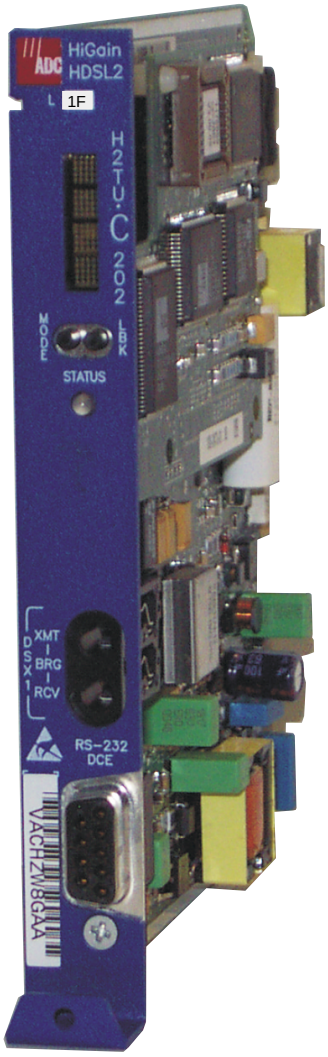
HiGain

USER MANUAL



H2TU-C-202 List 1F Line Unit

Product Catalog: 150-2402-16
CLEI Code: VACHVW8C

Revision History of This Practice

Revision	Release Date	Revisions Made
01P	March 15, 2000	Preliminary release.
02	January 8, 2002	ADC Rebranding

USING THIS MANUAL

The following conventions are used in this manual:

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

Notes contain information about special circumstances.

Cautions indicate the possibility of equipment damage or personal injury.

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

For a list of abbreviations used in this document, refer to "Appendix E - Glossary" on page 59.

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

OVERVIEW

The HiGain HDSL2 product family is the industry's first practical implementation of High bit-rate Digital Subscriber Line 2 (HDSL2). HiGain HDSL2 products are fully compliant with the HDSL2 standard (ANSI T1.418-2000). Providing full rate DS1 access using just a single copper pair, HDSL2 is a cost-effective solution that offers an open architecture. The open architecture inherent in HDSL2 guarantees interoperability allowing simple and economic accommodation of network growth.

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

FEATURES

The H2TU-C-202 List 1F line unit is the Central Office (CO) side of a DS1 transmission system.

- HDSL2 transmission features
  - Three-span range with two regenerators (36 kft, 24 AWG)
  - Lightning and power-cross protection on HDSL2 interfaces
  - Full duplex HDSL2 transmission on one pair at 1.552 Mbps
  - Ultra-low wander for Stratum 1 transport
  - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)
- Front-panel provisioning features
  - DS1 bridge access
  - Four Status Light Emitting Diodes (LEDs)
  - RS-232 craft port for connection to a maintenance terminal
- HiGain HDSL2 maintenance screens for inventory, provisioning, and troubleshooting
  - DS1 and HDSL2 performance monitoring
  - Non-volatile alarm histories
  - Alarm histories
  - Performance Report Messaging (PRM) support for SPRM and NPRM at the H2TU-R
- Configuration options
  - Selectable DSX-1 pre-equalizer
  - Bipolar Violation Transparency (BPVT)
  - Bit Error Rate (BER) alarm
  - Loss of Signal/Alarm Indicator Signal (LOS/AIS) payload alarm option
  - Remote provisioning
  - Selectable loopback activation codes
- Compatible with 200 or 400 mechanics, high-density shelves

- Digital Data Service (DDS) latching loopback
- Payload (PL) and HiGain (HG) loopback source identification
- Network Management and Administration (NMA) interface
- Margin Alarm (MAL) threshold

The term 'DS1' in this manual refers to DS1 and DSX-1 interfaces.

COMPATIBILITY

The H2TU-C-202 is designed to mount in 200 and 400 mechanics, high-density shelves. For a list of compatible shelves see "Appendix C - Compatibility" on page 57.

APPLICATIONS

HiGain HDSL2systems provide a cost-effective, easy-to-deploy method for delivering DS1 High Capacity Digital Service (HCDS) over a single copper pair. HiGain HDSL2 systems support a multitude of network connections and system models.

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

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

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

HIGAIN REGENERATORS

For applications without regenerators (doublers), the H2TU-C-202 is directly connected to an H2TU-R remote unit by one HDSL2 cable pair. The H2TU-C-202 is compatible with all HiGain H2TU-Rs.

For regenerator applications, one to two regenerators may be used in the HDSL2 loop between the H2TU-C and H2TU-R, for instance:

- The H2TU-C-202 can power one regenerator (H2RU-407 or H2RU-409) and a remote unit (H2TU-R-402) for a total of two spans.
- If the H2TU-R is locally powered, the H2TU-C can power up to two regenerators for a total of three spans.

Future releases of the H2TU-C-202 List 1F will support regenerators.

FRONT PANEL

Figure 1 shows the H2TU-C-202 List 1F front panel. Table 1 on page 4 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 51.

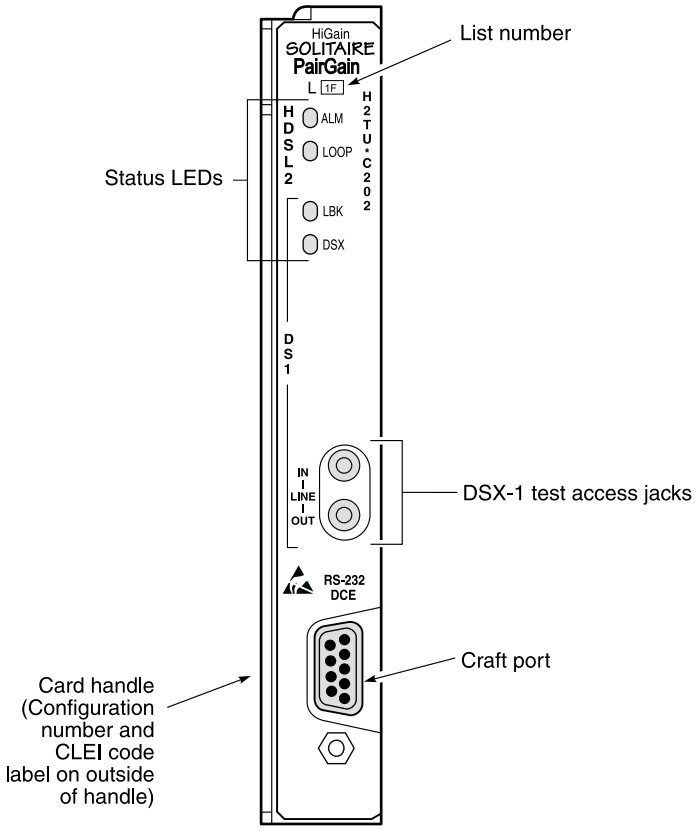


Figure 1. *H2TU-C-202 List 1F Front Panel*

Table 1. *Front-panel Description*

Front-panel Feature	Function
List number	Identifies the list number of the H2TU-C-202.
Status LEDs (four)	See Table 2.
DSX-1 test access jacks	Provides line splitting access to the DSX-1 lines from the front panel.
Craft (RS-232) port	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.
Configuration number	The configuration number identifies the version of the product. New configuration numbers usually accompany changes in the last two characters of the CLEI code. The configuration number is found on a small label attached to the front panel. It can also be the last two numbers (following the x) of the 13-character part number label affixed to the PC board. For example: 150-1234-01-x**01**.

Table 2 lists and describes the four H2TU-C-202 front-panel Status LEDs.

Table 2. *Status and Alarm LEDs*

Status LED	Selection
ALM	Solid red when a fuse alarm is present. Flashes red once per second when a local alarm is present. Flashes red five times per second when a remote alarm is present. Off when no alarm is present.
LOOP	Solid green while all HDSL2 spans are up. Flashes green once per second during a loop acquisition on the span. Flashes green five times per second when a margin or loop attenuation threshold is exceeded.
LBK	Solid yellow when the H2TU-C-202 is in loopback, NLOC, or CREM mode. Flashes yellow five times per second when the system is armed. Off when the system is not armed or in loopback mode.
DSX	Solid green when DSX-1 signal is present and no alarm is present. Flashes green once per second for BPV, FERR, UAS, or CRC DSX-1 error. Flashes green five times per second when network side framing or line code provisioning does not match the DSX-1 signal being received. Off when DSX-1 signal is not present.

INSTALLATION

Upon receipt of the equipment, visually 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 Telecommunications.

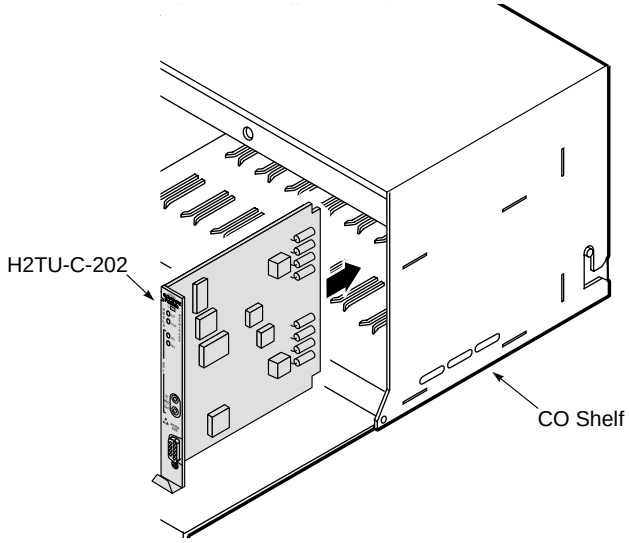


Figure 2. *Installing the H2TU-C into a Shelf*

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

To comply with the intrabuilding wiring requirements of GR-1089 CORE, Section 4.5.9, the shields of the ABAM-type cables that connect the H2TU-C-202 List 1F DSX-1 output ports to the cross-connect panel must be grounded at both ends.

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

2 Place your thumbs on the H2TU-C front-panel and push the H2TU-C into the card guides until properly seated.

VERIFICATION

Once the H2TU-C-202 is installed, verify that it is operating properly. To do this, monitor the four status LEDs.

Verification without a Downstream Device

If there is no downstream device installed:

1. Verify that the H2TU-C powers up. The four status LEDs illuminate and report the status. (See Table 2 on page 4 for a list of status LED messages.)
2. Verify that the H2TU-C attempts to communicate with downstream devices (the LOOP LED flashes green). Even if a downstream device is not present, the H2TU-C attempts communication with downstream devices until a downstream device is detected.

Verification with a Downstream Device

If a downstream device has been installed:

1. Verify that the H2TU-C powers up. (The Loop LED illuminates.)
2. Verify that the H2TU-C attempts to communicate with downstream devices (the Loop LED flashes green). One of the following occurs:
   - If downstream devices are successfully identified and the HDSL2 loop synchronizes, the H2TU-C Loop LED will be steady green.
   - If downstream devices are not successfully identified, the H2TU-C will:
     - attempt communication again and the Loop LED will keep flashing
     - repeat the cycle until a downstream device is detected

     Connect the H2TU-C-202 to the maintenance terminal to monitor the alarm messages on the terminal.
3. If there is more than one span, verify that each subsequent span synchronizes normally by monitoring the Loop status LED.
4. If a remote unit is installed, verify that the last span synchronizes normally. The H2TU-C Loop LED should stay steady green.
5. Verify that a valid DS1 signal has been applied to the H2TU-C and the H2TU-R.
   - If no DS1 signal is being applied to either the H2TU-C or the H2TU-R inputs, then the DSX LED is off.
   - If a valid DS1 signal is being supplied to the H2TU-C and H2TU-R, then DS1 alarm indications should be absent and the Loop LED should light steady green.

PROVISIONING REQUIREMENTS

After a successful installation, complete the following tasks:

1. Set the date and time (see "Setting Date and Time" on page 10).
2. Set the circuit ID number (see "Setting Circuit ID Numbers" on page 11).
3. Make any desired changes to configuration (see "Configuring the System" on page 12).
4. Clear the Performance and Alarm history screens and Event Log to remove miscellaneous data acquired during startup. This ensures the collection of accurate and meaningful data (see "Monitoring System Activity and Performance" on page 24).

Refer to "Provisioning" on page 7 for instructions on configuring and monitoring the H2TU-C.

PROVISIONING

The H2TU-C-202 List 1F can be provisioned by accessing the HiGain HDSL2 maintenance screens (Figure 3 on page 9). The maintenance screens are accessed through 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). This gives you full access to all H2TU-C status, history, inventory, and provisioning screens.

All configuring is accomplished through the maintenance terminal screens with the exception of the bidirectional (NLOC and CREM) loopback which is enabled or disabled by depressing the front-panel LBK pushbutton.

The H2TU-C-202 contains a non-volatile RAM (NVRAM) which stores the system option settings. The settings are retained if shelf power is lost or if the H2TU-C-202 is unplugged.

USING A MAINTENANCE TERMINAL

Connecting to a Maintenance Terminal

The craft port on the front panel allows you to connect the H2TU-C-202 to a maintenance terminal (ASCII terminal or PC running a terminal emulation program). Once connected to a maintenance terminal, you can access the maintenance, provisioning, and performance screens.

To connect to a maintenance terminal:

1. Connect a standard 9-pin terminal cable to the RS-232 craft port (Figure 1 on page 3) on the H2TU-C-202 front panel.
2. Connect the other end of the cable to the serial port on the maintenance terminal.
3. Start a terminal emulation program such as ProComm (emulating a VT-100 terminal).
4. Configure the maintenance terminal to the following communication settings:
   - 9600 baud
   - No parity
   - 8 data bits
   - 1 stop bit
   - Hardware flow control to OFF
5. If necessary, press CTRL + R to refresh the HiGain HDSL2 logon screen.

The Logon Screen

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

To select a menu from the HiGain HDSL2 logon screen (Figure 3 on page 9), do one of the following:

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

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

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** (VT-100 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) Older management units require use of control keys instead of arrow keys.

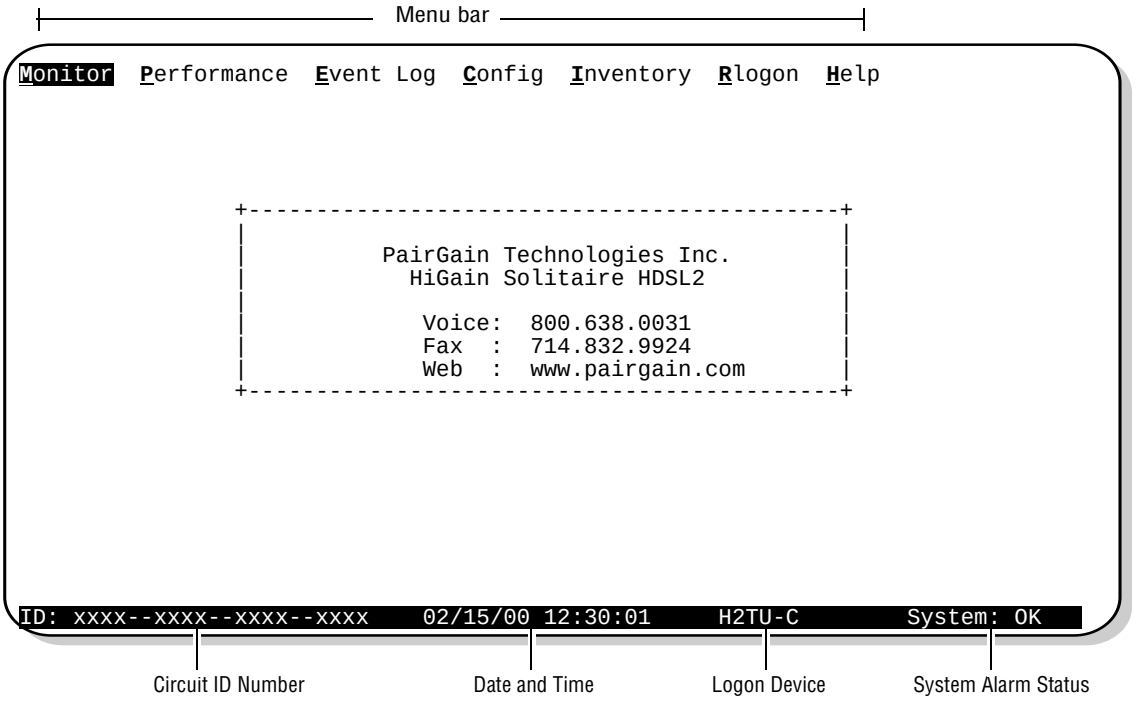


Figure 3. *Logon Screen*

Table 4. *Logon Screen Menus*

Press this key:	To access this menu:	Menu Functions
M	Monitor Menu	Monitors loopbacks and alarms, provides a graphical representation of circuit activity, including ES, UAS, SES, and line code.
P	Performance Menu	Provides performance and alarm histories for current, 25-hour, 48-hour, or 31-day periods for either the DS1 or HDSL2 interface. Selecting this menu after a remote logon will permit viewing of the H2TU-R Blockage Indicator (BI) History screen, as displayed from the DS1 interface (see Figure 11 on page 25 and Figure 18 on page 33).
E	Event Log Menu	Identifies the 100 most recent system events and reports the date and time of occurrence (see Figure 23 on page 38. Selecting this menu after a remote logon will display the Sectionalized Event Log for the H2TU-R (see Figure 24 on page 39).
C	Config Menu	Provides standard configuration options, PairGain 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. Selecting the Config menu after a remote logon will display the Signal Generator menu item, which gives access to the Signal Generator configuration sub-menu (see Figure 28 on page 49).
I	Inventory Screen	Provides product information about the various devices that are in the system and lists circuit and device identifications (see Figure 5 on page 11).
R	Rlogon	Remote logon can be performed from the H2TU-C or H2TU-R remote unit. Remote logon from the H2TU-C will permit viewing of the H2TU-R Blockage Indicator History screen, Sectionalized Event Log screen, and Signal Generator configuration sub-menu. To log off from the remote unit, again type R.
H	Help Menu	Provides a glossary of terms used in the HiGain HDSL2 maintenance screens, a list of navigational keys, and ADC contact information.

PROVISIONING TASKS

After the H2TU-C-202 is successfully installed, perform these basic provisioning tasks:

- Set date and time
- Set circuit ID numbers
- Make any necessary configuration changes
- Clear history, alarm, and event log screens to ensure accuracy of new data

Setting Date and Time

Figure 4. *Configuration Menu - Date and Time*

1. Type **C** to select the Config menu.
2. Select **Date and Time**, then press **ENTER**.
3. Enter the date in the format indicated, then press **ENTER**.
4. Enter the time in the format indicated (entering seconds is optional), then press **ENTER**.

Setting Circuit ID Numbers

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

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

-------------------------   Product Information  ---------------------------
Unit     : H2TU-C         H2TU-R
Product  : H2TU-C-202     H2TU-R-402
List     : 1F             4
Sw Ver.  : 2.06           2.06
Build  # : 00             00
Checksum : 0x3FAE         0x3FAE
H2 Xcvr  : L1-RA2 1.31    L1-RA2 1.31
Serial # : 01232456789    0123456789
CLEI     : VACHVW8CAA     VARHLUUCAA
Mfg. Date: 02/05/00       02/05/00

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

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



Enter new ID and press <Enter> to set.
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C        System: OK
```

Figure 5. *Inventory Screen*

1 Type **I** to select the Inventory screen.

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

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

Configuring the System

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

- Standard options (Figure 7 on page 13)
- PairGain options (Figure 8 on page 13)
- Date and time (see "Setting Date and Time" on page 10)
- Master Clear (see "Monitoring System Activity and Performance" on page 24)
- Reset to factory default configuration (Figure 9 on page 23)

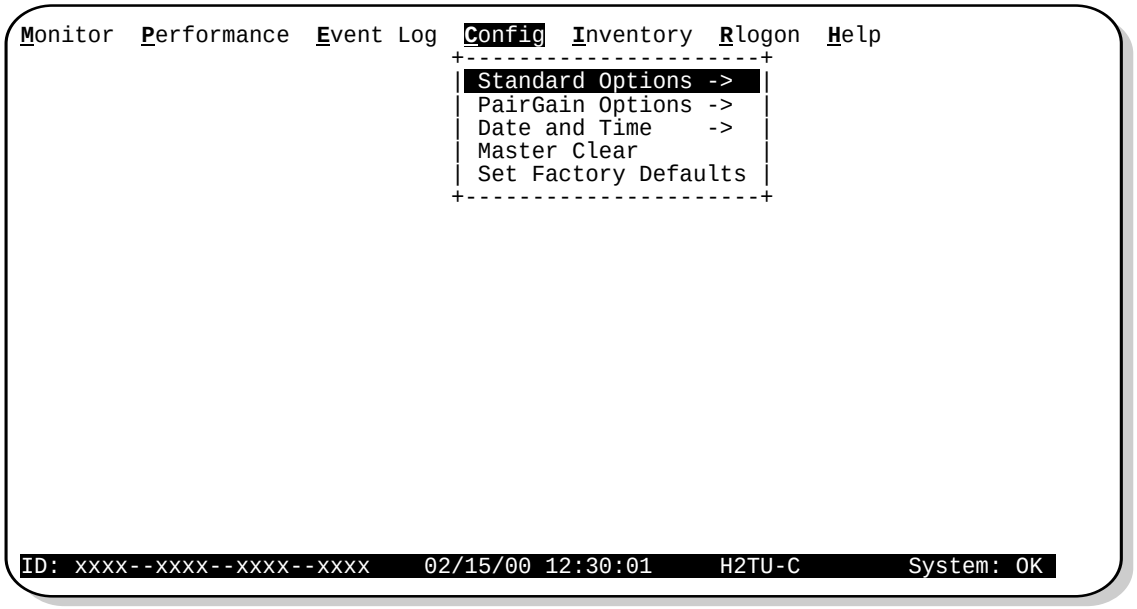


Figure 6. *Configuration Menu*

Making Changes to Standard and PairGain Options

Figure 7 and Figure 8 on page 13 show the Standard and PairGain configuration options. Standard options are those that are supported by HiGain HDSL2 units when connected to units from other vendors. PairGain options are an extended set of options available only when using HiGain units exclusively. For a description of each option and a list of possible option settings, refer to Table 5 on page 14 and Table 6 on page 15. To make changes to these options:

1. Type **C** to select the Config menu.
2. Use the ↑ and ↓ arrow keys to select **Standard Options** or **PairGain Options**, and press **ENTER**.
3. Use the arrow keys to select an option.
4. Press the **SPACEBAR** to cycle through the available settings for that option.
5. Press **ENTER** to activate your choice.

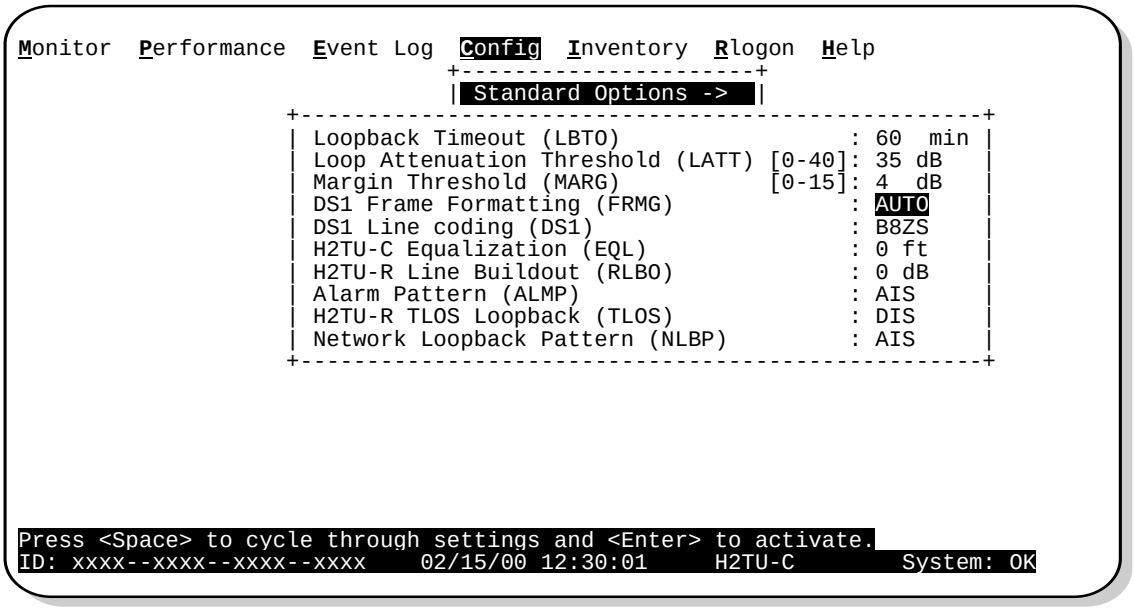


Figure 7. *Configuration Menu - Standard Options (Defaults Shown)*

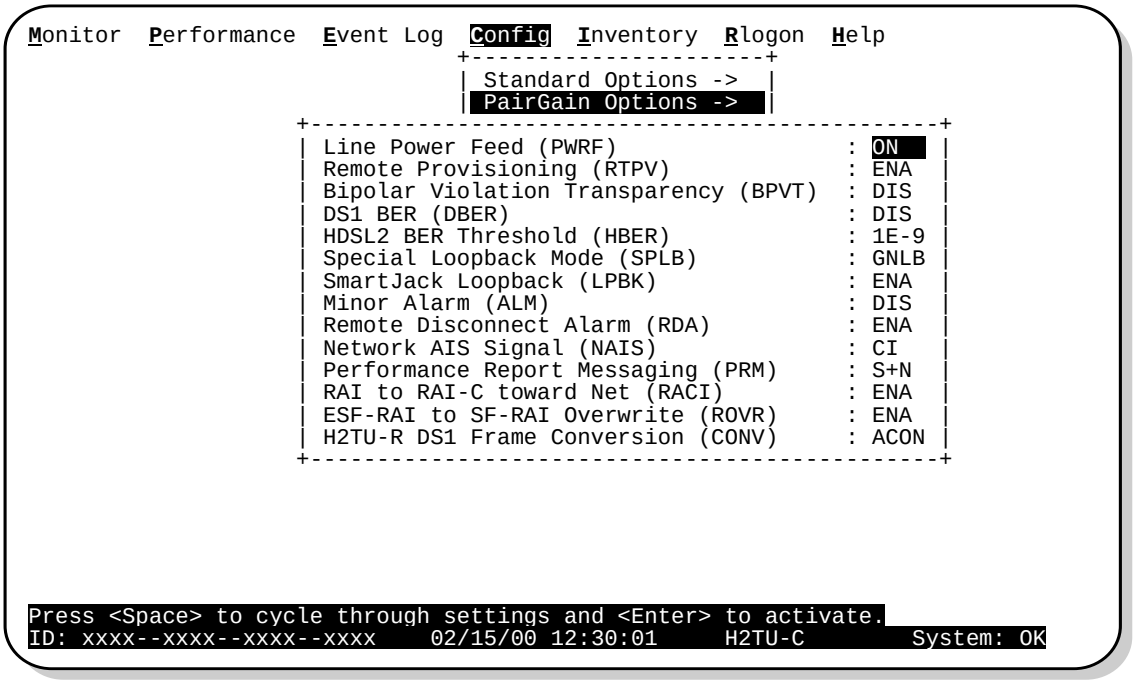


Figure 8. *Configuration Menu - PairGain Options (Defaults Shown)*

Table 5 describes the Standard Config screen options and Table 6 on page 15 describes the PairGain Config screen options. Each lists their maintenance terminal screen display codes. Selections in bold typeface are the factory default settings.

Table 5. *H2TU-C-202 List 1F Standard Config Screen Options*

System Settings Screen Options	Screen Display Code	Selection	Description
Loopback Timeout	LBTO	NONE	Disables automatic time-out cancellation of all loopbacks.
		20	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
		60	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
		120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
Loop Attenuation Threshold	LATT	0 through 40 dB	Determines the maximum loop attenuation before an alarm is declared. Zero disables the alarm. The loop attenuation threshold can only be set through the HDSL2 maintenance screens.
		35 dB	Default value.
Margin Threshold	MARG	0 to 15 dB	Determines the minimum allowable margin below which a system alarm can occur. Zero disables the alarm. The Margin (Alarm) Threshold can only be set through the HiGain HDSL2 maintenance screens.
		4dB	Default value.
DS1 Frame Formatting	FRMG	**AUTO**	Configures the HiGain HDSL2 system to operate in an auto-framing (AUTO) mode 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.
		UNFR	Configures the HiGain 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 (See "DS1 Line Code Option" on page 18.)	DS1	AUTO	The H2TU-C-202 and H2TU-R monitor the incoming DS1 bit streams for the B8ZS code. If the H2TU-R detects this code, the H2TU-C enters B8ZS output mode. The H2TU-C reverts back to AMI output mode if no B8ZS codes are received at the H2TU-R input for 5 seconds. Similarly, when the H2TU-C detects the B8ZS code, the H2TU-R enters the B8ZS mode and returns to AMI mode if no B8ZS code is received at the H2TU-C input for 5 seconds.
		B8ZS	Places both the H2TU-C and H2TU-R into their B8ZS modes.
		AMI	Places both the H2TU-C and H2TU-R into their AMI modes.
H2TU-C Equalization See "Equalization (EQL) Option." on page 18.)		**0**	Sets the Equalizer to DSX-1 for 0 to 132 feet.
		133	Sets the Equalizer to DSX-1 for 133 to 265 feet.
		266	Sets the Equalizer to DSX-1 for 266 to 398 feet.
		399	Sets the Equalizer to DSX-1 for 399 to 532 feet.
		533	Sets the Equalizer to DSX-1 for 533 to 655 feet.
H2TU-R Line Buildout	RLBO	DSX	Sets the DS equalizer toward the Customer Interface (CI) to the DSX-1 zero-foot equalization level.
		0 dB	Sets the DS1 RLBO level toward the Customer Interface (CI) to 0 dB. H2TU-R Line Buildout can only be set through the HDSL2 maintenance screens.
		-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 (See "Alarm Pattern Option (ALMP)" on page 18.)	ALMP	**AIS**	Enables the HiGain HDSL2 system to output an AIS payload at its DS1 ports for LOSW and DS1 LOS. For priority resolution, see Figure 22 on page 37.
		LOS	Enables the HiGain HDSL2 system to output an LOS condition at its DS1 ports for LOSW and DS1 LOS.

Table 5. *H2TU-C-202 List 1F Standard Config Screen Options (Cont.)*

System Settings Screen Options	Screen Display Code	Selection	Description
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 22 on page 37.
		DIS	Disables Transmit Loss of Signal (TLOS) logic loopback.
Network Loopback Pattern	NLBP	**AIS**	Enables the H2TU-R to transmit an AIS towards CI for any network loopback. For priority resolution, see Figure 22 on page 37.
		LOS	Enables the H2TU-R to transmit an LOS towards CI for any network loopback.

Table 6. *H2TU-C-202 List 1F PairGain Config Screen Options*

System Settings Screen Options	Screen Display Code	Selection	Description
Line Power Feed	PWRF	OFF	Disables powering to the HDSL2 pair.
		ON	Keeps the HDSL2 line voltage at nominal -185 Vdc.
Remote Provisioning	RTPV	**ENA**	Enables remote provisioning.
		DIS	Disables remote provisioning.
Bipolar Violation Transparency (See "Bipolar Violation Transparency (BPTV) Option" on page 18.)	BPVT	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 HiGain HDSL2 transparent to BPVs.
		DIS	Disables BPV Transparency.
DS1 BER Threshold (See "DS1 BER (DBER) Option" on page 19.)	DBER	ENA	Enables the fixed 24-hour DS1 BER threshold (10^{-6}).
		DIS	Prevents the generation of a system alarm due to DS1 BER.
		NONE	Prevents generation of a system alarm due to BER.
HDSL2 BER Threshold (See "HDSL2 BER (HBER) Option" on page 18.)	HBER	1E-7	System alarm is initiated and the HCRC LED turns red when BER exceeds 10^{-7}.
		1E-9	System alarm is initiated and the HCRC LED turns red when the Block Error Rate exceeds 10^{-9}. (Block Error Rate is based on the definition of Bit Error Rate.)
		NONE	Prevents generation of a system alarm due to BER.
Special Loopback Mode	SPLB	**GNLB**	Configures the HiGain HDSL2 system to respond to the generic inband loopback codes.
		A1LB and A2LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Teltrend addressable repeater.
		A3LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
		A4LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom Mod 1 addressable repeater.
		A5LB	Configures the HiGain system to respond to the inband loopback codes of the Teltrend Mod 1 addressable repeater.
SmartJack Loopback	LPBK	**ENA**	Enables the HiGain HDSL2 system to recognize all inband SmartJack (SMJK) loopback commands.
		DIS	Configures the HiGain HDSL2 system to ignore all inband SmartJack loopback commands.

Table 6. *H2TU-C-202 List 1F PairGain Config Screen Options (Cont.)*

System Settings Screen Options	Screen Display Code	Selection	Description
Minor Alarm	ALM	ENA	Enables the generation of the output alarm on pins 30 and 22 when a system alarm condition occurs.
		DIS	Disables the generation of the output alarm on pins 30 and 22 when a system alarm condition occurs.
Remote Disconnect Alarm	RDA	**ENA**	Enables a remote DS1 LOS condition at the input to the H2TU-R to generate an LOS alarm. AIS or LOS (depending on ALMP) is sent towards the network.
		DIS	Prevents a remote DS1 LOS condition at the input to the H2TU-R from causing an LOS alarm. The alarm relay contacts do not close and LOS is sent towards the network from the H2TU-C instead of AIS.
Network Alarm Indication Signal 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 22 on page 37.
		AIS	When configured for AIS, an AIS pattern is sent to the network.
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 Overwrite See "ESF RAI to SF RAI Overwrite (ROVR) Option" on page 21.	ROVR	**ENA**	If the CONV option is set to FCON or ACON, an ESF DS1 payload from the network with an embedded RAI pattern is converted to an SF-RAI pattern towards the CI at the H2TU-R.
		DIS	Prevents conversion to an SF-RAI pattern.
RAI to RAI-CI Toward NET See "RAI to RAI-CI toward NET (RACI)" on page 22.	RACI	**ENA**	Allows a 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 See "ESF RAI to SF RAI Overwrite (ROVR) Option" on page 21.	ROVR	**ENA**	If the CONV option is set to FCON or ACON, an ESF DS1 payload from the network with an embedded RAI pattern is converted to an SF-RAI pattern towards the CI at the H2TU-R.
		DIS	Prevents conversion to an SF-RAI pattern.
H2TU-R DS1 Frame Conversion See "H2TU-R DS1 Frame Conversion (CONV) Option" on page 19.	CONV	OFF	Framing functionally determined by the framing option. Frame format conversion is inhibited at the H2TU-R.
		DEFAULT	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.

HDSL2 BER (HBER) Option. The HBER option permits the monitoring of loop integrity and reporting of alarms when excessive errors are detected. The PM primitive used for this purpose is the CRC checksum performed on the HDSL2 frame for both directions of transmission. It is, therefore, called a block error rate rather than the bit error rate associated with the DS1 interface. The CRC errors and counts are displayed on the Monitor screen for both the H2TU-C and H2TU-R. The HBER option allows an alarm to be generated if the total number of CRCs at either the H2TU-C or H2TU-R exceeds the selected BER threshold during the last 30-minute interval.

- HBER option = 1E-7. Alarm is generated if CRC > 400 in the last 30 minutes.
- HBER option = 1E-9. Alarm is generated if CRC > 4 in the last 30 minutes.

Once initiated, the HBER count clears when the CRC count drops below the selected threshold or after the alarm has been declared for 30 minutes. Selecting NONE inhibits this alarm.

DS1 Line Code Option. The DS1 line code option should always be set to conform to the type of DS1 service (AMI or B8ZS) being provided by the HiGain system. The Auto mode, which can adapt to either AMI or B8ZS, should only be used in applications that require it (such as when HiGain acts as a standby circuit to DS1 circuits whose line codes are not known or may be both AMI and B8ZS). This is because the Auto mode induces one BPV in the DS1 bit stream whenever it switches from AMI to B8ZS. The Auto mode allows both the H2TU-C and the H2TU-R to set its DS1 output code to that which is being received at the distant end DS1 input. This forces the input and the output codes in each direction of transmission to be identical.

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

Alarm Pattern Option (ALMP). To improve HiGain HDSL2 compatibility with the switch-to-protect features used in Digital Loop Carrier (DLC) feeder applications, the H2TU-C-202 has an Alarm Pattern (ALMP) option that allows you to select either an AIS or LOS DS1 output payload for the following alarms:

- LOSW on any loop
- DS1 LOS

Bipolar Violation Transparency (BPTV) Option. The H2TU-C-202 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-202 and its associated remote units remove this limitation and become BPV transparent by detecting and counting input BPVs at each end and then by replicating them at the DS1 output port of the distant end.

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

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

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

Parameter	Threshold Count
CV-L (BPV)	133,400
CV-P (CRC)	132,960
ES-L, ES-P, PRM-NE, PRM-FE	648
SES-L, SES-P	100
UAS-P, UAS-L	10

H2TU-R DS1 Frame Conversion (CONV) Option. Frame format conversion is only applicable to the remote H2TU-R, but selectable by the H2TU-C or H2TU-R. This option enables the network to be ESF, which is used to embed SPRM or NPRM into the datalink 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 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 21 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

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, and overwrites bit 2 of every DS0 channel with a zero.

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

AIS-CI (Alarm Indication Signal-Customer Installation). The H2TU-C-202 List 1F in conjunction with the H2TU-R-402 List 4 supports the AIS-CI function. AIS-CI is a variant of AIS which is transmitted toward the network when either an AIS defect or an LOS defect has been detected in the signal received from the CI at the H2TU-R unit. AIS-CI is a regular AIS signal modulated by an AIS signature.

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

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

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

RAI to RAI-CI toward NET (RACI). The H2TU-C-202 List 1F in conjunction with the H2TU-R-402 List 4 support the RAI-CI function.

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

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

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

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

To prevent the transmission of RAI-CI during the failure-clearing interval of a network failure, the transition from RAI to RAI-CI is delayed for 20 seconds following the detection of conditions 1 and 2 above. Since RAI-CI meets the definition of RAI, it may be detected and used exactly as is 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 Datalink (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 in-band by setting each of the 24 channel timeslots to 1000 1011 (left-to-right). In addition to the criteria specified above, the generation of SF RAI-CI has to be held off for 1 second to examine the DS0s for a framed, all-zeros pattern. If present, the generation of SF RAI-CI is suspended for the duration of the all-zeros pattern.

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

Resetting to Factory Defaults

Resetting the H2TU-C to its original factory settings may cause interruption of service. Please note that this reset feature has no effect on the option settings that are controlled by the dip switch.

To reset the H2TU-C-202 List 1F to its original factory defaults:

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

2 Select **Set Factory Defaults**, then press **ENTER**.

3 Type **Y** if you are certain you want to reset the H2TU-C or press **N** to cancel this action.

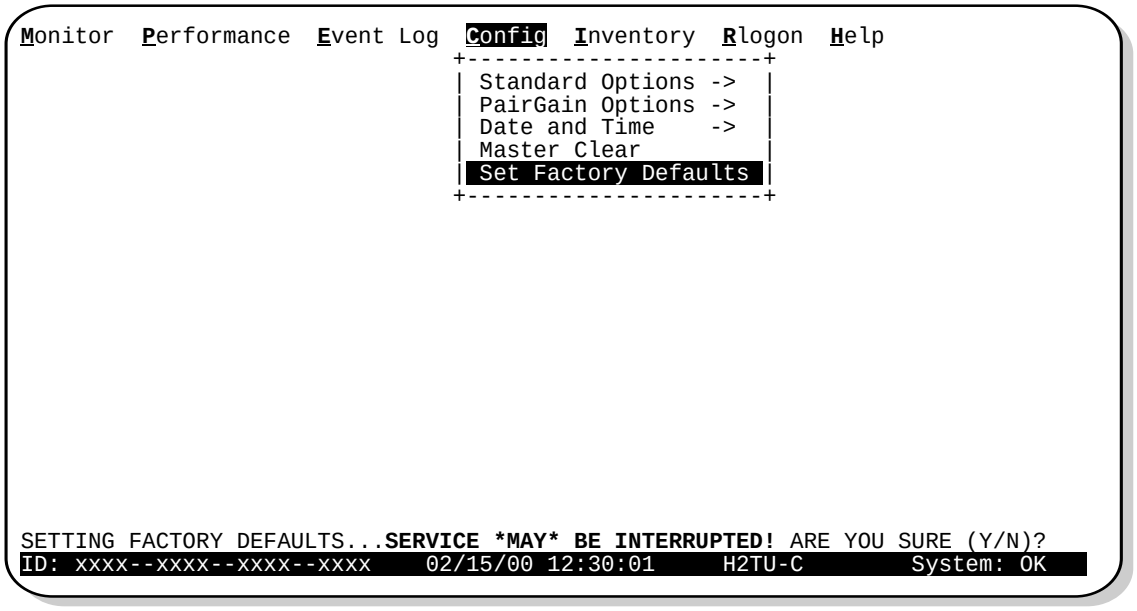


Figure 9. *Configuration Menu - Reset to Factory Defaults*

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

The H2TU-C-202 provides three sets of maintenance screens for monitoring system activity and assessing performance.

- The Monitor screens provide a graphical representation of circuit activity and allow initiation of loopbacks.
- The Performance screens provide current, 25-hour, 48-hour, and 31-day performance histories and a continuous alarm history.
- Following a remote log on, the Performance screens provide current and 8-hour Blockage Indicator histories at the H2TU-R DS1 interface.
- Following a remote log on, the Sectionalized Event Log screen displays events for all four legs of the H2TU-R DS1 interface.

SYSTEM OVERVIEW

As shown in Figure 10, the H2TU-C can support up to two regenerators with three HDSL2 spans.

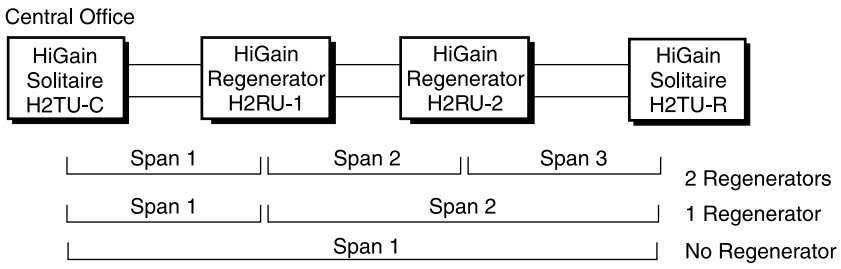


Figure 10. *System Spans*

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

PERFORMANCE MONITORING FROM THE H2TU-R

In addition to the standard features of the H2TU-R, its functionality has been enhanced to produce unique Performance Monitoring (PM) and testing capabilities.

Network surveillance is a key maintenance strategy. Real-time monitoring of performance through sectionalized analysis allows maintenance personnel to quickly locate a service degradation or failure. This also makes it easier to determine if the customer or network operator must bear responsibility for service and repair.

The Performance Monitoring screens analyze the DS1 transmission by tracking the four transmission legs shown in Figure 11 on page 25.

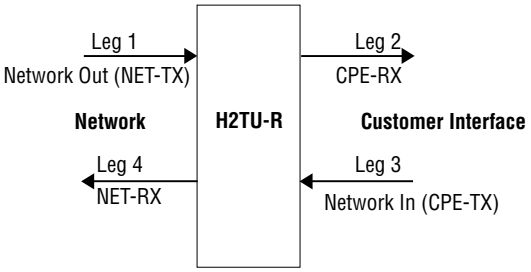


Figure 11. *Sectionalized Analysis of the DS1 Interface*

When installed on one end of an HDSL2 DS1 circuit, the remote unit provides the following special network benefits:

- Real-time performance monitoring of DS1 signals in both directions of transmission
- Non-intrusive access to real-time performance monitoring data (CPE-provided ESF signal)
- On-demand access using the craft port, inband or Facility Data Link (FDL) access to stored DS1 PM data including:
  - Current status
  - Sectionalized events for all four legs of DS1 transmission
  - Blockage indicator (a quality-of-service summary statistic for the NET-TX and CPE-TX transmission legs at the DS1 interface)
  - ANSI 15-minute and 24-hour statistics
- On-demand access to stored HDSL PM data
- AIS-CI insertion toward the network upon detection of incoming LOS or AIS at the network interface
- RAI-CI insertion toward the network upon receiving RAI from the CPE, if the signal from the network is not impaired
- Loopback toward the network with AIS insertion to the CPE equipment
- Adaptive frame format conversion if enabled in:
  - SF to ANSI T1.403 ESF
  - Non-standard to standard ANSI T1.403 ESF
  - AT&T PUB 54016 to ANSI T1.403 ESF
- Non-intrusive access to real-time performance monitoring data (CPE-provided SF or ESF signal)

Network Elements (NEs), such as the ADA T3AS test and performance monitoring system, can be used to collect the performance monitoring data to allow full-time surveillance of the DS1 signal. By installing T3AS at a network boundary (for example, Interexchange Carrier [IEC] Point of Presence [POP], and a remote unit at the network interface), the Local Exchange Carrier (LEC) can monitor the performance of its portion of the network, and rapidly sectionalize circuit problems. By sectionalizing problems in its network the LEC can know what trouble exists and who is responsible without external involvement.

USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

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

Figure 12 shows an armed circuit with an active loopback and alarms. Terms used on the system diagram are defined in the onscreen Help menu glossary. Abnormal situations are highlighted on the diagram. See Table 11 on page 27 for screen field descriptions.

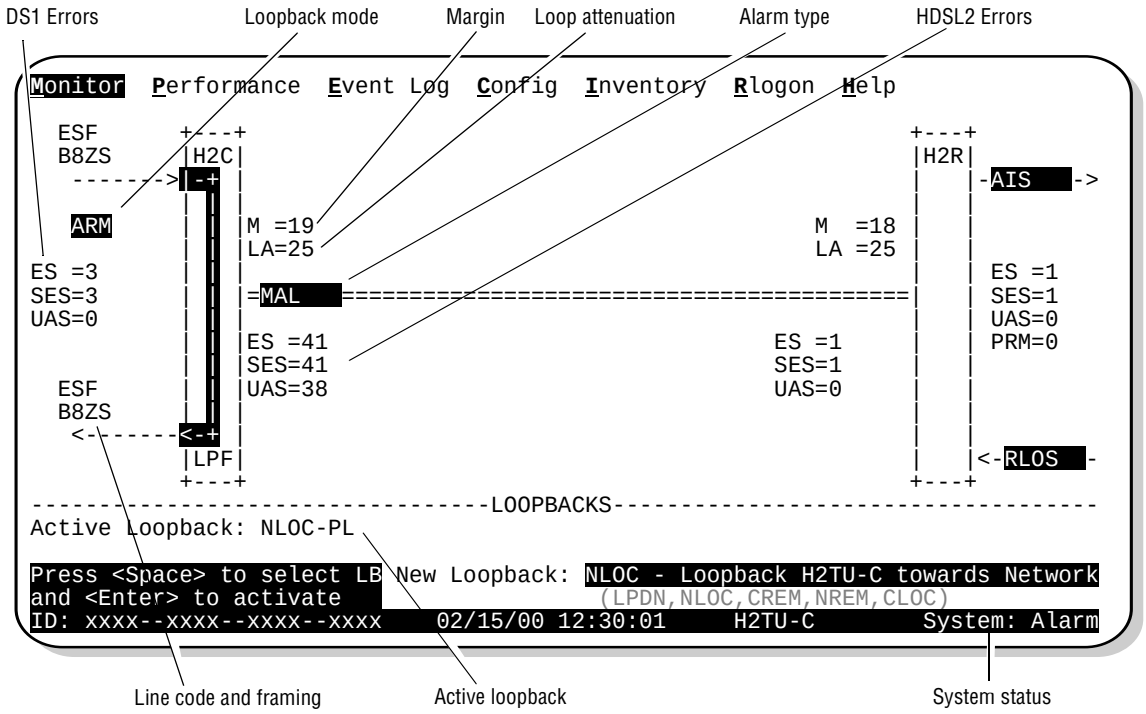


Figure 12. *Monitor Screen - Active Loopback with Alarms*

2 To initiate a loopback, press the **SPACEBAR** to cycle through the loopback choices. Press **ENTER** to make your choice, and type **Y** or **N** when prompted with the message: `Are you sure (Y/N)?` For more information about loopbacks, see "Loopback Operation" on page 41.

3 To initiate a loopdown, press the **SPACEBAR** to select **LPDN**, then press **ENTER**. Type **Y** or **N** when prompted with the message: `Are you sure (Y/N)?`

Table 11. *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 18 on page 42 for a summary of the HiGain HDSL2 loopback codes.
Code type	Type of DS1 line coding used (B8ZS, AMI, or AUTO).
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors included are: DS1 Frame errors, BPV, and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.
DS1 UAS Count	Unavailable Errored Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame type	Type of DS1 framing detected at the input stream (SF, ESF, or UNFR).
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. (An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors.) This value is a running total of the last 24 hours.
HDSL2 UAS Count	Unavailable Errored Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
HG	The loopback was initiated from a HiGain (HG) front panel or by a HiGain maintenance terminal loopback command.
ID	Circuit identification (ID) number.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation (PAM) Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to the loop attenuation at 196 kHz and should be kept under 35 dB.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10^{-7} Bit Error Rate.
PL	The loopback was initiated by a command embedded in the DS1 data path payload (PL).
PRM	The sum of the Performance Report Messaging - Near End (PRM-NE) and Performance Report Messaging - Far End (PRM-FE) counts.
System Status	The presence or absence of an alarm condition is indicated on the lower right corner of all screens. **System: OK** indicates that there are no alarms present; **System: Alarm** indicates the presence of an alarm. Refer to "Using the Performance Screens to View Alarm Data" on page 34 for detailed alarm information.

USING THE PERFORMANCE SCREENS TO VIEW PERFORMANCE DATA

The Performance screens display:

- CRC statistics for the HDSL2 or DS1 interface in 31-day, 48-hour, 25-hour, and current history reports.
- Alarm statistics for the HDSL2 (Figure 21 on page 36) or DS1 interfaces (Figure 19 on page 34 and Figure 20 on page 35) on a continuous basis.
- Following a remote logon, Blockage Indicator statistics for the current hour and the last 8 hours at the H2TU-R DS1 interface (Figure 18 on page 33).

To view the Blockage Indicator (BI) History screen, type R to log on to the H2TU-R remote unit before proceeding with steps 1 through 3 that follow.

To access the Performance history screens:

1 Type 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. Select **H2TU-R DS1** if you wish to view the BI History screen.

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

When logged on to the H2TU-R remote unit, type R to return to the H2TU-C logon screen.

Performance History at the DS1 Interface

Figure 13 is an example of an H2TU-R 31-day DS1 performance screen as viewed from the line unit. In addition, there are 48-hour, 25-hour, and current statistic screens for the DS1 interface for the H2TU-R as well as the H2TU-C. Table 12 describes the acronyms used in the performance history screens.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

                H2TU-R DS-1 31 Day History (Page 1 of 3)
-------------------------------------------------------------------------------
 Date     ES-L  SES-L  UAS-L   CV-L   CV-P   ES-P  SES-P  UAS-P PRM-NE PRM-FE
 02/01       -      -      -      -      -      -      -      -      -      -
 02/02       -      -      -      -      -      -      -      -      -      -
 02/03       -      -      -      -      -      -      -      -      -      -
 02/04       -      -      -      -      -      -      -      -      -      -
 02/05       -      -      -      -      -      -      -      -      -      -
 02/06       -      -      -      -      -      -      -      -      -      -
 02/07       -      -      -      -      -      -      -      -      -      -
 02/08       -      -      -      -      -      -      -      -      -      -
 02/09       -      -      -      -      -      -      -      -      -      -
 02/10       -      -      -      -      -      -      -      -      -      -
 02/11       -      -      -      -      -      -      -      -      -      -
 02/12      14     10     10     10     12     10      0      0      0      0
 02/13       0      0      0      0      2      0      0      0      0      0

              Press: (N)ext Page, (P)revious Page, C(l)ear History
-------------------------------------------------------------------------------
Press <Space> to cycle through   Interface  : H2TU-R DS-1
choices and <Enter> to view      Statistics : 31 Day History
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C        System: OK
```

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

Table 12. *Error Acronyms Used on the DS1 Performance History Screens*

Acronym	Description	Acronym	Description
ES-L	Errored Seconds - Line Seconds with BPV ≥1.	SES-P	Severely errored seconds - Path Seconds with SES or CRC(ESF) ≥320 or FE [(a)] (SF) ≥8 (F_T + F_S).
CV-P	Code Violation - Path Total count of FE errors for SF, or CRC-6 errors for ESF.	UAS-P	Unavailable seconds - Path A second of unavailability based on SES-P or AIS ≥1.
SES-L	Severely errored seconds - Line Seconds with BPV plus EXZ ≥1544 or LOS ≥1.	PRM-NE [(b)]	Performance Report Monitoring - Near End The PRM from CPE indicates errors, and the signal received from the network at the remote is error-free.
CV-L	Code Violation - Line Total BPV count.	PRM-FE [(b)]	Performance Report Monitoring - Far End The PRM from the network indicates errors, and the signal received from the CPE is error-free.
UAS-L	Unavailable seconds - Line Seconds with LOS ≥1.	B8ZSS [(c)]	B8ZS Monitored Seconds Seconds with B8ZS detection when AMI option is active.
ES-P	Errored Seconds - Path Seconds with SEF [(d)], CRC (ESF) or FE [(e)](SF) ≥1.	MSEC [(c)]	Monitored Seconds of the current (15 minute/1 hour/1 day) screen.
		BI [(c)]	BI = [0.2 x ES + 0.4 x SES + UAS)/ MSEC] x 100% (MSEC is the same as the DS1 MSEC)

(a) FE is a frame bit error.
(b) Only appears on H2TU-R Performance History screens.
(c) Only appears on the H2TU-R Blockage Indicator (BI) History screen.
(d) 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.
(e) FE is a frame bit error.

Performance History at the HDSL2 Interface

The HDSL2 interface (Figure 14) has 31-day, 48-hour, 25-hour, and current statistic screens for the H2TU-C.

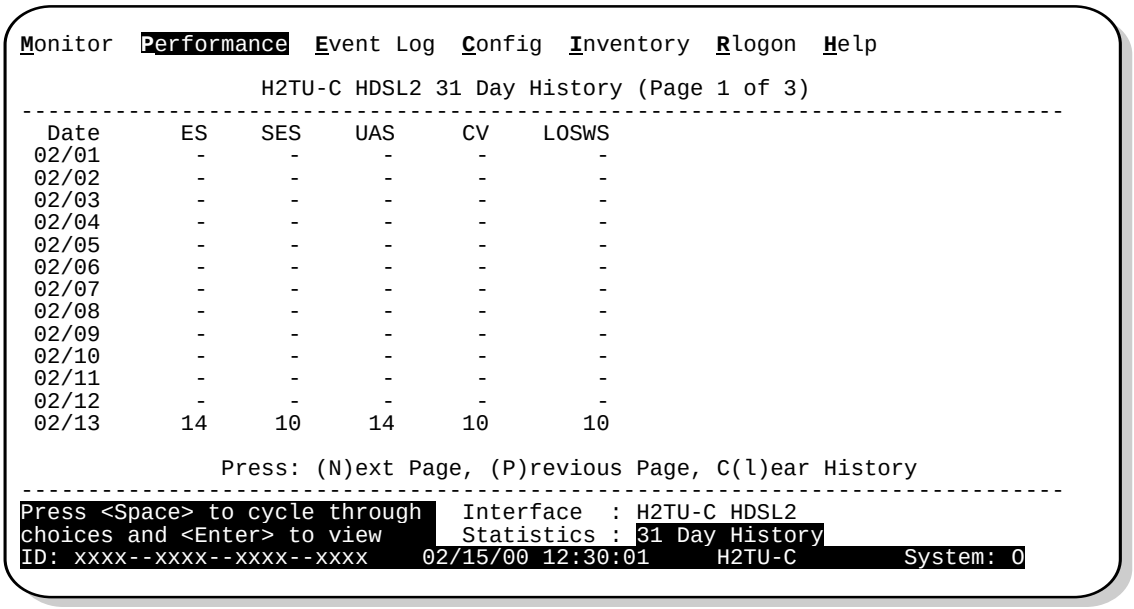


Figure 14. *H2TU-C HDSL2 31-day Performance History*

Table 13. *Error Acronyms Used on the HDSL2 Performance History Screens*

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

Current Statistics Screens for the DS1 Interface

Examples of current statistics screens are shown below. Figure 15 and Figure 16 show statistics for the DS1 interface at the remote unit and line unit, respectively. These screens report 15 minute, 1 hour, and 1 day statistics. Refer to Table 12 on page 29 for descriptions of the kinds of errors reported on these screens.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

                       H2TU-R DS-1  Current Statistics
-------------------------------------------------------------------------------
          1 Day   1 Hour   15 Min
Start     00:00    12:00    12:30
ES-L          0        0        0
SES-L         0        0        0
UAS-L         0        0        0
CV-L          0        0        0
CV-P          0        0        0
ES-P          0        0        0
SES-P         0        0        0
UAS-P         0        0        0
PRM-NE        0        0        0
PRM-FE        0        0        0
B8ZSS         0        0        0
MSEC       3482     1801        1


                     Press: C(l)ear Current Statistics
-------------------------------------------------------------------------------
Press <Space> to cycle through   Interface  : H2TU-R DS-1
choices and <Enter> to view      Statistics : Current
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C         System: OK
```

Figure 15. *H2TU-R DS1 Current Statistics*

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

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

B8ZSS         0        0        0
MSEC       3482     1801        1

                     Press: C(l)ear Current Statistics
-------------------------------------------------------------------------------
Press <Space> to cycle through   Interface  : H2TU-C DS-1
choices and <Enter> to view      Statistics : Current
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C         System: OK
```

Figure 16. *H2TU-C DS1 Current Statistics*

Current Statistics for HDSL2 Interface

Figure 17 shows statistics for the HDSL2 interface at the H2TU-C. This screen reports 1-day, 1-hour, and 15-minute statistics. Refer to Table 13 on page 30 for descriptions of the kinds of errors reported on this screen.

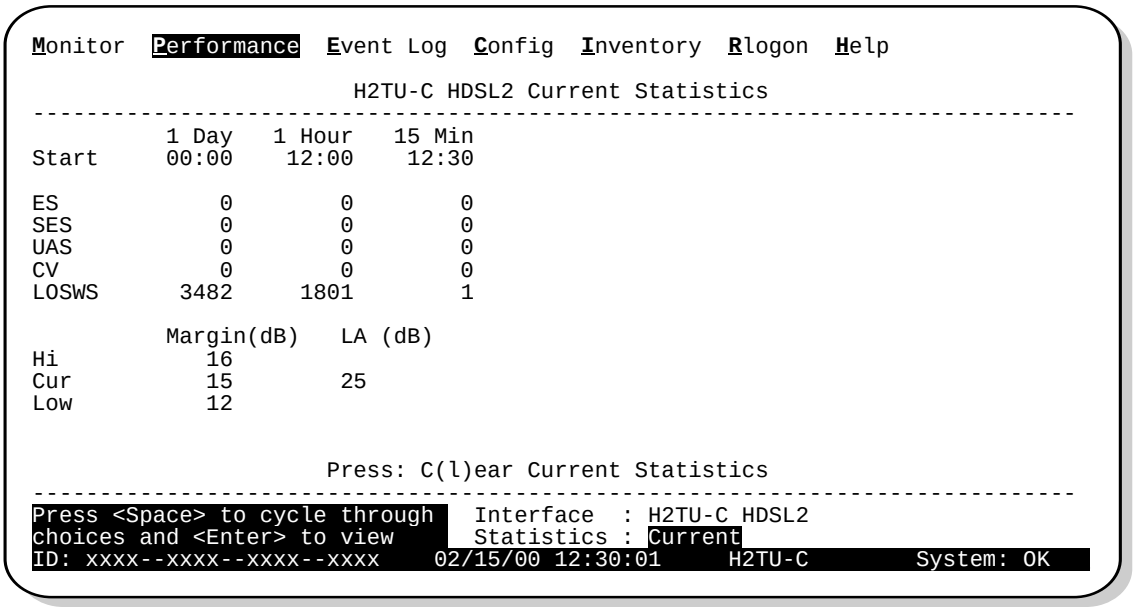


Figure 17. *H2TU-C HDSL2 Current Statistics*

Blockage Indicator Statistics at the H2TU-R DS1 Interface

Figure 18 is an example of an H2TU-R Blockage Indicator (BI) History screen as viewed from the line unit following a remote log on. This screen can also be viewed when logged on locally at the remote unit. The BI statistics can also be retrieved using inband or Facility Data Link access.

BI is a quality of service (QoS) summary statistic which provides a quick indicator of circuit performance at the H2TU-R. The BI weighs and averages PM primitives to give a relative index of performance for leg 1 (NET TX) and leg 3 (CPE TX) of the DS1 interface (see Figure 11 on page 25).

This screen displays the BI as a percentage for the current hour and for each of the eight preceding hours.

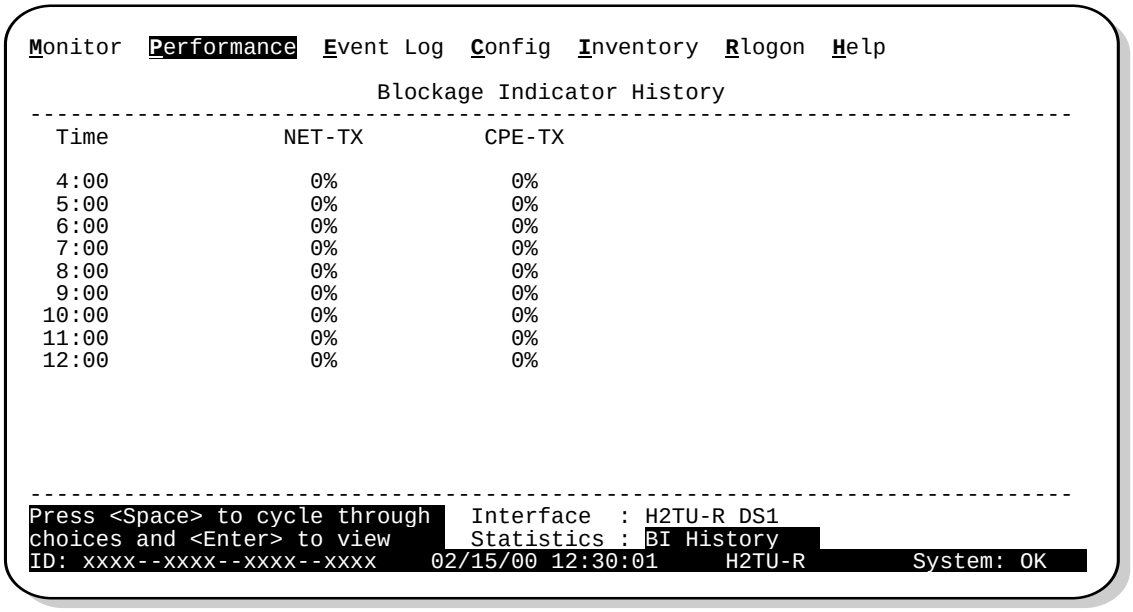


Figure 18. *H2TU-R Blockage Indicator History Screen*

BI is calculated as follows:

BI = [(UAS + .4 SES+.2 ES) / MON] x 100

where:	BI = 0%	indicates the circuit leg is clean.
	BI = 99%	indicates that the circuit leg is out of service.
	BI = % that is BI < 99%	indicates partial trouble in the circuit leg. This percentage is greater than 0% and less than 99%. The higher the BI percentage, the more trouble on that particular circuit leg.
	MON =	the number of seconds that were monitored in obtaining the UAS, SES, and ES data.
	ES	Errored Seconds are a combination of DS1 path and line parameters as defined in ANSI T1.231-1997.
	SES	Severely Errored Seconds are based on parameters similar to ES, but are more severe in number.
	UAS	Unavailable Seconds. Upon the onset of 10 contiguous SES, line unavailability is declared. For the line (including HDSL loops) to become available, there must be a minimum period of 10 seconds which are free of SES.

Type **R** to return to the H2TU-C logon screen.

USING THE PERFORMANCE SCREENS TO VIEW ALARM DATA

To access the alarm history screens:

1 Type P to select the Performance menu.

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

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

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

5 Press L to clear the selected alarm history screen.

Alarm History at the H2TU-C DS1 Interface

The Alarm History screen reports DS1 statistics for the H2TU-C (Figure 19) and the H2TU-R (Figure 20 on page 35) on a continuous basis. The types of alarms reported are described in Table 15 on page 35. Current alarms are shown in reverse video.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

 LLOS         02/15/00 00:00       02/15/00 00:45       ALARM          12
 LAIS                                                   OK              0
 DBER         02/15/00 00:37       02/15/00 00:45       OK              7









                          Press: C(l)ear Alarm History
-------------------------------------------------------------------------------
Press <Space> to cycle through   Interface  : H2TU-C DS-1
choices and <Enter> to view      Statistics : Alarm History
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C        System: Alarm
```

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

Table 14. *H2TU-C DS1 Alarm Descriptions*

Screen Alarm	Description	To inhibit
LLOS [a]	Local Loss of Signal—Loss of the H2TU-C DSX-1 input signal.	Cannot be inhibited.
LAIS	Local Alarm Indication Signal—Indicates an AIS (all ones) pattern is being transmitted from the local DS1 output port.	Cannot be inhibited.
DBER	Line Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.	Select DIS for the DBER system option.

(a) This is a DS1-specific alarm that also issues a minor alarm (sent to the management unit or the backplane), if enabled.

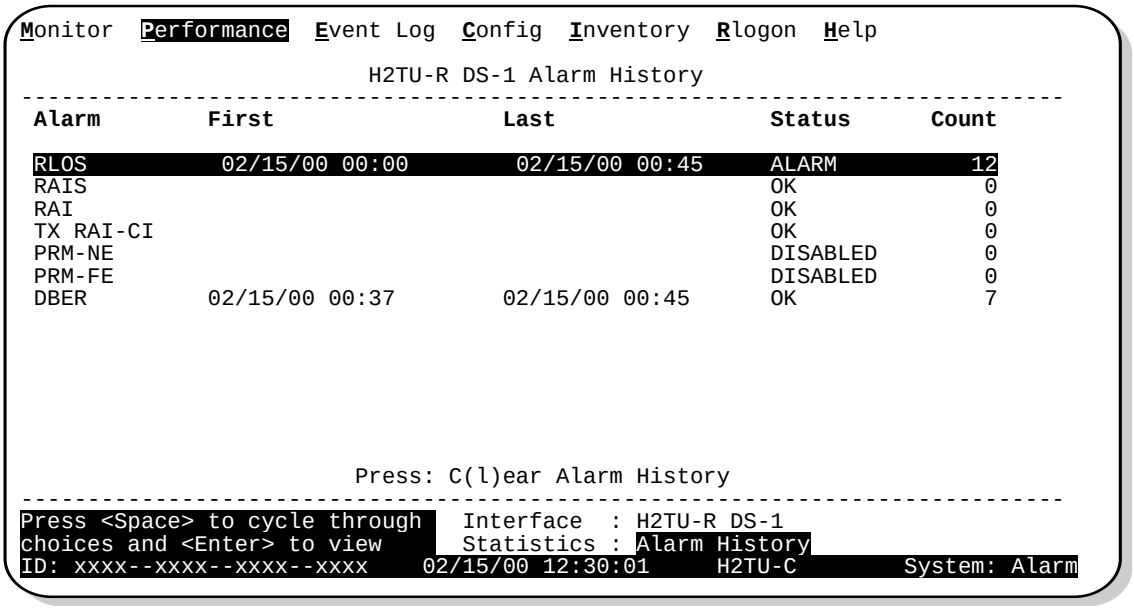


Figure 20. *H2TU-R DS1 Alarm History Screen*

Table 15. *H2TU-R DS1 Alarm Descriptions*

Screen Alarm	Description	To inhibit
RLOS [a]	Remote Loss of Signal— Loss of the H2TU-R DS1 input signal.	Cannot be inhibited.
RAIS	Remote Alarm Indication Signal—Indicates an AIS (an all ones) pattern is being received at the H2TU-R DS1 input port. By default AIS-CI [b] is sent towards the network (see Figure 21 on page 36).	Cannot be inhibited.
RAI	Remote Alarm Indication—An RAI pattern is transmitted toward the network when an RAI pattern is detected at the H2TU-R input and the signal from the network has defects.	Cannot be inhibited.
TX RAI-CI	Remote Alarm Indication - Customer Installation—Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends a RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS, or LOF), then the RAI is automatically passed on to the network. This is applicable to SF or ESF framing. RACI must be enabled to convert RAI to RAI-CI.	Cannot be inhibited.
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.	Set DBER threshold to DIS.
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.	Set DBER threshold to DIS.
DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6}.	Select DIS for the DBER system option.

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

Alarm History at the HDSL2 Interface

Figure 21 shows the H2TU-C HDSL2 alarm history, and Table 16 describes the alarms.

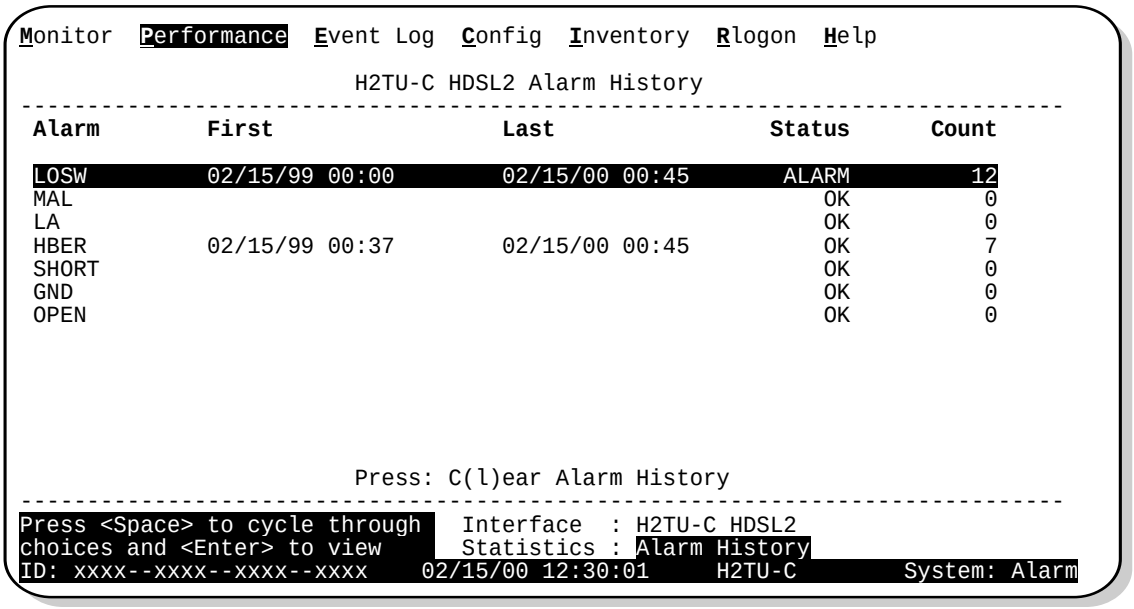


Figure 21. *H2TU-C HDSL2 Alarm History Screen*

Table 16. *HDSL2 Alarm Descriptions*

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

Remote LOS and AIS Response

Figure 22 shows the different ways the H2TU-R can respond to the network, depending on the configuration of the TLOS, RDA, NLBP, ALMP, and NAIS configuration options described in Table 5 on page 14 and Table 6 on page 15.

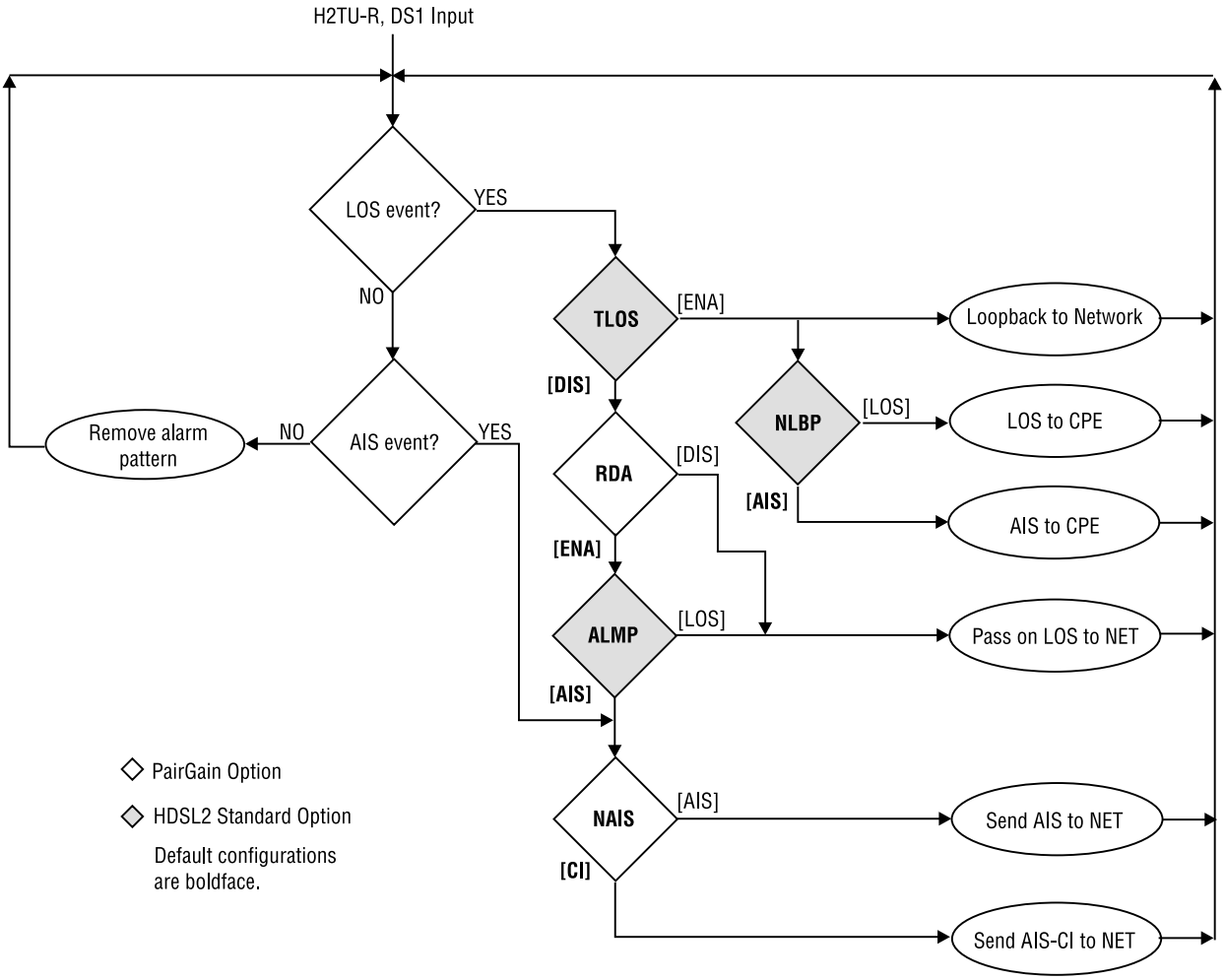


Figure 22. *LOS and AIS Response Priorities*

USING THE EVENT LOG TO TRACK SYSTEM EVENTS

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

- Press **N** or **P** to page through the event log.
- Press **T** to return to the top of the log.
- Press **L** to clear the event log.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

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

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

        Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-C        System: OK
```

Figure 23. *System Event Log*

USING THE SECTIONALIZED EVENT LOG TO ISOLATE TROUBLE

The Sectionalized Event Log screen (Figure 24 on page 39) displays the date and time of the 100 most recent sectionalized events for all four legs of the H2TU-R DS1 interface (see Figure 11 on page 25). The screen provides a description of each event with the most recent event displayed first.

Sectionalized events isolate trouble to a particular circuit leg. For example, an ES listed under the NET-TX column indicates an errored second condition exists on the NET-TX circuit leg beginning with the time stamp and continuing until an OK or other new event is recorded.

On signals without FAR END or NEAR END PRM present, event data in the CPE-RX and NET-RX circuit legs will be limited to trouble alarms.

To view the H2TU-R Sectionalized Event Log, type **R** to logon remotely, then type **E**.

- 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.

- Type **ESC** + **R** to return to the H2TU-C logon screen.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help

                    Sectionalized Event Log (Page 1 of 7)
-------------------------------------------------------------------------------
#   Date and Time          NET-TX       CPE-RX       CPE-TX       NET-RX

1   10/21/99 12:25:00        OK           OK          Alarm       AIS-CI
2   10/21/99 12:25:00       Alarm        AIS           OOF        AIS-CI
3   10/21/99 12:25:00       Alarm        AIS           OOF           OK
4   10/21/99 12:25:00       Alarm         OK            OK           OK
5   10/21/99 00:13:32       Alarm         OK            OK           OK
6   09/16/99 00:13:27        OK           OK            OK           OK
7   09/16/99 00:13:27        ES           OK           SES           OK
8   09/16/99 00:11:16        OK           OK           SES           OK
9   09/16/99 00:10:43       RAI          RAI           SES           OK
10  09/16/99 00:10:30       RAI          RAI            OK           OK
11  09/16/99 00:04:11        OK           OK            OK           OK
12  09/16/99 00:00:40        OK           OK          Alarm       AIS-CI
13  09/16/99 00:00:02        OK           OK            OK           OK
14  - Empty -
15  - Empty -

        Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log
ID: xxxx--xxxx--xxxx--xxxx    02/15/00 12:30:01     H2TU-R       System: OK
```

Figure 24. *H2TU-R Sectionalized Event Log Screen*

Sectionalized events use the following status definitions:

Table 17. *Sectionalized Event Descriptions*

Screen Section	Events
OK	Signal is clean
ES	Errored Seconds condition
SES	Severely Errored Seconds condition
ALARM	LOS
AIS	Alarm Indicator Signal condition
RAI	Remote Alarm Indicator condition
AIS-CI	Customer AIS
RAI-CI	Customer RAI
NOT SECT	No Sectionalized Data Available
OOF	Out-of-frame condition

CLEARING THE HISTORY, ALARM, AND EVENT LOG SCREENS

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

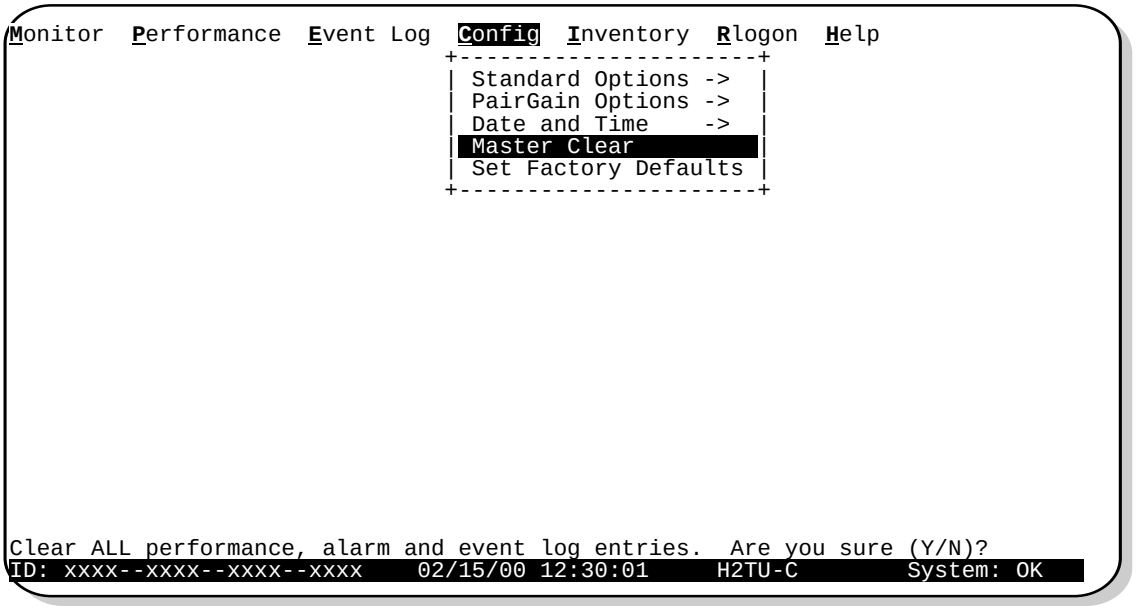


Figure 25. *Master Clear*

To clear the Event Log:

1. Type **E** to select the Event Log screen (type **R** and then **E** if you wish to clear the Sectionalized Event Log screen at the remote unit).
2. Type **L** to clear the screen.
3. Type **Y** to confirm the clearing of the history screen.

To clear an individual history or alarm screen:

1. Type **P** to select the Performance screen (type **R** and then **P** if you wish to select the Blockage Indicator (BI) History screen at the remote unit).
2. Press the **SPACEBAR** to select either interface (**H2TU-C DS1, H2TU-R DS1, H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**. Select **H2TU-R DS1** if you wish to select the BI History screen at the remote unit.
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**.
4. Type **L** to clear the screen.
5. Type **Y** to confirm the clearing of the history screen.

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

1. Type **C** to select the Config screen.
2. Select **Master Clear**.

3 Type Y to clear all screens.

TESTING

LOOPBACK OPERATION

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

- Generic Loopback (GNLB) options, including the SmartJack (SMJK) option (see Table 18 on page 42)
- Special Loopback (SPLB) options (see "Special Loopback Commands" on page 43 and the following command tables:
  - Addressable Repeater Loopback commands: A1LB, A2LB, A5LB (see Table 19 on page 46)
  - Addressable Repeater Loopback commands: A3LB, A4LB (Table 20 on page 48)

The H2TU-C is configured for generic (GNLB) or special loopback modes (A1LB, A2LB, A3LB, A4LB, or A5LB) by setting the loopback mode from the Config menu> PairGain Options.

Loopback commands can be initiated by:

- Selecting the loopback command from the Monitor menu when connected to the craft port of the H2TU-C or H2TU-R. (See "Using the Monitor Screen to View System Activity" on page 26.)
- Entering the inband loopback command code into the test equipment connected to the H2TU-C or H2TU-R. (See "A1LB, A2LB, and A5LB Test Procedures" on page 46 and "A3LB and A4LB Test Procedures" on page 48.)
- Pressing the loopback pushbutton on the front panel for at least 5 seconds to activate a dual loopback (NLOC and CREM) at the H2TU-C.

Loopback timeouts are set with the Config screen Loopback Timeout option (see Figure 7 on page 13 and Table 5 on page 14). Loopbacks can be terminated by issuing a loopdown command or by selecting LPDN from the Monitor screen (see Figure 12 on page 26).

GENERIC LOOPBACK COMMANDS

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

Figure 26 summarizes the available loopbacks in the system, and Table 18 summarizes the HiGain HDSL2 generic loopback commands. See "Generic Loopback Commands" for the test procedures.

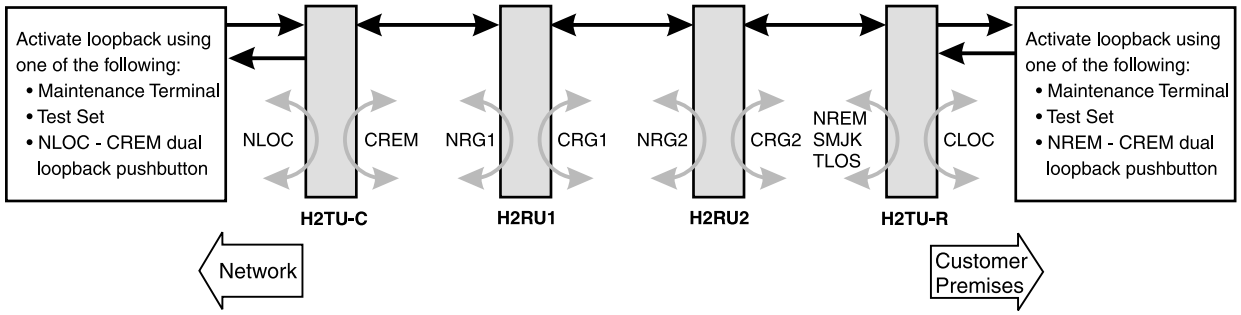


Figure 26. *Loopback Summary*

Table 18. *Summary of HiGain HDSL2 Loopback Codes and Activation Methods*

			Method of Activation	
Loopback	**Code**	**Description**	**Test Set**	**Craft Port**
NLOC	1111000 4-in-7	DSX-1 signal is looped back to the network at the H2TU-C.	X	X
NRG1	110000 2-in-6	DSX-1 signal is looped back to the network at the regenerator 1.	X	X
NRG2	111000 3-in-6	DSX-1 signal is looped back to the network at the regenerator 2.	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	Signal from the customer is looped back to the customer at the H2TU-R.	X	X
CRG1	111100 4-in-6	Signal from the customer is looped back to the customer at regenerator 1.	X	X
CRG2	111110 5-in-6	Signal from the customer is looped back to the customer at regenerator 2.	X	X
CREM	1111110 6-in-7	Signal from the customer is looped back to the customer at the H2TU-C.	X	X
SMJK LpUp (PL)	11000 2-in-5	SmartJack Loopup or NID payload (PL) code. Invokes H2TU-R loopback towards network.	X	
SMJK LpUp (ESF-DL)	1111-1111-0 100-1000	SmartJack Loopup or NID (ESF-DL) code. Invokes H2TU-R loopback towards network.	X	
SMJK LpDn (PL)	11100 3-in-5	SmartJack Loopdown or NID payload (PL) code. Removes SMJK, NLOC, NREM, CLOC, CREM, CRGx, and NRGx.	X	
SMJK LpDn (ESF-DL)	1111-1111-0 010-0100	SmartJack Loopdown or NID (ESF-DL) code. Removes SMJK, NLOC, NREM, CLOC, CREM, CRGx, and NRGx.	X	

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

Use the inband commands to enable or disable the SMJK loopback options. The H2TU-C-202 List 1F system setting is normally enabled to recognize all inband SmartJack loopback commands.

The loopback pushbutton on the front panel activates or deactivates a dual loopback (NLOC and CREM) at the H2TU-C when depressed 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 Status LED on the front panel should be green, and the loopback mode should also be identified on the Monitor screen.)

2 Have the CO tester transmit a DS1 test signal towards the 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 Status LED on the front panel should be green, 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.

SPECIAL LOOPBACK COMMANDS

In addition to the GNLB loopback command mode, a HiGain HDSL2 system can be configured for special loopback command modes. These are selected by configuring the unit for the desired loopback mode (Config menu, Special Loopback Mode option) from the maintenance terminal Monitor screen. Once a loopback mode is activated, other loopback commands can be sent by a test set connected to the craft port of the H2TU-C or H2TU-R (see Table 19 on page 46 and Table 20 on page 48 for list of SPLB commands).

A1LB through A5LB are five special, addressable, repeater loopback modes which are supported by the H2TU-C. These loopback modes provide the HiGain HDSL2 system with sophisticated maintenance and troubleshooting tools. A1LB, A2LB, and A5LB are patterned after the Teltrend addressable DS1 repeater loopbacks. A3LB and A4LB are patterned after the Wescom addressable DS1 repeater loopbacks. All five SPLBs have been enhanced to handle the specific requirements of the following HiGain customers:

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

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

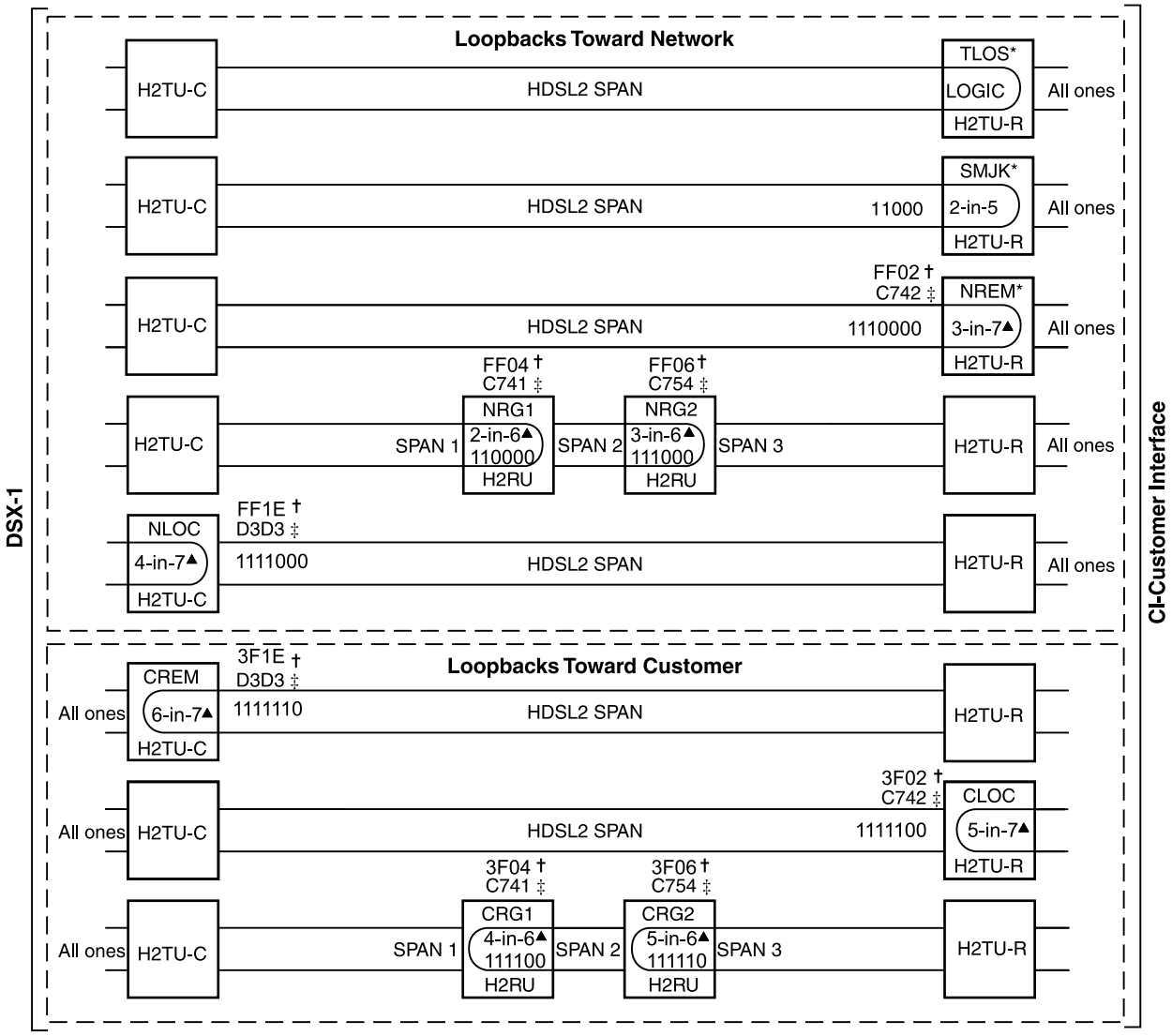
- Query loopback
- IOR (Intelligent Office Repeater) power-down
- Four loopback time-out choices
- Initiation from either end
- repeating bit error signatures
- Alternate query loopback

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

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

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

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



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

† A3LB and A4LB loopback codes.

‡ A1LB, A2LB, and A5LB loopback codes.

▲ GNLB loopback codes.

Figure 27. *Loopback Modes*

A1LB, A2LB, and A5LB Test Procedures

Using the codes listed in Table 19, a network tester can activate NLOC, NRG, or NREM loopbacks (or SMJK, if enabled). A tester at the customer premises can activate CLOC, CRG, or CREM loopbacks. Information specific to HiGain is shown in bold type.

Following Table 19 is a step-by-step test procedure for verifying the integrity of the HDSL2 channels at every module location as well as the DS1 channels to the customer and the local DSX-1 interface.

Table 19. *Addressable Repeater Loopback Commands*

Loopback	Binary Code [a] (Hexidecimal Equivalent)	Description
ARMING or NI LPBK (inband)	11000-11000 ...	Arming code
ARMING or NI LPBK (ESF Data Link)	1111-1111-0100-1000 (FF48)	Arming code
IR LPDN or DISARM (inband)	11100-11100 ...	Disarming code
IR LPDN or DISARM (ESF Data Link)	1111-1111-0010-0100 (FF24)	Disarming code
IOR LPBK (NLOC and CREM 230-232 bit errors and 229-231 bit errors) [b]	1101-0011-1101-0011 (D3D3)	NLOC—DSX-1 signal is looped back to the network at the H2TU-C. CREM—Signal from customer is looped back to the customer at the H2TU-C.
ILR-1 LPBK (10 bit errors) [c]	**1100-0111-0100-0001 (C741)**	**NRG1—DSX-1 signal is looped back to the network at H2RU1. CRG1—Signal from customer is looped back to the customer at regenerator 1.**
ILR-20 LPBK (200 bit errors) [c]	**1100-0111-0101-0100 (C754)**	**NRG2—DSX-1 signal is looped back to the network at H2RU2. CRG2—Signal from customer is looped back to the customer at regenerator 2.**
ILR-2 LPBK (20 bit errors) [c]	**1100-0111-0100-0010 (C742)**	**NREM—DSX-1 signal is looped back to the network at the H2TU-R. CLOC—Signal from customer is looped back to the customer at the H2TU-R.**
IR LPDN (except SMJK)	1001-0011-1001-0011 (9393)	Loopdown (H2TU-C, H2RU, or H2TU-R)
IR QUERY LPBK	1101-0101-1101-0101 (D5D5)	Query loopback
IR ALTERNATE QUERY LPBK	1101-0101-1110-1010 (D5EA)	Alternate query loopback
TIME-OUT OVERRIDE	1101-0101-1101-0110 (D5D6)	Loopback time-out override
FAR END NI ACTIVATE [d]	1100-0101-0101-0100 (C554)	Unblock AIS
IOR POWER DOWN (H2TU-C) [e]	0110-0111-0110-0111 (6767)	Removes HDSL2 line power

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

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

(c) The first and second regenerator and the H2TU-R are assigned the ILR-1, ILR-20, and ILR-2 loopback codes respectively. They respond with 10, 200, and 20 bit errors respectively (excluding the frame bits).

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

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

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

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

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

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

3 Verify, if possible, that the H2TU-R Loopback LED is either flashing yellow at 4-second intervals (indicating that the system is armed), or is a steady yellow (indicating that it is both armed and in SMJK loopback). The H2TU-C Status LED also flashes yellow when the system is armed.

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

4 Once armed, the H2TU-C can be looped back by sending Intelligent Office Repeater (IOR) LPBK activation code 1101-0011-1101-0011 (D3D3) for at least 5 seconds. You should observe the following activation response pattern:

a 2 seconds of AIS (an all ones pattern)

b 2 seconds of returning data pattern

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

– 10 errors, if ILR-1 (Regenerator 1) was sent

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

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

d Normal looped data

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

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

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

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

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

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

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

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

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

A3LB and A4LB Test Procedures

The H2TU-C-202 List 1F 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 (see Table 5 on page 14) determines the duration of this loopback unless it is overridden by the reception of a second identical 16-bit loopup command before the timer expires. When this time-out override state exists, the only way to loop the H2TU-C down is to issue one of the three loopdown commands listed in Table 20. The automatic time-out mode is restored during subsequent loopback sessions.

Table 20 summarizes the codes required to execute Addressable 3 and 4 (A3LB and A4LB) repeater loopback commands. All code sequences must be present for at least 5 seconds. Information specific to HiGain HDSL2 regenerators is shown in bold.

Table 20. *Addressable Repeater Loopback Commands (A3LB and A4LB)*

Loopback	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
NRG1	**1111-1111-0000-0100 (FF04)**	**H2RU regenerator 1 loopup from NI**
CRG1	**0011-1111-0000-0100 (3F04)**	**H2RU regenerator 1 loopup from CI**
NRG2	**1111-1111-0000-0110 (FF06)**	**H2RU regenerator 2 loopup from NI**
CRG2	**0011-1111-0000-0110 (3F06)**	**H2RU regenerator 2 loopup from CI**
NREM	1111-1111-0000-0010 (FF02)	H2TU-R loopup from NI
CLOC	0011-1111-0000-0010 (3F02)	H2TU-R loopup from CI
SMJK	11000-11000-11000 ...	H2TU-R loopup from NI
SMJK	100000 100000 100000 ...	H2TU-R loopup from NI [b]
SMJK	1111-1111-0100-1000 (FF48)	H2TU-R loopup from NI (ESF-DL)
Loopdown	11100-11100-11100 ...	H2TU-C and H2TU-R loopdown from NI OR CI
Loopdown	100-100-100 ...	H2TU-C and H2TU-R loopdown from NI OR CI
Loopdown	1111-1111-0010-0100 (FF24)	H2TU-C and H2TU-R loopdown from NI OR CI (ESF-DL)

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

TESTING WITH THE H2TU-R SIGNAL GENERATOR

The H2TU-R Signal Generator screen allows transmission of a test signal from the H2TU-R toward either the CI or the network.

1 Type R to logon remotely, then type C to select the Config menu.

2 Use the ↑ and ↓ arrow keys to select **Signal Generator** and press ENTER.

3 Use the arrow keys to select an option.

4 Press the SPACEBAR to cycle through the available settings for that option (refer to Table 21 on page 50 for a list of signal generator option settings).

5 Press ENTER to activate your choice.

The signal generator options and settings can be changed while signal generation is active, but they do not take effect until ENTER is pressed.

6 Type R to return to the H2TU-C logon screen. You can exit the Signal Generator screen while signal generation is active.

```
Monitor  Performance  Event Log  Config  Inventory  Rlogon  Help
                              +----------------------+
                              | Standard Options ->  |
                              | PairGain Options ->  |
                              | Signal Generator ->  |
                             +-------------------------------------+
                             |  Test Signal Generator  : OFF       |
                             |  Test Signal Pattern    : ALL 1     |
                             |  Test Signal Linecode   : AMI       |
                             |  Test Signal Direction  : NET & CPE |
                             |  Test Signal Framing    : SF        |
                             +-------------------------------------+
```

Figure 28. *H2TU-R Signal Generator Screen*

Table 21. *Signal Generator Option Settings*

Option	Settings
Test Signal Generator	On or Off
Test Signal Pattern	All ones, all zeroes, 2^{23-1} pseudo random, 2^{20-1} pseudo random, 2^{15-1} pseudo random, 1:7 pattern, 2:8 pattern, 3:24 pattern
Test Signal Linecode	AMI or B8ZS
Test Signal Direction	Toward NET and CPE or toward CPE only
Test Signal Framing	SF, ESF, UNFR

OCT55 TEST PATTERN WITH AMI CODE

The OCT55 test pattern can be used in unframed mode to stress the system and verify data integrity without creating any line errors. When a framed OCT55 test pattern is used, excessive zero anomalies may occur which cause the H2TU-C to report ES, SES, and UAS errors according to ANSI T1.231-1997.

APPENDIX A - SPECIFICATIONS

Power	
HDSL2 Span Voltage	0 or -185 Vdc
CO Supply	-48 Vdc nominal (-42.5 to -56.5 Vdc) (See "Power Consumption" and "Maximum Power Dissipation" and "Maximum Current Drain" on page 52.)
Electrical Protection	Secondary surge and power cross protection on HDSL2 ports. Requires external primary protection.
Fusing	Internal; connected to FUSE ALARM output on pin 25
Environmental	
Operating Temperature	-40 °F to +149 °F (-40 °C to +65 °C)
Operating Humidity	5% to 95% (non-condensing)
Physical	
Height	5.6 in. (14.22 cm)
Width	0.7 in. (1.7 cm)
Depth	5.6 in. (14.22 cm)
Weight	1 lb., 2 oz. (.51 kg)
Mounting	200 and 400 mechanics high-density shelf
HDSL2	
Line Rate	1.552 Mbps OPTIS
Transmission	Full duplex
Media	One non-loaded, copper, two-wire cable pair
Output	+16.8 dBm ±0.5 dB at 135Ω (0-450 kHz) at CO side; +16.5 dBm ±0.5 dB at 135Ω (0-350 kHz) at remote side
Line Impedance	135 Ω
Maximum Loop Attenuation	35 dB at 196 kHz, 135 Ω
Start-up Time	30 sec. (typical), 1 min. (maximum) per span
DSX-1	
Line Impedance	100 Ω
Line Rate	1.544 Mbps ±200 bps
Line Format	Alternate Mark Inversion (AMI) or Bipolar with 8-Zero Substitution (B8ZS)
Frame Format	Extended SuperFrame (ESF), SuperFrame (SF), or Unframed (UNFR)
Pulse Output	6 V^{pk-pk} pre-equalized for 0 to 655 feet of ABAM cable
Input Level	+1.5 to -7.5 dB DSX
System	
One-way DS1 Delay	<400 µs per span without regenerators
Wander (Looped)	Meets MTIE DS1.101 requirements
Wideband Jitter (Looped)	0.2 UI maximum
Narrowband Jitter (Looped)	0.1 UI maximum

POWER CONSUMPTION

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

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

Table 22 describes line-powered and local powered circuits on 9 kft, 26 AWG loops without a regenerator.

Table 22. *H2TU-C Power Parameters—No Regenerator*

	-48 Vdc Power Consumption (Watts)	Heat Dissipation (Watts)	-42.5 Vdc Current (mA)
Remote Power Source	**Maximum**	**Maximum**	**Maximum**
Line powered	10.3	5.7	242.0
Local powered	4.0	4.0	94.0

MAXIMUM POWER DISSIPATION

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

In COs, the maximum power dissipation for open-faced, natural convection-cooled mountings is limited to 134.7 watts per square foot per GR-63-CORE. The footprint of a standard 28-slot, 23-inch HCS-417 shelf is 7.024 square feet. Therefore, the maximum bay dissipation is limited to 946 watts. Use this limit and the parameters in Table 22 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.

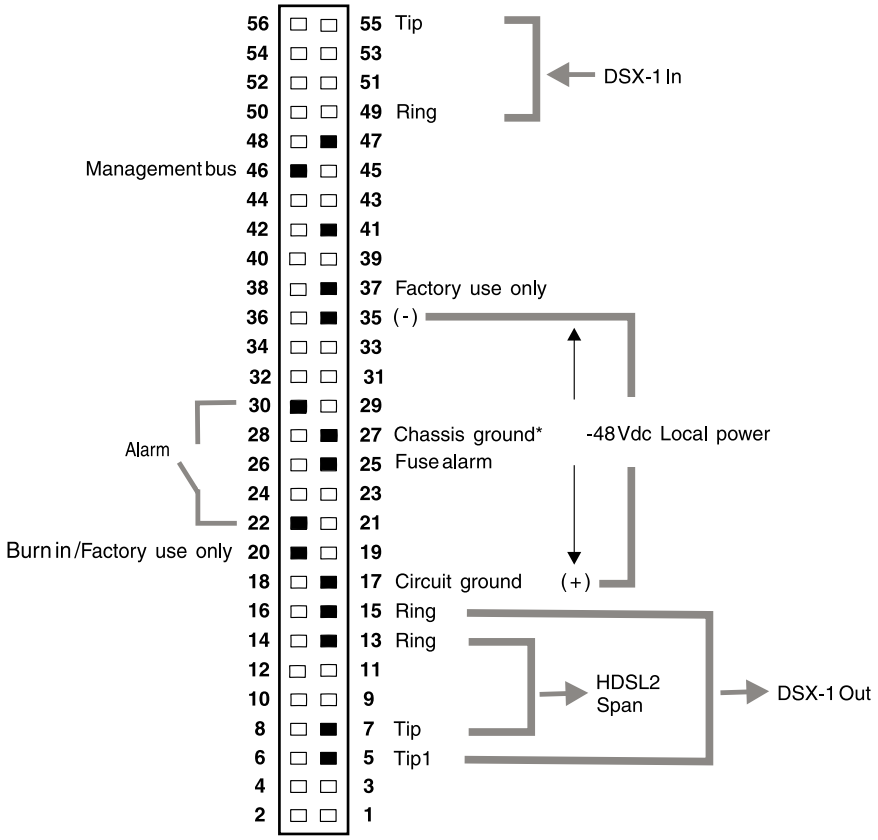
The -48 Vdc Power Consumption is the maximum total power that the H2TU-C consumes or draws from the shelf power source. This parameter is needed when the H2TU-C is in a location remote to the CO it is serving. It determines the battery capacity required to maintain an 8-hour, standby battery reserve 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 22 to perform this analysis.

MAXIMUM CURRENT DRAIN

The Maximum Current Drain is the maximum current drawn from the shelf power supply when its at its minimum voltage (-42.5 Vdc). This determines the shelf fusing requirements. Use the -42.5 Vdc current data in Table 22 to determine the shelf fusing requirements for your particular H2TU-C applications.

H2TU-C-202 LIST 1F CARD-EDGE CONNECTOR

Figure 29 shows the card-edge connector on the H2TU-C-202 List 1F. Active pins are highlighted in black.



Note: Active pins are highlighted in black.

* Chassis ground may be connected to Earth ground per local practice.

Figure 29. *H2TU-C-202 List 1F Card-edge Connector*

Network Management Control Bus

The H2TU-C provides a Network Management Control Bus on pin 46 of the card-edge connector. This allows the various ADC Management System protocols to manage the H2TU-C through the HMU-231 HiGain Management Unit.

Some H2TU-C-202 List 1F features are affected when it is under management. Consult the management unit practice for further information (see "Appendix D - Product Support" on page 58).

Fuse Alarm

Pin 25 on the card-edge connector is a Fuse Alarm that is driven to -48 Vdc through a 1000 Ω resistor whenever its onboard fuse opens.

System Alarm Output Pins

Pins 22 and 30 on the card-edge connector (see Figure 29) are the H2TU-C-202 System Alarm output pins.

CRAFT PORT

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

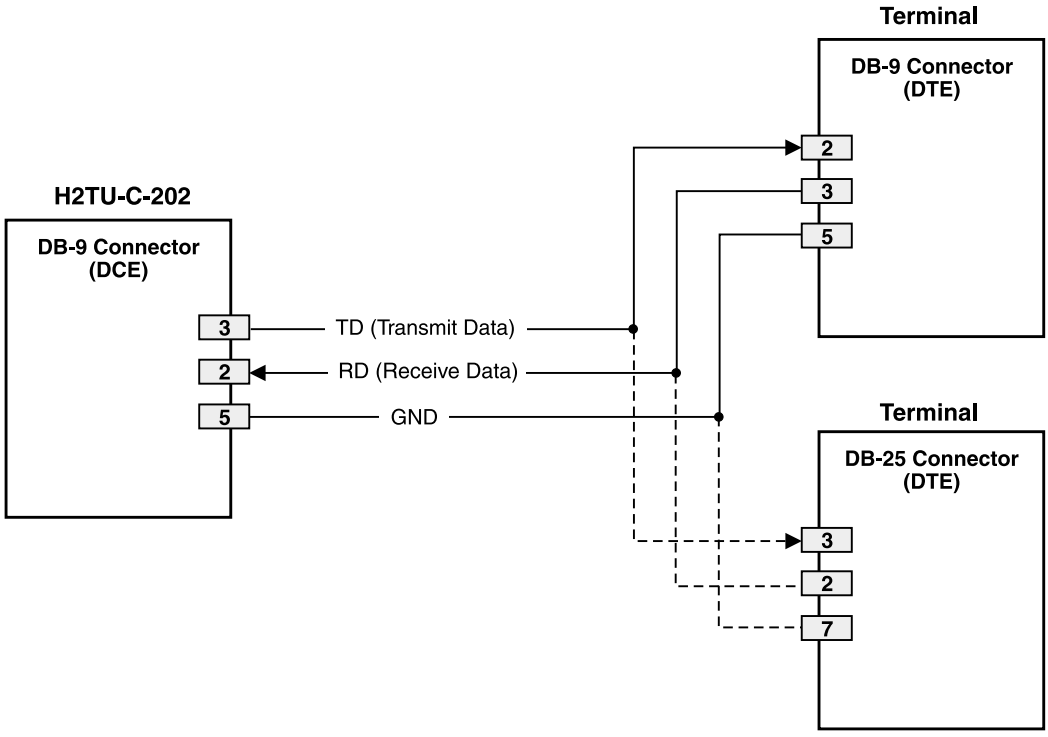


Figure 30. *RS-232 Craft Port Pinouts*

APPENDIX B - FUNCTIONAL OPERATION

ADC HDSL2 technology provides full-duplex services at standard DS1 rates over copper wires between an H2TU-C and an H2TU-R, which comprise one HiGain HDSL2 system. HiGain HDSL2 systems use ADC Overlapped Pulse Amplitude Modulation (PAM) Transmission with Interlocking Spectra (OPTIS) transceiver systems to establish full-duplex, 1.552 kbps data channels between the H2TU-C-202 and a remotely located H2TU-R.

Figure 31 shows a block diagram of the H2TU-C-202. The H2TU-C-202 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).

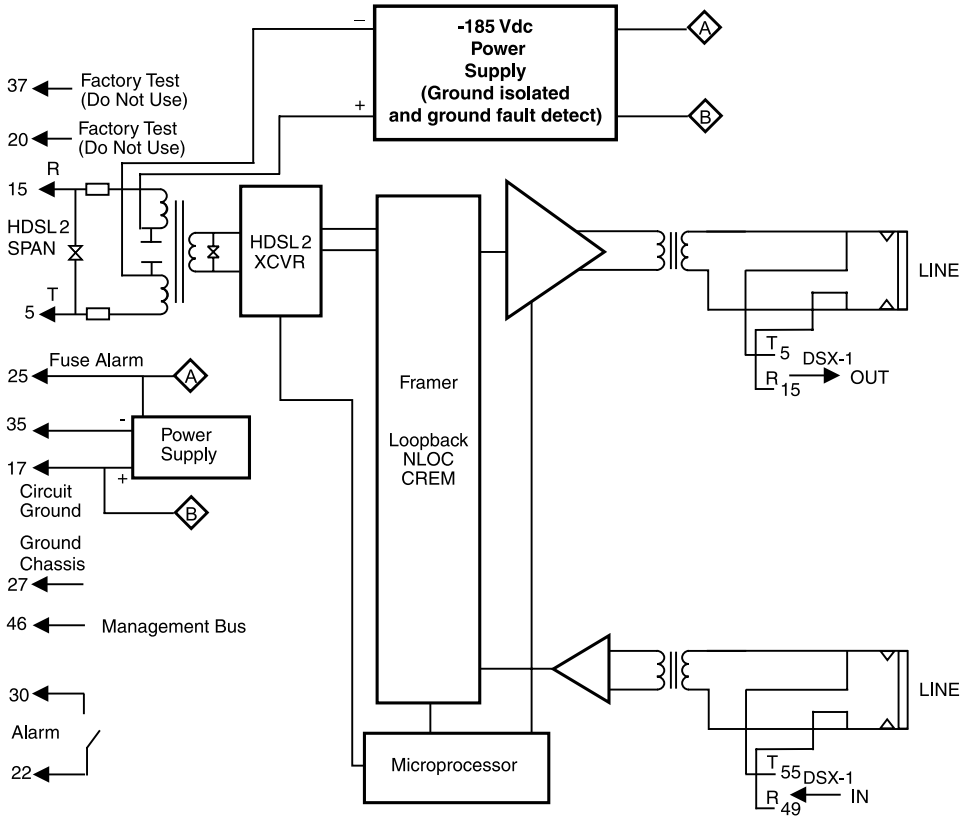


Figure 31. *H2TU-C-202 List 1F Block Diagram*

TIMING

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

GROUND FAULT DETECT

The H2TU-C has a Ground Fault Detect (GFD) circuit which detects a ground or a resistive path to ground on any wire of any span in the loop with a non-zero voltage. GFD is always active in HDSL2 because power is fixed at -185 Vdc.

When the circuit is active, the system is compliant with Class A2 requirements of GR-1089. When the circuit is not active, the system is compliant with Class A3 requirements of GR-1089.

When the GFD circuit detects a grounded loop, the line power is immediately removed from the spans and a PWR FEED GND alarm is generated and displayed. The power is reapplied 30 seconds later as part of a new start-up procedure. If the ground condition persists on the span, the power is removed again once the GFD circuit detects the grounded loop.

The indication of the location of the ground fault can be obtained by monitoring the voltages on the spans on the H2TU-C side as it sequentially powers devices in subsequent spans.

APPENDIX C - COMPATIBILITY

The HiGain HDSL2 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.

DS1 REPEATER SHELVES AND RELATED EQUIPMENT

The HiGain HDSL2 system uses HDSL2 transmission technology as recommended by ANSI committee in compliance with DS1-E1.4 HDSL2 standards.

The H2TU-C-202 is compatible with the following 200 and 400 mechanics, high-density shelve enclosures:

- Indoor enclosures
  - PairGain HRE-425 (12-slot)
  - PairGain HRE-204 (4-slot)
  - PairGain HRE-420 (1-slot)
  - PairGain HRE-443 (3-slot)
- Shelves
  - PairGain HCS-340 (3-slot)
- Outdoor enclosures
  - PairGain HRE-454, List 5 and List 6 (4-slot)

APPENDIX D - PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products. Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center (TAC).

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

APPENDIX E - GLOSSARY

A

ADSL-Asymmetrical Digital Subscriber Line

AIS-Alarm Indication Signal

ALM-Alarm

ALMP-Alarm Pattern

AMI-Alternate Mark Inversion

ANSI-American National Standards Institute

AOR-Addressable Office Repeater

ASCII-American Standard Code for Information Interchange

AUTO-Auto-Framing Mode

AWG-American Wire Gauge

B

B8ZS-Bipolar with 8-Zero Substation

BER-Bit Error Rate

BPV-Bipolar Violation

BPVT-Bipolar Violation Transparency

C

CEV-Controlled Environmental Vault

CI-Customer Interface

CLEI-Common Language Equipment Identifier

CLOC-Customer Local Loopback

CO-Central Office

CONV-Conversion

CPE-Customer Premises Equipment

CRC-Cyclical Redundancy Check

CREM-Customer Remote Loopback

CRG-Customer Regenerator Loopback

CSA-Carrier Service Area

CV-Code Violation

CV-P-Code Violation-Path

D

DBER-D1 Bit Error Rate

DBER-DS1 Block Error Rate

DDS-Digital Data Service

DIS-Disabled

DLC-Digital Loop Carrier

DL-Datalink

DSX-1-Digital Signal, level 0

E

ECI-Equipment Catalog Item

ENA-Enabled

EQL-Equalization

ESD-Electrostatic Discharge

ESF-DL-DS1 Extended SuperFrame Digital Loop

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-Frame Bit for Datalink, Facility Datalink

FE-Far End

FPS-Framing Pattern Sequence

G

GFD-Ground Fault Detect

H

H2TU-C-HiGain HDSL2 Line Unit

HCDS-High Capacity Digital Service

HDSL2-Digital Subscriber Line 2

HDSL-High Bit Rate Digital Subscriber Line

HG-HiGain

HMU-HiGain Main Unit

I

ID-Identification

ILR-Intelligent Line Repeater

IOR-Intelligent Office Repeater

L

LAIS-Local Alarm Indication Loss

LA-Loop Attenuation

LED-Light Emitting Diodes

LLOS-Local Loss of Signal

LOS-Loss of Signal

LOSW-Loss of Sync Word

LPDN-Loopdown

LPF-Line Power Feed

M

MAL-Margin Alarm

MARG-Margin Alarm

MSEC-Monitored Seconds

N

NE - Near End

NEBS-Network Equipment-Building System

NID-Network Interface Device

NI-Network Interface

NLOC-Network Local Loopback

NMA-Network Management and Administration

NPRM-Network PRM

NREM-Network Remote Loopback

NRG-Network Regenerator Loopback

NVRAM-non-volatile RAM

O

OOF-Out-of-Frame

OPTIS-Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra

P

PAM-Pulse Amplitude Modulation

PL-Payload

PM-Performance Monitoring

POTS-Plain Old Telephone Service

PRM-FE-Performance Report Messaging - Far End

PRM-NE-Performance Report Messaging - Near End

PRM-Performance Report Messaging

R

RAI-CI-Remote Alarm Indication-Customer Installation

RAIS-Remote Alarm Indication Signal

RDA-Remote Disconnect Alarm

RLOS-Remote Loss of Signal

ROVR-RAI Overwrite

S

SDSL-Symmetrical Digital Subscriber Line

SES-P-Severely Errored Seconds-Pat

SES-Severely Errored Seconds

SF-SuperFrame

SMJK-SmartJack

SNET-Southern New England Telephone

SPRM-Supplemental PRM

T

TLOS-Transmit Loss of Signal

U

UAS-P-Unavailable seconds-Path

UAS-Unavailable Seconds

CERTIFICATION AND WARRANTY

FCC CLASS A COMPLIANCE

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

LIMITED WARRANTY

ADC DSL Systems, Incorporated (“ADC”) warrants that, for a period of ten (10) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. ADC's obligation, under this warranty, is limited to replacing or repairing, at ADC's option, any such hardware product which is returned during the 12-month warranty period per ADC's instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

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

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

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

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

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

MODIFICATIONS

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

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

STANDARDS COMPLIANCE

The H2TU-C-202 List 1F has been tested and verified to comply with the applicable sections of the following standards.

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

For technical assistance, refer to *“Appendix D - Product Support”* on page 58.

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