

TECHNICAL PRACTICE



H2TU-C-202 List 3E
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CLEI Code: VACJ1KCE

Revision History of This Practice

Issue	Release Date	Revisions Made
1	December 4, 2000	Initial release
2	February 28, 2001	Added sealing current and HDSL2 span connection to Loop 2; updated screens.

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February 28, 2001

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USING THIS TECHNICAL PRACTICE

The following conventions are used in this manual:

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



Notes contain information about special circumstances.



Cautions indicate the possibility of personal injury or equipment damage.



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

For a list of abbreviations used in this document, refer to [“Appendix E - Abbreviations”](#) on page 63.

INSPECTING SHIPMENT

Upon receipt of the equipment:

- Unpack each container and inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC DSL Systems, Inc. Order replacement equipment, if necessary.
- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact ADC DSL Systems, Inc., as described in [“Returns”](#) on page 60. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The H2TU-C-202 List 3E line unit is the Central Office (CO) side of a T1 transmission system. The HiGain® HDSL2 product family is fully compliant with the HDSL2 standard ANSI T1.418. Providing full-rate T1 access using a single copper pair, HDSL2 is a cost-effective solution that offers an open architecture. The open architecture inherent in HDSL2 guarantees interoperability allowing simple and economic accommodation of network growth.

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

FEATURES

Features specific to the List 3E family of HDSL2 modules include:

- Report menu option for downloading status and performance monitoring data to a file
- Enhanced loopback commands controlled by the SmartJack Loopback (LPBK) option as follows:
 - 100 inband loopdown command
 - 100000 (1-in-6) inband loopup command
- Sources sealing current when connected to an H2TU-R-402 List 5E or higher

Standard features include:

- HDSL2 transmission features
 - Lightning and power cross-protection on HDSL2 interfaces
 - Full-duplex HDSL2 transmission on one pair at 1.552 Mbps
 - Ultra-low wander (Stratum 1 compliant)
 - Grounded loop detection on High-bit-rate Digital Subscriber Line 2 (HDSL2)
- Front-panel provisioning features
 - DS1 splitting and bridging access
 - 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
 - Performance Report Messaging (PRM) support for Supplemental PRM (SPRM) and Network PRM (NPRM) at the H2TU-R
 - Payload (PL) and HiGain (HG) loopback source identification
 - Margin Alarm (MAL) threshold

- Configuration options
 - Selectable DS1 pre-equalizer
 - Bipolar Violation Transparency (BPVT)
 - Bit Error Rate (BER) alarm
 - Loss of Signal/Alarm Indication Signal (LOS/AIS) payload alarm
 - Remote provisioning
- Compatible with Small Cross-Section Shelf (SXSS) and equipment
- Digital Data Service (DDS) latching loopback
- Network Management and Administration (NMA) interface



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

COMPATIBILITY

The H2TU-C-202 List 3E is designed to mount in 200 mechanics shelve. For a list of compatible shelves, see [“Appendix C - Compatibility” on page 59](#).

APPLICATIONS

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

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

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

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

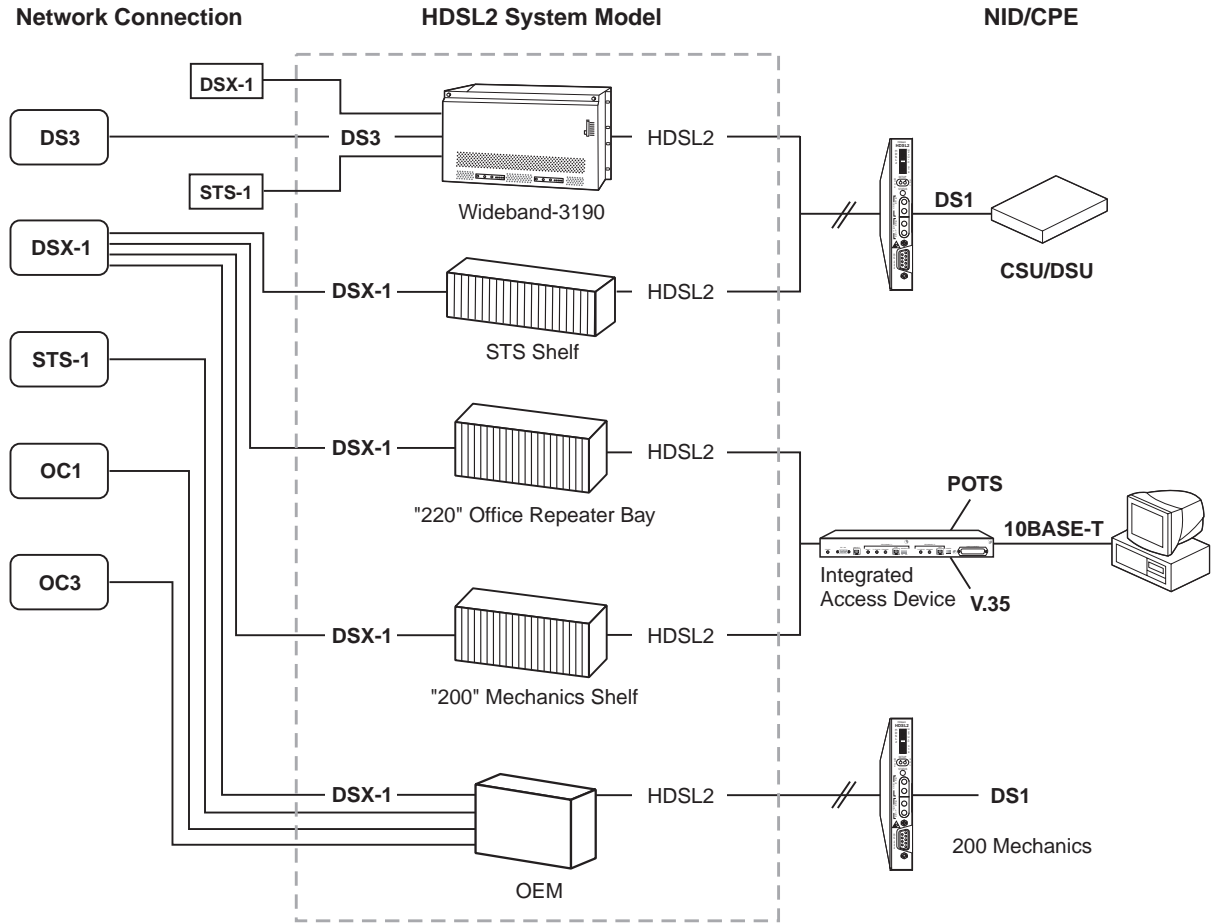


Figure 1. HDSL2 System Model

FRONT PANEL

Figure 2 shows the H2TU-C-202 List 3E front panel. Table 1 on page 5 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 53.

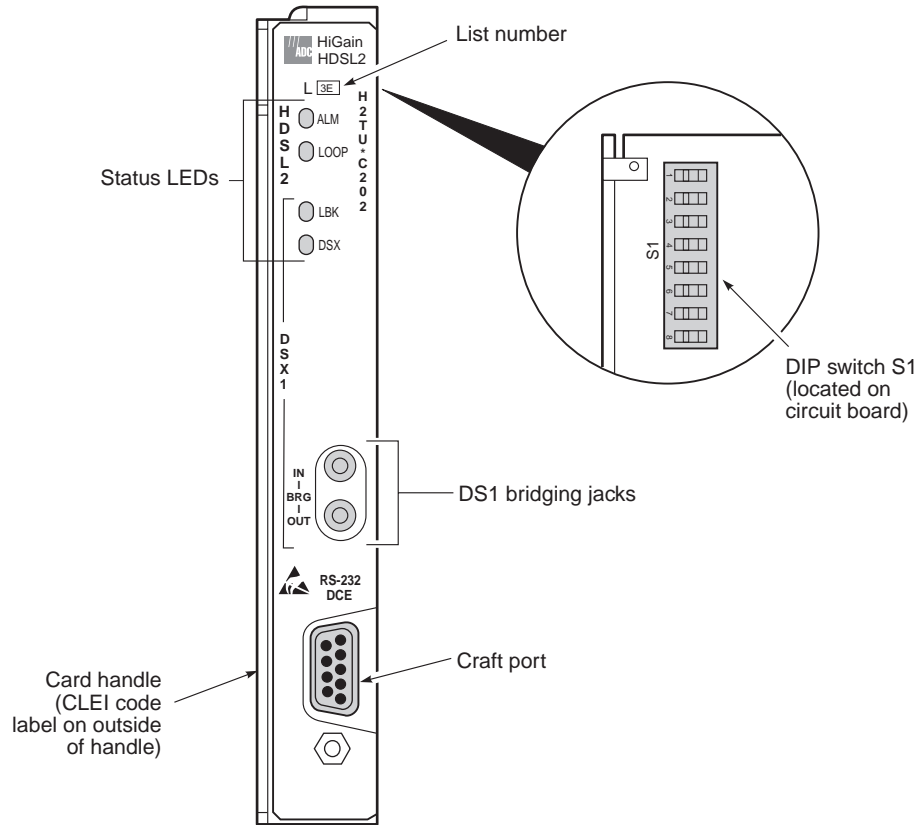


Figure 2. H2TU-C-202 List 3E Front Panel

Table 1. *Front-Panel Description*

Front-Panel Features	Function
List number	Identifies the list number of the H2TU-C-202.
DIP switch S1 (located on circuit board)	A switch bank, located on the board, containing eight switches. (See Figure 3 and Table 2 on page 6 for details.)
Status LEDs	The Status LEDs indicate the following conditions:
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 the NLOC or CREM loopback 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.
DS1 bridging jacks	Provides non-intrusive bridging jack access to (IN) and from (OUT) the HDSL2 span at the DSX-1 interface. Allows the two DS1 payloads to be monitored.
Craft port (RS-232)	Provides bidirectional communication between the unit and an external terminal to allow configuration and performance monitoring through the Maintenance Terminal screens.
CLEI and ECI bar code label	Provides the human-readable Common Language Equipment Identifier (CLEI) code number and the Equipment Catalog Item (ECI) bar code number.

ON-BOARD DIP SWITCH S1

The H2TU-C-202 circuit board has an 8-position DIP switch, S1 (see Figure 3). The functions of DIP switch S1 are listed in Table 2.



DIP switch S1 is the only means by which the options it controls can be set. The maintenance terminal screens showing these option settings are read-only.

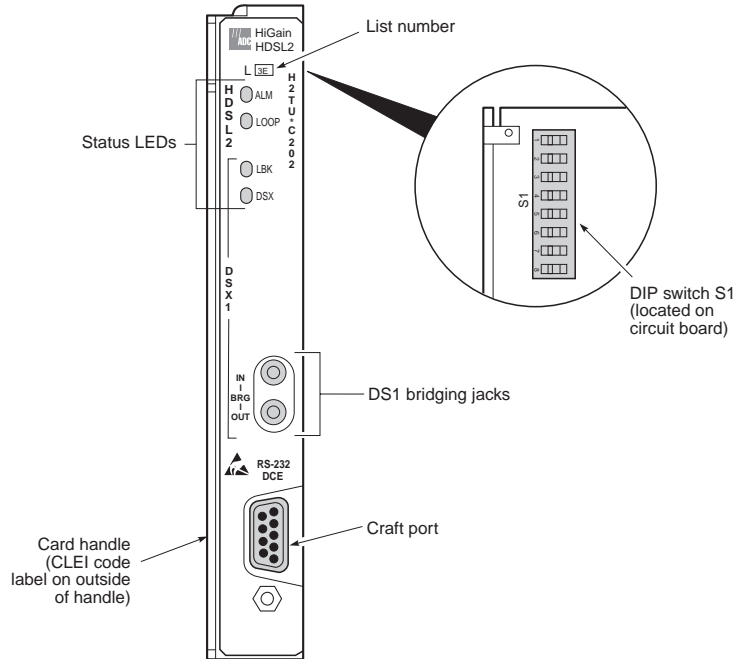


Figure 3. DIP Switch S1

Table 2. Functions of DIP Switch S1 (default settings are in boldface type)

Left Side Options	Switch Number	Right Side Options
Sets the Equalizer for 133 to 265 feet	1 (a)	Sets the Equalizer to 0
Sets the Equalizer for 266 to 398 feet	2 (a)	Sets the Equalizer to 0
Sets the Equalizer for 399 to 532 feet	3 (a)	Sets the Equalizer to 0
Sets the Equalizer for 533 to 655 feet	4 (a)	Sets the Equalizer to 0
Selects line code Alternate Mark Inversion (AMI)	5	Selects line code Bipolar with 8-zero Substitution (B8ZS)
Enables the Loopback Timeout (LBTO) to 120 minutes after initiation	6	Disables 120 minute LBTO and replaces it with NONE, no timeout
Enables system response to DDS latching loopback commands for Fractional T1 (FT1) loopback capability and enables CP disconnect and trouble indication	7	Disables system response to DDS latching loopback commands for Fractional T1 (FT1) loopback capability and disables CP disconnect and trouble indication
Configures the system for local powering	8	Configures the system for Span powering

(a) Only one of the DSX-1 line equalization switches (1 - 4) can be selected at a time. If more than one switch is enabled, the lowest value setting has priority.

INSTALLATION



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

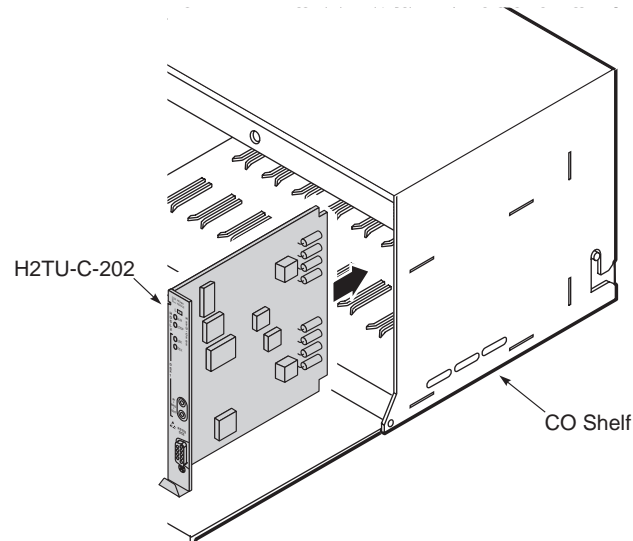


Figure 4. Installing the H2TU-C-202 List 3E



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



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

- 1 Align the H2TU-C with the enclosure slot guides 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-edge connector until it snaps into its seated position.

VERIFICATION

Once the H2TU-C-202 is installed, verify that it is operating properly. To do this, monitor the four status LEDs. (See [Table 1 on page 5](#) for status LED descriptions.)

Verification without an H2TU-R Remote Unit

If there is no H2TU-R remote unit installed:

- 1 Verify that the H2TU-C powers up. The four status LEDs illuminate and report the status. (See [Table 1 on page 5](#) for status LED descriptions.)
- 2 Verify that the H2TU-C attempts to communicate with a remote unit (the LOOP LED flashes green). Even if a remote unit is not present, the H2TU-C continually attempts communication with remote unit until a remote unit is detected.

Verification with an H2TU-R Remote Unit

If an H2TU-R remote unit has been installed:

- 1 Verify that the H2TU-C powers up. (The LOOP LED illuminates.)
- 2 Verify that the H2TU-C attempts to communicate with remote unit (the LOOP LED flashes green). One of the following events occurs:
 - If the remote unit is successfully identified and the HDSL2 loop synchronizes, the H2TU-C LOOP LED lights a steady green.
 - If remote unit is not successfully identified, the H2TU-C continues to attempt communication and the LOOP LED continues to flash until a remote unit is detected.
- 3 Verify that a valid DS1 signal has been applied to the H2TU-C and the H2TU-R.
 - If no DS1 signal is being applied to the H2TU-C or H2TU-R inputs, the LOOP LED flashes red.
 - If a valid DS1 signal is being supplied to the H2TU-C and H2TU-R, the LOOP LED illuminates steady green.

PROVISIONING

There are two provisioning methods:

- Setting the DIP switch located on the H2TU-C-202 circuit card
- Using a maintenance terminal (ASCII terminal or a PC running terminal emulation software) connected to the H2TU-C craft port (or to an H2MU craft port) to access the HiGain maintenance screens (Figure 5 on page 10). Using a maintenance terminal allows you full access to all H2TU-C status, history, inventory, and provisioning screens.



The options set with DIP switch S1 (Figure 3) cannot be set from a maintenance terminal. See “On-board DIP Switch S1” on page 6.

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 2 on page 4) 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 VT100 terminal).
- 4 Configure the maintenance terminal to the following communication settings:
 - 9600 baud
 - No parity
 - 8 data bits
 - 1 stop bit
 - Hardware flow control to OFF
- 5 If necessary, press **CTRL** + **R** to refresh the HiGain HDSL2 logon screen.

Logon Screen

The HiGain HDSL2 maintenance terminal screens allow you to monitor, provision, and troubleshoot an H2TU-C-202 system.

To select a menu from the HiGain HDSL2 logon screen (Figure 5 on page 10), do one of the following:

- Type the underlined 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 11 describes the menus.

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

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

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



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

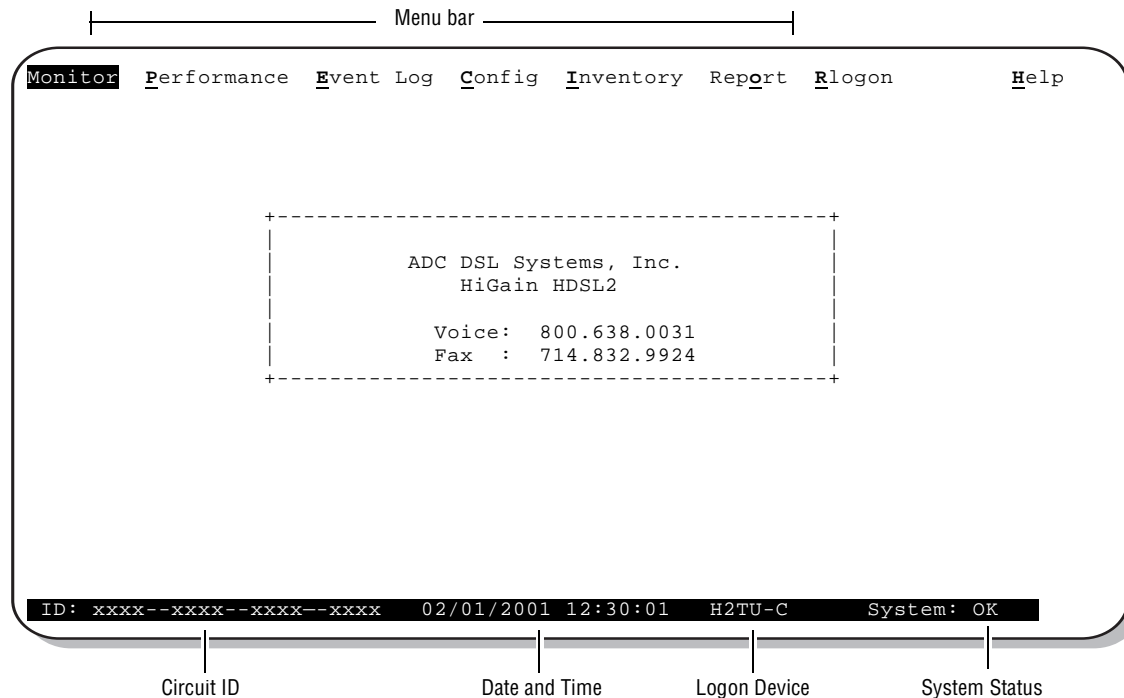


Figure 5. *Logon Screen*

Table 4. Logon Screen Menus

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

PROVISIONING TASKS

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

- 1 Set the date and time (see "[Setting Date and Time](#)" on page 12).
- 2 Set the circuit ID number (see "[Setting Circuit ID Numbers](#)" on page 13).
- 3 Make any necessary changes to configuration (see "[Configuring the System](#)" on page 14).
- 4 Clear history, alarm, and event log screens to remove miscellaneous data during startup (See "[Clearing the History, Alarm, and Event Log Screens](#)" on page 25.)

Setting Date and Time



Figure 6. Configuration Menu - Date and Time

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **D**ate and **T**ime, 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 screen provides product information on all units in the system and allows setting of the circuit and unit identification numbers.

```

Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon  Help
-----
Product Information
Unit      : H2TU-C          H2TU-R
Product  : H2TU-C-202     H2TU-R-402
List     : 3E             5E
Sw Ver.  : 2.12           2.12
Build #  : 20             20
Checksum : 0xCE32         0xCE32
H2 Xcvr  : L1-RA2 1.31    L1-RA2 1.31
Serial # : 01232456789    0123456789
CLEI    : VACJDKCEAA      VARHJU8GAA
Mfg. Date: 11/05/00      11/05/00

-----
Circuit and Unit Identifications
-----
Circuit ID : xxxx--xxxx--xxxx--xxxx
H2TU-R ID  : xxxx--xxxx--xxxx--xxxx

Circuit Notes:

ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK

```

Figure 7. Inventory Screen

- 1 Press **I** to select the Inventory screen.
- 2 Type the Circuit ID number, then press **ENTER**.
- 3 Type the ID numbers of all other devices listed in the system, pressing **ENTER** after each entry.

Configuring the System

The Config menu (Figure 8) allows you to make the following types of system configuration changes:

- Standard options (Figure 9 on page 15)
- ADC options (Figure 10 on page 15)
- Date and time (see “Setting Date and Time” on page 12)
- Master clear (see “Clearing the History, Alarm, and Event Log Screens” on page 25)
- Reset to factory default configuration (Figure 11 on page 25)



Figure 8. Config Menu

Making Changes to Standard and ADC Options

Figure 9 and Figure 10 on page 15 show the Standard and ADC configuration options. Standard options are those supported by HiGain HDSL2 units when connected to units from other vendors. ADC options are an extended set of options that are only available when using HiGain HDSL2 units exclusively. For a description of each option and a list of possible option settings, refer to Table 5 on page 16 and Table 6 on page 17.

To make changes to these options:

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **Standard Options** or **ADC Options**, then press **ENTER**.
- 3 Use the arrow keys to select an option.
- 4 Press the **SPACEBAR** to cycle through the available settings for that option.

- 5 Press **ENTER** to activate your choice.

```

Monitor Performance Event Log Config Inventory Report Rlogon Help
+-----+
| Standard Options -> |
+-----+
| Loopback Timeout (LBTO)                : 120 min
| Loop Attenuation Threshold (LATT) [0-40]: 32 dB
| Margin Threshold (MARG)                 [0-15]: 5 dB
| DS1 Frame Formatting (FRMG)             : AUTO
| DS1 Line coding (DSL)                   : B8ZS
| H2TU-C Equalization (EQL)                : EXT
| H2TU-R Line Buildout (RLBO)              : -7.5 dB
| Alarm Pattern (ALMP)                     : AIS
| H2TU-R TLOS Loopback (TLOS)              : DIS
| Network Loopback Pattern (NLBP)         : AIS
+-----+

Use <Spacebar> to cycle through option settings and <Enter> to activate
ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK

```

Figure 9. Config Screen – Standard Options (defaults shown)

```

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

Use <Spacebar> to cycle through option settings and <Enter> to activate
ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK

```

Figure 10. Config Screen – ADC Options (Defaults Shown)

Table 5 describes the standard Config screen options. Table 6 on page 17 describes the ADC Config screen options. Selections in bold type are the factory default settings.

Table 5. H2TU-C-202 List 3E Standard Config Screen Options

Standard Config Screen Options	Selection	Description
Loopback Timeout ^(a)	NONE	Disables automatic time-out cancellation of all loopbacks.
	120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
Loop Attenuation Threshold	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 HiGain maintenance screens.
	32 dB	Default value.
Margin Threshold	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 maintenance screens.
	5 dB	Default value.
DS1 Frame Formatting	AUTO	Configures the HiGain HDSL2 system to operate in an auto-framing (AUTO) mode. It detects and locks to both SF or ESF DS1 frame patterns. Line and path performance parameters are maintained and displayed. Unframed payloads will cause the ES-P and SES-P counters to increment.
	UNFR	Configures the same as AUTO except unframed payloads do not cause the ES-P and SES-P counters to increment.
DS1 Line Coding	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 ^(a) See "H2TU-C Equalization (EQL) Option." on page 19.	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.
H2TU-R Line Buildout	533	Sets the Equalizer to DSX-1 for 533 to 655 feet.
		Sets the DS1 receive level output toward the Customer Interface (CI). H2TU-R Line Buildout can only be set through the maintenance screens.
	0 dB	Sets the DS1 RLBO level toward the CI to 0 dB.
	-7.5 dB	Sets the DS1 RLBO level toward the CI to -7.5 dB.
Alarm Pattern See "Alarm Pattern (ALMP) Option." on page 19.	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 28 on page 44 .
	LOS	Enables the HiGain HDSL2 system to output an LOS condition at its DS1 ports for LOSW and DS1 LOS.
H2TU-R TLOS Loopback	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 28 on page 44 .
	DIS	Disables Transmit Loss of Signal (TLOS) logic loopback.
Network Loopback Pattern	AIS	Enables the H2TU-R to transmit an AIS towards CI for any network loopback. For priority resolution, see Figure 28 on page 44 .
	LOS	Enables the H2TU-R to transmit an LOS towards CI for any network loopback.

(a) This option is controlled through the DIP switch setting.

Table 6. H2TU-C-202 ADC Config Screen Options

ADC Config Screen Options	Selection	Description
Line Power Feed ^(a)	OFF	Disables powering to the HDSL2 pair.
	ON	Keeps the HDSL2 line voltage at nominal -185 Vdc.
Remote Provisioning	ENA	Enables remote provisioning.
	DIS	Disables remote provisioning.
Bipolar Violation Transparency See “Bipolar Violation Transparency (BPVT) Option” on page 19.	ENA	Enables BPVs and HDSL2 CRC errors at the DS1 input to be converted into DS1 BPVs at the DS1 output at the distant end. This makes HiGain HDSL2 transparent to BPVs.
	DIS	Disables BPV Transparency.
DS1 BER Threshold See “DS1 BER (DBER) Option” on page 19.	ENA	Enables the fixed 24-hour DS1 BER threshold.
	DIS	Prevents the generation of a system alarm due to DS1 BER.
HDSL2 BER Threshold See “HDSL2 BER Threshold (HBER) Option” on page 18 and “System Alarm Output Pins” on page 56.	1E-6	System alarm relay contact closes and the Status LED flashes red when the Block Error Rate exceeds 10^{-6} . (Block Error Rate is based on the definition of Bit Error Rate.)
	1E-7	System alarm relay contact closes and the Status LED flashes red when BER exceeds 10^{-7} .
	NONE	Prevents generation of a system alarm due to BER.
Special Loopback Mode	GNLB	Configures the HiGain HDSL2 system to respond to the generic inband loopback codes.
	A2LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Teltrend addressable repeater.
	A3LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom addressable repeater.
	A4LB	Configures the HiGain HDSL2 system to respond to the inband loopback codes of the Wescom Mod 1 addressable repeater.
SmartJack Loopback	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.
Minor Alarm	ENA	Enables the generation of the output alarm on pins 20 and 21 when a system alarm condition occurs.
	DIS	Disables the generation of the output alarm on pins 20 and 21 when a system alarm condition occurs.
Network AIS Pattern	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 28 on page 44 .
	AIS	When configured for AIS, an AIS pattern is sent to the network.

Continued

Table 6. H2TU-C-202 ADC Config Screen Options (Continued)

ADC Config Screen Options	Selection	Description
Performance Report Messaging	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/FOF 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.
SF-RAI to SF-RAI-CI towards NET See “SF-RAI to SF-RAI-CI toward NET (RACI) Option” on page 23.	ENA	Allows DS1 SF-RAI (yellow LED) signal received by the H2TU-R to be converted to an SF-RAI-CI signal towards the network.
	DIS	Prevents conversion of the DS1 SF-RAI to SF RAI-CI. It does not prevent SF RAI-CI to ESF RAI-CI from occurring when FCON is active.
ESF-RAI to SF-RAI Overwrite See “ESF RAI to SF RAI Overwrite (ROVR) Option” on page 23.	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.	OFF	Framing determined by the DS1 frame formatting option.
	ACON	Auto (ACON) detection of framing and potential frame conversion at the remote.
	FCON	Auto detection of framing and forced frame format conversion (FCON) at the H2TU-R.
Fractional T1 Mode ^(a) See “Fractional T1 Mode (FT1) Option” on page 22.	ENA	Enables system response to DDS latching loopback commands for fractional T1 applications, CP disconnect, and trouble indication. For priority resolution, see Figure 28 on page 44 .
	DIS	Disables system response to DDS latching loopback commands for fractional T1 applications, CP disconnect, and trouble indication.

(a) This option is controlled through the DIP switch setting.

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

- HBER option = 1E-6. Alarm is generated if CRC > 93
- HBER option = 1E-7. Alarm is generated if CRC > 9

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

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

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

Bipolar Violation Transparency (BPVT) Option. The H2TU-C-202 improves compatibility with Digital Loop Carrier (DLC) feeder applications because of its ability to transmit T1 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 T1 bits up to a maximum of 12000 ($BER=7.7 \times 10^{-3}$). This maximum rate is more than adequate since it exceeds the maximum 10^{-3} BER required by most DLC systems.

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

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

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

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

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

This option has the following settings:

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

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

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

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

- **FCON:** This is the forced conversion setting. [Table 8](#) lists the HiGain HDSL2 responses to both the ACON and FCON settings for the CONV option. The responses are identical, except in cases 3 and 4. In these cases, the FCON reply is attempting to force the network (or the far-end PM-NIU) to send ESF. It also alerts the CPE with an AIS alarm pattern while forcing the ESF to the network. Continuity is maintained as for ACON. [Table 9 on page 21](#) below 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	FCON Option
			NET > CPE NET < CPE	NET > CPE NET < CPE
1	ESF	SF	ESF → SF ESF ← SF	ESF → SF ESF ← SF
2	ESF	ESF	ESF → ESF ESF ← ESF	ESF → ESF ESF ← ESF
3	SF	ESF	SF → SF ESF ← ESF	SF → AIS ESF ← ESF
4	SF	SF	SF → SF SF ← SF	SF → AIS ESF ← SF

Table 9. *Extended SuperFrame Format*

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

Table 10. *SuperFrame Format*

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

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

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

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

Table 11. DDS NI and DS0 DP Latching Loopback Sequence

Enable Sequence	Minimum Number of Bytes	Byte Name	Network Code
1	35	Transition in Progress (TIP)	S0111010
2A	35	NI Loop Select Code (LSC)	S1000001
2B	35	DS0 DP Loop Select Code (LSC)	S0000101
3	100	Loopback Enable Code (LBE)	S1010110
4	35	All Ones	S1111111
5	100	LBE	S1010110
6	32	Far End Voice (FEV)	S1011010
Disable/Loopdown	35	TIP	S0111010

The sequences in [Table 11](#) above are sent in timeslot 1. The S in the Network Code column is a “don’t care” bit. The loopback is activated after the detection of Sequence 6. Upon completion of the enable sequence, the Test Center continues to transmit FEV bytes in multiples of 20 until FEV confirmation bytes are returned or until about 2 seconds have elapsed. If the confirmation bytes are not received, a failed attempt is reported. Anticipate the minimum number of bytes when the loopback code is transmitted by a preprogrammed machine test pattern generator. These minimum number of bytes will most likely be exceeded when the codes are sent manually. Also, manual testing may inject random data signals between valid control sequences. The detection algorithm ignores these occurrences and only responds to valid control codes.

[Table 12](#) lists the relationship between the latching loopback sequences and the specific HiGain HDSL2 loopback they initiate.

Table 12. HiGain HDSL2 Loopback vs. Latching Sequence

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

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

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

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

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

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

The unframed AIS pattern that is normally sent towards the network for a CILOS fault condition must be replaced by the new patterns listed in Table 13 on page 23 when the FT1 loopback option is selected.

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

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

(a) "Don't care" bit

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.

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

RAI-CI is transmitted toward the network when these two conditions are simultaneously true at the point from which RAI-CI is 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.

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

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

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

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



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

Resetting the H2TU-C



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 to its original factory defaults:

- 1 Press **C** to select the Config menu.
- 2 Use the **↑** and **↓** arrow keys to select **Set Factory Defaults**, then press **ENTER**.
- 3 Press **Y** if you are certain you want to reset the H2TU-C, or press **N** to cancel this action.

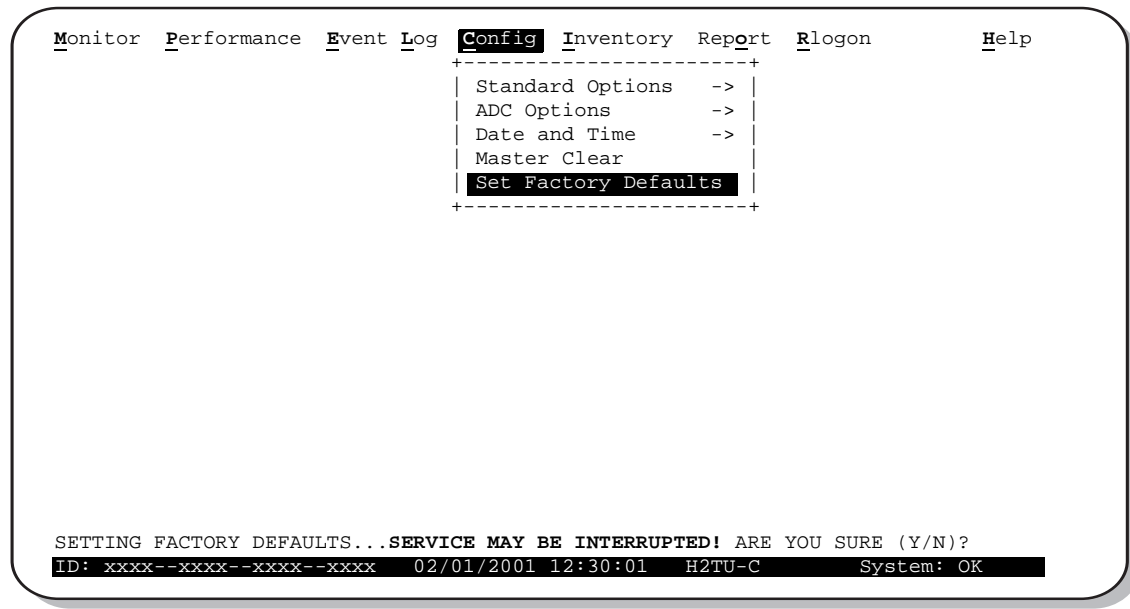


Figure 11. Config Menu - Set Factory Defaults

Clearing the History, Alarm, and Event Log Screens

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

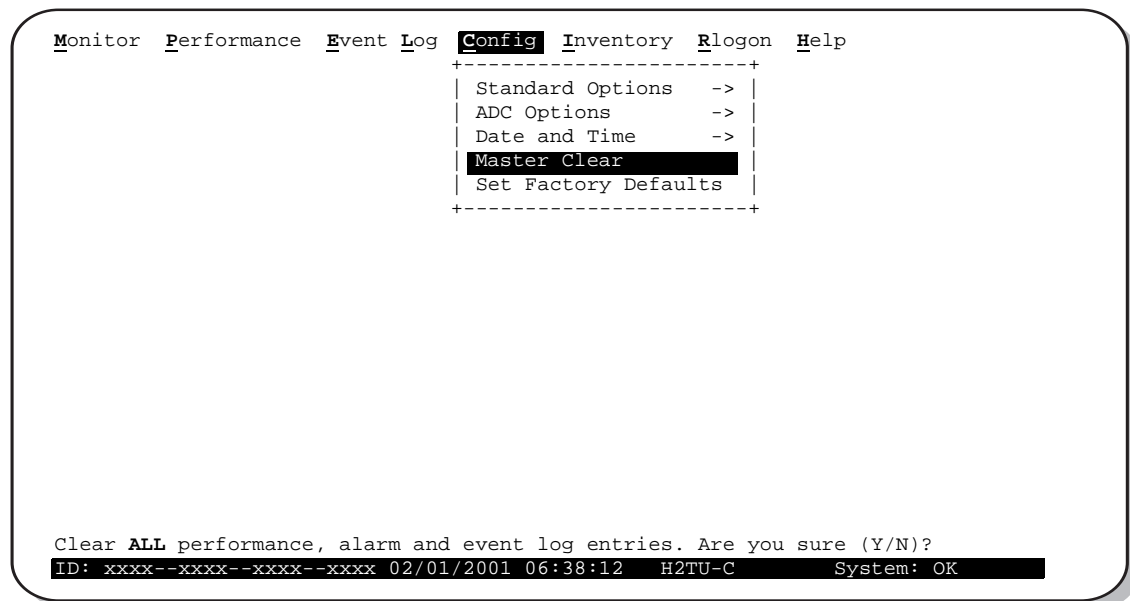


Figure 12. Config Menu - Master Clear

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

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

- 1 Press **P** to select the Performance screen.
- 2 Press the **SPACEBAR** to select either interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2** or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25 Hour History**, **48 Hour History**, or **31 Day History**) and press **ENTER** after your selection.
 - Selecting **31 Day History** allows you to clear the Current, 25 Hour, 48 Hour, and 31 Day performance history screens for the selected interface.
 - Selecting **Alarm History** allows you to clear the alarm history screen for the selected interface. For information about the DS1 and HDSL2 Alarm screens, see [Table 17 on page 37](#).
- 4 Press **L** to clear the screen.

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

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

MONITORING SYSTEM ACTIVITY AND PERFORMANCE

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

- The Monitor screens provide a graphical representation of circuit activity and allow initiation of loopbacks.
- The Performance screens provide current, 25-hour, 48-hour, and 31-day performance histories and a continuous alarm history.
- The Event Log screen provides a description of the 100 most recent events which includes their origin, time and date of occurrence, and message.

USING THE MONITOR SCREEN TO VIEW SYSTEM ACTIVITY

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

Figure 13 shows an armed circuit with an active loopback and alarms. Terms used on the system diagram are defined in the onscreen Help menu glossary. Abnormal situations are highlighted on the diagram. See Table 14 on page 28 for screen field descriptions.

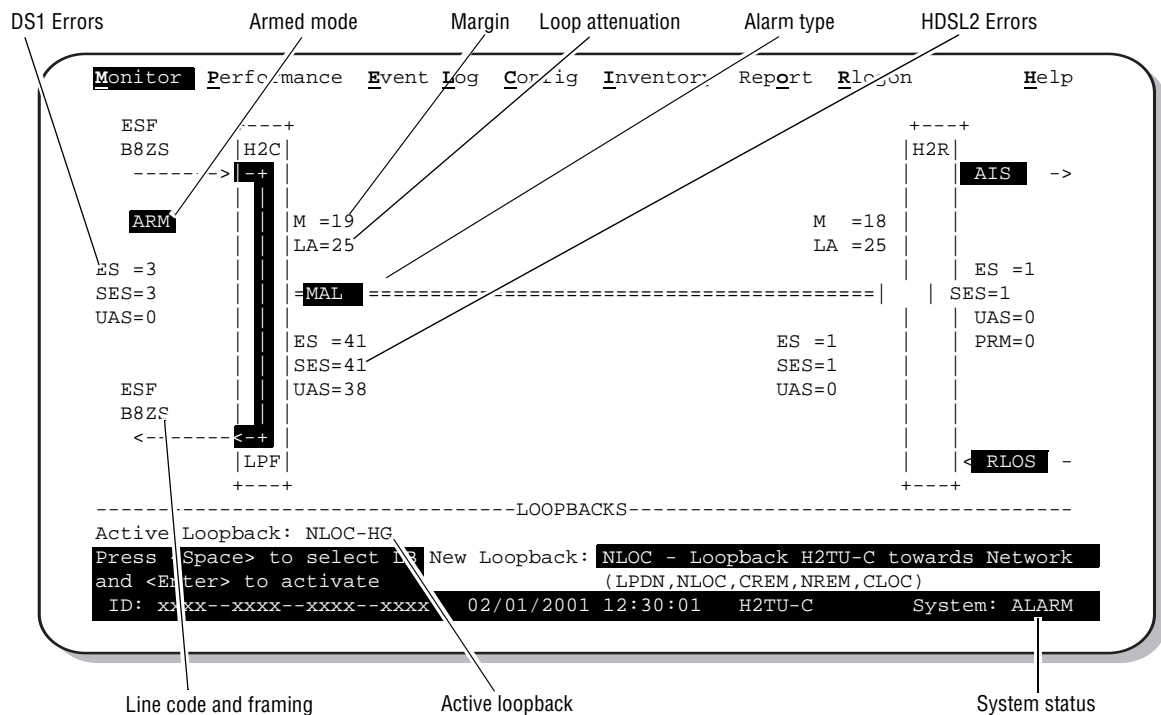


Figure 13. Monitor Screen - Active Loopback with Alarms

- 2 To initiate a loopback, press the **SPACEBAR** to cycle through the loopback choices. Press **ENTER** to make your choice.
- 3 When prompted with the message: *Are you sure (Y/N)?*, press **Y** to initiate the loopback or **N** to cancel. For more information about loopbacks and troubleshooting, see “Testing” on page 43.
- 4 To initiate a loopdown of all active loopbacks, press the **SPACEBAR** to select **LPDN**, then press **ENTER**.
- 5 When prompted with the message: *Are you sure (Y/N)?*, press **Y** to initiate the loopdown or **N** to cancel.

Table 14. Monitor Screen Descriptions

Field	Description
Active Loopback	An active loopback is indicated on the lower third of the Monitor screen. Available loopbacks are indicated by gray text. See Table 22 on page 46 for a summary of the HiGain HDSL2 loopback codes and activation methods.
Alarm Type	Indicates type of alarm.
Armed Mode	Indicates system is in an armed state and ready for loopback commands.
Code Type	Type of DS1 line coding used (B8ZS or AMI).
DS1 ES Count	Errored Seconds—The sum of the Errored Seconds-Line (ES-L) and Errored Seconds-Path (ES-P) counts detected on the DS1 input over a 24-hour period. Errors included are: DS1 Frame errors, BPV, and ESF CRC errors.
DS1 SES Count	Severely Errored Seconds—The sum of the DS1 Severely Errored Seconds-Line (SES-L) and Severely Errored Seconds-Path (SES-P) counts over the last 24 hours.
DS1 UAS Count	Unavailable Errored Seconds—The number of seconds during which the DS1 input signal was absent over a 24-hour period.
Frame Type	Type of DS1 framing used on the input stream (SF, ESF or UNFR).
HDSL2 ES Count	Errored Seconds—The number of 1-second intervals that contained at least one CRC or LOSW error. This value is a running total of the last 24 Hours.
HDSL2 SES Count	Severely Errored Seconds—The number of 1-second intervals that contain at least 50 CRC errors or one or more LOSW defects. (An LOSW defect occurs when at least three consecutive HDSL frames contain one or more frame bit errors.) This value is a running total of the last 24 hours.
HDSL2 UAS Count	Unavailable Errored Seconds—The number of seconds the HDSL2 loop is unavailable. This occurs after 10 contiguous HDSL SES and is retired after 10 contiguous non-SES seconds. This value is a running total of the last 24 hours.
ID	Circuit identification (ID) number.
LA	Loop Attenuation—Indicates the attenuation of the Overlapped Pulse Amplitude Modulation Transmission with Interlocking Spectra (OPTIS) pulse from the distant end. The value is related to the 196 kHz loss of the cable pair. The loop attenuation is a more direct indication of the loop attenuation to the OPTIS signal than is the 196 kHz loss. The normal HiGain HDSL2 LA operation range is from 0 to 40 dB.
LPF	Line Power Feed—Indicates the HDSL2 line power is on.
M	Margin—The signal-to-noise ratio at all HDSL2 ports, relative to a 10 ⁻⁷ Bit Error Rate.
MAL	margin Alarm—Indicates the margin on HDSL2 loop has dropped below the threshold (0 to 15db) as set by the operator.
HG (or PL)	HG displays when the loopback is initiated from a HiGain (HG) front panel or by a HiGain HDSL2 maintenance terminal loopback command. PL displays when the loopback is initiated by a command embedded in the DS1 data path payload (PL).
PRM	The sum of the Performance Report Messaging-Near End (PRM-NE) and Performance Report Messaging-Far End (PRM-FE) counts.
System Status	The presence or absence of an alarm condition is indicated on the lower right corner of all screens. System: OK indicates that there are no alarms present. System: Alarm indicates the presence of an alarm. Refer to “Using the Performance Screens to View Alarm Data” on page 35.

USING THE PERFORMANCE SCREENS TO VIEW PERFORMANCE DATA

The Performance screens display:

- CRC statistics for the HDSL2 or DS1 interface in 31-day, 48-hour, 25-hour and current history reports.
- Alarm statistics for DS1 interfaces (Figure 23 on page 36 and Figure 24 on page 36) or the HDSL2 (Figure 25 on page 38) on a continuous basis.

To access the Performance history screens:

- 1 Press **P** to select the Performance screen.
- 2 Press the **SPACEBAR** to select either interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press the **SPACEBAR** to select the type of statistics (**Current**, **Alarm History**, **25 Hour History**, **48 Hour History**, or **31 Day History**), then press **ENTER**.

Performance History at the DS1 Interface

Figure 14 below and Figure 15 on page 30 are examples of the H2TU-R 31-day and H2TU-C 25-hour history DS1 performance screens, respectively, as viewed from the line unit. In addition, there are 48-hour, 25-hour, and current statistic screens for the DS1 interface for the H2TU-R, as well as for the H2TU-C. Table 15 on page 31 describes the acronyms used in the performance history screens.

Monitor	Performance	Event Log	Config	Inventory	Report	Rlogon	Help			
H2TU-R DS1 31 Day History (Page 1 of 3)										
Date	CV-L	ES-L	SES-L	UAS-L	PDVS-L	ES-P	SES-P	UAS-P	PRM-NE	PRM-FE
01/21	-	-	-	-	-	-	-	-	-	-
01/22	-	-	-	-	-	-	-	-	-	-
01/23	-	-	-	-	-	-	-	-	-	-
01/24	-	-	-	-	-	-	-	-	-	-
01/25	-	-	-	-	-	-	-	-	-	-
01/26	-	-	-	-	-	-	-	-	-	-
01/27	-	-	-	-	-	-	-	-	-	-
01/28	-	-	-	-	-	-	-	-	-	-
01/29	-	-	-	-	-	-	-	-	-	-
01/30	-	-	-	-	-	-	-	-	-	-
01/31	14	10	10	12	10	10	0	0	0	0
02/01	0	0	0	2	0	0	0	0	0	0
Press: (N)ext Page, (P)revious Page, C(l)ear History										
Use <Space> to cycle through choices and <Enter> to view				Interface : H2TU-R DS1 Statistics : 31 Day History						
ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK										

Figure 14. H2TU-R DS1 31-day Performance History

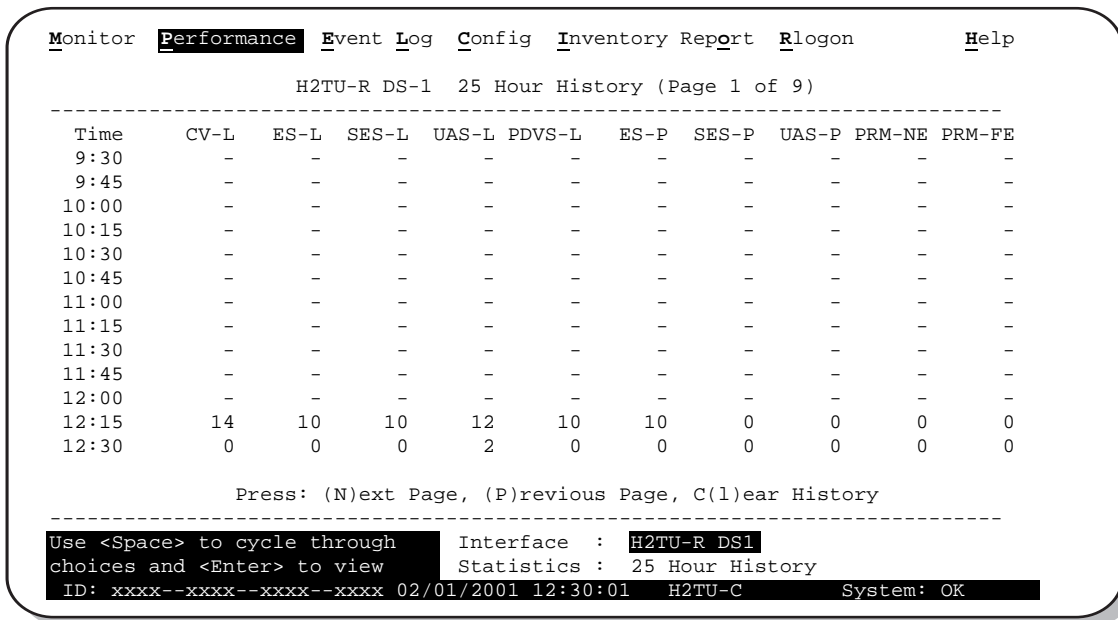


Figure 15. H2TU-C DS1 25-hour Performance History

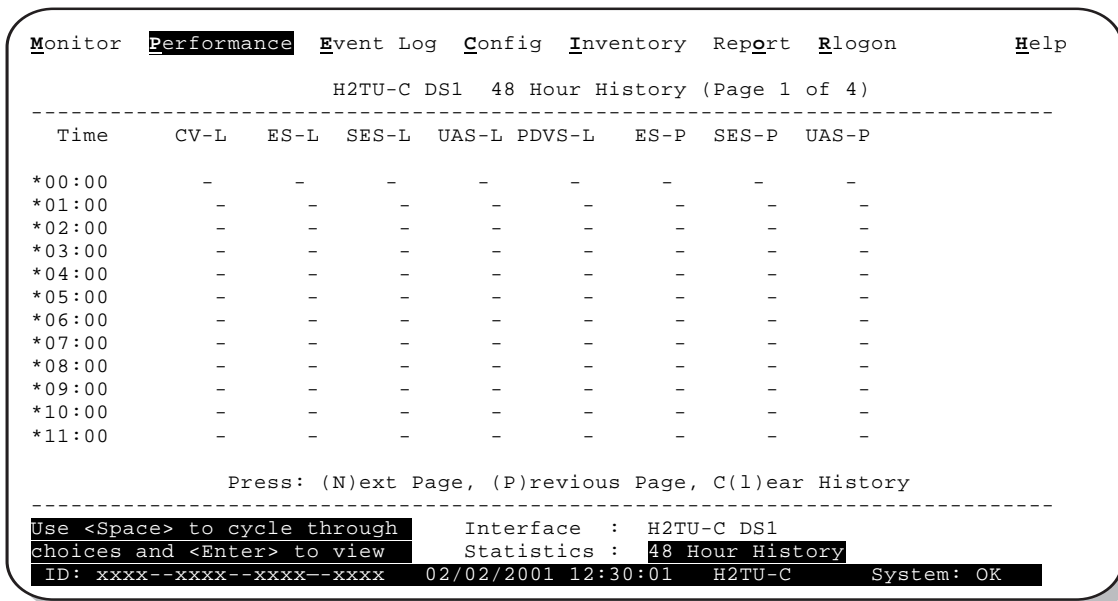


Figure 16. H2TU-C DS1 48-Hour Performance History

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

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

(a) Only displays on H2TU-R Performance History screens.

(b) Displays on the DS1 Current Statistics screens.

(c) Severely Errored Frame—Two or more frame bit errors occurring in a 0.75 ms interval for SF or a 3 ms interval for ESF.

(d) FE is a frame bit error.

Performance History at the HDSL2 Interface

Figure 17 is an example of a 31-day HDSL2 performance screen as viewed from the H2TU-C. The HDSL2 interface has 31-day, 48-hour, 25-hour, and current statistic screens for the H2TU-C. Table 16 on page 33 describes the acronyms used in the performance history screens.

```

Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon      Help
-----
                H2TU-C HDSL2 31 Day History (Page 1 of 3)
-----
  Date      CV      ES      SES      UAS      LOSWS
-----
  01/20     -      -      -      -      -
  01/21     -      -      -      -      -
  01/22     -      -      -      -      -
  01/23     -      -      -      -      -
  01/24     -      -      -      -      -
  01/25     -      -      -      -      -
  01/26     -      -      -      -      -
  01/27     -      -      -      -      -
  01/28     -      -      -      -      -
  01/29     -      -      -      -      -
  01/31     -      -      -      -      -
  02/01     14     10     10     14     10

                Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through      Interface : H2TU-C HDSL2
choices and <Enter> to view      Statistics : 31 Day History
ID: xxxx--xxxx--xxxx--xxxx      02/01/2001 12:30:01 H2TU-C      System: OK
    
```

Figure 17. H2TU-C HDSL2 31-day Performance History

```

Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon      Help
-----
                H2TU-C HDSL2 48 Hour History (Page 1 of 4)
-----
  Time      CV      ES      SES      UAS      LOSWS
-----
  *00:00    -      -      -      -      -
  *01:00    -      -      -      -      -
  *02:00    -      -      -      -      -
  *03:00    -      -      -      -      -
  *04:00    -      -      -      -      -
  *05:00    -      -      -      -      -
  *06:00    -      -      -      -      -
  *07:00    -      -      -      -      -
  *08:00    -      -      -      -      -
  *09:00    -      -      -      -      -
  *10:00    -      -      -      -      -
  *11:00    -      -      -      -      -

                Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through      Interface : H2TU-C HDSL2
choices and <Enter> to view      Statistics : 48 Hour History
ID: xxxx--xxxx--xxxx--xxxx      02/01/2001 12:30:01 H2TU-C      System: OK
    
```

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


```

Monitor Performance Event Log Config Inventory Report Rlogon Help
                H2TU-C HDSL2 25 Hour History (Page 1 of 9)
-----
Time      CV      ES      SES      UAS      LOSWS
*22:15    -      -      -      -      -
*22:30    -      -      -      -      -
*22:45    -      -      -      -      -
*23:00    -      -      -      -      -
23:15     -      -      -      -      -
23:30     -      -      -      -      -
23:45     -      -      -      -      -
00:00     -      -      -      -      -
00:15     -      -      -      -      -
00:30     -      -      -      -      -
00:45     -      -      -      -      -
01:00     -      -      -      -      -
-----
Press: (N)ext Page, (P)revious Page, C(l)ear History
-----
Use <Space> to cycle through choices and <Enter> to view
Interface : H2TU-C HDSL2
Statistics : 25 Hour History
ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK

```

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

Table 16. Error Acronyms Used in the HDSL2 Performance History Screens

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

Current Statistics Screens for the DS1 Interface

Examples of current statistics screens are shown below. [Figure 20](#) and [Figure 21](#) show statistics for the DS1 interface at the remote unit and line unit, respectively. These screens report 1-day, 1-hour, and 15-minute statistics. Refer to [Table 15 on page 31](#) for descriptions of the kinds of errors reported on these screens.

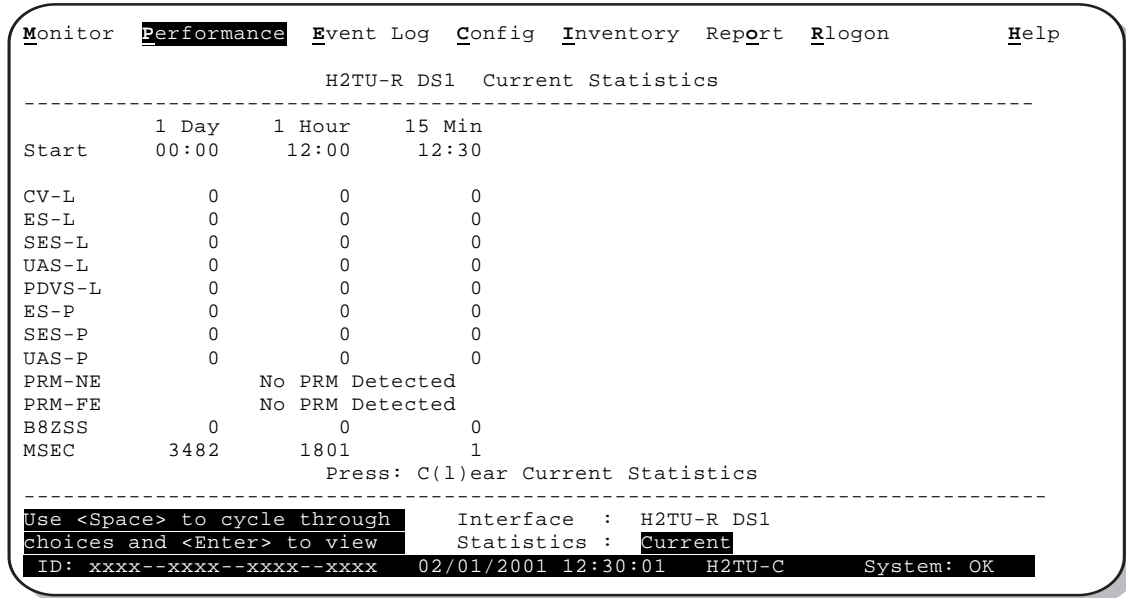


Figure 20. H2TU-R DS1 Current Statistics

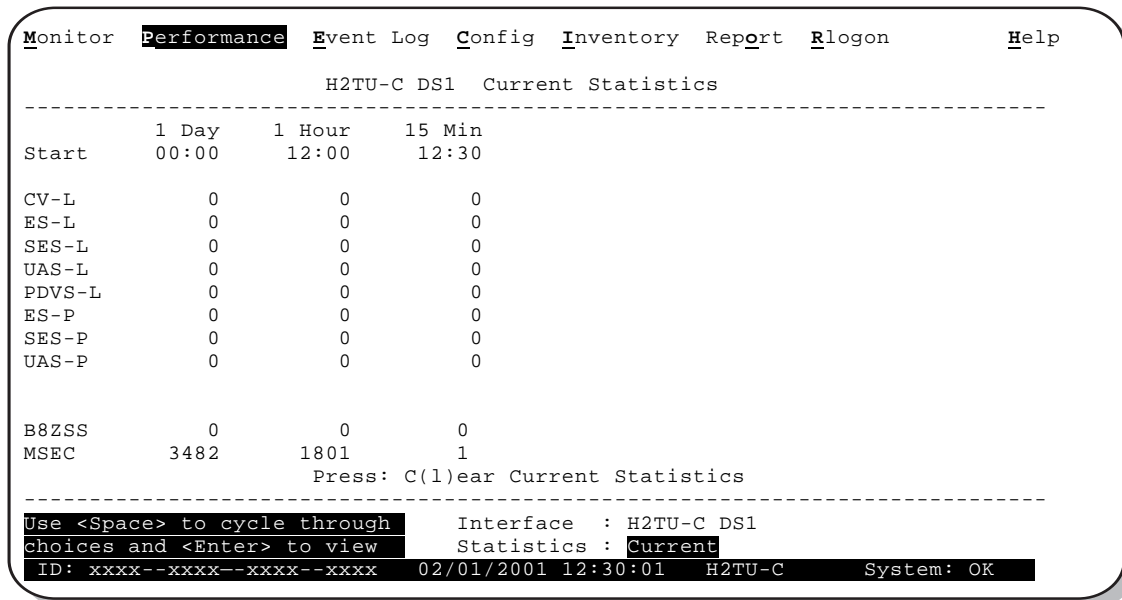


Figure 21. H2TU-C DS1 Current Statistics

Current Statistics for HDSL2 Interface

Figure 22 shows statistics for the HDSL2 interface at the H2TU-C. This screen reports 1-day, 1-hour, and 15-minute statistics. Refer to Table 15 on page 31 for descriptions of the kinds of errors reported on this screen.

```

Monitor  Performance  Event Log  Config  Inventory  Report  Rlogon  Help
-----
                H2TU-R DS1  Current Statistics
-----
Start      1 Day      1 Hour      15 Min
          00:00      12:00      12:30
CV-L           0           0           0
ES-L           0           0           0
SES-L          0           0           0
UAS-L          0           0           0
PDVS-L         0           0           0
ES-P           0           0           0
SES-P          0           0           0
UAS-P          0           0           0
PRM-NE                No PRM Detected
PRM-FE                No PRM Detected
B8ZSS          0           0           0
MSEC          3482        1801         1
                Press: C(1)ear Current Statistics
-----
Use <Space> to cycle through  Interface : H2TU-R DS1
choices and <Enter> to view  Statistics : Current
ID: xxxx--xxxx--xxxx--xxxx  02/01/2001 12:30:01  H2TU-C  System: OK

```

Figure 22. H2TU-C HDSL2 Current Statistics

USING THE PERFORMANCE SCREENS TO VIEW ALARM DATA

To access the alarm history screens:

- 1 Press **P** to select the Performance menu.
- 2 Press the **SPACEBAR** to select an interface (**H2TU-C DS1**, **H2TU-R DS1**, **H2TU-C HDSL2**, or **H2TU-R HDSL2**), then press **ENTER**.
- 3 Press the **SPACEBAR** until **Alarm History** is selected, then press **ENTER**.
- 4 Press **N** or **P** to page through the alarm history screens.
- 5 Press **L** to clear the selected alarm history screen.

Alarm History at the DS1 Interface

The Alarm History screen reports DS1 statistics for the H2TU-C (Figure 23) and the H2TU-R (Figure 24) on a continuous basis. The types of alarms reported are described in Table 17 on page 37. Current alarms are shown in reverse video.

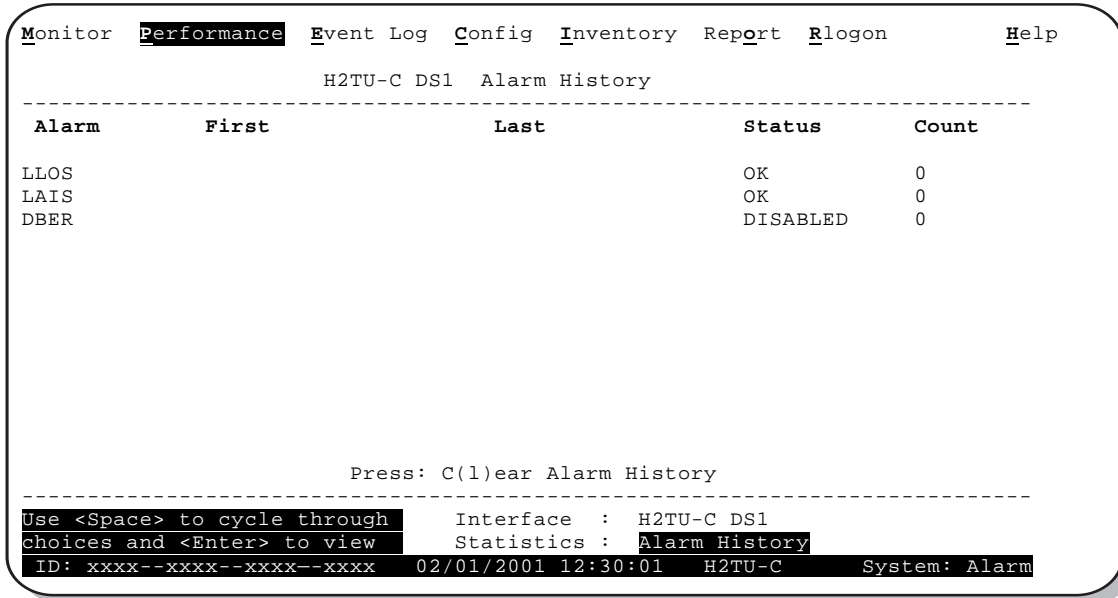


Figure 23. H2TU-C DS1 Alarm History Screen

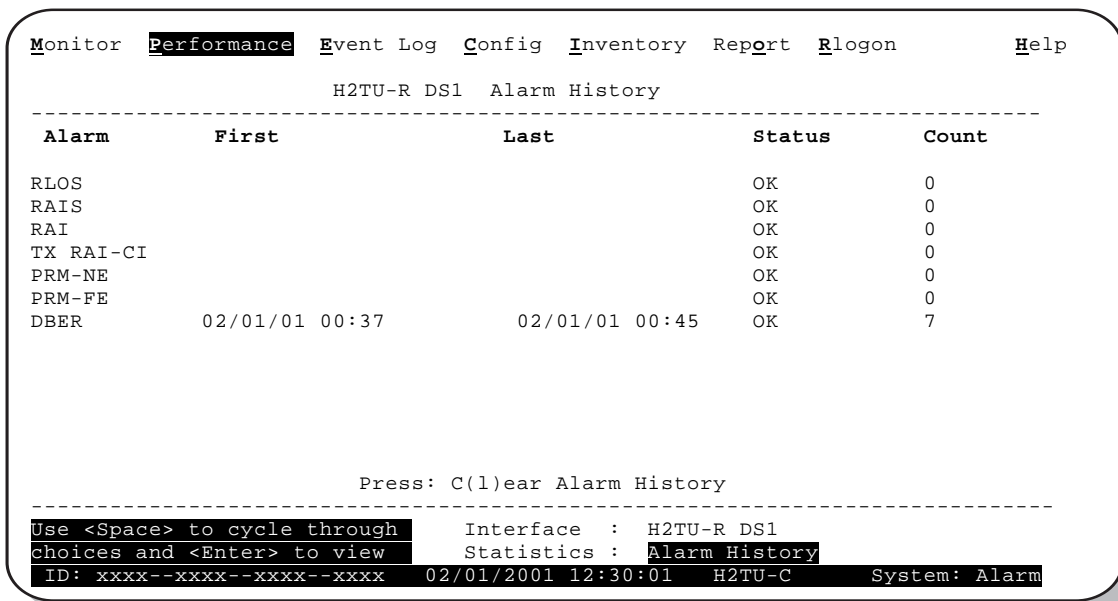


Figure 24. H2TU-R DS1 Alarm History Screen

Table 17. DS1 Alarm Descriptions

Screen Alarm	Description
H2TU-C DS1 ALARMS (see Figure 23 on page 36)	
LLOS ^(a)	Local Loss of Signal—Loss of the H2TU-C DSX-1 input signal.
LAIS	Line Alarm Indication Signal—Indicates an AIS (all ones) pattern is being received from the local DS1 input port. The ALMP option determines whether AIS (default) or LOS is sent towards the CPE.
DBER	Bit Error Rate—The DS1 BER has exceeded built-in 24-hour threshold limit of approximately 10^{-6} .
H2TU-R DS1 ALARMS (see footnote 24 on page 36)	
RLOS ^(a)	Remote Loss of Signal— Loss of the H2TU-R DS1 input signal.
RAIS	Remote Alarm Indication Signal—Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port. The AIS-CI ^(b) pattern is sent towards the network (see Figure 28 on page 44).
RAI	Remote RAI - Remote Alarm Indication at the H2TU-R—Indicates an RAI alarm (yellow LED) from the CPE with errors from the line unit or network.
TX RAI-CI	Transmit RAI-CI - Remote Alarm Indication at the H2TU-R—Upon reception of an RAI (yellow LED) from the CPE, the H2TU-R sends a RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or LOF), then the RAI is passed on to the network unaltered. This is applicable to SF or ESF framing. In an all SF environment, RACI must be enabled to convert SF RAI to SF RAI-CI.
PRM-NE	Performance Report Monitoring - Near End—The count of the PRM-NE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
PRM-FE	Performance Report Monitoring - Far End—The count of the PRM-FE register at the H2TU-R exceeds the 10^{-6} BER threshold at 648 events since 12:00:00 AM.
DBER	Bit Error Rate—The DS1 BER has exceeded the built-in 24-hour threshold limits of approximately 10^{-6} .
<p>(a) This is a DS1-specific alarm that also issues a minor alarm (sent to the management unit or the backplane), if enabled.</p> <p>(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.</p>	

Alarm History at the HDSL2 Interface

Figure 25 shows the H2TU-C HDSL2 alarm history, and Table 18 describes the alarms.

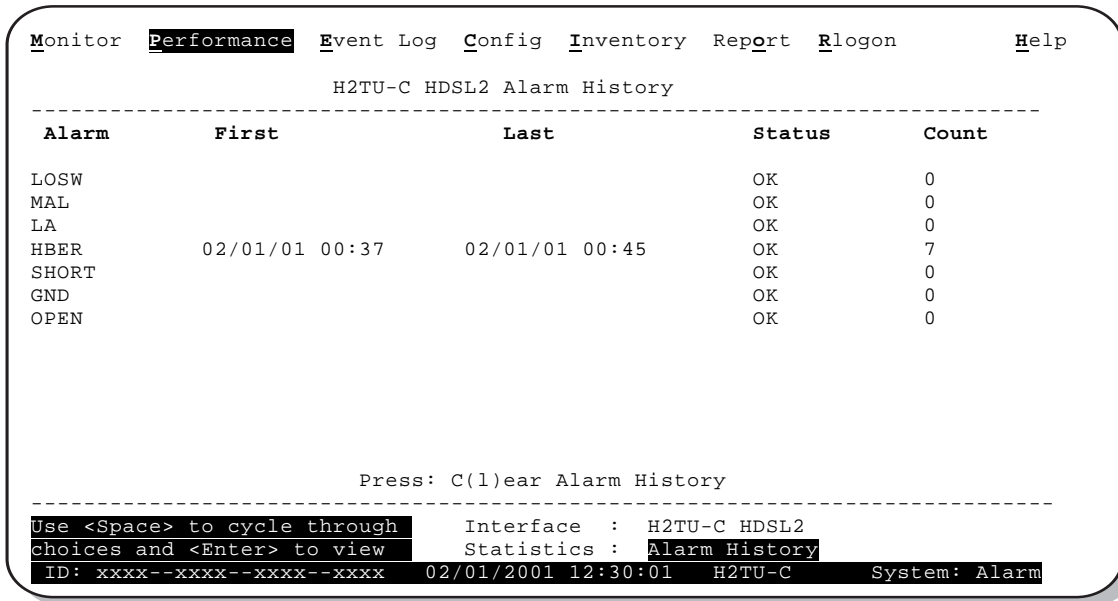


Figure 25. H2TU-C HDSL2 Alarm History Screen

Table 18. HDSL2 Alarm Descriptions

Screen Alarm	Description
LOSW	Loss of Sync Word—The HDSL2 loop has lost synchronization.
MAL	Margin—The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system.
LA	Loop Attenuation—The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold.
HBER	Block Error Rate—The HDSL2 BER has exceeded the set threshold limits of 10 ⁻⁶ or 10 ⁻⁷ .
SHORT ^(a)	Indicates a short between the Tip and Ring of the HDSL2 pair.
GND ^(a)	The HDSL2 loop is grounded.
OPEN ^(a)	Indicates a line power open condition.

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

USING THE EVENT LOG TO TRACK SYSTEM EVENTS

To view a running log of system events, press **E** to select the Event Log. The Event Log displays the date and time of the 100 most recent events (most recent displayed first) and provides a description of each event. See [Table 19 on page 40](#) for a complete list of event log messages.

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

System Event Log (Page 1 of 7)			
#	Origin	Date and Time	Entry
1	System	01/19/01 12:25:00	DS1 Alarm Register reset
2	System	01/20/01 12:25:00	HDSL2 Alarm Register Reset
3	System	01/21/01 12:25:00	DS1 Performance Register Reset
4	System	01/22/01 12:25:00	HDSL2 Performance Register Reset
5	System	01/23/01 00:13:32	Time set 12:25:00
6	System	01/24/01 00:13:27	Date set 02/01/01
7	H2TU-C	01/25/01 00:13:27	NLOC: Loop-down
8	H2TU-C	01/26/01 00:11:16	NLOC: Loop-up
9	H2TU-R	01/27/01 00:10:43	DS1 LOS Alarm: End
10	H2TU-R	01/28/01 00:10:30	DS1 LOS Alarm: Begin
11	System	01/29/01 00:04:11	DS1C: AUTO to AMI
12	H2TU-C	01/30/01 00:00:40	HDSL2 LOSW Alarm: End
13	H2TU-C	01/31/01 00:00:02	HDSL2 LOSW Alarm: Begin
14	- EMPTY -		
15	- EMPTY -		

Press: (N)ext Page, (P)revious Page, (T)op of Log, C(l)ear Log

ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK

Figure 26. System Event Log

Table 19. *Event Log Entry Messages List*

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

USING THE REPORT MENU

The Report menu provides screens containing status and performance monitoring data for line and remote units which can be downloaded to a file for analysis or future reference (see [Figure 27](#)). [Table 20 on page 42](#) describes the four types of line and remote unit reports provided by the Report menu.

To select each individual report, do the following:

- 1 Press **O** to select Report menu.
- 2 Press the **SPACEBAR** to select a report.
- 3 Use your terminal emulation software (HyperTerminal or Procomm) to capture the selected report to your printer or to a file. Press **ENTER** to generate.
- 4 End the captured report.
- 5 Press **CTRL + R** to refresh the Report menu screen.



```
Monitor Performance Event Log Config Inventory Report Rlogon Help
Report Type : Full Report
Please select report type by pressing <Space>, then start terminal logging
and press <Enter> to generate the report.
ID: xxxx--xxxx--xxxx--xxxx 02/01/2001 12:30:01 H2TU-C System: OK
```

Figure 27. Report Menu - Full Report

Table 20. Report Types

Type	Contains the following information:
Full Report	<ul style="list-style-type: none">• Circuit and unit identifications• Product information• System configuration• Current performance statistics• Alarm history• Performance history• System event log
Short Report	<ul style="list-style-type: none">• Product information• System configuration• Current performance statistics• Circuit and unit identification
System Information Report	<ul style="list-style-type: none">• Circuit and unit identifications• Product information• System configuration
Event Report	<ul style="list-style-type: none">• Circuit and unit identifications• Product information• System event log

TESTING

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

SYSTEM ALARMS

Table 21 provides a summary of the system alarms displayed on the H2TU-C-202 alarm history screens (see “Using the Performance Screens to View Alarm Data” on page 35).

Table 21. System Alarms Summary

Message on Screen	Alarm	Description	To Inhibit
SHRT ^(a)	Short	A short exists between the Tip and Ring of the HDSL2 pair.	Cannot be inhibited.
GND ^(a)	Ground	The HDSL2 loop is grounded.	Cannot be inhibited.
OPEN ^(a)	Open	A line power open condition exists.	Cannot be inhibited.
LOSW ^(a)	Loss of Sync Word	The HDSL2 loop has lost synchronization.	Cannot be inhibited.
LLOS ^(a)	Local Loss of Signal	Loss of the DSX-1 input signal.	Cannot be inhibited.
RLOS ^(a)	Remote Loss of Signal	Loss of the H2TU-R DS1 input signal.	Cannot be inhibited.
LAIS	Line Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received at the H2TU-C-DS1 input port.	Cannot be inhibited.
RAIS	Remote Alarm Indication Signal	Indicates an AIS (all ones) pattern is being received at the H2TU-R DS1 input port.	Cannot be inhibited.
RAI	Remote RAI—Remote Alarm Indication at the H2TU-R	Indicates an RAI alarm (yellow) from the CPE with errors from the line unit or network.	Cannot be inhibited.
TX RAI-CI	Transmit RAI-CI—Remote Alarm Indication at the H2TU-R	Upon reception of an RAI (yellow alarm) from the CPE, the H2TU-R sends RAI-CI towards the network if the network signal received at the H2TU-R is clear. If the network signal is impaired (LOS, AIS or LOF), then the RAI is passed on to the network unaltered.	Cannot be inhibited.
MAL ^(a)	Margin Alarm	The margin on the HDSL2 loop has dropped below the minimum threshold value set for the system.	Set the Margin Alarm Threshold option to 0 (zero).
LA ^(a)	Loop Attenuation	The attenuation on the HDSL2 loop has exceeded the maximum value set for the HDSL2 loop attenuation threshold.	Set the HDSL2 Loop Attenuation Threshold option to zero.
DBER	DS1 Bit Error Rate	The DS1 BER has exceeded the set threshold limits of approximately 10^{-6} .	Select DIS for the DBER system option.
HBER ^(a)	HDSL2 Block Error Rate	The HDSL2 BER has exceeded the set threshold limits of 10^{-6} or 10^{-7} .	Select NONE for the HBER system option.
PRM-FE	Performance Report Messaging - Far End	Indicates H2TU-R PRM-NE BER threshold is exceeded.	Set DBER threshold to DIS.
PRM-NE	Performance Report Messaging - Near End	Indicates H2TU-R PRM-NE BER threshold is exceeded.	Set DBER threshold to DIS.

(a) Only these alarms assert the System Alarm bus on pins 22 and 30 of the card-edge connector (when the ALM option is enabled).

Alarm Option for Digital Loop Carrier (DLC) Feed

To improve HiGain HDSL2 compatibility with the switch-to-protect features used in 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

Remote LOS and AIS Response

Figure 28 shows the different ways the H2TU-R can respond to the network, depending on the configuration of the TLOS, NLBP, FT1, ALMP, and NAIS configuration options described in Table 5 on page 16 and Table 6 on page 17. See Table 13 on page 23 for response of the H2TU-C and H2TU-R to LOS and AIS alarm conditions.

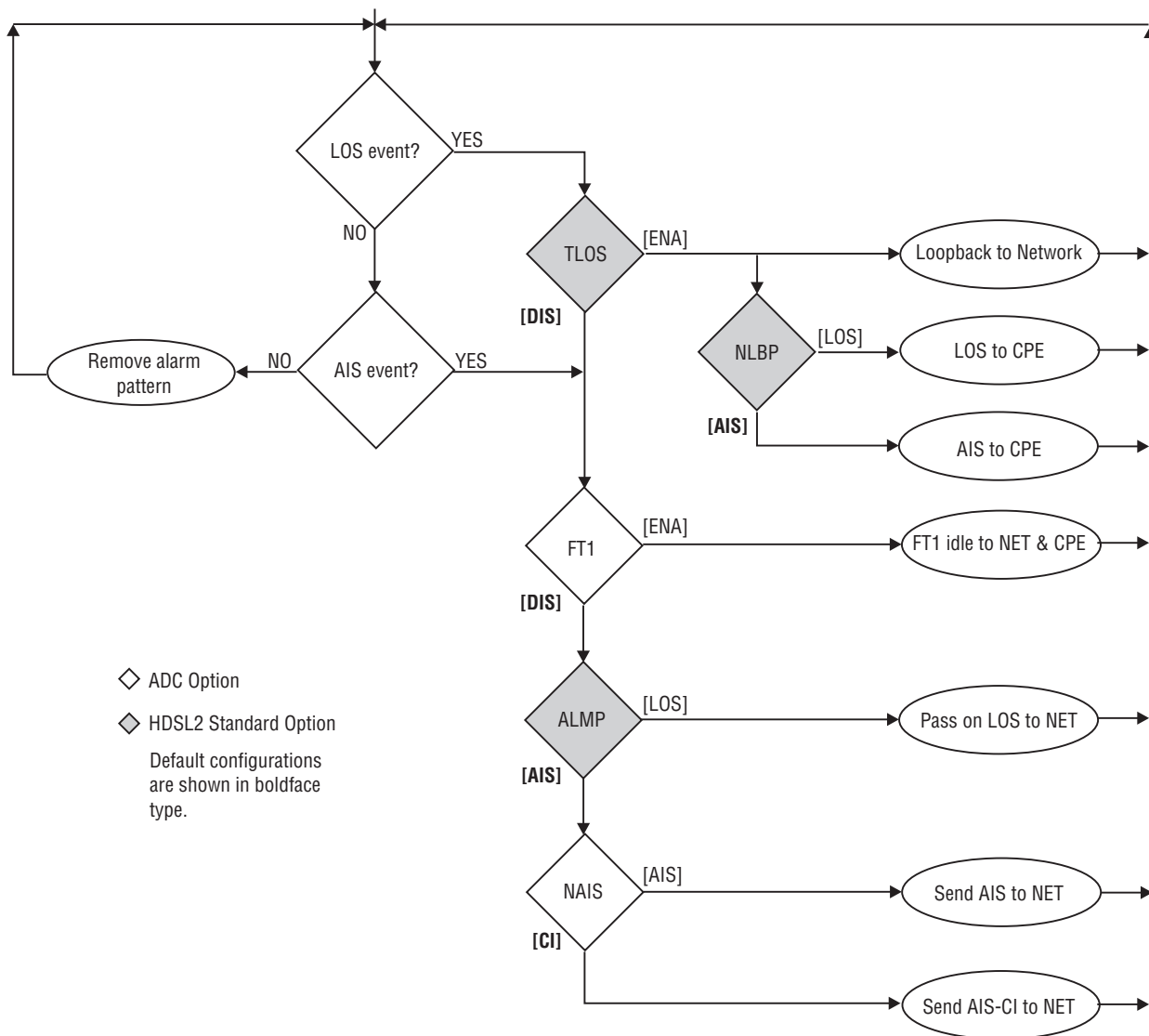


Figure 28. H2TU-R LOS and AIS Response Priorities

OCT55 TEST PATTERN WITH AMI LINE CODE

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

LOOPBACK OPERATION

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

- Generic Loopback (GNLB) options, including the SmartJack (SMJK) option (see [Table 22 on page 46](#))
- Special Loopback (SPLB) options (see “[Special Loopback Commands](#)” on page 46 and in the following command tables:
 - Addressable Repeater Loopback commands: A2LB (see [Step 23 on page 50](#))
 - Addressable Repeater Loopback commands: A3LB, A4LB ([Table 24 on page 52](#))
- SmartJack (SMJK) Loopback commands (see [Step 25 on page 52](#))

Loopback commands can be initiated by:

- Selecting the loopback type from the Monitor menu when connected to the craft port of the H2TU-C or H2TU-R
- Entering the loopback code into the test equipment connected to the H2TU-C or H2TU-R

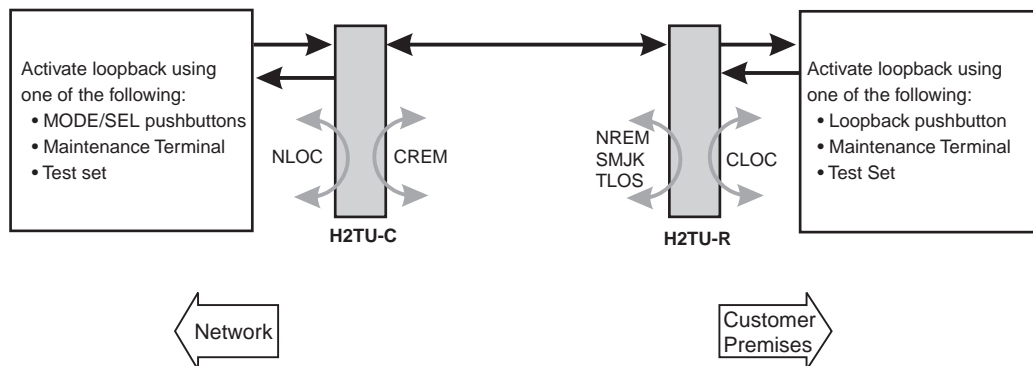


Figure 29. Loopback Summary



HiGain HDSL2 supports multiple loopbacks, but a single loopback is the preferred method.

Generic Loopback Commands

The HiGain HDSL2 Generic Loopback (GNLB) commands allow you to use inband codes to loop up either NLOC (4-in-7) or NREM (3-in-7) towards the network. In addition, these inband codes loop up CREM (6-in-7) or CLOC (5-in-7) towards the customer. Either loopup condition can be terminated (looped down) with the 3-in-5, SMJK loopdown code. All inband codes must be present for at least 5 seconds before the HiGain HDSL2 system responds. TLOS is a logic loopback caused by loss of the T1 input from the CI.

Figure 29 on page 45 summarizes the available loopbacks in the system, and Table 22 summarizes the HiGain HDSL2 generic loopback commands. See “GNLB Test Procedures” on page 48 for the test procedures that apply when using the GNLB mode.

Table 22. Summary of HiGain HDSL2 Generic Loopback Codes and Activation Methods

Loopback	Code	Description	Method of Activation	
			Test Set	Craft Port
NLOC	1111000 4-in-7	DSX-1 signal is looped back to the network at the H2TU-C.	X	X
NREM	1110000 3-in-7	DSX-1 signal is looped back to the network at the H2TU-R.	X	X
CLOC	1111100 5-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-R.	X	X
CREM	1111110 6-in-7	DS1 signal from the customer is looped back to the customer at the H2TU-C.	X	X

Special Loopback Commands

In addition to the GNLB loopback command mode, a HiGain HDSL2 system can be configured for one of three special loopback command modes. These are selected from the ADC Options in the maintenance terminal Config menu, ADC Options screen (see Table 6 on page 17). 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 23 on page 50 and Table 24 on page 52 for list of SPLB commands).

A2LB through A4LB are special, addressable, repeater loopback modes that are supported by the H2TU-C-202. These loopback modes provide the HiGain HDSL2 system with sophisticated maintenance and troubleshooting tools. A2LB is patterned after the Teltrend addressable T1 repeater loopbacks. A3LB and A4LB are patterned after the Wescom addressable T1 repeater loopbacks.

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

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

A2LB can be configured to do one of the following:

- Block the arming code (after 2 seconds) from exiting the H2TU-C into the network, and replace it with the AIS code.
- Unblock the AIS code by executing the Far End Activate code.

A3LB and A4LB test procedures are identical. The SMJK loopup and loopdown commands are controlled by the LPBK setting.

SmartJack Loopback Commands

The HiGain HDSL2 SmartJack (SMJK) Loopback (LPBK) commands allow you to use inband, out-of-band, and universal codes to initiate and terminate loopback testing of the HiGain HDSL2 circuit (see “[SmartJack Test Procedure](#)” on page 52 for additional information).

MANUAL LOOPBACK SESSION

A manual loopback session allows you to select any one of the HiGain HDSL2 loopbacks listed in [Table 22](#) on page 46.

Setting the Loopback Time-out Option

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

- 1 Using a maintenance terminal, open the Config menu, display the Standard Options screen, then set the Loopback Time-out parameter.
- 2 Select the desired setting:
 - NONE (time-out disabled)
 - 20 minutes
 - 60 minutes
 - 120 minutes (default setting)

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



SMJK loopback commands are only activated by inband commands.

LOOPBACK TEST PROCEDURES

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

General Troubleshooting Tips

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

- H2TU-C is making a positive connection with its shelf connector.
- H2TU-C internal equalizer is set to the correct distance range per [Table 6](#) on page 17. All equalizers should be set to the distance from the DSX-1 to the shelf.

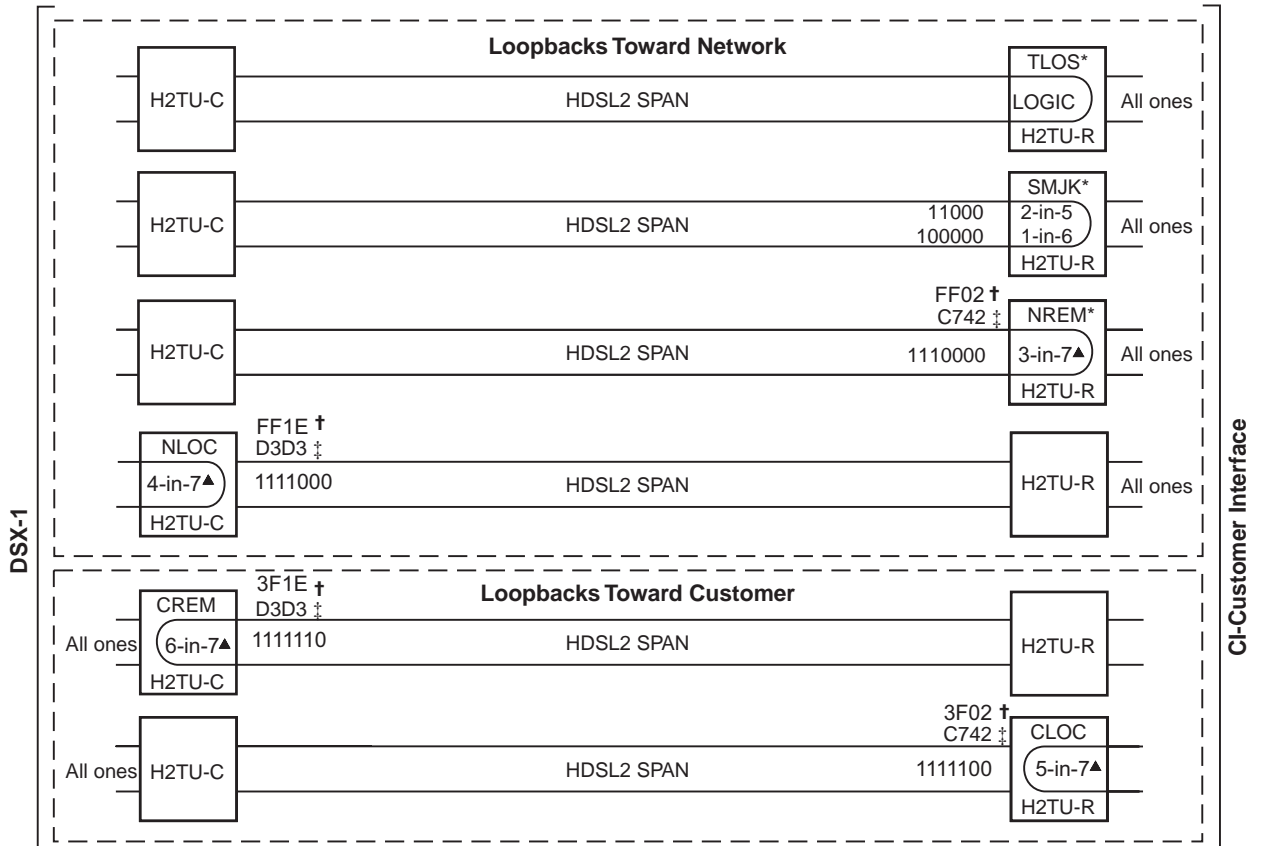
The transmit and receive DSX-1 ports have splitting access jacks and miniature 210-series, bridging jacks as shown in [Figure 2 on page 4](#). Connecting one cable between the two bridging jacks and another between the two LINE jacks splits the IN and OUT and creates metallic loopbacks towards both the DSX-1 and the H2TU-C-202. If separate plugs are inserted into both LINE jacks with the other end disconnected, the BRG jacks can be used to send and receive test patterns towards the DSX-1.

GNLB Test Procedures

[Figure 30](#) provides a graphical representation of the various loopback configurations with the associated GNLB commands shown. Also, refer to [Table 22 on page 46](#) for a description of these commands.

To perform the GNLB loopback test procedure:

- 1 Have the CO tester send the NREM (3-in-7) inband loopup code for 5 seconds. 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 signal returned (looped) 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 LBK LED on the front panel should be a steady yellow, and the loopback mode should also be identified on the Monitor screen.
- 5 Repeat Step 2. If the test passes, the problem is in the downstream direction. If it fails, the problem is in the upstream direction.



* Set the NLBP option to AIS to send AIS (indicated by an all ones pattern) for any network loopback.
 † A3LB and A4LB loopback codes.
 ‡ A2LB loopback codes.
 ▲ GNLB loopback codes.

Figure 30. Loopback Modes

A2LB Test Procedures

Using the codes listed in [Table 23](#), a network tester can activate NLOC or NREM loopbacks (or SMJK, if enabled). A tester at the customer premises can activate CLOC or CREM loopbacks.

Table 23. *Addressable Repeater Loopback Commands (A1LB, A2LB, A5LB)*

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

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

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

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

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

To perform the A2LB test procedures:

- 1 Send the inband Arming and NI LPBK code 11000 to the H2TU-C for at least 5 seconds.
- 2 Monitor the output of the H2TU-C for the return of the pattern. Return of the pattern indicates one of the following:
 - The H2TU-R has looped up (if the SMJK Loopback option is enabled).
 - An external NID has looped up (if the SMJK Loopback option is disabled), and the H2TU-C and H2TU-R have been armed.

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



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

- 4 Once armed, the H2TU-C can be looped back by sending Intelligent Office Repeater (IOR) LPBK activation code 1101-0011-1101-0011 (D3D3) for at least 5 seconds. You should observe the following activation response pattern in the order presented:
- a 2 seconds of AIS (all ones pattern)
 - b 2 seconds of returning data pattern
 - c Logic errors (including the frame bit) occurring in the returned pattern comprising:
 - 231 errors, if IOR LPBK (H2TU-C) was sent
 - 20 errors, if ILR-2 (H2TU-R) was sent
 - d Normal looped data

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



Some Intelligent Repeater (IR) test sets do not count frame errors as bit errors when the test pattern is framed and the H2TU-C-202 is set to the Auto framing mode. To improve compatibility with those test sets, the H2TU-C generates 231 (NLOC and CREM) ID bit errors. As a result, the H2TU-C may indicate one more or one less bit error, depending on the test set type and the number of frame bits contained in the block of errored bits. To avoid this uncertainty, ADC recommends sending unframed IR commands.

The H2TU-C is now in logic loopback if the IOR NLOC loopback command was sent. The Time-out Override command or a Loopdown command can override the selection made for the loopback time-out (see [“Setting the Loopback Time-out Option” on page 47](#)). 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 FDL code (FF24).



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

- 5 Once the test is complete, do one of the following:
- If the system is to loopdown but remain armed, send the IR 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 FDL code (FF24).



The Armed mode has an automatic time-out of 120 minutes but this timer is reset to 120 for 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 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 “[Setting the Loopback Time-out Option](#)” on page 47) 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 25](#) on page 52. The automatic time-out mode is restored during subsequent loopback sessions.

[Table 24](#) summarizes the codes required to execute Addressable 3 and 4 (A3LB and A4LB) repeater loopback commands that are identified in List 3E HDSL2 products. All code sequences must be present for at least 5 seconds. Information specific to HiGain HDSL2 regenerators is shown in bold.

Table 24. Addressable Repeater Loopback Commands (A3LB and A4LB)

Name	Description	Binary Code ^(a) (Hexadecimal Equivalent)
NLOC	H2TU-C loopup from NI	1111-1111-0001-1110 (FF1E)
CREM	H2TU-C loopup from CI	0011-1111-0001-1110 (3F1E)
NREM	H2TU-R loopup from NI	1111-1111-0000-0010 (FF02)
CLOC	H2TU-R loopup from CI	0011-1111-0000-0010 (3F02)

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

SmartJack Test Procedure

The HiGain H2TU-R supports the standard SmartJack loopback 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 any of the three SmartJack loopup commands listed in [Table 25](#). NREM, on the other hand, is initiated by the 3-in-7 inband command or by a command issued from the maintenance terminal.

The SmartJack loopback option, LPBK, enables or disables the ability of the H2TU-R to emulate the family of SmartJack loopback commands listed in [Table 25](#).

Table 25. SmartJack Loopup and Loopdown Commands

Inband 2-in-5 Loopup Code	Inband 3-in-5 Loopdown Code ^(a)	Out-of-Band ESF-FDL Loopup Codes	Out-of-Band ESF-FDL Loopdown Codes ^(a)	Inband 1-in-6 Loopup Code	Inband 1-in-3 Loopdown Code ^(a)
11000	11100	1111-1111-0100-1000	1111-1111-0010-0100	100000	100

(a) These universal loopdown codes can release any and all existing loopup states regardless of loopback direction or method of initiation. The codes are permanently enabled and independent of all loopback option settings, including the LPBK option.

APPENDIX A - SPECIFICATIONS

Power

Line Voltage	0, -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 54.)
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

HDSL2

Line Code	1.552 Mbps OPTIS
Transmission	Full duplex
Media	One non-loaded, copper, two-wire cable pair
Output	+16.8 dBm \pm 0.5 dB at 135 Ω (0-450 kHz) at CO side; +16.5 dBm \pm 0.5 dB at 135 Ω (0-350 kHz) at remote side
Line Impedance	135 Ω
Maximum Provisioning Loss	35 dB at 196 kHz
Start-up Time	30 sec. (typical), 1 min. (maximum) per span

DSX-1

DSX-1 Line Impedance	100 Ω
Line Rate	1.544 Mbps \pm 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)
DSX-1 Pulse Output	6 V ^{pk-pk} pre-equalized for 0-655 feet of ABAM cable
DSX-1 Input Level	+1.5 to -7.5 dB DSX

System

One-way DS1 Delay	<400 μ s
Wander (Looped)	Meets MTIE T1.101 requirements
Wideband Jitter (Looped)	0.2 UI maximum
Narrowband Jitter (Looped)	0.1 UI maximum

POWER CONSUMPTION

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

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

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

Table 26. H2TU-C Power Parameters

	-48 Vdc Power Consumption (Watts)	Heat Dissipation (Watts)	-42.5 Vdc Current (mA)
Remote Power Source	Maximum	Maximum	Maximum
Line-powered	13.9	7.7	330
Local-powered	8.9	7.0	212

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 in accordance with 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 26 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, stand-by battery reserve for emergency situations. Battery capacity, therefore, limits the maximum number of line units which can be installed in a remote enclosure. Use the data in Table 26 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 26 to determine the shelf fusing requirements for your particular H2TU-C applications.

LOOP ATTENUATION

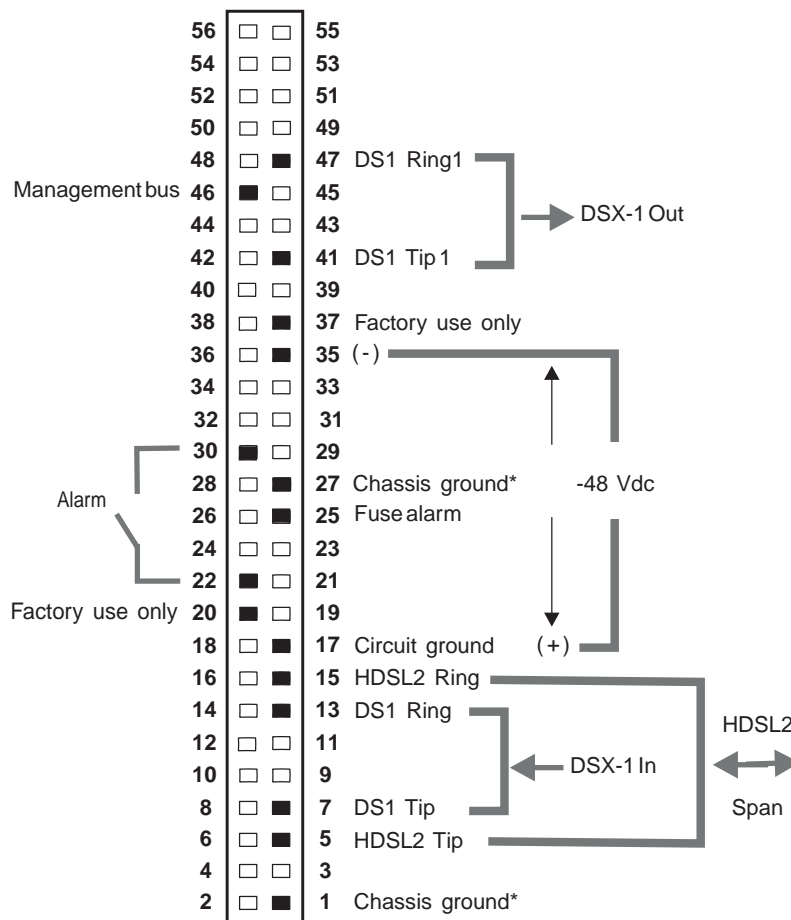
Each loop has no more than 35 dB of loss at 196 kHz, with driving and terminating impedances of 135 Ω (see Table 27 below).

Table 27. HDSL2 Cable Attenuation Chart

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

H2TU-C-202 CARD-EDGE CONNECTOR

Figure 31 shows the card-edge connector on the H2TU-C-202.



*Chassis ground may be tied to earth ground per local practice.
Note: Active pins are highlighted in black.

Figure 31. H2TU-C-202 List 3E 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-319 HiGain Management Unit.



Some H2TU-C-202 List 3E features are affected when it is under management. Consult the management unit practice for further information (see “Appendix D - Product Support” on page 60).

Fuse Alarm

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

System Alarm Output Pins

Pins 22 and 30 on the card-edge connector (see Figure 31 on page 55) are the H2TU-C-202 System Alarm output pins.

CRAFT PORT

Figure 32 shows the pinout for the craft port connector and its connection to a DB-9 or DB-25 connector on a maintenance terminal.

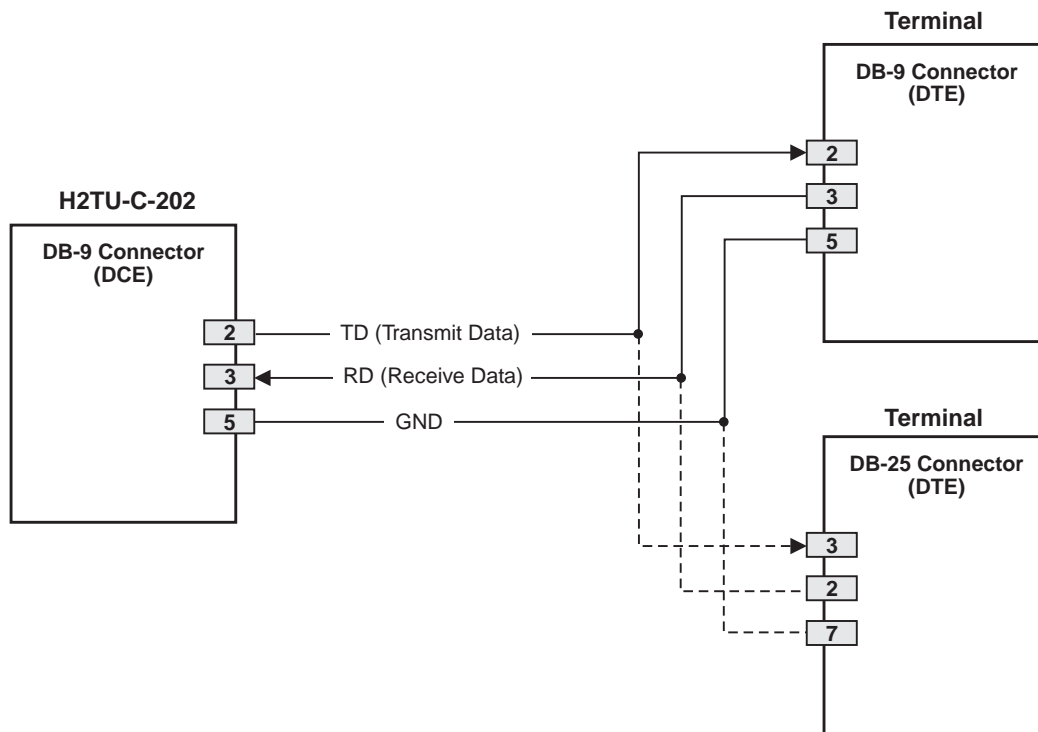


Figure 32. RS-232 Craft Port Pinouts

APPENDIX B - FUNCTIONAL OPERATION

ADC's HDSL2 technology provides full-duplex services at standard T1 rates over copper wires between an H2TU-C and an H2TU-R, which comprise one HiGain HDSL2 system. HiGain HDSL2 systems use Overlapped Pulse Amplitude Modulation (PAM) Transmission with Interlocking Spectra (OPTIS) transceiver systems to establish full-duplex, 1.552 kbps data channels between the H2TU-C-202 and a remotely located H2TU-R.

A block diagram of the H2TU-C-202 is shown in Figure 33. 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 and synchronizes with it. The H2TU-C recognizes Superframe (SF), including D4, or Extended Superframe (ESF) framing. When the data is unframed, the H2TU-C arbitrarily defines a frame bit.

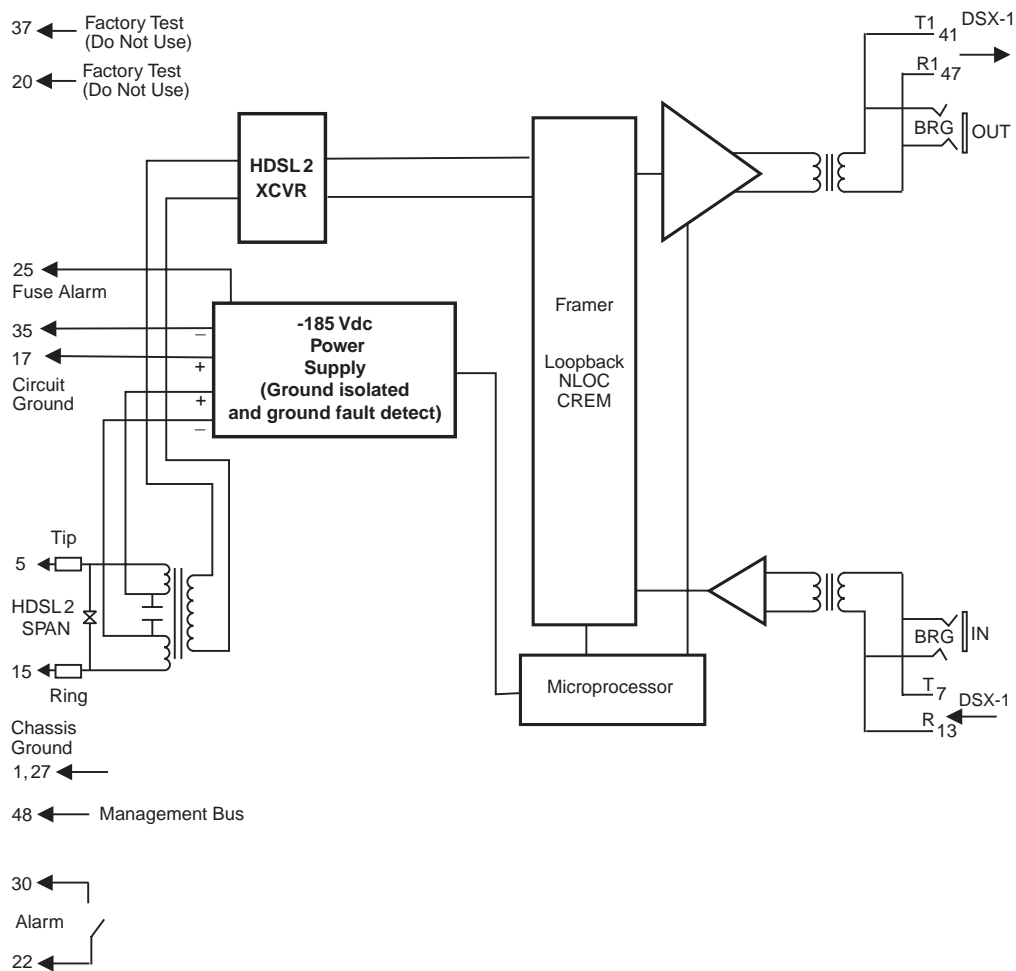


Figure 33. H2TU-C-202 List 3E Block Diagram

TIMING

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

GROUND FAULT DETECT

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

APPENDIX C - COMPATIBILITY

The HiGain HDSL2 system uses HDSL2 transmission technology as recommended by Bellcore TA-TSY-001210. HiGain HDSL2 complies with GR-63-CORE, TR-TSY-000499, and GR-1089-CORE.

The H2TU-C-202 List 3E is compatible with the following T1 repeater shelves and associated equipment:

- HiGain Card Shelf HCS-417 (23" shelf)
- HiGain Card Shelf HCS-418 (19" shelf)
- HiGain Card Shelf HCS-402 (2-slot)
- AT&T 220 Office Repeater Bay (ORB)
- AT&T Small Cross-Section Shelf (SXSS)
- Kentrox 220 (The ALM option must be disabled [DIS] to resolve a conflict between the H2TU-C alarm relay output and the Kentrox external equalizer output. Both use pins 20 and 21.)
- Wescom® 342-30

APPENDIX D - PRODUCT SUPPORT

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

TECHNICAL SUPPORT

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

Telephone: 800.638.0031 or 714.730.3222
The 800 telephone support line is toll-free in the U.S. and Canada.

Fax: 714.832.9924

Email: wsd_support@adc.com

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

RETURNS

To return equipment to ADC Wireline Systems Division:

- 1** Locate the number of the purchase order under which the equipment was purchased. You will need to provide this number to ADC Wireline Systems Division Customer Service to obtain a return authorization.
- 2** Call or write ADC Wireline Systems Division Customer Service to ask for a Return Material Authorization (RMA) number and any additional instructions. Use the telephone number, fax number, or email address listed below:
 - Telephone: 800.370.9670
 - Fax: 714.832.9923
 - Email Address: rma@adc.com
- 3** Include the following information, in writing, along with the equipment you are returning:
 - Company name, address, telephone number, and the name of a person Customer Service can contact regarding this equipment.
 - The purchase order number provided to Customer Service when the RMA number was requested.
 - A description of the equipment, as well as the number of units that you are returning. Be sure to include the model and part number of each unit.
 - The shipping address to which Customer Service should return the repaired equipment.

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



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

- If there is another reason for returning the equipment, please let us know so we can determine how best to help you.
- 4 Pack the equipment in a shipping carton.
 - 5 Write the ADC Wireline Systems Division address and the RMA number you received from Customer Service clearly on the outside of the carton and return to:

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

Attention: RMA (Number)



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

APPENDIX E - ABBREVIATIONS

A

ACON: Auto Conversion of DS1 frame
ADSL: Asymmetric Digital Subscriber Line
AIS: Alarm Indication Signal

B

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

C

CLOC: Customer Local Loopback
CRC: Cyclic Redundancy Check
CREM: Customer Remote Loopback
CV: Code Violation

D

DBER: DS1 Bit Error Rate
DDS: Digital Data Service
DL: Datalink
DLC: Digital Loop Carrier
DSX-1: DS1 Cross-connect Frame

E

ECI: Equipment Catalog Item
ES: Errored Seconds
ESD: Electrostatic Discharge
ESF: Extended SuperFrame
EXZ: The occurrence of 8 consecutive zeroes for B8ZS or 16 for AMI

F

FCON: Framed Conversion of DS1 frame

G

GNLB: Generic Loopback

H

H2TU-R: HiGain HDSL2 Remote Unit
 HiGain Remote Unit
HCS: HiGain Central Office
HG: HiGain
HMU: HiGain Management Unit

I

ID: Identifier
IN: Transmit
IR: Intelligent Repeater

L

LAIS: Line Alarm Indication Signal
LBTO: Loopback Timeout
LOF: Loss OF Frame
LOS: Loss Of Signal
LOSW: Loss of Sync Word
LPF: Line Power Feed

M

M: HDSL2 Margin
MSEC: Monitored Seconds

N

NE: Near End
NID: Network Interface Device
NIU: Network Interface Unit
NMA: Network Management and Administration
NPRM: Network Performance Report Messaging

O

OPTIS:
 Overlapped Pulse Amplitude Modulation (PAM)
 Transmission with Interlocking Spectra
 Overlapped Pulse Amplitude Modulation Transmission
 with Interlocking Spectra
ORB: Office Repeater Bay
OUT: Receive

P

PDVS: Pulse Density Violation Seconds
POTS: Plain Old Telephone Service

R

RA: Remote Alarm Indication
RLOS: Remote Loss of Signal

S

- SDSL.** Symmetrical Digital Subscriber Line
- SES.** Severely Errored Seconds
- SF.** SuperFrame
- SMJK.** SmartJack
- SPRM.** Supplemental Performance Report Messaging

T

- TLOS:** Transmit Loss of Signal

U

- 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 sixty (60) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. ADC’s obligation, under this warranty, is limited to replacing or repairing, at ADC’s option, any such hardware product which is returned during the 60-month warranty period per ADC’s instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

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

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

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

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

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

MODIFICATIONS

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

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

STANDARDS COMPLIANCE

The H2TU-C-202 List 3E 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 60.

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