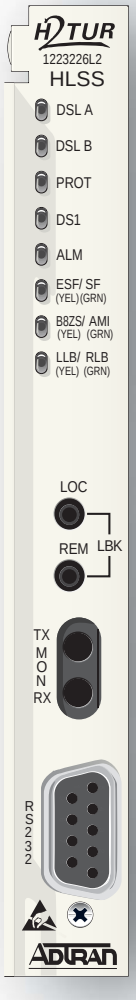

T200 HLSS HDSL2 Remote Transceiver Unit Installation and Maintenance Practice

Part Number: 61223226L2-5A
CLEI: T1L7YERA_ _
July 2005

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Revision History

Revision	Date	Description of Changes
A	July 2005	Initial release

Conventions

The following typographical conventions are used in this document:

This font indicates a cross-reference link. First-time references to tables and figures are shown in **this font**.

This font indicates screen menus, fields, and parameters.

THIS FONT indicates keyboard keys (ENTER, ESC, ALT). Keys that are to be pressed simultaneously are shown with a plus sign (ALT+X indicates that the ALT key and X key should be pressed at the same time).

This font indicates references to other documentation and is also used for emphasis.

`This font` indicates on-screen messages and prompts.

`This font` indicates text to be typed exactly as shown.

This font indicates silkscreen labels or other system label items.

This font is used for strong emphasis.

NOTE

Notes inform the user of additional but essential information or features.

CAUTION

Cautions inform the user of potential damage, malfunction, or disruption to equipment, software, or environment.

WARNING

Warnings inform the user of potential bodily pain, injury, or death.

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Training Phone: 800-615-1176, ext. 7500

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T200 HLSS HDSL2 Remote Transceiver Unit

GENERAL

This practice is an installation and maintenance guide for the ADTRAN T200 HLSS HDSL2 Remote Transceiver Unit (HLSS H2TU-R). The part number (P/N) for the module is 1223226L2.

Description

HDSL2 provides extended range to DS1/T1 transport while providing spectral compatibility with ADSL and other transport technologies. DSX-1 signals are provided to, and received by, the H2TU-C (Central Office unit) from the network and converted to HDSL2 signals. The H2TU-R terminates local loop HDSL2 signals and transforms the signal into traditional DS1 signals to be delivered to the customer.

The ADTRAN Dual-Port HLSS H2TU-R incorporates the HDSL Loop Support System® (HLSS) for protection switching utilizing one card through an HDSL2 1:1 facility protection switching scheme designed to interface with the ADTRAN Total Access 3000 Dual-Port HLSS H2TU-C (P/N 1181214L2).

Dual-Port Protection Switching

The Dual-Port H2TU-C will connect to the MDF with two cable pairs, one carrying a primary HDSL2 circuit, and the other carrying a secondary HDSL2 circuit. At the H2TU-R, the primary and secondary cable pairs are connected to the enclosure backplane. This cable configuration is illustrated in **Figure 1**.

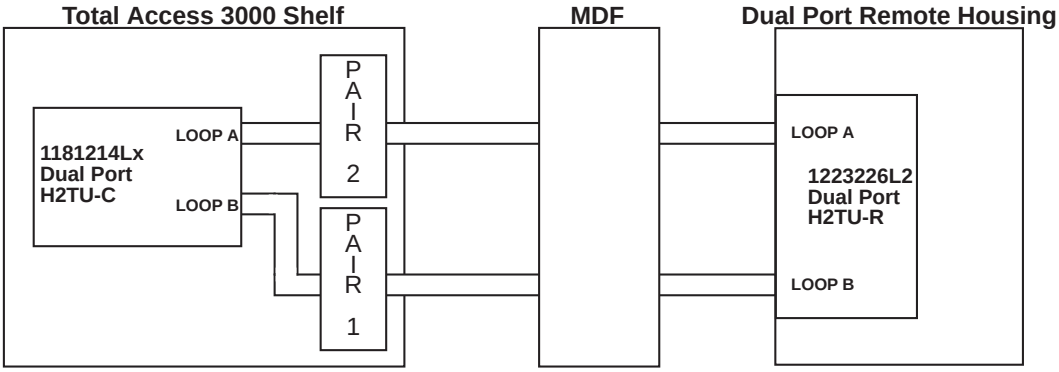


Figure 1. Dual Port Cable Configuration

Compatibility

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

Table 1. ADTRAN Unit Compatibility

Unit Number	Description
1181214L2	Total Access 3000 Dual-Port HLSS H2TU-C

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-5
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. The ADTRAN T200 Dual-Mount housing (P/N 1245034L1) is required when deploying the T200 H2TU-R for HDSL Loop Support System (HLSS™) protection circuits.

Compliance

Table 3 shows the compliance codes for the H2TU-R. The HLSS H2TU-R is NRTL listed to the applicable UL standards. The HLSS 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 –140 VDC nominal (negative only with respect to ground) and meets all requirements of Bellcore GR-1089-CORE (Class A3) and ANSI T1.418-2002.

Table 3. Compliance Codes

Code	Input	Output
Power Code (PC)	C	C
Telecommunication Code (TC)	X	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.

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 "Appendix C, Warranty" for further information. If possible, keep the original shipping container for returning the HLSS H2TU-R for repair or for verification of shipping damage.

CAUTION

Electronic modules can be damaged by Electrostatic 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.

The HLSS H2TU-R does not have configuration switches. Configuration is performed via firmware. For more information, refer to "Control Port Operation-HDSL2" on page 10.

Instructions for Installing the Module

The HLSS H2TU-R plugs directly into the enclosure. Installation wiring is not required. To install the HLSS H2TU-R, 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 bottom of the unit ensures that the module is firmly seated against the chassis backplane.

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.

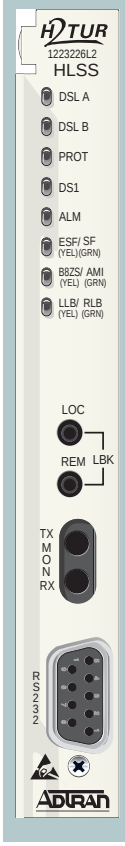
NOTE

This product is intended for installation in r**estricted access locations** only.

Front Panel LED Indicators

LED indicators mounted on the front panel of the unit provide the status of the HDSL circuit. Each is described in **Table 4**.

Table 4. Front Panel LEDs

Module	Label	Indication	Description
	**DSL A/ DSL B**	● Green	Normal operation: DSL receiver signal is synchronized, no errors, and margin is ≥ 3 dB
		● Red	DSL receiver out of sync, errors, or margin < 3 dB
	PROT *	○ Off	Unit is not configured for protection switching
		● Green	Unit is configured for protection switching
		● Red	Protection is enabled but unavailable due to circuit conditions
	DS1	● Green	Normal operation: Good signal from the CPE is present
		● Red	No DS1 signal or present with errors
	ALM	○ Off	No alarm condition detected
		● Yellow	Loss of DSX-1 to the remote-end unit
		● Red	Loss of DS1 to the unit
	ESF/SF	○ Off	Unit has detected unframed data
		● Green	Unit has detected SF data
		● Yellow	Unit has detected ESF data
	B8ZS/ AMI	● Green	Unit is provisioned for B8ZS line code
		● Yellow	Unit is provisioned for AMI line code
	LLB/RLB	○ Off	Unit is not in active loopback
		● Yellow	Unit is in active loopback toward network and customer

* During initial training, the **PROT** LED may turn red until both loops are up and stable.

Front Panel Pushbuttons

There are two loopback pushbuttons accessible from the front panel. The **LOC** pushbutton controls a bidirectional loopback at the H2TU-R. The **REM** pushbutton controls a bidirectional loopback at the H2TU-C. Press the button once to activate, and again to release the loopback.

CONNECTIONS

All connections of the H2TU-R are made through card edge connectors. The pin assignments for this unit are shown in **Table 5**.

Table 5. Card Edge Pin Assignments

Pin	Name	Description
1	CH GND	Chassis ground
5	DS1-T1	DS1 receive out tip (to customer)
7	Loop A-T	Loop A tip (facility)
11	CH GND	Chassis ground
13	Loop A-R	Loop A ring (facility)
15	DS1-R1	DS1 receive out ring (to customer)
27	CH GND	Chassis ground
41	Loop B-T	Auxiliary Loop 2 tip (for protection switching)
47	Loop B-R	Auxiliary Loop 2 ring (for protection switching)
49	DS1-R	DS1 transmit in ring (from customer)
55	DS1-T	DS1 transmit in tip (from customer)

When the H2TU-R 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.

HDSL2 SYSTEM TESTING

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

The front panel LEDs provide diagnostics for HDSL2 loops, DS1 signals, alarms, provisioning, and loopbacks. See Table 4 on page 5 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.

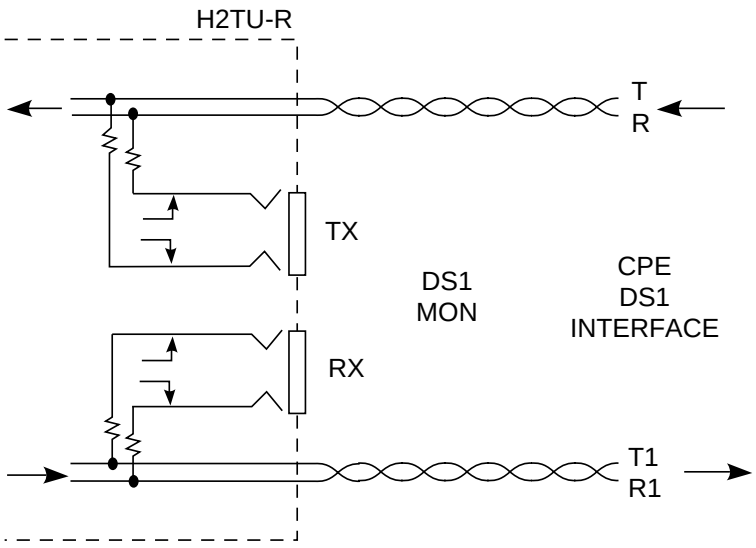


Figure 2. H2TU-R MON Diagram

H2TU-R Network Loopbacks

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

- Loopback activation may be accomplished using the control port of the H2TU-C or H2TU-R.
- The H2TU-R will respond to the industry standard HDSL loopback codes as designated in the ANSI document T1E1.4/92.
- 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.

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 can also be looped back in the direction of the customer using any one of the following methods:

- Terminal control port of the H2TU-C
- Terminal control port of the H2TU-R
- Front-panel **LOC** pushbutton of the H2TU-R

The H2TU-C can be looped using the **REM** pushbutton 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).

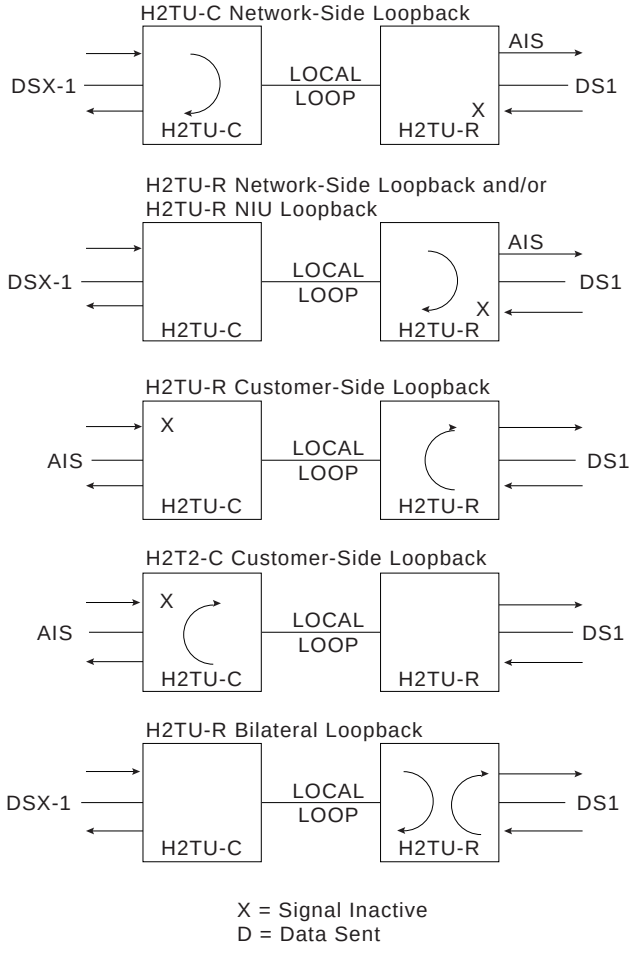


Figure 3. HDSL2 Loopbacks

PROVISIONING

Through management access via the front panel DB-9 connector, the provisioning settings can be viewed and manipulated. For more information, refer to "Control Port Operation-HDSL2" on page 10.

Table 6 lists the available provisioning options and the factory default settings.

Table 6. Provisioning Options

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

1. The forced frame format conversion (FFFC) mode sets the H2TU-C to ESF and the H2TU-R to SF. This mode should be used to force SF (DS1 from customer) to ESF (DSX-1 to network) conversion in the absence of network provided ESF framing.
2. Customer Loss Indicator
   - AIS – Send AIS to network upon T1 loss of signal or T1 AIS from customer.
   - LPBK – HTU-R initiates a network loopback upon T1 loss of signal or T1 AIS from customer.
   - AIS/CI – HTU-R sends customer disconnect indication upon loss of signal, loss of synchronization, or receipt of T1 AIS from customer.

     Note: The CI is generated by transmitting the framing received from the network while overwriting the payload with a repeating pattern. For applications where the DS1 is Extended Superframe, the data link is overwritten with a Yellow Alarm that is interrupted once every second by a 100 millisecond code burst of 7E (HEX).

CONTROL PORT OPERATION-HDSL2

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**.

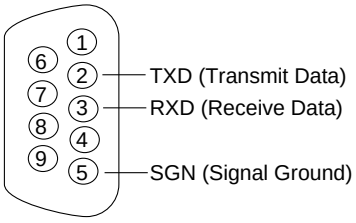


Figure 4. RS-232 (DB-9) Pin Assignments

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 a personal computer with terminal emulation capability is used, 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.

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 (**Figure 5**).

NOTE

The screens illustrated in Figure 5 through Figure 28 apply to an HDSL2 circuit deployed with the ADTRAN HDSL2 technology. The circuit includes a Dual-Port HLSS H2TU-C and a Dual-Port HLSS H2TU-R.

Menu Structure

The menu structure for the HDSL2 products is a layered menu. Each menu level consists of the following screen objects:

- Submenus – These objects are elements that move the display down to the next menu level.
- Menu items – These objects are the mechanism by which changes are made to the current settings.

  The HDSL2 products support the following menu item types:

  - Read-only – This menu item displays information that cannot be changed, such as the status.
  - Read-write – This menu item displays information that, when selected, can be changed.

Options that can be changed from menus are labeled with a number. To change an option, select the appropriate number, and press ENTER. A new menu will appear with a list of the available options.

Main Menu

The Main Menu provides access to detailed performance and configuration information.

```
Circuit ID:                                              01/19/05 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

To display a particular screen from the menu, press the number key associated with the screen title, and press ENTER.

The menu options are as follows:

HDSL2 Unit Information Screen

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.

```
Circuit ID:                                                    01/19/05 17:00:23
                     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: 1181214L2                     P/N: 1223226L2
              S/N: 123456789                     S/N: 123456789
             CLEI: T1L7XGLAAA                   CLEI: T1L7YERAAA
             Manf: 12/28/2004                   Manf: 12/28/2004
              Ver: A00003                        Ver: A00003
```

Figure 6. HDSL2 Unit Information Screen

Provisioning

The Provisioning menu (**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. The Restore Factory Defaults at the bottom of the list is useful when re-deploying a module.

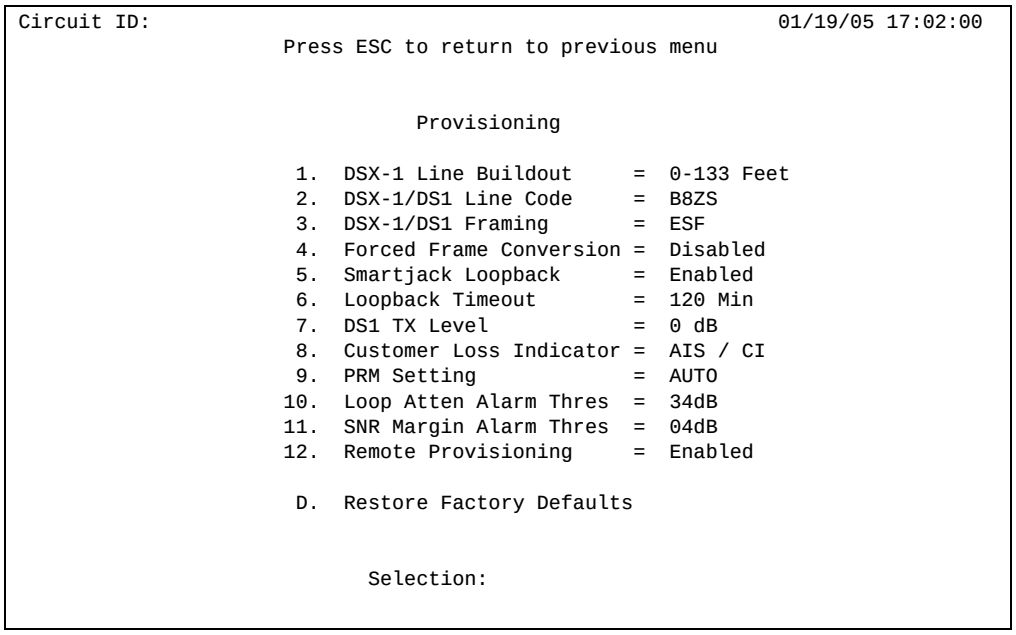


Figure 7. Provisioning Screen

Span Status

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.

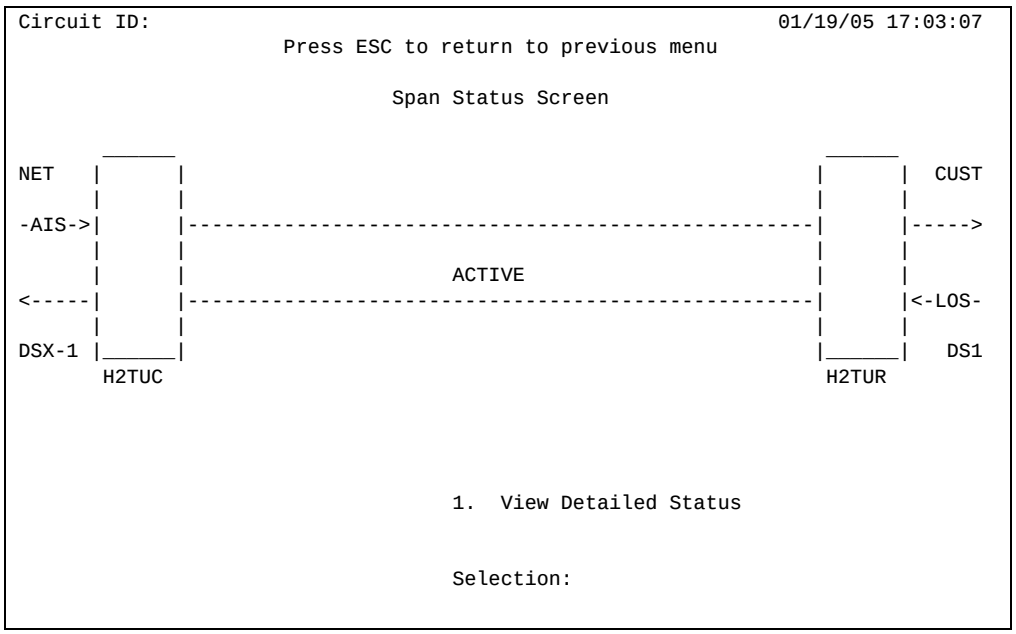


Figure 8. Span Status Screen

Detailed Span Status

The Detailed Status selection from the Span Status Menu (**Figure 9**) displays the HDSL2 and T1 status for each receiver point. All registers can be cleared (returned to zero) and the Forward Error Correction counts can be reset. Clearing the registers requires confirmation.

The FEC BER count for each loop include the following parameters:

- Raw BER – Raw BER is the uncorrected Bit Error Rate received at the module.
- Eff BER – Effective BER is the Bit Error Rate after errors were corrected.

```
Circuit ID:                                                  01/19/05 17:03:59
                    Press ESC to return to previous menu

                            Detailed Status Screen

                    LOOP A                              LOOP B
                  MARGIN       ATTEN                  MARGIN       ATTEN
Interface   (CUR/MIN/MAX) (CUR/MAX)             (CUR/MIN/MAX) (CUR/MAX)
---------   ------------- ---------             ------------- ---------
H2TUC         17/17/17      00/00                 17/17/17      00/00
H2TUR         17/17/17      00/05                 17/17/17      00/00


                LOOP A         LOOP A               LOOP B         LOOP B
Interface    FEC RAW BER    FEC EFF BER          FEC RAW BER    FEC EFF BER
---------   -------------  -------------        -------------  -------------
H2TUC        <1E-09   ACT   <1E-09   ACT        <1E-09   ACT   <1E-09   ACT
H2TUR        <1E-09   ACT   <1E-09   ACT        <1E-09   ACT   <1E-09   ACT

                            1. Reset Min/Max
                            2. View Performance History
                            3. Reset FEC Error counts

                            Selection:
```

Figure 9. Detail Status Screen

Loopbacks and Test

Figure 10 illustrates the Loopback and Test Commands menu, which provides the ability to initiate 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 HSDL2 circuit component can be looped toward the network or customer from this screen.

```
Circuit ID:                                                  01/19/05 17:05:17
                    Press ESC to return to previous menu

                          Loopback and Test Commands

        ______                                                ______
NET    |      |                                              |      |  CUST
       |      |                                              |      |
------>|      |----------------------------------------------|      |----->
       |      |                                              |      |
       |      |                                              |      |
<------|      |----------------------------------------------|      |<-----
       |      |                                              |      |
DSX-1  |______|                                              |______|   DS1
       H2TUC                                                 H2TUR

         1.  Run Self Tests
         2.  H2TU-C  Loopup  Net
         3.  H2TU-C  Loopup  Cust
         4.  H2TU-R  Loopup  Net
         5.  H2TU-R  Loopup  Cust


                            Selection:
```

Figure 10. Loopback and Test Commands Menu

Performance History

The Performance History menus (**Figure 11** and **Figure 12**) display the historical HDSL2 and T1 performance data in several different registers. At each 15-minute interval, the performance information is transferred from the current to the previous 15-minute performance data register. This unit stores performance data in 15-minute increments for the previous 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.

Select a module and interface to view the corresponding performance data (options 8 through 11, as indicated in Figure 11 and Figure 12). Line (L) and Path (P) related data can be viewed.

```
Circuit ID:                                                  01/19/05 17:07:51
                    Press ESC to return to previous menu

          Menu                 15 Minute H2TUC DSX-1 Performance Data

    1.  Definitions              ES-L  SES-L LOSS-L PDVS-L B8ZS-L CV-L
    2.  Reset Data               000   000   000    000    000    00000
    3.  15 Min Data        17:00 000   000   000    000    000    00000
    4.  60 Min Data        16:45 000   000   000    000    000    00000
    5.  24 Hr Data         16:30 000   000   000    000    000    00000
    6.  Line Data          16:15 000   000   000    000    000    00000
    7.  Path Data          16:00 000   000   000    000    000    00000
    8.  H2TUC DSX-1        15:45 000   000   000    000    000    00000
    9.  H2TUC LOOP         15:30 000   000   000    000    000    00000
   10.  H2TUR LOOP         15:15 000   000   000    000    000    00000
   11.  H2TUR DS1

                            ___                                    ___
                           | C |                                  | R |
                       -8->|   |----------------------------------|   |--->
                           |   |9                               10|   |
                       <---|   |----------------------------------|   |<-11
    B.  Backward           |___|                                  |___|
                           Selection:
```

Figure 11. Performance History Path Data Menu, 15-Minute

```
Circuit ID:                                                  01/19/05 17:06:01
                    Press ESC to return to previous menu

          Menu                 24 Hour H2TUC DSX-1 Performance Data

    1.  Definitions              ES-L  SES-L LOSS-L PDVS-L B8ZS-L CV-L
    2.  Reset Data               00011 00002 00000  00000  00000  0000028
    3.  15 Min Data        01/18 00000 00000 00000  00000  00000  0000000
    4.  60 Min Data        01/17 00000 00000 00000  00000  00000  0000000
    5.  24 Hr Data         01/16 00000 00000 00000  00000  00000  0000000
    6.  Line Data          01/15 00000 00000 00000  00000  00000  0000000
    7.  Path Data          01/14 00000 00000 00000  00000  00000  0000000
    8.  H2TUC DSX-1        01/13 00000 00000 00000  00000  00000  0000000
    9.  H2TUC LOOP         01/12 00000 00000 00000  00000  00000  0000000
   10.  H2TUR LOOP
   11.  H2TUR DS1

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

Figure 12. 24-Hour Performance History Line Data Menu

Abbreviations used in the Performance History screens are defined in the Data Definitions (**Figure 13** and **Figure 14**).

```
Circuit ID:                                                  01/19/05 17:08:21
                     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
  LOSS-L  Loss of Signal Seconds          LOS>= 1
  PDVS-L  Pulse Density Violation Secs    EXZ>=1; >7 zeros if B8ZS, >15 if AMI
  B8ZS-L  B8ZS Seconds                    B8ZS coded signal received when
                                           provisioned for AMI coding
  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 13. Performance Data Definitions Screen

```
Circuit ID:                                                  01/19/05 17:08:48
                     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 14. Performance Data Definitions Screen, Page 2

Scratch Pad, Circuit ID, and Time/Date

The Scratch Pad, Circuit ID, and Time/Date Screen **(Figure 15)** provides the medium for setting the system time and date and where the Circuit ID and pertinent circuit notes may be recorded. The Scratch Pad, Circuit ID, and Time Date Screen has the following parameters:

- The Scratch Pad can be up to 50 characters of user-defined information.
- 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, 2003, as “010203”).

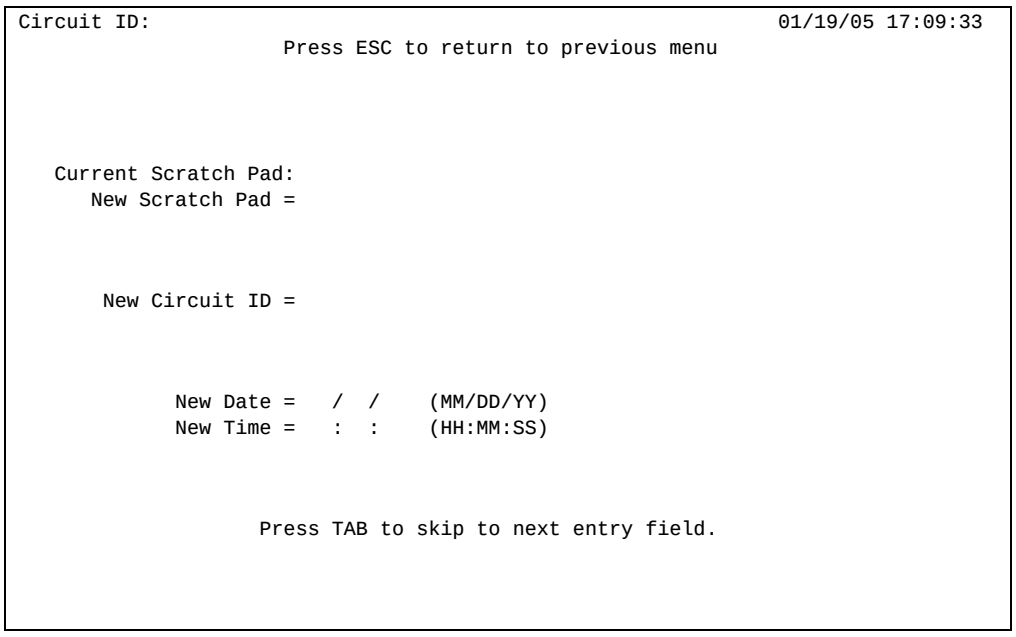


Figure 15. Scratch Pad, Circuit ID, Time/Data Screen

Terminal Modes

This unit includes two terminal emulation modes:

- Manual Update Mode – This mode allows manual updates to be made to 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. Press the spacebar three times to refresh the screen which will reflect the most current circuit conditions and provisioning options.
- 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.

The desired terminal mode can be selected from the Terminal Modes Menu screen (**Figure 16**). Additionally, pressing CTRL+T while on *any* screen provides toggling between the two terminal modes.

```
Circuit ID:                                                  01/19/05 17:09:59
                      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 16. Terminal Modes Menu Screen

Alarm History

Three screens provide the history of alarms on the circuit. These screens include a time, date, first/last occurrence and count for each type of HDSL2, T1 alarm, and facility alarm history. The alarm history types are as follows:

- "T1 Alarm History" on page 20
- "Span History" on page 20

T1 Alarm History

The T1 Alarm History screen (**Figure 17**) provides a detailed alarm history and events log for the DSX-1 and DS1 T1 spans.

```
Circuit ID:                                                    01/19/05 17:10:48
                    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)    01/19/05  07:43:36   01/19/05  07:43:36   Alarm       001

H2TU-R     RED(LOS/LOF) 01/01/00  00:00:04   01/01/00  00:00:04   Alarm       001
 (DS1)     YELLOW(RAI)                                          OK          000
           BLUE(AIS)                                            OK          000









-------------------------------------------------------------------------------
    1.  T1 Alarm            C.  Clear T1 Alarms
    2.  Span H2TUC to H2TUR

                            Selection:
```

Figure 17. T1 Alarm History Screen

Span History

While the T1 Alarm History logs events for the DSX-1 and DS1 loops, the Span History screen (**Figure 18**) shows the alarm history for the HDSL span between the H2TU-C and H2TU-R.

```
Circuit ID:                                                    01/19/05 17:11:16
                    Press ESC to return to previous menu

                             HDSL2 Span History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
SPAN C-R   LA  LOS     01/19/05  07:52:03   01/19/05  07:55:11   OK          005
           LB  LOS                                              OK          000

H2TU-C     LA  MRGN                                             OK          000
           LB  MRGN                                             OK          000
H2TU-R     LA  MRGN                                             OK          000
           LB  MRGN                                             OK          000

H2TU-C     LA  ATTEN                                            OK          000
           LB  ATTEN                                            OK          000
H2TU-R     LA  ATTEN                                            OK          000
           LB  ATTEN                                            OK          000

-------------------------------------------------------------------------------
    1.  T1 Alarm            C.  Clear Span Alarms
    2.  Span H2TUC to H2TUR

                            Selection:
```

Figure 18. Span History Screen

Event History

The Event History screen (**Figure 19**) provides a log history of HDSL2 circuit events. The following is a list (but not all-inclusive) 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
- Span Power Option Change
- Time/Date Changed From/To
- Loop Segment XX In/Out of Sync
- Splice Detector Reset
- Bad Splice Detected

```
Circuit ID:                                                  01/19/05 17:11:49
                    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                           01/19/05 07:43:37  H2TU-C
   3.  Service State Setting Change                01/19/05 07:43:37  H2TU-C
   4.  Segment 1 Loop 1 In Sync                    01/19/05 07:43:37  H2TU-C
   5.  Segment 1 Loop 2 In Sync                    01/19/05 07:43:37  H2TU-C
   6.  Segment 1 Loop 1 Out of Sync                01/19/05 07:52:09  H2TU-C
   7.  Segment 1 Loop 1 In Sync                    01/19/05 07:52:34  H2TU-C
   8.  Segment 1 Loop 1 Out of Sync                01/19/05 07:52:41  H2TU-C
   9.  Segment 1 Loop 1 In Sync                    01/19/05 07:53:47  H2TU-C
  10.  Segment 1 Loop 1 Out of Sync                01/19/05 07:53:54  H2TU-C


       Page Number:   1/  2   Number of Events:  15            More...
 ------------------------------------------------------------------------------
     'P' - Previous Page  'H' - Home      'R' - Reset Events
     'N' - Next Page      'E' - End

                             Selection:
```

Figure 19. Event History Screen

System PM/Screen Report

The System PM/Screen Report option (**Figure 20**), accessed from the Main Menu, offers the following types of reports from the performance monitoring data:

- Full System/History Report
- Current Status Report
- System Configuration Report
- Alarm/Event History

Selecting a report type will create a scrollable display of all the reports for that category, which is more efficient than accessing the menus individually for each report.

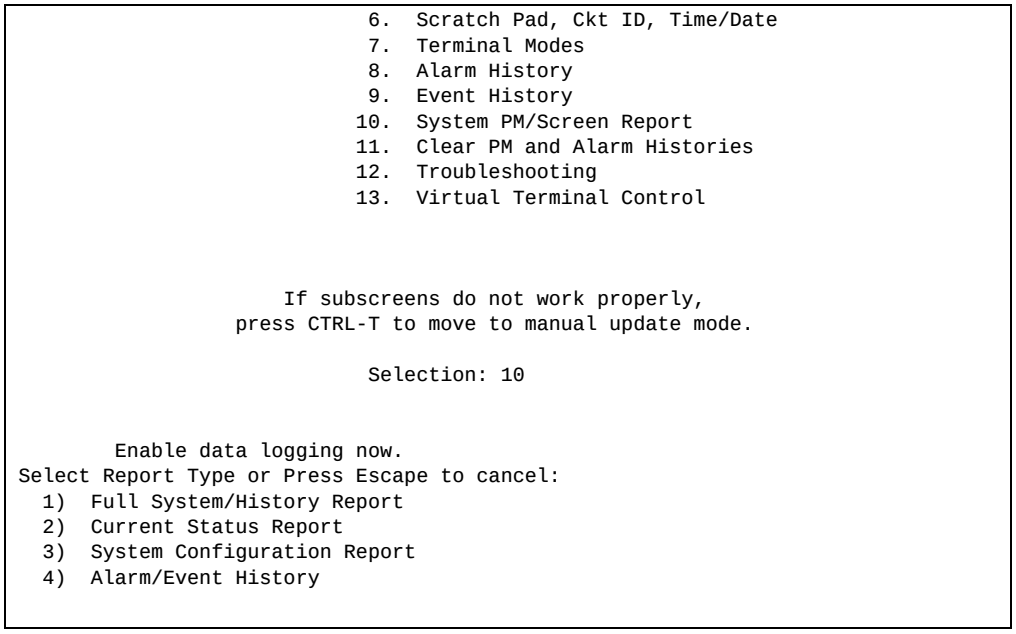


Figure 20. System PM/Screen Report

Clear PM and Alarm Histories

The Clear PM and Alarm Histories option (**Figure 21**) initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu displays a confirmation, which, when selected, will clear the history data for all elements in the circuit. Press N or the ESC key if you do not wish to clear the histories at this time.

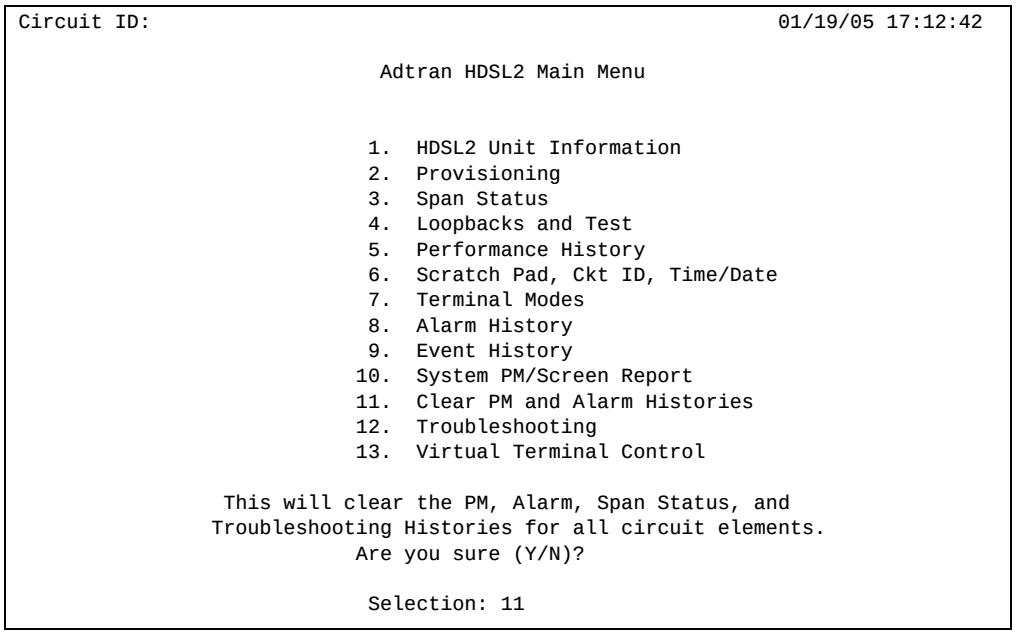


Figure 21. Clear PM and Alarm Histories Screen

Troubleshooting

The Troubleshooting screens include the new feature “Splice Detection.” This and other new features are described in more detail in “Appendix B, HDSL2 Enhanced Features”.

The Troubleshooting screen (**Figure 22**) provides contact information for ADTRAN, and displays three troubleshooting menu items.

```
Circuit ID:                                                  01/19/05 17:13:22
                      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             3. Chronic Circuit Guidance
  Fax: 256.963.6217

                                          Selection:
```

Figure 22. Troubleshooting Screen

The menu options are as follows:

- “Troubleshooting Guidance” on page 25
- “General Information” on page 25
- “Chronic Circuit Guidance” on page 26

Troubleshooting Guidance

The Troubleshooting Guidance screen (**Figure 23**) option (accessed from the Troubleshooting screen option 1) analyzes circuit information and makes repair recommendations. The help screens are presented in a hierarchy from most to least critical. Clear one trouble and if another exists it will display next on this screen.

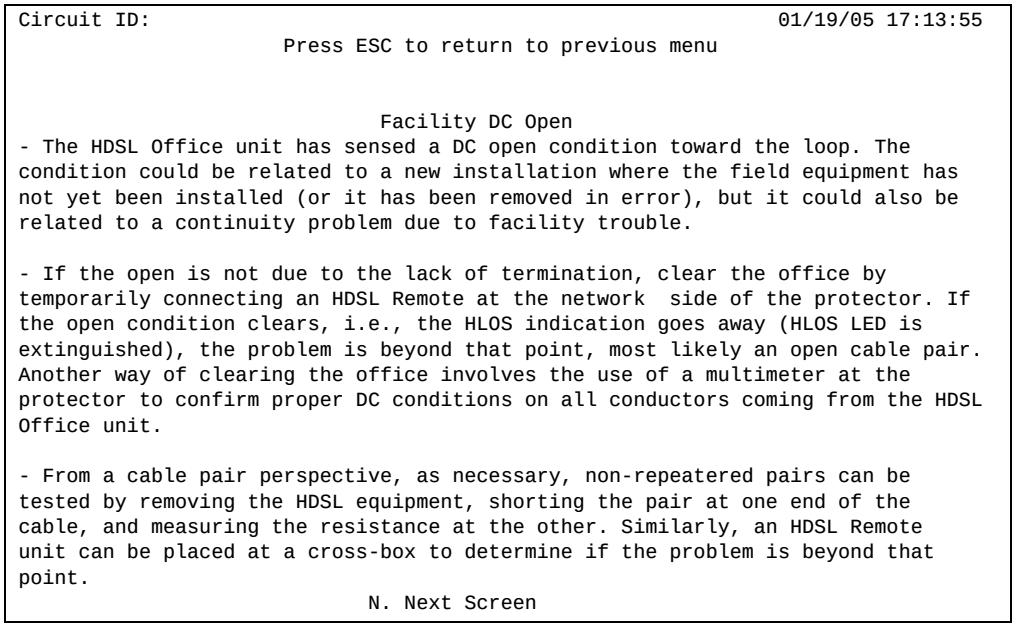


Figure 23. Troubleshooting Guidance Screen

General Information

The General Information screen (**Figure 24**) provides the deployment guidelines details and test details to ensure a robust HDSL2 service.

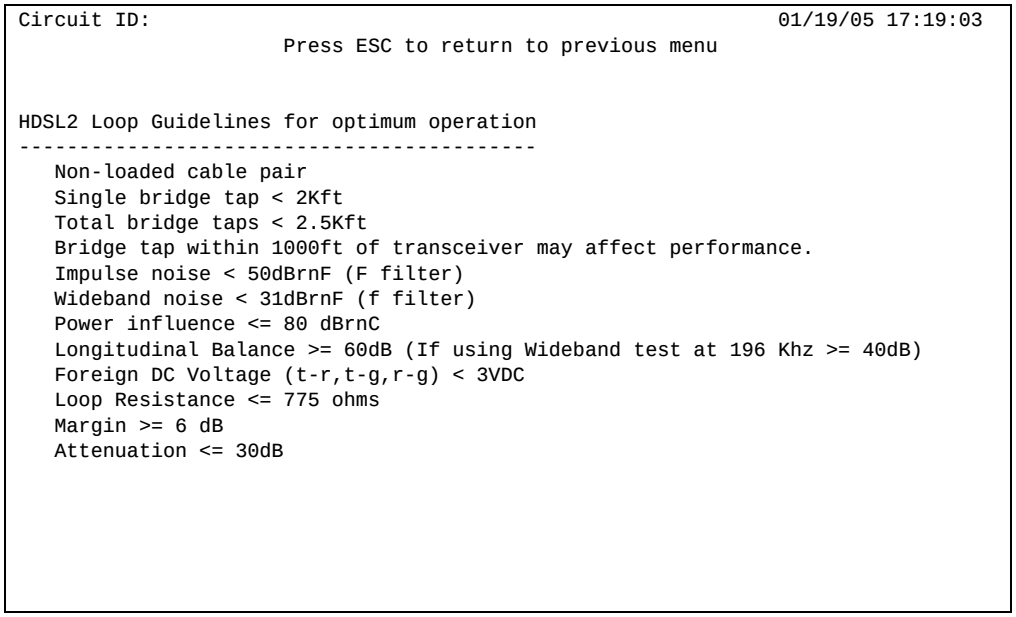


Figure 24. General Information Screen

Chronic Circuit Guidance

Selecting the Chronic Circuit Guidance option, from the main Troubleshooting screen, displays the Chronic Circuit Problems screen (**Figure 25**). This screen provides general information about circuits with deteriorating splice connections and menu options for the Bad Splice Detect feature. Splices that are varying in impedance will cause the HDSL unit to see a reduced and/or fluctuating signal quality (margin). The HDSL unit will attempt to track these changes, but when the changes become too severe, errors or loss of synchronization result. This is reflected by the symptoms described on this screen.

If a circuit meets the criteria listed on the screen then the possibility of an impedance, varying splice should be considered.

```
Circuit ID:                                                  01/19/05 17:21:12
                      Press ESC to return to previous menu
                             Chronic Circuit Problems

  Field experience has shown that many chronic circuit failures are due to
  bad splices. These type circuits generally have the following symptoms:

  - Wire pairs pass all electrical tests and meet deployment guidelines.
  - Large margin fluctuations will occur on the suspect pair. This can be seen
    on the Detailed Status Screen. (Min & Max margins differ by > 6 dB)
  - Pairs experience errored seconds (ES,SES,UAS) and/or loss of sync (LOS).
  - The bad splice will most severely impair the unit closest to the splice.

    This HDSL unit has the ability to test for bad splices. This detection
    should be used as a last resort after all other loop testing has been
    done. The detection is an approximation which can point the technician
    to the general area of the suspect splice.(+/- 550 ft). For best
    results, re-splice all splices close to the indicated trouble.


    1.  View Splice Results
    2.  View Histogram Screen
    3.  Reset Splice Detector
```

Figure 25. Chronic Circuit Problems Screen

To access a particular menu item, press the number associated with that item, and press ENTER. The menu options are as follows:

- “View Splice Results” on page 27
- “Splice Histogram” on page 28
- “Reset Splice Detector” on page 28

View Splice Results

Selecting the View Splice Results screen (**Figure 26**) will report one of three results for each transceiver in the Splice Detection Results column:

- NTF – No Trouble Found is reported.
- LOS – Loss of Synchronization (remote unit has not been detected) has been reported.
- Number – A number is reported if a detected anomaly exceeds the detection count threshold of eight. The number shown in this column represents the number of feet from the transceiver (Reference Point) to that anomaly.

In this example, a detection has occurred approximately 290 feet from an H2TU-C module on Loop 1.

The (B) Back command will allow the technician to scroll back through the last 14 days Splice Detection Results.

```
Circuit ID:                                                  01/19/05 17:22:52
                     Press ESC to return to previous menu

* Note: Chronic Circuit Results are only valid after all other circuit    *
* qualification tests have been performed and failed to show a trouble !! *

Splice Detector Version 1 Result Definitions:
---------------------------------------------
NTF    - No Trouble Found yet.
LOS    - Unit not in sync.
Number - Distance from Reference point (in ft.) of suspect splice.

 Reference    Splice Detection Results        Version          Result Shown
   Point        Loop 1        Loop 2          Number             for date
 ---------    ----------    ----------        -------            MM/DD/YY
   H2TUC          290           NTF              01              --------
   H2TUR          NTF           NTF              01              01/19/05

                                                            (B)Back
```

Figure 26. View Splice Results Screen

Splice Histogram

The Splice Histogram screen (**Figure 27**) displays the counters that the splice detector uses to make a decision. For HDSL2, the screen displays six columns:

- Columns 1 and 4, labeled Splice (feet), represent the distance away from the respective transceiver that the anomaly detector is evaluating.
- Columns 2 and 5 display the Loop 1 and Loop 2 H2TU-C counters that show detection of an anomaly.
- Columns 3 and 6 display the Loop 1 and Loop 2 H2TU-R counters that show detection of an anomaly.

In this example, the distances shown are corresponding to an H2TU-C module since that is the transceiver that has detected the anomaly. The count of 09 in the 290 feet row under the H2TU-C column (shown in reverse video) indicates that an anomaly has been detected nine times at this distance from an H2TU-C module. Nine exceeds the count-detection threshold of eight; therefore, this result is reported to the Splice Result screen. The H2TU-R column shows 00 for all counts in columns 3 and 6, it is not necessary to change (C) the view of the distance column to show the distances an H2TU-R module is evaluating.

```
Circuit ID:                                                  01/19/05 17:23:54
                     Press ESC to return to previous menu

                              Splice Histogram Screen
HTUR Lp A - Splice Distances being displayed. (C) Change
Splice | H2TUC  H2TUR                  Splice | H2TUC H2TUR
(feet) | L1 L2  L1 L2                  (feet) | L1 L2 L1 L2
------ | -- --  -- --                  ------ | -- -- -- --
 0000  | 00 00  00 00                   3930  | 00 00 00 00
 0290  | 09 00  00 00                   4210  | 00 00 00 00
 0570  | 00 00  00 00                   4495  | 00 00 00 00
 0850  | 00 00  00 00                   4780  | 00 00 00 00
 1130  | 00 00  00 00                   5065  | 00 00 00 00
 1410  | 00 00  00 00                   5350  | 00 00 00 00
 1690  | 00 00  00 00                   5635  | 00 00 00 00
 1970  | 00 00  00 00                   5920  | 00 00 00 00
 2250  | 00 00  00 00                   6205  | 00 00 00 00
 2530  | 00 00  00 00                   6490  | 00 00 00 00
 2810  | 00 00  00 00                   6775  | 00 00 00 00
 3090  | 00 00  00 00                   7060  | 00 00 00 00
 3370  | 00 00  00 00                   7345  | 00 00 00 00
 3650  | 00 00  00 00                   7630  | 00 00 00 00
```

Figure 27. Histogram Screen

Reset Splice Detector

Choosing Reset Splice Detector will prompt to make sure a reset is desired. If Y (yes) is chosen the splice detector will re-initialize and start running again.

Virtual Terminal Control

The Virtual Terminal Session Control screen (**Figure 28**) a switch to the H2TU-C menu system 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.

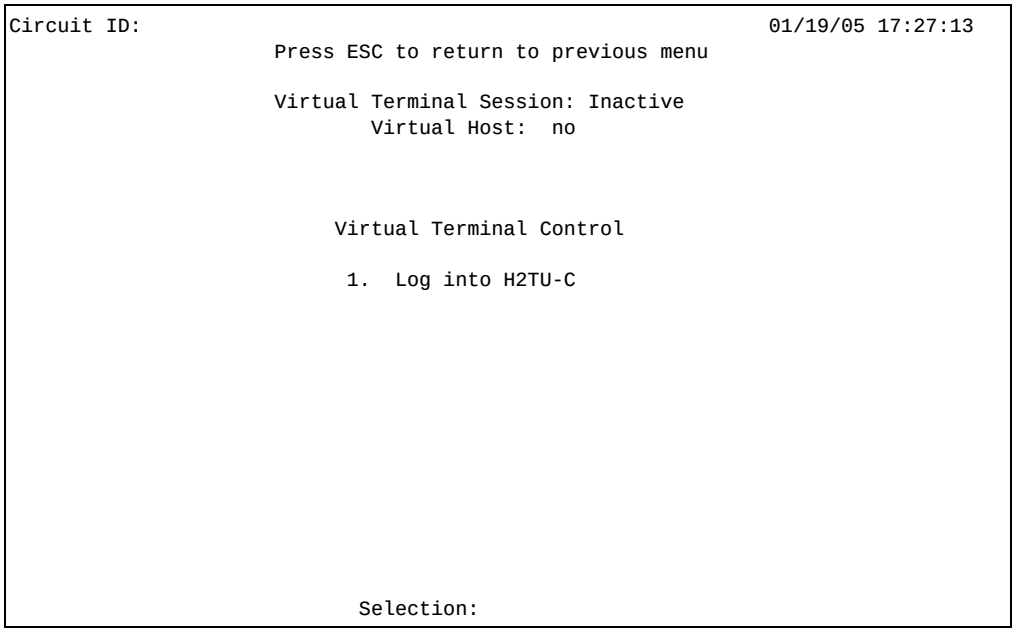


Figure 28. Virtual Terminal Control Screen

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

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

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

  and where L_{BTAP} = Total length of all bridged taps (in kilofeet)

These deployment criteria are summarized in the chart shown in **Figure 29**.

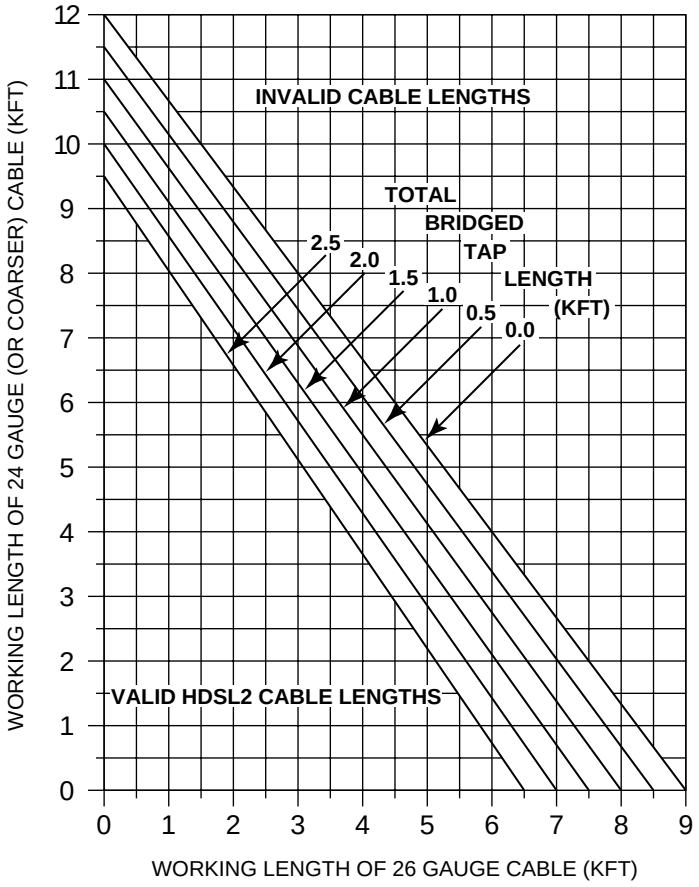


Figure 29. HDSL2 Deployment Guidelines

Loop loss (per kilofoot) for other wire is summarized in **Table 7**.

Table 7. 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

An approximation for the maximum amount of wideband noise as measured using an F filter on an HDSL2 loop having 35 dB loss is less than –47 dBrnF.

An approximation for the maximum level of impulse noise as measured using an F filter on an HDSL2 loop having 35 dB loss is less than or equal to –38 dBrnF.

The accepted industry standards for Longitudinal noise (Power Influence) for DSL circuits is shown in **Table 8**.

Table 8. Power Influence Measurement

Measurement	Power Influence
≤80 dBrnC	Acceptable
80-90 dBrnC	Marginal
≥90 dBrnC	Unacceptable

For additional information on these and other deployment issues, refer to *Supplemental Deployment Information for HDSL, HDSL2, and HDSL4 (HDSLx)* (P/N 61221HDSLL1-10).

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.

MAINTENANCE

The ADTRAN H2TU-R does not require 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 "Appendix C, Warranty".

TROUBLESHOOTING PROCEDURES

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

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. 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.

PRODUCT SPECIFICATIONS

Specifications for the HLSS H2TU-R are detailed in **Table 10**.

Table 10. ADTRAN T200 H2TU-R Specifications

Specification	Description
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 "HDSL2 Deployment Guidelines" on page 30 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 ± 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:	750 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 dB, –15 dB
DS1 Input Signal Level:	0 to 22.5 dB
DS1 Line Coding:	AMI, B8ZS (default)
Power	
Maximum Heat Dissipation:	≤ 6.5 watts
Clock Sources	
Clock Sources:	HDSL2 Loop Derived
Internal Clock Accuracy:	± 25 ppm, (exceeds Stratum 4). Meets T1.101 timing requirements.

Table 10. ADTRAN T200 H2TU-R Specifications (Continued)

Specification	Description
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:	Height: 5.5 inches Width: 0.7 inches Depth: 6.0 inches
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	
T200 HLSS HDSL2 Remote Transceiver Unit:	1223226L2

Appendix A
HDSL2 Loopbacks

HDSL2 LOOPBACK AND CONTROL CODES

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 H2TUC loopback is similar to an Intelligent Office Repeater loopback and the H2TU-R loopbacks are similar to an in-line T1 Repeater loopback.

In-band 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.

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 in-band codes are shown leftmost bit transmitted first, and the ESF data link codes with rightmost bit transmitted first.

Table A-1. HDSL2 Loopback Control Codes

Type	Source *	Code	Name
Abbreviated	(N)	3in7 (1110000)	Loopback data from network toward network in the H2TU-R
	(N)	4in7 (1111000)	Loopback data from network toward network in the H2TU-C
	(C)	5in7 (1111100)	Loopback data from customer toward customer in the H2TU-R
	(C)	6in7 (1111110)	Loopback data from customer toward customer in the H2TU-C
Wescom	(N)	FF1E (1111 1111 0001 1110)	Loopback data from network toward network at H2TU-C
	(C)	3F1E (0011 1111 0001 1110)	Loopback data from customer toward customer at H2TU-C
	(N)	FF02 (1111 1111 0000 0010)	Loopback data from network toward network at H2TU-R
	(C)	3F02 (0011 1111 0000 0010)	Loopback data from customer toward customer at H2TU-R
	(N)	FF48 (ESF-DL) (1111 1111 0100 1000)	Loopback data from network toward network at H2TU-R
	(N/C)	1in3 (100)	Loop down everything
	(N/C)	FF24 (ESF-DL) (1111 1111 0010 0100)	Loop down everything

* The Source column indicates from which side of the interface the control codes are sent. For example, an (N) indicates a network sourced code while a (C) indicates a customer sourced code.

Note: All codes are in-band unless labeled ESF-DL.

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

Table A-2. In-Band Addressable Loopback Codes

(All codes listed below must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.)

Function	Code	Source	Code and Response
Arm	11000 (2-in-5 pattern)	(N)	If the pattern is sent from the network, the units arm, and the H2TU-R loops back, if NIU Loopback is enabled.
Disarm	11100 (3-in-5 pattern)	(N/C)	The H2TU-C is removed from the armed state. If any of the units are in loopback when the 11100 pattern is received, they loop down. The **LBK** LEDs turn *off* on all units.
H2TU-C Network Loopback	D3D3 (1101 0011 1101 0011)	(N)	If the units have been armed and no units are in loopback, the H2TU-C loops back toward the network, 2 seconds of AIS (all ones) are sent, 5 seconds of data pass, and then 231 bit errors are injected into the DSX-1 signal. As long as the pattern continues to be sent, 231 errors are injected every 20 seconds. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 231 bit errors resume at 20-second intervals. If smartjack is enabled, then the H2TU-R can be in network loopback when the H2TU-C loop-up codes are sent.
HRE Network Loop up	C741 (1100 0111 0100 0001)	(N)	If an HRE is present, the units have been armed, the HRE loops back toward the network, 2 seconds of AIS (all 1s) are sent, 5 seconds of data pass, and then 10 bit errors are injected into the DSX-1 signal. As long as the pattern continues to be sent, 10 bit errors are injected every 20 seconds. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 10 bit errors resumes at 20-second intervals.
HTU-R Loop up	C742 (1100 0111 0100 0010)	(N)	When set from the network, an H2TU-R network loopback is activated and a 20-bit error confirmation is sent every 10 seconds.

Table A-2. In-Band Addressable Loopback Codes (Continued)

(All codes listed below must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.)

Function	Code	Source	Code and Response
Loop down	9393 (1001 0011 1001 0011)	(N)	When sent from the network, all units currently in loopback loop down. Armed units do not disarm. In order to behave like a smartjack, the H2TU-R does not loop down from a network loopback in response to the 9393 pattern if NIU Loopback is enabled.
Loop-back Time Out Override	D5D6 (1101 0101 1101 0110)	(N)	If the units are armed and this pattern is sent, the loopback time out is disabled. The time out option is updated on the Provisioning menu of the H2TU-R (viewable through the RS-232 port) to “None.” As long as the units remain armed, the time out remains disabled. When the units are disarmed, the loopback time out returns to the value it had before the D5D6 code was sent. As long as the pattern continues to be sent, errors are injected again every 20 seconds as follows: H2TU-C 231 errors H2TU-R 20 errors
Span Power Disable	6767 (0110 0111 0110 0111)	(N)	If the units are armed and this pattern is sent, the H2TU-C deactivates its span power supply, turning off the H2TU-R. As long as the pattern continues to be sent, the span power supply remains disabled. When the pattern is no longer being sent, the H2TU-C reactivates its span power supply, turning the remote unit(s) on. All units retrain and return to the disarmed and unlooped state.

Appendix B
HDSL2 Enhanced Features

FEATURE OVERVIEW

HDSL2 LOOP SUPPORT SYSTEM (HLSS)

This HLSS H2TU-R incorporates an HDSL2 1:1 Dual-Port Protection Switching implementation. The Central Office unit will connect to the Main Distribution Frame (MDF) with two cables, one carrying the active (Loop A) HDSL2 circuit, and the other carrying the backup (Loop B) HDSL2 circuit. The pairs terminate at the customer premises on the backplane of industry standard T200 or T400 Network Channel Terminating Equipment (NCTE).

FORWARD ERROR CORRECTION

Forward Error Correction is a method of adding information to the data transmission to allow errors to be corrected at the receiver. The HLSS equipment utilizes the bandwidth of the backup pair to transmit this error correction information. With FEC enabled, both pairs are used to transmit the signal. In this arrangement there is not a designated primary or backup pair; if either pair fails, the remaining pair maintains the connectivity. Switchover time is near instantaneous. When switchover occurs and only one loop remains, the performance reverts back to traditional HDSL2 performance levels. Two pair operation, and the improved performance, is automatically restored when the faulty loop is corrected.

TSCAN

This unit is equipped to support the TScan™ feature, which provides data retrieval and diagnostic capabilities for remote management of DS1 circuits. TScan allows provisioning, performance, and event history information to be retrieved by the test center via the Facility Data Link (FDL). In addition, TScan can be used to determine the nature and location of faults on DS1 trouble circuits. TScan is accessible only through the remote test center.

TScan is a patent-pending single-ended diagnostic routine residing on a host server at the central test facility that issues commands and retrieves data via FDL from the H2TU-C.

TScan performs the following functions (see **Figure B-1**):

- Detection and location of an open on one or both conductors
- Detection and location of a short between Tip and Ring
- Detection and location of a ground fault from either or both conductors
- Detection of foreign voltage
- H2TU-C Self Diagnostics
- Remote detection of the presence or absence of a ground connection in the remote mount.

TScan allows operators to integrate these capabilities across multiple computing platforms with existing operating systems.

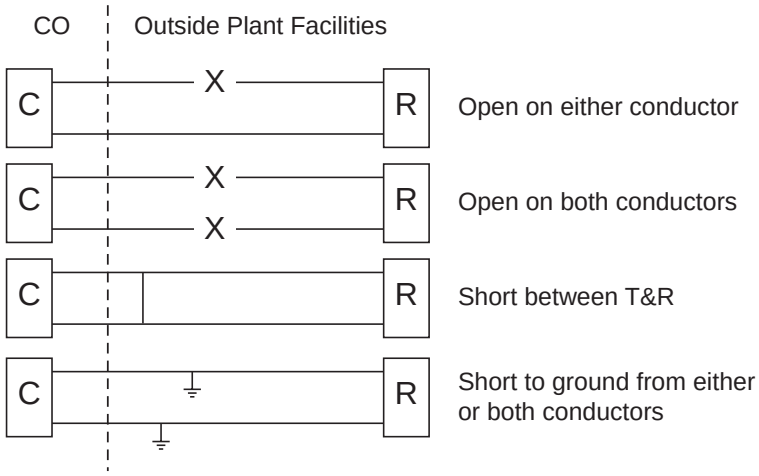


Figure B-1. TScan Diagnostic Capabilities

NOTE

For implementation of TScan please contact an ADTRAN sales representative.

BAD SPLICE DETECTION

The Runtime TScan splice detection feature is an ADTRAN proprietary non-intrusive method for detection of anomalies (poor splice connections) in the copper plant.

Data transmission transceivers, especially echo-cancelled technologies, such as HDSL2 (or HDSL4) are subject to degraded performance in the presence of deteriorating splice connections. This deterioration is often undetected by normal testing methods. Often, these splices present no problem for the data transmission equipment until the point at which oxidation within the splice itself causes a rapid impedance change. Such a change in impedance may cause errors, signal margin fluctuation, and/or a retrain of the DSL transceivers. To address the difficulty in identifying deteriorating splice connections, ADTRAN has developed the splice detection feature, which non-intrusively monitors the cable pair during runtime for the presence of deterioration.

NOTE

The Splice Detection Feature is included with this product as an aid to troubleshooting. Due to inconsistency in environmental conditions and their effect on telecommunications plant, ADTRAN cannot guarantee the accuracy of the measurements. Comparison to existing engineering drawings should provide exact locations of suspect splices indicated by ADTRAN algorithms.

Support Mechanisms

The support mechanisms for this feature can logically be divided into the following six segments:

- "Splice Detection Algorithm" on page B-3
- "Screen Support" on page B-4
- "EOC Support" on page B-4
- "FDL Support" on page B-4
- "EEPROM Support" on page B-4
- "Event Support" on page B-4

These support mechanisms are described in the following subsections.

Splice Detection Algorithm

The splice detection algorithm is designed to detect bad splices in training mode and data mode. The training mode detection is important if the splice is bad enough to prevent synchronization. In data mode, the detector will run periodically after synchronization is achieved. The HDSL2/HDSL4 transceiver monitors the loop for impedance changes that are of a magnitude to cause the received signal of the transceiver to be degraded. When a significant impedance change is detected by the transceiver, the approximate distance from that transceiver to the anomaly is recorded on the Splice Histogram screen by incrementing the appropriate counter. When enough counts are accumulated at a particular distance, this distance will be reported on the Splice Results screen.

Screen Support

The craft terminal port allows access to the splice detection menus via the Troubleshooting selection on the main menu. The Chronic Circuit Guidance selection takes the customer to the main splice detection screen which describes the symptoms of a circuit with bad splices.

This menu provides three choices:

1. View Splice Results – Choosing this option will take the customer to a screen that displays the results of the splice detection These results are calculate for each receiver point on the circuit. If multiple bad splices are detected for a receiver, the worst is reported.
2. View Histogram Screen – Choosing this option will take the customer to the Histogram Screen which displays the raw counters for each element at all receiver points.
3. Reset Splice Detector – Choosing this option will allow the customer to reset the splice detector. This choice requires a confirmation. The reset of the detector is done locally and the command is sent across the EOC so that all units will also reset their detectors.

EOC Support

To get full coverage of the loop, all elements in the circuit run a local detector and then transmit the results (local histogram counts and corresponding distance buffers) of that detection across the EOC to the terminating units (CO and RT). The terminating units can then use these counts to present a result to the customer.

FDL Support

All the information available on the troubleshooting screens is also available via the FDL, allowing the detection to be monitored via network management utilities.

EEPROM Support

The results of the splice detector are stored to the Electronically Erasable Programmable Read-Only Memory (EEPROM) on a daily basis at the same time the 24-hour PM registers are stored to EEPROM. A total of 14 days splice detection history is retained. This history is read from the EEPROM upon power up.

Event Support

An event log entry “Splice Detector Reset” is made any time the splice detector is reset. Also an event log entry “Bad Splice Detected” is made on the first detection occurrence seen since the last splice detection reset. This entry serves to alert the technician that a trouble has been detected without filling up the event log.

Splice Detection Screens

Chronic Circuit Screen

The Chronic Circuit screen (**Figure B-2**) displays general information about circuits with bad splices.

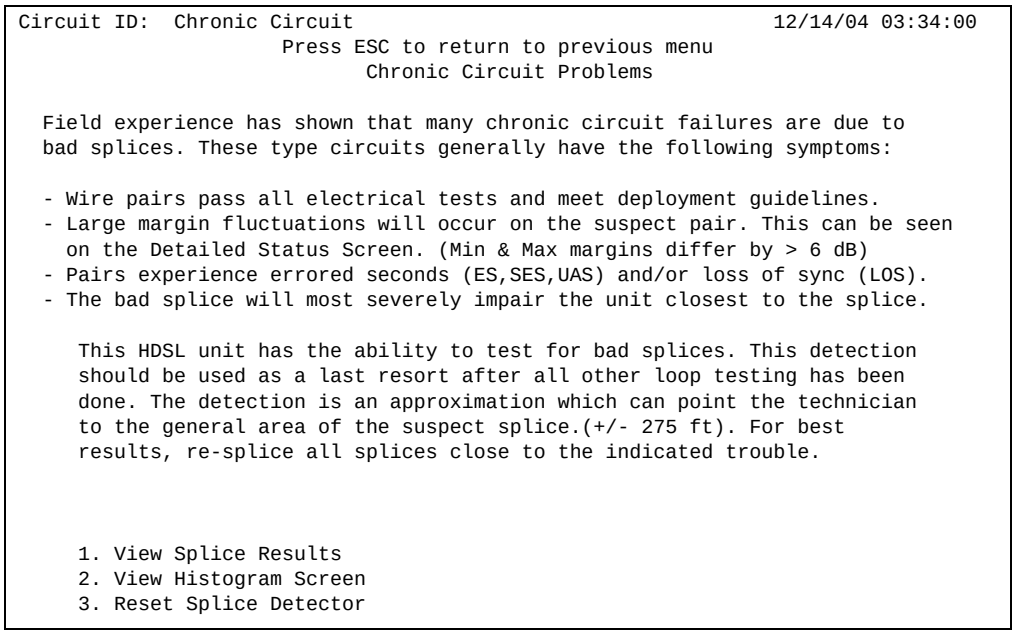


Figure B-2. Chronic Circuit Screen

NOTE

Since this detector employs a very sensitive measurement, it is imperative that all obvious troubles be cleared prior to relying on the splice detection information for troubleshooting the circuit. This is reflected by the following screen statement: “Wire pairs pass all electrical tests and meet deployment guidelines.”

Splices that are varying in impedance will cause the HDSL unit to detect a reduced and/or fluctuating signal quality (margin). The HDSL unit will attempt to track these changes, but when the changes become too severe, errors or loss of synchronization result. This is reflected by the symptoms described on this screen. If a circuit meets these criteria, the possibility of an impedance-varying splice should be considered.

The menu items on the Chronic Circuit screen are as follows:

- “View Splice Results” on page B-6
- “View Histogram Screen” on page B-7
- “Reset Splice Detector” on page B-7

View Splice Results

Selecting the View Splice Results option from the menu displays this screen (**Figure B-3**). Results will be reported in the Splice Detection Results column for each transceiver:

- NTF – Reported if the unit is active and problems have not been detected, or the number of anomalies detected have not yet reached the detection count threshold, which facilitates the reporting of the result to this screen. (Eight is the present threshold.)
- LOS – Reported if the remote unit has not been detected.
- Number – Reported if an anomaly has been detected a number of times that exceeds the detection count threshold of eight. The number shown in this column represents the number of feet from the transceiver (Reference Point) to that anomaly. This number will also reflect the highest anomaly count seen, as it is possible to have more than one bad splice per circuit. This screen will report the worst (most frequently detected) anomaly.

In this example, a detection has occurred approximately 250 feet from an H2TU-C module. The (B) Back command will allow the technician to scroll back through the last 14 days Splice Detection Results.

```
Circuit ID:  Chronic Circuit                                  12/14/04 03:31:36
                     Press ESC to return to previous menu

* Note: Chronic Circuit Results are only valid after all other circuit    *
* qualification tests have been performed and failed to show a trouble !! *

Splice Detector Version 1 Result Definitions:
---------------------------------------------
NTF    - No Trouble Found yet.
LOS    - Unit not in sync.
Number - Distance from Reference point (in ft.) of suspect splice.

 Reference    Splice Detection Results        Version          Result Shown
   Point        Loop 1        Loop 2          Number             for date
 ---------    ----------    ----------        -------            MM/DD/YY
   H2TUC          250           NTF              01              --------
   H2TUR          NTF           NTF              --              12/14/04

                                                            (B)Back
```

Figure B-3. Splice Results Screen

View Histogram Screen

The View Splice Histogram Screen (**Figure B-4**) displays the counters that the splice detector uses to make its result decision, displayed in columns. The columns labeled Splice (feet) represent the distance from the respective transceiver that the anomaly detector is evaluating. Adjacent columns display the counters incremented by an HDSL2 module when its detects an anomaly.

H2TU-C and H2TU-R modules exchange this information so that each transceiver's counters are visible locally at each end of the circuit. Since the distances that each transceiver is evaluating may or may not be exactly the same, the distance column reflects each transceiver's distance calculation. Pressing the C (Change) key will show what distance each transceiver is using locally to update its counters. The counters on this screen are always valid for all transceivers shown; however, the distance associated with that counter should be found by using the C (Change) key to get the most accurate distance.

In the example below, the distances shown are corresponding to an H2TU-C module since that is the transceiver that has detected the anomaly. The count of 09 in the 250 feet row under the H2TU-C column indicates that an anomaly has been seen nine times at this distance from an H2TU-C module. Since nine exceeds the count detection threshold of eight, this result is reported to the Splice Result Screen. Since the H2TU-R shows 00 for all counts in other columns, it is not necessary to Change (C) the view of the distance column to show the distances an H2TU-R module is evaluating.

```
Circuit ID:  Chronic Circuit                                  12/14/04 03:31:36
                     Press ESC to return to previous menu

                    Circuit Splice Histogram Screen
HTUC Lp A - Splice Distances being displayed. (C) Change

Splice | H2TUC  H2TUR                  Splice | H2TUC H2TUR
(feet) | L1 L2  L1 L2                  (feet) | L1 L2 L1 L2
------ | -- --  -- --                  ------ | -- -- -- --
 0000  | 00 00  -- --                   3830  | 00 00 -- --
 0250  | 09 00  -- --                   4110  | 00 00 -- --
 0470  | 00 00  -- --                   4395  | 00 00 -- --
 0750  | 00 00  -- --                   4680  | 00 00 -- --
 1030  | 00 00  -- --                   4965  | 00 00 -- --
 1310  | 00 00  -- --                   5250  | 00 00 -- --
 1590  | 00 00  -- --                   5535  | 00 00 -- --
 1870  | 00 00  -- --                   5820  | 00 00 -- --
 2150  | 00 00  -- --                   6105  | 00 00 -- --
 2430  | 00 00  -- --                   6390  | 00 00 -- --
 2710  | 00 00  -- --                   6675  | 00 00 -- --
 2990  | 00 00  -- --                   6960  | 00 00 -- --
 3270  | 00 00  -- --                   7245  | 00 00 -- --
 3550  | 00 00  -- --                   7530  | 00 00 -- --
```

Figure B-4. Splice Histogram Screen

Reset Splice Detector

Choosing option 3 will prompt to make sure a reset is desired. If Y (yes) is chosen the splice detector will re-initialize and start running again.

Compatibility

The H2TU-C and H2TU-R both run local detectors; therefore, a splice-detection capable H2TU-C will be able to detect bad splices up to slightly more than half the circuit length. Likewise, a splice detection capable H2TU-R will be able to detect bad splices up to slightly more than half the circuit from the remote end. With older (non-splice detection units) the splice-detection capable units will not receive Embedded Operations Channel (EOC) messages from the older units so visibility from the other end is lost. Splice detection support is not available for two-wire repeaters.

Using the Bad Splice Detector

A brief synopsis of how the splice detection feature could be utilized on a trouble call could be as follows:

1. Check the HDSL units for margin fluctuation by checking the Min & Max margins on the Detailed Span Status screen (differ by > 6 dB) corresponding to the time of the trouble.
2. Check for recorded errors (ES, SES, UAS) and/or loss of sync (LOS) in Performance History data that also correspond to the time of the reported trouble.
3. Check that the copper pairs pass specifications using appropriate test equipment.
4. If copper pairs pass all tests, re-install the HDSL units. After they achieve synchronization, clear the PM and Alarm histories from the main menu.
5. Go to the Chronic Circuit menu and reset the splice detector. (It is recommended that the splice detector be reset after a circuit is installed to avoid undesirable results due to old splice detect data left in the non-volatile memory).
6. Allow the units to run for a few hours or days (depending on severity of problem) and then re-check.
7. Go to Splice Detector Results screen and see if any indicated trouble is reported.
8. If a bad splice has been detected, it is recommended re-splicing the closest splices to the indicated trouble (±275 feet for HDSL-2 and ±550 feet for HDSL-4. In general, the shorter the distance, the more accurate the measurement).
9. If no trouble is reported on the Splice Detection Results screen, go to the Histogram screen and check for anomalies that have been detected. The anomaly can exist but may not have reached the threshold level to report it to the Splice Detection Results screen. Any non-zero counter numbers on this screen may correspond to a suspect splice point that should be investigated.

NOTE

If a cable pair acceptance test verified the cable pairs at turn up, and the Splice Detector was reset at that time, then the trouble-shooting procedure would include step 1 and step 2, then proceed immediately with step 8 on the first trouble call.

Event History Screen

The Event History screen (**Figure B-5**) shows the messages reported in the event log due to the splice detector. Any reset of the detector is shown as well as the first detect seen since the last reset.

```
Circuit ID:  Chronic Circuit                                  12/14/04 03:31:36
                     Press ESC to return to previous menu

 Num   Description of Event                       Date     Time      Source
-------------------------------------------------------------------------------
   1.  H2TU-C Event Log Reset                     04/14/04 03:34:36  H2TU-C
   2.  H2TU-C Powered Up                          04/14/04 03:30:01  H2TU-C
   3.  H2TU-R Powered Up                          04/14/04 03:30:15  NO ID
   4.  Splice Detector Reset                      04/14/04 03:30:29  H2TU-R
   5.  Bad Splice Detected                        04/14/04 07:30:33  NO ID









       Page Number:   1/  1   Number of Events:   5
 ------------------------------------------------------------------------------
     'P' - Previous Page  'H' - Home      'R' - Reset Events
     'N' - Next Page      'E' - End

                           Selection:
```

Figure B-5. Event History Screen

FAULT (GFI, SHORT) BRIDGING

The Fault Bridging feature minimizes circuit downtime by sustaining the circuit during the impairment until good signal returns, thereby preventing a retrain. Downtime can occur when an intermittent impairment (GFI, short, micro-interruption, bad splice, noise burst, etc.) briefly affects the HDSL loop.

Fault bridging addresses two general types of problems:

- Brief power fault incidents (lightning)
- Brief signal distortions

In the older generation HDSL2 and HDSL4 transceivers, a brief short or GFI would cause a hardware control to quickly shut down the span power supply for safety reasons. The software would then detect the power fault and would hold the span supply off for 3 seconds. The HDSL units would then reinitialize and retrain in approximately 25 to 30 seconds.

In the new enhanced units a combination of hardware and software enhancements allows the units to sustain communication during brief interruptions in the span supply or brief distortions of the HDSL signal. The hardware will still react to shut down the span supply for the duration of a power fault to comply with safety requirements; however, the software will wait much longer (150 msec of fault) before holding the span supply off. This will allow the span power to return immediately if the power fault disappears. The hardware contains extra capacitance to help maintain the power supply voltages during this brief interruption of span power. When the software detects the power fault, the data pump goes into a fault bridging mode to protect the data pump filters and to maintain service until the anomaly clears.

The software also implements the same fault bridging mode if the HDSL received signal is distorted out on the loop during a non-power fault event (analog signal micro-interruption) to keep the data pump stable until the anomaly clears.

Appendix C
Warranty

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.

Refer to the following subsections for sales, support, Customer and Product Service (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 CAPS prior to returning equipment to ADTRAN.

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

Carrier Networks Division
901 Explorer Blvd.
Huntsville, AL 35806