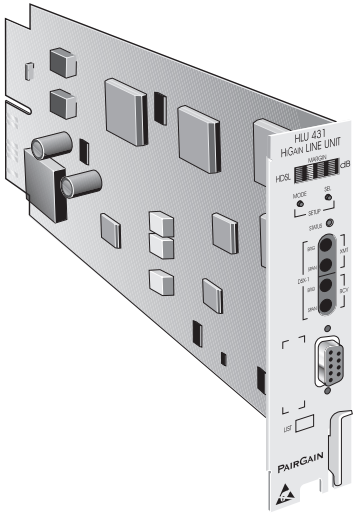
HiGain Line Unit

Quick Installation Guide

Model	List Number	Part Number	CLEI Code
HLU-431	1E	150-1504-15	T1L2FVDAAA



PairGain Technologies, Inc.
Engineering Services Technical Practice

Section 350-431-115-01

PairGain

Revision History of This Practice

Revision	Release Date	Revisions Made
01	September 15, 1998	Initial release

USING THIS MANUAL

Two types of messages, identified by icons, appear in the text.

Notes contains information about special circumstances.

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

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INTRODUCTION

The PairGain® HiGain® Line Unit Model HLU-431 List 1E (Part Number 150-1504-15) is the Central Office (CO) side of a repeaterless T1 transmission system and is used in conjunction with the HRU Remote Unit to provide a complete HiGain High-bit-rate Digital Subscriber Line (HDSL) system.

This guide addresses HLU-431 List 1E operation when used with and without doublers. For applications without doublers, the HLU-431 List 1E is directly connected to the HRU by the two cable pairs. For doubler applications, one or two doublers may be used in the HDSL loops between the HLU-431 List 1E and the HRU.

When used in conjunction with an HRU-412 HiGain Remote Unit, the system provides 1.544 Mbps transmission on two unconditinoed copper pairs over the full Carrier Service Area (CSA) range. The CSA includes loops up to 12,000 feet using AWG 24 or 9,000 feet using AWG 26 wire, including bridged taps.

COMPATIBILITY

The HLU-431 mounts in the PairGain shelves listed below. The HLU-431 slot pins are shown in "Card-Edge Connectors" on page 6.

- HRE-420, Single Slot
- HRE-422, Dual Slot
- HRE-427, Seven Slot
- HRE-450, Single Slot Outdoor
- HRE-454, Four Slot Outdoor

Use the HLU-431 List 1E with up to two doublers. The doublers can be the HiGain HDU-451, HDU-437, or HDU-439. The HLU-431 List 1E has self-adjusting line voltages to accommodate applications with an HRU-412 and doublers. The line power supply converts the -48 Vdc battery power to -130 Vdc (when there are no doublers) or -200 Vdc (when doublers are in use) feed that provides simplex power feed on the two HDSL line interfaces.

FEATURES

Figure 1 shows the front panel of the HLU-431 Line Unit List 1E. Table 1 describes the front panel features.Table 2 shows the states of the HLU-431 List 1E tri-color Status LED.

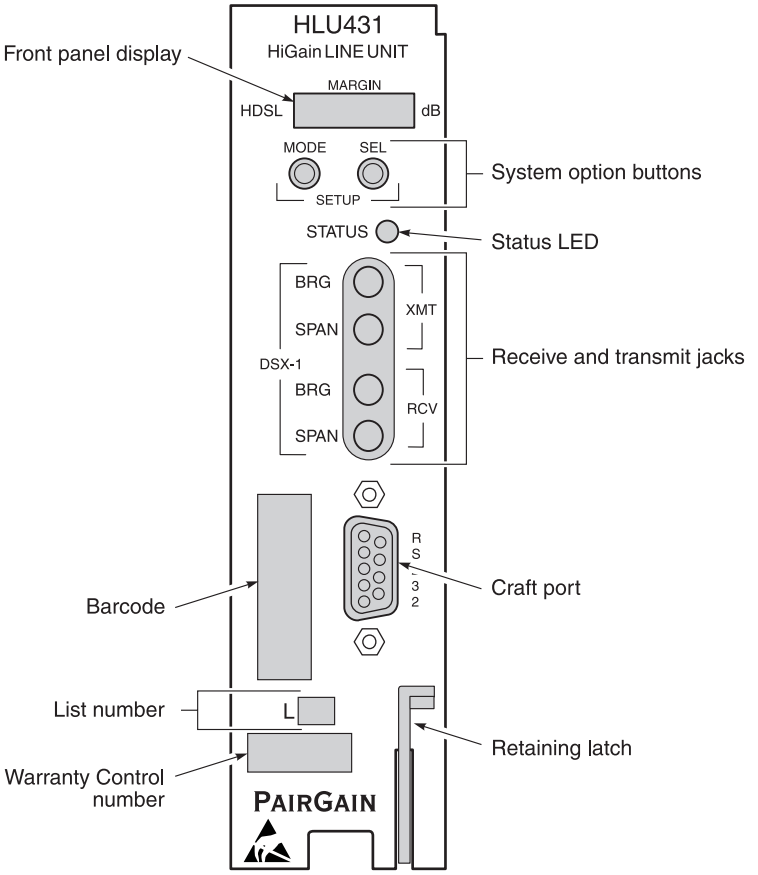


Figure 1. *The Front Panel*

Table 1. *Front Panel Features*

Feature	Function
Front panel display	Provides information about the HDSL, signal to noise margin, and optional settings. The front panel display illuminates when power is applied and remains on for five minutes when the conserve power mode is not set through the MODE and SEL buttons.
Status LED	See Table 2 for status descriptions.
System option buttons	Use the MODE and SEL buttons to set system configuration options.
Receive and transmit jacks	The miniature 210 jacks, or SmartJacks, provide spanning and bridging test access for the DSX-1 transmit and receive signals.
Craft port	Provides access to system maintenance, provisioning, and performance monitoring menus and screens.
Retaining latch	Secures the HLU-431 List 1E in a shelf slot.

Table 2. *Status LED States*

State	Description
Green	Normal Operation.
Flashing Green	HDSL Acquisition.
Flashing Red	Minor Alarm. Press the SEL button to disable the alarm.
Red	Fuse Alarm.
Yellow	Self Test in progress or an HLU-431 List 1E loopback in effect (CREM) or (NLOC).
Flashing Yellow	The HLU-431 List 1E is in an ARMED (pre-loopback) state.

INSTALLATION

This section describes how to install the HLU-431 List 1E into a shelf.

INSPECT THE SHIPMENT

Upon receipt of the equipment, visually inspect it for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to PairGain Technologies (see "Product Support" on page 21).

INSTALLING THE LINE UNIT

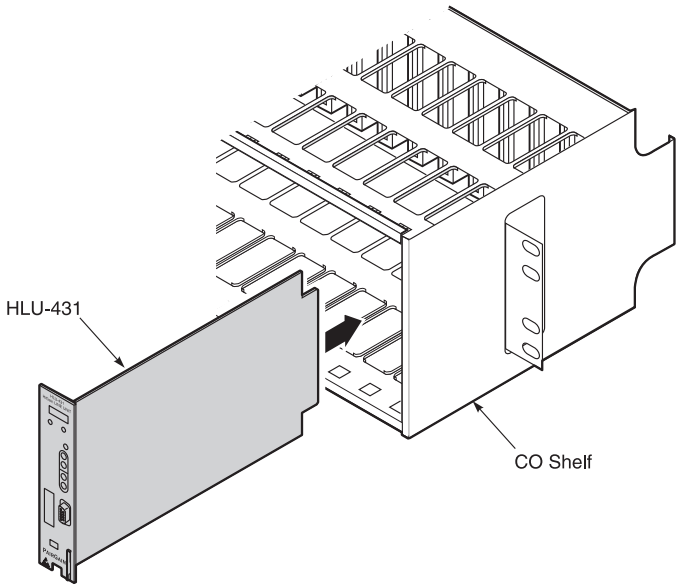


Figure 2. *Installing the HLU-431*

To install the HLU-431 into a shelf:

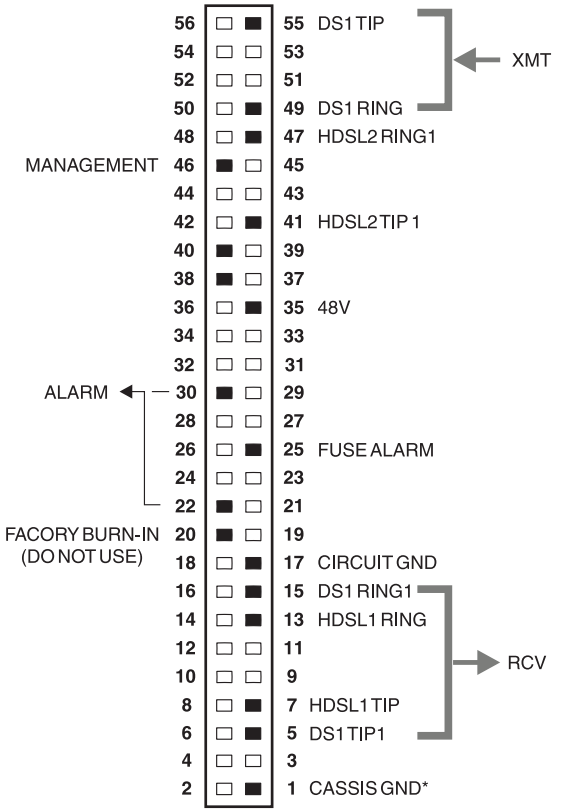
1 Use the card guide to slide the HLU-431 into the desired slot.

2 Push the HLU-431 into the slot until it contacts the slot connector. The retaining latch on the front of the HLU-431 opens.

3 Press on the front panel of the HLU-431 until it is entirely within the card guides. The retaining latch closes.

CARD-EDGE CONNECTORS

Figure 3 shows the HLU-431 card-edge connector pinouts.



* Chassis GND may be tied to earth GND per local practice.

Figure 3. *Card Edge Connector Pinouts*

PROVISIONING

The HLU-431 List 1E contains a non-volatile RAM (NVRAM) which stores the system option settings. The options are set through buttons on the front panel, or through the RS-232 interface. They are retained if shelf power is lost or if the HLU-431 List 1E is unplugged. Table 3 on page 10 lists the system options for the HLU-431 List 1E.

USING THE SEL AND MODE FRONT PANEL BUTTONS

To provision the HLU-431 List 1E through the SEL and MODE front-panel buttons:

1 Press the MODE button for approximately one second. The message displayed on the front panel alternates between the first system parameter and its current setting.

2 Press the SEL button to step the display through all possible settings (one at a time) of the parameter being displayed.

3 Press the MODE button to select the desired parameter and move to the next parameter. After you have configured the last parameter, the display prompts you to confirm the settings.

4 Do one of the following:

- Press the SEL button to install the settings.
- Press the MODE button to bypass the settings.

If neither button is pressed in 30 seconds, the settings are bypassed.

RESET OPTIONS TO FACTORY DEFAULTS

To return the system options back to the original factory default settings:

1 Press the SEL button until the DFLT NO message appears.

2 Press the SEL button again and DFLT YES displays indicating the factory default values are now in effect.

To terminate the DFLT mode without setting the factory default values, press the MODE button or do nothing for 30 seconds.

USING THE CRAFT PORT

The Craft port, a 9-pin RS-232 connector, on the HLU-431 front panel allows you to use a standard RS-232 cable to connect your system to a maintenance terminal or PC running a terminal emulation program. Once connected you can access the maintenance, provisioning, and performance screens.

To provision the HLU-431 through the Craft port:

1 Configure the maintenance terminal to the following communication settings:

- 1200 to 9600 baud (9600 baud is recommended)
- Parity: NONE
- 8 data bits
- 1 stop bit
- Hardware Flow Control set to NONE
- VT Terminal Emulation

If using the Microsoft Windows terminal emulation program, from the Settings, Terminal Preference menu, deselect *Show Scroll Bars* and *Use Function*, *Arrow*, and *Ctrl Keys for Windows*.

2 Use a serial cable to connect the RS-232 COM port on the maintenance terminal to the HLU-431 front panel Craft port.

3 On each screen, type the key represented by the letter in parenthesis for the parameter to be changed. Each entry of this letter scrolls the parameter to its next value.

4 After all selections have been made, press E to exit and C to confirm the changes. This activates the new choices and returns control to the Main Menu screen.

The following three user options cannot be set from the front panel buttons: Circuit ID, DS0 Blocking, and Margin Alarm Threshold.

SYSTEM OPTIONS SETTINGS

Table 3 lists the configuration options for the HLU-431 List 1E.

Table 3. *HLU-431 List 1E System Options*

Option	Selection	Description
EQL	0*	Sets the equalizer to DSX-1 for 0 - 133 feet.
	133	Sets the equalizer to DSX-1 for 133 - 266 feet.
	266	Sets the equalizer to DSX-1 for 266 - 399 feet.
	399	Sets the equalizer to DSX-1 for 399 - 533 feet.
	533	Sets the equalizer to DSX-1 for 533 - 655 feet.
ZBTS	ON	Tells HiGain that the ESF frame is operating in its ZBTSI mode.
	OFF*	Tells HiGain that the ESF frame is operating in its normal non-ZBTSI mode.
ESAL	17	Activates the alarm input signal to the LITESPAN microprocessor and flashes the red STATUS LED when 17 Errored Seconds (ES) (17 HDSL CRC errors on either HDSL loop or a total of 17 BPVs and FERR) occur within a 24-hour period.
	170	Activates the alarm input signal to the LITESPAN microprocessor and flashes the red STATUS LED when 170 ES (170 HDSL CRC errors on either HDSL loop or a total of 170 BPVs and FERR) occur within a 24-hour period.
	NONE*	Prevents generation of an alarm due to excessive Errored Seconds.
ALM	DIS*	Disables assertion of the Alarm input signal to the LITESPAN processor from the HLU processor. Note the HDSL LED still flashes Red for an alarm condition even when the ALM DIS option is chosen.
	ENA	Enables assertion of the Alarm input signal to the LITESPAN processor from the HLU processor.

An asterix (*) indicates factory default settings

Table 3. *HLU-431 List 1E System Options (Cont.)*

Option	Selection	Description
DS0	BLK	The DS0 blocking option can only be set through the RS-232 craft port with a terminal. The four-character HLU-431 List 1E front panel LED readout displays the BLK indicates if at least one channel is blocked.
	NONE*	No channels are blocked.
LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
	20	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
	60*	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
	120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
LPBK	DIS	Configures the HLU-200 to ignore the 2 in 5 SmartJack loopback command.
	ENA*	Enables the HLU-200 to respond to the 2 in 5 SmartJack loopback command.
SPLB	GNLB*	Configures the HiGain system to respond to the generic (3/4/5/6 in 7) in-band loopback codes.
	A1LB and A2LB	Configures the HiGain system to respond to the Teltrend addressable repeater in-band loopback codes.
	A3LB	Configures the HiGain system to respond to the Wescom addressable repeater in-band loopback codes.
	A4LB	Configures the HiGain system to respond to the Wescom Mod 1 addressable repeater in-band loopback codes.
	A5LB	Configures the HiGain system to respond to the Teltrend Mod 1 addressable repeater in-band loopback codes.
PWRF	DIS	Disables powering to the HRU and/or doubler over the HDSL pairs.
	ENA*	Enables powering to the HRU and/or doubler over the HDSL pairs.

An asterix (*) indicates factory default settings

Table 3. *HLU-431 List 1E System Options (Cont.)*

Option	Selection	Description
DS1	B8ZS	Places both the HLU and HRU into their B8ZS modes.
	AMI*	Places both the HLU and HRU into their AMI modes.
	AUTO	The HLU and HRU independently monitor their incoming T1 bit streams for the B8ZS pattern. If either unit detects this pattern, it enters its B8ZS mode.
FRMG	AUTO*	Configures HiGain to operate in an auto-framing (AUTO) mode in which it continuously searches the input T1 bit stream for a valid SF or ESF frame pattern. This feature is required for fractional T1 applications (DS0 blocking) where it insures proper channel time slot alignment. While HiGain can also process unframed data in this AUTO mode, it is recommended that the UNFR mode be used for all unframed applications. Using the AUTO mode for unframed applications runs the risk of detecting “pseudo valid” frame sequences, which can affect the data integrity.
	UNFR	Configures HiGain to operate in an unframed mode. This mode disables the auto framing process and forces HiGain to function as a transparent bit pipe.
HAIS	2LP*	Causes HiGain to transmit the AIS signal at both the HLU and HRU T1 output ports when both of the HDSL loops are not in sync (LOSW).
	1LP	Causes HiGain to transmit the AIS signal at both the HLU and HRU T1 output ports when either of the two HDSL loops is not in sync (LOSW) or if a minor alarm occurs.
SAIS	ENA*	Causes the HRU to transmit the AIS signal towards the CI when in NREM loopback.
	DIS	Prevents the AIS signal from being transmitted to the NI and replaces it with the network test signal in the HRU List 6 and 8 or by a quiet termination (LOS) in the HRU List 7.
MARG	0 to 15 dB	The Margin Alarm Threshold determines the minimum allowable margin below which an alarm will occur.
	4*	Default value.

An asterix (*) indicates factory default settings

Table 3. *HLU-431 List 1E System Options (Cont.)*

Option	Selection	Description
CONF	YES	Confirms that all operating modes (listed in this table) are to be updated to their current selections.
	NO*	Prevents the most recently selected operating mode selections from being updated. They remain as they were before the system options settings mode was entered.

An asterix (*) indicates factory default settings

TESTING

The HLU-431 List 1E 4-character front panel display has many useful system diagnostic messages. They are listed in Table 4. This display turns on when power is initially applied to the HLU-431 List 1E. To conserve power, the display only remains on for five minutes if neither the MODE or SEL buttons are pressed. The use of either button activates the four-character display and restarts the five-minute power-control timer.

ALARMS

Only one alarm can be displayed at a time, therefore, only the highest priority alarm is displayed if more than one alarm exists. Table 4 lists the alarms in order of priority.

Table 4. *Status Menu Alarm Messages*

Message	Full Name	Description
NONE	No Alarms	
LLOS	Local Loss of Signal	No signal at the HLU-431 List 1E local T1 interface.
RLOS	Remote Loss of Signal	No signal at the HRU remote T1 interface.
LOSW1 or LOSW2	Loss of Sync Word 1 or 2	HDSL loop 1 or 2 has lost sync.
H1ES or H2ES	HDSL Loop 1 or 2 Errored Second	Loop 1 or 2 CRCs have exceeded the user selected ES threshold.
DS1	Digital Service 1	DS1 input BPVs at the HRU have exceeded the user selected ES threshold.
RAIS or LAIS	Remote Alarm Indicating Signal	Indicates an AIS (all ones) pattern is being transmitted from the remote or T1 output port.
MAL1 or MAL2	Margin Alarm 1 or 2	The margin on HDSL loop 1 or 2 has dropped below the threshold (1 to 15 dB) set by the user.
CHREV	Channels Reserved	The Loop 1 and 2 HDSL pairs are reversed at the HRU input port. Loop 1 is specified to carry the (-) simplex DC voltage, and Loop 2 is specified to carry the (+) simplex DC voltage.
ACO	Alarm CutOff	A minor alarm occurred and was retired to an ACO condition after pressing the **SEL** button on the HLU front panel.

LOOPBACKS

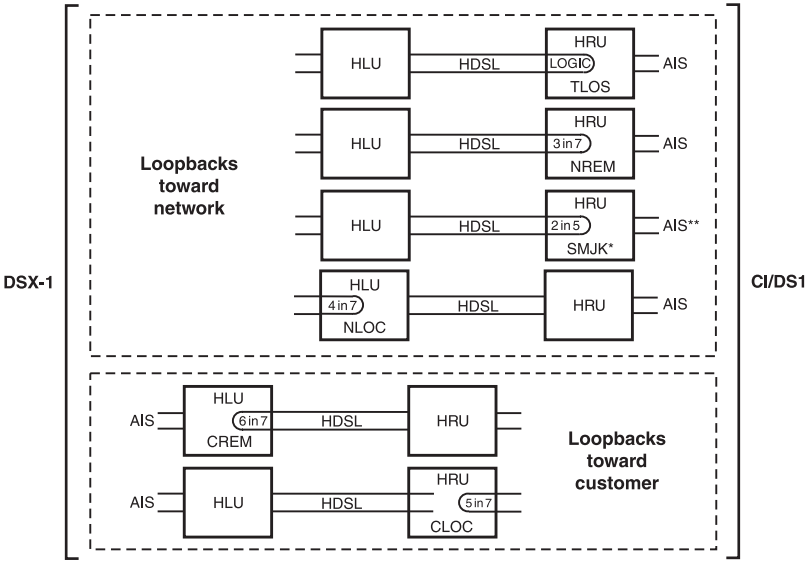
Table 5 and Table 6 list the HLU-431 List 1E loopback messages. Figure 4 on page 17 shows the GNLB locations and their activation codes.

Table 5. *Status Menu Loopback Messages: (With and Without Doublers)*

Message	Full Name	Description
SMJK	SmartJack Loopback	Loopback at HRU (remote) toward the CBA initiated by either the (2 in 5) in-band loopback code or the out-of-band ESF data link code.
NREM	Network Remote Loopback	Loopback at HRU (remote) toward the CBA initiated by upstream in-band codes or from the maintenance terminal.
NLOC	Network Local Loopback	Loopback at HLU, (local) toward the CBA initiated by upstream in-band codes or from the maintenance terminal.
CLOC	Customer Local Loopback	Loopback at HRU (local) toward CI initiated from CPE (customer) by in-band codes or from the maintenance terminal.
CREM	Customer Remote Loopback	Loopback at HLU, (remote) toward customer initiated from CPE (customer) by in-band codes or from the maintenance terminal.
ARM	Armed	The HiGain system detected the IR loopback (2 in 5) arming code.
TLOS	Transmit Loss of Signal (Loopback)	HRU is in a logic loopback state caused by a loss of its T1 input from the CI, if enabled at the HRU via its TLOS switch option.

Table 6. *Status Menu Loopback Messages: (Doublers Only)*

Message	Full Name	Description
NDU1	Network Doubler 1 Loopback	The loopback at doubler 1 toward the CBA initiated by in-band codes, or the maintenance terminal.
NDU2	Network Doubler 2 Loopback	The loopback at doubler 2 toward the CBA initiated by in-band codes or the maintenance terminal.
CDU1	Customer Doubler 1 Loopback	The loopback at doubler 1 toward CI initiated by in-band codes or the maintenance terminal.
CDU2	Customer Doubler 2 Loopback	The loopback at doubler 2 toward CI initiated by in-band codes or the maintenance terminal.



* The Smart-Jack loopback is a metallic loopback in the HRU Lists 6, 7 and 8. It is a logic loopback in HRU Lists 1 through 5.

** Set the SAIS option to ENA to send the AIS pattern to the CI during Smart-Jack Loopback.

Figure 4. *GNLB Block Diagram*

FOUR-CHARACTER DIAGNOSTIC MESSAGES

Table 7 lists the HLU-431 List 1E diagnostic messages.

Table 7. *Four-Character Front Panel Messages*

Message	Full Name	Description
FERR	Framing Bit Error Occurred	Framing bit error occurred at HLU T1 input.
LBPV	Local Bipolar Violation	A bipolar violation has been received at the T1 input to the HLU-319.
SIG 1 or 2	Signal 1 or Signal 2	The HLU and HRU or 1st Doubler transceivers are trying to establish contact with each other on Loops 1 or 2 of span 1.
S2L1 or 2*	Signal 2 Loop or Loop 2	The 1st Doubler and either HRU or 2nd Doubler transceivers are trying to establish contact with each other on loops 1 or 2 of span 2.
S3L1 or 2*	Signal 3 Loop or Loop 3	The 2nd Doubler and HRU transceivers are trying to establish contact with each other on loops 1 or 2 of span 3.
ACQ 1 or 2	Acquisition 1 or Acquisition 2	The HLU and HRU or 1st Doubler multiplexers are trying to establish synchronization over each of Loops 1 or 2 of span 1.
A2L1 or 2*	Acquisition 2 Loop 1 or Loop 2	The 1st Doubler and either HRU or 2nd Doubler multiplexers are trying to establish synchronization with each other on loops 1 or 2 of span 2.
A3L1 or 2*	Acquisition 3 Loop 1 or Loop 2	The 2nd Doubler and either HRU multiplexers are trying to establish synchronization with each other on loops 1 or 2 of span 3.
ACO	Alarm CutOff	A minor alarm has occurred, and been retired to an ACO condition, by pressing the **SEL** button on the HLU front panel.
Self Test		The HLU is in a self test mode. This occurs every power ON/OFF cycle.

* These messages only apply to systems with doublers present.

Table 7. *Four-Character Front Panel Messages (Cont.)*

Message	Full Name	Description
ALRM	Alarm Condition Exists	A minor alarm condition is in effect.
1=xx or 2=yy	HDSL Loop Margins	Indicates the power of the received HDSL signal on each Loop relative to noise. Any value of 06 or greater is adequate for reliable system operation.
PWR FEED SHRT	Power Feed Short	Indicates a short between the 2 HDSL pairs in span 1. This same message can occur with an HRU that is drawing the correct amount of power over good cable pairs but cannot communicate with the HLU.
PWR FEED OPEN	Power Feed Open	Indicates an open circuit in the T&R of either HDSL pair in span 1.
PWR FEED OFF	Power Feed Off	HDSL span power has been turned off by setting the PSFD option to DIS.
BAD RT?	No response from HRU	The HLU does not receive any response from the HRU. Thus, the integrity of the HRU is questionable.
VER	HLU Software Version #	Displays during the System Settings review mode. Depress the **MODE** button for three seconds to view the software version.
LIST 0xL	The List number of the HLU	Displayed during System Settings review mode defined above.
FRM	Frame: SF, ESF, UNFR, NONE	Defines the type of frame pattern being received from the DSX-1. Displayed during System Settings mode defined above.
CODE	Line Code: AMI, B8ZS	This is the line code that HLU-431 List 1E is receiving at its DSX-1 interface. Displayed during System Setting review mode.

* These messages only apply to systems with doublers present.

Table 7. *Four-Character Front Panel Messages (Cont.)*

Message	Full Name	Description
DS0	DS0 Blocked Channels	Indicates status of DS0 blocked channels. NONE indicates no channels are blocked. BLK indicates some channels are blocked.
MNGD	Managed	The HLU-431 List 1E is under control of the HMU network management unit. In this state, the RS-232 Craft port on the HLU-431 front panel is inoperative.

* These messages only apply to systems with doublers present.

SPECIFICATIONS

Maximum Power Consumption	14 Watts without Doubler 23 Watts with Doubler
Maximum Heat Dissipation	6 Watts without Doubler 8 Watts with Doubler
Mounting	STS, high-density slot 431
Dimensions	Height: 5.6 in. (14 cm.) Width: 1.4 in. (3.5 cm.) Depth: 5.6 in. (14 cm.) Weight: 1 lb. 2 oz.

DOCUMENTATION

The HLU-431 List 1E has a complete technical practice that you can download from the PairGain Technical Manuals Web page at: www.pairgain.com. A password is required. If you do not have a password, contact your PairGain sales representative.

If you have any comments on any PairGain documentation, send mail to technical_publications@pairgain.com. Type the product name and the section number of the document in the subject area of the email message.

PRODUCT SUPPORT

This section contains product support and warranty information.

TECHNICAL SUPPORT

PairGain Technical Assistance is available 24 hours a day, 7 days a week by contacting PairGain Customer Service Engineering group at:

Telephone: (800) 638-0031 or (714) 832-9922

Fax: (714) 832-9924

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.

In addition, PairGain maintains a computer bulletin board system for obtaining current information on PairGain products, product troubleshooting tips and aids, accessing helpful utilities, and for posting requests or questions. This system is available 24-hours a day by calling (714) 730-2800. Transmission speeds up to 28.8 kbps are supported with a character format of 8-N-1.

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 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

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

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 the appropriate instruction manual for the unit you are installing to get information on:

- Cabling
- Correct connections
- Grounding
- Line vs. local power

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

To comply with the Central Office intra-building requirements of GR-1089 CORE, section 4.5.9, the shields of the ABAM-type cables that connect the HLU DSX-1 output ports to the cross-connect panel must be grounded at both ends.

MODIFICATIONS

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by PairGain Technologies, Inc. may void the user's authority to operate the equipment.

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

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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