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

CONTENTS

TABLES

1. GENERAL

The ADTRAN 2-Wire T200 HDSL2 Transceiver Unit for the Remote end (H2TU-R) is a network terminating unit used to deploy an HDSL2 T1 circuit using 2-wire metallic facilities. **Figure 1** illustrates the H2TU-R (P/N 1223026L2) front panel.

Revision History

This is the initial issue of this practice. Future changes to this documentation will be explained in this section.

Description

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

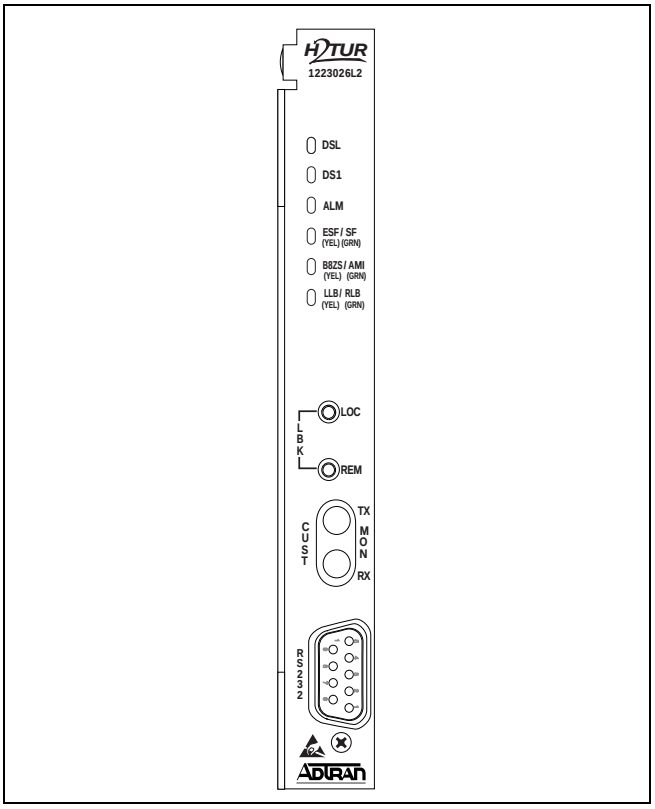


Figure 1. ADTRAN T200 H2TU-R

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 contains an onboard fuse. If the fuse opens, all front panel indicators turn off. The fuse is not designed to be replaced in the field.

Compatibility

This version of the H2TU-R works with multiple list versions of the HDSL2 transceiver unit for the central office (H2TU-R) as listed in **Table 1**.

Table 1. ADTRAN Unit Compatibility

Unit Number	Description
122x001L1 or L2	220/E220 H2TU-C
122x003L1 or L2	DDM+ H2TU-C
122x004L1 or L2	3192 H2TU-C
122x006L1	T200 H2TU-C
118111xL1 or L2	Total Access 3000 H2TU-C

x = any generic release

The H2TU-R is a T200 mechanics card which will fit Type 200 or Type 400 mechanics enclosures, as listed in **Table 2**. This table also provides reference information on the ADTRAN enclosures.

Table 2. H2TU-R Enclosure Compatibility

Part Number	Description[1]	Document Number
1242007Lx	HR12 Metal Enclosure Remote Shelf	61242007LX-5x
1242008L1	HR4 Installation/ Maintenance	61242008L1-5
1242034L2	T400 Single Mount (removable RJ-48 jacks)	61242034L2-5
1242034L3	T400 Single-Mount High Voltage Enclosure	61242034L3-5
1245034L1[2]	T200 Dual-Mount Installation/ Maintenance	61245034L1-5

1 In all applications the H2TU-R must be installed in NEBS compliant and UL listed enclosures to insure full compliance with this unit.

2 ADTRAN's T200 Dual-Mount housing (P/N 1245034L1) is required when using the T200 H2TU-R for HDSL Loop Support System (H-LSSTM) protection circuits.

Compliance

Table 3 shows the compliance codes for the H2TU-R. The T200 H2TU-R is NRTL listed to the applicable UL standards. The T200 H2TU-R is to be installed in a restricted access location and in a Type "B" or "E" enclosure only.

This product is span powered by a voltage of –190 VDC nominal (negative only with respect to ground), GFI protection < 5 mA, and meets all requirements of Bellcore GR-1089-CORE (Class A2) and ANSI T1.418-2002. This product is NRTL listed to the applicable UL standards.

Table 3. Compliance Codes

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

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate this equipment.

2. INSTALLATION

After unpacking the HDSL2 unit, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. Refer to the *Warranty and Customer Service* section for further information. If possible, keep the original shipping container for returning the T200 H2TU-R for repair or for verification of shipping damage.

CAUTION

Electronic modules can be damaged by Electro-Static Discharge (ESD). When handling modules, wear an antistatic discharge wrist strap to prevent damage to electronic components. Place modules in antistatic packing material when transporting or storing. When working on modules, always place them on an approved antistatic mat that is electrically grounded.

There are no configuration switches for the T200 H2TU-R. Configuration is performed via software discussed in the *Control Port Operation-HDSL2* section of this practice.

The T200 H2TU-R plugs directly into the enclosure. No installation wiring is required.

Instructions for Installing the Module

To install the HDSL2, perform the following steps:

1. Hold the unit by the front panel while supporting the bottom edge of the module and engage the enclosure edge.
2. Align the unit edges to fit in the lower and upper guide grooves for the enclosure slot.
3. Slide the unit into the access module slot. Simultaneous thumb pressure at the top and at the bottom of the unit will ensure that the module is firmly seated against the backplane of the chassis.

When the unit first powers up it runs the a series of self-tests. Once the power up self-test is complete the status LEDs will reflect the true state of the hardware.

WARNING

Up to –200 VDC may be present on telecommunications wiring. The DSX-1 interface is intended for connection to intra-building wiring only. Ensure chassis ground is properly connected.

NOTE

This product is intended for installation in **Restricted Access Locations** only.

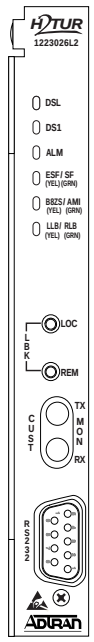
Span Powering Options

This H2TU-R unit is span powered. If a locally powered unit is required, order part number 1223024L2.

Front Panel LED Indicators

There are six front panel mounted LED status indicators, described in **Table 4.**

Table 4. Front Panel Indications



Name	Indication	Description
DSL	Green Red	DSL sync, no errors currently detected, and signal margin > 2 dB No DSL sync, errors being detected, or signal margin ≤ 2 dB
DS1	Green Red	DS1 signal is present and no errors currently being detected No DS1 signal or framing mismatch
ALM	OFF Red Yellow	No active alarm present Loss of DS1 signal to the unit Loss of DSX signal to the H2TU-C
ESF/SF	OFF Yellow Green	Unit is provisioned for UNFRAMED data Unit is provisioned for ESF data Unit is provisioned for SF data
B8ZS/ AMI	Yellow Green	Indicates DS1 is provisioned for B8ZS line code Indicates DS1 is provisioned for AMI line code
LLB/ RLB	OFF Yellow Green	Unit is NOT in loopback Unit is in loopback (network and/or customer) at H2TU-R Active remote loopback from the H2TU-C toward the customer

Front Panel Pushbuttons

Two loopback (LBK) pushbuttons are accessible from the front panel. The **REM** loopback button controls a customer loopback at the H2TU-C. The **LOC** loopback button controls a bidirectional loopback at the H2TU-R. Table 5 details the loopback pushbutton operation.

Table 5. Front Panel Loopback Pushbuttons

Switch Label	Function
REM	Pressing this button changes the H2TU-C loopback state as follows: • If the H2TU-C is not in loopback, pressing this button will activate a bilateral loopback. • If the H2TU-C is in loopback, pressing this button will deactivate the bilateral loopback.
LOC	Pressing this button changes the H2TU-R loopback state as follows: • If the H2TU-R is not in loopback, pressing this button will activate a bilateral loopback. • If the H2TU-R is in loopback, pressing this button will deactivate the bilateral loopback

3. CONNECTIONS

All connections of the H2TU-R are made through card edge connectors. The pin assignments for this unit are shown in Table 6.

Table 6. Card Edge Pin Assignments

Pin	Name	Description
1	CH GND	Chassis ground
5	DS1-T1	DS1 receive out tip (to customer)
7	H1-T	HDSL2 Loop tip (facility)
11	CH GND	Chassis ground
12	GND	Ground for protection switching
13	H1-R	HDSL2 Loop ring (facility)
15	DS1-R1	DS1 receive out ring (to customer)
20	VCC	+5 VDC for protection switching
27	CH GND	Chassis ground
40	PROT-1	Control line for protection switching
49	DS1-R	DS1 transmit in ring (from customer)
55	DS1-T	DS1 transmit in tip (from customer)

When the circuit pack is installed in any of the H2TU-R enclosures, all connections are made through the enclosure backplanes.

NOTE

Ensure that the 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 six front-panel LEDs provide diagnostics for HDSL2 loops, DS1 signals, alarms, provisioning, and loopbacks. See Table 4 on page 4 of this practice for details.

The H2TU-R provides local and remote loopback capabilities via the loopback pushbutton on the front panel.

The DS1 **MON** jacks provide access for DS1 signal monitoring.

DS1 MON Bantam Jacks

The **MON** jack provides a non-intrusive 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 2** is an illustration of specific jack detail.

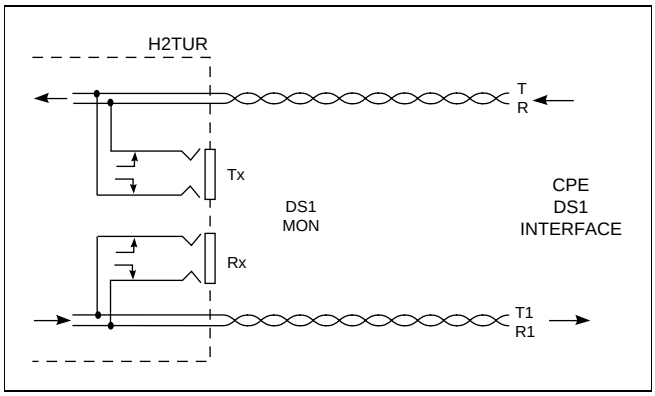


Figure 2. H2TU-R MON Diagram

H2TU-R Network Loopbacks

The H2TU-R responds to multiple loopback activation processes in the following order.

- First, loopback activation may be accomplished using the control port of the H2TU-C or H2TU-R.
- Second, the H2TU-R will respond to the industry standard 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 of this practice.
- Third, the H2TU-R responds to T1 Network Interface Unit smartjack loopback codes as described in Bellcore TR-TSY-000312 if the H2TU-R is optioned for smartjack loopback enabled. The smartjack loopback codes are also provided in *Appendix A*, *HDSL2 Loopbacks*.

This unit contains smartloop technology. That is, it constantly monitors the DSX-1 for a framing pattern. The unit will initiate the proper loopback regardless of how the loopback control sequence is sent (framed or unframed).

Receiving the in-band codes for more than five seconds or the ESF codes four consecutive times will cause the appropriate loopback action.

The H2TU-R will respond to the loopback codes by activating the smartjack loopback from either the disarmed or armed state. The loop down codes will return the unit to its previous state (armed or normal).

Refer to *Appendix A*, *HDSL2 Loopbacks* for more details on loopbacks and loopback arming sequences.

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 using any one of the following methods:

- the terminal control port of the H2TU-C,
- the terminal control port of the H2TU-R, or
- the front-panel **LOC LBK** button of the H2TU-R.

The H2TU-C can be looped using the **REM LBK** button on the front panel of the H2TU-R.

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 (defaulted to 120 minutes).

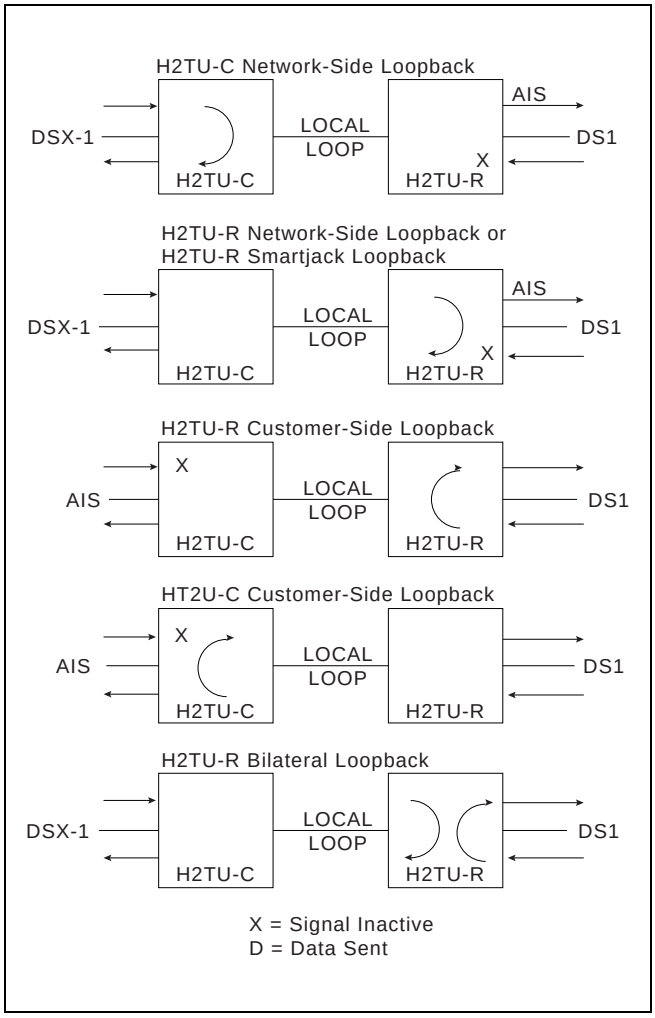


Figure 3. HDSL2 Loopbacks

Control Port Terminal Access

The H2TU-R provides a front panel 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 4**

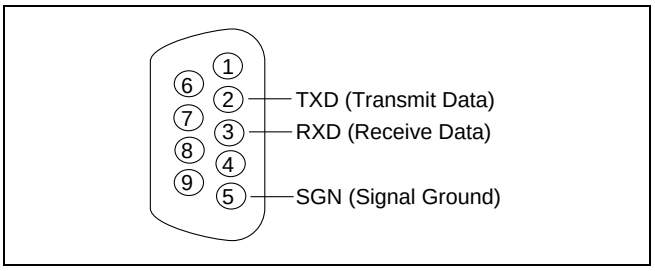


Figure 4. RS-232 (DB-9) Pin Assignments

The terminal interface operates at data rates from 1.2 kbps to 19.2 kbps. The asynchronous data format is fixed at 8 data bits, no parity, and 1 stop bit. The supported terminal type is dumb terminal, VT100 or compatible. The line wrap feature of emulation programs should also be disabled.

NOTE

If you are using a personal computer 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 timeouts.

A terminal session is initiated by entering multiple spacebar 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, which will be detailed in the *Control Port Operation-HDSL2* section.

5. PROVISIONING

Through management access via the front panel DB-9 connector, the provisioning settings can be viewed and manipulated, as detailed in the *Control Port Operation-HDSL2* section.

Table 7 lists the available provisioning options and the factory default settings.

Table 7. Provisioning Options

Provisioning Option	Option Settings	Default Settings
1. DSX-1 Line Build Out	0-133 ft. 133-266 ft. 266-399 ft. 399-533 ft. 533-655 ft.	0 to 133 ft.
2. DSX-1/DS1 Line Code	B8ZS, AMI	B8ZS
3. DSX-1/DS1 Framing	SF, ESF, Unframed, Auto	ESF
4. Force Frame Conversion	Disabled, Enabled	Disabled
5. Smartjack Loopback	Disabled, Enabled	Enabled
6. Loopback Time Out	None, 120 Min	120 Minutes
7. Latching Loopback Mode	T1 (Disabled), FT1 (Enabled)	T1 (Disabled)
8. DS1 Tx Level	0 dB, –7.5 dB, –15 dB	0 dB
9. Customer Loss Indicator	AIS, Loopback, AIS/CI	AIS/CI
10. Performance Reporting Messages	None, SPRM, NPRM, AUTO (both)	AUTO
11. Loop Attenuation Alarm Threshold	0 (Disabled), 1-99 dB	30 dB
12. SNR Margin Alarm Threshold	0 (Disabled), 1-15 dB	04 dB
13. Remote Provisioning	Disabled, Enabled	Enabled
D. Restore Factory Defaults	Resets all options to initial settings	N/A

6. CONTROL PORT OPERATION-HDSL2

The screens illustrated in Figure 5 through Figure 26 apply to an HDSL2 circuit deployed with the ADTRAN HDSL2 technology. The circuit includes an H2TU-C and an H2TU-R. Other configurations are possible (for example, other vendor's equipment) and their displays will vary slightly from those shown in this section.

First displayed is the ADTRAN HDSL2 Main Menu (**Figure 5**), from which the various OAM&P (Operation, Administrative, Maintenance, and Provisioning) screens may be accessed. To display a particular screen from the menu, press the number key associated with the screen title and then press the ENTER key.

```
Circuit ID:                                              10/29/03 09:29:45

                            Adtran HDSL2 Main Menu


                              1.  HDSL2 Unit Information
                              2.  Provisioning
                              3.  Span Status
                              4.  Loopbacks and Test
                              5.  Performance History
                              6.  Scratch Pad, Ckt ID, Time/Date
                              7.  Terminal Modes
                              8.  Alarm History
                              9.  Event History
                             10.  System PM/Screen Report
                             11.  Clear PM and Alarm Histories
                             12.  Troubleshooting
                             13.  Virtual Terminal Control


                      If subscreens do not work properly,
                  press CTRL-T to move to manual update mode.

                                Selection:
```

Figure 5. HDSL2 Main Menu

The HDSL2 Unit Information Screen (**Figure 6**), 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 (**Figure 7**) 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.

```
Circuit ID:                                                  10/29/03 09:29:45
                    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
              P/N: 1223001L2                     P/N: 1223026L2
              S/N: 123456789                     S/N: 123456789
             CLEI: T1L7JBMAAA                   CLEI: T1L7MERAAA
             Manf: 10/01/2003                   Manf: 10/01/2003
              Ver: A04                           Ver: A01
```

Figure 6. HDSL2 Unit information Screen

```
 Circuit ID:                                                 10/29/03 09:29:45
                     Press ESC to return to previous menu


                              Provisioning

                       1.  DSX-1 Line Buildout     =  EXTERNAL
                       2.  DSX-1/DS1 Line Code     =  B8ZS
                       3.  DSX-1/DS1 Framing       =  ESF
                       4.  Forced Frame Conversion =  Disabled
                       5.  Smartjack Loopback      =  Enabled
                       6.  Loopback Timeout        =  120 Min
                       7.  Latching Loopback Mode  =  T1 (Disabled)
                       8.  DS1 TX Level            =  0 dB
                       9.  Customer Loss Indicator =  AIS / CI
                      10.  PRM Setting             =  AUTO
                      11.  Loop Atten Alarm Thres  =  30dB
                      12.  SNR Margin Alarm Thres  =  04dB
                      13.  Remote Provisioning     =  Enabled
                       D.  Restore Factory Defaults



                             Selection:
```

Figure 7. Provisioning Screen

The Span Status Screen (**Figure 8**) 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 screen (**Figure 9**), accessed from the Span Status Menu, 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.

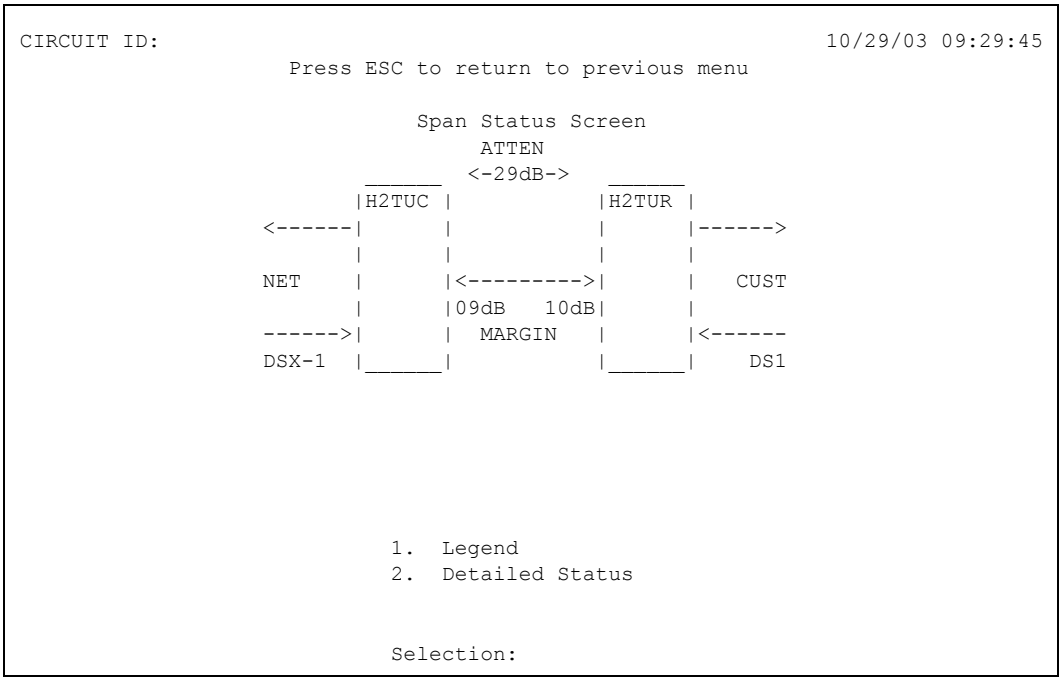


Figure 8. Span Status Screen

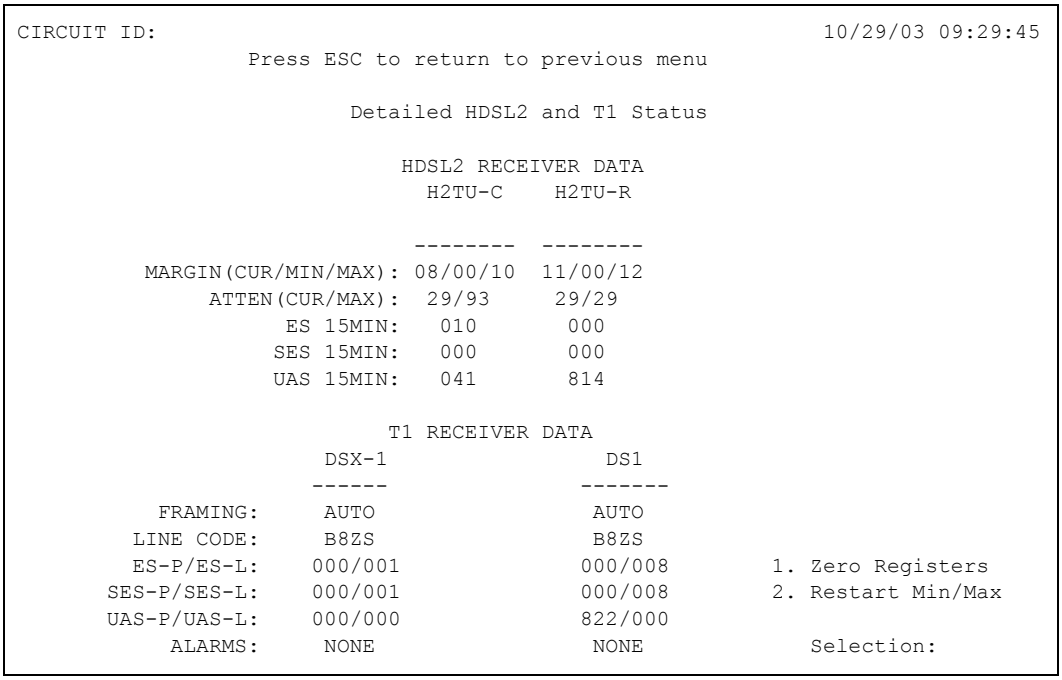


Figure 9. Detail Status Screen

The Loopback and Test Commands Screen (**Figure 10**) provides the user with the ability to evoke or terminate all available HDSL2 loopbacks. It also provides a self-test option to perform a self-diagnostic of the H2TU-C and H2TU-R. Each HDSL2 circuit component can be looped toward the network or customer from this menu.

The Performance History Screens (**Figure 11**, **Figure 12**, and **Figure 13**) display the historical HDSL2 and T1 performance data in several different registers. 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. Additionally, some units store up to 48 hours of 60-minute interval data.

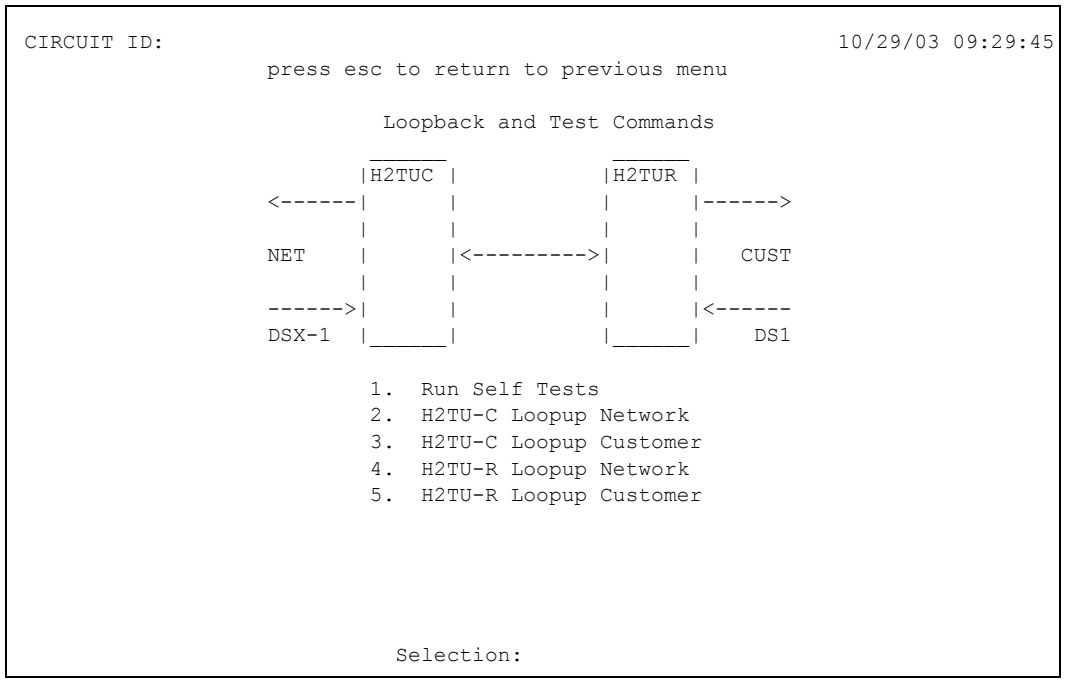


Figure 10. Loopback and Test Commands Screen

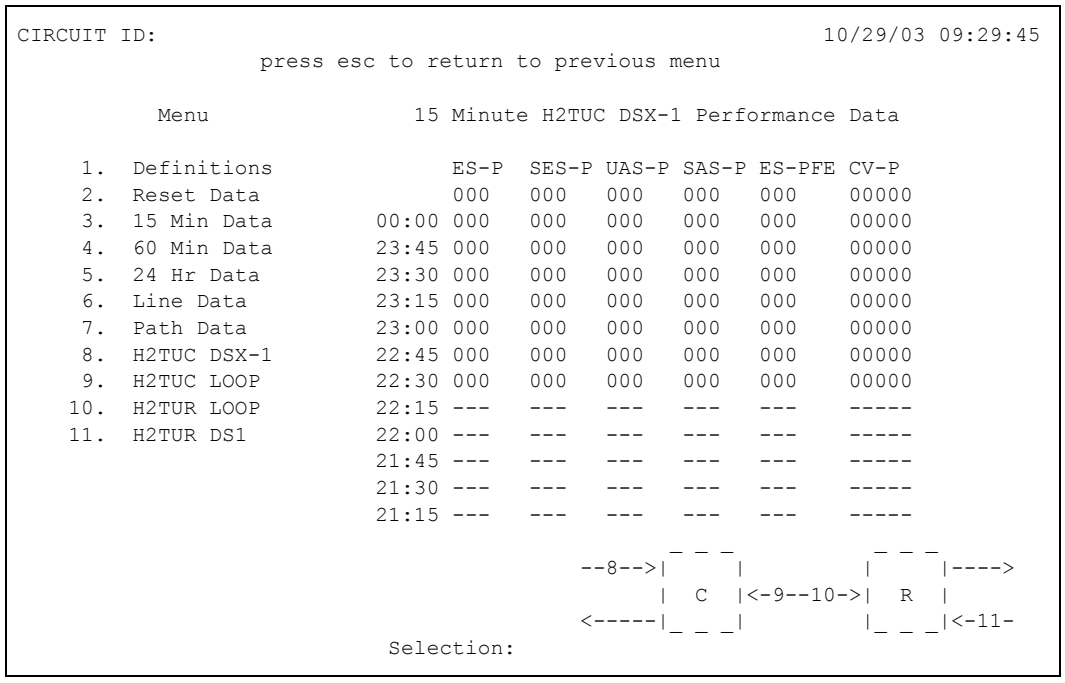


Figure 11. Performance History, Path Data

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) related data can be viewed.

```
CIRCUIT ID:                                                  10/29/03 09:29:45
                Press ESC to return to previous menu

          Menu                 60 Minute H2TUC DSX-1 Performance Data

     1.  Definitions                ES-L  SES-L UAS-L PDVS-L B8ZS-L CV-L
     2.  Reset Data                 0001  0001  0000  0002   0427   00000
     3.  15 Min Data      01/01 00:00 1800  1800  1800  0000   0000   00000
     4.  60 Min Data      12/31 23:00 ----  ----  ----  ----   ----   -----
     5.  24 Hr Data       12/31 22:00 ----  ----  ----  ----   ----   -----
     6.  Line Data        12/31 21:00 ----  ----  ----  ----   ----   -----
     7.  Path Data        12/31 20:00 ----  ----  ----  ----   ----   -----
     8.  H2TUC DSX-1      12/31 19:00 ----  ----  ----  ----   ----   -----
     9.  H2TUC LOOP       12/31 18:00 ----  ----  ----  ----   ----   -----
    10.  H2TUR LOOP       12/31 17:00 ----  ----  ----  ----   ----   -----
    11.  H2TUR DS1        12/31 16:00 ----  ----  ----  ----   ----   -----
                          12/31 15:00 ----  ----  ----  ----   ----   -----
                          12/31 14:00 ----  ----  ----  ----   ----   -----
                          12/31 13:00 ----  ----  ----  ----   ----   -----

                                                _ _ _           _ _ _
                                     --8-->|     |          |     |---->
                                           |  C  |<-9--10->|  R  |
                                     <-----|_ _ _|          |_ _ _|<-11-
                          Selection:
```

Figure 12. Performance History, Line Data

```
CIRCUIT ID:                                                  10/29/03 09:29:45
                Press ESC to return to previous menu

          Menu                 24 Hour H2TUC DSX-1 Performance Data

     1.  Definitions                ES-L  SES-L UAS-L PDVS-L B8ZS-L CV-L
     2.  Reset Data                 04497 04497 04496 00002  00460  0000000
     3.  15 Min Data       12/31 ----- ----- ----- -----  -----  -------
     4.  60 Min Data       12/30 ----- ----- ----- -----  -----  -------
     5.  24 Hr Data        12/29 ----- ----- ----- -----  -----  -------
     6.  Line Data         12/28 ----- ----- ----- -----  -----  -------
     7.  Path Data         12/27 ----- ----- ----- -----  -----  -------
     8.  H2TUC DSX-1       12/26 ----- ----- ----- -----  -----  -------
     9.  H2TUC LOOP        12/25 ----- ----- ----- -----  -----  -------
    10.  H2TUR LOOP        12/24 ----- ----- ----- -----  -----  -------
    11.  H2TUR DS1         12/23 ----- ----- ----- -----  -----  -------
                           12/22 ----- ----- ----- -----  -----  -------




                                                _ _ _           _ _ _
                                     --8-->|     |          |     |---->
                                           |  C  |<-9--10->|  R  |
                                     <-----|_ _ _|          |_ _ _|<-11-
                          Selection:
```

Figure 13. Performance History, Line Data

Abbreviations used in the Performance History Screens are defined in the Data Definitions (**Figure 14** and **Figure 15**).

```
CIRCUIT ID:                                                  10/29/03 09:29:45
                  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
  PDVS-L  Pulse Density Violation Secs    EXZ>=1; >7 zeros if B8ZS, >15 if AMI
  B8ZS-L  B8ZS Seconds                    B8ZS coded signal received
  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

```
CIRCUIT ID:                                                  10/29/03 09:29:45
                  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
  SAS-P   SEF/AIS Seconds               SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  ES-PFE  Far End Errored Seconds       n/a                  PRM bits G1-G6,SE,
                                                              or SL=1, or RAI
  CV-P    Code Violation Count          FE count             CRC error count

NOTE: Under a 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)

The Scratch Pad, Circuit ID and Time/Date Screen (**Figure 16**) allows three main functions:

- Setting/updating system date and time
- Logging the circuit ID
- Logging pertinent work notes

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, 2003, as “010203”).

The Circuit ID field may contain up to 25 characters.

The Scratch Pad is a user-defined field that can contain any alphanumeric characters up to 50 characters in length.

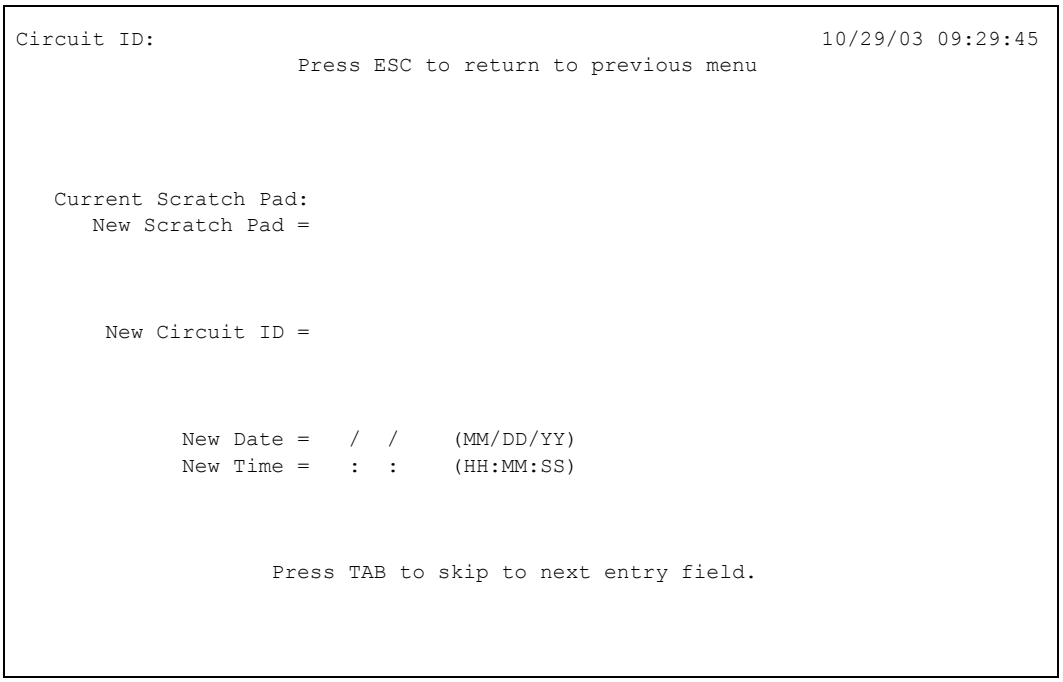


Figure 16. Scratch Pad, Circuit ID, Time/Data Screen

This unit includes two terminal emulation modes. The desired terminal mode can be selected from the Terminal Modes Screen (**Figure 17**). Additionally, pressing CTRL+T while on any screen toggles between the two 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.

The second 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. The Real Time update mode is the default mode.

```
CIRCUIT ID:                                                  10/29/03 09:29:45
                    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 Menu Screen

The Alarm History screens are divided into two separate screens: T1 Alarm History (**Figure 18**) and HDSL2 Span History (**Figure 19**).

T1 Alarm History screen displays:

- DSX-1/DS1 Red Alarm
- DSX-1/DS1 Yellow Alarm
- DSX-1/DS1 Blue Alarm

HDSL2 Span History screen displays:

- Loss of Sync for each HDSL2 receiver
- Margin Threshold Alarm for each HDSL2 receiver
- Attenuation Threshold Alarm for each HDSL2 receiver

```
Circuit ID:                                                    10/29/03 09:29:45
                     Press ESC to return to previous menu

                                T1 Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
H2TU-C     RED(LOS/LOF) 01/01/00  00:00:20   11/04/03  08:30:21   Alarm      004
 (DSX-1)   YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000

H2TU-R     RED(LOS/LOF) 01/01/00  00:00:04   11/04/03  08:30:04   Alarm      004
 (DS1)     YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000









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

Figure 18. T1 Alarm History Screen

```
Circuit ID:                                                    10/29/03 09:29:45
                     Press ESC to return to previous menu

                              HDSL2 Span History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
SPAN 1     LOOP HLOS                                           OK         000


H2TU-C           MRGN   09/29/03  12:15:22   11/04/03  08:30:21   OK         005
H2TU-R           MRGN   10/20/03  15:14:26   10/30/03  10:43:03   OK         010




H2TU-C           ATTN                                          OK         000
H2TU-R           ATTN                                          OK         000




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

Figure 19. HDSL2 Span History Screen

The Event History screen (**Figure 20**) provides a log history of HDSL2 circuit events. Events are recorded in the Events History screen. The following is a list of possible events:

- Circuit ID Change
- DS1 Transmit Level Option Change
- DSX/DS1 Alarm Type Active/Inactive
- DSX-1 Line Build Out Option Change
- Element Network/Customer Loop up/Loop down
- Event Log Reset
- External Alarm Blocking Change
- Framing Option Change
- H2TU-C/H2TU-R Powered Up
- HDSL/T1 PM Registers Reset
- Line Code Option Change
- Loopback Time Out Option Change
- Network Source Setting Change
- NIU Loopback Option Change
- Option were Auto Provisioning from SCU
- Service State Setting Change
- Span Power Option Change
- Time/Date Changed From/To
- Loop Segment XX In/out of Sync

```
Circuit ID:                                                  10/29/03 09:29:45
                     Press ESC to return to previous menu

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

   1.  H2TU-R Powered Up                           01/01/00 00:00:01  H2TU-R
   2.  H2TU-C Powered Up                           01/01/00 00:00:31  H2TU-C
   3.  Loop Segment 1 in sync                      01/01/00 00:00:31  H2TU-C
   4.  Date changed to                             09/29/03 00:52:39  H2TU-C
   5.  Time changed to                             09/29/03 11:48:00  H2TU-C
   6.  H2TU-R Powered Up                           09/29/03 12:15:01  H2TU-R
   7.  H2TU-C Powered Up                           09/29/03 12:15:28  H2TU-C
   8.  Loop Segment 1 in sync                      09/29/03 12:15:28  H2TU-C
   9.  H2TU-R Powered Up                           09/29/03 12:15:01  H2TU-R
  10.  Loop Segment 1 out of sync                  09/29/03 12:16:27  H2TU-C


       Page Number:   1/  1   Number of Events:   8
     ------------------------------------------------------
     'P' - Previous Page  'H' - Home      'R' - Reset Events
     'N' - Next Page      'E' - End

                            Selection:
```

Figure 20. Event History Screen

The System PM/Screen Report option from the Main Menu (**Figure 21**) offers these four types of reports on performance monitoring:

1. Full System/History Report
2. Current Status Report
3. System Configuration Report
4. Alarm/Event History

Selecting a report type will display all the reports for that category on the screen at once, which is more efficient than stepping through menus individually to view each report.

The Clear PM and Alarm Histories option (**Figure 22**) initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu displays the prompt, "This will clear the history data for all elements in the circuit. Are you sure (Y/N)?"

```
                              6.  Scratch Pad, Ckt ID, Time/Date
                              7.  Terminal Modes
                              8.  Alarm History
                              9.  Event History
                             10.  System PM/Screen Report
                             11.  Clear PM and Alarm Histories
                             12.  Troubleshooting
                             13.  Virtual Terminal Control


                        If subscreens do not work properly,
                    press CTRL-T to move to manual update mode.

                                 Selection: 10


          Enable data logging now.
Select Report Type or Press Escape to cancel:
  1)  Full System/History Report
  2)  Current Status Report
  3)  System Configuration Report
  4)  Alarm/Event History
```

Figure 21. System PM/Screen Report

```
Circuit ID:                                                  10/29/03 09:29:45

                               Adtran HDSL2 Main Menu

                              1.  HDSL2 Unit Information
                              2.  Provisioning
                              3.  Span Status
                              4.  Loopbacks and Test
                              5.  Performance History
                              6.  Scratch Pad, Ckt ID, Time/Date
                              7.  Terminal Modes
                              8.  Alarm History
                              9.  Event History
                             10.  System PM/Screen Report
                             11.  Clear PM and Alarm Histories
                             12.  Troubleshooting
                             13.  Virtual Terminal Control

                   This will clear the PM, Alarm, Span Status, and
                  Troubleshooting Histories for all circuit elements.
                               Are you sure (Y/N)?

                                 Selection: 11
```

Figure 22. Clear PM and Alarm Histories Screen

The Troubleshooting screen (**Figure 23**) compiles information received from all facilities and equipment in the circuit and presents them in both Real-Time and 7-Day historical format.

The Troubleshooting Guidance screen (**Figure 24**) option (accessed from the Troubleshooting screen) analyzes this information and makes repair recommendations.

```
Circuit ID:                                                  10/29/03 09:29:45
                      Press ESC to return to previous menu
                                Troubleshooting

For HELP based on detected problems, select Troubleshooting Guidance from the
list below. If further assistance is needed, contact ADTRAN Tech Support.









Hours: Normal 7am - 7pm CST                      1. Troubleshooting Guidance
       Emergency 7 days x 24 hours               2. General Information
Phone: 800.726.8663 / 888.873.HDSL
  Fax: 256.963.6217

                             Selection:
```

Figure 23. Troubleshooting Screen

```
Circuit ID:                                                  10/29/03 09:29:45
                      Press ESC to return to previous menu
                        DSX-1 Loss of Signal (Red Alarm)

- Patch test set REC jack into H2TUC MON TX jack to verify integrity of
signal to the H2TUC from the network (verify test set in MON mode).

- If signal to H2TUC is missing, insert test set at DSX panel IN Jack connecting
toward H2TUC (to verify wiring between DSX and H2TUC shelf). Check H2TUC to
verify DSX-1 LOS alarm is cleared. This verifies TX(out) and RX(in) pairs are
not swapped.

- If signal from DSX OK, verify cross-connect wiring at DSX panel is turned over
(OUT to IN) and (IN to OUT).

-If DSX wiring OK, connect test set REC to the DSX MON, network side equipment,
to verify signal from network (verify test set to MON). If no signal,
troubleshoot office problems.

For Total Access cards verify the following:
- Provisioning>Network Source is configured correctly for Mux or DSX operation.
- Provisioning>Service State is not configured for OOS-Unassigned.
- Mux card is mapped correctly.
- Mux card is functioning correctly.
```

Figure 24. Troubleshooting Guidance Screen

The General Information screen (**Figure 25**) shows the Loop Deployment Guidelines for this type of circuit. Should trouble occur on the circuit, many test details are available here.

The Virtual Terminal Session Control screen (**Figure 26**) allows the user to log into the H2TU-C from the H2TU-R. Terminal control of the H2TU-C is retained until 5 minutes of idle time passes, or it may be released immediately by pressing CTRL+X.

```
Circuit ID:                                                  10/29/03 09:29:45
                      Press ESC to return to previous menu


HDSL2 Loop Guidelines for optimum operation
-----------------------------------------
Non-loaded cable pair
Single bridge tap < 2Kft
Total bridge taps < 2.5Kft
Bridge tap within 1000ft of transceiver may affect performance.
Impulse noise < 50dBrnF (F filter)
Wideband noise < 31dBrnF (f filter)
Power influence <= 80 dBrnC
Longitudinal Balance >= 60dB (If using Wideband test at 196 Khz >= 40dB)
Foreign DC Voltage (t-r,t-g,r-g) < 3VDC
Loop Resistance <= 775 ohms
Margin  >= 6 dB
Attenuation <= 28 dB


                                Selection:
```

Figure 25. General Information Screen

```
Circuit ID:                                                  10/29/03 09:29:45
                      Press ESC to return to previous menu

                      Virtual Terminal Session: Inactive
                              Virtual Host:  no


                           Virtual Terminal Control

                            1.  Log into H2TU-C









                              Selection:
```

Figure 26. 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:

- All loops are nonloaded only.
- For loops with 26-AWG cable, the maximum loop length including bridged tap lengths is 9 kft.
- For loops with 24-AWG cable, the maximum loop length including bridged tap lengths is 12 kft.
- Any single bridged tap is limited to 2 kft.
- Total bridged tap length is limited to 2.5 kft.
- The total length of multigauge cable containing 26-AWG cable must not exceed the following:

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

These deployment criteria are summarized in the chart shown in **Figure 27**.

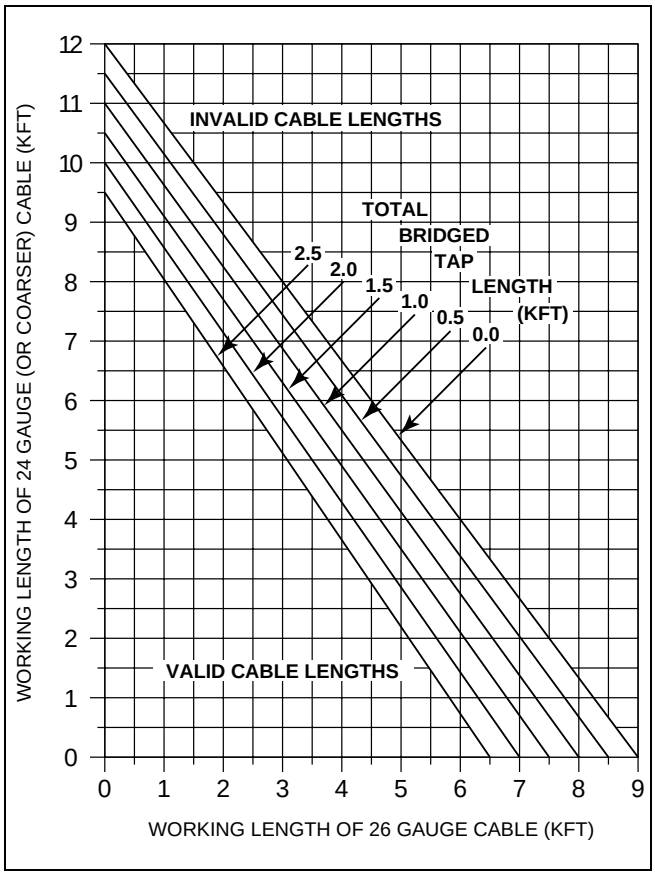


Figure 27. HDSL2 Deployment Guidelines

Loop loss per kilofoot for other wire is summarized in **Table 8**.

Table 8. HDSL2 Loss Values

Cable Gauge	Cable Type	Temperature (°F) 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	2.545	2.629
19	PIC	1.551	1.587	1.634
19	Pulp	1.817	1.856	1.909

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.

8. TROUBLESHOOTING PROCEDURES

Table 9 is a troubleshooting guide for the T200 H2TU-R.

9. MAINTENANCE

The ADTRAN H2TU-R requires no routine maintenance. In case of equipment malfunction, use the front panel bantam jack 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. Refer to Warranty and Customer Service section of this Practice.

10. PRODUCT SPECIFICATIONS

Specifications for the HDSL2 ADTRAN T200 H2TU-R 2-Wire HDSL (HDSL2) Remote Unit are detailed in Table 10.

11. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

U.S. and Canada customers can also receive a copy of the warranty via ADTRAN's toll-free faxback server at 877-457-5007.

- Request document 414 for the *U.S. and Canada Carrier Networks Equipment Warranty*.
- Request document 901 for the *U.S. and Canada Enterprise Networks Equipment Warranty*.

Refer to the following subsections for sales, support, CAPS requests, or further information.

ADTRAN Sales

Pricing/Availability:
800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

Standard hours: Monday - Friday, 7 a.m. - 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

Contact Customer and Product Service (CAPS) prior to returning equipment to ADTRAN.

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

Table 9. Troubleshooting Guide

Condition	Solution
All Front Panel LED indicators are *off*.	1. Make sure the H2TU-R is properly seating in the housing. 2. Verify that the H2TU-C is delivering sufficient voltage to the loop, if H4TU-R is span powered. 3. If steps 1 and 2 pass, and LED indicators remain off, replace the H2TU-R.
Power is present and adequate, but loop sync is not available (DSL LED is *off*).	1. Verify that the loop conforms with CSA guidelines (not too long, etc.). 2. Verify that loop loss at 196 kHz is not greater than 35 dB. 3. Verify that noise on the HDSL2 loop is within acceptable limits. If steps 1 through 3 pass and loop sync is still not available, replace the unit.

Table 10. 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 Mbps
Baud Rate	517.333 k baud
Service Range	Defined by Carrier Service Area Guidelines
Loop Loss	Refer to the *HDSL2 Deployment Guidelines* section for details
Bridged Taps	Single Taps < 2 kft, Total Taps < 2.5 kft
Performance	Compliant with T1.418-2000 (HDSL2 Standard)
H2TU-R Tx Power (Data) Level	16.8 $\pm$ 0.5 dBm (0 to 450 kHz)
H2TU-R Tx Power (Activation) Level	16.6 + 0.5 dBm (0 to 450 kHz)
Input Impedance	135 ohms
Maximum Loop Resistance	900 ohms per span
Return Loss	12 dB (50 kHz to 200 kHz)
Customer Interface	
DS1 (T1.403-compatible)	(ITU-T I.431 compliant)
DS1 Signal Output Level	0 (default), –7.5 or –15 dB
DS1 Input Signal Level	0 to 22.5 dB
DS1 Line Coding	AMI, B8ZS (default)
DS1 Framing Format	SF, ESF (default), Unframed, Auto
Power	
Span-powered by H2TU-R Maximum Heat Dissipation	3.0 W
Clock Sources	
Clock Sources	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% noncondensing
Compliance	
UL Listed Bellcore NEBS Level 3 (SR-3580) FCC 47CFR Part 15, Class A	
Part Number	
ADTRAN T200 H2TU-R 2-Wire HDSL (HDSL2) Remote Unit	1223026L2

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Appendix A
HDSL2 Loopbacks

HDSL2 MAINTENANCE MODES

This appendix describes operation of the HDSL2 system with regard to detection of inband 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 an in-line T1 Repeater loopback.

Inband control code sequences are transmitted over the DS1 link by either the *unframed* or *overwrite* method. The HDSL2 elements respond to either method.

The unframed method produces periodic control sequences, and the normal DS1 framing bit is omitted.

The overwrite method produces periodic control sequences. However, once per frame, the framing bit overwrites one of the bits in the control sequence.

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

DDS Latching Loopback Operation

If the unit is optioned for FT1 mode, then DDS Latching Loopback operation is supported as described in Bellcore TA-TSY-000077, Issue 3, Section 5.1.3. The H2TU-C in the HDSL2 circuit is treated as an Identical Tandem Dataport, and the H2TU-R is treated as a Different Tandem Dataport. The H2TU-R will establish a network loopback upon detection of standard DDS NI-NEI/RPTR loopback sequence.

Loopback Control Codes

A summary of control sequences is given in **Table A-1** and **Table A-2**.

NOTE

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

Table A-1. HDSL2 Loopback Control Codes

Type	Source[1]	Code[2,3]	Name
Abbreviated	(N)	3in7 (1110000)	Loopback data from network toward network in the HTU-R.
	(N)	4in7 (1111000)	Loopback data from network toward network in the HTU-C.
	(C)	6in7 (1111110)	Loopback data from customer toward customer in HTU-C.
	(C)	5in7 (1111100)	Loopback data from customer toward customer in HTU-R.
Wescom	(N)	FF1E (1111 1111 0001 1110)	Loopback data from network toward network at HTU-C.
	(C)	3F1E (0011 1111 0001 1110)	Loopback data from customer toward customer at HTU-C.
	(N)	FF02 (1111 1111 0000 0010)	Loopback data from network toward network at HTU-R.
	(C)	3F02 (0011 1111 0000 0010)	Loopback data from customer toward customer at HTU-R.
	(C)	FF48 (1111 1111 0100 1000)	Loopback data from customer toward customer at HTU-R.(FDL)
	(N)	FF48 (1111 1111 0100 1000)	Loopback data from network toward network at HTU-R. (FDL)
	(N/C)	1 in 3 (100)	Loopdown everything.
	(N/C)	FF24 (1111 1111 0010 0100)	Loopdown everything. (ESF-DL)

1. The Source column indicates which side of the interface the control codes are sent from. For example, an (N) indicates a network sourced code while a (C) indicates a customer sourced code.
2. All codes are in-band unless labeled FDL.
3. All codes listed above must be sent for a minimum of 5 seconds to be detected and acted upon.

Table A-2. In-Band Addressable Loopback Codes

Function	Code (Hex / Binary)	Response
ARM (in-band) - also known as 2-in-5 pattern	11000 (binary)	The H2TU-R will loop back toward the network. No AIS or errors will be sent as a result of this loopback. The H2TU-C will arm.
Disarm (in-band) - also known as 3-in-5 pattern	11100 (binary)	The H2TU-C is 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.
H2TU-C Loop Up	D3D3 or 1101 0011 1101 0011	If armed, the H2TU-C will loop back, 2 seconds of AIS (all ones) will be transmitted, the looped data will be sent for 5 seconds, and then a burst of 231 logic (bit) errors will be injected. The burst of 231 logic errors will continue every 20 seconds as long as the D3D3 pattern is detected. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 231 logic errors will resume every 20 seconds.
Loop Down w/o Disarm	9393 or 1001 0011 1001 0011	When sent from the network, all units currently in loopback will loop down. Armed units will not disarm.
Loopback Query	D5D5 or 1101 0101 1101 0101)	If the units are armed, and the H2TU-C or H2TU-R are in network loopback, logic errors will be injected toward the network to indicate a loopback is present toward the network. The number of errors injected is determined by the unit that is in loopback. As long as the pattern continues to be sent, errors are injected again every 20 seconds: H2TU-C 231 errors H2TU-R 20 errors
Loopback Time Out Override	D5D6 or 1101 0101 1101 0110	If the units are armed or a unit is currently in loopback when this pattern is sent from the network, the loopback time out will be disabled. As long as the units remain armed, the time out will remain disabled. When the units are disarmed, the loopback time out will revert to the previous loopback time out setting. If any element is in network loopback a bit error confirmation will be sent. H2TU-C 231 bps H2TU-R 20 bps
Span Power Disable	6767 or 0110 0111 0110 0111	If the units are armed and 6767 is sent from the network, the H2TU-C will disable span power. If the pattern is sent from the network, the span power will be disabled as long as 6767 pattern is detected. Once the pattern is no longer received, the H2TU-C will reactivate span power. All units will then retrain and return to the disarmed and unlooped state.
H2TU-R Loopback	C742 1100 0111 0100 0010	FDL, ESF only. When set from the network, an H2TU-R network loopback is activated, and a 20-bit error confirmation is sent. When set from the customer, an H2TU-R customer loopback is activated with a 20-bit error confirmation.

Note: All codes listed above must be sent for a minimum of 5 seconds to be detected and acted upon