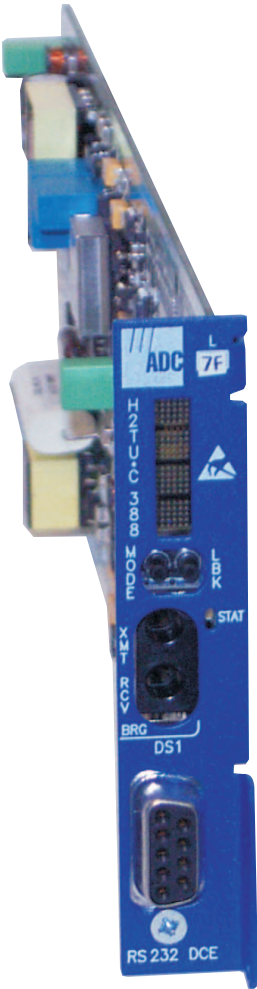


# USER MANUAL



**HiGain H2TU-C-388 List 7F Line Unit**  
Product Catalog: H2TU-C-388-7F  
CLEI: VACJLK6E



## Revision History of This Manual

To order copies of this manual, use document catalog number LTPH-UM-1214-02. (Copies of this publication 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.)

Revision	Release Date	Revisions Made
1	February 7, 2003	Initial release.
2	July 21, 2003	Added BERT and ground detection.

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*July 21, 2003*

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## 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.**

For a list of abbreviations used in this document, refer to “Appendix E - Abbreviations” on page 69.

## INSPECTING 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 “Appendix D - Product Support” on page 68. If you must store the equipment for a prolonged period, store the equipment in its original container.



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# OVERVIEW

The H2TU-C-388 List 7F (H2TU-C) line unit is the Central Office (CO) side of a T1 transmission system. The HiGain HDSL2 product family is fully compliant with the HDSL2 standard ANSI T1.418.

The H2TU-C, when used with an H2TU-R remote unit, transmits a 1.544 Mbps payload on one unconditioned copper pair over the full Carrier Service Area (CSA) range. The CSA includes loops up to 12,000 feet of 24 AWG wire or 9,000 feet of 26 AWG wire, including bridged taps.

The H2TU-C is designed to mount in Double Dual Module Plus (DDM+) shelves. For a list of compatible shelves, see “Appendix C - Compatibility” on page 67.

## FEATURES

Standard features include:

- HDSL2 transmission features
  - Enhanced lightning protection
  - Power cross-protection on HDSL2 interfaces
  - Full-duplex HDSL2 transmission on one pair at 1.552 Mbps
  - Ultra-low wander (Stratum 1 compliant)
  - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)
- Front-panel features
  - Four character status display
  - DSX-1 signal access
  - Status Light Emitting Diode (LED)
  - RS-232 craft port for maintenance terminal connection
  - MODE and LBK pushbuttons for system settings display and loopback activation
  - Dual loopback commands
- Maintenance screens to provision, monitor, and troubleshoot HDSL2 system
  - DS1 and HDSL2 performance monitoring
  - Loop attenuation and insertion loss reporting
  - Non-volatile storage of performance monitoring parameters
  - Performance Report Messaging (PRM) support for Supplemental PRM (SPRM) and Network PRM (NPRM) at the H2TU-R
  - Payload (PL) and HDSL Generic (HG) loopback source identification
  - Margin Alarm (MAL) threshold
  - Report menu option for downloading status and performance monitoring data to a file
  - 16-bit inband retrieval of margin and pulse attenuation
  - Remote provisioning through TL1 FDL or 11-bit inband commands
  - Remote access and control of H2TU-R test signal generator
  - Remote Frame Ground Status report on maintenance screen and TL1 command

- Bit-Error-Rate Test (BERT) Generator
- Configuration options
  - Selectable DSX-1 pre-equalizer
  - Bipolar Violation Transparency (BPVT) options
  - Bit Error Rate (BER) alarm
  - Power Back Off - Customer (PBOC) and Power Back Off - Network (PBON) options for configuring power output levels
  - Loss of Signal/Alarm Indication Signal (LOS/AIS) payload alarm option
  - Selectable loopback activation codes
- Additional Loopback Timeout (LBTO) settings of 8 hours and 24 hours



**DS1 is used throughout this document to refer to either the remote unit's DS1 interface or the line unit's DSX-1 interface.**

## APPLICATIONS

HiGain HDSL2 systems provide a cost-effective, easy-to-deploy method for delivering T1 High Capacity Digital Service (HCDS) over a single copper pair. HiGain HDSL2 systems support a multitude of network connections and system models.

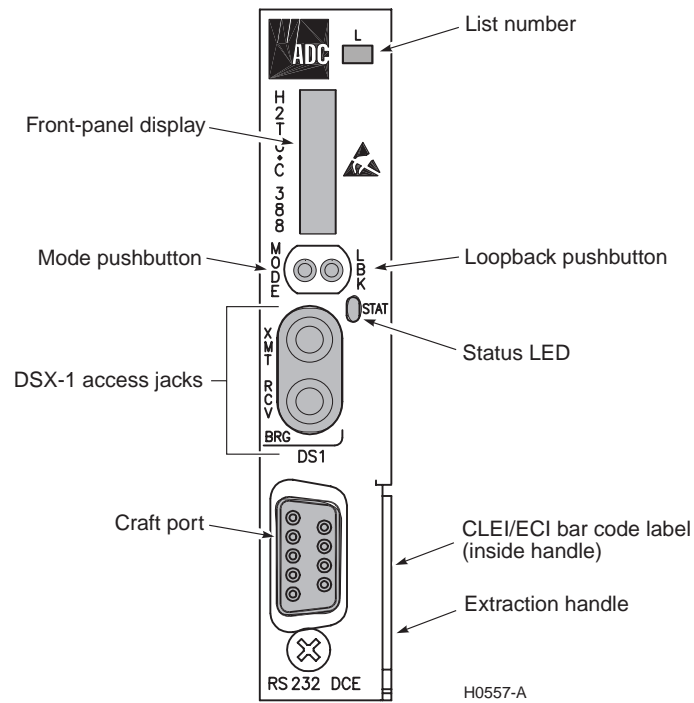
- The service is deployed over one unconditioned, non-loaded copper pair.
- Conventional inline DS1 repeaters are no longer required.
- Cable pair conditioning, pair separation and bridged tap removal are not required.

Each loop has no more than 35 dB of insertion loss (INSL) at 196 kHz, with driving and terminating impedances of 135 $\Omega$ . In general, HiGain HDSL2 systems:

- Operate effectively in the same cable binder group with other HDSL2 lines, HDSL, T1, ADSL, SDSL, POTS, DDS, and other transmission schemes.
- Can be used with customers requiring DS1 service on a temporary or permanent basis.
- Provide a means of quickly deploying service in advance of fiber-optic transmission systems.

# FRONT PANEL

Figure 1 shows the H2TU-C front panel. Table 1 on page 4 describes the front-panel components. For pinout diagrams of the H2TU-C card-edge connector and craft port, refer to “Appendix A - Specifications” on page 62.



**Figure 1.** H2TU-C Front Panel

**Table 1. Front-Panel Description**

Front-Panel Feature	Function
Front-panel display	Displays four-character status, provisioning, and alarm system messages. The front-panel display illuminates when power is initially applied. To conserve power the display only remains on for 5 minutes. Using the MODE or LBK pushbuttons reactivates the display and restarts the 5-minute timer. Refer to Table 2 on page 4 for a listing of the four-character messages.
List number	List number identifies the list number of the H2TU-C.
MODE and LBK pushbuttons	Permits user options to be monitored and modified without the need of a maintenance terminal. Used to initiate all HiGain loopbacks and test states as well as to display DSX-1 line parameters and line unit identity.
Status LED	The status LED can report the following conditions:
Off	Line power is off.
Green	Normal operation.
Flashing red (at turnup)	HDSL2 acquisition.
Red	Fuse alarm.
Flashing red	System alarm.
Yellow	An H2TU-C Customer Remote Loopback (CREM) or a Network Local Loopback (NLOC) is in effect. (While performing the CREM or NLOC, the status LED remains green.)
Flashing yellow	H2TU-C is in an Armed state.
CLEI and ECI bar code label	Provides the human-readable Common Language Equipment Identifier (CLEI) code number and the Equipment Catalog Item (ECI) bar code number.
DSX-1 access jacks	
BRG	Provides non-intrusive bridging jack access to (RCV) and from (XMT) the HDSL2 span at the DSX-1 interface. Allows the two DS1 payloads to be monitored.
DB-9 craft port (RS-232)	Provides bidirectional communication between the unit and an external terminal to allow configuration and performance monitoring through the maintenance terminal screens.
Extraction handle	Used to insert and extract the H2TU-C.

Table 2 lists the front-panel display messages. The four-character display reports the code of an alarm, loopback, or diagnostic message and, in some cases, is followed by a second four-character message that modifies the first message with a value or current configuration setting.

**Table 2. Front-Panel Display Messages**

Message	Full Name	Description
<b>ALARM MESSAGES</b>		
ACO	Alarm Cutoff	A system alarm has occurred, and has been retired to an ACO condition by pressing the LBK pushbutton on the H2TU-C front panel. The front panel displays the following messages in the order given: ACO, ALARM, and then the alarm condition. The Status LED lights green.
ALRM	Alarm Condition Exists	A system alarm condition is in effect.
DBER	DS1 Bit Error Rate	A system DS1 BER alarm is in effect and remains in effect until cleared.
HBER	HDSL2 Block Error Rate	A system HDSL2 Block Error Rate alarm is in effect.
LA	Loop Attenuation	Indicates that the attenuation on the HDSL2 loop has exceeded the maximum threshold value.
LAIS	Line Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received or transmitted at the H2TU-C DS1 input or output ports.
LLOS	Line (Unit) Loss of Signal	Indicates that no signal is detected at the DSX-1 input to the H2TU-C. Causes a system alarm.
LOSW	Loss of Sync Word	Indicates that the HDSL2 loop has lost synchronization.
MAL	Margin Alarm	The margin on HDSL2 loop has dropped below the threshold (0 to 15 dB) as set by the operator.

**Table 2. Front-Panel Display Messages (Continued)**

<b>Message</b>	<b>Full Name</b>	<b>Description</b>
PWR FEED GND	Power Feed Ground	The HDSL2 loop is grounded.
PWR FEED OPEN	Power Feed Open	Indicates a line power open condition.
PWR FEED SHRT	Power Feed Short	Indicates a short between the Tip and Ring of the HDSL2 pair.
PRMF	Performance Report Messaging - Far End	H2TU-R PRM-FE BER threshold has been exceeded.
PRMN	Performance Report Messaging - Near End	H2TU-R PRM-NE BER threshold has been exceeded.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received or transmitted at the H2TU-R DS1 input or output ports.
RLOS	Remote (Unit) Loss of Signal	Indicates that no signal is detected at the DS1 input to the H2TU-R. Causes a system alarm.
RRAI	Remote RAI—Remote Alarm Indication at the H2TU-R (Net signal has errors.)	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
LOF	Loss of Frame	The DS1 input does not contain the ESF or SF frame-pattern setting of the FRMG option.
TRCI	Transmit RAI-CI—TX RAI-CI Indication - Customer Installation at the H2TU-R (Net signal does not have errors.)	Upon reception of an RAI (yellow) from the CPE, the H2TU-R sends RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or Loss of Frame [LOF]), then the RAI is automatically passed on to the network.
SPN <i>n</i>	Span Number	Accompanies the LOSW alarm and identifies the span where the LOSW alarm occurred.
TUC	Transmission Unit Central Office	Accompanies the DBER, HBER, MAL, and LA alarm and indicates that the alarm has occurred at the H2TU-C central office unit.
TUR	Transmission Unit Remote End	Accompanies the DBER, HBER, MAL, and LA alarm and indicates that the alarm has occurred at the H2TU-R remote unit.

*Continued*

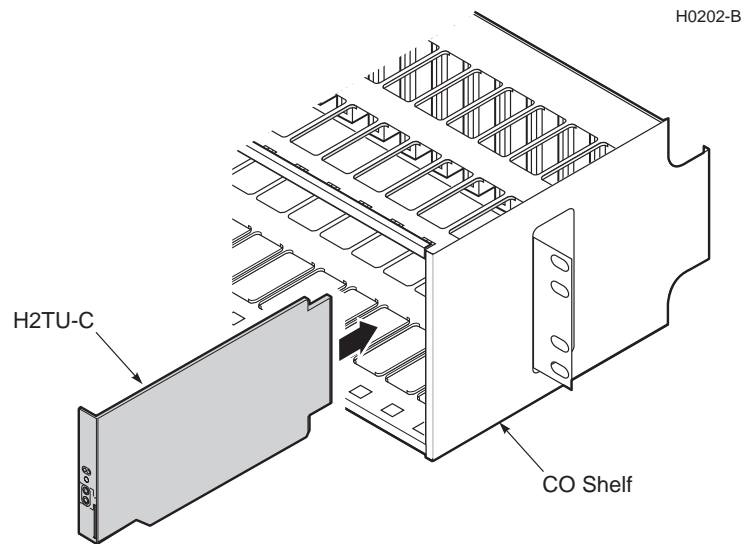
**Table 2. Front-Panel Display Messages (Continued)**

Message	Full Name	Description
<b>LOOPBACK MESSAGES</b>		
CLOC	Customer Local Loopback	Signal from customer is looped back to the customer at the H2TU-R.
COLB	Central Office Loopback	Dual loopback at the H2TU-C.
CREM	Customer Remote Loopback	Signal from customer is looped back to the customer at H2TU-C.
NLOC	Network Local Loopback	DSX-1 signal is looped back to the network at the H2TU-C.
NREM	Network Remote Loopback	DSX-1 signal is looped back to the network at the H2TU-R.
RULB	Remote Unit Loopback	Dual loopback at the H2TU-R.
SMJK	Remote SmartJack Loopback	DSX-1 signal is looped back to the network at the H2TU-R SmartJack module.
<b>DIAGNOSTIC MESSAGES</b>		
A = xx	Maximum Loop Attenuation	The Attenuation (A) message appears followed by xx, where xx is the loop attenuation of the longest (maximum loss) span, measured in dB.
ACQ	Acquisition	The multiplexers of the H2TU-C and H2TU-R (or the H2TU-C and first regenerator) are trying to establish synchronization over the HDSL2 loop of Span 1.
ARM	HiGain System Armed	Armed to respond to Intelligent Repeater Loop (ILR) codes.
BAD RT?	No Response from H2TU-R	The H2TU-C receives no response from the H2TU-R and all HDSL2 loop conditions are normal. Therefore, the integrity of the H2TU-R or the HDSL2 loop is questionable.
BAD RGND	H2TU-R Frame Ground Signal	The H2TU-R does not have a frame ground connection.
FERR	Framing Bit Error Occurred	Framing bit error has occurred at H2TU-C DSX-1 input.
HES	HDSL2 CRC Error	H2TU-C HDSL2 Loop Cyclical Redundancy Check (CRC) error.
LBPV	Local Bipolar Violation	A bipolar violation has been received at the DSX-1 input to the H2TU-C.
M=xx	HDSL2 Loop Margin	Indicates the power of the received HDSL2 signal relative to noise (signal to noise with respect to 21.5 dB). Any value of 6 dB or greater is adequate for reliable system operation.
PWR FEED OFF	Power Feed Off	HDSL2 span power has been turned off by setting the PWFD option to off, or HDSL2 span power has been turned off by use of the A2LB Intelligent Office Repeater (IOR) Power Down code.
PWR FEED ON	Power Feed On	Indicates that the HDSL2 loop is not grounded or shorted.
SIG	Signaling	The transceivers of the H2TU-C and H2TU-R are trying to establish contact with each other over the HDSL2 loop of Span 1.
<b>SYSTEM INFORMATION MESSAGES <sup>(a)</sup></b>		
VER x.xx	Software Version Number	The software version number of the H2TU-C.
LIST xx	List Number	The list number of the H2TU-C.
FRM xxxx	Frame: SF, ESF, UNFR, or AUTO	Defines the type of frame pattern being received from the DSX-1: SuperFrame (SF), Extended SuperFrame (ESF), Unframed (UNFR), or AUTO.
CODE xxxx	Line Code: AMI or B8ZS	The DS1 line code setting: Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS).
LATT xx	Loop Attenuation	The current loop attenuation threshold setting measured in decibels.
MARG xx	Margin	The current margin threshold setting measured in decibels.

(a) System information messages are displayed in Scroll Mode. To scroll through the messages, press the MODE pushbutton for 3 or more seconds. After system information messages scroll, the front panel displays the line card options (see Table 5 on page 16 and Table 6 on page 17).



# INSTALLATION



*Figure 2. Installing the H2TU-C into a Shelf*



Upon receipt of the equipment, 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.



When installing an H2TU-C in a chassis, be sure to wear an antistatic wrist strap. Avoid touching components on the circuit board.



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 H2TU-C DSX-1 output ports to the cross-connect panel must be grounded at both ends.

- 1 Align the H2TU-C with the shelf card-slot guides and slide the unit in.
- 2 Push on the H2TU-C front panel to secure the unit in the shelf.

## VERIFICATION

Once the H2TU-C is installed, verify that it is operating properly. To do this, monitor the following:

- Status LED
- Status messages reported by the front-panel display (Table 2 on page 4 lists the status messages).



**For information regarding turn-up instructions, see the Help menu and select Turn-up Aid.**

### Verification without an H2TU-R Remote Unit

If there is no H2TU-R remote unit installed:

- 1 Verify that the H2TU-C powers up. The front-panel display illuminates and reports status messages. (Table 2 on page 4 lists the status messages.)
- 2 Verify that the H2TU-C attempts to communicate with a remote unit (status LED flashes red). Even if a remote unit is not present, the following events should continue to occur:
  - The front-panel display reports various four-character status messages.
  - The H2TU-C attempts communication with a remote unit.

### Verification with an H2TU-R Remote Unit

If an H2TU-R remote unit has been installed:

- 1 Verify that the H2TU-C powers up. (The front-panel display illuminates and reports various status messages.)
- 2 Verify that the H2TU-C attempts to communicate with the remote unit (status LED flashes red). One of the following then occurs:
  - The H2TU-C detects and synchronizes with the remote unit. If no DS1 signal is being applied at either end, then the appropriate DS1 alarms (LLOS or RLOS) are reported on the front-panel display. The status LED flashes red until the DS1 signal is applied at both ends. The status LED then turns to a steady green and normal margin messages are reported on the front-panel display.
  - If the remote unit is not detected, the H2TU-C reports four-character status messages. The H2TU-C attempts communication again and reports four-character status messages. The H2TU-C repeats this cycle until a remote unit is detected.

# PROVISIONING

## DISPLAYING SYSTEM PARAMETER SETTINGS

To scroll through the current settings of all system parameters, press the MODE pushbutton for 3 or more seconds. The H2TU-C displays the following parameters:

- Software version number
- List number
- Type of frame pattern received from the DSX-1
- Line code of the signal received from the DSX-1
- All user-configured parameter settings
- Loop attenuation threshold setting
- Margin alarm threshold setting

## ACCESSING THE PROVISIONING SCREENS

### Connecting to a Maintenance Terminal

The craft port on the front panel allows you to connect the H2TU-C to a maintenance terminal, such as an ASCII terminal or PC running a terminal emulation program. Once connected to a maintenance terminal, you can access the maintenance, provisioning, and performance screens.

To connect to a maintenance terminal:

- 1 Connect the cable to the RS-232 craft port on the H2TU-C front panel (Figure 1 on page 3).
- 2 Connect the other end of the cable to the serial port on the maintenance terminal.
- 3 Start a terminal emulation program such as Procomm (emulating a VT100 terminal).
- 4 Configure the maintenance terminal for the following communication settings:
  - 9600 baud
  - No parity
  - 8 data bits
  - 1 stop bit
  - Hardware flow control set to OFF
- 5 If necessary, press **CTRL** + **R** to refresh the HDSL2 logon screen.

## Logon Screen

The maintenance terminal screens allow you to monitor, provision, and troubleshoot an HDSL2 system.

To select a menu from the logon screen shown in Figure 3, do one of the following:

- Press the underlined letter of the menu.
- Use the **←** **→** arrow keys to select the menu, then press **ENTER**.

Table 3 below summarizes the navigational keys. They are also listed in the onscreen Help menu. Table 4 on page 11 describes the logon screen menus.

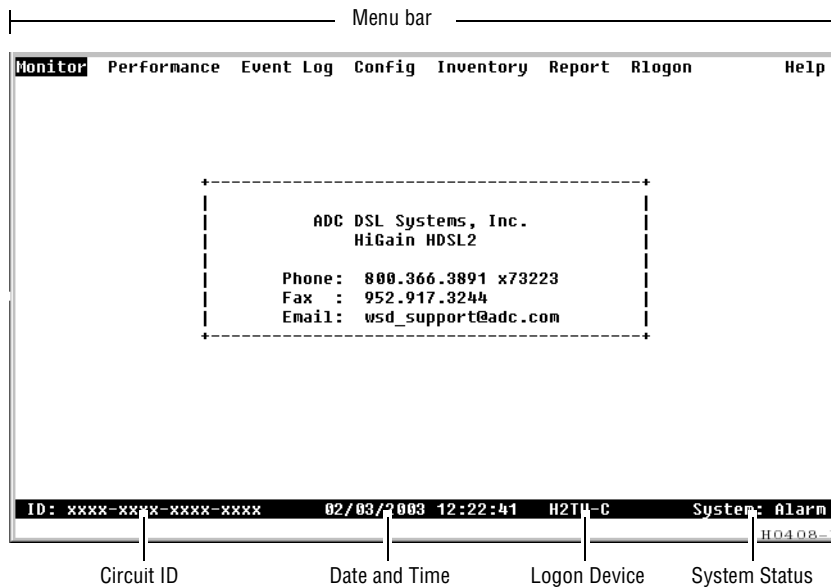


**Most VT100 emulation programs support a print screen option. For Windows-based programs, such as Procomm or HyperTerminal, see the Help menu for instructions.**

*Table 3. Navigational Keys for the Maintenance Terminal Screens*

Key (a)	Function
<b>SPACEBAR</b>	Cycle through selections.
<b>ENTER</b>	Activate the current setting or choice, or display a menu.
<b>ESC</b> or <b>F11</b> (VT100 only)	Return to the parent menu.
<b>↑</b> or <b>CTRL + E</b>	Select the submenu or item above the current one, or return to the previous menu.
<b>↓</b> or <b>CTRL + X</b>	Select the submenu or item below the current one.
<b>→</b> or <b>CTRL + D</b>	Select the menu or item to the right of the current one.
<b>←</b> or <b>CTRL + S</b>	Select the menu or item to the left of the current one, or return to the previous menu.
<b>CTRL + R</b>	Refresh the screen.

(a) Legacy management units require use of control keys instead of arrow keys.



*Figure 3. Logon Screen*

**Table 4.** Logon Screen Menus

<b>Press this key:</b>	<b>To access this menu:</b>	<b>Menu Functions</b>
<b>M</b>	Monitor	Monitors loopbacks and alarms, provides a graphical representation of circuit activity, including ES, UAS, SES, and line code.
<b>P</b>	Performance	Provides performance and alarm histories for current, 25-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 interface. Selecting this menu after a remote logon will permit viewing of the H2TU-R Blockage Indicator (BI) History screen, as displayed from the DS1 interface. See Figure 11 on page 26 and Figure 18 on page 33.
<b>E</b>	Event Log	Identifies the 100 most recent system events and reports the date and time of occurrence. Selecting this menu after a remote logon displays the Sectionalized Event Log for the H2TU-R. See Figure 25 on page 38.
<b>C</b>	Config	Provides standard configuration options, ADC options, date and time setting, and a reset option (factory settings). Also provides a master clear option that clears all performance, alarm, and event log entries. Selecting the Config menu after a remote logon will display the Signal Generator menu item, which provides access to the Signal Generator configuration submenu (see Figure 33 on page 50).
<b>I</b>	Inventory	Provides product information about the various devices that are in the system and lists circuit and device identifications.
<b>O</b>	Report	Provides four types of reports: Full Report, Short Report, System Information Report, and Event Report.
<b>R</b>	Rlogon/Rlogout	Remote logon can be performed from the H2TU-C or H2TU-R. The screen displays Rlogout when the H2TU-C or H2TU-R is remotely logged on to the other unit at the end of the circuit.  Remote logon from the H2TU-C permits viewing of the H2TU-R Blockage Indicator History screen and Sectionalized Event Log screen.  To log off from the remote unit, press <b>R</b> . Rlogout changes to Rlogon. The unit is now locally logged on until <b>R</b> is pressed again to reinitiate the remote logon.
<b>H</b>	Help	Provides a glossary of terms used in the maintenance screens, a list of navigational keys, aids for turn-up and printing, and ADC contact information.

## PROVISIONING TASKS

After the H2TU-C is successfully installed, perform these basic provisioning tasks:

- Set date and time (see “Setting Date and Time” on this page).
- Set circuit ID numbers (see “Setting Circuit ID Numbers” on page 13).
- Make any configuration changes (see “Configuring the System” on page 13).
- Clear history, alarm, and event log screens to remove miscellaneous data acquired during startup (see “Clearing the History, Alarm, and Event Log Screens” on page 24).

### Setting Date and Time

```
Monitor Performance Event Log Config Inventory Report Rlogon Help
-----+-----+-----+-----+-----+-----+-----+
| Standard Options -> |
| ADC Options -> |
| Date and Time -> |
|-----+-----+-----+-----+-----+
| Date (mm/dd/yyyy) : 01/27/2003 |
| Time (hh:mm[:ss]) : 14:09:38 |
|-----+-----+-----+-----+-----+
ID: xxxx--xxxx--xxxx--xxxx 01/27/2003 14:09:40 H2TU-C System: Alarm
H0410-A
```

*Figure 4. Config Menu - Date and Time*

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **Date and Time**, then press **ENTER**.
- 3 Type the date in the format indicated, then press **ENTER**.
- 4 Type the time in the format indicated (entering seconds is optional), then press **ENTER**.

## Setting Circuit ID Numbers

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
----- Product Information -----
Unit      : H2TU-C      H2TU-R
Product   : H2TU-C-388  H2TU-R 402
List      : 7F         7F
Sw Ver    : 4.00       4.00
Build #   : 12         12
Checksum  : 0xB58E     0xB58E
H2 Xcvt   : MT-U2.6.5B MT-U2.6.5B
Serial #  : 123-456-78 123-123-99
CLEI     : UACJLK6EAA  VAR1PERAAA
Mfg. Date: 01/31/2003  01/31/2003

----- Circuit and Unit Identifications -----
Circuit ID : xxxx--xxxx--xxxx--xxxx
H2TU-R ID  : xxxx--xxxx--xxxx--xxxx
Circuit Notes:

ID: xxxx--xxxx--xxxx--xxxx 01/31/2003 10:15:44 H2TU-C System: OK
H0516-A

```

*Figure 5. Inventory Screen*

The Inventory screen provides product information on all units in the system and allows setting of the circuit and unit identification numbers.

- 1 Press **I** to select the Inventory screen.
- 2 Type the Circuit ID number, then press **ENTER**.
- 3 Type the ID numbers of all other devices listed in the system, pressing **ENTER** after each entry.

## Configuring the System

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
| Standard Options -> |
| ADC Options -> |
| Date and Time -> |
| Master Clear |
| Set Factory Defaults |
-----
ID: xxxx--xxxx--xxxx--xxxx 01/27/2003 14:11:11 H2TU-C System: Alarm
H0413-A

```

*Figure 6. Config Menu*

The Config menu (see Figure 6) allows you to make the following changes:

- Standard options (see Figure 7 on page 14).
- ADC options (see Figure 8 on page 15).

- Date and time (see “Setting Date and Time” on page 12).
- Master clear (see “Clearing the History, Alarm, and Event Log Screens” on page 24).
- Reset to factory default configuration (see “Resetting to Factory Defaults” on page 24).



Most configuration options can also be set from a network test center through TL1 commands embedded in the FDL ESF framed payload (intrusive) or in the payload itself with 11-bit commands (intrusive).

To obtain additional information about remote provisioning commands, contact customer service. See “Appendix D - Product Support” on page 68.

## Making Changes to Standard and ADC Options

Figure 7 on this page and Figure 8 on page 15 show the Standard and ADC configuration options. Standard options are those supported by HiGain HDSL2 units when connected to units from other vendors. ADC options are an extended set of options that are only available when using HiGain units exclusively. For a description of each option and a list of option settings, refer to Table 5 on page 16 and Table 6 on page 17.

To make changes to these options:

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **Standard Options** or **ADC Options**, then press **ENTER**.
- 3 Use the arrow keys to select an option.
- 4 Press **SPACEBAR** to cycle through the settings for that option.
- 5 Press **ENTER** to activate your choice.

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
+-----+
| Standard Options -> |
+-----+
| Loopback Timeout (LBT0) : 60 min |
| Loop Attenuation Threshold (LATT) [0-40]: 38 dB |
| Margin Threshold (MARG) [0-15]: 4 dB |
| DS1 Frame Formatting (FRMG) : UNFR |
| DS1 Line coding (DS1) : B8ZS |
| H2TU-C Equalization (EQL) : 0 ft |
| H2TU-R Line Buildout (RLB0) : 0 dB |
| Alarm Pattern (ALMP) : AIS |
| H2TU-R TL0S Loopback (TL0S) : DIS |
| Network Loopback Pattern (NLBP) : AIS |
| Power Back Off Network (PBON) : DEF |
| Power Back Off Customer (PBOC) : DEF |
+-----+
Use <Spacebar> to cycle through option settings and <Enter> to activate
ID: xxxx 01/23/2003 10:48:24 H2TU-C System: Alarm
H0519-A

```

**Figure 7.** Config Menu - Standard Options (defaults shown)



```

Monitor Performance Event Log Config Inventory Report Rlogon Help
      +-----+
      | Standard Options -> |
      | ADC Options -> |
      +-----+
      | Line Power Feed (PWRF) : ON |
      | Bipolar Violation Transparency (BPUT) : DIS |
      | DS1 BER (DBER) : DIS |
      | HDSL2 BER Threshold (HBER) : NONE |
      | Special Loopback Mode (SPLB) : GNLB |
      | Smartjack Loopback (LPBK) : ENA |
      | Remote Disconnect Alarm (RDA) : ENA |
      | Network AIS Pattern (NAIS) : AIS |
      | Performance Report Messaging (PRM) : AUTO |
      | RAI to RAI-CI toward NET (RACI) : DIS |
      | ESF-RAI to SF-RAI Overwrite (ROUR) : DIS |
      | H2TU-R DS1 Frame Conversion (CONU) : ACON |
      +-----+
      Use <Spacebar> to cycle through option settings and <Enter> to activate
      ID: XXXXXX--XXXX--XXXX--XXXX 01/31/2003 11:47:55 H2TU-C System: OK
      H0521-A

```

*Figure 8. Config Menu - ADC Options (defaults shown)*

Table 5. H2TU-C Standard Config Menu Options

Standard Config Menu Options	Front-Panel Display Code	Selection	Description
Loopback Timeout	LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
		20 min	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
		<b>60 min</b>	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
		120 min	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
		8 hr	Sets automatic cancellation of all loopbacks to 8 hours after initiation.
		24 hr	Sets automatic cancellation of all loopbacks to 24 hours after initiation.
Loop Attenuation Threshold	LATT	0 through 40 dB	Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold can only be set through the maintenance screens.
		<b>38 dB</b>	Default value.
Margin Threshold	MARG	0 to 15 dB	Determines the minimum allowable margin below which a system alarm can occur. Zero disables the alarm. The Margin (Alarm) Threshold can only be set through the maintenance screens.
		<b>4 dB</b>	Default value.
DS1 Frame Formatting	FRMG	AUTO	Configures the HDSL2 system to operate in an auto-framing (AUTO) mode in which it continuously searches the input DS1 bit stream for a valid SF or ESF frame pattern. Both line and path performance parameters are maintained. Unframed payloads will cause the ES-P and SES-P counters to increment.
		SF	Configures the HiGain HDSL2 system to search for the SF framing pattern at its DS1 input.
		ESF	Configures the HiGain HDSL2 system to search for the ESF framing pattern at its DS1 input.
		<b>UNFR</b>	Configures the HDSL2 system to operate in an unframed mode. This mode disables the auto framing process and forces the system to function as a transparent bit pipe. Only line parameters are considered when monitoring DS1 performance.
DS1 Line Coding See "DS1 Line Coding (DS1) Option" on page 19.	DS1	<b>B8ZS</b>	Places both the H2TU-C and H2TU-R into their B8ZS modes.
		AMI	Places both the H2TU-C and H2TU-R into their AMI modes.
H2TU-C Equalization See "Equalization (EQL) Option." on page 19.	EQL	<b>0 ft</b>	Sets the equalizer to DSX-1 for 0 to 132 feet.
		133 ft	Sets the equalizer to DSX-1 for 133 to 265 feet.
		266 ft	Sets the equalizer to DSX-1 for 266 to 398 feet.
		399 ft	Sets the equalizer to DSX-1 for 399 to 532 feet.
		533 ft	Sets the equalizer to DSX-1 for 533 to 655 feet.
H2TU-R Line Buildout	RLBO		Sets the DS1 receive level output toward the Customer Interface (CI). H2TU-R Line Buildout can only be set through the maintenance screens.
		<b>0 dB</b>	Sets the DS1 RLBO level toward the CI to 0 dB.
		-7.5 dB	Sets the DS1 RLBO receive level toward the CI to -7.5 dB.
		-15.0 dB	Sets the DS1 RLBO receive level toward the CI to -15.0 dB.
Alarm Pattern See "Alarm Pattern (ALMP) Option." on page 19.	ALMP	<b>AIS</b>	Enables the HDSL2 system to output an AIS payload at its DS1 ports for LOSW and DS1 LOS. For priority resolution, see Figure 33 on page 50.
		LOS	Enables the HDSL2 system to output an LOS condition at its DS1 ports for LOSW and DS1 LOS.
H2TU-R TLOS Loopback	TLOS	ENA	Enables a logic loopback at the H2TU-R when an LOS occurs at its DS1 input, if enabled at the H2TU-R. For priority resolution, see Figure 33 on page 50.
		<b>DIS</b>	Disables Transmit Loss of Signal (TLOS) logic loopback.

**Table 5.** H2TU-C Standard Config Menu Options (Continued)

Standard Config Menu Options	Front-Panel Display Code	Selection	Description
Network Loopback Pattern	NLBP	<b>AIS</b>	Enables the H2TU-R to transmit an AIS toward CI for any network loopback. For priority resolution, see Figure 33 on page 50.
		LOS	Enables the H2TU-R to transmit an LOS toward CI for any network loopback.
Power Back Off - Network See "Power Back Off (PBON and PBOC) Options" on page 22.	PBON	<b>DEF</b>	Configures the power output levels of the H2TU-C network unit toward the customer to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
		ENH	Configures the power output levels of the H2TU-C network unit toward the customer to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
Power Back Off - Customer See "Power Back Off (PBON and PBOC) Options" on page 22.	PBOC	<b>DEF</b>	Configures the power output levels of the H2TU-R customer unit toward the network to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
		ENH	Configures the power output levels of the H2TU-R customer unit toward the network to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1/E1.4.

**Table 6.** H2TU-C ADC Config Menu Options

ADC Config Menu Options	Front-Panel Display Code	Selection	Description
Line Power Feed	PWRF	OFF	Disables powering to the HDSL2 pair.
		<b>ON</b>	Keeps the HDSL2 line voltage at nominal -180 Vdc.
Bipolar Violation Transparency See "Bipolar Violation Transparency (BPVT) Option" on page 19.	BPVT	ENA	Enables HDSL2 CRC and BPV errors at the DS1 input to be converted into DS1 BPVs at the DS1 output at the distant end. This makes HDSL2 transparent to BPVs.
		<b>DIS</b>	Disables BPV Transparency.
DS1 BER Threshold See "DS1 Bit Error Rate (DBER) Option" on page 19.	DBER	ENA	Enables the fixed 24-hour DS1 BER threshold ( $10^{-6}$ ).
		<b>DIS</b>	Prevents the generation of a system alarm due to DS1 BER.
HDSL2 BER Threshold See "HDSL2 Block Error Rate Threshold (HBER) Option" on page 19.	HBER	1E-6	Front-panel alarm is displayed and the Status LED flashes red when the Block Error Rate (BER) threshold exceeds $10^{-6}$ . BER is based on the definition of Bit Error Rate.
		1E-7	Front-panel alarm is displayed and the Status LED flashes red when the Block Error Rate (BER) threshold exceeds $10^{-7}$ .
		<b>NONE</b>	Prevents generation of a system alarm due to BER.

*Continued*

Table 6. H2TU-C ADC Config Menu Options (Continued)

ADC Config Menu Options	Front-Panel Display Code	Selection	Description
Special Loopback Mode	SPLB	<b>GNLB</b>	Configures the HDSL2 system to respond to the generic inband loopback codes.
		A1LB and A2LB	Configures the HDSL2 system to respond to the inband loopback codes of the Westell addressable repeater.
		A3LB	Configures the HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
		A4LB	Configures the HDSL2 system to respond to the inband loopback codes of the Wescom Mod 1 addressable repeater.
		A5LB	Configures the HDSL2 system to respond to the inband loopback codes of the Westell Mod 1 addressable repeater.
SmartJack Loopback	LPBK	<b>ENA</b>	Enables the HDSL2 system to recognize all inband SmartJack (SMJK) loopback commands.
		DIS	Configures the HDSL2 system to ignore all inband SmartJack loopback commands.
Remote Disconnect Alarm	RDA	<b>ENA</b>	Enables a remote DS1 LOS condition at the input to the H2TU-R to generate an LOS alarm. AIS or LOS (depending on ALMP) is sent toward the network.
		DIS	Prevents a remote DS1 LOS condition at the input to the H2TU-R from causing an LOS alarm. The alarm relay contacts do not close and LOS is sent toward the network from the H2TU-C instead of AIS.
Network AIS Signal	NAIS	CI	If ALMP is set to AIS, this option specifies which pattern is sent to the network when a remote LOS or AIS occurs. When configured for CI, an AIS-CI pattern is sent to the network. For priority resolution, see Figure 33 on page 50.
		<b>AIS</b>	When configured for AIS, an AIS pattern is sent to the network.
Performance Report Messaging	PRM	SPRM	The H2TU-R generates SPRM if no PRM is present from the CPE. If the CPE is sending PRM, the PRM is converted to an SPRM. TL1 commands and responses are enabled.
		NPRM	The H2TU-R generates Network PRM (NPRM) if no PRM is present from the CPE. If the CPE is sending PRMs, NPRM is generated in addition to the existing PRM every second. TL1 commands and responses are enabled.
		<b>AUTO</b>	The H2TU-R generates both SRPMs and NPRMs whenever possible.
		OFF	ESF Data Link (DL) is completely transparent. No PRMs are generated. There are no TL1 responses unless the system is first armed by a TL1 command, which enables Performance Monitoring (PM).
RAI to RAI-CI Toward NET See "RAI to RAI-CI toward NET (RACI)" on page 23.	RACI	ENA	Allows a DS1 RAI (yellow alarm) signal received by the H2TU-R to be converted to an RAI-CI signal toward the network.
		<b>DIS</b>	Prevents conversion of the DS1 RAI to an RAI-CI signal.
ESF-RAI to SF-RAI Overwrite See "ESF-RAI to SF-RAI Overwrite (ROVR) Option" on page 22.	ROVR	ENA	If the CONV option is set to FCON or ACON, an ESF DS1 payload from the network with an embedded RAI pattern is converted to an SF-RAI pattern toward the CI at the H2TU-R.
		<b>DIS</b>	Prevents conversion to an SF-RAI pattern.
H2TU-R DS1 Frame Conversion See "H2TU-R DS1 Frame Conversion (CONV) Option" on page 20.	CONV	OFF	Framing functionally determined by the framing option. Frame format conversion is inhibited at the H2TU-R.
		<b>ACON</b>	Auto (ACON) detection of framing and potential frame conversion at the remote.
		FCON	Auto detection of framing and forced frame format conversion (FCON) at the H2TU-R.

**HDSL2 Block Error Rate Threshold (HBER) Option.** The HBER option permits the monitoring of loop integrity and reporting of alarms when excessive errors are detected. The PM primitive used for this purpose is the CRC checksum performed on the HDSL2 frame for both directions of transmission. It is, therefore, called a block error rate rather than the bit error rate associated with the DS1 interface. The CRC errors and counts are displayed on the Monitor screen for both the H2TU-C and H2TU-R. The HBER option allows an alarm to be generated if the total number of CRC errors at either the H2TU-C or H2TU-R exceeds the selected HBER threshold during the last 1-minute interval.

- HBER option = 1E-6. Alarm is generated if CRC errors > 93
- HBER option = 1E-7. Alarm is generated if CRC errors > 9

Once initiated, the HBER count clears when the CRC error count drops below the selected threshold. Selecting NONE inhibits this alarm.

**DS1 Line Coding (DS1) Option.** The DS1 line code option should always be set to conform to the type of DS1 service (AMI or B8ZS) being provided by the HiGain system.

**Equalization (EQL) Option.** The equalizer option causes the DS1 output signal of the H2TU-C to conform to a specific pulse template when it arrives at the DSX-1 cross-connect point. The degree of pulse-shaping required is a function of the distance between the H2TU-C's equipment bay and the DSX-1 panel. Thus, the equalizer has six discrete settings, in increments of 133 feet to cause the maximized separation of 655 feet.

**Alarm Pattern (ALMP) Option.** To improve HDSL2 compatibility with the switch-to-protect features used in Digital Loop Carrier (DLC) feeder applications, the H2TU-C has an Alarm Pattern (ALMP) option that allows you to select either an AIS or LOS DS1 output payload for the following alarms:

- LOSW on any loop
- LOS DS1

**Bipolar Violation Transparency (BPVT) Option.** The H2TU-C improves compatibility with Digital Loop Carrier (DLC) feeder applications because of its ability to transmit DS1 BPV occurrences between its DS1 interfaces. This feature is required to support protection switching in DLC applications. Each DLC terminal must be able to monitor the integrity of its Receive DS1 payload and then switch to the protect line when the integrity of the path drops below specific user selected limits.

An essential requirement of this feature is the need for each DLC terminal to detect BPVs in its DS1 input. Standard HDSL systems correct DS1 BPVs at the input and therefore prevent them from being detected by the DLC terminals to which they are connected. The H2TU-C and its associated remote units remove this limitation and become BPV transparent by detecting and counting input BPVs at each end and then by replicating them at the DS1 output port of the distant end.

The BPV count is converted into BPVs at the distant end during the following second at a rate of 1 BPV every 128 DS1 bits up to a maximum of 12000 ( $BER = 7.7 \times 10^{-3}$ ). This maximum rate is more than adequate since it exceeds the maximum  $10^{-3}$  BER required by most DLC systems.

**DS1 Bit Error Rate (DBER) Option.** The DS1 BER alarm occurs when any of the DS1 or DSX-1 performance monitoring parameters listed in Table 7 exceed the counts shown for the 24-hour period between 12:00:00 AM and 11:59:59 PM. These thresholds correspond to a  $10^{-6}$  BER. All PM counters clear to zero at 12:00:00 AM or when Master Clear is selected.

**Table 7.** DS1/DSX-1 24-Hour PM Threshold

Parameter	Threshold Count
CV-L (BPV)	133,400
CV-P (CRC)	132,960
ES-L, ES-P, PRM-NE PRM-FE	648
SES-L, SES-P	100
UAS-P, UAS-L	10

**H2TU-R DS1 Frame Conversion (CONV) Option.** Frame format conversion is only applicable to the remote H2TU-R, but selectable by the H2TU-C or H2TU-R. This option enables the network to be ESF which is used to embed SPRM or NPRM into the data link toward the network. During conversion, frame bit errors are regenerated to ensure transparency.

The HDSL2 system attempts to find ESF or SF framing or determines that no framing exists. The DS1 framing is then synchronized with the HDSL2 frame. If the framing is lost, the system generates an Out-of-Frame (OOF) defect which results in UAS-P. As a result, the system reverts to frame search mode.

This option has the following settings:

- **OFF** — No frame conversion takes place. All framing issues are determined by the FRMG option settings of AUTO, ESF, SF, and UNFR.
- **ACON** — This is the automatic conversion setting. If the system detects ESF from the network and SF from the CPE, it automatically converts the CPE SF to ESF toward the network as well as the network ESF to SF toward the CPE.

Upon power-on-reset, after loopdown, or after changing the frame conversion option, the framing needs to be re-established before a complete conversion takes place. If there is a failure condition (LOS, AIS, or LOF) during steady state, the previous conversion state is maintained to ensure continuity when the system returns from the failure condition.

If SF is received from the network, the H2TU-R forces an ESF toward the network for about 1.5 seconds. This signals to the far end PM-NIU at the network boundary that frame conversion is requested. If the far end PM-NIU is capable of conversion, it changes the framing to ESF. If not, then the H2TU-R reverts to SF and does not apply any conversion.

If an ESF is received from the CPE, it is passed on to the network, and the network's inbound framing is passed on to the CPE.

- **FCON** — This is the forced conversion setting. Table 8 lists the HDSL2 responses by case number to both the ACON and FCON settings for the CONV option. The responses are identical, except in cases 3 and 4. In these cases, the FCON reply is attempting to force the network or the far end PM-NIU to send ESF. It also alerts the CPE with an AIS alarm pattern while forcing the ESF to the network. Continuity is maintained as for ACON. Table 9 and Table 10 on page 22 list the ESF and SF frame formats, respectively.

**Table 8.** Response to H2TU-R DS1 Frame Conversion Options

Case Number	NET Transmit	CPE Transmit	ACON Option	FCON Option
			NET > CPE NET < CPE	NET > CPE NET < CPE
1	ESF	SF	ESF →SF ESF ←SF	ESF →SF ESF ←SF
2	ESF	ESF	ESF →ESF ESF ←ESF	ESF →ESF ESF ←ESF
3	SF	ESF	SF →SF ESF ←ESF	SF →AIS ESF ←ESF
4	SF	SF	SF →SF SF ←SF	SF →AIS ESF ←SF

**Table 9.** Extended SuperFrame Format

ESF Number	Frame Bits		
	Framing Pattern Sequence (FPS) - 2 kbps	Frame Bit for Data Link (FDL) - 4 kbps	Cyclical Redundancy Check (CRC) Bits - 2 kbps
1		m <sup>(a)</sup>	
2			C1
3		m <sup>(a)</sup>	
4	0		
5		m <sup>(a)</sup>	
6			C2
7		m <sup>(a)</sup>	
8	0		
9		m <sup>(a)</sup>	
10			C3
11		m <sup>(a)</sup>	
12	1		
13		m <sup>(a)</sup>	
14			C4
15		m <sup>(a)</sup>	
16	0		
17		m <sup>(a)</sup>	
18			C5
19		m <sup>(a)</sup>	
20	1		
21		m <sup>(a)</sup>	
22			C6
23		m <sup>(a)</sup>	
24	1		

(a) m = messages

**Table 10.** SuperFrame Format

SF Number	Frame Bits	
	Terminal Framing Bit	SuperFrame Signaling Bit
1	1	
2		0
3	0	
4		0
5	1	
6		1
7	0	
8		1
9	1	
10		1
11	0	
12		0

**ESF-RAI to SF-RAI Overwrite (ROVR) Option.** If the ESF-RAI to SF-RAI Overwrite (ROVR) option is enabled, it allows a network ESF-RAI or ESF-RAI-CI pattern to be converted into a CPE SF-RAI or SF-RAI-CI pattern, and overwrites bit 2 of every DS0 channel with a zero.

If the ROVR option is disabled, it prevents conversion of a network ESF payload with an embedded RAI pattern. Disabling the ROVR option preserves the integrity of the CPE payload as it was originally transmitted.

**Power Back Off (PBON and PBOC) Options.** Power Back Off Network (PBON) and Power Back Off Customer (PBOC) allow the HDSL2 circuit to support two transmit power templates: default (DEF), higher level, and enhanced (ENH), lower level. These are defined in Section 6.1.4.2 of the ANSI T1E1.4 HDSL2 standard. Each HDSL2 receiver detects the level it is receiving during the start-up, preactivation sequence. It then compares this level to the level it should be receiving according to the PBON and PBOC option settings (DEF or ENH). If the received level is outside the template limits, the receiver sends a message to the upstream HDSL2 transmitter requesting the proper level. These levels are adjusted only during the start-up routine or if the PBON or PBOC option settings are changed during normal operation. Since the ENH template levels are up to 15 dBm below those of the DEF template, the ENH setting can be used to reduce crosstalk levels into adjacent circuits. For example, if crosstalk noise is being induced by the H2TU-R, set the PBOC option to its lower (ENH) level setting. Conversely, if the HDSL2 signal at the H2TU-R is being affected by crosstalk noise induced from adjacent pairs, set the PBOC option to its higher (DEF) level setting.



**Changing these Power Back Off option settings on a live circuit causes the HDSL2 loop to momentarily drop and then reacquire synchronization. This setting can also affect the operating margins.**

**AIS-CI (Alarm Indication Signal-Customer Installation).** The H2TU-C, in conjunction with the H2TU-R, supports the AIS-CI function. AIS-CI is a variant of AIS which is transmitted toward the network when either an AIS defect or an LOS defect has been detected in the signal received from the CI at the H2TU-R unit. AIS-CI is a regular AIS signal modulated by an AIS signature.

The AIS-CI signal is a repetitive pattern with a period of 1.26 seconds. The pattern is formed by sequentially interleaving 1.11 seconds of an unframed all ones pattern and 0.15 seconds of all ones modified by the AIS-CI signature. The AIS-CI signature is defined as a pattern which recurs at 386 bit intervals (two DS1 frame lengths) in the DS1 signal and is 01111100 11111111 (right to left). This results in a repetitive pattern of 6176 bits. If the first bit is numbered bit 0, bits 3088, 3474, and 5790 are logical zeroes and all other bits in the pattern are logical ones.



An alternative interpretation of the AIS-CI signature is that the AIS signal, modified by the AIS-CI signature, is equivalent to an ESF signal in which the FPS bits, the CRC-6 bits, and the payload are set to all ones, and the DL is overwritten by the pattern 01111100 11111111.



**The NAIS option controls the AIS-CI feature. When NAIS is set to CI, the AIS to AIS-CI conversion is enabled. When NAIS is set to AIS, the conversion is inhibited.**

**RAI to RAI-CI toward NET (RACI).** The H2TU-C in conjunction with the H2TU-R supports the RAI-CI function.

The RAI-CI signal is a RAI signal which contains a signature indicating that an LOF or AIS failure has occurred in the customer installation (CI) at the H2TU-R unit and that the defect or failure which caused the origination of that RAI is not found in the signal from the network. Therefore, RAI-CI is transmitted toward the network when the following two conditions are simultaneously true at the point from which RAI-CI originated (at the H2TU-R, toward the network):

- Condition 1—RAI is received from the CI.
- Condition 2—No LOF, LOS, or AIS failure is detected in the signal received from the network.

Sending RAI-CI terminates within 500  $\mu$ s when either of the following occurs:

- Cessation of RAI from the CI.
- Declaration of LOF, LOS, or AIS in the signal from the network.

To prevent the transmission of RAI-CI during the failure-clearing interval of a network failure, the transition from RAI to RAI-CI is delayed for 20 seconds following the detection of conditions 1 and 2 above. Since RAI-CI meets the definition of RAI, it may be detected and used exactly as RAI. The longer period of time required for detection of RAI-CI does not affect its use for functions which require RAI.

The RAI-CI pattern is a function of the payload frame format as follows:

- ESF—The RAI-CI signal is a repetitive pattern in the Frame Bit for Data Link (FDL) with a period of 1.08 seconds. RAI-CI is formed by sequentially interleaving 0.99 (+/- 2 ms) seconds of the normal message 00000000 11111111 (right-to-left) with 90 milliseconds (+/- 2 ms) of the message 00111110 11111111 (right-to-left) to flag the signal as RAI-CI.
- SF—The SF-RAI-CI signal is transmitted inband by setting each of the 24 channel time lots to 1000 1011 (left-to-right). In addition to the criteria specified above, the generation of SF-RAI-CI has to be held off for 1 second to examine the DS0s for a framed, all-zeros pattern. If present, the generation of SF-RAI-CI is suspended for the duration of the all-zeros pattern.



**Since the RAI to RAI-CI conversion modifies the payload, an RACI option is available to inhibit the RAI to RAI-CI conversion for those applications that cannot tolerate payload modifications.**

## Resetting to Factory Defaults

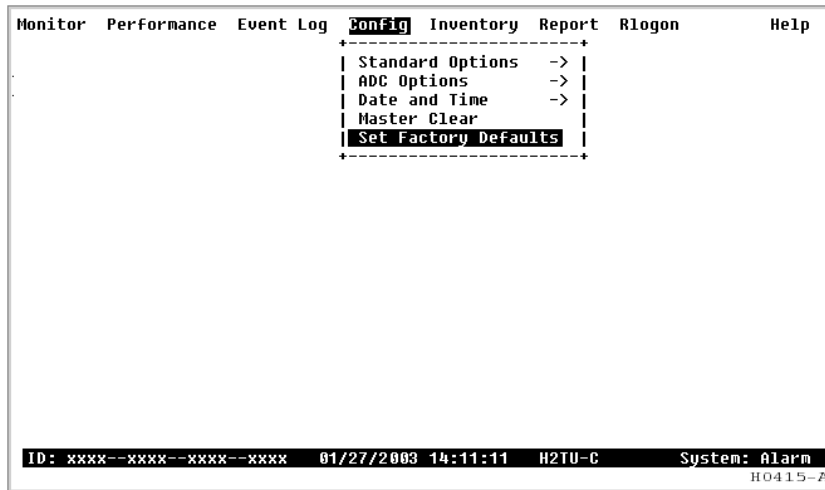


Figure 9. Config Menu - Set to Factory Defaults



Resetting the H2TU-C to its original factory settings may cause interruption of service.

To reset the H2TU-C to its original factory defaults (refer to Figure 9):

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **Set Factory Defaults**, then press **ENTER**.
- 3 Press **Y** to reset the H2TU-C or press **N** to cancel this action.

## Clearing the History, Alarm, and Event Log Screens

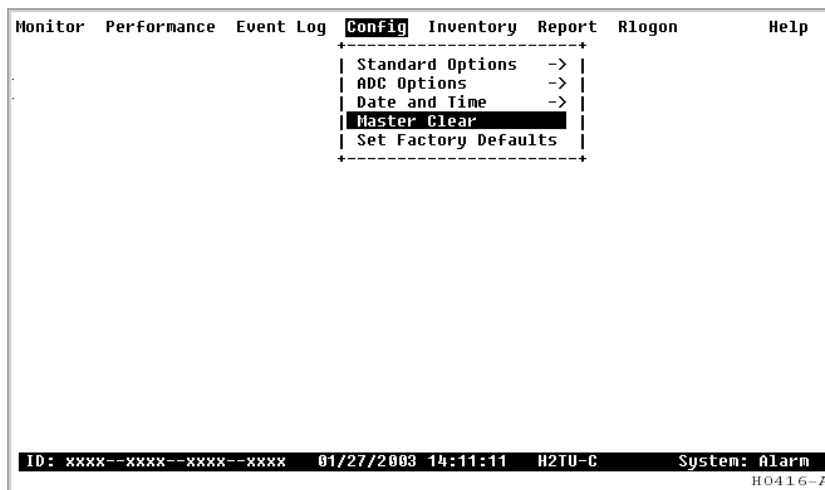


Figure 10. Config Menu - Master Clear

Select Master Clear to clear the History, Alarm and Event Log screens after the system has been installed and is functioning properly. This removes miscellaneous data acquired during the start-up session and ensures that you have meaningful data thereafter.

To clear the Event Log, press **E** to select the Event Log screen, then press **L** to clear the screen.

To clear an individual history or alarm screen, do the following:

- 1 Press **P** to select the Performance screen.
- 2 Press **SPACEBAR** to select either interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press **↓** to select statistics.
- 4 Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25-Hour History**, **48-Hour History**, or **31-Day History**), and press **ENTER** after your selection.
  - Selecting **31-Day History** allows you to clear the current, 25-hour, 48-hour, and 31-day performance history screens for the selected interface.
  - Selecting **Alarm History** allows you to clear the alarm history screen for the selected interface. For information about the DS1 and HDSL2 Alarm screens, see Table 15 on page 39 and Table 16 on page 40, respectively.
- 5 Press **L** to clear the screen.
- 6 Press **Y** to confirm.

To clear ALL history, alarm, and event log screens by this method:

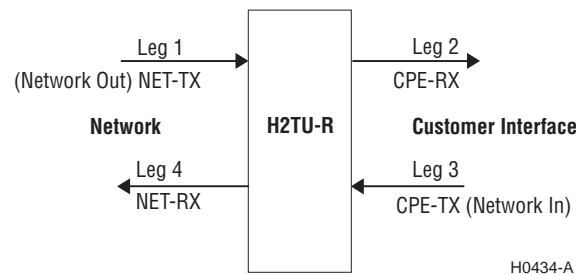
- 1 Press **C** to select the Config screen.
- 2 Use the **↑** and **↓** arrow keys to select **Master Clear**.
- 3 Press **ENTER** to activate.
- 4 Press **Y** to clear all screens.

# MONITORING SYSTEM ACTIVITY AND PERFORMANCE

The HDSL2 system provides the following maintenance screens for monitoring system activity and assessing performance.

- The Monitor screen provides a graphical representation of circuit activity and allow initiation of loopbacks.
- The Performance screens provide current, 25-hour, 48-hour, and 31-day performance histories and a continuous alarm history.
- The Event Log provides a description of the 100 most recent events, which include their origin, time and date of occurrence, and message.
- Following a remote logon, the Performance screens provide current and 8-hour Blockage Indicator histories at the H2TU-R DS1 interface and at each point of the HDSL2 interface.
- Following a remote logon, the Sectionalized Event Log screen displays events for all four legs of the H2TU-R DS1 interface .

## PERFORMANCE MONITORING FROM THE H2TU-R



**Figure 11.** Sectionalized Analysis of the DS1 and HDSL2 Interface

Network surveillance is a key maintenance strategy. Real-time monitoring of performance through sectionalized analysis allows maintenance personnel to quickly locate a service degradation or failure. This also makes it easier to determine if the customer or network operator must bear responsibility for service and repair.

The Performance Monitoring screens analyze the DS1 transmission by tracking the four transmission legs shown in Figure 11.

When installed on one end of an HDSL2 DS1 circuit, the remote unit provides the following special network benefits:

- Real-time performance monitoring of DS1 signals in both directions of transmission
- Non-intrusive access to real-time performance monitoring data (CPE-provided SF or ESF signal)
- Easy access to stored DS1 PM data using the Craft port, 11-bit inband commands, or Facility Data Link (FDL):
  - Performance statistics (current, 25-hour, 48-hour, and 31-day)
  - Sectionalized events for all four legs of DS1 transmission
  - Blockage Indicator (a quality-of-service summary statistic for the NET-TX and CPE-TX transmission legs at the DS1 interface and at each point of the HDSL2 interface)

- Easy access to stored HDSL2 PM data
- AIS-CI insertion toward the network upon detection of incoming LOS or AIS at the network interface
- RAI-CI insertion toward the network upon receiving RAI from the CPE, if the signal from the network is not impaired
- Loopback toward the network with AIS insertion to the CPE equipment
- Adaptive frame format conversion if enabled in:
  - SF to ANSI T1.403 ESF
  - Non-standard to standard ANSI T1.403 ESF
  - AT&T PUB 54016 to ANSI T1.403 ESF
- Easy access to remote provisioning:
  - Non-intrusive, FDL using TL1 commands
  - Intrusive, using 11-bit payload commands

Network Elements (NE), such as the ADA T3AS test and performance monitoring system, can be used to collect the performance monitoring data to allow full-time surveillance of the DS1 signal. By installing T3AS at a network boundary, such as Interexchange Carrier (IEC), Point of Presence (POP), and a remote unit at the network interface, the Local Exchange Carrier (LEC) can monitor the performance of its portion of the network and rapidly sectionalize circuit problems. By sectionalizing problems in its network, the LEC knows, without external involvement, what trouble exists as well as the responsible party.

## **PAYLOAD RETRIEVAL OF MARGIN AND PULSE ATTENUATION PARAMETERS**

The H2TU-C has been enhanced with a new feature that allows an upstream test center to retrieve information on the circuit's margin and pulse attenuation. This is accomplished by issuing an intrusive 16-bit inband command DBDB (1101 1011 1101 1011) from the test center towards the line unit. The command is patterned after the 16-bit intelligent repeater loopback commands described in "Loopback Test Procedures" on page 55. The command must be sent for at least 5 seconds. The circuit may be armed. The line unit must be in the NLOC network loopback state before the retrieval command is issued. After detecting the 16-bit command, the line unit generates and returns a specific number of bit errors indicating a specific combination of margin and pulse attenuations as listed in Table 11 on page 28. The error burst occurs every 20 seconds for as long as the DBDB command is being received. The error burst response always reflects the most recent performance parameters. If the HDSL2 loop is down, LOSW, a response corresponding to a margin of 5 or less, will be sent. This command is a permanent feature of the List 7F and cannot be disabled.

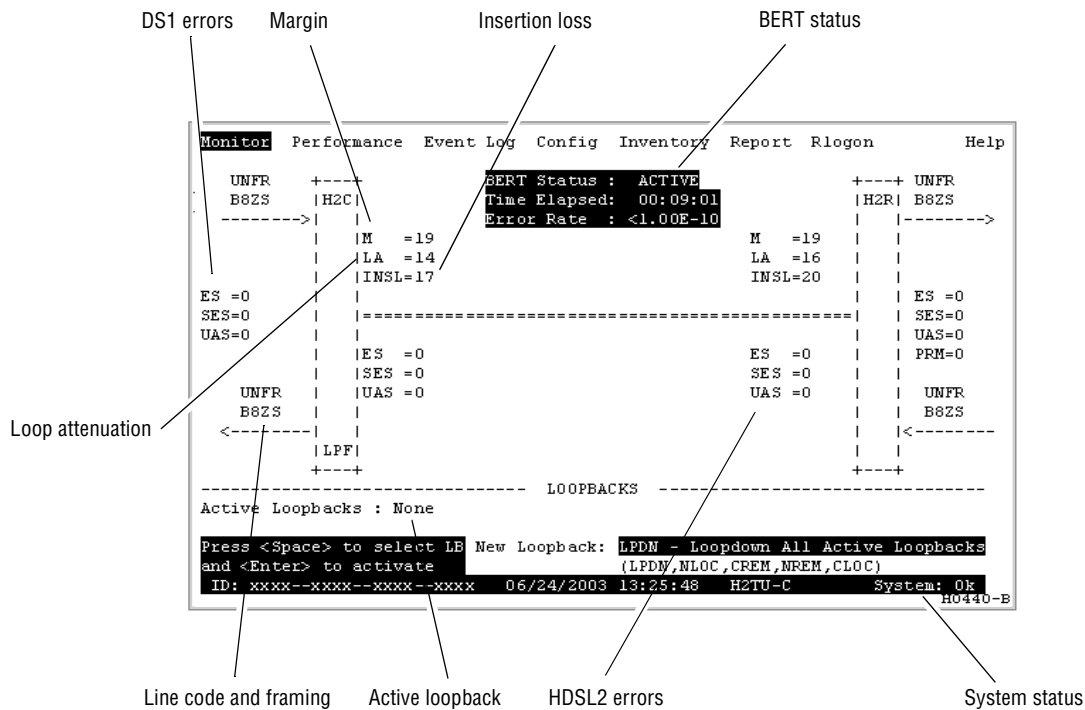
**Table 11.** Bit Error Indication of Margin and Pulse Attenuation Parameters <sup>(a)</sup>

Margin (dB)	Pulse Attenuation (dB)	Bit Errors Sent
5 or less	31 or higher	101
5 or less	26 - 30	102
5 or less	0 - 25	103
6 - 10	31 or higher	104
6 - 10	26 - 30	105
6 - 10	0 - 25	106
11 or higher	31 or higher	107
11 or higher	26 - 30	108
11 or higher	0 - 25	109

(a) Expected bit error response.

## USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

Figure 12 displays BERT status information and Figure 13 on page 29 indicates that the line unit is Armed and in an alarm condition.



**Figure 12.** Monitor Screen - BERT Status

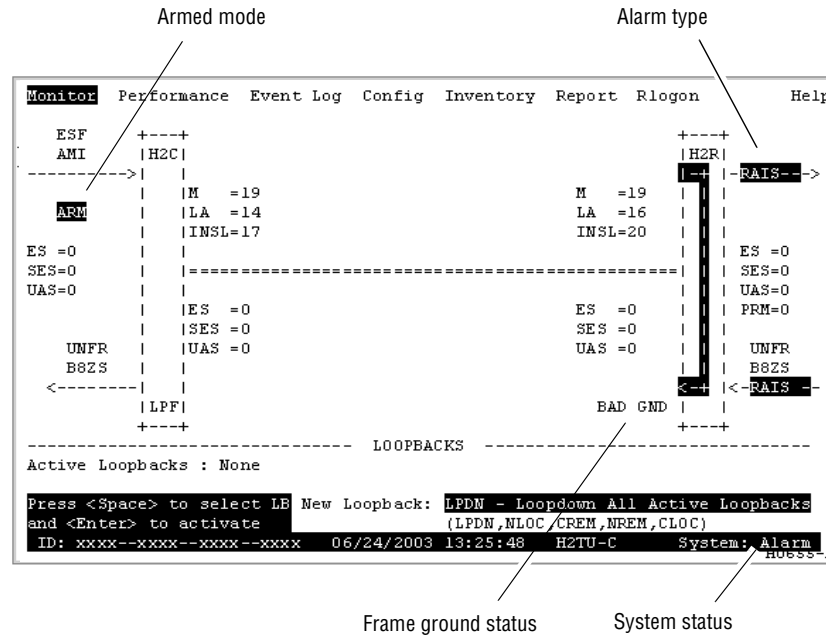


Figure 13. Monitor Screen - ARMED

- 1 Press **M** to view the system diagram.

Figure 12 shows an armed circuit with an active loopback and alarms. Terms used on the system diagram are defined in the onscreen Help menu glossary. Abnormal situations are highlighted on the diagram. Table 12 on page 29 describes the screen fields.

- 2 To initiate a loopback, press the **SPACEBAR** to cycle through the loopback choices. Press **ENTER** to make your choice.

When prompted with the message: Are you sure (Y/N)?, press **Y** to initiate the loopback or **N** to cancel. For more information about loopbacks, see “Testing” beginning on page 48.

- 3 To initiate a loopdown of all active loopbacks, press the **SPACEBAR** to select **LPDN**, then press **ENTER**. When prompted with the message: Are you sure (Y/N)?, press **Y** to initiate the loopdown or **N** to cancel.

Table 12. Monitor Screen Descriptions

Field	Description
Active Loopback	An active loopback is indicated on the lower third of the Monitor screen. Available loopbacks are indicated by gray text. See Table 22 on page 52 for a summary of the HDSL2 generic loopback codes and activation methods.
Alarm Type	Indicates type of alarm.
Armed Mode	Indicates system is in an armed state for an intelligent repeater (IR) loopback command.
BERT Status	Provides BERT Generator status, elapsed time, and BERT results.
Code Type	Type of DS1 line coding received or sent (B8ZS or AMI).
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors include DS1 frame errors, BPV, and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.

**Table 12. Monitor Screen Descriptions (Continued)**

<b>Field</b>	<b>Description</b>
DS1 UAS Count	Unavailable Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame Type	Type of DS1 framing detected at the input stream (SF, ESF, or UNFR).
Frameground status	Central Office (CO) unit reports absence of a ground.
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors. This value is a running total of the last 24-hours.
HDSL2 UAS Count	Unavailable Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
HG or (PL)	HG displays when the loopback was initiated from a HiGain (HG) front panel or by a maintenance terminal loopback command. PL displays when the loopback was initiated by a command embedded in the DS1 data path payload (PL).
ID	Circuit identification number.
INSL	Insertion Loss—The signal loss value for a 196 kHz signal over the cable.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to insertion loss at 196 kHz and should be kept under 28 dB. This value differs from the insertion loss value of a conventional 196 kHz signal.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10 <sup>-7</sup> Bit Error Rate.
MAL	Margin Alarm—Indicates the margin on HDSL2 loop has dropped below the threshold (0 to 15 dB) set by the operator.
PRM	The sum of the Performance Report Messaging - Near End (PRM-NE) and Performance Report Messaging - Far End (PRM-FE) counts.
System Status	The presence or absence of an alarm condition is indicated on the lower right corner of all screens. <b>System: OK</b> indicates that there are no alarms present; <b>System: Alarm</b> indicates the presence of an alarm. Refer to “Using the Performance Screens to View Alarm Data” on page 38.

## USING THE PERFORMANCE SCREENS TO VIEW PERFORMANCE DATA

The Performance screens display:

- CRC statistics for the HDSL2 or DS1 interface in 31-day, 48-hour, 25-hour, and current history reports.
- Alarm statistics for the DS1 or HDSL2 interfaces on a continuous basis.

To access the Performance history screens:

- 1 Press **P** to select the Performance screen.
- 2 Press the **SPACEBAR** to select either interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25-Hour History**, **48-Hour History**, **31-Day History**, or **BI History**), then press **ENTER**.

To view the Blockage Indicator (BI) History screen, you must first log on to the remote unit.



- 1 Press **R** to log on to the H2TU-R remote unit.
- 2 Press **P** to select the Performance screen.
- 3 Press the **SPACEBAR** to select **H2TU-R DS1**, then press **ENTER**.
- 4 Press the **SPACEBAR** to select **BI History**. Press **ENTER**. For more information, see “Blockage Indicator Statistics at the H2TU-R DS1 and HDSL2 Interface” on page 34.
- 5 To return to the H2TU-C logon screen, press **R**.

## Performance History at the DS1 Interface

The Performance History for the DS1 Interface provides a 31-day, 48-hour, 25-hour, and current statistics screens for the H2TU-C and H2TU-R (as viewed from the H2TU-C). To gain access to the Blockage Indicator History screen, you must be logged on remotely. See “Using the Performance Screens to View Performance Data” on this page for logon procedures.

Figure 14 on page 31 and Figure 16 on page 32 are examples of DS1 performance history screens at the remote unit. Figure 15 on page 32 is an example of DS1 performance history screen at the line unit. Refer to Table 13 on page 33 for descriptions of the errors reported on DS1 interface screens. Asterisks indicate performance monitoring from the previous day.

Figure 17 on page 33 and Figure 18 on page 33 show statistics for the DS1 interface at the remote unit and line unit, respectively. These screens report 1-day, 1-hour, and 15-minute statistics.

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help	
H2TU-C DS1 31 Day History (Page 1 of 3)								
Date	CU-L	ES-L	SES-L	UAS-L	CU-P	ES-P	SES-P	UAS-P
12/23	-	-	-	-	-	-	-	-
12/24	-	-	-	-	-	-	-	-
12/25	-	-	-	-	-	-	-	-
12/26	-	-	-	-	-	-	-	-
12/27	-	-	-	-	-	-	-	-
12/28	-	-	-	-	-	-	-	-
12/29	-	-	-	-	-	-	-	-
12/30	-	-	-	-	-	-	-	-
12/31	-	-	-	-	-	-	-	-
01/01	-	-	-	-	-	-	-	-
01/02	-	-	-	-	-	-	-	-
01/03	-	-	-	-	-	-	-	-
Press: (N)ext Page, (P)revious Page, C(l)ear History								
Use <Space> to cycle through choices and <Enter> to view				Interface : H2TU-C DS1 Statistics : 31-Day History				
ID: xxxx		01/22/2003 21:18:51		H2TU-C		System: Alarm		
H0435-A								

*Figure 14. H2TU-R DS1 31-Day Performance History*

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
H2TU-C DS1 48 Hour History (Page 1 of 4)
-----
Time    CU-L  ES-L  SES-L  UAS-L  CU-P  ES-P  SES-P  UAS-P
-----
*22:00  -    -    -    -    -    -    -    -
*23:00  -    -    -    -    -    -    -    -
*00:00  -    -    -    -    -    -    -    -
*01:00  -    -    -    -    -    -    -    -
*02:00  -    -    -    -    -    -    -    -
*03:00  -    -    -    -    -    -    -    -
*04:00  -    -    -    -    -    -    -    -
*05:00  -    -    -    -    -    -    -    -
*06:00  -    -    -    -    -    -    -    -
*07:00  -    -    -    -    -    -    -    -
*08:00  -    -    -    -    -    -    -    -
*09:00  -    -    -    -    -    -    -    -

Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through choices and <Enter> to view
Interface : H2TU-C DS1
Statistics : 48-Hour History
ID: xxxx      01/22/2003 21:24:08 H2TU-C System: Alarm
-----
H0436-A
    
```

Figure 15. H2TU-C DS1 48-Hour Performance History

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
H2TU-R DS1 25 Hour History (Page 1 of 9)
-----
Time    CU-L  ES-L  SES-L  UAS-L  CU-P  ES-P  SES-P  UAS-P  PRM-NE  PRM-FE
-----
*20:30  -    -    -    -    -    -    -    -    -    -
*20:45  -    -    -    -    -    -    -    -    -    -
*21:00  -    -    -    -    -    -    -    -    -    -
*21:15  -    -    -    -    -    -    -    -    -    -
21:30   -    -    -    -    -    -    -    -    -    -
21:45   -    -    -    -    -    -    -    -    -    -
22:00   -    -    -    -    -    -    -    -    -    -
22:15   -    -    -    -    -    -    -    -    -    -
22:30   -    -    -    -    -    -    -    -    -    -
22:45   -    -    -    -    -    -    -    -    -    -
23:00   -    -    -    -    -    -    -    -    -    -
23:15   -    -    -    -    -    -    -    -    -    -

Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through choices and <Enter> to view
Interface : H2TU-R DS1
Statistics : 25-Hour History
ID: xxxx      01/22/2003 21:28:50 H2TU-C System: Alarm
-----
H0437-A
    
```

Figure 16. H2TU-R DS1 25-Hour Performance History

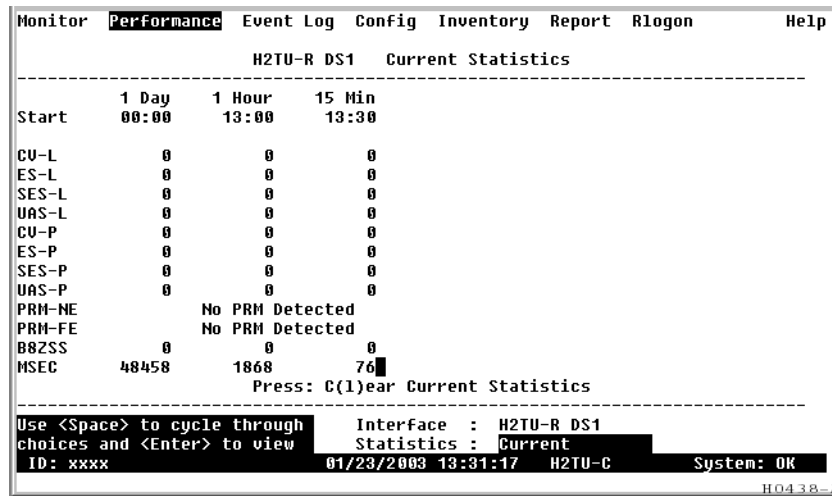


Figure 17. H2TU-R DS1 Current Statistics

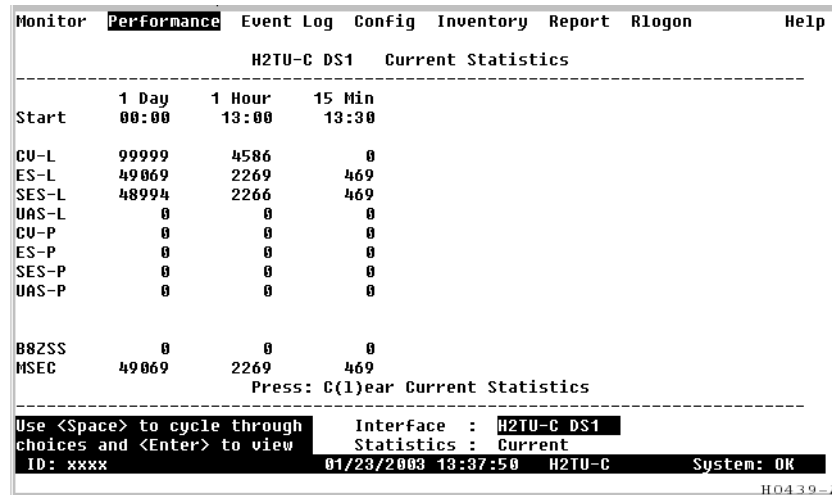


Figure 18. H2TU-C DS1 Current Statistics

Table 13. Error Acronyms Used on the DS1 Performance History Screens

Error Acronym	Description	Error Acronym	Description
CV-L	Code Violation - Line <sup>(a)</sup> Total BPV count.	UAS-P	Unavailable Seconds - Path A second of unavailability based on SES-P or AIS ≥ 1.
ES-L	Errored Seconds - Line Seconds with BPV ≥ 1.	PRM-NE <sup>(b)</sup>	Performance Report Monitoring - Near End The PRM registers in the ESF/FDL from CPE indicate errors, and the signal received from the network at the remote is error-free.
SES-L	Severely Errored Seconds - Line Seconds with BPV plus EXZ ≥ 1544 or LOS ≥ 1.	PRM-FE <sup>(b)</sup>	Performance Report Monitoring - Far End The PRM registers in the ESF/FDL from the network indicate errors, and the signal received from the CPE is error-free.

Continued

**Table 13.** Error Acronyms Used on the DS1 Performance History Screens (Continued)

Error Acronym	Description	Error Acronym	Description
UAS-L	Unavailable Seconds - Line Seconds with LOS $\geq 1$ .	B8ZSS <sup>(c)</sup>	B8ZS Monitored Seconds Seconds with B8ZS detection when AMI option is active.
CV-P	Code Violation - Path <sup>(d)</sup> Total count of FE errors for SF or CRC-6 errors for ESF.	MSEC <sup>(c)</sup>	Monitored Seconds of the current (15-minute/1-hour/1-day) screen.
ES-P	Errored Seconds - Path Seconds with SEF <sup>(e)</sup> , CRC (ESF), or FE (SF) $\geq 1$ .	BI <sup>(f)</sup>	Blockage Indicator (BI) = $[(0.2 \times ES + 0.4 \times SES + UAS) / MSEC] \times 100\%$ (MSEC is the same as the DS1 MSEC)
SES-P	Severely Errored Seconds - Path Seconds with SES, CRC (ESF) $\geq 320$ , or FE <sup>(g)</sup> (SF) $\geq 8 (F_T + F_S)$ .		

(a) Line (L) refers to the AMI DS1 line used to transport the payload.

(b) Appears on H2TU-R Performance History screens.

(c) Appears on the DS1 Current Statistics screens.

(d) Path (P) refers to the total framed payload being transported between two points.

(e) Severely Errored Frame—Two or more frame bit errors occurring in a 0.75 ms interval for SF or a 3 ms interval for ESF.

(f) Appears on the H2TU-R Blockage Indicator (BI) History screen.

(g) FE is a frame bit error.

## Blockage Indicator Statistics at the H2TU-R DS1 and HDSL2 Interface

Figure 19 and Figure 20 on page 35 are examples of H2TU-R Blockage Indicator (BI) History screens as viewed from the H2TU-R following a remote logon. These screens can also be viewed when logged on locally at the remote unit. The BI statistics can also be retrieved using inband or Facility Data Link (FDL) access.

BI is a quality of service (QoS) summary statistic which supplies a quick indicator of circuit performance at the H2TU-R. The DS1 BI weighs and averages PM primitives to provide a relative index of performance for leg 1 (NET TX) and leg 3 (CPE TX) of the DS1 interface as shown in Figure 11 on page 26. The HDSL2 BI weighs and averages PM primitives to provide a relative index of performance at each point of the HDSL2 interface.

BI displays as a percentage for the current hour and for each of the eight preceding hours. After viewing the information, press **R** to return to the H2TU-C logon screen.

BI is calculated as follows:

$$BI = [(UAS + .4 SES + .2 ES) / MON] \times 100$$

where: BI = 0% indicates the circuit leg is clean.

BI = 99% indicates that the circuit leg is out-of-service.

BI = % that is BI < 99% indicates partial trouble in the circuit leg. This percentage is greater than 0% and less than 99%. The higher the BI percentage, the more trouble on that particular circuit leg.

MON = indicates the number of seconds that were monitored in obtaining the UAS, SES, and ES data.

ES = Errored Seconds are a combination of DS1 path and line parameters as defined in ANSI T1.202-1997.

SES = Severely Errored Seconds are based on parameters similar to ES, but are more severe in number.

UAS = Unavailable Seconds or line unavailability is declared at the onset of 10 contiguous SES. For the line, including HDSL loops, to become available, there must be a minimum period of 10 seconds which are free of SES.

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help
H2TU-R DS1 Blockage Indicator History							
Time	NET-TX	CPE-TX					
07:00	-	-					
08:00	-	-					
09:00	-	-					
10:00	-	-					
11:00	-	-					
12:00	-	-					
13:00	-	-					
14:00	0%	0%					
15:00	0%	0%					
Press: C(1)ear History							
Use <Space> to cycle through choices and <Enter> to view				Interface : H2TU-R DS1 Statistics : BI History			
ID: XXXXX--XXXX--XXXX--XXXX				01/31/2003 15:03:30		H2TU-R System: OK	
H0553-A							

Figure 19. H2TU-R DS1 Blockage Indicator History Screen

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help
H2TU-R HDSL2 Blockage Indicator History							
Time	SPAN-1						
07:00	-						
08:00	-						
09:00	-						
10:00	-						
11:00	-						
12:00	-						
13:00	-						
14:00	0%						
15:00	0%						
Press: C(1)ear History							
Use <Space> to cycle through choices and <Enter> to view				Interface : H2TU-R HDSL2 Statistics : BI History			
ID: XXXXX--XXXX--XXXX--XXXX				01/31/2003 15:01:59		H2TU-R System: OK	
H0554-A							

Figure 20. H2TU-R HDSL2 Blockage Indicator History Screen

## Performance History at the HDSL2 Interface

The HDSL2 interface has 31-day, 48-hour, 25-hour, and current statistic screens for the H2TU-C. Figure 21 and Figure 22 are examples of 31-day and 48-hour performance history screens. Figure 23 and Figure 24 on page 37 are examples of 25-hour and current statistics performance history screens. Refer to Table 14 on page 37 for descriptions of the kinds of errors reported on all HDSL2 performance screens. Asterisks indicate performance monitoring from the previous day.

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help
H2TU-C HDSL2 31 Day History (Page 1 of 3)							
Date	CU	ES	SES	UAS	LOSWS		
12/24	-	-	-	-	-		
12/25	-	-	-	-	-		
12/26	-	-	-	-	-		
12/27	-	-	-	-	-		
12/28	-	-	-	-	-		
12/29	-	-	-	-	-		
12/30	-	-	-	-	-		
12/31	-	-	-	-	-		
01/01	-	-	-	-	-		
01/02	-	-	-	-	-		
01/03	-	-	-	-	-		
01/04	-	-	-	-	-		
Press: (N)ext Page, (P)revious Page, C(l)ear History							
Use <Space> to cycle through choices and <Enter> to view		Interface : H2TU-C HDSL2		Statistics : 31-Day History			
ID: xxxx	01/23/2003 12:06:00		H2TU-C		System: OK		

Figure 21. H2TU-C HDSL2 31-Day Performance History

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help
H2TU-C HDSL2 48 Hour History (Page 1 of 4)							
Time	CU	ES	SES	UAS	LOSWS		
*13:00	-	-	-	-	-		
*14:00	-	-	-	-	-		
*15:00	-	-	-	-	-		
*16:00	-	-	-	-	-		
*17:00	-	-	-	-	-		
*18:00	-	-	-	-	-		
*19:00	-	-	-	-	-		
*20:00	-	-	-	-	-		
*21:00	-	-	-	-	-		
*22:00	-	-	-	-	-		
*23:00	-	-	-	-	-		
*00:00	-	-	-	-	-		
Press: (N)ext Page, (P)revious Page, C(l)ear History							
Use <Space> to cycle through choices and <Enter> to view		Interface : H2TU-C HDSL2		Statistics : 48-Hour History			
ID: xxxx	01/23/2003 12:09:03		H2TU-C		System: OK		

Figure 22. H2TU-C HDSL2 48-Hour Performance History

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
H2TU-C HDSL2 25 Hour History (Page 1 of 9)
-----
Time      CU      ES      SES     UAS     LOSWS
-----
*11:15    -      -      -      -      -
*11:30    -      -      -      -      -
*11:45    -      -      -      -      -
*12:00    -      -      -      -      -
12:15     -      -      -      -      -
12:30     -      -      -      -      -
12:45     -      -      -      -      -
13:00     -      -      -      -      -
13:15     -      -      -      -      -
13:30     -      -      -      -      -
13:45     -      -      -      -      -
14:00     -      -      -      -      -
-----
Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through choices and <Enter> to view
Interface : H2TU-C HDSL2
Statistics : 25-Hour History
ID: xxxx      01/23/2003 12:12:37 H2TU-C      System: OK
-----
H0443-A

```

Figure 23. H2TU-C HDSL2 25-Hour Performance History

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
H2TU-C HDSL2 Current Statistics
-----
Start      1 Day   1 Hour   15 Min
11:40     12:00   12:15
-----
CU          0        0        0
ES          0        0        0
SES         0        0        0
UAS         0        0        0
LOSWS       0        0        0
-----
Margin(dB)  LA(dB)   INSL(dB)
Hi          18       1        1
Cur        18       1        1
Low         17
-----
Press: C(l)ear Current Statistics
-----
Use <Space> to cycle through choices and <Enter> to view
Interface : H2TU-C HDSL2
Statistics : Current
ID: xxxx      01/23/2003 12:15:51 H2TU-C      System: OK
-----
H0444-A

```

Figure 24. H2TU-C HDSL2 Current Statistics

Table 14. Error Acronyms Used on the HDSL2 Performance History Screens

Error Acronym	Description
CV	Code Violation Total count of HDSL2 CRC errors.
ES	Errored Seconds Seconds with HDSL2 CRC $\geq 1$ or LOSW $\geq 1$
SES	Severely Errored Seconds Seconds with HDSL2 CRC $\geq 50$ or LOSW $\geq 1$
UAS	Unavailable Seconds Based on 10 contiguous SES occurrences
LOSWS	Loss of Sync Word Second Seconds with LOSW $\geq 1$

## USING THE PERFORMANCE SCREENS TO VIEW ALARM DATA

To access the alarm history screens:

- 1 Press **P** to select the Performance screen.
- 2 Press the **SPACEBAR** to select an interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press the **SPACEBAR** until **Alarm History** is selected, then press **ENTER**.
- 4 Press **N** or **P** to page through the alarm history screens.
- 5 Press **L** to clear the selected alarm history screen.

### Alarm History at the DS1 Interface

The Alarm History screen reports on a continuous basis the DS1 statistics for the H2TU-C (Figure 25) and the H2TU-R (Figure 26 on page 38). The types of alarms reported are described in Table 15 on page 39. Current alarms are shown in reverse video.

Monitor	Performance	Event Log	Config	Inventory	Report	RLogon	Help
H2TU-C DS1 Alarm History							
Alarm	First	Last			Status	Count	
LLOS					OK	0	
LAIS					OK	0	
DBER					DISABLED	0	
LOF					OK	0	
Press: C(1)ear Alarm History							
Use <Space> to cycle through choices and <Enter> to view		Interface : H2TU-C DS1 Statistics : Alarm History					
ID: xxxx	01/23/2003 12:23:52	H2TU-C			System: OK		

Figure 25. H2TU-C DS1 Alarm History Screen

Monitor	Performance	Event Log	Config	Inventory	Report	RLogon	Help
H2TU-R DS1 Alarm History							
Alarm	First	Last			Status	Count	
RLOS					OK	0	
RAIS	01/23/03 11:40	01/23/03 11:40			OK	1	
RAI					OK	0	
TX RAI-CI					OK	0	
PRM-NE					DISABLED	0	
PRM-FE					DISABLED	0	
DBER					DISABLED	0	
LOF					OK	0	
Press: C(1)ear Alarm History							
Use <Space> to cycle through choices and <Enter> to view		Interface : H2TU-R DS1 Statistics : Alarm History					
ID: xxxx	01/23/2003 12:32:08	H2TU-C			System: OK		

Figure 26. H2TU-R DS1 Alarm History Screen



**Table 15. DS1 Alarm Descriptions**

Screen Alarm	Front-Panel Alarm	Description
<b>H2TU-C DS1 ALARMS (see Figure 25 on page 38)</b>		
LLOS <sup>(a)</sup>	LLOS	Line (Unit) Loss of Signal—Loss of the H2TU-C DSX-1 input signal.
LAIS	LAIS	Line Alarm Indication Signal—Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port. The ALMP option determines whether AIS (default) or LOS is sent toward the CPE.
DBER	xxx-DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately $10^{-6}$ . (xxx denotes either TUC or TUR.)
LOF	xxx-LOF	Loss of Framing—Indicates that DS1 frame error is detected in the incoming DS1 frame pattern. The frame errors are only monitored when the configured frame pattern is received. Only occurs when FRMG option is set to SF or ESF.
<b>H2TU-R DS1 ALARMS (see Figure 26 on this page)</b>		
RLOS <sup>(a)</sup>	RLOS	Remote (Unit) Loss of Signal—Loss of the H2TU-R DS1 input signal.
RAIS	RAIS	Remote Alarm Indication Signal—Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port. By default AIS-CI <sup>(b)</sup> is sent toward the network. See Figure 33 on page 50.
RAI	RRAI	Remote RAI - Remote Alarm Indication at the H2TU-R—Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
TX RAI-CI	TRCI	Transmit RAI-CI - Remote Alarm Indication at the H2TU-R—Upon reception of an RAI (yellow) from the CPE, the H2TU-R sends an RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or LOF), then the RAI is passed on to the network unaltered. This is applicable to SF or ESF framing. In an all SF environment, RAI-CI must be enabled to convert SF-RAI to SF-RAI-CI.
PRM-NE	PRMN	Performance Report Monitoring - Near End—The count of the PRM-NE register at the H2TU-R exceeds the $10^{-6}$ BER threshold at 648 events since 12:00:00 AM.
PRM-FE	PRMF	Performance Report Monitoring - Far End—The count of the PRM-FE register at the H2TU-R exceeds the $10^{-6}$ BER threshold at 648 events since 12:00:00 AM.
DBER	xxx-DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately $10^{-6}$ . (xxx denotes either TUC or TUR.)
LOF	xxx-LOF	Loss of Framing— Indicates that DS1 frame error is detected in the incoming DS1 frame pattern. The frame errors are only monitored when the configured frame pattern is received. Only occurs when FRMG option is set to SF or ESF.

(a) This is a DS1-specific alarm that also issues a minor alarm (sent to the management unit or the backplane), if enabled.

(b) AIS-CI is a modified AIS alarm pattern. Equipment not suited to detect AIS-CI still detects this signal as an AIS. AIS-CI is sent toward the network indicating that an LOS (RLOS) or AIS (RAIS) has been received from the CPE.

## Alarm History at the HDSL2 Interface

The HDSL2 Alarm History screens report alarms at the H2TU-C and the H2TU-R. Figure 27 shows the H2TU-C HDSL2 alarm history. Table 16 describes the alarms that are reported at the H2TU-C or H2TU-R.

Alarm	First	Last	Status	Count
LOSW			OK	0
MAL	01/23/03 11:40	01/23/03 11:40	OK	1
LA			OK	0
HBER			DISABLED	0
SHORT			OK	0
GND			OK	0
OPEN			OK	0

Figure 27. H2TU-C HDSL2 Alarm History Screen

Table 16. HDSL2 Alarm Descriptions

Screen Alarm	Front-Panel Alarm	Description
<b>HDSL2 ALARMS at the H2TU-C and H2TU-R</b>		
LOSW	SPN $n$ -LOSW	Loss of Sync Word—The HDSL2 loop has lost synchronization.
MAL	xxx-MAL	Margin—The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system. (xxx denotes either TUC or TUR.)
LA	xxx-LA	Loop Attenuation—The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold. (xxx denotes either TUC or TUR.)
HBER	xxx-HBER	Block Error Rate—The HDSL2 BER has exceeded the set threshold limits of $10^{-6}$ or $10^{-7}$ . (xxx denotes either TUC or TUR.)
<b>HDSL2 ALARMS at the H2TU-C only</b>		
SHORT	PWR FEED SHRT	A short between the Tip and Ring of the HDSL2 pair is present.
GND	PWR FEED GND	The HDSL2 loop is grounded.
OPEN	PWR FEED OPEN	A line power open condition is present.

## USING THE SYSTEM EVENT LOG TO TRACK EVENTS

The System Event Log screen, when viewed from the H2TU-C (Figure 28) or H2TU-R (Figure 29), displays 100 of the most recent events (most recent event displayed first) and provides the following information:

- Origin tags to identify the source of a Write entry (see “Origin Tags” on page 43)
- Date and time
- Event log messages (see Table 17 on page 42)

To view a running log of system events:

- Press **E** to select the H2TU-C Event Log (or press **R** to log on remotely, then press **E** to select the H2TU-R Event Log).
- Press **N** or **P** to page through the event log.
- Press **T** to return to the top of the log.
- Press **L** to clear the event log.

#	Origin	Date and Time	Entry
1	Line Unit	01/23/03 11:40:14	HDSL2 Unavailability: End
2	Remote Unit	01/23/03 11:40:11	DS1 AIS Alarm: End
3	Remote Unit	01/23/03 11:40:09	DS1 AIS Alarm: Begin
4	Line Unit	01/23/03 11:40:07	HDSL2 MAL Alarm: End
5	Line Unit	01/23/03 11:40:05	HDSL2 MAL Alarm: Begin
6	LU Craft Port	01/23/03 11:40:04	Event Log Reset
7	- EMPTY -		
8	- EMPTY -		
9	- EMPTY -		
10	- EMPTY -		
11	- EMPTY -		
12	- EMPTY -		
13	- EMPTY -		
14	- EMPTY -		
15	- EMPTY -		

Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log  
 ID: xxxx 01/23/2003 13:19:51 H2TU-C System: OK  
 H0448-A

Figure 28. H2TU-C System Event Log

#	Origin	Date and Time	Entry
1	RU Craft Port	01/31/03 14:48:13	Event Log Reset
2	- EMPTY -		
3	- EMPTY -		
4	- EMPTY -		
5	- EMPTY -		
6	- EMPTY -		
7	- EMPTY -		
8	- EMPTY -		
9	- EMPTY -		
10	- EMPTY -		
11	- EMPTY -		
12	- EMPTY -		
13	- EMPTY -		
14	- EMPTY -		
15	- EMPTY -		

Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log  
 ID: xxxxxx--xxxx--xxxx--xxxx 01/31/2003 15:00:30 H2TU-R System: OK  
 H0551-A

Figure 29. H2TU-R System Event Log

## Event Log Messages

Table 17 lists all the possible messages that can be displayed by the System Event Log screen.

**Table 17.** *Event Log Entry Messages*

Any DS1 Alarm History reset
Any DS1 PM register reset
Any HDSL2 Alarm History reset
Any HDSL2 PM register reset
Any Loop Down (any segment)
Any Loop Up (any segment)
Any provisioning option change: <provisioning mnemonic>: changed from <old> to <new>
CPE DBER alarm (1-day threshold crossed of any PM data except PRM-NE or PRM-FE)
CPE DS1 AIS begins/ends
CPE DS1 LOS begins/ends
CPE PRM-NE BER alarm ( <i>at the remote only</i> : 1-day threshold crossed of PRM-NE: trouble on CPE receive)
Current statistics reset
Event Log reset
H2TU-C Power up/down
H2TU-R Power up/down
HDSL2 DC pair open begins/ends on any segment
HDSL2 Ground fault begins/ends on any segment
HDSL2 HBER alarm (threshold crossed) on any segment.
HDSL2 loop attenuation (threshold crossed) on any HDSL2 interface
HDSL2 margin alarm (threshold crossed) on any HDSL2 interface
HDSL2 unavailability begins/ends on any segment
Master zero reset
NTWK DBER alarm (1-day threshold crossed of any PM data)
NTWK DS1 LOS begins/ends
NTWK PRM-FE BER alarm ( <i>at the remote only</i> : 1-day threshold crossed of PRM-FE: trouble on NTWK far end)
NTWK DS1 AIS begins/ends
Power Feed Open begins/ends
Power Feed Short begins/ends
RAI begins/ends
RAI-CI begins/ends (RAI-CI sent from the remote towards the network)
Network initiated restart (from Power Back Off change)

## Origin Tags

The origin tags identify the source of all Write entries and how an event occurred. The exact meaning is dependent on the type of event and the unit reporting the event. A Write entry changes a system parameter or an option setting, but it does not affect circuit status changes, such as alarms. Table 18 lists the various origin tags and their definitions.

**Table 18.** *Origin Tags*

Origin Tag	Description
<b>Provisioning changes initiated at the line unit (logged on to the line unit)</b>	
LU Craft Port	Event was initiated from the RS-232 craft port located on the H2TU-C front panel.
LU Front Panel	Event was initiated from the MODE and/or LBK pushbutton on the H2TU-C front panel.
<b>Provisioning changes initiated at the line unit (logged on to the remote unit)</b>	
Line Unit	This generic origin tag can only occur when viewing the Event Log screen at the remote unit. It is a general indication that the event was initiated at the line unit. The Event Log screen must then be viewed at the line unit (through an <b>R</b> logon command) for more specific origin information.
<b>Provisioning changes initiated at the remote unit (logged on to the remote unit)</b>	
RU Front Panel	Event was initiated from the LBK pushbutton on the H2TU-R front panel.
RU Craft Port	Event was initiated from the RS-232 craft port located on the H2TU-R front panel.
TL1 Command	Event was initiated by a non-intrusive TL1 command embedded in the FDL of the ESF DS1 signal received by the HDSL2 circuit.
11 Bit Command	Event was initiated by an intrusive command in the DS1 payload received by the HDSL2 circuit.
<b>Provisioning changes initiated at the remote unit (logged on to the line unit)</b>	
Remote Unit	This generic origin tag can only occur when viewing the Event Log screen at the line unit. It is a general indication that the event was initiated at the remote unit. The Event Log screen must then be viewed at the remote unit (through an <b>R</b> logon command) for more specific origin information.
<b>Loopback commands</b>	
Remote Unit	Implies that the loopback command was initiated at the remote unit by the front-panel pushbuttons, craft port, or in the remote unit's DS1 input payload. A loopback initiated from a terminal would have a Remote Unit tag if the initiating terminal is in a remote logon session.
Line Unit	Implies that the loopback command was initiated at the line unit by the front-panel pushbuttons, craft port, or in the line unit's DSX-1 input payload.
<b>Alarms</b>	
Remote Unit	Indicates that the alarm occurred at the remote unit.
Line Unit	Indicates that the alarm occurred at the line unit. LOSW, SHORT, GND, and OPEN are always tagged as line unit alarms.

## USING THE SECTIONALIZED EVENT LOG TO ISOLATE TROUBLE

The Sectionalized Event Log screen, shown in Figure 30, displays the date and time of the 100 most recent sectionalized events (most recent event displayed first) for all four legs of the H2TU-R DS1 interface. The screen provides a description of each event with the most recent event displayed first.



The Sectionalized Event Log screen can only be viewed through an Rlogon session from the H2TU-C end, or through a local logon session from the H2TU-R end.

To view the H2TU-R Sectionalized Event Log:

- 1 Press **R** to log on remotely, then press **E**.
- 2 Use the **↑** and **↓** arrow keys to select **Sectionalized Event Log**, then press **ENTER**.
  - Press **N** or **P** to page through the event log.
  - Press **T** to return to the top of the log.
  - Press **L** to clear the event log.
- 3 Press **ESC** to exit the Sectionalized Event Log screen, then press **R** to return to the H2TU-C logon screen.

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
-----
Sectionalized Event Log (Page 1 of 7)
-----
# Date and Time NET-TX CPE-RX CPE-TX NET-RX
1 - EMPTY -
2 - EMPTY -
3 - EMPTY -
4 - EMPTY -
5 - EMPTY -
6 - EMPTY -
7 - EMPTY -
8 - EMPTY -
9 - EMPTY -
10 - EMPTY -
11 - EMPTY -
12 - EMPTY -
13 - EMPTY -
14 - EMPTY -
15 - EMPTY -

Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log
ID: XXXXX--XXXX--XXXX--XXXX 01/31/2003 14:58:54 H2TU-R System: OK
H0552-A
  
```

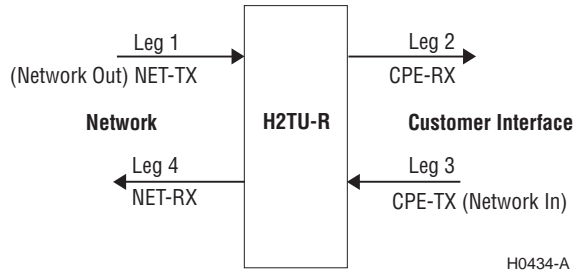
Figure 30. Sectionalized Event Log Screen



On signals without Far End or Near End PRM present, event data in the CPE-RX and NET-RX circuit legs is limited to trouble alarms.

Sectionalized events isolate trouble to a particular circuit leg (see Figure 31). For example, an ES listed under the NET-TX column indicates that an errored second condition exists on the NET-TX circuit leg beginning with the time stamp and continuing until an OK or other new event is recorded.

Sectionalized events use the status definitions described in Figure 30 on page 44 and in Table 19 on this page.



**Figure 31.** Sectionalized Analysis of the DS1 Interface

**Table 19.** Sectionalized Event Definitions

Transmission Leg	Event Name	Event Description
Leg 1 (NET-TX)	Alarm	HDSL2 LOSW or DS1 LOS received from the network
	AIS	AIS received from the network
	RAI	RAI received from the network
	OOF	More than 2 seconds of OOF received
	SES	BPV $\geq$ 1544, CRC (ESF) $\geq$ 320, or FE (SF) $\geq$ 8
	ES	BPV, SEF, CRC (ESF), or FE (SF)
	OK	Leg 1 is clear
Leg 2 (CPE-RX)	Alarm <sup>(a)</sup>	Inferred alarm because RAI is received from the CPE at leg 3 and leg 1 is clear
	AIS	Reported only when remote actively sends out AIS to CPE
	RAI	Leg 1 is in RAI state
	SES <sup>(a)</sup>	Inferred SES. PRM received from CPE has G6 or SE bit set.
	ES <sup>(a)</sup>	Inferred ES. PRM received from CPE has any of G1 through G5 set, LV, or FE set.
	NOT SECT	Cannot be sectionalized; no PRM received from the CPE.
	OK	PRM received from CPE has no errors.
Leg 3 (CPE-TX)	Alarm	LOS received from CPE
	AIS	AIS received from CPE
	RAI	RAI received from CPE
	OOF	More than 2 seconds of OOF received
	SES	BPV + EXZ $\geq$ 1544 of F (ESF) $\geq$ 320 or FE (SF) $\geq$ 8
	ES	BPV, SEF, CRC (ESF), or FE (SF)
	OK	Leg 3 is clear
Leg 4 (NET-RX)	Alarm <sup>(a)</sup>	Inferred alarm because RAI is received from the network at leg 1 and leg 3 is clear
	AIS-CI	Remote actively sends out AIS-CO to the network due to an LOS or AIS at leg 3
	RAI-CI	Remote actively sends out RAI-CI due to leg 3 RAI and leg 1 is clear
	SES <sup>(a)</sup>	Inferred SES. PRM received from CPE has G6 or SE bit set.
	ES <sup>(a)</sup>	Inferred ES. PRM received from CPE has any of G1 through G5 set, LV, or FE set.
	NOT SECT	Cannot be sectionalized; no PRM received from the CPE.
	OK	PRM received from CPE has no errors.

(a) An inferred failure or error condition displays in reverse video on the monitor.

## USING THE REPORT MENU

The Report menu (Figure 32) provides screens containing status and performance monitoring data for line and remote units which can be downloaded to a file for analysis or future reference. Table 20 on page 47 describes the report types provided by the Report menu.

To select each individual report, do the following:

- 1 Press **O** to select Report menu.
- 2 Press the **SPACEBAR** to select a report.
  - Continuous Print Mode generates a non-stop version of the report.
  - Page Mode generates a page-by-page version of the report for easy viewing on the screen.
- 3 Use a terminal emulation software such as HyperTerminal or Procomm to capture the selected report to a connected printer. Press **ENTER** to generate.
- 4 End the captured report.
- 5 Press **CTRL** + **R** to refresh the Report menu screen.

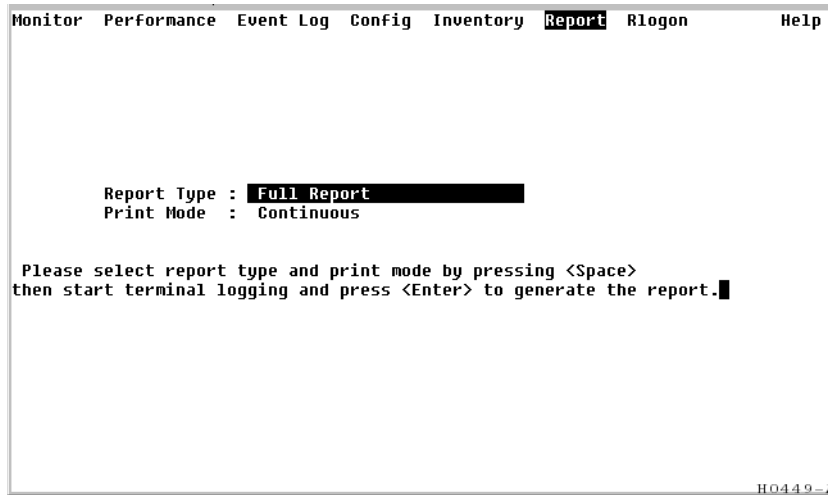


Figure 32. Report Menu - Full Report



**Table 20. Report Types**

<b>Type</b>	<b>Contains the following information:</b>
Full Report	<ul style="list-style-type: none"><li>• Circuit and unit identifications</li><li>• Product information</li><li>• System configuration</li><li>• Current performance statistics</li><li>• Alarm history</li><li>• Performance history</li><li>• System event log</li></ul>
Short Report	<ul style="list-style-type: none"><li>• Product information</li><li>• System configuration</li><li>• Current performance statistics</li><li>• Circuit and unit identification</li></ul>
System Information Report	<ul style="list-style-type: none"><li>• Circuit and unit identifications</li><li>• Product information</li><li>• System configuration</li></ul>
Event Report	<ul style="list-style-type: none"><li>• Circuit and unit identifications</li><li>• Product information</li><li>• System event log</li></ul>

# TESTING

This section provides information about front-panel system alarms, LOS and AIS response, OCT55 test procedure, and loopback testing.

## SYSTEM ALARMS

Table 21 summarizes all possible system alarms in order of priority as they appear on the line unit front panel. When multiple alarms occur, the front-panel display only reports the highest priority alarm. Additionally, the alarm history screens display alarms, but provide greater detail (see “Front-Panel Display Messages” on page 4). All alarms that are not inhibited flash red on the front-panel Status LED.

**Table 21.** *Front-Panel System Alarms Summary*

Front-Panel Message <sup>(a)</sup>	Alarm	Description	To Inhibit
PWR FEED SHRT <sup>(b)</sup>	Power Feed Short	A short exists between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
PWR FEED GND <sup>(b)</sup>	Power Feed Ground	The HDSL2 loop is grounded.	Cannot be inhibited.
PWR FEED OPEN <sup>(b)</sup>	Power Feed Open	A line power open condition exists.	Cannot be inhibited.
SPN <i>n</i> -LOSW	Span( <i>n</i> )-Loss of Sync Word <sup>(c)</sup>	The HDSL2 loop has lost synchronization.	Cannot be inhibited.
LLOS	Line (Unit) Loss of Signal	Loss of the DSX-1 input signal.	Cannot be inhibited.
RLOS	Remote (Unit) Loss of Signal	Loss of the H2TU-R DS1 input signal.	Cannot be inhibited.
LAIS	Line Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H2TU-C DS1 input port.	Cannot be inhibited.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H2TU-R DS1 input port.	Cannot be inhibited.
TRCI	Transmit RAI-CI—Remote Alarm Indication at the H2TU-R	Upon reception of an RAI (yellow) from the CPE, the H2TU-R sends RAI-CI toward the network if the network signal received at the H2TU-R is clear.  If the network signal is impaired (LOS, AIS, or LOF), then the RAI is passed on to the network unaltered.	Cannot be inhibited.
RRAI	Remote RAI—Remote Alarm Indication at the H2TU-R	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.
xxx-LOF	Loss of Frame	DS1 frame error is detected in the selected frame format made in the FRMG option ( <i>xxx</i> denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays).	Change FRMG option to AUTO or UNFR.
xxx-DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set threshold limits of approximately $10^{-6}$ . <i>xxx</i> denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.	Select DIS for the DBER system option.
PRMF	Performance Report Messaging - Far End	Indicates H2TU-R PRM-FE BER threshold is exceeded.	Set DBER threshold to DIS.
PRMN	Performance Report Messaging - Near End	Indicates H2TU-R PRM-NE BER threshold is exceeded.	Set DBER threshold to DIS.

*Continued*

**Table 21.** *Front-Panel System Alarms Summary (Continued)*

<b>Front-Panel Message <sup>(a)</sup></b>	<b>Alarm</b>	<b>Description</b>	<b>To Inhibit</b>
xxx-HBER	HDSL2 Block Error Rate	The HDSL2 BER has exceeded the set threshold limits of $10^{-6}$ or $10^{-7}$ . xxx denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.	Select NONE for the HBER system option.
xxx-MAL	Margin Alarm	The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system. xxx denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.	Set the Margin Alarm Threshold option to 0 (zero).
xxx-LA	Loop Attenuation	The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold. xxx denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.	Set the HDSL2 Loop Attenuation Threshold option to zero.

(a) The message, ALRM, displays prior to any alarm message.

(b) Message displays repeatedly as long as the alarm condition exists and is not included in the priority order.

(c) When the HDSL2 loop loses sync word (LOSW), a system alarm condition exists. However, since the H2TU-C enters the acquiring mode, the front-panel status LED flashes red, and the ACQ or SIG message displays instead of the ALRM message.

## Alarm Option for the Digital Loop Carrier Feed

To improve HDSL2 compatibility with the switch-to-protect features used in Digital Loop Carrier (DLC) feeder applications, the H2TU-C has an Alarm Pattern (ALMP) option that allows either AIS or LOS DS1 output payload selection for the following alarms:

- LOSW on any loop
- LOS DS1

## Retiring System Alarms

To retire a system alarm, press the LBK pushbutton to execute an Alarm Cutoff (ACO). An ALRM message has two parts: the generated alarm and a generated alarm message. An ACO turns off the generated alarm and replaces the ALRM message with an ACO message. The second part of the ALRM message, which defines the cause of the alarm, remains. Both parts of the message remain until the alarm condition clears or another higher priority alarm occurs.

## Remote LOS and AIS Response

Figure 33 shows the different ways the HDSL2 can respond to the network, depending on the configuration of the TLOS, NLBP, RDA, ALMP, and NAIS configuration options described in Table 5 on page 16 and Table 6 on page 17.

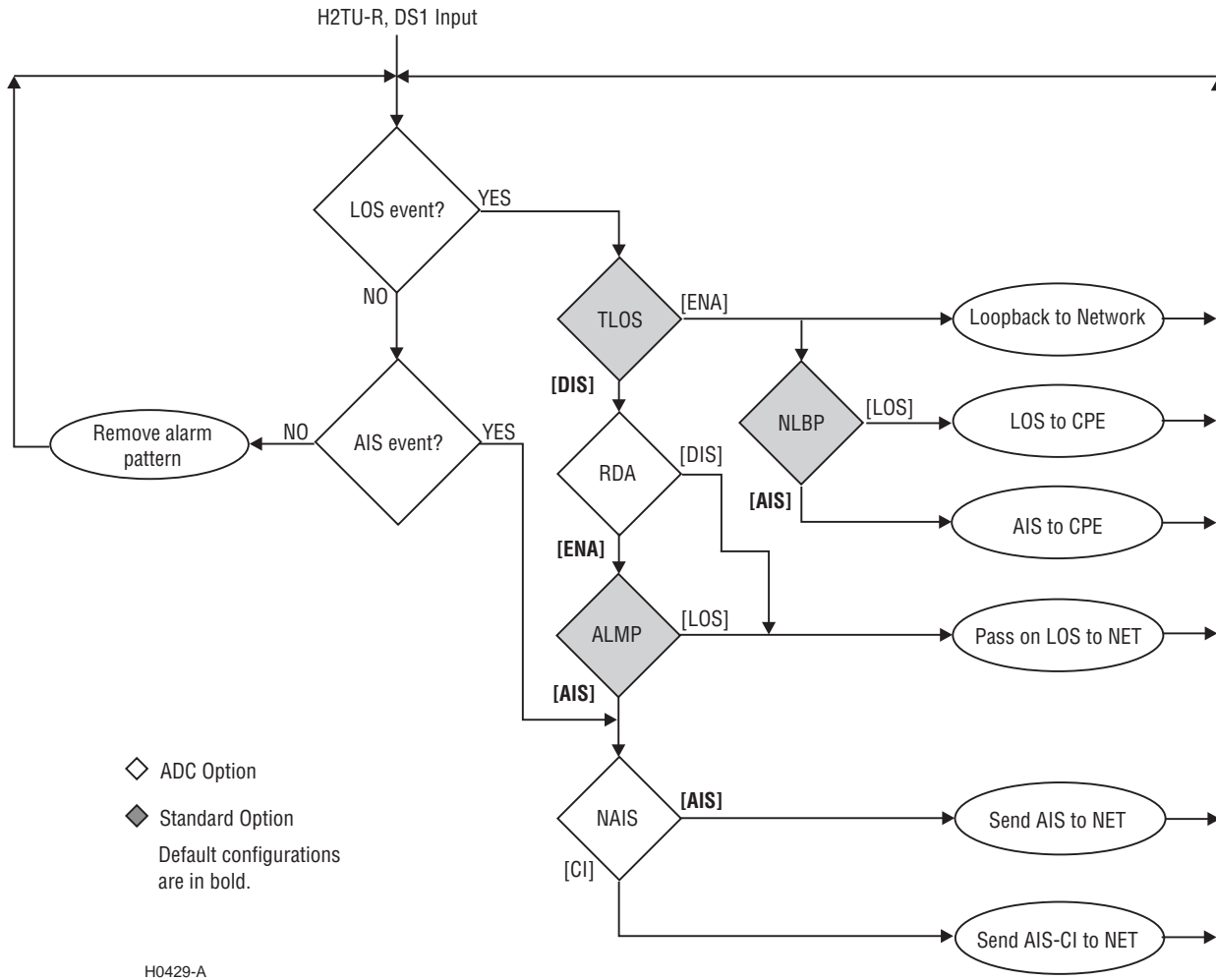


Figure 33. H2TU-R LOS and AIS Response Priorities

## OCT55 TEST PATTERN WITH AMI LINE CODE

The OCT55 test pattern can be used in unframed mode to stress the system and verify data integrity. In an SF or ESF framing mode, excessive zero anomalies may occur, which causes the H2TU-C to report ES, SES, and UAS errors according to ANSI T1.231-1997.

## LOOPBACK OPERATION

HiGain HDSL2 has a family of loopback options for analyzing circuit functionality. The loopback signal is transmitted and returned to the sending device for comparison. This allows you to verify the integrity of the HDSL2 channels to the H2TU-C, the H2TU-C DSX-1 interface and the DS1 channels to the customer. Loopback options include:

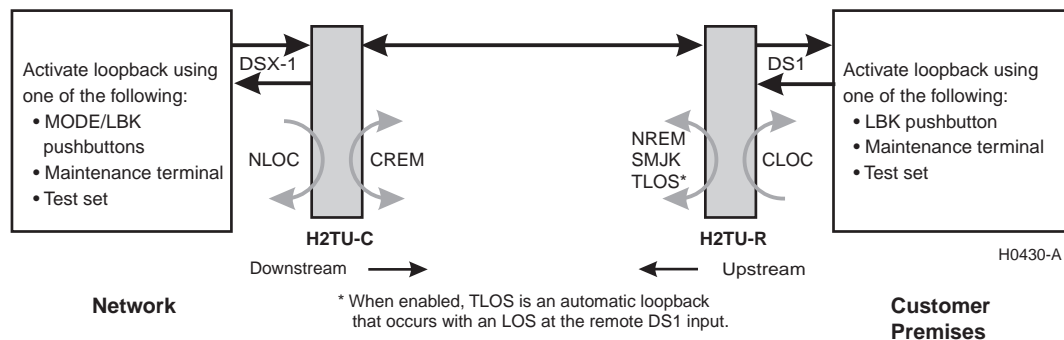
- Generic Loopback (GNLB) options, including the SmartJack (SMJK) option and double loopbacks (see Table 22 on page 52)
- Special Loopback (SPLB) options (see “Special Loopback Commands” on page 53) and the following command tables:
  - Addressable Repeater Loopback commands: A1LB, A2LB, A5LB (see Table 23 on page 58)
  - Addressable Repeater Loopback commands: A3LB, A4LB (see Table 24 on page 59)

Loopback commands can be initiated by (see Figure 34):

- Selecting the loopback type using the MODE and LBK pushbuttons on the H2TU-C front panel or the manual loopback (LBK) pushbutton on the H2TU-R
- Selecting the loopback type from the Monitor menu when connected to the craft port of the H2TU-C or H2TU-R
- Entering the loopback code (except for COLB and RULB) into the test equipment connected to the H2TU-C or H2TU-R.



**HiGain supports multiple loopbacks, but a single loopback is the preferred method.**



**Figure 34.** Loopback Summary

## GENERIC LOOPBACK COMMANDS

The HDSL2 Generic Loopback (GNLB) commands allows the use of inband codes to loop up either NLOC (4-in-7) or NREM (3-in-7) towards the network. Additionally, these inband codes loop up CREM (6-in-7) or CLOC (5-in-7) towards the customer. Either loopup condition can be terminated (looped down) with the 3-in-5, SMJK loopdown code. All inband codes must be present for at least 5 seconds before the HDSL2 system responds. TLOS is a logic loopback caused by loss of the DS1 input from the CI.

Figure 34 on page 51 summarizes the available loopbacks in the system, and Table 22 summarizes the HDSL2 generic loopback commands. See “GNLB Test Procedures” on page 55 for the test procedures that apply when using the GNLB mode.



**HiGain systems feature the SmartJack option which can emulate a Network Interface Device (NID) for loopback testing of the HDSL2 circuit. SMJK and NREM loopbacks perform the same functions, but their initiation differs. SMJK indicates that the loopback was initiated by the 2-in-5 inband command. Conversely, NREM is initiated by the 3-in-7 inband command, or by a command issued from the maintenance terminal.**

**Use the inband commands to enable or disable the SMJK loopback options. The HDSL2 system setting is normally enabled to recognize all inband SmartJack loopback commands.**

*Table 22. Summary of HDSL2 Loopback Codes and Activation Methods*

Loopback	Code	Description	Method of Activation		
			Test Set	Craft Port	MODE/LBK
NLOC	1111000 4-in-7	DSX-1 signal is looped back to the network at the H2TU-C.	X	X	X
NREM	1110000 3-in-7	DSX-1 signal is looped back to the network at the H2TU-R.	X	X	X
CLOC	1111100 5-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-R.	X	X	X
CREM	1111110 6-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-C.	X	X	X
COLB		Dual loopback at the H2TU-C. DSX-1 signal is looped back to the network at the H2TU-C and signal from the customer is looped back to the customer at the H2TU-C.		X	X
RULB		Dual loopback at the H2TU-R. DSX-1 signal is looped back to the network at the H2TU-R and signal from the customer is looped back to the customer at the H2TU-R.		X	X
SMJK LpUp (PL)	11000 2-in-5	SmartJack Loopup or NID payload (PL) code. Invokes H2TU-R loopback toward network.	X		
SMJK LpUp (ESF-DL)	1111-1111-0100-1000	SmartJack Loopup or NID (ESF-DL) code. Invokes H2TU-R loopback toward network.	X		
SMJK LpDn (PL)	11100 3-in-5	SmartJack Loopdown or NID payload (PL) code. Removes SMJK, NLOC, NREM, CLOC, and CREM.	X		
SMJK LpDn (ESF-DL)	1111-1111-0010-0100	SmartJack Loopdown or NID (ESF-DL) code. Removes SMJK, NLOC, NREM, CLOC, and CREM.	X		

## SPECIAL LOOPBACK COMMANDS

In addition to the GNLB loopback command mode, an HDSL2 system can be configured for special loopback command modes. The H2TU-C can be configured from the maintenance terminal Monitor screen using the Config menu and Special Loopback Mode option. Once a loopback mode is activated, other loopback commands can be sent by a test set connected to the craft port of the H2TU-C or H2TU-R. See Table 23 on page 58 and Table 24 on page 59 for list of SPLB commands.

A1LB through A5LB are five special, addressable, repeater loopback modes which are supported by the H2TU-C. These loopback modes provide the HDSL2 system with sophisticated maintenance and troubleshooting tools. A1LB, A2LB, and A5LB are patterned after the Westell addressable DS1 repeater loopbacks. A3LB and A4LB are patterned after the Wescom addressable DS1 repeater loopbacks. All five SPLBs are enhanced to handle the specific requirements of the following HDSL2 customers:

- A1LB (Westell) = Southwestern Bell
- A2LB (Westell) = Southwestern Bell
- A3LB (Wescom) = New England Telephone, Bell Atlantic
- A4LB (Wescom Mod 1) = New York Telephone
- A5LB (Westell Mod 1) = Southern New England Telephone (SNET), Southwestern Bell, Pacific Bell

The A1LB loopback selection complies with that proposed for HDSL2 systems in the DS1-E1.4/92 recommendation with the following additions:

- Query loopback
- IOR (Intelligent Office Repeater) power-down
- Four loopback time-out choices
- Initiation from either end
- Repeating bit error signatures
- Alternate query loopback

These additions make A1LB identical to A2LB. A1LB is given a separate identity to allow future DS1/E1 enhancements to be added without affecting A2LB.

A5LB differs from A2LB in that A5LB does not block the arming code from exiting the H2TU-C into the network. A1LB and A2LB can be configured to do one of the following:

- Block the arming code (after 2 seconds) from exiting the H2TU-C into the network and replace it with the AIS code.
- Unblock the AIS code by executing the Far End Activate code. Since A5LB never blocks the arming code from exiting the H2TU-C, the Far End Activate code is not available in A5LB.

A3LB differs from A4LB in that A3LB supports the additional (1-in-6) SMJK loopback command.

## MANUAL LOOPBACK SESSION

A manual loopback session allows for any HDSL2 loopback selection as listed in Table 22 on page 52 with the exception of SmartJack loopbacks, which can only be issued by inband commands.

### Setting the Loopback Time-Out Option

Before initiating a loopback session, verify that the Loopback Time-Out parameter is set to the desired setting. Table 5 on page 16 describes this option.

- 1 Log on to the maintenance terminal.
- 2 Select **Config, Standard Options**, then **LBTO**.
- 3 Verify the LBTO setting.

### Activating Manual Loopback Mode



With the exception of SmartJack, any of the HDSL2 loopbacks can be executed using the **MODE** and **LBK** pushbuttons.

When executing a manual loopback session using the **MODE** and **LBK** pushbuttons:

- The next loopback option can be displayed by pressing the **MODE** pushbutton, however, the previously activated loopback remains active until the **LBK** pushbutton is pressed, which activates the new loopback.
- If neither pushbutton is pressed for a period of 30 seconds and no loopback is in effect, the manual loopback session terminates, and the display returns to normal mode.
- If any loopback is in effect, the 30-second time-out is inhibited. The active loopback and the manual loopback sessions continue until the loopback times out in accordance with the **LBTO** setting.
- If there is an active loopback, pressing the **MODE** and **LBK** pushbuttons for 5 or more seconds terminates any active loopback, ends the manual loopback session, and returns the display to normal mode.

To initiate a manual loopback session:

- 1 Press both the **MODE** and **LBK** pushbuttons on the front panel for at least 3 seconds. The following message appears on the front-panel display:
 

```
MAN LPBK NLO?
```
- 2 Press **LBK** to activate **NLOC**. The display changes to `MAN LPBK NLOC`.
- 3 Press **MODE** to advance to the next available loopback:
  - `NRE? = NREM`
  - `CRE? = CREM`
  - `CLO? = CLOC`
  - `COL? = dual loopback at H2TU-C.`
  - `RUL? = dual loopback at H2TU-R.`
- 4 Press **LBK** to activate the selected loopback. The previous loopback is terminated.

Once a loopback is selected and activated, the loopback stays active until it times out (based on the **LBTO** setting). When a loopback times out, the display then returns to the normal display mode.



Loopbacks can be terminated manually and exited from the MAN LPBK mode by simultaneously pressing the MODE and LBK pushbuttons for 3 or more seconds. If no loopback is active, the MAN LPBK mode automatically terminates after 30 seconds.

All loopbacks, except dual loopbacks, can be initiated by inband commands in the DS1 payload. Loopbacks can also be initiated by a command from the HDSL2 system using front-panel pushbuttons or maintenance screen selections. Therefore, whenever a loopback is active, the method by which it was activated is indicated in the Loopback and Status screens by the annotation HG or PL adjacent to the identified loopback. For example, NREM-HG indicates that the loopback was initiated by the HDSL2 system.



**SMJK loopback commands are only activated by inband commands. Dual loopback commands are only activated by the front-panel pushbuttons or maintenance screen selections.**

## LOOPBACK TEST PROCEDURES

The following sections provide step-by-step test procedures for verifying the integrity of the HDSL2 channels at every module location as well as the DS1 channels to the customer and the local DSX-1 interface.

### General Troubleshooting Tips

If trouble is encountered on the DSX-1 interfaces of the H2TU-C, verify that the:

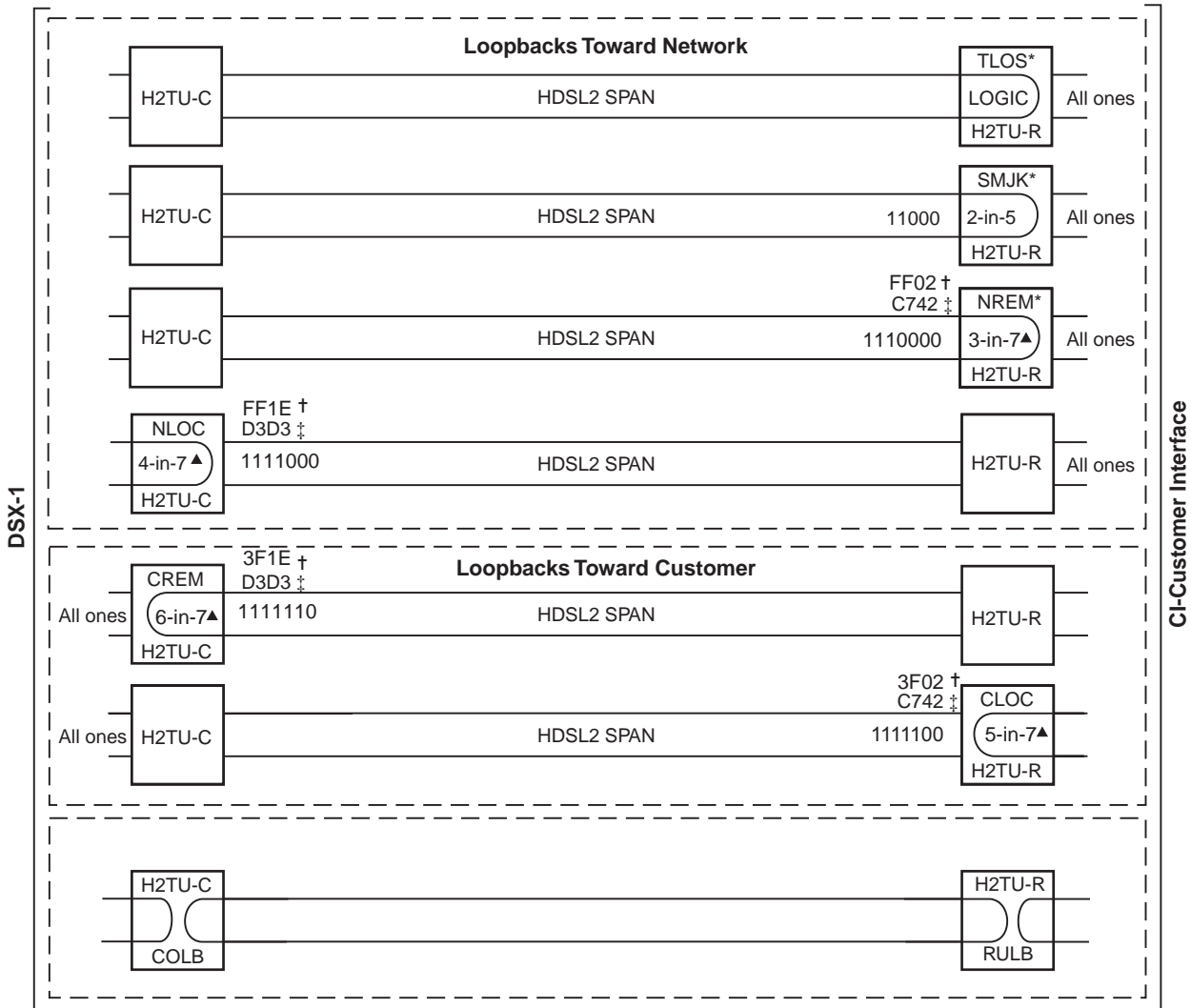
- H2TU-C is making a positive connection with its mounting assembly (shelf) connector.
- H2TU-C internal equalizer is set to the correct distance range per Table 5 on page 16. All equalizers should be set to the distance from the DSX-1 to the shelf.

### GNLB Test Procedures

Figure 35 on page 56 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. See Table 22 on page 52 for a description of these commands.

To perform the GNLB loopback test procedure:

- 1 Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. Observe the NREM message on the front-panel display. The Status LED on the front panel should be green, and the loopback mode should also be identified on the Monitor screen.
- 2 Have the CO tester transmit a DS1 test signal toward the H2TU-C and verify that the returned (looped) signal to the test set is error-free.
- 3 If Step 2 fails, have the CO tester transmit the (3-in-5) inband loopdown code.
- 4 Have the CO tester send the NLOC (4-in-7) inband loopup for 5 seconds. Observe the NLOC message on the front-panel display. The Status LED on the front panel should be yellow, and the loopback mode should also be identified on the Monitor screen.
- 5 Repeat Step 2. If the test passes, the problem is in the downstream direction. If it fails, the problem is in the upstream direction.



\* Set the NLBP option to AIS to send AIS (indicated by an all ones pattern) for any network loopback.

† A3LB and A4LB loopback codes.

‡ A1LB, A2LB, and A5LB loopback codes.

▲ GNLB loopback codes.

H0431-A

Figure 35. Loopback Modes

### A1LB, A2LB, and A5LB Test Procedures

Using the codes listed in Table 23 on page 58, a network tester can activate NLOC or NREM loopbacks (or SMJK, if enabled). A tester at the customer premises can activate CLOC or CREM loopbacks.

Use the test procedure for verifying the integrity of the HDSL2 channels at every module location as well as the DS1 channels to the customer and the local DSX-1 interface.



**For information regarding the 16-bit DBDB command for retrieving information on the circuit's margin and pulse attenuation, see "Payload Retrieval of Margin and Pulse Attenuation Parameters" on page 27.**

To perform the A2LB loopback test procedures:

- 1 Send the inband Arming and NI LPBK code 11000 to the H2TU-C for at least 5 seconds.
- 2 Monitor the output of the H2TU-C for the return of the pattern. Return of the pattern indicates one of the following:
  - The H2TU-R has looped up, if the SMJK Loopback option is enabled.
  - An external NID has looped up, if the SMJK Loopback option is disabled, and the H2TU-C and H2TU-R have been armed.



**If the Arming code is not returned after 5 seconds, the system may be armed, but there is no active loopback.**

- 3 Once armed, the H2TU-C can be looped back by sending Intelligent Office Repeater (IOR) LPBK activation code 1101-0011-1101-0011 (D3D3) for at least 5 seconds. You should observe the following activation response pattern:
  - a 2 seconds of AIS (all ones pattern)
  - b 2 seconds of returning data pattern
  - c Logic errors (including the frame bit) occurring in the returned pattern comprising:
    - 231 errors, if IOR LPBK (H2TU-C) was sent
    - 20 errors, if ILR-2 (H2TU-R) was sent
  - d Normal looped data

This error pattern repeats every 20 seconds as long as the IOR loopback pattern is being sent. This also applies to ILR, Time-out Override, and Query commands.

The H2TU-C is now in logic loopback if the IOR NLOC loopback command was sent. The Time-Out Override command or a Loopdown command can override the selection made for the loopback time-out. If the Time-Out Override code 1101-0101-1101-0110 (D5D6) is received after activating a loopback, then the automatic timed expiration of the loopback is inhibited. If this Time-Out Override is sent, then the only method to loop the H2TU-C down is one of the following:

- Issue the IR loopdown (LPDN) code 1001-0011-1001-0011 (9393)
- Issue the NI LPDN and Disarm inband code 11100 or the ESF-DL code (FF24).



**The Time-Out Override function is only valid for the current active loopback. The automatic time-out timer is restored during subsequent loopback sessions.**

- 4 Once the test is complete, do one of the following:
  - If the system is to loopdown but remain Armed, send the IR (Intelligent Repeater) LPDN code for universal loopdown.
  - If all the equipment is to be looped down, disarmed and returned to normal operation, send the disarm inband code 11100 or the ESF DL code (FF24).



The Armed mode has an automatic time-out of 120 minutes, but this timer is reset to 120 for any of the following events:

- Loopback terminates (manually or time-out)
- Query
- Alternate query
- Far-End activate
- Another ARM command

This timer is inhibited while any of the valid command codes are being sent. Once the codes are removed, the timer restarts at 120.

**Table 23.** Addressable Repeater Loopback Commands (A1LB, A2LB, A5LB)

Loopback	Binary Code (Hexadecimal Equivalent) <sup>(a)</sup>	Description
ARMING or NI LPBK (inband)	11000-11000 ...	Arming code
ARMING or NI LPBK (ESF Data Link)	1111-1111-0100-1000 (FF48)	Arming code
IR LPDN or DISARM (inband)	11100-11100 ...	Disarming code
IR LPDN or DISARM (ESF Data Link)	1111-1111-0010-0100 (FF24)	Disarming code
IOR LPBK (NLOC and CREM) 230-232 bit errors and 229-231 bit errors <sup>(b)</sup>	1101-0011-1101-0011 (D3D3)	NLOC—DSX-1 signal is looped back to the network at the H2TU-C. CREM—Signal from customer is looped back to the customer at the H2TU-C.
ILR-2 LPBK (NREM or CLOC) 20 bit errors <sup>(c)</sup>	1100-0111-0100-0010 (C742)	NREM—DSX-1 signal is looped back to the network at the H2TU-R. CLOC—Signal from customer is looped back to the customer at the H2TU-R.
IR LPDN (except SMJK)	1001-0011-1001-0011 (9393)	Loopdown (H2TU-C or H2TU-R)
IR QUERY LPBK <sup>(d)</sup>	1101-0101-1101-0101 (D5D5)	Query loopback
IR ALTERNATE QUERY LPBK	1101-0101-1110-1010 (D5EA)	Alternate query loopback
TIME-OUT OVERRIDE	1101-0101-1101-0110 (D5D6)	Loopback time-out override
FAR END NI ACTIVATE (A1LB and L2LB only) <sup>(e)</sup>	1100-0101-0101-0100 (C554)	Unblock AIS
IOR POWER DOWN (H2TU-C) <sup>(f)</sup>	0110-0111-0110-0111 (6767)	Removes HDSL2 line power

(a) The leftmost bit arrives first in all sequences. The detection algorithm functions reliably with a random  $10^{-3}$  Bit Error Rate (BER) on the facility. The entire arming and loopback sequence can also be initiated at the remote H2TU-R location.

(b) The H2TU-R identifies CREM and the H2TU-C identifies NLOC with 231 bit errors, excluding the frame bits. When framed data is being sent in the AUTO framing mode, the number of the 231 bit errors detected by the test set varies from 229 to 231, depending on whether the test set counts frame errors as bit errors, and on the number of frame bits as data bit errors will indicate fewer bits than the H2TU-R and H2TU-C transmit for a CI and NI loopback.

(c) The H2TU-R is assigned the ILR-2 loopback code. It responds with 20 bit errors (excluding the frame bits).

(d) The H2TU-C List 7F is enhanced to respond to the IR query loopback code (D5D5) when a SMJK loopback is activated.

(e) Allows the NIU Activate Command that originates at the H2TU-R to pass through inhibited toward the network and is always enabled. No option to disable.

(f) The IOR Power Down code must remain present for the duration of the power down mode. When this code is removed, the HDSL2 system returns to its normal unlooped and unarmed state.

## A3LB and A4LB Test Procedures

The H2TU-C can be looped back by sending the Addressable Office Repeater (AOR) LPBK activation code 1111-1111-0001-1110 (FF1E) for at least 5 seconds. This causes the H2TU-C to enter the NLOC state. The Loopback Time-Out setting determines the duration of this loopback unless it is overridden by the reception of a second identical 16-bit loopup command before the timer expires. When this time-out override state exists, the only method to loop the H2TU-C down is to issue one of the three loopdown commands listed in Table 24. The automatic time-out mode is restored during subsequent loopback sessions.

Table 24 summarizes the codes required to execute Addressable 3 and 4 (A3LB and A4LB) repeater loopback commands. All code sequences must be present for at least 5 seconds.

**Table 24.** *Addressable Repeater Loopback Commands (A3LB and A4LB)*

Name	Binary Code <sup>(a)</sup> (Hexadecimal Equivalent)	Description
NLOC	1111-1111-0001-1110 (FF1E)	H2TU-C loopup from NI
CREM	0011-1111-0001-1110 (3F1E)	H2TU-C loopup from CI
NREM	1111-1111-0000-0010 (FF02)	H2TU-R loopup from NI
CLOC	0011-1111-0000-0010 (3F02)	H2TU-R loopup from CI
SMJK	11000-11000-11000 ...	H2TU-R loopup from NI
SMJK	100000 100000 100000 ...	H2TU-R loopup from NI <sup>(b)</sup>
SMJK	1111-1111-0100-1000 (FF48)	H2TU-R loopup from NI (ESF-DL)
Loopdown	11100-11100-11100 ...	H2TU-C and H2TU-R loopdown from NI OR CI
Loopdown	100-100-100 ...	H2TU-C and H2TU-R loopdown from NI OR CI
Loopdown	1111-1111-0010-0100 (FF24)	H2TU-C and H2TU-R loopdown from NI OR CI (ESF-DL)

(a) The leftmost bit arrives first in all sequences. The detection algorithm functions reliably with a random  $10^{-3}$  Bit Error Ratio (BER) on the facility. The entire arming and loopback sequence can also be initiated at the remote H2TU-R location.

(b) Not supported by A4LB.

## TESTING WITH H2TU-C BERT GENERATOR

The H2TU-C BERT Generator screen allows transmission of a selected test signal from the H2TU-C towards either the network (NET) or customer (CPE). Bit error rates are calculated and displayed on the Monitor screen (Figure 12 on page 28).



**It is not recommended using the Bit Error Rate Tester from the remote and line unit at the same time.**

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **BERT Generator**, then press **ENTER**.
- 3 Use the arrow keys to select an option and press the **SPACEBAR** to cycle through the settings. Refer to Table 25 for a list of BERT generator option settings.
- 4 Press **ENTER** to activate your choice.
- 5 To view BERT status, press **ESC** twice, then use the **←** arrow key to select the **Monitor** menu.
- 6 Press **ENTER**. You can exit the status screen while signal generation is active.

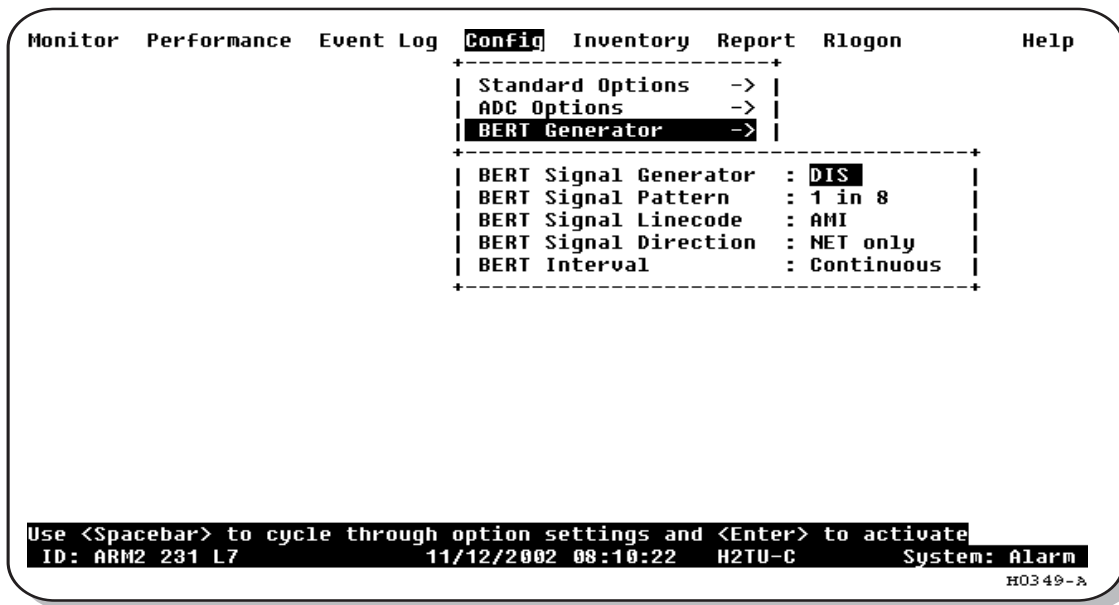


Figure 36. H2TU-C BERT Generator Screen

Table 25. BERT Signal Generator Option Settings

Option	Description <sup>(a)</sup>
BERT Signal Generator	Enabled (ENA) or <b>Disabled (DIS)</b>
BERT Signal Pattern	<b>1:8</b> pattern, 2:8 pattern, 3:24 pattern, 2 <sup>23-1</sup> pseudo random, 2 <sup>20-1</sup> pseudo random, 2 <sup>15-1</sup> pseudo random
BERT Signal Linecode	<b>AMI</b> or B8ZS
BERT Signal Direction	Toward CPE or toward <b>NET</b>
BERT Interval	5 minutes, 60 minutes, <b>Continuous</b> (default)

(a) Default values are in bold.

## TESTING WITH H2TU-R BERT GENERATOR

The H2TU-R BERT Generator screen allows transmission of a test signal from the H2TU-R towards either the network (NET) or customer (CPE). Bit error rates are calculated and display on the Monitor screen.

- 1 Press **R** to logon remotely, then press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **BERT Generator**, then press **ENTER**.
- 3 Use the arrow keys to select an option, then press the **SPACEBAR** to cycle through the settings. Refer to Table 25 on page 60 for a list of BERT Generator option settings.
- 4 Press **ENTER** to activate your choice.
- 5 To view BERT status, press **ESC** twice, then, using the **←** arrow key to select the **Monitor** menu, press **ENTER**.
- 6 Press **R** to return to the H2TU-C logon screen. You can exit the status screen while signal generation is active.

```

Monitor Performance Event Log Config Inventory Report Rlogout Help
+-----+
| Standard Options -> |
| ADC Options -> |
| BERT Generator -> |
+-----+
| BERT Signal Generator : DIS |
| BERT Signal Pattern : 1 in 8 |
| BERT Signal Linecode : AMI |
| BERT Signal Direction : NET only |
| BERT Interval : Continuous |
+-----+

Use <Spacebar> to cycle through option settings and <Enter> to activate
ID: ARM2 231 L7 11/13/2002 08:20:13 H2TU-R System: OK
H0350-A

```

Figure 37. H2TU-R BERT Generator Screen



The test pattern is sent out from the remote unit towards the network (toward NET) or towards the customer (toward CPE). Both test payloads must be looped back so they can be returned to the unit for BER detection.

Tests done towards the NET must be looped at some point at or beyond the network. The test payload, for the NET direction, also passes back and forth over the HDLSL2 link to the H2TU-R before it is analyzed for errors. Tests done towards the CPE should be looped back at some external point beyond the remote unit, or they can be looped back internally by a higher loopback, such as NREM.

# APPENDIX A - SPECIFICATIONS

## Power

HDSL2 Span Voltage	0 or -180 $\pm$ 5 Vdc
CO Supply	-48 Vdc nominal (-42.5 Vdc to -56.5 Vdc) See "Power Consumption" and "Maximum Power Dissipation" and "Maximum Current Drain" on page 63.
Electrical Protection	Secondary surge and power cross protection on HDSL2 ports. Requires external primary protection.
Fusing	Internal; connected to "FUSE ALARM" output on pin 117

## Environmental

Operating Temperature	-40°F to +149°F (-40°C to +65°C)
Operating Humidity	5% to 95% (non-condensing)

## Physical

Height	3.62 in. (9.2 cm)
Width	0.69 in. (1.8 cm)
Depth	10 in. (25.4 cm)
Weight	0.5 lb (.23 kg)
Mounting	DDM+ high-density shelves

## HDSL2

Line Code	1.552 Mbps Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS)
Transmission	Full duplex
Media	One non-loaded, copper, two-wire cable pair
Output	+16.8 dBm $\pm$ 0.5 dB at 135 $\Omega$ (0-450 kHz) at CO side; +16.5 dBm $\pm$ 0.5 dB at 135 $\Omega$ (0-350 kHz) at remote side
Line Impedance	135 $\Omega$
Maximum Insertion Loss	35 dB at 196 kHz
Maximum Loop Attenuation	28 dB
Start-up Time	30 sec. typical, 1 min. maximum per span

## DSX-1

DSX-1 Line Impedance	100 $\Omega$
DSX-1 Pulse Output	6 V <sup>pk-pk</sup> pre-equalized for 0-655 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX

## System

One-way DS1 Delay	<500 $\mu$ s
Wander (Looped)	Meets MTIE T1.101 requirements
Wideband Jitter (Looped)	0.2 UI maximum
Narrowband Jitter (Looped)	0.1 UI maximum



## POWER CONSUMPTION

The three most important power parameters of an H2TU-C are its maximum power consumption, maximum power dissipation, and maximum current drain.

Table 26 describes line-powered circuits on 9 kft, 26 AWG loops without a regenerator.

*Table 26. H2TU-C Power Parameters*

	<b>-48 Vdc Power Consumption (Watts)</b>	<b>Heat Dissipation (Watts)</b>	<b>-42.5 Vdc Current (mA)</b>
<b>Remote Power Source</b>	<b>Maximum</b>	<b>Maximum</b>	<b>Maximum</b>
Line-powered	7.8	4.7	185
Locally-powered	6.5	4.5	140

## MAXIMUM POWER DISSIPATION

The maximum power dissipation measures the power that is converted into heat and contributes to the total heat generated in the space around the unit. It is used to determine the maximum number of fully loaded shelves per bay that does not exceed the maximum allowable power dissipation density in watts per square foot to comply with GR-63.

In COs, the maximum power dissipation for open-faced, natural convection-cooled mountings is limited to 134.7 watts per square foot per GR-63-CORE. Use this limit and the parameters in Table 26 to determine the maximum number of H2TU-C circuits that can occupy one CO bay.



**This is a worst case situation since it assumes the entire CO is subjected to the maximum power density. More favorable conditions would permit increasing the number of shelves per bay without jeopardizing the CO thermal integrity.**

The thermal loading limitations imposed when using the H2TU-C in a Controlled Environmental Vault (CEV) or other enclosures are determined by applying its power parameters to the manufacturer's requirements for each specific housing.

The -48 Vdc Power Consumption is the maximum total power that the H2TU-C consumes or draws from the shelf power source. This parameter is needed when the H2TU-C is in a location remote to the CO it is serving. It determines the battery capacity required to maintain an 8-hour standby battery reserve for emergency situations. Battery capacity, therefore, limits the maximum number of line units which can be installed in a remote enclosure. Use the data in Table 26 above to perform this analysis.

## MAXIMUM CURRENT DRAIN

The maximum current drain is the maximum current drawn from the shelf power supply when it is at its minimum voltage (-42.5 Vdc). This determines the shelf fusing requirements. Use the -42.5 Vdc current data in Table 26 above to determine the shelf fusing requirements for your particular H2TU-C applications.

# LOOP ATTENUATION

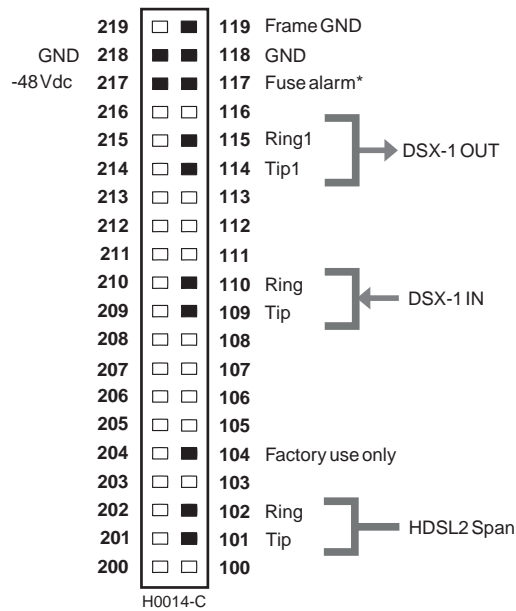
Each loop has no more than 35 dB of insertion loss at 196 kHz, with driving and terminating impedances of 135Ω, as shown in Table 27 below. This is equivalent to no more than 28 dB loop attenuation.

*Table 27. HDSL2 Reach Chart*

Cable Gauge	Insertion Loss <sup>(a)</sup> at 196 kHz (dB/kft)	Loop Attenuation (dB/kft)	Maximum Reach (kft)	Ω per kft
26/0.4 mm	3.88	3.1	9	83
24/0.51 mm	2.84	2.2	12	52
22/0.61 mm	2.18	1.7	16	32
19/0.91 mm	1.54	1.2	23	16

(a) Insertion Loss = 1.25 times loop attenuation

# H2TU-C CARD-EDGE CONNECTOR



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

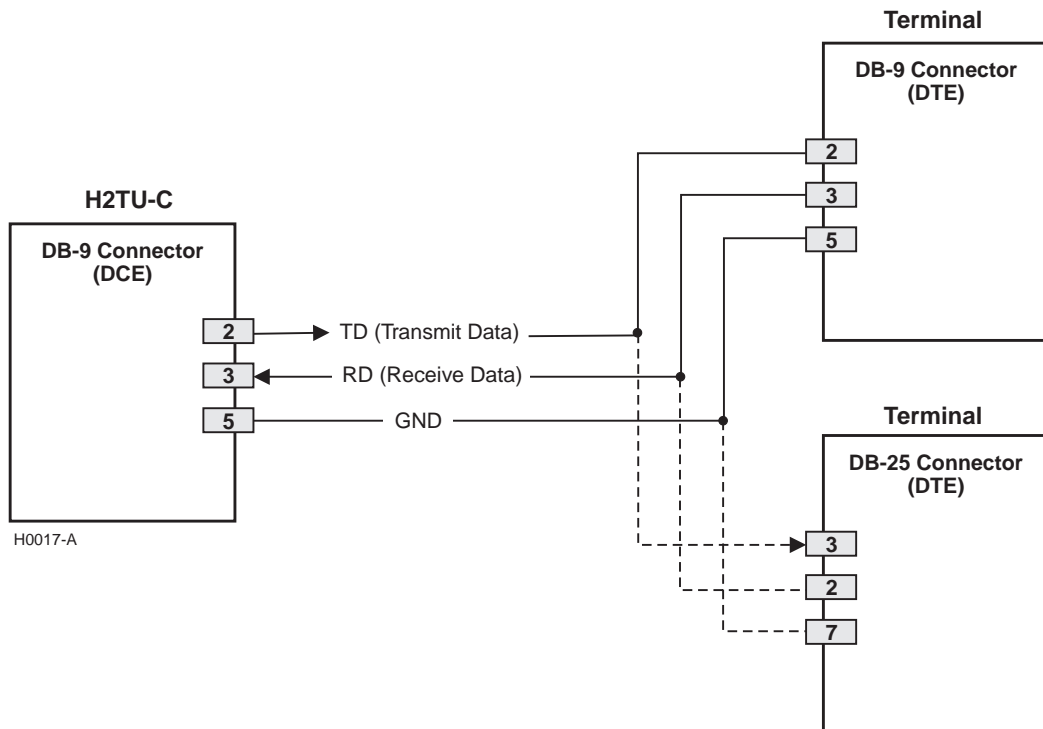
*Figure 38. H2TU-C Card-Edge Connector*

## Fuse Alarm

Pin 117 on the card-edge connector is a Fuse Alarm that is driven to -48 Vdc whenever its onboard fuse opens.

## CRAFT PORT

Figure 39 shows the pinout for the craft port connector and its connection to a DB-9 or DB-25 connector on a maintenance terminal.



**Figure 39.** RS-232 Craft Port Pinouts

# APPENDIX B - FUNCTIONAL OPERATION

ADC HDSL2 technology provides full-duplex services at standard DS1 rates over copper wires between an H2TU-C and an H2TU-R, which comprise one HDSL2 system. ADC systems use ADC Overlapped Pulse Amplitude Modulation (OPAM) transceiver systems to establish a full-duplex, 1.552 kbps data channel between an H2TU-C and a remotely located H2TU-R.

Figure 40 shows the H2TU-C block diagram. The H2TU-C receives a 1.544 Mbps DSX-1 data stream from the DSX-1 digital cross-connect interface. The H2TU-C contains a DS1 frame synchronizer controlled by an 8-bit microprocessor that determines the type of framing on the DS1 stream. The H2TU-C synchronizes to the type of framing detected. The H2TU-C recognizes SuperFrame (SF), including D4 or Extended SuperFrame (ESF).

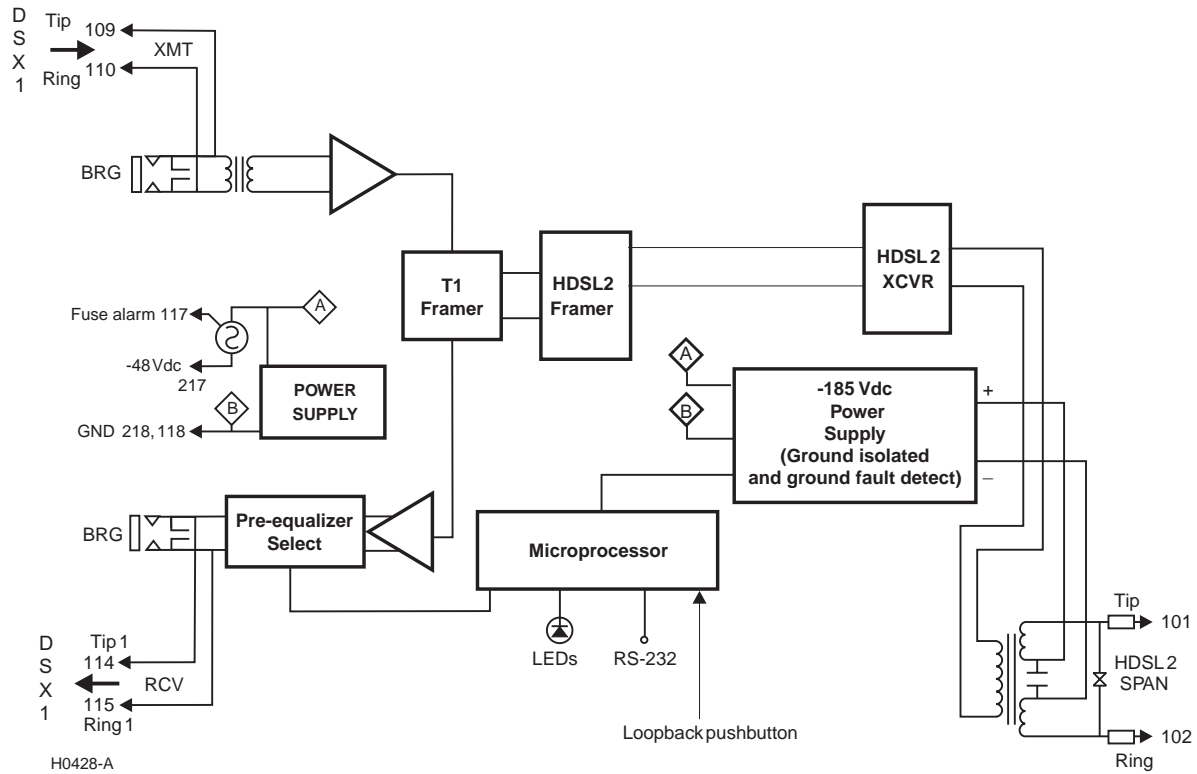


Figure 40. Block Diagram

## TIMING

The low loop wander (0.5 UI max) of an H2TU-C, when used with remote units, allows the circuit to be used in all critical timing applications, including those that are used to transport Stratum 1 timing.

## GROUND FAULT DETECTION

The H2TU-C has a Ground Fault Detection (GFD) circuit which detects a ground or a resistive path to ground on any wire of the HDSL2 loop. This makes the product compliant with the Class A2 requirements of GR-1089.

## APPENDIX C - COMPATIBILITY

The HiGain system uses HDSL2 transmission technology as recommended by ANSI committee in compliance with the ANSI T1.418-2000 HDSL2 standards. HiGain HDSL2 complies with GR-63-CORE, TR-TSY-000499, and GR-1089-CORE.

The H2TU-C is compatible with the following DDM+ high-density shelves and associated equipment:

- ADC HiGain HCS-402, 2-slot shelf with #150-1193-01 adapter
- Larus FT2 1188 (23-inch, 28-slot, connectorized shelf)
- AT&T DS1 Ext. (23-inch, 28-slot, connectorized shelf)
- Larus FT2 1190 (12 slots) for a 51A cabinet (23-inch distant terminal)

# APPENDIX D - 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.

**Sales Assistance**

800.366.3891 extension 73000  
(USA and Canada)  
952.917.3000  
Fax: 952.917.3237

- Quotation Proposals
- Ordering and Delivery
- General Product Information

**Systems Integration**

800.366.3891, extension 73000  
(USA and Canada)  
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**

800.366.3891, extension 73223 or  
952.917.3223  
Fax: 952.917.3244  
Email: [wsd.support@adc.com](mailto: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/technicalsupport](http://www.adc.com/technicalsupport)

**Online Technical Publications**

- [www.adc.com/documentationlibrary/technicalpublications](http://www.adc.com/documentationlibrary/technicalpublications)

**Product Return Department**

800.366.3891 extension 73748 or  
952.917.3748  
Fax: 952.917.3237  
Email: [repair&return@adc.com](mailto:repair&return@adc.com)

- ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products.

*All telephone numbers with an 800 prefix are toll-free in the USA and Canada.*

# APPENDIX E - ABBREVIATIONS

## A

<b>ACO:</b>	Alarm Cutoff
<b>ACQ:</b>	Acquisition
<b>AIS:</b>	Alarm Indication Signal
<b>ALRM:</b>	Alarm Condition
<b>AMI:</b>	Alternate Mark Inversion
<b>AOR:</b>	Addressable Office Repeater
<b>AUTO:</b>	Auto-Framing Mode
<b>AWG:</b>	American Wire Gauge

## B

<b>B8ZS:</b>	Bipolar with 8-Zero Substitution
<b>BER:</b>	Bit Error Rate
<b>BI:</b>	Blockage Indicator
<b>BPV:</b>	Bipolar Violation
<b>BPVT:</b>	Bipolar Violation Transparency
<b>BRG:</b>	Bridge

## C

<b>CLEI:</b>	Common Language Equipment Identifier
<b>CLOC:</b>	Customer Local Loopback
<b>CO:</b>	Central Office
<b>CONV:</b>	Conversion
<b>CRC:</b>	Cyclical Redundancy Check
<b>CREM:</b>	Customer Remote Loopback
<b>CV:</b>	Code Violation
<b>CV-P:</b>	Code Violation - Path

## D

<b>DIS:</b>	Disabled
<b>DL:</b>	Datalink
<b>DLC:</b>	Digital Loop Carrier

## E

<b>ECI:</b>	Equipment Catalog Item
<b>ENA:</b>	Enabled

<b>ESD:</b>	Electrostatic Discharge
<b>ESF:</b>	Extended SuperFrame
<b>ES-L:</b>	Errored Seconds - Line
<b>EXZ:</b>	The occurrence of 8 consecutive zeroes for B8ZS or 16 for AMI.

## F

<b>FCON:</b>	Frame Conversion
<b>FDL:</b>	Frame Bit for Datalink
<b>FE:</b>	Far End
<b>FERR:</b>	Framing Bit Error
<b>FPS:</b>	Framing Pattern Sequence

## G

<b>GFD:</b>	Ground Fault Detection
<b>GNLB:</b>	Generic Loopback

## H

<b>H2TU-R:</b>	HiGain HDSL2 Remote Unit
<b>HBER:</b>	HDSL2 Block Error Rate
<b>HCDS:</b>	High Capacity Digital Service

## I

<b>INSL:</b>	Insertion Loss
<b>IOR:</b>	Intelligent Office Repeater
<b>IR:</b>	Intelligent Repeater

## L

<b>LA:</b>	Loop Attenuation
<b>LAIS:</b>	Line Alarm Indication Signal
<b>LATT:</b>	Loop Attenuation
<b>LED:</b>	Light Emitting Diode
<b>LLOS:</b>	Local Loss of Signal
<b>LOS:</b>	Loss of Signal
<b>LOSW:</b>	Loss of Sync Word
<b>LPDN:</b>	Loopdown
<b>LPF:</b>	Line Power Feed

**M**

**MAL:** Margin Alarm  
**MARG:** Margin  
**MSEC:** Monitored Seconds

**N**

**NE:** Near End  
**NID:** Network Interface Device  
**NLOC:** Network Local Loopback  
**NPRM:** Network PRM  
**NREM:** Network Remote Loopback

**O**

**OOF:** Out-of-Frame  
**OPTIS:** Overlapped PAM Transmission with Interlocking Spectra

**P**

**PBOC:** Power Back Off - Customer  
**PBON:** Power Back Off - Network  
**PRM:** Performance Report Messaging  
**PRMF:** Performance Report Messaging - Far End  
**PRM-FE:** Performance Report Messaging - Far End  
**PRMN:** Performance Report Messaging - Near End  
**PRM-NE:** Performance Report Messaging - Near End

**Q**

**QoS:** Quality of Service

**R**

**RAI-CI:** Remote Alarm Indication-Customer Installation  
**RAIS:** Remote Alarm Indication Signal  
**RDA:** Remote Disconnect Alarm  
**RLOS:** Remote Loss of Signal  
**ROVR:** RAI Overwrite  
**RRAI:** Remote Alarm Indication

**S**

**SES:** Severely Errored Seconds  
**SES-L:** Severely Errored Seconds - Line

**SES-P:** Severely Errored Seconds - Path  
**SF:** SuperFrame  
**SMJK:** SmartJack  
**SNET:** Southern New England Telephone  
**SPLB:** Special Loopback  
**SPRM:** Supplemental PRM

**T**

**TLOS:** Transmit Loss of Signal  
**TRCI:** TX RAI-CI Indication - Customer Installation  
**TUC:** Transmission Unit Central Office  
**TUR:** Transmission Unit Remote End

**U**

**UAS-P:** Unavailable Seconds - Path  
**UNFR:** Unframed



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# 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

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.

## SAFETY STANDARDS COMPLIANCE

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

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety
- Binational standard, UL-60950/CSA C22.2 No. 60950-00 Third Edition: Safety of Information Technology Equipment

For technical assistance, refer to "Appendix D - Product Support" on page 68.

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