HIGAIN LINE UNIT

QUICK INSTALLATION GUIDE

Model	List Number	Part Number	CLEI Code
HLU-319	2E	150-1140-25	T1L1BH43AA

ℐPAIRGAIN

Revision History of This Practice

Revision	Release Date	Revisions Made
01	June 30, 1998	Initial Release

Copyright ©1998 PairGain Technologies, Inc.

PairGain and HiGain are registered trademarks of PairGain Technologies, Inc.

Information contained in this document is company private to PairGain Technologies, Inc. and shall not be modified, used, copied, reproduced or disclosed in whole or in part without the written consent of PairGain.

Other product names mentioned in this practice are used for identification purposes only and may be trademarks or registered trademarks of their respective companies.

USING THIS MANUAL

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

Notes contain information about special circumstances.

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

INSPECTING SHIPMENT

Upon receipt of the equipment:

- Unpack each container and 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. Order replacement equipment, if necessary.

- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact PairGain as described in the Warranty. If you must store the equipment for a prolonged period, store the equipment in its original container.

ABBREVIATIONS

AMI	Alternate Mark Inversion
B8ZS	Bipolar with 8 Zero Subsitution
CO	Central Office
CSA	Carrier Service Area
ES	Errored Seconds
ESF	Extended Superframe
HDSL	High-bit-rate Digital Subscriber Line
HDU	HiGain Doubler Unit
HLU	HiGain Line Unit
HRU	HiGain Remote Unit
SF	Super Frame
ZBTSI	Zero Byte Time Slot Interchange

TABLE OF CONTENTS

PRODUCT OVERVIEW

The PairGain® HiGain® HLU-319 is the Central Office (CO) side of a repeaterless T1 transmission system. When used in conjunction with a HiGain remote unit (HRU), the system provides 1.544 Mbps transmission on two unconditioned copper pairs over the full Carrier Service Area (CSA) range. The HLU-319 can be used in applications with or without HiGain Doubler Units (HDUs).

The CSA includes loops up to 12,000 feet of 24 AWG or 9,000 feet of 26 AWG wire, including bridged taps. The HiGain system uses HDSL (High-bit-rate Digital Subscriber Line) transmission technology as recommended by Bellcore TA-TSY-001210. The HiGain system complies with TR-TSY-000063 (Network Equipment Building System (NEBS) Generic Equipment requirements) and TR-TSY-000499 (Transport System Generic Requirements—TSGR) common requirements.

HLU-319 FEATURES

- Selectable DS-1 pre-equalizer

- 130 to 200 Vdc HDSL line power for HDU and HRU

- Ground fault-detecting circuit

- Front panel HDSL Signal/Noise (S/N) margin display

- Compatible with Span Terminating Shelf (STS) high-density shelves

- Selectable loopback activation codes

- RS-232 Craft Port

- Network Management Administration (NMA) interface

- Non-volatile front panel operator setup

- Front panel DS1 splitting and bridge access

- Lightning and power cross protection on HDSL interfaces

- 784 kbps full duplex 2B1Q HDSL transmission on two wire pairs

- Front panel status LED

- On/Off front panel display power cycling

- DS1 LOS detector (125 consecutive zeros)

- Margin threshold alarm

- HDSL AIS (Alarm Indicating Signal) and Smart-Jack AIS options

- Easy return to factory default user settings

- Circuit ID option

- Low power consumption

COMPATIBILITY

The HLU-319 is compatible with the following T1 repeater shelves and associated equipment:

- Charles Ind. #3192 (28-slot connectorized)

- Charles Ind. #3192-9F Alarm Card

- Larus #1185 (28-slot connectorized)

- Larus #1184 Alarm Card

- Charles Ind. #3192-WR (28-slot wire wrap)

- Charles Ind. #343-00 (12- to 14-slot wire wrap)

- Charles Ind. #319-02 (22-slot connectorized)

- Charles Ind. #319-04 (22-slot wire wrap)

- Charles Ind. #340-00 (9- to 11-slot wire wrap)

- PairGain HMS-318 (22-slot, 19-inch shelf)

- PairGain HHS-319 (3-slot, 19-inch horizontal shelf)

- PairGain HMS-317 (28-slot, 23-inch shelf)

- PairGain HMS-308 (8-slot remote enclosure)

The Charles Ind. #343-00 and #340-00 shelves do not support the HLU-319 Minor Alarm output on pin H. Also, if slots 1 and 2 of these shelves were wired for the 3408 Fault Locate unit, they must be rewired to accept the HLU-319.
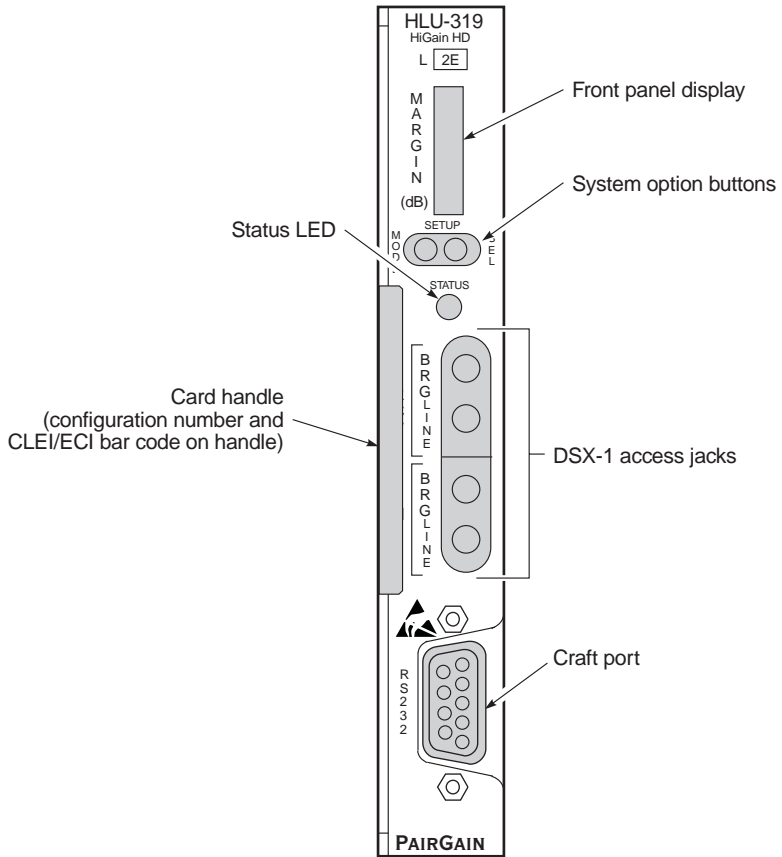
FRONT PANEL

Figure 1 shows the HLU-319 front panel.

Figure 1.   HLU-319 Front Panel

Table 1.   *HLU-319 Front Panel Features*

Name	Function
Front panel display	Displays four-character status, provisioning, and alarm system messages.
System option buttons (MODE and SEL)	Permit the user options to be monitored and modified without using a maintenance terminal. Used to initiate all HiGain loopbacks and to display DSX-1 line parameters and line unit identity.
Status LED	See Table 2 for status descriptions.
DSX-1 access jacks	
SPAN	Provides splitting jack access to (XMT) and from (RCV), the HDSL span at the DSX-1 interface. Breaks the XMT and RCV paths to permit test signal insertion and retrieval.
BRIDGE	Provides non-intrusive bridging jack access to (XMT) and from (RCV) the HDSL span at the DSX-1 interface. Allows the two T1 payloads to be monitored.
Craft (RS-232) port	Provides bidirectional communication between the unit and an external terminal to allow configuration and performance monitoring through the Maintenance Terminal screens.
CLEI/ECI bar code label	Provides the human-readable Common Language Equipment Identifier (CLEI) code number and the Equipment Catalog Item (ECI) bar code number.
Configuration Number	Contains either a five or six-digit warranty configuration number or a stand-alone two- or three-digit configuration number as follows: Digit 1 - Last digit of shipment year Digit 2 and 3 - Shipment month Digit 4, 5 and 6 - Configuration number

The HLU-319 front panel tri-color Status LED has the following states:

Table 2. *Status LED States*

State	Description
Green	Normal operation
Flashing green	HDSL acquisition
Red	Fuse Alarm
Flashing red	Minor alarm
Yellow	Self Test is in process or an HLU-319 Customer Remote Loopback (CREM) or a Network Local Loopback (NLOC) is in effect
Flashing yellow	HLU-319 is in an Armed state

FRONT PANEL MESSAGES

The front panel display has many useful system diagnostic messages. They are listed in Table 3. The display turns on when power is initially applied to the HLU-319. To conserve power, the display 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.

Table 3. *HLU-319 Front Panel Display Messages*

Message	Full Name	Description
NONE	No Alarms	No alarms.
LLOS	Local Loss of Signal	No signal from HLU-319 local DSX-1 interface.
RLOS	Remote Loss of Signal	No signal from HRU- remote DS1 interface.
LOSW1	Loss of Sync Word 1	HDSL loop 1 has lost sync.
LOSW2	Loss of Sync Word 2	HDSL loop 2 has lost sync.
H1ES	HDSL Loop 1 Errored Second	Loop 1 CRCs have exceeded the user-selected ES threshold.

Table 3. *HLU-319 Front Panel Display Messages (Cont.)*

Message	Full Name	Description
H2ES	HDSL Loop 2 Errored Second	Loop 2 CRCs have exceeded the user-selected ES threshold.
DS1	Digital Service 1	T1 input BPVs, at either the HLU-319 or HRU, have exceeded the user-selected ES threshold.
DS0	DS0 Blocked Channels: NONE or BLK	Indicates status of DS0 blocked channels. NONE indicates that no channels are blocked. BLK indicates that some channels are blocked.
MNGD	Managed	The HLU-319 is being managed by the HMU-319 management unit. In this state, the front panel Craft port is disabled.
RAIS	Remote Alarm Indicating Signal	Indicates an AIS (all ones) pattern is being transmitted from the remote T1 output port.
LAIS	Local Alarm Indicating Signal	Indicates an AIS (all ones) pattern is being transmitted from the local T1 output port.
MAL1	Margin Alarm 1	The margin on HDSL loop 1 has dropped below the threshold (0 to 15 dB) set by the user. Setting the threshold to 0 inhibits the margin alarm.
MAL2	Margin Alarm 2	The margin on HDSL loop 2 has dropped below the threshold (0 to 15 dB) set by the user. Setting the threshold to 0 inhibits the margin alarm.
CHREV	Channels Reversed	The loop 1 and 2 HDSL pairs are reversed at the HRU line 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-319 front panel.

Table 3. *HLU-319 Front Panel Display Messages (Cont.)*

Message	Full Name	Description
LBPV	Local Bipolar Violation	A bipolar violation was received at the DSX-1 input to the HLU-319.
SIG1	Signal 1	The HLU-319 and the first doubler transceivers are trying to establish contact on loop 1 of span 1.
S2L1	Signal 2 Loop 1	The first doubler is trying to establish contact with either the HRU or the second doubler transceivers on loop 1 of span 2.
S2L2	Signal 2 Loop 2	The first doubler is trying to establish contact with either the HRU or the second doubler transceivers on loop 2 of span 2.
S3L1	Signal 3 Loop 1	The second doubler and HRU transceivers are trying to establish contact on loop 1 of span 3.
S3L2	Signal 2 Loop 2	The second doubler and HRU transceivers are trying to establish contact on loop 2 of span 3.
ACQ1	Acquisition 1	The HLU-319U and the first doubler multiplexers are trying to synchronize over loop 1 of span 1.
ACQ2	Acquisition 2	The HLU-319 and the first doubler multiplexers are trying to synchronize over loop 2 of span 1.
A2L1	Acquisition 2 Loop 1	The first doubler is trying to synchronize with either the HRU or the second doubler multiplexers on loop 1 of span 2.
A2L2	Acquisition 2 Loop 2	The first doubler is trying to synchronize with either the HRU or the second doubler multiplexers on loop 2 of span 2.
A3L1	Acquisition 3 Loop 1	The second doubler and the HRU multiplexers are trying to synchronize on loop 1 of span 3.

Table 3.   *HLU-319 Front Panel Display Messages (Cont.)*

Message	Full Name	Description
A3L2	Acquisition 3 Loop 2	The second doubler and the HRU multiplexers are trying to synchronize on loop 2 of span 3.
BAD RT?	No response from HRU	The HLU-319 is not receiving any HRU, and therefore the HRU's integrity is questionable.
LIST XXXX	HLU-319 List number	To display the List number, press the MODE button for three seconds.
VER XXXX	HLU-319 software version number	To display the software version, press the MODE button for three seconds.
FRM	Frame: SF, ESF, UNFR, None	Defines the type of frame pattern being received from the DSX-1. To display frame pattern, press the MODE button for three seconds.
SIG2	Signal 2	The HLU-319 and the first doubler transceivers are trying to establish contact on loop 2 of span 1.
FERR	Framing Bit Error	Framing bit error occurred at the HLU-319 input.
ARM	HiGain system is Armed	The HiGain system is Armed and ready to respond to Intelligent Repeater loop codes.
SMJK	Smart-Jack Loopback	The loopback at HRU (remote) toward network initiated by either the (2 in 5) in-band loopback code or the out-of-band ESF data link loopback code.
NREM	Network Remote Loopback	The loopback at HRU (remote) toward network initiated from CO (network) by either the Intelligent Line Repeater (ILR) number 2 code, the HLU-319 front panel Manual Loopback push buttons, the HRU front panel push button, or the maintenance terminal.
NLOC	Network Local Loopback	The loopback at HLU-319 (local) toward network initiated from CO (network) by either the Intelligent Office Repeater (IOR) code, the HLU-319 front panel Manual Loopback push buttons, or the maintenance terminal.

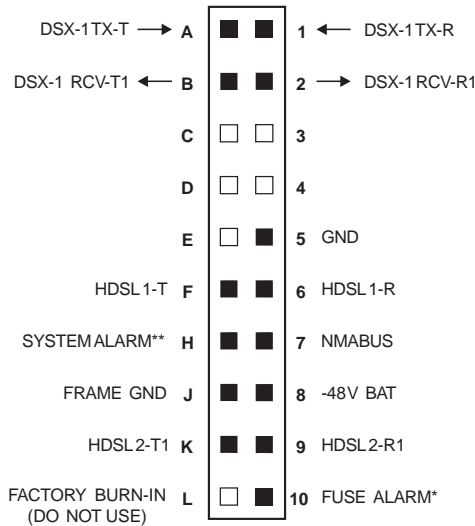***Table 3.***   *HLU-319 Front Panel Display Messages (Cont.)*

Message	Full Name	Description
CLOC	Customer Local Loopback	The loopback at HRU (local) toward CI initiated from CPE (customer) by either the ILR number 2 code, the HLU-319 front panel Manual Loopback push buttons, or the maintenance terminal.
CREM	Customer Remote Loopback	The loopback at HLU-319 (remote) toward customer initiated from CPE (customer) by either the IOR code, the HLU-319 front panel Manual Loopback push buttons, or 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 DS1 input from the CI when ENAbled at the HRU-412, List 6 or List 7, through its TLOS switch option.
SELF-TEST	Self-test	The HLU-319 is in self-test mode, which occurs whenever the power is turned on.
ALRM	Alarm condition exists	A minor alarm has occurred.
1=xx	HDLS Loop 1 Margin	Indicates the power of the received HDSL signal on loop 1 relative to noise. Any value of 06 or greater is adequate for reliable system operation.
2=yy	HDSL Loop 2 Margin	Indicates the power of the received HDSL signal on loop 2 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 two HDSL pairs, or that an HRU that is drawing the correct amount of power over good cable pairs but cannot communicate with the HLU-319.
PWR FEED OPEN	Power Feed Open	Indicates an open circuit in the Tip and Ring of either HDSL pair.
PWR FEED OFF	Power Feed Off	HDSL span power has been turned off by setting the PWFD option to DIS.

Table 3. *HLU-319 Front Panel Display Messages (Cont.)*

Message	Full Name	Description
CODE	Line Code: AMI, B8ZS	The line code that the HLU-319 is receiving at the DSX-1 interface, if the DS1 option is set to Auto. Otherwise, this code mimics either of the other two DS1 line code settings. To view the code, press the MODE button for three seconds.

CARD-EDGE CONNECTOR

The HLU-319 card-edge connector pinouts are shown in Figure 2.


```
DSX-1 TX-T  ───►  A   ■ ■   1  ◄───  DSX-1 TX-R
DSX-1 RCV-T1 ◄──  B   ■ ■   2  ───►  DSX-1 RCV-R1
                  C   □ □   3
                  D   □ □   4
                  E   □ ■   5   GND
HDSL 1-T          F   ■ ■   6   HDSL 1-R
SYSTEM ALARM**    H   ■ ■   7   NMABUS
FRAME GND         J   ■ ■   8   -48V BAT
HDSL 2-T1         K   ■ ■   9   HDSL 2-R1
FACTORY BURN-IN   L   □ ■   10  FUSE ALARM*
(DO NOT USE)
```

 * **Fuse Alarm**
   Normal = Floating (0 to -60 VDC Maximum)
   Activated = -48 Vdc, 10mA Maximum

 ** **System Alarm**
   Normal = Floating (+5 to -60 VDC Maximum)
   Activated = +5 V, 10mA Maximum

Figure 2. *HLU-319 Card Edge Connector Pinouts*

INSTALLATION

⚠️ **This product contains static-sensitive components. Be sure to ground yourself properly before touching the HLU-319.**

1 Slide the HLU-319 into the shelf card guides for the desired slot, then push the unit in until it is entirely within the card guide:
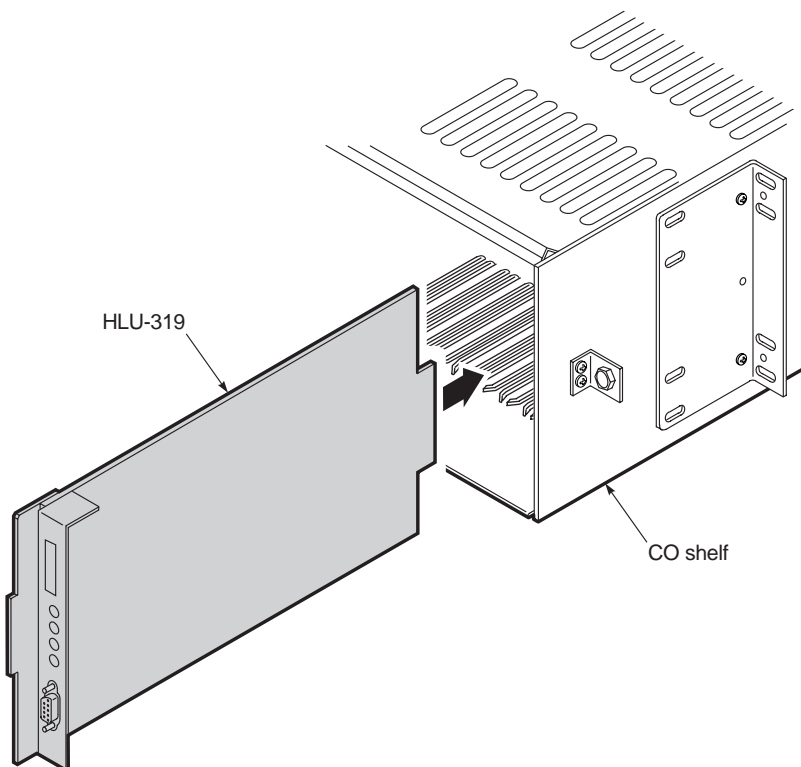

Figure 3.   *Installing the HLU-319*

2 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.

HDSL LINE VOLTAGE OPERATION

The HLU-319 140V output voltage when used in a non-doubler system is always unipolar. This setting keeps the HDSL cable pair voltage at or below ground potential, thereby avoiding corrosion problems caused by cable voltages more positive than ground.

The 200V output voltage used in a system containing doublers is bipolar. This setting reduces the maximum ground referenced voltage to 100V, but applies positive voltage to the cable pairs, which could accelerate corrosion on the cable pairs. The specific bipolar voltage levels existing between ground and the two loops for a system containing doublers depends on the following factors:

- loop length

- number of doublers

- type of doublers (which List)

- whether the HRU is locally powered or line powered

The line voltage power supply is ground referenced, but also ground isolated by 200 k Ω. This ground isolation reduces problems due to induced noise currents and large surge voltages, which are ground referenced. It also reduces ground fault currents, which improves product safety.

GROUND FAULT-DETECTING CIRCUIT

The HLU-319 List 2E has been enhanced with a ground fault-detecting circuit, as described in paragraph R7-1, Section 7.2.1 of GR-1089-CORE, Issue 1, Revision 1, December, 1996.

Ground faults occurring at any point along any span on any conductor are immediately detected and the HiGain circuit shuts down. The line unit then applies power periodically to the first span to detect the ground fault condition. This power cycling and ground fault protection continues as long as the fault condition exists.

PROVISIONING

There are two methods for provisioning the HLU-319:

- Use the MODE and SEL buttons on the front panel.
- Access system settings screens through the Craft port.

No dip switches or jumpers are required to provision the HLU-319, as it contains a non-volatile RAM (NVRAM) which stores the system option settings. System settings are retained if shelf power is lost or if the HLU-319 is unplugged.

USING THE SEL AND MODE FRONT PANEL BUTTONS

To provision the HLU-319 through the MODE and SEL buttons on the front panel:

1   Press the MODE button and release it after 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 selected parameter.

3 After the desired setting has been selected, press the MODE button.

This updates the current displayed mode to the selected setting, and then advances to the next configurable parameter.

After the last parameter has been selected, the following confirmation message appears on the front panel display:

```
CONF NO
```

4 Do one of the following:

- To cancel the session without saving the requested parameter changes, press the MODE button. (If there is no input for 30 seconds, the display returns to its normal mode without saving the new changes.)

- To accept the requested parameter changes, press the SEL button. (A YES message displays, and the display returns to its normal mode after saving the new changes.)

In either case the display returns to its normal mode.

RESTORING DEFAULT SETTINGS

All user options, except setting the Circuit ID, can be set to the factory default values using the SEL and MODE buttons. To set the user options to their default values:

1 Press the SEL button for six seconds until the following message appears:

```
DFLT NO
```

2 Press the SEL button while the DFLT NO message is displayed.

The message changes to DFLT YES, indicating the factory default values are now in effect.

To terminate the DFLT mode without setting the factory default values, do one of the following:

- Press the MODE button *or*

- Wait 30 seconds for the display to return to its normal state.

USING THE MAINTENANCE TERMINAL MENUS

The Craft port allows you to connect the HLU-319 to a maintenance terminal or PC running a terminal emulation program. The Craft port is a standard RS-232 (DB-9, female) connector on the front panel. Once connected to a maintenance terminal, you can access the maintenance, provisioning, and performance screens.

Connecting to the Craft Port

To connect to a maintenance terminal:

1   Connect a standard 9-pin terminal cable to the Craft port on the HLU-319 front panel.

2   Connect the other end of the console cable to the console port on the maintenance terminal.

3   If necessary, start a terminal emulation program.

4   Configure the maintenance terminal to the following communication settings:

- 1200 to 9600 baud (9600 baud is recommended)

- no parity

- 8 data bits

- stop bit

- hardware flow control to OFF

Navigating the Maintenance Terminal Menus

Table 4 lists keys you can use on the maintenance terminal to navigate within the Maintenance Terminal screens.

__Table 4.__   Navigational Keys on the Maintenance Terminal

Key	Function
U	Updates a report
C	Clears a report
S	Selects the next Span Status screen
P	Selects the previous page of a report
N	Selects the next page of a report
E	Exits the current screen
ESC	Exits the current screen

Selecting an Option

To select an option within the Maintenance Terminal screens, you can:

- Press the key indicated to the left of the selection.
- Press the letter in parenthesis of the parameter to be changed.

An invalid entry produces the following message and identifies the name of the field where the invalid entry occurred:

```
> error
```

This happens only for margin alarm threshold or DS0 blocking.

System Options Settings

Table 5.   *HLU-319 System Options*

Mode	Selection	Description
EQL	0*	Sets the equalizer to DSX-1 for 0 - 132 feet.
	133	Sets the equalizer to DSX-1 for 133 - 265 feet.
	266	Sets the equalizer to DSX-1 for 266 - 398 feet.
	399	Sets the equalizer to DSX-1 for 399 - 532 feet.
	533	Sets the equalizer to DSX-1 for 533 - 655 feet.
LPBK	DIS	Configures the HiGain system to ignore the (2 in 5) in-band SmartJack loopback command.
	ENA*	Enables the HiGain system to recognize the (2 in 5) in-band 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 doubler.
	ENA*	Enables powering to the HRU and doubler.
ZBTS	ON	Notifies the HiGain system that the ESF frame is operating in its ZBTSI mode.

Table 5. *HLU-319 System Options (Cont.)*

Mode	Selection	Description
	OFF*	Notifies the HiGain system that the ESF frame is operating in its normal non-ZBTSI mode.
ESAL	17	Flashes the red STATUS LED when 17 Errored Seconds (ES) (17 HDSL CRC errors on either HDSL loop or a total of 17 BPVs) occur within a 24-hour period.
	170	Flashes the red STATUS LED when 170 ES (170 HDSL CRC errors on either HDSL loop or a total of 170 BPVs) occur within a 24-hour period.
	NONE*	Prevents generation of an alarm due to excessive errored seconds.
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.
ALM	DIS*	This generic HiGain ALM option is not supported by the HLU-319 List 2E. Its setting has no effect on the unit operation.
	ENA	
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. If no B8ZS patterns are received for five seconds, it reverts back to its AMI mode.

Table 5. *HLU-319 System Options (Cont.)*

Mode	Selection	Description
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 the HiGain system 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-412 List 6 and List 7 to transmit the AIS signal towards the CI when in NREM or SmartJack loopback.
	DIS	Causes the HRU-412 List 6 to transmit the signal from the network toward the CI when an HRU NREM or SmartJack loopback is executed. The AIS signal is off.
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.
MARG	0 to 15 dB	The Margin Alarm Threshold can only be set using a terminal connected to the RS-232 Craft port. This setting determines the minimum allowable margin below which an alarm will occur. Setting the threshold to "0" inhibits the margin alarm.

Table 5.   *HLU-319 System Options (Cont.)*

Mode	Selection	Description
	4 dB*	Default value.
DS0	BLK	The DS0 blocking option can only be set using a terminal connected to the RS-232 Craft port. The 4-character HLU-319 front panel LED readout only displays the status of the blocking option. BLK indicates at least one channel is blocked.
	NONE*	No channels are blocked.

* Denotes the default setting.

ALARMS

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

Table 6.   Status Menu Alarm Messages

Message	Full Name	Description
NONE	No Alarms	
LLOS	Local Loss of Signal	No signal at the HLU- List 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 Cyclical Redundancy Checks 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

The HLU-319 loopback messages are described in Table 7.

Table 7. *Loopback Messages*

Message	Full Name	Description
SMJK	Smart-Jack Loopback	Loopback at HRU (remote) toward the Network 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 Network initiated by upstream in-band codes or from the maintenance terminal.
NLOC	Network Local Loopback	Loopback at HLU, (local) toward the Network 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 through its TLOS switch option.
NDU1	Network Doubler 1 Loopback	The loopback at doubler 1 toward the Network initiated by in-band codes, or the maintenance terminal.
NDU2	Network Doubler 2 Loopback	The loopback at doubler 2 toward the Network initiated by in-band codes or the maintenance terminal.

Table 7. *Loopback Messages (Cont.)*

Message	Full Name	Description
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.

SPECIFICATIONS

HDSL Line Code

784 kbps 2B1Q

HDSL Output

+13.5 dBm ± 0.5 dB at 135 Ω

HDSL Line Impedance

135 Ω

Maximum Provisioning Loss

35 dB at 196 kHz, 135 Ω

Line Clock Rate

Internal Stratum 4 clock

HDSL Start-up Time

30 seconds (typical), 60 seconds (maximum) per span

One-way DS1 Delay

<220 microseconds per span

DSX-1 Line Impedance

100 Ω

DSX-1 Pulse Output

Pre-equalized for 0 to 655 feet of ABAM-specification cable

ABAM cables must be grounded at both ends for GR-1089 CORE, section 4.5.9 compliance

DSX-1 Input Level

+1.5 to -7.5 dBDSX

DSX-1 Line Rate

1.544 Mbps ± 200 bps

DSX-1 Line Format

AMI, B8ZS or ZBTSI

DSX-1 Frame Format

ESF, SF or UNFR

Maximum Power Consumption

14 Watts (without doubler); 25 Watts (with doubler)

Maximum Heat Dissipation

6 Watts (without doubler); 9 Watts (with doubler)

Fusing

Internal; connected to Fuse Alarm output on pin 10

HDSL Span Voltage (Differential)

130 or 200 VDC

Margin Indicator

Displays HDSL loop Signal-to-Noise Ratio margin for each HDSL loop relative to 10^{-7} Bit Error Rate operation

Electrical Protection

Secondary surge protection on DS1 and HDSL ports; Power cross protection on HDSL ports

Operating Temperature and Humidity

-40° to +65° Celsius, 5 to 95% (non-condensing)

Mounting

STS, high-density slot

Dimensions

Height:	5.9 in. (15 cm)
Width:	1.4 in. (3.5 cm)
Depth:	10 in. (25.4 cm)
Weight:	1 lb. 11 oz.

PRODUCT SUPPORT

This section contains product support and warranty information.

RELATED DOCUMENTATION

The HLU-319 List 2E 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.

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

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

ISO 9001

DNV

DNV Certification, Inc.
Certificated Firm

ᵮPAIRGAIN