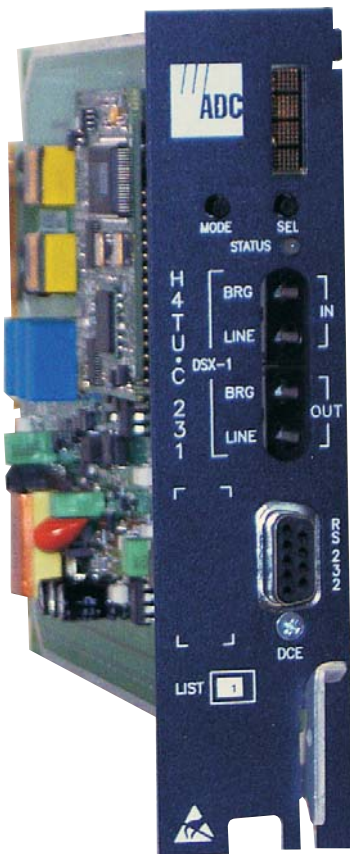# HDSL4

USER MANUAL

H4TU-C-231 List 1 Line Unit
Product Catalog: H4TU-C-231-L1
CLEI: VACJMTNE

ADC

Revision History of This Manual

To order copies of this document, use document catalog number LTPH-UM-1138-02.

Issue	Release Date	Revisions Made
1	March 15, 2002	Initial release
2	September 12, 2003	Added "Maximum Loop Attenuation" to Appendix A - Specifications.

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 67. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The H4TU-C-231 List 1 is the Central Office (CO) side of a repeaterless T1 transmission system. The four-wire HDSL4 product family (hereafter referred to as "HDSL4") is based on the HDSL4 standard ANSI T1.418 Issue 2.

The H4TU-C, when used with an H4TU-R remote unit, transmits a 1.544 Mbps payload up to a maximum distance of 12 kft. over two unconditioned copper pairs. Using two doublers (H4Ds), the Carrier Service Area (CSA) reach can be extended to a maximum of 34 kft.

The H4TU-C-231 List 1 is designed to mount in 220 mechanics shelves. For a list of compatible shelves see .

FEATURES

The H4TU-C-231 List 1 line unit is the Central Office (CO) side of a T1 transmission system.

- HDSL4 transmission features

    - Three-span range with two doublers (36 kft, 24 AWG)

    - Lightning and power cross-protection on HDSL4 interfaces

    - Full-duplex HDSL4 transmission on four wire at 1.568 Mbps

    - Ultra-low wander (Stratum 1 compliant)

    - Grounded loop detection on either HDSL4 spans

    - Spectrum compatibility with Asymmetric Digital Subscriber Line (ADSL) services

    - Bit Error Rate Tester (BERT)

- Front-panel provisioning features

    - Four-character status display

    - DS1 splitting and bridging access

    - Status Light Emitting Diode (LED)

    - RS-232 craft port for connection to a maintenance terminal

    - MODE and SEL pushbuttons

    - Front panel dual loopback commands

- Maintenance screens for inventory, provisioning, and troubleshooting

    - DS1 and HDSL4 performance monitoring

    - DS1 and HDSL4 alarm histories

    - 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

    - Sources sealing current when connected to any locally powered H4TU-R-402 List 1

    - Remote access and control of H4TU-R test signal generator

- Both doubler and non-doubler applications are compatible with ADSL services at same binder group

- Configuration options

    - Selectable DSX-1 pre-equalizer

- Bipolar Violation Transparency (BPVT)

    - Bit Error Rate (BER) alarm

    - Power Back Off Network (PBON) and Power Back Off Customer (PBOC) options for configuring HDSL4 transmit power levels

    - Loss of Signal/Alarm Indication Signal (LOS/AIS) payload alarm

    - Remote provisioning

    - Concurrent detection of all loopback activation codes

- Additional Loopback Timeout (LBTO) settings of 8 hours and 24 hours

- Network Management and Administration (NMA) interface

> **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

HDSL4 systems provide a cost-effective, easy-to-deploy method for delivering T1 High Capacity Digital Service (HCDS) over two pair of wires. HDSL4 systems support a multitude of network connections.

- The service is deployed over two unconditioned, non-loaded copper pair at 784 kps per loop.

- Conventional, inline DS1 repeaters are no longer required.

- Cable pair conditioning, pair separation, and bridged tap removal are not required.

For Span 1, each loop has no more than 47 dB of inserting loss at 196 kHz, with driving and terminating impedances of 135Ω; for Span 2 and Span 3, each loop has no more than 43 dB of insertion loss at 196 kHz. In general, HDSL4 systems:

- Operate effectively in the same cable binder group with other HDSL4 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 H4TU-C-231 List 1 front panel. Table 1 on page 4 describes the front-panel components. For a list of front-panel display messages, refer to Table 2 on page 5. For pinout diagrams of the H4TU-C card-edge connector and craft port, refer to Figure 32 on page 62 and Figure 33 on page 63.
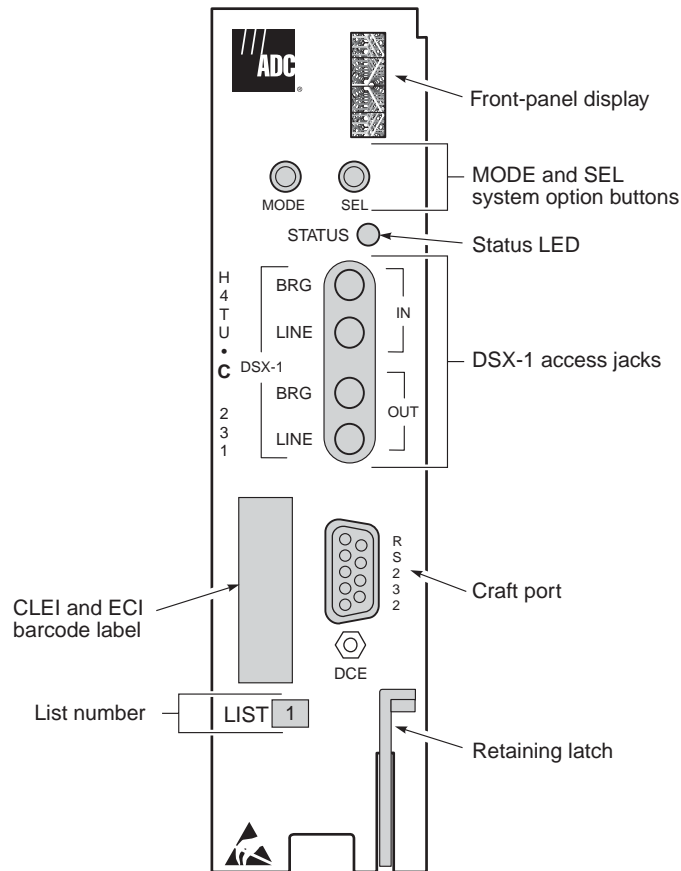
Figure 1. *H4TU-C-231 List 1 List 1 Front Panel*

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 SEL buttons reactivates the display and restarts the 5-minute timer. Refer to Table 2 on page 5 for a listing of the four-character messages.
MODE and SEL system option buttons	Permits user options to be monitored and modified without the need of a maintenance terminal. Used to initiate all HDSL4 loopbacks and 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.
Red	Fuse alarm.
Flashing red	HDSL4 acquisition or system alarm.
Yellow	An H4TU-C-231 List 1 Customer Remote Loopback (CREM) or a Network Local Loopback (NLOC) is in effect.
Flashing yellow	H4TU-C-231 List 1 is in an Armed (ARM) state.
DSX-1 access jacks	
BRG	Provides non-intrusive bridging jack access to (IN) and from (OUT) the HDSL4 span at the DSX-1 interface. Allows the two DS1 payloads to be monitored.
LINE	Provides splitting jack access to (IN) and from (OUT) the HDSL4 span at the DSX-1 interface. Breaks the IN and OUT paths to permit test signal insertion and retrieval.
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.
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.
List number	Identifies the list number of the H4TU-C-231.
Retaining latch	Retains the card in the shelf when pulled up and extracts the card from the shelf when pulled down.

Table 2 lists the front-panel display messages. The four-character display reports the code of a pertinent 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
ALARM MESSAGES		
ACO	Alarm Cutoff	A system alarm has occurred, and has been retired to an ACO condition by pressing the SEL pushbutton on the H4TU-C front panel.
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.
DU1U or DU1D	Doubler 1 Upstream or Downstream Port	Precedes LA, HBR, and MAL and indicates the first H4D doubler HDSL4 upstream or downstream interface.
DU2U or DU2D	Doubler 2 Upstream or Downstream Port	Precedes LA, HBR, and MAL and indicates the second H4D doubler HDSL4 upstream or downstream interface.
HBRx	HDSL4 Block Error Rate Loop 1 or Loop 2	A system HDSL4 Block Error Rate alarm is in effect. (x indicates Loop 1 or Loop 2.)
LAx	Loop Attenuation Loop 1 or Loop 2	The attenuation on the HDSL4 loop has exceeded the maximum threshold value. (x indicates Loop 1 or Loop 2.)
LAIS	Line Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received or transmitted at the H4TU-C DS1 input or output ports.
LLOS	Line Loss of Signal	Indicates that no signal is detected at the DSX-1 input to the H4TU-C. Causes a system alarm.
LOF	Loss of Frame	The DS1 input does not contain the ESF or SF frame pattern setting of the FRMG option.
LOSW	Loss of Sync Word	Indicates that one of the HDSL4 loops has lost synchronization.
LRAI	Line RAI	Indicates an RAI alarm (yellow) from the CPE with an error-free signal from the line unit or network. RAI signal is transmitted towards the network.
MALx	Margin Alarm Loop 1 or Loop 2	The margin at Loop 1 or Loop 2 of the HDSL4 interface has dropped below the threshold (0 to 15 dB) set by the operator. (x indicates Loop 1 or Loop 2.)
PWR FEED GND	Power Feed Ground	The HDSL4 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 Loop 1 and Loop 2 of the HDSL4 pair.
PRMF	Performance Report Messaging - Far End	H4TU-R PRM-FE BER threshold has been exceeded at far end.
PRMN	Performance Report Messaging - Near End	H4TU-R PRM-NE BER threshold has been exceeded at near end.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received or transmitted at the H4TU-R DS1 input or output ports.
RLOS	Remote (Unit) Loss of Signal	Indicates that no signal is detected at the DS1 input to the H4TU-R. Causes a system alarm.
RRAI	Remote RAI—Remote Alarm Indication at the H4TU-R (Net signal has errors.)	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network. RAI-CI signal is transmitted towards the network.
SPNn	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, LA, and LOF alarms and indicates that the alarm has occurred at the H4TU-C central office unit.
TUR	Transmission Unit Remote End	Accompanies the DBER, HBER, MAL, LA, and LOF alarms and indicates that the alarm has occurred at the H4TU-R remote unit.

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

Message	Full Name	Description
LOOPBACK MESSAGES		
CDU1	Customer Doubler 1 Loopback	DS1 signal from customer is looped back to the customer at H4D1 (111100).
CDU2	Customer Doubler 2 Loopback	DS1 signal from customer is looped back to the customer at H4D2 (111110).
CLOC	Customer Local Loopback	DS1 signal from customer is looped back to the customer at the H4TU-R.
COLB	Central Office Loopback	Dual loopback at the H4TU-C.
CREM	Customer Remote Loopback	DS1 signal from customer is looped back to the customer at the H4TU-C.
NDU1	Network Doubler 1 Loopback	Signal is looped back to the network at H4D1 (110000).
NDU2	Network Doubler 2 Loopback	Signal is looped back to the network at H4D2. (111000)
NLOC	Network Local Loopback	DSX-1 signal is looped back to the network at the H4TU-C.
NREM	Network Remote Loopback	DSX-1 signal is looped back to the network at the H4TU-R.
RULB	Remote Unit Loopback	Dual loopback at the H4TU-R.
SMJK	Remote SmartJack Loopback	DSX-1 signal is looped back to the network at the H4TU-R SmartJack module.
DIAGNOSTIC MESSAGES		
A=xx	Maximum Loop Attenuation	The Attenuation (A) message appears followed by xx, where xx is the highest loop attenuation of all HDSL interfaces.
ACQ1 or ACQ2	Acquisition 1 or Acquisition 2	The multiplexers of the H4TU-C and H4TU-R are trying to establish synchronization over HDSL4 Loop 1 or Loop 2.
ARM	System Armed	Armed to respond to Intelligent Repeater Loop (ILR) codes.
BAD RT?	No Response from H4TU-R	The H4TU-C receives no response from the H4TU-R, and all HDSL4 loop conditions are normal. Therefore, the integrity of the H4TU-R or the HDSL4 loops is questionable.
FERR	Framing Bit Error Occurred	Framing bit error occurred at H4TU-C DSX-1 input.
HxES	HDSL4 CRC Error Loop 1 or Loop 2	H4TU-C HDSL4 Loop 1 or Loop 2 Cyclical Redundancy Check (CRC) error. (Loop 1 has display priority over Loop 2.)
LBPV	Local Bipolar Violation	A bipolar violation has been received at the DSX-1 input to the H4TU-C.
1=xx or 2=yy	HDSL4 Loop Margin	Indicates the power of the received HDSL4 signal of each loop relative to noise (S/N with respect to 21.5 dB). Any value of 6 dB or greater is adequate for reliable system operation.
MNGD	Managed	The H4TU-C is under control of the HMU-319 network management unit. In this state, the front-panel craft port and pushbuttons are disabled.
PWR FEED OFF	Power Feed Off	HDSL4 span power has been turned off by setting the PWRF option to off, or HDSL4 span power has been turned off by use of the A5LB Intelligent Office Repeater (IOR) powerdown code.
PWR FEED ON	Power Feed On	Indicates that the HDSL4 loop power is applied and neither pair is grounded.
SIG1 or SIG2	Signaling	The transceivers of the H4TU-Cand H4TU-R are trying to establish contact with each other over HDSL4 on Loop 1 or Loop 2.
SYSTEM INFORMATION MESSAGES [a]		
VER $x.xx$	Software Version Number	The software version number of the H4TU-C.
LIST xx	List Number	The list number of the H4TU-C.

Continued

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

Message	Full Name	Description
FRM *xxxx*	Frame: SF, ESF, UNFR	Defines the type of frame pattern being received from the DSX-1: SuperFrame (SF), Extended SuperFrame (ESF), or Unframed (UNFR).
CODE *xxxx*	Line Code: AMI, B8ZS	The line code that the H4TU-C is receiving at its DSX-1 interface, if the DS1 option is set to AUTO. Otherwise, it mimics either of the other two DS1 line codes: Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS).
LATT *xx*	Loop Attenuation	The current loop attenuation threshold setting measured in dB.
MARG *xx*	Margin	The current margin threshold setting measured in dB.

(a) System information messages scroll in the order listed. 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 19 and Table 6 on page 20).

INSTALLATION

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.
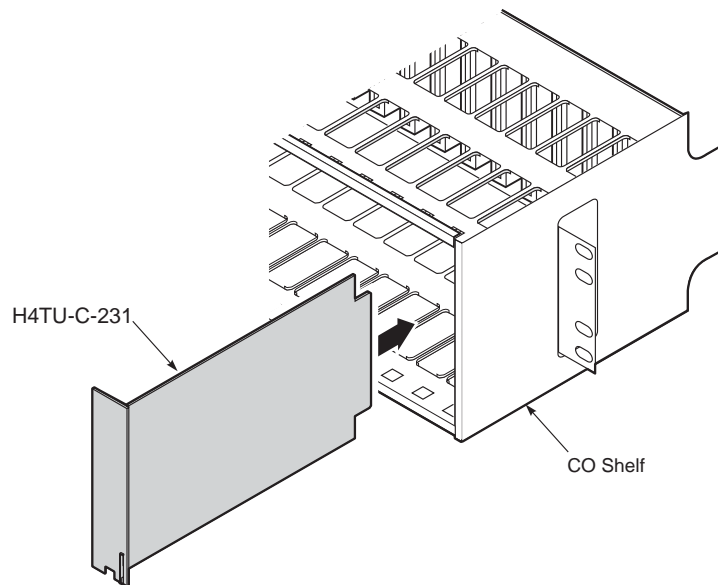
Figure 2.   Installing the H4TU-C-231 List 1 into a Shelf

When installing an H4TU-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 H4TU-C DSX-1 output ports to the cross-connect panel must be grounded at both ends.

1   Align the H4TU-C with the enclosure slot guides and slide the unit in. Push the unit back until it touches the backplane card-edge connector and the retaining latch on the front panel opens.

2   Place your thumbs on the front panel and push the H4TU-C into the slot guides until properly seated.

VERIFICATION

Once the H4TU-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 (see Table 2 on page 5)

Verification without a Downstream Device

If there is no downstream device installed:

1 Verify that the H4TU-C powers up. The front-panel display illuminates and reports status messages. (See Table 2 on page 5 for a list of messages.)

2 Verify that the H4TU-C attempts to communicate with downstream devices (status LED flashes red). Even if a downstream device is not present, the following events should occur:

- The front-panel display reports various four-character status messages.

- The H4TU-C again attempts communication until a downstream device is detected.

Verification with a Downstream Device

If a downstream device has been installed:

1 Verify that the H4TU-C powers up. (The front-panel display illuminates and reports various status messages.)

2 Verify that the H4TU-C attempts to communicate with downstream devices (status LED flashes red). One of the following occurs:

- If downstream devices are successfully identified and the HDSL4 loop synchronizes, the H4TU-C status LED lights steady green. The H4TU-C reports normal margin and loop attenuation messages on the front-panel display.

- If downstream devices are not successfully identified, the H4TU-C reports four-character status messages. The H4TU-C attempts communication again and reports four-character status messages. The H4TU-C repeats this cycle until a downstream device is detected.

3 If there is more than one span, verify that each subsequent span synchronizes normally by monitoring the front-panel display messages.

4 If a remote unit is installed, verify that the last span synchronizes normally. The H4TU-C status LED should light a steady green and the front-panel display should report normal margin messages.

5 Verify that a valid DS1 signal has been applied to the H4TU-C and the H4TU-R.

- If no DS1 signal is being applied to either the H4TU-C or the H4TU-R inputs, then the appropriate DS1 alarms (LLOS or RLOS) display on the front panel and the status LED flashes red.

- If a valid DS1 signal is being supplied to the H4TU-C and H4TU-R, then DS1 alarm indications should be absent and the status LED should be steady green.

PROVISIONING

There are two methods for provisioning:

- Use the MODE and SEL buttons on the front panel of the H4TU-C to:
    - Set system options
    - Reset the H4TU-C to its factory default settings for system options
    - Display system option settings (scroll mode)
    - Select system loopbacks

- Use a maintenance terminal (VT100 terminal or a PC running terminal emulation software) connected to the H4TU-C craft port (or to an HMU craft port) to access the maintenance screens (Figure 3 on page 13). This gives you full access to all H4TU-C status, history, inventory, and provisioning screens.

> **The MNGD message displays if the H4TU-C-231 List 1 is under HMU management. When this occurs, the front-panel pushbuttons and craft port are disabled.**

> **No dip switches or jumpers are required to provision the H4TU-C-231 List 1 as it contains a non-volatile RAM (NVRAM) which stores the system option settings. System option settings are retained if shelf power is lost or if the H4TU-C-231 List 1 is unplugged.**

USING THE MODE AND SEL BUTTONS

Setting Options through MODE and SEL

To provision the H4TU-C-231 List 1 through the MODE and SEL pushbuttons on the front panel:

1   Press the MODE button for 1 second and then release it. The front-panel display alternately shows the first system parameter and its current setting.

2   Press the SEL button to step through all possible settings of the selected parameter. (See Table 5 on page 19 and Table 6 on page 20.)

3   After the desired setting has been selected, press the MODE button. This updates the currently displayed parameter to the selected setting, then advances to the next configurable parameter. After the last parameter has been selected, a CONF NO message appears on the front-panel display.

4   Do one of the following:

- To cancel the session without saving the requested parameter changes, press the MODE button or do nothing. (After 30 seconds, the display returns to its normal mode without saving the new changes.)

- To accept the requested parameter changes, press the SEL button. (A CONF YES message displays and returns to its normal mode after saving the new changes.)

Resetting to Factory Default Values

All user options for the H4TU-C-231 List 1 (Table 6 on page 20) can be set to the factory default values using the MODE and SEL pushbuttons. To set the user options to their default values:

1   Press the SEL pushbutton for 6 seconds until the following message appears:

DFLT NO

2   Press the SEL pushbutton while the DFLT NO message is displayed.

The message changes to DFLT YES indicating the factory default values are now in effect and the display returns to the normal mode.

To terminate the DFLT mode without setting the factory default values, do one of the following:

•   Press the MODE pushbutton to return to the normal display mode.

•   Wait 30 seconds for the unit to return to the normal display mode.

Displaying System Parameter Settings

To scroll through the current settings of all system parameters, press the MODE pushbutton for 3 or more seconds. The H4TU-C-231 List 1 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

Disabling an Alarm

System alarms can be disabled by pressing the SEL pushbutton on the H4TU-C-231 List 1 front panel for less than 3 seconds. This executes an ACO and returns the H4TU-C-231 List 1 to its non-alarm state. For more information about alarms, see "System Alarms" on page 43.

Loopback Modes

See "Loopback Operation" on page 47 for instructions on using the MODE and SEL pushbuttons to activate loopbacks.

USING A MAINTENANCE TERMINAL

Connecting to a Maintenance Terminal

The craft port on the front panel allows you to connect the H4TU-C-231 List 1 to a maintenance terminal (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 a standard 9-pin terminal cable to the RS-232 craft port (Figure 1 on page 3) on the H4TU-C front panel.

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 to the following communication settings:

   •   9600 baud

   •   No parity

   •   8 data bits

   •   1 stop bit

   •   Hardware flow control to OFF

5   If necessary, press `CTRL` + `R` to refresh the HDSL4 logon screen.

Logon Screen

The maintenance terminal screens allow you to monitor, provision, and troubleshoot an H4TU-C system.

To select a menu from the logon screen (Figure 3 on page 13), do one of the following:

•   Press the underlined letter of the menu.

•   Use the `←` `→` arrow keys to select the menu and then press `ENTER`.

Table 3 summarizes the navigational keys. They are also listed in the onscreen Help menu. Table 4 on page 13 describes the Logon screen menus.

Table 3.   *Navigational Keys for the HDSL4 Maintenance Terminal Screens*

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

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

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

Menu bar

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help




              +-----------------------------------------+
              |                                         |
              |         ADC DSL Systems, Inc.           |
              |               HDSL4                      |
              |                                         |
              |         Voice:  800.638.0031            |
              |         Fax  :  714.730.2400            |
              +-----------------------------------------+






 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C       System: OK
```

Circuit ID Number   Date and Time   Logon Device   System Status
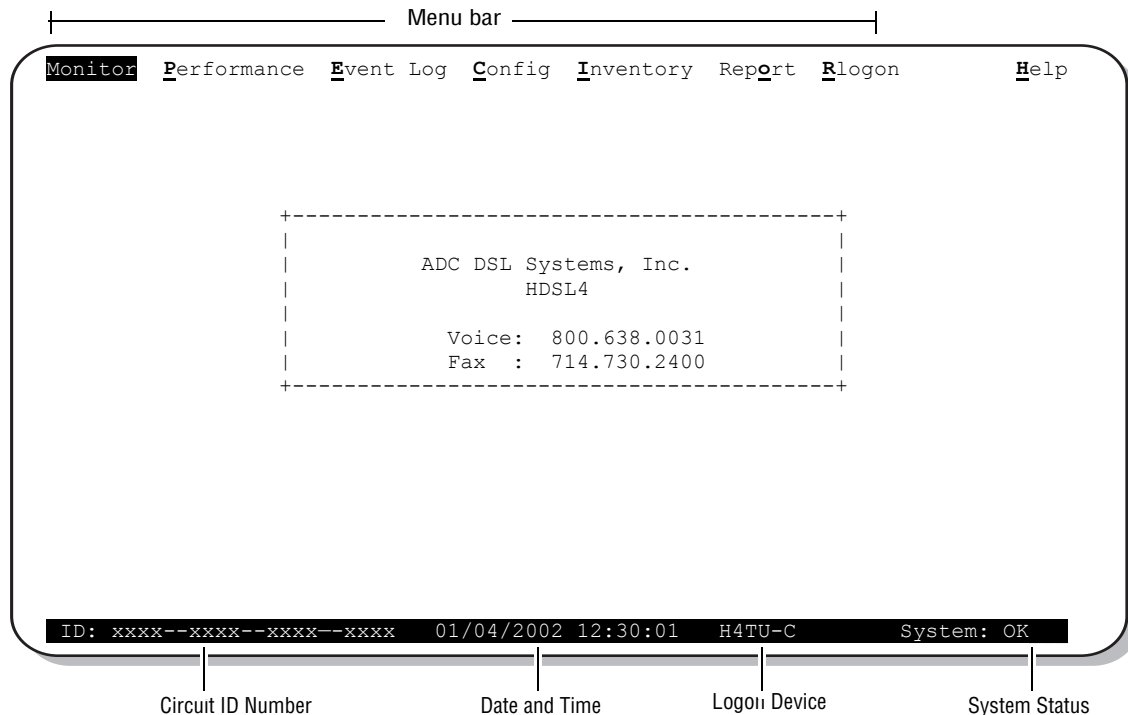
Figure 3.   Logon Screen

Table 4.   Logon Screen Menus

Press this key:	To access this menu:	Menu Functions
M	Monitor	Monitors loopbacks and alarms, and provides a graphical representation of circuit activity, including ES, UAS, SES, and line code.
P	Performance	Provides performance and alarm histories for current, 25-hour, 48-hour, or 31-day periods for either the DS1 or HDSL4 interface.
E	Event Log	Identifies the 100 most recent system events and reports the date and time of occurrence.
C	Config	Provides standard configuration options, ADC options, BER tester (BERT), 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 displays the BERT Generator menu, which provides access to the BERT Signal Generator configuration submenu.
I	Inventory	Provides product information about the various devices that are in the system and lists circuit and device identifications.
O	Report	Provides four types of reports: Full Report, Short Report, System Information Report, and Event Report.

Continued

Table 4. *Logon Screen Menus (Continued)*

Press this key:	To access this menu:	Menu Functions
R	Rlogon / Rlogout	Remote logon can be performed from the H4TU-C or the H4TU-R. The screen displays "**R**logout" when the H4TU-C or H4TU-R is remotely logged on to the other unit at the end of the circuit.
		Remote logon from the H4TU-C will permit viewing of the H4TU-R BERT Generator configuration submenu.
		To log off the remote unit, press R . "**R**logout" changes to "**R**logon." The unit is now locally logged on until R is pressed again to reinitiate a remote logon.
H	Help	Provides a glossary of terms used in the maintenance screens, a list of navigational keys, print guide, and ADC contact information.

PROVISIONING TASKS

After H4TU-C-231 List 1 is successfully installed, perform these basic provisioning tasks.

• Set date and time (see "Setting Date and Time" below)

• Set circuit ID numbers (see "Setting Circuit ID Numbers" on page 16)

• Make any necessary configuration changes (see "Configuring the System" on page 17)

• Clear history, alarm, and event log screens to remove miscellaneous data 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      -> |
                         | BERT Generator   -> |
                         | Date and Time    -> |
                         +------------------------------+
                         | Date (mm/dd/yyyy): 01/04/2002|
                         | Time (hh:mm[:ss]): 12:30:01  |
                         +------------------------------+




 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C        System: OK
```

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

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

```
 Monitor   Performance   Event Log   Config   Inventory   Report   Rlogout        Help

------------------------- Product Information --------------------------
Unit     : H4TU-C        H4TU-R         H4DU-1          H4DU-2
Product  : H4TU-C-231    H4TU-R-402     H4D-409         H4D-409
List     : 1             1              1               1
Sw Ver   : 4.00          4.00           4.00            4.00
Build  # : 08            08             08              08
Checksum : 0xA015        0xA015         0x633C          0x633C
H4 Xcvr  : GSPN B165     GSPN B165      GSPN B165       GSPN B165
Serial # : 215689543     215610839      123456789012    123456789012
CLEI     : VACJMTNEAA    VAR1EADAAA     ABCDEFGHIJ      1234567890
Mfg. Date: 9/12/01       7/27/01        11/21/2001      11/20/2001

----------------------- Circuit Identification ------------------------

Circuit ID  : xxxx--xxxx--xxxx--xxxx

Circuit Notes:



 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002   12:10:31   H4TU-C        System: OK
```

Figure 5.   Inventory Menu

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. (The Circuit ID number may consist of up to 24 alphanumeric characters.)

4   Type any relevant circuit notes, and then press **ENTER**.

Configuring the System

The Config menu (Figure 6) allows you to make the following types of system configuration changes:

- Standard options (Figure 7 on page 18)

- ADC options (Figure 8 on page 18)

- BERT Generator (Figure 30 on page 57)

- Date and time (see "Setting Date and Time" on page 15)

- Master clear (see "Clearing the History, Alarm, and Event Log Screens" on page 24)

- Reset to factory default configuration (Figure 9 on page 23)

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon          Help
                             +---------------------+
                             | Standard Options -> |
                             | ADC Options      -> |
                             | BERT Generator   -> |
                             | Date and Time    -> |
                             | Master Clear        |
                             | Set Factory Defaults |
                             +---------------------+



 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C        System: OK
```
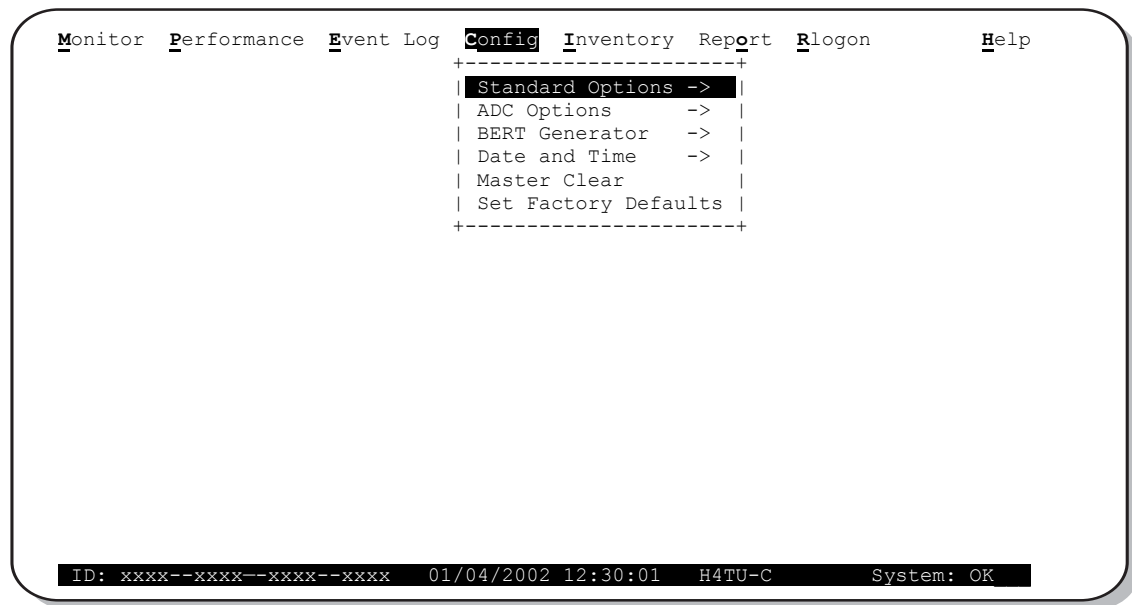
Figure 6.   Config Menu

Making Changes to Standard and ADC Options

Figure 7 and Figure 8 on page 18 show the Standard and ADC configuration options. Standard options are those that are supported by HDSL4 units when connected to units from other vendors. ADC options are an extended set of options that are only available when using ADC HDSL4 units exclusively. For a description of each option and a list of possible option settings, refer to Table 5 on page 19 and Table 6 on page 20. 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 the **SPACEBAR** to cycle through the available settings for that option.

5   Press **ENTER** to activate your choice.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help
                      +---------------------+
                      | Standard Options -> |
         +----------------------------------------------------+
         | Loopback Timeout (LBTO)                 : 60 min |
         | Loop Attenuation Threshold (LATT) [0-50]: 38 dB  |
         | Margin Threshold (MARG)           [0-15]: 4  dB  |
         | DS1 Frame Formatting (FRMG)             : AUTO    |
         | DS1 Line coding (DS1)                   : AUTO    |
         | H4TU-C Equalization (EQL)               : EXT     |
         | H4TU-R Line Buildout (RLBO)             : 0 dB    |
         | Alarm Pattern (ALMP)                    : AIS     |
         | H4TU-R TLOS Loopback (TLOS)             : 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--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C       System: OK
```

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)                 : AUTO |
           | Remote Provisioning (RTPV)             : ENA  |
           | Bipolar Violation Transparency (BPVT)  : DIS  |
           | DS1 BER (DBER)                         : DIS  |
           | HDSL4 BER Threshold (HBER)             : NONE |
           | SmartJack Loopback (LPBK)              : ENA  |
           | Remote Disconnect Alarm (RDA)          : ENA  |
           +--------------------------------------------------+




 Use <Spacebar> to cycle through option settings and <Enter> to activate
  ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C       System: OK
```

Figure 8. *Config Menu - ADC Options (Defaults Shown)*

Table 5 describes the Standard Config screen options and lists their front-panel display codes. Table 6 on page 20 describes the ADC Config menu options. Selections in bold typeface are the factory default settings.

Table 5. *H4TU-C-231 List 1 Standard Config Screen Options*

Standard Config Screen Options	Screen 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.
		60 min	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 50 dB	Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold cannot be set from the front-panel pushbuttons.
		35 dB	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.
		4dB	Default value.
DS1 Frame Formatting	FRMG	**AUTO**	Configures the HDSL4 system to operate in an auto-framing (AUTO) mode. It detects and locks to both SF or ESF DS1 frame patterns. Line and path performance parameters are maintained and displayed. Unframed payloads cause the ES-P and SES-P counters to increment.
		SF	Configures the HDSL4 system to search for the SF framing pattern at its DS1 input.
		ESF	Configures the HDSL4 system to search for the ESF framing pattern at its DS1 input.
		UNFR	Configures the same as AUTO except unframed payloads do not cause the ES-P and SES-P counters to increment.
DS1 Line Coding (see "DS1 Line Coding (DS1) Option" on page 21)	DS1	**AUTO**	The H4TU-C and H4TU-R monitor the incoming DS1 bit streams for the B8ZS code. If the H4TU-R detects this code, the H4TU-C enters B8ZS output mode. The H4TU-C reverts back to AMI output mode if no B8ZS codes are received at the H4TU-R input for 5 seconds. Similarly, when the H4TU-C detects the B8ZS code, the H4TU-R enters the B8ZS mode and returns to AMI mode if no B8ZS code is received at the H4TU-C input for 5 seconds.
		B8ZS	Places both the H4TU-C and H4TU-R into B8ZS mode.
		AMI	Places both the H4TU-C and H4TU-R into AMI mode.
H4TU-C Equalization See "H4TU-C Equalization (EQL) Option." on page 21.)	EQL	**EXT**	Disables the H4TU-C internal equalizer, allowing connection of external equalizer hardware to perform the same or a similar function.
		0 ft	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.
H4TU-R Line Buildout	RLBO		Sets the DS1 receive level output toward the Customer Interface (CI). Line buildout can only be set through the maintenance screens.
		0 dB	Sets the DS1 RLBO level toward the CI to 0 dB.
		-7.5 dB	Sets the DS1 RLBO level toward the CI to -7.5 dB.
		-15 dB	Sets the DS1 RLBO level toward the CI to -15.0 dB.

Table 5. *H4TU-C-231 List 1 Standard Config Screen Options (Continued)*

Standard Config Screen Options	Screen Display Code	Selection	Description
Alarm Pattern See "Alarm Pattern (ALMP) Option." on page 22.	ALMP	**AIS**	Enables the HDSL4 system to output an AIS payload at its DS1 ports for LOSW and LOS DS1. For priority resolution, see Figure 27 on page 46.
		LOS	Enables the HDSL4 system to output an LOS condition at its DS1 ports for LOSW and LOS DS1.
H4TU-R TLOS Loopback	TLOS	ENA	Enables a logic loopback at the H4TU-R when an LOS occurs at its DS1 input. For priority resolution, see Figure 27 on page 46.
		DIS	Disables TLOS logic loopback.
Network Loopback Pattern	NLBP	**AIS**	Enables the H4TU-R to transmit AIS towards the CI for any network loopback. For priority resolution, see Figure 27 on page 46.
		LOS	Enables the H4TU-R to transmit LOS towards the CI for any network loopback.
Power Back Off - Network See "Power Back Off (PBON and PBOC) Options" on page 22.	PBON	**DEF**	Configures the power output levels of the H4TU-C network unit toward the customer to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1.418.
		ENH	Configures the power output levels of the H4TU-C network unit toward the customer to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1.418.
Power Back Off - Customer See "Power Back Off (PBON and PBOC) Options" on page 22.	PBOC	**DEF**	Configures the power output levels of the H4TU-R customer unit toward the network to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1.418.
		ENH	Configures the power output levels of the H4TU-R customer unit toward the network to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1.418.

Table 6. *H4TU-C-231 List 1 ADC Config Screen Options*

ADC Config Menu Options	Screen Display Code	Selection	Description
Line Power Feed	PWRF	OFF	Disables powering to the HDSL4 pair.
		LOW	Keeps the HDSL4 line voltage at nominal -185 Vdc.
		HIGH	Keeps the HDSL4 line voltage at nominal ±123 Vdc.
		AUTO	Keeps the HDSL4 line voltage at -185 Vdc when line powering up to two devices (one doubler and one remote unit or two doubler units). When line powering of more than two devices is required, the line unit automatically switches to ±123 Vdc.
Remote Provisioning	RTPV	**ENA**	Enables remote provisioning.
		DIS	Disables remote provisioning.
Bipolar Violation Transparency (See "Bipolar Violation Transparency (BPVT) Option" on page 22.)	BPVT	ENA	Enables BPVs and HDSL4 CRC errors at the DS1 input to be converted into DS1 BPVs at the DS1 output at the distant end. This makes HDSL4 transparent to BPVs.
		DIS	Disables BPV Transparency.

Continued

Table 6.   *H4TU-C-231 List 1 ADC Config Screen Options (Continued)*

ADC Config Menu Options	Screen Display Code	Selection	Description
DS1 BER Threshold See "DS1 Bit Error Rate (DBER) Option" on page 22.	DBER	ENA	Enables the fixed 24-hour DS1 BER threshold.
		DIS	Prevents the generation of a system alarm due to DS1 BER.
HDSL4 BER Threshold (See "HDSL4 Block Error Rate Threshold (HBER) Option" on page 21 and "Craft Port" on page 63.)	HBER	1E-6	System alarm relay contact closes and the Status LED flashes red when the Block Error Rate (BER) exceeds 10^{-6}. (Block Error Rate is based on the definition of Bit Error Rate.)
		1E-7	System alarm relay contact closes and the Status LED flashes red when BER exceeds 10^{-7}.
		NONE	Prevents generation of a system alarm due to BER.
SmartJack Loopback	LPBK	**ENA**	Enables the HDSL4 system to recognize all inband SmartJack (SMJK) loopback commands.
		DIS	Configures the HDSL4 system to ignore all inband SmartJack loopback commands.
Remote Disconnect Alarm	RDA	**ENA**	Enables a remote DS1 LOS condition at the input to the H4TU-R to generate an LOS alarm. AIS or LOS (depending on ALMP) is sent towards the network.
		DIS	Prevents a remote DS1 LOS condition at the input to the H4TU-R from causing an LOS alarm. The front-panel Status LED still flashes red and the ALRM RLOS message is displayed, but the alarm relay contacts do not close and LOS is sent towards the network from the H4TU-C instead of AIS.

HDSL4 Block Error Rate Threshold (HBER) Option. The HBER option permits monitoring of loop integrity and reporting of alarms when excessive errors are detected. The performance monitoring (PM) primitive used for this purpose is the CRC checksum performed on the HDSL4 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 Monitor screen displays the CRC errors and counts for both the H4TU-C and H4TU-R. The HBER option allows an alarm to be generated if the total number of CRCs at either the H4TU-C or H4TU-R exceeds the selected BER threshold during the last 1-minute interval.

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

Once initiated, the HBER count clears when the CRC 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 system. The Auto mode, which can adapt to either AMI or B8ZS, should only be used in applications that require it (such as when ADC system acts as a standby circuit to DS1 circuits whose line codes are not known or may be both AMI and B8ZS). This is because the Auto mode induces one BPV in the DS1 bit stream whenever it switches from AMI to B8ZS. The Auto mode allows both the H4TU-C and the H4TU-R to set its DS1 output code to that which is being received at the distant end DS1 input. This forces the input and the output codes in each direction of transmission to be identical.

H4TU-C Equalization (EQL) Option. The equalizer shapes the DS1 output signal of the H4TU-C to conform to a very 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 H4TU-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 HDSL4 compatibility with the switch-to-protect features used in Digital Loop Carrier (DLC) feeder applications, the H4TU-C-231 List 1 has an 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 H4TU-C-231 List 1 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 H4TU-C-231 List 1 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 x 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 through 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
CV-P (FE in SF)	691
ES-L, ES-P, PRM-NE, PRM-FE	648
SES-L, SES-P	100
UAS-P, UAS-L	10

Power Back Off (PBON and PBOC) Options. Power Back Off Network (PBON) and Power Back Off Customer (PBOC) allow the HDSL4 circuit to support two transmit power templates: default (DEF), higher level, and enhanced (ENH), lower level. These are defined in the four-wire section of the ANSI T1.418 Issue 2 HDSL4 standard. Each HDSL4 receiver detects the level it is receiving during the start-up, pre-activation 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 HDSL4 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 H4TU-R, set the PBOC option to its lower (ENH) level setting. Conversely, if the HDSL4 signal at the H4TU-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 HDSL4 loop to momentarily drop and then reacquire synchronization. This setting can also affect the operating margins.**

Resetting to Factory Defaults

> ⚠️ **Resetting the H4TU-C to its original factory settings may cause interruption of service.**

To reset the H4TU-C to its original factory defaults:

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` if you are certain you want to reset the H4TU-C, or press `N` to cancel this action.

```
 Monitor   Performance   Event Log   Config   Inventory   Report   Rlogout        Help
                            +-----------------------+
                            | Standard Options   -> |
                            | ADC Options        -> |
                            | BERT Generator     -> |
                            | Date and Time      -> |
                            | Master Clear          |
                            | Set Factory Defaults  |
                            +-----------------------+
















 SETTING FACTORY DEFAULTS..SERVICE MAY BE INTERRUPTED! ARE YOU SURE (Y/N)?
   ID: xxxx--xxxx--xxxx--xxxx    01/04/2002    12:09:55    H4TU-C        System: OK
```

Figure 9.   *Configuration Menu - Reset to Factory Defaults*

Clearing the History, Alarm, and Event Log Screens

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 startup session and ensures collection of accurate and meaningful data thereafter.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogout        Help
                       +----------------------+
                       | Standard Options   -> |
                       | ADC Options        -> |
                       | BERT Generator     -> |
                       | Date and Time      -> |
                       | Master Clear       -> |
                       | Set Factory Defaults  |
                       +----------------------+




     Clear ALL performance, alarm and event log entries.  Are you sure (Y/N)?
     ID: xxxx--xxxx--xxxx--xxxx   01/04/2002   12:09:15   H4TU-C      System: OK
```
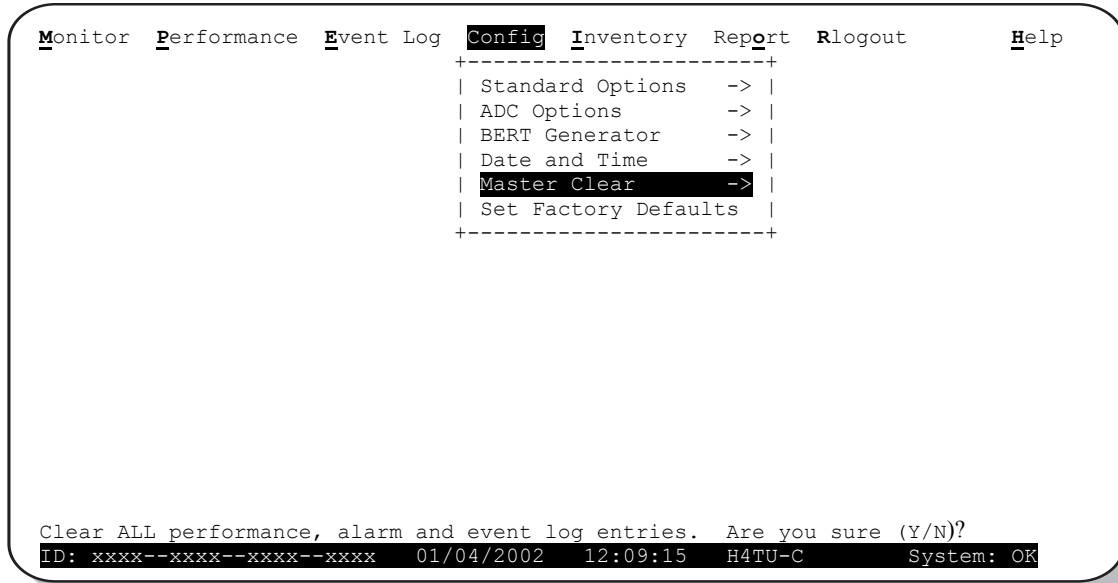
Figure 10.   Configuration Menu - Master Clear

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 the **SPACEBAR** to select either interface (**H4TU-C DS1, H4TU-R DS1, H4TU-C HDSL** or **H4TU-R HDSL**), then press **ENTER**.

3   Press the **↓** key 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 HDSL4 Alarm screens, see Table 11 on page 36.

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 confirm (clear all screens).

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

The HDSL4 system provides the following maintenance screens for monitoring system activity and assessing performance.

- The Monitor screens provide 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.

SYSTEM OVERVIEW

The H4TU-C-231 List 1 supports up to two doublers with three HDSL4 spans as shown in Figure 11.
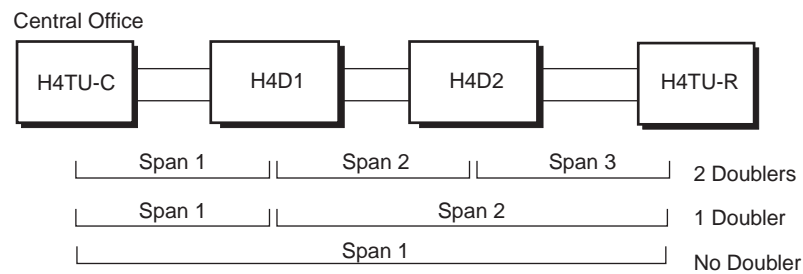
Figure 11. *System Spans*

The Monitor and Performance screens provide important activity and performance information about the HDSL4 spans and span devices.

USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

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. See Table 8 on page 27 for screen field descriptions.
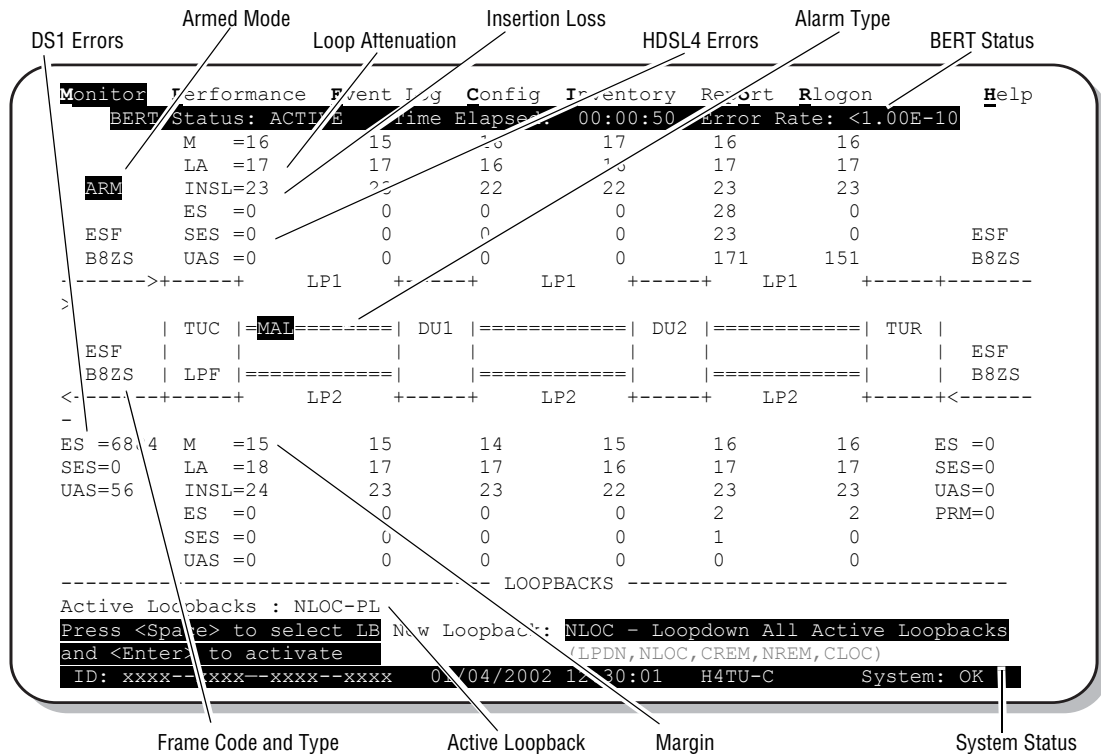
Figure 12.   *Monitor Screen - Active Loopback with Alarms*

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 and troubleshooting, see "Testing" on page 43.

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

Table 8.   *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 16 on page 52 for a summary of the HDSL4 generic loopback codes and activation methods.
Alarm type	Indicates type of alarm.
MAL	Margin Alarm—Indicates the margin on HDSL4 loop has dropped below the threshold (0 to 15dB) set by the operator.
Armed mode	Indicates system is in an armed state for an intelligent repeater loopback command.
BERT Status	Provides BERT Generator status, elapsed time, and BERT results.
DS1 Errors	Type of DS1 line coding received or sent (B8ZS or AMI).
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 included are: DS1 frame errors, BPV, and ESF CRC errors.
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.
UAS Count	Unavailable Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame and Code Type	
ESF	Type of DS1 framing used on the input stream (SF, ESF, or UNFR).
B8ZS	Type of DS1 line coding used (B8ZS or AMI).
HDSL4 Errors	
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.
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.
UAS Count	Unavailable Seconds—The number of seconds the HDSL4 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.
ID	Circuit identification (ID) number.
INSL	Insertion Loss—The signal loss value for a 196 kHz signal over the cable pair.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation (OPAM) transmission pulse from the distant end. Proper HDSL4 loop operation requires that this value be less than 34 dB. This value differs from the Insertion Loss value of a conventional 196 kHz signal.
LPF	Line Power Feed—Indicates the HDSL4 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL4 ports, relative to a 10^{-7} Bit Error Rate.
PL (or HG)	PL displays when the loopback was initiated by a command embedded in the DS1 data path payload (PL). HG displays when the loopback was initiated from a HDSL Generic (HG) front panel or by a maintenance terminal loopback command.
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. **System: OK** indicates that there are no alarms present; **System: Alarm** indicates the presence of an alarm. Refer to "Using the Performance Screens to View Alarm Data" on page 35.

USING THE PERFORMANCE SCREENS TO VIEW PERFORMANCE DATA

The Performance screens display:

- DS1 and HDSL4 statistics in 31-day, 48-hour, 25-hour, and current history reports.

- Alarm statistics for the HDSL4 (Figure 22 on page 35) or DS1 interfaces (Figure 23 on page 36) 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 (**H4TU-C DS1, H4TU-R DS1, H4TU-C HDSL**, **H4DU-1 NET HDSL, H4DU-1 CPE HDSL, H4DU-2 NET HDSL, H4DU-2 CPE HDSL** or **H4TU-R HDSL**), then press **ENTER**.

3   Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25-Hour History, 48-Hour History**, or **31-Day History**), then press **ENTER**.

Performance History at the DS1 Interface

The performance history for the DS1 interface provides 31-day, 48-hour, 25-hour, and current statistics screens for the H4TU-C and the H4TU-R (as viewed from the H4TU-C).

Figure 13 is an example of an a DS1 performance history screen at the remote unit. Figure 15 and Figure 14 on page 29 are examples of DS1 performance history screens at the line unit. Table 9 on page 31 describes the acronyms used in the performance history screens. Asterisks indicate performance monitoring from the previous day.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                  H4TU-R DS1   31-Day History (Page 1 of 3)
 ------------------------------------------------------------------------------
   Date    CV-L    ES-L  SES-L  UAS-L    CV-P    ES-P  SES-P   UAS-P PRM-NE PRM-FE

   12/13      0       0      0      0       0       0      0   86400     -      -
   12/14      0       0      0      0       0       0      0   86400     -      -
   12/15      0       0      0      0       0       0      0   86400     -      -
   12/16      0       0      0      0       0       0      0   86400     -      -
   12/17      0       0      0      0       0       0      0   86400     -      -
   12/18      0       0      0      0       0       0      0   86400     -      -
   12/19      0       0      0      0       0       0      0   86400     -      -
   12/20      0       0      0      0       0       0      0   86400     -      -
   12/21      0       0      0      0       0       0      0   86400     -      -
   12/22      0       0      0      0       0       0      0   86400     -      -
   12/23      0       0      0      0       0       0      0   86400     -      -
   12/24      0       0      0      0       0       0      0   86400     -      -

           Press: (N)ext Page, (P)revious Page, C(l)ear History
 ------------------------------------------------------------------------------
 Use <Space> to cycle through    Interface  :  H4TU-R DS1
 choices and <Enter> to view     Statistics :  31-Day History
   ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 07:28:02   H4TU-C         System: OK
```

Figure 13. *H4TU-R DS1 31-Day Performance History*

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                    H4TU-C DS1   25-Hour History (Page 1 of 9)
    -------------------------------------------------------------------------------
     Time    CV-L    ES-L   SES-L   UAS-L    CV-P    ES-P   SES-P   UAS-P

    *15:15      0       0       0       0       0       0       0     900
    *15:30      0       0       0       0       0       0       0     900
    *15:45      0       0       0       0       0       0       0     900
    *16:00      0       0       0       0       0       0       0     900
     16:15      0       0       0       0       0       0       0     900
     16:30      0       0       0       0       0       0       0     900
     16:45      0       0       0       0       0       0       0     900
     17:00      0       0       0       0       0       0       0     900
     17:15      0       0       0       0       0       0       0     900
     17:30      0       0       0       0       0       0       0     900
     17:45      0       0       0       0       0       0       0     900
     18:00      0       0       0       0       0       0       0     900

               Press: (N)ext Page, (P)revious Page, C(l)ear History
    -------------------------------------------------------------------------------
    Use <Space> to cycle through      Interface  :  H4TU-C DS1
    choices and <Enter> to view       Statistics :  25-Hour History
     ID: xxxx--xxxx--xxxx--xxxx     01/04/2002 12:30:01   H4TU-C       System: OK
```

Figure 14. H4TU-C DS1 25-Hour Performance History

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                    H4TU-C DS1   48-Hour History (Page 1 of 4)
    -------------------------------------------------------------------------------
     Time    CV-L    ES-L   SES-L   UAS-L    CV-P    ES-P   SES-P   UAS-P

    *17:00      0       0       0       0       0       0       0    3600
    *18:00      0       0       0       0       0       0       0    3600
    *19:00      0       0       0       0       0       0       0    3600
    *20:00      0       0       0       0       0       0       0    3600
    *21:00      0       0       0       0       0       0       0    3600
    *22:00      0       0       0       0       0       0       0    3600
    *23:00      0       0       0       0       0       0       0    3600
    *00:00      0       0       0       0       0       0       0    3600
    *01:00      0       0       0       0       0       0       0    3600
    *02:00      0       0       0       0       0       0       0    3600
    *03:00      0       0       0       0       0       0       0    3600
    *04:00      0       0       0       0       0       0       0    3600

               Press: (N)ext Page, (P)revious Page, C(l)ear History
    -------------------------------------------------------------------------------
    Use <Space> to cycle through      Interface  :  H4TU-C DS1
    choices and <Enter> to view       Statistics :  48-Hour History
     ID: xxxx--xxxx--xxxx--xxxx     01/04/2002 12:30:01   H4TU-C       System: OK
```

Figure 15. H4TU-C DS1 48-Hour Performance History

Examples of current statistics screens are shown below. Figure 16 and Figure 17 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. Refer to Table 9 on page 31 for descriptions of the kinds of errors reported on these screens.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon          Help

                     H4TU-R DS1  Current Statistics
   ----------------------------------------------------------------------------
                1 Day                1 Hour               15 Min
   Start        05:57                07:00                07:00

   CV-L            0                    0                    0
   ES-L            0                    0                    0
   SES-L           0                    0                    0
   UAS-L           0                    0                    0
   CV-P            0                    0                    0
   ES-P            0                    0                    0
   SES-P           0                    0                    0
   UAS-P           0                    0                    0
   PRM-NE                        No PRM Detected
   PRM-FE                        No PRM Detected
   B8ZSS           0                    0                    0
   MSEC            0                    0                    0
                     Press: C(l)ear Current Statistics
   ----------------------------------------------------------------------------
   Use <Space> to cycle through    Interface  :  H4TU-R DS1
   choices and <Enter> to view      Statistics :  Current
    ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C      System: OK
```

Figure 16. *H4TU-R DS1 Current Statistics*

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon          Help

                     H4TU-C DS1  Current Statistics
   ----------------------------------------------------------------------------
                1 Day                1 Hour               15 Min
   Start        05:57                07:00                07:00

   CV-L            0                    0                    0
   ES-L            0                    0                    0
   SES-L           0                    0                    0
   UAS-L           0                    0                    0
   CV-P            0                    0                    0
   ES-P            0                    0                    0
   SES-P           0                    0                    0
   UAS-P         4242                  476                  476


   B8ZSS           0                    0                    0
   MSEC          4242                  476                  476
                     Press: C(l)ear Current Statistics
   ----------------------------------------------------------------------------
   Use <Space> to cycle through    Interface  :  H4TU-C DS1
   choices and <Enter> to view      Statistics :  Current
    ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C      System: OK
```

Figure 17. *H4TU-C DS1 Current Statistics*

Table 9. *Acronyms Used on the DS1 Performance History Screens*

Acronym	Description	Acronym	Description
CV-L	Code Violation - Line Total BPV count.	SES-P	Severely Errored Seconds - Path Seconds with SES or CRC(ESF) $\geq$320 or FE [a](SF) $\geq$8 ($F_T + F_S$).
ES-L [b]	Errored Seconds - Line Seconds with BPV $\geq$1.	UAS-P	Unavailable Seconds - Path A second of unavailability based on SES-P or AIS $\geq$1.
SES-L	Severely Errored Seconds - Line Seconds with BPV plus EXZ $\geq$1544 or LOS $\geq$1.	PRM-NE [c]	Performance Report Messaging - Near End The PRM from CPE indicates errors, and the signal received from the network at the remote is error-free.
UAS-L	Unavailable Seconds - Line Seconds with LOS $\geq$1.	PRM-FE [c]	Performance Report Messaging - Far End The PRM from the network indicates errors, and the signal received from the CPE is error-free.
CV-P	Code Violation - Path Total count of SF frame bit (FB) errors or CRC(ESF) errors.	B8ZSS [d]	B8ZS Errored Seconds Seconds with B8ZS detection when AMI option is active.
ES-P [e]	Errored Seconds - Path Seconds with SEF [f], CRC (ESF), or FE [a](SF) $\geq$1.	MSEC [d]	Monitored Seconds of the current (15 minute/1 hour/1 day) screen.

(a) FE is a frame bit error.
(b) Line (L) refers to the AMI DS1 line used to transport the payload.
(c) Only displays on H4TU-R Performance History screens.
(d) Displays on the DS1 Current Statistics screens.
(e) Path (P) refers to the total framed payload being transported between two points.
(f) 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.

Performance History at the HDSL4 Interface

The HDSL4 interface has 31-day, 48-hour, 25-hour, and current statistic screens for the H4TU-C. Figure 18 and Figure 19 below are examples of 31-day and 48-hour performance history screens. Figure 20 on page 33 is an example of a 25-hour performance history screen. Refer to Table 10 on page 34 for descriptions of the kinds of errors reported on all HDSL4 performance screens. Asterisks indicate performance monitoring from the previous day.

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

              H4TU-C HDSL        31-Day History (Page 1 of 3)     LP1/LP2
-------------------------------------------------------------------------------
   Date      CV          ES           SES          UAS          LOSWS

  01/19     0/0         0/0          0/0          0/0          0/0
  01/20     0/0         0/0          0/0          0/0          0/0
  01/21     0/0         0/0          0/0          0/0          0/0
  01/22     0/0         0/0          0/0          0/0          0/0
  01/23     0/0         0/0          0/0          0/0          0/0
  01/24     0/0         0/0          0/0          0/0          0/0
  01/25     0/0         0/0          0/0          0/0          0/0
  01/26     0/0         0/0          0/0          0/0          0/0
  01/27     0/0         0/0          0/0          0/0          0/0
  01/28     0/0         0/0          0/0          0/0          0/0
  01/29     0/0         0/0          0/0          0/0          0/0
  01/30     0/0         0/0          0/0          0/0          0/0

           Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Use <Space> to cycle through     Interface  : H4TU-C HDSL
choices and <Enter> to view      Statistics : 31-Day History
 ID: xxxx--xxxx--xxxx--xxxx    02/01/2002 12:30:01   H4TU-C        System: OK
```

Figure 18.   H4TU-C HDSL (Loop 1/Loop2) 31-Day Performance History

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

              H4TU-C HDSL        48-Hour History (Page 1 of 4)     LP1/LP2
-------------------------------------------------------------------------------
   Time      CV          ES           SES          UAS          LOSWS

 *08:00     0/0         0/0          0/0          0/0          0/0
 *09:00     0/0         0/0          0/0          0/0          0/0
 *10:00     0/0         0/0          0/0          0/0          0/0
 *11:00     0/0         0/0          0/0          0/0          0/0
 *12:00     0/0         0/0          0/0          0/0          0/0
 *13:00     0/0         0/0          0/0          0/0          0/0
 *14:00     0/0         0/0          0/0          0/0          0/0
 *15:00     0/0         0/0          0/0          0/0          0/0
 *16:00     0/0         0/0          0/0          0/0          0/0
 *17:00     0/0         0/0          0/0          0/0          0/0
 *18:00     0/0         0/0          0/0          0/0          0/0
 *19:00     0/0         0/0          0/0          0/0          0/0

           Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Use <Space> to cycle through     Interface  : H4TU-C HDSL
choices and <Enter> to view      Statistics : 48-Hour History
 ID: xxxx--xxxx--xxxx--xxxx    02/01/2002 12:30:01   H4TU-C        System: OK
```

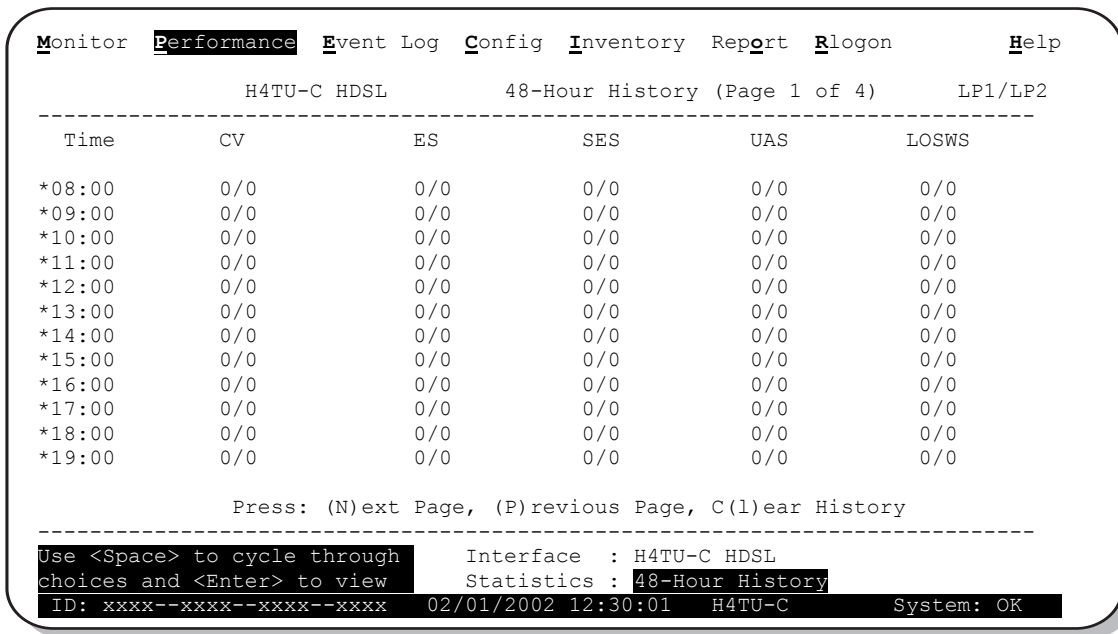*Figure 19.   H4TU-C HDSL (Loop 1/Loop 2) 48-Hour Performance History*

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                H4TU-C HDSL        25-Hour History (Page 1 of 9)     LP1/LP2
     -------------------------------------------------------------------------------
       Time        CV            ES           SES          UAS          LOSWS

     *06:45       0/0           0/0          0/0          0/0          0/0
     *07:00       0/0           0/0          0/0          0/0          0/0
     *07:15       0/0           0/0          0/0          0/0          0/0
     *07:30       0/0           0/0          0/0          0/0          0/0
      07:45       0/0           0/0          0/0          0/0          0/0
      08:00       0/0           0/0          0/0          0/0          0/0
      08:15       0/0           0/0          0/0          0/0          0/0
      08:30       0/0           0/0          0/0          0/0          0/0
      08:45       0/0           0/0          0/0          0/0          0/0
      09:00       0/0           0/0          0/0          0/0          0/0
      09:15       0/0           0/0          0/0          0/0          0/0
      09:30       0/0           0/0          0/0          0/0          0/0

                Press: (N)ext Page, (P)revious Page, C(l)ear History
     -------------------------------------------------------------------------------
      Use <Space> to cycle through      Interface  :  H4TU-C HDSL
      choices and <Enter> to view       Statistics :  25-Hour History
       ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C      System: OK
```

Figure 20. *H4TU-C HDSL (Loop 1/Loop 2) 25-Hour Performance History*

Figure 20 shows statistics for the HDSL4 interface at the H4TU-C. This screen reports 1-day, 1-hour, and 15-minute statistics. Refer to Table 10 on page 34 for descriptions of the kinds of errors reported on this screen.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                H4TU-C HDSL        Current Statistics         LP1/LP2
     -------------------------------------------------------------------------------
                   1 Day              1 Hour              15 Min
      Start        05:57              07:00               07:30

      CV           0/0                0/0                 0/0
      ES           0/0                0/0                 0/0
      SES          0/0                0/0                 0/0
      UAS          0/0                0/0                 0/0
      LOSWS        0/0                0/0                 0/0

                 Margin(dB)   LA(dB)   INSL(dB)
      Hi          16/17
      Cur         14/16        0/0      0/0
      Low         13/13


                       Press: C(l)ear Current Statistics
     -------------------------------------------------------------------------------
      Use <Space> to cycle through      Interface  :  H4TU-C HDSL
      choices and <Enter> to view       Statistics :  Current
       ID: xxxx--xxxx--xxxx--xxxx    02/01/2002 12:30:01   H4TU-C      System: OK
```

Figure 21. *H4TU-C HDSL (Loop 1/Loop 2) Current Statistics*

Table 10. *Acronyms Used on the HDSL4 Performance History Screens*

Acronym	Description
CV	Code Violation Total count of HDSL4 CRC errors
ES	Errored Seconds Seconds with HDSL4 CRC ≥1 or LOSW ≥1
SES	Severely Errored Seconds Seconds with HDSL4 CRC ≥50 or LOSW ≥1
UAS	Unavailable Seconds Based on 10 contiguous SES occurrences
LOSWS	Loss of Sync Word Second Seconds with LOSW ≥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 (**H4TU-C DS1, H4TU-R DS1, H4TU-C HDSL**, **H4DU-1 NET HDSL, H4DU-1 CPE HDSL, H4DU-2 NET HDSL, H4DU-2 CPE HDSL** or **H4TU-R HDSL**), then press **ENTER**.

3   Press the **SPACEBAR** until **Alarm History** is selected, then press **ENTER**. (To clear the selected alarm history screen, press **L**.)

Alarm History at the DS1 Interface

The Alarm History screen reports DS1 statistics for the H4TU-C (Figure 22) and the H4TU-R (Figure 23 on page 36) on a continuous basis. The types of alarms reported are described in Table 11 on page 36. Current alarms are shown in reverse video.

```
 Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                        H4TU-C DS1   Alarm History
 ------------------------------------------------------------------------------
   Alarm        First              Last              Status        Count

   LLOS       01/03/02                               ALARM          12
   LAIS                                              OK              0
   DBER                                              OK              7
   LOF        01/03/02                               OK              0








                        Press: C(l)ear Alarm History
 ------------------------------------------------------------------------------
 Use <Space> to cycle through     Interface  :  H4TU-C DS1
 choices and <Enter> to view      Statistics :  Alarm History
   ID: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C        System: Alarm
```
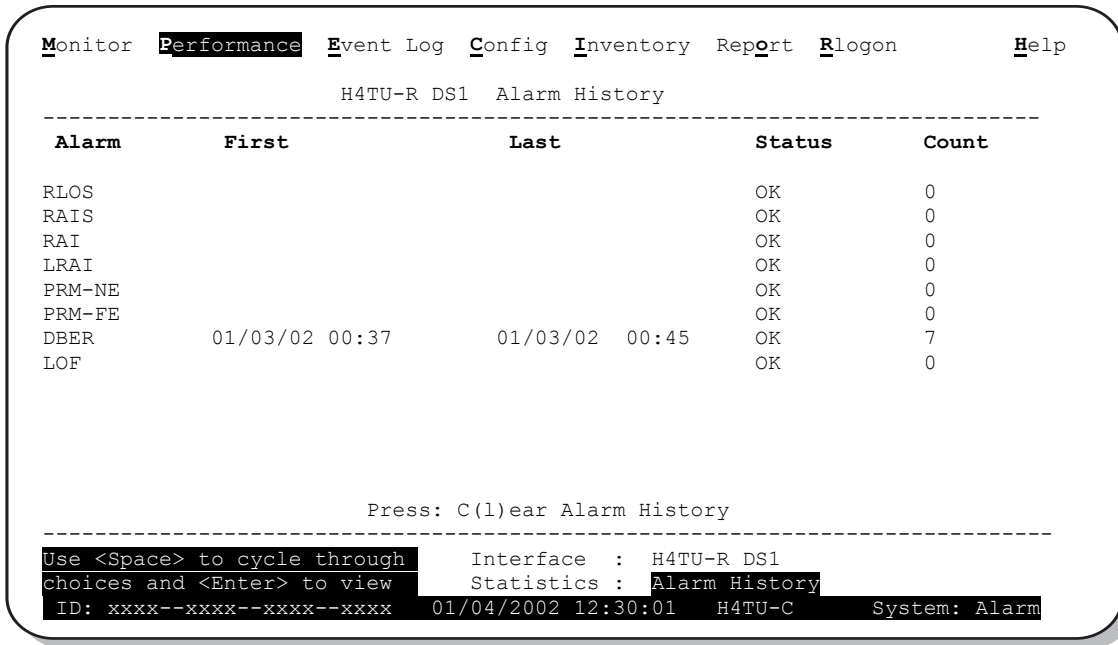
Figure 22.   H4TU-C DS1 Alarm History Screen

```
   Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                        H4TU-R DS1  Alarm History
   ------------------------------------------------------------------------------
     Alarm      First                  Last                Status      Count

     RLOS                                                  OK            0
     RAIS                                                  OK            0
     RAI                                                   OK            0
     LRAI                                                  OK            0
     PRM-NE                                                OK            0
     PRM-FE                                                OK            0
     DBER       01/03/02 00:37         01/03/02  00:45     OK            7
     LOF                                                   OK            0




                        Press: C(l)ear Alarm History
   ------------------------------------------------------------------------------
   Use <Space> to cycle through      Interface  :  H4TU-R DS1
   choices and <Enter> to view       Statistics :  Alarm History
    ID: xxxx--xxxx--xxxx--xxxx      01/04/2002 12:30:01   H4TU-C     System: Alarm
```

Figure 23.   *H4TU-R DS1 Alarm History Screen*

Table 11.   DS1 Alarm Descriptions

Screen Alarm	Front-Panel Alarm	Description
H4TU-C DS1 ALARMS (see Figure 22 on page 35)		
LLOS [a]	LLOS	Line (Unit) Loss of Signal—Loss of the H4TU-C DSX-1 input signal.
LAIS [a]	LAIS	Line Alarm Indication Signal—Indicates an AIS (unframed all ones) pattern is being received at the H4TU-C DS1 input port.
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 Frame—Indicates the incoming DS1 frame pattern is other than the one selected, ESF or SF, by the FRMG option. Only occurs if the FRMG option is set to SF or ESF. (*xxx* denotes either TUC or TUR.)
H4TU-R DS1 ALARMS (see Figure 23)		
RLOS [b]	RLOS	Remote (Unit) Loss of Signal—Loss of the H4TU-R DS1 input signal.
RAIS	RAIS	Remote Alarm Indication Signal—Indicates an AIS (unframed all ones) pattern is being received at the H4TU-R DS1 input port. By default AIS-CI [b] is sent towards the network (see Figure 27 on page 46)
RAI	RRAI	Remote RAI - Remote Alarm Indication at the H4TU-R—Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
LRAI	LRAI	Line (Clear) Remote Alarm Indication—An RAI condition is detected at the remote and the signal from the line unit is error-free. RAI signal is transmitted towards the network.
PRM-NE	PRMN	Performance Report Messaging - Near End—The count of the PRM-NE register at the H4TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
PRM-FE	PRMF	Performance Report Messaging - Far End—The count of the PRM-FE register at the H4TU-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.)

Continued

Table 11. *DS1 Alarm Descriptions (Continued)*

Screen Alarm	Front-Panel Alarm	Description
LOF	*xxx*-LOF	Loss of Frame—Indicates the incoming DS1 payload does not contain the specific frame pattern, ESF or SF, selected by the FRMG option. Only occurs if the FRMG option is set to SF or ESF. (*xxx* denotes either TUC or TUR.)

(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 HDSL4 Interface

The HDSL4 Alarm History screens report alarms for the HDSL4 interface at the H4TU-C and H4TU-R. Figure 24 shows the H4TU-C HDSL4 alarm history. Table 12 on page 38 describes the alarms that are reported at the H4TU-C or H4TU-R.

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                      H4TU-C HDSL        Alarm History
--------------------------------------------------------------------------------
 Alarm       First                  Last               Status      Count

LOSW-LP1   01/03/02 16:45       01/03/02 16:45        OK            1
MAL -LP1   01/03/02 16:44       01/03/02 16:44        OK            1
LA  -LP1                                              OK            0
HBER-LP1                                              DISABLED      0
LOSW-LP2   01/03/02 16:45       01/03/02 16:45        OK            1
MAL -LP2                                              OK            0
LA  -LP2                                              OK            0
HBER-LP2                                              DISABLED      0
SHORT                                                 OK            0
GND                                                   OK            0
OPEN                                                  OK            0


                    Press: C(l)ear Alarm History                       -
--------------------------------------------------------------------------------
Use <Space> to cycle through    Interface  :  H4TU-C HDSL
choices and <Enter> to view     Statistics :  Alarm History
 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C     System: Alarm
```

Figure 24. *H4TU-C HDSL4 Alarm History Screen*

Table 12. *HDSL4 Alarm Descriptions*

Screen Alarm	Front-Panel Alarm	Description
HDSL4 ALARMS at the H4TU-C and H4TU-R		
LOSW	SPN*n*-LOSW	Loss of Sync Word—The HDSL4 loop has lost synchronization.
MAL	*xxxx*-MAL*x*	Margin—The margin on the HDSL4 loop has dropped below the minimum threshold value set for the system.
		xxxx denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.
LA	*xxxx*-LA*x*	Loop Attenuation—The attenuation on the HDSL4 loop has exceeded the maximum value set for the HDSL4 loop attenuation threshold.
		xxxx denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.
HBER	*xxxx*-HBR*x*	Block Error Rate—The HDSL4 BER has exceeded the set threshold limits of 10^{-6} or 10^{-7}.
		xxxx denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.
HDSL4 ALARMS at the H4TU-C only		
SHORT	PWR FEED SHRT	Indicates a short between the Loop 1 and Loop 2 of the HDSL4 pair.
GND	PWR FEED GND	One of the HDSL4 loop is grounded.
OPEN	PWR FEED OPEN	Indicates a line power open condition.

USING THE EVENT LOG TO TRACK SYSTEM EVENTS

To view a running log of system events, press E to select the Event Log. The Event Log displays the date and time of the 100 most recent events (most recent displayed first) and provides a description of each event. See Table 13 on page 40 for an alphabetical listing of all possible event log messages.

- 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.

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help

                      System Event Log (Page 1 of 7)
 ----------------------------------------------------------------------------
 #   Origin          Date and Time         Entry

 1   Line Unit       01/03/02 16:44:41     MAL Alarm TUC Lp 1: End
 2   Line Unit       01/03/02 16:44:41     LOSW Alarm span 1: End
 3   Line Unit       01/03/02 16:44:39     MAL Alarm TUC Lp 1: Begin
 4   Managment Host  01/03/02 16:45:10     Time set to 16:44:18
 5   Line Unit       01/03/02 16:45:03     DS1 AIS Alarm: Begin
 6   Line Unit       01/03/02 16:45:03     LOSW Alarm span 1: Begin
 7   Line Unit       01/03/02 00:00:00     Time set to 16:45:00
 8   Line Unit       01/03/02 16:15:33     MAL Alarm TUC Lp 1: End
 9   Line Unit       01/03/02 16:15:33     LOSW Alarm span 1: End
 10  Line Unit       01/03/02 16:15:31     MAL Alarm TUC Lp 1: Begin
 11  Line Unit       01/03/02 16:15:03     DS1 AIS Alarm: Begin
 12  Line Unit       01/03/02 16:15:03     LOSW Alarm span 1: Begin
 13  Line Unit       01/03/02 00:00:00     Time set to 16:15:00
 14  Line Unit       01/03/02 14:53:17     MAL Alarm TUC Lp 2: End
 15  Line Unit       01/03/02 14:53:16     LOSW Alarm span 1: End

        Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log
 ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C     System: OK
```

Figure 25.   System Event Log

Table 13. *Event Log Entry Messages List*

Event Log Messages
HDSL4 DC pair open begins/ends on any segment
HDSL4 Ground fault begins/ends on any segment
H4TU-C Power up/down
H4TU-R Power up/down
HDSL4 margin alarm (threshold crossed) on any HDSL4 Interface (I/F)
HDSL4 loop attenuation (threshold crossed) on any HDSL4 I/F
HDSL4 HBER alarm (threshold crossed) on any HDSL4 I/F
HDSL4 LOSW begins/ends on any segment
CPE DBER alarm (1-day threshold of any PM data crossed—except PRM-NE or PRM-FE)
CPE PRM-NE BER alarm (*at the remote only*: 1-day PRM-NE threshold crossed: trouble on CPE receive)
NTWK PRM-FE BER alarm (*at the remote only*: 1-day PRM-FE threshold crossed: trouble on NTWK far end)
NTWK DBER alarm (1-day threshold of any PM data crossed)
CPE DS1 LOS begins/ends
CPE DS1 AIS begins/ends
NTWK DS1 LOS begins/ends
NTWK DS1 AIS begins/ends
TX RAI-CI begins/ends (RAI-CI sent from the remote towards the network)
RAI begins/ends
Any HDSL4 PM register reset
Any DS1 PM register reset
Any DS1 Alarm History reset
Any HDSL4 Alarm History reset
Event Log reset
Current statistics reset
Master zero reset
Any provisioning option change: <provisioning mnemonic>: changed from <old> to <new>
Any Loop Up (any segment)
Any Loop Down (any segment)
Power Feed Short begins / ends

USING THE REPORT MENU

The Report menu (Figure 26) 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 14 on page 42 describes the four types of reports 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 and print mode.

 –   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 your terminal emulation software (HyperTerminal or Procomm) to capture the selected report to your printer. Press **ENTER** to generate. (If Page Mode is selected, press the **SPACEBAR** to continue or **ESC** to quit.)

4   End the captured report.

5   Press **CTRL** + **R** to refresh the Report menu screen.

```
    Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help




            Report Type :  Full Report
            Print Mode  : Continuous
Please select report type and print mode by pressing <Space>,  then start
terminal logging and press <Enter> to generate the report.





    ID: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-C      System: OK
```

Figure 26.   *Report Menu - Full Report*

Table 14.   *Report Types*

Type	Contains the following information:
Full Report	• Circuit and unit identifications • Product information • System configuration • Current performance statistics • Alarm history • Performance history • System event log
Short Report	• Circuit and unit identifications • Product information • System configuration • Current performance statistics
System Information Report	• Circuit and unit identifications • Product information • System configuration
Event Report	• Circuit and unit identifications • Product information • System event log

TESTING

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

SYSTEM ALARMS

Table 15 summarizes all possible system alarms in order of priority as they appear on the front panel. When multiple alarms occur, the front-panel display only reports the highest priority alarm. The alarm history screens display alarms also, but provide greater detail (see "Using the Performance Screens to View Performance Data" on page 28). Alarms that are not inhibited will drive the front-panel Status LED to a flashing red alarm state.

Table 15.   *Front-Panel System Alarms*

Front-Panel Message [a]	Alarm	Description	To Inhibit:
PWR FEED SHRT [b]	Power Feed Short	A short exists between the Loop 1 and Loop 2 of the HDSL4 pair.	Cannot be inhibited.
PWR FEED GND [b]	Power Feed Ground	One of the HDSL4 loops is grounded.	Cannot be inhibited.
PWR FEED OPEN [b]	Power Feed Open	A line power open condition exists.	Cannot be inhibited.
SPNn-LOSW	Span(n)-Loss of Sync Word [c]	The HDSL4 loop has lost synchronization. The span closest to the network has highest priority.	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 H4TU-R DS1 input signal.	Disable the RDA (Remote Disconnect Alarm) option. The front-panel Status LED still flashes red and the ALRM RLOS message displays to alert you of the LOS state. LOS is sent towards the network from the H2TU-C. This option prevents the common occurrences of a CPE LOS condition from generating recurring alarms and AIS payloads.
LAIS	Line Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H4TU-C DS1 input port.	Cannot be inhibited.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H4TU-R DS1 input port.	Cannot be inhibited.
LRAI	Line RAI—Remote Alarm Indication at the H4TU-R (Net signal does not have errors.)	Indicates an RAI alarm (yellow) from the CPE with an error-free signal from the line unit or network. RAI signal is transmitted towards the network.	Cannot be inhibited.
RRAI	Remote RAI—Remote Alarm Indication at the H4TU-R (Net signal has errors.)	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.

Continued

Table 15. *Front-Panel System Alarms (Continued)*

Front-Panel Message [a]	Alarm	Description	To Inhibit:
xxx-DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set 24-hour threshold limit of approximately 10^{-6}. (*xxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Select DIS for the DBER system option.
xxx-LOF	Loss of Frame	The DS1 input does not contain the ESF or SF frame pattern setting of the FRMG option. (*xxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Change FRMG option to AUTO or UNFR.
PRMN	Performance Report Messaging - Near End	H4TU-R PRM-NE BER threshold has been exceeded.	Set DBER threshold to DIS.
PRMF	Performance Report Messaging - Far End	H4TU-R PRM-FE BER threshold has been exceeded.	Set DBER threshold to DIS.
xxxx-HBR*x* [d]	HDSL4 Block Error Rate	The HDSL4 BER has exceeded the set threshold limits of 10^{-6} or 10^{-7}. *xxxx* denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.	Select NONE for the HBER system option.
xxxx-MAL*x* [d]	Margin Alarm	The margin on the HDSL4 loop has dropped below the minimum threshold value set for the system. *xxxx* denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.	Set the Margin Alarm Threshold option to zero.
xxxx-LA*x* [d]	Loop Attenuation	The attenuation on the HDSL4 loop has exceeded the maximum value set for the HDSL4 loop attenuation threshold. *xxxx* denotes TUC, TUR, or first (DU1U/DU1D) or second (DU2U/DU2D) doubler HDSL4 upstream or downstream interface. If TUC and TUR occur at the same time, then TUC displays. The single *x* indicates Loop 1 or Loop 2.	Set the HDSL4 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 HDSL4 loop loses sync word (LOSW), a system alarm condition exists. However, since the H4TU-C-231 List 1 enters the acquiring mode, the front-panel status LED flashes red, and the ACQ or SIG message displays instead of the ALRM message.
(d) Only these alarms assert the System Alarm bus on pin H of the card-edge connector, if the ALM option is set to enabled.

Alarm Option for Digital Loop Carrier (DLC) Feed

To improve compatibility with the switch-to-protect features used in DLC feeder applications, the H4TU-C-231 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

Retiring System Alarms

To retire a system alarm, press the SEL button to execute an Alarm CutOff (ACO). An ACO turns the alarm off 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 27 shows the different ways the H4TU-R can respond to the network, depending on the configuration of the TLOS, NLBP, RDA, and ALMP configuration options described in Table 5 on page 19 and Table 6 on page 20.
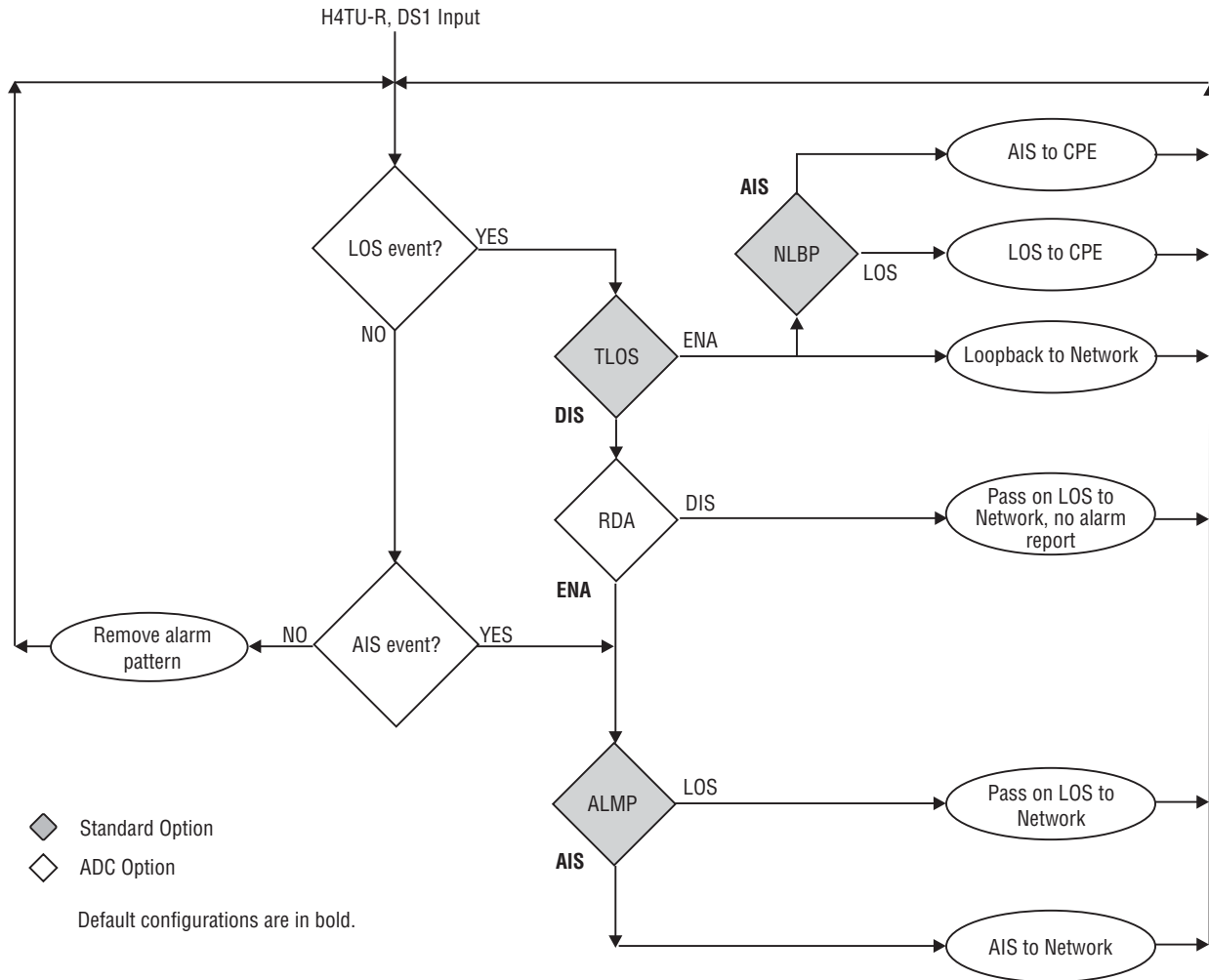
Figure 27. *H4TU-R LOS and AIS Response Priorities*

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 cause the H4TU-C to report ES, SES, and UAS errors according to ANSI T1.231-1997.

LOOPBACK OPERATION

HDSL4 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 HDSL4 channels to the H4TU-C, the H4TU-C DSX-1 interface, and the DS1 channels to the customer.

Loopback options include:

- Generic Loopback (GNLB) options, including the SmartJack (SMJK) option (see Table 16 on page 52)

- A3LB Addressable Repeater Loopback command (see Table 17 on page 53)

- A5LB Addressable Repeater Loopback command (see Table 18 on page 54)

Loopback commands can be initiated by:

- Selecting the loopback type using the MODE and SEL pushbuttons on the H4TU-C front panel or the manual loopback (SEL) pushbutton on the H4TU-R front panel

- Selecting the loopback type from the Monitor menu when connected to the craft port of the H4TU-C or H4TU-R

- Entering the loopback code (exceptions are COLB and RULB) into the test equipment connected to the H4TU-C or H4TU-R
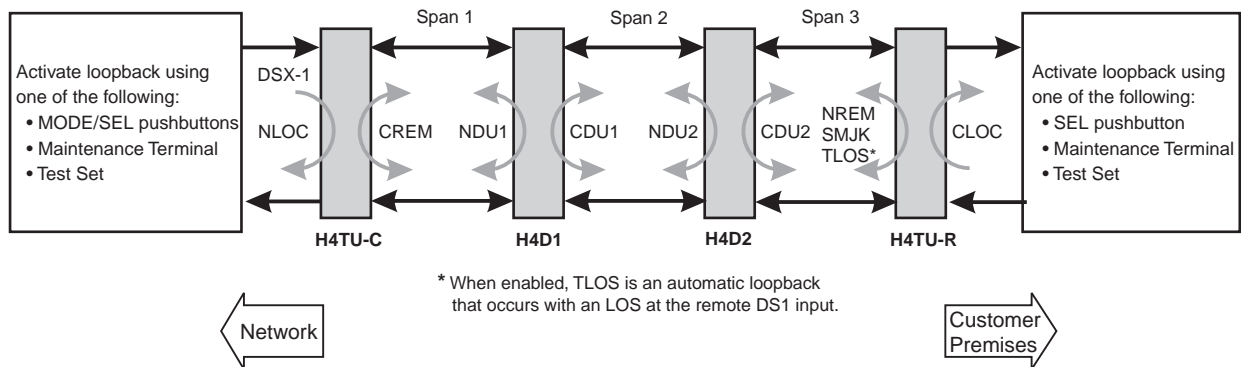
Figure 28.   Loopback Summary

> ✎ **ADC HDSL4 supports multiple loopbacks, but a single loopback is the preferred method. HDSL4 automatically rejects activation of closed loop loopbacks. For example, an NREM and CREM cannot be activated at the same time.**

Generic Loopback Commands

The HDSL4 Generic Loopback (GNLB) commands allow you to use inband codes to loop up either NLOC (4-in-7) or NREM (3-in-7) towards the network. In addition, 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 HDSL4 system responds. TLOS is a logic loopback caused by loss of the DS1 input from the CI.

Figure 29 on page 51 summarizes the available loopbacks in the system, and Table 16 on page 52 summarizes the HDSL4 generic loopback commands. See "GNLB Test Procedures" on page 52 for the test procedures that apply

> **HDSL4 systems feature the SmartJack option, which can emulate a Network Interface Device (NID) for the purpose of loopback testing of the HDSL4 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. NREM, on the other hand, is initiated by the 3-in-7 inband command or by a command issued from the maintenance terminal or the MODE and SEL pushbuttons.**
>
> **Use the inband commands to enable or disable the SMJK loopback options. The H4TU-C-231 List 1 system setting is normally enabled to recognize all inband SmartJack loopback commands.**

Special Loopback Commands

A3LB and A5LB loopback commands can be sent by a test set connected to the H4TU-C or H4TU-R. (See Table 17 on page 53 and Table 18 on page 54 for a list of the commands.)

A3LB and A5LB are special, addressable, repeater loopback modes which are supported by the H4TU-C. These loopback modes provide the HDSL4 system with sophisticated maintenance and troubleshooting tools. A3LB and A5LB are patterned after the Westell addressable T1 repeater loopbacks.

The A5LB loopback selection complies with that proposed for HDSL4 systems in the T1E1.4/92 loopback 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

A5LB does not block the arming code from exiting the H4TU-C-231 into the network. Since A5LB never blocks the arming code from exiting the H4TU-C, the Far-End Activate code is not available in A5LB. A3LB supports the additional (1-in-6) SMJK loopback command.

Manual Loopback Session

A manual loopback session allows you to select any one of the HDSL4 loopbacks listed in Table 16 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.

1 Use the MODE and SEL pushbuttons as described in "Setting Options through MODE and SEL" on page 10.

(The loopback time-out parameter is also user-selectable from the Config Menu, Standard Options screen when using a maintenance terminal.)

2 Select the desired setting:

- NONE (time-out disabled)

- 20 minutes

- 60 minutes

- 120 minutes

- 8 hours

- 24 hours

Activating Manual Loopback Mode

With the exception of SmartJack, any of the HDSL4 loopbacks can be executed using the MODE and SEL pushbuttons.

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

- **The next loopback option can be displayed by pressing the MODE pushbutton, however, the previously activated loopback remains active until the SEL 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 SEL pushbuttons for 3 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 SEL pushbuttons on the front panel for at least 3 seconds. The following message appears on the front-panel display:

`MAN LPBK NLO?` (XXXX indicates loopback choices)

2 Press SEL to activate NLOC. The display changes to `MAN LPBK NLOC`.

3 Press MODE to advance to the next available loopback:

- NDx? = Doubler 1 or Doubler 2, if H4D is available

- NRE? = NREM

- CRE? = CREM

- CDx? = Doubler 1 or Doubler 2, if H4D is available

- CLO? = CLOC

- COL? = Dual loopback at H4TU-C

- DxL? = Dual loopback at Doubler 1 or Doubler 2, if available

- RUL? = Dual loopback at H4TU-R

4 Press SEL 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 returns to the normal display mode.

You can terminate loopbacks manually and exit the MAN LPBK mode by simultaneously pressing the MODE and SEL pushbuttons for 3 or more seconds. If no loopback is active, the MAN LPBK mode automatically terminates after 30 seconds.

All loopbacks can be initiated by inband commands in the DS1 payload or by a command from the HDSL4 system (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 information (Monitor screen) by the annotation HG or PL adjacent to the identified loopback. For example, NREM-HG indicates that the loopback was initiated by the HDSL4 system.

SMJK loopback commands are only activated by inband commands.
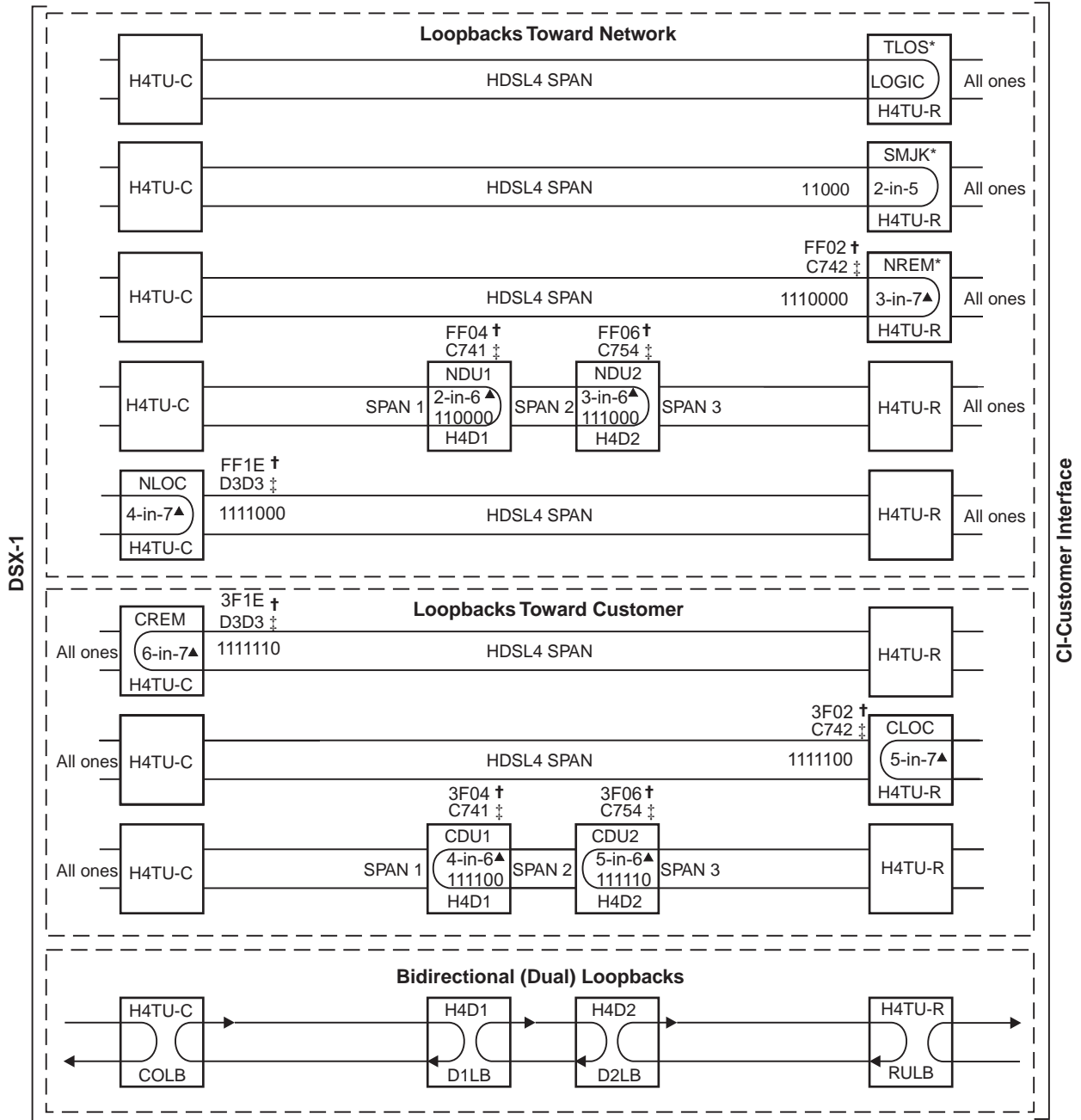
LOOPBACK TEST PROCEDURES

The following sections provide step-by-step test procedures for verifying the integrity of the HDSL4 channels at every module location as well as the DS1 channels to the customer and the local DSX-1 interface. Figure 29 on page 51 summarizes the available loopbacks in the system.

General Troubleshooting Tips

If trouble is encountered on the DSX-1 interface of the H4TU-C, verify that the:

- H4TU-C is making a positive connection with its shelf connector.

- H4TU-C internal equalizer is set to the correct distance range per Table 6 on page 20. All equalizers should be set to the distance from the DSX-1 to the shelf.

The transmit and receive DSX-1 ports have splitting access jacks and miniature, 210-series, bridging jacks as shown in Figure 1 on page 3. The BRG jacks can be used to send and receive DSX-1 test patterns.

Loopbacks Toward Network

| H4TU-C | HDSL4 SPAN | TLOS* / LOGIC / H4TU-R | All ones |

| H4TU-C | HDSL4 SPAN | 11000 | SMJK* / 2-in-5 / H4TU-R | All ones |

FF02 †
C742 ‡

| H4TU-C | HDSL4 SPAN | 1110000 | NREM* / 3-in-7▲ / H4TU-R | All ones |

FF04 † C741 ‡   FF06 † C754 ‡

| H4TU-C | SPAN 1 | NDU1 / 2-in-6▲ / 110000 / H4D1 | SPAN 2 | NDU2 / 3-in-6▲ / 111000 / H4D2 | SPAN 3 | H4TU-R | All ones |

FF1E †
D3D3 ‡

| NLOC / 4-in-7▲ / H4TU-C | 1111000 | HDSL4 SPAN | H4TU-R | All ones |

Loopbacks Toward Customer

3F1E † D3D3 ‡

| All ones | CREM / 6-in-7▲ / H4TU-C | 1111110 | HDSL4 SPAN | H4TU-R | All ones |

3F02 † C742 ‡

| All ones | H4TU-C | HDSL4 SPAN | 1111100 | CLOC / 5-in-7▲ / H4TU-R |

3F04 † C741 ‡   3F06 † C754 ‡

| All ones | H4TU-C | SPAN 1 | CDU1 / 4-in-6▲ / 111100 / H4D1 | SPAN 2 | CDU2 / 5-in-6▲ / 111110 / H4D2 | SPAN 3 | H4TU-R |

Bidirectional (Dual) Loopbacks

| H4TU-C / COLB | H4D1 / D1LB | H4D2 / D2LB | H4TU-R / RULB |

DSX-1

CI-Customer Interface

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

† A3LB loopback codes.

‡ A5LB loopback codes.

▲ GNLB loopback codes.

Figure 29. *Loopback Modes*

GNLB Test Procedures

Figure 29 on page 51 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. Refer to Table 16 on page 52 for a description of these commands.

Table 16.   Summary of HDSL4 Loopback Codes

Loopback	Code	Description	Method of Activation		
			Test Set	Craft Port	MODE/SEL
NLOC	1111000 4-in-7	DSX-1 signal is looped back to the network at the H4TU-C.	X	X	X
NREM	1110000 3-in-7	DSX-1 signal is looped back to the network at the H4TU-R.	X	X	X
NDU1	110000 2-in-6	Signal is looped back to the network at H4D1.	X	X	X
CDU1	111100 4-in-6	DS1 signal from customer is looped back to the customer at H4D1.	X	X	X
NDU2	111000 3-in-6	Signal is looped back to the network at H4D2.	X	X	X
CDU2	111110 5-in-6	DS1 signal from customer is looped back tot he customer at H4D2.	X	X	X
D1LB		Dual loopback at H4D1.			X
D2LB		Dual loopback at H4D2.			X
CLOC	1111100 5-in-7	DS1 signal from the customer is looped back to the customer at the H4TU-R.	X	X	X
CREM	1111110 6-in-7	DS1 signal from the customer is looped back to the customer at the H4TU-C.	X	X	X
COLB		Dual loopback at the H4TU-C. DSX-1 signal is looped back to the network at the H4TU-C and DS1 signal from the customer is looped back to the customer at the H4TU-C.			X
RULB		Dual loopback at the H4TU-R. DSX-1 signal is looped back to the network at the H4TU-R and DS1 signal from the customer is looped back to the customer at the H4TU-R.			X
SMJK LpUp (PL)	11000 2-in-5	SmartJack Loopup or NID payload (PL) code. Invokes H4TU-R loopback towards network.	X		
SMJK LpUp (ESF-DL)	1111-1111- 0100-1000	SmartJack Loopup or NID (ESF-DL) code. Invokes H4TU-R loopback towards 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		

To perform the GNLB loopback test procedure:

1   Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. You should 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 towards the H4TU-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. You should 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.

A3LB Test Procedure

The H4TU-C-231 List 1 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 H4TU-C to enter the NLOC state. The Loopback Time-Out setting (see "Setting the Loopback Time-Out Option" on page 49) 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 way to loop the H4TU-C down is to issue one of the three loopdown commands listed in Table 17. The automatic time-out mode is restored during subsequent loopback sessions.

Table 17 summarizes the codes required to execute an A3LB Addressable Repeater Loopback command. All code sequences must be present for at least 5 seconds.

Table 17.   *A3LB Addressable Repeater Loopback Commands*

Name	Binary Code [a] (Hexadecimal Equivalent)	Description
NLOC	1111-1111-0001-1110 (FF1E)	H4TU-C loopup from NI.
CREM	0011-1111-0001-1110 (3F1E)	H4TU-C loopup from CI.
NREM	1111-1111-0000-0010 (FF02)	H4TU-R loopup from NI.
NDU1	1111-1111-0000-0100 (FF04)	Signal is looped back to the network at H4D1.
CDU1	0011-1111-0000-0100 (3F04)	DS1 signal from customer is looped back to the customer at H4D1.
NDU2	1111-1111-0000-0110 (FF06)	Signal is looped back to the network at H4D2.
CDU2	0011-1111-0000-0110 (3F06)	DS1 signal from customer is looped back tot he customer at H4D2.
D1LB		Dual loopback at H4D1.
D2LB		Dual loopback at H4D2.
CLOC	0011-1111-0000-0010 (3F02)	H4TU-R loopup from CI.
SMJK	11000-11000-11000 ...	H4TU-R loopup from NI.
SMJK	100000 100000 100000 ...	H4TU-R loopup from NI.
SMJK	1111-1111-0100-1000 (FF48)	H4TU-R loopup from NI (ESF-DL).
Loopdown	11100-11100-11100 ...	H4TU-C and H4TU-R loopdown from NI OR CI.
Loopdown	100-100-100 ...	H4TU-C and H4TU-R loopdown from NI OR CI.
Loopdown	1111-1111-0010-0100 (FF24)	H4TU-C and H4TU-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 H4TU-R location.

A5LB Test Procedure

Using the codes listed in Table 18, 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.

Table 18.   *A5LB Addressable Repeater Loopback Commands*

Name	Binary Code [a] (Hexadecimal Equivalent)	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 or CREM) 230-232 bit errors 229-231 bit errors [b]	1101-0011-1101-0011 (D3D3)	H4TU-C loopup
ILR-1 LPBK (NDU1 and CDU1 10 bit errors)	Doubler-1 loopup	1100-0111-0100-0001 (C741)
ILR-20 LPBK (NDU2 and CDU2 200 bit errors)	Doubler-2 loopup	1100-0111-0101-0100 (C754)
ILR-2 LPBK (NREM and CLOC 20 bit errors)	H4TU-R loopup	1100-0111-0100-0010 (C742)
ILR-2 LPBK (NREM or CLOC) 20 bit errors [c]	NREM—DSX-1 signal is looped back to the network at the H4TU-R. CLOC—DS1 signal from customer is looped back to the customer at the H4TU-R.	1100-0111-0100-0010 (C742)
IR LPDN	1001-0011-1001-0011 (9393)	Loopdown (H4TU-C or H4TU-R)
IR QUERY LPBK	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
IOR POWER DOWN (H4TU-C) [d]	0110-0111-0110-0111 (6767)	Removes HDSL4 line power

(a) The leftmost bit arrives first in all sequences. The detection algorithm functions reliably with a random 10^{-3} BER on the facility. The entire arming and loopback sequence can also be initiated at the remote H4TU-R location.

(b) The H4TU-R identifies CREM (and the H4TU-C identifies NLOC) with 231 bit errors, including 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 or not the test set counts frame errors as bit errors, and on the number of frame bits contained in the block of 231 error bits. The H4TU-R and H4TU-C generate this bit pattern in a series of discontinuous bursts containing 20-bit errors each, including frame bits. Those test sets that do not count frame error bits as data bit errors will indicate fewer bits than the H4TU-R and H4TU-C transmit for a CI and NI loopback.

(c) The H4TU-R is assigned the ILR-2 loopback code. It responds with 20 bit errors (excluding the frame bits).

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

To perform the A5LB test procedures:

1 Send the inband Arming and NI LPBK code 11000 to the H4TU-C for at least 5 seconds.

2 Monitor the output of the H4TU-C for the return of the pattern. Return of the pattern indicates one of the following:

- The H4TU-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 H4TU-C and H4TU-R have been armed.

3 Verify, if possible, that the H4TU-R Loopback LED is either flashing yellow at four times per second (indicating that the system is armed), or is a steady yellow (indicating that it is both armed and in SMJK loopback). The H4TU-C Status LED also flashes yellow when the system is armed.

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

4 Once armed, the H4TU-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 in the order presented:

- 2 seconds of AIS (all ones pattern)

- 2 seconds of returning data pattern

- 231 logic errors (including the frame bit) occurring in the returned pattern comprising:

  - 10 errors, if ILR-1 (Doubler 1) was sent

  - 200 errors, if ILR-20 (Doubler 2) was sent

  - 20 errors, if ILR-2 (H4TU-R) was sent

- 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.

> **Some Intelligent Repeater (IR) test sets do not count frame errors as bit errors when the test pattern is framed and the H4TU-C-231 is set to the Auto framing mode. To improve compatibility with those test sets, the H4TU-C generates 231 (NLOC and CREM) ID bit errors. As a result, the H4TU-C may indicate one more or one less bit error, depending on the test set type and the number of frame bits contained in the block of errored bits. To avoid this uncertainty, ADC recommends sending unframed IR commands.**

The H4TU-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 (see "Setting the Loopback Time-Out Option" on page 49). 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 way to loop the H4TU-C down is to do one of the following:

- Issue the IR (Intelligent Repeater) LPDN (loopdown) 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.

5 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 (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.

TESTING WITH H4TU-C BERT GENERATOR

The H4TU-C BERT Generator screen allows transmission of an unframed test signal from the H4TU-C toward either the CI or the network.

> 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 (Figure 30).

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 19 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.

```
    Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon        Help
                          +--------------------+
                          | Standard Options -> |
                          | ADC Options      -> |
                          | BERT Generator   -> |
                          +------------------------------------+
                          | BERT Signal Generator  : ENA       |
                          | 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: xxxx--xxxx--xxxx--xxxx    01/04/2002 12:30:01   H4TU-C     System: OK
```

Figure 30. H4TU-C BERT Generator Screen

Table 19. BERT Signal Generator Option Settings

Option	Description
BERT Signal Generator	Enabled (ENA) or Disabled (DIS)
BERT Signal Pattern	1-in-8 pattern, 2-in-8 pattern, 3-in-24 pattern, 2^{23-1} pseudo random, 2^{20-1} pseudo random, 2^{15-1} pseudo random
BERT Signal Line Code	AMI or B8ZS
BERT Signal Direction	Toward CPE or toward NET
BERT Interval	5 minutes, 60 minutes, Continuous (default)

TESTING WITH **H4TU-R BERT GENERATOR**

The H4TU-R BERT Generator screen allows transmission of an unframed test signal from the H4TU-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 (Figure 31).

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 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 H4TU-C logon screen. You can exit the status screen while signal generation is active.

```
   Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon       Help
                         +--------------------+
                         | Standard Options -> |
                         | ADC Options      -> |
                         | BERT Generator   -> |
                         +-------------------------------------+
                         | BERT Signal Generator  : ENA        |
                         | 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: xxxx--xxxx--xxxx--xxxx   01/04/2002 12:30:01   H4TU-R      System: OK
```

Figure 31.   H4TU-R BERT Generator Screen

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

Tests done towards the NET must be looped at some point external to the higher circuit. Tests done towards the CPE can either 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. The test payload, for the CPE direction, also passes back and forth over the HDSL4 link to the H4TU-C before it is analyzed for errors.

APPENDIX A - SPECIFICATIONS

Power

Line Voltage	0, -185 Vdc, ±123 Vdc (Voltage is applied across Loop 1 and Loop 2.)
CO Supply	-48 Vdc nominal (-42.5 to -56.5 Vdc)
	(See "Power Consumption", "Maximum Power Dissipation", and "Maximum Current Drain" on page 61.)
Electrical Protection	Secondary surge and power cross-protection on HDSL4 ports. Requires external primary protection.
Fusing	Internal, connected to "FUSE ALARM" output on pin 32

Environmental

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

Physical

Height	5.9 in. (15.0 cm)
Width	1.4 in. (3.5 cm)
Depth	10.0 in. (25.4 cm)
Weight	8.0 oz. (0.23 kg)
Mounting	220 mechanics high-density shelf

HDSL4

Line Rate	784 kbps Overlapped Pulse Amplitude Modulation (OPAM) transmission per HDSL4 standard in ANSI T1.418 Issue 2.
Transmission	Full duplex
CSA Reach	34 kft. maximum using 26 AWG wire: 12kft. (span 1), 11 kft. (span 2), 11 kft. (span 3)
Media	One non-loaded, copper, two-wire cable pair
Output	+14.1 dBm ±0.5 dBm at 135Ω
Line Impedance	135 Ω
Maximum Insertion Loss	Span 1 = 47 dB at 196 kHz Span 2 and Span 3 = 43 dB at 196 kHz
Maximum Loop Attenuation	Span 1 = 31 dB Span 2 and Span 3 = 29 dB
Start-up Time	30 sec. (typical), 1 min. (maximum) per span

DSX-1

Line Impedance	100 Ω
Line Rate	1.544 Mbps ±200 bps
Line Format	Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS)
Frame Format	Extended SuperFrame (ESF), SuperFrame (SF), or Unframed (UNFR)
Pulse Output	6 $V^{pk\text{-}pk}$ pre-equalized for 0 to 655 feet of ABAM cable
Input Level	+1.5 to -7.5 dB DSX

System

One-way DS1 Delay	<700 µs
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 H4TU-C are its maximum power consumption, its maximum power dissipation and its maximum current drain.

Table 20 describes line-powered and locally powered (remote) circuits on the maximum reach condition (34 kft.) using 26 AWG wire.

Table 20. H4TU-C Power Parameters

Number of Doublers	Remote Power Source	-48 Vdc Power Consumption (Watts)		Heat Dissipation (Watts)		-42.5 Vdc Current (mA)	
		Typical	Maximum	Typical	Maximum	Typical	Maximum
None	Locally powered	7.6	8.4	5.9	6.4	179	197
None	Line-powered	11.0	12.1	6.2	6.8	259	285
1	Locally powered	14.6	16.1	6.6	7.2	344	378
1	Line-powered	20.0	22.0	7.1	7.8	471	518
2	Locally powered	26.7	29.4	8.4	9.2	628	691
2	Line-powered	32.9	36.2	9.3	10.3	774	852

MAXIMUM POWER DISSIPATION

The maximum power dissipation measures the power that is converted into heat that builds up within the unit. It 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 21 on page 61 to determine the maximum number of H4TU-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 H4TU-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 H4TU-C consumes or draws from the shelf power source. This parameter is needed when the H4TU-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 20 on page 60 to perform this analysis.

MAXIMUM CURRENT DRAIN

The maximum current drain is the maximum current drawn from the shelf power supply when its at its minimum voltage (-42.5 Vdc). This determines the shelf fusing requirements. Use the -42.5 Vdc current data in Table 20 on page 60 to determine the shelf fusing requirements for your particular H4TU-C applications.

LOOP ATTENUATION, INSERTION LOSS, AND REACH

For Span 1, each loop has no more than 47 dB of insertion loss at 196 kHz, with driving and terminating impedances of 135Ω, as shown in Table 21 below. This is equivalent to no more than 34 dB loop attenuation.

For Span 2 and Span 3, each loop has no more than 43 dB of insertion loss at 196 kHz, with driving and terminating impedances of 135Ω. This is equivalent to no more than 31 dB loop attenuation.

Table 21.   HDSL4 Reach Chart

Cable Gauge	Insertion Loss [a] at 196 kHz (dB/kft)	Loop Attenuation (dB/kft)	Maximum Reach (kft) Span 1	Maximum Reach (kft) Span 2 and Span 3	Ω per kft
26/0.4 mm	3.88	2.8	12	11.0	83
24/0.51 mm	2.84	2.0	16	15.0	52
22/0.61 mm	2.18	1.6	21	20.6	32
19/0.91 mm	1.54	1.1	29	27.8	16

(a) Insertion Loss = 1.38 times loop attenuation

H4TU-C-231 LIST 1 CARD-EDGE CONNECTOR

Figure 32 shows the card-edge connectors on the H4TU-C-231 List 1. Active pins are highlighted in black.
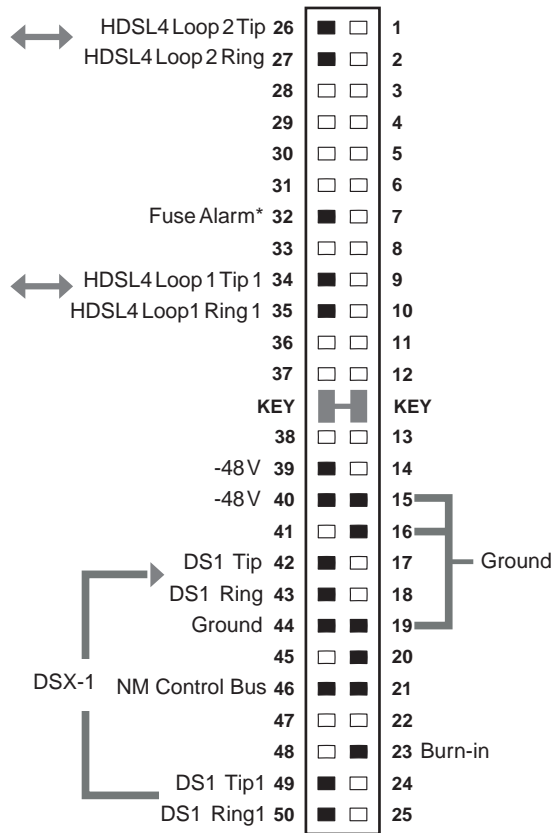
* Fuse alarm is normally floating and at -48V when activated.

Figure 32.   *H4TU-C-231 List 1 Card-Edge Connector*

Network Management Control Bus

The H4TU-C provides a Network Management Control Bus on pin 46 of the card-edge connector. This allows the various ADC Management System protocols to manage the H4TU-C through the HMU-319 management unit. Whenever the H4TU-C is under management, the MNGD message displays periodically on the front-panel display.

> **Some H4TU-C-231 List 1 features are affected when it is under management. Consult the management unit practice for further information (see "Appendix D - Product Support" on page 67).**

Fuse Alarm

Pin 32 on the card-edge connector is a fuse alarm that is driven to -48 Vdc through a diode whenever the onboard fuse opens.

CRAFT PORT

Figure 33 shows the pinout for the craft port connector and its connection to a DB-9 or DB-25 connector on a maintenance terminal.
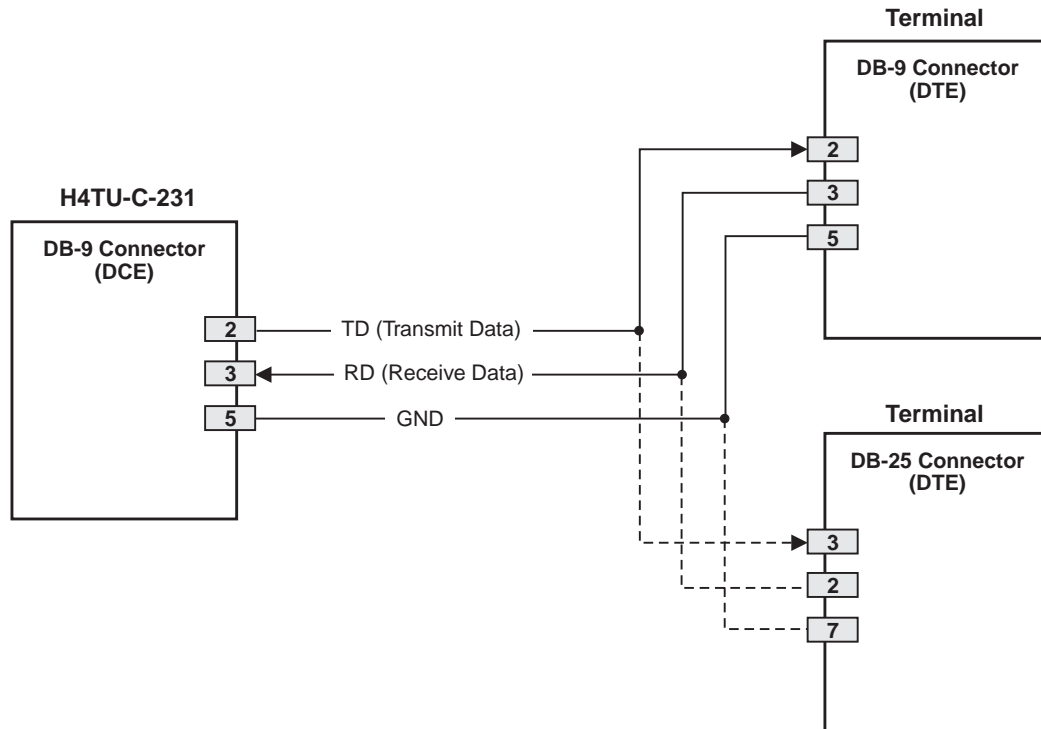
Figure 33.   RS-232 Craft Port Pinouts

APPENDIX B - FUNCTIONAL OPERATION

HDSL4 technology provides full-duplex services at standard T1 rates over two pairs of copper wire between an H4TU-C, H4Ds (if necessary), and an H4TU-R which comprise one ADC system. ADC systems use Overlapped Pulse Amplitude Modulation Transmission (OPAM) transceiver systems to establish two, full-duplex, 784 kbps data channels between the H4TU-C-231 and a remotely located H4TU-R. This provides a total capacity of 1.568 Mbps between the two units.

A block diagram of the H4TU-C-231 is shown in Figure 34. The H4TU-C-231 receives a 1.544 Mbps DSX-1 data stream from the DSX-1 digital cross-connect interface. The H4TU-C contains a DS1 frame synchronizer controlled by an 8-bit microprocessor that determines the type of framing on the DS1 stream and synchronizes to it. The H4TU-C recognizes SuperFrame (SF) or Extended SuperFrame (ESF) framing. When the data is unframed, the H4TU-C arbitrarily defines a frame bit.
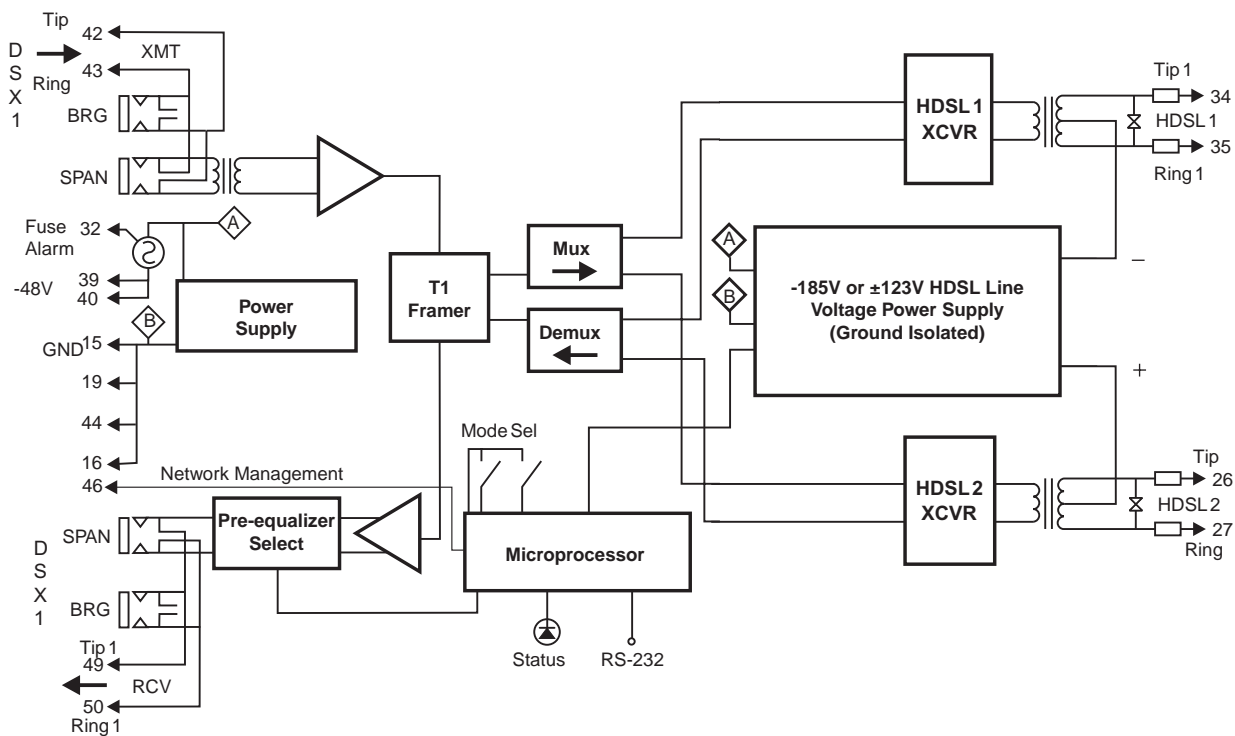

Figure 34. *H4TU-C-231 List 1 Block Diagram*

TIMING

The low-loop wander (0.5 UI max) of an H4TU-C, when used with compatible doublers and 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 DETECT

The H4TU-C has a Ground Fault Detection (GFD) circuit which detects a ground or a resistive path to ground on any wire of the HDSL4 loop. This makes the product compliant with the Class A2 requirements of GR-1089.

SPECTRUM ISSUES

The asymmetric 776 kbps spectrum, defined in ANSI T1.418 Issue 2, allows the HDSL4 product to be spectrally compatible with ADSL services in adjacent pairs in the same binding groups for all non-doubler applications. A combination of asymmetric and symmetric spectrums is used for ADSL compatibility in doubler applications.

APPENDIX C - COMPATIBILITY

The HDSL4 system uses HDSL4 transmission technology as recommended by ANSI committee in compliance with the August 1999 T1-E1.4/99-006R5 HDSL4 standards.

The H4TU-C-231 List 1 is compatible with the following DS1 repeater shelves and associated equipment:

- ADC HCS-417 (23-inch shelf)
- ADC HCS-418 (19-inch shelf)
- ADC HCS-402 (2-slot))
- AT&T 220 Office Repeater Bay (ORB)
- AT&T Small Cross-Section Shelf (SXSS)
- Kentrox 220
- Wescom® 342-30

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	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration 800.366.3891	• 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
Technical Assistance Center 800.366.3891 Email: wsd_support@adc.com	• Technical Information • System/Network Configuration • Product Specification and Application • Training (product-specific) • Installation and Operation Assistance • Troubleshooting and Repair/Field Assistance
Online Technical Support	• www.adc.com/Knowledge_Base/index.jsp
Online Technical Publications	• www.adc.com/documentationlibrary/technicalpublications/
Product Return Department 800.366.3891 Email: rma@adc.com	• ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products.
All telephone numbers with an 800 prefix are tool-free in the USA and Canada.	

APPENDIX E - ABBREVIATIONS

A

ACO: Alarm Cutoff
ADSL: Asymmetric Digital Subscriber Line
AIS: Alarm Indication Signal
ALMP: Alarm Pattern
AMI: Alternate Mark Inversion
AOR: Addressable Office Repeater
ARM: Armed
ASCII: American Standard Code for Information Interchange
AWG: American Wire Gauge

B

B8ZS: Bipolar with 8-Zero Substitution
BER: Bit Error Rate
BPVT: Bipolar Violation Transparency
BRG: Bridge

C

CEV: Controlled Environmental Vault
CI: Customer Installation
CLEI: Common Language Equipment Identifier
CLOC: Customer Local Loopback
CO: Central Office
COLB: Central Office Loopback
CPE: Customer Premises Equipment
CREM: Customer Remote Loopback
CSA: Carrier Service Area
CV: Code Violation
CV-L: Code Violation - Line

D

DBER: DS1 Bit Error Rate Threshold
DDS: Digital Data Service
DL: Data Link
DLC: Digital Loop Carrier
DS1: Digital Signal, level 1
DSX-1: Digital Signal Cross-Connect, level 1

E

ECI: Equipment Catalog Item
EQL: Equalization
ESD: Electrostatic Discharge
ESF: Extended SuperFrame
ES-L: Errored Seconds - Line
ES-P: Errored Seconds - Path

F

FE: Far End
FRMG: Framing

H

H4TU-C: HDSL4 Line Unit
H4TU-R: HDSL4 Remote Unit
HBER: HDSL4 Block Error Rate
HCS: HiGain Card Shelf
HG: HDSL Generic
HMU: HiGain Management Unit

I

ID: Identification
IN: Transmit
INSL: Insertion Loss
IOR: Intelligent Office Repeater

L

LA: Loop Attenuation
LAIS: Local Alarm Indication Signal
LATT: Loop Attenuation
LBTO: Loopback Timeout
LED: Light Emitting Diode
LLOS: Line (Unit) Loss of Signal
LOF: Loss of Frame
LOSW: Loss of Sync Word
LPDN: Loopdown
LPF: Line Power Feed
LRAI: Line RAI

M

M: HDSL4 Margin
MAL: Margin Alarm
MARG: Margin
MNGD: Managed
MSEC: Monitored Seconds

N

NE: Near End
NI: Network Interface
NID: Network Interface Device
NLBP: Network Loopback Pattern
NLOC: Network Local Loopback
NMA: Network Management and Administration
NREM: Network Remote Loopback

O

OPAM: Overlapped Pulse Amplitude Modulation
OUT: Receive

P

PBOC: Power Back Off - Customer
PBON: Power Back Off - Network
PL: Payload
POTS: Plain Old Telephone Service
PRM: Performance Report Messaging
PRM-FE: Performance Report Messaging - Far End
PRM-NE: Performance Report Messaging - Near End
PWRF: Line Power Feed

R

RAI: Remote Alarm Indication
RAI-CI: Remote Alarm Indication - Customer Installation
RAIS: Remote Alarm Indication Signal
RDA: Remote Disconnect Alarm
RLOS: Remote Loss of Signal
RRAI: Remote RAI
RTPV: Remote Provisioning
RULB: Remote Unit Loopback

S

S/N: Signal- to-Noise Ratio
SDSL: Symmetrical Digital Subscriber Line
SES: Severely Errored Seconds
SES-L: Severely Errored Seconds - Line
SES-P: Severely Errored Seconds - Path
SF: SuperFrame
SMJK: SmartJack

T

TLOS: Transmit Loss of Signal

U

UAS: Unavailable Seconds
UAS-L: Unavailable Seconds - Line
UAS-P: Unavailable Seconds - Path
UNFR: Unframed

CERTIFICATION AND WARRANTY

FCC CLASS A COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

LIMITED WARRANTY

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

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

The transportation charges for shipment of returned products to ADC will be prepaid by the Buyer. ADC will pay transportation charges for shipment of replacement products to Buyer, unless no trouble is found (NTF), in which case the Buyer will pay transportation charges.

ADC may use reconditioned parts for such repair or replacement. This warranty *does not* apply to any product which has been repaired, worked upon, or altered by persons not authorized by ADC or in ADC's sole judgment has been subjected to misuse, accident, fire or other casualty, or operation beyond its design range.

Repaired products have a 90-day warranty, or until the end of the original warranty period—whichever period is greater.

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

MODIFICATIONS

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

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

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

For technical assistance, refer to "Appendix D - Product Support" on page 67.

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