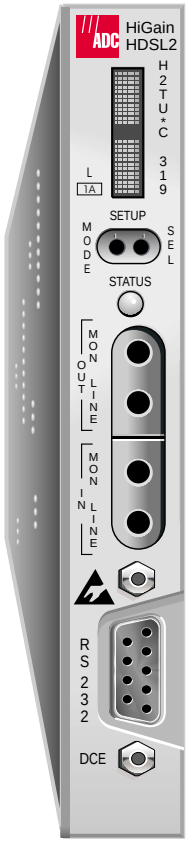
HiGain

TECHNICAL PRACTICE



H2TU-C-319 List 1A Line Unit
Product Catalog: LTPH-TP-1066-02
Part Number: 150-2400-11

Revision History of This Practice

Issue	Release Date	Revisions Made
1	August 15, 2000	Initial release.
2	April 9, 2001	Updated HDSL2 loop pinout from Loop 1 to Loop 2.

USING THIS TECHNICAL PRACTICE

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 61.

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 "Returns" on page 59. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The H2TU-C-319 List 1A (H2TU-C) line unit is the Central Office (CO) side of a T1 transmission system. The HiGain HDSL2 product family is fully compliant with the HDSL2 standard ANSI T1.418. Providing full-rate T1 access using a single copper pair, HDSL2 is a cost-effective solution that offers an open architecture. The open architecture inherent in HDSL2 guarantees interoperability allowing simple and economic accommodation of network growth.

HiGain HDSL2 products provide 1.552 Mbps transmission on one unconditioned copper pair over the full Carrier Service Area (CSA) range. The CSA includes loops up to 12,000 feet of 24 AWG wire or 9,000 feet of 26 AWG wire, including bridged taps.

FEATURES

Features specific to the List 1A family of HDSL2 modules include:

The H2TU-C-319 line unit is the Central Office (CO) side of a T1 transmission system.

- HDSL2 transmission features
  - Lightning and power cross-protection on HDSL2 interfaces
  - Full duplex HDSL2 transmission on one pair at 1.552 Mbps
  - Ultra-low wander (Stratum 1 compliant)
  - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)
- Front-Panel provisioning features
  - Four-character status display
  - DS1 splitting and monitor access
  - Status Light Emitting Diodes (LEDs)
  - MODE and SEL system option buttons
  - RS-232 craft port for connection to a maintenance terminal
- HDSL2 maintenance screens for inventory, provisioning, and troubleshooting
  - DS1 and HDSL2 performance monitoring
  - Non-volatile alarm histories
  - Payload (PL) and HiGain (HG) loopback source identification
  - Margin Alarm (MAL) threshold
- Configuration options
  - Selectable DS1 pre-equalizer
  - Bipolar Violation Transparency (BPVT)
  - Bit Error Rate (BER) alarm
  - Loss of Signal/Alarm Indication Signal (LOS/AIS) payload alarm
  - Remote provisioning
  - Selectable loopback activation codes
  - 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.

COMPATIBILITY

The H2TU-C is designed to mount in 3192 mechanics shelves. For a list of compatible shelves, see "Appendix C - Compatibility" on page 58.

APPLICATIONS

HiGain HDSL2 systems provide a cost-effective, easy-to-deploy method for delivering T1 High Capacity Digital Service (HCDS) over a single copper pair. HiGain HDSL2 systems support a multitude of network connections and system models, as shown in Figure 1 on page 3.

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

Each loop has no more than 35 dB of loss at 196 kHz with driving and terminating impedances of 135 Ω. In general, HiGain HDSL2 systems:

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

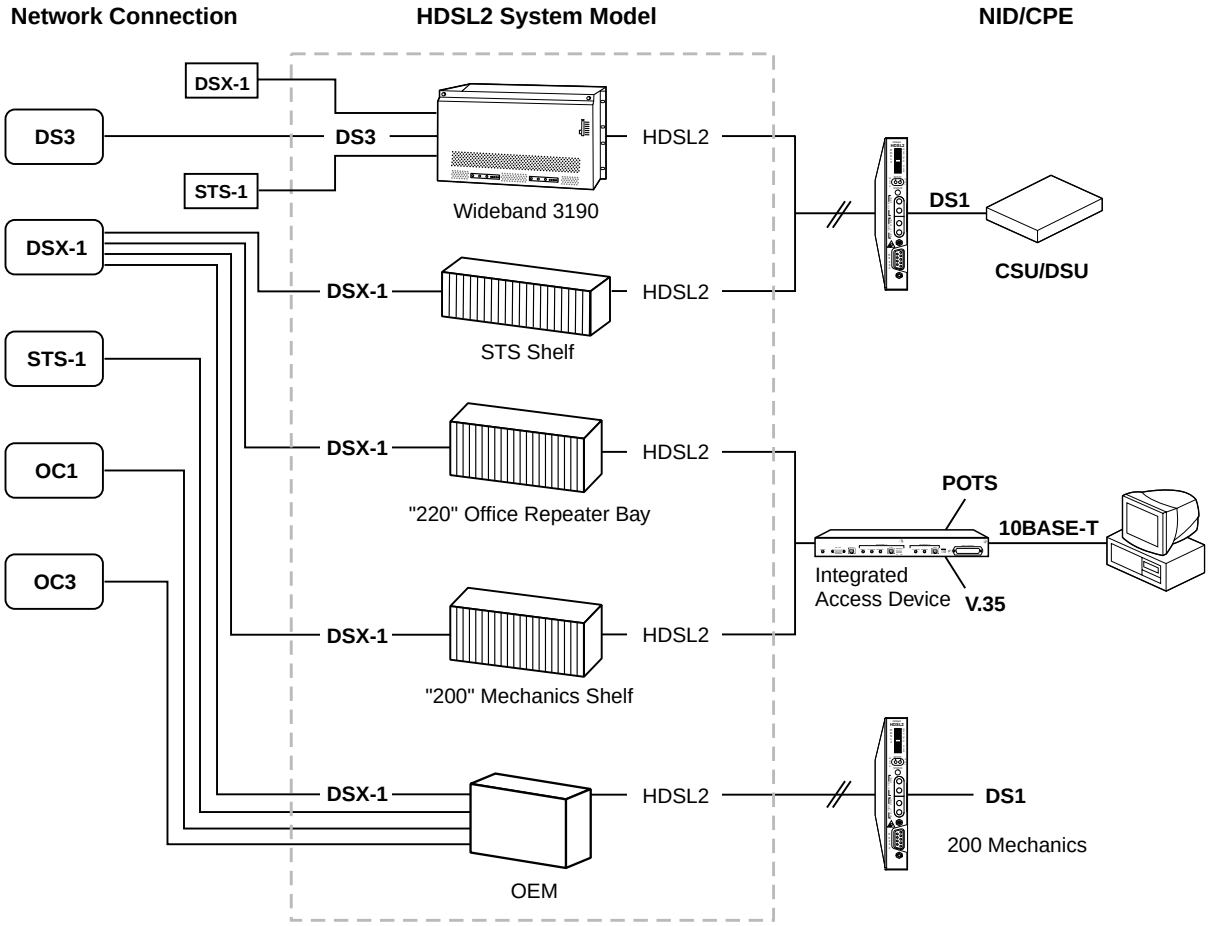


Figure 1. *HDSL2 System Model*

FRONT PANEL

Figure 2 shows the H2TU-C-319 List 1A front panel. Table 1 on page 5 describes the front-panel components. For pinout diagrams of the H2TU-C-319 List 1A card-edge connector and craft port, refer to "Appendix A - Specifications" on page 52.

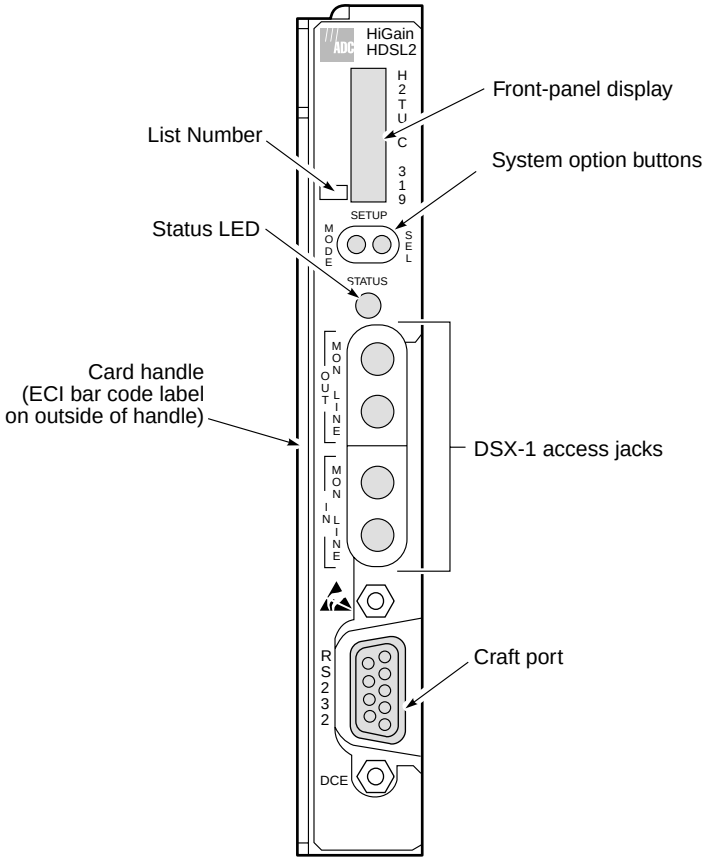


Figure 2. *H2TU-C-319 List 1A Front Panel*

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 pushbuttons reactivates the display and restarts the 5-minute timer. Refer to Table 2 on page 6 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 HiGain loopbacks and test states as well as to display DSX-1 line parameters and line unit identity.
Status LED	The status LED can report the following conditions:
Off	Line power is off.
Green	Normal operation.
Flashing green	HDSL2 acquisition.
Red	Fuse alarm.
Flashing red	System alarm.
Yellow	An H2TU-C Customer Remote Loopback (CREM) or a Network Local Loopback (NLOC) is in effect.
Flashing yellow	H2TU-C is in an Armed state.
Alternating green and red	Host alarm reporting disabled.
Alternating yellow and red	Host alarm reporting disabled and active system alarm.
DSX-1 access jacks	
MON	Provides non-intrusive monitor jack access to (IN) and from (OUT) the HDSL2 span at the MUX DSX-1 interface.
LINE	Provides splitting jack access to (IN) and from (OUT) the HDSL2 span at the MUX 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.
ECI bar code label	Provides the Equipment Catalog Item (ECI) bar code number.
List number	Identifies the list number of the H2TU-C.

(a) When the H2TU-C is managed by a HiGain Management Unit (HMU), and the HMU user disables the H2TU-C alarms, the Status LED will flash yellow/green when no alarms are present and yellow/red when alarms are present. The HMU will not report any H2TU-C alarms.

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

Table 2. *Front-Panel Display Messages*

Message	Full Name	Description
ALARM MESSAGES		
ACO	Alarm Cut Off	A system alarm has occurred, and has been retired to an ACO condition by pressing the SEL pushbutton on the H2TU-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.
HBER	HDSL2 Block Error Rate	A system HDSL2 Block Error Rate alarm is in effect.
LA	Loop Attenuation	Indicates that the attenuation on the HDSL2 loop has exceeded the maximum threshold value.
LAIS	Line Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received or transmitted at the H2TU-C DS1 input or output ports.
LLOS	Local Loss of Signal	Indicates that no signal is detected at the DSX-1 input to the H2TU-C. Causes a system alarm.
LOSW	Loss of Sync Word	Indicates that the HDSL2 loop has lost synchronization.
MAL	Margin Alarm	The margin on HDSL2 loop has dropped below the threshold (0 to 15 dB) as set by the operator.
PWR FEED GND	Power Feed Ground	The HDSL2 loop is grounded.
PWR FEED OPEN	Power Feed Open	Indicates a line power open condition.
PWR FEED SHRT	Power Feed Short	Indicates a short between the Tip and Ring of the HDSL2 pair.
PRMF	Performance Report Messaging - Far End	H2TU-R PRM-FE BER threshold has been exceeded.
PRMN	Performance Report Messaging - Near End	H2TU-R PRM-NE BER threshold has been exceeded.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received or transmitted at the H2TU-R DS1 input or output ports.
RLOS	Remote Loss of Signal	Indicates that no signal is detected at the DS1 input to the H2TU-R. Causes a system alarm.
RRAI	Remote RAI—Remote Alarm Indication at the H2TU-R (Net signal has errors.)	Indicates an RAI alarm (yellow LED) from the CPE with errors from the line unit or network.
SPN*n*	Span Number	Accompanies the LOSW alarm and identifies the span where the LOSW alarm occurred.
TRCI	Transmit RAI-CI—TX RAI-CI Indication - Customer Installation at the H2TU-R (Net signal does not have errors.)	Upon reception of an RAI (yellow LED) from the CPE, the H2TU-R sends RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or Loss of Frame [LOF]), then the RAI is automatically passed on to the network.
TUC	Transmission Unit Central Office	Accompanies the HBER, MAL, and LA alarm and indicates that the alarm has occurred at the H2TU-R remote unit.
TUR	Transmission Unit Remote End	Accompanies the HBER, MAL, and LA alarm and indicates that the alarm has occurred at the H2TU-R remote unit.

Continued

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

Message	Full Name	Description
LOOPBACK MESSAGES		
CLOC	Customer Local Loopback	Signal from customer is looped back to the customer at the H2TU-R.
CREM	Customer Remote Loopback	Signal from customer is looped back to the customer at H2TU-C.
NLOC	Network Local Loopback	DSX-1 signal is looped back to the network at the H2TU-C.
NREM	Network Remote Loopback	DSX-1 signal is looped back to the network at the H2TU-R.
SMJK	Remote SmartJack Loopback	DSX-1 signal is looped back to the network at the H2TU-R SmartJack module.
DIAGNOSTIC MESSAGES		
A = *xx*	Maximum Loop Attenuation	The Attenuation (A) message appears followed by *xx*, where *xx* is the loop attenuation of the longest (maximum loss) span, measured in dB.
ACQ	Acquisition	The multiplexers of the H2TU-C and H2TU-R (or the H2TU-C and first regenerator) are trying to establish synchronization over the HDSL2 loop of Span 1.
A*n*L	Acquisition *n* Loop	The multiplexers of the two devices on Span *n* are trying to establish synchronization with each other, where *n* is the number of the span.
ARM	HiGain System Armed	Armed to respond to Intelligent Repeater Loop (ILR) codes.
BAD RT?	No Response from H2TU-R	The H2TU-C receives no response from the H2TU-R and all HDSL2 loop conditions are normal. Therefore, the integrity of the H2TU-R or the HDSL2 loop is questionable.
FERR	Framing Bit Error Occurred	Framing bit error occurred at H2TU-C DSX-1 input.
FLDL	Flash Download	Flash download of firmware upgrades. Contact Customer Service for upgrade procedures (see "Appendix D - Product Support" on page 59).
HES	HDSL2 CRC Error	H2TU-C HDSL2 Loop Cyclical Redundancy Check (CRC) error.
LBPV	Local Bipolar Violation	A bipolar violation has been received at the DSX-1 input to the H2TU-C.
M=xx	HDSL2 Loop Margin	Indicates the power of the received HDSL2 signal relative to noise (S/N with respect to 21.5 dB). Any value of 6 dB or greater is adequate for reliable system operation.
MNGD	Managed	The H2TU-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	HDSL2 span power has been turned off by setting the PWFD option to off, or HDSL2 span power has been turned off by use of the A2LB Intelligent Office Repeater (IOR) Power Down code.
PWR FEED ON	Power Feed On	Indicates that the HDSL2 loop is not grounded or shorted.
SIG	Signaling	The transceivers of the H2TU-C and H2TU-R (or the H2TU-C and first regenerator) are trying to establish contact with each other over the HDSL2 loop of Span 1.
S*n*L	Signal *n* Loop	The transceivers of the two devices on Span *n* are trying to establish contact with each other, where *n* is the span number.

Continued

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

Message	Full Name	Description
SYSTEM INFORMATION MESSAGES [(a)]		
CODE *xxxx*	Line Code: AMI or B8ZS	The DS1 line code setting: Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS).
FRM *xxxx*	Frame: SF, ESF, or UNFR	Defines the type of frame pattern being received from the DSX-1: SuperFrame (SF), Extended SuperFrame (ESF), or Unframed (UNFR).
LATT *xx*	Loop Attenuation	The current loop attenuation threshold setting measured in decibels.
LIST *xx*	H2TU-C List Number	The list number of the H2TU-C.
MARG *xx*	Margin	The current margin threshold setting measured in decibels.
VER *x.xx*	H2TU-C Software Version Number	The software version number (x.xx).

(a) System information messages are displayed in Scroll Mode. To scroll through the messages, press the MODE pushbutton for 3 or more seconds.

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.

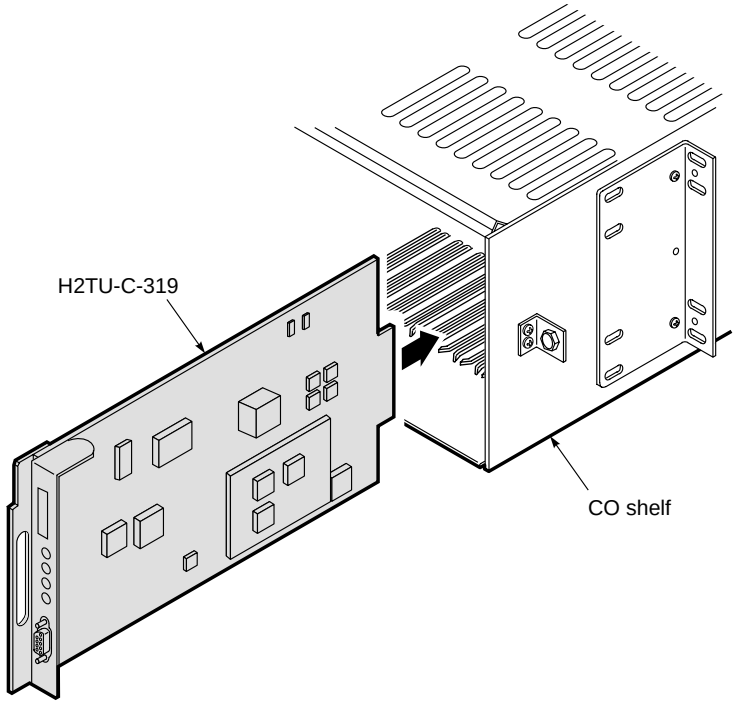


Figure 3. *Installing the H2TU-C-319 List 1A into a Shelf*

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

To comply with the intrabuilding wiring requirements of GR-1089 CORE, Section 4.5.9, the shields of the ABAM-type cables that connect the H2TU-C DSX-1 output ports to the cross-connect panel must be grounded at both ends.

1 Align the H2TU-C with the enclosure slot guides, then push the unit in until it touches the backplane card-edge connector.

2 Place your thumbs on the H2TU-C front panel and push the H2TU-C firmly into the slot guides until the unit clicks into the backplane and is properly seated.

VERIFICATION

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

- Status LED
- Status messages reported by the front-panel display (Table 2 on page 6 lists the status messages).

Verification without an H2TU-R Remote Unit

If there is no H2TU-R remote unit installed:

1 Verify that the H2TU-C powers up. The front-panel display illuminates and reports status messages. (See Table 2 on page 6 lists the messages.)

2 Verify that the H2TU-C attempts to communicate with a remote unit (status LED flashes red). Even if a remote unit is not present, the following events should occur:

- The front-panel display reports various four-character status messages.
- The H2TU-C again attempts communication with a remote unit until a remote unit is detected.

Verification with an H2TU-R Remote Unit

If an H2TU-R remote unit has been installed:

1 Verify that the H2TU-C powers up. (The front-panel display illuminates and reports various status messages.)

2 Verify that the H2TU-C attempts to communicate with the remote unit (status LED flashes red). One of the following occurs:

- If the remote unit is successfully identified and the HDSL2 loop synchronizes, the H2TU-C status LED lights a steady green. The H2TU-C reports normal margin messages on the front-panel display.
- If the remote unit is not identified, the H2TU-C reports four-character status messages. The H2TU-C attempts communication again and reports four-character status messages. The H2TU-C repeats this cycle until a remote unit is detected.

3 Verify that a valid DS1 signal has been applied to the H2TU-C and the H2TU-R.

- If no DS1 signal is being applied to either the H2TU-C or the H2TU-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 H2TU-C and H2TU-R, then DS1 alarm indications should be absent and the status LED should be a steady green.

PROVISIONING

There are two provisioning methods:

- Use the MODE and SEL pushbuttons on the front panel of the H2TU-C to:
  - Set system options
  - Reset the H2TU-C to its factory default settings for system options
  - Display system option settings (scroll mode)
  - Select system loopbacks
  - Select MTA test mode
- Use a maintenance terminal, such as an ASCII terminal or a PC running terminal emulation software connected to the H2TU-C craft port or an HMU craft port, to access the maintenance screens. Figure 4 on page 14 shows the maintenance screen. This provides full access to all H2TU-C status, history, inventory, and provisioning screens.

No dip switches or jumpers are required to provision the H2TU-C 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 H2TU-C is unplugged.

USING THE MODE AND SEL PUSHBUTTONS

Setting Options through MODE and SEL

To provision the H2TU-C through the MODE and SEL pushbuttons on the front panel:

1 Press the MODE pushbutton 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 pushbutton to step through all possible settings of the selected parameter.

3 After the desired setting has been selected, press the MODE pushbutton. This updates the current 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 pushbutton 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 pushbutton. A `CONF YES` message displays, and the display returns to its normal mode after saving the new changes.

Resetting to Factory Default Values

All user options for the H2TU-C, described in Table 5 on page 19, 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 until the `DFLT NO` message appears.

The message changes to `DFLT YES` indicating the factory default values are now in effect, and then 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 H2TU-C displays the following parameters:

- H2TU-C software version number
- H2TU-C 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 H2TU-C front panel. This executes an ACO and returns the H2TU-C to its non-alarm state. For more information, see “Retiring System Alarms” on page 41.

Loopback Modes

See “Loopback Operation” on page 43 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 H2TU-C 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, as shown in Figure 2 on page 4, on the 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 that emulates 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 HiGain HDSL2 logon screen.

The Logon Screen

The HiGain HDSL2 maintenance terminal screens allow you to monitor, provision, and troubleshoot an H2TU-C system.

To select a menu from the HiGain HDSL2 logon screen, shown in Figure 4 on page 14, do one of the following:

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

Table 3 summarizes the navigational keys. They are also listed in the onscreen Help menu. Table 4 on page 14 describes the Logon screen menus.

Table 3. *Navigational Keys for the HiGain HDSL2 Maintenance Terminal Screens*

Key [a]	Function
SPACEBAR	Cycle through selections.
ENTER	Activate the current setting or choice, or display a menu.
ESC	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 the 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, see the Help menu for instructions.

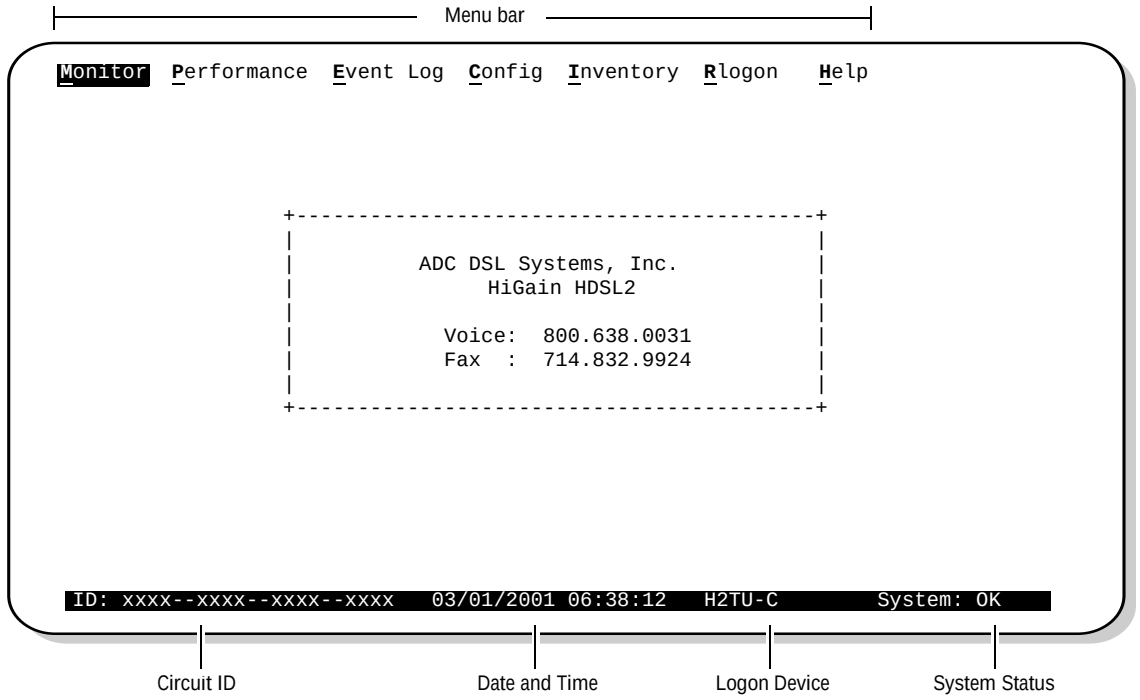


Figure 4. *Logon Screen*

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, 24-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 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, 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.
I	Inventory	Provides product information about the various devices that are in the system and lists circuit and device identifications.
R	Rlogon/Rlogout	Remote logon can be performed from the H2TU-C or H2TU-R. The screen displays "**R**logout" when the H2TU-C or H2TU-R is remotely logged on to the other unit at the end of the circuit. To logoff 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 the remote logon.
H	Help	Provides a glossary of terms used in the maintenance screens, a list of navigational keys, and ADC contact information.

PROVISIONING TASKS

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

- Set date and time (see "Setting Date and Time" on this page).
- Set circuit ID numbers (see "Setting Circuit ID Numbers" on page 16).
- Make any 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 25).

Setting Date and Time

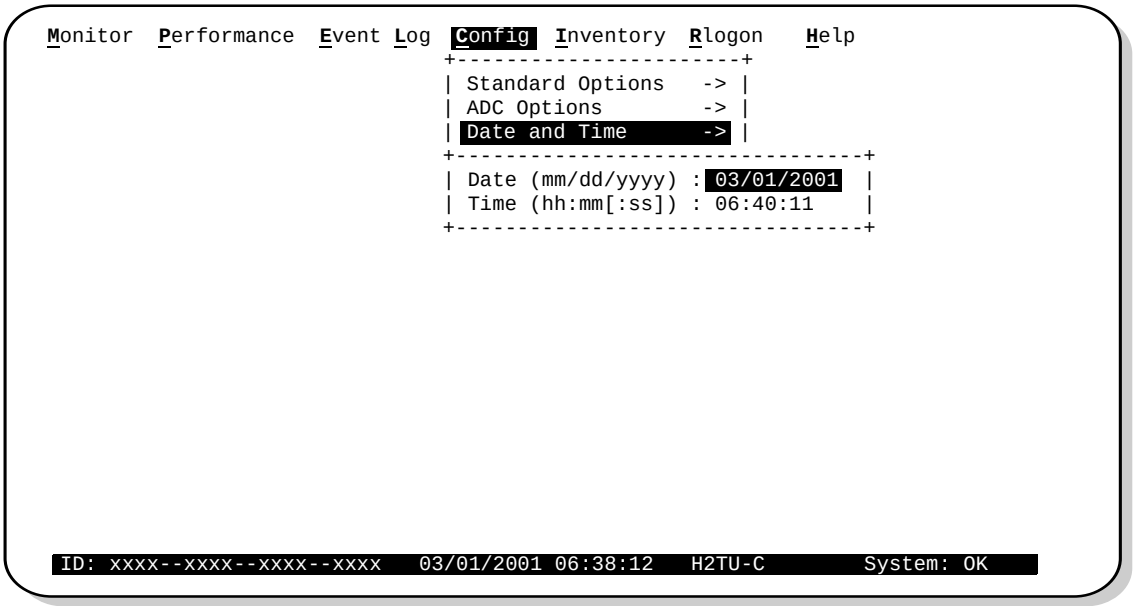


Figure 5. *Config Menu - Date and Time*

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

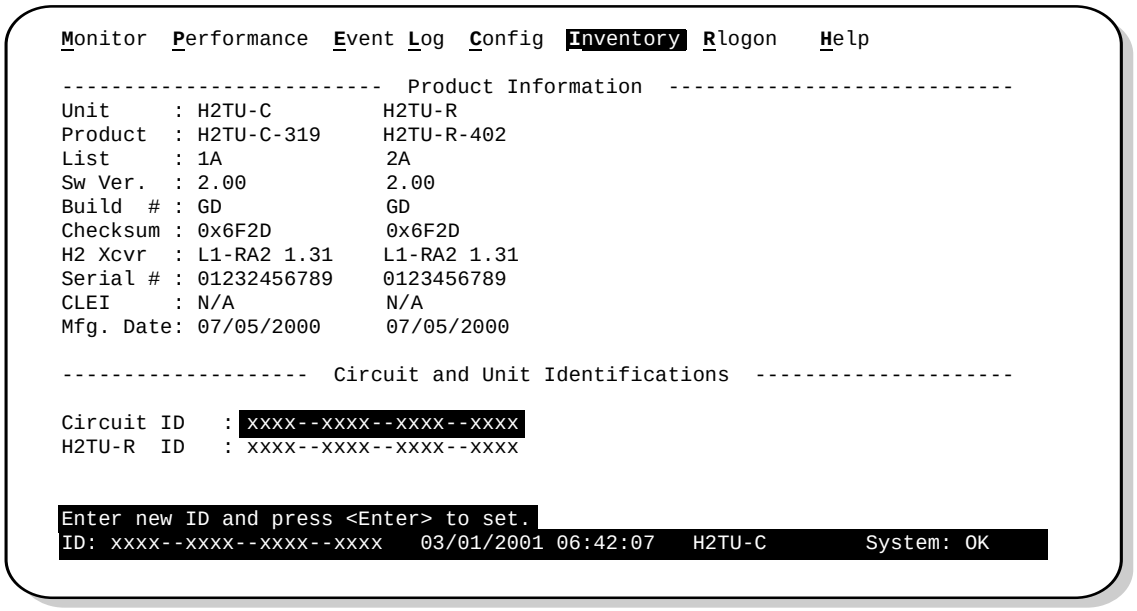


Figure 6. *Inventory Screen*

1 Press **I** to select the Inventory menu.

2 Type the Circuit ID number, then press **ENTER**.

3 Type the ID numbers of all other devices listed in the system, pressing **ENTER** after each entry.

Configuring the System

The Config menu (see Figure 7 below) allows you to make the following changes:

- Standard options (see "Making Changes to Standard and ADC Options" below).
- ADC options (see "Making Changes to Standard and ADC Options" below).
- Date and time (see "Setting Date and Time" on page 15).
- Master clear (see "Clearing the History, Alarm, and Event Log Screens" on page 25).
- Reset to factory default configuration (see "Resetting the H2TU-C" on page 24).

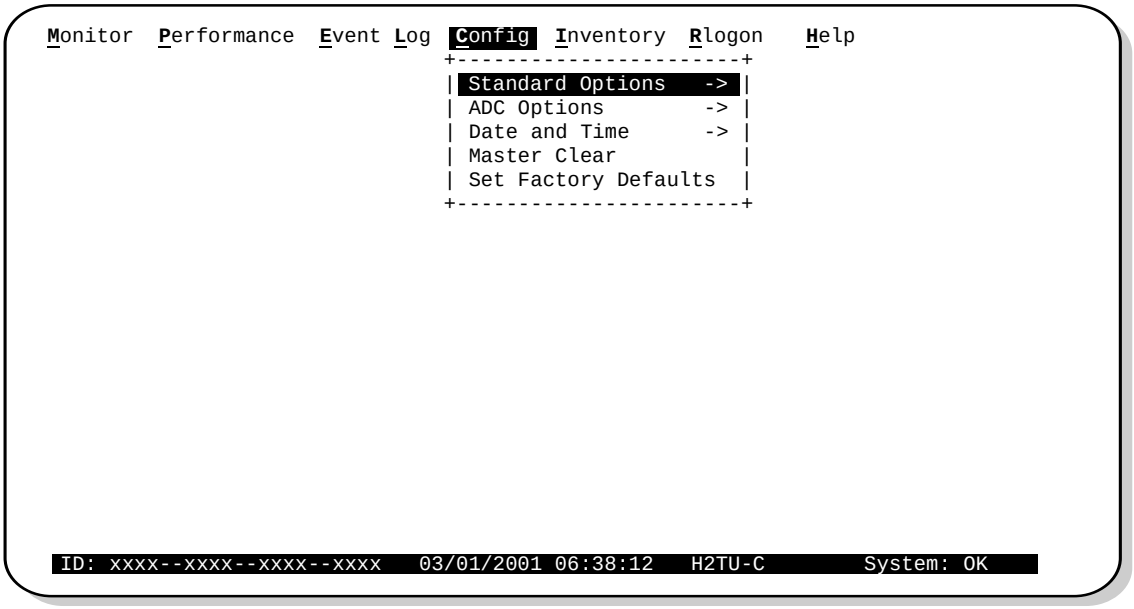


Figure 7. *Config Menu*

Making Changes to Standard and ADC Options

Figure 8 and Figure 9 on page 18 show the Standard and ADC configuration options. Standard options are those supported by HiGain HDSL2 units when connected to units from other vendors. ADC options are an extended set of options that are only available when using HiGain units exclusively. For a description of each option and a list of 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.

The message "May need to change MUX option after changing this option" appears when changing the DS1 Line Coding (DS1) or H2TU-C Equalization (EQL) option in the Standard Options configuration screen. (Applies to HiGain products using multiplexers, such as the Wideband 3190 system.)

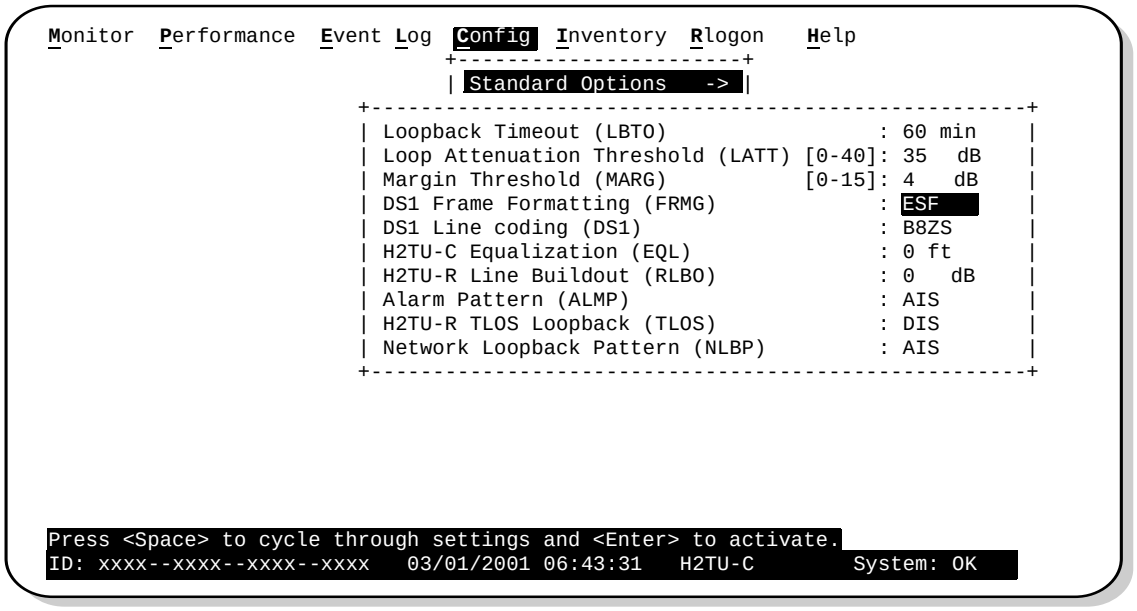


Figure 8. *Config Menu - Standard Options (defaults shown)*

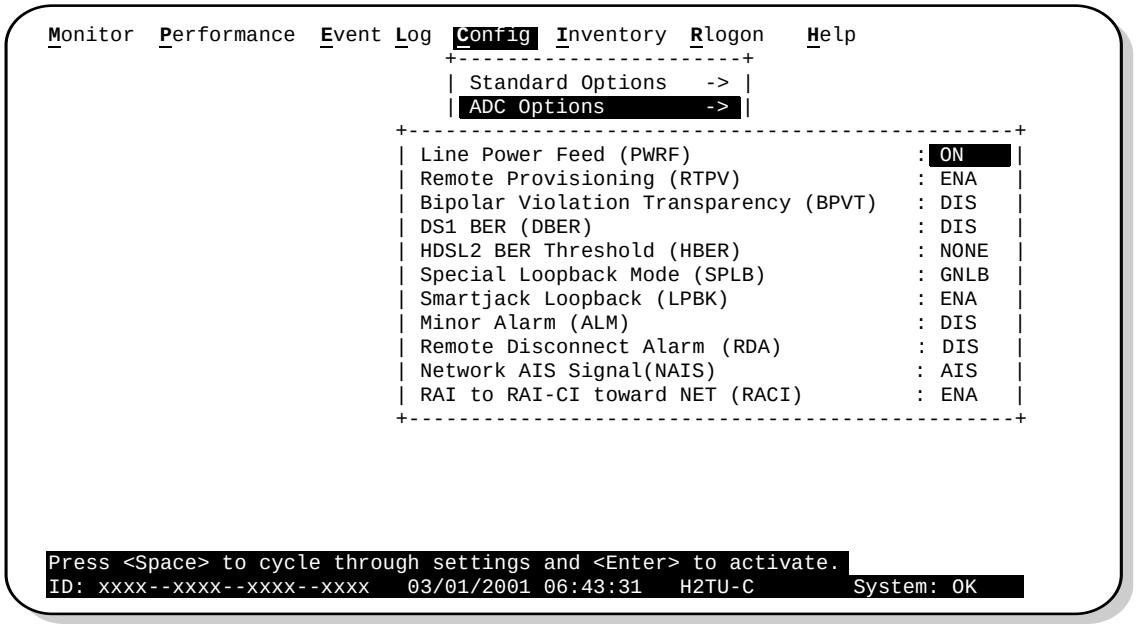


Figure 9. *Config Menu - ADC Options (defaults shown)*

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

Table 5. *H2TU-C-319 List 1A Standard Config Menu Options*

Standard Config Menu Options	Front-Panel Display Code	Selection	Description
Loopback Timeout	LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
		20	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
		60	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
		120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
Loop Attenuation Threshold	LATT	0 through 40 dB	Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold can only be set through the maintenance screens.
		35 dB	Default value. Zero disables the alarm.
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.
		4 dB	Default value.
DS1 Frame Formatting	FRMG	AUTO	Configures the line unit 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 will cause the ES-P and SES-P counters to increment.
		SF	Configures the HiGain HDSL2 system to search for the SF framing pattern at its DS1 input.
		ESF	Configures the HiGain HDSL2 system to search for the ESF framing pattern at its DS1 input.
		UNFR	Configures the same as AUTO except unframed payloads do not cause the ES-P and SES-P counters to increment.
DS1 Line Coding	DS1	AUTO	The H2TU-C and H2TU-R monitor the incoming DS1 bit streams for the B8ZS code. If the H2TU-R detects this code, the H2TU-C enters B8ZS output mode. The H2TU-C reverts back to AMI output mode if no B8ZS codes are received at the H2TU-R input for 5 seconds. Similarly, when the H2TU-C detects the B8ZS code, the H2TU-R enters the B8ZS mode and returns to AMI mode if no B8ZS code is received at the H2TU-C input for 5 seconds.
		B8ZS	Places both the H2TU-C and H2TU-R into their B8ZS modes.
		AMI	Places both the H2TU-C and H2TU-R into their AMI modes.
H2TU-C Equalization See "H2TU-C Equalization (EQL) Option." on page 22.	EQL	**0**	Sets the Equalizer to DSX-1 for 0 to 132 feet.
		133	Sets the Equalizer to DSX-1 for 133 to 265 feet.
		266	Sets the Equalizer to DSX-1 for 266 to 398 feet.
		399	Sets the Equalizer to DSX-1 for 399 to 532 feet.
		533	Sets the Equalizer to DSX-1 for 533 to 655 feet.
H2TU-R Line Buildout	RLBO	**0 dB**	Sets the DS1 RLBO level toward the Customer Interface (CI).
		-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 dB.

Continued

Table 5. *H2TU-C-319 List 1A Standard Config Menu Options (Cont.)*

Standard Config Menu Options	Front-Panel Display Code	Selection	Description
Alarm Pattern	ALMP	**AIS**	Enables the HiGain HDSL2 system to output an AIS payload at its DS1 ports for LOSW and LOS DS1. For priority resolution, see Figure 26 on page 42 for LOS/AIS response priorities.
		LOS	Enables the HiGain HDSL2 system to output an LOS condition at its DS1 ports for LOSW and LOS DS1.
H2TU-R TLOS Loopback	TLOS	ENA	Enables a logic loopback at the H2TU-R when an LOS occurs at its DS1 input, if enabled at the H2TU-R. For priority resolution, see Figure 26 on page 42.
		DIS	Disables TLOS logic loopback.
Network Loopback Pattern	NLBP	**AIS**	Enables the H2TU-R to transmit an AIS towards CI for any network loopback. For priority resolution, see Figure 26 on page 42.
		LOS	Enables the H2TU-R to transmit LOS toward the CI for any network loopback.

Table 6. *H2TU-C-319 List 1A ADC Config Menu Options*

ADC Config Menu Options	Front-Panel Display Code	Selection	Description
Line Power Feed	PWRF	OFF	Disables powering to the HDSL2 pair.
		ON	Keeps the HDSL2 line voltage at nominal -185 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 HDSL2 CRC errors at the DS1 input to be converted into DS1 BPVs at the DS1 output at the distant end. This makes HiGain HDSL2 transparent to BPVs.
		DIS	Disables BPV Transparency.
DS1 BER Threshold See "DS1 BER (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.
HDSL2 BER Threshold See "HDSL2 BER Threshold (HBER) Option" on page 22 and "System Alarm Output Pin" on page 55.	HBER	1E-6	System alarm relay contact closes and the Status LED flashes red when the Block Error Rate (BER) exceeds 10^{-6}.
		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.
Special Loopback Mode	SPLB	**GNLB**	Configures the HiGain HDSL2 system to respond to the generic inband loopback codes.
		A1LB and A2LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Teltrend addressable repeater.
		A3LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
		A4LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom Mod 1 addressable repeater.
		A5LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Teltrend Mod 1 addressable repeater.

Continued

Table 6. *H2TU-C-319 List 1A ADC Config Menu Options (Cont.)*

ADC Config Menu Options	Front-Panel Display Code	Selection	Description
SmartJack Loopback	LPBK	**ENA**	Enables the HiGain HDSL2 system to recognize all inband SmartJack loopback commands.
		DIS	Configures the HiGain HDSL2 system to ignore all inband SmartJack loopback commands.
Minor Alarm	ALM	ENA	Enables the generation of the output alarm on pin H when a system alarm condition occurs.
		DIS	Disables the generation of the output alarm on pin H when a system alarm condition occurs.
Remote Disconnect Alarm	RDA	ENA	Enables a remote DS1 LOS condition at the input to the H2TU-R to generate an LOS alarm. AIS or LOS (depending on ALMP) is sent towards the network.
		DIS	Prevents a remote DS1 LOS condition at the input to the H2TU-R from causing an LOS alarm. The front-panel Status LED still flashes red and the ALRM RLOS message is displayed, but the alarm output on pin H (-48 V) is not asserted and AIS is sent towards the network from the H2TU-C. When the H2TU-C is managed by a HiGain Management Unit (HMU), and RDA is disabled, only HDSL2 alarms will be reported by the HMU.
Network AIS Signal	NAIS	CI	If ALMP is set to AIS, this option specifies which pattern is sent to the network when a remote LOS or AIS occurs. When configured for CI, an AIS-CI pattern is sent to the network.
		AIS	When configured for AIS, an AIS pattern is sent to the network.
RAI to RAI-CI toward NET See "RAI to RACI-CI toward NET (RACI) Option" on page 23.	RACI	**ENA**	Allows a DS1 SF-RAI (yellow alarm) signal received by the H2TU-R to be converted to an SF-RAI-CI signal toward the network.
		DIS	Prevents conversion of the DS1 SF-RAI to SF RAI-CI. It does not prevent RAI-CI conversions for ESF payloads or SF RAI-CI to ESF RAI-CI from occurring when FCON is active.

HDSL2 BER Threshold (HBER) Option. The HBER option permits the monitoring of loop integrity and reporting of alarms when excessive errors are detected. The PM primitive used for this purpose is the CRC checksum performed on the HDSL2 frame for both directions of transmission. It is, therefore, called a block error rate rather than the bit error rate associated with the DS1 interface. The CRC errors and counts are displayed on the monitor screen for both the H2TU-C and H2TU-R. The HBER option allows an alarm to be generated if the total number of CRCs at either the H2TU-C or H2TU-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 HiGain system. The Auto mode, which can adapt to either AMI or B8ZS, should only be used in applications that require it (such as when HiGain 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 H2TU-C and the H2TU-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.

H2TU-C Equalization (EQL) Option. Equalization is the configuration of system transmission characteristics within specified limits. An adaptive equalizer inserts a frequency-shaped loss that corresponds to an equivalent addition of an appropriate cable length. By simulating the additional cable loss necessary for correct operation, the equalizer compensates for a range of variation in transmission path characteristics.

Bipolar Violation Transparency (BPVT) Option. The H2TU-C improves compatibility with Digital Loop Carrier (DLC) feeder applications because of its ability to transmit DS1 BPV occurrences between its DS1 interfaces. This feature is required to support protection switching in DLC applications. Each DLC terminal must be able to monitor the integrity of its Receive DS1 payload and then switch to the protect line when the integrity of the path drops below specific user selected limits. An essential requirement of this feature is the need for each DLC terminal to detect BPVs in its DS1 input. Standard HDSL systems correct DS1 BPVs at the input and therefore prevent them from being detected by the DLC terminals to which they are connected. The H2TU-C and its associated remote units remove this limitation and become BPV transparent by detecting and counting input BPVs at each end and then by replicating them at the DS1 output port of the distant end.

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

DS1 BER (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. See "Clearing the History, Alarm, and Event Log Screens" on page 25.

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

Parameter	Threshold Count
CV-L (BPV)	133,400
CV-P (CRC in ESF)	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

Network AIS Signal (NAIS) Option. The H2TU-C in conjunction with the H2TU-R-402 List 2 or 2A supports the AIS-CI function. AIS-CI is a variant of AIS which is transmitted toward the network when either an AIS defect or an LOS defect has been detected in the signal received from the CI at the H2TU-R unit. AIS-CI is a regular AIS signal modulated by an AIS signature.

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

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

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

RAI to RACI-CI toward NET (RACI) Option. The H2TU-C in conjunction with the H2TU-R-402 List 2 or 2A supports the RAI-CI function.

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

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

Sending RAI-CI terminates within 500 µs when either of the following occurs:

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

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

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

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

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

Resetting the H2TU-C

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

To reset the H2TU-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 want to reset the H2TU-C, or press **N** to cancel this action.

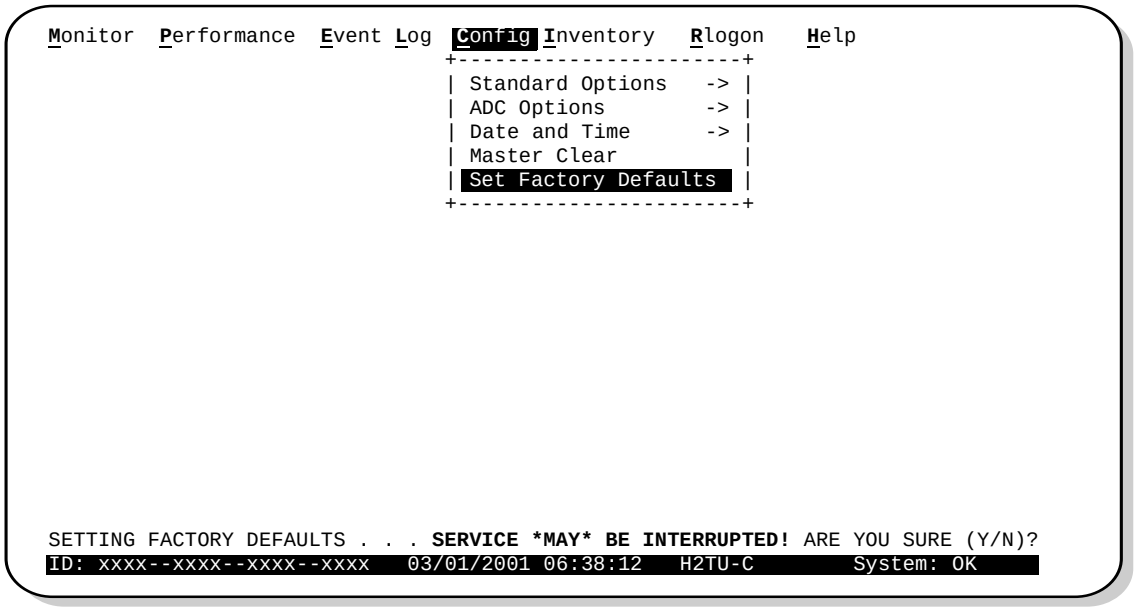


Figure 10. *Config Menu - Set to Factory Defaults*

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 that you have meaningful data thereafter.

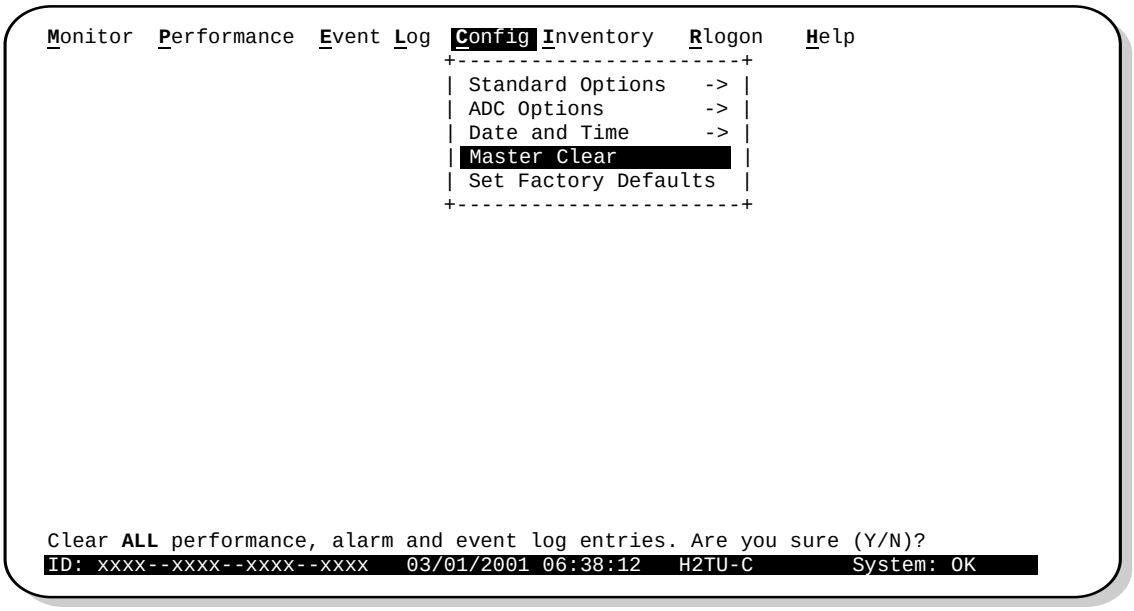


Figure 11. *Config Menu - Master Clear*

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 an interface (**H2TU-C DS1, H2TU-R DS1, H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press ENTER.
3. Press the SPACEBAR to select the type of statistics (**Current**, **Alarm History**, **25-Hour History, 48-Hour History**, or **31-Day History**), press ENTER after your selection.
   - Selecting **31 Day History** allows you to clear the Current, 25-Hour, 48-Hour, and 31-Day performance history screens for the selected interface.
   - Selecting **Alarm History** allows you to clear the alarm history screen for the selected interface. For information about the DS1 and HDSL2 alarm screens, see Table 11 on page 36.
4. Press L to clear the screen.

To clear all history, alarm, and event log screens:

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

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

The H2TU-C 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. These descriptions include the origin, time and date of occurrence, and a brief message describing the event.

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. Table 8 on page 27 describes the screen field.

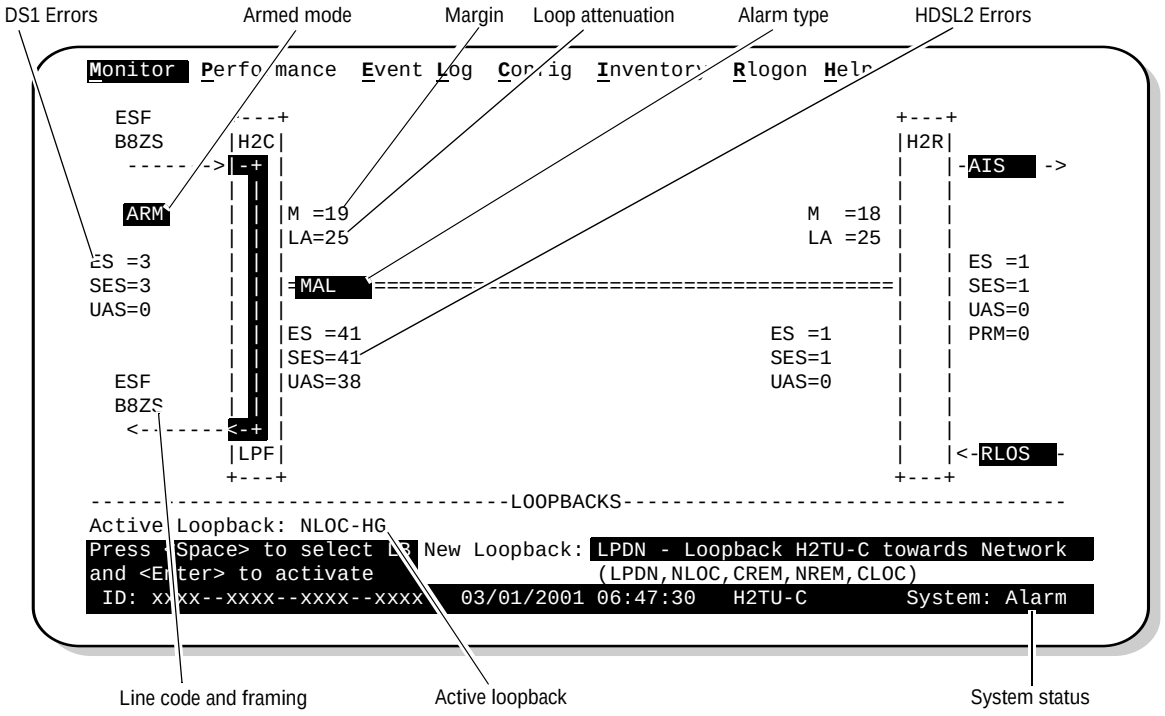


Figure 12. *Monitor Screen - Active Loopback with Alarms*

2 To initiate a loopback, press the **SPACEBAR** to cycle though the loopback choices. Press **ENTER** to select 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 40.

3 To initiate a loopdown of all active loopbacks, press the SPACEBAR to select **LPDN**, then press ENTER.

When prompted with the message: `Are you sure (Y/N)?,` press Y to initiate the loopdown or N to cancel.

Table 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 15 on page 44 for a summary of the HiGain HDSL2 generic loopback codes and activation methods.
Alarm Type	Indicates type of alarm.
Armed Mode	Indicates system is in an armed state and ready for an intelligent repeater (IR) loopback command.
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors included are: DS1 frame errors, BPV, and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.
DS1 UAS Count	Unavailable Errored Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame Type	Type of DS1 framing used on the input stream (SF, ESF, or UNFR).
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. (An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors.) This value is a running total of the last 24 hours.
HDSL2 UAS Count	Unavailable Errored Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
ID	Circuit identification (ID) number.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to the 196 kHz loss of the cable pair. The loop attenuation is a more direct indication of the loop attenuation to the OPTIS signal than is the 196 kHz loss. The normal HiGain HDSL2 LA operation range is from 0 to 40 dB.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10^{-7} Bit Error Rate.
MAL	Margin Alarm—Indicates the margin on HDSL2 loop has dropped below the threshold (0 to 15dB) as set by the operator.
HG (or PL)	HG displays when the loopback was initiated from a HiGain (HG) front panel or by a HiGain maintenance terminal loopback command. PL displays when the loopback was initiated by a command embedded in the DS1 data path payload (PL).
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:

- CRC statistics for the HDSL2 or DS1 interface in 31-day, 48-hour, 25-hour, and current history reports.
- Alarm statistics for the DS1 interfaces (Figure 22 on page 35 and Figure 23 on page 36) 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 an interface (**H2TU-C DS1, H2TU-R DS1, H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.

3 Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25-Hour History, 48-Hour History**, 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 H2TU-C and the H2TU-R (as viewed from the H2TU-C).

Figure 13 below and Figure 14 on page 29 are examples of DS1 performance history screens at the remote unit. Figure 15 on page 29 is an example of DS1 performance history screens at the line unit. Refer to Table 9 on page 31 for descriptions of the kinds of errors reported on DS1 interface screens. Asterisks indicate performance monitoring from the previous day.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon    Help

                        H2TU-R DS1   31 Day History (Page 1 of 3)
-------------------------------------------------------------------------------
  Date     ES-L  SES-L  UAS-L   CV-L     CV-P   ES-P  SES-P  UAS-P PRM-NE PRM-FE
 02/09        -      -      -      -        -      -      -      -      -      -
 02/10        -      -      -      -        -      -      -      -      -      -
 02/11        -      -      -      -        -      -      -      -      -      -
 02/12        -      -      -      -        -      -      -      -      -      -
 02/13        -      -      -      -        -      -      -      -      -      -
 02/14        -      -      -      -        -      -      -      -      -      -
 02/15        -      -      -      -        -      -      -      -      -      -
 02/16        -      -      -      -        -      -      -      -      -      -
 02/17        -      -      -      -        -      -      -      -      -      -
 02/18        -      -      -      -        -      -      -      -      -      -
 02/19        -      -      -      -        -      -      -      -      -      -
 02/20       14     10     10     12       10     10      0      0      0      0
 02/21        0      0      0      2        0      0      0      0      0      0

               Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  :  H2TU-R DS1
choices and <Enter> to view     Statistics :  31 Day History
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 13. *H2TU-R DS1 31-Day Performance History*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon   Help

                        H2TU-R DS1   25 Hour History (Page 1 of 9)
-------------------------------------------------------------------------------
  Time     ES-L   SES-L  UAS-L   CV-L    CV-P   ES-P  SES-P  UAS-P PRM-NE PRM-FE
 02/09        -      -      -      -       -      -      -      -      -      -
 02/10        -      -      -      -       -      -      -      -      -      -
 02/11        -      -      -      -       -      -      -      -      -      -
 02/12        -      -      -      -       -      -      -      -      -      -
 02/13        -      -      -      -       -      -      -      -      -      -
 02/14        -      -      -      -       -      -      -      -      -      -
 02/15        -      -      -      -       -      -      -      -      -      -
 02/16        -      -      -      -       -      -      -      -      -      -
 02/17        -      -      -      -       -      -      -      -      -      -
 02/18        -      -      -      -       -      -      -      -      -      -
 02/19        -      -      -      -       -      -      -      -      -      -
 02/20       14     10     10     12      10     10      0      0      0      0
 02/21        0      0      0      2       0      0      0      0      0      0

               Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-R DS1
choices and <Enter> to view     Statistics :  25 Hour History
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 14. *H2TU-R DS1 25-Hour Performance History*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon   Help

                        H2TU-R DS1   48 Hour History (Page 1 of 9)
-------------------------------------------------------------------------------
  Time     ES-L   SES-L  UAS-L   CV-L    CV-P   ES-P  SES-P  UAS-P
 23:00        -      -      -      -       -      -      -      -
  1:00        -      -      -      -       -      -      -      -
  2:00        -      -      -      -       -      -      -      -
  3:00        -      -      -      -       -      -      -      -
  4:00        -      -      -      -       -      -      -      -
  5:00        -      -      -      -       -      -      -      -
  6:00        -      -      -      -       -      -      -      -
  7:00        -      -      -      -       -      -      -      -
  8:00        -      -      -      -       -      -      -      -
  9:00        -      -      -      -       -      -      -      -
  10:00       -      -      -      -       -      -      -      -
  11:00      14     10     10     12      10     10      0      0
  12:00       0      0      0      2       0      0      0      0

               Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-R DS1
choices and <Enter> to view     Statistics :  48 Hour History
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

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

Current Statistics Screens for the DS1 Interface

Examples of current statistics screens are shown below. Figure 16 and Figure 17 show statistics for the DS1 interface at the remote unit and the 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   Rlogon   Help

                        H2TU-R DS-1  Current Statistics
--------------------------------------------------------------------------------
          1 Day    1 Hour    15 Min
Start     00:00     12:00     12:30

ES-L          0         0         0
SES-L         0         0         0
UAS-L         0         0         0
CV-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        0         0         0
PRM-FE        0         0         0
B8ZSS         0         0         0
MSEC       3482      1801         1
                        Press: C(l)ear Current Statistics
--------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  :  H2TU-R DS1
choices and <Enter> to view     Statistics :  Current
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 16. *H2TU-R DS1 Current Statistics*

```
Monitor  Performance  Event Log  Config  Inventory   Rlogon   Help

                        H2TU-C DS-1  Current Statistics
--------------------------------------------------------------------------------
          1 Day    1 Hour    15 Min
Start     00:00     12:00     12:30

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


B8ZSS         0         0         0
MSEC       3482      1801         1
                        Press: C(l)ear Current Statistics
--------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  :  H2TU-R DS1
choices and <Enter> to view     Statistics :  Current
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 17. *H2TU-C DS1 Current Statistics*

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

Error Acronym	Description	Error Acronym	Description
CV-L	Code Violation - Line Total BPV count.	SES-P	Severely Errored Seconds - Path Seconds with SEF or CRC(ESF) ≥ 320 or FE [(d)](SF) ≥ 8 (F_T + F_S).
ES-L	Errored Seconds - Line Seconds with BPV ≥ 1.	UAS-P	Unavailable Seconds - Path A second of unavailability based on SES-P or AIS ≥ 1.
SES-L	Severely Errored Seconds - Line Seconds with BPV plus EXZ ≥ 1544 or LOS ≥ 1.	PRM-NE [(a)]	Performance Report Monitoring - 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 ≥ 1.	PRM-FE [(a)]	Performance Report Monitoring - 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 FE rerrors for SF or CRC-6 errors for ESF.	B8ZSS [(b)]	B8ZS Monitored Seconds Seconds with B8ZS detection when AMI option is active.
ES-P	Errored Seconds - Path Seconds with SEF [(c)], CRC(ESF), or FE [(d)](SF) ≥ 1.	MSEC [(b)]	Monitored Seconds of the current (15 minute/1 hour/1 day) screen.

(a) Only displays on H2TU-R Performance History screens.
(b) Displays on the DS1 Current Statistics screens.
(c) 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.
(d) FE is a frame bit error.

Performance History at the HDSL2 Interface

The HDSL2 interface has 31-day, 48-hour, 25-hour, and current statistic screens for the H2TU-C. Figure 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 HDSL2 performance screens. Asterisks indicate performance monitoring from the previous day.

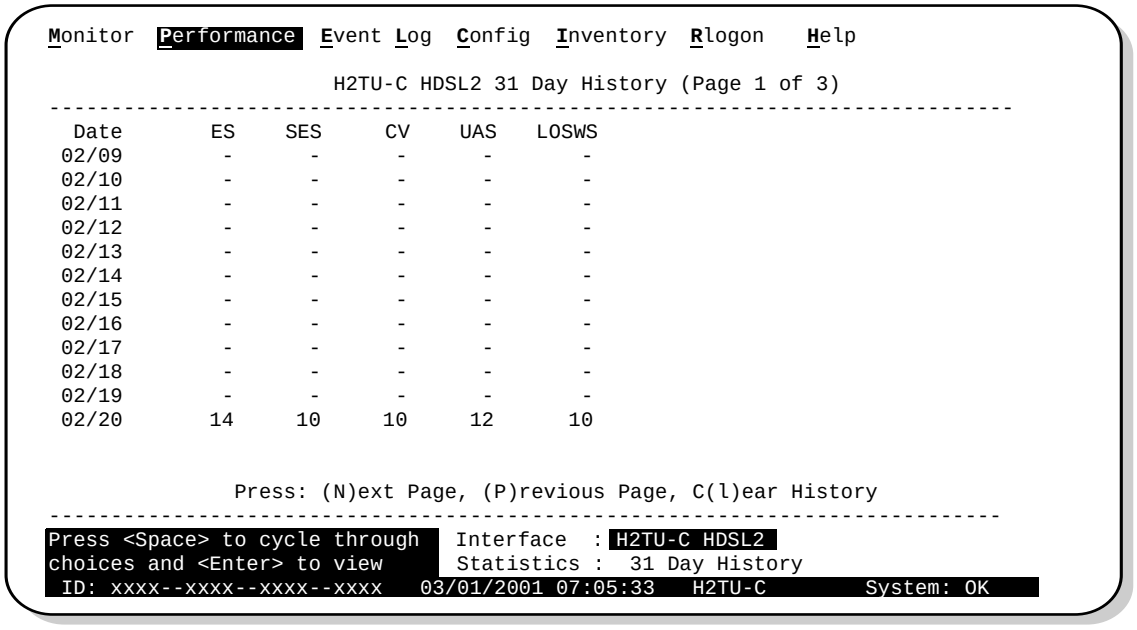


Figure 18. *H2TU-C HDSL2 31-Day Performance History*

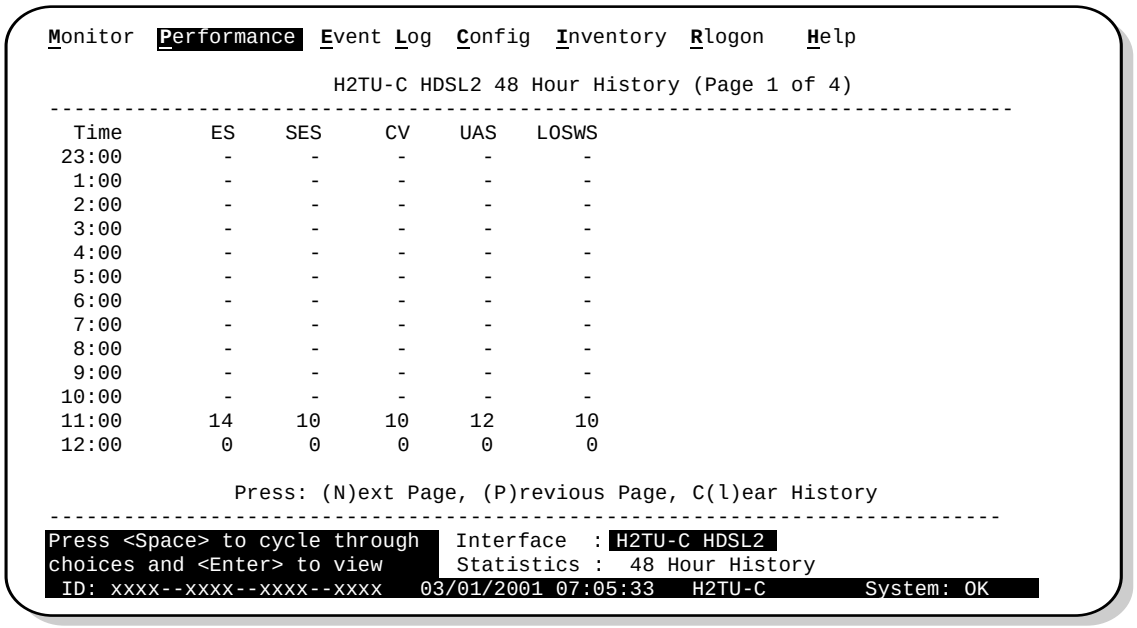


Figure 19. *H2TU-C HDSL2 48-Hour Performance History*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon   Help

                      H2TU-C HDSL2 25 Hour History (Page 1 of 4)
--------------------------------------------------------------------------------
  Time       ES    SES     CV    UAS   LOSWS
  9:45        -      -      -      -       -
 10:00        -      -      -      -       -
 10:15        -      -      -      -       -
 10:30        -      -      -      -       -
 10:45        -      -      -      -       -
 11:00        -      -      -      -       -
 11:15        -      -      -      -       -
 11:30        -      -      -      -       -
 11:45        -      -      -      -       -
 12:00        -      -      -      -       -
 12:15       14     10     10     12      10
 12:30        0      0      0      0       0
 12:45        0      0      0      0       0

              Press: (N)ext Page, (P)revious Page, C(l)ear History
--------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-C HDSL2
choices and <Enter> to view     Statistics :  25 Hour History
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 20. *H2TU-C HDSL2 25-Hour Performance History*

```
Monitor  Performance  Event Log  Config  Inventory   Rlogon   Help

                      H2TU-C HDSL2 Current Statistics
--------------------------------------------------------------------------------
          1 Day    1 Hour    15 Min
Start     00:00     12:00     12:30

ES            0         0         0
CV            0         0         0
SES           0         0         0
UAS           0         0         0
LOSWS      3482      1801         1

          Margin(dB)   LA (dB)
Hi           16
Cur          15        25
Low          12


                      Press: C(l)ear Current Statistics
--------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-C HDSL2
choices and <Enter> to view     Statistics :  Current
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: OK
```

Figure 21. *H2TU-C HDSL2 Current Statistics*

Table 10. *Error Acronyms Used on the HDSL2 Performance History Screens*

Error Acronym	Description
ES	Errored Seconds Seconds with HDSL2 CRC ≥ 1 or LOSW ≥ 1
SES	Severely Errored Seconds Seconds with HDSL2 CRC ≥ 50 or LOSW ≥ 1
UAS	Unavailable Seconds Based on 10 contiguous SES occurrences
CV	Code Violation Total count of HDSL2 CRC errors.
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 menu.

2 Press the **SPACEBAR** to select an interface (**H2TU-C DS1, H2TU-R DS1, H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.

3 Press the **SPACEBAR** until **Alarm History** is selected, then press **ENTER**.

- Press **N** or **P** to page through the alarm history screens.
- Press **L** to clear the selected alarm history screen.

Alarm History at the DS1 Interface

The Alarm History screen reports current DS1 statistics for the H2TU-C as shown in Figure 22 below. DS1 statistics for the H2TU-R are shown in Figure 23 on page 36. 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   Rlogon   Help

                      H2TU-C DS-1 Alarm History
-------------------------------------------------------------------------------
 Alarm        First                Last               Status       Count

LLOS                                                 OK           0
LAIS                                                    OK           0
DBER                                                    DISABLED     0
LOF                                                  OK           0









                        Press: C(l)ear Alarm History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-C DS-1
choices and <Enter> to view     Statistics :  Alarm History
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:05:33   H2TU-C        System: Alarm
```

Figure 22. *H2TU-C DS1 Alarm History Screen*

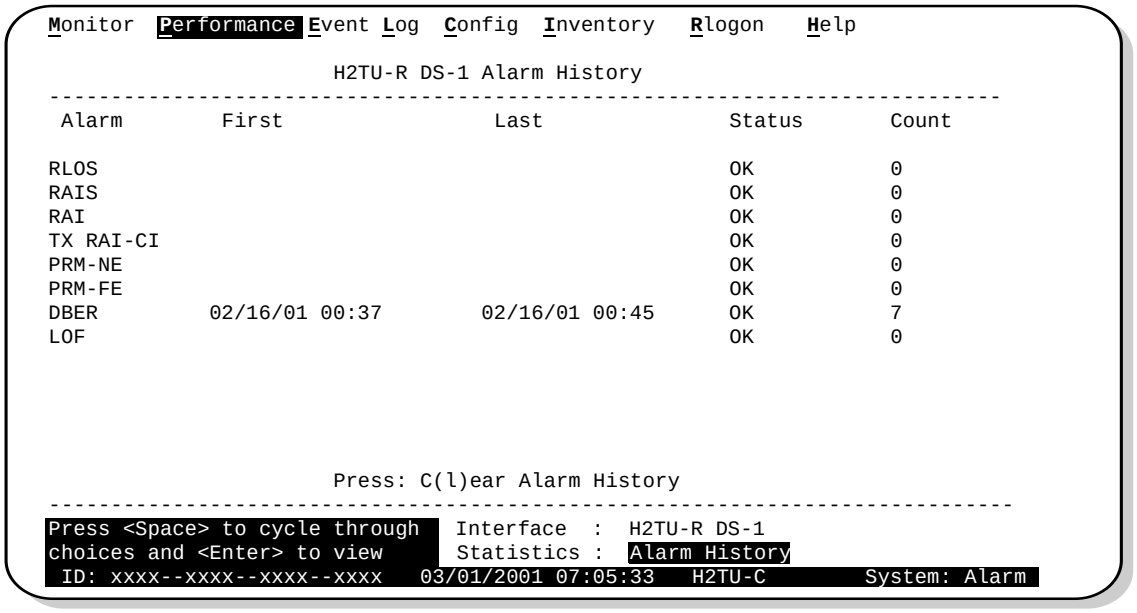


Figure 23. *H2TU-R DS1 Alarm History Screen*

Table 11. *DS1 Alarm Descriptions*

Screen Alarm	Front-Panel Alarm	Description
H2TU-C DSI Alarms (see Figure 22 on page 35)		
LLOS [a]	LLOS	Local Loss of Signal—Loss of the H2TU-C DSX-1 input signal.
LAIS[c]	LAIS	Line Alarm Indication Signal—Indicates an AIS (all ones) pattern is being detected at the H2TU-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	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.
H2TU-R DS1 Alarms (see Figure 23 above)		
RLOS [a]	RLOS	Remote Loss of Signal—Loss of the H2TU-R DS1 input signal.
RAIS [c]	RAIS	Remote Alarm Indication Signal—AIS is being detected at the H2TU-R DS1 input port. By default (see Figure 26 on page 42) AIS-CI [b] is sent toward the network if NAIS is set to CI.
RAI	RRAI	Remote Alarm Indication—Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
TX RAI-CI	TRCI	Transmit RAI-CI - Remote Alarm Indication at the H2TU-R—Upon reception of an RAI (yellow LED) from the CPE, the H2TU-R sends an RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or LOF), then the RAI is passed on to the network unaltered. This is applicable to SF or ESF framing. In an all SF environment, RACI must be enabled to convert SF-RAI to SF-RAI-CI.
PRM-NE	PRMN	Performance Report Monitoring - Near End—The count of the PRM-NE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
PRM-FE	PRMF	Performance Report Monitoring - Far End—The count of the PRM-FE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
DBER	*xxx*-DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}. (*xxx* denotes either TUC or TUR.)

(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.
(c) This display only appears if the NAIS option is set to CI.

Alarm History at the HDSL2 Interface

Figure 24 shows the H2TU-C HDSL2 alarm history and Table 12 describes the alarms.

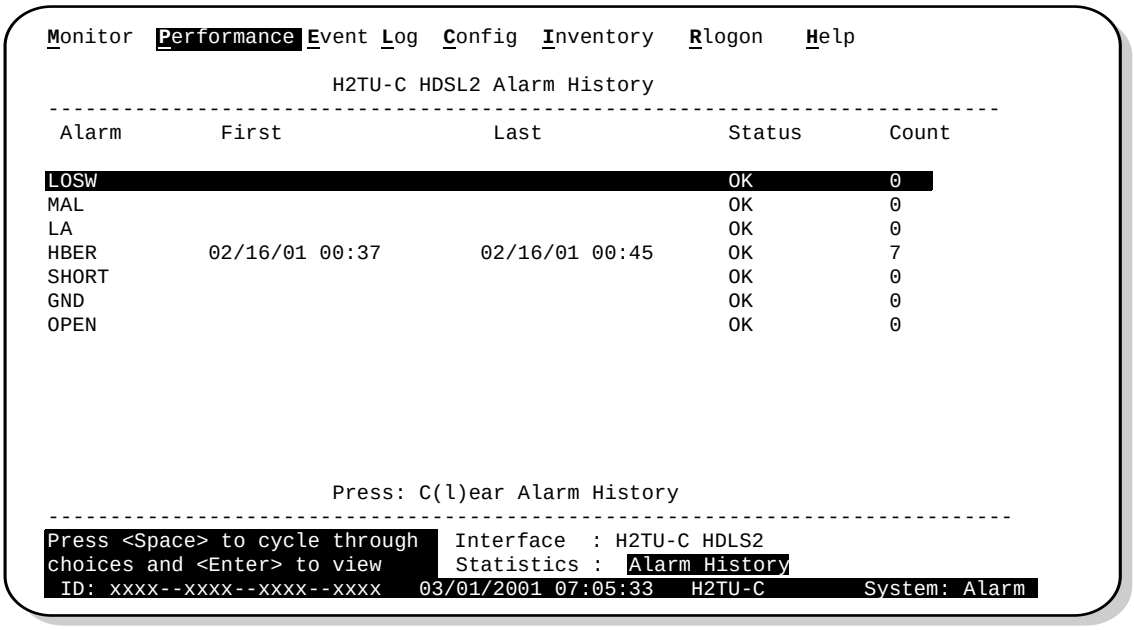


Figure 24. *H2TU-C HDSL2 Alarm History Screen*

Table 12. *HDSL2 Alarm Descriptions*

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

(a) Displays only on the H2TU-C HDSL2 interface.

USING THE SYSTEM EVENT LOG TO TRACK 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. Table 13 on page 39 lists the 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    Config  Inventory   Rlogon    Help

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

1   System          01/21/01 12:25:00     DS1 Alarm Register reset
2   System          01/22/01 12:25:00     HDSL2 Alarm Register Reset
3   System          01/23/01 12:25:00     DS1 Performance Register Reset
4   System          01/24/01 12:25:00     HDSL2 Performance Register Reset
5   System          01/25/01 00:13:32     Time set 12:25:00
6   System          01/26/01 00:13:27     Date set 10/21/00
7   H2TU-C          01/27/01 00:13:27     NLOC: Loop-down
8   H2TU-C          01/28/01 00:11:16     NLOC: Loop-up
9   H2TU-R          01/29/01 00:10:43     DS1 LOS Alarm: End
10  H2TU-R          01/30/01 00:10:30     DS1 LOS Alarm: Begin
11  System          01/31/01 00:04:11     DS1C: AUTO to AMI
12  H2TU-C          02/01/01 00:00:40     HDSL2 LOSW Alarm: End
13  H2TU-C          02/02/01 00:00:02     HDSL2 LOSW Alarm: Begin
14  - EMPTY -
15  - EMPTY -

        Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log
 ID: xxxx--xxxx--xxxx--xxxx   03/01/2001 07:07:54   H2TU-C        System: OK
```

Figure 25. *System Event Log*

Event Log Messages

Table 13 lists all the possible messages that can be displayed by the System Event Log screen.

Table 13. *Event Log Messages*

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

TESTING

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

FRONT PANEL SYSTEM ALARMS

Table 14 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 Alarm Data" on page 35). All alarms that are not inhibited will drive the front-panel Status LED to a flashing red alarm state.

Table 14. *Front-Panel System Alarms Summary*

Front-Panel Message [a]	Alarm	Description	To Inhibit
PWR FEED SHRT [b]	Power Feed Short	A short exists between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
PWR FEED GND [b]	Power Feed Ground	The HDSL2 loop is grounded.	Cannot be inhibited.
PWR FEED OPEN [b]	Power Feed Open	A line power open condition exists.	Cannot be inhibited.
SPN*n*-LOSW [c]	Span(*n*)-Loss of Sync Word [d]	The HDSL2 loop has lost synchronization. The span closest to the network has highest priority.	Cannot be inhibited.
LLOS [c]	Local Loss of Signal	Loss of the DSX-1 input signal.	Cannot be inhibited.
RLOS [c]	Remote Loss of Signal	Loss of the H2TU-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 [e]	Line Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received at the H2TU-C DSX-1 input port.	Set NAIS to AIS.
RAIS [e]	Remote Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port.	Set NAIS to AIS.
TRCI	Transmit RAI-CI—Remote Alarm Indication at the H2TU-R (Net signal does not have errors.)	Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or LOF), then the RAI is passed on to the network unaltered.	Cannot be inhibited for ESF payloads. Set RACI options to DIS to disable SF payloads.
RRAI	Remote RAI—Remote Alarm Indication at the H2TU-R (Net signal has errors.)	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.
LOF	Loss of Frame	The DS1 input does not contain the ESF or SF frame pattern setting of the FRMG option.	Change FRMG option to AUTO or UNFR.

Continued

Table 14. *Front-Panel System Alarms Summary (Cont.)*

Front-Panel Message [a]	Alarm	Description	To Inhibit
xxx-DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set threshold limits of approximately 10^{-6}. (*xxxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Select DIS for the DBER system option.
PRMF	Performance Report Messaging - Far End	Indicates H2TU-R PRM-FE BER threshold is exceeded.	Set DBER threshold to DIS.
PRMN	Performance Report Messaging - Near End	Indicates H2TU-R PRM-NE BER threshold is exceeded.	Set DBER threshold to DIS.
xxx-HBER [c]	HDSL2 Block Error Rate	The HDSL2 BER has exceeded the set threshold limits of 10^{-6} or 10^{-7}. (*xxxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Select NONE for the HBER system option.
xxx-MAL [c]	Margin Alarm	The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system. (*xxxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Set the Margin Alarm Threshold option to 0 (zero).
xxx-LA [c]	Loop Attenuation	The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold. (*xxxx* denotes either TUC or TUR. If TUC and TUR occur at the same time, then TUC displays.)	Set the HDSL2 Loop Attenuation Threshold option to zero.

(a) The message, ALRM, displays prior to any alarm message.
(b) Message displays repeatedly as long as the alarm condition exists and is not included in the priority order.
(c) Only these alarms assert the System Alarm bus on pin H of the card-edge connector if the ALM option is enabled.
(d) When the HDSL2 loop loses sync word (LOSW), a system alarm condition exists. However, since the H2TU-C enters the acquiring mode, the front-panel status LED flashes red, and the ACQ or SIG message displays instead of the ALRM message.
(e) These alarms can only occur when the NAIS option is set to CI.

Alarm Option for the Digital Loop Carrier Feed

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

- LOSW on any loop
- LOS DS1

Retiring System Alarms

To retire a system alarm, press the SEL pushbutton and 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 26 shows the different ways the H2TU-R can respond to the network, depending on the configuration of the TLOS, NLBP, RDA, ALMP, and NAIS configuration options described in Table 5 on page 19 and Table 6 on page 20.

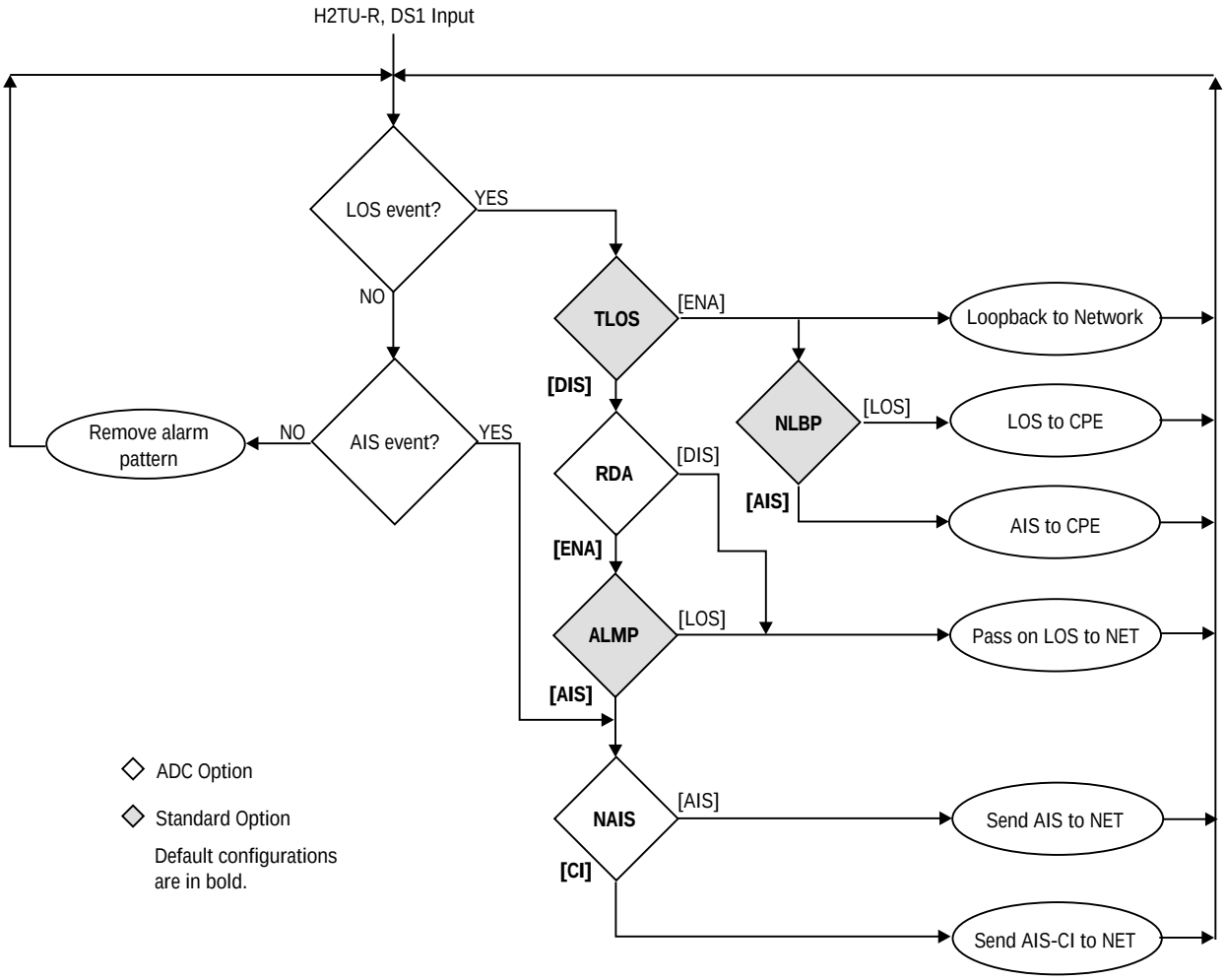


Figure 26. *H2TU-R LOS and AIS Response Priorities*

OCT55 Test Pattern with AMI Line Code

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

LOOPBACK OPERATION

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

- Generic Loopback (GNLB) options, including the SmartJack (SMJK) option and double loopbacks (see Table 15 on page 44)
- Special Loopback (SPLB) options (see "Special Loopback Commands" on page 45) and the following command tables:
  - Addressable Repeater Loopback commands: A1LB, A2LB, A5LB (see Table 16 on page 49)
  - Addressable Repeater Loopback commands: A3LB, A4LB (Table 17 on page 51)

Loopback commands can be initiated by:

- Selecting the loopback type using the MODE and LBK buttons on the H2TU-C front panel (or the Manual Loopback button on the H2TU-R)
- Selecting the loopback type from the Monitor Menu when connected to the craft port of the H2TU-C or H2TU-R
- Entering the loopback code (exceptions are COLB, D*x*LB, and RULB) into the test equipment connected to the H2TU-C or H2TU-R

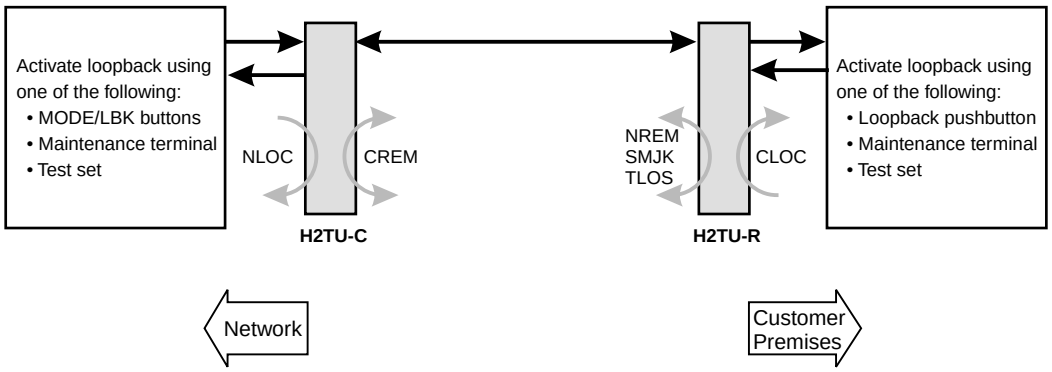


Figure 27. *Loopback Summary*

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

GENERIC LOOPBACK COMMANDS

The HiGain 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 HiGain system responds.

Figure 27 on this page summarizes the available loopbacks in the system, and Table 15 on page 44 summarizes the HiGain generic loopback commands.

Table 15. *Summary of HiGain Loopback Codes and Activation Methods*

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

HiGain systems feature the SmartJack option which can emulate a Network Interface Device (NID) loopback testing of the HiGain 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.

Use the inband commands to enable or disable the SMJK loopback options.
The H2TU-C system setting is normally enabled to recognize all inband SmartJack loopback commands.

SPECIAL LOOPBACK COMMANDS

In addition to the GNLB loopback command mode, a HiGain system can be configured for special loopback command modes. These are selected by configuring the unit for the desired loopback mode (Config menu, Special Loopback Mode option) from the maintenance terminal Monitor screen. Once a loopback mode is activated, other loopback commands can be sent by a test set connected to the craft port of the H2TU-C or H2TU-R (see Table 16 on page 49 and Table 17 on page 51 for list of SPLB commands).

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

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

The A1LB loopback selection complies with that proposed for HDSL2 systems in the DS1E1.4/92 recommendation with the following additions:

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

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

A5LB differs from A2LB in that A5LB does not block the arming code from exiting the H2TU-C-319 into the network. A1LB and A2LB can be configured to do one of the following:

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

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

MANUAL LOOPBACK SESSION

A manual loopback session allows you to select any one of the HiGain loopbacks listed in Table 15 on page 44 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. (See Table 5 on page 19 for a description of this option.)

1 Logon to the maintenance terminal screens.

2 Select **Config**, **Standard Options**, then **LBTO**.

3 Verify the LBTO setting.

Activating Manual Loopback Mode

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

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

- **The next loopback option can be displayed by pressing the MODE button; however, the previously activated loopback remains active until the LBK button is pressed, which activates the new loopback.**
- **If neither button 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 session, continue until the loopback times out in accordance with the LBTO setting.**
- **If there is an active loopback, pressing the MODE and LBK buttons for 5 or more seconds terminates any active loopback, ends the manual loopback session, and returns the display to normal mode.**

To initiate a manual loopback session:

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

`MAN LPBK NLO?`

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

3 Press MODE to advance to the next available loopback:

- NRE? = NREM
- CRE? = CREM
- CLO? = CLOC

4 Press LBK to activate the selected loopback. The previous loopback is terminated.

Once a loopback is selected and activated, the it 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 LBK buttons for 3 or more seconds. If no loopback is active, the `MAN LPBK` mode automatically terminates after 30 seconds.

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

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

LOOPBACK TEST PROCEDURES

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

General Troubleshooting Tips

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

- the H2TU-C is making a positive connection with its mounting-assembly (shelf) connector.
- the H2TU-C internal equalizer is set to the correct distance range per Table 5 on page 19. All equalizers should be set to the distance from the DSX-1 to the shelf.

GNLB Test Procedures

Figure 28 on page 48 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. Refer to Table 15 on page 44 for a description of these commands.

To perform the GNLB loopback test procedure:

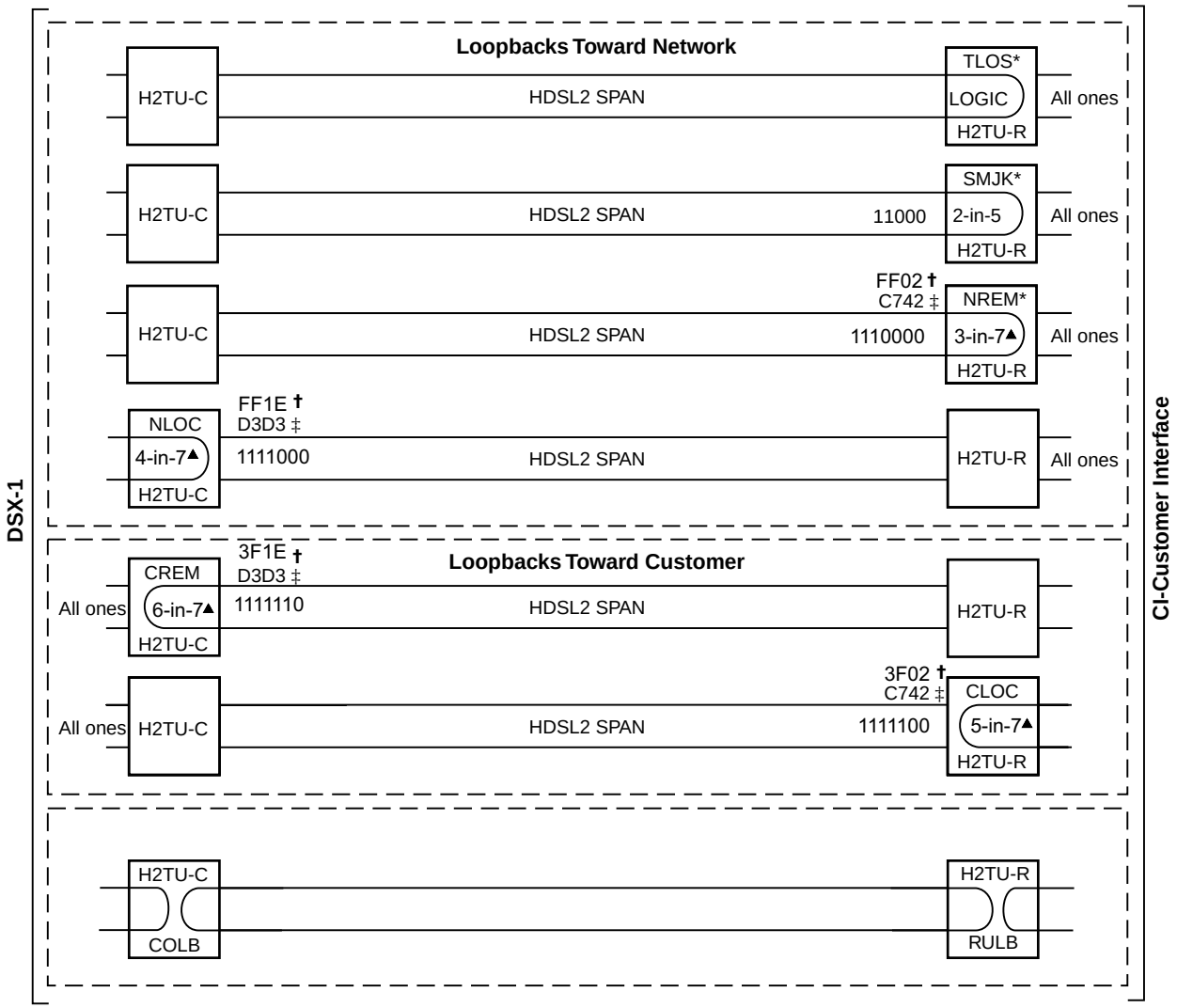
1 Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. You should be able to observe the NREM message on the front-panel display. (The Status LED on the front panel should be green, and the loopback mode should also be identified on the Span Status screen.)

2 Have the CO tester transmit a DS1 test signal towards the H2TU-C and verify that the returned (looped) signal to the test set is error-free.

3 If Step 2 fails, have the CO tester transmit the 3-in-5 inband loopdown code.

4 Have the CO tester send the NLOC (4-in-7) inband loopup for 5 seconds. You should be able to 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 Span Status screen.)

5 Repeat Step 2. If the test passes, the problem is in the downstream direction. If the test fails, the problem is in the upstream direction.



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

† A3LB and A4LB loopback codes.

‡ A1LB, A2LB, and A5LB loopback codes.

▲ GNLB loopback codes.

Figure 28. *Loopback Modes*

A1LB, A2LB, and A5LB Test Procedures

Using the codes listed in Table 16, 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.

Following Table 16 is a step-by-step test procedure for verifying the integrity of the HDSL2 channels at every module location as well as the DS1 channels to the customer and the local DSX-1 interface.

Table 16. *Addressable Repeater Loopback Commands (A1LB, A2LB, A5LB)*

Loopback	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 and 229-231 bit errors) [b]	1101-0011-1101-0011 (D3D3)	NLOC—DSX-1 signal is looped back to the network at the H2TU-C. CREM—Signal from customer is looped back to the customer at the H2TU-C.
ILR-2 LPBK (20 bit errors) [c]	1100-0111-0100-0010 (C742)	NREM—DSX-1 signal is looped back to the network at the H2TU-R. CLOC—Signal from customer is looped back to the customer at the H2TU-R.
IR LPDN (except SMJK)	1001-0011-1001-0011 (9393)	Loopdown (H2TU-C or H2TU-R)
IR QUERY LPBK	1101-0101-1101-0101 (D5D5)	Query loopback
IR ALTERNATE QUERY LPBK	1101-0101-1110-1010 (D5EA)	Alternate query loopback
TIME-OUT OVERRIDE	1101-0101-1101-0110 (D5D6)	Loopback time-out override
FAR END NI ACTIVATE (A1LB and A2LB only) [d]	1100-0101-0101-0100 (C554)	Unblock AIS
IOR POWER DOWN (H2TU-C) [e]	0110-0111-0110-0111 (6767)	Removes HDSL2 line power

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

(b) The H2TU-R identifies CREM (and the H2TU-C identifies NLOC) with 231 bit errors, excluding the frame bits. When framed data is being sent in the AUTO framing mode, the number of the 231 bit errors detected by the test set varies from 229 to 231, depending on whether 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 H2TU-R and H2TU-C generate this bit pattern in a series of discontinuous bursts containing 20-bit errors each, excluding frame bits. Those test sets that do not count frame error bits as data bit errors will indicate fewer bits than the H2TU-R and H2TU-C transmit for a CI and NI loopback.

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

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

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

To perform the A1LB, A2LB, and A5LB loopback test procedures:

1 Send the inband Arming and NI LPBK code 11000 to the H2TU-C for at least 5 seconds.

2 Monitor the output of the H2TU-C for the return of the pattern. Return of the pattern indicates one of the following:

- The H2TU-R has looped up (if the SMJK Loopback option is enabled)
- An external NID has looped up (if the SMJK Loopback option is disabled), and the H2TU-C and H2TU-R have been armed.

3 Verify, if possible, that the H2TU-R Loopback LED is either flashing yellow at four times per second intervals (indicating that the system is armed), or is a steady yellow (indicating that the system is both armed and in SMJK loopback). The H2TU-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 H2TU-C can be looped back by sending Intelligent Office Repeater (IOR) LPBK activation code 1101-0011-1101-0011 (D3D3) for at least 5 seconds. You should observe the following activation response pattern:

a 2 seconds of AIS (an all ones pattern)

b 2 seconds of returning data pattern

c Logic errors (including the frame bit) occurring in the returned pattern comprising:

– 231 errors, if IOR LPBK (H2TU-C) was sent

– 20 errors, if ILR-2 (H2TU-R) was sent

d Normal looped data

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

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

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

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

5 Once the test is complete, do one of the following:

- If the system is to loop down but remain Armed, send the IR LPDN code.
- 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 termination (manually or time-out)**
- **Query**
- **Alternate query**
- **Far End activation**
- **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.

A3LB and A4LB Test Procedures

The H2TU-C can be looped back by sending the Addressable Office Repeater (AOR) LPBK activation code 1111-1111-0001-1110 (FF1E) for at least 5 seconds. This causes the H2TU-C to enter the NLOC state. The loopback time-out setting determines the duration of this loopback unless it is overridden by the reception of a second identical 16-bit loopup command before the timer expires. When this time-out override state exists, the only way to loop the H2TU-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 Addressable 3 and 4 (A3LB and A4LB) repeater loopback commands.

Table 17. *Addressable Repeater Loopback Commands (A3LB and A4LB)*

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

(a) The leftmost bit arrives first in all sequences. The detection algorithm functions reliably with a random 10^{-3} Bit Error Ratio (BER) on the facility. The entire arming and loopback sequence can also be initiated at the remote H2TU-R location.
(b) Not supported by A4LB.

APPENDIX A - SPECIFICATIONS

Power	
HDSL2 Span Voltage	0 or -185 Vdc
CO Supply	-48 Vdc nominal (-42.5 Vdc to -56.5 Vdc) See "Power Consumption" and "Maximum Power Dissipation" and "Maximum Current Drain" on page 53.
Electrical Protection	Secondary surge and power cross protection on HDSL2 ports. Requires external primary protection.
Fusing	Internal; connected to "FUSE ALARM" output on pin 10
Environmental	
Operating Temperature	-40 °F to +149 °F (-40 °C to +65 °C)
Operating Humidity	5% to 95% (non-condensing)
Physical	
Height	4.750 in. (12.10 cm)
Width	0.625 in. (1.59 cm)
Depth	10 in. (25.4 cm)
Weight	0.5 lb. (.23 kg)
Mounting	3192 mechanics shelf
HDSL2	
Line Code	1.552 Mbps OPTIS
Transmission	Full duplex
Media	One non-loaded, copper, two-wire cable pair
Output	+16.8 dBm ±0.5 dB at 135Ω (0-450 kHz) at CO side; +16.8 dBm ±0.5 dB at 135Ω (0-350 kHz) at remote side
Line Impedance	135 Ω
Maximum Provisioning Loss	35 dB at 196 kHz
Start-up Time	30 sec. typical, 1 min. maximum per span
DSX-1	
DSX-1 Line Impedance	100 Ω
DSX-1 Pulse Output	6 V^{pk-pk} pre-equalized for 0-655 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX
System	
One-way DS1 Delay	<400 µs per span without regenerators
Wander (Looped)	Meets MTIE T1.101 requirements
Wideband Jitter (Looped)	0.2 UI maximum
Narrowband Jitter (Looped)	0.1 UI maximum

POWER CONSUMPTION

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

Table 18 describes line-powered circuits on 9 kft, 26 AWG loops without a regenerator.

Table 18. *H2TU-C-319 List 1A Power Parameters*

	-48 Vdc Power Consumption (Watts)	Heat Dissipation (Watts)	-42.5 Vdc Current (mA)
Remote Power Source	**Maximum**	**Maximum**	**Maximum**
Line-powered	12.5	7.0	294.0
Local-powered	5.0	5.0	117.0

MAXIMUM POWER DISSIPATION

The maximum power dissipation measures the power that is converted into heat which 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. The footprint of a standard 28-slot, 23-inch HMS-317 shelf is 7.024 square feet. Therefore, the maximum bay dissipation is limited to 946 watts. Use this limit and the parameters in Table 18 to determine the maximum number of H2TU-C circuits that can occupy one CO bay.

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

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

The -48 Vdc Power Consumption is the maximum total power that the H2TU-C consumes or draws from the shelf power source. This parameter is needed when the H2TU-C is in a location remote to the CO it is serving. It determines the battery capacity required to maintain an 8-hour, standby battery reserve for emergency situations. Battery capacity, therefore, limits the maximum number of line units which can be installed in a remote enclosure. Use the data in Table 18 above to perform this analysis.

MAXIMUM CURRENT DRAIN

The Maximum Current Drain is the maximum current drawn from the shelf power supply when it is at its minimum voltage (-42.5 Vdc). This determines the shelf fusing requirements. Use the -42.5 Vdc current data in Table 18 above to determine the shelf fusing requirements for your particular H2TU-C applications.

LOOP ATTENUATION

Each loop has no more than 35 dB of loss at 196 kHz, with driving and terminating impedances of 135 Ω (see Table 19 below).

Table 19. *HDSL2 Cable Attenuation Chart*

Cable Gauge	Loss at 196 kHz (dB/kft)	Ω per kft
26/0.4 mm	3.88	83
24/0.51 mm	2.84	52
22/0.61 mm	2.18	32
19/0.91 mm	1.54	16

H2TU-C-319 LIST 1A CARD-EDGE CONNECTOR

Figure 29 shows the pin assignments of the card-edge connector on the H2TU-C-319 List 1A card. Active pins are highlighted in black.

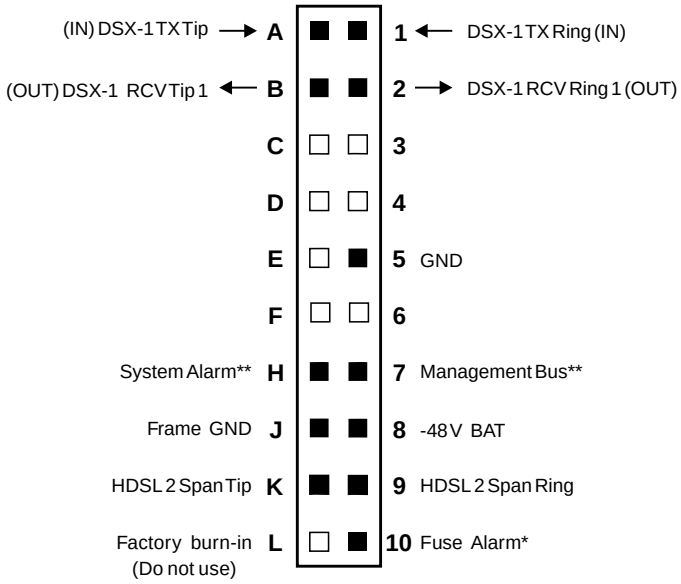


Figure 29. *H2TU-C-319 List 1A Card-Edge Connector*

The HDSL2 span is accessed on pins K and 9 which are assigned to Loop 2 in 4W HDSL circuits.

Network Management Control Bus

The H2TU-C provides a Network Management Control Bus on pin 7 of the card-edge connector. This allows the various ADC Management System protocols to manage the H2TU-C through the HMU-319 HiGain Management Unit. Whenever the H2TU-C is under management, the `MNGD` message displays periodically on the front-panel display.

Some H2TU-C features are affected when it is under management. Consult the management unit practice for further information.

Fuse Alarm

Pin 10 on the card-edge connector is a Fuse Alarm that is driven to -48 Vdc through a diode whenever its onboard fuse opens. It emulates the function of the Fuse Alarm output from pin 10 on normal, high density (HD) repeaters. Pin 10 is connected to pin 5 of the 1184 Alarm Card (slot 1 in the HD shelf) and causes the 1184 Fuse ALM LED to light when the pin 10 signal is activated. Its normally floating output must never be driven above ground or below -80 Vdc. It can sink a current of 10 mA. The H2TU-C does not support the BPV function (pin E) of normal HD repeaters.

System Alarm Output Pin

Pin H on the card-edge connector, shown in Figure 29, is the H2TU-C System Alarm output pin. The following notes apply to pin H:

- Pin H replaces the Local Loss of Signal (LLOS) on normal high-density (3192) repeaters.
- The normally floating output of pin H can connect to pin 1 of the 1184 or 3192-9F Alarm Card in position 29 of the high density (HD) shelf.
- The H2TU-C forces pin H to +5Vdc (maximum of 10 mA) for a system alarm condition. Pin H then remains at +5 Vdc for the duration of the alarm condition.
- If the Wescom 1184 Alarm Card is installed in the shelf, its LOS LED lights for every MNRALM.
- The H2TU-C Status LED flashes red for the duration of a system alarm condition.
- Setting the ALM option to DIS only prevents the system alarm bus on pin H from being activated for a system alarm event. The Status LED still flashes red and the ALRM message still displays.
- "Front Panel System Alarms" on page 40 describes the system alarms that activate pin H.

Pin H must never be taken above +5 Vdc or below -60 Vdc.

CRAFT PORT

Figure 30 shows the pinout for the craft port connector and its connection to a DB-9 or DB-25 connector on a maintenance terminal.

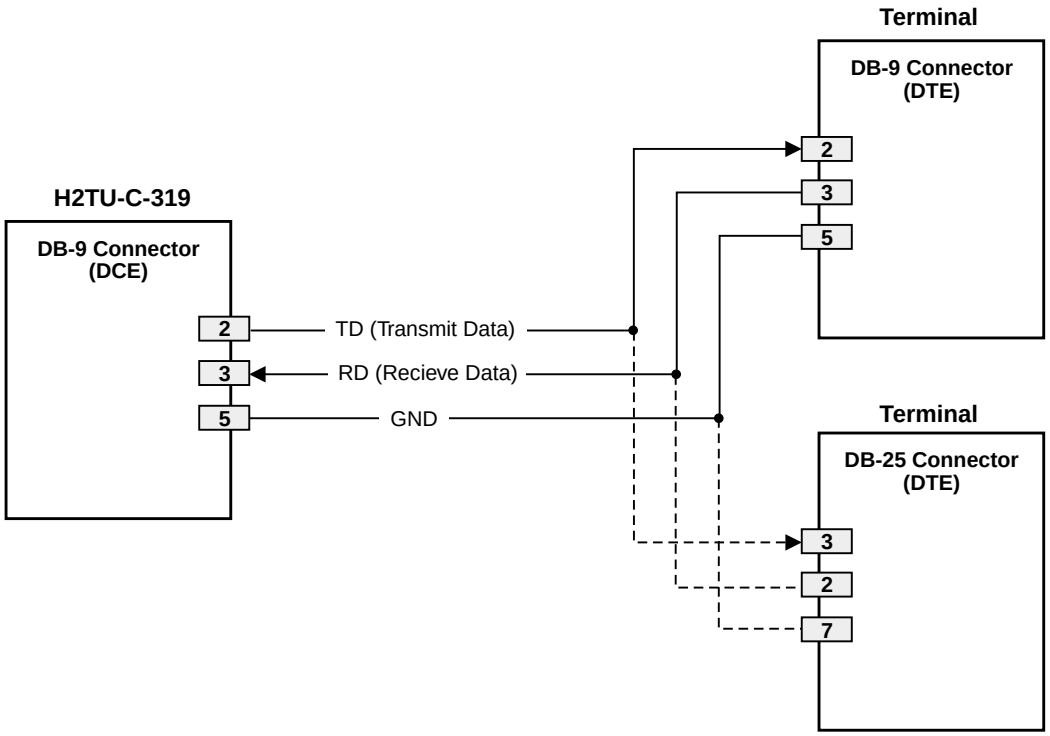


Figure 30. *RS-232 Craft Port Pinouts*

APPENDIX B - FUNCTIONAL OPERATION

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

Figure 31 shows a block diagram of the H2TU-C. The H2TU-C receives a 1.544 Mbps DSX-1 data stream from the DSX-1 digital cross connect interface. The H2TU-C contains a DS1 frame synchronizer controlled by an 8-bit microprocessor that determines the type of framing on the DS1 stream and synchronizes to it. The H2TU-C recognizes Superframe (SF), including D4 or Extended Superframe (ESF) framing.

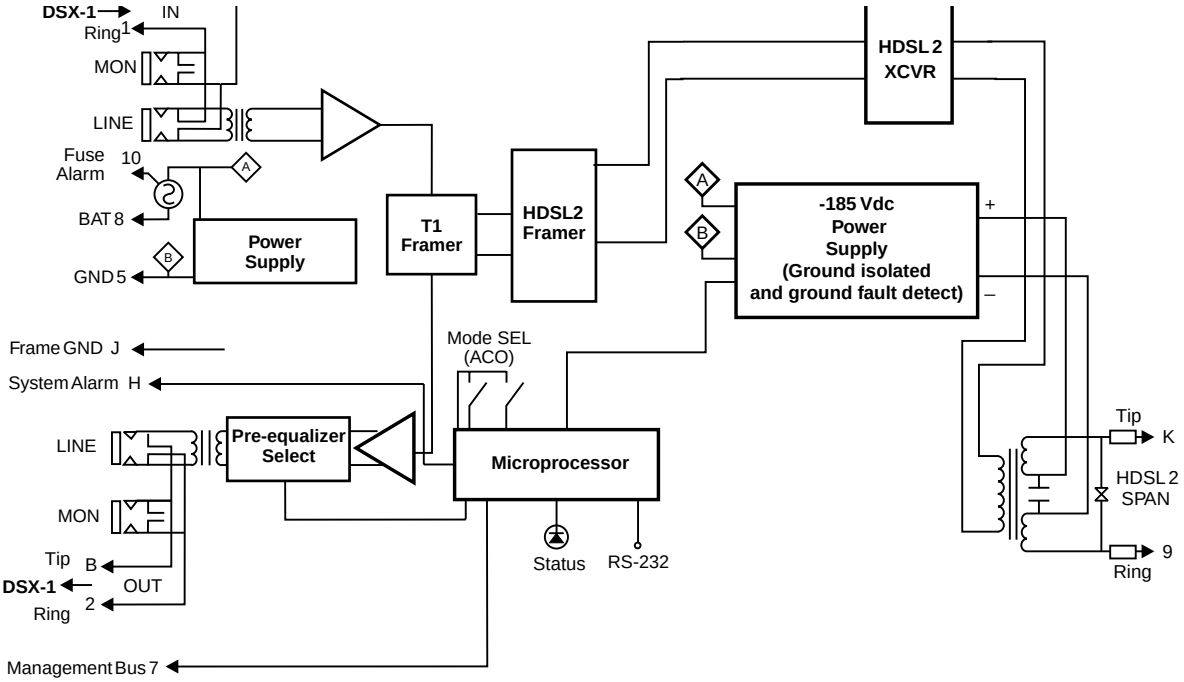


Figure 31. *H2TU-C-319 List 1A Block Diagram*

TIMING

The low loop wander (0.3 UI max) of an H2TU-C, when used with compatible regenerators and remote units, allows the circuit to be used in all critical timing applications, including those used to transport Stratum 1 timing.

GROUND FAULT DETECT

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

APPENDIX C - COMPATIBILITY

The HiGain HDSL2 system uses HDSL2 transmission technology as recommended by ANSI committee in compliance with the August 1999 T1-E1.4/99-006R5 HDSL2 standards.

The H2TU-C are designed to mount in the following shelves with 3192 mechanics:

- ADC HCS-402 (2-slot, test shelf with adapter)
- ADC HHS-319 (3-slot, 19-inch horizontal shelf)
- ADC HMS-308 (8-slot remote enclosure)
- ADC HMS-317 (28-slot, 23-inch shelf)
- Charles Ind. #3192 (28-slot connectorized)
- Charles Ind. #3192-WR (28-slot wire wrap)
- Charles Ind. #343-00 (12- to 14-slot wire wrap)
- Charles Ind. #319-02 (22-slot connectorized)
- Charles Ind. #319-04 (22-slot wire wrap)
- Charles Ind. #340-00 (9-slot to 11-slot wire wrap)
- Larus #1185 (28-slot connectorized)

Charles Ind. 343-00 and 340-00 shelves do not support the H2TU-C System Alarm output on pin H. Also, if slots 1 and 2 of these shelves were wired for the 3408 Fault Locate unit, they must be rewired to accept the H2TU-C.

APPENDIX D - PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products.

TECHNICAL SUPPORT

Technical support is available 24 hours a day, 7 days a week by contacting the ADC Wireline Systems Division Customer Service Engineering Group at one of the following numbers:

Telephone:	800.638.0031 or 714.730.3222 The 800 telephone support line is toll-free in the U.S. and Canada.
Fax:	714.832.9924
Email:	wsd_support@adc.com
Online:	www.adc.com/knowledge_base_frames

A Customer Service Engineer answers technical assistance calls Monday through Friday between 7:30 AM and 5:30 PM, Pacific Time, excluding holidays. At all other times, an on-duty Customer Service Engineer returns technical assistance calls within 30 minutes.

RETURNS

To return equipment to ADC Wireline Systems Division:

1 Locate the number of the purchase order under which the equipment was purchased. You will need to provide this number to ADC Wireline Systems Division Customer Service to obtain a return authorization.

2 Call or write ADC Wireline Systems Division Customer Service to ask for a Return Material Authorization (RMA) number and any additional instructions. Use the telephone number, fax number, or email address listed below:

- Telephone: 800.370.9670
- Fax: 714.832.9923
- Email Address: rma@adc.com

3 Include the following information, in writing, along with the equipment you are returning:

- Company name, address, telephone number, and the name of a person Customer Service can contact regarding this equipment.
- The purchase order number provided to Customer Service when the RMA number was requested.
- A description of the equipment, as well as the number of units that you are returning. Be sure to include the model and part number of each unit.
- The shipping address to which Customer Service should return the repaired equipment.

- The reason for the return:
  - The equipment needs an ECO/ECN upgrade.
  - The equipment is defective.

If the equipment is defective, please tell us what you observed just before the equipment malfunctioned. Be as detailed in your description as possible.

  - If there is another reason for returning the equipment, please let us know so we can determine how best to help you.

4 Pack the equipment in a shipping carton.

5 Write the ADC Wireline Systems Division address and the RMA number you received from Customer Service clearly on the outside of the carton and return to:

ADC Wireline Systems Division
14352 Franklin Ave.
Tustin, CA 92780-7013

Attention: **RMA (Number)**

All shipments are to be returned prepaid. ADC will not accept any collect shipments.

APPENDIX E - ABBREVIATIONS

A

ACO: Alarm Cutoff

ACQ: Acquisition

AIS: Alarm Indication Signal

ALRM: Alarm Condition

AMI: Alternate Mark Inversion

AnL: Acquisition n Loop

AOR: Addressable Office Repeater

AWG: American Wire Gauge

B

B8ZS: Bipolar with 8-Zero Substitution

BPV: Bipolar Violation

BPVT: Bipolar Violation Transparency

C

CLOC: Customer Local Loopback

CO: Central Office

CSA: Carrier Service Area

D

DBER: DS1 Bit Error Rate

DLC: Digital Loop Carrier

DS0: Digital Signal, level 0

DSX-1: DS1 Cross-Connect Frame

E

ECI: Equipment Catalog Item

EQL: Equalization

ES: Errored Seconds

ESD: Electrostatic Discharge

ESF: Extended SuperFrame

EXZ: The occurrence of 8 consecutive zeroes for B8ZS or 16 for AMI

F

FERR: Framing Bit Error

FLDL: Flash Download

G

GFD: Ground Fault Detect

H

HBER: HDSL2 Block Error Rate

HCDS: High Capacity Digital Service

HG: HiGain

I

ID: Identification

ILR: Intelligent Line Repeater

IOR: Intelligent Office Repeater

IR: Intelligent Repeater

L

LA: Loop Attenuation

LAIS: Line Alarm Indication Signal

LATT: Loop Attenuation

LED: Light Emitting Diode

LLOS: Local Loss of Signal

LOF: Loss of Frame

LOS: Loss of Signal

LOSW: Loss of Sync Word

LPDN: Loopdown

LPF: Line Power Feed

M

MAL: Margin Alarm

MON: Monitor

MSEC: Monitored Seconds

N

NID: Network Interface Device

NLOC: Network Local Loopback

NMA: Network Management and Administration

NREM: Network Remote Loopback

O

OPTIS: Overlapped PAM Transmission with Interlocking Spectra

P

PAM: Pulse Amplitude Modulation

PL: Payload

PRMF: Performance Report Messaging - Far End

PRM-FE: Performance Report Messaging - Far End

PRMN: Performance Report Messaging - Near End

PRM-NE: Performance Report Messaging - Near End

R

RAI-CI: Remote Alarm Indication-Customer Installation

RAIS: Remote Alarm Indication Signal

RDA: Remote Disconnect Alarm

RLOS: Remote Loss of Signal

RRAI: Remote Alarm Indication

S

SES: Severely Errored Seconds

SES-L: Severely Errored Seconds - Line

SES-P: Severely Errored Seconds - Path

SF: SuperFrame

SMJK: SmartJack Loopback

SNET: Southern New England Telephone

SPLB: Special Loopback

SPNn: Span Number

T

TRCI: Transmit RAI-CI

TX RAI-CI Indication - Customer Installation

TUC: Transmission Unit Central Office

TUR: Transmission Unit Remote End

U

UAS: Unavailable Errored Seconds

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.

STANDARDS COMPLIANCE

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

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

For technical assistance, refer to “Appendix D - Product Support” on page 59.

ADC DSL Systems, Inc.

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Technical Assistance

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