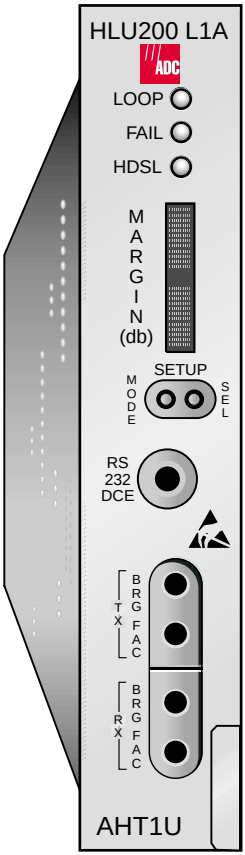
HiGain

USER MANUAL



HLU-200 List 1A Line Unit
ProductCatalog: 350-200-111-02
CLEI: SLL2U6LG

Revision History of This Manual

To order copies of this document, use document catalog number 350-200-111-02.

Issue	Release Date	Revisions Made
1	October 4, 1999	Initial Release
2	February 14, 2002	ADC Rebranding

USING THIS MANUAL

The following conventions are used in this manual:

- `Monospace type` indicates screen text.
- Keys you press are indicated by small icons such as Y or ENTER. Key combinations to be pressed simultaneously are indicated with a plus sign as follows: CTRL + ESC.
- Items you select are in **bold**.

Three types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of personal injury or equipment damage.

The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.

UNPACK AND INSPECT YOUR SHIPMENT

Upon receipt of the equipment:

- Unpack each container and inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC DSL Systems, Inc. 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 ADC DSL Systems, Inc. as described in Product Support on page 23. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The ADC® HiGain® Line Unit Model HLU-200 List 1A (AHT1U) is an asynchronous DS1 interface unit that plugs into the Channel Bank Assembly (CBA) of a DSC Litespan® 2000 optical loop carrier system to provide a High-bit-rate Digital Subscriber Line (HDSL) interface. The HLU-200 is essentially an AT1U line unit with the T1 line interface circuit replaced by an HDSL interface circuit. 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 Serving Area (CSA) range. The CSA includes loops of up to 12,000 feet of AWG 24 or 9,000 feet of AWG 26 wire, including bridged taps. The CSA range can be doubled with a HiGain Doubler Unit (HDU) or tripled with two HDUs.

This guide describes HLU-200 List 1A operation when used with and without doublers. The HRU can be placed up to 3000 feet into the network for extra range without doublers. However, this requires an external Network Interface Device (NID) to be placed at the Network Interface (NI), and the HRU must have the Smart-Jack (LB) option set to Disable. The HLU-200 List 1A powers both the HDU and HRU, but the HRU must be locally powered for two-doubler applications.

The HLU-200 List 1A is different from the HLU-200 List 1F only in that the +5 V fuse has been increased from 0.75 A to 1.0 A for improved reliability.

COMPATIBILITY

The HLU-200 List 1A operates as a channel card in a DSC Litespan-2000 Channel Bank. The Litespan-2000 system consists of a Central Office (CO) bank connected to a remote bank over an Optical Carrier 3 (OC3) fiber link. Each bank has slots for 56-channel plug-ins. The HLU-200 is typically installed in the remote bank, where it is used to transmit a T1 payload to a remote HRU-412. The transmission is over two unconditioned HDSL cable pairs, with or without doublers. The HLU-200 is the HDSL equivalent to an AT1U channel card, used to transmit a T1 payload to a remote location over conventional T1 spans.

The HLU-200 List 1A is compatible with Litespan-2000 software releases 7.1.x and 8.1.x and above. The HLU-200 List 1A is not compatible with the Litespan-2000 Management System and must be maintained, provisioned and monitored from the front-panel RS-232 maintenance port.

The HLU-200 can be cross-connected to another HLU-200 or to another asynchronous T1 channel unit in the same channel bank or in the distant channel bank. These point-to-point dedicated circuits are initiated by issuing the standard TL1-based cross-connect commands to the Maintenance and Test Interface (MTI) card. The MTI card identifies the HLU-200 List 1A as an AHT1U plug.

FRONT PANEL

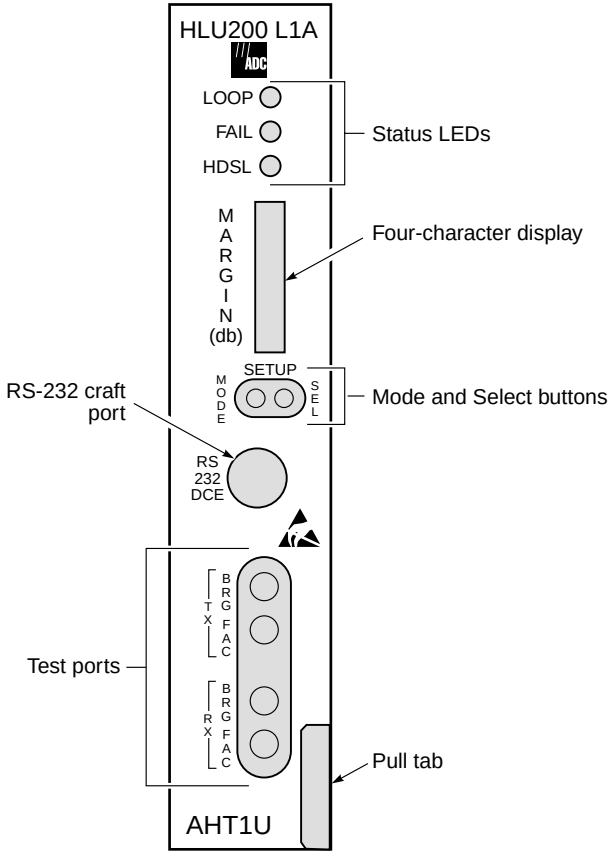


Figure 1. *HLU-200 List 1A Front Panel*

Table 1. *Front Panel Features*

Name	Function
Status LEDs	Indicates system status.
Loop LED	Lights whenever any of the HLU-200 system loopbacks are in effect. Flashes when the AHT1U is in the armed state for an intelligent repeater loopback command.
Fail LED	A red LED controlled by the CBA. Used with revision 7.1.2, and higher software versions, this LED lights when the HLU-200 is first plugged into the CBA and remains lit until the CBA has finished program download and communication with the HLU-200. It also lights whenever there is a service-affecting failure within the CBA. (The LED remains lit at all times when the HLU-200 is used with revision 7.1.1 CBAs.)
HDSL LED	Flashes green during HDSL synchronization. Lights steady green when both HDSL loops are in sync and no minor alarm conditions exist. Flashes red for any of the alarm conditions, or if the on-board 48 V fuse opens. Lights steady yellow when a self-test is in progress.
System option buttons	MODE and SEL buttons are used to set system options.
Four-character display	Four-character LCD that provides status messages for HDSL, signal-to-noise margin, optional settings, and alarms.
RX and test ports	Splitting access and bridging jacks (210-Bantam-type).
RS-232 craft port	Accessed through a DB9/210 adapter (p/n 120-1035-01, shipped with every unit) and configured as Data Circuit-terminating Equipment (DCE) that allows you to control the HLU-200 through a maintenance terminal (or a PC with terminal emulation software).
Pull tab	Used to remove the HLU-200 from the CBA.

Unlike the HLU-200 List 1F, the four-character display of the HLU-200 List 1A does not illuminate when first inserted into a shelf slot. This conserves power if the entire CBA is power cycled. The List 1A display illuminates for five minutes when either of the front-panel buttons, MODE or SEL, is pressed.

INSTALLATION

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 ADC.

SETTING THE HDSL LINE VOLTAGE OPTION

The HDSL line powering voltage is set by the S1 switch. Bipolar (BIP) sets the HDSL line voltage to +65 Vdc on loop 2 (+100 Vdc for doubler circuits) and -65 Vdc on loop 1 (-100 Vdc for doubler circuits). This setting reduces the maximum ground referenced voltage but applies positive voltage to the cable pairs, which could accelerate corrosion on the cable pairs. Unipolar (UNI) sets the HDSL line voltage to 0 Vdc on loop 2 and to -130 Vdc on loop 1 (-200 Vdc for doubler circuits). 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 line voltage power supply, used for both options, is ground referenced and also ground isolated by 200 kΩ. The ground isolation reduces problems due to induced noise currents and large surge voltages that are ground referenced. Ground isolation also reduces ground-fault currents, which improves product safety. The safety issue depends solely on the differential voltage across Loop 1 and Loop 2 and is independent of the S1 setting.

INSTALLING THE HLU-200

To install the HLU-200 into a Litespan-2000 channel bank:

1 Slide the HLU-200 into the card guides for the desired slot, then push the unit in until it touches the channel-bank backplane card-edge connector.

2 Carefully push the unit in until it is entirely within the card guide, making sure that the unit is properly seated.

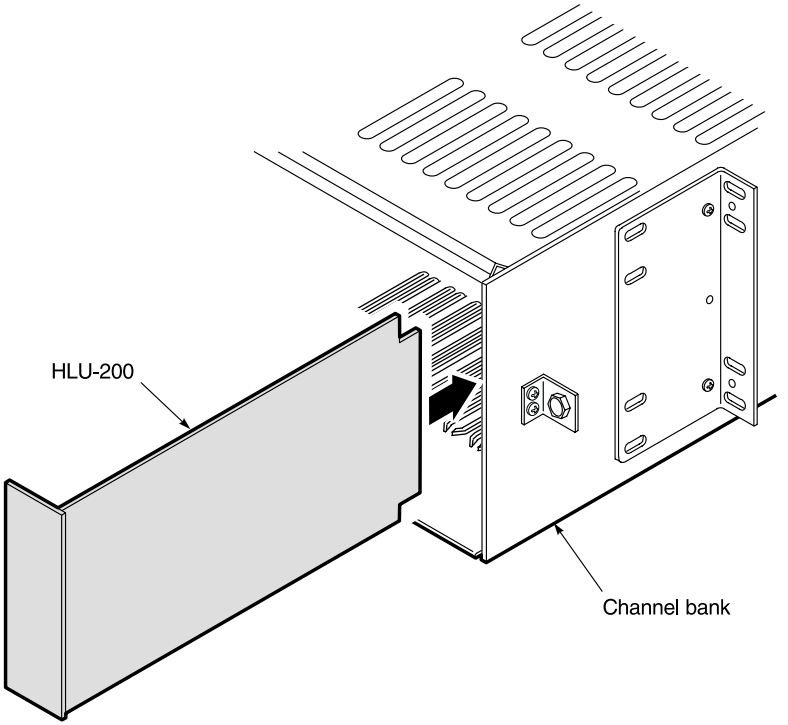


Figure 2. *Installing the HLU-200*

PROVISIONING

All HLU-200 List 1A user options can be set using either the front panel Mode and Select buttons (in conjunction with the four-character display) or from the Maintenance Terminal menus through a maintenance terminal connected to the front-panel RS-232 maintenance port.

Only the DS1 line code (B8ZS or AMI) is sent to the Litespan system manager, which reads the value and then provisions the Litespan Gate Array. The HLU-200 line code setting is not available from OMAPS (Paragraph 14.3) and must be provisioned directly from the HLU-200.

USING THE MODE AND SELECT BUTTONS

To provision the HLU-200 through the SEL and MODE front-panel buttons:

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

2 Press the **SEL** button to step 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.

The following three user options (Default Settings and Using the Craft Port on page 8, and System Settings on page 9) must be set using the maintenance terminal interface: Circuit ID, Time and Date, DS0 Blocking, and Margin Alarm Threshold.

DEFAULT SETTINGS

To return the system options 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 210 bantum jack connector, needs a DB9 adapter. The HLU-200 front panel allows you to use a standard RS-232 cable to connect your system to a maintenance terminal or PC for running a terminal emulation program. Once connected you can access the maintenance, provisioning, and performance screens.

To provision the HLU-200 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, you must deselect *Show Scroll Bars* and *Use Function, Arrow, and Ctrl Keys for Windows.*

2 On each screen, enter the key represented by the letter in parentheses for the parameter to be changed.

- Each entry of the letter scrolls the parameter to its next value.
- 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.

SYSTEM SETTINGS

Boldface type indicates the factory default settings for the following system settings.

Table 2. *System Settings*

Mode	Selection	Description
ZBTS	ON	Informs HiGain that the ESF frame is operating in its ZBTSI mode.
	OFF	Informs 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.
LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
	20	Sets automatic time-out to 20 minutes after initiation.
	60	Sets automatic time-out to 60 minutes after initiation.
	120	Sets automatic time-out to 120 minutes after initiation.
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.

Table 2. *System Settings (Cont.)*

Mode	Selection	Description
LPBK	DIS	Configures the HLU-200 to ignore the 2-in-5 Smart-Jack loopback command.
	ENA	Enables the HLU-200 to respond to the 2-in-5 Smart-Jack 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.
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 AUTO mode is not supported. If selected, the DS1 code defaults to AMI.
CONF	YES	Confirms that all operating parameters (except Margin) are to be updated to the new selections.
	NO	Prevents newly selected operating parameters from being updated. These options remain as they were before the setting options procedure was started.
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.

Table 2. *System Settings (Cont.)*

Mode	Selection	Description
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 toward 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, if an HRU List 6 or 8 is detected, or by a quiet termination (LOS), if an HRU List 7 is detected.
MARG	Range: 0 to 15 dB	The MARG (Margin Alarm Threshold) can only be set using the Maintenance Terminal menus. This setting determines the minimum allowable margin below which a minor alarm can occur. A 0 dB setting disables this option. Default setting is 1 dB.
DS0	BLK	The DS0 Blocking Option can only be set using the Maintenance Terminal menus. The four-character front panel display only displays the status of the blocking option. BLK indicates at least one channel is blocked. Blocked channels are replaced by the FF Idle Code.
	NONE	Indicates no channels are blocked.

TROUBLESHOOTING

Minor alarm and diagnostic messages routinely appear on the HLU-200 front-panel four-character display. This display automatically turns on when power is initially applied to the HLU-200. To conserve power, the display remains on for only 5 minutes if neither the **MODE** or **SEL** buttons are pressed. The use of either button activates the four-character display and restarts the 5-minute power-control timer.

ALARMS

Only one alarm can be displayed at a time, so the highest priority alarm is displayed if more than one alarm exists. The following table lists the alarms ordered by priority.

Table 3. *Minor alarm and diagnostic message displays.*

Message	Full Name	Description
ALRM LOSW	Loss of Sync Word (1)	One of the HDSL loops has lost synchronization.
ALRM RLOS	Remote Loss of Signal	Loss of the HRU DS1 input signal.
DS1	DS1 BPV errors	Indicates that the number of BPVs at the HLU or HRU DS1 inputs have exceeded the 24-hour ES threshold.
ALRM MAL1 or ALRM MAL2	Margin Alarm Loop1 or Margin Alarm Loop2	Indicates that the margin on HDSL Loop 1 or Loop 2 has dropped below the threshold (1 to 15 dB) set by the user.
H1ES or H2ES	HDSL CRC Error Channel 1 or Channel 2	Indicates HDSL Loop 1 or Loop 2 has exceeded the user-defined 24-hour ES CRC threshold.

(1) When both HDSL loops lose sync word (LOSW), a system alarm condition exists. However, since the HLU enters a self test cycling mode, the front panel LED lights yellow instead of red and the `SELF TEST` message displays instead of the `ALRM` message.

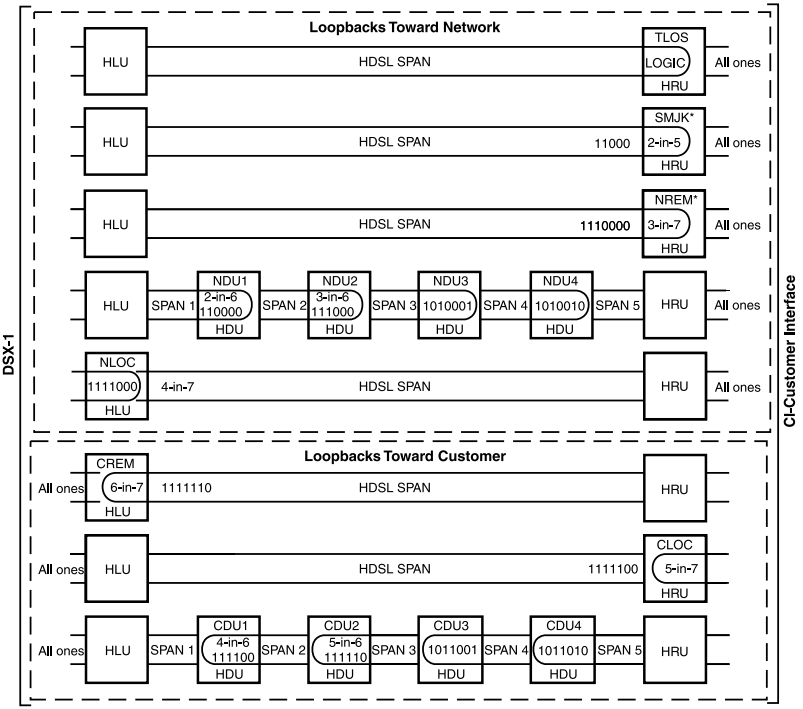
LOOPBACKS

The HLU-200 loopback messages are listed in the following table. The GNLB locations and their activation codes are also shown in Figure 3 on page 14.

Table 4. *Loopback Messages*

Message	Full Name	Description
CREM	Customer Remote Loopback	Signal from customer is looped back to customer at the HLU.
NLOC	Network Local Loopback	CBA signal is looped back to CBA at HLU.
CLOC	Customer Local Loopback	Signal from Customer is looped back to customer at HRU.
NREM	Network Remote Loopback	CBA signal is looped back to CBA at HRU.
SMJK	Remote Smart-Jack Loopback	Signal from CBA is looped back to CBA at HRU.
TLOS	Transmit Loss Of Signal	HRU is in a logic loopback state caused by a loss of its T1 input from the CI, if enabled at the HRU use the TLOS switch option.
ARM	HiGain System ARMED	Armed to respond to Intelligent Repeater Loop Codes.

The following generic loopback mode diagram (Figure 3), shows the GNLB locations and their activation codes.



* Set the SAIS option to ENA to send AIS (indicated by an all ones pattern) to the CI during SmartJack loopback, NREM, and TLOS. Use the 3-in-5 code to loop down.

Figure 3. *Generic Loopback Mode*

FOUR-CHARACTER DIAGNOSTIC MESSAGES

The HLU-200 diagnositc messages are listed in the table below.

Table 5. *Four-Character Diagnostic Messages*

Message	Full Name	Description
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.
ACQ 1 or ACQ2	Acquisition 1 or 2	The multiplexers of the HLU, and HRU or first doubler are trying to establish synchronization over Loop 1 or Loop 2 of Span 1.
A*n*L1 or A*n*L2	Acquisition *n* Loop 1 or Loop 2	The multiplexers of the two devices on Span *n* are trying to establish synchronization with each other on Loop 1 or Loop 2, where *n* is the number of the span.
FRM	Frame: SF, ESF, UNFR, NONE	Defines the type of frame pattern being received from the DSX-1: SuperFrame (SF), Extended SuperFrame (ESF), Unframed (UNFR), or NONE. Displayed during System Settings review mode.
SIG 1 or SIG 2	Signal 1 or Signal 2	The transceivers of the HLU, and HRU or first doubler are trying to establish contact with each other on Loop 1 or Loop 2 of Span 1.
S*n*L1 or S*n*L2	Signal *n* Loop 1 or Loop 2	The transceivers of the two devices on Span *n* are trying to establish contact with each other on Loop 1 or Loop 2, where *n* is the number of the span.
ACO	Alarm CutOff	A system alarm has occurred, and has been retired to an ACO condition by pressing the SEL button on the HLU front panel.
SELF TEST	Self Test	The HLU is in a self-test mode. This occurs every power On/Off cycle.
ALRM	Alarm Condition Exists	A minor alarm condition is in effect.
PWRF SHRT	Power Feed Short	Indicates a short between the two HDSL pairs. 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.

Table 5. *Four-Character Diagnostic Messages (Cont.)*

Message	Full Name	Description
SF	Super Frame	Indicates the T1 input to the AHT1U in a superframe format, if the FRMC option is set to AUTO.
ESF	Extended Super Frame	Indicates the T1 input to the AHT1U in an extended superframe format, if the FRMC option is set to AUTO.
PWRF OFF	Power Feed Off	HDSL span power has been turned off by setting the PWFD option to DIS, or HDSL span power has been turned off by use of the A1LB/A2LB/A5LB Intelligent Office Repeater (IOR) Power Down code.
BAD RT?	No response from HRU	The HLU does not receive any response from the HRU. The integrity of the HRU or the two HDSL loops (they may be open) is questionable.
VER *xxxx*	HLU-200 Version Number	The software version number (*xxxx*) appears during the System Settings review mode. Press the MODE button for 3 seconds to display the software version.
LIST 0xL	HLUs List No.	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: SuperFrame (SF), Extended SuperFrame (ESF), Unframed (UNFR), or NONE. Displayed during System Settings review mode.

SPECIFICATIONS

Maximum Power Consumption	
Without doubler	13 W
With doubler	20 W
Maximum Heat Dissipation	
Without doubler	5 W
With doubler	6.3 W
Mounting	
Litespan-2000	CBA/ONU-48, 96
Dimensions	
Height	4.42 inches (11.22 cm)
Width	0.84 inches (2.13 cm)
Depth	10.2 inches (25.9 cm)
Weight	1 lb. (.45 kg)

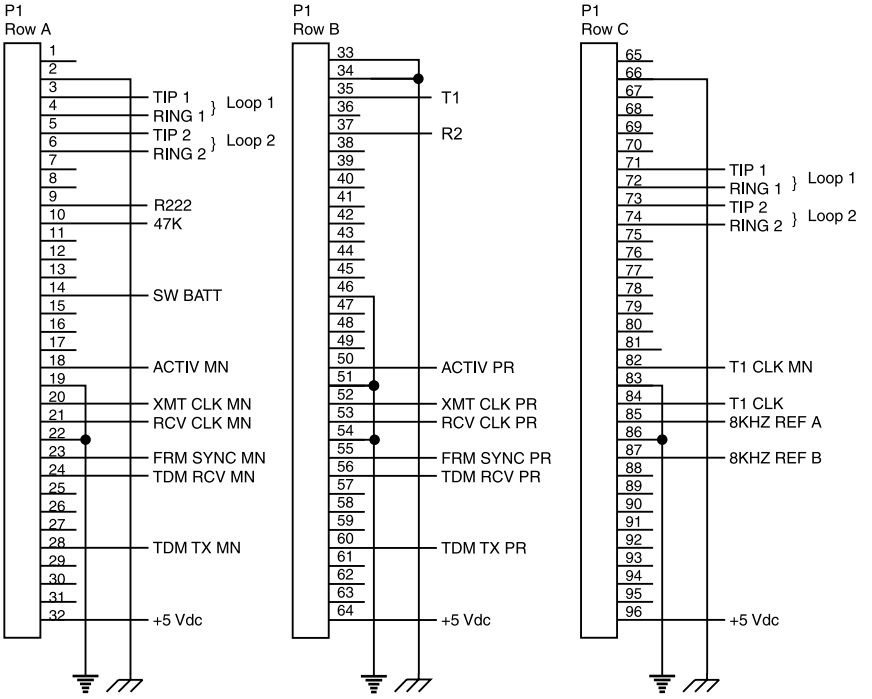


Figure 4. *Card-edge Connector*

POWER PARAMETERS

NON DOUBLER AHT1U APPLICATIONS

This section discusses HLU-200 List 1A operations when used without doublers. Nondoubler HLU-200 current drains on the two CBA power supplies, power consumption and dissipation are listed in Table 6.

Table 6. *HLU-200 List 1A Power Parameters for Non-doubler Applications*

	Line-powered HRU		Locally-powered HRU
Power Bus	**CPE-I (1) OFF**	**CPE-I (1) ON**	**CPE-I (1) ON or OFF**
+5 Vdc	600 mA	600 mA	600 mA
-48 Vdc	133 mA	200 mA	0 mA
Power Consumption	9.38 W	12.6 W	2.9 W
Power Dissipation	4.23 W	4.88 W	2.9 W

(1) CPE-I = Customer Premises Equipment current

The maximum power dissipation measures the power converted into heat inside the unit. It contributes to the total heat generated in the space around the unit.

The maximum power consumption is the total power that the HLU draws from the CBA power buses. This parameter is needed when the Litespan-2000 is battery powered. It determines the battery capacity required to maintain an 8-hour, standby battery reserve for emergencies.

The HLU line power supply converts the -48 Vdc battery output to -130 Vdc (-200 Vdc for doublers), which provides a simplex power feed on the two HDSL line interfaces.

DOUBLER AHTIU APPLICATIONS

One or two doublers may be used in the HDSL loops between the HLU-200 and the HRU. When using two doublers in an HDSL loop, the HRU must be locally powered. This section discusses HLU-200 operation with the following doublers:

HDU-451 List 3 and List 4; HDU-439 (all lists) and HDU-437 List 1 mini doublers; and the HDU-409 (all lists), HDU-407 (all lists), and HDU-404 (all lists) micro doublers.

The HLU-200 List 1A must not be used with older, higher powered HDU-451 List 1 or List 2 doublers. The HDU-451 List 3 and List 4 are low-power doublers that consume 40 percent less power than the List 1 or List 2.

Table 7 lists the current drains on the two CBA power busses and the unit power consumption and dissipation in doubler applications using the HDU-451 List 3 and List 4, the HDU-437 or the HDU-439. Table 8 on page 21 is for doubler applications using the HDU-404, HDU-407, or HDU-409.

HLU-200 List 1A does not support single-doubler applications that require the line-powered HRU to provide 60 mA of CPE current to power an external NID. Such applications exceed the maximum allowed slot current of 360 mA at -48 Vdc.

All single-doubler applications with line-powered HRUs and all two-doubler applications with locally-powered HRUs require one empty CBA slot per circuit to ensure that the slot power dissipation and consumption remains within the prescribed limits.

Table 7. *HLU-200 List 1A Power Parameters for Doubler Applications (HDU-451 List 3 and 4; HDU-437, and HDU-439)*

	Line-powered HRU One Doubler		Locally-powered HRU	
Power Bus	**CPE-I (1) OFF**	**CPE-I ON (2)**	**One Doubler**	**Two Doublers**
+5 Vdc	600 mA	600 mA	600 mA	600 mA
-48 Vdc	351 mA	443 mA	133 mA	351 mA
Power Consumption	19.8 W Total 9.6 W per slot	24.2 W Total 12.1 W per slot	9.3 W	19.8 W Total 9.6 W per slot
Power Dissipation	6.3 W Total 3.2 W per slot	7.2 W Total 3.6 W per slot	4.2 W	6.3 W Total 3.2 W per slot

(1) CPE-I = Customer Premises Equipment current
(2) Not supported. Exceeds 360 mA, -48 Vdc per slot.

Table 8. *HLU-200 List 1A Power Parameters for Doubler Applications (HDU-407, HDU-407, and HDU409)*

	Line-powered HRU One Doubler		Locally-powered HRU	
Power Bus	**CPE-I (1) OFF**	**CPE-I ON**	**One Doubler**	**Two Doublers**
+5 Vdc	600 mA	600 mA	600 mA	600 mA
-48 Vdc	252 mA	319 mA	114 mA	202 mA
Power Consumption	15.1 W Total 7.5 W per slot	18.3 W Total 9.2 W per slot	8.5 W	12.7 W Total 6.4 W per slot
Power Dissipation	4.8 W/Total 2.4 W per slot	5.6 W Total 2.8 W per slot	4.0 W	6.2 W Total 3.1 W per slot

(1) CPE-I = Customer Premises Equipment current

Table 9 on page 22 shows the HLU-200 List 1A entries that must be added to the Worksheet PW-1 that appears in the Litespan-2000 OSP-363-205-020 Engineering and Planning practice.

Table 9. *HLU-200 List 1A Power Worksheet*

Doubler Model	CPE-I	No. of HDUs	HRU Power		Worksheet Factors			
			Line	Local	A	B	C	D
None	Off	None	X		0.6	0	0.133	0
None	On	None	X		0.6	0	0.2	0
None	Off/On	None		X	0.6	0	0	0
HDU-451 List 3 & 4; HDU-439; HDU-437	Off	1	X		0.6	0	0.351	0
HDU-451 List 3 & 4; HDU-439; HDU-437	Off/On	1		X	0.6	0	0.133	0
HDU-451 List 3 & 4; HDU-439; HDU-437	Off/On	2		X	0.6	0	0.351	0
HDU-409, HDU-407, HDU-404	Off	1	X		0.6	0	0.319	0
HDU-409, HDU-407, HDU-404	Off/On	1		X	0.6	0	0.144	0
HDU-409, HDU-407, HDU-404	Off/On	2		X	0.6	0	0.202	0

PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products. Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center (TAC).

Sales Assistance 800.366.3891 ext. 73000 (USA and Canada) or 952.917.3000 Fax: 952.917.3237	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration 800.366.3891, ext. 73000 (USA and Canada) or 952.917.3000	• Complete Solutions (from concept to installation) • Network Design and Integration Testing • System Turn-Up and Testing • Network Monitoring (upstream or downstream) • Power Monitoring and Remote Surveillance • Service/Maintenance Agreements • Systems Operation
ADC Technical Assistance Center 800.638.0031(USA and Canada) or 714.730.3222 Fax: 714.730.2400 Email: wsd_support@adc.com	• Technical Information • System/Network Configuration • Product Specification and Application • Training (product-specific) • Installation and Operation Assistance • Troubleshooting and Repair/Field Assistance
Online Technical Support	• www.adc.com/Knowledge_Base/index.jsp
Online Technical Publications	• www.adc.com/library1/
Product Return Department 800.366.3891 ext. 73748 (USA and Canada) or 952.917.3748 Fax: 952.917.3237 Email: repair&return@adc.com	• ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products.

All 800 lines are toll-free in the USA and Canada.

CERTIFICATION AND WARRANTY

FCC CLASS A COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may 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.

LIMITED WARRANTY

ADC DSL Systems, Incorporated (“ADC”) warrants that, for a period of sixty (60) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. ADC's obligation, under this warranty, is limited to replacing or repairing, at ADC's option, any such hardware product which is returned during the 12-month warranty period per ADC's instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

ADC warrants that, for a period of 90 days from the date of purchase, the software furnished with its products will operate substantially in accordance with the ADC published specifications and documentation for such software. ADC’s entire liability for software that does not comply with the foregoing warranty and is reported to ADC during the 90-day warranty period is, at ADC’s option, either (a) return of the price paid or (b) repair or replace of the software. ADC also warrants that, for a period of thirty (30) days from the date of purchase, the media on which software is stored will be free from material defects under normal use. ADC will replace defective media at no charge if it is returned to ADC during the 30-day warranty period along with proof of the date of shipment.

ADC DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO ITS PRODUCTS AND ANY ACCOMPANYING WRITTEN MATERIALS. FURTHER, ADC DOES NOT WARRANT THAT SOFTWARE WILL BE FREE FROM BUGS OR THAT ITS USE WILL BE UNINTERRUPTED OR REGARDING THE USE, OR THE RESULTS OF THE USE, OF THE SOFTWARE IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY OR OTHERWISE.

MODIFICATIONS

Any changes or modifications made to this device that are not expressly approved by ADC DSL Systems, 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.

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