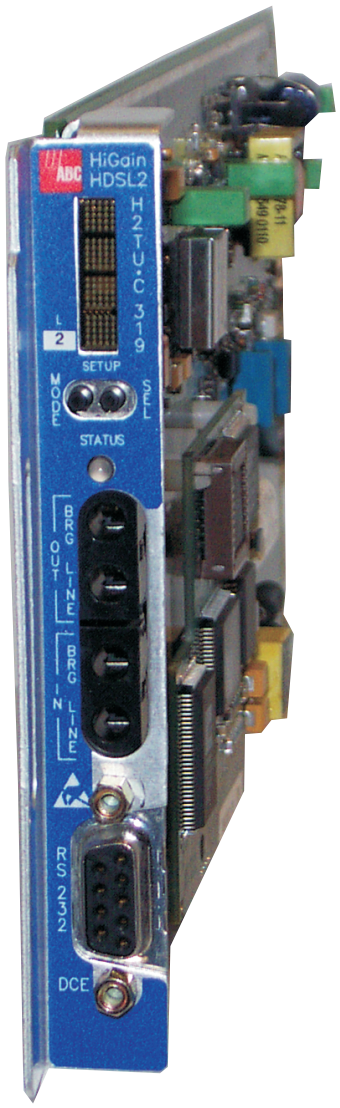
# HiGain

# USER MANUAL




**H2TU-C-319 List 2 Line Unit**
Product Catalog: H2TU-C-319-L2
CLEI: VACJKUYE

## Revision History of This Manual

To order copies of this document, use document catalog number LTPH-UM-1113-01.

| Issue | Release Date | Revisions Made |
|---|---|---|
| 1 | January 9, 2002 | Initial release |


### Copyright

*January 9, 2002*

*© 2002 ADC DSL Systems, Inc. All rights reserved.*

### Trademark Information

*ADC is a registered trademark of ADC Telecommunications, Inc. HiGain is a registered trademark of ADC DSL Systems, Inc. No right, license, or interest to such trademarks is granted hereunder, and you agree that no such right, license, or interest shall be asserted by you with respect to such trademark. Other product names mentioned in this practice are used for identification purposes only and may be trademarks or registered trademarks of their respective companies.*

### Disclaimer of Liability

*Information contained in this document is company private to ADC DSL Systems, Inc., and shall not be modified, used, copied, reproduced or disclosed in whole or in part without the written consent of ADC.*

*Contents herein are current as of the date of publication. ADC reserves the right to change the contents without prior notice. In no event shall ADC be liable for any damages resulting from loss of data, loss of use, or loss of profits, and ADC further disclaims any and all liability for indirect, incidental, special, consequential or other similar damages. This disclaimer of liability applies to all products, publications and services during and after the warranty period.*

# USING THIS MANUAL

The following conventions are used in this manual:

- `Monospace type` indicates screen text.
- Keys you press are indicated by small icons such as Y or ENTER. Key combinations to be pressed simultaneously are indicated with a plus sign as follows: CTRL + ESC.
- Items you select are in **bold**.
- Three types of messages, identified by icons, appear in text.

**Notes contain information about special circumstances.**

**Cautions indicate the possibility of personal injury or equipment damage.**

**The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.**

For a list of abbreviations used in this document, refer to "Appendix E - Abbreviations" on page 60.

# 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.

# TABLE OF CONTENTS

**Overview** ____ **1**
Features ....1
Compatibility ....2
Applications ....2
**Front Panel** ____ **3**
**Installation** ____ **7**
Verification ....8
Verification without an H2TU-R Remote Unit ....8
Verification with an H2TU-R Remote Unit ....8
**Provisioning** ____ **9**
Using the MODE and SEL Pushbuttons ....9
Setting Options through MODE and SEL ....9
Resetting to Factory Default Values ....10
Displaying System Parameter Settings ....10
Disabling an Alarm ....10
Loopback Modes ....10
Using a Maintenance Terminal ....11
Connecting to a Maintenance Terminal ....11
The Logon Screen ....11
Provisioning Tasks ....14
Setting Date and Time ....14
Setting Circuit ID Numbers ....15
Configuring the System ....16
Clearing the History, Alarm, and Event Log Screens ....23
**Monitoring System Activity and Performance** ____ **24**
Using the Monitor Screen to View System Activity ....24
Using the Performance Screens to View Performance Data ....26
Performance History at the DS1 Interface ....26
Current Statistics Screens for the DS1 Interface ....28
Performance History at the HDSL2 Interface ....30
Using the Performance Screens to View Alarm Data ....33
Alarm History at the DS1 Interface ....33
Alarm History at the HDSL2 Interface ....35
Using the System Event Log to Track Events ....36
Event Log Messages ....37
**Testing** ____ **38**

Front Panel System Alarms ..... 38
Alarm Option for the Digital Loop Carrier Feed ..... 39
Retiring System Alarms ..... 39
Remote LOS and AIS Response ..... 40
OCT55 Test Pattern with AMI Line Code ..... 40
Loopback Operation ..... 41
Generic Loopback Commands ..... 42
Special Loopback Commands ..... 43
Manual Loopback Session ..... 44
Setting the Loopback Time-Out Option ..... 44
Activating Manual Loopback Mode ..... 44
Loopback Test Procedures ..... 45
General Troubleshooting Tips ..... 45
GNLB Test Procedures ..... 45
A1LB, A2LB, and A5LB Test Procedures ..... 47
Testing with H2TU-C BERT Generator ..... 50
Testing with H2TU-R BERT Generator ..... 51
**Appendix A - Specifications ..... 52**
Power Consumption ..... 53
Maximum Power Dissipation ..... 53
Maximum Current Drain ..... 53
Loop Attenuation ..... 54
H2TU-C-319 List 2 Card-Edge Connector ..... 54
Network Management Control Bus ..... 55
Fuse Alarm ..... 55
System Alarm Output Pin ..... 55
Craft Port ..... 56
**Appendix B - Functional Operation ..... 57**
Timing ..... 57
Ground Fault Detect ..... 57
**Appendix C - Compatibility ..... 58**
**Appendix D - Product Support ..... 59**
Technical Support ..... 59
Returns ..... 59
**Appendix E - Abbreviations ..... 60**
**Certification and Warranty ..... Inside Back Cover**

# LIST OF FIGURES

1. H2TU-C-319 List 2 Front Panel ..... 3
2. Installing the H2TU-C-319 List 2 into a Shelf ..... 7
3. Logon Screen ..... 12
4. Config Menu - Date and Time ..... 14
5. Inventory Screen ..... 15
6. Config Menu ..... 16
7. Config Menu - Standard Options (defaults shown) ..... 17
8. Config Menu - ADC Options (defaults shown) ..... 17
9. Config Menu - Set to Factory Defaults ..... 22
10. Config Menu - Master Clear ..... 23
11. Monitor Screen - Active Loopback with Alarms ..... 24
12. H2TU-R DS1 31-Day Performance History ..... 26
13. H2TU-R DS1 25-Hour Performance History ..... 27
14. H2TU-C DS1 48-Hour Performance History ..... 27
15. H2TU-R DS1 Current Statistics ..... 28
16. H2TU-C DS1 Current Statistics ..... 28
17. H2TU-C HDSL2 31-Day Performance History ..... 30
18. H2TU-C HDSL2 48-Hour Performance History ..... 30
19. H2TU-C HDSL2 25-Hour Performance History ..... 31
20. H2TU-C HDSL2 Current Statistics ..... 31
21. H2TU-C DS1 Alarm History Screen ..... 33
22. H2TU-R DS1 Alarm History Screen ..... 34
23. H2TU-C HDSL2 Alarm History Screen ..... 35
24. System Event Log ..... 36
25. H2TU-R LOS and AIS Response Priorities ..... 40
26. Loopback Summary ..... 41
27. Loopback Modes ..... 46
28. H2TU-C BERT Generator Screen ..... 50
29. H2TU-R BERT Generator Screen ..... 51
30. H2TU-C-319 List 2 Card-Edge Connector ..... 54
31. RS-232 Craft Port Pinouts ..... 56
32. H2TU-C-319 List 2 Block Diagram ..... 57

# LIST OF TABLES

1. Front-Panel Descriptions ..... 4
2. Front-Panel Display Messages ..... 5
3. Navigational Keys for the HiGain HDSL2 Maintenance Terminal Screens ..... 11
4. Logon Screen Menus ..... 13
5. H2TU-C-319 List 2 Standard Config Menu Options ..... 18
6. H2TU-C-319 List 2 ADC Config Menu Options ..... 19
7. DS1/DSX-1 24-hour PM Threshold ..... 21
8. Monitor Screen Descriptions ..... 25
9. Error Acronyms Used on the DS1 Performance History Screens ..... 29
10. Error Acronyms Used on the HDSL2 Performance History Screens ..... 32
11. DS1 Alarm Descriptions ..... 34
12. HDSL2 Alarm Descriptions ..... 35
13. Event Log Messages ..... 37
14. Front-Panel System Alarms Summary ..... 38
15. Summary of HiGain Loopback Codes and Activation Methods ..... 42
16. Addressable Repeater Loopback Commands (A1LB, A2LB, A5LB) ..... 47
17. Addressable Repeater Loopback Commands (A3LB and A4LB) ..... 49
18. BERT Signal Generator Option Settings ..... 50
19. H2TU-C-319 List 2 Power Parameters ..... 53
20. HDSL2 Reach Chart ..... 54

# OVERVIEW

The H2TU-C-319 List 2 (H2TU-C) is the Central Office (CO) side of a repeaterless T1 transmission system. The system provides 1.544 Mbps transmission on one unconditioned copper pair over the full Carrier Service Area (CSA) range. Enhanced firmware also allows the H2TU-C to be deployed in Wideband 3190 protection switching applications. These applications must meet the following system requirements: HiGain multiplexers (HXU-358s) using software version 1.04 or higher, an HMU-319 List 7A or List 7C using software version 3.06 or higher, an HRE-206 remote enclosure equipped with a PSC-606 List 1 protection switching controller, and an H2TU-R-402 List 1B or List 1C remote unit.

## FEATURES

Features specific to the H2TU-C-319 List 2 include:

- Support for automatic (1 x N) protection switching (APS)
- Bit Error Rate Tester (BERT)

Standard features include:

- 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 pushbuttons
  - 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

- Compatible with 3192 mechanics shelves
- 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.

- 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 135Ω. In general, HiGain HDSL2 systems:

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

# FRONT PANEL

Figure 1 shows the H2TU-C-319 List 2 front panel. Table 1 on page 4 describes the front-panel components. For pinout diagrams of the H2TU-C-319 List 2 card-edge connector and craft port, refer to "Appendix A - Specifications" on page 52.

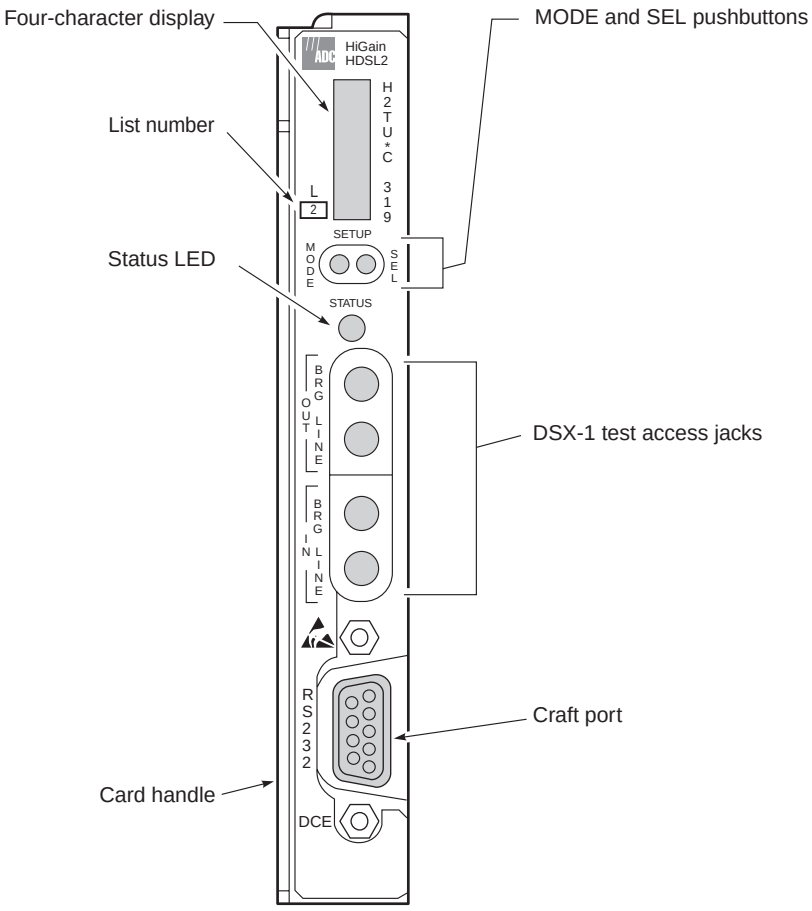



***Figure 1.*** *H2TU-C-319 List 2 Front Panel*

***Table 1.*** *Front-Panel Descriptions*

| 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 5 for a listing of the four-character messages. |
| MODE and SEL pushbuttons | Permits user options to be monitored and modified without the need of a maintenance terminal. Used to initiate all HiGain loopbacks and test states as well as to display DSX-1 line parameters and line unit identity. |
| Status LED | The status LED can report the following conditions: |
| Off | Line power is off. |
| Green | Normal operation. |
| Red | Fuse alarm. |
| Flashing red | HDSL2 aquisition or susyem 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. |
| DSX-1 access jacks | |
| BRG | Provides non-intrusive bridging 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. |
| Card handle | Used to insert and extract card. |
| List number | Identifies the list number of the H2TU-C. |

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

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

| Message | Full Name | Description |
|---|---|---|
| **ALARM MESSAGES** | | |
| ACO | Alarm Cut Off | A system alarm has occurred, and has been retired to an ACO condition by pressing SEL 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. |
| LRAI | Line RAI | Indicates an RAI alarm (yellow) from the CPE with an error-free signal from the line unit or network. |
| 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. |
| 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. |
| **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. |

*Continued*

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

| Message | Full Name | Description |
|---|---|---|
| **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. |
| 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 A1LB, A2LB, or A5LB 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. |
| **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

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

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, then push the unit firmly into the slot guides until it enters the backplane connector.

**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.**

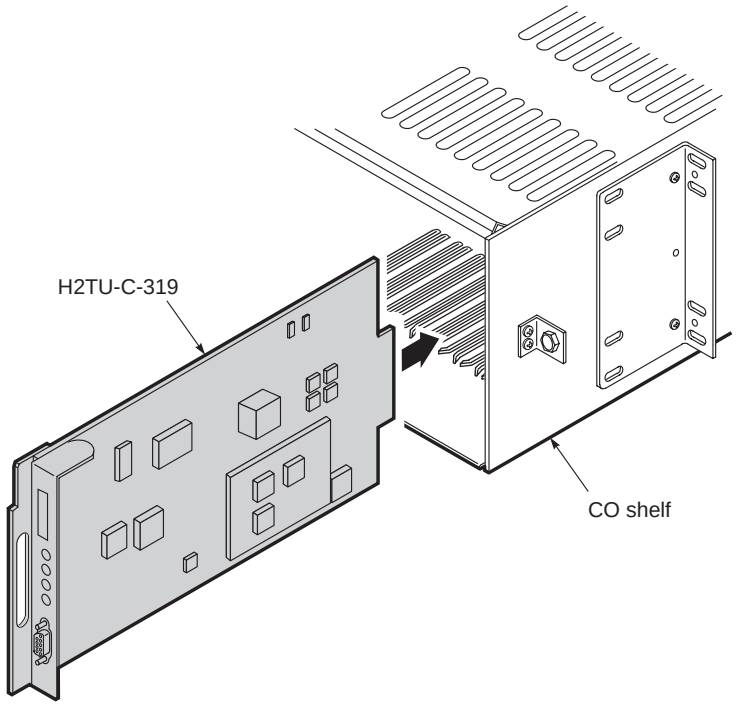



***Figure 2.*** *Installing the H2TU-C-319 List 2 into a Shelf*

# VERIFICATION

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

- Status LED
- Status messages reported by the front-panel display (Table 2 on page 5 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 (Table 2 on page 5 lists the status messages).

**2** Verify that the H2TU-C attempts to communicate with a remote unit (status LED flashes red). Even if a remote unit is not present, the following events should 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
- 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 3 on page 12 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 18, 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 39.

## Loopback Modes

See “Loopback Operation” on page 41 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 1 on page 3, 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 3 on page 12, 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 13 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.**

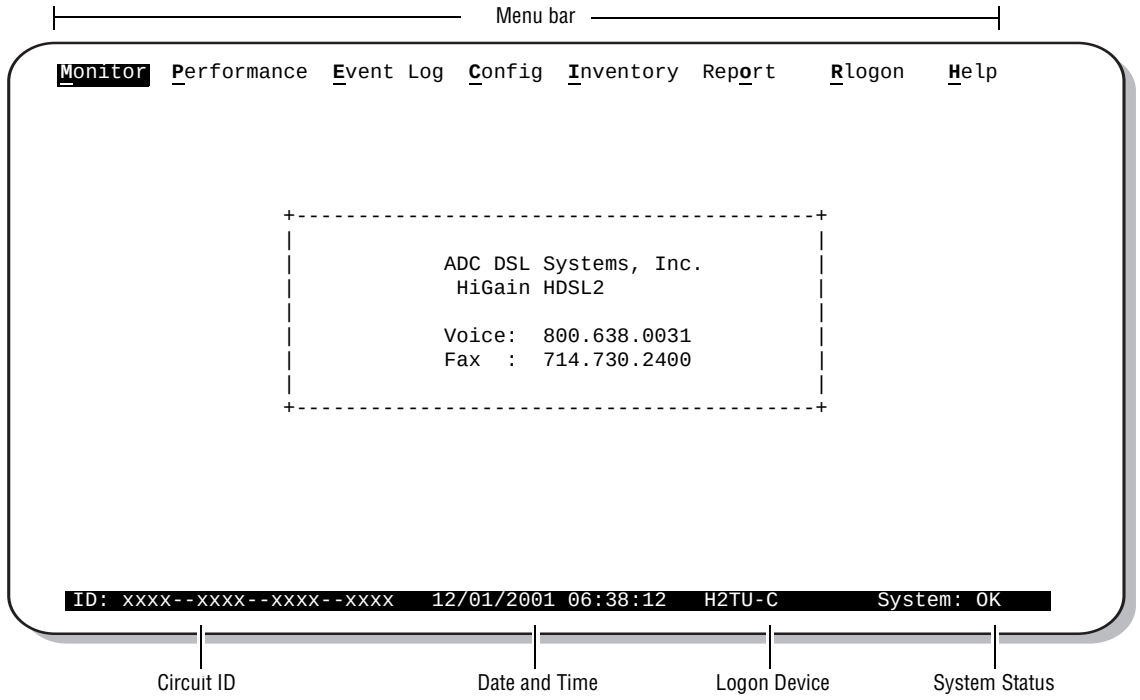



***Figure 3.*** *Logon Screen*

***Table 4.*** *Logon Screen Menus*

| Press this key: | To access this menu: | Menu Functions |
|---|---|---|
| M | Monitor | Monitors loopbacks and alarms, provides a graphical representation of circuit activity, including ES, UAS, SES, and line code. |
| P | Performance | Provides performance and alarm histories for current, 25-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 interface. Selecting this menu after a remote logon will permit viewing of the H2TU-R Blockage Indicator (BI) History screen, as displayed from the DS1 interface. See and Figure 16 on page 28. |
| E | Event Log | Identifies the 100 most recent system events and reports the date and time of occurrence. Selecting this menu after a remote logon displays the Sectionalized Event Log for the H2TU-R. For more information on current statistics, see Figure 21 on page 33. |
| 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. |
| O | Report | Provides four types of reports: Full Report, Short Report, System Information Report, and Event Report. |
| R | Rlogon/Rlogout | Remote logon can be performed from the H2TU-C or H2TU-R. The screen displays Rlogout when the H2TU-C or H2TU-R is remotely logged on to the other unit at the end of the circuit.<br>To log off from the remote unit, press R. Rlogout changes to Rlogon. 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, aids for turn-up and printing, and ADC contact information. |

# PROVISIONING TASKS

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

- Set date and time (see "Setting Date and Time" on this page).
- Set circuit ID numbers (see "Setting Circuit ID Numbers" on page 15).
- Make any configuration changes (see "Configuring the System" on page 16).
- Clear history, alarm, and event log screens to remove miscellaneous data during startup (see "Clearing the History, Alarm, and Event Log Screens" on page 23).

## Setting Date and Time

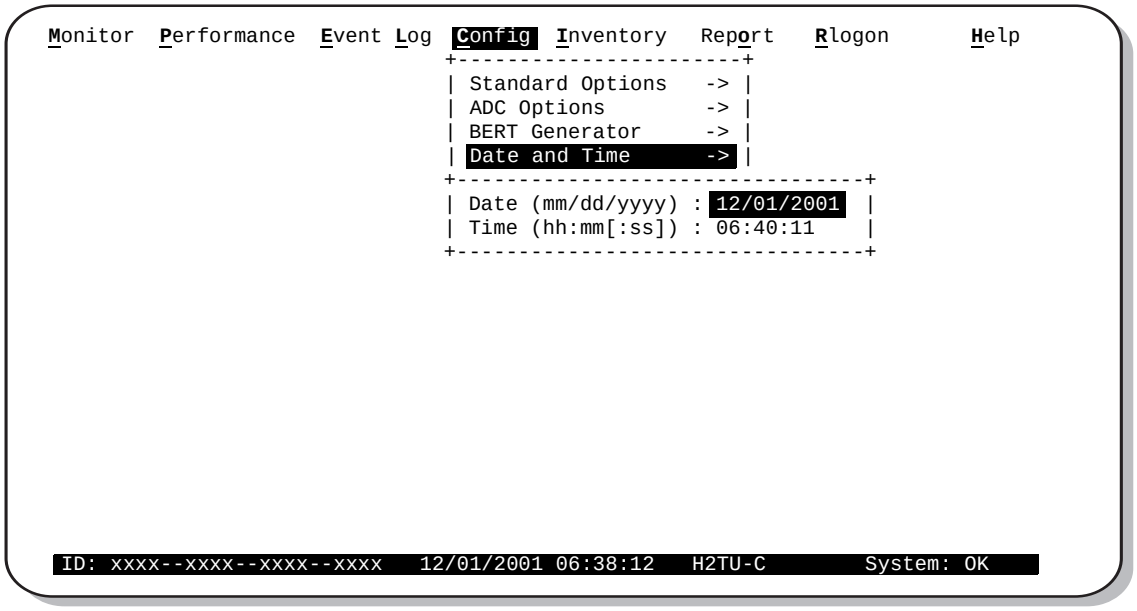



***Figure 4.*** *Config Menu - Date and Time*

1 Press C to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **Date and Time**, then press ENTER.

3 Type the date in the format indicated, then press ENTER.

4 Type the time in the format indicated (entering seconds is optional), then press ENTER.

## Setting Circuit ID Numbers

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

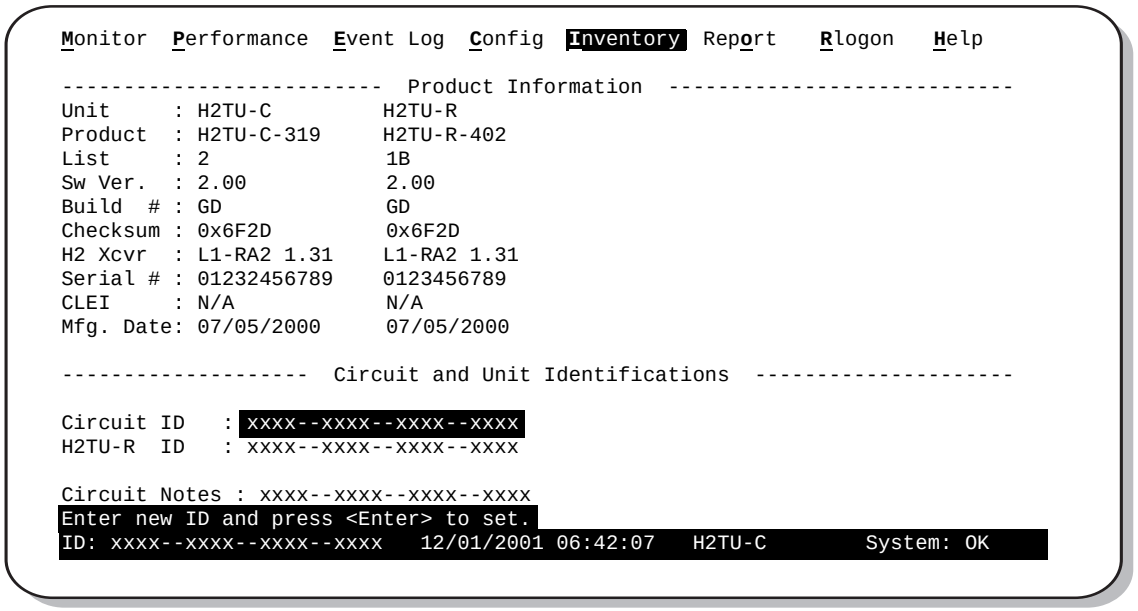



***Figure 5.*** *Inventory Screen*

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 6 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 14).
- Master clear (see "Clearing the History, Alarm, and Event Log Screens" on page 23).
- Reset to factory default configuration (see "Resetting the H2TU-C" on page 22).
- BERT Generator (see "Testing with H2TU-R BERT Generator" on page 51).

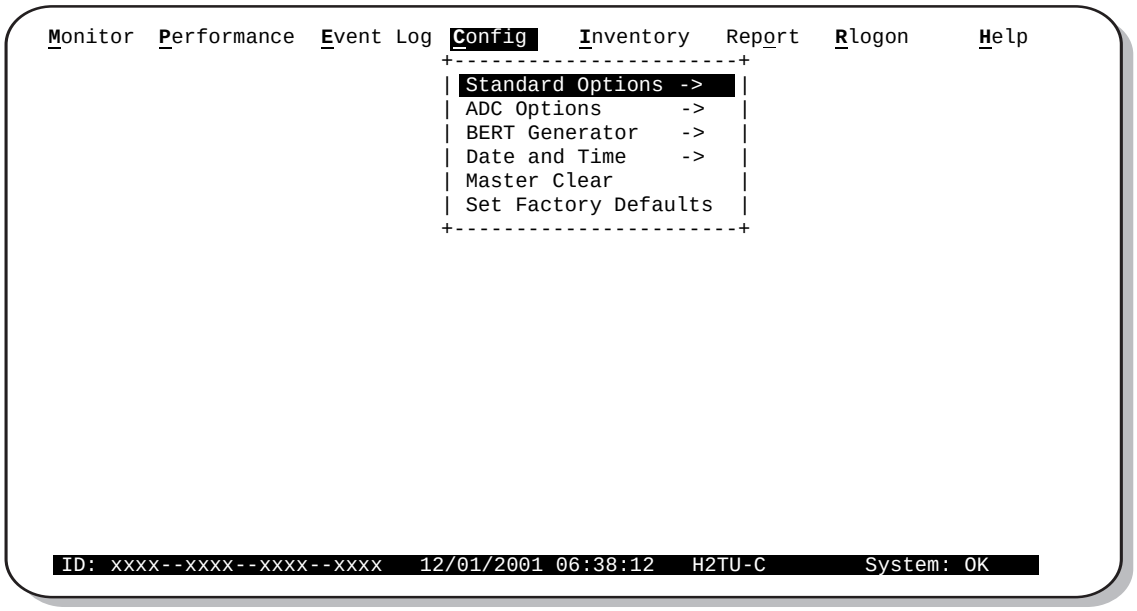



***Figure 6.*** *Config Menu*

### Making Changes to Standard and ADC Options

Figure 7 and Figure 8 on page 17 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 18 and Table 6 on page 19. 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.

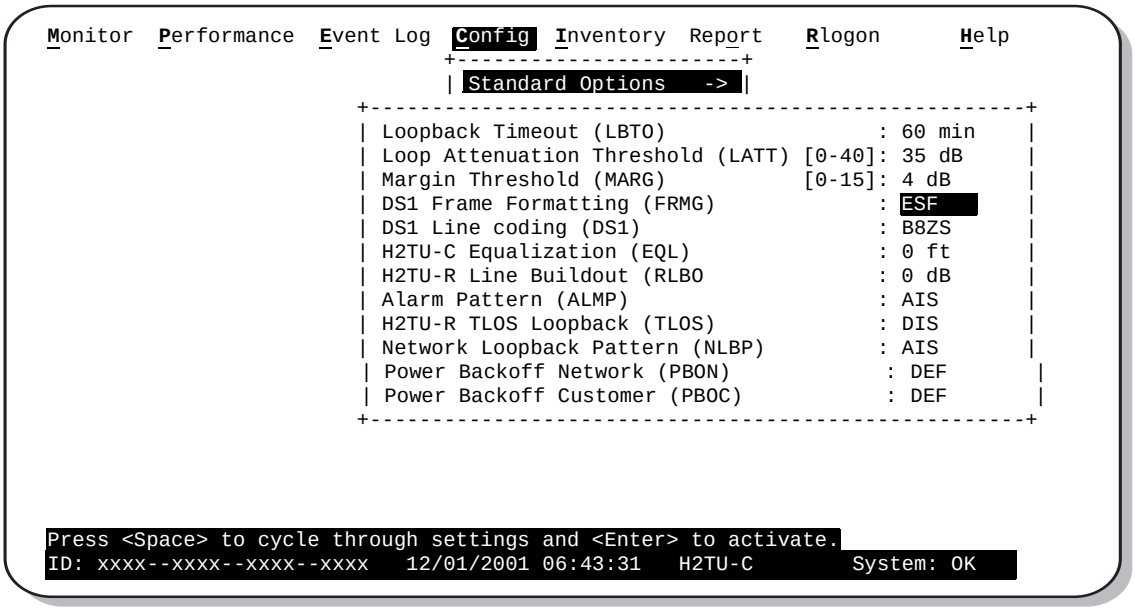



***Figure 7.*** *Config Menu - Standard Options (defaults shown)*

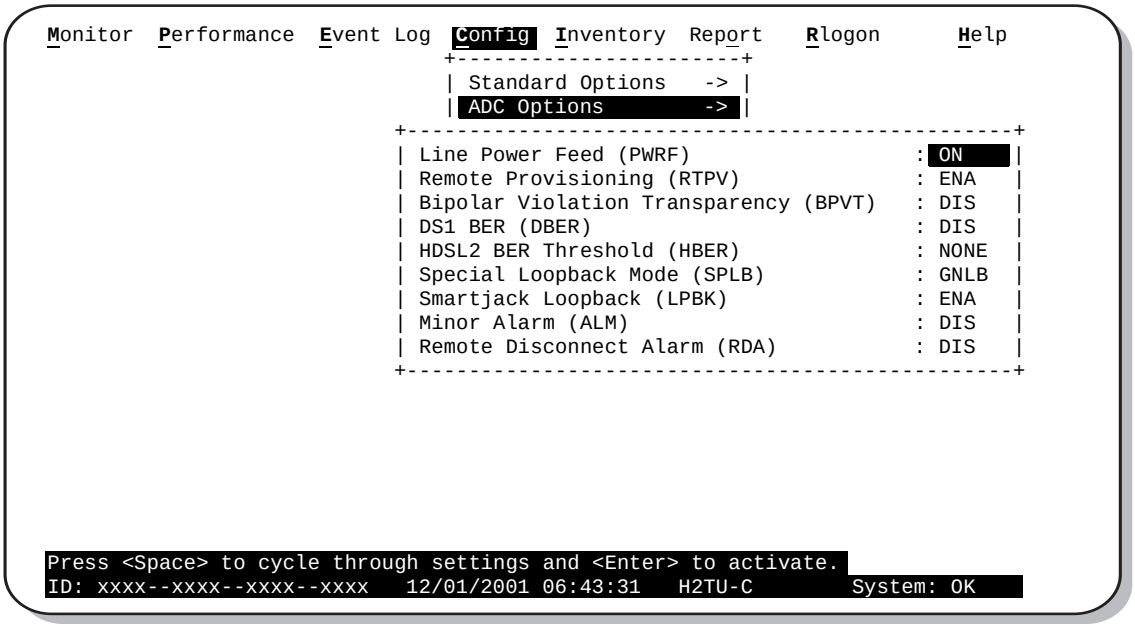



***Figure 8.*** *Config Menu - ADC Options (defaults shown)*

Table 5 describes the Standard Config screen options and lists their front-panel display codes. Table 6 on page 19 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 2 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. |
| | | 8 hr | Sets automatic cancellation of all loopbacks to 8 hours after initiation. |
| | | 24 hr | Sets automatic cancellation of all loopbacks to 24 hours after initiation. |
| Loop Attenuation Threshold | LATT | 0 through 40 dB | Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold can only be set through the maintenance screens. |
| | | **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.<br>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.<br>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<br>See "H2TU-C Equalization (EQL) Option." on page 20. | 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 2 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 25 on page 40 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 25 on page 40. |
| | | **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 25 on page 40. |
| | | LOS | Enables the H2TU-R to transmit LOS toward the CI for any network loopback. |
| Power Back Off - Customer<br>See "Power Back Off (PBON and PBOC) Options" on page 21. | PBOC | **DEF** | Configures power output levels of the H2TU-R customer unit toward network to comply with the Default template per Section 6.1.4.2 of ANSI T1.418. |
| | | ENH | Configures power output levels of the H2TU-R customer unit toward network to comply with the Enhanced template per Section 6.1.4.2 of ANSI T1.418. |
| Power Back Off - Network<br>See "Power Back Off (PBON and PBOC) Options" on page 21. | PBON | **DEF** | Configures power output levels of the H2TU-C network unit toward customer to comply with the Default template per Section 6.1.4.2 of ANSI T1.418. |
| | | ENH | Configures power output levels of the H2TU-C network unit toward customer to comply with the Enhanced template per Section 6.1.4.2 of ANSI T1.418. |

***Table 6.*** *H2TU-C-319 List 2 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<br>See "Bipolar Violation Transparency (BPVT) Option" on page 21. | 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<br>See "DS1 BER (DBER) Option" on page 21. | 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<br>See "HDSL2 BER Threshold (HBER) Option" on page 20 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. |

*Continued*

***Table 6.*** *H2TU-C-319 List 2 ADC Config Menu Options (Cont.)*

| ADC Config Menu Options | Front-Panel Display Code | Selection | Description |
|---|---|---|---|
| Special Loopback Mode | SPLB | **GNLB** | Configures the HiGain HDSL2 system to respond to the generic in-band loopback codes. |
| | | A1LB and A2LB | Configures the HiGain HDSL2 system to respond to the in-band loopback codes of the Teltrend addressable repeater. |
| | | A3LB | Configures the HiGain HDSL2 system to respond to the in-band loopback codes of the Wescom addressable repeater. |
| | | A4LB | Configures the HiGain HDSL2 system to respond to the in-band loopback codes of the Wescom Mod 1 addressable repeater. |
| | | A5LB | Configures the HiGain HDSL2 system to respond to the in-band loopback codes of the Teltrend Mod 1 addressable repeater. |
| SmartJack Loopback | LPBK | **ENA** | Enables the HiGain HDSL2 system to recognize all in-band SmartJack loopback commands. |
| | | DIS | Configures the HiGain HDSL2 system to ignore all in-band 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 (-48V) is not asserted and AIS is sent towards the network from the H2TU-C.<br>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. |

**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 = $7.7 \times 10^{-3}$). 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 23.

***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 |

**Power Back Off (PBON and PBOC) Options.** Power Back Off Network (PBON) and Power Back Off Customer (PBOC) allow the HDSL2 circuit to support two transmit power templates: default (DEF), higher level, and enhanced (ENH), lower level. These are defined in the four-wire section of the ANSI T1.418 Issue 2 HDSL2 standard. Each HDSL4 receiver detects the level it is receiving during the start-up, pre-activation sequence. It then compares this level to the level it should be receiving according to the PBON and PBOC option settings (DEF or ENH). If the received level is outside the template limits, the receiver sends a message to the upstream HDSL2 transmitter requesting the proper level. These levels are adjusted only during the start-up routine or if the PBON or PBOC option settings are changed during normal operation. Since the ENH template levels are up to 15 dBm below those of the DEF template, the ENH setting can be used to reduce crosstalk levels into adjacent circuits. (For example, if crosstalk noise is being induced by the H2TU-R, set the PBOC option to its lower (ENH) level setting. Conversely, if the HDSL2 signal at the H2TU-R is being affected by crosstalk noise induced from adjacent pairs, set the PBOC option to its higher (DEF) level setting.

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

## 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.

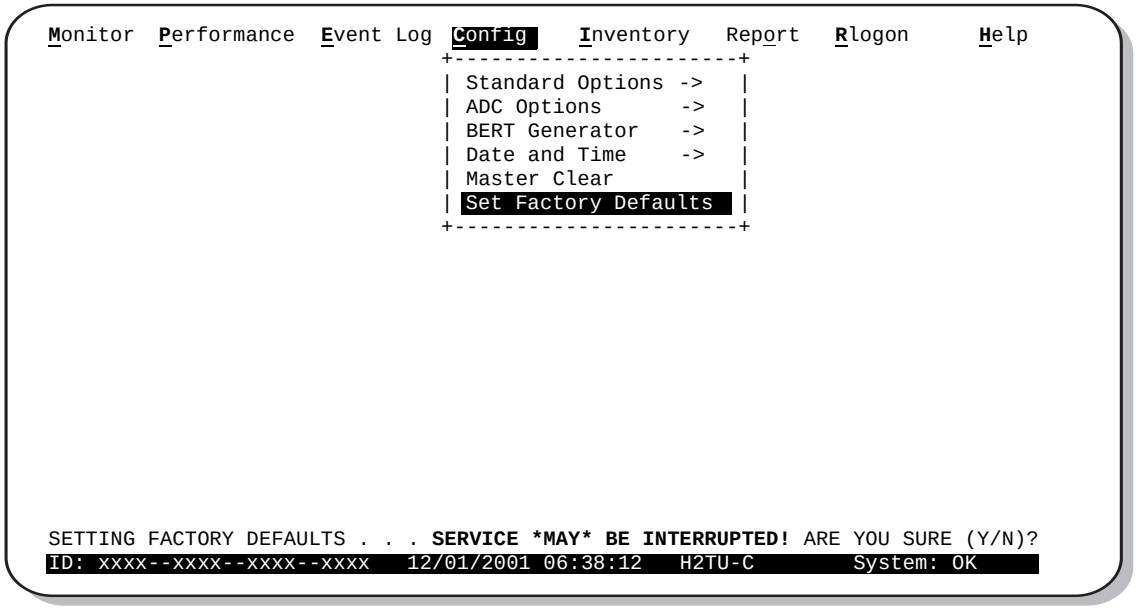



***Figure 9.*** *Config Menu - Set to Factory Defaults*

## 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.

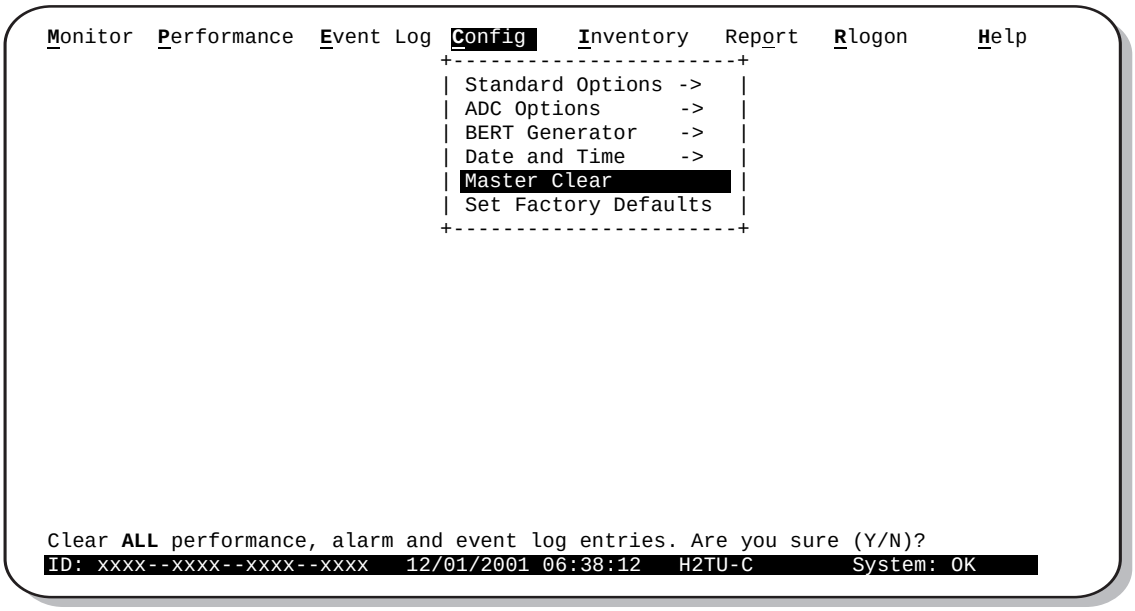



***Figure 10.*** *Config Menu - Master Clear*

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 34.
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 11 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 25 describes the screen field.

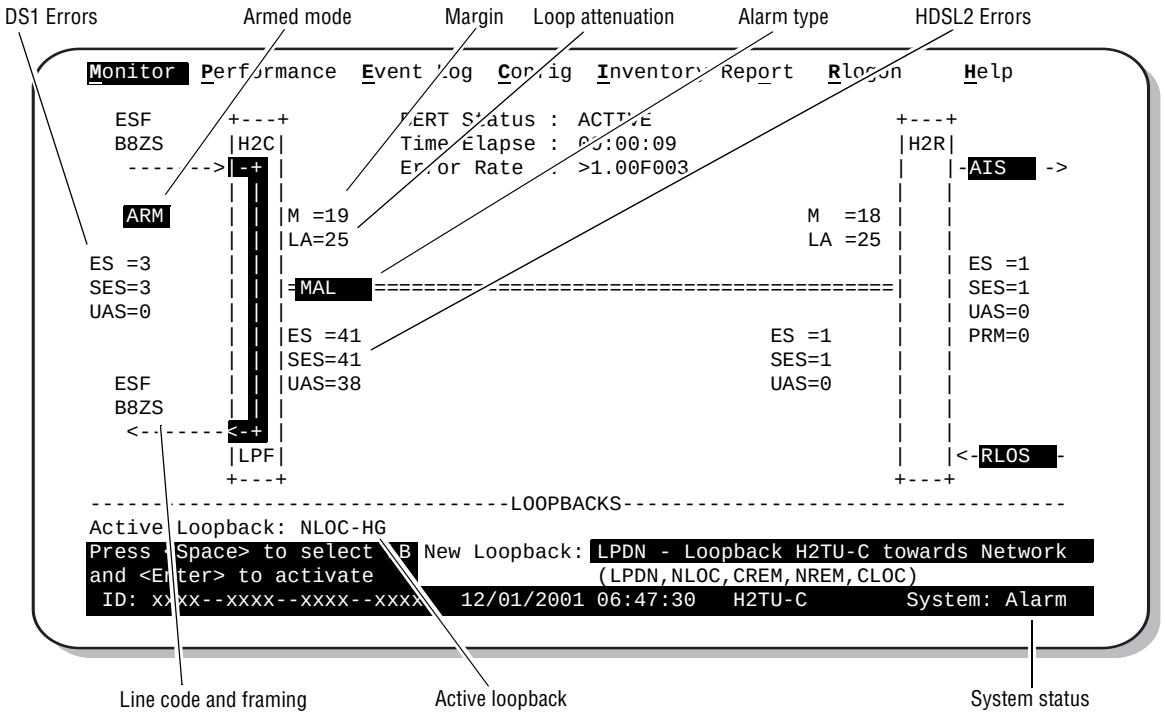



***Figure 11.*** *Monitor Screen - Active Loopback with Alarms*

**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 38.

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 42 for a summary of the HiGain HDSL2 generic loopback codes and activation methods. |
| Alarm Type | Indicates type of alarm. |
| LA | Loop Attenuation (LA)—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation (OPAM) transmission 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 OPAM signal than is the 196 kHz loss. The normal HiGain HDSL2 LA operation range should be kept under 45 dB. |
| MAL | Margin Alarm—Indicates the margin on HDSL2 loop has dropped below the threshold (0 to 15dB) set by the operator. |
| Armed Mode | Indicates system is in an armed state for an intelligent repeater loopback command. |
| BERT Status | Provides BERT Generator status, elapsed time, and BERT results. |
| DS1 Errors | |
| ES Count | Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors included are: DS1 frame errors, BPV, and ESF CRC errors. |
| SES Count | Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours. |
| UAS Count | Unavailable Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period. |
| Frame and Code Type | |
| ESF | Type of DS1 framing used on the input stream (SF, ESF, or UNFR). |
| B8ZS | Type of DS1 line coding used (B8ZS or AMI). |
| HDSL4 Errors | |
| ES Count | Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours. |
| SES Count | Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. (An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors.) This value is a running total of the last 24 hours. |
| UAS Count | Unavailable Seconds—The number of seconds the HDSL4 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours. |
| ID | Circuit identification (ID) number. |
| LPF | Line Power Feed—Indicates the HDSL4 line power is on. |
| Margin | Margin (M)—The signal-to-noise ratio at all HDSL4 ports, relative to a $10^{-7}$ Bit Error Rate. |
| PL (or HG) | PL displays when the loopback was initiated by a command embedded in the DS1 data path payload (PL). HG displays when the loopback was initiated from a HiGain (HG) front panel or by a HiGain maintenance terminal loopback command. |
| PRM | The sum of the Performance Report Messaging-Near End (PRM-NE) and Performance Report Messaging-Far End (PRM-FE) counts. |
| System Status | The presence or absence of an alarm condition is indicated on the lower right corner of all screens. **System: OK** indicates that there are no alarms present; **System: Alarm** indicates the presence of an alarm. Refer to "Using the Performance Screens to View Alarm Data" on page 33. |

# 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 21 on page 33 and Figure 22 on page 34) or DS1 interfaces (Figure 22 on page 34) 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 12 below and Figure 13 on page 27 are examples of DS1 performance history screens at the remote unit. Figure 14 on page 27 is an example of DS1 performance history screens at the line unit. Refer to Table 9 on page 29 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  Report   Rlogon       Help

                        H2TU-R DS1   31 Day History (Page 1 of 3)
-------------------------------------------------------------------------------
  Date     CV-L   ES-L  SES-L  UAS-L    CV-P   ES-P  SES-P  UAS-P PRM-NE PRM-FE
 11/09       -      -      -      -       -      -      -      -      -      -
 11/10       -      -      -      -       -      -      -      -      -      -
 11/11       -      -      -      -       -      -      -      -      -      -
 11/12       -      -      -      -       -      -      -      -      -      -
 11/13       -      -      -      -       -      -      -      -      -      -
 11/14       -      -      -      -       -      -      -      -      -      -
 11/15       -      -      -      -       -      -      -      -      -      -
 11/16       -      -      -      -       -      -      -      -      -      -
 11/17       -      -      -      -       -      -      -      -      -      -
 11/18       -      -      -      -       -      -      -      -      -      -
 11/19       -      -      -      -       -      -      -      -      -      -
 11/20      14     10     10     12      10     10      0      0      0      0
 11/21       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   12/01/2001 07:05:33   H2TU-C        System: OK
```

***Figure 12.*** *H2TU-R DS1 31-Day Performance History*

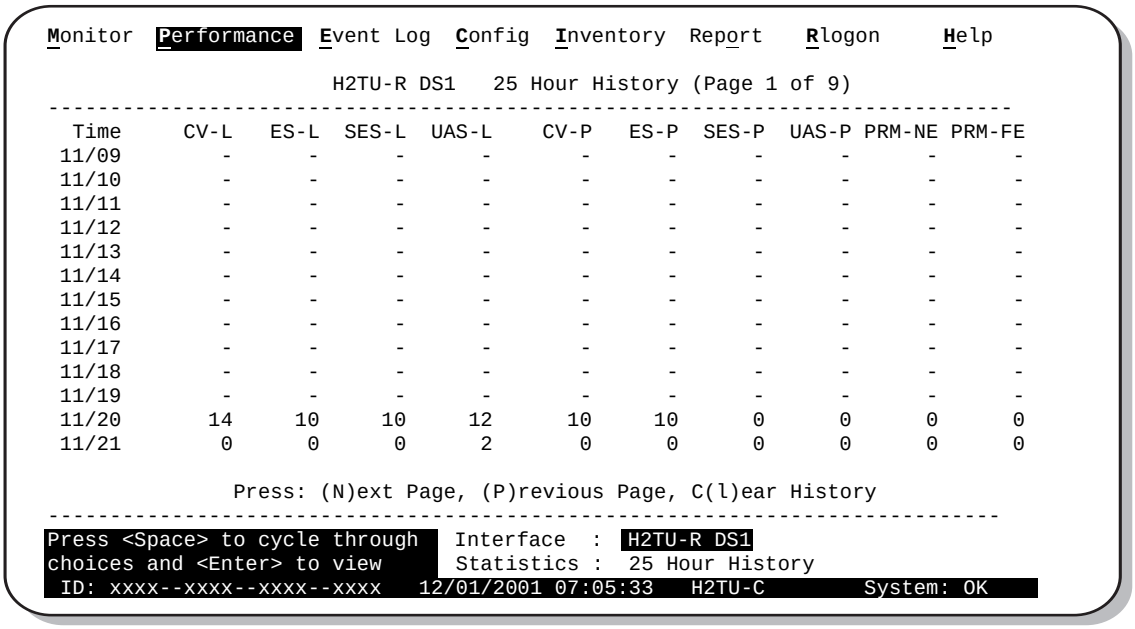



***Figure 13.*** *H2TU-R DS1 25-Hour Performance History*

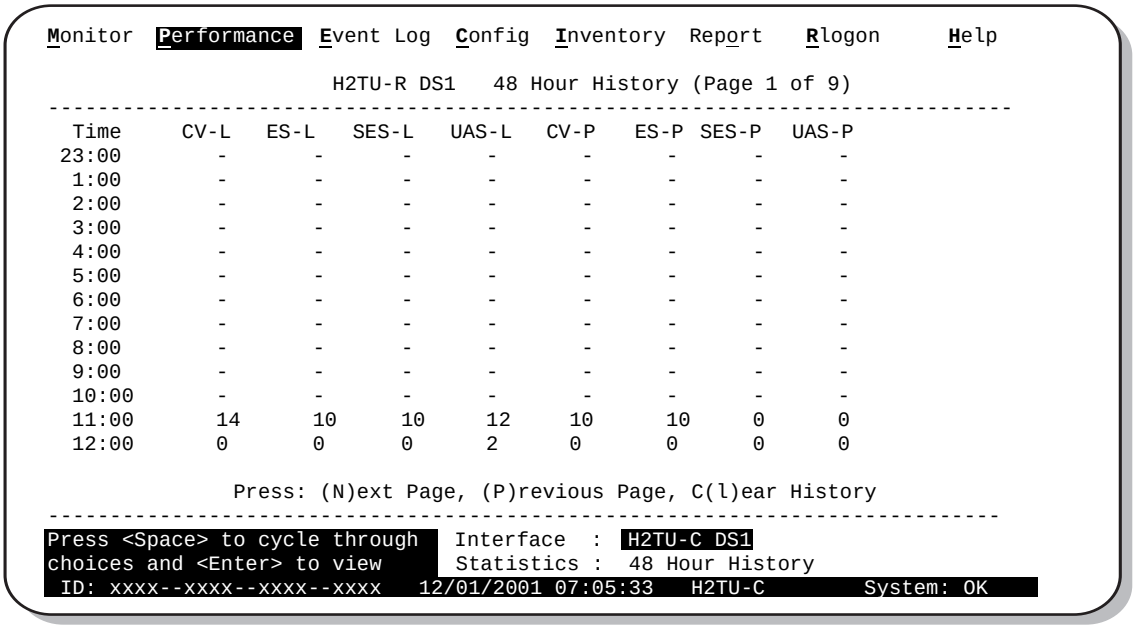



***Figure 14.*** *H2TU-C DS1 48-Hour Performance History*

## Current Statistics Screens for the DS1 Interface

Examples of current statistics screens are shown below. Figure 15 and Figure 16 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 29 for descriptions of the kinds of errors reported on these screens.

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

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

CV-L          0         0         0
ES-L          0         0         0
SES-L         0         0         0
UAS-L         0         0         0
CV-P          0         0         0
ES-P          0         0         0
SES-P         0         0         0
UAS-P         0         0         0
PRM-NE        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   12/01/2001 07:05:33   H2TU-C        System: OK
```

***Figure 15.*** *H2TU-R DS1 Current Statistics*

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

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

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


B8ZSS         0         0         0
MSEC       3482      1801         1
                      Press: C(l)ear Current Statistics
--------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  :  H2TU-C DS1
choices and <Enter> to view     Statistics :  Current
 ID: xxxx--xxxx--xxxx--xxxx   12/01/2001 07:05:33   H2TU-C        System: OK
```

***Figure 16.*** *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<br>Total BPV count. | SES-P | Severely Errored Seconds - Path<br>Seconds with SEF or CRC(ESF) ≥ 320 or FE [(d)](SF) ≥ 8 ($F_T$ + $F_S$). |
| ES-L | Errored Seconds - Line<br>Seconds with BPV ≥ 1. | UAS-P | Unavailable Seconds - Path<br>A second of unavailability based on SES-P or AIS ≥ 1. |
| SES-L | Severely Errored Seconds - Line<br>Seconds with BPV plus EXZ ≥ 1544 or LOS ≥ 1. | PRM-NE [(a)] | Performance Report Monitoring - Near End<br>The PRM from CPE indicates errors, and the signal received from the network at the remote is error-free. |
| UAS-L | Unavailable Seconds - Line<br>Seconds with LOS ≥ 1. | PRM-FE [(a)] | Performance Report Monitoring - Far End<br>The PRM from the network indicates errors, and the signal received from the CPE is error-free. |
| CV-P | Code Violation - Path<br>Total count of FE errors for SF or CRC-6 errors for ESF. | B8ZSS [(b)] | B8ZS Monitored Seconds<br>Seconds with B8ZS detection when AMI option is active. |
| ES-P | Errored Seconds - Path<br>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 17 and Figure 18 below are examples of 31-day and 48-hour performance history screens. Figure 19 on page 31 is an example of a 25-hour performance history screen. Refer to Table 10 on page 32 for descriptions of the kinds of errors reported on all HDSL2 performance screens. Asterisks indicate performance monitoring from the previous day.

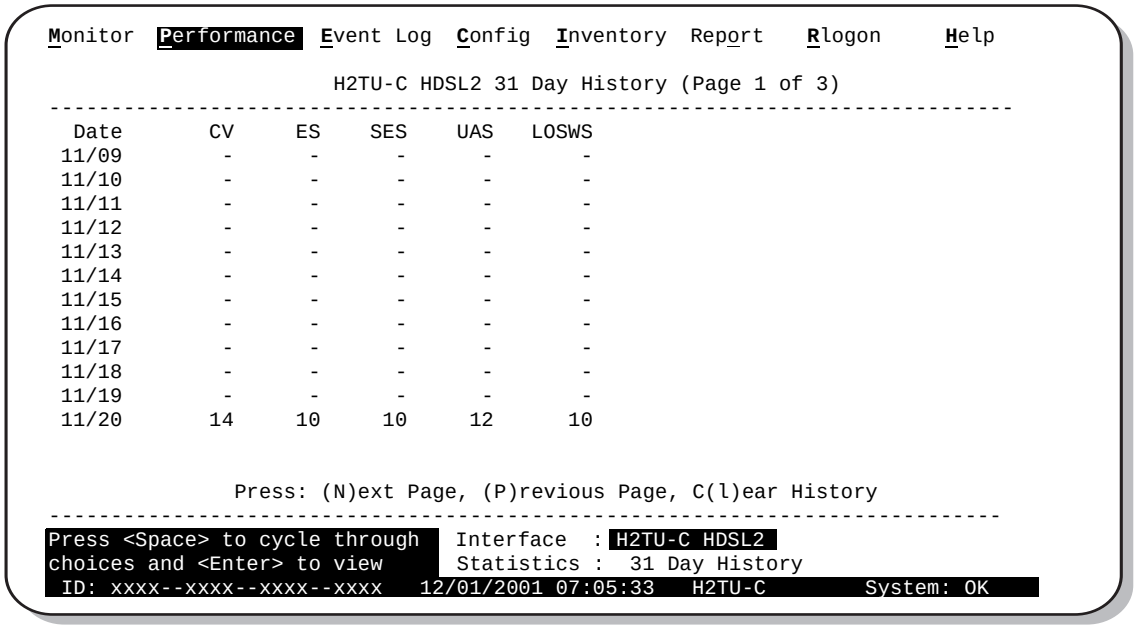



***Figure 17.*** *H2TU-C HDSL2 31-Day Performance History*

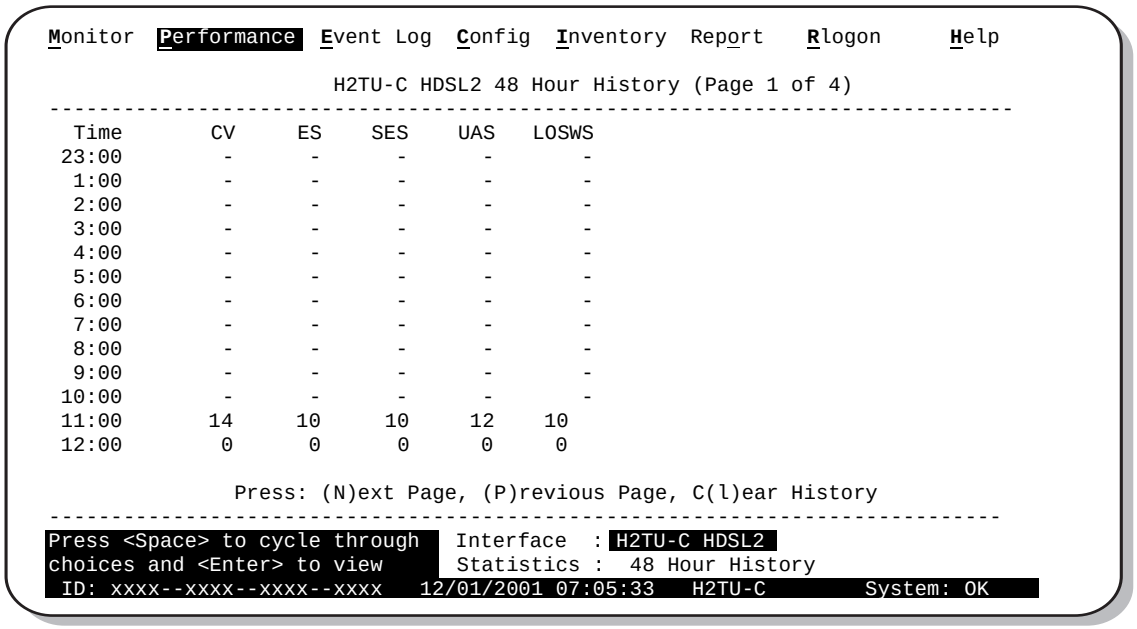



***Figure 18.*** *H2TU-C HDSL2 48-Hour Performance History*

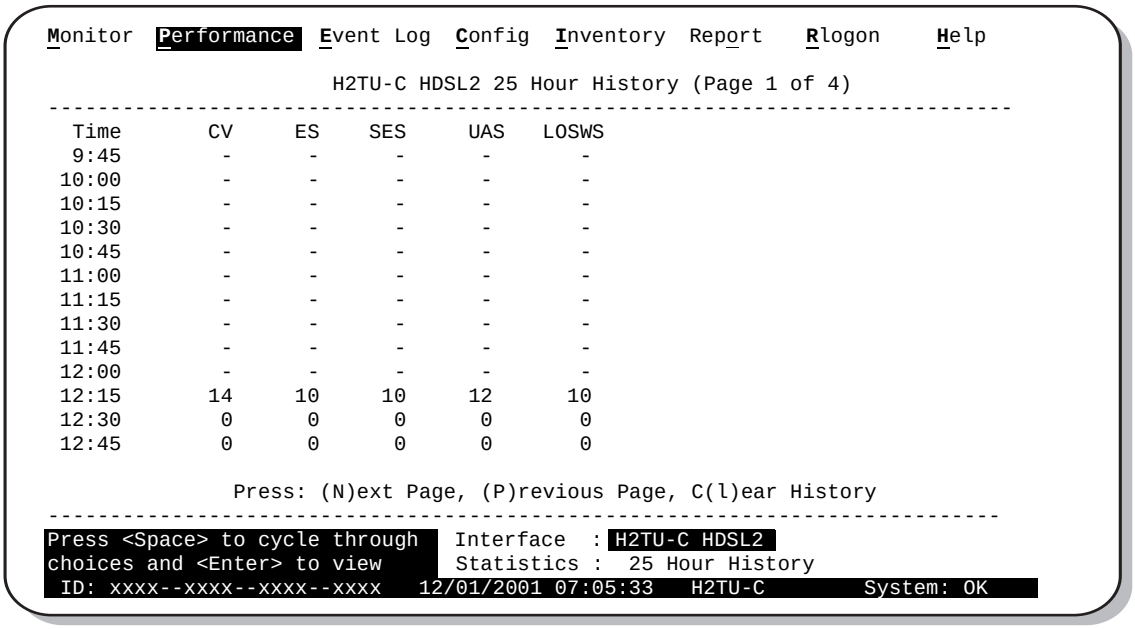



***Figure 19.*** *H2TU-C HDSL2 25-Hour Performance History*

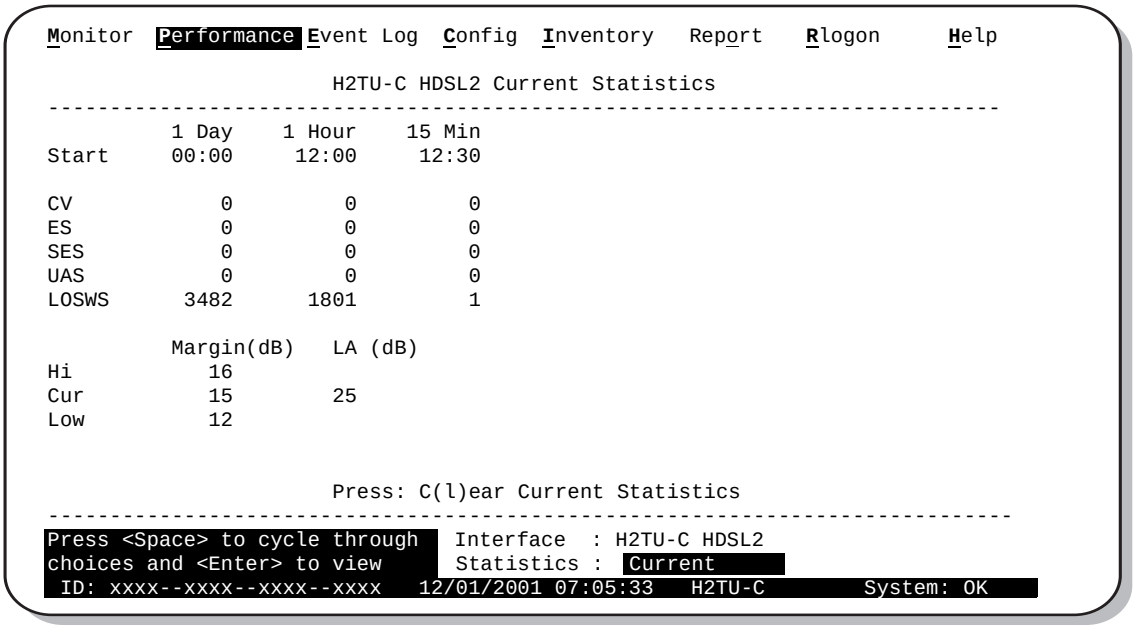



***Figure 20.*** *H2TU-C HDSL2 Current Statistics*

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

| Error Acronym | Description |
|---|---|
| ES | Errored Seconds<br>Seconds with HDSL2 CRC ≥ 1 or LOSW ≥ 1 |
| SES | Severely Errored Seconds<br>Seconds with HDSL2 CRC ≥ 50 or LOSW ≥ 1 |
| UAS | Unavailable Seconds<br>Based on 10 contiguous SES occurrences |
| CV | Code Violation<br>Total count of HDSL2 CRC errors. |
| LOSWS | Loss of Sync Word Second<br>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 21 below. DS1 statistics for the H2TU-R are shown in Figure 22 on page 34. The types of alarms reported are described in Table 11 on page 34. Current alarms are shown in reverse video.

```
Monitor  Performance  Event Log  Config  Inventory   Report    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   12/01/2001 07:05:33   H2TU-C        System: Alarm
```

***Figure 21.*** *H2TU-C DS1 Alarm History Screen*

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

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

RLOS                                                   OK           0
RAIS                                                   OK           0
RAI                                                    OK           0
LRAI                                                    OK           0
PRM-NE                                                 OK           0
PRM-FE                                                 OK           0
DBER          12/01/01 00:37        12/01/01 00:45     OK           7
LOF                                                    OK           0




                        Press: C(l)ear Alarm History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  :  H2TU-R DS-1
choices and <Enter> to view     Statistics :  Alarm History
 ID: xxxx--xxxx--xxxx--xxxx   12/01/2001 07:05:33   H2TU-C        System: Alarm
```

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

***Table 11.*** *DS1 Alarm Descriptions*

| Screen Alarm | Front-Panel Alarm | Description |
|---|---|---|
| **H2TU-C DSI Alarms (see Figure 21 on page 33)** | | |
| 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 22 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 25 on page 40) 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. |
| PRM-NE | PRMN | Performance Report Monitoring - Near End—The count of the PRM-NE register at the H2TU-R exceeds the $10^{-6}$ BER threshold at 648 events since 12:00:00 AM. |
| PRM-FE | PRMF | Performance Report Monitoring - Far End—The count of the PRM-FE register at the H2TU-R exceeds the $10^{-6}$ BER threshold at 648 events since 12:00:00 AM. |
| DBER | *xxx*-DBER | Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately $10^{-6}$. (*xxx* denotes either TUC or TUR.) |
| LOF | 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. |

(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 23 shows the H2TU-C HDSL2 alarm history and Table 12 describes the alarms.

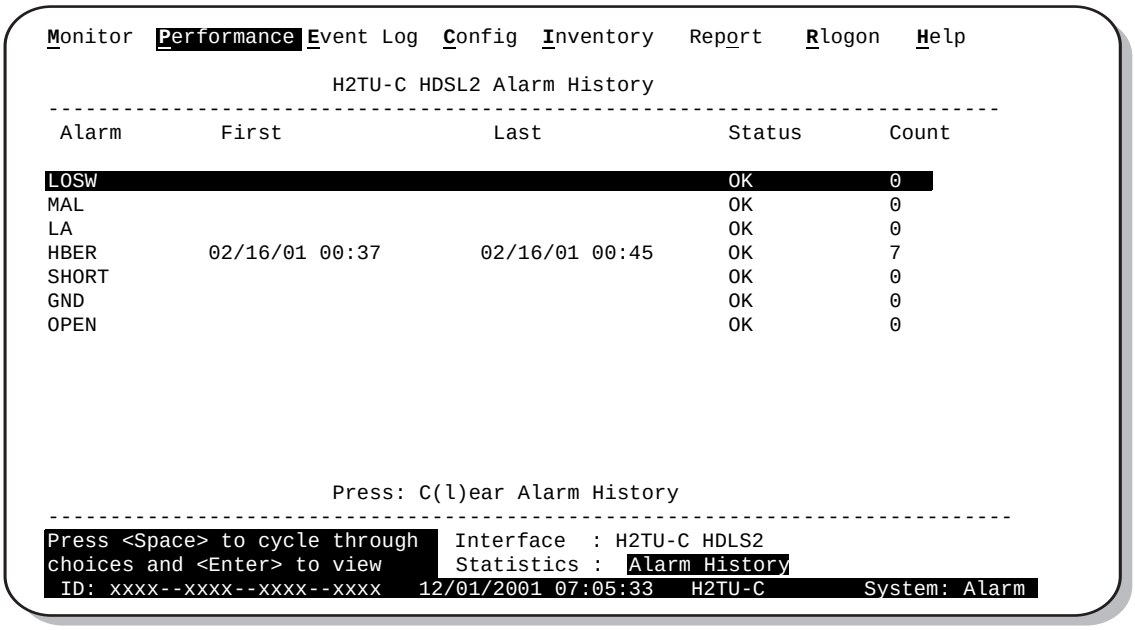



***Figure 23.*** *H2TU-C HDSL2 Alarm History Screen*

***Table 12.*** *HDSL2 Alarm Descriptions*

| Screen Alarm | Front-Panel Alarm | Description |
|---|---|---|
| LOSW | 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 37 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 Log  Config  Inventory   Report    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   12/01/2001 07:07:54   H2TU-C        System: OK
```

***Figure 24.*** *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 |

# 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 33). 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. |
| LOSW [c] | Loss of Sync Word [d] | The HDSL2 loop has lost synchronization. | 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. |
| LRAI | Line (unit) Remote Alarm Indication | Indicates an RAI condition is detected at the remote and the signal from the line unit is error-free. | Cannot be inhibited. |
| 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. |
| *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. |

*Continued*

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

| Front-Panel Message [a] | Alarm | Description | To Inhibit |
|---|---|---|---|
| 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 25 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 18 and Table 6 on page 19.

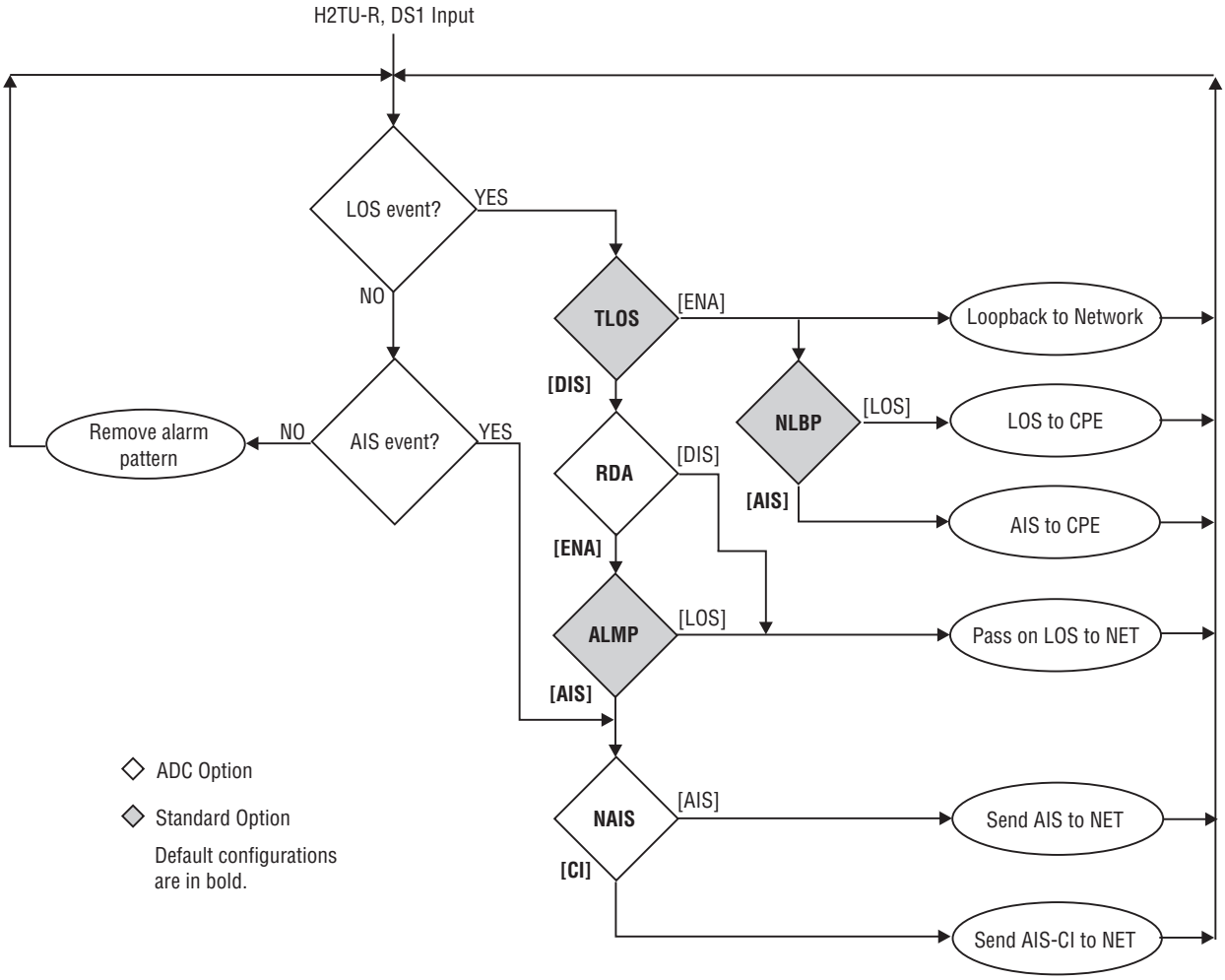



***Figure 25.*** *H2TU-R LOS and AIS Response Priorities*

# 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 42)
- Special Loopback (SPLB) options (see "Special Loopback Commands" on page 43) and the following command tables:
  - Addressable Repeater Loopback commands: A1LB, A2LB, A5LB (see Table 16 on page 47)
  - Addressable Repeater Loopback commands: A3LB, A4LB (see Table 17 on page 49)

Loopback commands can be initiated by:

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

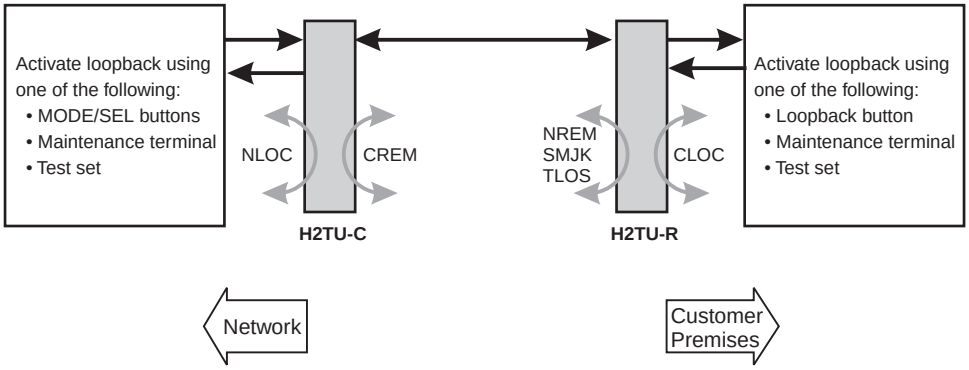



***Figure 26.*** *Loopback Summary*

**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 in-band codes to loop up either NLOC (4-in-7) or NREM (3-in-7) towards the network. In addition, these in-band 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 in-band codes must be present for at least 5 seconds before the HiGain system responds.

Figure 26 on this page summarizes the available loopbacks in the system, and Table 15 on page 42 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/SEL** |
| NLOC | 1111000<br>4-in-7 | DSX-1 signal is looped back to the network at the H2TU-C. | X | X | X |
| NREM | 1110000<br>3-in-7 | DSX-1 signal is looped back to the network at the H2TU-R. | X | X | X |
| CLOC | 1111100<br>5-in-7 | DS1 signal from the customer is looped back to the customer at the H2TU-R. | X | X | X |
| CREM | 1111110<br>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<br>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<br>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 in-band command. NREM, on the other hand, is initiated by the 3-in-7 in-band command, or by a command issued from the maintenance terminal.**

**Use the in-band commands to enable or disable the SMJK loopback options.**
**The H2TU-C system setting is normally enabled to recognize all in-band 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 47 and Table 17 on page 49 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 42 with the exception of SmartJack loopbacks, which can only be issued by in-band 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 18 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 SEL pushbuttons.**

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

- **The next loopback option can be displayed by pressing the MODE pushbutton; however, the previously activated loopback remains active until the SEL pushbutton is pressed, which activates the new loopback.**
- **If neither pushbutton is pressed for a period of 30 seconds and no loopback is in effect, the manual loopback session terminates, and the display returns to normal mode.**
- **If any loopback is in effect, the 30-second time-out is inhibited. The active loopback and the manual loopback session, continue until the loopback times out in accordance with the LBTO setting.**
- **If there is an active loopback, pressing the MODE and SEL pushbuttons for 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 SEL pushbuttons on the front panel for at least 3 seconds. The following message appears on the front-panel display:

`MAN LPBK NLO?`

**2** Press SEL 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 SEL to activate the selected loopback. The previous loopback is terminated.

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

All loopbacks (except dual loopbacks) can be initiated by in-band commands in the DS1 payload. Loopbacks can also be initiated by a command from the HiGain system (front-panel pushbuttons or maintenance screen selections). Therefore, whenever a loopback is active, the method by which it was activated is indicated in the Loopback and Status 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 in-band commands. Dual loopback commands are only activated by the front-panel pushbuttons or maintenance screen selections.**

# LOOPBACK TEST PROCEDURES

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

## General Troubleshooting Tips

If trouble is encountered on the DSX-1 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 18. All equalizers should be set to the distance from the DSX-1 to the shelf.

## GNLB Test Procedures

Figure 27 on page 46 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. Refer to Table 15 on page 42 for a description of these commands.

To perform the GNLB loopback test procedure:

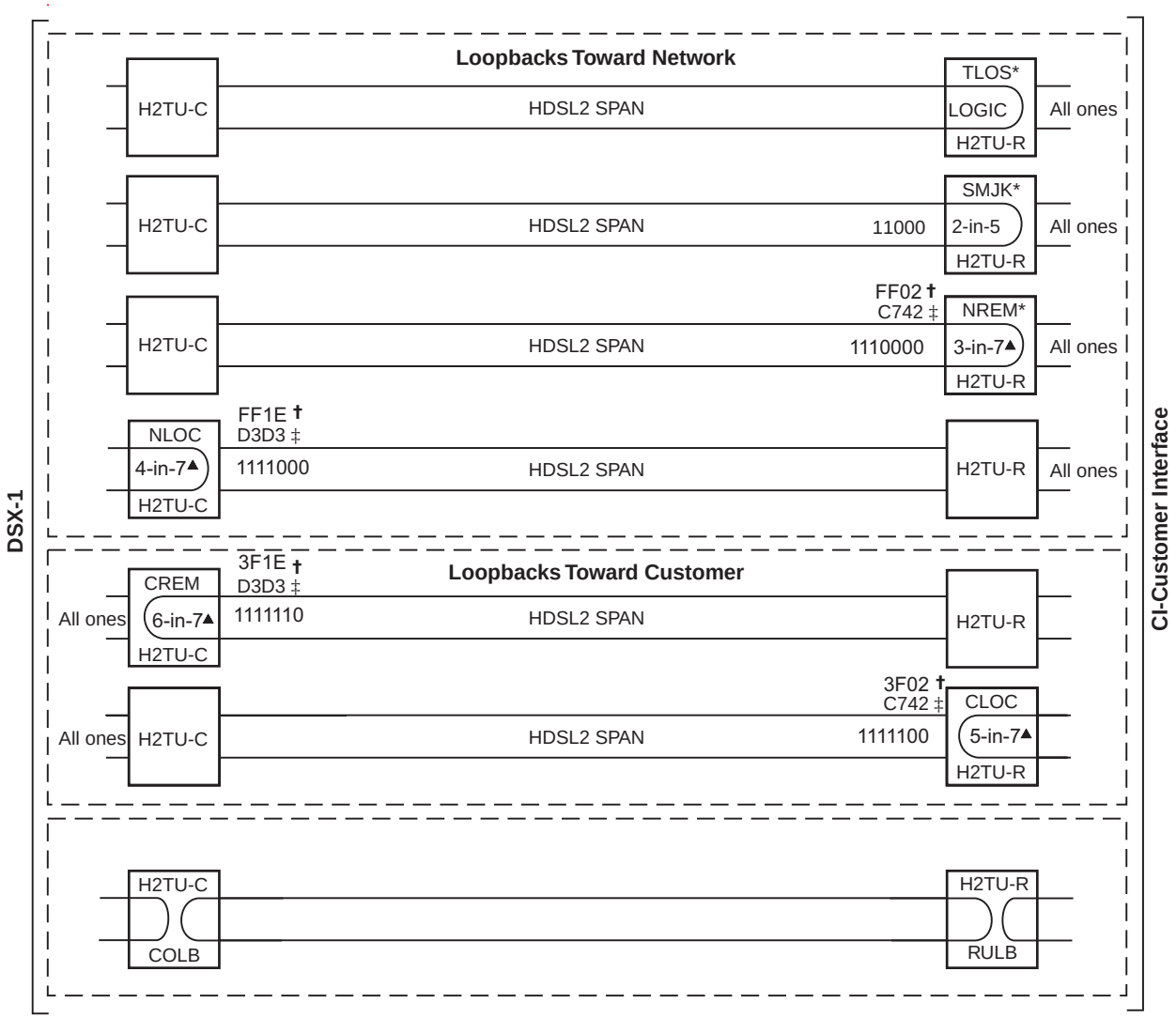
**1** Have the CO tester send the NREM (3-in-7) in-band loopup code for 5 seconds. You should be able to observe the NREM message on the front-panel display. (The Status LED on the front panel should be green, and the loopback mode should also be identified on the Span Status screen.)

**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 in-band loopdown code.

**4** Have the CO tester send the NLOC (4-in-7) in-band 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 27.*** *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 (in-band) | 11000-11000 ... | Arming code |
| ARMING or NI LPBK (ESF Data Link) | 1111-1111-0100-1000 (FF48) | Arming code |
| IR LPDN or DISARM (in-band) | 11100-11100 ... | Disarming code |
| IR LPDN or DISARM (ESF Data Link) | 1111-1111-0010-0100 (FF24) | Disarming code |
| IOR LPBK<br>(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.<br>CREM—Signal from customer is looped back to the customer at the H2TU-C. |
| ILR-2 LPBK<br>(20 bit errors) [c] | 1100-0111-0100-0010 (C742) | NREM—DSX-1 signal is looped back to the network at the H2TU-R.<br>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<br>(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 in-band 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:

- 2 seconds of AIS (an all ones pattern)
- 2 seconds of returning data pattern
- 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
- 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 in-band 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 in-band 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.

# TESTING WITH H2TU-C BERT GENERATOR

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

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

1 Press C to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **BERT Generator,** then press ENTER.

3 Use the arrow keys to select an option and press the SPACEBAR to cycle through the settings. Refer to Table 18 for a list of BERT generator option settings.

4 Press ENTER to activate your choice.

5 To view BERT status, press ESC twice, then use the ← arrow key to select the **Monitor** menu.

6 Press ENTER. You can exit the status screen while signal generation is active.

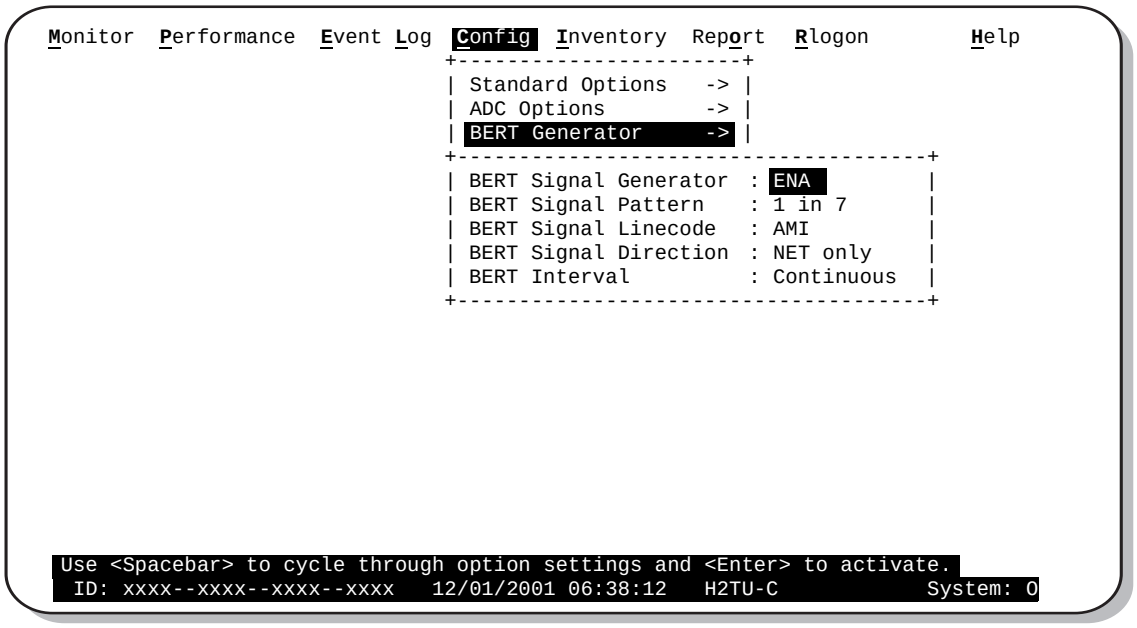



***Figure 28.*** *H2TU-C BERT Generator Screen*

***Table 18.*** *BERT Signal Generator Option Settings*

| Option | Description |
|---|---|
| BERT Signal Generator | Enabled (ENA) or Disabled (DIS) |
| BERT Signal Pattern | 1:7 pattern, 2:8 pattern, 3:24 pattern, $2^{23-1}$ pseudo random, $2^{20-1}$ pseudo random, $2^{15-1}$ pseudo random |
| BERT Signal Linecode | AMI or B8ZS |
| BERT Signal Direction | Toward CPE or toward NET |
| BERT Interval | 5 minutes, 60 minutes, Continuous (default) |

# TESTING WITH H2TU-R BERT GENERATOR

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

**1** Press **R** to logon remotely, then press **C** to select the Config menu.

**2** Use the ↑ and ↓ arrow keys to select **BERT Generator,** then press **ENTER**.

**3** Use the arrow keys to select an option and press the **SPACEBAR** to cycle through the settings. Refer to Table 18 on page 50 for a list of BERT generator option settings.

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

**5** To view BERT status, press **ESC** twice, then use the ← arrow key to select the **Monitor** menu.

**1** Press **ENTER**. You can exit the status screen while signal generation is active.

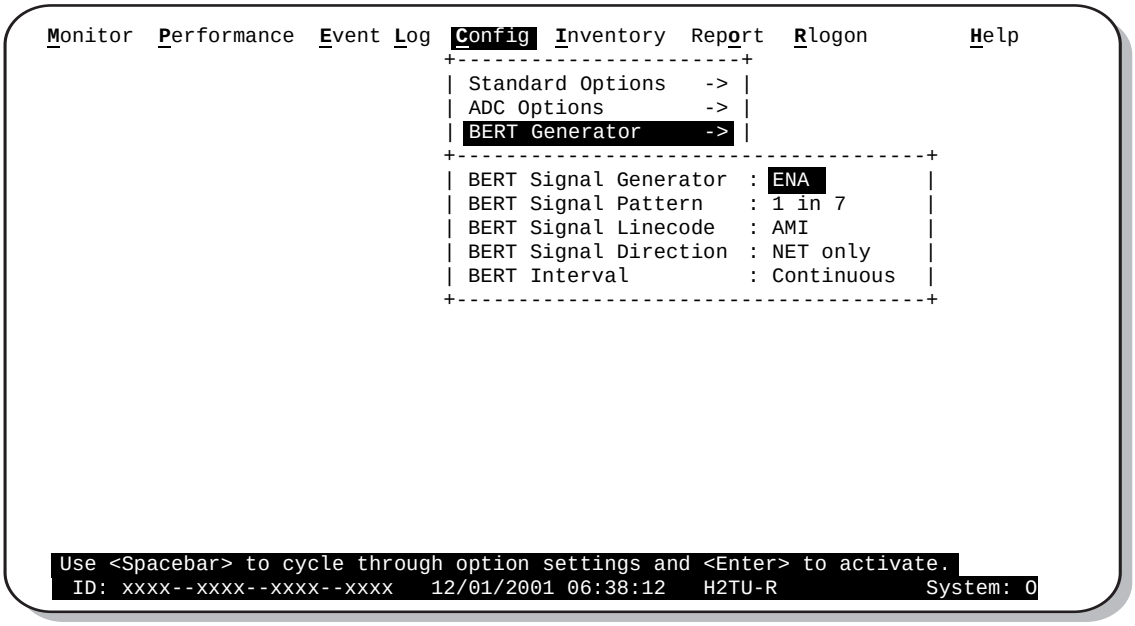



***Figure 29.*** *H2TU-R BERT Generator Screen*

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

**Tests done towards the NET must be looped at some point external to the higher circuit. Tests done towards the CPE can either be looped back at some external point beyond the remote unit, or they can be looped back internally by a higher loopback, such as NREM. The test payload, for the CPE direction, also passes back and forth over the HDSL2 link to the H2TU-C before it is analyzed for errors.**

# APPENDIX A - SPECIFICATIONS

**Power**

| | |
|---|---|
| HDSL2 Span Voltage | 0 or -180 Vdc ±5 Vdc |
| CO Supply | -48 Vdc nominal (-42.5 Vdc to -56.5 Vdc)<br>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 dBm at 135Ω (0-450 kHz) at CO side;<br>+16.8 dBm ±0.5 dBm at 135Ω (0-350 kHz) at remote side |
| Line Impedance | 135Ω |
| 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 | 100Ω |
| DSX-1 Pulse Output | 6 $V^{pk\text{-}pk}$ 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 |
| 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 19 describes line-powered circuits on 9 kft, 26 AWG loops without a regenerator.

***Table 19.*** *H2TU-C-319 List 2 Power Parameters*

| | -48 Vdc Power Consumption (Watts) | Heat Dissipation (Watts) | -42.5 Vdc Current (mA) |
|---|---|---|---|
| **Remote Power Source** | **Maximum** | **Maximum** | **Maximum** |
| Line-powered | 12.0 | 7.0 | 286 |
| Local-powered | 8.6 | 6.7 | 205 |

# 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 19 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 19 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 19 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 135Ω as shown in Table 20 below. This is equivalent to no more than 28 dB loop attenuation.

***Table 20.*** *HDSL2 Reach Chart*

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

(a) Insertion Loss = 1.25 times loop attenuation

# H2TU-C-319 LIST 2 CARD-EDGE CONNECTOR

Figure 30 shows the pin assignments of the card-edge connector on the H2TU-C-319 List 2 card. Active pins are highlighted in black.

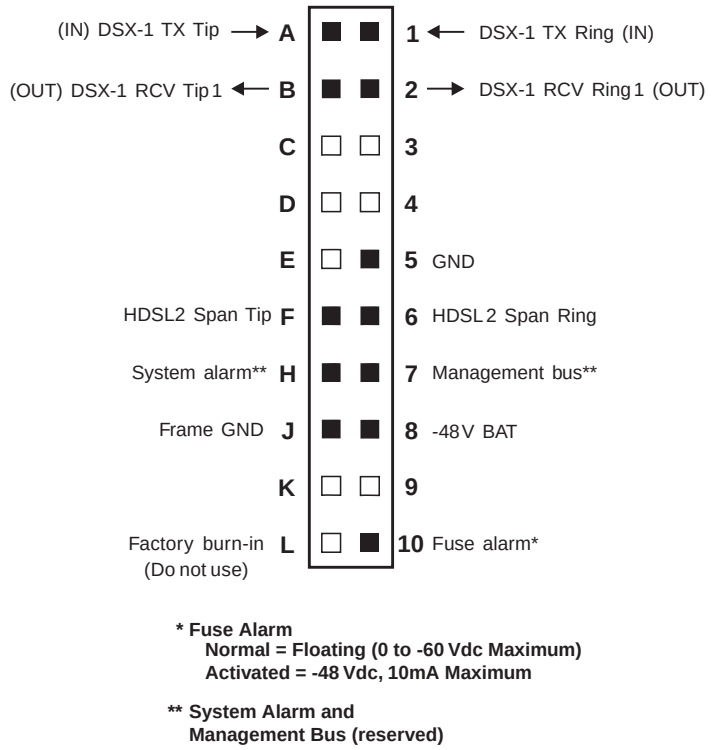



***Figure 30.*** *H2TU-C-319 List 2 Card-Edge Connector*

## 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 30, 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 38 describes the system alarms that activate pin H.

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

# CRAFT PORT

Figure 31 shows the pinout for the craft port connector and its connection to a DB-9 or DB-25 connector on a maintenance terminal.

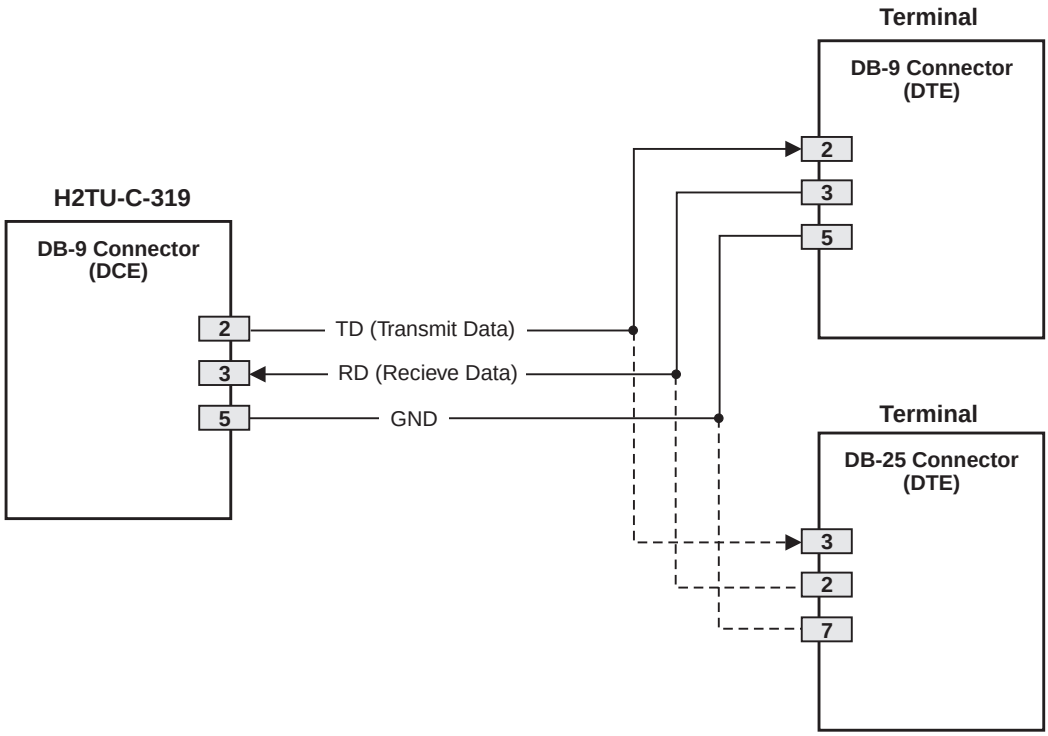



***Figure 31.*** *RS-232 Craft Port Pinouts*

# 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 32 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.

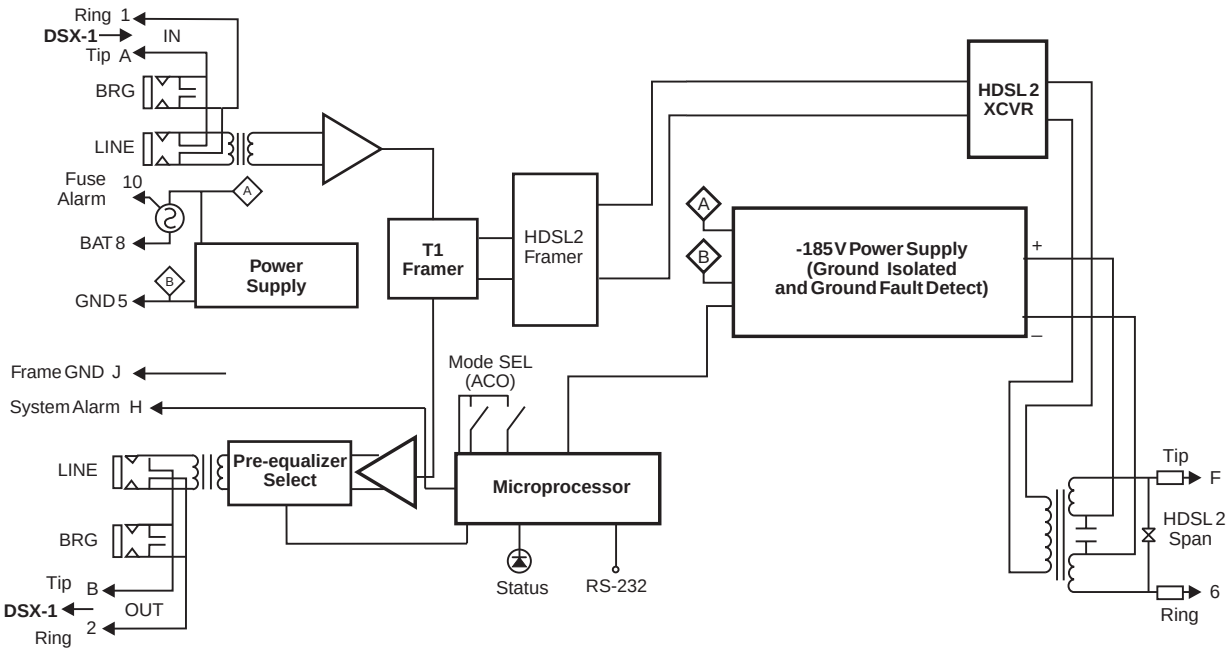



***Figure 32.*** *H2TU-C-319 List 2 Block Diagram*

## 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-319 List 6 is 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 is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center (TAC).

| | |
|---|---|
| **Sales Assistance**<br>800.366.3891 extension 73000<br>(USA and Canada)<br>952.917.3000<br>Fax: 952.917.3237 | • Quotation Proposals<br>• Ordering and Delivery<br>• General Product Information |
| **Systems Integration**<br>800.366.3891, extension 73000<br>(USA and Canada)<br>952.917.3000 | • Complete Solutions (from concept to installation)<br>• Network Design and Integration Testing<br>• System Turn-Up and Testing<br>• Network Monitoring (upstream or downstream)<br>• Power Monitoring and Remote Surveillance<br>• Service/Maintenance Agreements<br>• Systems Operation |
| **BIA Technical Assistance Center**<br>800.638.0031<br>714.730.3222<br>Fax: 714.730.2400<br>Email: wsd_support@adc.com | • Technical Information<br>• System/Network Configuration<br>• Product Specification and Application<br>• Training (product-specific)<br>• Installation and Operation Assistance<br>• Troubleshooting and Repair/Field Assistance |
| **Online Technical Suppport** | • www.adc.com/Knowledge_Base/index.jsp |
| **Online Technical Publications** | • www.adc.com/library1/ |
| **Product Return Department**<br>800.366.3891 ext. 73748 or<br>952.917.3748<br>Fax: 952.917.3237<br>Email: repair&return@adc.com | • ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products. |
| *All 800 lines are toll-free in the USA and Canada.* | |

# APPENDIX E - ABBREVIATIONS

## A

**ACO.** Alarm Cutoff

**ACQ.** Acquisition

**AIS.** Alarm Indication Signal

**ALRM.** Alarm Condition

**AMI.** Alternate Mark Inversion

**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

**CPE.** Customer Premises Equipment

## D

**DBER.** DS1 Bit Error Rate

**DLC.** Digital Loop Carrier

**DSX-1.** DS1 Cross-Connect Frame

## E

**EQL.** Equalization

**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

**ILR.** Intelligent Line Repeater

**IOR.** Intelligent Office Repeater

**IR.** Intelligent Repeater

## L

**LAIS.** Line Alarm Indication Signal

**LATT.** Loop Attenuation

**LED.** Light Emitting Diode

**LLOS.** Local Loss of Signal

**LOS.** Loss of Signal

**LOSW.** Loss of Sync Word

**LPDN.** Loopdown

**LPF.** Line Power Feed

**LRAI.** Line RAI

## M

**M.** HDSL4 Margin

**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

**PBOC.** Power Back Off - Customer

**PBON.** Power Back Off - Network

**PL.** Payload

**PRMF.** Performance Report Messaging - Far End

**PRMN.** Performance Report Messaging - Near End

## R

**RAIS.** Remote Alarm Indication Signal

**RDA.** Remote Disconnect Alarm

**RLOS.** Remote Loss of Signal

**RRAI.** Remote Alarm Indication

## S

**SF.** SuperFrame

**SMJK.** SmartJack Loopback

**SNET.** Southern New England Telephone

**SPLB.** Special Loopback

## T

**TUC.** Transmission Unit Central Office

**TUR.** Transmission Unit Remote End

## U

**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 twelve (12) 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 12-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 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.

## SAFETY STANDARDS COMPLIANCE

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

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety
- Binational standard, UL-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.**
14402 Franklin Avenue
Tustin, CA 92780-7013
Tel: 714.832.9922
Fax: 714.832.9924

**Technical Assistance**

Tel: 800.638.0031
Tel: 714.730.3222
Fax: 714.730.2400

DOCUMENT: LTPH-UM-1113-01, ISSUE 1

1210951