T200 H2TU-R Circuit Pack
2-Wire HDSL (HDSL2) Remote Unit
Installation and Maintenance

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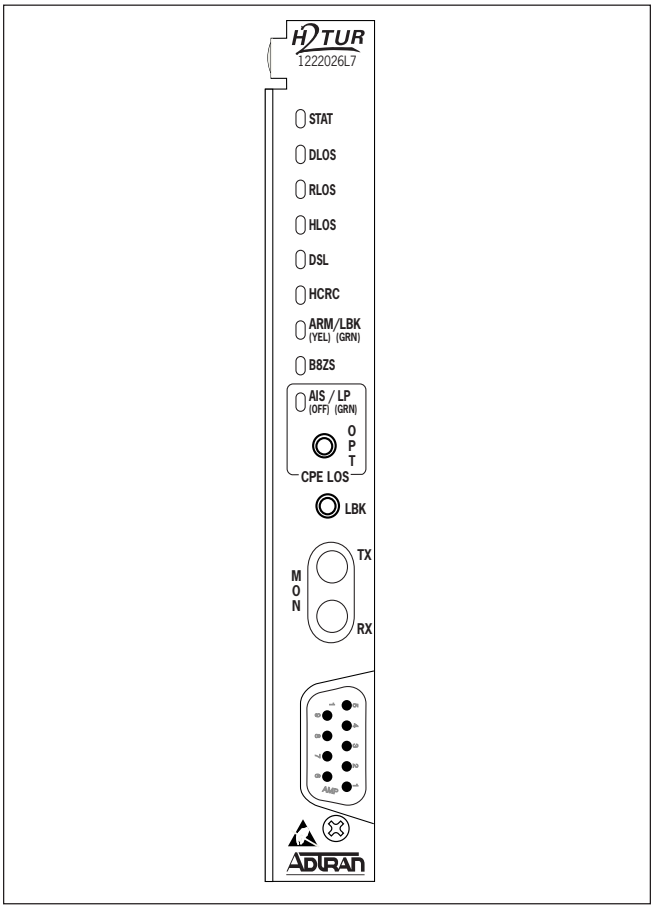


Figure 1. ADTRAN T200 H2TU-R

1. GENERAL

The ADTRAN 2-wire T200 HDSL2 transceiver unit for the remote end (H2TU-R), P/N 1222026L7, is a network terminating unit used to deploy an HDSL2 T1 circuit using 2-wire metallic facilities, see **Figure 1**. The H2TU-R is a T200 mechanics card which will fit T200 or T400 mechanic enclosures. The H2TU-R can be housed in the ADTRAN standalone metal enclosures (P/N 1242034LX or 1245034L1). Refer to the appropriate ADTRAN practice for more information. The T200 H2TU-R card can also plug into the ADTRAN HR12 HDSL2 remote shelf (P/N 1242007LX), or the ADTRAN HR4 HDSL2 remote shelf (P/N 1242008L1).

This version of the H2TU-R works with multiple list versions of the HDSL2 transceiver unit for the central office (H2TU-C) as listed below.

Unit Number	Description
1221001LX	220/E220 H2TU-C
1221002L1	LiteSpan® H2TU-C
1221003LX	DDM+ H2TU-C
1221004LX	3192 H2TU-C
1221006L6	T200 H2TU-C
1221007L4	H2TU-C for Soneplex® LEC
1181111LX	Total Access® H2TU-C
1222001LX	2nd Gen 220/E220 H2TU-C
1222003LX	2nd Gen DDM+ H2TU-C
1222004LX	2nd Gen 3192 H2TU-C
1222007L4	2nd H2TU-C for Soneplex®
1181112LX	2nd Gen Total Access H2TU-C

The H2TU-R can be deployed in circuits using one H2TU-C and one H2TU-R.

The H2TU-R terminates local loop HDSL2 signals originating from the Central Office (CO) unit and transforms the HDSL2 signal into traditional DS1 signals to be delivered to the customer.

The H2TU-R (P/N 1222026L7) can be used with any H2TU-C to complete a fully span-powered HDSL2 circuit. Span power is provided from the H2TU-C. Span powering meets all requirements of Class A2 voltages as specified by Bellcore GR-1089-CORE. This unit is intended for Span Power Only. If a locally power unit is needed, refer to P/N 1222024L7.

Revision History

This is the second release of this document. This revision includes update Provisioning and Alarm History Screen.

2. INSTALLATION

CAUTION!
SUBJECT TO ELECTROSTATIC DAMAGE OR DECREASE IN RELIABILITY.
HANDLING PRECAUTIONS REQUIRED.

After unpacking the unit, inspect it for damage. If damage is discovered, file a claim with the carrier, then contact ADTRAN. See *Warranty and Customer Service*.

The settings on the H2TU-C are encoded and transmitted to the H2TU-R once the circuit has achieved synchronization. There are no switch settings on the H2TU-R.

Remote Provisioning

This H2TU-R can be used to provision the entire HDSL2 circuit via the craft interface.

Compliance Codes

Table 1 shows the Compliance Codes for the H2TU-R. The H2TU-R complies with the requirements covered under UL 60950 third edition and is intended to be installed in an enclosure with an Installation Code (IC) of "B" or "E."

Table 1. Compliance Codes

Code	Input	Output
Installation Code (IC)	A	–
Telecommunication Code (TC)	X	X
Power Code (PC)	C	C

NOTE

This product is intended for installation in RESTRICTED ACCESS LOCATIONS only. Up to -200 Vdc may be present on the HDSL2 telecommunications port.

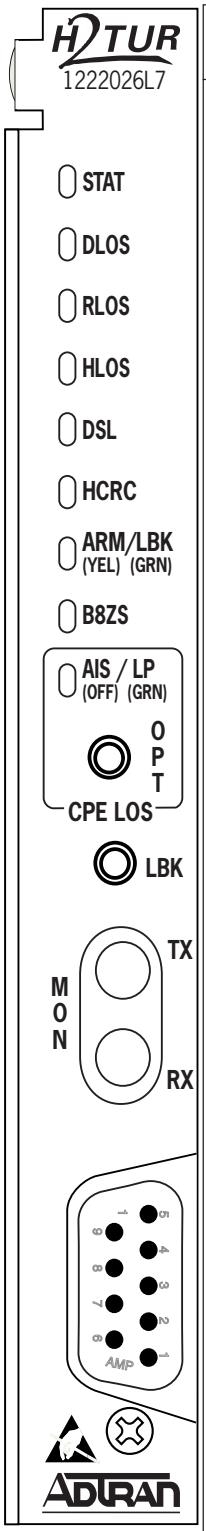
Front Panel Indicators

There are nine front panel mounted status indicators. Each indicator is described in **Table 2**.

Front Panel DS1 Monitor Jack

The H2TU-R provides DS1 monitor bantam jacks. These jacks provide a test point for DS1 traffic to and from the customer. See Section 4, *HDSL2, System Testing,* for more details.

Table 2. Front Panel Indicators



Label	Condition	Description
STAT	*Off*	Indicates no power present at H2TU-R.
	Blinking Green	The unit is in the process of acquiring HDSL2 synchronization.
	Solid Green	Normal Operation: HDSL2 synchronization is achieved.
DLOS	*Off*	DSX-1 signal is present at the H2TU-C.
	Red	Loss of DSX-1 signal into the H2TU-C.
RLOS	*Off*	DS1 signal is present at the H2TU-R.
	Red	Loss of DS1 signal into the H2TU-R from the CPE.
HLOS	*Off*	Normal operation: HDSL2 synchronization on the Loop.
	Blinking Red	GFI or overcurrent condition detected.
	Solid Red	Loss of HDSL2 synchronization on the Loop.
DSL	*Off*	Unit is in the process of acquiring HDSL2 synchronization, or HDSL2 synchronization has been lost as evidenced by the *Red* HLOS indicator.
	Green	Normal operation: Indicates good signal quality on the Loop. No routine maintenance or verification is required.
	Yellow	Marginal operation: Indicates marginal signal quality on the Loop. Degraded conditions suggest verification of key HDSL2 parameters. For details, refer to the Troubleshooting Guide in section 8 of this practice.
	Red	Alarm condition: Indicates poor signal quality on the Loop. Requires prompt troubleshooting of HDSL2 circuit, including verification of pulse attenuation, insertion loss, and other parameters. For details, refer to the Troubleshooting Guide in section 8 of this practice.
	Blinking	Pulse attenuation (ATTEN on Span Status Screen) on Loop is above the recommended threshold for quality service. If the pulse attenuation is 30 dB or below, the DSL LED will remain solid. As described above, the signal quality (margin) on the Loop is indicated by the color of the DSL LED. For instance, if the signal quality on the Loop is good and the pulse attenuation is bad, the LED will *Blink Green*. If the signal quality is marginal and the pulse attenuation is good, the LED will be *Solid Yellow*.
HCRC	*Off*	Normal operation: No HDSL2 CRC error detected within the last 24 hours on the Loop (no local loop trouble).
	Blinking Yellow	One or more HDSL2 CRC errors are being detected on the Loop (local loop trouble).
	Solid Yellow	Four or more HDSL2 CRC errors have occurred on the Loop within the last 30 minutes. After a HDSL2 CRC error occurs, the HCRC LED will remain *Yellow* for 30 minutes. If no HDSL2 CRC errors occur within a rolling 30 minute interval, the HCRC LED will extinguish.
ARM/LBK	*Off*	Unit is not in the armed or loopback state.
	Yellow	Arming sequence has been detected. In this state, the unit is armed (ready for loopback), but not in loopback.
	Green	A loopback is active on this specific unit.
B8ZS	*Off*	Indicates AMI line code.
	Green	Indicates B8ZS line code.
AIS/LP	*Green*	Indicates loopback will occur upon customer loss of signal.
	Off	Indicates AIS will be sent to the network upon customer loss of signal.

3. CONNECTIONS

All connections of the H2TU-R are made through card edge connectors. **Figure 2** gives the card edge pin assignments for the H2TU-R circuit pack.

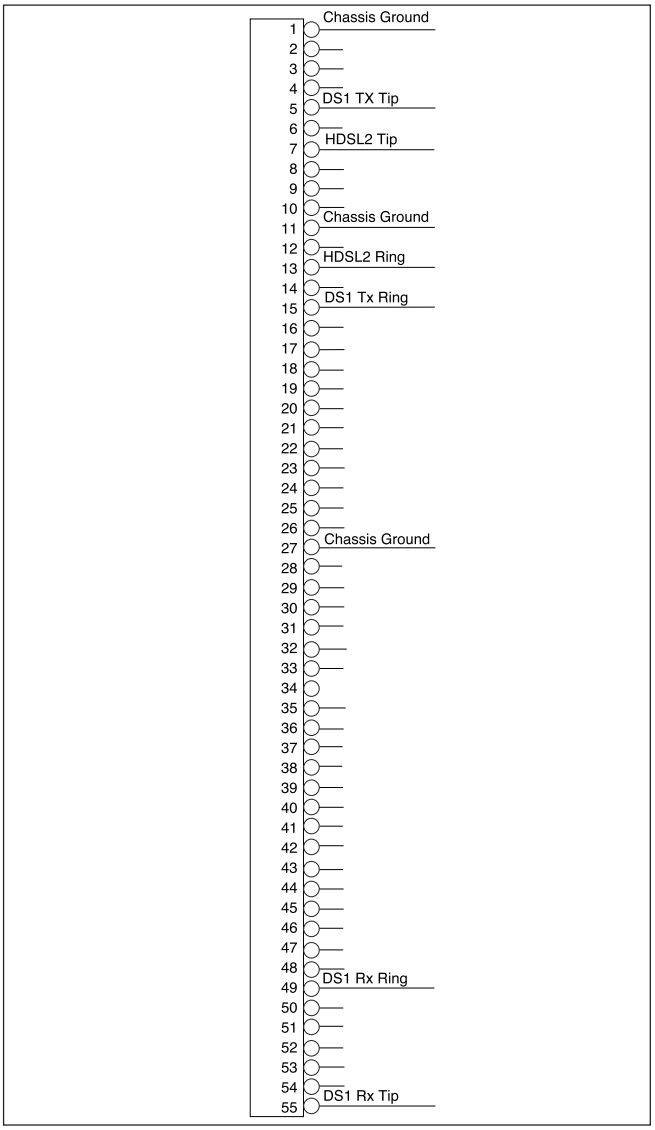


Figure 2. H2TU-R Edge Connector Wiring

When the circuit pack is installed in any of the H2TU-R enclosures, all connections are made through the enclosure backplanes. See the following ADTRAN documents for more information:

Document Number	Description
61242007LX-5	HR12 I&M
61242008L1-5	HR4 I&M
61242034L2-5	T400 Single Mount I&M (removable RJ-48 jacks)
61242034L3-5	T400 Single Mount HV I&M
61245034L1-5	T200 Dual Mount I&M

CAUTION

Ensure chassis ground is properly connected for either standalone or shelf-mounted applications.

4. HDSL2 SYSTEM TESTING

The T200 H2TU-R provides diagnostic, loopback, and signal monitoring capabilities.

The nine front panel LEDs provide diagnostics for HDSL2 loops, DS1 signals, alarms, provisioning, and loopbacks. See section 2, Installation, for details.

The H2TU-R provides a bidirectional loopback via the loopback button on the front panel. See the *H2TU-R Network Loopbacks and Customer Loopbacks* sections for more details.

The H2TU-R also provides a nonintrusive test point of the DS1 signal via the jack labeled "MON" on the front panel.

DS1 MON Bantam Jacks

The "MON" jack provides a nonintrusive access point for monitoring the characteristics of the transmit and receive signals at the DS1 interface point.

For example, the DS1 MON jack on the H2TU-R could be used to connect to a bit error rate tester to monitor for synchronization, test patterns, etc. **Figure 3** is an illustration of specific jack detail.

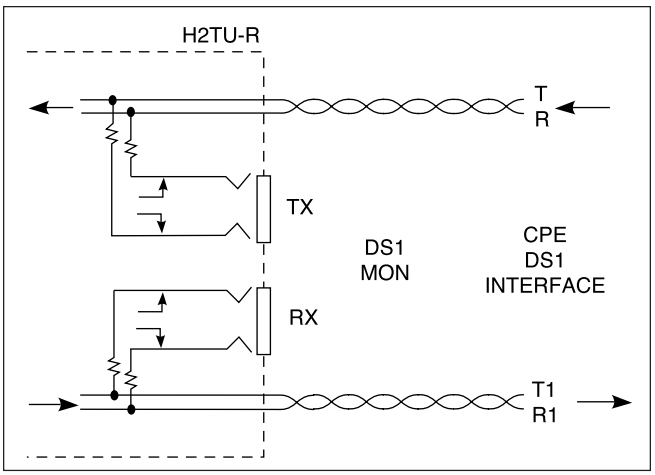


Figure 3. H2TU-R MON Diagram

NOTE

For the MON jacks, the Tx and Rx indications relate to the direction of the signal to/from the CPE, respectively.

H2TU-R Network Loopbacks

The H2TU-R responds to multiple loopback activation processes. The loopback position is a logic loopback located within the H2TU-R internal HDSL2 transceiver. See **Figure 4**.

First, manual loopback activation may be accomplished using the control port of the H2TU-R.

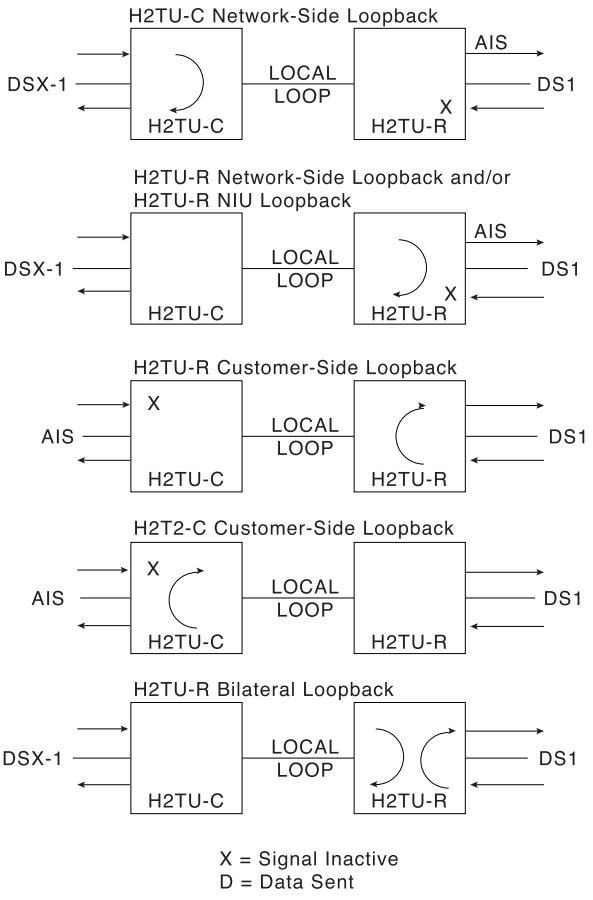


Figure 4. HDSL2 Loopbacks

Second, the H2TU-R will respond to the industry *defacto* HDSL loopback codes as designated in the ANSI document T1E1.4/92. A synopsis of the method described by ANSI is presented in Appendix A.

Third, the H2TU-R responds to T1 Network Interface Unit (NIU) loopback codes as described in Bellcore TR-TSY-000312. The NIU loopback codes are as follows:

In-Band Codes

Loop up 11000

Loop down .. 11100

ESF Codes

Loop up 1111 1111 0100 1000

Loop down .. 1111 1111 0010 0100

Receiving the in-band codes for more than five seconds or the ESF codes four consecutive times will cause the appropriate loopback action. The ESF codes must be transmitted in the Facility Data Link (FDL).

NOTE

The NIU loopback option must be enabled before the H2TU-R can respond to the NIU loopback.

The H2TU-R will respond to the loop up codes by activating the NIU loopback from either the disarmed or armed state. The loop down codes will return the H2TU-R to the state from the armed or loop up state.

Refer to Appendix A for more details on loopbacks and loopback arming sequences.

Figure 3 illustrates all of the possible loopback locations of the ADTRAN HDSL2 equipment.

Customer Loopbacks

In addition to the loopbacks in the direction of the network, the H2TU-R may also be looped back in the direction of the customer. The H2TU-C and H2TU-R Customer Side Loopbacks are illustrated in Figure 3.

NOTE

Network and customer loopbacks are governed by the loopback time out option (Default=120 minutes).

5. FRONT PANEL OPERATION

The front panel contains two pushbuttons on the faceplate. These are labeled “LBK” and “OPT.”

The LBK pushbutton controls a bidirectional loopback at the H2TU-R. Pressing the button causes a bidirectional loopback to occur. If the bidirectional loopback is active, pressing the button a second time will disable the loopback.

The OPT pushbutton controls the Customer Loss of Signal response. Press the button to toggle the setting between a Network Loopback and AIS. The front panel LED labeled “AIS/LP” indicates the current setting.

6. CONTROL PORT OPERATION

The H2TU-R provides a faceplate-mounted DB-9 connector that supplies an RS-232 interface for connection to a controlling terminal. The pinout of the DB-9 is illustrated in **Figure 5**.

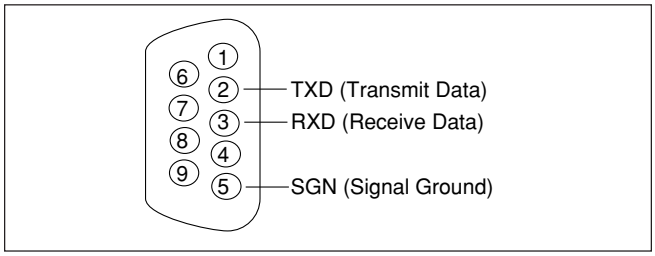


Figure 5. RS-232 (DB-9) Connector Pinout

The terminal interface operates at data rates from 1.2 kbps to 19.2 kbps. A terminal session is initiated by entering multiple space bar characters which are used by the H2TU-R to determine the rate of the terminal. The asynchronous data format is fixed at 8 data bits, no parity, and 1 stop bit.

NOTE

When operating in Virtual Terminal Mode, the terminal baud rate should be 4.8 kbps or higher.

The H2TU-R supports two types of terminal emulation modes. The Manual Update Mode is a dumb terminal mode, where the user can utilize print screen and log file commands easily. This mode also includes a message on the top of the terminal screen (3 SPACES TO UPDATE).

NOTE

Pressing “CTRL” and “T” while on any screen will toggle between the Manual and Real Time Terminal Modes.

The Real Time Update Mode is a VT100 terminal mode. This mode enables all screens highlighting and cursor placement. Print screen and log file commands are not available in this mode.

The default terminal mode is Real Time Update Mode.

NOTE

If you are using a personal computer (PC) with terminal emulation capability, be sure to disable any power-saving programs. Otherwise, communication between the PC and the HDSL2 unit may be disrupted, resulting in misplaced characters or screen time outs.

Operation

For abbreviations used in the screen diagrams, see **Table 3**.

The screens illustrated in Figures 6 through 21 apply to an HDSL2 circuit deployed with ADTRAN's HDSL2 technology. The circuit includes an H2TU-C and an H2TU-R. Other configurations are possible (i.e., HDSL2 repeater, other vendor's equipment) and their displays will vary slightly from those shown in this section.

Table 3. Screen Abbreviations

Abbreviation	Definition
ES	Errored Seconds
	DSX/DS1 ..... (SF) Second in which a BPV or frame bit error occurs
	(ESF) Second in which a BPV or CRC error occurs
	HDSL2 ..... Second in which a CRC error occurs
SES	Severely Errored Seconds
	DSX/DS1 ..... (SF) Second in which 1544 BPVs or 8 frame bit errors occur
	(ESF) Second in which 1544 BPVs or 320 CRC errors occur
	HDSL2 ..... Second in which 165 CRC errors occur
UAS	Unavailable Seconds
	DSX/DS1 ..... Second in which there is a loss of signal or sync
	HDSL2 ..... Second in which there is a loss of signal or sync
SF	Superframe Format
ESF	Extended Superframe Format
B8ZS	Bipolar with 8 Zero Substitution
AMI	Alternate Mark Inversion
LBO	Line Buildout
BPV	Bipolar Violation
	DSX/DS1 ..... Second in which a bipolar violation occurs
NIU	T1 Network Interface Unit
S/N	Serial Number
15M	Fifteen-Minute period
24H	Twenty-Four-Hour period

A terminal session is initiated by entering multiple space bar characters, which are used by the H2TU-R to determine the speed of the terminal. Once the speed has been determined, an HDSL2 Main Menu is presented, as illustrated in **Figure 6**.

The Main Menu provides access to detailed performance and configuration information. Selecting the corresponding number or letter can access the following screens:

1. HDSL2 Unit Information
2. Provisioning
3. Span Status
4. Loopback and Test Commands
5. Performance History
6. Scratch Pad, Circuit ID, Time/Date
7. Terminal Modes
8. Alarm History
9. Event History
10. Virtual Terminal Control

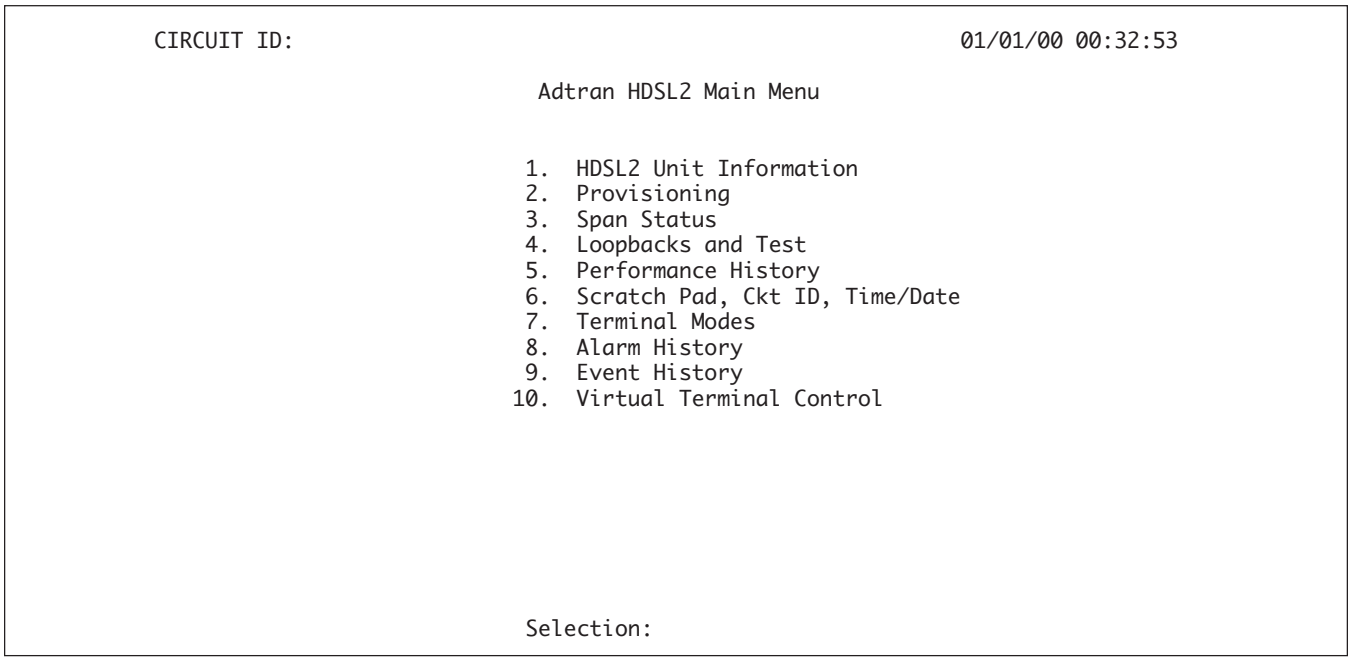


Figure 6. HDSL2 Main Menu Screen

The HDSL2 Unit Information Screen, illustrated in **Figure 7**, provides detailed product information on each component in the HDSL2 circuit. This screen also displays contact information for ADTRAN Technical Support, Internet site, and address.

The Provisioning Screen, illustrated in **Figure 8**, displays the current provisioning settings for the HDSL2 circuit. To change a particular option setting, select the appropriate number, and a new menu will appear with a list of the available settings.
Options that cannot be changed from this screen are marked with an asterisk "*".

```
CIRCUIT ID:                                                  01/01/00 00:35:20
                    Press ESC to return to previous menu

                                ADTRAN
                           901 Explorer Boulevard
                         Huntsville, Alabama 35806-2807
--------------------- For Information or Technical Support ---------------------
      Support Hours ( Normal 7am - 7pm CST, Emergency 7 days x 24 hours )
Phone: 800.726.8663 / 888.873.HDSL  Fax: 256.963.6217  Internet: www.adtran.com
--------------------------------------------------------------------------------

             ADTN H2TU-C                      ADTN H2TU-R
            List: 4                          List: 7
             S/N: 123456789                   S/N: 123456789
            CLEI: T1L3X8XAAA                 CLEI: T1L3W71AAA
            Manf: 01/01/2000                 Manf: 01/01/2000
```

Figure 7. HDSL2 Information Screen

```
CIRCUIT ID:                                                  01/01/00 00:35:31

                    Press ESC to return to previous menu

                              Provisioning

                      1.  DSX-1 Line Buildout     =  0-133 Feet
                      2.  DSX-1/DS1 Line Code     =  B8ZS
                      3.  NIU Loopback            =  Enabled
                      4.  Loopback Timeout        =  120 Min
                      5.  DS1 TX Level            =  0 dB
                      6.  Customer Loss Indicator =  AIS
                      7.  PRM Setting             =  None
                      8.  Loop Atten Alarm Thres  =  30 dB
                      9.  SNR Margin Alarm Thres  =  06 dB

                                   Selection:
```

Figure 8. Provisioning Screen

The Span Status Screen, illustrated in **Figure 9**, provides quick access to status information for each HDSL2 receiver in the circuit. The Legend selection provides a description of the messages that are used on the Span Status Screens.

The Detailed Status selection from the System Status Menu, illustrated in **Figure 10**, displays the HDSL2 and T1 status for each receiver point.

From this screen, all registers can be zeroed (which requires confirmation), and MIN/MAX can be reset.

NOTE

The insertion loss reading shown on the Detailed Status Screen is an approximation that is valid for some loops. Caution should be used when using this value.

```
CIRCUIT ID:                                                  01/01/00 00:36:49
                    Press ESC to return to previous menu

                              Span Status Screen
                                   ATTEN
                               ______  <-23dB->   ______
                              |H2TUC |            |H2TUR |
                          <---|      |            |      |--->
                              |      |            |      |
                        NET   |      |<---------->|      |   CUST
                              |      |15dB   14dB |      |
                          --->|      |  MARGIN    |      |<---
                        DSX-1 |______|            |______|    DS1




                                   1.  Legend
                                   2.  Detailed Status


                                   Selection:
```

Figure 9. Span Status Screen

```
CIRCUIT ID:                                                  01/01/00 00:37:20
                    Press ESC to return to previous menu

                         Detailed HDSL2 and T1 Status

                              HDSL2 RECEIVER DATA
                                H2TU-C    H2TU-R

                               --------  --------
                MARGIN(CUR/MIN/MAX): 11/00/12  11/00/13
                     ATTEN(CUR/MAX):  30/30     29/29
                  INS LOSS (CUR/MAX):  38/38     37/37
                            ES 15MIN:   001       001
                           SES 15MIN:   000       001
                           UAS 15MIN:   014       017

                                T1 RECEIVER DATA
                             DSX-1                 DS1
                            -------               -------
                   FRAMING:   UNFR                  UNFR
                 LINE CODE:   B8ZS                  B8ZS
                  ES-P/ES-L:  001/000               000/000       1. Zero Registers
                SES-P/SES-L:  001/000               000/000       2. Restart Min/Max
                UAS-P/UAS-L:  000/382               000/391
                     ALARMS:   NONE                  NONE            Selection:
```

Figure 10. Detailed Status Screen

Figure 11 illustrates the Loopback and Test Commands Screen, which provides the user with the ability to invoke or terminate all available HDSL2 loopbacks. Each HDSL2 circuit component can be looped toward the network or customer from this screen. It also provides a self-test option to perform a self-diagnostic of the H2TU-C and H2TU-R.

The Performance History Screens, illustrated in **Figure 12** and **Figure 13** display the historical HDSL2 and T1 performance data in several different registers.

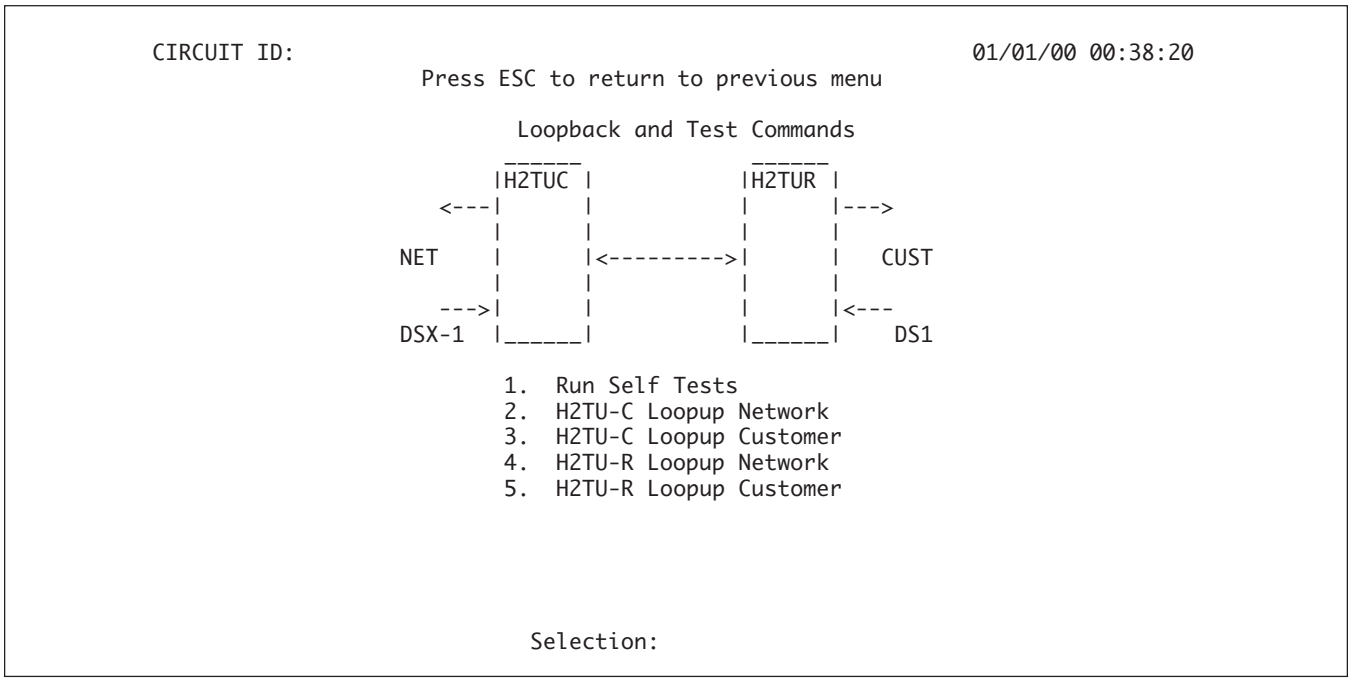


Figure 11. Loopback and Test Commands Screen

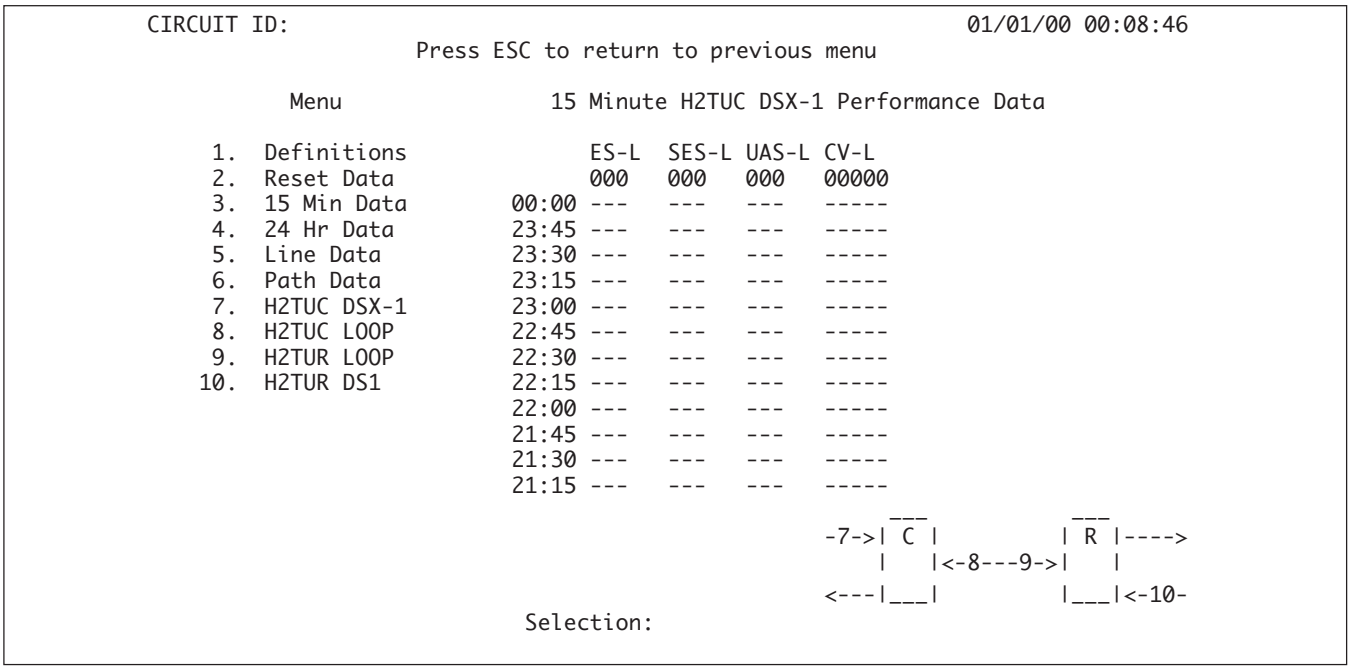


Figure 12. 15-Minute Performance History Line Data Screen

At each 15-minute interval, the performance information is transferred to the 15-minute performance data register. This unit stores performance data in 15-minute increments for the last 24-hour period. At each 24-hour interval, the performance data is transferred into the 24-hour performance data registers. This unit stores up to 31 days of 24-hour interval data.

The user is prompted to select a module and interface to view the corresponding performance data. Line (L) and Path (P) can be viewed.

Abbreviations used in the Performance History screens are defined in Data Definition Screens, see **Figure 14** and **Figure 15**.

```
CIRCUIT ID:                                                  01/01/00 00:08:22
                    Press ESC to return to previous menu

          Menu                  24 Hour H2TUC DSX-1 Performance Data

     1.  Definitions            ES-L  SES-L UAS-L CV-L
     2.  Reset Data             00000 00000 00000 0000000
     3.  15 Min Data       12/31 ----- ----- ----- -------
     4.  24 Hr Data        12/30 ----- ----- ----- -------
     5.  Line Data         12/29 ----- ----- ----- -------
     6.  Path Data         12/28 ----- ----- ----- -------
     7.  H2TUC DSX-1       12/27 ----- ----- ----- -------
     8.  H2TUC LOOP        12/26 ----- ----- ----- -------
     9.  H2TUR LOOP        12/25 ----- ----- ----- -------
    10.  H2TUR DS1         12/24 ----- ----- ----- -------
                           12/23 ----- ----- ----- -------
                           12/22 ----- ----- ----- -------

                                                 ___           ___
                                            -7->| C |         | R |---->
                                                |   |<-8---9->|   |
                                            <---|___|         |___|<-10-

                                Selection:
```

Figure 13. 24-Hour Performance History Line Data Screen

```
CIRCUIT ID:                                                  01/01/00 00:54:35
                    Press ESC to return to previous menu

                         Performance Data Definitions

H2TUC, H2TUR, and H2R LOOP Related:     HDSL2 Framing
  ES-L    Errored Seconds                 CRC>=1 or LOSW>=1
  SES-L   Severely Errored Seconds        CRC>=50 or LOSW>=1
  UAS-L   Unavailable Seconds             >10 cont. SES-Ls

DS1 and DSX-1 Line Related:             Superframe and Extended Superframe
  ES-L    Errored Seconds                 (BPV+EXZ)>=1 or LOS>= 1
  SES-L   Severely Errored Seconds        (BPV+EXZ)>=1544 or LOS>=1
  UAS-L   Unavailable Seconds             >10 cont. SES-Ls
  CV-L    Code Violation Count            (BPV+EXZ) count

NOTE: Reverse video indicates invalid data due to a terminal restart (or power
      cycle), a data register reset, or a system date or time change.


    N.  Next
    P.  Previous            Selection:
```

Figure 14. Performance Data Definitions Screen

Figure 16 illustrates the Scratch Pad, Circuit ID, and Time/Date Screen. The Scratch Pad data can be any alphanumeric string up to 50 characters in length. The Circuit ID can be any alphanumeric string up to 25 characters in length. The time should be entered using military time (for example, enter 3:15 p.m. as "151500"). The date should be entered as MMDDYY (for example, enter January 02, 2000, as "010200").

```
CIRCUIT ID:                                                    01/01/00 00:55:00
                    Press ESC to return to previous menu

                          Performance Data Definitions

DS1 and DSX-1 Path Related:          Superframe          Extended Superframe
  ES-P    Errored Seconds              FE>=1 or            CRC>=1 or
                                        SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  SES-P   Severely Errored Seconds     FE>=8 or            CRC>=320 or
                                        SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  UAS-P   Unavailable Seconds          >10 cont. SES-Ps    >10 cont. SES-Ps

  CV-P    Code Violation Count         FE count            CRC error count

NOTE: Under o UAS-P condition, ES-P and SES-P counts are inhibited.
      Under a SES-L or SES-P condition, the respective CV-L or CV-P count is
      inhibited.



    P.  Previous            Selection:
```

Figure 15. Performance Data Definitions Screen (continued)

```
CIRCUIT ID:                                                    01/01/00 00:44:17




   Current Scratch Pad:
      New Scratch Pad =


       New Circuit ID =


             New Date =   /  /    (MM/DD/YY)
             New Time =   :  :    (HH:MM:SS)


                   Press TAB to skip to next entry field.


                            Press ESC to Exit.
```

Figure 16. Scratch Pad, Circuit ID, Time/Date Screen

This unit includes two terminal emulation modes. These modes are described on the Terminal Modes Screen, illustrated in **Figure 17**.

NOTE

Pressing "CTRL" and "T" while on any screen will toggle between Manual and Real Time Terminal Modes.

The Manual Update Mode allows the user to manually update the provisioning option screens. This mode supports efficient print screen and log file utilities for storage of key provisioning parameters, alarm or performance history and current system status. "3 SPACES TO UPDATE" appears at the top of each screen. By pressing the space bar 3 times, the screen will be refreshed and will reflect the most current circuit conditions and provisioning options.

NOTE

When the H2TU-R is used with the following H2TU-Cs: 1221001L4, 1221003L4, 1221004L4, 1221007L4, and 1181111L4, a remote virtual terminal session is supported while accessing the terminal screens via the craft ports (DB-9) on the faceplate. When operating in Virtual Terminal Mode, the terminal baud rate should be 4.8 kbps or higher. The remote terminal session is automatically initiated if a terminal is connected to the H2TU-R, and the HDSL2 loops are in sync with the H2TU-C. When a remote terminal session is in progress, the screens are not accessible from the H2TU-C. Once a remote terminal session is terminated, the screens are available at the H2TU-C. The remote terminal session is terminated by typing "CTRL" + X " on the terminal at the H2TU-R. Alternatively, if there is no keyboard input at the H2TU-R's terminal for a period of 5 minutes, the remote session will time out, and the screens will once again be available at the H2TU-C. After the 5 minute time out, the remote terminal session can be reinstated at the H2TU-R by pressing the space bar several times.

The default terminal emulation mode is the Real Time Update Mode (VT100). This mode provides real time updating of HDSL2 circuit conditions and provisioning options as changes occur. While in Real Time Update Mode, the unit is anticipating baud poll responses from the terminal.

```
CIRCUIT ID:                                                    01/01/00 00:44:30
                    Press ESC to return to previous menu

                            TERMINAL MODES MENU

    MANUAL UPDATE MODE:

    * You can print or log screens
    * No text is highlighted
    * "3 SPACES TO UPDATE" appears at the top of each screen,
       reminding you to press the spacebar 3 times to update the screen
    * There is a delay between screen changes & updates
    * After 30 min. of no interaction, a new baud rate search is begun
    * Ignores input until screen is finished printing.

    REAL-TIME UPDATE MODE:

    * Faster of the two modes
    * You cannot print screens to a log file
    * Highlighting is enabled
    * Recommended for daily operation


              Press CTRL+T to toggle update modes on any screen.
```

Figure 17. Terminal Modes Screen

The Alarm History Screen, illustrated in **Figure 18**, provides the user with a detailed alarm history and events log for the HDSL2 and T1 spans.
This screen includes a time, date, first/last occurrence, and count for each type of HDSL2 or T1 alarm.

The Event History Screen, illustrated in **Figure 19**, provides a log history of HDSL2 circuit events.

```
CIRCUIT ID:                                                    01/01/00 00:44:49
                    Press ESC to return to previous menu

                                T1 Alarm History
LOCATION   ALARM       FIRST                LAST                CURRENT   COUNT
-------------------------------------------------------------------------------
H2TU-C     RED(LOS/LOF)                                          OK         000
 (DSX-1)   YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000

H2TU-R     RED(LOS/LOF)                                          OK         000
 (DS1)     YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000









-------------------------------------------------------------------------------
 1. T1 Alarm       2. HDSL2 Span                      C. Clear T1 Alarm
                             Selection:
```

Figure 18. Alarm History Screen

```
 CIRCUIT ID:                                                   01/01/00 00:45:05
                    Press ESC to return to previous menu

       Num   Description of Event                       Date     Time
       ------------------------------------------------------------------

    1.  H2TU-R Powered Up                          01/01/00 00:00:01
    2.  H2TU-C Powered Up                          01/01/00 00:30:17









         Page Number:   1/  1   Number of Events:   2
       ------------------------------------------------------------------
       'P' - Previous Page  'H' - Home      'R' - Reset Events
       'N' - Next Page      'E' - End

                            Selection:
```

Figure 19. Event History Screen

Figure 20, illustrates the Virtual Terminal Control Screen.

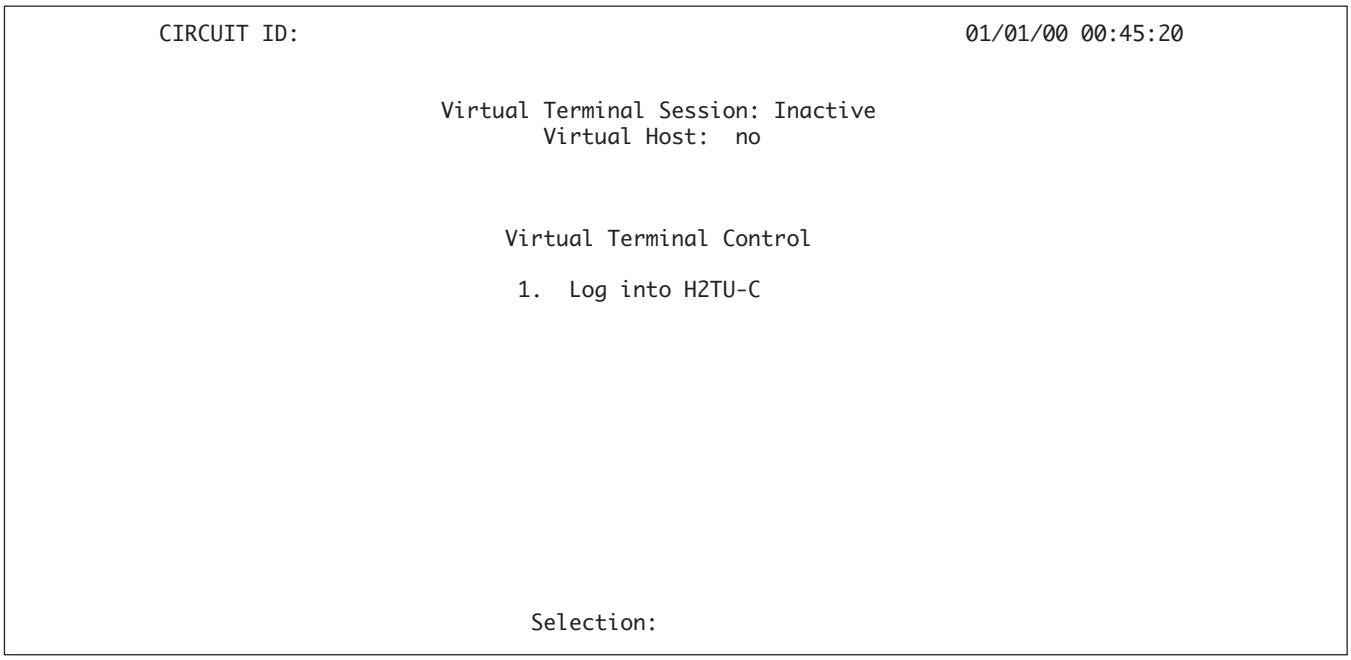


Figure 20. Virtual Terminal Control Screen

7. HDSL2 DEPLOYMENT GUIDELINES

The ADTRAN HDSL2 system is designed to provide DS1-based services over loops designed to comply with Carrier Service Area (CSA) guidelines. CSA deployment guidelines are given below.

1. All loops are non-loaded only.
2. For loops with 26-AWG cable, the maximum loop length including bridged tap lengths is 9 kft.
3. For loops with 24-AWG cable, the maximum loop length including bridged tap lengths is 12 kft.
4. Any single bridged tap is limited to 2 kft.
5. Total bridged tap length is limited to 2.5 kft.
6. The total length of multi-gauge cable containing 26-AWG cable must not exceed

   $12 - \{(3*L_{26})/(9-L_{BTAP})\}$ (in kft)

   L_{26} = Total length of 26-AWG cable excluding bridged taps (in kft)

   L_{BTAP} = Total length of all bridged taps (in kft)

This deployment criteria is summarized in the chart shown in **Figure 21**.

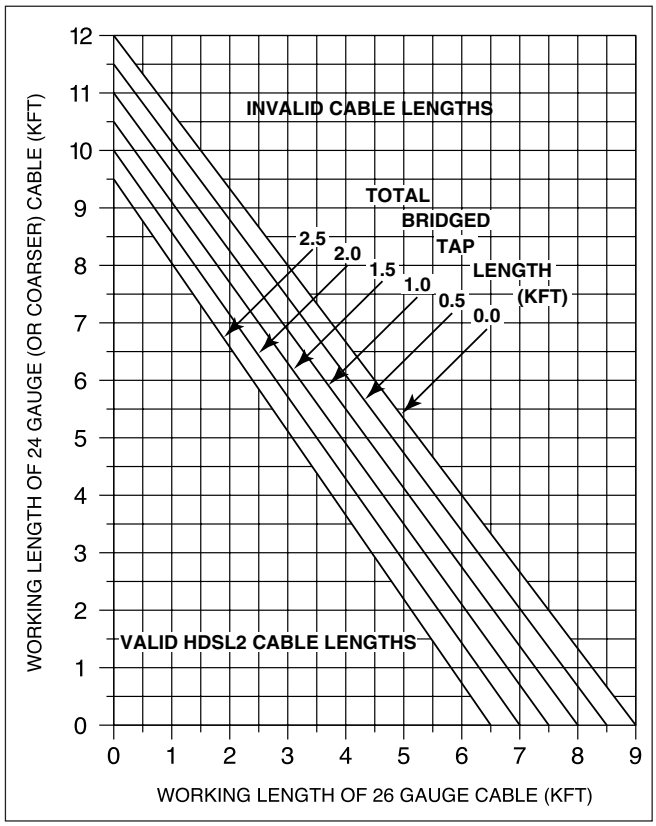


Figure 21. Deployment Guidelines

Loop loss per kft for other wire is summarized in **Table 4**.

Table 4. HDSL2 Loss Values (200 kHz cable loss in dB/kft at 135 Ω)

Cable Gauge	Cable Type	Temperature: 68°	90°	120°
26	PIC	3.902	4.051	4.253
26	Pulp	4.030	4.179	4.381
24	PIC	2.863	2.957	3.083
24	Pulp	3.159	3.257	3.391
22	PIC	2.198	2.255	2.333
22	Pulp	2.483	2.45	2.629
19	PIC	1.551	1.587	1.634
19	Pulp	1.817	1.856	1.909

Recommended maximum local loop loss information for PIC cable at 70° F, 135 Ω, resistive termination is provided in **Table 5**.

Table 5. Loop Insertion Loss Data

Frequency (Hz)	Maximum Loss (dB)
3,000	12.0
10,000	15.0
50,000	25.5
100,000	30.0
150,000	32.75
196,000	35.0
200,000	35.25
250,000	37.5
325,000	42.00

An approximation for the maximum amount of wideband noise on an HDSL2 local loop as measured by a 50 kb filter is ≤ 31 dBrn.

An approximation for the maximum level of impulse noise as measured using a 50 kb filter on an HDSL2 loop is ≤ 50 dBrn.

NOTE

These approximations are to be used as guidelines only and may vary slightly on different loops. Adhering to the guidelines should produce performance in excess of 10^{-7} BER.

For further information regarding deployment guidelines and applications, reference ADTRAN's Supplemental Deployment Information for HDSL/HDSL2 document, P/N 61221HDSLL1-10.

8. TROUBLESHOOTING PROCEDURES

Use **Table 6** to troubleshoot the ADTRAN H2TU-R.

9. MAINTENANCE

The ADTRAN H2TU-R requires no routine maintenance. In case of equipment malfunction, use the faceplate Bantam jack and/or DB-9 connector to help locate the source of the problem.

ADTRAN does not recommend that repairs be performed in the field. Repair services may be obtained by returning the defective unit to the ADTRAN Customer and Product Service (CAPS) Department.

Table 6. Troubleshooting Guide

Condition: All front panel indicators are *Off*. Solutions: 1. Make sure the H2TU-R is properly seated in the housing. 2. Verify that the H2TU-C is delivering sufficient simplex voltage to the loops. 3. If Steps 1 and 2 pass, replace the H2TU-R.
Condition: Power is present and adequate, but loop sync is not available (HLOS). Solutions: 1. Verify that the loop conforms with CSA guidelines (not too long, etc.). 2. Verify that the tip and ring of the HDSL2 loop belong to the same twisted pair. 3. Verify that loop loss at 196 kHz is not greater than 35 dB. 4. Verify that noise on the HDSL2 loop is within acceptable limits (see section 7 of this practice). 5. If steps 1 through 4 pass and loop sync is still not available, replace the H2TU-R.
Condition: HCRC LED is *blinking yellow*. Solution: Errors are being taken on the HDSL2 loop. The craft interface will identify the source. BERT tests to the appropriate loopbacks should also reveal the source of the problem.
Condition: DSL LED is *yellow*, *red* or *blinking*. Solutions: 1. Verify that loss (pulse attenuation) on Current System Status screen is < 30 dB. 2. Verify that the loop conforms with CSA guidelines (not too long, etc.). 3. Verify that loop loss at 196 kHz is not greater than 35 dB. 4. Verify that noise on the HDSL2 loop is within acceptable limits (see section 7 of this practice). 5. If steps 1 through 4 pass and LED is *yellow*, good service can be assumed.

10. PRODUCT SPECIFICATIONS

Table 7 lists the H2TU-R specifications.

Table 7. ADTRAN T200 H2TU-R Specifications

Loop Interface

Modulation Type	16-TC PAM
Mode	Full Duplex, Partially Overlapped Echo Canceling
Number of Pairs	One
Bit Rate	1.552 mpbs
Baud Rate	517.333k baud
Service Range	Defined by Carrier Service Area Guidelines
Loop Loss	35 dB maximum @ 196 kHz
Bridged Taps	Single Taps < 2 kft, Total Taps < 2.5 kft
Performance	Compliant with T1.418-2000 (HDSL2 Standard)
Return Loss	12 dB (50 kHz to 200 kHz)
Input Impedance	135 Ω
H2TU-C Tx Pwr (Data) Level	16.6 ± 0.5 dBm (0 to 450 kHz)
H2TU-C Tx Pwr (ACT) Level	16.3 + 0.5 dBm (0 to 350 kHz)
Maximum Loop Resistance	900Ω per span

Customer Interface

DS1 (T1.403 compatible) (ITU-T1.431 compliant)

DS1 Signal Output Level	0, -7.5 or -15 dB
DS1 Input Signal Level	0 to -22.5 dB
DS1 Line Coding	AMI, B8ZS
DS1 Framing Format	SF, ESF, Unframed

Power

Span-powered by H2TU-C

Maximum Heat Dissipation	3.0 W (Span Power Mode)
Span Current	15 mA to 20 mA (with 1 H2TU-R)

Clock Sources

Clock Sources	Internal, HDSL2 Loop Derived
Internal Clock Accuracy	± 25 ppm, (exceeds Stratum 4). Meets T1.101 timing requirements.

Tests

Diagnostics	Loopback (H2TU-R), initiated with HDSL2 in-band codes, initiated with T1 NIU in-band codes, initiated with H2TU-C command, initiated manually, H2TU-R control port. Self-Test.

Physical

Dimensions	5.5 in. High, 0.7 in. Wide, 6.0 in. Deep
Weight	< 1 pound

Environment

Temperature	Operating (Standard): -40° C to +70° C; Storage: -40° C to +85° C
Relative Humidity	Up to 95 percent non-condensing

Part Number

H2TU-R T200 Circuit Pack	1222026L7

11. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN U.S. and Canada Carrier Networks Equipment Warranty, Repair, and Return Policy and Procedure,* document 60000087-10).

Contact CAPS prior to returning equipment to ADTRAN.

For service, CAPS requests, or further information, contact one of the following numbers:

ADTRAN Sales

Pricing and Availability
(800) 827-0807

ADTRAN Technical Support

Pre-sales Applications/Post-sales Technical Assistance
(800) 726-8663

Standard hours: Monday-Friday, 7 a.m. to 7 p.m. CST
Emergency hours: 7 days/week, 24 hours/day

ADTRAN Repair/CAPS

Return for repair/upgrade
(256) 963-8722

Repair and Return Address

ADTRAN, Inc.
CAPS
901 Explorer Boulevard
Huntsville, Alabama 35806-2807

Appendix A
HDSL2 Loopbacks

HDSL2 MAINTENANCE MODES

This Appendix describes operation of the HDSL2 system with regard to detection of in-band and ESF facility data link loopback codes.

Upon deactivation of a loopback, the HDSL2 system will synchronize automatically.

Loopback Process Description

In general, the loopback process for the HDSL2 system elements is modeled on the corresponding DS1 system process. Specifically, the H2TU-C loopback is similar to an Intelligent Office Repeater loopback, and the H2TU-R loopbacks are similar to a T1 Smart Jack loopback.

The unit can detect the loopback activation or deactivation code sequence *only* if an error rate of $1E^{-03}$ or better is present.

Loopback Control Codes

A summary of network and customer control sequences is given in **Table A-1**.

NOTE

In all control code sequences presented, the in-band codes are shown left-most bit transmitted first, and the ESF data link codes with right-most bit transmitted first.

Table A-1. In-Band Addressable Loopback Codes

Function / Code **Response**
Arm/ 11000 (also known as a 2-in-5 pattern) When sent from the network, the H2TU-C will arm and the H2TU-R will loop up toward the network. No AIS or errors will be sent as a result of this loopback. When sent from the customer, this code will only arm all of the units.
Arm/ FF48 (1111 1111 0100 1000) ESF facility datalink: ESF only; when sent from the network, all units will be armed and an H2TU-R network loopback will be activated. This code has no functionality when sent from the customer.
Disarm/ 11100 (also known as a 3-in-5 pattern) All units are removed from the armed state. If any of the units are in loopback when the 11100 pattern is received, they will loop down. The LBK LEDs will turn off on all units.
Disarm/ FF24 (1111 1111 0010 0100) ESF facility datalink: ESF only; disarms and/or loop down all units.
H2TU-C Loop Up / D3D3 (1101 0011 1101 0011) [1] If the units have been armed and no units are in loopback*, the H2TU-C will loop up toward the network (when sent from the network) or loop up toward the customer (when sent from the customer). Two seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and then 231 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 231 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 231 bit errors will resume at 20-second intervals.
H2TU-R Address 20 for extended demarc / C754 (1100 0111 0101 0100) An H2TU-R network loopback is activated, and a 200-bit error confirmation is sent. 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and then 200 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 200 errors will be injected every 10 seconds (when sent from the network) or every 20 seconds (when sent from the customer). The HDSL2 office unit will not block transmission of far end NIU loopback from the customer premise (H2TU-R).
Loopdown / 9393 (1001 0011 1001 0011) [2] All units currently in loopback will loop down and remain in the armed state if armed.
Query Loopback / D5D5 (1101 0101 1101 0101) [1] The H2TU-C or H2TU-R is in loopback, errors are injected into the DSX-1 signal upon detection of the query loopback pattern. As long as the pattern continues to be sent, errors are injected again every 20 seconds (10 seconds for H2TU-R). The number of errors injected each time depends on which unit is in loopback. 231 errors are injected if the H2TU-C is in loopback and 200 at a time if the H2TU-R is in loopback.
Query Loop Parameters/ DBDB (1101 1011 1101 1011)[1] The H2TU-C is in network loopback, errors are injected into the DSX-1 signal upon detection of the query loop parameters pattern. As long as a pattern continues to be sent, errors are injected again every 20 seconds. The number of errors injected each time depends on the current status of signal quality and pulse attentuation parameters on each loop. 111 errors are injected if all HDSL2 receiver points (H2TU-C and H2TU-R) indicate pulse attenuation is 30 or lower and signal quality (margin) is 6 or higher. Eleven errors at a time are injected if any of the 12 receiver points indicate pulse attenuation is greater than 30 and/or signal quality (margin) is less than 6. This code has no functionality when sent from the customer.
Loopback Time Out Override / D5D6 (1101 0101 1101 0110) [1,*] If the units are armed and this pattern is sent, the loopback time out will be disabled. The time out option will be updated on the PROVISIONING menu of the H2TU-C (viewable through the RS-232 port) to NONE. As long as the units remain armed, the time out will remain disabled. When the units are disarmed, the loopback time out will return to the value it had before the D5D6 code was sent.
Span Power Disable / 6767 (0110 0111 0110 0111) [1,*] If the units are armed and this pattern is sent, the H2TU-C will deactivate its span power supply, turning off the H2TU-R. As long as the pattern continues to be sent, the span power supply will remain disabled. When the pattern is no longer being sent, the H2TU-C will reactivate its span power supply, turning the remote unit(s) on. All units will retrain and return to the disarmed and unlooped state.

Note: All codes listed above must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.
* If NIU is enabled, then the H2TU-R can be in network loopback when the H2TU-C loop-up codes are sent.

[1] Units must be armed with 11000b or FF48h before this code will work.
[2] In order to behave like a NIU, the H2TU-R will not loop down from the network side with 9393h if the NIU loopback option is enabled.