HiGain

USER MANUAL

H2TU-C-388 List 1E Line Unit
Product Catalog: 150-2406-15
CLEI: VACH4WYC

Revision History of This Manual

Revision	Release Date	Revisions Made
01	December 2, 1999	Initial release
02	April 21, 2000	Updated log and loopback modes screens and added SPN, TUC, and TUR.
03	January 24, 2002	ADC rebranding; removed regenerator information

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 indicated in **bold**.
- Three types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of equipment damage or personal injury.

The Electrostatic Discharge (ESD) susceptibility 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 "List of Abbreviations" on page 64.

INSPECTING SHIPMENT

Upon receipt of the equipment:

- Unpack each container and inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC DSL Systems, Inc. Order replacement equipment, if necessary.
- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact ADC DSL Systems, Inc. as described in "Appendix D - Product Support" on page 63. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The ADC HiGain® product family is the industry's first practical implementations of High bit-rate Digital Subscriber Line 2 (HDSL2). HiGain products are fully compliant with the HDSL2 standard. Providing full-rate T1 access using just a single copper pair, HDSL2 is a cost-effective solution and offers an open architecture. The open architecture inherent in HDSL2 guarantees interoperability, allowing simple, economic accommodation of network growth.

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

FEATURES

The H2TU-C-388 List 1E line unit is the Central Office (CO) side of a T1 transmission system.

- HDSL2 transmission features
  - Lightning and power cross protection on HDSL2 interfaces
  - Full duplex HDSL2 transmission on one pair at 1.552 Mbps
  - Ultra-low wander (Stratum 1 compliant)
  - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)
- Front-panel provisioning features
  - Four-character status display
  - Status LED
  - RS-232 craft port for connection to a maintenance terminal
- HiGain HDSL2 maintenance screens for inventory, provisioning, and troubleshooting
  - High-performance, non-volatile performance monitoring
  - Non-volatile alarm histories
  - Performance Report Messaging (PRM) support for Supplemental PRM (SPRM) and Network PRM (NPRM) at the H2TU-R
- Configuration options
  - Selectable DS1 pre-equalizer
  - Bipolar Violation Transparency (BPVT) options
  - Bit Error Rate (BER) alarm
  - Loss of Signal/Alarm Indication Signal (LOS/AIS) payload alarm option
  - Remote provisioning
  - Selectable loopback activation codes
- Compatible with Double Dual Module Plus (DDM+) high-density shelves
- Flash download of firmware updates
- Digital Data Service (DDS) latching loopback
- Payload (PL) and HiGain (HG) loopback source identification
- Network Management and Administration (NMA) interface

- Margin threshold alarm

COMPATIBILITY

The H2TU-C-388 is designed to mount in DDM+ high-density shelves. For a list of compatible shelves, see "Appendix C - Compatibility" on page 62.

APPLICATIONS

HiGain HDSL2 systems provide a cost-effective, easy-to-deploy method for delivering DS1 High Capacity Digital Service (HCDS) over a single copper pair. HiGain HDSL2 systems support a multitude of network connections and system models. See Figure 1 on page 3.

- The service is deployed over one unconditioned, non-loaded copper pair.
- Conventional inline T1 repeaters are no longer required.
- Cable pair conditioning, pair separation, and bridged tap removal are not required.

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

- Operate effectively in the same cable binder group with other HDSL2 lines, HDSL, T1, ADSL, SDSL, POTS, Digital Data Service (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.

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

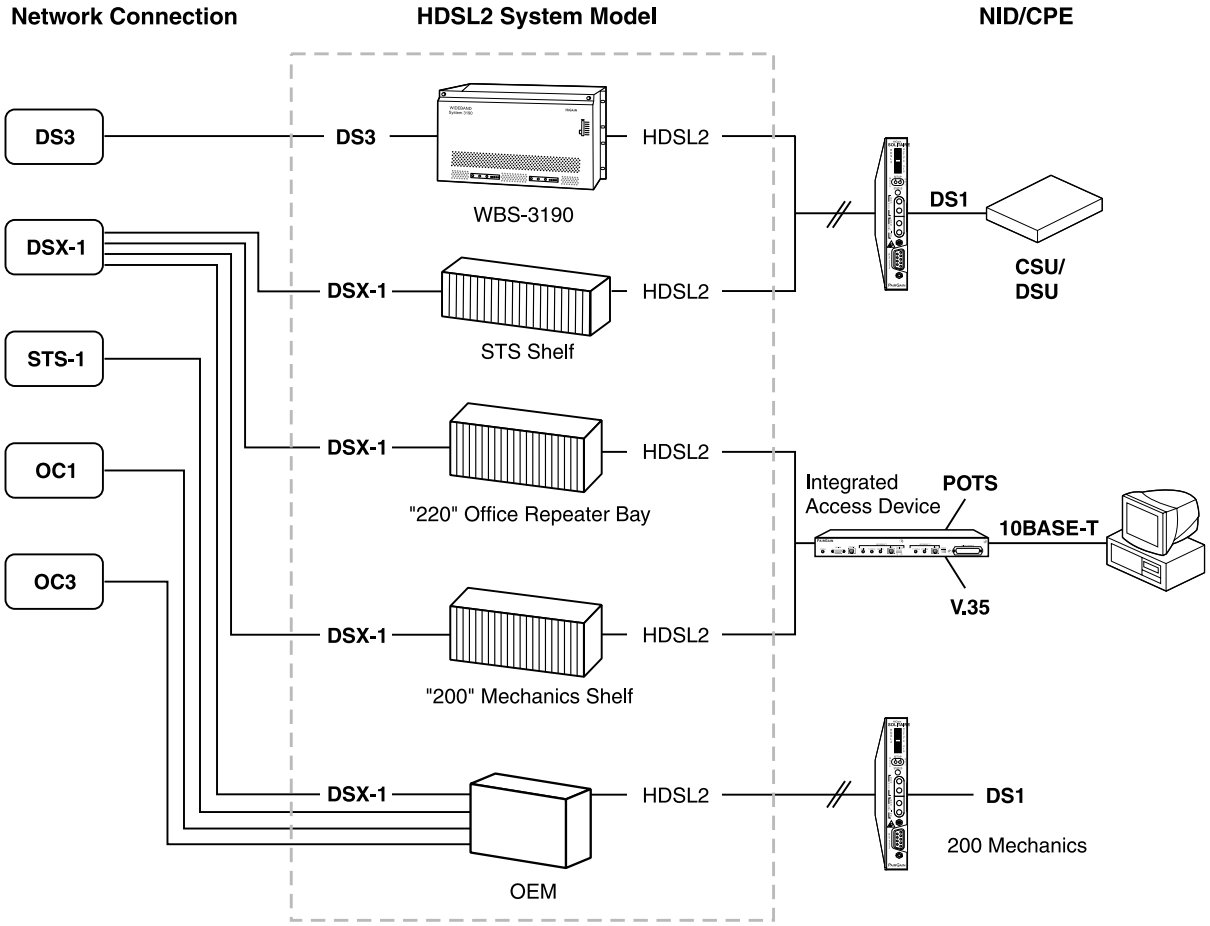


Figure 1. *HDSL2 System Model*

FRONT PANEL

Figure 2 shows the H2TU-C-388 List 1E front panel. Table 1 on page 5 describes the front-panel components. For a list of front-panel display messages, refer to Table 2 on page 6. For pinout diagrams of the H2TU-C card-edge connector and craft port, refer to "Appendix A - Specifications" on page 56.

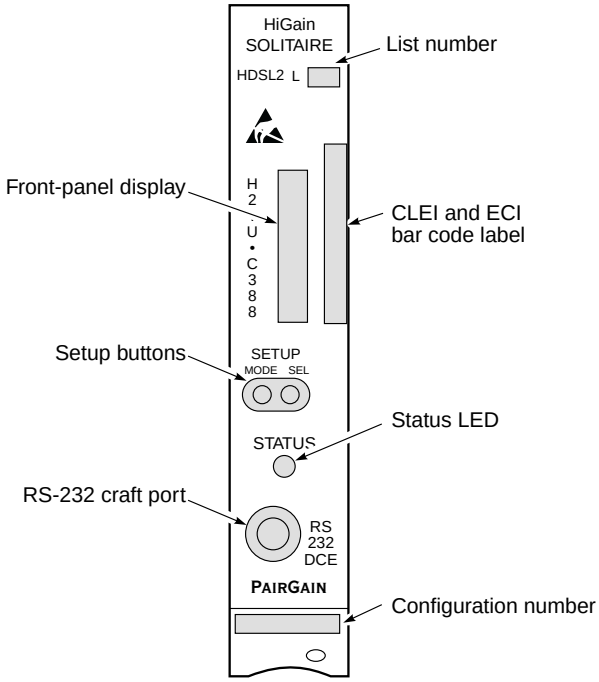


Figure 2. *H2TU-C-388 List 1E Front Panel*

Table 1. *Front-panel Description*

Front-panel Feature	Function
Front-panel display	Displays four-character status, provisioning, and alarm system messages. The front-panel display illuminates when power is initially applied. To conserve power the display only remains on for 5 minutes. Using the MODE or SEL buttons reactivates the display and restarts the 5-minute timer. Table 2 on page 6 lists the four-character messages.
MODE and SEL system option buttons	Permits user options to be monitored and modified without the need for a maintenance terminal. Used to initiate all HiGain loopbacks and to display DSX-1 line parameters and line unit identity.
Status LED	The status LED can report the following conditions:
Off	Line power is off.
Green	Normal operation.
Red	Fuse alarm.
Flashing red	HDSL2 acquisition and system alarm.
Yellow	An H2TU-C-388 Customer Remote Loopback (CREM) or a Network Local Loopback (NLOC) is in effect.
Flashing yellow	H2TU-C-388 is in an Armed (ARM) state.
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.
List number	Identifies the list number of the H2TU-C-388.
CLEI and ECI bar code label	Provides the human-readable Common Language Equipment Identifier (CLEI) code number and the Equipment Catalog Item (ECI) bar code number.
Configuration Number	For some products, the configuration number may contain either a standalone two or three-digit configuration number or a five or six-digit warranty configuration number as follows: Digit 1 - Last digit of shipment year Digit 2 and 3 - Shipment month Digits 4, 5, and 6 - Configuration number The configuration number identifies the version of the product. New configuration numbers usually accompany changes in the last two characters of the CLEI code. The configuration number is found on a small label attached to the unit. It is the last two numbers (following the x) of a 13-character part number. For example: 150-1234-01-x**01**.

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 CutOff	A system alarm has occurred and has been retired to an ACO condition once the SEL button on the H2TU-C front panel is pressed.
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	Local Alarm Indication Signal	Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port.
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 Remote Alarm Indication Signal	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.
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.
PWR FEED GND	Ground	The HDSL2 loop is grounded.
PWR FEED OPEN	Open	Indicates a line power open condition.
PWR FEED SHORT	Short	Indicates a short between the Tip and Ring of the HDSL2 pair.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port.
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 - Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
TRCI	TX RAI-CI Indication - Customer Installation	Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends RAI-CI toward the network, if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or Loss of Frame [LOF]), then the RAI is automatically passed to the network.
TUC	Transmission Unit Central Office	Accompanies the HBER, MAL, and LA alarms and indicates that the alarm has occurred at the H2TU-C central office unit.
TUR	Transmission Unit Remote End	Accompanies the HBER, MAL, and LA alarms 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 the H2TU-C.
NLOC	Network Local Loopback	DSX-1 signal is looped back to the network at the H2TU-C.

Continued

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

Message	Full Name	Description
NREM	Network Remote Loopback	DSX-1 signal is looped back to the network at the H2TU-R.
SMJK	Remote SmartJack Loopback	DSX-1 signal is looped back to the network at the H2TU-R SmartJack module.
DIAGNOSTIC MESSAGES		
A = *xx*	Maximum Loop Attenuation	The Attenuation (A) message appears followed by *xx*, where *xx* is the loop attenuation of the longest (maximum loss) span, measured in dB.
ACQ	Acquisition	The multiplexers of the H2TU-C and H2TU-R or the H2TU-C and first regenerator are trying to establish synchronization over the HDSL2 loop of Span 1.
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. 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 updates. Contact Customer Service for update procedures, as described in "Appendix D - Product Support" on page 63.
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-388.
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-388 is under control of the HMU-319 Network management unit. In this state, the front-panel craft port and push buttons are disabled.
PWR FEED OFF	Power Feed Off	HDSL2 span power has been turned off by setting the PWFD option to off or by using the A2LB Intelligent Office Repeater (IOR) Power Down code.
PWR FEED ON	Power Feed On	Indicates that the HDSL2 loop is not grounded or shorted.
SIG	Signaling	The transceivers of the H2TU-C and H2TU-R (or the H2TU-C and first regenerator) are trying to establish contact with each other over the HDSL2 loop of Span 1.
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, UNFR	Defines the type of frame pattern being received from the DSX-1: SuperFrame (SF), Extended SuperFrame (ESF), Unframed (UNFR).
LATT *xx*	Loop Attenuation	The current loop attenuation threshold setting measured in dB.
LIST *xx*	H2TU-C-388 List Number	The list number of the H2TU-C-388.
MARG *xx*	Margin	The current margin threshold setting measured in dB.
VER *x.xx*	H2TU-C-388 Software Version	The software version number (x.xx).

(a) System Information Messages are displayed in Scroll Mode. To scroll through the messages, press the MODE and SEL buttons for 3 or more seconds.

INSTALLATION

Upon receipt of the equipment, inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC.

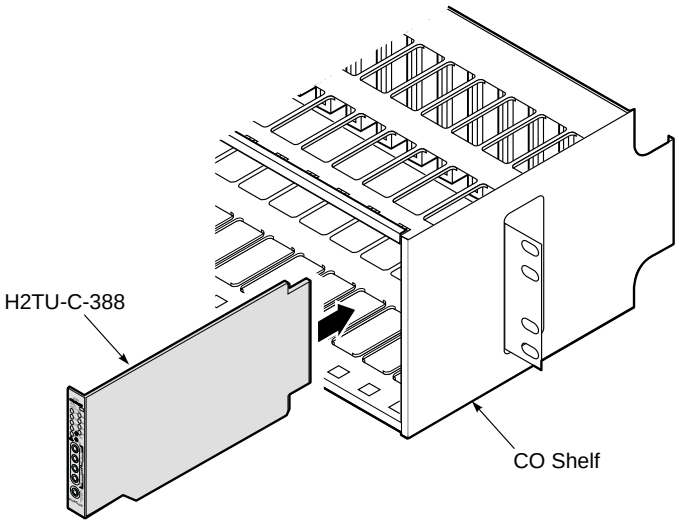


Figure 3. *Installing the H2TU-C 388 List 1E into a Shelf*

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

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

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

2 Press on the H2TU-C front-panel to seat it.

VERIFICATION

Once the H2TU-C-388 is installed, verify that it is operating properly. To do this, monitor the following:

- Status LED
- Status messages reported by the front-panel display, as described in Table 2 on page 6.

Verification without an H2TU-R Remote Unit

If there is no H2TU-R remote unit installed:

1 Verify that the H2TU-C powers up. The front-panel display illuminates and reports status messages. (See Table 2 on page 6 for a list of 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:

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

b The H2TU-C again attempts communication 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:

a 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.

b 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.

a 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.

b 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 REQUIREMENTS

Refer to "Provisioning" on page 11 for instructions on configuring and monitoring the H2TU-C-388.

The H2TU-C-388 List 1E can be provisioned by using the MODE and SEL buttons on the front panel or by accessing the HiGain HDSL2 maintenance screens. While the MODE and SEL buttons can be used to manually accomplish some provisioning tasks, such as setting system options, the HiGain HDSL2 maintenance screens can handle all provisioning tasks. The maintenance screens are available when you connect a PC to the craft port.

After a successful installation, complete the following tasks:

1 Set the Date and Time, as described in "Setting Date and Time" on page 15.

2 Set the circuit IDs, as described in "Setting Circuit ID Numbers" on page 16.

3 Make changes to configuration, as described in "Making Changes to the System Configuration" on page 17.

4 Clear the Performance, Alarm history, and Event Log screens to remove miscellaneous data acquired during Startup or use Master Clear in the Master Clear in the Config Menu. This ensures the collection of accurate and meaningful data, as described in "Clearing the History, Alarm, and Event Log Screens" on page 28.

PROVISIONING

There are two provisioning methods:

- Use the MODE and SEL buttons 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 or scroll mode
  - Select system loopbacks
- Use a maintenance terminal, such as ASCII terminal or a PC running terminal emulation software, connected to the H2TU-C craft port or to an HMU craft port to access the HiGain HDSL2 maintenance screens. The maintenance screen, shown in Figure 4 on page 14, 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-388 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-388 is unplugged.

USING THE MODE AND SEL BUTTONS

Setting Options through MODE and SEL

To provision the H2TU-C-388 through the MODE and SEL buttons on the front panel:

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

2 Press the SEL button to step through all possible settings of the selected parameter.

3 After the desired setting has been selected, press the MODE button. 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 button or do nothing. After 30 seconds, the display returns to its normal mode without saving the new changes.
- To accept the requested parameter changes, press the SEL button. A `CONF YES` message displays, and the display returns to its normal mode after saving the new changes.

Resetting to Factory Default Values

All user options for the H2TU-C-388 List 1E, described in Table 5 on page 19, can be set to the factory default values using the MODE and SEL buttons. To set the user options to their default values:

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

```
DFLT NO
```

2 Press the SEL button until the `DFLT NO` message appears.

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

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

- Press the MODE button 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 button for 3 or more seconds. The H2TU-C displays the following parameters:

- H2TU-C-388 software version number
- H2TU-C-388 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

If the system is in a Minor alarm state, the alarm relay can be disengaged by pressing the SEL buttons. This turns off the Alarm Cutoff (ACO) indication.

Loopback Modes

"Loopback Operation" on page 46 provides instructions on using the MODE and SEL buttons to activate loopbacks.

USING A MAINTENANCE TERMINAL

Connecting to a Maintenance Terminal

A miniature, 3-pin, 210 Bantam-type jack on the front panel serves as a craft port and allows connection between the H2TU-C-388 and a maintenance terminal, such as ASCII terminal or PC running a terminal emulation program. A 210-to-DB-9 adapter is provided with every unit to facilitate the use of standard RS-232, DB-9 cables, as shown in Figure 27 on page 59. Once connected to a maintenance terminal, you can access the maintenance, provisioning, and performance screens.

To connect to a maintenance terminal:

1. Insert the 210-to-DB9 adapter into the RS-232 jack on H2TU-C-388 front panel.
2. Connect an RS-232 cable to the adapter.
3. Connect the other end of the cable to the serial port on the maintenance terminal.
4. Start a terminal emulation program, such as ProComm, that emulates a VT100 terminal.
5. Configure the maintenance terminal to the following communication settings:
   - 9600 baud
   - No parity
   - 8 data bits
   - 1 stop bit
   - Hardware flow control to OFF
6. 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-388 system.

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

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

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

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

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

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

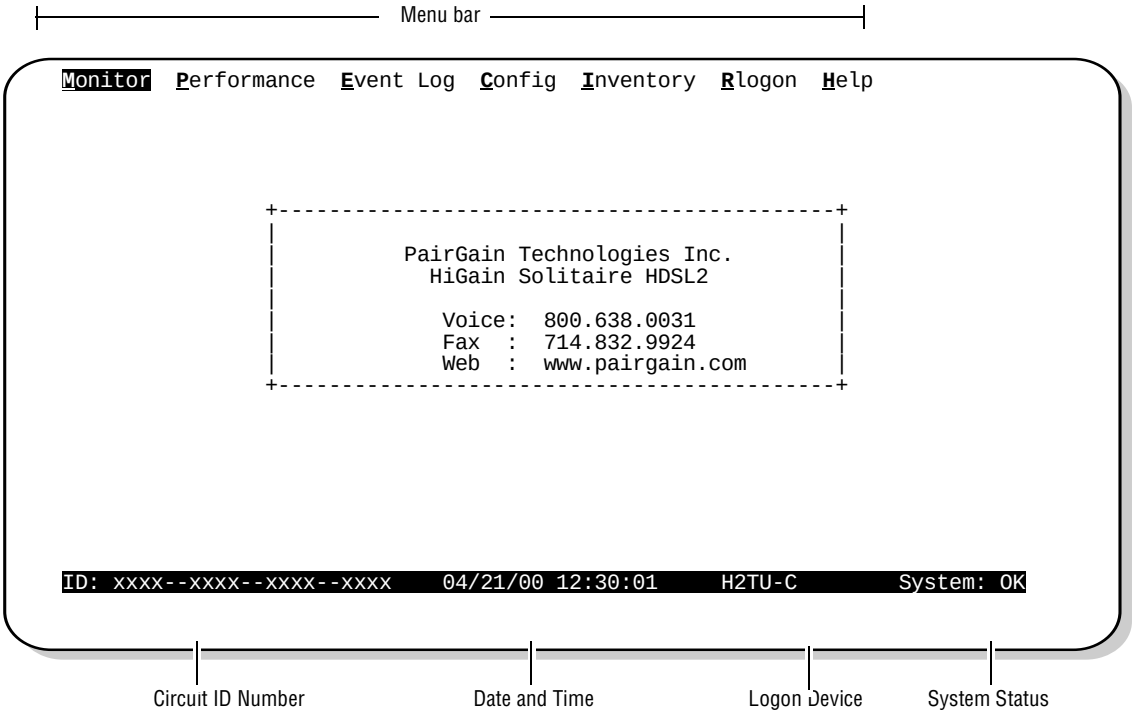


Figure 4. *Logon Screen*

Table 4. *Logon Screen Menus*

Press this key:	To access this menu:	Menu Functions
M	Monitor	Monitors loopbacks and alarms, and provides a graphical representation of circuit activity, including ES, UAS, SES, and line code.
P	Performance	Provides performance and alarm histories for current, 24-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 interface.
E	Event Log	Identifies the 100 most recent system events and reports the date and time of occurrence.
C	Config	Provides standard configuration options, PairGain HDSL2 options, date and time setting, master clear, and a reset option (factory settings).
I	Inventory	Provides product information about the various devices that are in the system and lists circuit and device identifications.
R	Rlogon/Rlogout	Performs remote logon or logout from the H2TU-C or the H2TU-R. The screen displays Rlogout when the H2TU-C or H2TU-R is remotely logged on the other unit at the end of the circuit. To logout from the remote unit, press R. Rlogout changes to Rlogon. The unit is now locally logged on until R is pressed again to re-initiate the remote logon.
H	Help	Provides a glossary of terms used in the HiGain HDSL2 maintenance screens, a list of navigational keys, and ADC contact information.

PROVISIONING TASKS

After the H2TU-C-388 is successfully installed, perform these basic provisioning tasks:

- Set date and time
- Set circuit ID numbers
- Make any configuration changes
- Clear history, alarm, and event log screens to remove miscellaneous data during startup

Setting Date and Time

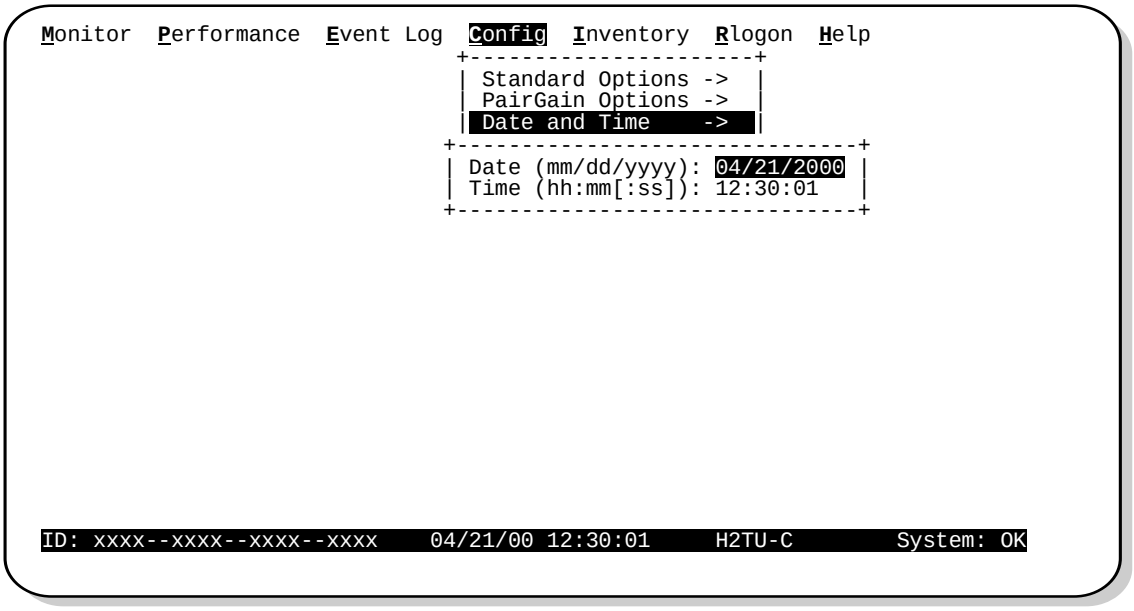


Figure 5. *Configuration Menu - Date and Time*

1. Press **C** to select the Config menu.
2. 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, then press **ENTER**. Typing seconds is optional.

Setting Circuit ID Numbers

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

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

-------------------------   Product Information  ---------------------------
Unit     : H2TU-C         H2TU-R
Product  : H2TU-C-319     H2TU-R-402
List     : 2E             4E
Sw Ver.  : 2.00           2.00
Build  # : 00             00
Checksum : 0x3FAE         0x3FAE
H2 Xcvr  : L1-RA2 1.31    L1-RA2 1.31
Serial # : 01232456789    0123456789
CLEI     : VACHDN0CAA     VARHJUUCAA
Mfg. Date: 02/05/00       02/05/00

-------------------  Circuit and Unit Identifications  --------------------

Circuit ID   : xxxx--xxxx--xxxx--xxxx
H2TU-R ID    : yyyy--yyyy--yyyy--yyyy



Enter new ID and press <Enter> to set.
ID: xxxx--xxxx--xxxx--xxxx    04/21/00 12:30:01     H2TU-C        System: OK
```

Figure 6. *Inventory Screen*

1 Press I to select the Inventory screen.

2 Type the Circuit ID number, then press ENTER.

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

Making Changes to the System Configuration

The Config menu, shown in Figure 7 below, allows you to make the following types of system configuration changes:

- Standard options, as described in "Making Changes to the System Configuration" on page 17
- PairGain options, as described in "Making Changes to the System Configuration" on page 17
- Date and time, as described in "Setting Date and Time" on page 15
- Master Clear, as described in "Clearing the History, Alarm, and Event Log Screens" on page 28
- Reset to factory default configuration, as described in Figure 10 on page 27

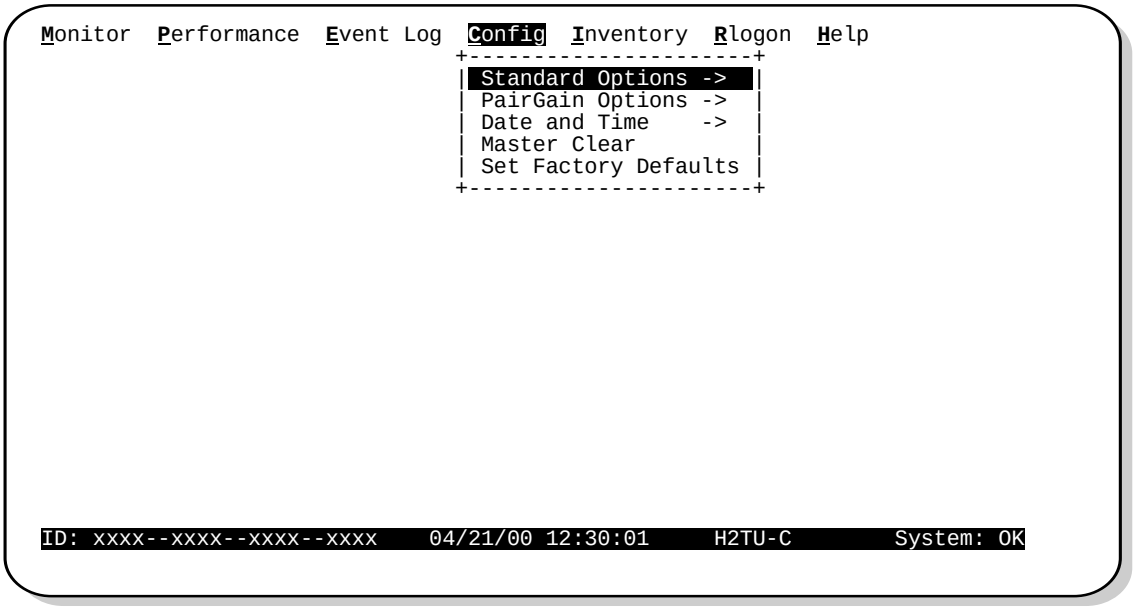


Figure 7. *Configuration Menu*

Making Changes to Standard and PairGain Options

Figure 8 and Figure 9 on page 18 show the Standard and PairGain configuration options. Standard options are those that are supported by HiGain HDSL2 units when connected to units from other vendors. PairGain options are an extended set of options that are only available when using HiGain units exclusively. For a description of each option and a list of possible option settings, refer to Table 5 on page 19 and Table 6 on page 20. To make changes to these options:

1 Press C to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **Standard Options** or **PairGain Options**, and press ENTER.

3 Use the arrow keys to select an option.

4 Press the SPACEBAR to cycle through the settings for that option.

5 Press ENTER to activate your choice.

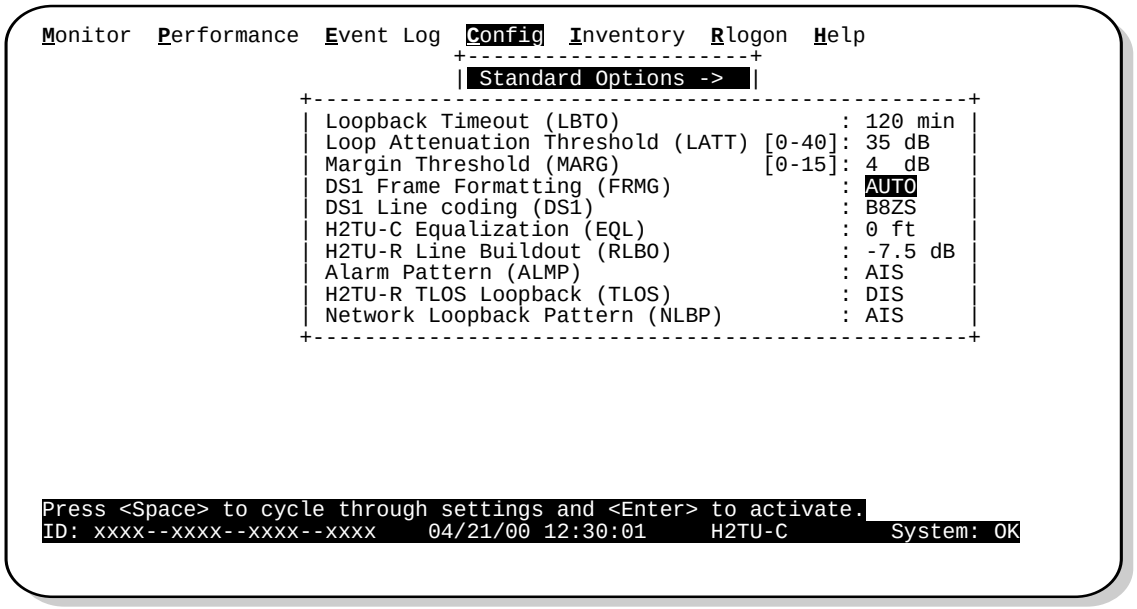


Figure 8. *Configuration Menu - Standard Options (Defaults Shown)*

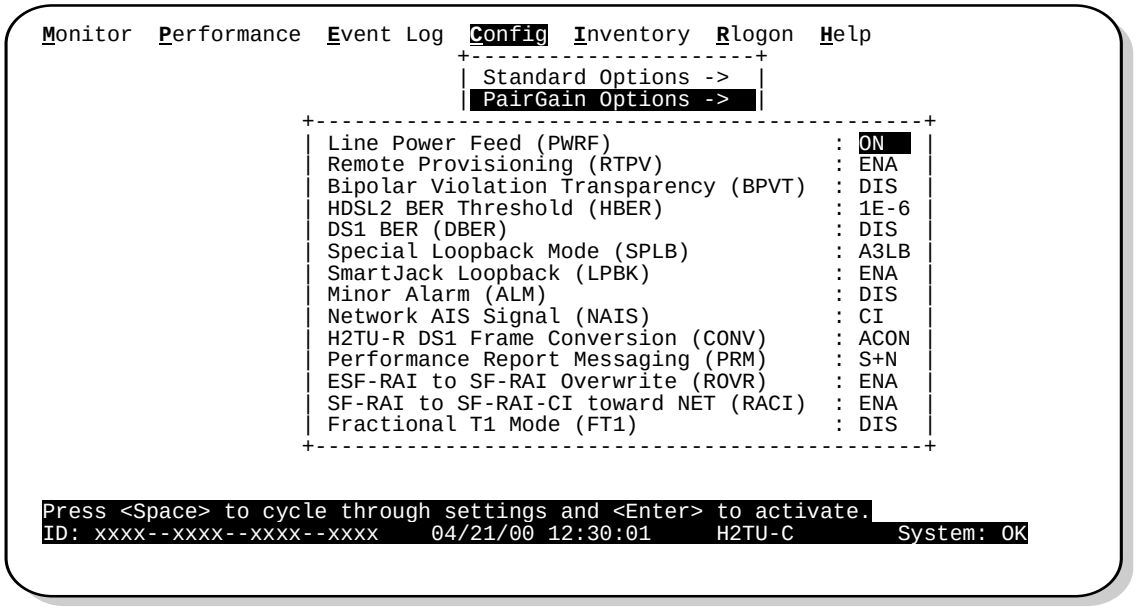


Figure 9. *Configuration Menu - PairGain Options (Defaults Shown)*

Table 5 below describes the Standard Config screen options. Table 6 on page 20 describes the PairGain Config screen options. Selections in bold typeface are the factory default settings.

Table 5. *H2TU-C-388 List 1E Standard Config Screen Options*

System Settings Screen Options	Front-panel Display Code	Selection	Description
Loopback Timeout	LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
		20	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
		60	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
		120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
Loop Attenuation Threshold	LATT	0 through 40 dB	Determines the maximum loop attenuation before an alarm is declared. The loop attenuation threshold can only be set through the HiGain HDSL2 maintenance screens.
		35 dB	Default value. Zero disables the alarm.
Margin Threshold	MARG	0 to 15 dB	Determines the minimum margin below which a system alarm can occur. Zero disables the alarm. The Margin Alarm Threshold can only be set through the HiGain HDSL2 maintenance screens.
		4dB	Default value.
DS1 Frame Formatting	FRMG	**AUTO**	Configures the HiGain HDSL2 system to operate in an auto-framing (AUTO) mode. It detects and locks to both SF or ESF DS1 frame patterns. Line and path performance parameters are maintained and displayed. Unframed payloads will cause the ES-P and SES-P counters to increment.
		UNFR	Same as the AUTO setting except unframed payloads will NOT cause the ES-P and SES-P counters to increment.
DS1 Line Coding	DS1	B8ZS	Places both the H2TU-C and H2TU-R into their B8ZS modes.
		AUTO	Places both the H2TU-C and H2TU-R into their AUTO framing modes.
		AMI	Places both the H2TU-C and H2TU-R into their AMI modes.
H2TU-C Equalization See "H2TU-C Equalization (EQL) Option." on page 21.	EQL	**0**	Sets the Equalizer to DSX-1 for 0 to 133 feet.
		133	Sets the Equalizer to DSX-1 for 133 to 266 feet.
		266	Sets the Equalizer to DSX-1 for 266 to 399 feet.
		399	Sets the Equalizer to DSX-1 for 399 to 533 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 to 0 dB. H2TU-R Line Buildout can only be set through the HDSL2 maintenance screens.
		-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.
Alarm Pattern	ALMP	**AIS**	Enables the HiGain HDSL2 system to output an AIS payload at its DS1 ports for LOSW and DS1 LOS. See Figure 23 on page 45 for LOS/AIS response priorities.
		LOS	Enables the HiGain HDSL2 system to output an LOS condition at its DS1 ports for LOSW and DS1 LOS.
H2TU-R TLOS Loopback	TLOS	ENA	Enables a logic loopback at the H2TU-R when an LOS occurs at its DS1 input, if enabled at the H2TU-R. See Figure 23 on page 45 for LOS/AIS response priorities.
		DIS	Disables TLOS logic loopback.
Network Loopback Pattern	NLBP	**AIS**	Enables the H2TU-R to transmit AIS toward the CI for any network loopback. See Figure 23 on page 45 for LOS/AIS response priorities.
		LOS	Enables the H2TU-R to transmit LOS toward the CI for any network loopback.

Table 6. *H2TU-C-388 List 1E PairGain Config Screen Options*

System Settings Screen 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	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 transparent to BPVs.
See "Bipolar Violation Transparency (BPVT) Option" on page 21.		**DIS**	Disables BPV Transparency.
HDSL2 BER Threshold	HBER	**1E-6**	The Status LED flashes red when the Block Error Rate (BER) exceeds 10^{-6}.
See "HDSL2 BER (HBER) Option" on page 22.		1E-7	The Status LED flashes red when BER exceeds 10^{-7}.
		NONE	Prevents generation of a system alarm due to BER.
DS1 BER	DBER	ENA	Enables the fixed 24-hour DS1 BER threshold.
		DIS	Prevents the generation of a system alarm due to DS1 BER.
Special Loopback Mode	SPLB	GNLB	Configures the HiGain system to respond to the generic inband loopback codes.
		A2LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Teltrend addressable repeater.
		A3LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
		A4LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom Mod 1 addressable repeater.
SmartJack Loopback	LPBK	**ENA**	Enables the HiGain HDSL2 system to recognize all inband SmartJack loopback commands.
		DIS	Configures the HiGain HDSL2 system to ignore all inband SmartJack loopback commands.
Minor Alarm	ALM	ENA	Enables the generation of the output alarm on pin H when a system alarm condition occurs.
		DIS	Disables the generation of the output alarm on pin H when a system alarm condition occurs.
Network Alarm Indication Signal	NAIS	**CI**	If ALMP is set to AIS, this option specifies which pattern is sent to the network when a remote LOS or AIS occurs. When configured for CI, an AIS-CI pattern is sent to the network.
		AIS	When configured for AIS, an AIS pattern is sent to the network.
H2TU-R DS1 Frame Conversion	CONV	OFF	No frame conversion takes place at the H2TU-R. Framing is determined by the FRMG option settings of AUTO and UNFR.
See "H2TU-R DS1 Frame Conversion (CONV) Option" on page 22.		**ACON**	Auto detection of framing and potential frame conversion at the H2TU-R.
		FCON	Auto detection of framing and forced frame format conversion at the H2TU-R.

Table 6. *H2TU-C-388 List 1E PairGain Config Screen Options (Cont.)*

System Settings Screen Options	Front-panel Display Code	Selection	Description
Performance Report Messaging	PRM	SPRM	The H2TU-R generates Supplemental PRM (SPRM) every second if no PRM is received from the CPE within 5 seconds of a reset or if an LOS/AIS/OOF condition occurs. Transaction Language 1 (TL1) commands and response are enabled.
		NPRM	The H2TU-R generates Network PRM (NPRM) if no PRM is present from the CPE. If the CPE is sending PRMs, NPRM is generated in addition to the existing PRM every second. TL1 commands and response are enabled.
		S + N	The H2TU-R generates an NPRM which is tagged on to an SPRM every second. The H2TU-R generates SPRM if no PRM is present from the CPE. If the CPE is sending PRM, the PRM is converted to an SPRM. TL1 commands and responses are enabled.
		OFF	ESF Datalink (DL) is completely transparent. No PRMs are generated. There are no TL1 responses unless the system is first armed by a TL1 command, which enables performance monitoring.
ESF RAI to SF RAI Overwrite	ROVR	**ENA**	If the CONV option is set to FCON or ACON, an ESF DS1 payload from the network with an embedded RAI pattern is converted to an SF-RAI pattern toward the CI at the H2TU-R.
See "ESF RAI to SF RAI Overwrite (ROVR) Option" on page 24.		DIS	Prevents conversion to an SF-RAI pattern.
SF RAI to SF RAI-CI Toward Network	RACI	**ENA**	Allows a DS1 SF-RAI (yellow alarm) signal received by the H2TU-R to be converted to an SF-RAI-CI signal toward the network.
See "SF RAI to SF RAI-CI Toward Network (RACI) Option" on page 24.		DIS	Prevents conversion of the DS1 SF-RAI.
Fractional T1 Mode	FT1	ENA	Enables system response to DDS latching loopback commands for fractional T1 applications and enables CPE disconnect or trouble indication. See Figure 23 on page 45 for LOS/AIS response priorities.
See "Fractional T1 (FT1) Option" on page 25.		**DIS**	Disables system response to DDS latching loopback commands for fractional T1 applications and CPE disconnect or trouble indications.

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 a 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-388 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 prevent them from being detected by the DLC terminals to which they are connected. The H2TU-C-388 and its associated remote units remove this limitation and become BPV transparent by detecting and counting input BPVs at each end and then by replicating them at the DS1 output port of the distant end.

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

HDSL2 BER (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 > 92
- 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 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.

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

Parameter	Threshold Count
CV-L (BPV)	133,400
ES-L, ES-P, PRM, PDVS-L	648
SES-L, SES-P	100
UAS-P, UAS-L	10

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

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

This option has the following settings:

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

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

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

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

- FCON: This is the forced conversion setting. Table 8 below lists the HiGain HDSL2 responses to both the ACON and FCON settings for the CONV option. The responses are identical, except in cases 3 and 4. In these cases, the FCON reply is attempting to force the network or the far-end PM-NIU to send ESF. It also alerts the CPE with an AIS alarm pattern while forcing the ESF to the network. Continuity is maintained as for ACON. Table 9 below and Table 10 on page 24 list the ESF and SF frame formats, respectively.

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

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

Table 9. *Extended SuperFrame Format*

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

Table 10. *SuperFrame Format*

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

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

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

SF RAI to SF RAI-CI Toward Network (RACI) Option. The Remote Alarm Indication - Customer Installation (RAI-CI) signal is a RAI signal which contains a signature indicating that an LOF or AIS failure has occurred within the customer's network.

RAI-CI is transmitted toward the network when the following two conditions are simultaneously true at the point from which RAI-CI is originated, such as at the H2TU-R, toward the network:

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

Since RAI-CI meets the definition of RAI, the RAI-CI may be detected and used exactly as an RAI.

For ESF, the RAI-CI signal is a repetitive pattern with a period of 1.08 seconds. RAI-CI is formed by sequentially interleaving 0.99 seconds of the unscheduled message 00000000 11111111 (right-to-left), which represents RAI in the DL, with 90 milliseconds of the message 00111110 11111111 (right-to-left) to flag the signal as RAI-CI.

For SF, the SF-RAI-CI signal is transmitted inband by setting each of the 24 channel time slots to 1000 1011 (left-to-right). In addition to the above criteria, the generation of SF-RAI-CI has to be held for 1 second to examine the DS0 channels for the presence of a frame with an all-zeroes pattern. If present, the generation of SF-RAI-CI is suspended for the duration of the all-zeroes pattern.

In all SF environments, the H2TU-R automatically converts a CPE DS1 payload with an embedded RAI signal into an RAI-CI pattern toward the network if the RACI option is enabled (default). Such a conversion affects the payload as described above. Disable RACI to avoid this payload-affecting conversion.

The SF RAI to SF RAI-CI option is only applicable in an all SF framing environment. If SF to ESF conversion is active and the CONV option is set to either ACON or FCON, the SF RAI is converted into ESF RAI in the FDL, regardless of the RACI setting.

Fractional T1 (FT1) Option. Fractional T1 circuits can be used in feeder networks to provide frame relay service. If such circuits are maintained by a DDS test group, then these circuits must respond to DDS/DS0 latching loopback commands which is the only tool test groups have at their disposal. A latching loopback, once it has been initiated by the correct sequence, remains locked or latched until the correct loopdown sequence has been detected.

The FT1 option, when enabled, allows the H2TU-C to respond to DS0 latching loopback commands and thus support fractional T1 frame-relay applications. This is in addition to the standard full bandwidth T1 2-in-5 loopup and 3-in-5 loopdown SmartJack commands. FT1 supports both the full T1 commands of ENA and the DDS latching loopback commands, which must also be enabled. For more information about latching loopback commands, refer to Bell Core TA-TSY-000077, Issue 3, April 1986.

The FT1 option supports both the DDS NI and DDS DS0 Data Port (DP) latching loopback sequences listed in Table 11.

Table 11. *DDS NI and DS0 DP Latching Loopback Sequence*

Enable Sequence	Minimum Number of Bytes	Byte Name	Network Code
1	35	Transition in Progress (TIP)	S0111010
2A	35	NI Loop Select Code (LSC)	S1000001
2B	35	DS0 DP Loop Select Code (LSC)	S0000101
3	100	Loopback Enable Code (LBE)	S1010110
4	35	All Ones	S1111111
5	100	LBE	S1010110
6	32	Far End Voice (FEV)	S0111010
Disable/Loopdown	35	TIP	S0111010

The sequences in Table 11 above are sent in timeslot 1. The S in the Network Code column is a “don’t care” bit. The loopback is activated after the detection of Sequence 6. Upon completion of the enable sequence, the Test Center continues to transmit FEV bytes in multiples of 20 until FEV confirmation bytes are returned or until approximately 2 seconds have elapsed.

If the confirmation bytes are not received, a failed attempt is reported. Anticipate the minimum number of bytes when the loopback code is transmitted by a preprogrammed machine test pattern generator. These minimum number of bytes will most likely be exceeded when the codes are sent manually. Also, manual testing may inject random data signals between valid control sequences. The detection algorithm ignores these occurrences and only responds to valid control codes.

Table 12 lists the relationship between the latching loopback sequences and the specific HiGain HDSL2 loopback they initiate.

Table 12. *HiGain HDSL2 Loopback vs. Latching Sequence*

HiGain HDSL2 Loopback	Latching Sequence
NREM	1, 2A, 3, 6
NLOC	1, 2B, 3, 6

The NLOC loopback is calleda tandem DS0 DP loopback. It is used to select one of many loopback points when there are several identical data ports in tandem. The NI loopback is assigned to the H2TU-R (NREM) since it is usually located at the Network Interface (NI). The DS0 DP tandem loopback is assigned to the rest of the HiGain HDSL2 loopbacks because most DDS test sets support this tandem command set.

The Test Center transmits a group of 40 TIP bytes to loop down the loopback. It continues to transmit TIP bytes in multiples of 20 until the TIP bytes are not returned or until about 2 seconds have elapsed. If the bytes are absent, a successful loopdown is reported; otherwise, a failed loopdown is reported. The loop-down can also be initiated by depressing the H2TU-R loopback control button or by any of the standard 3-in-5 loop-down commands. The implemented detection/release loopback algorithm functions properly in the presence of a 10^{-3} bit error rate.

Since the FT1 mode is a combination of both the full T1 and the latching loopback modes, all codes are always active. Therefore, if a loopback is initiated by a latching sequence, it can be looped down by either a latching or generic loopback and vice versa. All loopback commands are completely symmetric in the FT1 mode.

If the latching sequence shown in Table 12 on page 25 is interrupted for more than 20 minutes, the detection is cleared, and the H2TU-C reverts back to its initial state where it searches for the initial sequence 1.

After a successful latching sequence terminates in a latched loopback state, this state remains until the Disable command is detected or until the LBTO option of NONE, 20, 60, or 120 minutes has expired, whichever occurs first.

The unframed AIS pattern that is normally sent toward the network for a CI LOS fault condition must be replaced by the new patterns listed in Table 13 when the FT1 loopback option is selected. In addition, the FT1 mode also requires an input AIS pattern to be converted into an unframed 7E output pattern at both ends.

Table 13. *Response of H2TU-C and H2TU-R to LOS and AIS*

			H2TU-C Output Pattern						
Case	**FT1 Option**	**H2TU-C Input**	**Framing**	**Payload**	**FDL**	**H2TU-R Input**	**H2TU-R Output**	**Status Screen**	**Front-panel Display**
1	ENA	SF	SF	01111110	N/A	LOS/AIS	01111110 UNFR	RCV RLOS/RAIS XMT IDLE	ALRM RLOS/RAIS
2	ENA	ESF	ESF	01111110	X[(a)]	LOS/AIS	01111110 UNFR	RCV RLOS/RAIS XMT IDLE	ALRM RLOS/RAIS
3	ENA	LOS/AIS	SF	01111110	N/A	LOS/AIS	01111110 UNFR	RCV RLOS/RAIS XMT IDLE	ALRM RLOS/RAIS
4	ENA	LOS/AIS	SF	PL	X[(a)]	SF/PL	AIS	RCV LLOS/LAIS XMT IDLE	ALRM LLOS/LAIS
5	ENA	LOS/AIS	SF	PL	X[(a)]	ESF/PL	AIS	RCV LLOS/LAIS XMT IDLE	ALRM LLOS/LAIS

(a) Don't care bit

Resetting the H2TU-C

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

To reset the H2TU-C-388 to its original factory defaults:

1 Press C to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **Set Factory Defaults**, then press ENTER.

3 Press Y if you want to reset the H2TU-C or press N to cancel this action.

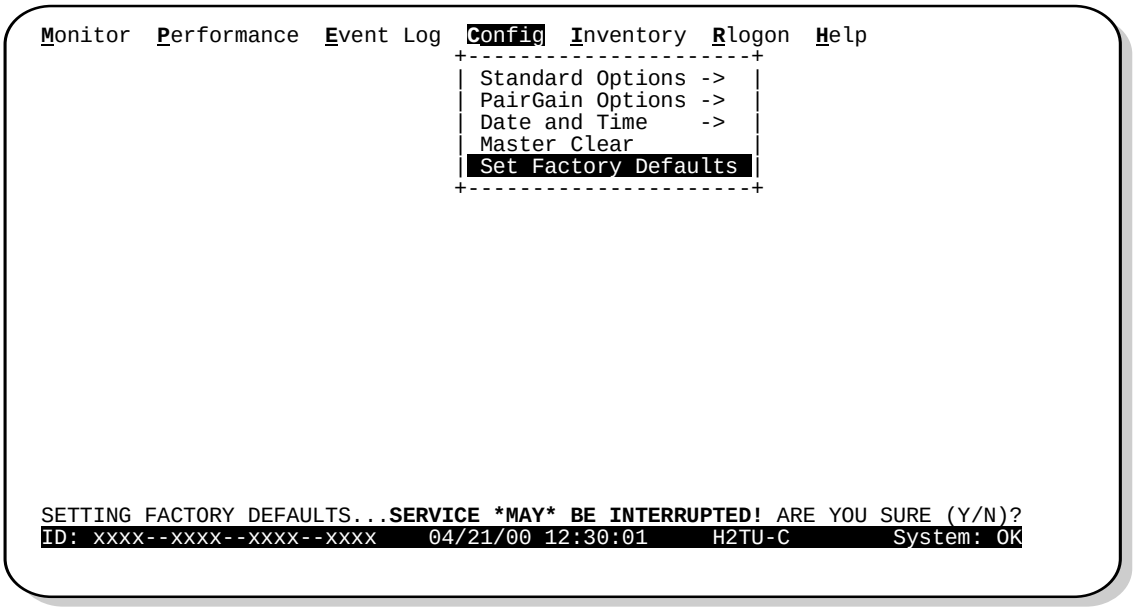


Figure 10. *Configuration Menu - Reset to Factory Defaults*

Clearing the History, Alarm, and Event Log Screens

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

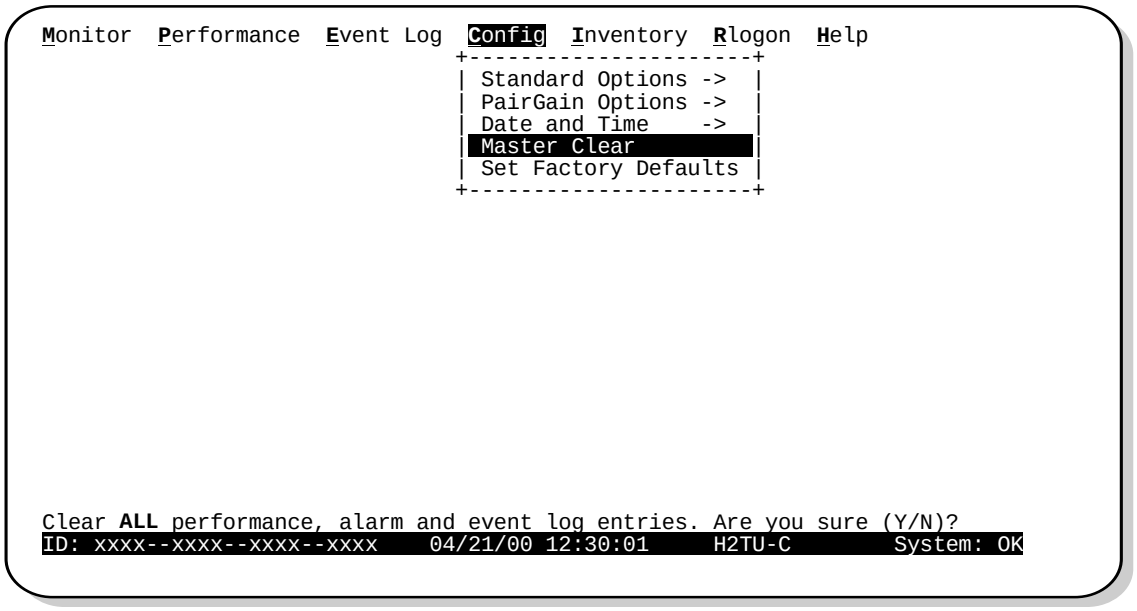


Figure 11. *Master Clear*

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

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

1. Press **P** to select the Performance screen.
2. Press the **SPACEBAR** to select either interface (**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**) and press **ENTER** after your selection.
   - Selecting **31 Day History** allows you to clear the Current, 25 Hour, 48 Hour, and 31 Day performance history screens for the selected interface.
   - Selecting **Alarm History** allows you to clear the alarm history screen for the selected interface. For information about the DS1 and HDSL2 Alarm screens, see Table 18 on page 40.
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. Select **Master Clear**.
3. Press **Y** to clear all screens.

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

The H2TU-C-388 provides two sets of maintenance screens for monitoring system activity and assessing performance. The screens are:

- The Monitor screens provide a graphical representation of circuit activity and allow initiation of loopbacks.
- The Performance screens provide current, 24-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.

The Monitor and Performance screens provide important activity and performance information about the HDSL2 spans and span devices.

USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

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

Figure 12 shows an armed circuit with an active loopback and alarms. Terms used on the system diagram are defined in the onscreen Help menu glossary. Abnormal situations are highlighted on the diagram. See Table 14 on page 31 for screen field descriptions.

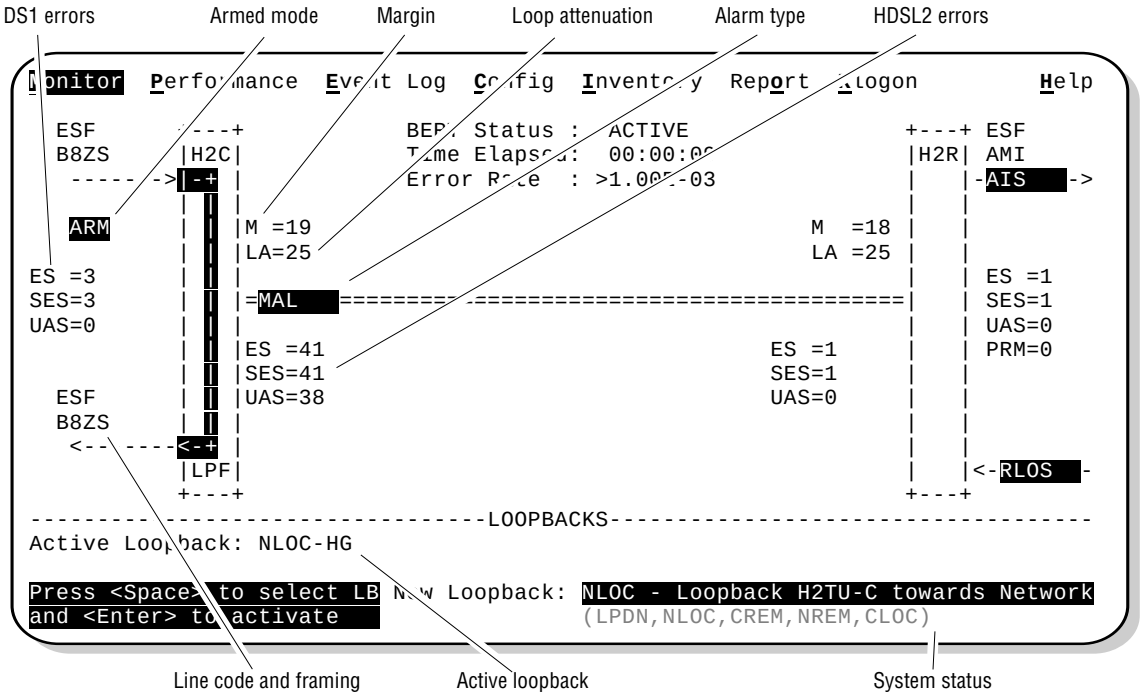


Figure 12. *Monitor Screen - Active Loopback with Alarms*

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

When prompted with the message: `Are you sure (Y/N)?`, press **Y** to initiate the loopback or **N** to cancel. For more information about loopbacks and troubleshooting, see "Testing" on page 43.

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 14. *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 21 on page 47 for a summary of the HiGain HDSL2 loopback codes.
Alarm Type	Indicates the type of alarm.
Armed Mode	Indicates the system is in an armed state for an intelligent repeater (IR) loopback command.
Code type	Type of DS1 line coding used (AMI or B8ZS).
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors included are: DS1 Frame errors and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.
DS1 UAS Count	Unavailable Errored Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame type	Type of DS1 framing detected at the input stream (SF, ESF, or UNFR).
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. (An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors.) This value is a running total of the last 24 hours.
HDSL2 UAS Count	Unavailable Errored Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
ID	Circuit identification (ID) number.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to the loop attenuation at 196 kHz and should be kept under 35 dB.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10^{-7} Bit Error Rate.
MAL	Margin Alarm— Indicates the margin on HDSL2 has dropped below the threshold (0 to 15 dB) as set by the operator.
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. Table 20 on page 43 lists the front-panel system alarms.

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 HDSL2 interfaces, shown in Figure 19 on page 38, or DS1 interfaces, shown in Figure 21 on page 40, 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

Figure 13 and Figure are examples of an H2TU-R 31-day and H2TU-C-25-hour history DSI performance screens, respectively, as viewed from the line unit In addition, there are 48-hour, 25-hour, and current statistic screens for the DS1 interface for the H2TU-R as well as the H2TU-C. Table 15 on page 34 describes the acronyms used in the performance history screens.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

                H2TU-R DS-1 31 Day History (Page 1 of 3)
-------------------------------------------------------------------------------
 Date    ES-L  SES-L  UAS-L   CV-L PDVS-L   ES-P  SES-P  UAS-P PRM-NE PRM-FE
 04/09     -      -      -      -      -      -      -      -      -      -
 04/10     -      -      -      -      -      -      -      -      -      -
 04/11     -      -      -      -      -      -      -      -      -      -
 04/12     -      -      -      -      -      -      -      -      -      -
 04/13     -      -      -      -      -      -      -      -      -      -
 04/14     -      -      -      -      -      -      -      -      -      -
 04/15     -      -      -      -      -      -      -      -      -      -
 04/16     -      -      -      -      -      -      -      -      -      -
 04/17     -      -      -      -      -      -      -      -      -      -
 04/18     -      -      -      -      -      -      -      -      -      -
 04/19     -      -      -      -      -      -      -      -      -      -
 04/20    14     10     10     12     10     10      0      0      0      0
 04/21     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 DS-1
choices and <Enter> to view     Statistics : 31 Day History
ID: xxxx--xxxx--xxxx--xxxx    04/21/00 12:30:01     H2TU-C        System: OK
```

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

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

                H2TU-R DS-1 25 Hour History (Page 1 of 9)
-------------------------------------------------------------------------------
  Time    ES-L  SES-L  UAS-L   CV-L PDVS-L   ES-P  SES-P  UAS-P
  9:30       -      -      -      -      -      -      -      -
  9:45       -      -      -      -      -      -      -      -
 10:00       -      -      -      -      -      -      -      -
 10:15       -      -      -      -      -      -      -      -
 10:30       -      -      -      -      -      -      -      -
 10:45       -      -      -      -      -      -      -      -
 11:00       -      -      -      -      -      -      -      -
 11:15       -      -      -      -      -      -      -      -
 11:30       -      -      -      -      -      -      -      -
 11:45       -      -      -      -      -      -      -      -
 12:00       -      -      -      -      -      -      -      -
 12:15      14     10     10     12     10     10      0      0
 12:30       0      0      0      2      0      0      0      0

              Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Press <Space> to cycle through  Interface  : H2TU-R DS-1
choices and <Enter> to view     Statistics : 25 Hour History
ID: xxxx--xxxx--xxxx--xxxx    04/21/00 12:30:01     H2TU-C        System: OK
```

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

Table 15. *Error Acronyms Used on the DS1 Performance History Screens*

Error Acronym	Description	Error Acronym	Description
ES-L	Errored Seconds - Line Seconds with BPV ≥1.	SES-P	Severely errored seconds - Path Seconds with SES or CRC(ESF) ≥320 or FE [(d)](SF) ≥8 (F_T + F_S).
SES-L	Severely errored seconds - Line Seconds with BPV plus EXZ ≥1544 or LOS ≥1.	UAS-P	Unavailable seconds - Path A second of unavailability based on SES-P or AIS ≥1.
UAS-L	Unavailable seconds - Line Seconds with LOS ≥1.	PRM-NE [(a)]	Performance Report Monitoring - Near End The PRM from CPE indicates errors, and the signal received from the network at the remote is error-free.
CV-L	Code Violation - Line Total BPV count.	PRM-FE [(a)]	Performance Report Monitoring - Far End The PRM from the network indicates errors, and the signal received from the CPE is error-free.
PDVS-L	Pulse Density Violation Seconds - Line Seconds with excessive zeroes (AMI = 16 zeroes, B8ZS = 8 zeroes).	B8ZSS [(b)]	B8ZS Monitored Seconds Seconds with B8ZS detection when AMI option is active.
ES-P	Errored Seconds - Path Seconds with SEF [(c)], CRC (ESF) or FE [(d)](SF) ≥1.	MSEC [(b)]	Monitored Seconds of the current (15 minute/1 hour/1 day) screen.

(a) Only appears on H2TU-R Performance History screens.
(b) Appears 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, shown in , has 31-day, 48-hour, 25-hour and current statistic screens for the H2TU-C. Figure 15 shows an example of the 31-day history and Figure 16 shows a 25-hour history example. Table 16 on page 35 describes the error acronyms.

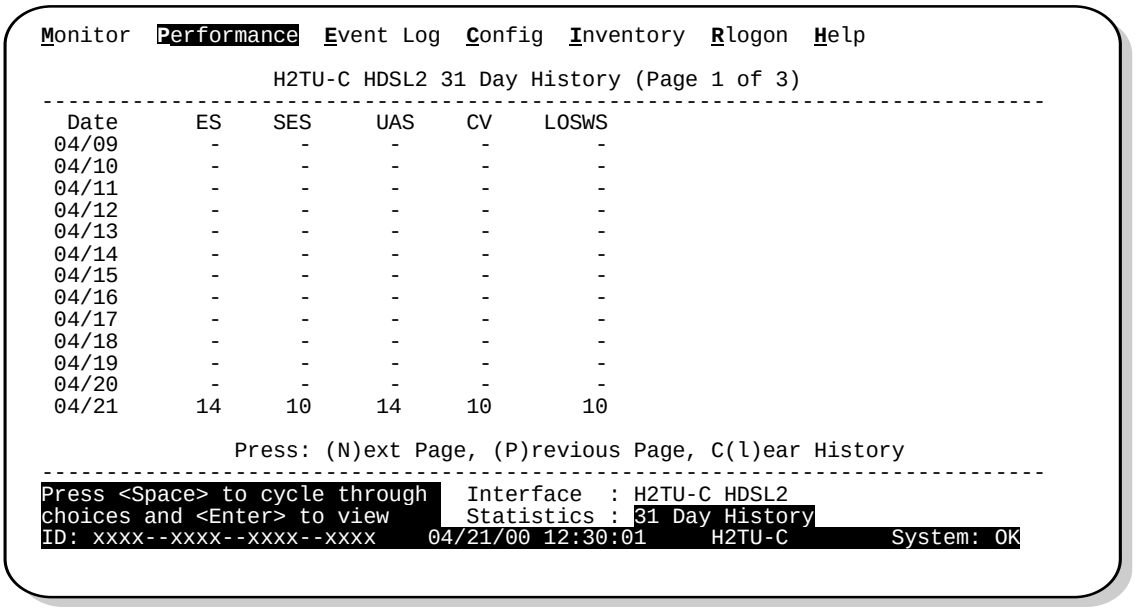


Figure 15. *H2TU-C HDSL2 31-day Performance History*

Table 16. *Error Acronyms Used on the HDSL2 Performance History Screens*

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

Current Statistics Screens for the DS1 Interface

Examples of current statistics screens are shown below. Figure 16 and Figure 17 show statistics for the DS1 interface at the remote unit and line unit, respectively. These screens report 1-day, 1-hour, and 15-minute statistics. Table 15 on page 34 describes the error types reported on these screens.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

ES-L          0        0        0
SES-L         0        0        0
UAS-L         0        0        0
CV-L          0        0        0
PDVS-L        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 DS-1
choices and <Enter> to view      Statistics : Current
ID: xxxx--xxxx--xxxx--xxxx    04/21/00 12:30:01     H2TU-C        System: OK
```

Figure 16. *H2TU-R DS1 Current Statistics*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

ES-L          0        0        0
SES-L         0        0        0
UAS-L         0        0        0
CV-L          0        0        0
PDVS-L        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 DS-1
choices and <Enter> to view      Statistics : Current
ID: xxxx--xxxx--xxxx--xxxx    04/21/00 12:30:01     H2TU-C        System: OK
```

Figure 17. *H2TU-C DS1 Current Statistics*

Current Statistics for HDSL2 Interface

Figure 18 shows statistics for the HDSL2 interface at the H2TU-C. This screen reports 1-day, 1-hour, and 15-minute statistics. Table 16 on page 35 describes the error types reported on this screen.

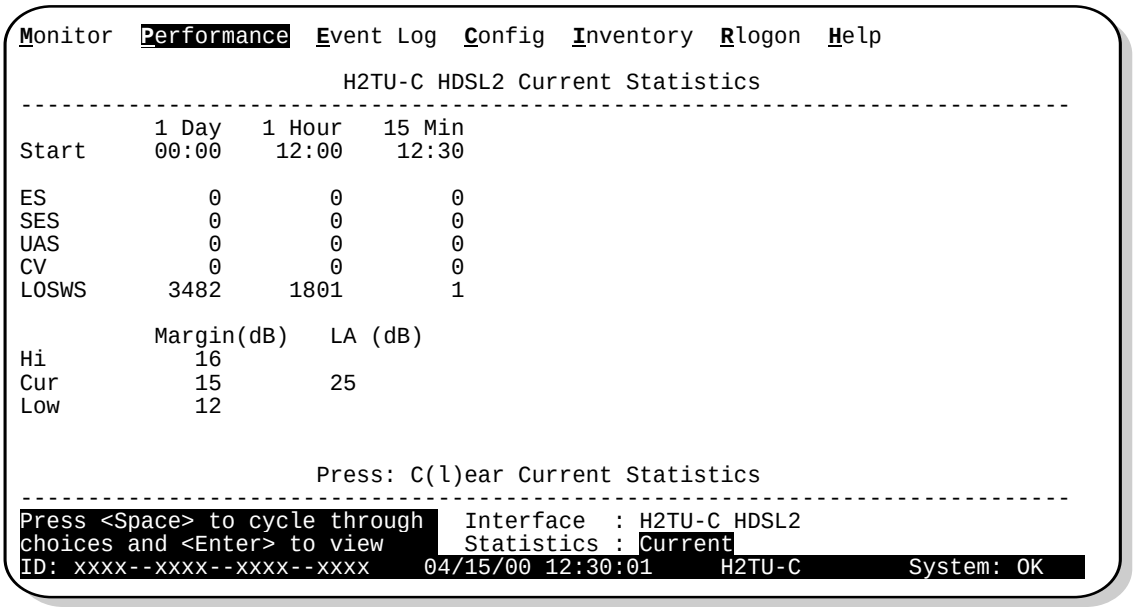


Figure 18. *H2TU-C-388 HDSL2 Current Statistics*

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

Alarm History at the DS1 Interface

The Alarm History screen reports DS1 statistics for the H2TU-C, as shown in Figure 19 below, and the H2TU-R, shown in Figure 21 on page 40, on a continuous basis. The types of alarms reported are described in Table 18 on page 40. Current alarms are shown in reverse video.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

 LLOS         03/16/00 00:00        03/16/00 00:45      ALARM          12
 LAIS                                                   OK              0
 DBER         03/16/00 00:37        03/16/00 00:45      OK              7









                          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    04/21/00 12:30:01     H2TU-C        System: Alarm
```

Figure 19. *H2TU-C DS1 Alarm History Screen*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

 RLOS         03/16/00 00:00        03/16/00 00:45      ALARM          12
 RAIS                                                   OK              0
 RAI                                                    OK              0
 TX RAI-CI                                              OK              0
 PRM-NE                                                 OK              0
 PRM-FE                                                 OK              0
 DBER         03/16/00 00:37        03/16/00 00:45      OK              7









                          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    04/21/00 12:30:01     H2TU-C        System: Alarm
```

Figure 20. *H2TU-R DS1 Alarm History Screen*

Table 17. *DS1 Alarm Descriptions*

Screen Alarm	Front-panel Alarm	Description
H2TU-C DS1 ALARMS (see Figure 19 on page 38)		
LLOS [a]	LLOS	Local Loss of Signal—Loss of the H2TU-C DSX-1 input signal.
LAIS	LAIS	Local Alarm Indication Signal—Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port.
DBER	DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.
H2TU-R DS1 ALARMS (see Figure 21 on page 40)		
RLOS [a]	RLOS	Remote Loss of Signal— Loss of the H2TU-R DS1 input signal.
RAIS	RAIS	Remote Alarm Indication Signal—Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port. By default (see Figure 23 on page 45) AIS-CI [b] is sent towards the network.
RAI	RRAI	Remote Alarm Indication at the H2TU-R - Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.
TX RAI-CI	TRCI	Transmit RAI-CI — Remote Alarm Indication at the H2TU-R—Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends a RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or LOF), then the RAI is passed on to the network unaltered. This is applicable to SF or ESF framing. In an all SF environment, RACI must be enabled to convert SF RAI to SF RAI-CI.
PRM-NE	PRMN	Performance Report Monitoring - Near End—The count of the PRM-NE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
PRM-FE	PRMF	Performance Report Monitoring - Far End—The count of the PRM-FE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
DBER	DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.

(a) This is a DS1-specific alarm that also issues a minor alarm (sent to the management unit or the backplane), if enabled.
(b) AIS-CI is a modified AIS alarm pattern. Equipment not suited to detect AIS-CI still detects this signal as an AIS. AIS-CI is sent toward the network indicating that an LOS (RLOS) or AIS (RAIS) has been received from the CPE.

Alarm History at the HDSL2 Interface

Figure 21 shows the H2TU-C HDSL2 alarm history. Table 18 describes the alarms.

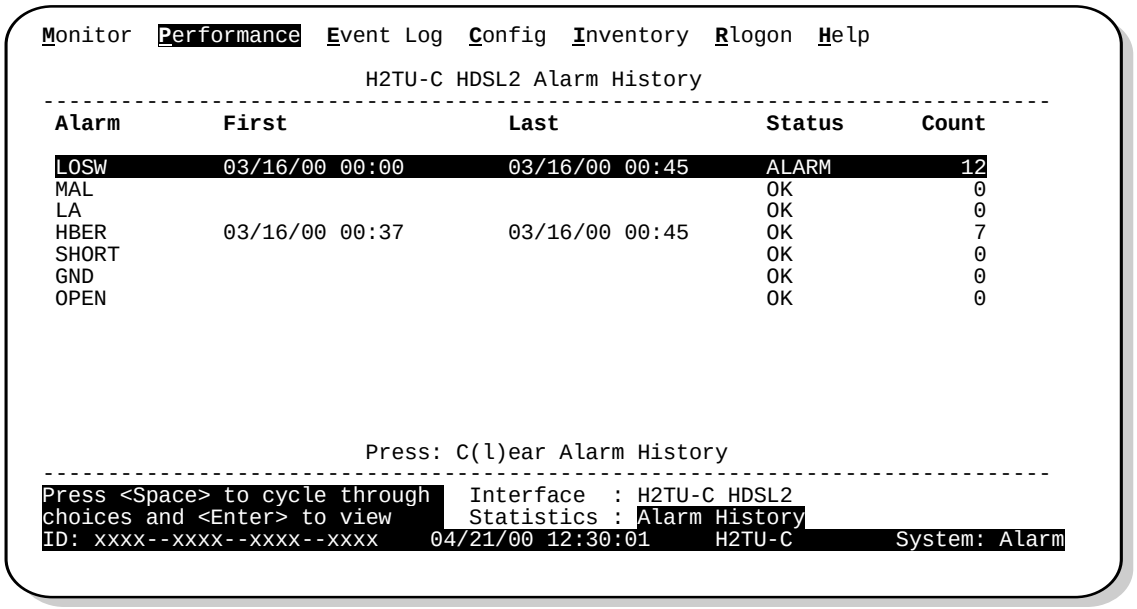


Figure 21. *H2TU-R DS1 Alarm History Screen*

Table 18. *HDSL2 Alarm Descriptions*

Screen Alarm	Description	To inhibit
LOSW	Loss of Sync Word—The HDSL2 loop has lost synchronization.	Cannot be inhibited.
MAL	Margin Alarm—The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system.	Set the Margin Alarm Threshold option to 0 (zero).
LA	Loop Attenuation—The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold.	Set the HDSL2 Loop Attenuation Threshold option to zero.
HBER	Block Error Rate—The HDSL2 BER has exceeded the set threshold limits of 10^{-7} or 10^{-9}.	Select NONE for the HBER system option.
SHORT[(a)]	Indicates a short between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
GND[(a)]	The HDSL2 loop is grounded.	Cannot be inhibited.
OPEN[(a)]	Indicates a line power open condition.	Cannot be inhibited.

(a) Appears only at the H2TU-C HDSL2 Interface.

USING THE EVENT LOG TO TRACK SYSTEM EVENTS

To view a running log of system events, press **E** to select the Event Log. The Event Log displays the date and time of the 100 most recent events (most recent displayed first) and provides a description of each event.

Do one of the following:

- 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  Rlogon  Help

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

1   System          04/21/00 12:25:00     DS1 Alarm Register reset
2   System          04/21/00 12:25:00     HDSL2 Alarm Register Reset
3   System          04/21/00 12:25:00     DS1 Performance Register Reset
4   System          04/21/00 12:25:00     HDSL2 Performance Register Reset
5   System          04/21/00 00:13:32     Time set 12:25:00
6   System          03/16/00 00:13:27     Date set 04/21/00
7   H2TU-C          03/16/00 00:13:27     NLOC: Loop-down
8   H2TU-C          03/16/00 00:11:16     NLOC: Loop-up
9   H2TU-R          03/16/00 00:10:43     DS1 LOS Alarm: End
10  H2TU-R          03/16/00 00:10:30     DS1 LOS Alarm: Begin
11  System          03/16/00 00:04:11     DS1C: AUTO to AMI
12  H2TU-C          03/16/00 00:00:40     HDSL2 LOSW Alarm: End
13  H2TU-C          03/16/00 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    04/21/00 12:30:01     H2TU-C        System: OK
```

Figure 22. *System Event Log*

Table 19. *Event Log Entry Messages*

Event Log Messages
Any DS1 Alarm History reset
Any DS1 PM register reset
Any HDSL2 Alarm History reset
Any HDSL2 PM register reset
Any Loop Down (any segment)
Any Loop Up (any segment)
Any provisioning option change: <provisioning mnemonic>: changed from <old> to <new>
CPE DBER alarm (1 day threshold crossed of any PM data except PRM-NE or PRM-FE)
CPE DS1 AIS begins / ends
CPE DS1 LOS begins / ends
CPE PRM-NE BER alarm (*at the remote only*: 1 day threshold crossed of PRM-NE: trouble on CPE receive)
Current statistics reset
Event Log reset
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 (1day threshold crossed of any PM data)
NTWK DS1 LOS begins / ends
NTWK PRM-FE BER alarm (*at the remote only*: 1 day threshold crossed of PRM-FE: trouble on NTWK far end)
NTWN DS1 AIS begins / ends
Power Feed Open begins / ends
Power Feed Short begins / ends
RAI begins / ends
TX-RAI-CI begins / ends (RAI-CI sent from the remote towards the network)

TESTING

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

FRONT-PANEL SYSTEM ALARMS

Table 20 on page 43 lists H2TU-C-388 alarm states in order of priority as they appear on the front panel. These alarms correlate with the alarms displayed on the alarm history screens, detailed in "Current Statistics Screens for the DS1 Interface" on page 36, however, the screens provide a more detailed analysis.

More than one alarm condition can exist at any given time, but only one message can be displayed on the front panel. For multiple alarms, only the highest priority alarm displays.

Table 20. *Front-Panel System Alarms Summary*

Front-Panel Message[a]	Alarm	Description	To Inhibit:
POWER FEED SHRT[b]	Short	A short exists between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
POWER FEED GND[b]	Ground	The HDSL2 loop is grounded.	Cannot be inhibited.
POWER FEED OPEN[b]	Open	A line power open condition exists.	Cannot be inhibited.
LOSW[b]	Loss of Sync Word[c]	The HDSL2 loop has lost synchronization.	Cannot be inhibited.
MTA	Metallic Test Access	The H2TU-C is in its MTA/LOSW test state.	Sets MTA option to disabled.
SPTE	Split Equipment	A test mode initiated by the HMU which splits the AUX port's DSX-1 payload and sends it to the MUX port.	Sets ADS1 option to MUX or CTHR.
SPTF	Split Facilities	A test mode initiated by the HMU which splits the facility DS1 payload from the AUX port #1 and sends it to the MUX port.	Sets ADS1 option to MUX or CTHR.
LLOS[b]	Local Loss of Signal	Loss of the DSX-1 input signal.	Cannot be inhibited.
RLOS[b]	Remote Loss of Signal	Loss of the H2TU-R DS1 input signal.	Cannot be inhibited.
LAIS	Local Alarm Indication Signal	Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port.	Cannot be inhibited.
RAIS	Alarm Indication Signal at the H2TU-R	Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port.	Cannot be inhibited.
RRAI	Remote Alarm Indication	Remote Alarm Indication at the H2TU-R - Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.
LRAI	Line RAI	Indicates an RAI alarm (yellow) from the CPE with an error-free signal from the line unit or network.	Cannot be inhibited.
TRCI	Remote Alarm Indication - Customer Installation	Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or LOF), then the RAI is passed on to the network unaltered.	Cannot be inhibited.
MAL[b]	Margin Alarm	The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system.	Set the Margin Alarm Threshold option to 0 (zero).
LA[b]	Loop Attenuation	The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold.	Set the HDSL2 Loop Attenuation Threshold option to zero.
DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set 24-hour threshold limit of approximately 10^{-6}.	Select DIS for the DBER system option.
HBER[b]	HDSL2 Block Error Rate	The HDSL2 BER has exceeded the set threshold limits of 10^{-6} or 10^{-7}.	Select NONE for the HBER system option.

Table 20. *Front-Panel System Alarms Summary (Cont.)*

Front-Panel Message[a]	Alarm	Description	To Inhibit:
PRMN	Performance Report Messaging - Near End	H2TU-R PRM-NE BER threshold has been exceeded.	Set DBER threshold to DIS.
PRMF	Performance Report Messaging - Far End	H2TU-R PRM-FE BER threshold has been exceeded.	Set DBER threshold to DIS.

(a) The message, ALRM, displays prior to any alarm message.
(b) When the HDSL2 loop loses sync word (LOSW), a system alarm condition exists. The H2TU-C-388 enters the acquiring mode, the front panel status LED flashes red, and the ACQ or SIG message displays instead of the ALRM message.

Alarm Option for the Digital Loop Carrier Feed

To improve HiGain HDSL2 compatibility with the switch-to-protect features used in the Digital Loop Carrier (DLC) feeder applications, the H2TU-C-388 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
- DS1 LOS

Retiring System Alarms

To retire a system alarm, press the SEL button and execute an Alarm Cut Off (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/AIS Response

Figure 23 on page 45 shows how the H2TU-R can respond to the network, depending on the configuration of the TLOS, NLBP, FT1, ALMP, and NAIS configuration options, described in Table 5 on page 19 and Table 6 on page 20.

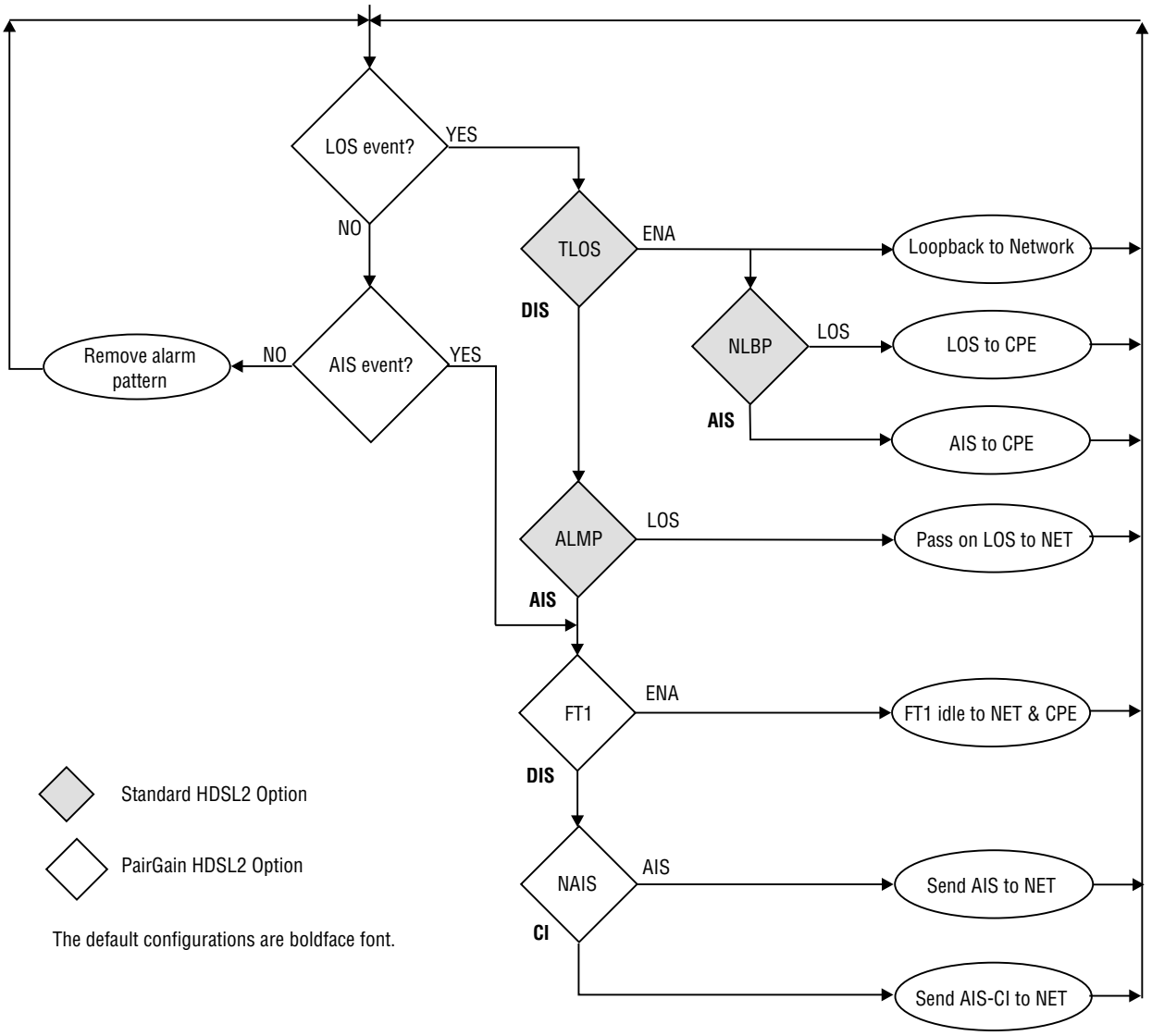


Figure 23. *H2TU-R LOS/AIS Response Priorities*

OCT55 Test Pattern with AMI Line Code

The OCT 55 test pattern can be used in unframed mode to stress the system and verify data integrity. In an SF or ESF framing mode, excessive zero anomalies may occur, which causes the H2TU-C to report ES, SES and UAS errors according to ANSI T1.231-1997.

LOOPBACK OPERATION

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

- Generic Loopback (GNLB), including the SmartJack (SMJK) option, as described in "Generic Loopback Commands" on page 46
- Special Loopback (SPLB) options, as described in "Special Loopback Commands" on page 48 and the following command tables:
  - Addressable Repeater Loopback commands: A2LB, as described in Table 22 on page 52
  - Addressable Repeater Loopback commands: A3LB, A4LB, as described in Table 23 on page 55

Loopback commands can be initiated by:

- Selecting the loopback type using the MODE and SEL buttons on the H2TU-C front panel or the Manual Loopback button on the H2TU-R
- Selecting the loopback type from the Monitor Menu when connected to the craft port of the H2TU-C or H2TU-R
- Entering the loopback code into the test equipment connected to the H2TU-C or H2TU-R

HiGain HDSL2 only supports one active loopback, however, SmartJack loopback can be present along with one other network loopback.

Generic Loopback Commands

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

Figure 24 summarizes the available loopbacks in the system, and Table 21 on page 47 summarizes the HiGain HDSL2 generic loopback commands. "GNLB Test Procedures" on page 50 details the test procedures when using the GNLB mode.

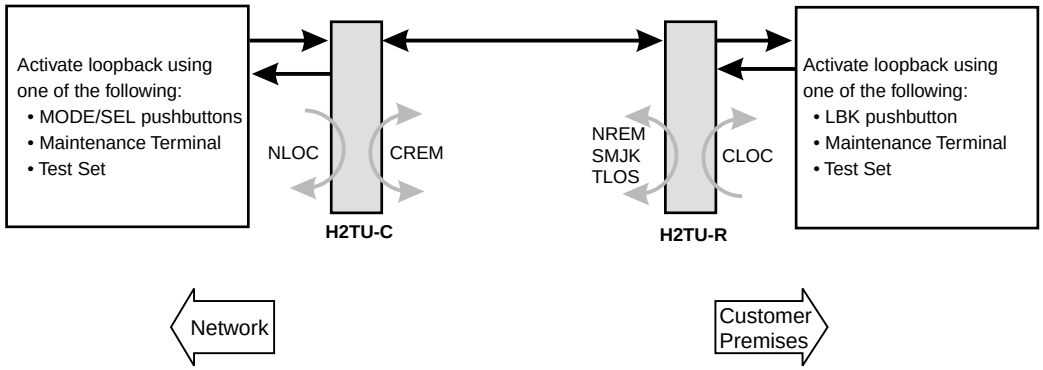


Figure 24. *Loopback Summary*

Table 21. *Summary of HiGain HDSL2 Loopback Codes and Activation Methods*

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

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

Use the inband commands to enable or disable the SMJK loopback options. The H2TU-C-388 system setting is normally enabled to recognize all inband SmartJack loopback commands.

Special Loopback Commands

In addition to the GNLB loopback command mode, a HiGain HDSL2 system can be configured for one of three special loopback command modes. These are selected from the maintenance terminal System Settings screen, detailed in Table 5 on page 19, or by using the MODE and SEL buttons, shown in Figure 25 on page 51. 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. Table 22 on page 52 and Table 23 on page 55 list the SPLB commands.

A2LB through A4LB are special, addressable, repeater loopback modes which are supported by the H2TU-C-388. These loopback modes provide the HiGain HDSL2 system with sophisticated maintenance and troubleshooting tools. A2LB is patterned after the Teltrend addressable T1 repeater loopbacks. A3LB and A4LB are patterned after the Wescom addressable T1 repeater loopbacks.

All three SPLBs have been enhanced to handle the specific requirements of the following HiGain HDSL2 customers:

- A2LB (Teltrend) = Southwestern Bell
- A3LB (Wescom) = New England Telephone, Bell Atlantic
- A4LB (Wescom Mod 1) = New York Telephone

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.

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

A HiGain HDSL2 system may take longer than normal to respond to inband loopback commands when its framing mode is set to UNFR and the inband commands are set in either an SF or ESF mode. The frame bits override the command bits and cause errors in the command sequence. These errors cause the HiGain HDSL2 system to reject some sequences.

Manual Loopback Session

A manual loopback session allows you to select any of the HiGain HDSL2 loopbacks listed in Table 21 on page 47 except SmartJack loopbacks, which can only be issued by inband commands.

Setting the Loopback Time-out Option

Before initiating a loopback session, verify that the Loopback Time-out parameter is set to the desired setting.

1 Use the MODE and SEL buttons, as described in "Setting Options through MODE and SEL" on page 11.

The Loopback Time-out parameter is also user-selectable from the System Settings screen when using a maintenance terminal.

2 Select the desired setting:

- NONE (time-out disabled)
- 20 minutes
- 60 minutes
- 120 minutes (default setting)

Activating Manual Loopback Mode

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

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

- **The next loopback option can be displayed by pressing the MODE button, however, the previously activated loopback remains active until the SEL button is pressed, which activates the new loopback.**
- **If neither button is pressed for a period of 30 seconds and no loopback is in effect, the manual loopback session terminates and the display returns to normal mode.**
- **If any loopback is in effect, the 30-second time-out is inhibited. The active loopback and the manual loopback session continue until the loopback times out in accordance with the LBTO setting.**
- **Only the SMJK loopback can exist with other network loopbacks at any given time.**
- **If there is an active loopback, pressing the MODE and SEL buttons for 3 or more seconds terminates any active loopback, ends the manual loopback session and returns the display to normal mode.**

To initiate a manual loopback session:

1 Press both the MODE and SEL buttons 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 (`CRE?, NRE?, CLO?, NR1?, CR1?, NR2?, CR2?`).

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

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

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

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

SMJK loopback commands are only activated by inband commands.

LOOPBACK TEST PROCEDURES

The following sections provide step-by-step test procedures for verifying the integrity of the 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.
- H2TU-C internal equalizer is set to the correct distance range, as detailed in Table 5 on page 19. All equalizers should be set to the distance from the DSX-1 to the shelf.

The transmit and receive DS1 DSX-1 ports have splitting access jacks and miniature, 210-series, bridging jacks as shown in Figure 2 on page 4. Connecting one cable between the two bridging jacks and another between the two LINE jacks splits the IN and OUT and creates metallic loopbacks toward both the DSX-1 and the H2TU-C-388. If separate plugs are inserted into both LINE jacks with the other end disconnected, the BRG jacks can be used to send and receive test patterns toward the DSX-1.

GNLB Test Procedures

Figure 25 on page 51 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. Table 21 on page 47 provides a description of these commands.

To perform the GNLB loopback test procedure:

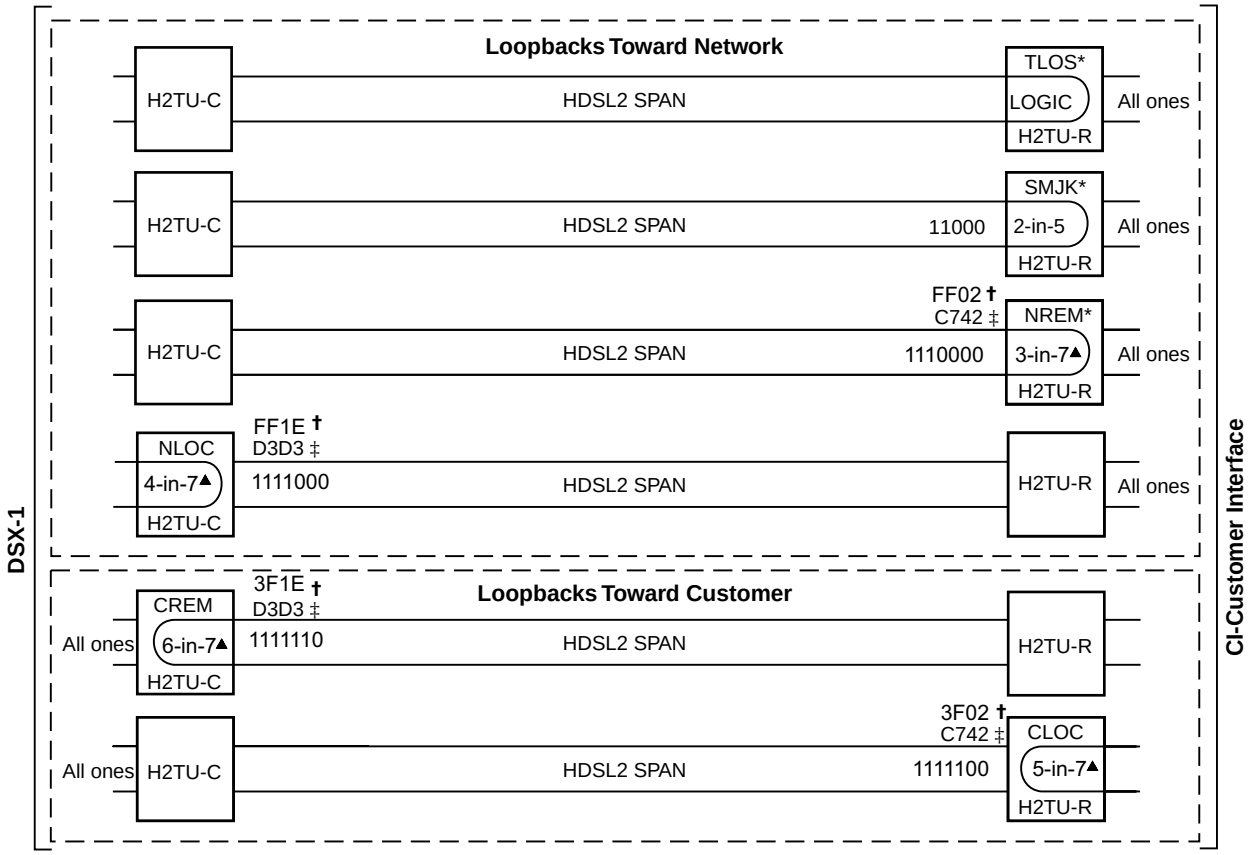
1 Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. You should be able to observe the NREM message on the front-panel display. The Status LED on the front panel should be green, and the loopback mode should also be identified on the Span Status screen.

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

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

4 Have the CO tester send the NLOC (4-in-7) inband loopup for 5 seconds. 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 it fails, the problem is in the upstream direction.



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

† A3LB and A4LB loopback codes.

‡ A2LB loopback codes.

▲ GNLB loopback codes.

Figure 25. *Loopback Modes*

A2LB Test Procedures

Using the codes listed in Table 22, 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. All loopbacks shown in Table 22 can also be initiated from the H2TU-C front-panel MODE and SEL buttons, as described in "Setting Options through MODE and SEL" on page 11.

Table 22. *Addressable Repeater Loopback Commands (A2LB)*

Name	Description	Binary Code [a] (Hexadecimal Equivalent)
ARMING or NI LPBK (inband)	Arming code	11000-11000 ...
ARMING or NI LPBK (ESF Data Link)	Arming code	1111-1111-0100-1000 (FF48)
IR LPDN or DISARM (inband)	Disarming code	11100-11100 ...
IR LPDN or DISARM (ESF Data Link)	Disarming code	1111-1111-0010-0100 (FF24)
IOR LPBK (NLOC and CREM) 230-232 bit errors 229-231 bit errors [b]	H2TU-C loopup	1101-0011-1101-0011 (D3D3)
IR LPDN	Loopdown (H2TU-C, H2RU, or H2TU-R)	1001-0011-1001-0011 (9393)
IR QUERY LPBK	Query loopback	1101-0101-1101-0101 (D5D5)
IR ALTERNATE QUERY LPBK	Alternate query loopback	1101-0101-1110-1010 (D5EA)
TIME-OUT OVERRIDE	Loopback time-out override	1101-0101-1101-0110 (D5D6)
FAR END NI ACTIVATE	Unblock AIS	1100-0101-0101-0100 (C554)
IOR POWER DOWN (H2TU-C) [c]	Removes HDSL2 line power	0110-0111-0110-0111 (6767)

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

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

To perform the A2LB test procedures:

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

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

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

3 Verify, if possible, that the H2TU-R Loopback LED is either flashing yellow at 4-second intervals (indicating that the system is armed), or is a steady yellow (indicating that it 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 in the order presented:

a 2 seconds of AIS (all ones pattern)

b 2 seconds of returning data pattern

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

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

d Normal looped data

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

Some Intelligent Repeater (IR) test sets do not count frame errors as bit errors when the test pattern is framed and the H2TU-C-388 is set to the Auto framing mode. To improve compatibility with those test sets, the H2TU-C 231 (NLOC and CREM) ID bit errors. As a result, the H2TU-C may indicate one more or one less bit error, depending on the test set type and the number of frame bits contained in the block of errored bits. To avoid this uncertainty, ADC recommends sending unframed IR commands.

The 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, detailed "Setting the Loopback Time-out Option" on page 49. If the Time-out Override code 1101-0101-1101-0110 (D5D6) is received after activating a loopback, then the automatic timed expiration of the loopback is inhibited. If this Time-out Override is sent, then the only way to loop the H2TU-C down is to do one of the following:

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

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

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

- If the system is to loopdown but remain Armed, send the IR (Intelligent Repeater) LPDN code (universal loopdown).
- If all the equipment is to be looped down, disarmed and returned to normal operation, send the disarm inband code 11100 or the ESF-DL code (FF24).

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

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

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

A3LB and A4LB Test Procedures

The H2TU-C-388 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, detailed "Setting the Loopback Time-out Option" on page 49, determines the duration of this loopback unless it is overridden by the reception of a second identical 16-bit loopup command before the timer expires. When this time-out override state exists, the only way to loop the H2TU-C down is to issue one of the three loopdown commands listed in Table 23. The automatic time-out mode is restored during subsequent loopback sessions.

Table 23 summarizes the codes required to execute Addressable 3 and 4 (A3LB and A4LB) repeater loopback commands. All code sequences must be present for at least 5 seconds.

Table 23. *Addressable Repeater Loopback Commands (A3LB and A4LB)*

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

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

APPENDIX A - SPECIFICATIONS

Power	
Line Voltage	0, -185 Vdc
CO Supply	-48 Vdc nominal (-42.5 Vdc to -56.5 Vdc) See "Power Consumption," "Maximum Power Dissipation," and "Maximum Current Drain" on page 57
Electrical Protection	Secondary surge and power cross protection on HDSL2 ports. Requires external primary protection
Fusing	Internal; connected to "FUSE ALARM" output on pin 117
Environmental	
Operating Temperature	-40 °F to +149 °F (-40 °C to +65 °C)
Operating Humidity	5% to 95% (non-condensing)
Physical	
Height	3.62 in. (9.2 cm)
Width	0.69 in. (1.8 cm)
Depth	10 in. (25.4 cm)
Weight	0.5 lb. (.23 kg)
Mounting	DDM+ high-density shelf
HDSL2	
Line Code	1.552 Mbps OPTIS
Transmission	Full duplex
Media	One non-loaded, copper, two-wire cable pair
Output	+13.8 dBm ±0.5 dB at 135 Ω (0-450 kHz) at CO side +13.5 dBm ±0.5 dB at 135 Ω (0-350 kHz) at remote side
Line Impedance	135 Ω
Maximum Provisioning Loss	35 dB at 196 kHz
Start-up Time	30 sec. typical, 1 min. maximum per span
DSX-1	
DSX-1 Line Impedance	100 Ω
DSX-1 Pulse Output	6 V^{pk-pk} pre-equalized for 0-655 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX
System	
One-way DS1 Delay	<400 µs
Wander (Looped)	Meets MTIE T1.101 requirements
Wideband Jitter (Looped)	0.2 UI maximum
Narrowband Jitter (Looped)	0.1 UI maximum

POWER CONSUMPTION

The maximum power consumption and heat dissipation depends upon the type of remote and regenerator units in the system and the CPE power setting.

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

Table 24 describes line-powered circuits on 9 kft, 26 AWG loops without a regenerator.

Table 24. *H2TU-C-388 Power Parameters—No Regenerator*

H2TU-R Model No.	H2TU-R CPE Power	-42.5 Vdc Power Consumption (Watts)		Heat Dissipation (Watts)		-42.5 Vdc Current (mA)	
		Typical	Maximum	Typical	Maximum	Typical	Maximum
H2TU-R-402		11.5	12.5	6.0	7.0	270.0	294.0

MAXIMUM POWER DISSIPATION

The Maximum Power Dissipation measures the power that is converted into heat. The heat builds up within the unit and contributes to the total heat generated in the space around the unit. The Maximum Power Dissipation is used to ensure that the maximum number of fully loaded shelves per bay 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 24 above to determine the maximum number of H2TU-C circuits that can occupy one CO bay.

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

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

The -42.5 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, stand-by 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 24 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 24 above to determine the shelf fusing requirements for your particular H2TU-C applications.

H2TU-C-388 CARD-EDGE CONNECTOR

Figure 26 shows the card-edge connector on the H2TU-C-388. Active pins are highlighted in black.

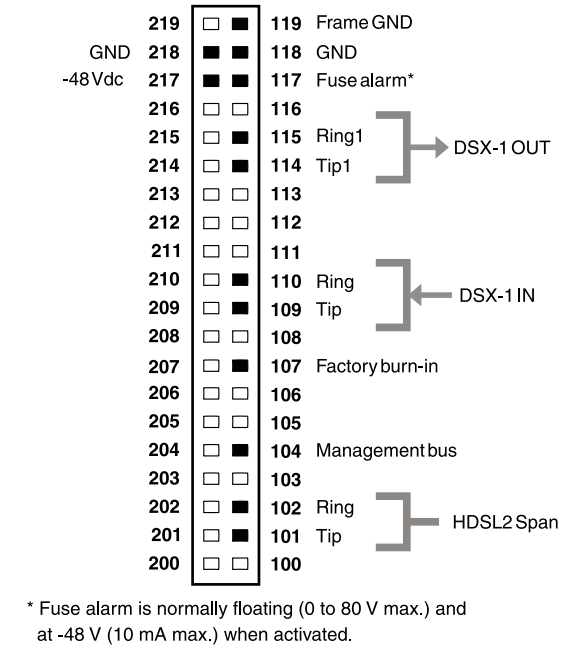


Figure 26. *H2TU-C-388 List 1E Card-Edge Connector*

Network Management Control Bus

The H2TU-C provides a Network Management Control Bus on pin 104 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-388 List 1E features are affected when it is under management. Consult the management unit practice for further information.

Fuse Alarm

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

CRAFT PORT

Figure 27 shows the craft port adaptor and its connection to a DB-9 or DB-25 connector on a maintenance terminal.

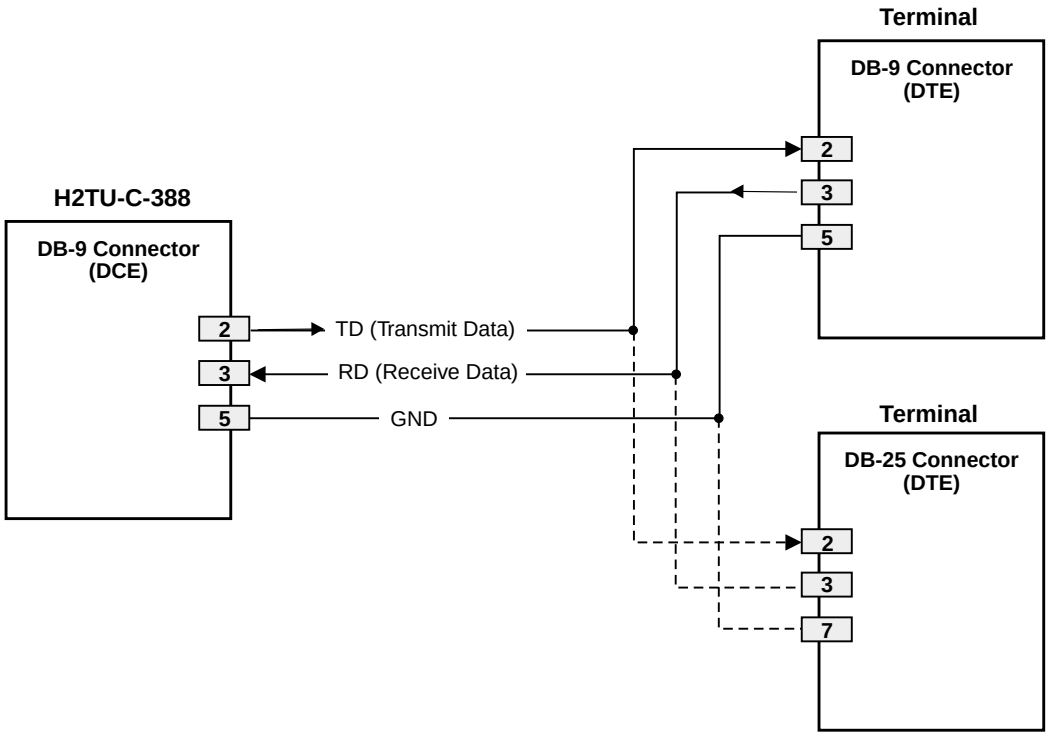


Figure 27. *210-to-DB-9 Adapter*

APPENDIX B - FUNCTIONAL OPERATION

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 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-388 and a remotely located H2TU-R.

Figure 28 shows a block diagram of the H2TU-C-388. The H2TU-C-388 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.

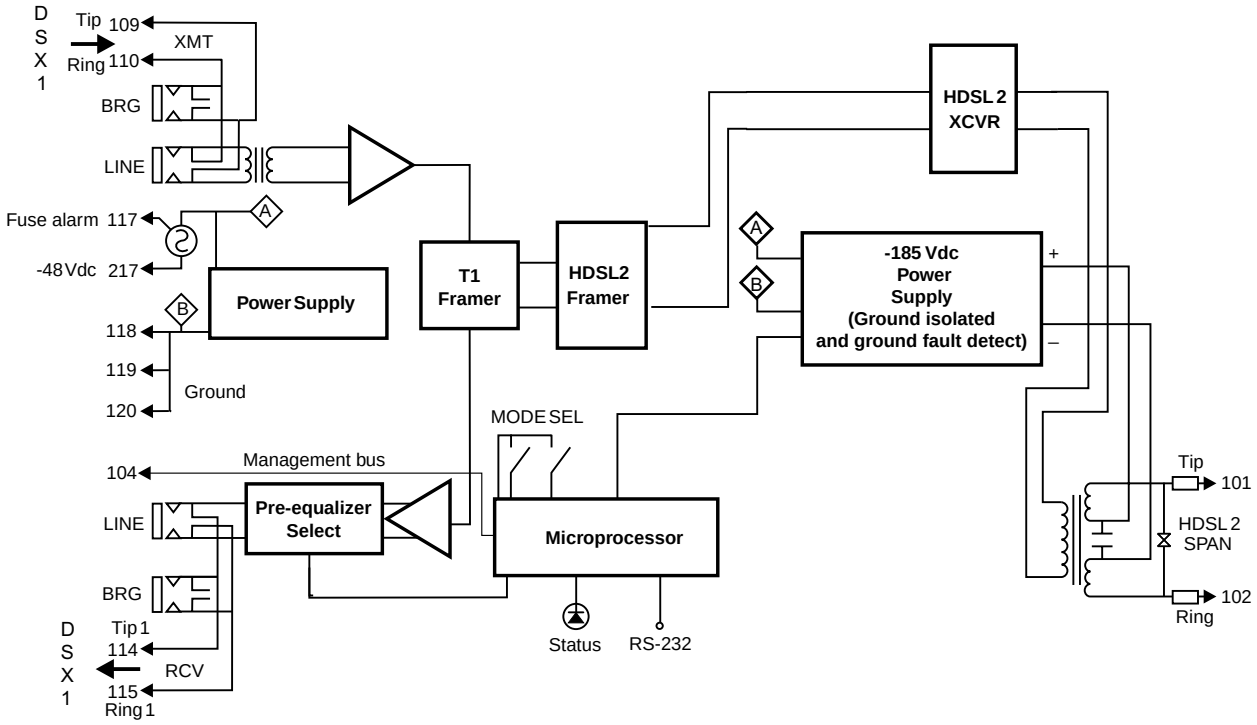


Figure 28. *H2TU-C-388 List 1E Block Diagram Timing*

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

GROUND FAULT DETECT

The H2TU-C-388 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-388 is compatible with the following DDM+ high-density shelves and associated equipment:

- ADC HCS-402, two-slot shelf with #150-1193-01 adapter
- Shelf (23-inch)
  - Larus FT2 1188 (28-slot, connectorized)
  - AT&T DS1 Ext. (28-slot, connectorized)
- Shelf (19-inch)
  - Larus FT21187 (20-slot, connectorized)
- Cabinet Distant Terminal (23-inch)
  - Larus FT2 1190 (12 slots) for a 51A cabinet.

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 800.366.3891 ext. 73000 (USA and Canada) or 952.917.3000 Fax: 952.917.3237	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration 800.366.3891, ext. 73000 (USA and Canada) or 952.917.3000	• Complete Solutions (from concept to installation) • Network Design and Integration Testing • System Turn-Up and Testing • Network Monitoring (upstream or downstream) • Power Monitoring and Remote Surveillance • Service/Maintenance Agreements • Systems Operation
BIA Technical Assistance Center 800.638.0031 (USA and Canada) or 714.730.3222 Fax: 714.730.2400 Email: wsd_support@adc.com	• Technical Information • System/Network Configuration • Product Specification and Application • Training (product-specific) • Installation and Operation Assistance • Troubleshooting and Repair/Field Assistance
Online Technical Support	• www.adc.com/Knowledge_Base/index.jsp
Online Technical Publications	• www.adc.com/library1/
Product Return Department 800.366.3891 ext. 73748 (USA and Canada) or 952.917.3748 Fax: 952.917.3237 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.	

LIST OF ABBREVIATIONS

A

A: Attenuation
ACO: Alarm CutOff
ACQ: Acquisition
AIS: Alarm Indication Signal
ALRM: Alarm
AMI: Alternate Mark Inversion
ARM: HiGain System Armed

B

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

C

CLEI: Common Language Equipment Identifier
CO: Central Office
CRC: Cyclical Redundancy Check
CREM: Customer Remote Loopback
CSA: Carrier Service Area

D

DBER: DS1 Bit Error Rate
DDM+: Double Dual Module Plus
DDS: Digital Data Service
DLC: Digital Loop Carrier
DSX-1: DS1 Cross-connect Frame

E

ECI: Equipment Catalog Item
ES: Errored Seconds
ESF: Extended SuperFrame
ES-L: Errored Seconds-Line
ES-P: Errored Seconds-Path
EXZ: The occurrence of 8 consecutive zeroes for B8ZS or 16 for AMI.

F

FERR: Framing Bit Error Occurred
FEV: Far End Voice
FLDL: Flash Download

G

GFD: Ground Fault Detect
GNLB: Generic Loopback

H

HBER: HDSL2 Block Error Rate
HCDS: High Capacity Digital Service
HDSL2: High bit-rate Digital Subscriber Line 2
HES: HDSL2 CRC Error
HG: HiGain

I

ID: Identification
IOR: Intelligent Office Repeater
IR: Intelligent Repeater

L

LA: Loop Attenuation
LAIS: Local Alarm Indication Signal
LBPV: Local Bipolar Violation
LEC: Loopback Enable Code
LLOS: Local Loss of Signal
LOS: Loss of Signal
LOSW: Loss of Sync Word
LPF: Line Power Feed
LRAI: Remote Alarm Indicator
LSC: Loop Select Code

M

MAL: Margin Alarm
MSEC: Monitored Seconds

N

NAIS: Network Alarm Indication Signal
NE: Near End
NID: Network Interface Device
NLOC: Network Local Loopback
NMA: Network Management and Administration
NPRM: Network PRM
NREM: Network Remote Loopback
NTF: No Trouble Found

O

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

Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra

P

PAM: Pulse Amplitude Modulation
PL: Payload
PRM: Performance Report Messaging
PRMF: Performance Report Messaging - Far End

PRM-FE:
Performance Report Messaging-Far End
PRMN: Performance Report Messaging - Near End
PRM-NE:
Performance Report Messaging-Near End
PWRF: Line Power Feed

R

RAI: Remote Alarm Indication
RAI-CI: Remote Alarm Indication - Customer Installation
RAIS: Remote Alarm Indication Signal
RLOS: Remote Loss of Signal
ROVR: RAI Overwrite
RTPV: Remote Provisioning

S

SES: Severely Errored Seconds
SES-L: Severely Errored Seconds-Line
SES-P: Severely Errored Seconds-Pat
SF: SuperFrame
SMJK: Remote SmartJack Loopback
SPLB: Special Loopback
SPRM: Supplemental PRM

T

TIP: Transition in Progress
TR1: Transaction Language 1
TRCI: TX RAI-CI Indication - Customer Installation
TUC: Transmission Unit Central Office
TUR: Transmission Unit Remote End

U

UAS: Unavailable Errored Seconds
UNFR: Unframed

CERTIFICATION AND WARRANTY

FCC 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 Inc. (“ADC”) warrants that, for a period of twelve months (12) 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 sixty-month warranty period per ADC's instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

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

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

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

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

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

RETURNS

ADC continues to repair faulty modules beyond the warranty program at a nominal charge. Contact your ADC sales representative for details and pricing.

MODIFICATIONS

Any changes or modifications made to this device that are not expressly approved by ADC DSL Systems, Inc. voids the user's warranty.

All wiring external to the products should follow the provisions of the current edition of the National Electrical Code.

STANDARDS COMPLIANCE

The H2TU-C-388 List 1E have been tested and verified to comply with the applicable sections of the following standards:

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

For technical assistance, refer to “Appendix D - Product Support” on page 63.

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