USER MANUAL

HiGain H2TU-C-388 List 7G Line Unit
Product Catalog: H2TU-C-388-L7G
CLEI: VACKBBBA

///ADC®

Revision History of This Manual

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Revision	Release Date	Revisions Made
1	March 28, 2003	Initial release.

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USING THIS MANUAL

The following conventions are used in this manual:

- `Monospace type` indicates screen text.

- Keys you press are indicated by small icons such as `Y` or `ENTER`. Key combinations to be pressed simultaneously are indicated with a plus sign as follows: `CTRL` + `ESC`.

- Items you select are in **bold**.

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

Notes contain information about special circumstances.

Cautions indicate the possibility of personal injury or equipment damage.

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

For a list of abbreviations used in this document, refer to "Appendix E - Abbreviations" on page 54.

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

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OVERVIEW

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

The H2TU-C, when used with an H2TU-R remote unit, transmits a 1.552 Mbps payload on one unconditioned copper pair over the full Carrier Service Area (CSA) range. The CSA includes loops up to 12,000 feet of 24 AWG wire or 9,000 feet of 26 AWG wire, including bridged taps.

The H2TU-C is designed to mount in Double Dual Module Plus (DDM+) high-density shelves. For a list of compatible shelves, see "Appendix C - Compatibility" on page 52.

FEATURES

Standard features include:

- HDSL2 transmission features

  - Lightning and power cross-protection on HDSL2 interfaces

  - Full-duplex HDSL2 transmission on one pair at 1.552 Mbps

  - Ultra-low wander (Stratum 1 compliant)

  - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)

  - Tip and ring reversal detection on HDSL2 loop

  - Sources sealing current when connected to an H2TU-R

- Front-panel features

  - DSX-1 signal access

  - Status Light Emitting Diodes (LEDs)

  - RS-232 craft port for maintenance terminal connection

- Digital Data Service (DDS) latching loopback

- Maintenance screens to provision, monitor, and troubleshoot HDSL2 system

  - DS1 and HDSL2 performance monitoring

  - Loop attenuation and insertion loss reporting

  - Non-volatile storage of performance monitoring parameters

  - Performance Report Messaging (PRM) support for Supplemental PRM (SPRM) and Network PRM (NPRM) at the H2TU-R

  - Payload (PL) and HDSL Generic (HG) loopback source identification

  - Margin Alarm (MAL) threshold

  - Report menu option for downloading status and performance monitoring data to a file

  - Remote provisioning through TL1 FDL

  - Fractional T1 (FT1) support

- Configuration options

  - Selectable DSX-1 pre-equalizer

  - Bipolar Violation Transparency (BPVT)

- Bit Error Rate (BER) alarm

- Remote provisioning

- Power Back Off - Customer (PBOC) and Power Back Off - Network (PBON) for configuring power output levels

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

- Selectable loopback activation codes

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

APPLICATIONS

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

- The service is deployed over one unconditioned, non-loaded copper pair.

- Conventional inline DS1 repeaters are no longer required.

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

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

- Operate effectively in the same cable binder group with other HDSL2 lines, HDSL, T1, ADSL, SDSL, POTS, DDS, and other transmission schemes.

- Can be used with customers requiring DS1 service on a temporary or permanent basis.

- Provide a means of quickly deploying service in advance of fiber-optic transmission systems.

FRONT PANEL

Figure 1 shows the H2TU-C front panel. Table 2 on page 6 describes the front-panel components. For pinout diagrams of the H2TU-C card-edge connector and craft port, refer to "Appendix A - Specifications" on page 47.
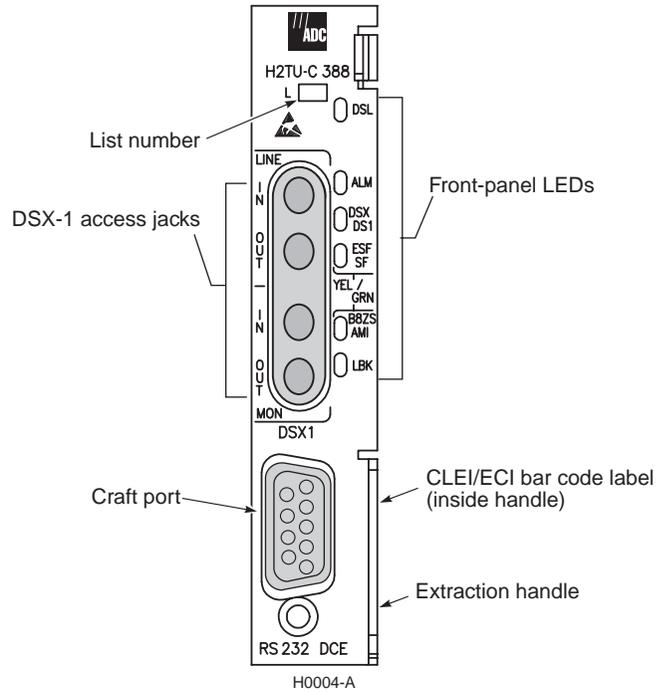
Figure 1.   H2TU-C Front Panel

Table 1. Front-Panel Description

Front-Panel Feature	Function
List number	Identifies the list number of the H2TU-C.
Front-panel LEDs	Display HDSL2 and DS1 line, provisioning, and alarm status through front-panel LEDs. Refer to Table 2 on page 6 for a listing of the front-panel LEDs and their functions.
DSX-1 access jacks	
MON	Provides non-intrusive monitoring jack access to (IN) and from (OUT) the HDSL2 span at the DSX-1 interface. Allows the two DS1 payloads to be monitored.
LINE	Provides splitting jack access to (IN) and from (OUT) the HDSL2 span at the DSX-1 interface. Breaks the OUT and IN paths to permit test signal insertion and retrieval.
Craft port (RS-232)	Provides bidirectional communication between the unit and an external terminal to allow configuration and performance monitoring through the maintenance terminal screens.
CLEI and ECI bar code label	Provides the human-readable Common Language Equipment Identifier (CLEI) code number and the Equipment Catalog Item (ECI) bar code number.
Extraction handle	Used to insert and extract the H2TU-C from the chassis.

INSTALLATION
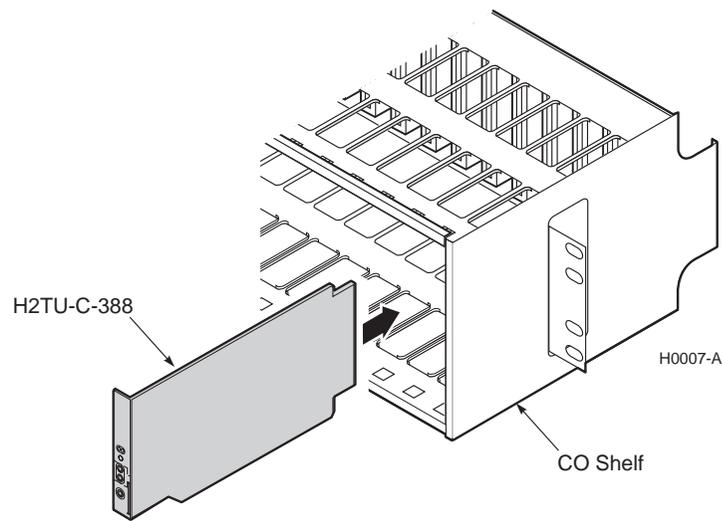
Figure 2.   H2TU-C Installation

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

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

1   Align the H2TU-C with the shelf card-slot guides and slide the unit in (see Figure 2).

2   Push on the H2TU-C front panel to secure the unit in the shelf.

VERIFICATION

Once the H2TU-C is installed, verify that it is operating properly. To do this, monitor the front-panel status LEDs. Table 2 below lists the LED status and their functions (the H2TU-C reports alarm types and loopback status on its front panel).

1 Verify that as the H2TU-C powers up, it attempts to communicate with a remote unit as the DSL LED flashes red once every second.

- If the H2TU-C is unable to communicate with the H2TU-R, the DSL LED displays solid red, indicating HBER, MARG, or PWRF alarms.

- If the H2TU-C is able to communicate with the H2TU-R, the DSL LED displays solid green, indicating that the HDSL2 spans are synchronized without error.

2 Verify the presence of a DS1 signal by confirming that the ALM LED is off (not lit). If the ALM LED displays red or yellow, a DS1 LOS condition exists. Refer to Table 2 to locate the problem.

3 Verify error free DS1 transmission by confirming that the DS1, framing (ESF/SF), and line code (B8ZS/AMI) LEDs display solid colors. Refer to Table 2 to locate the problem if these LEDs are either flashing or display solid red.

Table 2.   LED Status and Functions

LED and Status	Function
DSL	
OFF	No power is applied to the H2TU-C.
Solid green	Normal operation: all HDSL2 spans are synchronized without error.
Solid red	HBER, MARG, or PWRF alarm is present at the H2TU-C.
Flashing red once every second	HDSL2 loop is attempting synchronization.
ALM	
OFF	Normal operation: the DSX-1 signal is present at both the H2TU-R and H2TU-C.
Solid yellow	RLOS is present at the H2TU-R.
Solid red	LLOS is present at the H2TU-C.
DSX/DS1	
Solid green	Normal operation: the DSX-1 signal is error free.
Solid red	LLOS, BPV, frame error, or CRC is present at the H2TU-C.
ESF/SF	
OFF	Framing is set to UNFR, unframed DSX-1 is present at the H2TU-C, or no DSX-1 is detected at the H2TU-C.
Solid yellow	ESF frame formatting is present at the H2TU-C.
Flashing yellow once every second	ESF frame formatting and frame error/CRC are present at the H2TU-C.
Solid green	SF frame formatting is present at the H2TU-C.
Flashing green once every second	SF frame formatting and frame error are present at the H2TU-C.
B8ZS/AMI	
Solid yellow	B8ZS is provisioned at the H2TU-C.
Flashing yellow once every second	B8ZS and excess zeros string are present at the H2TU-C.
Solid green	AMI is provisioned at the H2TU-C.
Flashing green once every second	AMI and BPV are present at the H2TU-C.
LBK	
OFF	H2TU-C is not in loopback.
Solid yellow	H2TU-C is in either NLOC or CREM (RLB).

PROVISIONING

ACCESSING THE PROVISIONING SCREENS

Use a maintenance terminal (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 status, history, inventory, and provisioning screens (see Figure 3 on page 8).

> No dip switches or jumpers are required to provision the H2TU-C as it contains a non-volatile RAM (NVRAM) which stores the system option settings. System option settings are retained if shelf power is lost or the H2TU-C is unplugged.

Connecting to a Maintenance Terminal

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

To connect to a maintenance terminal:

1   Connect a standard 9-pin terminal cable to the RS-232 craft port on the H2TU-C front panel (Figure 1 on page 3).

2   Connect the other end of the cable to the serial port on the maintenance terminal.

3   Start a terminal emulation program such as Procomm (emulating a VT100 terminal).

4   Configure the maintenance terminal for the following communication settings:

   - 9600 baud

   - No parity

   - 8 data bits

   - 1 stop bit

   - Hardware flow control set to OFF

5   If necessary, press `CTRL` + `R` to refresh the HDSL2 logon screen.

Logon Screen

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

To select a menu from the logon screen (Figure 3 on page 8), do one of the following:

- Press the underlined letter of the menu.

- Use the `←` `→` arrow keys to select the menu, then press `ENTER`.

Table 3 on page 8 summarizes the navigational keys. They are also listed in the onscreen Help menu. Table 4 on page 9 describes the logon screen menus.
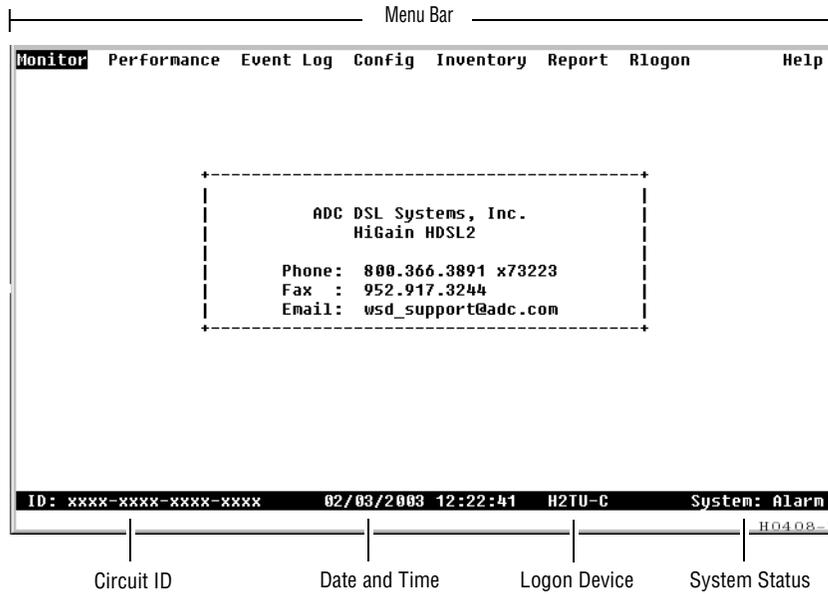
Figure 3.   Logon Screen

Table 3.   Navigational Keys for the Maintenance Terminal Screens

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

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

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

Table 4. Logon Screen Menus

Press this key:	To access this menu:	Menu Functions
M	Monitor	Monitors loopbacks and alarms, provides a graphical representation of circuit activity, including ES, UAS, SES, and line code.
P	Performance	Provides performance and alarm histories for current, 25-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 interface.
E	Event Log	Identifies the 100 most recent system events and reports the date and time of occurrence.
C	Config	Provides standard configuration options, ADC options, date and time setting, and a reset option (factory settings). Also provides a master clear option that clears all performance, alarm, and event log entries.
I	Inventory	Provides product information about the various devices that are in the system and lists circuit and device identifications.
O	Report	Provides four types of reports: Full Report, Short Report, System Information Report, and Event Report.
R	Rlogon/Rlogout	Remote logon can be performed from the H2TU-C or H2TU-R. The screen displays Rlogout when the H2TU-C or H2TU-R is remotely logged on to the other unit at the end of the circuit. To log off from the remote unit, press R. Rlogout changes to Rlogon. The unit is now locally logged on until R is pressed again to reinitiate the remote logon.
H	Help	Provides a glossary of terms used in the maintenance screens, a list of navigational keys, print guide, and ADC contact information.

PROVISIONING TASKS

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

- Set date and time (see "Setting Date and Time" on this page).

- Set circuit ID numbers (see "Setting Circuit ID Numbers" on page 11).

- Make any configuration changes (see "Configuring the System" on page 12).

- Clear history, alarm, and event log screens to remove miscellaneous data acquired during startup (see "Clearing the History, Alarm, and Event Log Screens" on page 24).

Setting Date and Time

To set the date and time:

1   Press **C** to select the Config menu.

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

3   Type the date in the format indicated (see Figure 4), then press **ENTER**.

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


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




ID: xxxx--xxxx--xxxx--xxxx    01/27/2003 14:09:40   H2TU-C          System: Alarm
                                                                          HO410-A
```

Figure 4.   Config Menu - Date and Time

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.

To set the circuit ID numbers:

1   Press `I` to select the Inventory screen.

2   Type the Circuit ID number in the field indicated (see Figure 5), then press `ENTER`.

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

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

------------------------ Product Information --------------------------
Unit     : H2TU-C        H2TU-R
Product  : H2TU-C-388    H2TU-R-402
List     : 7G            7H
Sw Ver   : 4.00          4.00
Build  # : 11            11
Checksum : 0xE3CF        0xE3CF
H2 Xcvr  : MTLK-V2.6.5   MTLK-V2.6.5
Serial # : 123456        123456
CLEI     : UACKBBBA      UARHDRUCAA
Mfg. Date: 01/20/2003    01/20/2003

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

Circuit ID   : xxxx--xxxx--xxxx--xxxx
H2TU-R  ID   : xxxx--xxxx--xxxx--xxxx
Circuit Notes: xxxx




| ID: xxxx--xxxx--xxxx--xxxx   01/20/2003 15:45:54   H2TU-C        System: OK |
                                                                  H0411-A
```

Figure 5. *Typical Inventory Screen*

Configuring the System

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

- Standard options (see Figure 7 on page 13).

- ADC options (see Figure 8 on page 13).

- Date and time (see "Setting Date and Time" on page 10).

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

- Reset to factory default configuration (see "Resetting to Factory Defaults" on page 23).

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




















 ID: xxxx--xxxx--xxxx--xxxx   01/27/2003 14:11:11   H2TU-C       System: Alarm
                                                                       HO413-A
```
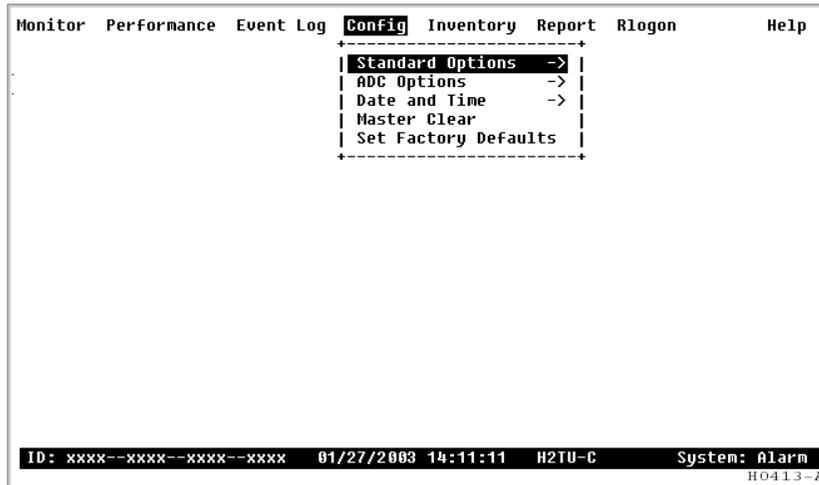
Figure 6.   Config Menu

Making Changes to Standard and ADC Options

Figure 7 on page 13 and Figure 8 on page 13 show the Standard and ADC configuration options. Standard options are those supported by HiGain HDSL2 units when connected to units from other vendors. ADC options are an extended set of options that are only available when using HiGain units exclusively.

Table 5 on page 14 and Table 6 on page 15 describe the Config menu options and the available settings for each option. The settings in bold type are the factory default settings.

To make changes to these options:

1 Press `C` to select the Config menu.

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

3 Use the arrow keys to select an option.

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

5 Press `ENTER` to activate your choice.

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon          Help
                               +----------------------+
                               | Standard Options  -> |
                      +----------------------------------------------------+
                      | Loopback Timeout (LBTO)                : 120 min   |
                      | Loop Attenuation Threshold (LATT) [0-40]: 32   dB  |
                      | Margin Threshold (MARG)          [0-15]: 4    dB   |
                      | DS1 Frame Formatting (FRMG)            : AUTO      |
                      | DS1 Line coding (DS1)                  : B8ZS      |
                      | H2TU-C Equalization (EQL)              : 0    ft   |
                      | H2TU-R Line Buildout (RLBO)            : -7.5  dB  |
                      | Alarm Pattern (ALMP)                   : AIS       |
                      | H2TU-R TLOS Loopback (TLOS)            : DIS       |
                      | Network Loopback Pattern (NLBP)        : AIS       |
                      | Power Back Off Network (PBON)          : DEF       |
                      | Power Back Off Customer (PBOC)         : DEF       |
                      +----------------------------------------------------+



Use <Spacebar> to cycle through option settings and <Enter> to activate
   ID: xxxx-xxxx-xxxx-xxxx      01/28/2003 16:09:07   H2TU-C       System: OK
                                                                    HO419-A
```

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

```
Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon          Help
                               +----------------------+
                               | Standard Options  -> |
                               | ADC Options       -> |
                      +----------------------------------------------------+
                      | Line Power Feed (PWRF)                 : ON        |
                      | Remote Provisioning (RTPV)             : ENA       |
                      | Bipolar Violation Transparency (BPVT)  : DIS       |
                      | DS1 BER (DBER)                         : DIS       |
                      | HDSL2 BER Threshold (HBER)             : 1E-6      |
                      | Special Loopback Mode (SPLB)           : GNLB      |
                      | Smartjack Loopback (LPBK)              : ENA       |
                      | Network AIS Pattern (NAIS)             : CI        |
                      | Performance Report Messaging (PRM)     : S+N       |
                      | RAI to RAI-CI toward NET (RACI)        : ENA       |
                      | ESF-RAI to SF-RAI Overwrite (ROUR)     : ENA       |
                      | H2TU-R DS1 Frame Conversion (CONV)     : OFF       |
                      | Fractional T1 Mode (FT1)               : DIS       |
                      +----------------------------------------------------+



Use <Spacebar> to cycle through option settings and <Enter> to activate
   ID: xxxx--xxxx--xxxx--xxxx   01/20/2003 15:43:47   H2TU-C       System: OK
                                                                    HO421-A
```

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

Table 5. *H2TU-C Standard Config Menu Options*

Standard Config Menu Options	Selection	Description
Loopback Timeout (LBTO)	NONE	Disables automatic time-out cancellation of all loopbacks.
	20 min	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
	60 min	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
	120 min	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
Loop Attenuation Threshold (LATT)	0 through 40 dB	Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold can only be set through the maintenance screens.
	32 dB	Default value.
Margin Threshold (MARG)	0 to 15 dB	Determines the minimum allowable margin below which a system alarm can occur. Zero disables the alarm. The Margin (Alarm) Threshold can only be set through the maintenance screens.
	4 dB	Default value.
DS1 Frame Formatting (FRMG)	**AUTO**	Configures the HDSL2 system to operate in an auto-framing (AUTO) mode in which it continuously searches the input DS1 bit stream for a valid SF or ESF frame pattern. Both line and path performance parameters are maintained. Unframed payloads will cause the ES-P and SES-P counters to increment.
	SF	Configures the HiGain HDSL2 system to search for the SF framing pattern at its DS1 input.
	ESF	Configures the HiGain HDSL2 system to search for the ESF framing pattern at its DS1 input.
	UNFR	Configures the HDSL2 system to operate in an unframed mode. This mode disables the auto framing process and forces the system to function as a transparent bit pipe. Only line parameters are considered when monitoring DS1 performance.
DS1 Line Coding (DS1)	**B8ZS**	Configures the HDSL2 system for B8ZS line code.
	AMI	Configures the HDSL2 system for AMI line code.
H2TU-C Equalization (EQL) See "H2TU-C Equalization (EQL) Option." on page 16.	**0** ft.	Sets the equalizer to DSX-1 for 0 to 132 feet.
	133 ft.	Sets the equalizer to DSX-1 for 133 to 265 feet.
	266 ft.	Sets the equalizer to DSX-1 for 266 to 398 feet.
	399 ft.	Sets the equalizer to DSX-1 for 399 to 532 feet.
	533 ft.	Sets the equalizer to DSX-1 for 533 to 655 feet.
H2TU-R Line Buildout (RLBO)		Sets the DS1 receive level output toward the Customer Interface (CI). H2TU-R Line Buildout can only be set through the maintenance screens.
	0 dB	Sets the DS1 RLBO level toward the CI to 0 dB.
	-7.5 dB	Sets the DS1 RLBO receive level toward the CI to -7.5 dB.
	-15.0 dB	Sets the DS1 RLBO receive level toward the CI to -15.0 dB.
Alarm Pattern (ALMP) See "Alarm Pattern (ALMP) Option." on page 16.	**AIS**	Enables the HDSL2 system to output an AIS payload at its DS1 ports for LOSW and DS1 LOS. For priority resolution, see Figure 26 on page 40.
	LOS	Enables the HDSL2 system to output an LOS condition at its DS1 ports for LOSW and DS1 LOS.
H2TU-R TLOS Loopback (TLOS)	ENA	Enables a logic loopback at the H2TU-R when an LOS occurs at its DS1 input, if enabled at the H2TU-R. For priority resolution, see Figure 26 on page 40.
	DIS	Disables Transmit Loss of Signal (TLOS) logic loopback.

Continued

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

Standard Config Menu Options	Selection	Description
Network Loopback Pattern (NLBP)	**AIS**	Enables the H2TU-R to transmit an AIS toward CI for any network loopback. For priority resolution, see Figure 26 on page 40.
	LOS	Enables the H2TU-R to transmit an LOS toward CI for any network loopback.
Power Back Off - Network (PBON) See "Power Back Off Customer (PBOC) and Power Back Off Network (PBON) Options" on page 17.	**DEF**	Configures the power output levels of the H2TU-C network unit toward the customer to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
	ENH	Configures the power output levels of the H2TU-C network unit toward the customer to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
Power Back Off - Customer (PBOC) See "Power Back Off Customer (PBOC) and Power Back Off Network (PBON) Options" on page 17.	**DEF**	Configures the power output levels of the H2TU-R customer unit toward the network to comply with the Default template as defined in Section 6.1.4.2 of ANSI T1/E1.4.
	ENH	Configures the power output levels of the H2TU-R customer unit toward the network to comply with the Enhanced template as defined in Section 6.1.4.2 of ANSI T1/E1.4.

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

ADC Config Menu Options	Selection	Description
Line Power Feed (PWRF)	OFF	Disables powering to the HDSL2 pair.
	ON	Keeps the HDSL2 line voltage at nominal -180 Vdc.
Remote Provisioning (RTPV)	**ENA**	Enables provisioning at the H2TU-R remote unit
	DIS	Disables provisioning at the H2TU-R remote unit
Bipolar Violation Transparency (BPVT) See "Bipolar Violation Transparency (BPVT) Option" on page 17.	ENA	Enables HDSL2 CRC and BPV errors at the DS1 input to be converted into DS1 BPVs at the DS1 output at the distant end. This makes HDSL2 transparent to BPVs.
	DIS	Disables BPV Transparency.
DS1 BER (DBER) See "DS1 BER (DBER) Option" on page 17.	ENA	Enables the fixed 24-hour DS1 BER threshold (10^{-6}).
	DIS	Prevents the generation of a system alarm due to DS1 BER.
HDSL2 BER Threshold (HBER) See "HDSL2 BER Threshold (HBER) Option" on page 18.	**1E-6**	Front-panel alarm is displayed and the Status LED flashes red when the Block Error Rate (BER) threshold exceeds 10^{-6}. BER is based on the definition of Bit Error Rate.
	1E-7	Front-panel alarm is displayed and the Status LED flashes red when the Block Error Rate (BER) threshold exceeds 10^{-7}.
	NONE	Prevents generation of a system alarm due to BER.
Special Loopback Mode (SPLB) See "Special Loopback (SPLB) Mode" on page 42.	**GNLB**	Configures the HDSL2 system to respond to the generic inband loopback codes.
	A3LB	Configures the HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
SmartJack Loopback (LPBK)	**ENA**	Enables the HDSL2 system to recognize all inband SmartJack (SMJK) loopback commands.
	DIS	Configures the HDSL2 system to ignore all inband SmartJack loopback commands.
Network AIS Pattern (NAIS)	**CI**	If ALMP is set to AIS, this option specifies which pattern is sent to the network when a remote LOS or AIS occurs. When configured for CI, an AIS-CI pattern is sent to the network. For priority resolution, see Figure 26 on page 40.
	AIS	When configured for AIS, an AIS pattern is sent to the network.

Continued

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

ADC Config Menu Options	Selection	Description
Performance Report Messaging (PRM)	SPRM	The H2TU-R generates Supplemental PRM (SPRM) every second if no PRM is present from the CPE within 5 seconds of a reset or an LOS/AIS/OOF condition occurs. TL1 commands and responses are enabled.
	NPRM	The H2TU-R generates Network PRM (NPRM) if no PRM is present from the CPE. If the CPE is sending PRMs, NPRM is generated, in addition to the existing PRM, every second. TL1 commands and responses are enabled.
	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.
RAI to RAI-CI towards NET See "RAI to RAI-CI toward NET (RACI) Option" on page 18.	**ENA**	Allows DS1 RAI (yellow alarm) signal received by the H2TU-R to be converted to an RAI-CI signal towards the network.
	DIS	Prevents conversion of the DS1 RAI to an RAI-CI signal.
ESF-RAI to SF-RAI Overwrite (ROVR) See "ESF-RAI to SF-RAI Overwrite (ROVR) Option" on page 19.	**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.
	DIS	Prevents conversion to an SF-RAI pattern.
H2TU-R DS1 Frame Conversion (CONV) See "H2TU-R DS1 Frame Conversion (CONV) Option" on page 19.	**OFF**	Framing determined by the DS1 frame formatting option.
	ACON	Auto (ACON) detection of framing and potential frame conversion at the remote.
	FCON	Auto detection of framing and forced frame format conversion (FCON) at the H2TU-R.
Fractional T1 Mode (FT1) See "Fractional T1 Mode (FT1) Option" on page 21.	ENA	Enables system response to DDS latching loopback commands for fractional T1 applications, CP disconnect, and trouble indication. For priority resolution, see Figure 26 on page 40.
	DIS	Disables system response to DDS latching loopback commands .

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

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

- LOSW on any loop
- LOS DS1

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

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

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

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

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

Table 7. *DS1 and 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

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

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

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

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

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

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

- Condition 1—RAI is received from the CI.

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

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

- Cessation of RAI from the CI.

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

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

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

- ESF—The RAI-CI signal is a repetitive pattern in the Frame Bit for Data Link (FDL) with a period of 1.08 seconds. RAI-CI is formed by sequentially interleaving 0.99 (+/- 2 ms) seconds of the normal message 00000000 11111111 (right-to-left) with 90 milliseconds (+/- 2 ms) of the message 00111110 11111111 (right-to-left) to flag the signal as RAI-CI.

- SF—The SF-RAI-CI signal is transmitted inband by setting each of the 24 channel time lots to 1000 1011 (left-to-right). In addition to the criteria specified above, the generation of SF-RAI-CI has to be held off for 1 second to examine the DS0s for a framed, all-zeros pattern. If present, the generation of SF-RAI-CI is suspended for the duration of the all-zeros pattern.

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

ESF-RAI to SF-RAI Overwrite (ROVR) Option. If the ESF-RAI to SF-RAI Overwrite (ROVR) option is enabled, it allows a network ESF-RAI or ESF-RAI-CI pattern to be converted into a CPE SF-RAI or SF-RAI-CI pattern.

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.

H2TU-R DS1 Frame Conversion (CONV) Option. Frame format conversion (see Table 8) 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 towards 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 Unavailable Seconds - Path (UAS-P). As a result, the system reverts to frame search mode.

This option has the following settings:

- OFF: No frame conversion takes place. All framing issues are determined by the FRMG option settings of AUTO 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 towards the network as well as the network ESF to SF towards the CPE.

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

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

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

- FCON: This is the forced conversion setting. Table 8 lists the 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 on page 20 and Table 10 on page 20 list the ESF and SF frame formats, respectively.

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

Case Number	NET Transmit	CPE Transmit	ACON Option 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

ESF Number	Frame Bits		
	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

Fractional T1 Mode (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, 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 allows the H2TU-C to respond to DS0 latching loopback commands and, therefore, 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 new DDS latching loopback commands, which must also be enabled. (For more information about latching loopback commands, refer to BellCore 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)	S 0 1 1 1 0 1 0
2A	35	NI Loop Select Code (LSC)	S 1 0 0 0 0 0 1
2B	35	DS0 DP Loop Select Code (LSC)	S 0 0 0 0 1 0 1
3	100	Loopback Enable Code (LBE)	S 1 0 1 0 1 1 0
4	35	All Ones	S 1 1 1 1 1 1 1
5	100	LBE	S 1 0 1 0 1 1 0
6	32	Far End Voice (FEV)	S 1 0 1 1 0 1 0
Disable/Loopdown	35	TIP	S 0 1 1 1 0 1 0

The sequences in Table 11 are sent in time slot 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 about 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 pre-programmed 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 called 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 loopdown can also be initiated by depressing the H2TU-R loopback control pushbutton or by any of the standard 3-in-5 loopdown commands. The implemented detection or 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 (page 21) 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, the 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 towards 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.

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

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

(a) Don't care bit.

Resetting to Factory Defaults

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

1 Press **C** to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **Set Factory Defaults** (see Figure 9), then press **ENTER**.

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

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

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




 ID: xxxx--xxxx--xxxx--xxxx    01/27/2003 14:11:11   H2TU-C        System: Alarm
                                                                        H0415-A
```

Figure 9.   Config Menu - Set 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 start-up session and ensures that you have meaningful data thereafter.

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

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

1   Press `P` to select the Performance screen.

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

3   Press `↓` to select statistics.

4   Press the `SPACEBAR` to select the type of statistics (**Current**, **Alarm History**, **25-Hour History**, **48-Hour History**, or **31-Day History**), and press `ENTER` after your selection.

   –   Selecting **31-Day History** allows you to clear the current, 25-hour, 48-hour, and 31-day performance history screens for the selected interface.

   –   Selecting **Alarm History** allows you to clear the alarm history screen for the selected interface. For information about the DS1 and HDSL2 Alarm screens, see Table 15 on page 29 and Table 16 on page 31, respectively.

5   Press `L` to clear the screen.

6   Press `Y` to confirm.

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

1   Press `C` to select the Config screen.

2   Use the `↑` and `↓` arrow keys to select **Master Clear** (see Figure 10).

3   Press `ENTER` to activate.

4   Press `Y` to clear all screens.
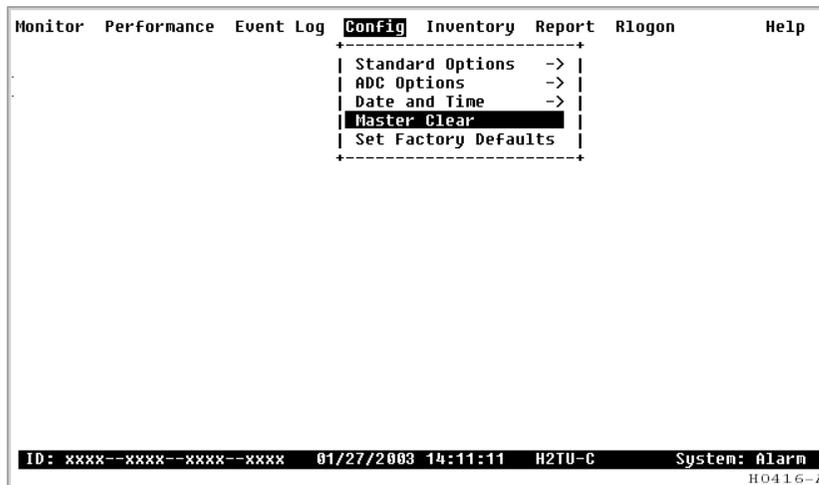
Figure 10.   Config Menu - Master Clear

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

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

- The Monitor screen provides a graphical representation of circuit activity and allows initiation of loopbacks.

- The Performance screens provide current, 25-hour, 48-hour, and 31-day performance histories and a continuous alarm history.

- The Event Log provides a description of the 100 most recent events, which include their origin, time and date of occurrence, and message.

> **When power is removed from the H2TU-C, all PM and Alarm data is lost.**

USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

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

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

Figure 11 shows an armed circuit with an active loopback and alarms. Terms used on the system diagram are defined in the onscreen Help menu glossary. Abnormal situations are highlighted on the diagram. Table 14 on page 26 describes the screen fields.

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

When prompted with the message: Are you sure (Y/N)?, press **Y** to initiate the loopback or **N** to cancel. For more information about loopbacks, see "Testing" beginning on page 39.

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 23 on page 44 for a summary of the HDSL2 generic loopback codes and activation methods.
Alarm Type	Indicates type of alarm. See Table 22 on page 39 for a summary of system alarms.
Code Type	Type of DS1 line coding received or sent (B8ZS or AMI).
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors include DS1 frame errors, BPV, and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.
DS1 UAS Count	Unavailable Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame Type	Type of DS1 framing detected at the input stream (SF, ESF, or UNFR).
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors. This value is a running total of the last 24 hours.
HDSL2 UAS Count	Unavailable Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
HG or (PL)	HG displays when the loopback was initiated from an HDSL2 Generic (HG) front panel or by a maintenance terminal loopback command. PL displays when the loopback was initiated by a command embedded in the DS1 data path payload (PL).
ID	Circuit identification number.
INSL	Insertion Loss—The signal loss value for a 196 kHz signal over the cable.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to insertion loss at 196 kHz and should be kept under 28 dB. This value differs from the insertion loss value of a conventional 196 kHz signal.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10^{-7} Bit Error Rate.
MAL	Margin Alarm—Indicates the margin on HDSL2 loop has dropped below the threshold (0 to 15 dB) set by the operator.
PRM	The sum of the Performance Report Messaging - Near End (PRM-NE) and Performance Report Messaging - Far End (PRM-FE) counts.
System Status	The presence or absence of an alarm condition is indicated on the lower right corner of all screens. **System: OK** indicates that there are no alarms present; **System: Alarm** indicates the presence of an alarm. Refer to "Using the Performance Screens to View Alarm Data" on page 31.

USING THE PERFORMANCE SCREENS TO VIEW PERFORMANCE DATA

The Performance screens display:

- CRC statistics for the HDSL2 or DS1 interface in 31-day, 48-hour, 25-hour, and current history reports.

- Alarm statistics for the DS1 interfaces (Figure 21 on page 32 and Figure 22 on page 32) or HDSL2 interfaces (Figure 23 on page 33) on a continuous basis.

To access the Performance history screens:

1 Press P to select the Performance screen.

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

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

Performance History at the DS1 Interface

The Performance History for the DS1 Interface provides a 31-day, 48-hour, 25-hour, and current statistics screens for the H2TU-C and H2TU-R (as viewed from the H2TU-C).

Figure 12 below and Figure 14 on page 28 are examples of DS1 performance history screens at the remote unit. Figure 13 on page 28 is an example of DS1 performance history screen at the line unit. Refer to Table 15 on page 29 for descriptions of the errors reported on DS1 interface screens. Asterisks indicate performance monitoring from the previous day.

Figure 15 on page 28 and Figure 16 on page 29 show statistics for the DS1 interface at the remote unit and line unit, respectively. These screens report 1-day, 1-hour, and 15-minute statistics.

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

                    H2TU-R DS1   31 Day History (Page 1 of 3)
-------------------------------------------------------------------------------
 Date    CU-L   ES-L  SES-L  UAS-L   CU-P   ES-P  SES-P  UAS-P PRM-NE PRM-FE

12/28     -      -      -      -      -      -      -      -      -      -
12/29     -      -      -      -      -      -      -      -      -      -
12/30     -      -      -      -      -      -      -      -      -      -
12/31     -      -      -      -      -      -      -      -      -      -
01/01     -      -      -      -      -      -      -      -      -      -
01/02     -      -      -      -      -      -      -      -      -      -
01/03     -      -      -      -      -      -      -      -      -      -
01/04     -      -      -      -      -      -      -      -      -      -
01/05     -      -      -      -      -      -      -      -      -      -
01/06     -      -      -      -      -      -      -      -      -      -
01/07     -      -      -      -      -      -      -      -      -      -
01/08     -      -      -      -      -      -      -      -      -      -

            Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Use <Space> to cycle through    Interface  : H2TU-R DS1
choices and <Enter> to view     Statistics : 31-Day History
ID: xxxx-xxxx-xxxx-xxxx        01/27/2003 07:20:21   H2TU-C        System: OK
                                                                    H0500-A
```

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

Figure 13.   H2TU-C DS1 48-Hour Performance History

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

Figure 15.   H2TU-R DS1 Current Statistics

Figure 16. *H2TU-C DS1 Current Statistics*

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

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

(a) Line (L) refers to the AMI DS1 line used to transport the payload.
(b) FE is a frame bit error.
(c) Appears on H2TU-R Performance History screens.
(d) Appears on the DS1 Current Statistics screens.
(e) Path (P) refers to the total framed payload being transported between two points.
(f) Severely Errored Frame—Two or more frame bit errors occurring in a 0.75 ms interval for SF or a 3 ms interval for ESF.

Performance History at the HDSL2 Interface

The HDSL2 interface has 31-day, 48-hour, 25-hour, and current statistic screens for the H2TU-C. Figure 17 and Figure 18 on page 30 are examples of 31-day and 48-hour performance history screens. Figure 19 and Figure 20 on page 31 are examples of 25-hour and current statistics performance history screens. Refer to Table 16 on page 31 for descriptions of the kinds of errors reported on all HDSL2 performance screens. Asterisks indicate performance monitoring from the previous day.

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

                        H2TU-C HDSL2 31 Day History (Page 1 of 3)
--------------------------------------------------------------------------------
  Date     CV     ES    SES    UAS  LOSWS

 12/28     -      -      -      -      -
 12/29     -      -      -      -      -
 12/30     -      -      -      -      -
 12/31     -      -      -      -      -
 01/01     -      -      -      -      -
 01/02     -      -      -      -      -
 01/03     -      -      -      -      -
 01/04     -      -      -      -      -
 01/05     -      -      -      -      -
 01/06     -      -      -      -      -
 01/07     -      -      -      -      -
 01/08     -      -      -      -      -

              Press: (N)ext Page, (P)revious Page, C(l)ear History
--------------------------------------------------------------------------------
Use <Space> to cycle through      Interface  :  H2TU-C HDSL2
choices and <Enter> to view       Statistics :  31-Day History
 ID: xxxx-xxxx-xxxx-xxxx          01/27/2003 07:25:42    H2TU-C          System: OK

                                                                         H0505-A
```

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

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

                      H2TU-C HDSL2 48 Hour History (Page 1 of 4)
--------------------------------------------------------------------------------
  Time     CV     ES    SES    UAS  LOSWS

*08:00     -      -      -      -      -
*09:00     -      -      -      -      -
*10:00     -      -      -      -      -
*11:00     -      -      -      -      -
*12:00     -      -      -      -      -
*13:00     1      1      0    143    138
*14:00     0      0      0      0      0
*15:00     0      0      0      0      0
*16:00     0      0      0      0      0
*17:00     0      0      0      0      0
*18:00     0      0      0      0      0
*19:00     0      0      0      0      0

              Press: (N)ext Page, (P)revious Page, C(l)ear History
--------------------------------------------------------------------------------
Use <Space> to cycle through      Interface  :  H2TU-C HDSL2
choices and <Enter> to view       Statistics :  48-Hour History
 ID: xxxx-xxxx-xxxx-xxxx          01/27/2003 07:26:28    H2TU-C          System: OK

                                                                         H0506-A
```

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

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

                      H2TU-C HDSL2 25 Hour History (Page 1 of 9)
--------------------------------------------------------------------------------
  Time     CV     ES    SES    UAS  LOSWS

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

              Press: (N)ext Page, (P)revious Page, C(l)ear History
--------------------------------------------------------------------------------
Use <Space> to cycle through      Interface  :  H2TU-C HDSL2
choices and <Enter> to view       Statistics :  25-Hour History
 ID: xxxx-xxxx-xxxx-xxxx          01/27/2003 07:27:17    H2TU-C          System: OK

                                                                         H0507-A
```

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

Figure 20.   *H2TU-C HDSL2 Current Statistics*

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

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

USING THE PERFORMANCE SCREENS TO VIEW ALARM DATA

To access the alarm history screens:

1   Press **P** to select the Performance screen.

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

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

4   Press **N** or **P** to page through the alarm history screens.

5   Press **L** to clear the selected alarm history screen.

Alarm History at the DS1 Interface

The Alarm History screen reports on a continuous basis the DS1 statistics for the H2TU-C (Figure 21 on page 32) and the H2TU-R (Figure 22 on page 32). The types of alarms reported are described in Table 16 on page 31. Current alarms are shown in reverse video.

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

                        H2TU-C DS1   Alarm History
--------------------------------------------------------------------------------
Alarm       First               Last              Status       Count

LLOS        01/24/03 00:00      01/24/03 00:00      OK           1
LAIS        01/24/03 00:00      01/25/03 13:29      OK           2
DBER        01/24/03 00:00      01/25/03 13:29      OK           2
LOF                                                 OK           0




                      Press: C(l)ear Alarm History
--------------------------------------------------------------------------------
Use <Space> to cycle through    Interface  : H2TU-C DS1
choices and <Enter> to view     Statistics : Alarm History
 ID: xxxx-xxxx-xxxx-xxxx       01/27/2003 07:29:29   H2TU-C        System: OK
                                                                      H0509-A
```

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


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

                        H2TU-R DS1   Alarm History
--------------------------------------------------------------------------------
Alarm       First               Last              Status       Count

RLOS                                                OK           0
RAIS        09/01/02 00:01      09/01/02 15:28      OK           4
RAI                                                 OK           0
TX RAI-CI                                           OK           0
PRM-NE                                              DISABLED     0
PRM-FE                                              DISABLED     0
DBER                                                DISABLED     0
LOF                                                 OK           0



                      Press: C(l)ear Alarm History
--------------------------------------------------------------------------------
Use <Space> to cycle through    Interface  : H2TU-R DS1
choices and <Enter> to view     Statistics : Alarm History
 ID: xxxx--xxxx--xxxx--xxxx    01/29/2003 12:32:09   H2TU-C        System: OK
                                                                      H0510-A
```

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

Table 17. *DS1 Alarm Descriptions*

Message on Screen	Description
H2TU-C DS1 Alarms (see Figure 21 on page 32)	
LLOS	Line (Unit) Loss of Signal—Loss of the H2TU-C DSX-1 input signal.
LAIS	Line Alarm Indication Signal—Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port. The ALMP option determines whether AIS (default) or LOS is sent toward the CPE.
DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.
LOF	Loss of Frame—Indicates the incoming DS1 payload does not contain the specific frame pattern, ESF or SF, selected by the FRMG option. Only occurs if the FRMG option is set to SF or ESF.
H2TU-R DS1 Alarms (see Figure 22 on page 32)	
RLOS	Remote (Unit) Loss of Signal—Loss of the H2TU-R DS1 input signal.
RAIS	Remote Alarm Indication Signal—Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port. By default AIS-CI [a] is sent toward the network. See Figure 26 on page 40.
RAI	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.

Continued

__Table 17.__ DS1 Alarm Descriptions

Message on Screen	Description
TX RAI-CI	Transmit RAI-CI - Remote Alarm Indication at the H2TU-R—Upon reception of an RAI (yellow) from the CPE, the H2TU-R sends an RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or LOF), then the RAI is passed on to the network unaltered. This is applicable to SF or ESF framing. In an all SF environment, RACI must be enabled to convert SF-RAI to SF-RAI-CI.
PRM-NE	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	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	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.
LOF	Loss of Frame—Indicates the incoming DS1 payload does not contain the specific frame pattern, ESF or SF, selected by the FRMG option. Only occurs if the FRMG option is set to SF or ESF.

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

Alarm History at the HDSL2 Interface

The HDSL2 Alarm History screens report alarms at the H2TU-C and the H2TU-R. Figure 23 shows the H2TU-C HDSL2 alarm history. Table 18 describes the alarms that are reported at the H2TU-C or H2TU-R.

__Figure 23.__ H2TU-C HDSL2 Alarm History Screen

Table 18. *HDSL2 Alarm Descriptions*

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

USING THE SYSTEM EVENT LOG TO TRACK EVENTS

The System Event Log screen (Figure 24) displays 100 of the most recent events (most recent event displayed first) and provides the following information:

- Origin tags to identify the source of a Write entry (see "Origin Tags" on page 36)

- Date and time

- Event log messages (see Table 19 on page 35)

To view a running log of system events, press E to select the Event Log.

- Press N or P to page through the event log.

- Press T to return to the top of the log.

- Press L to clear the event log.

Figure 24. *System Event Log*

Event Log Messages

Table 19 lists all the possible messages that can be displayed by the System Event Log screen.

Table 19.   *Event Log Entry Messages*

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

Origin Tags

The origin tags identify the source of all Write entries and how an event occurred. The exact meaning is dependent on the type of event and the unit reporting the event. A Write entry changes a system parameter or an option setting, but it does not affect circuit status changes, such as alarms. Table 20 lists the various origin tags and their definitions.

Table 20.   Origin Tags

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

USING THE REPORT MENU

The Report menu (Figure 25) provides screens containing status and performance monitoring data for line and remote units which can be downloaded to a file for analysis or future reference. Table 21 on page 38 describes the four types of reports provided by the Report menu.

To select each individual report, do the following:

1   Press `O` to select Report menu.

2   Press the `SPACEBAR` to select a report type and print mode.

- Continuous Print Mode generates a non-stop version of the report.

- Page Mode generates a page-by-page version of the report for easy viewing on the screen.

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

4   End the captured report.

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

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




              Report Type :  Full Report
              Print Mode  :  Continuous

      Please select report type and print mode by pressing <Space>
    then start terminal logging and press <Enter> to generate the report.█




                                                                    H0119-A
```

Figure 25.   *Report Menu - Full Report*

Table 21.   Report Types

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

TESTING

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

SYSTEM ALARMS

Table 22 provides a summary of the system alarms displayed on the H2TU-C alarm history screens (see "Using the Performance Screens to View Alarm Data" on page 31).

Table 22. *System Alarms Summary*

Message on Screen	Alarm	Description	To Inhibit
SHORT	Power Feed Short	A short exists between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
GROUND	Power Feed Ground	The HDSL2 loop is grounded.	Cannot be inhibited.
OPEN	Power Feed Open	A line power open condition exists.	Cannot be inhibited.
LOSW	Loss of Sync Word	The HDSL2 loop has lost synchronization.	Cannot be inhibited.
LLOS	Line (Unit) Loss of Signal	Loss of the DSX-1 input signal.	Cannot be inhibited.
RLOS	Remote (Unit) Loss of Signal	Loss of the H2TU-R DS1 input signal.	Cannot be inhibited.
LAIS	Line Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H2TU-C DS1 input port.	Cannot be inhibited.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (unframed all ones) pattern is being received at the H2TU-R DS1 input port.	Cannot be inhibited.
TX RAI-CI	Transmit RAI-CI—Remote Alarm Indication at the H2TU-R	Upon reception of an RAI (yellow) from the CPE, the H2TU-R sends RAI-CI toward the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or LOF), then the RAI is passed on to the network unaltered.	Cannot be inhibited.
RRAI	Remote RAI—Remote Alarm Indication at the H2TU-R	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.
LOF	Loss of Frame	The DS1 input does not contain the ESF or SF frame pattern setting of the FRMG option.	Change FRMG option to AUTO or UNFR.
DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set threshold limits of approximately 10^{-6}.	Select DIS for the DBER system option.
PRM-FE	Performance Report Messaging - Far End	Indicates H2TU-R PRM-FE BER threshold is exceeded.	Set DBER threshold to DIS.
PRM-NE	Performance Report Messaging - Near End	Indicates H2TU-R PRM-NE BER threshold is exceeded.	Set DBER threshold to DIS.
HBER	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.
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.

Alarm Option for the Digital Loop Carrier Feed

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

- LOSW on any loop

- LOS DS1

Remote LOS and AIS Response

Figure 26 shows the different ways the HDSL2 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 14 and Table 6 on page 15.
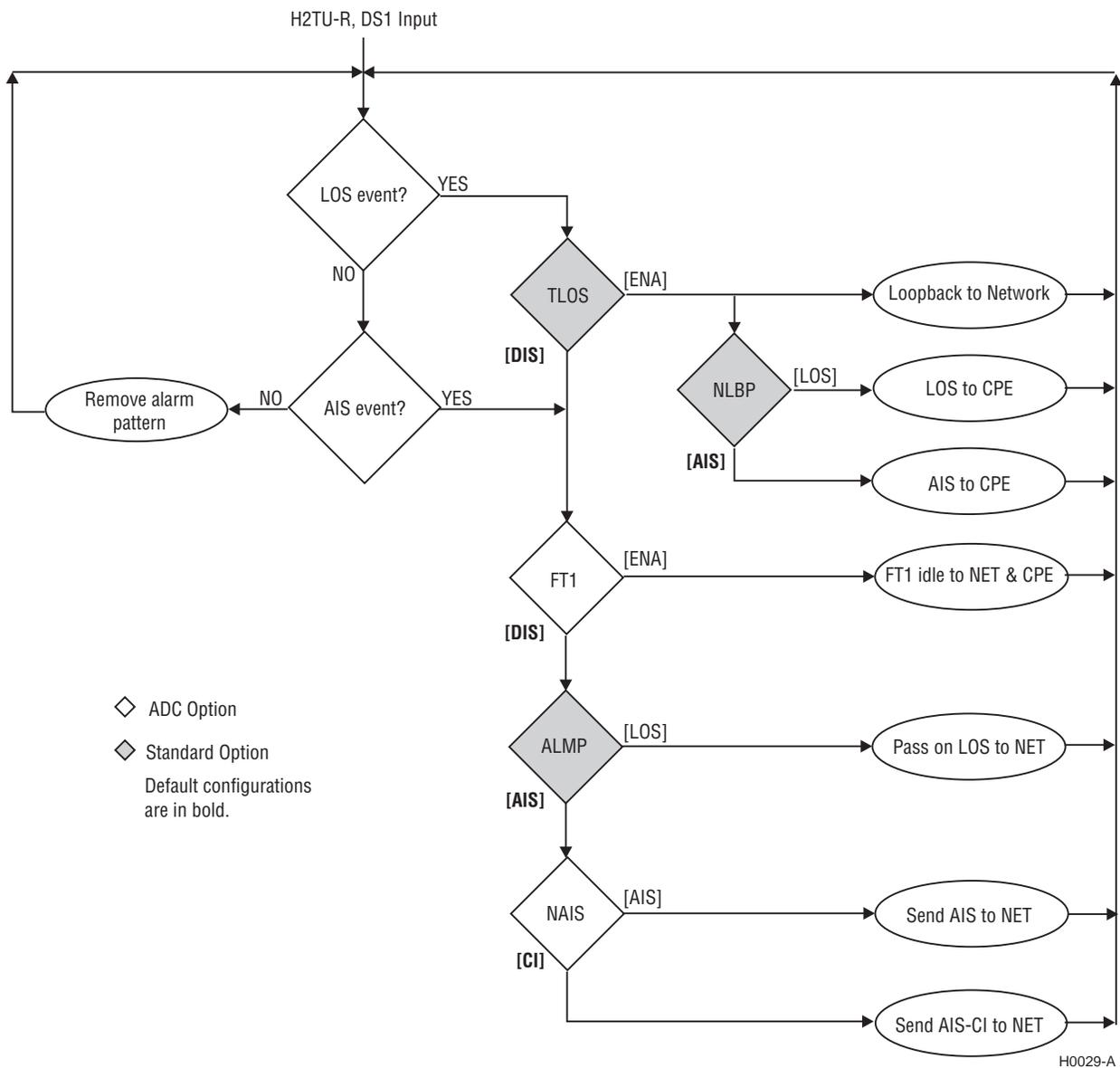

Figure 26.   H2TU-R LOS and AIS Response Priorities

OCT55 TEST PATTERN WITH AMI LINE CODE

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

LOOPBACK OPERATION

HiGain HDSL2 has a variety 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 commands can be initiated by (refer to Figure 27):

- Entering the loopback code into the test equipment connected to the H2TU-C or H2TU-R.

- Selecting the loopback type from the Monitor menu when connected to the H2TU-C or H2TU-R (see "Loopback Testing Using a Maintenance Terminal" on page 46).

- Using the loopback pushbuttons (LLB and RLB) on the H2TU-R (see "Loopback Testing Using Remote Unit Front-Panel Pushbuttons" on page 46).

- Special loopback modes:

  - Generic Mode Loopback (GNLB) commands, including the SmartJack (SMJK) option (see "GNLB Mode Loopback Commands" on page 42).

  - A3LB Mode Addressable Repeater Loopback commands (see "A3LB Mode Loopback Commands" on page 42).

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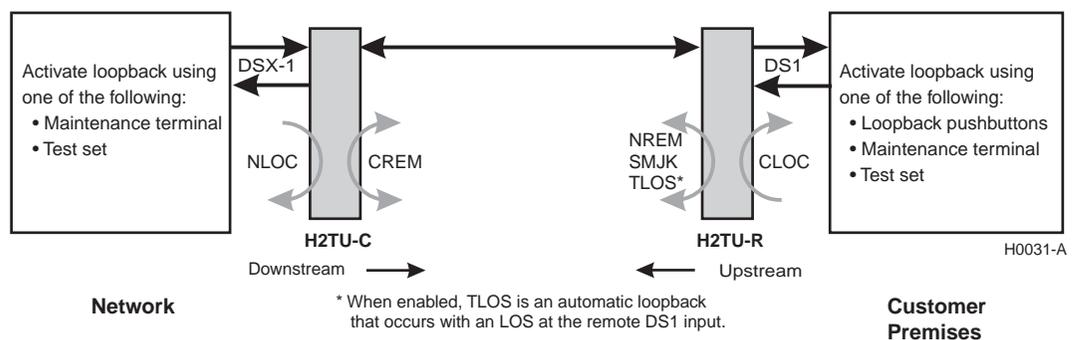

Figure 27. Loopback Summary

SPECIAL LOOPBACK (SPLB) MODE

The HDSL2 system can be configured from the ADC Options menu for one of two SPLB modes, GNLB or A3LB. These modes permit the HDSL2 system to respond to the loopback commands described in the following paragraphs.

GNLB Mode Loopback Commands

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

Figure 27 on page 41 summarizes the available loopbacks in the system, and Table 23 on page 44 summarizes the HDSL2 generic loopback commands. See "GNLB Test Procedures" on page 44 for the test procedures that apply when using the GNLB Special Loopback Mode.

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

A3LB Mode Loopback Commands

A3LB loopback commands can be sent by a test set connected to the H2TU-C or H2TU-R. See Table 24 on page 46 for a list of the commands.

A3LB is a special, addressable, repeater loopback mode which is supported by the H2TU-C. This loopback mode provides the HDSL2 system with sophisticated maintenance and troubleshooting tools. A3LB is patterned after the Westell addressable T1 repeater loopbacks.

A3LB supports the additional (1-in-6) SMJK loopback command.

> **SMJK loopback commands are activated only 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 interfaces of the H2TU-C, verify that the:

- H2TU-C is making a positive connection with its mounting assembly (shelf) connector.

- H2TU-C internal equalizer is set to the correct distance range per Table 5 on page 14. All equalizers should be set to the distance from the DSX-1 to the shelf.

Setting the Loopback Time-Out Option

Before activating any loopback, verify that the Loopback Time-Out option is set to the desired value. Table 5 on page 14 describes this option.

1   Log on to the maintenance terminal.

2   Press `ESC` to clear the screen, then press `C` to select the Config menu.

3   Select **Standard Options**, then **LBTO**.

4   Press the `SPACEBAR` to select the LBTO, then press `ENTER`.

Once activated, a loopback stays active until it times out (based on the LBTO setting) or until a loopdown command is executed to terminate the loopback. When a loopback terminates, the display returns to its normal display mode.

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

GNLB Test Procedures

Figure 28 on page 45 is a graphical representation of the various loopback configurations with the associated GNLB commands shown. Table 23 summarizes the codes required to execute GNLB loopback commands. All code sequences must be present for at least 5 seconds.

To perform the GNLB loopback test procedure:

1   Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. The RLB/LLB LED on the H2TU-R front panel should be green, and the loopback mode should also be identified on the Monitor screen.

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

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

4   Have the CO tester send the NLOC (4-in-7) inband loopup for 5 seconds. The RLB/LLB LED on the H2TU-R front panel should be yellow, and the loopback mode should also be identified on the Monitor screen.

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

Table 23.   *Summary of HDSL2 Generic Loopback Codes and Activation Methods*

Loopback	Code	Description	Method of Activation	
			Test Set	Craft Port
NLOC	1111000 4-in-7	DSX-1 signal is looped back to the network at the H2TU-C.	X	X
NREM	1110000 3-in-7	DSX-1 signal is looped back to the network at the H2TU-R.	X	X
CLOC	1111100 5-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-R.	X	X
CREM	1111110 6-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-C.	X	X
SMJK LpUp (PL) [a]	11000 2-in-5	SmartJack Loopup or NID payload (PL) code. Invokes H2TU-R loopback toward network.	X	
SMJK LpUp (ESF-DL) [a]	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	
SMJK LpUp [a]	100000 1-in-6	SmartJack Loopup code from the network. Invokes H2TU-R loopback towards network.	X	
SMJK LpDn	100 1-in-3	SmartJack Loopdown code from the network or customer interfaces. Removes any loopback in the system.	X	

(a) This loopback command is valid only when the SmartJack Loopback (LPBK) option is ENABLED.

* Set the NLBP option to AIS to send AIS (indicated by an all ones pattern) for any network loopback.
† A3LB loopback code.
▲ GNLB loopback codes.

H0033-A
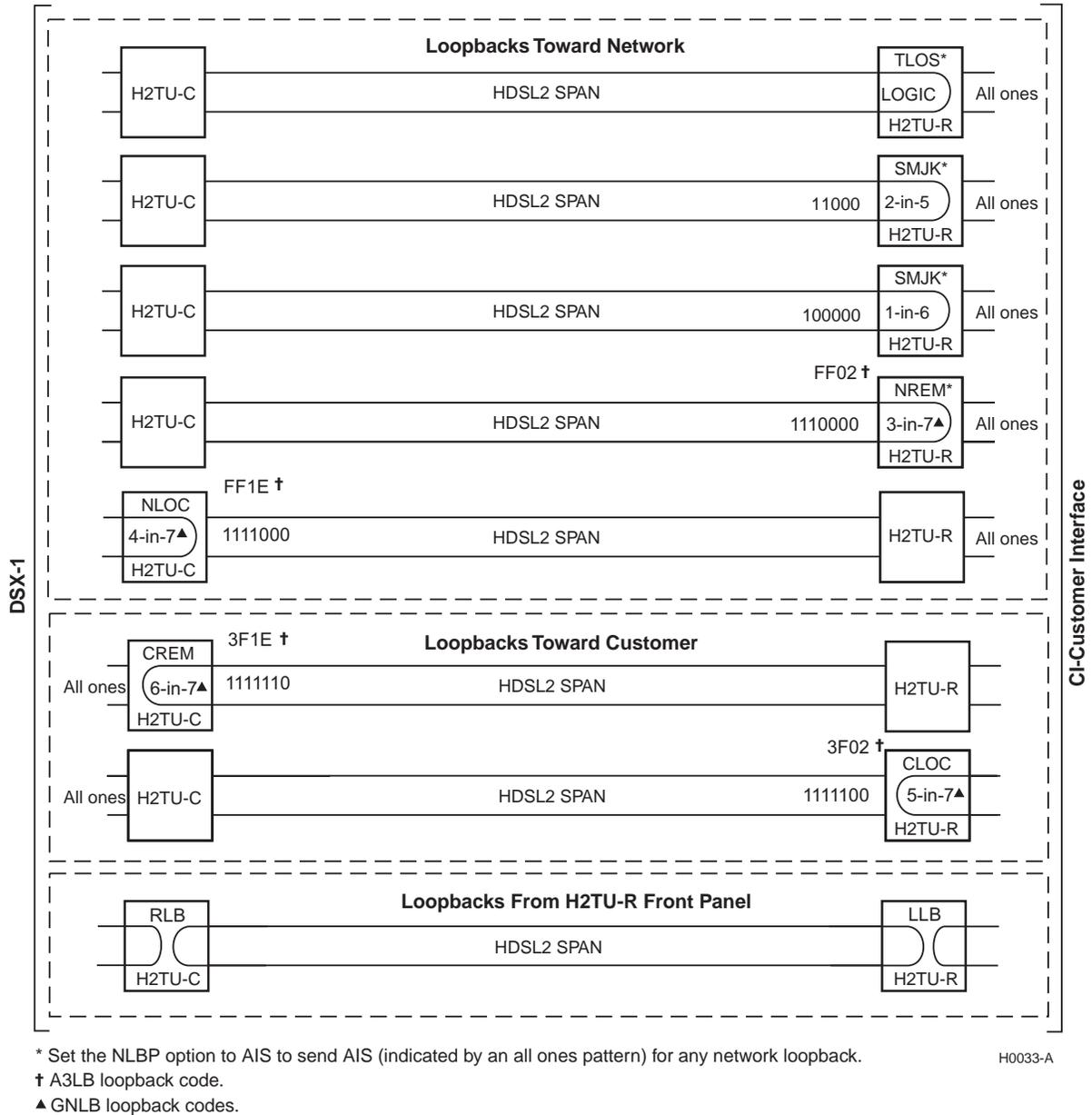
Figure 28.   Loopback Modes

A3LB Test Procedures

Figure 28 on page 45 is a graphical representation of the various loopback configurations with the associated A3LB commands shown.

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

Table 24 on page 46 summarizes the codes required to execute Addressable 3 (A3LB) repeater loopback commands. All code sequences must be present for at least 5 seconds.

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

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

(a) The leftmost bit arrives first in all sequences. The detection algorithm functions reliably with a random 10^{-3} Bit Error Ratio (BER) on the facility. The entire arming and loopback sequence can also be initiated at the remote H2TU-R location.
(b) This loopback command is only valid when the SmartJack Loopback (LPBK) option is configured to ENABLED.

Loopback Testing Using a Maintenance Terminal

To activate a loopback session using a maintenance terminal:

1 Press `ESC` to clear the Config menu, then press `M` to select the Monitor screen.

2 Press the `SPACEBAR` to select the **NLOC**, **NREM**, **CLOC**, or **CREM** loopback, then press `ENTER` to activate the loopback. Press `Y` to confirm.

3 To manually terminate the loopback, press the `SPACEBAR` to select **LPDN**, then press `ENTER`. Press `Y` to confirm.

Loopback Testing Using Remote Unit Front-Panel Pushbuttons

On the H2TU-R front panel, press the appropriate pushbutton for 5 or more seconds:

• LLB—Activates a dual loopback at the H2TU-R (NREM + CLOC).

• RLB—Activates a dual loopback at the H2TU-C (NLOC + CREM).

To loopdown any active loopback in the system, including SMJK and TLOS, press the LLB or RLB pushbutton for 5 or more seconds. To activate a dual loopback after a loopdown, again press the LLB or RLB pushbutton for 5 or more seconds.

APPENDIX A - SPECIFICATIONS

Power

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

Environmental

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

Physical

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

HDSL2

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

DSX-1

DSX-1 Line Impedance	100Ω
DSX-1 Pulse Output	6 V^{pk-pk} pre-equalized for 0-266 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX

System

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

POWER CONSUMPTION

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

Table 25 describes line-powered and locally powered circuits on 9 kft, 26 AWG loops.

Table 25. *H2TU-C Power Parameters*

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

MAXIMUM POWER DISSIPATION

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

In COs, the maximum power dissipation for open-faced, natural convection-cooled mountings is limited to 134.7 watts per square foot per GR-63-CORE. Use this limit and the parameters in Table 25 to determine the maximum number of H2TU-C circuits that can occupy one CO bay.

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

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

The -48 Vdc Power Consumption is the maximum total power that the H2TU-C consumes or draws from the shelf power source. This parameter is needed when the H2TU-C is in a location remote to the CO it is serving. It determines the battery capacity required to maintain an 8-hour standby battery reserve for emergency situations. Battery capacity, therefore, limits the maximum number of line units which can be installed in a remote enclosure. Use the data in Table 25 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 25 above to determine the shelf fusing requirements for your particular H2TU-C applications.

INSERTION LOSS AND LOOP ATTENUATION

Each loop has no more than 35 dB of insertion loss at 196 kHz, with driving and terminating impedances of 135Ω, as shown in Table 26 below. This is equivalent to no more than 28 dB loop attenuation.

Table 26.   HDSL2 Reach Chart

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

(a) Insertion Loss = 1.25 times loop attenuation

H2TU-C CARD-EDGE CONNECTOR

```
219  □ ■  119  Frame GND
GND    218  ■ ■  118  GND
-48 Vdc 217  ■ ■  117  Fuse alarm*
       216  □ □  116
       215  □ ■  115  Ring1  ┐
       214  □ ■  114  Tip1   ├─► DSX-1 OUT
       213  □ □  113  ┘
       212  □ □  112
       211  □ □  111
       210  □ ■  110  Ring  ┐
       209  □ ■  109  Tip   ├─◄ DSX-1 IN
       208  □ □  108  ┘
       207  □ ■  107  Factory use only
       206  □ □  106
       205  □ □  105
       204  □ ■  104  Factory use only
       203  □ □  103
       202  □ ■  102  Ring  ┐
       201  □ ■  101  Tip   ├─ HDSL2 Span
       200  □ □  100  ┘
       H0014-B
```
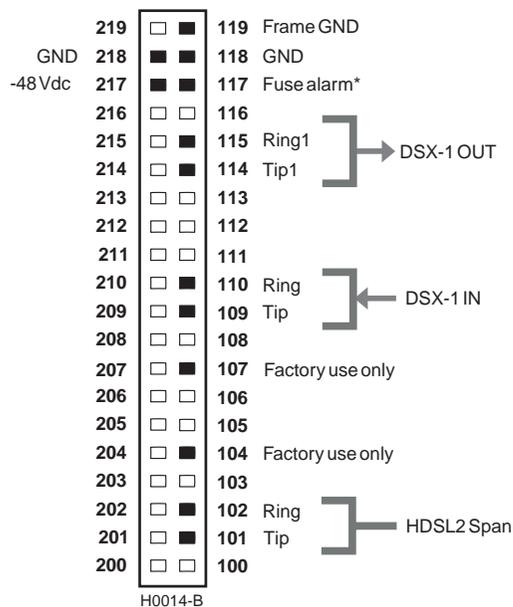
* Fuse alarm is normally floating (0 to 80 Vdc max.) and
at -48 Vdc (10 mA max.) when activated.

Figure 29.   H2TU-C Card-Edge Connector

Fuse Alarm

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

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

CRAFT PORT

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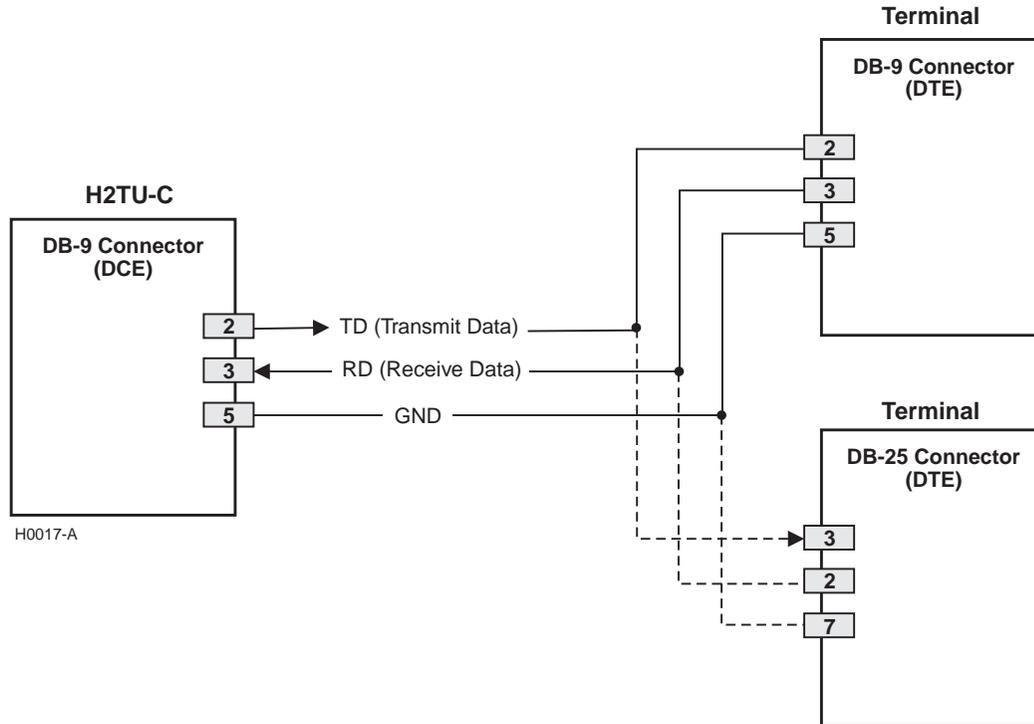

Figure 30. *RS-232 Craft Port Pinouts*

APPENDIX B - FUNCTIONAL OPERATION

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

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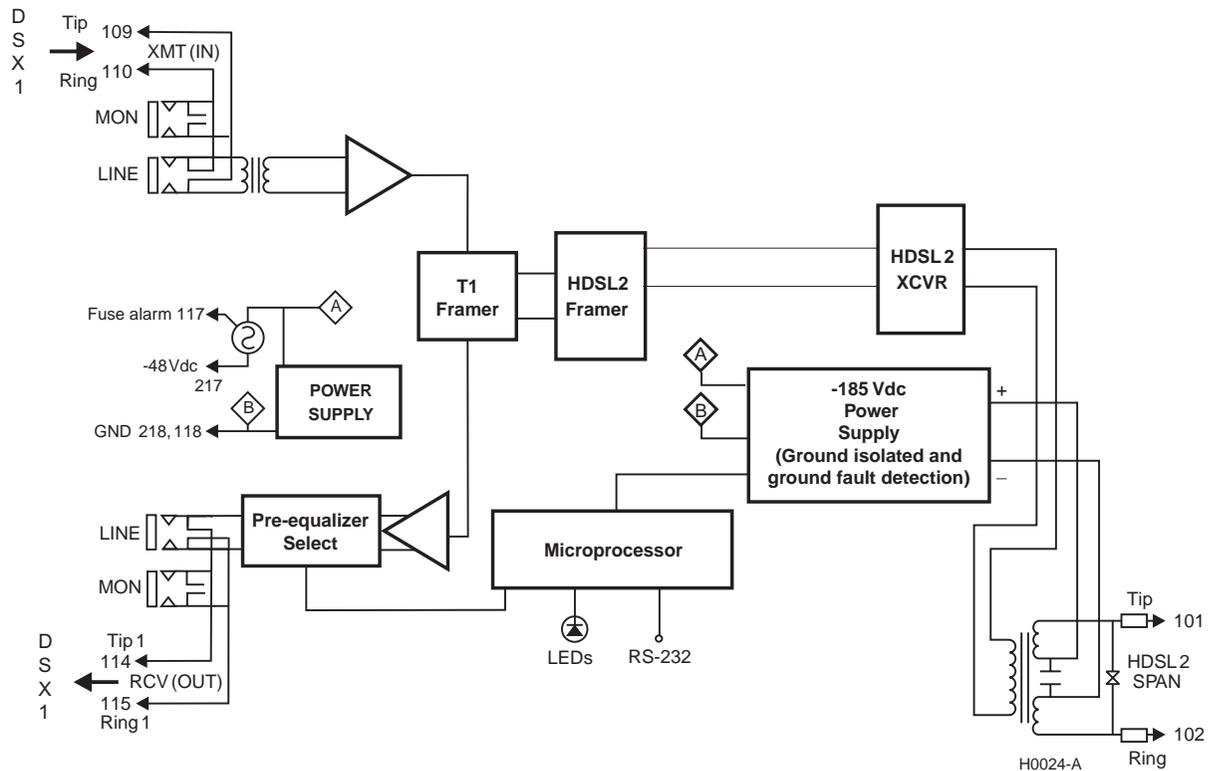
Figure 31. *H2TU-C Block Diagram*

TIMING

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

GROUND FAULT DETECTION

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

APPENDIX C - COMPATIBILITY

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

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

- ADC HiGain HCS-402, 2-slot shelf with #150-1193-01 adapter

- Larus FT2 1188 (23-inch, 28-slot, connectorized shelf)

- AT&T DS1 Ext. (23-inch, 28-slot, connectorized shelf)

- Larus FT2 1190 (12 slots) for a 51A cabinet (23-inch distant terminal)

APPENDIX D - PRODUCT SUPPORT

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

Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center.

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

- Quotation Proposals
- Ordering and Delivery
- General Product Information

Systems Integration
800.366.3891, extension 73000 (USA and Canada)
952.917.3000

- Complete Solutions (from concept to installation)
- Network Design and Integration Testing
- System Turn-Up and Testing
- Network Monitoring (upstream or downstream)
- Power Monitoring and Remote Surveillance
- Service/Maintenance Agreements
- Systems Operation

ADC Technical Assistance Center
800.366.3891 ext. 73223
952.917.3223
Fax: 952.917.3244
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/technical support

Online Technical Publications

- www.adc.com/documentation library/ technical publications

Product Return Department
800.366.3891 ext. 73748 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 telephone numbers with an 800 prefix are toll-free in the USA and Canada.

APPENDIX E - ABBREVIATIONS

A

ACON: Auto Conversion of DS1 frame

AIS: Alarm Indication Signal

AIS-CI: Alarm Indication Signal-Customer Installation

AOR: Addressable Office Repeater

AUTO: Auto-Framing Mode

AWG: American Wire Gauge

B

BER: Bit Error Rate

BPV: Bipolar Violation

BPVT: Bipolar Violation Transparency

C

CLEI: Common Language Equipment Identifier

CO: Central Office

CONV: Conversion

CREM: Customer Remote Loopback

CV: Code Violation

CV-P: Code Violation - Path

D

DBER: DS1 BER

DDM+:   Double Dual Module Plus

DDS: Digital Data Service

DIS: Disabled

DL: Datalink

DLC: Digital Loop Carrier

DS0:   Digital Signal, Level 0

E

ECI: Equipment Catalog Item

ENA: Enabled

ESD: Electrostatic Discharge

ESF: Extended SuperFrame

ES-L: Errored Seconds - Line

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

F

FCON: Frame Conversion

FDL: Facility Datalink
            Frame Bit for Datalink

FE: Far End

FT1:   Fractional T1

G

GFD: Ground Fault Detection

GNLB: Generic Loopback

H

H2TU-R: HiGain HDSL2 Remote Unit

HCDS: High Capacity Digital Service

I

INSL: Insertion Loss

L

LA: Loop Attenuation

LED: Light Emitting Diode

LOF: Loss of Frame

LOS: Loss of Signal

LOSW: Loss of Sync Word

LPF: Line Power Feed

M

MSEC: Monitored Seconds

N

NE: Near End

NI: Network Interface

NID: Network Interface Device

NIU: Network Interface Unit

NLOC: Network Local Loopback

NPRM: Network Performance Report Messaging

NREM: Network Remote Loopback

NVRAM: Non-Volatile Random Access Memory

O

OOF: Out-of-Frame

OPTIS: Overlapped PAM Transmission with Interlocking Spectra

P

PBOC: Power Back Off - Customer

PBON: Power Back Off - Network

PDVS: Pulse Density Violation Seconds

PL: Payload Loopback Command

PRM: Performance Report Messaging

PRM-FE: Performance Report Messaging - Far End

PRM-NE: Performance Report Messaging - Near End

S

SES: Severely Errored Seconds

SES-L: Severely Errored Seconds - Line

SES-P: Severely Errored Seconds - Path

SF: SuperFrame

SMJK: SmartJack

SPRM: Supplemental Performance Report Messaging

T

TLOS: Transmit Loss of Signal

U

UAS-P: Unavailable Seconds - Path

CERTIFICATION AND WARRANTY

FCC CLASS A COMPLIANCE

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

LIMITED WARRANTY

Product warranty is determined by your service agreement. Contact your sales representative or Customer Service for details.

MODIFICATIONS

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

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

SAFETY STANDARDS COMPLIANCE

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

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety
- Binational standard, UL-60950/CSA C22.2 No. 60950-00 Third EditionUL-1950/CSA C22.2 No. 950-95: Safety of Information Technology Equipment

For technical assistance, refer to "Appendix D - Product Support" on page 53.

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