QUICK INSTALLATION

HiGain
HLU-231 List 9D
Line Unit

THE HLU-231 LIST 9D

The HiGain® HLU-231 List 9D line unit 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 CSA includes loops up to 12,000 feet of 24 AWG or 9,000 feet of 26 AWG wire, including bridged taps. This line unit can be used in applications with or without HiGain Doubler Units (HDUs).

FEATURES

- Front-panel status LED and four-character status display
- Ultra-low wander
- Five-span range with four doublers (60 kft, 24 AWG)
- Selectable Power Feed modes
- Loss of Signal (LOS)/Alarm Indicator Signal (AIS) payload alarm option
- Additional screens for inventory and troubleshooting
- Payload (PL) or HiGain (HG) loopback source identification
- Reduced power consumption
- Low line-power option (-140V) for circuits with a single doubler
- Bit Error Rate (BER) alarm options
- Bipolar Violation Transparency (BPVT) options
- Grounded loop detection

SPECIFICATIONS

Operating Temperature	-40°F to +149°F (-40°C to +65°C)
Operating Humidity	5% to 95% non-condensing
HDSL Span Voltage	-135 or ±112 Vdc
Mounting	220 mechanics shelf
HDSL Line Code	784 kbps 2B1Q
HDSL Output	+13.5 dBm ±0.5 dB at 135Ω
Maximum Provisioning Loss	35 dB at 196 KHz, 135Ω
DS1 Line Rate	1.544 Mbps ±200 bps
DS1 Line Format	Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS)
DS1 Frame Format	Extended SuperFrame (ESF), SuperFrame (SF)
DSX-1 Pulse Output	6 $V^{pk\text{-}pk}$, pre-equalized for 0 to 655 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX

1 INSTALLATION

To ensure proper installation of the HLU-231 L9D:

1. Align the HLU-231 with the shelf rails and slide the unit in.
2. When the HLU-231 is properly seated, the retaining latch on the HLU snaps closed.

2 POWER-UP SEQUENCE

When the HLU-231 powers up, the four-character display illuminates and reports status messages.

If the HLU-231 is not communicating with the next span device, the following occurs:

1. Alarm and diagnostic messages display (see Table 2, "Front-Panel Alarm Messages" and Table 4, "Front Panel Diagnostic Messages"), followed by the SELF TEST message.
2. The Status LED turns yellow, indicating it has entered self-test mode.

If the HLU-231 is communicating with the next span device, the following occurs:

1. The Status LED flashes green while acquiring each device in the system and turns a steady green when the entire system is operating without any alarms.
2. The four-character display reports margin (signal-to-noise ratio) readings and insertion loss.
3. If the status LED is not solid green, the display reports alarm conditions (see Table 2, "Front-Panel Alarm Messages").

3 PROVISIONING

1. Access the Maintenance Terminal screens by pressing the **SPACEBAR** several times.
   a. Set the date and time (select Set Clock from the Main Menu).
   b. Set the circuit IDs (select View System Inventory).
2. Access the System Settings selection on the Main Menu to change the default settings of any system parameters.
3. Access the View Troubleshooting screen to view a graphical analysis of any potential system problems.

When the HLU-231 has been successfully installed and provisioned, clear the Span Status, Performance Data, Performance History, and Alarm History screens to ensure accurate data and alarm reporting.

Continued

Four-character display
Displays status, provisioning, and alarm messages. See table below for a list of message descriptions.

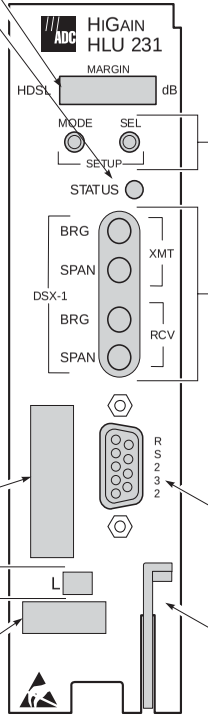
Status LED

Reports the following conditions:

Green LED	Normal operation
Flashing Green LED	HDSL acquisition
Red LED	Fuse alarm
Flashing Red LED	System alarm
Yellow LED	Self Test is in process or a Customer Remote Loopback (CREM) or Network Local Loopback (NLOC) is in effect.
Flashing Yellow LED	System is in Armed (ARM) mode.

Modem settings
1200-9600 baud
8 data bits
No parity
1 stop bit
Hardware flow control: OFF
Terminal emulation software: VT100

Front Panel



System option pushbuttons (for manual setting of system parameters)

Use MODE and SEL to manually modify user options, initiate loopbacks, and display DSX-1 line parameters.

1. Press the MODE pushbutton for 3 seconds and release. The front panel alternately displays the first system parameter and its current setting.
2. Press SEL to step through all possible system settings for the displayed parameter.
3. Press MODE to update the parameter and advance to the next parameter.
4. After scrolling through all the parameters, press SEL to confirm changes when prompted with a CONF YES message, or press MODE to cancel all changes.

DSX-1 test access jacks

SPAN	Provides splitting jack access to (XMT) and from (RCV) the HDSL span at the DSX-1 interface.
BRG	Provides non-intrusive bridging jack access to (XMT) and from (RCV) the HDSL span at the DSX-1 interface. Allows monitoring of the T1 payloads.

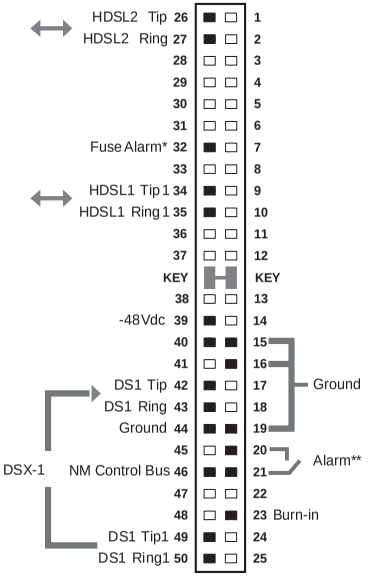
Craft port provisioning

To access all system maintenance, provisioning and performance screens, connect a standard 9-pin terminal cable between the serial port on a PC and the HLU craft port.

Retaining latch

Retains the card in the shelf when pulled up; extracts the card when pulled down.

Card-Edge Connector



* Fuse alarm is normally floating and at -48 Vdc when activated.

** System minor alarm contacts (pins 20 and 21) are normally open and close upon alarm.

4 LOOPBACK TESTING

Initiate loopback testing from the HiGain maintenance menus or use the MODE and SEL buttons. The hexidecimal inband codes shown below can be sent by a test set.

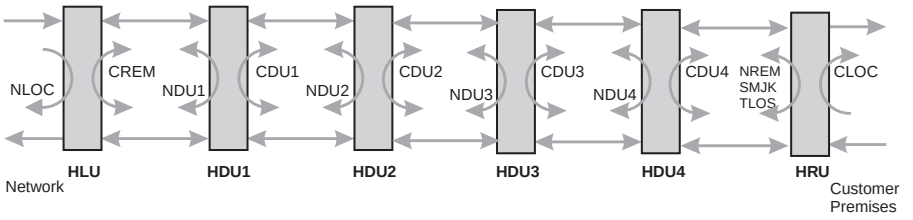


Table 1. *A5LB Special Loopback Commands*

Inband Code	Description
11000 . . .	ARMING or NI LPBK (2-in-5 arming code)
11100 . . .	IR LPDN or DISARM (3-5 disarming code)
D3D3	IOR LPBK (NLOC and CREM 230-232 bit errors and 229-231 bit errors)
C741	ILR-1 LPBK (NDU1 and CDU1 10 bit errors)
C754	LR-20 LPBK (NDU2 and CDU2 200 bit errors)
C743	ILR-3 LPBK (NDU3 and CDU3 30 bit errors)
C744	ILR-4 LPBK (NDU4 and CDU4 40 bit errors)
C742	ILR-2 LPBK (NREM and CLOC 20 bit errors)

For more information about the Maintenance Terminal screens, provisioning, and loopback mode testing, refer to the HLU-231 List 9D user manual, document number LTPH-UM-1236-*xx*. It can be downloaded from the ADC Website at www.adc.com.

Table 2. *Front-Panel Alarm Messages* [(a)]

Message	Description
LOSW	One of the HDSL loops has lost synchronization
LLOS	No signal is detected at the DSX-1 input to the HLU.
RLOS	No signal is detected at the DS1 input to the HRU.
BER	A system Bit Error Rate alarm is in effect.
MAL1 or MAL2	The margin on HDSL Loop 1 or 2 has dropped below the threshold (1 to 15 dB) setting.
NONE	No alarm present.

(a) ALRM displays prior to any alarm message. Pressing the SEL button initiates an Alarm Cutoff (ACO) message.

Table 3. *System Configuration Codes*

Code	Description
VER *xxxx*	The release revision of the firmware (appears during the System Settings review mode).
LIST *xxxx*	The model number of the product (appears during the System Settings review mode).
FRM *xxxx*	Indicates the type of frame pattern being received from the DSX-1, where *xxxx* is SF, ESF, UNFR, or NONE.
CODE *xxxx*	The line code setting, where *xxxx* is Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS).
PLEV *xxxx*	Indicates the HDSL line voltage in its LOW (-135 Vdc), HIGH (±112 Vdc), or DIS (disabled) state.

To comply with the intrabuilding wiring requirements of GR-1089 CORE, Section 4.5.9, the shields of the ABAM-type cables that connect the HLU-231 List 9D DSX-1 output ports to the cross-connect panel must be grounded at both ends.

Table 4. *Front Panel Diagnostic Messages*

Message	Description (normal operating messages in bold)
1=*xx* or 2=*yy*	Indicates the power of the received HDSL signal on each loop relative to noise. Any value of 6 dB or greater is adequate for reliable system operation.
ACQ1 or ACQ2	The multiplexers of the HLU and the HRU, or the first doubler, are trying to establish synchronization over Loop 1 or Loop 2 of Span 1.
A*n* L1 or A*n* L2	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.
BAD RT?	The HLU is not receiving any response from the HRU.
FERR	Framing bit error occurred at HLU DSX-1 input.
H1ES or H2ES	HDSL Loop 1 or Loop 2 CRC error.
***n* HDU**	Number (*n*) of doublers in the circuit.
INSL *xx*DB	The maximum Insertion Loss message (INSL) appears followed by *xx*DB, where *xx* is the maximum insertion in dB of all spans and loops.
LBPV	A local bipolar violation has been received at the DSX-1 input to the HLU-231.
MNGD	The HLU is under control of the HMU-319 Network Management Unit.
PWR FEED GND	One of the HDSL loops has been grounded.
PWR FEED ON	Indicates that the HDSL loops are not grounded or shorted.
PWR FEED OFF	HDSL span power has been turned off.
PWR FEED SHRT	Indicates a short between the two HDSL pairs or the inability of the HRU to communicate with the HLU.
SELF TEST	The HLU is in a self-test mode. This occurs every power on/off cycle.
SIG1 or SIG2	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	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.

Table 5. *System Setting Messages*

Display Code	Description (default values in bold)
EQL [(a)]	Sets the DSX-1 Equalizer (EQL) to: **EXT** (replaces the Internal Equalizer with an External Equalizer), 0 (0 to 132 ft.), 133 (133 to 265 ft.), 266 (266 to 398 ft.), 399 (399 to 532 ft.), 533 (533 to 655 ft.).
LPBK	Enables (**ENA**) or disables (DIS) all inband SMJK loopback commands.
SPLB	Configures the system for generic inband loopback commands (GNLB) or special loopback commands (A1LB, A2LB, A3LB, **A5LB**).
PWRF	DIS = disables HDSL powering. LOW = HDSL line voltage is -140 Vdc maximum. **AUTO** = automatically switches between -140 Vdc for non-doubler applications and ±112 Vdc for doubler applications. HIGH = ±112 Vdc for all applications.
BERT	**NONE** = prevents generation of a system alarm due to excessive BER. 1E-6 or 1E-7 = alarm activates when BER threshold exceeds 10.
LBTO [(a)]	Loopback timeout = NONE, 20, 60 or **120** minutes.
ALM	Enables (ENA) or disables (**DIS**) alarm indications due to remote DS1 LOS at HRU input.
LNCD [(a)]	Line code = places the HLU and HRU in **B8ZS** or AMI mode.
SAIS	Enables (**ENA**) or disables (DIS) transmission of AIS signal during NREM/SMJK loopbacks.
MARG	0 to 15 dB (default = **4 dB**)
RDA	Enables (**ENA**) or disables (DIS) alarm indications due to remote DS1 LOS at HRU input.
ALMP	Enables a line to output an (**AIS**) payload of all ones or an (LOS) condition at its DS1 ports for LOSW, DS1 LOS, and margin alarms.
RTPV	Enables (ENA) provisioning at the remote (when remotely logged in) or disables (DIS) provisioning at the remote.
BPVT	Enables (ENA) or disables (**DIS**) Bipolar Violation Transparency (BPVT).

(a) Can be configured using the MODE and SEL buttons on the HLU front panel as well as through the craft port.

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

Product warranty is determined by your service agreement. Contact your sales representative or Customer Service for details.

Modifications

Any changes or modifications made to this device that are not expressly approved by ADC DSL Systems, Inc. voids the user's warranty.

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

Standards Compliance

This equipment has been tested and verified to comply with the applicable sections of the following safety standards:

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety
- Binational standard, UL-1950/CSA-C22.2 No. 950-95: Safety of Information Technology Equipment

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