName (RFC1213)
- snmpEnableAuthenTraps (RFC1213)
- nws2WriteProtected (NWS2000 MIB)
- nws2WriteCommunity (NWS2000 MIB)
- nws2BootpRarpRequests (NWS2000 MIB)
- SLIP IP address (default = 0.0.0.0 (none))
- SLIP IP network mask (default = none)
- IP trap table (10 recipients; default = none)
  - IP address
  - SNMP community name

- General unit level parameters (these parameters are configured during boot)
  - backplane (isolated or bussed; default = bussed)
  - link test disable/enable for each port (default = enabled)
  - ports disabled (default = enabled)
- IPX trap table (10 recipients; default = none)
  - IPX address
  - SNMP write community name
- Routing information (5 entries; default = none)
- Intrusion
  - MAC address for each of the 17 ports
  - Intrusion Status (Disabled, Enabled, Tripped) for all 17 ports
  - Security Password (6 characters)
  - IPX Frame Type
  - SAP Disable
  - IP Frame Type

- VT100
  - VT100 Refresh rate
  - Modem Initialization string up to 40 characters in length
  - BOOTP/RARP timeout interval
  - Maximum retry count for BOOTP/RARP

Runtime Features

The Runtime component of the repeater firmware v1.3 provides a backup port feature, intrusion protection, and RJ-45 autopolarity reversal.

Backup Port Usage

You can designate a backup port that provides a redundant connection for a primary port to protect mission-critical applications (e.g., order entry PCs connected to a file server). The repeater activates the backup port when the primary port loses link test or is autopartitioned by the hardware. Any port on the repeater can back up any other port on the same repeater. However, a port on the repeater cannot back up a port on another repeater.

During normal operation, the backup port is disabled. About every 5 seconds, the repeater monitors the status of the primary port. If the primary port loses its link test (e.g., the NIC loses power) or has been autopartitioned by the hardware, the repeater disables the primary port, enables the backup port, and sends an SNMP "health state trap" to each management station contained in its IP and IPX trap tables. The primary port remains disabled to prevent it from being incorrectly re-enabled. If the backup port fails, the repeater does not re-enable the primary port.

To re-enable the primary port after a backup port has been activated, you must use an SNMP network manager to change the backup port status.

The repeater does not monitor backup ports during BOOTP/RARP initialization and downloading of new firmware.

Intrusion Protection

Firmware v1.30 supports intrusion protection, which provides a method of preventing unauthorized access to the network. Intrusion protection allows any SNMP manager to configure one MAC address per port and to enable or disable intrusion protection on a per port basis.

NOTE: Do not set intrusion protection on an uplink port that receives multiple MAC addresses. Otherwise, the repeater disables the port.

Follow these steps to enable intrusion protection for a port:

1. Use an SNMP MIB browser to set the authorized MAC address in the nw2IntrusionPortMACAddress or nw2IntrusionPortMACAddressStr MIB variable.
2. Set the nw2IntrusionPortStatus MIB variable to enable(2).

Once you configure intrusion for a port, the repeater's firmware monitors the port for intruders. If the port detects an unauthorized MAC address, the repeater partitions the port, i.e., sets nw2IntrusionPortStatus to tripped(3)and generates a Novell Health State trap in the trap table. To restore the port after it detects an intruder, use an SNMP manager to set the rptrBasPortAdminState MIB variable (located in the Novell MIB) to enable(2).

Changing the Status of a Port

The SNMP manager lets you change the intrusion status of a port via the nw2IntrusionPortStatus MIB variable. To do so, verify that the nw2SecurityStatus MIB variable is set to disable(1). Then set the nw2IntrusionPortStatus MIB variable to disable(1), enable(2), or tripped(3).

NOTE: If the SNMP manager tries to change the settings of nw2IntrusionPortStatus when nw2SecurityStatus is set to enable(2), a PDU error occurs.

Security

The security feature provides further network security by restricting access to the nw2IntrusionPortStatus and nw2IntrusionPortMACAddress MIB variables, which prevents any changes to the intrusion table. To use the security feature, you must use an SNMP manager that supports security.

RJ-45 Autopolarity Reversal

Autopolarity reversal is a port-level programmable feature provided with Boot v1.30. When enabled, autopolarity reversal can automatically invert the polarity of the port to correct a wiring error. Boot v1.30 enables Autopolarity reversal before it starts its BOOTP/RARP sequence. If Runtime v1.30 is running with an older version of Boot, it enables Autopolarity reversal when the Boot sequence completes and Runtime is executing. Resetting the repeater disables Autopolarity reversal.

Supported Frame Types

The Netelligent 2008 and 2016 repeaters support the following frame types:

- 802.3 RAW: IPX
- 802.2 (TYPE II): IPX
- 802.2 SNAP: IPX and IP
- Ethernet_II: IPX and IP

Supported Protocols

The repeater supports both the IP and IPX protocol stacks for SNMP management. The VT100 management interface is also supported over the TCP/IP stack. All pertinent frame types are supported for each of these protocol stacks.

TCP/IP Support

The repeater supports SNMP over IP. This requires the full implementation of the UDP/IP protocol stack which includes address resolution protocols (ARP, RARP, and BOOTP), a control and error message protocol (ICMP), and IP fragmentation (supported to a maximum packet size of 1520 bytes).

For greater management flexibility, the IP stack is supported over both ETHERNET_II (default) and 802.2 SNAP header with 802.3 frame types.

BOOTP, RARP, and TFTP packets originate from the repeater. For BOOTP and RARP, both 802.2 SNAP over 802.3 and ETHERNET_II frame types are sent consecutively. If the repeater receives a response, it uses the frame type of the response to set the nw2IPFrameType MIB variable (stored in NVRAM). All IP reception and transmission use the same frame type. To allow the repeater to route any IP traffic, the frame type must also match the default gateway's frame type. The repeater supports only one frame type (802.2 SNAP or ETHERNET_II SNMP) per IP network.

The repeater performs the follow steps to determine the IP frame type to use:

1. If a response is received from a BOOTP or RARP server, use the frame type of the received packet.
2. If no response is received from a BOOTP or RARP server, use the value stored in NVRAM for the frame type.
3. If no value is stored in NVRAM, use the default value of ETHERNET_II.
4. You can change the frame type at any time by setting the nw2IPFrameType MIB variable through the VT100 interface or SNMP.

IPX Support

The repeater supports IPX over ETHERNET_II, 802.3 RAW, 802.2 header with 802.3, and 802.2 SNAP header with 802.3 frame types. The default frame type used by the repeater is 802.2 over 802.3.

SNMP requests and responses, RIP (requests and responses), IPX diagnostics, and Compaq's propriety protocol are all packets that do not originate from the repeater but use IPX. A management station sends these packets to the repeater and waits for the response. The SNMP management agent receives the packet and sends it back using the same frame type and IPX network number that was used to send the packet. The repeater supports all IPX frame types for response type traffic.

The repeater originates packets for SNMP traps and RIP/SAP broadcasts. Therefore, the repeater must know the IPX frame type and network number to be able to transmit the packets. This requires the use of MIB variables, one of which is the nw2IPXFrameType variable.

The repeater performs the following steps to determine the IPX frame type to use on packets it originates:

1. Use the value stored in NVRAM for the frame type.
2. If no value is stored in NVRAM, use the default value of 802.2 over 802.3.
3. You can change the frame type at any time by setting the nw2IPXFrameType MIB variable through the VT100 interface or SNMP.

The repeater determines the IPX network numbers for SNMP traps through the MIB variables that indicate the IPX trap receiver addresses. The repeater learns IPX network numbers for RIP and SAP broadcasts by analyzing the RIP broadcasts that IPX routers send over the network. If the repeater cannot learn the network number through the network traffic, it uses the default network number 0.

IP / IPX Autodiscovery

The repeater supports both IP and IPX autodiscovery mechanisms. Therefore, standard management platforms such as Novell's ManageWise and HP OpenView can autodiscover the repeater.

IPX Autodiscovery

The repeater supports Novell IPX autodiscovery through its HMI-compliance mechanism. IPX autodiscovery supports the SAP, RIP, and IPX diagnostics protocols. Using SAP, the repeater advertises itself as HMI compliant. When Novell's NMS or ManageWise initiates autodiscovery, it produces bindery requests through NCP to a NetWare server. This allows NMS to obtain the internal network number of the HMI-compliant device and, through RIP, obtain the MAC address and other necessary information to start SNMP over IPX communication. IPX diagnostics are implemented only to support the NetExplorer server. This protocol is not directly involved with the NMS autodiscovery algorithm, but is used to update the NMS database with the current network configuration.

Novell servers keep a cache of the services available on the network. The cache has an aging mechanism, so services such as the repeater's HMI services can be deleted. To prevent this deletion, the repeater broadcasts its services via SAP every 55 seconds. You can disable or enable these SAP broadcasts through a MIB variable. The default setting is enabled.

IP Autodiscovery

The repeater supports a generic IP autodiscovery used by many leading SNMP platforms (e.g. HP OpenView, SunNet Manager, and NetView 6000). IP autodiscovery uses the ARP cache of gateways or routers present on the network. The gateways and routers have ARP cache aging mechanisms that refresh the cache and remove undetected addresses, making it necessary to periodically update the cache for IP autodiscovery. If there is not enough SNMP traffic, addresses may be deleted from the cache. The repeater periodically transmits an ICMP ping to its IP default gateway. You can use either SNMP or VT100 management interfaces to change a MIB variable that matches the rate of ping transmissions with the IP gateway's cache aging timer. This guarantees that the gateway's ARP cache is current and valid. If no default IP gateway is set up, the repeater does not transmit the pings and IP autodiscovery is not guaranteed.

A MIB variable lets you disable or enable IP autodiscovery. The repeater retains in NVRAM all settings for IP autodiscovery enable and ping timer MIB variables.

IPX-Based Smart Module Management Protocol

In addition to SNMP over IP and IPX, the repeater supports the IPX-Based Smart Module Management Protocol (SMMP). This proprietary, IPX-based protocol is designed to manage Compaq repeaters.

Fault Processing

The repeater responds to fault conditions in the following ways:

- **Powered Down Repeater**: After power is removed from the repeater, the SNMP network manager re-synchronizes the inter-hub communications and ignores (does not detect) the repeater.
- **Hot Swapping a Repeater**: When a repeater is removed from or added to an existing stack, an inter-hub communication error occurs. After the SNMP network manager re-synchronizes inter-hub communications, is sees the new stack configuration.
- **Repeater Hardware Failure**: If the top or bottom repeater has a hardware failure (for example, the CPU fails), the SNMP network manager re-synchronizes inter-hub communications and sees a shorter stack. If one of the middle repeaters fails, the SNMP network manager sees two sub-stacks (one stack above and one stack below the failed repeater). The sub-stacks can be merged by cabling around the failed repeater or by powering off the defective repeater (if the bypass circuitry has not failed).
- **Powering a Repeater Off and Back On**: For 5 seconds to 170 minutes (maximum number BOOTP/RARP retries and the maximum BOOTPP/RARP time out) after a repeater has had its power cycled, it is unable to participate in the inter-hub communications. During this interval, the repeater performs a POST and makes BOOTP and RARP requests. Until these tasks are complete, the SNMP network manager sees the same results that occur when there is a repeater hardware failure (that is, a shorter stack or two sub-stacks).

Compaq-Specific Parameters

This section contains parameters that are specific to the Netelligent 2008 and 2016 repeaters.

- **Ethernet Node Address Range**: Compaq has initially reserved 262,144 physical node addresses (i.e., MAC addresses) for the 2008 and 2016 repeaters. Each repeater must have a unique node address. The address consists of six bytes. The first three bytes are fixed, while the last three bytes are unique for each repeater. Shown below is the node address range in an MSB (most significant bit) hex form. The three-byte VV VV VV field starts with 58 00 00 and increments by one up to a maximum value of 5B FF FF.

  00 00 79 VV VV VV

- **Enterprise Number**: The MIB II enterprise number is 215.
- **sysObjectID**: The system object ID contains the following:

  1.3.6.1.4.1.215.1.1.4.2.6

- **sysDescr**: The system description strings contain the product name.
- **SAP ID**: A hex 05A9 SAP ID is used to advertise the repeater service. Novell assigns this SAP ID to Compaq Computer Corporation.
- **Well Known IPX Socket ID**: The well known IPX socket ID used for the IPX-Based Smart Module Management Protocol is hex 8468. Novell assigns this socket IP to Compaq Computer Corporation.

Using IPX

You can set the repeater's IP address, IP net mask, and IP default gateway using the DOS-based SETIP.EXE utility. The network must support IPX between the workstation and the repeater (that is, IPX routers are required between segments). To set the address, you must know the repeater's MAC address and its Novell network number.

You can use Compaq Netelligent Management Software to set the SNMP write community string. Be sure you set the write community for the bottom repeater in the stack so that the new string propagates through the stack and is not overwritten with the prior setting.

NOTE: These utilities require a PC with an Ethernet NIC, a NIC driver, and an IPX protocol stack.

Using SNMP (over IP and over IPX)

Once you set the IP address for any repeater in a Netelligent 2008/2016 repeater stack, you can set the IP addresses for the remaining repeaters by making SNMP over IP requests. You must use the DOS-based SETIP.EXE utility to set the IP address of the initial repeater (see "Using IPX" in this chapter). An SNMP network manager can set/update the IP addresses (and other configurations parameters) for each of the repeaters in a stack by modifying the nws2StackTable MIB object and sending it to a repeater that has a valid IP address. Only one repeater in the stack requires connectivity.

You can use SNMP over IPX to set the IP address of each repeater in the stack, even if none of the repeaters in the stack have a valid IP address. For example, Novell's NMS could autodiscover a Netelligent 2008/2016 repeater stack, and then use SNMP over IPX to modify the nws2StackTable MIB object.

VT100 Management

The Netelligent 2008/2016 repeater provides a VT100 terminal interface in the Runtime operational mode This interface enables simple management through the following three modes of communications:

- Serial port connection using VT100 terminal protocol over a modem or direct connection using a null modem cable
- Telnet over an IP Ethernet connection
- Telnet over SLIP (serial interface) with or without a modem

The repeater allows only one active user interface at a time. For example, if a session is active using Telnet over Ethernet, you cannot start another session using the serial or Ethernet connections.

VT100 Screens

The VT100 interface uses two basic types of screens: menu and data. *Menu screens* provide a moving bar type of selection interface, and might also contain update fields. *Data screens* may contain general purpose entry fields and update fields, including array update fields that can be scrolled. You can edit an entry field but not an update field, which the user interface updates with the current value. Each screen provides the following basic information:

- sysTime in the lower right corner
- sysName in the upper left corner (first 25 characters)
- IP address in the upper right corner

Navigating the VT100 Interface

Navigating the VT100 interface requires using two types of keystrokes: administrative and non-administrative.

Administrative keystrokes let you move from one field to another or from one screen to another. These types of keystroke include the following:

- **<Enter> key** — Validates the entry. If an entry is not valid when you press the <Enter> key, an error message appears on the screen and the cursor remains on the field. The <Enter> key is the only valid key you can press to exit a screen.
- **<Tab> key** — Lets you move the cursor forward from one field to another. If you have changed field, the interface validates it before the cursor moves to the next field. If the field is not valid, an error message appears on the screen and the cursor remains on the field.
- **Arrow keys** — Let you move the cursor forward from field to field (using the right and down arrow keys) or backward (using the left and up arrow keys).

Non-Administrative keystrokes are processed within the context of a field and include the following:

- All alphanumeric and punctuation keys
- Backspace key (used to modify an edit field)

- Function keys, F1 through F4
- Space bar (used to toggle between entries in a toggle field). The change takes place as soon as the entry appears between the angle brackets (< >).

Notes:

— Information you can edit is highlighted and non-editable information is in normal text.

— All menu items in the menu selection screen are case insensitive.

— If you use the Windows Terminal program, select Terminal Preferences from the Settings menu. Then uncheck the Use Function, Arrow, and Ctrl Keys for Windows option box. This enables the arrow keys to function correctly in the interface program.

Starting the Management Session

NOTE: The Login screen in the VT100 console interface requires that you enter your password within a specific amount of time. Therefore, we recommend that you read through the following steps to become familiar with the procedure.

When you apply power to the repeater, the Boot phase starts (the STATUS LED is orange). After about 20 seconds, the STATUS LED changes to green to indicate that the repeater is in the Runtime phase and is ready for the management session.

After the repeater has entered the Runtime mode, follow these steps to start a management session.

If the repeater uses a null modem connection, start with Step 1.

If the repeater uses a regular modem connection, start with Step 2.

1. In the Runtime mode, the repeater firmware displays a modem initialization string every 10 seconds, with each string representing a different baud rate (9600, 2400, 1200, and 300). When the firmware detects the baud rate that matches the terminal baud rate, it displays a readable alphanumeric character string similar to the following:

at&fs0=1

2. Within 20 seconds after a readable alphanumeric character string appears, enter the following command:

   VT100

   The Login screen appears.

Figure 4-1. Login Screen

NOTE: If the 20 seconds expires before you enter VT100, you must wait for the port to cycle back to the modem initialization string.

3. Within 20 seconds after the Login screen appears, enter the password. The default password is <public>. The Main menu screen appears.

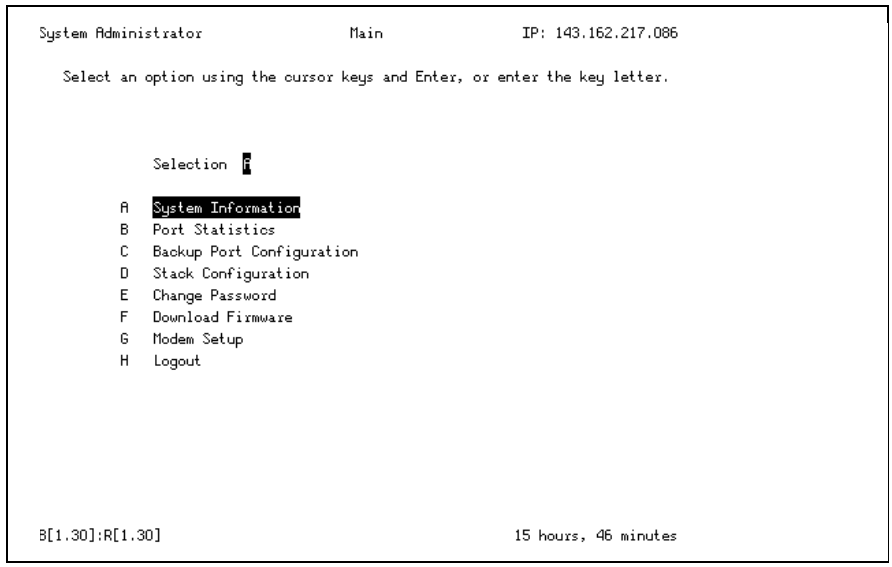


Figure 4-2. Main Menu Screen

Error Messages

If you enter an incorrect password, the following error message appears:

ERROR: Password incorrect, please re-enter.

The following sections describe each menu option screen.

Viewing System Information

The System Information screen shows the primary system identification information.

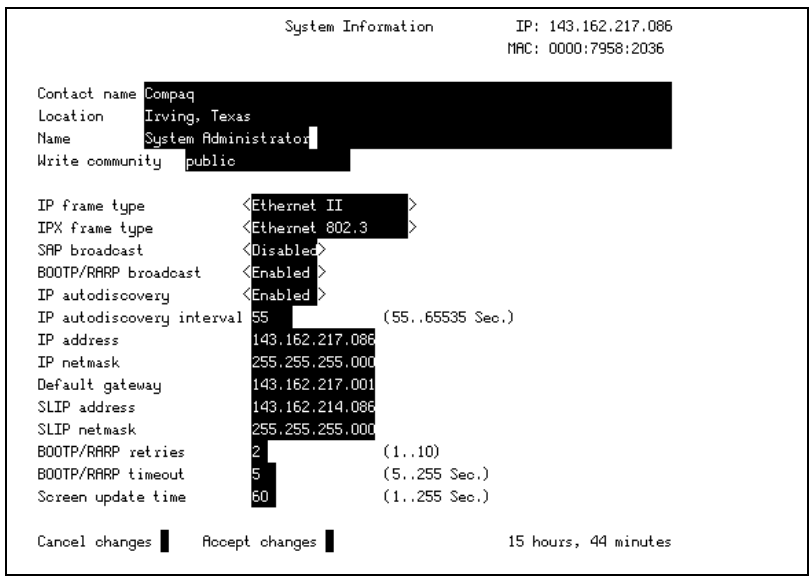


Figure 4-3. System Information Screen

You can select the following IP frame types: Ethernet II or Ethernet 802.2 SNAP.

You can select the following IPX frame types: Ethernet II, Ethernet 802.2, Ethernet 802.3, or Ethernet 802.2 SNAP

Error Messages

The following error message can occur if there are incorrect entries:

ERROR: The field must be in the range [0...255]

The following error messages can occur if entered values are out of range:

ERROR: The value is too small
ERROR: The value is too large

Viewing the Stack Configuration

The Stack Configuration screen shows the backplane type (*isolated* or *non-isolated*), IP address, IP netmask, and default gateway for a selected unit in the stack. To select a unit, move the cursor to the Unit field and press <-> or <+> to change the unit number.

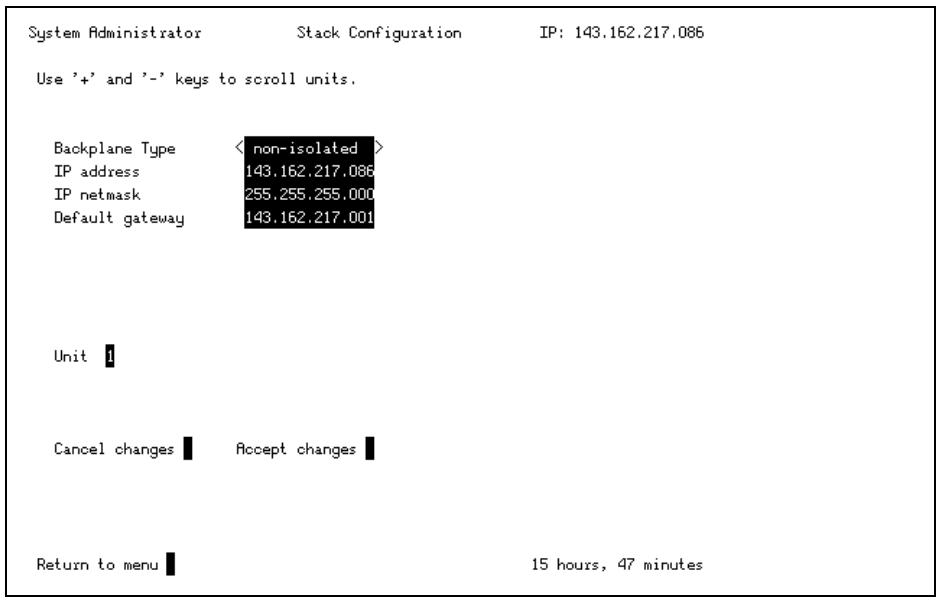


Figure 4-4. Stack Configuration Screen

Error Messages

The following error message can occur if there is an incorrect entry:

ERROR: The field must be in the range [0…255]

Viewing the Backup Port Configuration

The Backup Port Configuration screen shows information about the primary and backup port and the current status of the ports. The screen also lets you add, delete, and enable or disable the state of backup port entries.

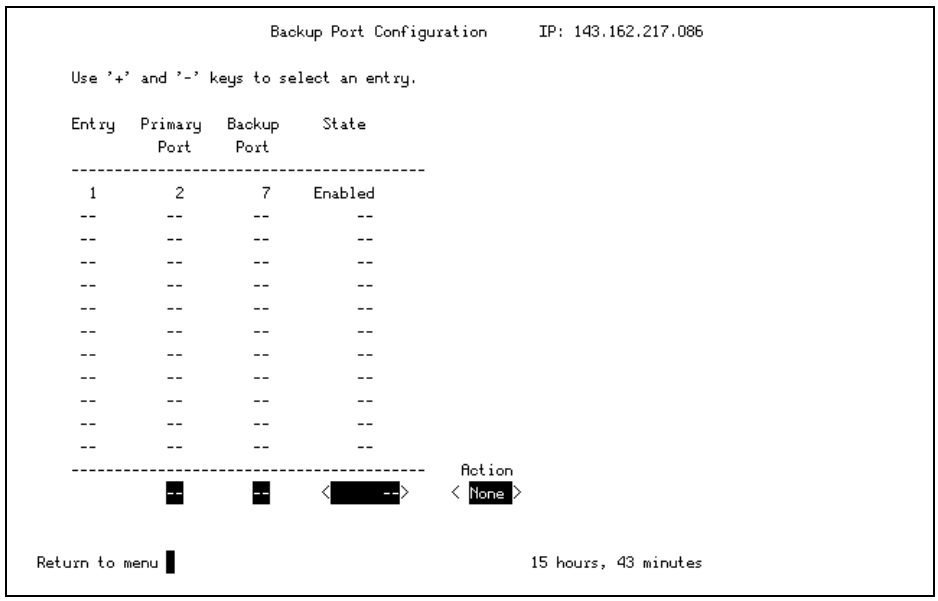


Figure 4-5. Backup Port Configuration Screen

Adding a Backup Port Entry

To add a backup port entry, follow these steps:

1. From the Action field, move the cursor to the Primary Port entry field. Then enter the number of the desired primary port.
2. Move the cursor to the Backup Port entry field. Then enter the number of the desired backup port.
3. Move the cursor to the Action field and press the space bar until Add appears.

4. Press the <Enter> key. The new backup port entry appears in the backup port configuration list.

Deleting a Backup Port Entry

To delete a backup port entry, follow these steps:

1. Press the - or + keys to highlight a backup port entry.
2. Move the cursor to the Action field and press the space bar until Delete appears.
3. Press the <Enter> key.

Updating the State of a Backup Port Entry

To update the state of a backup port entry, follow these steps:

1. Press the - or + keys to highlight a backup port entry.
2. Move the cursor to the State entry field.
3. Press the space bar until the desired option (Disabled or Enabled) appears.
4. Press the <Enter> key.

Error Messages

The following error messages can occur if there are incorrect entries:

ERROR: Input fields not complete

ERROR: Invalid port number

To move to the Return to menu field, the cursor must first be in the Action field.

Viewing Port Statistics

The Port Statistics screen shows statistical information for each port, as shown in the following illustration.

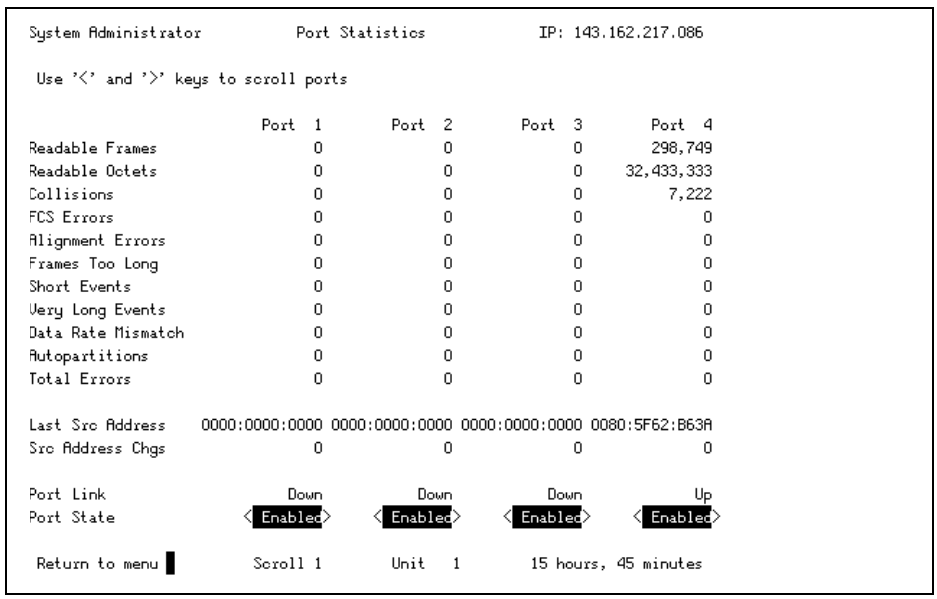


Figure 4-6. Port Statistics Screen

To scroll forward or backward to other ports, move the cursor to the Scroll field and press the < > keys.

To enable or disable ports, move the cursor to the Port State field for the desired port. Then press the space bar to toggle between the Enabled and Disabled option.

NOTE: Refer to the glossary for definitions of these statistics.

Changing Your Password

The Change Password screen lets you change your current password. To change your password, follow these steps:

1. Enter the old password in the Old password field.

   NOTE: You must enter information in the Old password field to advance the cursor to the New and Verify password fields.

2. Enter the new password in the New password and Verify password fields.

3. Press the <Enter> key.

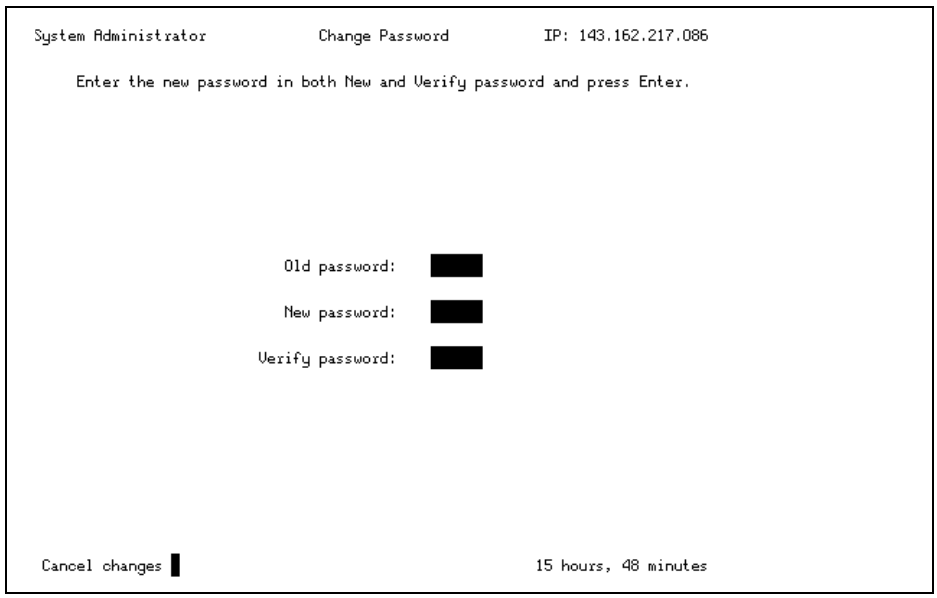


Figure 4-7. Change Password Screen

Error Messages

The following error messages can occur if there are incorrect entries:

ERROR: Old password not valid

ERROR: Verify Password does not match New Password

Downloading Firmware

The Download Firmware screen lets you download an updated version of firmware. The download can take place via a serial connection using XMODEM (default) or TFTP over Ethernet, or via a Telnet connection using TFTP over SLIP or Ethernet. Null modem SLIP connections can only occur at 9600 baud. SLIP connections over a remotely linked modem are available at 2400, 9600, and 19.2K baud.

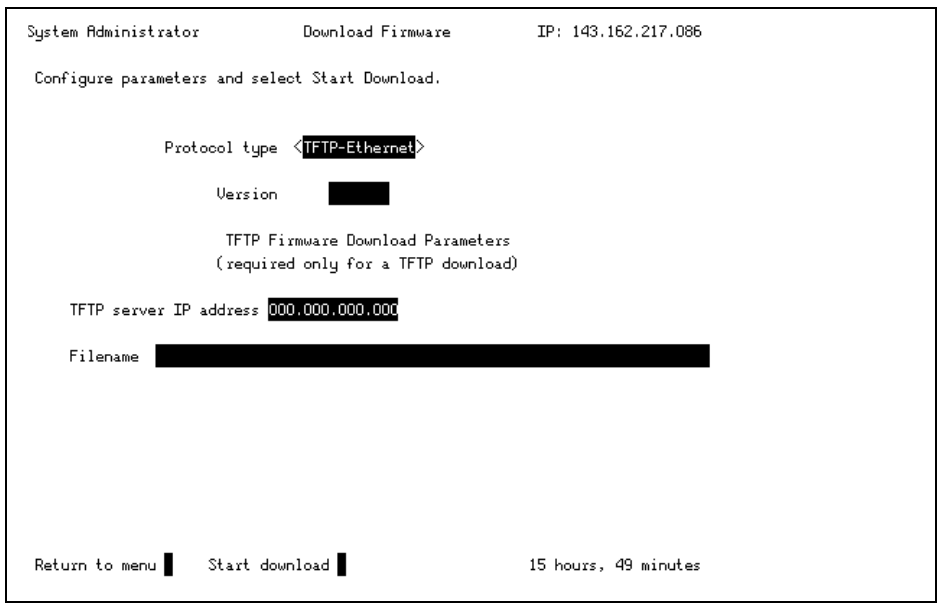


Figure 4-8. Download Firmware Screen

To download firmware, follow these steps:

1. Position the cursor on the Protocol type field. Press the space bar to select the desired option (XMODEM, TFTP-Ethernet, TFTP-SLIP, etc.).
2. Position the cursor on the Version field and enter the firmware version. This information must be correct for a successful download. Refer to any release notes, README files, or other documentation that accompanies the firmware upgrade for the correct firmware version.
3. If you selected TFTP as the protocol type, enter the TFTP server IP address in the TFTP server IP address field and enter the firmware image filename in the Filename field.
4. To execute the download, position the cursor on the Start download field and press the <Enter> key. Or, to cancel the download and return to the Main menu screen, position the cursor on the Return to menu field and press the <Enter> key.

   The following error message can occur if there are incorrect entries:

   ERROR: Invalid parameter set

   ERROR: The field must be in the range [0...255]

   ERROR: Version string invalid

   ERROR: Invalid product identifier

   ERROR: Invalid version identifier

   ERROR: Invalid unit type

   ERROR: Invalid major version number

Setting Up the Modem

The Modem Setup screen lets you enter the modem's initialization string and disable or enable auto negotiation. The default initialization string is usually adequate. For more information, refer to the modem documentation.

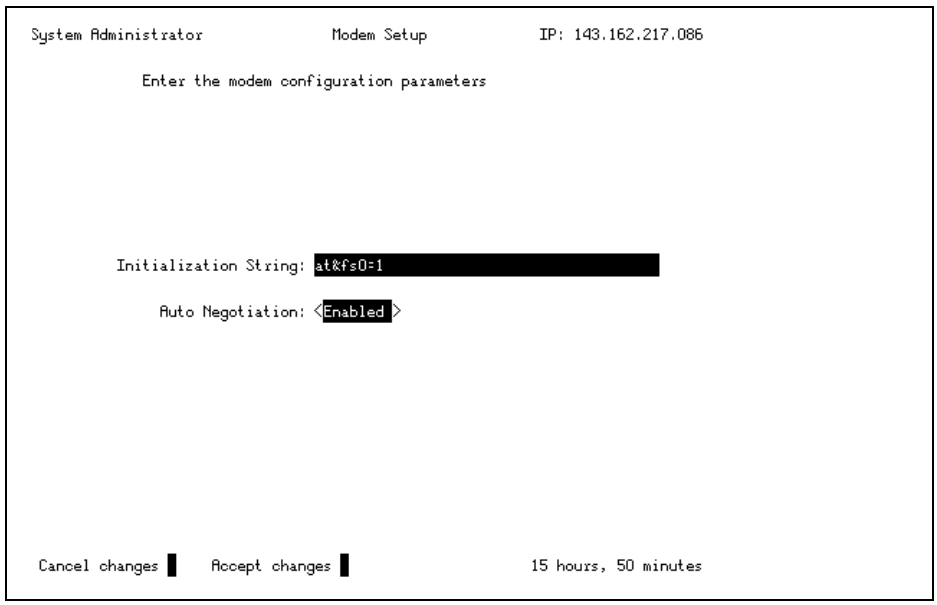


Figure 4-9. Modem Setup Screen

Logging Out of the Management Session

The Logout screen lets you end the VT100 management session.

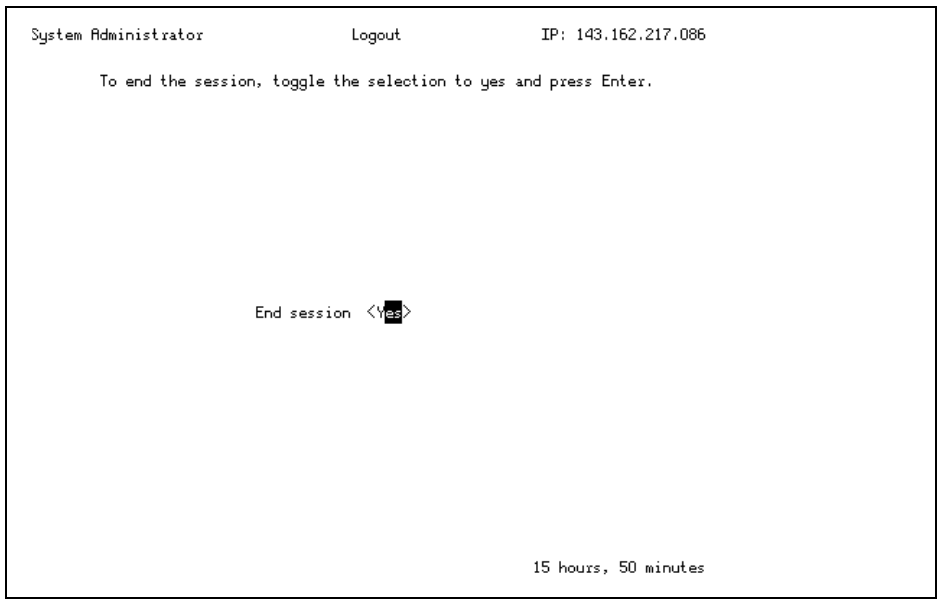


Figure 4-11. Logout Screen

If you select Yes, the Login screen reappears and you have 10 seconds to retype the password if desired.

SNMP Management

Using SNMP over IP or SNMP over IPX, an SNMP network manager can manage any unit in a Netelligent 2008/2016 repeater stack. You can set various parameters, including the write community and write protect flag, using the nws2StackTable MIB object. Modifying this object sets parameters for each repeater in a stack by sending SNMP requests to a single repeater. The remaining SNMP management requests (for example, enable/disable ports, backup port assignments, trap table entries, statistics) must be directed to the SNMP agent in each individual repeater in the stack.

SNMP over IP requires the full support of the UDP/IP protocol stack, which includes address resolution protocols, a control and error message protocol, and IP fragmentation. ARP (Address Resolution Protocol), RARP (Reverse Address Resolution Protocol), and BOOTP provide address resolution capabilities. ARP allows the dynamic mapping of IP addresses to a given hardware address. The Netelligent 2008/2016 repeater supports ICMP (Internet Control Message Protocol) as the standard for error and control message exchanges. The repeater supports IP fragmentation up to a maximum packet size of 1520 bytes.

Supported MIBs

The 2008 and 2016 repeaters support the following MIBs:

- **RFC1213** — Management Information Base for Network Management of TCP/IP-based Internets (MIB II); the firmware supports the following groups in MIB II:
  - System Group
  - Interfaces Group
  - Address Translation Group
  - atPhysAddress is supported for read only
  - atNetAddress is supported for read only
  - IP Group
  - ICMP Group
  - UDP Group
  - SNMP Group
- **RFC1516** — Definitions of Managed Objects for the IEEE 802.3 Repeater Devices (technically part of MIB II).
  - rptrReset does not perform an actual repeater reset
  - rptrNonDisruptTest does not perform an actual test
- **NWS2000 MIB**
- **Novell Repeater MIB** — This MIB is required to support Novell's NMS.

- ❏ rptrBasReset does not perform an actual repeater reset
- ❏ rptrBasSelfTest1 does not perform an actual self test
- ❏ rptrBasSelfTest2 does not perform an actual self test

Statistics

The Netelligent 2008 and 2016 repeaters support the following Ethernet statistics at the module (or repeater or group) level:

- total frames
- total octets
- total errors
- total partitioned ports (current number)
- transmit collisions
- very long events
- all link status (bit map)
- backplane (internal or isolated)
- chassis ID (MAC address of the logical bottom repeater)
- slot number (1 = topmost repeater)

The repeaters support the following Ethernet statistics at the port level:

- readable frames
- readable octets
- collisions
- short events
- runt frames
- very long events
- frames too long

- late events
- frame check sequence errors (FCS)
- frame alignment errors
- data rate mismatches
- total errors
- new last source address (0 if port never used)
- last source address
- source address changes
- autopartitions
- autopartition state (yes/no)
- link test status
- link state
- port administration (enabled/disable)
- port type
- port operational status (yes/no/not available)

When you power off the repeater, the statistics listed above are cleared.

Traps

The Netelligent 2008 and 2016 repeaters support the following trap types:

- **Cold Start Trap —** signifies that this repeater is reinitializing itself.
- **Authentication Failure Trap —** signifies that this repeater has been sent a protocol message that is not properly authenticated.
- **Novell Repeater MIB Traps —** an enterprise specific trap defined by the Novell Repeater MIB.

- **Group Map Change Trap** (rptrGroupMapChange) — signifies that this repeater recognizes that the stack map has changed (i.e., one or more repeaters have been added or removed). This trap, which is sent by the logical bottom repeater (note that a physical stack may have more than 1 logical bottom repeater; see section 3.11.5), occurs each time that the repeater's power is cycled and for each event that causes the stack map to change (e.g., hot swapping, repeater failure). This trap will return a 16 bit value (maximum of 10 bits used; 1 bit per repeater) that contains a bit map of the available repeaters (LSB is repeater 1).
- **Health State Trap** (rptrHealth) — signifies that the health of this repeater has changed. A specific message will be returned. Health state traps include:
  - **Port Autopartition Trap** — indicates that a port has been autopartitioned as a result of 32 consecutive collisions or because the DTE was jabbering.
  - **Backup Port Activated Trap** — a backup port has taken over for a failed port.
  - **Intrusion Port Trap** — an intruder was detected and the port was disabled.
- Reset Trap (rptrReset) signifies that the repeater has completed a reset action triggered by a management command.

The logical bottom repeater transmits the Group Map Change Trap. The repeater that flags the trap condition sends all other traps.

To receive a trap, the SNMP network management station must place its IP and/or IPX address into the repeater's trap table (nws2IPTrapReceiverTable for IP traps or nws2IPXTrapReceiverTable for IPX traps). The IP and IPX trap tables can each contain 10 entries. To receive traps from each repeater in a stack, the the SNMP network manager must enter trap table entries into each repeater.

Novell NMS HMI Compliance

The repeater firmware emulates an HMI driver to support repeater autodiscovery in Novell networks. A Hub Management Interface (HMI) driver is an ODI driver running on a NetWare server that is compliant with the Novell HMI specification. A node may emulate an HMI driver by supporting the Novell NWHUB.MIB and IPX autodiscovery. The repeater requires an attached Novell NetWare server to support IPX autodiscovery. IPX autodiscovery requires that the firmware support the following protocols:

- **SAP —** The Novell Services Advertising Protocol (SAP) allows the firmware to advertise its services. SAP requests are broadcast over IPX every 60 seconds. The SAP packet contains the SAP IDs of the available services. A repeater's SAP packet uses a hex SAP ID of "0239" (HMI services) and a hex SAP ID of "05A9" (repeater services; used to display the correct icon on the NMS segment map). The NetWare server stores the available services in its bindery.
- **RIP —** Routing Information Protocol (RIP) is the routing protocol used by TCP/IP and IPX routers. The firmware supports RIP to allow NMS to ascertain the repeater's MAC address, thus allowing NMS to initiate SNMP over IPX communications.
- **IPX Diagnostics —** IPX diagnostics are required to support the Novell NetExplorer server which updates the NMS database with the current network configuration.
- **SNMP over IPX —** If NMS discovers a repeater using IPX, it manages it using SNMP over IPX. Therefore, the firmware must support SNMP over IPX and IPX traps.

Out-of-Band Management (SLIP)

The Netelligent 2008/2016 repeater uses SLIP (Serial Line Internet Protocol) to provide out-of-band (remote) management via the COM serial port on the repeater's front panel. The connected repeater acts as an IP gateway, allowing the remote SNMP manager to communicate with any repeater in the stack as long as all stacked repeaters are on the same segment or there is a bridge or router providing connectivity between segments. The RFC1213 IpRouteTable MIB object must be initialized or the default gateway set to the IP address of the connected repeater to enable the correct forwarding and routing of IP packets from all of the repeaters in the stack.

To allow a SLIP connection, you must set the IP address and subnet mask for the SLIP interface. You can set these parameters by downloading a text configuration file via XMODEM in boot (see the section "Using XMODEM.") or through MIB variables or VT100 in Runtime (see the section "VT100 Management" in this chapter). To establish a SLIP connection, the repeater uses the first packet it receives to synchronize the connection and then discards the packet. This forces the SNMP remote manager to resend the packet (the user perceives this as a slight delay). The connection remains synchronized until 3 minutes after the repeater receives the last packet.

NOTE: The repeater supports IP fragmentation over SLIP. This provides for a maximum IP packet size of 1520 bytes for both SLIP and Ethernet. Without fragmentation, the maximum IP packet size is 1006 bytes per the Berkeley UNIX implementation.

Updating Flash

You can update the Flash in the repeater using XMODEM, a BOOTP and TFTP server, or a TFTP download via MIB variables through SLIP or in-band.

NOTES:

— The repeater does not respond to SNMP network manager requests during Flash updates.

— The MIB variable nw2rptrReset can be used to reset the repeater (i.e., simulate cycling power to the repeater). The repeater retains all configuration parameters but resets the statistics. This allows the user to update Flash if the BOOTP server is configured with a newer version of Flash.

Using XMODEM

You can use XMODEM (from boot) to update the repeater's Flash through the serial COM port via a null modem cable (9600 baud) or remotely via a modem (9600, 2400, 1200, or 300 baud). The XMODEM Flash update requires that you download a binary Flash image file in addition to a text configuration file. To update the Flash using XMODEM, follow the procedure described in the sub-section "Using XMODEM" under "Configuring the Repeater During the Boot Process" in this chapter.

You can also use XMODEM to update the Flash from the VT100 interface. This method does not require a configuration file. See the section "VT100 Management" in this chapter.

Using a BOOTP and TFTP Server

The BOOTP/TFTP download method requires that the BOOTP and TFTP servers have the same IP address. The BOOTP vendor specific BOOT_QUOTESERVER field contains the firmware version string. See the section "Using a BOOTP or RARP Server" for an example USRBOOTP configuration file.

To use the BOOTP/TFTP method, copy the latest image file to the TFTP server. The next time the repeater is powered on, its firmware makes a BOOTP request that can initiate a Flash download request from the TFTP server which updates the Flash.

NOTE: The BOOTP/TFTP method of updating Flash allows only a higher version of firmware to be downloaded. This prevents excessive downloads that could wear out the Flash.

Using TFTP via MIB Variables

You can initiate a TFTP download by setting the following repeater MIB variables.

- ***nws2DownloadImagePathname*** — The fully qualified path name of the image file to download and the name of the image file
- ***nws2DownloadServerIp*** — The IP address of the TFTP server
- ***nws2DownloadImageVersion*** — The desired firmware version string
- ***nws2DownloadState*** — Set to downloading to initiate the TFTP download.

The firmware makes the same TFTP server request performed for the BOOTP/TFTP download.

You can also initiate a TFTP download from the Download Firmware screen in the VT100 interface. See the section “VT100 Management” in this chapter.

Using TFTP Over SLIP

Once a SLIP connection is made to any repeater in a Netelligent 2008/2016 repeater stack, you can use TFTP to update the Flash in any or all of the repeaters in the stack, one at a time, as long as the repeaters are in the same segment. To initiate the TFTP download, set the same MIB variables listed in the previous section, “Using a TFTP Server via MIB Variables.”

NOTES:

— You can update repeaters in a Netelligent 2008/2016 repeater stack in any sequence. After the repeater with the SLIP connection is updated, it re-initializes itself and retains its SLIP connection.

— If a non-recoverable error occurs while downloading the Flash using TFTP over SLIP, the firmware breaks the SLIP connection and performs a POST. You must use XMODEM to initiate the remote Flash download.

Repeater MAC Address

The MAC address is a unique identifier assigned by the manufacturer to distinguish individual nodes. If you use management software to manage the repeater, you must know the MAC address to set the IP address. The MAC address is marked on a label located at the upper right corner of the repeater's faceplate.

The MAC address is a 12 hexadecimal (6-byte) character (for example, 000079580014) that consists of the following elements:

The first six digits are unique to the manufacturer (this number is assigned by the IEEE).

The second six digits represent the unique node identifier assigned by Compaq. These six digits always begin with “5" (for example, 500000).

Appendix A
Specifications

Electrical Specifications

Battery Backup

- Battery backup for non-volatile RAM

Ports and Connectors

- Netelligent 2016 16-port repeater — 16 RJ-45 ports
- Netelligent 2008 8-port repeater — 8 RJ-45 ports
- Two RJ-45 Hub Expansion Ports (one IN and one OUT)
- Optional Media Expansion Port (only on the 16-port repeater)

The following optional snap-in media expansion modules are available for the 16-port repeater to support alternative cabling:

- BNC connector for Thinnet (Part Number 267064-001)
- DB-15 AUI connector (Part Number 267063-001)
- One pair of 10Base-FL ST connectors (Part Number 267065-001

LED Indicators

- Power (PWR), Segmentation (SEG), and Collision (COL) status
- Media Expansion Port (MEP) (only on the 16-port repeater)
- RJ-45 port

Controls

- Two-position (MDI/MDIX) uplink switch

Serial Port

- Supports asynchronous data transfer through external devices

Power Requirements

- Voltage: 120 to 240 VAC
- Frequency: 50 to 60 Hz
- Power: 0.25 to 0.50 Amps maximum (for 16-port model; the 8-port model draws slightly less power)

Power Consumption

- Typical: 10 W; Maximum: 15 W

Power Cord (USA)

- Shielded 1.8 meters (6 feet), 10 Amps

Physical Specifications

Dimensions

- 1.75 x 17 x 8.4 inches, 4.45 x 43.18 x 21.21 centimeters (HxWxD)

Weight

- 4.4 pounds (2 kg)

Environmental Specifications

Operating Environment

- 32° to 120° F (0° to 49° C)
- 5% to 95% humidity (non-condensing)

Storage Environment

- 32° to 151° F (0° to 66° C)
- 5% to 95% humidity (non-condensing)
- 0 to 30,000 feet altitude (0 to 9 kilometers)

Glossary

10Base-2	An IEEE 802.3 Ethernet standard for thin coaxial cable (ThinNet). Stations are daisy-chained with a maximum segment length of 200 meters. The repeater uses 10Base-2 in its repeater expansion port (REP) to provide a common, bussed Ethernet segment. The REP 10Base-2 is implemented using twisted pair (not coax), limiting the maximum length to 76.2 meters (250 feet).
10Base-T	An IEEE standard (802.3) for unshielded twisted-pair (UTP) wiring. Stations are connected using a star topology. The maximum segment length is 100 meters (328 feet).
100Base-TX	An IEEE standard (802.3u) for high-speed Ethernet.
802.2	An IEEE standard that governs Logical Link Control (LLC). The LLC layer can provide either connections-oriented services, connectionless services, or a combination of both.
802.3	An IEEE standard that governs Carrier Sense Multiple Access/Collision Detect (CSMA/CD) networks. 802.3, referred to as Ethernet, operates on different cable types (e.g., UTP, coax, fiber).
Address Resolution Protocol	Used by the TCP/IP protocol stack to dynamically bind an IP address with a MAC address
Alternate Media Connector	An optional module that plugs into a 16-port repeater to provide an AUI, BNC, or fiber Media Expansion Port (MEP). The MEP is the 17th port.
ARP	*See* Address Resolution Protocol.
Autodiscovery	The ability of a network manager to discover the node address and functionality of network devices. The 8-port and 16-port repeaters support IPX autodiscovery.
Autopartition	The automatic disabling of a port by hardware after a specific number of consecutive collisions occur.

Backplane	The data bus connections used to interconnect different communication modules inside a networking concentrator.
Backup port	Provides a redundant connection for a primary port in mission critical applications. The firmware activates the backup port when the primary port loses link test or becomes autopartitioned by the hardware. The repeater allows any port in the repeater to back up another port within the repeater.
BNC	A type of connector used for thin coaxial cable. BNC connectors are used to connect stations in a ThinNet (10Base-2) network.
BOOTP	Bootstrap Protocol. You can use a BOOTP server to set the initial repeater configuration parameters (e.g., IP address, IP net mask, IP default gateway) and to assist in downloading the latest version of the Flash. A repeater BOOTP request contains the repeater's MAC address.
Boot Sectors	The repeater uses four 16KB sectors of Flash as the firmware boot sectors. The boot sectors, which are hardware write-protected, cannot be modified by downloading the Flash.
Bridge	A program running on a computer connecting two LANs that allows traffic from one network to be exchanged with the other network. The networks can be the same or different (e.g., Ethernet and Token Ring).
Carrier Sense	The monitoring of a local area network by a node to determine if another node is transmitting.
Coax, Coaxial Cable	A type of shielded cable used in communication networks. Different types of coaxial cable include Ethernet and RG-6.
Collision	Simultaneous transmission on the communication media.

Concentrator	A device that houses other repeaters and modules, to provide connectivity between data terminals in a network.
Configuration	The layout of nodes and components in the network.
Cross Connect	A panel on which the leads of station cable are mounted so that a technician or the system administrator can make electrical connections between the communications devices wired to the cables.
Dielectric	A substance that does not conduct electrical current.
Flash	A memory device that allows unlimited read and limited write (about 100KB) cycles. Flash PROM in the repeater contains the boot sectors (hardware write-protected), an SNMP information sector, and the Flash program sectors.
Ethernet II	Ethernet II or DIX was defined by Digital, Intel, and Xerox. The frame format for Ethernet II differs from that of 802.3 in that the header specifies a packet type instead of the packet length.
FDDI	*See* Fiber Distributed Data Interface.
Fiber Distributed Data Interface	A high-speed networking standard. The underlying medium is fiber optics, and the topology is a dual-attached, counter-rotating token ring.
HMI driver	A Repeater Management Interface (HMI) driver is an ODI driver running on a NetWare server that is compliant with the Novell HMI specification..
Hot Swappable	A module, switch, or repeater's ability to be added or removed from a stack without removing power from the switch or repeater.
ICMP	See Internet Control Message Protocol .

Internet Control Message Protocol	Provides error handling and control messages for TCP/IP.
Interrepeater Communication	The 10Base-T interrepeater communication is implemented using the REP, bidirectional, RS-485, 38.4 K Baud, serial connection. This link uses a bucket brigade with token passing protocol to pass information from repeater to repeater within a stack.
IP Address	The Internet Protocol address assigned to a repeater, module, or node. Internet Protocol provides connectionless, best effort datagram delivery service.
IPX Diagnostics	Required to support the Novell NetExplorer server. The NetExplorer server is used to update the NMS database with the current network configuration.
Jabbering	Continuous transmission from a node, generally as a result of a hardware or firmware failure.
LED	*See* Light Emitting Devices.
Light Emitting Devices	Considered to be eye safe due to relatively low optical power which, by design, emit incoherent light at a power level well within guidelines for eye safety.
Link Test	A test that is performed by the hardware to ensure the integrity of the cable. The link test can be disabled to allow old style NICs incapable of performing a link test to connect to the repeater.
Local Area Network	A data communications network consisting of host computers or other equipment interconnected to terminal devices, such as personal computers, often via twisted-pair wire or coaxial cable. Typically, the network is limited to a single premise.
MAC Address	The Ethernet MAC address is a 6-byte node address. All Ethernet node addresses are unique. The MAC address of a repeater must be known before the repeater IP address can be set.

Manageable	A repeater is manageable if it contains an SNMP agent and there is a data communications path to that agent.
Management Information Base	Describes an agent's configuration flexibility, diagnostic ability, and information that can be reported to a network management station.
Media Expansion Port	Created by plugging an optional Alternate Media Connector into the 16-port repeater. The MEP (the 17th port) provides an AUI, BNC, or fiber connection.
MEP	*See* Media Expansion Port.
MIB	*See* Management Information Base.
Modular Cord	A cord containing four twisted pairs of wires, with a modular plug on one or both ends.
Module	The component that provides connectivity ports for the LAN. Modules are installed in larger systems, called concentrators.
Network Interface Card	A card that plugs into a device and allows it to be connected to a network.
NIC	*See* Network Interface Card.
NMS, Novell	Novell's NetWare Management System (NMS) is an integrated network management system that provides a platform for managing a multivendor, heterogeneous network environment. NMS can autodiscover network services by monitoring transmitted SAP IDs. The 8-port and 16-port repeaters will advertise that they have an HMI driver and repeater services
Node	A device that is attached to a network and communicates by means of the network. Any network station
Partition	The electrical disconnecting of a node from a LAN at its point of connection to a repeater. The node remains physically attached.

PDU	*See* Protocol Data Unit.
Plenum Cord	Communications cord with fire-retardant insulation, generally used in suspended ceilings and other places where air circulates back to the building's air-conditioning system.
Port	An external connector used to connect PCs and other node devices to the network.
POST	*See* Power-On Self-Test.
Power-On Self-Test	A sequence of events a repeater or module performs when it powers up to check the functionality of the unit.
Protocol Data Unit	A packet that contains control information and optional data.
RARP	*See* Reverse Address Resolution Protocol.
REP	*See* Repeater Expansion Port.
Repeater	Localizes the connections for multiple network nodes. A repeater is sometimes called a concentrator.
Repeater Expansion Port	The REP is used to interconnect up to 10 repeaters to form a single logical stack.
Reverse Address Resolution Protocol	A RARP server can be used to set a repeater's IP address.
RIP	*See* Routing Information Protocol.
RJ-45	An 8-wire modular connector used for 10Base-T Ethernet and some telephones.

Routing Information Protocol	The routing protocol used by TCP/IP and IPX routers. Using a distance-vector routing protocol, it optimizes the routing between source and destination addresses by minimizing the hop count. The firmware supports RIP to allow NMS to ascertain the repeater MAC address, thus allowing NMS to initiate SNMP over IPX communication.
RS-232	The EIA (Electronics Industry Association) recommended Standard 232 defines a standard way of transferring serial information by wire using single-ended line drivers and receivers. RS-232 lines generally include transmit, receive, ground and various control lines.
RS-485	The EIA (Electronics Industry Association) recommended Standard 485 defines a standard way of transferring serial information by wire using differential line drivers and receivers.
Router	A device used to connect two or more networks at the Network layer of the ISO-OSI reference model. The router must understand the communication protocols being used because it uses information provided by the protocols in each packet to determine how to route the packets.
SAP	*See* Services Advertising Protocol.
SAP ID	The SAP ID is used to identify the type of services available by a server. The 8-port and 16-port repeaters use a hex SAP ID of 05A9 to advertise themselves as a repeater service.
Segment	A segment is a separate collision domain. Each Ethernet segment supports a 10-Mb/s bandwidth. A multiple segment implementation increases the bandwidth of a local area network.

Segmentation	Segmentation is the process of dividing a network into multiple collision domains.
Services Advertising Protocol	SAP allows the firmware to advertise its services. The SAP requests, which are issued over IPX, are broadcast every 60 seconds. The SAP packet contains the SAP IDs of the available services. The 8-port and 16-port repeater SAP packets will use a hex SAP ID of 0239 (HMI services) and a hex SAP ID of 05A9 (10Base-T Repeater services; used to display the correct icon on the NMS segment map).
Stack	A stack is a group of interconnected repeaters.
Stack Table	The stack table is a repeater MIB object (*nws2StackTable*) that has an entry for each repeater in a stack. Each entry contains the backplane number, module type, MAC address, IP address, IP default gateway, IP net mask, and reset. An SNMP network manager can change these configuration parameters for each unit in a stack by updating the stack table in any unit.
Telco	A 25-pair polarized connector that is used to consolidate multiple voice or data lines.
Twisted-Pair Wire	Two insulated copper wires twisted together. The twists vary in length to reduce the potential for signal interference between pairs. In cables greater than 25 pairs, the twisted pairs are grouped and bound together in a common cable sheath. Twisted pair cable is the most common of transmission media.
TFTP	*See* Trivial File Transfer Protocol.
Trap	A trap is an unsolicited event sent from an agent to a network management station. Examples of traps include cold start, port autopartition, and backup port enabled.

Trivial File Transfer Protocol	Can be used to download a new Flash image.
UDP	*See* User Datagram Protocol.
Unshielded Twisted Pair	UTP cable is usually connected using RJ-45 connectors.
User Datagram Protocol	Provides reliable connectionless delivery service using IP. It adds the ability to distinguish among multiple destinations within a given host.
UTP	*See* Unshielded Twisted Pair.
Wiring Environment	Any building communications wiring system.
Wiring Closet	A room, closet or cabinet where station cable is terminated on crossconnect blocks and where the building communications system can be administered.

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