

## QUICK INSTALLATION



## HLU-388 LIST 5 LINE UNIT

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The HiGain<sup>®</sup> Line Unit HLU-388 List 5 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 (American Wire Gauge) 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

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- Front panel status LED, 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 (-140 Vdc) for circuits with a single doubler
  - Bit Error Rate (BER) alarm options
  - Bipolar Violation Transparency (BPVT) options
  - Grounded loop detection
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## SPECIFICATIONS

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<b>Operating Temperature</b>	-40 °F to 149 °F (-40 °C to + 65°C)
<b>Operating Humidity</b>	5% to 95% non-condensing
<b>HDSL Span Voltage</b>	0, -140, or ±112 Vdc
<b>Mounting</b>	DDM+ high-density shelf
<b>HDSL Line Code</b>	784 kbps 2B1Q
<b>HDSL Output</b>	+13.5 dBm ±0.5 dB, 135 Ω
<b>Maximum Provisioning Loss</b>	35 dB at 196 kHz, 135 Ω
<b>DS1 Line Rate</b>	1.544 Mbps ±200 bps
<b>DS1 Line Format</b>	Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS)
<b>DS1 Frame Format</b>	Extended SuperFrame (ESF), SuperFrame (SF), or UNFR
<b>DSX-1 Pulse Output</b>	6 V <sup>pk-pk</sup> , pre-equalized for 0 to 655 feet of ABAM cable
<b>DSX-1 Input Level</b>	+1.5 to -7.5 dB DSX

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# 1 INSTALLATION

To ensure proper installation of the HLU:

- 1 Lift the entire front panel and align the HLU 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 tables “[Front Panel Alarm Messages](#)” and “[Front Panel Diagnostic Messages](#)” on the back side of this guide), 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).

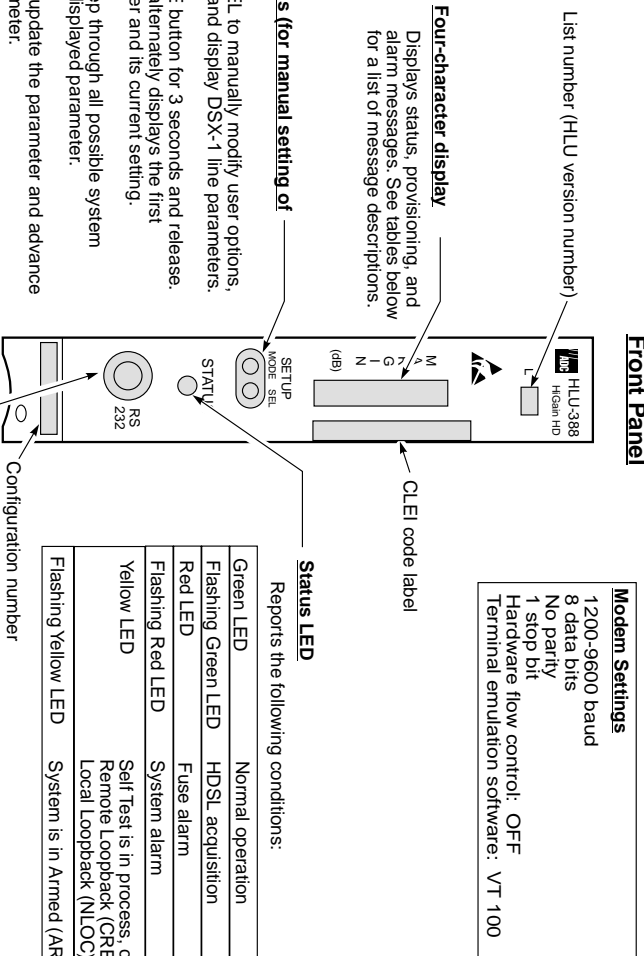
# 3 PROVISIONING

- 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

### Status LED

Reports the following conditions:

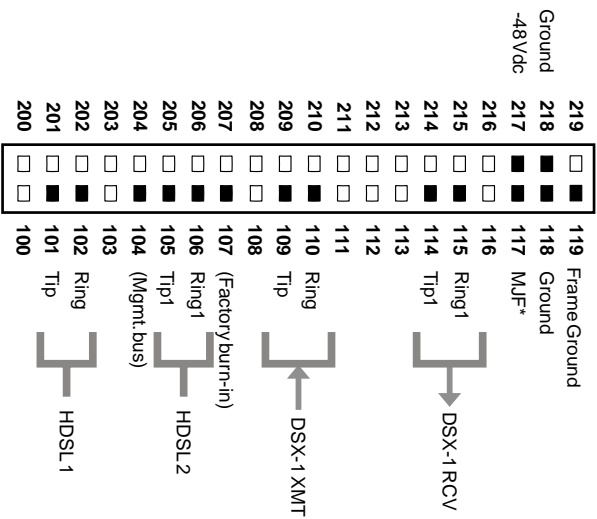
Green LED	Normal operation
Flashing Green LED	HDSL acquisition
Red LED	Fuse alarm
Flashing Red LED	System alarm
Yellow LED	Self Test is in process, or a Customer Remote Loopback (CREM) or Network Local Loopback (NLOC) is in effect
Flashing Yellow LED	System is in Armed (ARM) mode

- 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.
- Press the MODE button for 3 seconds and release. The front panel alternately displays the first system parameter and its current setting.
  - Press SEL to step through all possible system settings for the displayed parameter.
  - Press MODE to update the parameter and advance to the next parameter.
  - 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.

### RS-232 Craft port

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.)

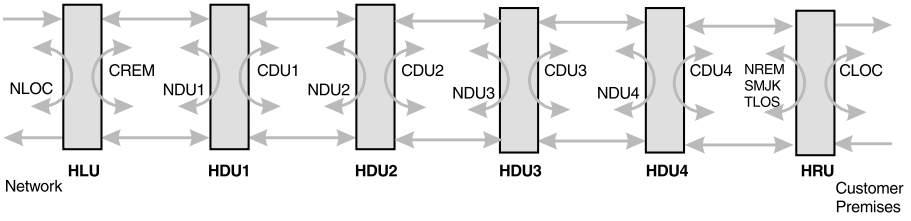
## Card-edge Connector



\* MUF (major fuse alarm) is normally floating (0 to 80 V 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.



## GNLB Loopback Commands

Inband Code		
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	DS1 signal is looped back to DS1 at HRU.
SMJK	11000	Signal from DS1 is looped back at the HRU by the HRU SmartJack module.
CREM	1111110	Signal from customer is looped back to the customer at the HLU.
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.
CLOC	1111100	Signal from customer is looped back to the customer at the HRU.
Loopdown	11100	Loops down any of the Inband loopup commands.



For detailed information about the Maintenance Terminal screens, provisioning, and loopback mode testing, refer to the HLU-388 List 5 technical practice, document number 150-388-105-xx. Copies of this publication or the technical practice can be downloaded from the ADC website at [www.adc.com](http://www.adc.com). To order a hard copy, please contact your sales representative.

## Front Panel Alarm Messages

Message	Description
LOSW	Indicates that one of the HDSL loops has lost sync.
LLOS	Indicates that no signal is detected at the DSX-1 input to the HLU.
RLOS	Indicates that no signal is detected at the DS-1 input to the HRU.
BER	A system Bit Error Rate alarm is in effect.
MAL1 or MAL2	The margin on HDSL Loop 1 or Loop 2 has dropped below the threshold set by the user.
NONE	No alarm present.

**NOTE:** Alarm (ALRM) displays prior to an alarm message. Pressing the SEL button initiates an Alarm Cutoff (ACO) condition.

## System Configuration Codes

Code	Description
VER xxxx	The release revision of the firmware (displays in System Settings review mode).
LIST xxxx	The model number of the product (displays in the System Settings review mode).
FRM xxxx	The frame pattern type received from the DSX-1, where xxxx is SF, ESF, UNFR, or NONE).
CODE xxxx	The line code setting, where xxxx is AM or B8ZS.
PLEV xxxx	Indicates the HDSL line voltage in its LOW (-140 Vdc), HIGH ( $\pm 112$ Vdc), or DIS (disabled).

## Front Panel Diagnostic Messages

Message	Description (default values in bold)
1=xx or 2=yy	Indicates the power of the received HDSL signal on each loop relative to noise. Any value of 6dB or greater is adequate for reliable system operation.
nHDU	Indicates the number (n) of doublers in the circuit (if any are present).
INSL xxdB	The maximum Insertion Loss message (INSL) appears followed by xxdB, where xx is the maximum insertion in dB of all spans and loops.
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.
AnL1 or AnL2	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.
LBPV	A local bipolar violation has been received at the DSX-1 input to the HLU.
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.
SrL1 or SrL2	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 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).

## System Settings

Display Code	Description (default values in bold)
EQL	Sets the Equalizer (EQL) DSX-1 to: <b>0 (0 to 133 ft.)</b> , 133 (133 to 266 ft.), 266 (266 to 399 ft.), 399 (399 to 533 ft.), 533 (533 to 655 ft.).
LPBK	Enables ( <b>ENA</b> ) or disables ( <b>DIS</b> ) all inband SMJK loopback commands.
SPLB	Configures the system for generic inband loopback commands ( <b>GNLB</b> ) or special loopback commands (A1LB, A2LB, A3LB, A4LB, A5LB).
PWRF	DIS = disables HDSL powering. LOW = HDSL line voltage at -140 Vdc maximum. <b>AUTO</b> = automatically switches between -140 Vdc for non-doubler applications and $\pm 112$ Vdc for doubler applications. HIGH = $\pm 112$ Vdc for all applications.
ZBTS	ON = ESF frame is operating in its Zero-Byte Time Slot Interchange (ZBTSI) mode. OFF = ESF frame is operating in its normal non-ZBTSI mode.
BERT	<b>NONE</b> = prevents generation of a system alarm due to excessive BER. 1E-6 or 1E-7 = alarm activates when BER threshold exceeds $10^{-6}$ or $10^{-7}$ , respectively.
LBTO	Loopback timeout = NONE, 20, <b>60</b> , 120 minutes.
DS1	Line code = places the HLU and HRU in B8ZS, AUTO or <b>AMI</b> mode.
FRMG	<b>AUTO</b> = configures the HiGain system to operate in an auto-framing mode. UNFR = configures the HiGain system to operate in an unframed mode.
HAIS	<b>2LP</b> = transmits the AIS signal at both the HLU and the HRU T1 output ports when both HDSL loops are not in sync (LOSW); <b>1LP</b> = applies when either of the two HDSL loops are not in sync or if a Margin alarm occurs.
SAIS	Enables ( <b>ENA</b> ) or disables ( <b>DIS</b> ) transmission of AIS signal during NREM/SMJK loopbacks.
RDA	Enables ( <b>ENA</b> ) or disables ( <b>DIS</b> ) alarm indications due to remote DS1 LOS at HRU input.
ALMP	Enables a line to output an ( <b>AIS</b> ) payload of all ones or an (LOS) condition at its DS1 ports for LOSW, DS1 LOS, and margin alarms.
BPVT	Enables ( <b>ENA</b> ) or disables ( <b>DIS</b> ) bipolar violation transparency (conversion of input DS1 BPVs and HDSL CRC errors into DS1 BPVs at the distant end's DS1 output port).
MARG <sup>(a)</sup>	0 to 15 dB (default - 4dB).
DSO <sup>(b)</sup>	NONE = no DSO channels blocked; BLK = some channels blocked.
CONF	YES = confirms that all operating modes are to be updated to their current selections. <b>NO</b> = prevents the most recently selected operating mode selection from being updated.

(a) MARG can only be set through the Maintenance Terminal.

(b) DSO can only be set through the Maintenance Terminal.

## 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

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