HiGain

QUICK INSTALLATION

HLU-388 LIST 5E
LINE UNIT

HLU-388 LIST 5E

The HiGain® HLU-388 List 5E 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 with HiGain Doubler Units (HDUs) to extend reach.

FEATURES

- Front panel status LED, four-character status display, and RS-232 craft port
- 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 (-140 Vdc) 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	-140 to ±112 Vdc
Mounting	DDM+ (Double Dual Module) high-density shelf
HDSL Line Code	784 kbps 2B1Q
HDSL Output	+13.5 dBm ±0.5 dB at 135 Ω
Maximum Provisioning Loss	35 dB at 196 kHz, 135 Ω
DS1 Line Rate	1.544 Mbps ±200 bps
DS1 Line Format	Alternate Mark Inversion (AMI), Bipolar with 8-Zero Substitution (B8ZS) or Zero Byte Time Slot Interchange (ZBTSI)
DS1 Frame Format	Extended SuperFrame (ESF), SuperFrame (SF), or Unframed (UNFR)
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 install the HLU-388:

1. Lift up the entire front panel and align the HLU-388 with the shelf rails.
2. Slide the unit in and press the front panel down to secure.

2 POWER-UP SEQUENCE

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

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

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

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

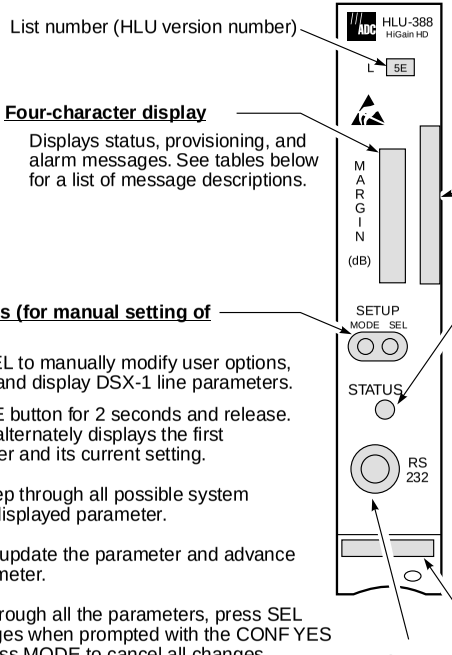
1. The Status LED flashes green while acquiring each device in the system, and turns a steady green when the entire system is operating without any alarms.
2. The four-character display reports margin (signal-to-noise ratio) readings and insertion loss.
3. If the status LED is not solid green, the display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

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

Continued

Front Panel



Modem Settings

1200-9600 baud
8 data bits
No parity
1 stop bit
Hardware flow control: OFF
Terminal emulation software: VT 100

System option buttons (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 button for 2 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 the CONF YES message, or press MODE to cancel all changes.

Status LED

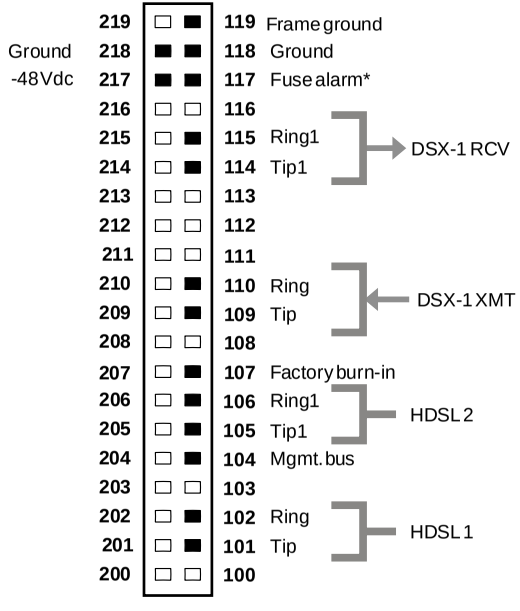
Reports the following conditions:

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

Craft port provisioning

Bantam 210 jack provides bidirectional communication between the unit and an external terminal by way of DB-9 or DB-25 connector to allow configuration and performance monitoring through the maintenance terminal menus. (Use adapter for jack, part number 120-1035-01.)

Card-edge Connector



* Fuse alarm is normally floating (0 to 80 Vdc maximum) and at -48 Vdc (10 mA maximum) when activated.

4 LOOPBACK TESTING

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

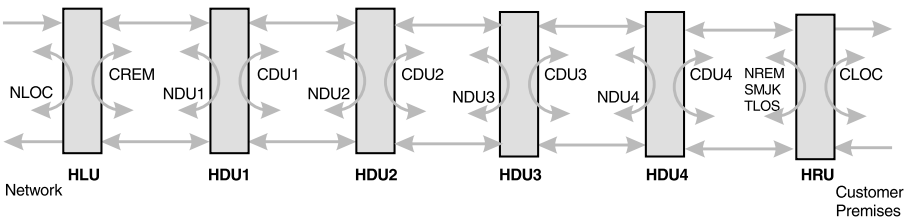


Table 1. *GNLB Loopback Commands*

Loopback	Inband Code	Description
NLOC	1111000	DSX-1 signal is looped back to DSX-1 at HLU.
NDU1	110000	Query to initiate loopback at doubler 1 to the network.
NDU2	111000	Query to initiate loopback at doubler 2 to the network.
NDU3	1010001	Query to initiate loopback at doubler 3 to the network.
NDU4	1010010	Query to initiate loopback at doubler 4 to the network.
NREM	1110000	DSX-1 signal is looped back to DSX-1 at the HRU.
SMJK	11000	DSX-I signal is looped back to DS1 at the HRU SmartJack module.
CLOC	1111100	Signal from customer is looped back to the customer at the HRU.
CDU1	111100	Query to initiate loopback at doubler 1 to the customer premises.
CDU2	111110	Query to initiate loopback at doubler 2 to the customer premises.
CDU3	1011001	Query to initiate loopback at doubler 3 to the customer premises.
CDU4	1011010	Query to initiate loopback at doubler 4 to the customer premises.
CREM	1111100	Signal from customer is looped back to the customer at the HLU.
Loopdown	11100	Deactivates any of the Inband loopback commands.

For more detailed information about the Maintenance Terminal screens, provisioning, and loopback mode testing, refer to the HLU-388 List 5E technical practice, document number 150-388-155-xx. It can be downloaded from the Customer Site portion of the ADC Web page at *www.adc.com*. A password is required to access the Customer Site Web pages. If you do not have a password, contact your sales representative.

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

Message	Description
LOSW	One of the HDSL loops has lost sync.
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* [(a)]

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 AMI, B8ZS or ZBTS.
PLEV *xxxx*	Indicates the HDSL line voltage in its LOW (-140 Vdc), HIGH (±112 Vdc) state, or DIS (disabled) state.

(a) To view system configuration codes, press the MODE button for 3 or more seconds.

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 06 (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 T1 input.
FRM	Defines the type of frame pattern being received from the DSX-1.
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 T1 input to the HLU-388.
MNGD	The HLU is under control of the HMU-319 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.
TLOS	HRU is in logic loopback mode caused by loss of its T1 input from the CI.

Table 5. *System Settings*

Display Code	Description (default values in bold)
EQL	Sets the DSX-1 Equalizer to: **0 (0 to 133 ft.)**, 133 (133 to 266 ft.), 266 (266 to 399 ft.), 399 (399 to 533 ft.), 533 (533 to 655 ft.).
LBPK	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, A4LB, A5LB).
PWRF	DIS = disables HDSL powering; LOW = HDSL line voltage is -140 Vdc max.; **AUTO** = automatically switches between -140 Vdc for nondoubler applications and ±112 Vdc for doubler applications); HIGH = ±112 Vdc for all applications.
ZBTS	ON = ESF frame is operating in Zero-Byte Time Slot Interchange (ZBTSI) mode. **OFF** = ESF frame is operating in non-ZBTSI mode.
BERT	**NONE** = prevents generation of a system alarm due to excessive BER 1E-6 or 1E-7 = alarm activates when BER threshold exceeds 10^{-6} or 10^{-7}.
LBTO	Loopback timeout = NONE, 20, 60, **120.**
DS1	Line code = **B8ZS**, or AMI.
FRMG	Framing = **AUTO** or UNFR (unframed).
HAIS	Transmits the AIS signal at the HLU and HRU output ports if one **(1LP)** or both (2LP) HDSL loops are not in sync.
SAIS	Enables (**ENA**) or disables (DIS) NREM/SMJK loopback mode.
DS0	DS0 blocking on (BLK) or off (**NONE**); can only be set through the craft port.
MARG	0 to 15 dB; the default is **4dB**; can only be set through the craft port.
RDA	Enables (**ENA**) or disables (DIS) remote DS1 LOS at HRU input.
ALMP	Enable line to output an (**AIS**) payload or an (LOS) condition.
RTPV	Enables (**ENA**) or disables (DIS) remote provisioning from the HRU. PWRF and RTPV cannot be set from the HRU.
BPVT	Enables (ENA) or disables (**DIS**) bipolar violation transparency.
CONF	Update all operating mode selections (YES or **NO**).

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

Trademark Information

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