HiGain

HiGain Wideband System 3190

Installation Guide

Model	List Number	Part Number	CLEI Code
HMS-357	1	150-2205-01	T3M1FH0ERA
HMS-357	2	150-2205-02	T3M1GH0ERA

PAIRGAIN TECHNOLOGIES, INC.

ENGINEERING SERVICES TECHNICAL PRACTICE

SECTION 800-357-100-01

PAIRGAIN

Revision History of This Practice

Revision	Release Date	Revisions Made
01	February 2, 1999	Initial Release

USING THIS TECHNICAL PRACTICE

The following conventions are used in this manual:

- `Monospace type` indicates screen text, including text you type at a screen prompt.
- Keys you press are indicated by small icons such as ENTER. Key combinations to be pressed simultaneously are indicated with a plus sign as follows: CTRL + ESC.
- Two types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of equipment damage or the possibility of personal injury.

ABOUT THIS MANUAL

This manual provides an overview of the HiGain Wideband System 3190, its features, applications, and main system components.

Step-by-step installation instructions begin on page 13 and lead you through basic system setup and provisioning.

- For detailed information about specific system components, refer to the technical practice for that component.
- For comprehensive provisioning information, refer to "Provisioning Reference" on page 43.

This manual also contains Wideband System 3190 specifications and guidelines for troubleshooting.

If you have comments or questions about this Technical Practice, send email to *technical_publications @pairgain.com*. Type the product name and document "section" number in the subject area of the email message.

RELATED DOCUMENTATION

Document Number	Title
400-100-100-xx	TL1 Command Set Reference
150-357-200-xx	HXU-357 List 1 HiGain Multiplexer Unit
150-357-100-xx	HFA-357 List 1 HiGain Fan Assembly Unit
100-319-200-xx	HTC-319 List 1 Test Card
150-319-107-xx	HMU-319 List 7 and 7A

For information about line units, doublers, remotes and management units, refer to the appropriate practice for the product model number.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PRODUCT OVERVIEW

The Wideband System 3190 (HMS-357 List 1 and List 2) combines an industry-standard M13 multiplexer function with the PairGain® High-bit-rate Digital Subscriber Line (HDSL) distribution system, providing the lowest-cost, T1 delivery system available. The Wideband System 3190 terminates 28 HDSL lines and multiplexes them into a single DS3 line. The Wideband System 3190 accommodates separate multiplexing and management functions that are independently configured, thus providing a common interface with an open architecture. This open architecture allows any industry-compliant 3192 card to function in a managed DS3-based shelf. PairGain recommends that third-party line units be certified for compliance in a Wideband System 3190 shelf.

The chassis incorporates the HiGain® 3190 line units (HLUs) and a management unit (HMU), thereby providing a common architecture that supports all system functions. The M13 multiplexer system provides a managed, high-level, DS3 trunk interface at the Central Office (CO). Both Terminal Access Option (TAO) and Transaction Language 1 (TL1) management systems are supported on X.25, 10BASE-T, and RS-232 interfaces. The Wideband System 3190 also features standard alarm relay contacts and accepts a redundant A/B office battery source.

The Wideband System 3190 (with a full complement of remote equipment) can be configured with up to six chassis (up to 168 lines) in a 7-foot rack and meet NEBS requirements for CO equipment.

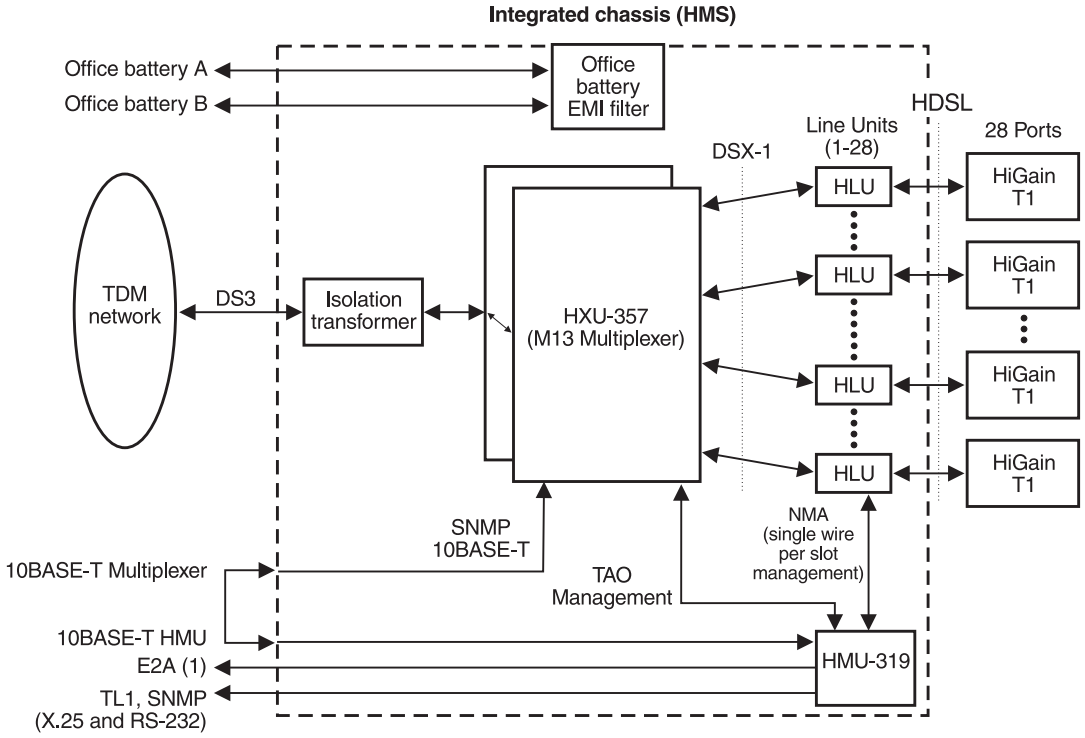


Figure 1. *HiGain Wideband System 3190*

FEATURES

Key features of the Wideband System 3190 are:

- Low cost per port
- Compatibility with industry-standard DS3 trunk circuits
- Compatibility with industry-standard 3192 channel cards
- Integrated open-management system based on PairGain's single-wire management of HLU cards
- Compatibility with existing HiGain line units, doublers, and remote units
- NEBS and UL compliance at a system level
- Support for two CO-supplied -48 Vdc power sources
- Integrated HDSL distributions system and M13 multiplexing system
- Dual multiplexer for reliability with optional 1+1 protection on the DS3 interface

APPLICATION

By incorporating the M13 function into the Wideband System 3190, substantial savings are achieved on the network side of the installation. Instead of 28 DSX1 lines connected to an office digital cross-connect system, now only one DS3 interface is required. This results in a minimum savings factor of five at this interface.

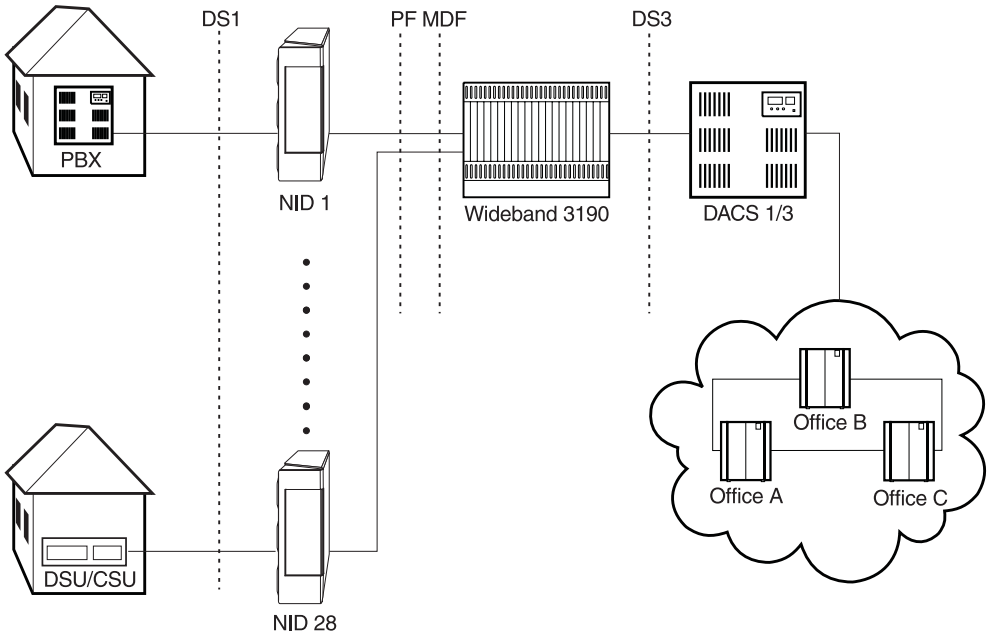


Figure 2. *HiGain Wideband System 3190 Application*

The HiGain Wideband System 3190 offers:

- A complete set of system-level products to current customers for the delivery of T1 from a DS3 trunk that assures the lowest costs available
- A lower-cost solution to new customers for remotely provisioned T1 services
- An “open architecture” based on the standard 3190 channel card
- Simple, repeaterless T1 HDSL line installation to quickly meet any unanticipated demand for T1 services

PRODUCT DESCRIPTION

This section provides a brief description of the major components that comprise a Wideband System 3190:

For more complete information about the HXU-357, the HFA-357, the HMU-319, and the various HDSL units, refer to the appropriate practices for those products. See “Appendix C - Service and Support” on page 96 for information on how to contact PairGain Technologies, Inc.

Chassis

- Product Name: HMS-357 List 1 and List 2
- Part Number: 150-2205-01, 150-2205-02

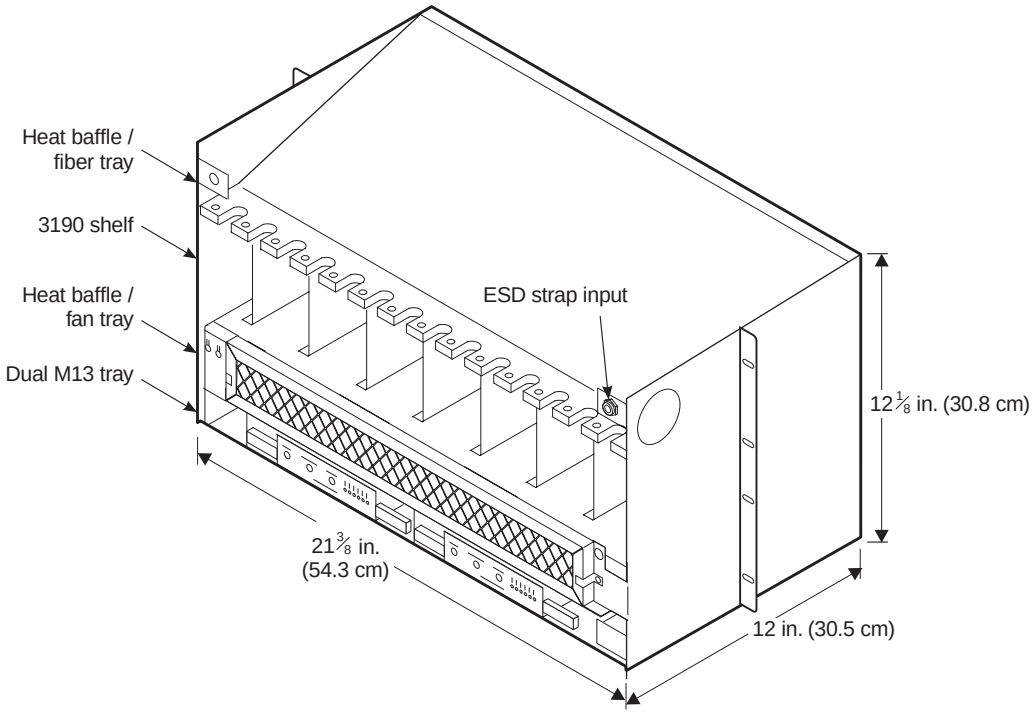


Figure 3. *Front View of 3190 Chassis (Cover Removed)*

The chassis provides an interface for management functions and subscriber lines. Its main components are described in Table 1.

Table 1. *Main Chassis Components*

Component	Description
Heat baffle / fiber tray	The upper heat baffle diverts heat out the back of the chassis. An optional fiber tray can be field-mounted to the front-top of this unit to facilitate fiber routing.
3190 Shelf	This standard 3190 shelf provides for up to 28 T1 ports to the field with common management.
Heat baffle / fan tray	The heat baffle/fan tray provides cooling for the dual multiplexer tray and accepts an optional fan assembly for additional cooling.
Dual multiplexer tray	This tray accepts two HXU-357 multiplexer cards in a 1 + 1 protection scheme that provides both DS3 and DSX1 protection.
ESD strap input	Wrist-strap input for protection against electrostatic discharge.

Multiplexer Unit

- Product Name: HXU-357 List 1
- Part Number: 150-2206-01

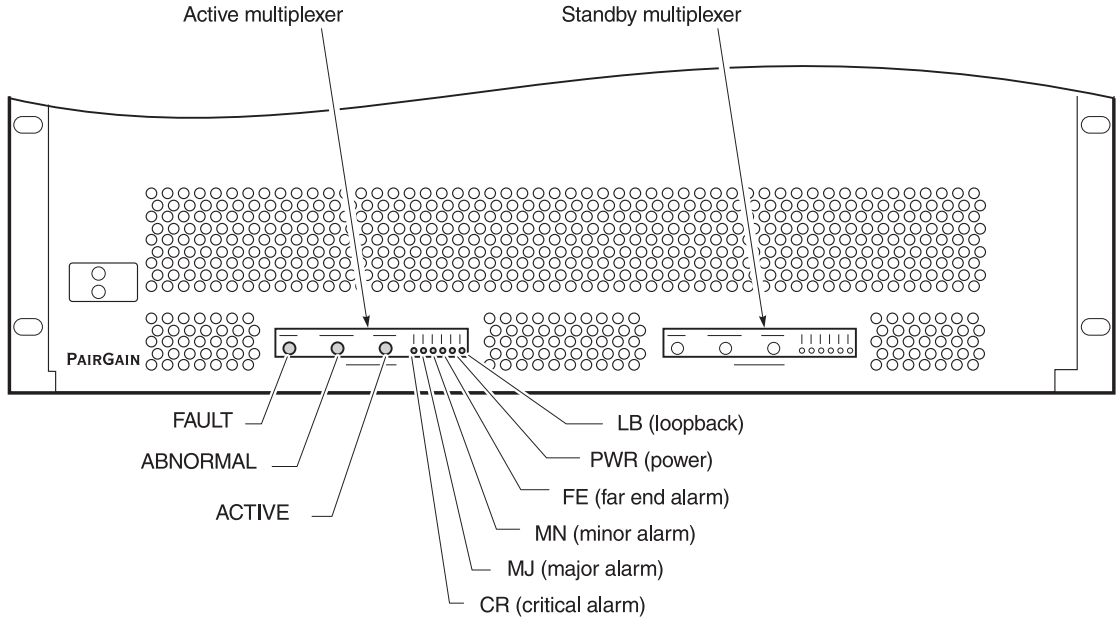


Figure 4. *HXU-357 Multiplexers*

There are two multiplexer cards mounted in the multiplexer tray. One is the active card and the other serves as a backup if the active card fails. These self-contained units are capable of multiplexing 28 DS1 channels into a single, industry-standard, DS3 data channel. The multiplexer cards provide several LED indicators for monitoring power and alarm status. Figure 4 identifies the location of these indicators, which are visible on the front panel of the chassis. Table 2 describes the various indicators.

Table 2. *HXU-357 Multiplexer Indicators*

Indicator	Name	Illuminates when . . .
FAULT (red)	Fault	a critical (CR), major (MJ) or minor (MN) alarm condition exists.
ABNORMAL (yellow)	Abnormal	an external status condition exists.
ACTIVE (green)	Active	the multiplexer is on-line.
CR (red)	Critical	a service-affecting fault exists or more than four DS1 inputs are removed or faulty.
MJ (red)	Major	a service-affecting fault exists or up to four DS1 inputs are removed or faulty.
MN (yellow)	Minor	a potentially service-affecting fault exists.
FE (yellow)	Far End	any remote alarm exists or a low-speed loopback is established at the far end.
PWR (green)	Power	power (A and B) is applied to the multiplexer card and the card is operating normally.
PWR A (green)	Power Supply A	-48 Vdc is being supplied to leg A of the power supply circuit. Located on the connector edge of the multiplexer card.
PWR B (green)	Power Supply B	-48 Vdc is being supplied to leg B of the power supply circuit. Located on the connector edge of the multiplexer card.
LB (yellow)	Loopback	a local DS1 or DS3 loopback is active.

Using M13 or C-Bit framing, the HXU-357 is capable of transmitting and receiving up to 28 DS1 signals over an electrical DS3 interface. The 28 DS1 channels provide a standard DSX-1 interface to the HXU-357. This allows customer access to the DSX-1 interface using a standard 3190 cut-through card, such as the HTC-319, or through the DSX-1 access jacks on the front of each HLU.

Dual HXU-357 cards provide full 1+1 protection (DSX-1/DS3). Through intracard communication the microprocessors on each card maintain traffic when a switch fault condition is detected and control alarm contact relays.

System Management Unit

- Product Name: HMU-319 List 7 and 7A
- Part Numbers: 150-1194-07 and 150-1194-71

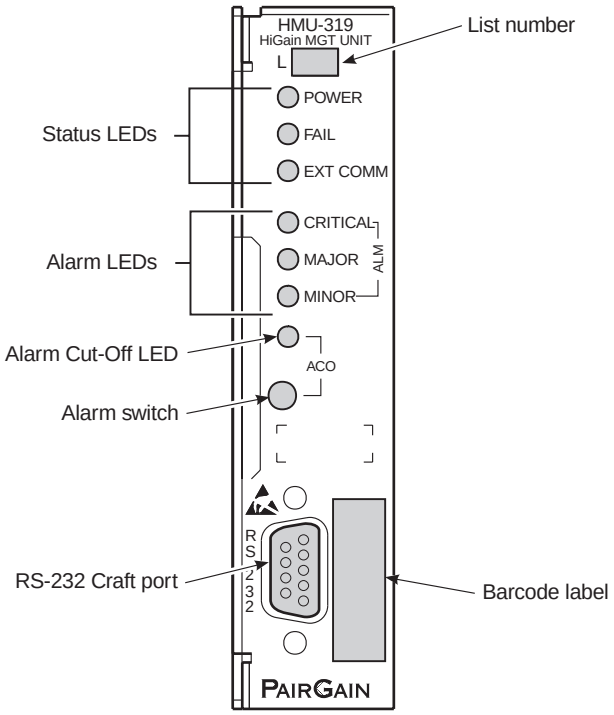


Figure 5. *HMU-319 List 7 and List 7A*

The Wideband System 3190 is managed by PairGain's standard HMU-319 management card. The HMU-319 provides network management and communication capabilities for HDSL T1 transmission service over unconditioned copper wires.

- Provides line management functions for up to 32 shelves, each with a capacity of 28 line units
  - Provisioning
  - Retrieval of performance and alarm data
  - Troubleshooting of line units
- Manages all system components (HLUs, HXUs, HDUs, and HRU).

- Provides comprehensive management capabilities
  - Basic Terminal Access Option (TAO) management software (HMU-319 List 7 and List 7A)
  - TL1/TELNET management software (HMU-319 List 7A)

To obtain the latest update of the management software (which is required for managing the multiplexer interface), contact Technical Support (see "Appendix C - Service and Support" on page 96).

For complete details, refer to the practice for the HMU-319 List 7 and List 7A management unit.

HiGain Line Units

- Product Name: HLU-319 Lists 1, 2D, 2E, 5, and 5E
- Part Numbers: 150-1140-01, 150-1140-24, 150-1140-25, 150-1140-05, and 150-1140-55

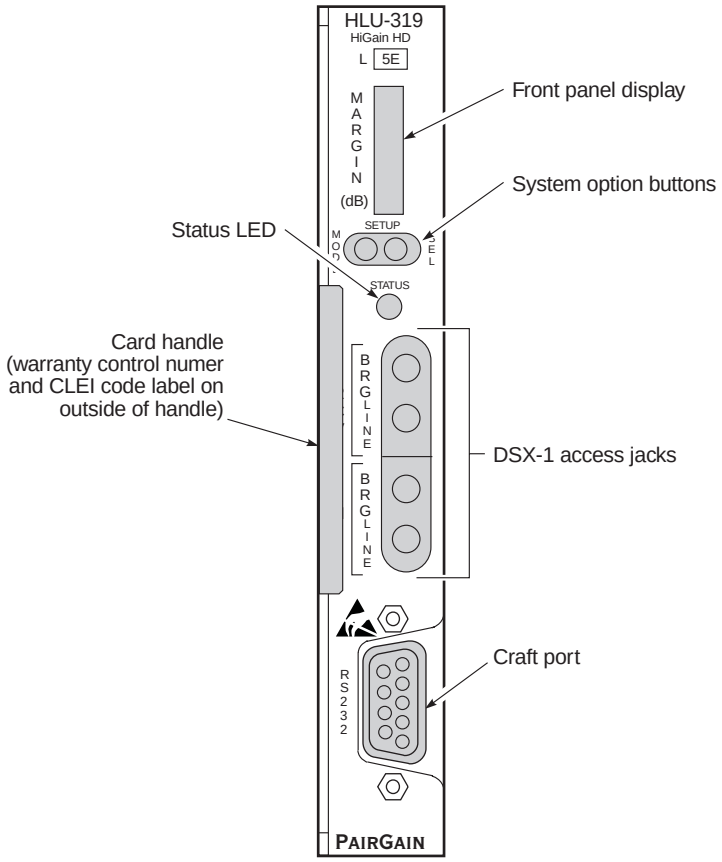


Figure 6. *Typical HLU-319 Line Unit*

The HiGain HLUs provide a repeaterless, T1 transmission system to and from the CO. When installed in a System 3190 and used with a HiGain Remote Unit (HRU), each line unit delivers 1.544 Mbps transmission on two unconditioned copper pairs over the full Carrier Service Area (CSA) range. The CSA includes loops up to 12,000 feet (3.658 km) of 24 AWG or 9,000 feet (2.743 km) of 26 AWG wire, including bridged taps. The HLU can also be used in applications with HiGain Doubler Units (HDUs). For complete details, refer to the technical practice for the HLU.

System 3190-compatible line units from other vendors will function in the HiGain Wideband System 3190. In addition, cards that support PairGain's single-wire per slot management system can be managed by the Wideband System 3190. Please check with the vendor to ascertain NEBS compliance.

HiGain Test and Loop-through Card

- Product Name: HTC-319 List 1
- Part Number: 150-1284-01

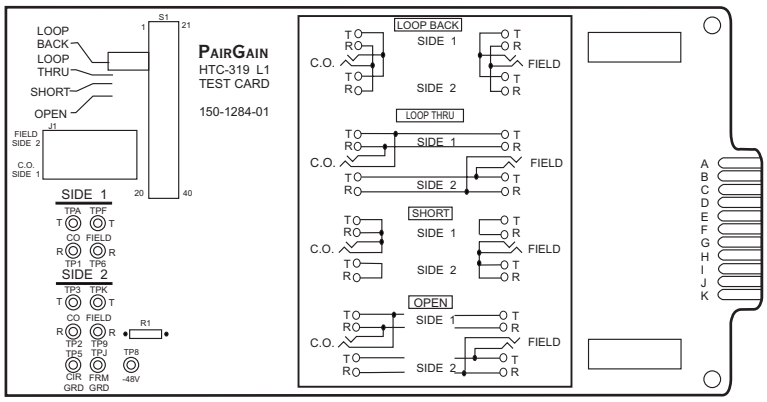


Figure 7. *HTC-319 List 1 Test and Loop-through Card*

The PairGain HTC-319 is an optional test card that plugs into any 3192 shelf slot. It provides access to test points on CO, DSX-1, and field circuits. When used with the HXU-357 List 1, it features:

- Switch-selectable loopback, loopthrough, and testing of Tip and Ring transmit and receive pairs for short and open circuits (CO and field circuits)
- Test point access to Tip and Ring XMT and RCV circuits (CO and field), circuit ground, frame ground and -48V power
- Current-limiting resistor in series with -48V test point protects power circuit from accidental shorting
- Miniature 210-jack access to CO and field circuits
- Normal DSX-1 access by routing the multiplexer DSX-1 port to the external lines (provides a normal DSX-1 interface at the main distribution frame for internal use)

See "Troubleshooting" on page 74 for information on system loopbacks and test points. See also "Installing a HiGain Test Card" on page 75.

HiGain Remote Units

An HRU functions as the remote end of a repeaterless T1 transmission system. An HRU connects to an HLU and HDUs. PairGain offers a large number of compliant units (see “HiGain System Products” on page 86). For complete details, refer to the practice for the specific HRU employed.

HiGain Doubler Units

The HDU is a low-power device that extends the range of a HiGain repeaterless T1 transmission system. Doubler units are installed between an HLU and an HRU.

Using one doubler, the CSA range encompasses approximately 24,000 feet (7.3 km) of AWG 24 wire or 18,000 feet (5.5 km) of AWG 26 wire loops. As shown in Table 3, each additional doubler increases the range by the original CSA length (12,000 feet [3.7 km] of 24 AWG or 9,000 feet [2.7 km] of 26 AWG). PairGain manufactures a complete line of doubler units to address all standard industry enclosures. (see “HiGain System Products” on page 86). For complete details, refer to the technical practice for the specific HDU employed.

Table 3. *CSA Range*

	CSA Range (Kft.)	
Number of Doublers	**24 AWG wire**	**26 AWG wire**
0	12	9
1	24	18
2	36	27
3	48	35
4	60	44

Fan Assembly

- Product Name: HFA-357 List 1
- Part Number: 150-2208-01

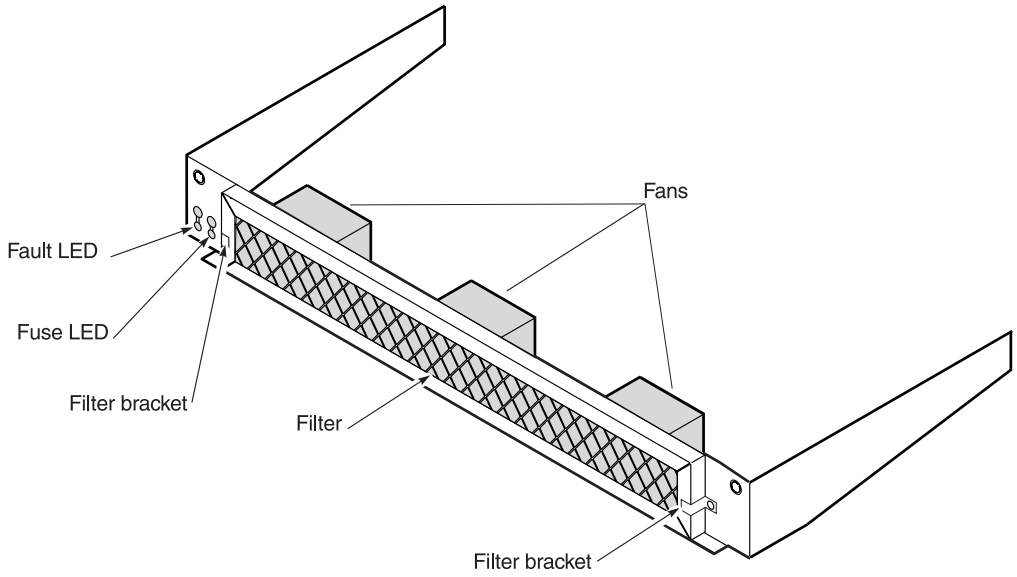


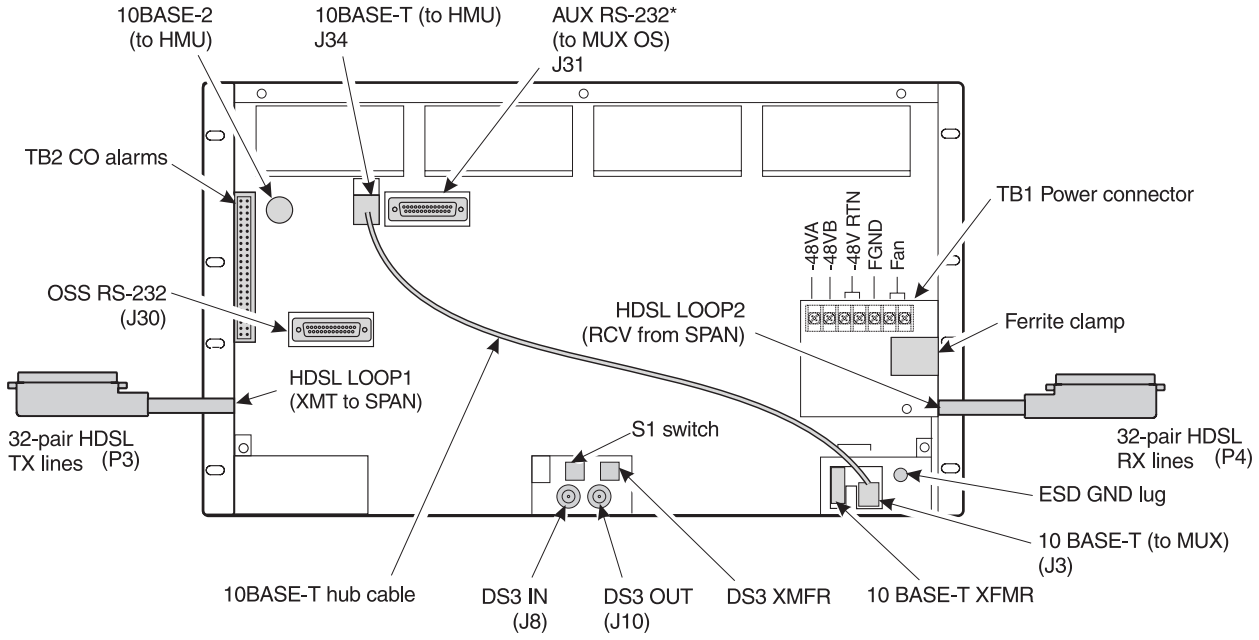
Figure 8. *Fan Assembly*

The optional fan assembly can be field-mounted in the lower heat baffle tray for additional cooling in demanding environments. It takes in air from the front of the chassis through filters and forces this air up through the chassis to the upper heat baffle. It should be installed when excessive temperatures are anticipated, or line doublers are installed, or when additional reliability is required.

The fan assembly has two power LEDs (Figure 8). The Fuse LED is on whenever the internal protection fuse opens. The Fault LED is on whenever one or more of the fans is running too slow or not at all. All fault conditions are monitored and reported by the HMU card.

Interfaces

Figure 9 shows the 3190 interfaces that are accessible from the backplane. Table 4 describes these interfaces.



* Future software upgrades will make the AUX port available for use as a craft interface.

Figure 9. *Wideband System 3190 Interfaces (Backplane View)*

Table 4. *Wideband System 3190 Interfaces*

Interface Location	Interface Type	Description
J3	RJ-45	10BASE-T (to HXU)
J8	BNC	DS3 In
J10	BNC	DS3 Out
J30	RS-232 DB-25 (female)	OSS craft port (DTE)
J31	RS-232 DB-25 (female)	AUX port (DTE) used to access and manage the multiplexer card. Currently not available for Craft interface.
J34	RJ-45	10BASE-T (to HMU)
TB1	7-position terminal block	Power connector (See Figure 37 on page 76.)
TB2	22-pin wirewrap	Alarm relays (See Figure 38 on page 76.)
P3	32-pair HDSL	HDSL Loop 1 (transmit to span)
P4	32-pair HDSL	HDSL Loop 2 (receive from span)

Alarms

The Wideband System 3190 displays an alarm summary on the HMU at all times. Any alarm that exists in the system is represented by a critical, major or minor alarm LED on the HMU front panel. The alarm LEDs on each HLU in the system provide additional fault isolation. In general, the HLU or HXU with an active red alarm LED is the unit directly associated with a fault.

The M13 function is provided by two HXU-357 cards wired in parallel. Both monitor the DS3 and DS1 interfaces and check for proper bit rate and line coding. If an error exists on these interfaces, both HXU cards issue an alarm. A missing HLU or HRU creates a faulty DS1 signal and causes the active and standby HXU to issue a line alarm. Unused ports on the HXU-357 must be configured as Unequipped and Out-of-Service to prevent them from reporting alarms to the system.

A/B Power Sources

Each chassis requires two A battery feeds and two B battery feeds rated at a maximum of 20A each for fully loaded chassis assemblies capable of driving a full complement of doublers and remote units.

The A/B power feeds provide total backup power for the HXU, HMU and HFA cards. The HMU, HXU and optional HFA have diode-ORed power feeds.

For the List 1 chassis, the line units are powered as a split feed with half of the line units on each battery feed. A loss of one battery feed forces 14 lines out of service. This reduces the maximum current required per battery feed for systems with the maximum number of doublers.

For the List 2 chassis, the line units are powered from the backplane through diode-ORed power feeds. A loss of one power feed will not affect service.

Fuses

System fuses are located in an external fuse tray typically mounted at the top of the CO rack. The HMU reports all fuse alarms within the Wideband System 3190. Each chassis within the rack must be equipped with A and B fuses for proper power protection. Depending upon the system configuration, fuse ratings can vary from 5A to 20A. See Table 25 on page 84 for fuse selection information.

PairGain does not recommend configurations in excess of 20A per power feed.

INSTALLATION

This section provides general installation instructions for the Wideband System 3190. Carefully review the recommendations in the following sections before beginning the installation procedures:

UNPACKING AND INSPECTION

Step	Procedure
1	Unpack the HiGain Wideband System 3190.
2	If there is evidence of damage during shipment, report it to the carrier immediately.
3	Verify that all items listed on the packing slips have been received and report any discrepancy.
4	Place the system in an appropriate storage area until installation can begin.

SAFETY PRECAUTIONS

Be careful when working near -48 Vdc power sources and connections. The HiGain Wideband System 3190 uses -48 Vdc office power. Remote HDSL equipment may operate with ±130 Vdc loop power.

Use an approved antistatic wrist strap that is connected to equipment ground before handling any modules. (An ESD strap input is provided on the open chassis above the HMU slot and on the back of the Wideband System 3190 chassis for this purpose.) Ensure that all uninstalled modules are stored in antistatic packing material. When working with modules, always place the module on an electrically grounded, antistatic mat.

POWER REQUIREMENTS

Each system must be individually fused to support redundant power feeds. The HMS-357 List 1 provides a split-power backplane to limit the current requirements of each battery feed line to less than 20A for any configuration. The HMS-357 List 2 provides a diode-ORed feed that requires system configurations that are limited to 20A per feed. For this reason, each battery feed line must be individually fused. However, fuse

requirements may be as low as 5A per fuse, depending upon the system configuration. See "Power Specifications" on page 82.

The power requirement for the shelf is characterized by three different measurements:

- **Current draw** is the actual current drawn from the -48 Vdc Office Battery by the system. This is useful in setting the requirements for shelf fusing. It is the total power consumption divided by the lowest office battery voltage anticipated (-42.5 Vdc).
- **Power consumption** is the total power used by the system and includes the power fed to the remote locations.
- **Power dissipation** is that part of the total power that is consumed by the CO end of the system. It represents the CO heating and is useful in calculating the power density (watts per square foot) for CO equipment.

The requirements in GR-63-CORE for a typical six-lineup floor plan (Figure 10) of 12-inch deep frames (305 mm) places the natural convection heat dissipation at 1450 W/m^2 (134.7 W/ft^2). This is increased to 1950 W/m^2 if forced-air fans are used.

Each 23-inch (584m) rack occupies 0.654m^2 (7.03 Ft^2) of floor space. This allows 948W per rack without the optional fan assembly and 1275W with the fan assembly.

For a maximum load, each rack should contain no more than four HMS-357s. Higher rack densities can be obtained by installing the optional fan assembly in each system, by limiting the number of line doublers in each system, or by changing the floor lineup of the racks.

The Wideband System 3190 has been designed to provide adequate convection cooling for an environment of 0°C to 50°C (32°F to 122°F) with up to 230W of internal heat dissipation.

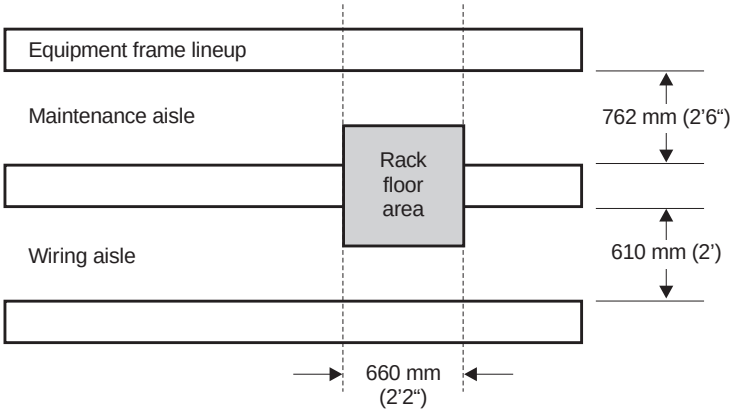


Figure 10. *Typical Six-lineup Floor Plan*

To avoid complex calculations, use the following simplified power and fan requirements.

- If only HiGain components are used and no CPE power is required, the Wideband System 3190 chassis can power up to 12 doublers without necessitating the use of fans. (Recommended HiGain components include the HLU-319 List 5, the HDU-409, the HRU-402 and the HRU-411).
- Chassis configurations that do not use doublers do not require the use of fans. However, NEBS requirements may restrict the installation to four chassis per rack if no fans are used.

For more detailed information about power, refer to "Power Specifications" on page 82.

METHOD OF PROCEDURE

Installation personnel, engineers and CO supervisors involved in the installation of the HiGain Wideband System 3190 should participate in the preparation of a Method of Procedure (MOP) for approval by CO management. Following is a list of tasks and considerations that need to be addressed and mutually agreed upon before proceeding with installation:

- Assignment of personnel
- Installation tools and methods
- Protection requirements for personnel, equipment and tools
- Evaluation of potential hazards that may affect service
- Scheduled time for installation
- Space requirements
- Power requirements
- Identification of procedures and tests required before connecting to working equipment
- Identification of work steps and any necessary notifications to CO personnel or engineers before work can start

INSTALLATION TOOLS

Following is a list of suggested tools for installing HiGain equipment:

Table 5. *Installation Tools*

❑ Pliers, needle nose, 4-$^1/_2$ inch	❑ Diagonal cutters, 5-inch
❑ Screwdriver, standard, 4-inch	❑ Screwdriver, standard, 6-inch
❑ Screwdriver, Phillips #1, 6-inch	❑ Multi-stripper
❑ Cable butting tool	❑ Wire-wrap gun, electric
❑ Cable stripper	❑ Cable cutters
❑ Wrenches	❑ Continuity checker
❑ Volt-ohm meter	❑ Grounding strap
❑ Wire-wrap bits/sleeves (22, 24, 26 gauge)	❑ Hand upwrap tool

SUMMARY OF INSTALLATION TASKS

Follow the installation tasks in the order presented. The installation instructions are sequential and use embedded management to verify proper installation of each card. After each card is installed, its function is verified and it is placed in a known state that removes the likelihood of false alarms.

To set up a HiGain Wideband System 3190, follow the general steps outlined in Figure 11. Table 6 lists installation procedures and references them to the appropriate page number.

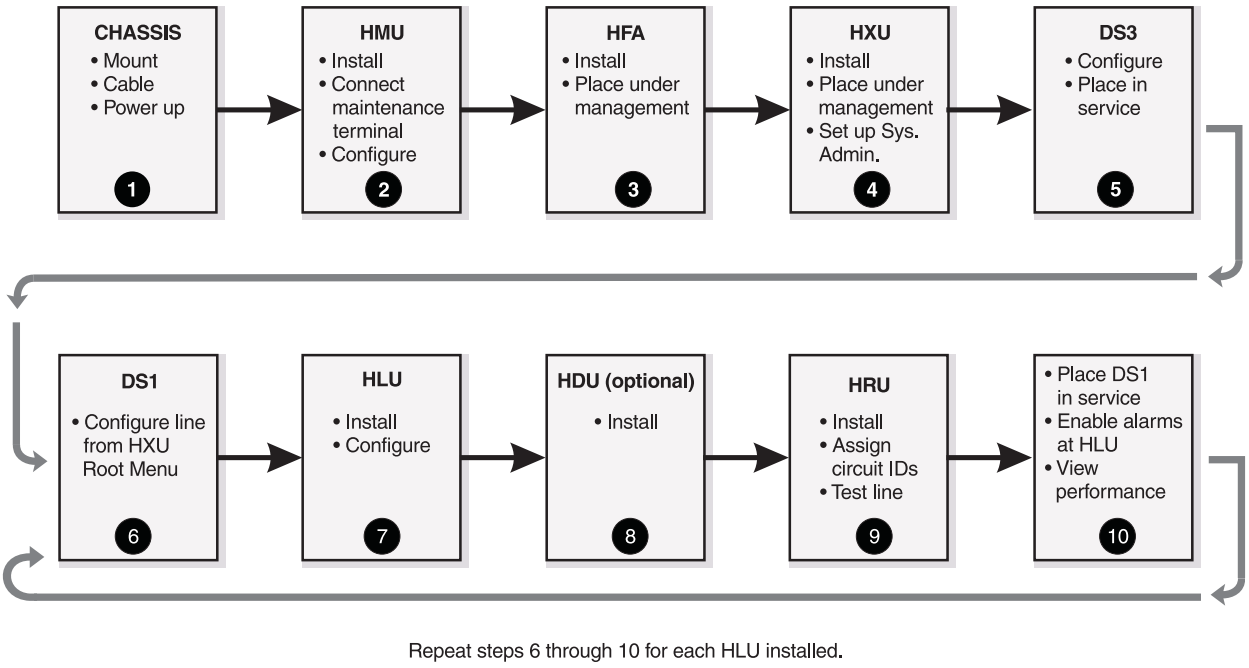


Figure 11. *Summary of Installation Tasks*

Table 6. *Summary of Installation Tasks*

Installation Task		Reference
1	Unpack and inspect equipment	"Unpacking and Inspection" on page 13
2	Review safety requirements	"Safety Precautions" on page 13
3	Review power requirements	"Power Requirements" on page 13
4	Review Method of Procedure	"Method of Procedure" on page 15
5	Gather installation tools	"Installation Tools" on page 15
6	Install the 3190 chassis	"Mounting the Chassis" on page 19
7	Set up a 10BASE-T configuration	"Setting Up a 10BASE-T Configuration" on page 21
8	Power the chassis	"Powering the 3190 Chassis" on page 23
9	Install the HMU	"Installing a HiGain Management Unit" on page 24
10	Connect a maintenance terminal	"Connecting a Local Maintenance Terminal for Line Management" on page 25 or "Connecting a Dial-Up Modem for Line Management" on page 26
11	Configure the HMU	"Setting the HMU Date and Time (Option H)" on page 27 "Setting the Shelf Identifier (Option D)" on page 27 "Setting the Local IP Address (Option A)" on page 28 "Setting the Ethernet Connection (Option G)" on page 28
12	Install HFA-357 fan assembly and place under management	"Installing a Fan Assembly" on page 29
13	Install the multiplexer cards	"Installing the Multiplexer Cards" on page 31
14	Place HXU under management	"Setting up the Communications Channel to the HXU-357" on page 32
15	Configure system information	"Setting up System Administration" on page 32
16	Configure the DS3 interface	"Configuring the HXU DS3 Interface" on page 33
17	Place DS3 interface in service	"Placing the HXU DS3 Interface In Service" on page 33
18	Configure the DS1 line from the HXU Root Menu	"Configuring the HXU DS1 Interface" on page 34
19	Install and configure the HLU-319 line unit	"Installing a HiGain Line Unit" on page 35
20	Install doublers, as needed	"Installing a HiGain Doubler Unit" on page 37
21	Install the remote unit	"Installing a HiGain Remote Unit" on page 38
22	Assign circuit IDs and test line	"Installing a HiGain Remote Unit" on page 38
23	Place line unit under HMU management	"Placing the HLU Under HMU Management" on page 39
24	Place the line in service	"Placing the Line in Service at the HXU" on page 40
25	View performance	"Viewing Performance at the HXU" on page 41

INSTALLING A CHASSIS IN A STANDARD RACK

Figure 12 shows a typical installation of four HMS-357s in a standard 23-inch, 7-foot CO rack. Higher rack densities (up to six chassis) can be obtained by installing the optional fan assembly in each system, by limiting the number of line doublers in each system, or by changing the floor lineup of the racks. See "Power Specifications" on page 82 for more information.

The installation should proceed from the bottom of the rack to the top.

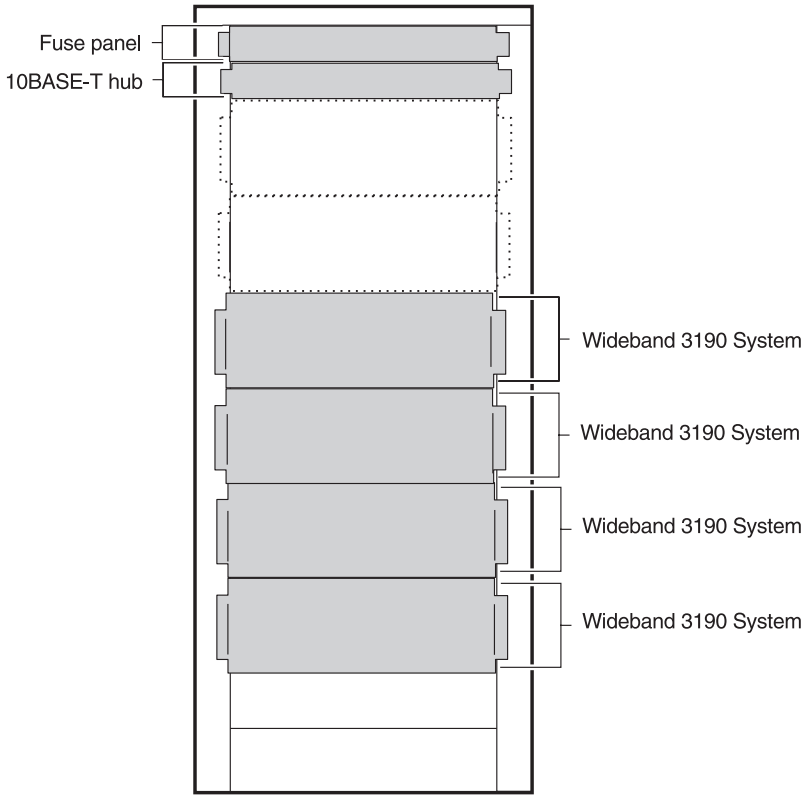


Figure 12. *Typical Installation in a CO Rack*

The 10BASE-T hub is optional. It is only required for multishelf configurations. For more information refer to "Multishelf 10BASE-T Configuration" on page 22.

A typical fuse panel is capable of supplying four redundant power feeds with up to a 20A fuse selection, such as Telect model 009-8004-101.

Proceed with the steps for mounting (page 19) and powering the chassis (page 23).

Mounting the Chassis

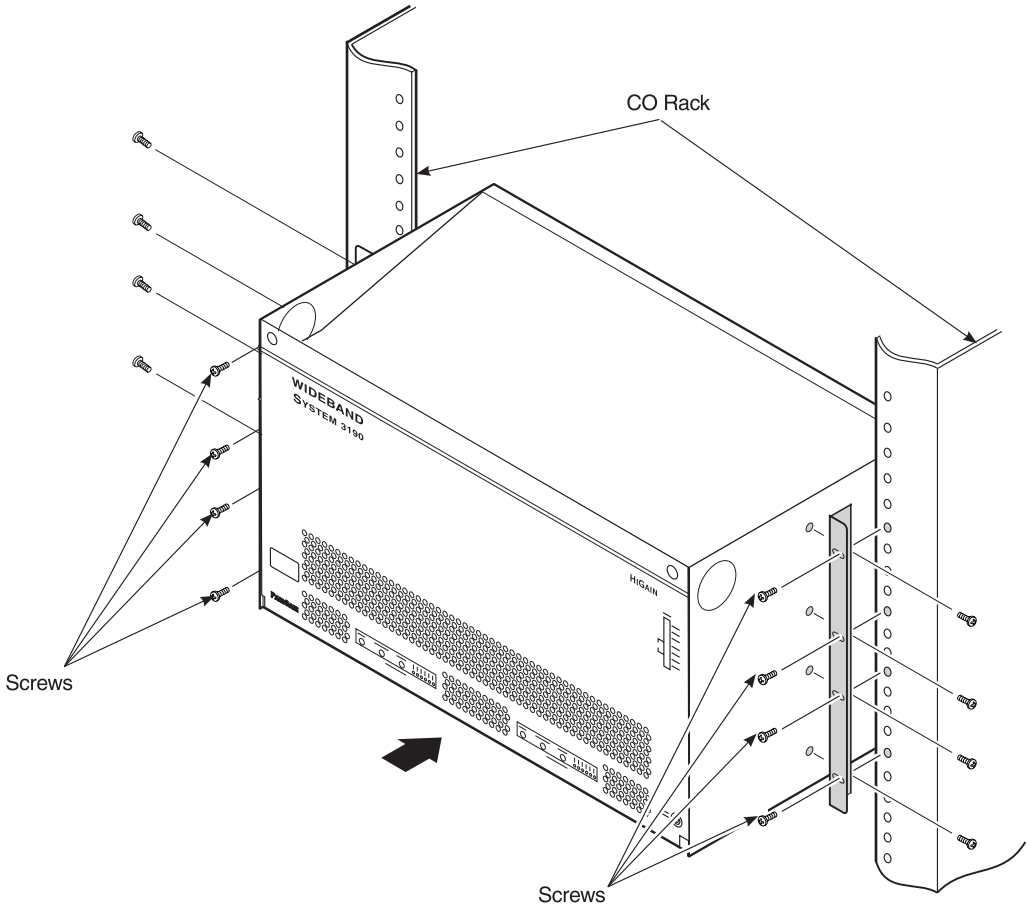
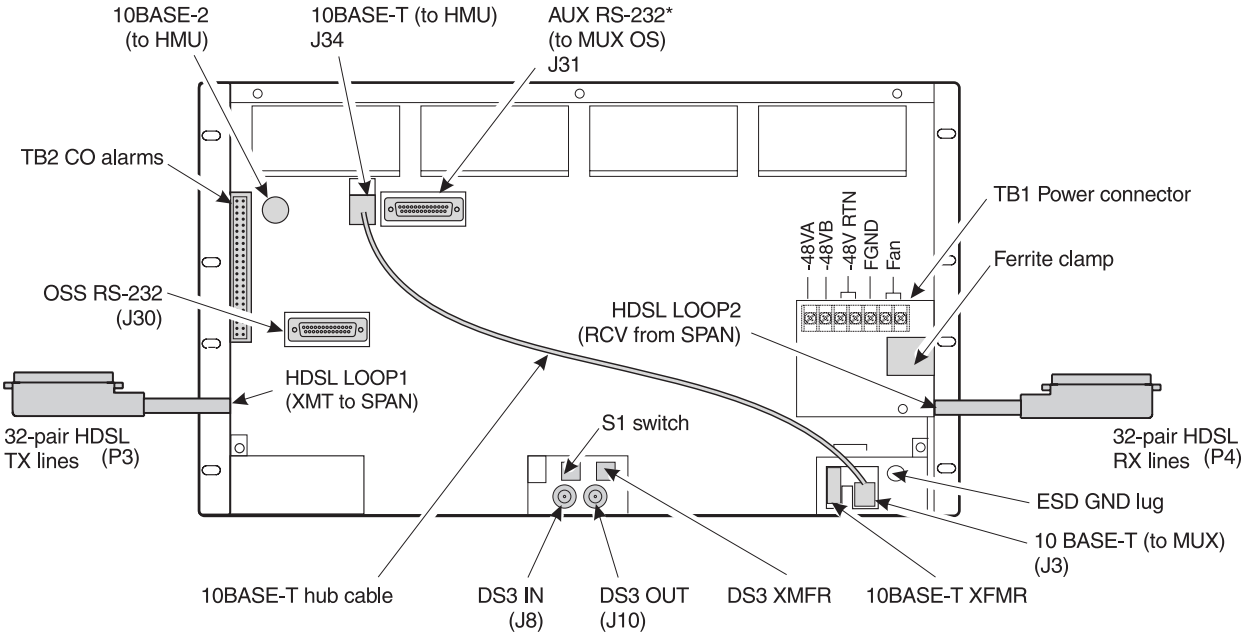


Figure 13. *Mounting the Wideband System 3190 in a CO Rack*

Verify that the battery feed is disconnected.

Step	Procedure
1	Install a mounting bracket on each side of the Wideband System 3190 chassis using the four screws provided for each bracket. Mounting brackets and screws are contained in the installation kit.
2	Remove the cover that covers the TB1 terminal block. Bend the HDSL cables that protrude from the sides of the chassis so that they do not obstruct the placement of the chassis into the rack (Figure 14).
3	Align the chassis mounting bracket holes with the rack's vertical mounting holes.
4	Install a 6 AWG chassis ground cable to the ESD ground lug following locally approved methods (Figure 14).
5	Mount the chassis in the rack using a Phillips screwdriver and the remaining eight screws.
6	Route and tie the shielded HDSL line to the rack. Use a dual, 32-pair, shielded ABAM cable.

Step	Procedure (Continued)
7	Connect the RS-232 OSS cable to the J30 connector on the backplane (Figure 14) and then secure it to the rack.
8	Connect the DS3 IN coax line to the DS3 IN BNC connector (J8) on the backplane.
9	Connect the DS3 OUT coax line to the DS3 OUT BNC connector (J10) on the backplane and then secure it to the rack.
10	For a standalone 10BASE-T configuration, install the hub cable between J34 and J3 on the backplane. (See "Standalone 10BASE-T Configuration" on page 21.) For multishelf configurations, install two RJ45 (shielded category 5) network cables from J34 to J3 to the assigned hub. (See "Multishelf 10BASE-T Configuration" on page 22.)
11	Remove the cover at TB2. There is one screw that must be removed.
12	Connect alarm relay wires from the CO alarm center to the wire wrap posts at TB2. Follow the CO site instructions for connecting alarm relays. See Figure 38 on page 76 for a diagram of the TB2 connector.



* Future software upgrades will make the AUX port available for use as a craft interface.

Figure 14. *Wideband System 3190 (Backplane View)*

Ordinarily, it is not necessary to remove the back cover during installation. However, if you wish to do so, first unplug the hub cable from J34 and J3. Then remove the six screws that fasten the back cover to the chassis.

Setting Up a 10BASE-T Configuration

The Wideband System 3190 can be implemented as a standalone shelf or can be connected by an external hub to other shelves in a 10BASE-T network.

Standalone 10BASE-T Configuration

Figure 15 shows a standalone 10BASE-T configuration. Each 3190 Wideband system is shipped with a hub cable for connecting the HXU-357 to the HMU-319 on the backplane of the 3190 chassis, eliminating the need for an external hub.

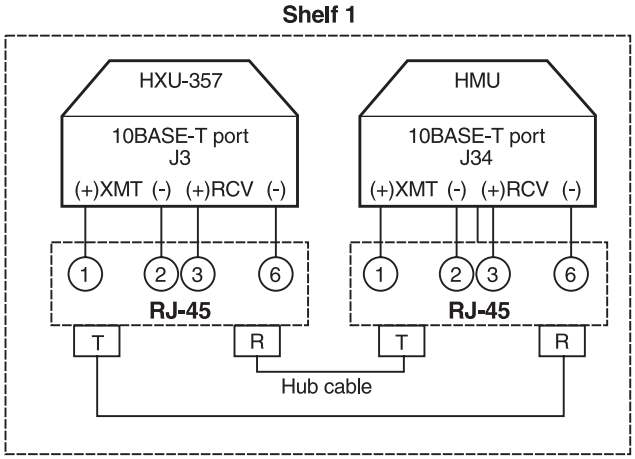


Figure 15. *Standalone 10BASE-T Configuration*

Step	Procedure
1	Connect the hub cable shipped with the Wideband System 3190 between the RJ-45 interfaces J34 and J3.
2	Connect a local maintenance terminal to the HMU-319 craft port or to the OSS port (J30) on the backplane of the chassis. (See "Connecting a Local Maintenance Terminal for Line Management" on page 25.) A modem can also be connected to the HMU for logon from a remote terminal using a dial-up connection. (See "Connecting a Remote Terminal" on page 46.)

Multishelf 10BASE-T Configuration

Line units located in an array of shelves (up to 32 shelves) can all be managed by the HMU from any of the shelves if the shelves are connected over a 10BASE-T network as shown in Figure 16. The 10BASE-T connectors of the HMU-319 and HXU-357 are compliant with IEEE 802.3 specifications.

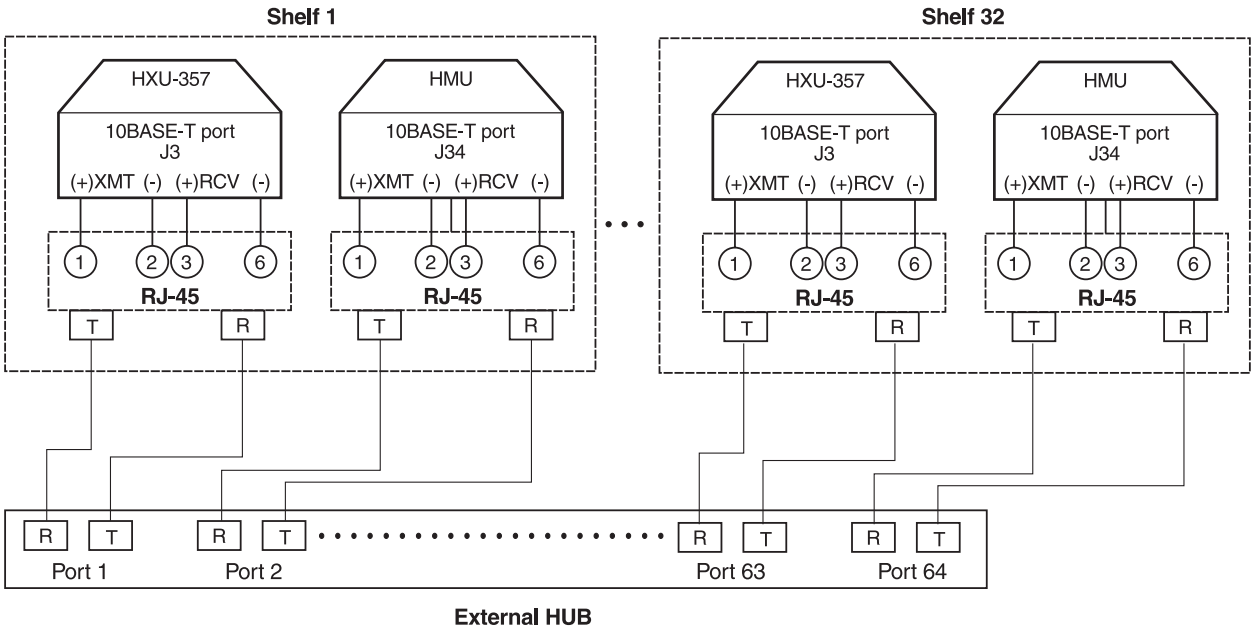


Figure 16. *Multishelf 10BASE-T Configuration*

Step	Procedure
1	Connect each CO shelf to an external hub, shown in Figure 16, using shielded category 5 cable. The maximum length of the cable is 328 feet (100 meters).
2	Connect a local maintenance terminal to the HMU-319 craft port or to an OSS port on any of the shelves in the network. (See "Connecting a Local Maintenance Terminal for Line Management" on page 25.) A modem can also be connected to the HMU for logon from a remote terminal using a dial-up connection. (See "Connecting a Remote Terminal" on page 46.)

Powering the 3190 Chassis

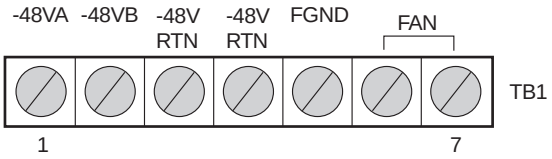


Figure 17. *TB1 Power Connector*

Step	Procedure
1	There is a slide panel that covers the TB1 power connector shown in Figure 14 on page 20. To remove it, first loosen the two screws that secure it (two turns of the screw using a #1 Phillips should be sufficient). Slide the panel to the left $^1/_4$-inch to release the slide panel, and then lift it to remove it.
2	To reduce EMI emissions, pry open the ferrite clamp (Figure 9 on page 11) with a flatblade screwdriver and route the battery feed wires through the clamp before connecting them to TB1. Close the clamp.
3	Attach a spade-lug connector to terminate the 12 AWG ground wire at frame ground (FGND) on the TB1 connector.
4	Connect the other end of the frame ground wire to the CO frame ground termination point using locally approved methods.
5	Connect a 12 AWG gauge wire to the -48 VA terminal at position 1 of TB1 (for slots 1-14). Connect the opposite end of this wire to the -48 Vdc CO battery supply at the fuse panel.
6	Connect a 12 AWG gauge wire to the -48 VB terminal in position 2 on TB1 (for slots 15-28). Connect the opposite end of this wire to the -48 Vdc CO battery supply at the fuse panel.
	PairGain does not recommend jumpering the A and B battery feeds at the terminal block. This doubles the battery current requirement and fuse size of the wire feeding the shelf. With jumpered A and B battery feeds, some shelf arrangements may exceed a typical 20A, 12-gauge feed.
7	Connect a 12 AWG gauge wire to the -48V RTN terminal in position 3 of TB1 (for slots 1-14). Connect the opposite end of this wire to the battery return of the CO battery supply at the fuse panel. (Fuse is removed.)
8	Connect a 12 AWG gauge wire to the -48V RTN terminal in position 4 of TB1 (for slots 15-28). Connect the opposite end of this wire to the battery return of the CO battery supply at the fuse panel. (Fuse is removed.)
9	If installing a third-party, rack-mounted, external fan assembly, connect position 6 and 7 on the TB1 power connector to the fan unit. These points provide a normally open, dry relay contact that closes under high temperature conditions (122°F / 50°C detected at the HMU).
10	Based on the power recommendations given in "Power Requirements" on page 13, install a fuse of equivalent or greater value in the fuse panel tray. Also see Table 25 on page 84.
11	Connect the fuse panel to the office power supply according to CO guidelines.
12	With a voltmeter, verify voltages on TB1 (Figure 17). There should be -48V across pins 1 and 3 and across pins 2 and 4.
13	To replace the slide panel that covers TB1, place the cover over the screws, aligning the panel holes with the screws. Then slide the panel to the right $^1/_4$-inch until it snaps into place. Tighten the screws.

INSTALLING A HIGAIN MANAGEMENT UNIT

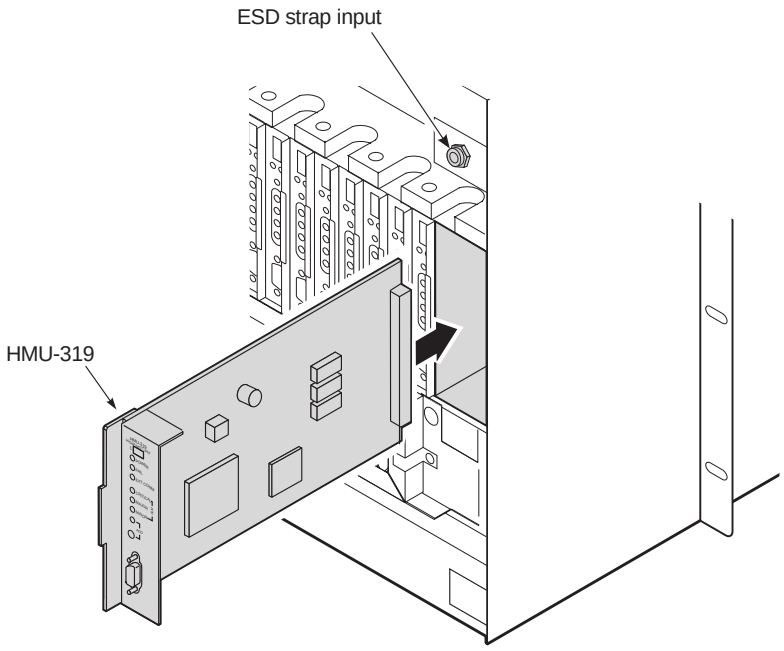


Figure 18. *HMU-319 Installation*

Whenever installing or removing units from the HMS-357 chassis, be sure to wear an antistatic wrist strap and connect it to the ESD strap input above the HMU slot on the inside of the chassis.

Step	Procedure
1	Unscrew the two hold-down lugs on each upper corner of the chassis front cover. The cover folds down.
2	Be sure to wear an antistatic wrist strap and plug it into the ESD strap input.
3	Hold the HMU-319 vertically with the front of the card toward you. Align the top and bottom edges of the HMU-319 with the guide rails in the HMU slot and slide the HMU-319 into the chassis (Figure 18).
4	Press the HMU-319 firmly into the connector at the back of the slot. When the pins on the HMU-319 connect to the pins on the shelf backplane, the HMU-319 powers up, the Power LED glows green and the Fail LED and Critical LED briefly flash red.

You can connect an external Alarm Cut-Off (ACO) push-button to the shelf ACO pins on the TB2 wire wrap (Figure 38 on page 76).

Connecting a Local Maintenance Terminal for Line Management

Once the HMU has been installed, you can monitor the installation of other components in the 3190 chassis by connecting the HMU to a local maintenance terminal (an ASCII terminal or PC running a terminal emulation program). To connect to a local terminal, use the HMU front panel craft port or the OSS port on the chassis backplane. The craft port is configured as a data communications equipment (DCE) interface with a DB9 female connector (see Table 20 on page 78). The OSS port is configured as a standard data terminal equipment (DTE) interface with a DB25 male connector. These interfaces support transmit (TX), receive (RX), data terminal ready (DTR) and data set ready (DSR) signals (see Table 19 on page 77).

The TAO software only supports one user session at a time at either of the two RS-232 ports (Craft or OSS). The TL1/TELNET software supports five simultaneous TL1 sessions or four TL1 and one TAO session. These multiple sessions can be accessed using the two RS-232 ports or by using TELNET over the 10BASE-T ports.

If the local terminal or modem connection is permanent, use the OSS port on the shelf backplane. This leaves the craft port on the front of the HMU available for temporary terminal connections or TL1 access.

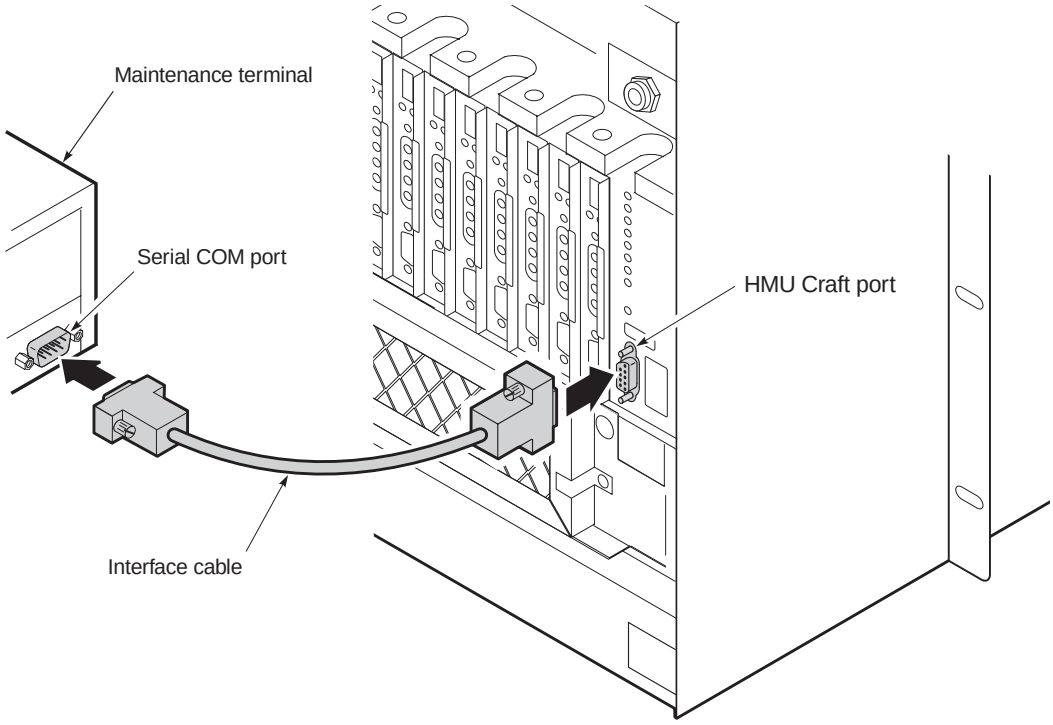


Figure 19. *Connecting a Terminal to the HMU Craft Port*

Step	Procedure
1	Connect a standard, 9-pin, terminal cable to the HMU front panel Craft (DB-9) port or connect a 25-pin, terminal cable to the OSS port on the shelf backplane. The craft port is configured as DCE. The OSS port is configured as DTE. **The HMU DCE should be connected to the DTE port of the local maintenance terminal. If the connection to the HMU requires a DTE-to-DTE or DCE-to-DCE interface, then use a null modem adapter that crosses the TX and RX connections. See Figure 27 on page 45.**
2	Connect the other end of the terminal cable to the serial COM port on the maintenance terminal.
3	If you are using a PC, start the terminal emulation program.
4	Configure the maintenance terminal as follows: • 9600 baud • No parity • 8 data bits • 1 stop bit

Connecting a Dial-Up Modem for Line Management

A modem can also be connected to the HMU for logon from a remote terminal using a dial-up connection. A modem connects to either the HMU front panel craft port or to the OSS port on the chassis backplane. Refer to "Connecting a Remote Terminal" on page 46 for details on setting up a remote terminal.

CONFIGURING THE HIGAIN MANAGEMENT UNIT

Once the HMU has been installed in the shelf, you need to complete the following basic configuration steps:

- Setting the HMU date and time stamp for all alarms and reporting (page 27)
- Setting up a Shelf Identifier (SID) for each shelf for on-screen displays (page 27)
- Setting the Local IP address (page 28)
- Setting the Ethernet connection (page 28)

Additional configuration options are described in "Configuring Shelf Management" on page 56.

Step	Procedure
1	Upon connecting to the HMU-319, the TL1 prompt (<), appears. Type **TAO**, and then press **ENTER** to invoke TAO. For more information about login, see "Logging on to the Management Interface" on page 50. **The factory default password setting is `public`. You can change the password. However, if you forget the new password, you must return the HMU to PairGain for reprogramming. See "Changing the Logon Password" on page 71 for instructions.**
2	Type the password, and then press **ENTER**. One of the following occurs: • If the HMU is managing a multishelf configuration, the Network Status menu appears. • If the HMU is managing a single shelf, the Shelf Status menu appears.

Step	Procedure (Continued)
3	From the Network Status screen (for multishelf configurations only), enter the number of the desired shelf (1 through 32) and then press **ENTER**.
4	From the Shelf Status screen, type **O** to select Shelf Options.

Setting the HMU Date and Time (Option H)

Setting the HMU date and time will globally configure these parameters for all HLU-319s in the system. The HMU-319 List 7A will also globally update the time and date settings for the HXUs in the chassis. HMU-319 List 7 does not globally update the time and date settings for the HXUs. In this case, the HXUs must be individually configured to match the HMU.

Step	Procedure
1	Type **H** and then press **ENTER** to select Change HMU Date and Time. The following prompt appears at the bottom of the screen: `Enter New Date (mm/dd/yy):`
2	At the prompt, type the current date using MM/DD/YY format, and then press **ENTER**. The following prompt appears at the bottom of the screen: `Enter New Time [hr:min]:`
3	At the prompt, type the current time using HH:MM 24-hour format, and then press **ENTER**.
4	Type **X** to exit the screen and return to the Shelf Status menu.

Setting the Shelf Identifier (Option D)

Step	Procedure
1	At the Shelf Options menu prompt, type **D** and then press **ENTER** to select SID Setup. The following prompt appears at the bottom of the screen: `Enter New SID Setup`
2	At the prompt, type a text string of 32 alphanumeric characters or less to identify the shelf, and then press **ENTER**. • The Shelf Identifier may be set to any value, but must be unique for each shelf in the network. • For multishelf configurations, the Shelf Identifier must be set to a unique value and cannot be left blank.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM before exiting (y/n)?`
4	Type **Y** to confirm, save the setting, and return to the Shelf Status menu**.**

Setting the Local IP Address (Option A)

Step	Procedure
1	At the Shelf Options menu prompt, type **A** and then press **ENTER** to select Local IP Address for the HMU. The following prompt appears at the bottom of the screen: `Enter New Local IP Address`
2	At the prompt, type the local IP address using the XXX.XXX.XXX.YYY format, where XXX and YYY are decimal numbers from 0 through 255. Do not select your own address. Your administrator should notify you of the unique address that has been assigned to the network. See "Network Addresses" on page 94 for more information. For multishelf configurations, the local IP address must be unique for each shelf on the network. The values for XXX should be the same for each shelf in the network. The values for YYY must be unique for each HMU and HXU in the network.
3	Press **ENTER**.
4	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
5	Type **Y** to confirm, save the setting, and reset the HMU**.** The program returns to the TAO prompt.

Setting the Ethernet Connection (Option G)

Step	Procedure
1	At the Shelf Options menu prompt, type **G** and then press **ENTER** to select Change Ethernet Connection. The following prompt appears at the bottom of the screen: `Enter New Change Ethernet Connection (1 = 10BASE-2 2 = 10BASE-T)`
2	Type **2** and then press **ENTER** to select 10BASE-T.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
4	Type **Y** to confirm, save the setting, and reset the HMU**.** The program returns to the TAO prompt.

INSTALLING A FAN ASSEMBLY

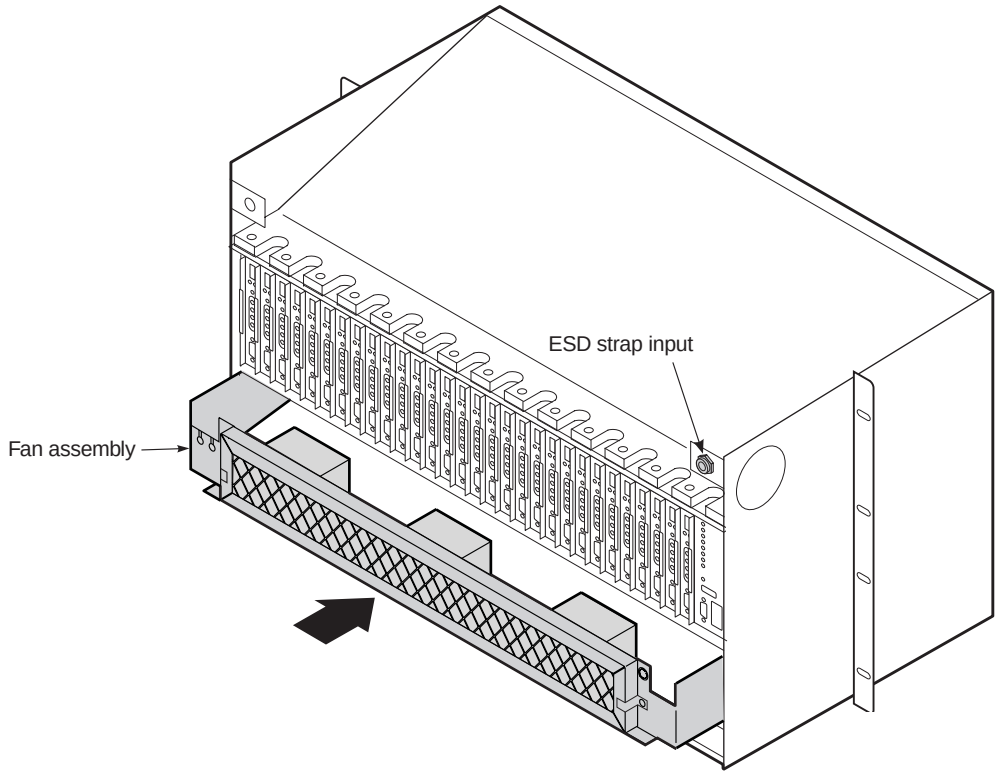


Figure 20. *Installing the Fan Assembly (Cover Removed)*

The HFA-357 fan assembly is installed from the front of the chassis, just above the multiplexer tray.

The fans begin operating as soon as the cable is connected. Avoid contact with the fan blades and do not allow any foreign matter to obstruct the operation of the fan blades.

Do not install fans without connecting the cable. A fan assembly that is not operational will block air flow and cause overheating.

Step	Procedure
1	Unscrew the two hold-down lugs on each side of the chassis front cover. The cover folds down.
2	Be sure to plug your ESD wrist strap into the ESD input above the HMU slot.
3	Locate the keyed Molex fan cable (connected to J38 on the inside of the chassis) and attach it to the circuit board on the fan assembly. The fans begin operating as soon as the cable is connected.
4	Slide the fan assembly into the opening above the multiplexer tray.
5	Secure the fan assembly in place with the hold-down lugs (one at each corner of the assembly).

Once the fan assembly is installed, it must be placed under HMU management.

Step	Procedure
1	Log on to the maintenance terminal connected to the HMU craft port, if you are not already logged on.
2	Type **TAO** at the prompt (<). Refer to “Accessing the Management Interface” on page 44 for guidance on using the management software.
3	From the Network Status screen (for multishelf configurations), enter the number of the desired shelf (1 through 32) and then press **ENTER**.
4	From the Shelf Status screen, type **O** to select Shelf Options.
5	From the Shelf Options screen, type **K** to select Fan Monitoring.
6	Type **2** to turn on fan monitoring.
7	Type **X** to exit the screen, then **Y** to confirm and save the setting.
8	Verify that the fans are running properly and that no alarms are indicated on the Shelf Status screen. Fan alarms and failures are now monitored by the HMU.

The fan assembly filter should be changed when dirty—normally every six to nine months.

1 To remove the filter, slightly loosen the bracket screws that secure the two filter brackets.

2 Move the brackets aside and slide out the filter.

3 Insert the new filter, adjust the brackets and tighten the bracket screws.

INSTALLING THE MULTIPLEXER CARDS

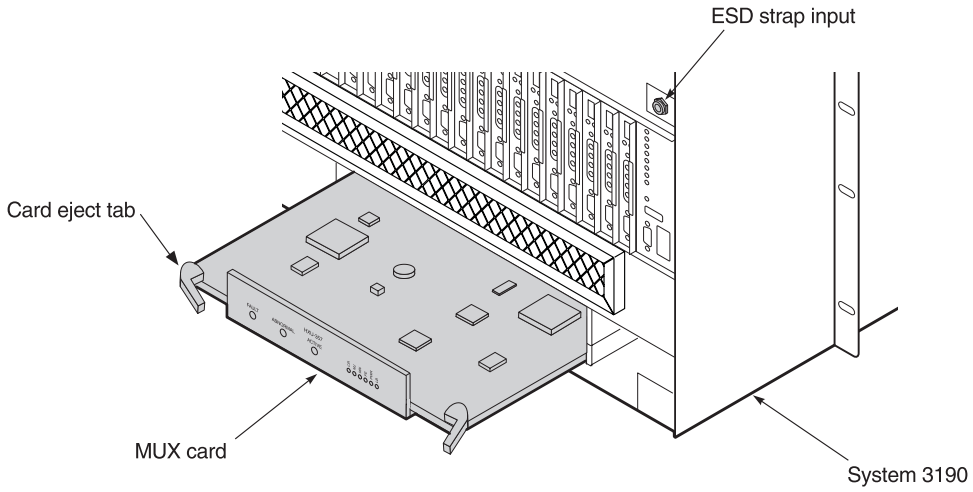


Figure 21. *Installing the HXU-357 Multiplexer Cards*

Step	Procedure
1	Verify that the S1 DIP switch (Figure 14 on page 20) located above the DS3 connector on the back of the chassis is properly configured for your particular system application. The DS3 signal shield (receive) on the coax connector can be isolated or grounded with the S1 DIP switch. • If it is connected to an ungrounded DS3 source, S1 must be set to GND. • If it is connected to a grounded DS3 source, S1 must be set to ISO. The ISO selection is the industry standard.
2	If you have not already done so, unscrew the two hold-down lugs on each side of the chassis front cover. The cover folds down.
3	Be sure to plug your ESD strap into the ESD input on the front of the chassis.
4	Align the edges of the HXU-357 multiplexer card with the guide rails in the multiplexer tray.
5	Grasping the card eject tabs, gently push the card into the bay.
6	Firmly press in on the tabs until the card snaps into place.
7	Repeat these steps for the other HXU-357.

The LEDs flash momentarily when the multiplexer cards are installed. The PWR LED and Activity LED remain lit on the active multiplexer. The LEDs on the inactive multiplexer should be off, except for the power LED.

After initial installation, the HXU-357 multiplexer unit must be configured properly or continuous alarms will occur when the DS1 interface is placed in operation mode. During installation, the DS1 interface should be configured as Out-of-Service and Unequipped (Maintenance mode). The DS3 interface is configured as Out-of-Service. For a complete description of the DS1 and DS3 mode settings, refer to Table 31 and Table 32 on page 93.

Setting up the Communications Channel to the HXU-357

The AUX port is not available to the user as a Craft interface when an HXU-357 is used in the shelf. HMU-319 List 7 uses the AUX port to communicate with the HXU-357. HMU-319 List 7A automatically sets up the AUX port when the IP address is assigned to support IP network communication with the HXU-357.

Step	Procedure
1	Log on to the maintenance terminal connected to the HMU craft port, if you are not already logged on.
2	Type **TAO** at the prompt (<). Refer to “Accessing the Management Interface” on page 44 for guidance on using the management software.
3	From the Network Status screen, enter the number of the desired shelf ID (1 through 32) and then press **ENTER**.
4	From the Shelf Status screen, type **O** to select Shelf Options.
5	From the Shelf Options screen, type **E** to configure the Mux port.
6	Do one of the following: • If there is an HMU-319 List 7 in the shelf, type **2** to select the AUX port as the multiplexer interface. • If there is an HMU-319 List 7A in the shelf, type **2** and enter the IP address of the multiplexer. Your administrator should supply this address. Also, refer to “Network Addresses” on page 94 for guidelines on assigning your own address scheme.
7	Type **X** to exit the screen, then **Y** to confirm and save the setting and return to the Shelf Status screen.

Setting up System Administration

Step	Procedure
1	From the Shelf Status screen, type **M** to log onto the HXU-357.
2	At the prompt, enter the password to access the HXU-357 Root Menu. The default password is `public`.
3	Type **5** to select System Administration from the Root Menu.
4	Type **2** to Change System Settings for the HXU-357, then select one of the following setting options by typing its number and entering the appropriate data. (The HMU-319 List 7A automatically sets the date and time parameters for the HXUs. If using an HMU-319 List 7, set the HXU time and date parameters here to match those of the HMU.) **1** Date **2** Time **3** System name **4** System location **5** Contact person
5	Press **CTRL** + **P** to return to the System Administration menu.

Step	Procedure (Continued)
6	Type 3 to select Change IP Address.
7	Enter the address and mask information (selections 1 through 1 0) established for your particular addressing plan. Consult your network administrator and refer to "Network Addresses" on page 94.
8	Press CTRL + R to return to the Root Menu.

Configuring the HXU DS3 Interface

The DS3 interface is configured in accordance with network requirements.

Step	Procedure
1	Type 1 to select the Configuration Management from the Root Menu.
2	Type 1 to select Configure DS3 Interface.
3	Configure the DS3 interface according to CO requirements. Select each of the following setting options by typing its number, then choosing one of the parameters listed for that option. The default parameters for each of these options can be found in Table 30 on page 91: 1 Configure DS3 mode 2 Configure DS3 line buildout 3 Configure DS3 transmit timing 4 Configure DS3 BER threshold
4	Press CTRL + R to return to the Root Menu.

Placing the HXU DS3 Interface In Service

Step	Procedure
1	From the Root Menu, type 1 to select Configuration Management.
2	Type 6 to select Service Mode.
3	Type 1 to select DS3 service mode.
4	Type 1 to set to In-Service. The In-Service mode prevents any changes to the DS3 configuration settings.

CONFIGURING THE HXU DS1 INTERFACE

This section provides instructions for configuring a single line from the HXU Root Menu. After the DS1 line is configured, the line unit, any necessary doublers, and the HRU are installed as described in the sections which follow. The final step is to place the line in service. For each additional line installation, this procedure is repeated as shown in Figure 11 on page 16.

The DS1 line being configured must be set to Unequipped and Out-of-Service to allow configuration changes and prevent unwanted alarms. This is the default setting; it should not require adjustment. If you need to reset the DS1 line, follow these instructions.

Step	Procedure
1	From the Root Menu, type 1 to select the Configuration Management submenu.
2	Type 2 to select Configure DS1 Interface.
3	Type the channel number of the HLU to be configured.
4	Type 1 to select Set the DS1 Line Code, and then 2 to select (B)8ZS line code. This is the default setting: it should not require adjustment. The HXU and HLU must be configured identically.
5	Type 2 to select Set DS1 Line Buildout.
6	Select the number that corresponds to the appropriate line buildout value dictated by your particular system configuration. The default is 0-133 feet. It should not require adjustment.
7	Type CTRL + R to return to the Root Menu.

INSTALLING A HIGAIN LINE UNIT

The HiGain Wideband System 3190 chassis holds up to 28 HiGain line units. Installing line units manufactured by other companies is not recommended unless they have been certified for compliance in the Wideband System 3190 shelf.

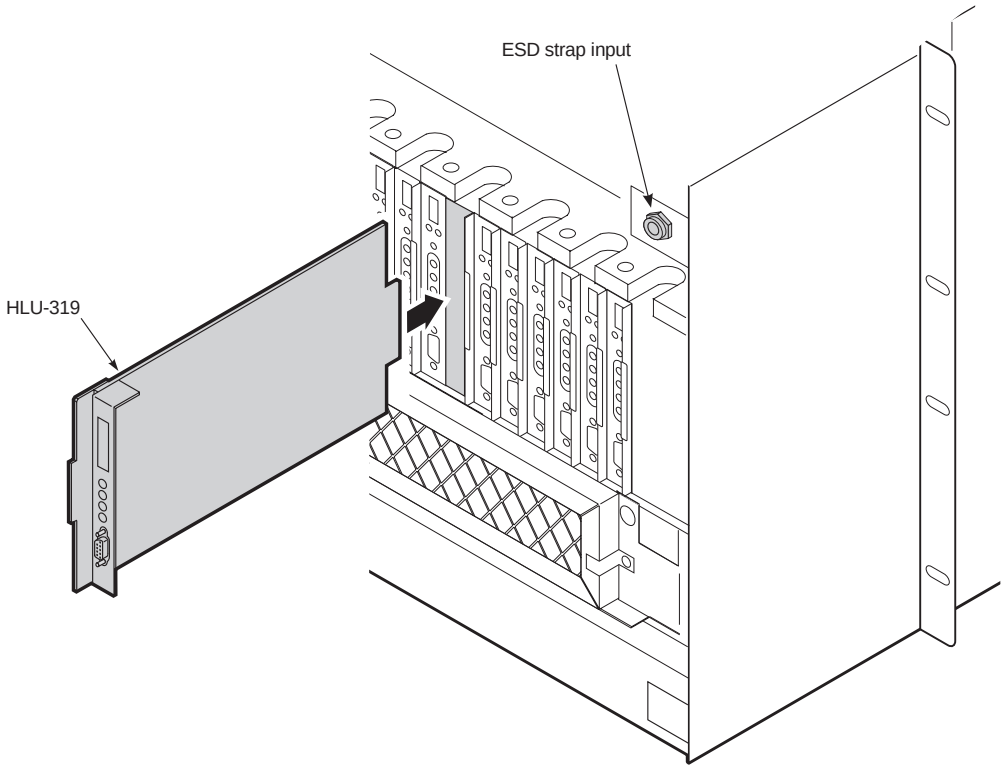


Figure 22. *Installing the HLU-319 into the Chassis*

Step	Procedure
1	If you have not already done so, open the chassis front cover by unscrewing the two hold-down lugs on the upper corners. The cover folds down.
2	Be sure to plug your ESD wrist strap into the ESD above the HMU slot.
3	Slide the HLU-319 into the card guides for the desired slot, then push the unit in until it touches the backplane card-edge connector and the retaining latch on the front panel opens (Figure 22).
4	Place your thumbs on the HLU-319 front panel and push the HLU-319 into the card-edge connector until it is entirely within the card guides and the retaining latch closes. This indicates that the card is properly seated.
5	Configure the HLU according to the steps on the following page. Do not enable alarms.

Once the HLU is installed, it must be configured. Since there is an HMU in the shelf, the HLU craft port is no longer available for provisioning. The HLU Maintenance Terminal screens are accessed through the HMU.

Figure 23 shows the HLU Maintenance Terminal Main Menu.

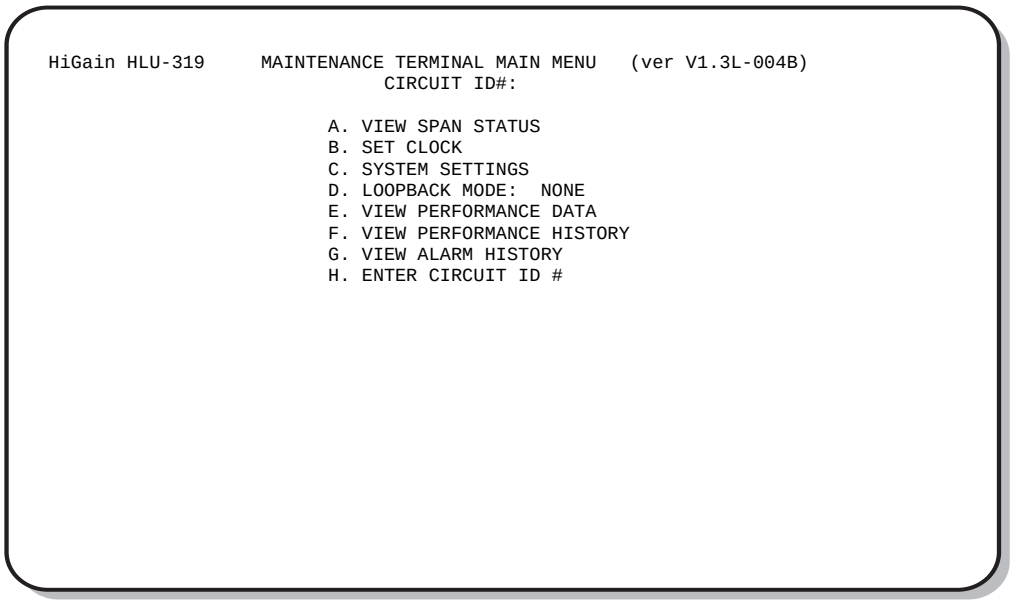


Figure 23. *HLU-319 Maintenance Terminal Main Menu*

Step	Procedure
1	Refer to the appropriate HLU technical practice for complete instructions on configuration. Instructions for the management interface software can be found in the HLU technical practice and in the Provisioning Reference section of this manual. (See "Logging on to the Management Interface" on page 50.)
2	From the Shelf Status menu, type the number of the line unit you wish to configure, and then press **ENTER**. The screen displays the message: `Slot Selected. Please Wait.` Then the Maintenance Terminal displays the Main Menu for the selected line unit. From this point on, all the standard line unit screens are available.
	If using third-party line units that support the 3190 management system, note that the configuration screens differ from HiGain screens. Please refer to the third-party literature for configuration information.
3	Make any necessary changes to the HLU configuration, according to CO requirements.

When management of the line unit is completed, the session terminates automatically if no keyboard activity is detected for a 5-minute period.

INSTALLING A HIGAIN DOUBLER UNIT

Installation of doublers is optional. Refer to your CO plan. To install an HDU in an enclosure, perform the following steps and refer to the enclosure installation manual for information about cabling, proper connections, grounding, and line and local power.

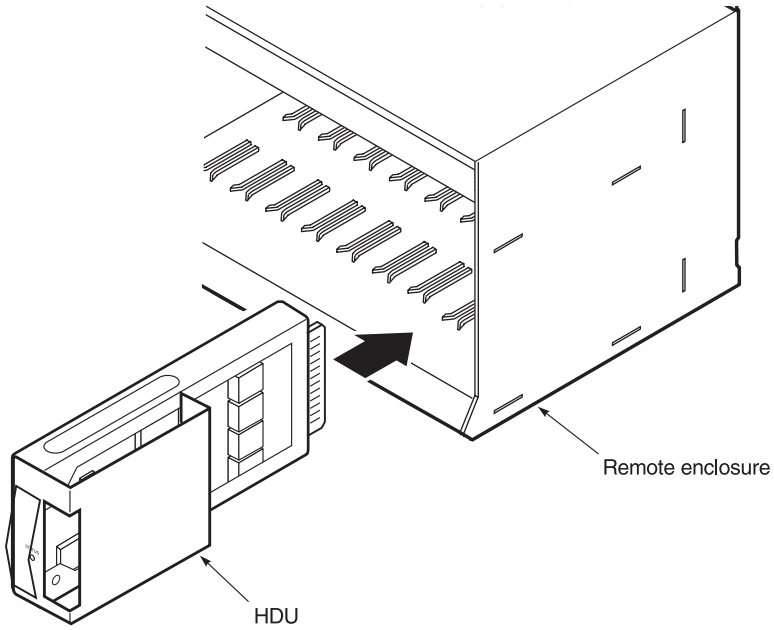


Figure 24. *Installing an HDU in a Remote Enclosure*

Step	Procedure
1	Slide the doubler into the card guides for the desired slot (see Figure 24).
2	Push the unit into the enclosure until it is seated in the card-edge connector. The unit should snap into place, indicating that it is properly seated.

Some enclosures may require you to adjust the retaining bar located on the front of the enclosure in order for the doubler unit to be installed. Refer to the appropriate PairGain technical practice.

Once the HDU is installed in the enclosure (and there is a proper connection between an HLU and the HDU), the front panel Status LED flashes green if power is applied from an upstream line unit. When the loops on both sides of the HDU synchronize, the LED constantly glows solid green. Refer to the HDU technical practice for more details on LED operation.

INSTALLING A HIGAIN REMOTE UNIT

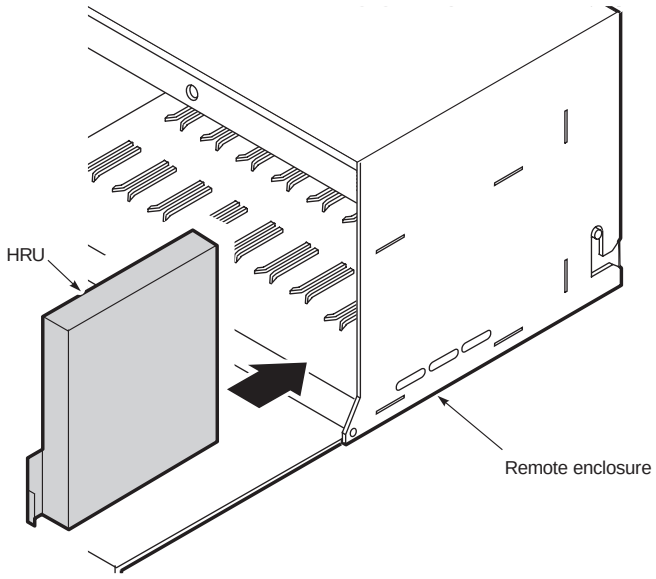


Figure 25. *HRU Installed in a Remote Enclosure*

Step	Procedure
1	Set the user options for status LEDs. Refer to the HRU technical practice for details. User options usually include setting the: • DS1 receive level • TLOS • Sealing current • Local or line power selection
2	Slide the remote unit into the card guides for the desired slot, then push the unit into the enclosure until it is seated in the card-edge connector. The unit should snap into place, indicating that the unit is properly seated. The HRU should power up within 30 seconds.
3	Log onto the maintenance terminal connected to the HMU craft port.
4	Type **TAO** at the prompt (<) and enter the password. The default password is `public`.
5	From the Network Status screen, type the number of the desired shelf (1 through 32) and then press **ENTER**.
6	From the Shelf Status screen, type the number of the line unit, and then press **ENTER**. The screen displays the message: `Slot Selected. Please Wait`. Then the Maintenance Terminal Main Menu for the selected line unit displays.
7	From the Maintenance Terminal Main Menu, select **H** (Enter Circuit ID#) from the Main Menu to display the line unit System Inventory screen.
8	To set a circuit ID, type the letter of the circuit device. Type the alpha-numeric characters to be assigned to the device and press **ENTER**. Choose **C** to confirm. If more than 24 characters are entered, a warning beep is emitted and only the first 24 characters are accepted. Set the IDs for all doublers and the remote unit on the line.

Step	Procedure
9	Perform loopback testing of the line by following the instructions provided in the HRU technical practice. This allows verification of the integrity of the HDSL channel to the HLU as well as the DS1 channel to the customer and the HLU DSX-1 interface. A loopback testing diagram is found on the inside front panel on the chassis and can also be found on page 74 of this manual.

The craft port on an HRU can be accessed for configuration whether or not it is managed by an HMU. Refer to "Connecting a Maintenance Terminal" on page 43 and the HRU practice for more information about provisioning the HRU.

PLACING THE LINE IN SERVICE

After the line installation is complete, the line must be placed in service by:

- enabling the alarms on the HLU
- placing the DS1 interface in service at the HXU

Placing the HLU Under HMU Management

To place the HLU under HMU management to monitor alarms, follow these steps.

Step	Procedure
1	Log onto the maintenance terminal connected to the HMU craft port if you have not already done so.
2	Type **TAO** at the prompt (<) and enter the password. The default password is `public`.
3	From the Network Status screen, type the number of the desired shelf (1 through 32) and then press **ENTER**.
4	From the Shelf Status screen, type **A** to select Alarm Management **(**Figure 31**)**. The following prompt appears: `Which Line Unit do you want to change the alarm settings on (1-28). (E)nable All, (D)isable All`

5	Type the slot number of the line unit you want to enable. When you enter a slot number (*x*), one of the following prompts appears.
	`Do you want to ENABLE alarm settings for Line Unit x (Y/N)`
	`Do you want to DISABLE alarm settings for Line Unit x (Y/N)`

6	Type an appropriate **Y** or **N** response for the alarm setting you are changing.

If an HLU card is hot-swapped while under HMU management, no setup is required. All configuration settings are automatically downloaded from the HMU.

If the HMU is managing the line unit, only the HMU maintenance terminal (ASCII terminal or PC running a terminal emulation program) can configure the line unit.

Removal of the HMU from the chassis enables the front panel craft port on the HLU.

Placing the Line in Service at the HXU

The Wideband System 3190 interfaces internally to the 28 lines at the common DSX-1 point (see Figure 1 on page 1). Once a line has been configured on the HLU, the DS1 interface at the HXU should be placed In-Service. Some alarm reporting will be lost if the line is not placed In-Service.

Viewing Status

Before placing a line in service, verify that all necessary provisioning changes have been made. Refer to the Provisioning section of this manual, to the individual technical practices for the Wideband System 3190 components, and to the CO installation plan for complete details.

Before placing the system in service, take a moment to reassess your configuration requirements.

- Check shelf status by accessing the HMU TAO software and viewing the Shelf Status screen.
- Check the HLU Maintenance terminal screens that are accessible through the Shelf Status menu.
- Check the System Configuration Status screens that are accessible when logging onto the multiplexer Root Menu through the Shelf Status Screen.

To access the System Configuration Status menu of the HXU-357:

Step	Procedure
1	Log onto the maintenance terminal connected to the HMU craft port, if you are not already logged on. Type **TAO** at the prompt (<).
2	From the Network Status screen (for multishelf configurations), type the number of the desired shelf (1 through 32), and then press **ENTER**.
3	Access the Root Menu from the Shelf Status Menu by typing **M**, and then logon.
4	Type **4** to select System Configuration Status and select any of the following status screens: **1** DS3 Interface Status **2** DS1 Interface Status **3** System Status **4** IP Addresses **5** Card Inventory
5	If necessary, access the Configuration Management screen or System Administration screen to make changes.

Placing the DS1 Interface In Service at the HXU

Step	Procedure
1	Log on to the maintenance terminal connected to the HMU craft port, if you are not already logged on. Type **TAO** at the prompt (<).
2	From the Network Status screen, type the number of the desired shelf (1 through 32), and then press **ENTER**.
3	Access the Root Menu from the Shelf Status Menu by typing **M** and then the password.
4	Type **1** to select Configuration Management.
5	Type **6** to select Service Mode.
6	Type **2** to select DS1 service mode.
7	Type the number of the channel line.
8	Type **1** to select (I)N SERVICE.
9	Press **CTRL** + **P** to return to the Configuration Management menu.
10	Type **7** to select DS1 Equip / Unequip.
11	Type the number of the channel line.
12	Type **1** to select (E)QUIPPED.

Once a line is placed In Service under the HXU Configuration Management menu, its provisioning cannot be changed. To reprovision a line, place it in maintenance mode (Unequipped and Out-of-Service). This does not affect changing DS1 parameters under the HLU Maintenance Terminal menu.

VIEWING PERFORMANCE AT THE HXU

Once the line has been installed and tested, you may wish to view the DS1 and DS3 performance data.

The HLU Maintenance Terminal screen for each line unit provides a more detailed list of PM statistics.

Step	Procedure
1	Log on to the maintenance terminal connected to the HMU craft port, if you are not already logged on. Type **TAO** at the prompt (<).
2	From the Network Status screen, type the number of the desired shelf (1 through 32), and then press **ENTER**.
3	Access the Root Menu from the Shelf Status Menu by typing **M**, and then the password.
4	Type **2** to select Performance Management.

Step	Procedure
5	Select one of the following performance histories or clear the statistics by typing the corresponding number: **1** DS3 Performance Current 15 Minutes **2** DS3 Performance Last 24 Hours **3** DS1 Performance Current 15 Minutes **4** DS1 performance Last 24 hours **5** Clear PM Stats
6	Type **CTRL** + **R** to return to the Root Menu.

For each new line to be installed, repeat the installation procedures by returning to the section entitled, "Configuring the HXU DS1 Interface" on page 34.

PROVISIONING REFERENCE

Once you have completed a basic installation, refer to this section for additional provisioning information. This reference section provides information about managing the Wideband System 3190 through the TAO management software. It includes general instructions for:

CONNECTING A MAINTENANCE TERMINAL

The HMU allows you to access maintenance, test and provisioning screens for every managed HLU and HXU in the Wideband System 3190. The HMU provides Terminal Access Option (TAO) software for configuring and managing the system.

Step	Procedure
1	Connect a maintenance terminal (an ASCII terminal or a PC running terminal emulation software) to the HMU in one of the following ways: • locally, using the craft port on its front panel • locally, using the OSS port on the 3190 chassis backplane • remotely, by connecting a modem and phone line to the craft port on the HMU front panel and establishing a dial-up connection from a remote terminal and modem • remotely, by connecting a modem and phone line to the OSS port on the 3190 chassis backplane and establishing a dial-up connection from a remote terminal and modem
2	Once a terminal connection is established, use the HMU management interface, called the TAO, to configure and manage each individual line unit and the multiplexers.

A line unit or multiplexer controlled by the HMU can only be configured through the HMU maintenance terminal—the line unit cannot be configured directly from the craft port or push-buttons on the line unit's front panel while being managed by the HMU. If the HMU-319 is not installed in the shelf, every line unit in the shelf can be managed by connecting a terminal to its front panel craft port. The craft port on the HRUs and HDUs can be accessed for configuration whether or not the HMU is installed.

The HMU monitors each line unit and multiplexer for alarm conditions, and reports status and alarm information for all line units under its control through the HMU front panel LEDs and the maintenance terminal interface. Each

line unit and multiplexer displays alarm information on the front panel LEDs, and sends the information to the HMU. Alarm conditions are categorized as critical, major, or minor.

The HMU can be inserted into or removed from the shelf without affecting the data carrying capabilities of the line units it manages. If the HMU fails, the line units and the multiplexers installed in the shelf are not affected.

The HMU-319 also provides a TL1 interface for managing HiGain systems. With the HMU-319, both the TAO and TL1 interfaces can be accessed using an RS-232 connection on a TELNET connection. At the time of this printing. For more information on the TL1/TELNET interface, refer to the TL1 Command Set Reference (400-100-100-xx).

ACCESSING THE MANAGEMENT INTERFACE

You can access the HMU-319 management interface (Figure 26) locally by directly connecting a local terminal or PC running a terminal emulation program (Figure 27 on page 45), or remotely, using a dial-up connection (Figure 28 on page 46).

During the terminal session, there are two ways to type numeric entries, depending on whether you are using a PC or emulating a VT100 terminal:

- Configure your terminal to emulate a VT100 terminal. This allows you to use the numeric keypad to type numbers during the terminal session.
- If you are emulating a PC, only use the numbers located above the letter keys on the keyboard. Using the numeric keypad may result in unexpected responses from the management interface or the HMU-319.

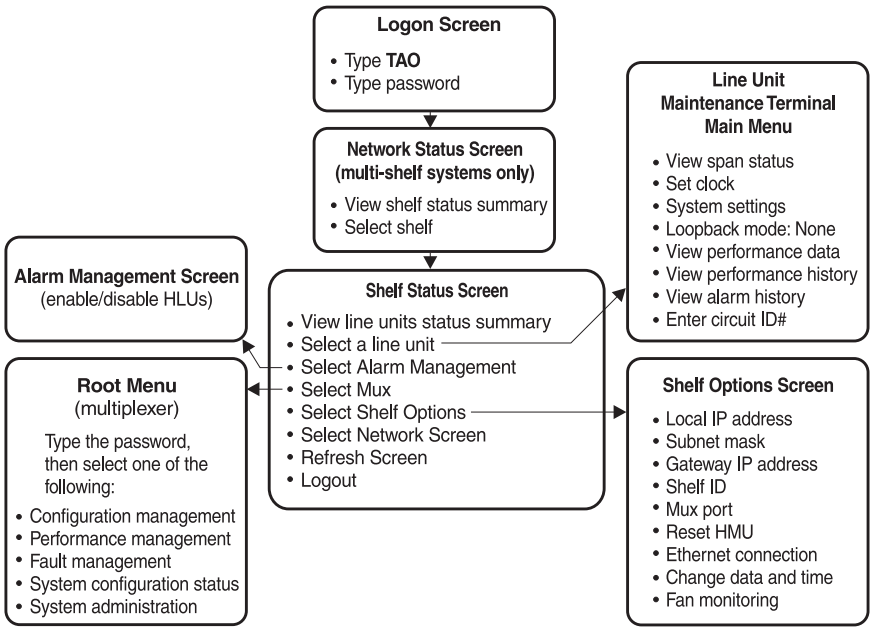


Figure 26. *Management Interface*

Connecting a Local Terminal

There are two choices for connecting a local maintenance terminal to the Wideband System 3190:

- Craft port on the HMU front panel
- OSS port on the chassis backplane

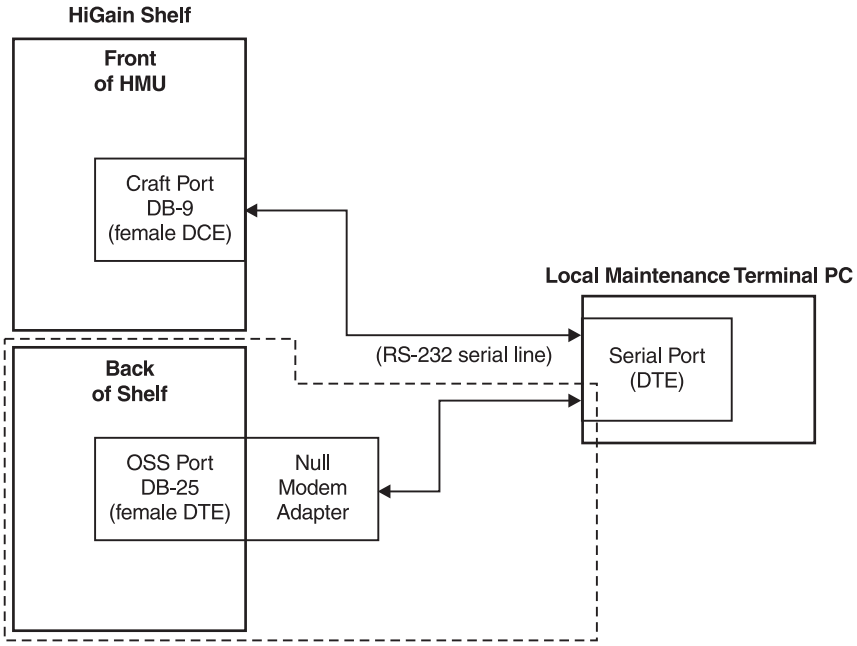


Figure 27. *Local Terminal Connection*

Step	Procedure
1	Connect a terminal cable to the serial COM port on the local maintenance terminal.
2	Connect the local maintenance terminal to the craft port or OSS port shown in Figure 27. The local maintenance terminal can be directly connected to the craft port. If the OSS port on the backplane of the shelf is used, it requires a null modem adapter. • Use a standard, 9-pin terminal cable when connecting to the HMU craft port. The craft port is configured as Data Communication Equipment (DCE). • Use a 25-pin terminal cable when connecting to the OSS port on the shelf backplane. The OSS port is configured as Data Terminal Equipment (DTE).
3	If you are using a PC, start a terminal emulation program.
4	Configure the maintenance terminal as follows: 9600 baud No parity 8 data bits 1 stop bit

Connecting a Remote Terminal

There are two choices for connecting a remote maintenance terminal to the Wideband System 3190:

- Craft port on the HMU front panel
- OSS port on the chassis backplane

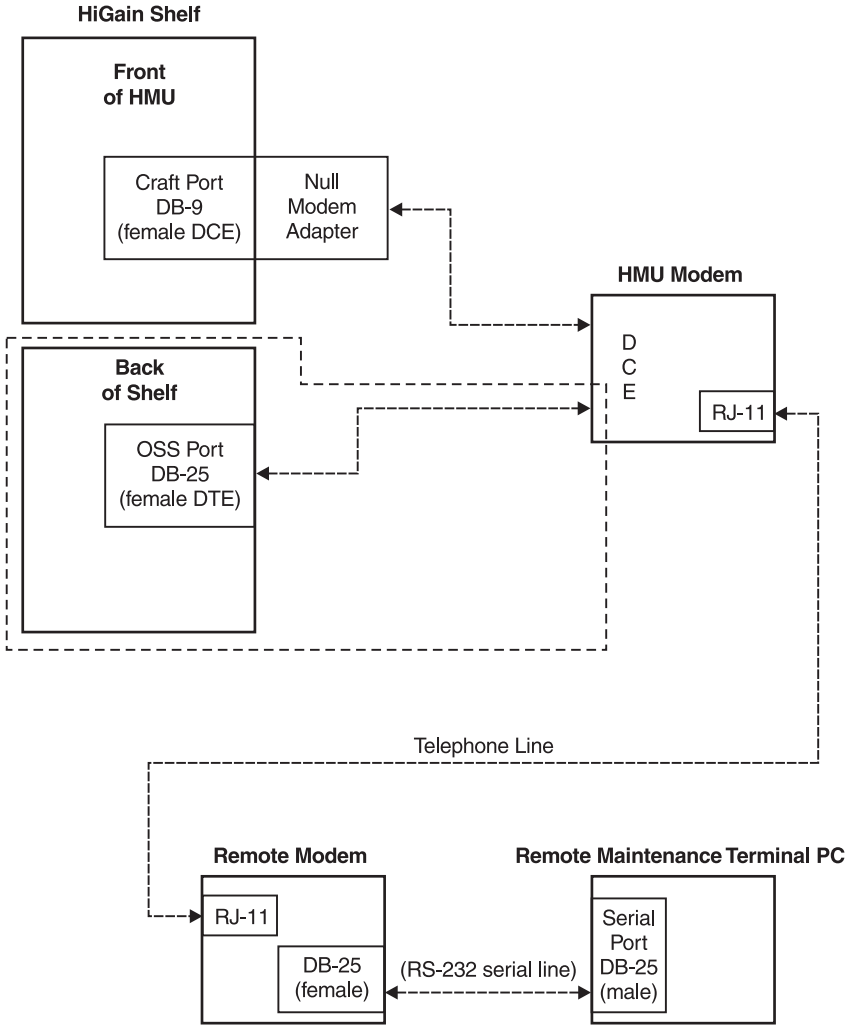


Figure 28. *Remote Terminal Connection*

Step	Procedure
1	Connect the HMU modem to the HMU craft port or to the OSS port on the backplane of the 3190 chassis as shown in Figure 28. The craft port on the HMU is a DCE device, and therefore requires a null modem adapter for proper communications with a DCE modem. A DB-9 null modem adapter may be placed directly on the craft port or a DB-25 null modem adapter may be placed on the modem's serial port connector. If the OSS port on the backplane of the shelf is used, it can be connected directly to a DCE modem.
2	Test and configure the remote modem to work with the HMU modem. See "Testing and Configuring a Remote Modem" on page 48.
3	Connect the remote modem to the HMU modem. See the instructions in "Connecting the Remote PC Modem" on page 49.
4	Configure the HMU modem (the modem connected to the HMU or the HiGain Management Shelf) as follows: 9600 baud No parity 8 data bits 1 stop bit Auto-answering enabled Result codes disabled Local Echo disabled
5	If you are using a PC as a remote terminal, start a terminal emulation program and configure the remote modem as follows: 9600 baud No parity 8 data bits 1 stop bit Auto-answering enabled Result codes disabled Local Echo disabled
6	From the remote maintenance terminal, dial the number of the HMU modem.

For a successful dial-up connection, the local and remote modems must be configured with identical modem speed, parity, stop bit, and data bit settings.

Testing and Configuring a Remote Modem

Use a PC to test and program the modem before connecting it to an HMU. The strings in the following procedure will properly configure most Hayes-compatible modems. However, if problems occur, contact the modem manufacturer.

Step	Procedure
1	Connect a modem to a PC and verify that it is in working condition.
2	Use a communications program to send the following initialization string to the modem: `AT&F` The string resets the modem to its original factory configuration and clears any previous programming that may conflict with the communication between the modem and the HMU.
3	Next, send the following configuration string to the modem: `ATE0Q1S0=1&W0Y0` This configures the modem to operate properly for the HMU. The commands in this configuration string are as follows: `AT` The command prefix indicating an AT command string `E0` Do not echo input characters `Q1` Do not return result codes `S0=1` Answer the phone after the first ring `&W0` Store current configuration as profile 0 `Y0` Use profile 0 as the power-up configuration This configuration disables all response codes and echo capability in the modem. (These codes are not used by the HMU.) The modem will not respond with an “OK” when the string is sent.

If the modem is properly configured, the Auto Answer (AA) lamp on the modem panel is on, indicating that the modem is waiting for the phone to ring and to answer an incoming call from a remote terminal.

Most modems have a number of switches that must be correctly configured for proper operation. Refer to your modem documentation for information regarding these switches. Be sure to use a complex password to preserve security.

Connecting the Remote PC Modem

These instructions are for connecting a remote modem and remote maintenance terminal. The Remote PC modem may be either internal or external.

Remote Internal Modem

An internal modem plugs into an ISA bus slot on the motherboard of the PC workstation and contains all of its own serial port circuitry.

Step	Procedure
1	Plug the phone line from the HMU modem into the RJ-11 phone connector on the back of the PC.
2	Power-up the computer.

Remote External Modem

External modems require a serial cable, an external power supply, and an unused serial port in the PC.

Step	Procedure
1	Plug a serial cable into the available serial port on the PC using a 9-to-25 pin converter or gender changer, if necessary. If the PC has two serial ports, a PC mouse is usually connected to the first port (COM1:) and the second port (COM2:) can be used by the modem. The serial ports are located on the back of the PC. The serial ports are DB-9 or DB-25 connectors with pins.
2	Plug the other end of the cable into the remote external modem (the port on the back of the modem is a female DB-25).
3	Plug a telephone line from the HMU modem into the back of the remote external modem. This is a female RJ-11 socket labeled “LINE” or “TELCO.” If neither socket is labeled, then use either.
4	Plug the modem into an external power supply and power it on.
5	Power on the PC.
6	Before starting up TAO, verify that the modem is responding to commands from the PC. Use a communications program, such as Procomm Plus or Window Terminal, to send an AT command to the modem. The modem responds with the string, “OK” to indicate successful operation.
7	Use the modem to call another modem or Bulletin Board System (BBS) to verify that it is connected and working properly. If any problems occur at this point, then refer to the modem owner’s manual for troubleshooting information.

Logging on to the Management Interface

The following instructions assume you are using an HMU-319 List 7 or 7A.

You can invoke TL1 by pressing ENTER at the TL1 prompt (<), however, the HMU-319 List 7 does not currently provide TL1 support for the HXU-357. The HMU-319 List 7A software provides full TL1 support. Check PairGain's FTP site for the latest software upgrades.

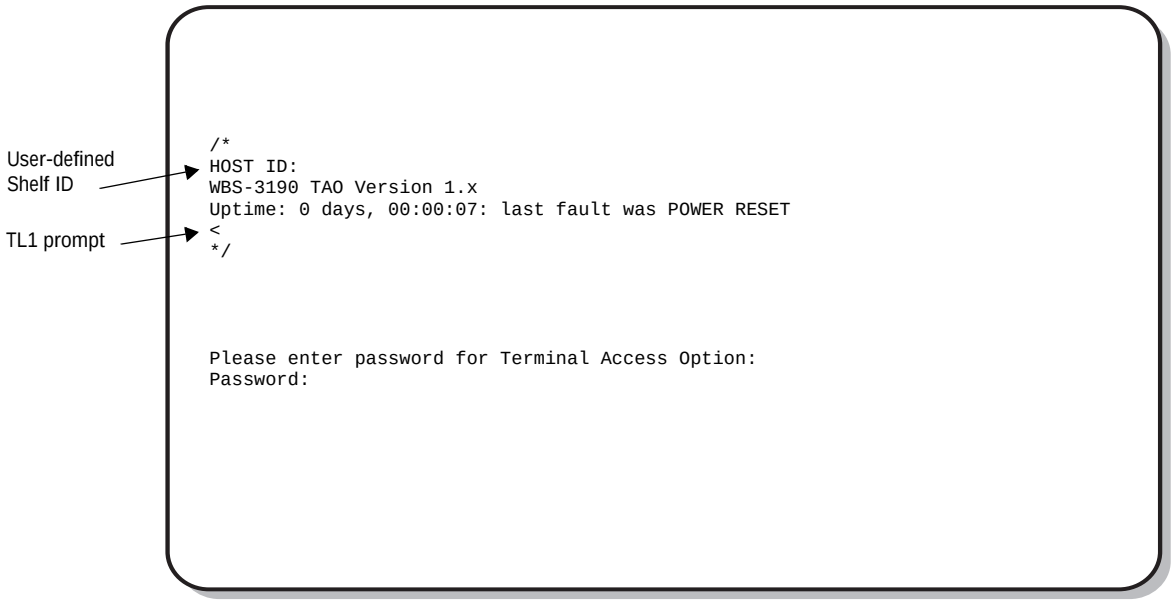


Figure 29. *Logon Screen*

Step	Procedure
1	Press the SPACEBAR slowly several times to activate the autobaud feature. Upon connecting to the HMU-319, the TL1 prompt (<), appears.
2	Type TAO, and then press ENTER to invoke TAO. Whenever you wish to switch back to TL1, press the CTRL + X keys. Refer to the *TL1 Command Set Reference* (400-100-100-xx) for more details on the management protocol screens.
	The factory default password setting is `public`. You can change the password to any alphanumeric combination (up to 20 characters). However, if you forget the new password, you must return the HMU to PairGain for reprogramming. See "Changing the Logon Password" on page 71 for instructions.
3	Type the password, and then press ENTER. The Network Status menu appears.

The TAO session terminates automatically if no keyboard activity is detected for a 5-minute period. If this occurs, press the SPACEBAR slowly several times to log on again. If you wish to log off at any time, press X from the Shelf menu, Network menu or Options menu.

After logging onto a shelf, you have access to all other shelves in the network and do not need to use the passwords for the other shelves.

Navigating the Network Status Screen

The Network Status screen is only available if the HMU is configured to manage a multishelf configuration. This screen displays a status summary of all the shelves in the system. The display for each shelf provides an indication of the alarm state of the shelf (worst alarm existing on the shelf) followed by the user-defined name given to the shelf during shelf setup.

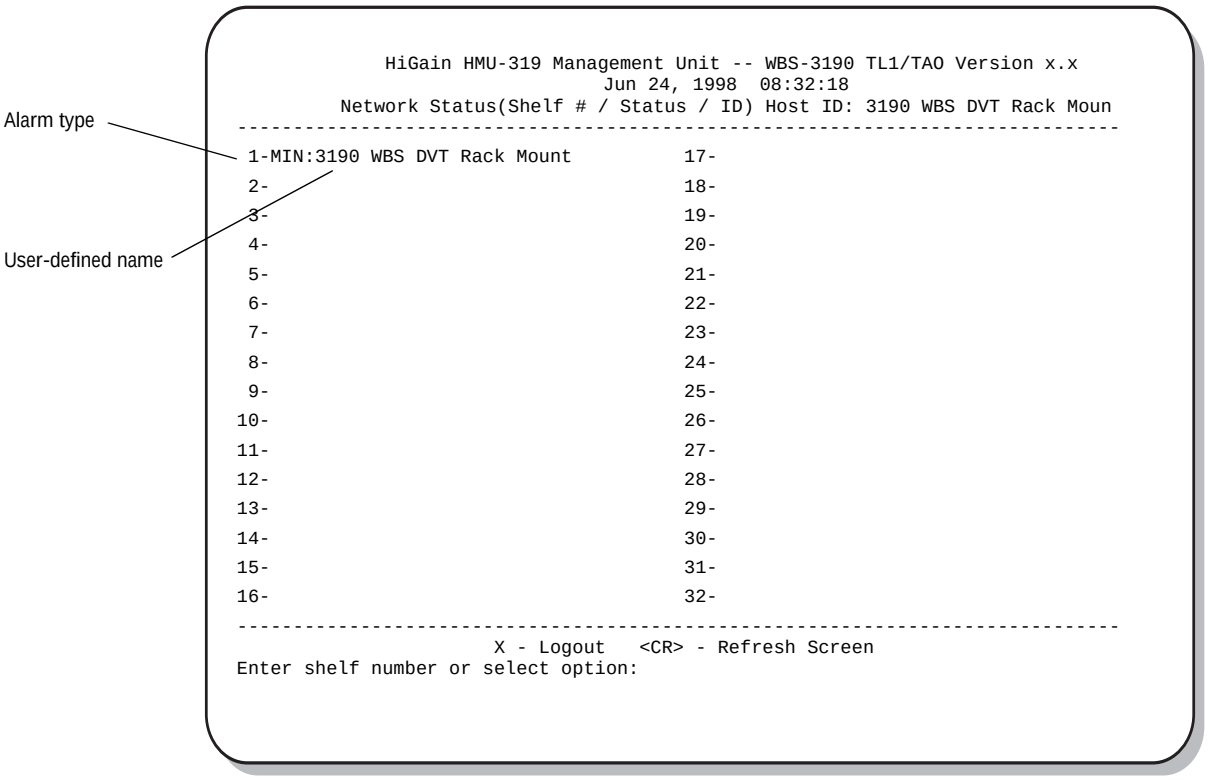


Figure 30. *Network Status Menu*

The first shelf number on the Network Status menu (Figure 30) displays information for the first shelf that is physically connected to the terminal (or modem, if you're using a dial-up connection).

Shelf numbers 2 through 32, which identify other shelves in the multishelf configuration, are assigned as they are randomly detected by the HMU. Thus, they do not correlate to the physical order in which the shelves are connected. For convenient identification, select a unique ID for each shelf.

The display for each of the active shelves is preceded by one of the following shelf status messages:

- NRM (normal): All line units in the shelf are in a normal state without any system alarms.
- MIN (minor): The shelf is in a minor alarm state.
- MAJ (major): The shelf is in a major alarm state.
- CRT (critical): The shelf is in a critical alarm state.

Refer to "HMU Alarms" on page 69 for more information.

From the screen shown in Figure 30, you can select a particular shelf, refresh the screen and display status, or you can terminate the session.

- To select a particular shelf from the network, type the number of the shelf, and then press **ENTER**.

  The Shelf Status screen for that shelf appears.

- To refresh the Network Status screen and show current status, press **ENTER**. (The menu text states that pressing <CR> refreshes the screen — <CR> means **ENTER**.)

- To terminate the session (log off), press the **X** key.

Navigating the Shelf Status Screen

Once a shelf has been selected, the HMU displays a Shelf Status screen. A Shelf Status screen is available for each shelf that is managed by the HMU, whether it is a single-shelf or multishelf configuration.

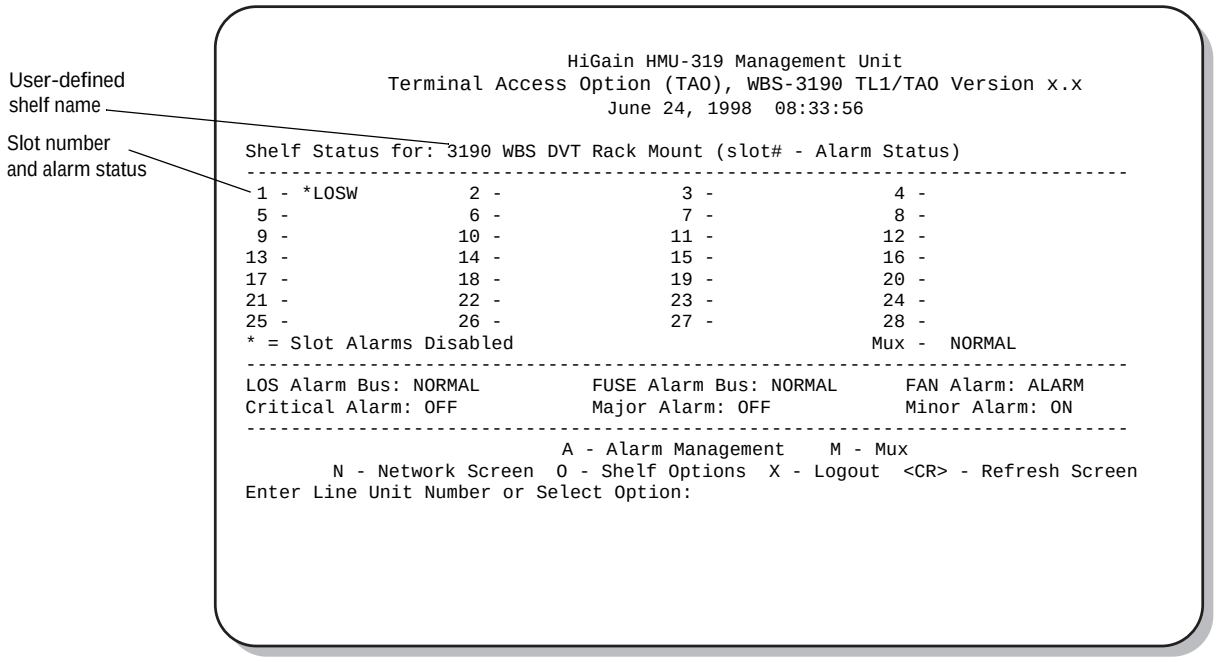


Figure 31. *Shelf Status Menu*

All screens shown in this guide depict PairGain equipment. If third-party, 3190-compliant line units are installed, please refer to the appropriate third-party user guide for more information about the product and the associated maintenance screens.

The Shelf Status displays a status summary for all the line units in the shelf. It lists the user-defined shelf name and indicates the state of each line unit in the shelf. You can also select any line unit within the shelf for further information or select “Alarm Management” to disable or enable alarm management on a specific line unit. The Shelf Options selection (O) brings up a shelf configuration menu (Figure 32 on page 55).

From the Shelf Status, you can perform the following tasks:

- To refresh the screen and show current status, press **ENTER**. (The menu text states that pressing <CR> refreshes the screen — <CR> means **ENTER**.)
- To display network status, type **N**, and then press **ENTER** (this option is only available for a multishelf configuration).
- To access a line unit, type the slot number of the line unit, and then press **ENTER**. (Press **ESC** to return to the Shelf Status menu.)
- To access the Shelf Options menu for the active shelf, type **O**, and then press **ENTER**. (Press **X** to return to the Shelf Status menu.)
- To access the multiplexer logon screen, Root Menu, type **M**.
- To access Alarm Management to enable or disable alarm management on a particular line unit, type **A**.
- To terminate the session (log out), press the **X** key.

Alarm Management and Status

When the HMU-319 is first installed, its alarm relays and LEDs are not asserted because the line units have not been enabled for reporting alarm status. All line unit alarms, even though polled for alarm status, must be enabled from the Shelf Status screen before they can report alarm status. Line units that have not been enabled are marked with an asterisk (*) on the Shelf Status screen. The Shelf Status screen displays alarm status, but the line units are prohibited from initiating any Minor, Major, or Critical HMU relay closures.

To enable alarm polling on a line unit from the Shelf Status menu:

Step	Procedure
1	Type **A** to select Alarm Management **(**Figure 31**)**. The following prompt appears: `Which Line Unit do you want to change the alarm settings on (1-28). (E)nable All, (D)isable All`

2	Do one of the following:
	Type **E** to enable alarms on all line units present in the shelf.
	Type the slot number of the line unit you want to change. If you enter a slot number (*x*), one of the following prompt appears.
	`Do you want to ENABLE alarm settings for Line Unit x (Y/N)`
	`Do you want to DISABLE alarm settings for Line Unit x (Y/N)`

The A(larm) Enable/Disable option of the HLU should match the HMU alarm setting for the line unit. This allows the HLU to still assert pin H on the backplane (LOS Alarm Bus) if it drops out of management. See the HLU practice for further information.

Resetting a Line Unit

Any managed HLU-319 unit can be reset remotely through the HMU.

At the Shelf Status screen, type **CTRL** + **R** (a hidden option) to invoke the HLU reset command. This action disrupts data on the T1 line.

The shelf screen displays the following messages if the line unit is reset:

```
WARNING!!! You are about to RESET a Line Unit!!!
Select the Line Unit that you want to RESET (1-28) 1
Are you sure that you want to RESET Line Unit 1 (Y/N) Y
A RESET request has been SENT to the Line Unit.
```

Viewing Fan Status

If fan alarm status has been enabled at the Shelf Options menu, the Shelf Status screen displays the fan option and status. The screen should indicate a NORMAL status.

Viewing Multiplexer Status

The Mux status reflects the state of the alarm relays asserted by the multiplexer. The Shelf Status screen displays the Mux status if the AUX port has been set up to accept multiplexer data. This is done from the Shelf Options menu as described in "Setting up the Communications Channel to the HXU-357" on page 32.

ACCESSING THE SHELF OPTIONS MENU

```
                          HiGain HMU-319 Management Unit
                Terminal Access Option (TAO), WBS-3190 TL1/TAO Version x.x
                              June 24, 1998  08:34:22

Shelf Options
------------------------------------------------------------
Software Version     : TL1/TAO Software Version x.x
Shelf ID             : 3190 WBS DVT Rack Mount
Ethernet Address     : 00:20:A7:30:10:6D
Local IP Address     : 200:200:200:23
Subnet Mask          : 255.255.255.0
Gateway IP Address   : 0.0.0.0
Ethernet Connection  : 10baseT
Mux Port             : AUX Port
Fan Monitoring       : ON
------------------------------------------------------
(A) Local IP Address          (B) Subnet Mask
(C) Gateway IP Address        (D) Shelf ID
(E) Mux Port                  (F) Reset HMU
(G) Ethernet Connection       (H) Change Date and Time
(K) Fan Monitoring
(X) Exit
--------------------------------------------------------------------

Select: X
```

Figure 32. *Shelf Options Screen for the HMU-319 List 7*

Step	Procedure
1	If you are managing a multishelf configuration, type the number of a shelf at the Network Status menu prompt, and then press **ENTER**. The Shelf Status menu for the selected shelf appears.
2	From the Shelf Status menu, type **O**, and then press **ENTER**. The Shelf Options menu appears (Figure 32).
3	Select one of the options from the menu (Table 7 on page 56). Instructions for configuring these options start on page 57.

The Shelf Options screen for the HMU-319 List 7A prompts you to enter the IP address for the multiplexer when selecting Option E. List 7 requires you to select the AUX port. See "Setting the Mux Port (Option E)" on page 58.

CONFIGURING SHELF MANAGEMENT

The Shelf Options menu parameters for the HMU are listed in Table 7. Most of these options are configured during the installation procedures. They are repeated here for your convenience.

Table 7. *Shelf Options Menu Parameters*

Option	Parameter	Description
A	Local IP Address	Sets the Local Internet Protocol (IP) Address used for communication between shelves in a multishelf network. This field must be set for multishelf operation, and each local IP address must be unique for all interconnected shelves. The format for this field is NNN.NNN.NNN.NNN where NNN is a decimal number from 0 through 255. Set this value to 0.0.0.0 to disable multishelf operation. See "Setting the Local IP Address (Option A)" on page 57 and "Network Addresses" on page 94.
B	Local Subnet Mask	A number used to identify a subnetwork so that an IP address can be shared on a network. The factory default value is 255.255.255.0. See "Setting the Local Subnet Mask (Option B)" on page 57 and "Trap IP Address" on page 95.
C	Default Gateway IP Address	The address of the gateway or connector between two or more dissimilar networks. The gateway performs protocol and bandwidth conversions. The factory default value is 0.0.0.0. See "Setting the Default Gateway IP Address (Option C)" on page 57 and "Network Addresses" on page 94.
D	SID Setup	The Shelf Identifier (SID) is an alphanumeric text string that identifies a shelf. This field must be set for multishelf operation, and each SID must be unique for all interconnected shelves. The maximum SID length is 32 characters. See "Setting the Shelf Identifier (Option D)" on page 58.
E	Mux Port	Reports alarms to the HMU if the port is set up to accept multiplexed data. See "Setting the Mux Port (Option E)" on page 58.
F	Reset HMU	Resets the HMU. This has no affect on line units in the shelf. See "Resetting the HMU (Option F)" on page 58.
G	Change Ethernet Connection	Use to set the Ethernet connection to 10BASE-T. See "Setting the Ethernet Connection (Option G)" on page 59.
H	Change System Date and Time	Sets the System Date and Time. Used to identify the date and time of autonomous alarm messages. See "Setting the Date and Time (Option H)" on page 59. The HMU globally sets the date and time parameters or all HLUs in the chassis. The HMU-319 List 7A will also set the date and time parameters for the HXU.
K	Fan Monitoring	Provides fan status if enabled. See "Setting Fan Monitoring (Option K)" on page 59.
X	Exit	Exits menu. See "Saving Settings (Option X)" on page 60.

Setting the Local IP Address (Option A)

Step	Procedure
1	At the Shelf Options menu prompt, type **A**, and then press **ENTER** to select Local IP Address. The following prompt appears at the bottom of the screen: `Enter New Local IP Address`
2	At the prompt, type the local IP address using the XXX.XXX.XXX.YYY format, where XXX and YYY are decimal numbers from 0 through 255. For multishelf configurations, the local IP address must be unique for each shelf on the network. The values for XXX should be the same for each shelf in the network. The values for YYY must be unique for each shelf.
3	Press **ENTER**.
4	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
5	Type **Y** to confirm, save the setting, and reset the HMU**.**

Setting the Local Subnet Mask (Option B)

Step	Procedure
1	Type **B**, and then press **ENTER** to select Local Subnet Mask. The following prompt appears at the bottom of the screen: `Enter New Local Subnet Mask`
2	Type the appropriate Local Subnet Mask value, and press **ENTER**. The recommended value is: 255.255.255.0
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
4	Type **Y** to confirm, save the setting, and reset the HMU**.**

Setting the Default Gateway IP Address (Option C)

Step	Procedure
1	Type **C**, and then press **ENTER** to select Default Gateway IP Address. The following prompt appears at the bottom of the screen: `Enter New Default Gateway IP Address`
2	Type the gateway IP Address, and press **ENTER**. The only recommended value is: 0.0.0.0
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
4	Type **Y** to confirm, save the setting, and reset the HMU**.**

Setting the Shelf Identifier (Option D)

Step	Procedure
1	Type **D**, and then press **ENTER** to select SID Setup. The following prompt appears at the bottom of the screen: `Enter New SID Setup`
2	At the prompt, type an alphanumeric text string of 32 characters or less to identify the shelf, and then press **ENTER**. The Shelf Identifier may be set to any value, but must be unique for each shelf in the network. For multishelf configurations, the Shelf Identifier must be set to a unique value and cannot be left blank.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM before exiting (y/n)?`
4	Type **Y** to confirm, save the setting, and return to the Shelf Status menu.

Setting the Mux Port (Option E)

Step	Procedure
1	Type **E**, and then press **ENTER** to select Change Mux Port Configuration. The following prompt appears at the bottom of the screen: `Enter New Mux Port (1 - None, 2 - AUX Port)`
2	Type **2**, and then press **ENTER** so the HMU can identify the multiplexer port. If there is an HMU-319 List 7A in the shelf, you will be prompted to enter the IP address of the multiplexer. Your administrator should supply this address. Refer to "Network Addresses" on page 94.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM before exiting (y/n)?`
4	Type **Y** to confirm, save the setting, and return to the Shelf Status menu**.**

Resetting the HMU (Option F)

Step	Procedure
1	Type **F**, and then press **ENTER** to reset the HMU.

Setting the Ethernet Connection (Option G)

Step	Procedure
1	Type **G**, and then press **ENTER** to select Change Ethernet Connection. The following prompt appears at the bottom of the screen: `Enter New Change Ethernet Connection (1 = 10BASE-2 2 = 10BASE-T)`
2	Type **2**, and then press **ENTER** to select 10BASE-T.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM and reset the HMU (y/n)?`
4	Type **Y** to confirm, save the setting, and reset the HMU.

Setting the Date and Time (Option H)

Step	Procedure
1	Type **H**, and then press **ENTER** to select Change HMU Date and Time. The following prompt appears at the bottom of the screen: `Enter New Date (mm/dd/yy):`
2	At the prompt, type the current date using MM/DD/YY format, and then press **ENTER**. The following prompt appears at the bottom of the screen: `Enter New Time [hr:min]:`
3	At the prompt, type the current time using HH:MM military format, and then press **ENTER**.
4	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM before exiting (y/n)?`
5	Type **Y** to confirm, save the setting, and return to the Shelf Status menu**.**

Setting Fan Monitoring (Option K)

Step	Procedure
1	From the Shelf Options screen, type **K** to select Fan Monitoring.
2	Type **2**, and then press **ENTER** to turn on fan monitoring.
3	Type **X** to exit the screen. The following prompt appears: `Your NVRAM settings have not been saved. Would you like to save NVRAM before exiting (y/n)?`
4	Type **Y** to confirm, save the setting, and return to the Shelf Status menu**.**

Saving Settings (Option X)

Once changes have been made, you are prompted to accept (Y) or reject (N) the changes. The screen displays an appropriate response for your selection. On occasion, the screen may prompt you to reset the HMU.

CONFIGURING THE MULTIPLEXER UNIT

Like the HMU-319 and the line units, the multiplexer unit has its own set of configuration screens:

- Figure 33 shows the Root Menu for the multiplexer unit.
- Figure 34 on page 62 is a graphical representation of the basic menus and submenus available from the Root Menu.
- Table 9 on page 63 through Table 13 provide detailed configuration information.
- Table 30 on page 91 provides a listing of all the default settings for the HXU-357.

The HXU-357 multiplexer units must be equipped to report alarms. At a minimum, you must configure the HXU-357 multiplexers for the Wideband System 3190 and set them up for system administration (Options 1 and 5 in the Root Menu). The Root Menu is accessible from the Shelf Status screen.

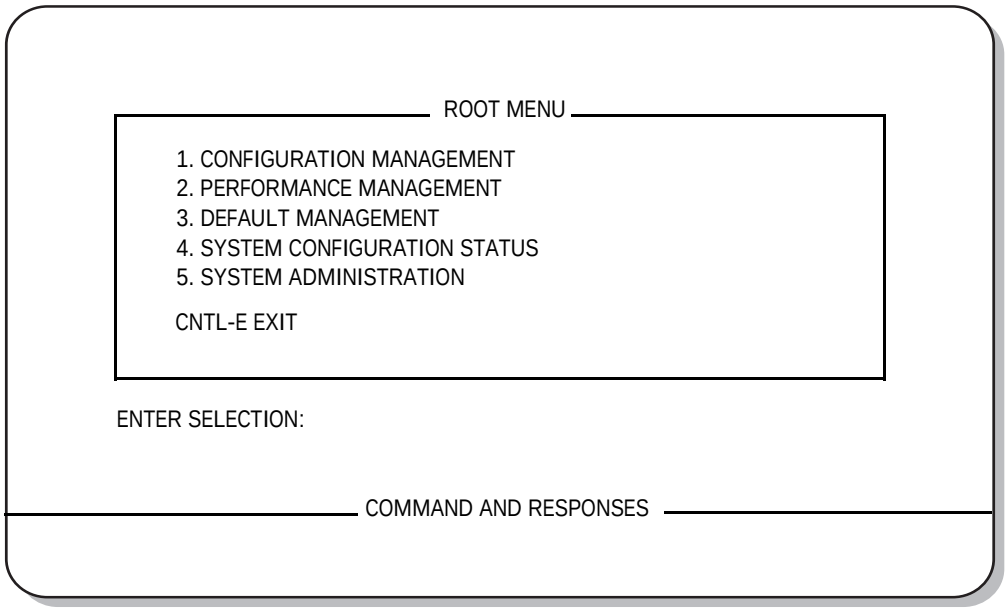


Figure 33. *Root Menu*

To view HXU-357 related screens in their proper format, the maintenance terminal needs to be fully VT100-compliant.

Various keyboard commands that can be used to navigate the Root menu are listed in Table 8.

Table 8. *Keyboard Commands*

Keyboard Command	Description
CTRL + D	Scroll the status buffer down a page
CTRL + E	Exit (return to "ID:" prompt)
CTRL + P	Return to previous menu
CTRL + R	Return to Root / Main Logon menu
CTRL + U	Scroll the status buffer up a page

The following steps are essential for setting up the HXU-357 for a basic configuration.

Step	Procedure
1	At the Shelf Status screen, type M to display the multiplexer logon prompt (ID:).
2	Type a valid password to display the Root menu (Figure 33 on page 60). The default password is `public`. PairGain recommends that you edit the default password for security. The password can be up to 30 characters with no spaces. See the System Administration submenu, selection 1 in Table 13 on page 67.
3	Type 1 to select the Configuration Management submenu (Figure 34 on page 62).
4	Refer to the configuration options shown in Table 9 on page 63 and configure the HXU-357 for your system application by typing the appropriate option keystrokes. The option keystrokes allow you to navigate through the submenus and make configuration choices. For example, typing 1, 1, 1, 2 selects Configuration Management, Configure DS3 Interface, Configure DS3 mode =, M13 mode.
5	Type CTRL + R to return to the Root menu.
6	Type 5 to select the System Administration submenu.
7	Refer to the system administration options shown in Table 13 on page 67 and configure the HXU-357 for your system application by typing the appropriate option keystrokes. For example, typing 5, 2, 1, selects System Administration, Change System Settings, Date = (MM/DD/YYYY).
8	Type CTRL + R to return to the Root menu. Make any other configuration selections you require.

The Shelf Status screen supports one active and one standby HXU-357 multiplexer. Both HXU-357 cards actively maintain a common database of user settings. If one card is removed, the standby card becomes the active card and automatically updates any new multiplexer card that is installed.

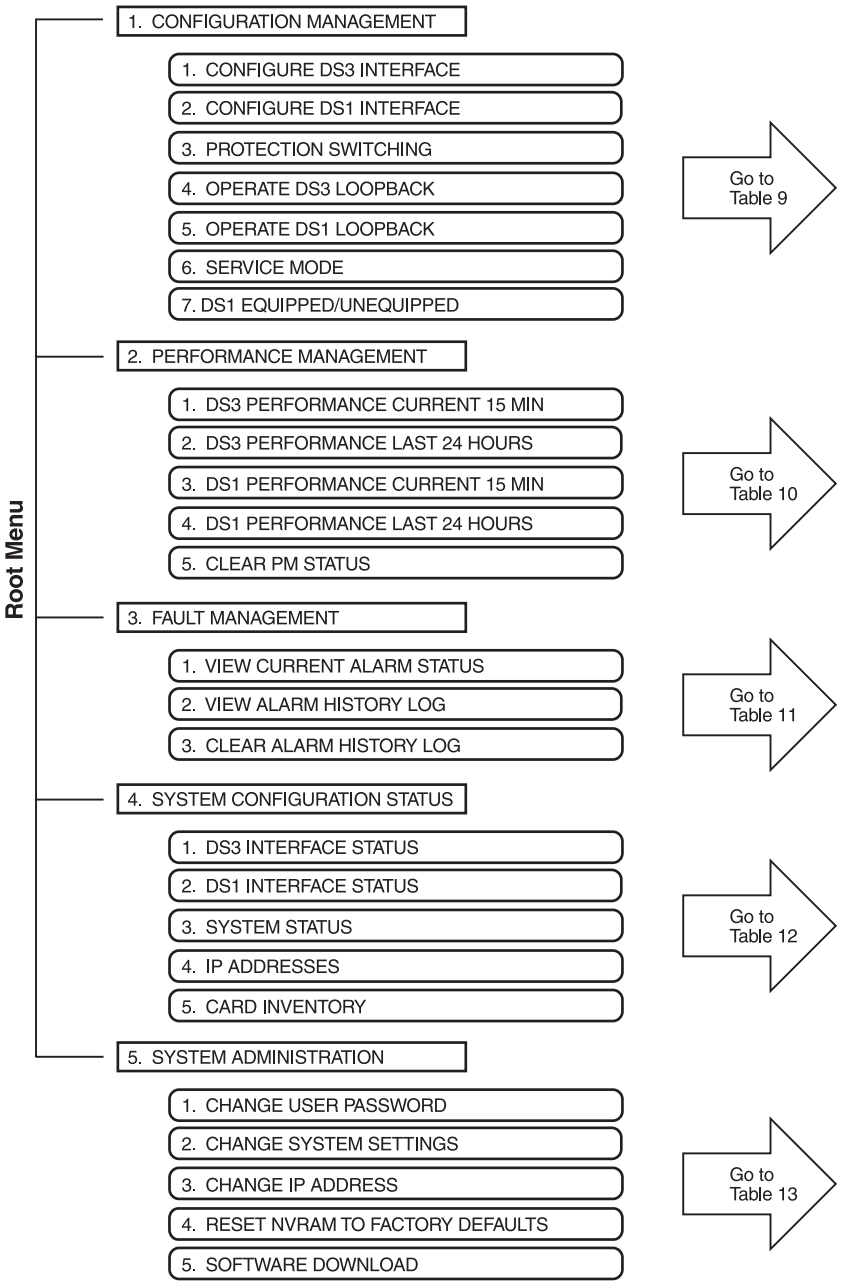


Figure 34. *Root Menu Options*

Table 9. *Configuration Management*

Type 1, 1 to select...	CONFIGURE DS3 INTERFACE
(See "Configuring the HXU DS3 Interface" on page 33.)	1 Configure DS3 mode = 1 C-Bit parity mode 2 M13 mode* 2 Configure DS3 line buildout 1 Set buildout to 0-50 ft.* 2 Set buildout to 50-450 ft. 3 Configure DS3 transmit timing 1 Set transmit timing to local* 2 Set transmit timing to loop 4 Configure DS3 BER threshold 1 Set threshold to $1x10^{-6}$ 2 Set threshold to $1x10^{-7}$ 3 Set threshold to$1x10^{-8}$ 4 Set threshold to $1x10^{-9}$*
Type 1, 2 to select...	CONFIGURE DS1 INTERFACE
(See "Configuring the HXU DS1 Interface" on page 34.)	0 All channels 1 thru 28 individual channel
These settings affect the HXU to HLU interface. If a standard HLU is used, always set this to the default selection.	1 Set DS1 line code CH# 1 2 12345678901234567890123456 78 Line code 1 Set to (A)MI 2 Set to (B)8ZS* A.....A 2 Set DS1 line buildout CH# 1 2 12345678901234567890123456 78 Line Bldout 1 Set to 0-133 ft.* 2 Set to 133-266 ft. 3 Set to 266-399 ft. 4 Set to 399-533 ft. 5 Set to 533-655 ft. 1111. 1
Type 1, 3 to select...	PROTECTION SWITCHING
An excessive number of protection switches causes an alarm that can only be cleared by this selection.	1 Protection mode 1 Allow protected mode 2 Switch traffic 1 Online card = Switch traffic card 3 Clear TMS 1 Clear TMS
* Default selection	

Table 9. *Configuration Management (Continued)*

Type 1, 4 to select...	OPERATE DS3 LOOPBACK
(See "Troubleshooting" on page 74).	1 Initiate facility loopback 2 Initiate terminal loopback 3 Initiate remote facility loopback 4 Release loopback*
Type 1, 5 to select...	OPERATE DS1 LOOPBACK
(See "Troubleshooting" on page 74).	0 All channels 1 thru 28 individual channel CH# 1 2 Loopback 12345678901234567890123456 78 Status F..... 1 Enable (F)acility loopback 2 Enable (T)erminal loopback 3 Enable (R)emote terminal loopback 4 Release loopback*
Type 1, 6 to select...	SERVICE MODE
(See "Placing the HXU DS3 Interface In Service" on page 33.)	1 DS3 service mode 1 Set to IN-SERVICE 2 Set to OUT-OF-SERVICE* 2 DS1 service mode 0 All channels 1 thru 28 individual channel Channel = CH# 1 2 Service 12345678901234567890123456 78 Mode I I I I . . . . 1 Set to (I)N-SERVICE 2 Set to (O)UT-OF-SERVICE*
Type 1, 7 to select...	DS1 EQUIP / UNEQUIP
(See "Placing the DS1 Interface In Service at the HXU" on page 41.)	Select DS1 channel 0 All channels 1 thru 28 individual channel Channel = CH# 1 2 EQPT 12345678901234567890123456 78 State U U U U . . . . 1 Set state to (E)QUIPPED 2 Set state to (U)NEQUIPPED*

* Default selection

Table 10. *Performance Management*

Type 2, 1 to select...	DS3 PERFORMANCE CURRENT 15 MINUTES
See "Viewing Performance at the HXU" on page 41.	Line code violations (CV) = Line errored seconds (LES) = P-bit code violations (PCV) = P-bit errored seconds (PES) = P-bit severely errored seconds (PSES) = C-bit code violations (CCV) = C-bit errored seconds (CES) C-bit severely errored seconds (CSES) = Severely errored framing seconds (SEFS) = Unavailable seconds (UAS) =
Type 2, 2 to select...	DS3 PERFORMANCE LAST 24 HOURS Line code violations (CV) = Line errored seconds (LES) = P-bit code violations (PCV) = P-bit errored seconds (PES) = P-bit severely errored seconds (PSES) = C-bit code violations (CCV) = C-bit errored seconds (CES) C-bit severely errored seconds (CSES) = Severely errored framing seconds (SEFS) = Unavailable seconds (UAS) Total switches =
Type 2, 3 to select... This only monitors the HXU-to-HLU interface. For more information, access the HLU Maintenance Terminal screens.	DS1 PERFORMANCE CURRENT 15 MINUTES Channel 1 2 3 4 5 6 7 ..... Errors = 0 0 0 0 0 0 0..... Error seconds 0 0 0 0 0 0 0 .....
Type 2, 4 to select... This only monitors the HXU-to-HLU interface.	DS1 PERFORMANCE LAST 24 HOURS Channel 1 2 3 4 5 6 7 ..... Errors = 0 0 0 0 0 0 0..... Error seconds 0 0 0 0 0 0 0 .....
Type 2, 5 to select... This only monitors the HXU-to-HLU interface.	CLEAR PM STATS 1 Clear all PM DS3 and DS1 status

Table 11. *Fault Management*

Type 3, 1 to select... (See Table 29 on page 89 for a listing of alarms reported by the HXU-357.)	VIEW CURRENT ALARM STATUS
Type 3, 2 to select...	VIEW ALARM HISTORY LOG
Type 3, 3 to select...	1 CLEAR ALARM HISTORY LOG

Table 12. *System Configuration Status*

Type **4**, **1** to select...	DS3 INTERFACE STATUS
(See "Viewing Status" on page 40.)	Operating mode = (C-bit / P-bit parity) Line code = B3ZS Line buildout = (0-50 ft. / 50 to 450 ft.) Transmit timing = (local / loop) BER threshold = (BER alarm setting) BER value = (current BER setting) Loopback = (none, facility, terminal, remote facility) Service mode = (IN-SERVICE / OUT-OF-SERVICE)
Type **4**, **2** to select...	DS1 INTERFACE STATUS
	Select channel (1-28 channel number) Channel = channel number Line code = AMI / B8ZS Line buildout = length in feet Loopback = (none, facility, terminal, remote facility) Service mode = (IN-SERVICE / OUT-OF-SERVICE)
Type **4**, **3** to select...	SYSTEM STATUS
	Protective mode = protected / unprotected On-line card = (A/B) Date = (MM/DD/YYYY) Time = (HH:MM:SS) System name = System 3190 System location = unknown location Contact person = default name
Type **4**, **4** to select...	IP ADDRESSES
These addresses must match those defined under the HMU. See "Setting the Local IP Address (Option A)" on page 28 and "Network Addresses" on page 94.	Local IP address = 0.0.0.0 Subnet mask = 255.255.255.0 Gateway IP address = 0.0.0.0 Trap IP address #1 = 0.0.0.0 (IP address used by HMU) Trap IP address #2 = 0.0.0.0 Trap IP address #3 = 0.0.0.0 Trap IP address #4 = 0.0.0.0 Local C-bit IP address = 0.0.0.0 (not used) Remote C-bit IP address = 0.0.0.0 (not used) C-bit subnet mask = 0.0.0.0 (not used)
Type **4**, **5** to select...	CARD INVENTORY
Card Inventory lists multiplexer hardware revision numbers, serial number, manufacture date, CLEI code, software revision and release date, and its hardware address.	M13 CCA420 = (#######) M13 CCA = (#######) M13 CCB = (#######) M13 CCP = (#######) M13 Serial # = (#######) Manufacture date = (MM/DD/YYYY) CLEI = (####) M13 software rev. = (#######) SW release date = (MM/DD/YYYY) MAC address = (####)

Table 13. *System Administration*

Type **5**, **1** to select...	CHANGE USER PASSWORD
(The default password is `public`.)	User password = The new password should consist of 30 alphanumeric characters or less. Enter new password:
Type **5**, **2** to select...	CHANGE SYSTEM SETTINGS
(See "Setting up System Administration" on page 32.)	**1** Date = (MM/DD/YYYY) Enter date: **2** Time = (HH:MM:SS) Enter time: **3** System name = Enter name: **4** System location = Enter location: **5** Contact person = Enter person:
Type **5**, **3** to select...	CHANGE IP ADDRESS
(See "Setting up System Administration" on page 32 and "Network Addresses" on page 94.)	**1** Local Ethernet IP address = 0.0.0.0 Enter address: **2** Subnet mask = 255.255.255.0 Enter mask: **3** Gateway IP address = 0.0.0.0 Enter address: **4** Trap IP address #1 = 0.0.0.0 (set to HMU local IP address) Enter address: **5** Trap IP address #2 = 0.0.0.0 Enter address: **6** Trap IP address #3 = 0.0.0.0 Enter address: **7** Trap IP address #4 = 0.0.0.0 Enter address: **8** Local C-bit IP address = 0.0.0.0 (not used) Enter address: **9** Remote C-bit IP address = 0.0.0.0 (not used) Enter address: **1** **0** C-bit subnet mask = 0.0.0.0 (not used) Enter mask:
Type **5**, **4** to select...	RESET NVRAM TO FACTORY DEFAULT
(See "HXU-357 Default Software Settings" on page 91.)	**1** Reset NVRAM Please read the caution in "Restoring HXU-357 Factory Defaults" on page 92 before proceeding.

Table 13. *System Administration (Continued)*

Type 5, 5 to select...	SOFTWARE DOWNLOAD
(See "Upgrading the Multiplexer Software" on page 87.)	Filename = 0.0.0.0 Server IP address = 0.0.0.0 (IP address of local HMU) 1 Set filename Set the download filename (maximum of 30 characters) 2 Set server IP address Set IP address (XXX.XXX.XXX.XXX) 3 Download controls 1 Start download 4 Start new program Warning system will reset 1 Start downloaded program

MANAGING ALARMS

The HiGain system reports alarms from the shelf, the line units, the fan assembly and the multiplexer unit.

HMU Alarms

The HMU-319 reports Critical, Major, and Minor alarms.

- CR: A critical alarm is generated if:
  - power to the shelf or one of the A/B feeds has been lost, causing the Visible and Audible Critical Alarms to be asserted.
  - shelf temperature exceeds 170°F / 77°C, causing the Visible and Audible Critical Alarms to be asserted.
  - the multiplexer is enabled, but not present.
  - the multiplexer reports a Critical alarm.
- MJ: A major alarm is generated if:
  - any line card issues a fuse alarm.
  - Shelf temperature exceeds 113°F / 45°C.
  - the multiplexer reports a Major alarm.
- MN: A minor alarm is generated if:
  - there is loss of sync on an HDSL loop.
  - there is loss of T1 signal at either the line unit or remote unit.
  - the HDSL loop margin falls below the selected margin threshold.
  - the multiplexer reports a Minor alarm.

HXU Alarms

The HXU-357 reports Critical, Major, Minor and Far-End alarms to the HMU.

- CRITICAL: The HXU reports a critical alarm if it detects:
  - a critical service-affecting fault.
  - more than four faulty DS1 inputs.
- MAJOR: A major alarm is generated if the HXU detects:
  - up to four faulty DSX-1 lines.
  - a major service-affecting fault.
- MINOR: The HXU reports a minor alarm if it detects:
  - a potential service-affecting fault condition.
  - a DS3 Far-End alarm.
  - a low-speed loopback.
  - a DS3 loopback.

- ABNORMAL: The HXU reports an Abnormal alarm if it detects:
  - DS3 Receive condition (LOS, BER, AIS or Idle).
  - DS1 transmit LOS condition.
  - Power A or Power B alarm.
- FAR END: The HXU reports a Far-End alarm if the far end of the DS3 has an alarm.

See Table 29 on page 89 for a list of alarms condition definitions.

When an Alarm Occurs

When any critical, major, or minor alarm occurs, the following events result:

- The HMU activates the appropriate audio and visual alarm relay circuits. These alarm relay circuits activate an external audio or visual alarm, if connected. See the shelf technical practice for external alarm wiring instructions.
- The appropriate alarm LEDs light on the HMU front panel.
- The management interface displays the alarm status on the Shelf Status screen (after the screen is updated).

To silence the alarm, do one of the following:

- Press the ACO push-button on the front panel of the HMU.
- Press the external ACO push-button (if installed).

The following events occur:

- The front panel ACO LED lights and remains lit until the original alarm is cleared or until another alarm occurs.
- The audio alarm relay circuits are disabled, causing any connected audio alarms to turn off.

Shelf Alarms for Multishelf Configurations

For multishelf configurations, the Network Status menu displays the alarm status for each shelf. The line unit ALM option must be enabled in order for the multishelf Network Status menu to report alarm status for a line unit.

The shelf alarm messages are listed in Table 14.

Table 14. *Shelf Alarm Messages*

Alarm Message	Description
ALARM	One or more alarm conditions exist on the shelf.
NORMAL	No alarm condition exists on the shelf.
UNKNOWN	Either an HMU malfunction exists on the shelf or an incompatible HMU software version has been installed.
BUSY	A user is already logged into the shelf management software.
BLANK	Empty slot or unknown plug.

Line Unit Alarms

The Shelf Status menu reports the alarm status for each line unit. This includes both physical alarms (LOS ALARM BUS and FUSE ALARM BUS) as well as alarm messages shown in Table 15.

The LOS ALARM BUS field on the Shelf Status menu indicates when any unmanaged HiGain line unit (or any other non manageable card installed in the shelf) is reporting a minor alarm on pin H of the line unit edge connector. Refer to the shelf and line unit technical practices for information on using pin H.

The FUSE ALARM BUS field on the Shelf Status menu indicates when any HiGain line unit (or any other card installed in the shelf) is reporting a fuse alarm on pin 10 of the line unit edge connector. Refer to the shelf and line unit technical practices for information on pin 10.

The line unit H1ES, H2ES, and DS1 Errored Seconds Threshold alarms are not supported by the Shelf Status menu. If any of these conditions exist on a line unit, the line unit status indicates NORMAL. For this reason, use of the line unit Errored Seconds Threshold alarm option is not recommended. Refer to the line unit documentation for instructions on setting the Errored Seconds Threshold option.

Table 15. *Line Unit Alarm Messages*

Alarm Message	Definition	Description
LOSW	Loss Of Sync Word	Loss of signal on an HDSL span.
RLOS	Remote Loss Of Signal	Loss of DS1 signal at the remote unit.
LLOS	Local Loss Of Signal	Loss of DSX-1 signal at the line unit.
MAL1, MAL2	Margin Alarm 1, Margin Alarm 2	Loop margin has dropped below the user-set, minimum threshold level.
NORMAL		No alarm condition exists.
UNKNOWN		Line unit failed to respond to status requests.

Enable the ALM (alarm) option of an unmanaged line unit to allow the unit to trigger an alarm on pin H of the shelf connector (the LOS Alarm Bus). A managed HLU initiates an HMU alarm message over the digital management bus between the HLU and HMU. An unmanaged HLU or a T1 repeater triggers the HMU alarm by driving the LOS Alarm Bus to ground. Refer to the line unit's documentation for instructions on enabling the ALM option.

CHANGING THE LOGON PASSWORD

The factory default password setting is `public`. You can change the password; however, if you forget the new password, you must return the HMU to PairGain for reprogramming.

In a multishelf configuration, you can set a password for each shelf. The password required to log onto the HMU Terminal Access Option management interface is the password for the shelf to which the terminal is physically connected. The status and SID of the shelf to which the terminal is connected is displayed in the first shelf field on the Network Status menu.

```
Shelf Status for: PairGain  (slot# - Alarm Status)
--------------------------------------------------------------------------------
 1 -                2 -                3 -                4 - LOSW
 5 -                6 -                7 -                8 -
 9 -               10 -               11 -               12 -
13 -               14 -               15 -               16 -
17 -               18 -               19 -               20 -
21 -               22 -               23 -               24 -
25 -               26 -               27 -               28 -
* = Slot Alarms Disabled                                 Mux -  NORMAL
--------------------------------------------------------------------------------
LOS Alarm Bus: NORMAL          FUSE Alarm Bus: NORMAL      FAN Alarm: ALARM
Critical Alarm: OFF            Major Alarm: OFF            Minor Alarm: ON
--------------------------------------------------------------------------------
                            A - Alarm Management    M - Mux
       N - Network Screen  O - Shelf Options  X - Logout  <CR> - Refresh Screen
Enter Line Unit Number or Select Option: O

!! CAUTION: THERE IS NO USER REMEDY FOR A FORGOTTEN PASSWORD !!
   THIS UNIT MUST BE RETURNED TO THE FACTORY FOR REPROGRAMMING IF THE PASSWORD IS
FORGOTTEN.

   ARE YOU SURE YOU WANT TO CHANGE THE PASSWORD? (Y/N)
   Enter (Y)es or (N)o
```

Figure 35. *Changing a Password from the Shelf Status Menu*

To change the logon password:

Step	Procedure
1	From the Shelf Status menu, simultaneously press **CTRL** + **P** (a hidden option). The system displays a warning message at the bottom of the screen and prompts you to confirm that you want to change the password.
2	Type **Y** but **do not** press **ENTER**. The following prompt appears at the bottom of the screen: `Enter old password:`
3	Type the existing password, and then press **ENTER**. The following prompt appears at the bottom of the screen: `Enter new password:`
4	Type the new password (maximum 20 alphanumeric characters, minimum 1), and then press **ENTER**. The following prompt appears at the bottom of the screen: `Retype new password:`
5	Type the new password again, and then press **ENTER**. The following prompt appears at the bottom of the screen: `Password changed`

LOGGING OFF

You can terminate a shelf session and log off in the following ways:

- Press X from the Shelf, Network, or Options menus.
- Leave the terminal keyboard inactive for 5 minutes.
- Disconnect the RS-232 cable from the craft port.

When a session terminates, the HMU returns to autobaud state where it waits for the next logon command.

In order to avoid delays while logging on in future sessions, always return to the HLU Main Menu screen in the current session before logging off or pressing ESC.

TROUBLESHOOTING

Figure 36 shows system loopbacks and test access points. Table 16 provides a legend for the various test points. You can easily access the various test points by installing a HiGain Test Card or through front panel jacks. See "Installing a HiGain Test Card" on page 75.

Removal and replacement of line units should not be your first approach to troubleshooting. You will lose important performance management information which may help you resolve a line problem. Before making a call to Product Support, read the Performance Management history and conduct voltmeter tests for leakage to determine if the source of trouble is a marginal line or a facility problem.

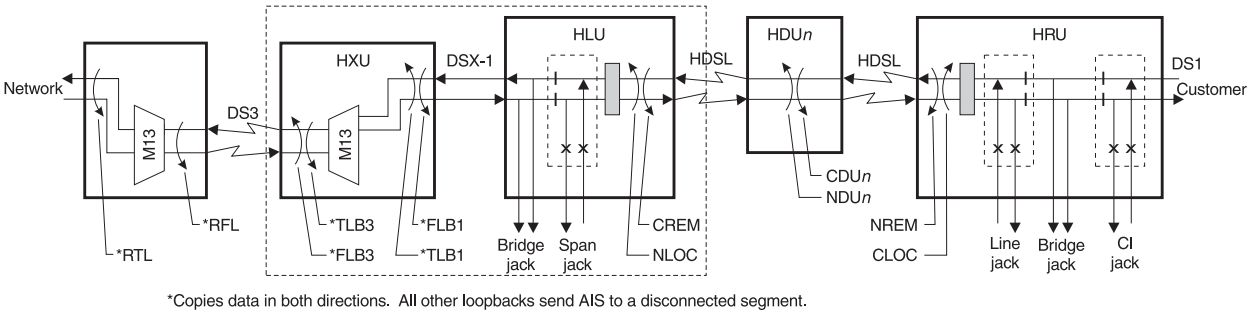


Figure 36. *System Loopbacks and Test Access*

Table 16. *Test Access Points*

Test Point	Loopback Definition
RTL[a] [b]	Remote terminal loopback from the far end DSX-1 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 5, 3). See Table 9 on page 63.
RFL[a] [b]	Remote facility loopback from the far end DS3 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 4, 3). See Table 9 on page 63.
TLB3[a] [b]	Terminal loopback to the customer at the DS3 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 4, 2). See Table 9 on page 63.
FLB3[a] [b]	Facility loopback to the network at the DS3 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 4, 1). See Table 9 on page 63.
FLB1[a] [b]	Facility loopback to the customer at the DSX-1 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 5, 1). See Table 9 on page 63.
TLB1[a] [b]	Terminal Loopback to the network at the DSX-1 line. Activated through the multiplexer unit (M option from the Shelf Status screen followed by the option sequence 1, 5, 2). See Table 9 on page 63.
CREM	Customer remote loopback is activated by selecting the line unit on the Shelf Status Screen and then the D selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.
NLOC	Network local loopback is activated by selecting the line unit on the Shelf Status screen and then the D selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.
CDU*n* [c]	Customer doubler loopback (where *n* = the number of the doubler) is activated by selecting the line unit on the Shelf Status screen and then the D selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.
NDU*n* [c]	Network doubler *n* loopback (where *n* = the number of the doubler) is activated by selecting the line unit on the Shelf Status screen and then the D selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.

Table 16. *Test Access Points (Continued)*

Test Point	Loopback Definition
NREM	Network remote loopback is activated by selecting the line on the Shelf Status Screen and then the **D** selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.
CLOC	Customer local loopback is activated by selecting the line of the Shelf Status screen and then the **D** selection (Loopback Mode) from the HLU Maintenance Terminal Main Menu.

(a) To perform this loopback command, the DS3 and DS1 ports must be configured as Out-of-Service.
(b) Copies data in both directions. All other loopbacks send AIS to a disconnected segment.
(c) The number of the doubler.

All affected lines must be Unequipped and Out-of-Service at the multiplexer during loopback testing to prevent line alarm reporting and unwanted protection switching from occurring.

INSTALLING A HIGAIN TEST CARD

The HiGain Test Card (HTC) provides a means to quickly check CO and field circuits by performing loopback, loop-through, short and open testing of Tip and Ring transmit and receive pairs. The HTC connects the internal DSX-1 signal to the field pairs terminating at the main distribution frame. Using this card allows the connection of external equipment to the HXU-357 at the DSX-1 interface. See "HiGain Test and Loop-through Card" on page 8 for a description of the HTC.

Step	Procedure
1	Plug the HTC-319 into the shelf slot whose circuits you want to test.
2	Set the four-position slide switch (S1) on the HTC-319 to the type of test you want to perform (LOOP BACK, LOOP THRU, SHORT, or OPEN). Refer to Figure 36 on page 74 for information on Wideband System 3190 test points.
3	Monitor the circuits at the corresponding test points on the card. The number of each test point corresponds to the edge connector pin of the circuit under test.
4	Repeat steps 2 and 3 as needed.

APPENDIX A - SYSTEM SPECIFICATIONS

INTERFACE SPECIFICATIONS

Figure 37 shows the wirewraps for the TB1 power connector, which are accessible from the backplane when the connector cover is removed.

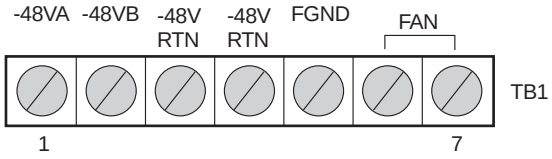


Figure 37. *Power Connector (TB1)*

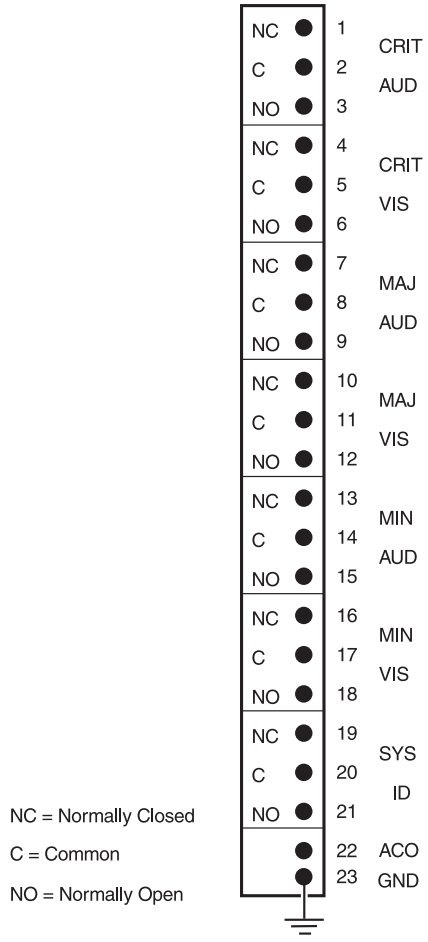


Figure 38. *Alarm Relays (TB2)*

All relay contacts are rated at 48 Vdc @ 1A.

Table 17. *Relay Specifications*

Parameter	
Rated Load	0.5A at 125 Vac
Maximum switching capacity	62.5 VA, 33W
Contact type	bifurcated for high sensitivity

Table 18. *RJ-45 Pinout for 10BASE-T Interface to HMU (J34)*

Pin	Description	
1	+XMT	output
2	-XMT	output
3	+RCV	input
6	-RCV	input
Cable must be shielded category 5.		

Table 19. *RS-232 DB-25 OSS Interface to HMU (DTE) - Male Connector*

Pin	Description	
2	TD	output
3	RD	input
5	CTS	input
6	DSR	input
7	GND	input
15	TXCLK (DTE)	input
17	RXCLK (DCE)	input
20	DTR	output
24	TXCLK (DCE)	output
Cable must be shielded.		

Table 20. *RS-232 DB-25 HMU Craft Interface (DCE) - Female Connector*

Pin	Description	
2	RD	output
3	TD	input
4	DTR	input
5	GND	input
6	DSR	output
Cable must be shielded.		

Table 21. *RS-232 DB-25 AUX Interface to HMU (DTE)*

Pin	Description	
2	TD	output
3	RD	input
6	DSR	input
7	GND	input
20	DTR	output
Cable must be shielded.		

The RS-232 DB-25 AUX interface should not be used when an HXU-357 is present in the shelf.

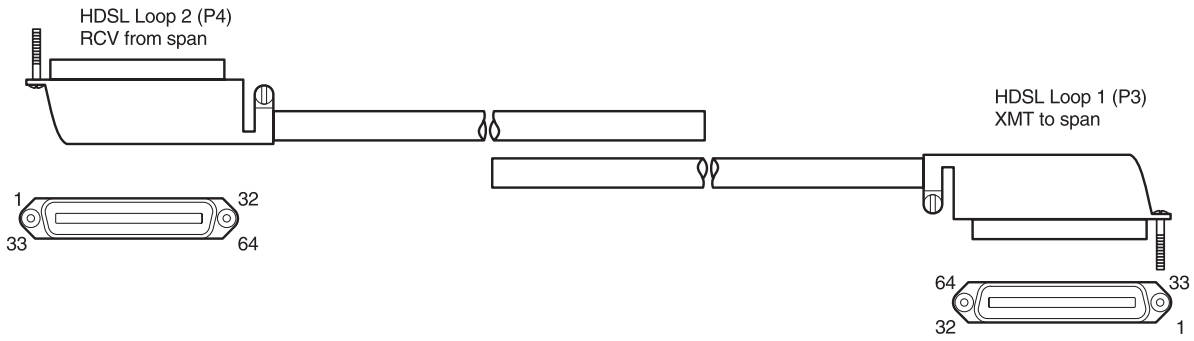


Figure 39. *HDSL Loop Cable and Connector*

P3 and P4 HDSL cable connectors require a female mating connector (157-82640-16).

Table 22. *HDSL Loop Cable Connector Pinout and Color Code*

	Ring Color Code	Ring Number	Cable Pin Number	Cable Pin Number	Tip Number	Tip Color Code
BINDER #1	Blue/White	1	1	33	1	White/Blue
	Orange/White	2	2	34	2	White/Orange
	Green/White	3	3	35	3	White/Green
	Brown/White	4	4	36	4	White/Brown
	Slate/White	5	5	37	5	White/Slate
	Blue/Red	6	6	38	6	Red/Blue
	Orange/Red	7	7	39	7	Red/Orange
	Green/Red	8	8	40	8	Red/Green
	Brown/Red	9	9	41	9	Red/Brown
	Slate/Red	10	10	42	10	Red/Slate
	Blue/Black	11	11	43	11	Black/Blue
	Orange/Black	12	12	44	12	Black/Orange
	Green/Black	13	13	45	13	Black/Green
	Brown/Black	14	14	46	14	Black/Brown
	Slate/Black	15	15	47	15	Black/Slate
	Blue/Yellow	16	16	48	16	Yellow/Blue
	Orange/Yellow	17	17	49	17	Yellow/Orange
	Green/Yellow	18	18	50	18	Yellow/Green
	Brown/Yellow	19	19	51	19	Yellow/Brown
	Slate/Yellow	20	20	52	20	Yellow/Slate
	Blue/Violet	21	21	53	21	Violet/Blue
	Orange/Violet	22	22	54	22	Violet/Orange
	Green/Violet	23	23	55	23	Violet/Green
	Brown/Violet	24	24	56	24	Violet/Brown
	Slate/Violet	25	25	57	25	Violet/Slate
BINDER #2	Blue/White	26	26	58	26	White/Blue
	Orange/White	27	27	59	27	White/Orange
	Green/White	28	28	60	28	White/Green
			29	61		
			30	62		
			31	63		
			32	64		

HXU-357 MULTIPLEXER CARD SPECIFICATIONS

DS3 Interface (Multiplexer)

Cable	728A RG-6/U
Number of duplex lines	1 per chassis
Line rate	44.736 megabits/s ±20 ppm
Line code	B3ZS
Line impedance	75Ω ±5Ω, unbalanced
Pulse amplitude	0.36V to 0.85V (meets TR-TSY-000499 requirements)
Jitter generation	≤ 0.3 UI rms
DS3 span buildout	0 to 450 ft. (0 to 137.2m)

DS1 Internal Interface

Number of lines	28
Line rate	1.544 megabits/s ±130 ppm
Line code	AMI/B8ZS selectable (per channel)
Line impedance	100Ω ±5%, balanced
Pulse amplitude	3.0V ±0.6V
Jitter generation	<0.3 UI rms (1 UI = 648 ns)
DS1 span buildout	1 to 655 ft. (.3 to 199.6m)
Cable	ABAM or equivalent

Power Requirements

Voltage	-41.5 to -56.3 Vdc
Power consumption	26W typical

DSX-1 INTERFACE (CO SIDE)

Output Level	6V peak to peak, pre-equalized for 0 to 655 ft. of ABAM cable
Input Level	+1.5 dB to -7.5 dB DSX
Impedance	100Ω
Line Rate	1.544 Mbps ±200 bps
Line Format	AMI, B8ZS, or ZBTSI
Frame Format	ESF, SF, and unframed

HDSL TRANSMISSION

Line Code	784 kbps 2B1Q
Transmission	Dual duplex
Media	Two non-loaded, two-wire, metallic cable pairs
Output Signal	+13.5 dBM ±0.5 dB into 135Ω
Impedance	135Ω
Maximum Provisioning Loss	35 dB at 196 kHz, 135Ω

SYSTEM

One-way DS1 Delay	<200 µs (HLU and HRU) + <80 µs per doubler + HXU delay
Wander (looped)	0.3 UI maximun (1 UI = 648 ns)
Narrow Wideband Jitter	0.3 UI maximum
Narrowband Jitter (looped)	0.1 UI maximum

SPAN

Each Span	CSA design rules: 9 kft @ 26 AWG or 12 kft @ 24 AWG, no load coils, bridged taps per CSA guidelines
Number of Spans	5 total, 4 line-powered

TEST AND LOOPBACK

DSX-1 Test Access	210 Bantam jacks, bridging, splitting/line, and splitting/drop
Alarms	ACO and visual alarms: Major, Minor, Critical
Loopbacks	Supports all standard in-band and out-of-band loopback modes

USER INTERFACES

HMU Craft Port	RS-232 (DCE)
OSS Interface	RS-232 (DTE) on HMS-357 backplane

ENVIRONMENTAL SPECIFICATIONS

The Wideband System 3190 is designed to meet NEBS CO requirements.

Temperature (Min./Max.)

Operational	32° to 122°F (0° to +50°C)
Non-operating	-40° to 140°F (-40° to +60°C)
Operational Altitude	197 ft. (60m) below sea level to 13,000 ft. (3962m) above sea level
Relative Humidity	
Operational	5 to 85% non-condensing
Short-term	5 to 90%
Non-operating	5 to 95%
Electromagnetic Compatibility	FCC Part 15, Class A, Subpart J; Bell TR EOP 000063, Section 4.10

PHYSICAL SPECIFICATIONS

Dimensions	12-$^{1}/_{8}$" H x 21-$^{3}/_{8}$" W x 11-$^{3}/_{4}$" D (30.8 x 54.3 x 30.5 cm)
Weight (unloaded)	37 lbs. (16.78 kg)
Chassis per 7-foot Rack	4
DS1 Capacity	28 lines
Power Feeds	-48 Vdc, A and B

POWER SPECIFICATIONS

CO Supply	-48 Vdc nominal (-41.5 Vdc to -56.5 Vdc)
Line Power to HDSL Remote Unit	-140 Vdc or ±112 Vdc

To determine the power requirements of a CO rack, use the guidelines in the following tables:

- Table 23 on page 83 describes the power requirements of various line configurations (A through F) typically used in a network.
- Table 24 shows the power requirements of the common equipment needed for a protected HMS-357.
- Table 25 combines this information into the system power requirements for each configuration. Although the power requirements of the system can vary greatly depending on the line makeup, in practice the line makeup seldom requires more than 30% of the lines to have doublers. With this type of provisioning, power limitations due to CO heating is seldom a factor.

Table 23. *HDSL Transport Line Configurations*

Line Type	HiGain Line Units	HiGain Doubler Units	Number of Doublers per Line	HiGain Remote Units	Current Draw per Line (mA)	Power Consumption per Line (Watts)	Power Dissipation per Line (Watts)
A	HLU-319 List 5		0	HRU-402 List 1	182.0 typ. 200.2 max.	7.7 typ. 8.5 max.	4.5 typ. 4.9 max.
B	HLU-319 List 5		0	HRU-411 List 1	193.0 typ. 212.3 max.	8.2. 9.0 max.	5.2 typ. 5.7 max.
C	HLU-319 List 5	HDU-409 List 2	1	HRU-402 List 1	294.0 typ. 323.4 max.	12.5 typ. 13.8 max.	5.9 typ. 6.5 max.
D	HLU-319 List 5	HDU-409 List 2	2	HRU-402 List 1	410.0 typ. 451.0 max.	17.8 typ. 19.1 max.	7.1 typ. 7.8 max.
E	HLU-319 List 5	HDU-409 List 2	3	HRU-402 List 1	539.0 typ. 592.9 max.	22.9 typ. 25.2 max.	8.1 typ. 8.9 max.
F	HLU-319 List 5	HDU-409 List 2	4[(a)]	HRU-402 List 1	557.0 typ. 612.7 max.	23.7 typ. 26.1 max.	8.0 typ. 8.8 max.

(a) Requires a locally powered HRU.

Table 24. *Common Equipment Power Consumption*

Equipment	Current Draw (mA)	Power Consumption (Watts)	Power Dissipation (Watts)
HXU-357 List 1 (2 units)	353 typ. 612 max.	15 typ. 26 max.	15 typ. 26 max.
HMU-319 List 7	118 typ. 141 max.	5 typ. 6 max.	5 typ. 6 max.
HFA-357	250 typ. 306 max.	11 typ. 13 max.	12 typ. 13 max.
Total System Power Consumption	1074 typ. 1671 max.	46 typ. 71 max.	47 typ. 71 max.

Table 25 shows the NEBS requirements for proper operation of the equipment. Table 26 shows power consumption and dissipation calculations for multisystem configurations, assuming a typical six-lineup floor plan (Figure 10 on page 14). The NEBS requirements for your particular floor plan may vary from the Table 26 examples.

Table 25. *Wideband System 3190 with Full Compliment of Card Types and Dual Multiplexers*

Line Type as defined in Table 23	List 1: A/B Fuse Split Feed @120%(Amps)	List 2: A/B Diode Feed @120% (Amps)	Current Draw from Office Battery (Amps)	Power Consumption (Watts)	Power Dissipation (Watts)
A	5	9	6.2 typ. 7.3 max.	262 typ. 309 max.	172 typ. 208 max.
B	6	9	6.5 typ. 7.6 max.	275 typ. 324 max.	192 typ. 230 max.
C	10	13	9.3 typ. 10.7 max.	396 typ. 456 max.	212 typ. 253 max.
D	11	17	12.5 typ. 14.3 max.	533 typ. 607 max.	246 typ. 290 max.
E	12	22	16.2 typ. 18.3 max.	687 typ. 776 max.	274 typ. 320 max.
F	12	23	16.7 typ. 18.8 max.	709 typ. 801 max.	271 typ. 317 max.

These configurations require fans to comply with the 230W heat dissipation rating of our chassis.

These configurations do not meet NEBS. The current feed should be limited to 20A.

Table 26. *Power Consumption and Power Dissipation for Multisystem Configurations*

Line Type as defined in Table 23	Four Systems (Watts)		Five Systems (Watts)		Six Systems (Watts)	
	Consumption	Dissipation	Consumption	Dissipation	Consumption	Dissipation
A	1048 typ. 1236 max.	688 typ. 833 max.	1310 typ. 1545 max.	859.4 typ. 1042 max.	1572 typ. 1855 max.	1031 typ. 1250 max.
B	1101 typ. 1294 max.	768 typ. 922 max.	1376 typ. 1618 max.	960 typ. 1153 max.	1851 typ. 1941 max.	1152 typ. 1383 max.
C	1583 typ. 1824 max.	850 typ. 1012 max.	1978 typ. 2280 max.	1062 typ. 1265 max.	2374 typ. 2736 max.	1275 typ. 1518 max.
D	2131 typ. 2428 max.	893 typ. 1159 max.	2664 typ. 3035 max.	1229 typ. 1448 max.	3197 typ. 3642 max.	1475 typ. 1738 max.
E	2747 typ. 3105 max.	1095 typ. 1282 max.	3434 typ. 3882 max.	1369 typ. 1602 max.	4121 typ. 4658 max.	1643 typ. 1923 max.
F	2837 typ. 3204 max.	1084 typ. 1270 max.	3546 typ. 4005 max.	1355 typ. 1587 max.	4255 typ. 4808 max.	1626 typ. 1904 max.

These configurations require fans to meet NEBS. (230W of heat dissipation per chassis, 948W per rack)

These configurations do not meet NEBS. The rack is limited to 1275W of heat dissipation.

For a 0°C to 50°C (32°F to 122°F) operating environment, a fan assembly is required for any of these situations:

- One system with ≥ 230W power dissipation
- Four systems with ≥ 948W power dissipation
- Extended temperature operation (65°C or 149°F)

No shelf configuration should exceed a total power dissipation ≥ 1275W.

COMPLIANCE STANDARDS

Table 27. *Compliance Standards*

Standard	Description
GR-499-CORE Issue 1, December 1995	Transport System Generic Requirements (TSGR): Common Requirements
GR-63-CORE Issue 1, October 1995	New Equipment-Building System (NEBS) Generic Equipment Requirements
GR-1089-CORE Issue 1, July 1994 Rev 1, December 1996	Electromagnetic Compatibility and electrical Safety Generic Criteria for Network Telecommunication Equipment
SR-3580, Level 3 NEBS	Bellcore's highest level of compliance for CO environment
TR-NWT TA-TSY-000199 Issue 4, November 1988	Specifications of Memory Administration Messages at the Operations System/Network Element Interface, Bellcore (TL1)
GR-454 TR-TSY-000454 Issue 1, July 1988	Supplier Documentation for Network Elements
FR-NWT-000482 TR-TSY-000482	OTGR, Operations Applications Messages Directory (TL1)
TR-TSY-000825 Issue 2, February 1988.	OTGR, User System Interface - User System Language, Bellcore (Craft interface and is compatible with TL1)
TR-TSY-000827 Issue 1, November 1988	OTGR, Generic Operations Interface: Non-OSI Communications Architecture, Bellcore (TPM1 is the minimum OSI stack with TP over X.25 and is used to carry TL1)
GR-833 TR-TSY-000833 Issue 2, February, 1988	OTGR, Operations Applications Messages - Network Maintenance: Network Element and Transport Surveillance Messages, Bellcore. (TL1)
GR-78 TR-NWT-000078 Issue 3, December 1991	Generic Physical Design Requirements for Telecommunication Products and Equipment
TR-TSY-000191 Issue 1, May 1986	Alarm Indication Signal Requirements and Objectives
PUB 49001 July 1982	Requirements for Compatibility or Telecommunication Equipment with Bell Systems Surveillance and Control Systems
PUB 49002 July 1982	General Remote Surveillance Philosophy and Criteria for Interoffice Transmission Equipment
ANSI T1.102-1987	Digital Hierarchy-Electrical Interfaces
ANSI T1.404-1989	Carrier to Customer Installation - DS3 Metallic Interface
ANSI T1.107-1988 ANSI T1.107a-1990	American National Standard for Telecommunication- Digital Hierarchy- Formats Specifications (DS3 format)

APPENDIX B - TECHNICAL REFERENCE

COMPATIBILITY

The Wideband System 3190 is an open platform based on the standard 3192 line card. As such, all 3192-compliant line cards operate within this shelf. However, due to FCC and NEBS testing guidelines, compliance is not guaranteed with all vendors when tested as a system. PairGain has verified that all its standard line units are in compliance with these guidelines when tested as a system in our HMS-357 shelf. It is the customer's responsibility to verify that other vendor's equipment meets system-level compliance when installed in our chassis.

HIGAIN SYSTEM PRODUCTS

Table 28. *HiGain System Products*

Model Name	Description
Line Units	
HLU-319 List 1	HDSL HiGain line unit for 3190 T1 live interface, 3190 mechanics
HLU-319 List 2x	HDSL HiGain line unit for 3190 T1 live interface, 3190 mechanics
HLU-319 List 5x[(a)]	HDSL HiGain line unit for 3190 T1 live interface, 3190 mechanics
Doubler Units	
HDU-409[(a)]	HDSL HiGain doubler unit for 239 T1 repeater mechanics
HDU-407	HDSL HiGain doubler unit for DDS/ISDN single-slot
HDU-404	HDSL HiGain doubler unit for 400 mechanics, low power
HDU-451	HDSL HiGain doubler unit for 400 mechanics, low power
HDU-437	HDSL HiGain doubler unit for DDS/ISDN
Remote Units	
HRU-402[(a)]	HDSL HiGain remote unit for 200 mechanics
HRU-411	HDSL HiGain remote unit for 200 mechanics, PCS support
HRU-412	HDSL HiGain remote unit for 400 mechanics
Central Office Equipment	
HMS-357 List 1 or List 2[(a)]	Wideband System 3190 Chassis
HFA-357 List 1[(a)]	Optional fan assembly
HXU-357 List 1[(a)]	HiGain multiplexer unit for DS3
HMU-319 List 7 or List 7A[(a)]	HiGain management unit

(a) Recommended unit for Wideband System 3190.

UPGRADING THE MULTIPLEXER SOFTWARE

When performing a software download in a protected system, the software must be loaded to both multiplexer modules individually. Upon completion of a download, the system switches to the standby multiplexer module, at which time a second download must be initiated to complete a full system upgrade.

Downloading a new version of multiplexer software assumes the following conditions:

- A serial connection between the maintenance terminal and the local HMU (the HMU installed in the same chassis as the multiplexer)
- A 10BASE-T Ethernet connection between the multiplexer and the HMU
- The AUX port is set up to communicate with the multiplexer
- A communications package on the maintenance terminal, such as HyperTerminal or ProComm, using XMODEM

Accessing the System Administration Screen

Step	Procedure
1	Upon connecting to the HMU-319, the TL1 prompt (<), appears.
2	Type **TAO** and press **ENTER** to invoke TAO.
3	Type the password and then press **ENTER**. The Network Status menu appears. If the Shelf Status menu appears instead, this indicates that the HMU is managing a single shelf and the HMU IP address has not been set. Set the HMU IP address before proceeding. See "Setting the Local IP Address (Option A)" on page 28.
4	Type the number of the shelf (1 through 32) and then press **ENTER**. The Shelf Status menu appears.
5	From the Shelf Status menu, select **M** to logon to the multiplexer.
6	At the multiplexer logon prompt (ID:), type a valid password to display the Root menu.
7	Select **5**, System Administration.

Verifying the Multiplexer IP Address

Step	Procedure
8	Select **3**, Change IP Address (Table 13 on page 67).
9	Verify that Local Ethernet IP address (selection **1**) and Subnet Mask (selection **2**) are properly set up.

Setting the Download Filename

Step	Procedure
10	Press CTRL + P to return to System Administration, and then select 5, Software Download.
11	Select 1 to enter the download file name. This is the name assigned to the software file on the personal computer that is connected to the local HMU craft port. Up to 30 characters are allowed for a file name. It must be a DOS name with an extension of .HEX, .HX or .X.

Setting the Server IP Address

Step	Procedure
12	Press CTRL + P to return to System Administration, and then select 5, Software Download.
13	Select 2 and type the local (HMU) IP address.

Beginning the Software Download

Step	Procedure
14	Press CTRL + P to return to System Administration, and then select 5, Software Download.
15	Select 3, Start Download, to go to the Software Download screen and then select 1 to begin the download. At this time, the HMU displays the message with sync characters: `Begin Transferring Mux File`
16	Begin the XMODEM download. You have 2 minutes to initiate the download of the software file. After a successful download, the following message is displayed: `Download Done`. The loaded program now resides in RAM and must be burned into Flash RAM in order to run it.

Burning in the Flash RAM to Complete the Software Update

Step	Procedure
17	Press CTRL + P to return to System Administration, and then select 5, Software Download.
18	Select 4, Start New Program, and then select 1 to start the downloaded program. This causes an HXU reset and a protection switch to the standby HXU. The standby HXU now becomes the active HXU.
19	Repeat the entire download procedure for the other HXU.

ALARMS

Table 29. *Alarms*

Alarm String	Channel	Condition and/or its Source
Critical Alarm	n/a	Traffic-affecting; five or more DS1 input faults; DS3 receive or transmit failure, DS3 receive LOS.
Major Alarm	n/a	Traffic-affecting; four or less DS1s.
Minor Alarm	n/a	Non traffic-affecting (A/B power supply fault, removal of the standby multiplexer, fault in standby multiplexer, configuration mismatch, software revision mismatch, too many protection switches between the multiplexers, DS1 and DS3 terminal and facility loopbacks).
Abnormal	n/a	All LOSs, DS3 receive (Idle, BER, AIS).
Far-end Alarm	n/a	Received yellow, FEAC alarm codes.
Online Card	n/a	Active card in alarm.
Offline Card	n/a	Standby card in alarm.
MPU Reset	n/a	Hardware reset of the card.
DS1 Transmit Loss of Signal	1 - 28	DS1 from HLU is not active.
DS1 Receive Loss of Signal	1 - 28	DS1 from the DS3 is not active.
DS1 Transmit Fault	1 - 28	DS1 signal transmitted is in error.
DS1 Receive Fault	1 - 28	DS1 signal received is in error.
DS1 Terminal Loopback	1 - 28	DS1 port is looped back to DS3 at multiplexer.
DS1 Facility Loopback	1 - 28	DS1 port looped back to HLU at multiplexer.
DS2 Receive out of Frame Quad 1	n/a	Ports 1-4 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 2	n/a	Ports 5-8 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 3	n/a	Ports 9-12 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 4	n/a	Ports 13-16 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 5	n/a	Ports 17-20 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 6	n/a	Ports 21-24 internal to HXU have lost frame. Check C-bit parity.
DS2 Receive out of Frame Quad 7	n/a	Ports 25-28 internal to HXU have lost frame. Check C-bit parity.
Protection Switch	n/a	A momentary alarm generated when a switch to protection has occurred.
DS3 Receive Loss of Signal	n/a	DS3 detects a loss of signal.
DS3 Receive Failure	n/a	DS3 detects a failure.
DS3 BER Threshold Crossing	n/a	DS3 errors exceed the set BER threshold.
DS3 Receive AIS	n/a	AIS pattern (all ones) has been detected in the DS3 Receive traffic.
DS3 Receive Idle	n/a	IDLE pattern has been detected in the DS3 Receive traffic.
DS3 TX Failure	n/a	DS3 transmit clock failure.
DS3 Terminal Loopback	n/a	The DS3 signal is looped back to the DS1s.
DS3 Facility Loopback	n/a	The DS3 signal is looped back to the DS3.

Table 29. *Alarms (Continued)*

Alarm String	Channel	Condition and/or its Source
Reserved	n/a	Reserved for future use.
Card A	n/a	Multiplexer in slot A is the source of local alarms.
Card B	n/a	Multiplexer in slot A is the source of local alarms.
Power Input A	n/a	Power source A failure.
Power Input B	n/a	Power source B failure.
Card Removed	n/a	The standby card has been removed.
Card - Card Comm	n/a	Multiplexer communication between slot A and slot B.
Configuration Mismatch	n/a	Detection of a configuration mismatch between the multiplexer cards.
Excessive Switching	n/a	More than three protections switches within 10 minutes.
Yellow Alarm	n/a	Receiving yellow alarm on DS3.
Far-end DS3 Equipment (Service-affecting)	n/a	FEAC far-end DS3 alarm. (C-Bit mode only)
Far-end DS3 Loss of Signal	n/a	FEAC far-end DS3 loss of signal. (C-Bit mode only)
Far-end DS3 Out of Frame	n/a	FEAC far-end DS3 loss of frame. (C-Bit mode only)
Far-end DS3 Receive AIS	n/a	FEAC far-end DS3 receive AIS. (C-Bit mode only)
Far-end DS3 Receive Idle	n/a	FEAC far-end DS3 receive IDLE. (C-Bit mode only)
Far-end DS3 Equipment (Non Service-affecting)	n/a	FEAC far-end DS3 equipment failure. (C-Bit mode only)
Far-end Common Equipment	n/a	FEAC far-end DS3 common equipment. (C-Bit mode only)
Far-end DS1 Multiple Loss of Signal	n/a	FEAC far-end DS3 multiple loss LOS. (C-Bit mode only)
Far-end DS1 Equipment (Service-affecting)	n/a	FEAC far-end DS1 equipment failure. (C-Bit mode only)
Far-end DS1 Single Loss of Signal	n/a	FEAC far-end DS1 LOS. (C-Bit mode only)
Far-end DS1 Equipment (Non Service-affecting)	n/a	FEAC far-end DS1 equipment failure. (C-Bit mode only)
Adjacent Card Failure	n/a	Redundant HXU card failure.
Network Configuration	n/a	Momentary alarm generated after a network configuration parameter has been modified.
Software Revision Mismatch	n/a	A fault occurs on the online card.

HXU-357 DEFAULT SOFTWARE SETTINGS

Table 30. *HXU-357 Default Software Settings*

Name or Item	Description	Default
DS3 operating mode	Normal operating mode is C-Bit	M13 mode
DS3 line buildout	Selectable DS3 cable length	0-100 feet
DS3 transmit timing	Selectable local (internal clock) or looped timing (external data)	Local (internal)
DS3 service mode	In-Service: normal operation Out-of-service: configuration, maintenance to perform loopbacks	Out-of-service
DS3 facility loopback	DS3 loopback toward the span	Disabled
DS3 terminal loopback	DS3 loopback toward the T1 facility	Disabled
DS3 remote facility loopback	DS3 loopback toward the span at the remote multiplexer	Disabled
DS1 line coding	Selectable to AMI or B8ZS	B8ZS
DS1 line buildout	Selectable cable length to DSX cross-connect	0-133 ft.
DS1 service mode	In-Service: normal operation Out-of-Service: configuration, maintenance to perform loopbacks	Out-of-service
DS1 equipped or unequipped state	Equipped (reports alarms) Unequipped (no alarm reporting)	Unequipped
DS1 facility loopback	Loopback toward the T1 facility	Disabled
DS1 terminal loopback	DS1 loopback toward the DS3 span	Disabled
DS1 remote terminal loopback	DS1 loopback toward the span at the remote multiplexer	Disabled
Password	Up to 30 alphanumeric characters long (not case-sensitive)	`public`
Date	Month/Day/Year, 20 days from fully charged condition (fully charged battery backup, 4 hours)	
Time	Hours:Minutes:Seconds, 20 days from fully charged condition (fully charged battery backup, 4 hours)	
BER (Bit Error Rate)	Selectable, four rates (10^{-6} 10^{-7} 10^{-8} 10^{-9})	10^{-9}
IP addresses	Local, subnet, gateway, and trap addresses	000.000.000.000
Protection mode	System dynamically determines protection mode. One card installed (unprotected), two cards installed (protected).	System-dependent
On-line card	Upon initial power up, the first card powered-up determines the on-line card.	If powered at the same time, A is the active multiplexer.

RESTORING HXU-357 FACTORY DEFAULTS

Although HXU-357 factory defaults can be restored (one multiplexer at a time) using the following procedure, we do not recommend it for systems that are fully configured and operational. This procedure will disrupt IP-based functions and may result in the loss of customer data.

Step	Procedure
1	From the Shelf Status screen, type **M** to log onto the HXU-357.
2	At the prompt, enter the password to access the HXU-357 Root Menu. The default password is `public`.
3	Type **5** for System Administration.
4	Type **4** to reset the non-volatile RAM.
5	Type **1** to reset to the factory defaults.
6	Press **CTRL** + **R** to return to the Root Menu.

HXU-357 DS1 / DS3 INTERFACE MODE DESCRIPTIONS

The HXU-357 DS1 interface (Table 31) must be configured as Unequipped and Out-of-Service to prevent alarm reporting and to allowing changing of DS1 parameters during installation.

The HXU-357 DS3 interface (Table 32) requires no equipping. To perform DS3 maintenance loopbacks and change DS3 parameters, the DS3 interface must be configured as Out-of-Service.

Table 31. *DS1 Interface Mode Descriptions*

Equipped State	Service State	DS1 Mode Description
Equipped	Out-of-Service	STANDBY MODE (no equipment installed at the line location) Change any DS1 parameter (DS1 line code, DS1 line buildout) Perform DS1 maintenance loopbacks (will generate loopback alarm) Alarm reporting enabled AIS pattern enabled Performance monitoring statistics available
Unequipped[(a)]	Out-of-Service[(a)]	MAINTENANCE MODE (normal maintenance or line troubleshooting) Change any DS1 parameter (DS1 line code, DS1 line buildout) Perform DS1 maintenance loopbacks (will generate loopback alarm) Alarm reporting disabled No performance monitoring statistics
Equipped	In-Service	OPERATION MODE (normal state during operation) Alarm reporting enabled AIS pattern enabled Performance monitoring statistics available No DS1 parameter (DS1 line code, DS1 line buildout) changes allowed No DS1 loopbacks allowed—only inband loopbacks and release loopbacks

(a) Default setting

Table 32. *DS3 Interface Mode Descriptions*

Equipped State	Service State	DS3 State Description
n/a	Out-of-Service	MAINTENANCE MODE Change any DS3 parameter (DS3 line buildout, DS3 transmit timing, DS3 BER threshold) Perform DS3 maintenance loopbacks Allow protection switching
n/a	In-Service	OPERATION MODE Allow alarm reporting Allow protection switching

NETWORK ADDRESSES

PairGain uses the standard Transmission Control Protocol / Internet Protocol (TCP/IP) on an Ethernet interface to send internal management information between chassis. The Wideband System 3190 can support up to 32 chassis using a low-cost 10BASE-T twisted pair or 10BASE-2 coax cable Local Area Network (LAN). If only TAO software is used and there is no need to download multiplexer software, then either type of cable can be used. Systems that use TL1 or require download functions must use 10BASE-T. 10Base-T also makes troubleshooting larger systems much easier.

PairGain recommends that the Wideband System 3190 be placed on its own LAN. Any connection to a larger network should be done through a router with the appropriate firewall protection. Selecting the IP address, subnet mask, TCP/IP server address and trap addresses are basically arbitrary, but some understanding of these functions are still required to make an informed choice.

Hardware Addresses and IP Addresses

To communicate, physical networks rely on 48-bit hardware addresses known as Media Access Control (MAC) addresses. Every network interface adapter has a unique hardware address assigned by the manufacturer and coded into the circuitry. On a local network, each piece of equipment picks up data which is addressed to it. In order for one device to send data to another, it must know the hardware address of the destination device. This works fine for small networks, where devices can easily broadcast their names and addresses on the network and make it easy to find them, but it does not work well for large networks or for communication between devices on different networks.

To solve this problem, a higher level of address, called an IP address, is used to identify each device in the internet. IP addresses, unlike hardware addresses, are not burned into the electronics, but are configured in software when a device is set up and plugged into a particular network. Each IP address is associated with a particular hardware device. For example, a Wideband System 3190 shelf has two components that have IP addresses—the HXU-357 and the HMU-319. Both HXUs share the same IP address using an automatic protection scheme. The IP address is a 32-bit digital address arranged as four 8-bit words, each from 0 to 255, separated by a period.

The IP address consists of two parts: the network ID (netid) and the host ID (hostid). The subnet mask determines which bits form the netid and hostid addresses. (See Table 33.)

Table 33. *Network Addressing*

Subnet Mask	Class C
11111111 11111111 11111111 00000000	
255.255.255.0	
IP Address	Class C
← *netid* → ← *hostid* →	
110nnnnn nnnnnnnn nnnnnnnn hhhhhhhh	
200.200.200.1	

Subnet Mask

A subnet is a physically separate part of a network, usually representative of all the devices at one geographic location or on the same LAN. The subnet mask is a quantity which is logically ANDed with an IP address to enable a device to determine which IP addresses are located on the local network and which addresses must go to the gateway for forwarding. An IP address of 200.200.200.1 and a subnet mask of 255.255.255.0, for example, indicates that only IP addresses which start with 200.200.200 can be found on the local physical network, and that all other addresses must go through the gateway. (255 is the decimal representation of 8 bits of all ones.)

The subnet mask is also a 32-bit word, but it is generally a string of ones followed by a string of zeroes. Each subnet bit that has a one value identifies a corresponding bit of the IP address that is part of the netid. The zero bits identify the *hostid*. The *netid* is further divided into five classes from A to E. Table 33 shows a Class C network address. Class C is recommended for most Wideband System 3190 applications. All Class C addresses are identified by the first three bits (110). The *hostid* should not be assigned all ones or all zeroes.

Using the foregoing restrictions and conventions, a Wideband System 3190 can be assigned any IP address that meets your needs, provided that it is on its own LAN and separated from any external network by a router. If this is not the case, then consult your system administrator. Table 34 provides some suggestions for addressing your system if it is on its own LAN. It shows a logical relationship between the HMU and HXU units within each chassis.

Table 34. *Sample Class C IP Address Plan for the HMS-357*

Suggested HMU Addressing for 1 to 32 Chassis	Suggested HXU Addressing for 1 to 32 Chassis
11001000 11001000 11001000 00000001 200.200.200.1 HMU chassis #1 255.255.255.0 Subnet mask	11001000 11001000 11001000 01100101 200.200.200.101 HXU chassis #1 255.255.255.0 Subnet mask
11001000 11001000 11001000 00100000 200.200.200.32 HMU chassis #32 255.255.255.0 Subnet mask	11001000 11001000 11001000 10000100 200.200.200.132 HXU chassis #32 255.255.255.0 Subnet mask

Routers or Gateways

At the place where two or more physical networks interconnect is a device called a gateway or router that handles linking of networks and routing of data packets between the networks that are attached to the gateway. If a device can not find the hardware address associated with a particular IP address on its own local network, it sends the packet on to the gateway. When the packet arrives at the gateway, the gateway transfers the packet to the network of the destination device. The process by which the gateway or router links IP addresses to hardware addresses is called Address Resolution Protocol (ARP). Each forwarding of the packet from one device to another is called a hop. If the device that is to receive the data is not directly connected to any of the physical networks which are connected to the gateway used by the sending device, it may take several hops for the packet to reach its destination. The destination may even be a port on another gateway connected to different physical networks.

Trap IP Address

Trap IP addresses are used to report network alarms to network management. For the Wideband System 3190, the trap IP addresses of the HXU-357 cards must be identical to the IP address assigned to the HMU-319 card in the chassis.

Duplicate addresses can cause troublesome network problems. Never guess at an IP number or subnet masks when setting up a device. Always consult with your administrator to obtain proper values.

APPENDIX C - SERVICE AND SUPPORT

PairGain Customer Service Group provides expert pre-sales and post-sales support and training for all its products.

TECHNICAL SUPPORT

Technical assistance is available 24 hours a day, 7 days a week by contacting PairGain Customer Service Group at:

Telephone:	(800) 638-0031 or (714) 832-9922 The 800 telephone support line is toll-free in the U.S. and Canada.
Fax:	(714) 832-9924
Email	support@pairgain.com

During normal business hours (8:00 AM to 5:00 PM, Pacific Time, Monday through Friday, excluding holidays), technical assistance calls are normally answered directly by a Customer Service Engineer. At other times, a request for technical assistance is handled by an on-duty Customer Service Engineer through a callback process. This process normally results in a callback within 30 minutes of initiating the request.

BBS

In addition, PairGain maintains an on-line Bulletin Board System (BBS) for obtaining current information on PairGain products, product troubleshooting tips and aids, helpful utilities, and for posting requests or questions. This system is available 24-hours a day by calling (714) 730-2800. You can access the BBS if you have a Hayes-compatible modem with a 2400 to 28,800 baud rate. The following setup format is required: 8 Data Bits, No Parity, 1 Stop Bit.

World Wide Web

PairGain product and company information can be found at *http://www.pairgain.com* using any Web browser.

For firmware updates, click the “Firmware” icon on the PairGain home page, type your password and select the type of firmware you wish to upgrade.

Returns

To return equipment to PairGain:

1 Locate the number of the purchase order under which the equipment was purchased. You will need to provide this number to PairGain Customer Service to obtain a return authorization.

2 Call or write PairGain Customer Service to ask for a Return Material Authorization (RMA) number and any additional instructions. Use the telephone or fax number listed below:

- Telephone: (800) 370-9670
- Fax: (714) 730-2961

3 Include the following information, in writing, along with the equipment you are returning:

- Company name, address, and the name of a person PairGain can contact regarding this equipment.
- The purchase order number provided to Customer Service when the RMA number was requested.
- A description of the equipment, as well as the number of units that you are returning. Be sure to include the model and part number of each unit.
- The shipping address to which PairGain should return the repaired equipment.
- The reason for the return:
  - The equipment needs an ECO/ECN upgrade.
  - The equipment is defective.

If the equipment is defective, please tell us what you observed just before the equipment malfunctioned. Be as detailed in your description as possible.

  - If there is another reason for returning the equipment, please let us know so we can determine how best to help you.

4 Pack the equipment in a shipping carton.

5 Write PairGain's address and the Return Material Authorization Number you received from Customer Service clearly on the outside of the carton:

PairGain Technologies, Inc.
14352 Franklin Ave.
Tustin, CA 92780-7013

Attention: **CRF RMA (Number)**

FCC and warranty information can be found on the inside back cover of this manual.

BAR CODE LABEL AND CONFIGURATION NUMBER

Figure 40 shows the location of the CLEI/ECI bar code label and the configuration number on the HMS-357. Table 35 gives a brief description of what each label contains. Other HiGain components residing in the HMS-357 system have their own bar code label and configuration number.

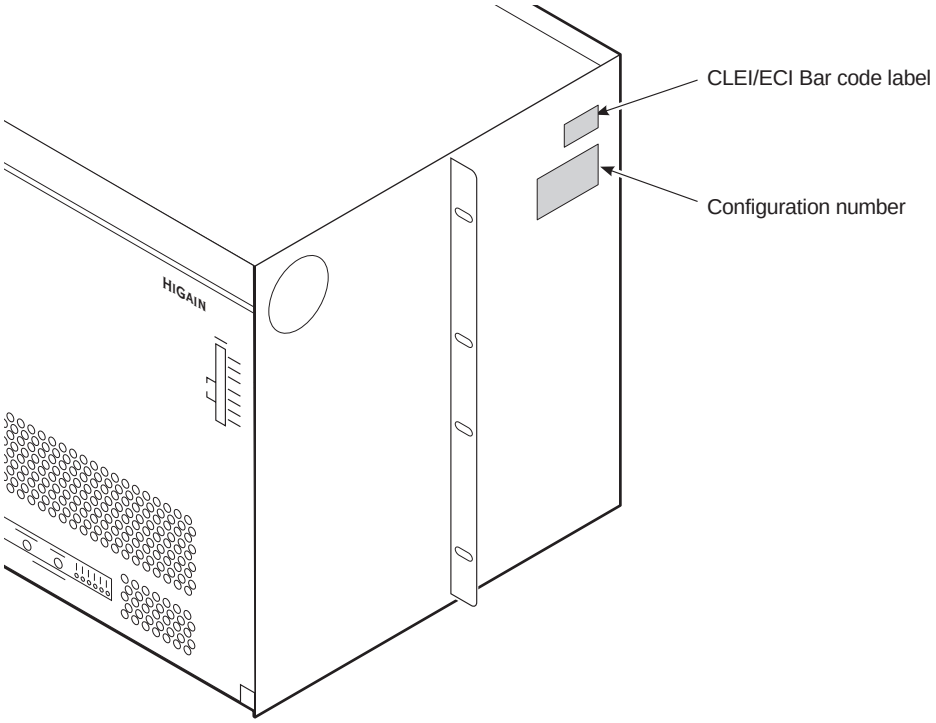


Figure 40. *Location of Bar Code Label and Configuration Number*

Table 35. *Bar Code Label and Configuration Number*

Name	Description
CLEI/ECI Bar Code Label	Contains human-readable Common Language Equipment Identified (CLEI) code number and Equipment Catalog Item (ECI) bar code number.
Configuration Number	Contains either a five or six-digit warranty configuration number or a standalone two or three-digit configuration number as follows: Digit 1 = Last digit of shipment year Digits 2 and 3 = Shipment month Digits 4, 5, and 6 = Configuration number

APPENDIX D - GLOSSARY

ACO	Alarm Cut Off
AIS	Alarm Indicator Signal
ALM	Alarm
AMI	Alternate Mark Inversion
B8ZS	Bipolar with 8-zero Substitution
BER	Bit Error Rate
BNC	Bayonet-locking Connector
BPV	Bipolar Violation
BPVT	BPV Transparency
CDU	Customer Doubler Unit
CI	Customer Interface
CO	Central Office
CLEI	Common Language Equipment Identified
CLOC	Customer Local Loopback
CPE	Customer Premises Equipment
CRC	Cyclic Redundancy Check
CREM	Customer Remote Loopback
CSA	Carrier Servicing Area
CSU	Channel Service Unit
DACS	Digital Access & Cross-connect System
DCE	Data Communications Equipment
DDS	Digital Data Service
DS	Digital Signal
DSR	Data Set Ready
DSU	Data Service Unit
DSX-1	Digital System Cross-connect frame
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
ECI	Equipment Catalog Item
ES	Errored Seconds
ESF	Extended Superframe
GND	Ground
HCDS	High Capacity Digital Service
HDSL	High-bit-rate Digital Subscriber Line
HDU	HiGain Doubler Unit
HFA	HiGain Fan Assembly
HLU	HiGain Line Unit
HMU	HiGain Management Unit
HRU	HiGain Remote Unit
HTC	HiGain Test Card
HXU	HiGain Multiplexer Unit
IP	Internet Protocol
LED	Light Emitting Diode
LOS	Loss of Signal
LOSW	Loss of Sync Word
M13	Multiplexer from DS1 to DS3
MDF	Main Distribution Frame
MIB	Management Information Base
NEBS	Network Equipment Building System
NI	Network Interface
NID	Network Interface Device
NDU	Network Doubler Unit
NLOC	Network Local Loopback
NMA	Network Management and Administration
NREM	Network Remote Loopback
NVRAM	Non Volatile Random Access Memory
OSS	Operation Support System
PBX	Private Branch Exchange
PCS	Personal Communications System
POTS	Plain Old Telephone Service
RCV	Receive
SAIS	SmartJack AIS
SF	SuperFrame
SID	Shelf Identifier
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SPLB	Special Loopback
STS	Span Termination System
TAO	Terminal Access Option
TCP/IP	Transmission Control Protocol / Internet Protocol
TELNET	The TCP/IP standard protocol for remote terminal service.
TFTP	Trivial File Transfer Protocol
TL1	Transaction Language 1
TMS	Time Multiplexed Switch

UAS Unavailable Seconds

UL Underwriters Laboratories

XMT Transmit

ZBTSI Zero Byte Timeslot Interchange

INDEX

Numerics

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

CERTIFICATION AND WARRANTY

FCC COMPLIANCE

This unit complies with the limits for Class A digital devices 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 instruction manual, can cause harmful 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.

Refer to the installation section of this manual for guidance on:

Cabling

Correct connections

Grounding

UL AND CUL LISTINGS

The HMS-357 List 1 and List 2 Wideband System 3190 is listed with the Underwriter Laboratory and meets all applicable Canadian safety standards of the CUL mark.

Use caution when installing or modifying telephone lines. Dangerous voltages may be present. Do not install telephone wiring during a lightning storm. Always disconnect telephone lines and power connections from wall outlets before servicing or disassembling this equipment.

All wiring external to the product should follow the provisions of the current edition of the National Electrical Code.

LIMITED WARRANTY

PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 60 months from the date of original shipment, given correct customer installation and regular maintenance. PairGain will repair or replace at Pairgain's option any unit without cost during this period if the unit is found to be defective for any reason other than abuse or incorrect use or installation.

Do not try to repair the unit. If it fails, replace it with another unit and return the faulty unit to PairGain for repair. Any modifications of the unit by anyone other than an authorized PairGain representative voids the warranty.

If a unit needs repair, call PairGain for a Return Material Authorization (RMA) number and return the defective unit, freight prepaid, along with a brief description of the problem, to:

PairGain Technologies, Inc.
14352 Franklin Avenue
Tustin, CA 92780
ATTN: Repair and Return Dept.
(800) 638-0031

Refer to the instructions under *"Returns"* on page 97 for complete return instructions.

PairGain continues to repair faulty modules beyond the warranty program at a nominal charge. Contact your PairGain sales representative for details and pricing.

MODIFICATIONS

Any changes or modifications made to this device that are not expressly approved by PairGain Technologies, Inc. may void the user's warranty.

All wiring external to the products should follow the provisions of the current edition of the National Electrical Code.

STANDARDS COMPLIANCE

The HiGain Wideband System 3190 has been tested and verified to comply with the applicable sections of the following standards.

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety

For technical assistance, refer to *"Appendix C - Service and Support"* on page 96.

Corporate Office
14402 Franklin Avenue
Tustin, CA 92780

Tel: (714) 832-9922
Fax: (714) 832-9924

For Technical Assistance:
(800) 638-0031

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