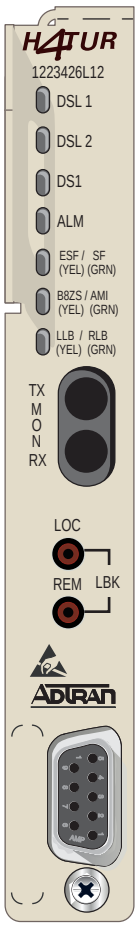
3192 HDSL4 Transceiver, Remote, Span Powered
Installation and Maintenance
Practice



1223426L12 3192 HDSL4 H4TU-R, Span Powered CLEI: T1L8CEACAA

61223426L12-5A
September 2004

Trademarks

Any brand names and product names included in this publication are trademarks, registered trademarks, or trade names of their respective holders.

To the Holder of the Document

The contents of this publication are current as of the date of publication. ADTRAN reserves the right to change the contents without prior notice.

In no event will ADTRAN be liable for any special, incidental, or consequential damages or for commercial losses even if ADTRAN has been advised thereof as a result of issue of this publication.

901 Explorer Boulevard
P.O. Box 140000
Huntsville, AL 35814-4000
(256) 963-8000

Revision History

The history of this document is as follows:

Revision	Release Date	Description
A	September 2004	This is the initial issue of this practice.

Conventions

The following typographical conventions are used in this document:

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

This font indicates references to other documentation, or sections of documents.

This font indicates the first reference to a table or figure.

`This font` indicates screen messages and prompts.

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

This font indicates screen menus, fields, and parameters.

This font indicates silk-screen labels or other equipment label items.

This font is used for emphasis.

This font is used for strong emphasis.

NOTE

Notes emphasize additional but essential information or features.

CAUTION

Cautions emphasize the potential for damage, malfunction, or disruption to equipment, software, or environment.

WARNING

Warnings emphasize the potential for bodily pain, injury, or death.

Training

ADTRAN offers training courses on our products. These courses include overviews on product features and functions while covering applications of ADTRAN's product lines. ADTRAN provides a variety of training options, including customized training and course taught at our facilities or at customer sites. For more information about training, please contact us.

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

Training Fax: 256-963-6700

Training Email: training@adtran.com

CONTENTS

FIGURES

TABLES

1. PRODUCT DESCRIPTION

The ADTRAN® 4-wire 3192 HDSL4 Transceiver Unit for the Remote end (H4TU-R), P/N 1223426L12, is a network terminating unit used to deploy an HDSL4 T1 circuit using 4-wire metallic facilities. See **Figure 1**. This H4TU-R is designed to be installed in a 3192 chassis.

The 3192 H4TU-R, Span Powered can be deployed in circuits using one H4TU-C, one H4TU-R, and up to two H4Rs.

The 3192 H4TU-R, Span Powered terminates local loop HDSL4 signals originating from the Central Office (CO) unit and transforms the HDSL4 signal into traditional DS1 signals to be delivered to the customer.

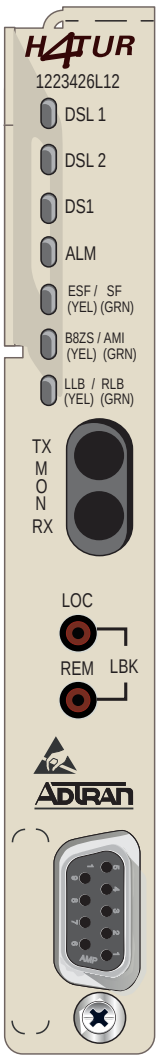


Figure 1. ADTRAN HDSL4 3192 H4TU-R, Span Powered

This version of the H4TU-R works with multiple list versions of the HDSL4 Transceiver Unit for the Central Office (H4TU-C) and repeater (H4R) as listed in **Table 1**.

Table 1. ADTRAN Unit Compatibility

Unit Number	Description
122x401L1 or L2	220 H4TU-C
122x403L1 or L2	DDM+ H4TU-C
122x404L1 or L2	3192 H4TU-R
118141xL1	Total Access H4TU-C
122x441L1	T200 H4R
122x445L1	239 H4R

NOTE: x = any generic release number

The 3192 H4TU-R, Span Powered can be used with any H4TU-C to complete a fully span-powered HDSL4 circuit. Span power is provided from the H4TU-C.

Compliance

Table 2 shows the compliance codes for the 3192 H4TU-R, Span Powered. This product is intended for installation in equipment with a Type “B” or “E” enclosure.

This product meets all requirements of Bellcore GR-1089-CORE (Class A2), ANSI T1.418-2002 and is NRTL listed to the applicable UL standards.

Table 2. Compliance Codes

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

2. INSTALLATION

After unpacking the unit, inspect it for damage. If damage is discovered, file a claim with the carrier, then contact ADTRAN. Refer to *Warranty and Customer Service* on page 33 in this practice. The settings on the H4TU-C are encoded and transmitted to the 3192 H4TU-R, Span Powered once the circuit has achieved synchronization. There are no switch settings on the 3192 H4TU-R, Span Powered.

CAUTION

Electronic modules can be damaged by 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.

WARNING

Up to –200 VDC may be present on telecommunications wiring. Ensure chassis ground is properly connected.

Installation Procedure

To install the 3192 H4TU-R, Span Powered, perform the following steps:

1. If present, remove the Access Module Blank from the appropriate access module slot of the chassis.
2. Hold the 3192 H4TU-R, Span Powered by the front panel while supporting the bottom edge of the module.
3. Align the module edges to fit in the lower and upper guide grooves for the access module slot.
4. Slide the module into the access module slot. Simultaneous thumb pressure at the top and at the bottom of the module will ensure that the module is firmly positioned against the backplane of the chassis.

3. FRONT PANEL OPERATION

The 3192 H2TU-R front panel controls consist of the following hardware for analysis of the HDSL4 circuit:

- Pushbuttons
- LED indicators
- Bantam jacks
- DB-9 RS-232 port

Pushbuttons

The front panel contains two pushbuttons. These are labeled **LOC** and **REM**.

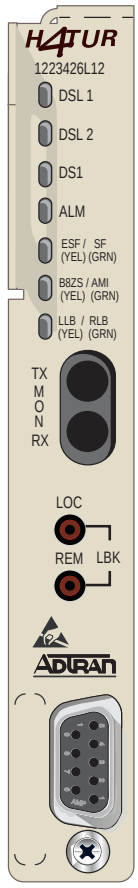
The **LOC** pushbutton controls a bidirectional loopback at the H4TU-R. Pressing the button causes a bidirectional loopback to occur. If the bidirectional loopback is active, pressing the button a second time will disable the loopback.

The **REM** pushbutton controls a bidirectional loopback at the H4TU-C. Pressing the button causes a loopback toward the H4TU-R and network to occur. If the loopback is active, pressing the button a second time will disable the loopback. Refer to *HDSL4 System Testing* on page 7 for further details.

Front Panel LED Indicators

There are seven front panel mounted status LED indicators. Each indicator is described in **Table 3**.

Table 3. Front Panel Indicators

Front Panel	LED	Indication	Description
	**DSL 1**	Green	DSL Loop 1 sync, no errors currently detected, and signal margin ≥ 3 dB
		Red	No DSL Loop 1 sync, errors being detected, or signal margin < 3 dB
	DSL 2	Green	DSL Loop 2 sync, no errors currently detected, and signal margin ≥ 3 dB
		Red	No DSL Loop 2 sync, errors being detected, or signal margin < 3 dB
	DS1	Green	DS1 signal is present and no errors currently being detected
		Red	No DS1 signal or signal is present with errors
	ALM	OFF	No active alarm present
		Red	Loss of DS1 signal to the unit
		Yellow	Loss of DSX-1 signal to the far-end unit
	ESF/SF	OFF	Unit is provisioned for UNFRAMED data
		Yellow	Unit is provisioned for ESF data
		Green	Unit is provisioned for SF data
	B8ZS/ AMI	Yellow	Unit is provisioned for B8ZS coded data
		Green	Unit is provisioned for AMI data
	LLB/ RLB	OFF	Unit is NOT in loopback
		Yellow	Unit is in loopback (network and/or customer)
		Green	H4TU-C is in loopback toward this unit

Front Panel DS1 Monitor Jack

The 3192 H4TU-R, Span Powered provides DS1 monitor bantam jacks. These jacks provide a test point for DS1 traffic to and from the customer. Refer to *HDSL4 System Testing* on page 7 for details.

Remote Provisioning

There are no configuration switches for the 3192 H4TU-R, Span Powered. Configuration is performed via software discussed in the *Control Port Operation* section of this practice.

The provisioning settings can be viewed and manipulated through management access via the front panel RS-232 port. **Table 4** lists the available provisioning options and their factory default settings.

Table 4. Provisioning Options

Provisioning Option	Option Settings	Default Setting
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 Min
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	34 dB
12. SNR Margin Alarm Threshold	0 (Disabled) 1–15 dB	04 dB
13. Remote Provisioning	Disabled Enabled	Enabled

4. CONNECTIONS

All connections of the 3192 H4TU-R, Span Powered are made through card edge connectors. **Figure 2** shows the card edge pin assignments for the 3192 H4TU-R, Span Powered circuit pack.

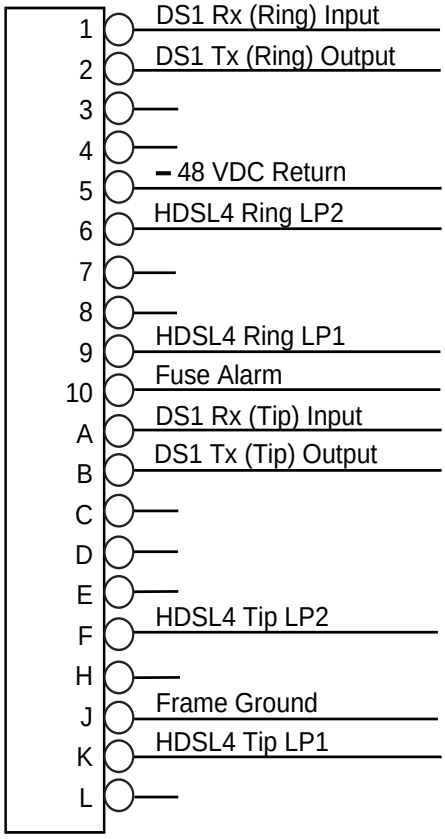


Figure 2. 3192 H4TU-R Edge Connector Wiring

When the 3192 H4TU-R, Span Powered is installed in the chassis, all connections are made through the enclosure backplanes.

CAUTION

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

5. HDSL4 SYSTEM TESTING

The 3192 H4TU-R, Span Powered provides diagnostic, loopback, and signal monitoring capabilities.

The front panel LEDs provide diagnostics for HDSL4 loops, DS1 signals, alarms, provisioning, and loopbacks. Refer to the *Installation* section for details.

The H4TU-R provides a bidirectional loopback via the loopback (**LBK**) buttons on the front panel. Refer to the *H4TU-R Network Loopbacks* and *Customer Loopbacks* sections for more details.

DS1 MON Bantam Jacks

The **MON** jacks provide 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 H4TU-R could be used to connect to a bit error rate tester to monitor for synchronization, test patterns, etc.

Figure 3 is an illustration of specific jack detail.

NOTE

For the **MON** jacks, the **TX** and **RX** indications relate to the direction of the signal to/from the CPE.

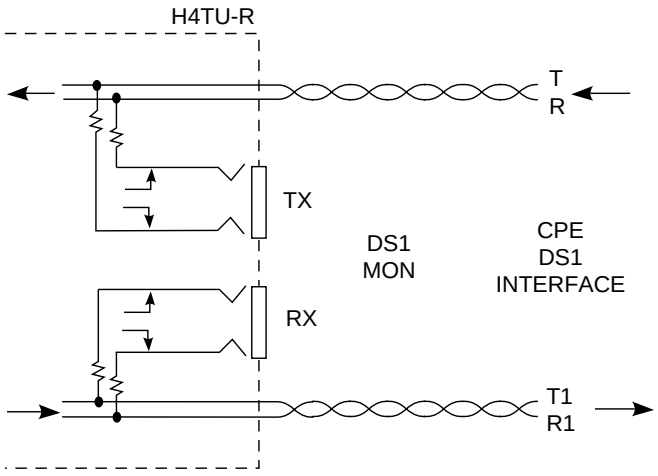


Figure 3. H4TU-R MON Diagram

H4TU-R Network Loopbacks

The loopback position is a logic loopback located within the H4TU-R internal HDSL4 transceiver. See **Figure 4**.

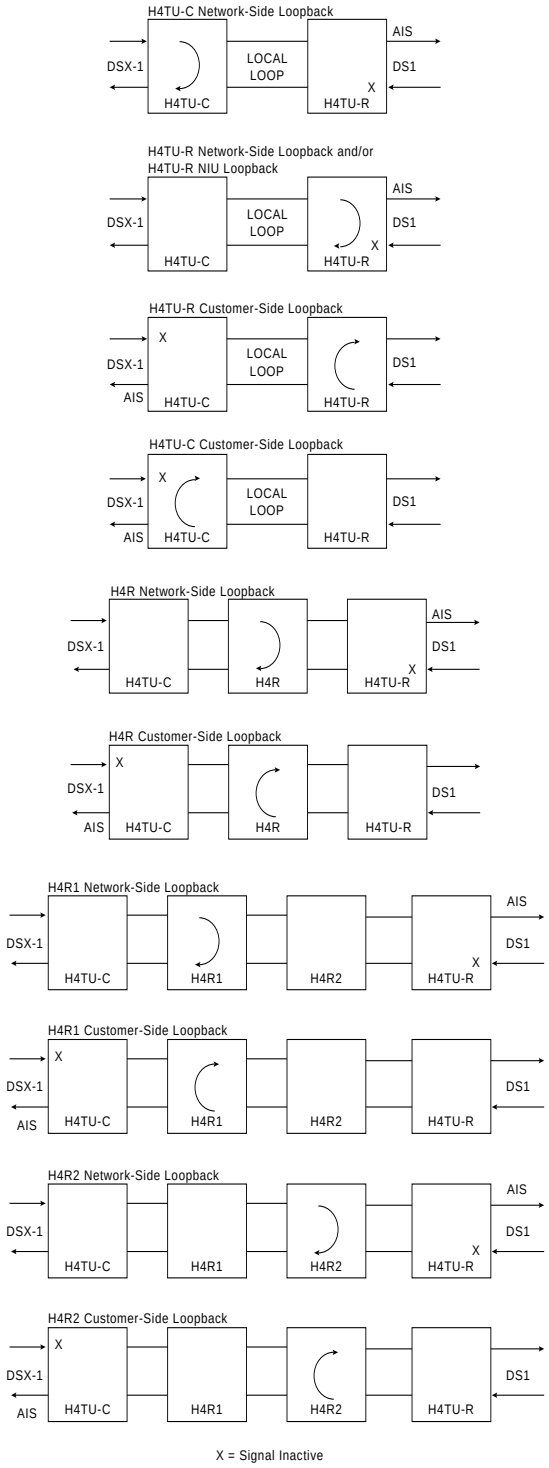


Figure 4. HDSL4 Loopbacks

The H4TU-R responds to multiple loopback activation processes.

- First, manual loopback on the H4TU-R and/or the H4TU-C unit can be controlled from the front panel. Refer to *Front Panel Operation* on page 3 of this practice for more detail.
- Second, loopback activation can be accomplished using the control port of the H4TU-R.
- Third, the H4TU-R responds to the industry standard HDSL loopback codes as designated in the ANSI document T1E1.4/92. These are described in *Appendix A*, *HDSL4 Loopbacks*.
- Fourth, the H4TU-R responds to T1 Network Interface Unit (NIU) loopback codes as described in Bellcore TR-TSY-000312. These codes are as follows:

  In-Band Codes

Loop up	11000 (2 in 5)
Loop down	11100 (3 in 5)

  ESF Codes

Loop up	1111 1111 0100 1000 (FF 48)
Loop down	1111 1111 0010 0100 (FF 24)

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

NOTE

The NIU loopback option must be enabled before the H4TU-R can respond to the NIU loopback.

The H4TU-R responds to the loopback codes by activating the NIU loopback from either the disarmed or armed state. The loop down codes return the H4TU-R to the disarmed or de-activated state depending upon the code utilized.

Customer Loopbacks

In addition to loopbacks in the direction of the network, the H4TU-R can also be looped back in the direction of the customer. The H4TU-C and H4TU-R Customer Side Loopbacks are illustrated in Figure 4.

NOTE

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

6. CONTROL PORT OPERATION

The H4TU-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 5**.

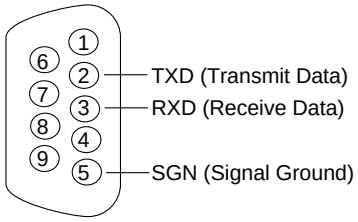


Figure 5. RS-232 (DB-9) Connector Pinout

The terminal interface operates at data rates from 1.2, 2.4, 4.8, 9.6, and 19.2 kbps. The asynchronous data format is fixed at 8 data bits, no parity, and 1 stop bit.

NOTE

If a personal computer with terminal emulation capability is being used, be sure to disable any power-saving programs. Otherwise, communication between the PC and the HDSL4 unit may be disrupted, resulting in misplaced characters or screen time outs.

Operation

The screens illustrated in this section apply to an HDSL4 circuit deployed with the ADTRAN HDSL4 technology. The circuit includes an H4TU-C, up to two H4Rs and an H4TU-R. Other configurations are possible (such as use of another vendor's equipment) and their displays will vary slightly from those shown in this section.

A terminal session is initiated by entering multiple spacebar characters which are used by the H4TU-R to determine the speed of the terminal. Once the speed has been determined, an HDSL4 Main Menu is displayed.

This ADTRAN HDSL4 Main Menu provides access to detailed performance and configuration information. The Operation, Administration, Maintenance, and Provisioning (OAM&P) screens are available as listed on the Main Menu (**Figure 6**).

To access a particular menu item, press the number associated with that item, and press ENTER.

```
Circuit ID:                                                  06/01/04 09:29:45

                              Adtran HDSL4 Main Menu


                             1.  HDSL4 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




                            Selection:
```

Figure 6. HDSL4 Main Menu

The HDSL4 Unit Information screen (**Figure 7**) provides detailed product information on each component in the HDSL4 circuit. This screen also displays contact information for ADTRAN Technical Support, Internet site, and address.

```
Circuit ID:                                                  06/01/04 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 H4TU-C                          ADTN H4TU-R
              P/N: 1223403L2                       P/N: 1222426L12
              S/N: 123456789                       S/N: 123456789
             CLEI: T1L7PODAAA                     CLEI: T1L8CEACAA
             Manf: 01/01/2004                     Manf: 04/11/2004
              Ver: A00                             Ver: A00

              ADTN H4R1                            ADTN H4R2
              P/N: 1223445L1                       P/N: 1223445L1
              S/N: BB50A8343                       S/N: BB50A8353
             CLEI: T1R6U83DAA                     CLEI: T1R6U83DAA
             Manf: 02/12/2004                     Manf: 02/12/2004
              Ver: A01                             Ver: 01
```

Figure 7. Unit Information Screen

The Provisioning menu (**Figure 8**) displays current provisioning settings for the HDSL4 circuit. Options that can be changed from this screen are labeled with a number (for example, “1” for DSX-1 Line Build Out). To change a particular option setting, select the appropriate option and press ENTER, and a new menu will appear with a list of the available settings.

The options shown in Table 4 are available with the 3192 H4TU-R, Span Powered (P/N 1223426L12). Some settings may differ when using different H4TU-Rs.

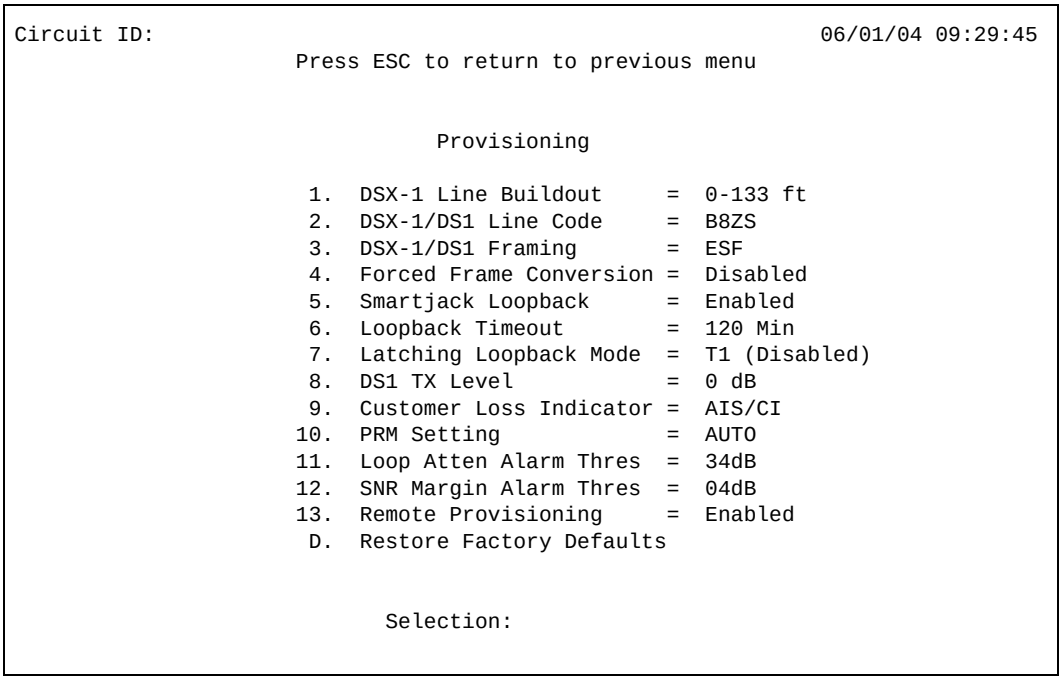


Figure 8. Provisioning Menu

The Span Status Screen (**Figure 9**) provides quick access to status information for each HDSL4 receiver in the circuit.

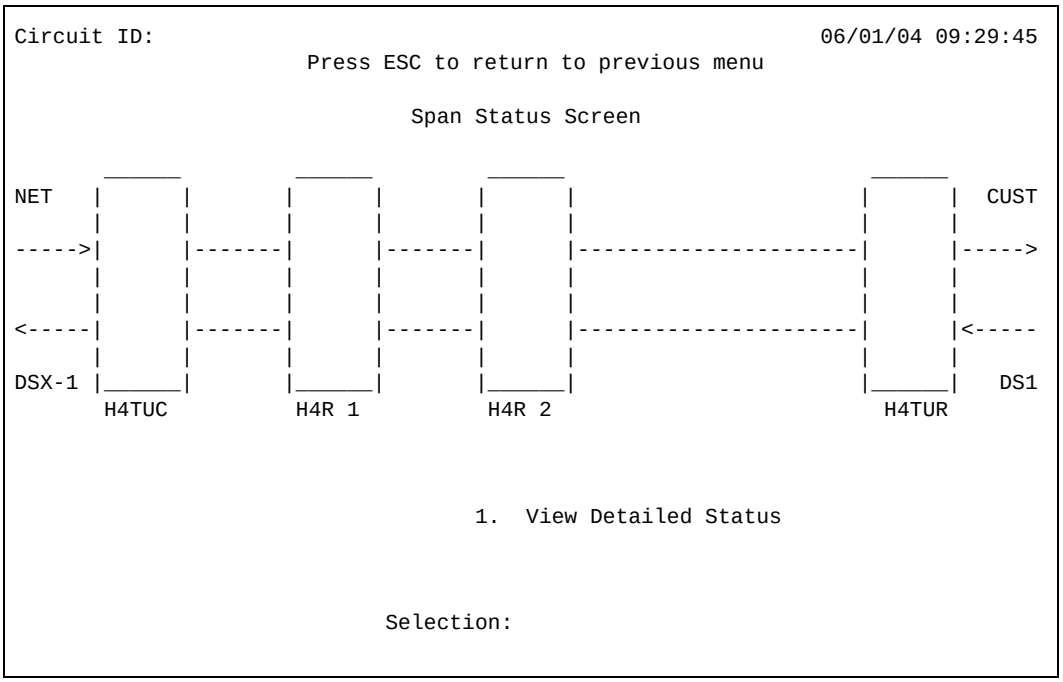


Figure 9. Span Status Screen

The Detailed Status Screen, from the Span Status screen (**Figure 10**), displays the HDSL4 status for each receiver point.

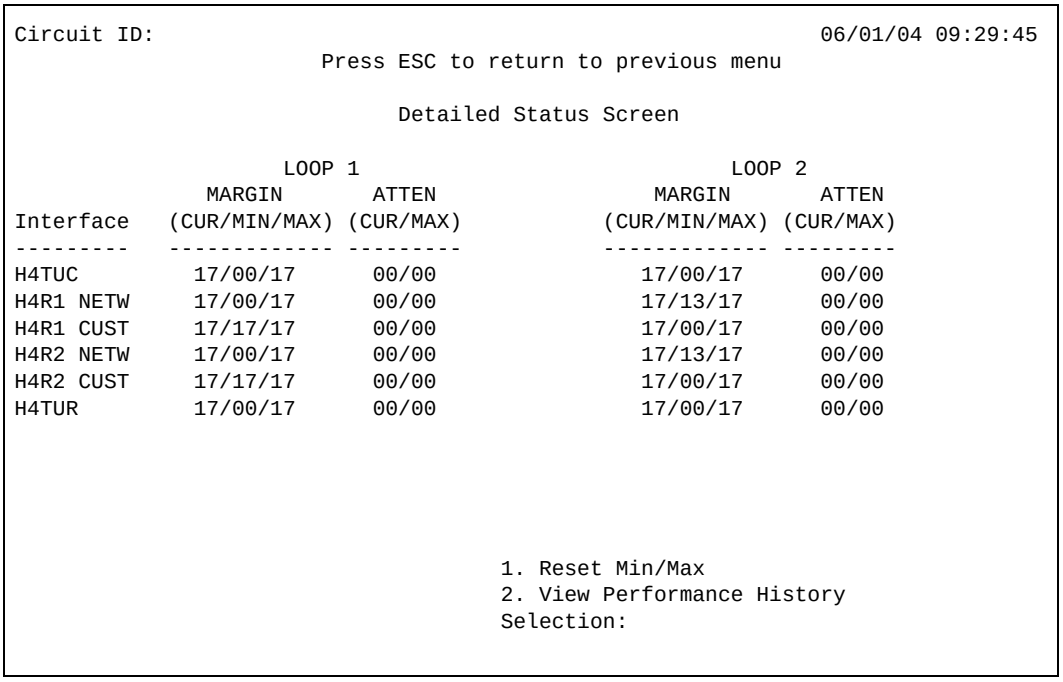


Figure 10. Detailed Status Screen

The Loopbacks and Test Commands menu (**Figure 11**) provides the ability to invoke or terminate all available HDSL4 loopbacks.

Each HDSL4 circuit component can be looped toward the network or customer from this screen. Unit self-tests can also be initiated from this screen.

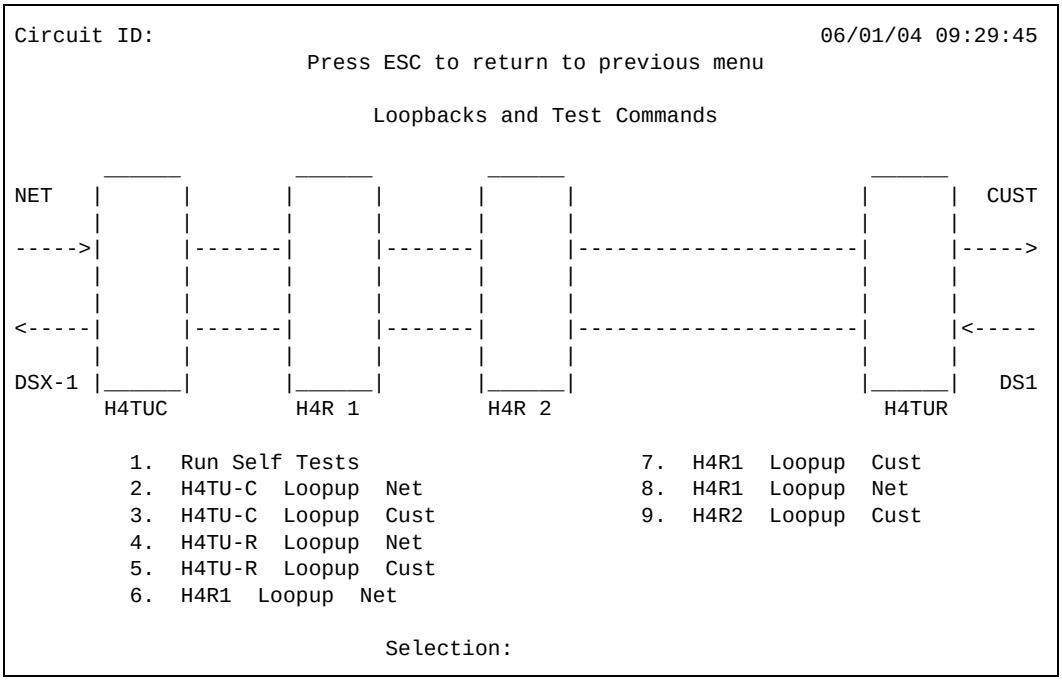


Figure 11. Loopbacks and Test Commands Menu

The Performance History screens (**Figure 12** and **Figure 13**) are used to select and display the historical HDSL4 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 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. Line Data or Path Data results are available by selecting the appropriate menu item.

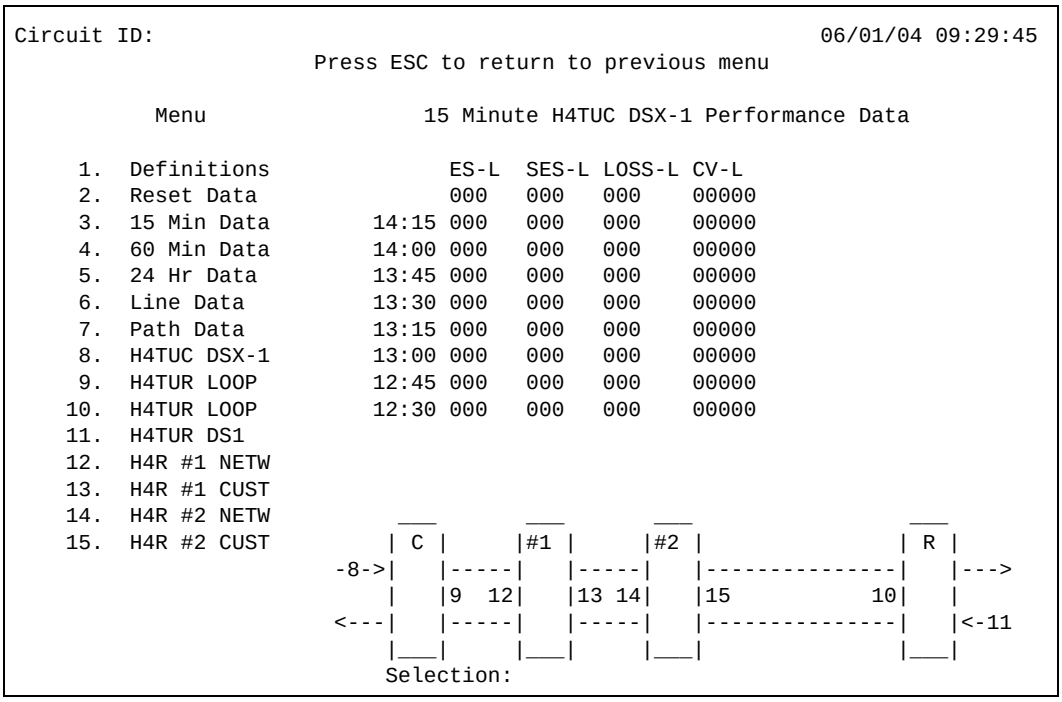


Figure 12. 15-Minute Performance Data Screen

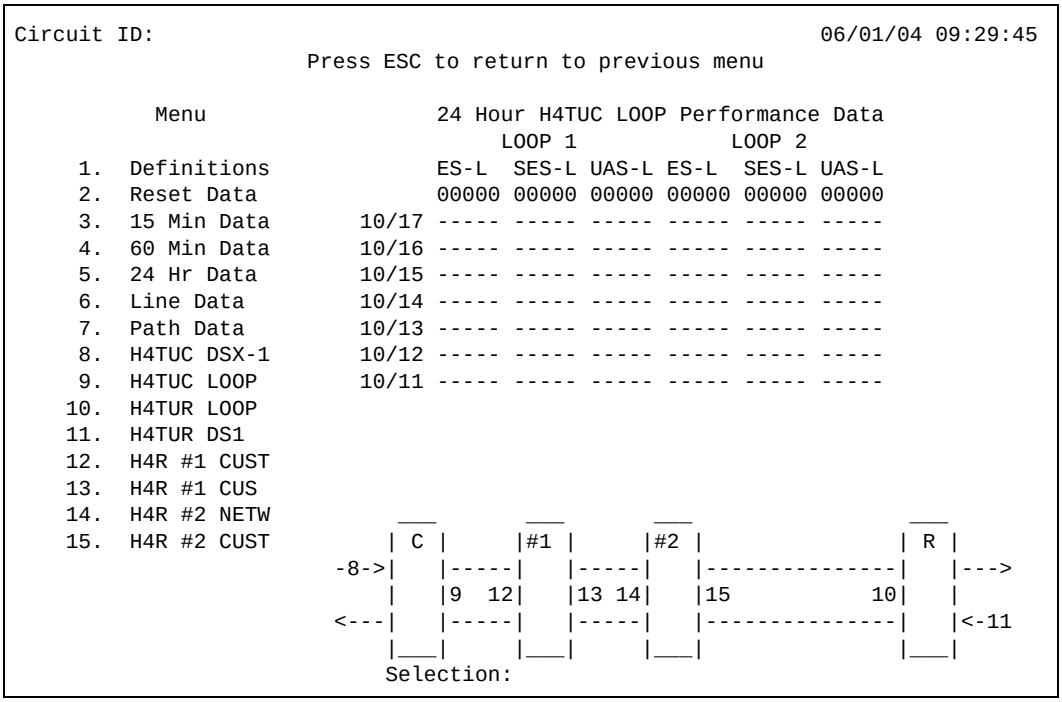


Figure 13. 24-Hour Performance Data Screen

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

Line related definitions are shown in Figure 14 while Path related definitions are provided in Figure 15.

```
Circuit ID:                                                  06/01/04 09:29:45


                          Performance Data Definitions

H4TUC, H4TUR, and H4R LOOP Related:     HDSL4 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
  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

```
Circuit ID:                                                  06/01/04 09:29:45


                          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 (Continued)

The Scratch Pad, Circuit ID, and Time/Date screen (**Figure 16**) provides a Scratch Pad for user-defined information and can be any alphanumeric string up to 50 characters in length. The Circuit ID can be any alphanumeric string up to 25 characters in length. The time should be entered using military time; enter 3:15 p.m. as “151500”. The date should be entered in the MMDDYY format; enter January 02, 2003, as “010203”.

```
Circuit ID:                                                  06/01/04 09:29:45




    Current Scratch Pad:
       New Scratch Pad =


        New Circuit ID =


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


                   Press TAB to skip to next entry field.
```

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

The T1 Alarm History menu (**Figure 17**) provides a detailed alarm history and events log for the T1 span. This screen includes a time, date, first and last occurrence, and count for each type of T1 alarm.

```
Circuit ID:                                                  06/01/04 09:29:45
Press ESC to return to previous menu

                                  T1 Alarm History
 LOCATION   ALARM       FIRST                LAST              CURRENT   COUNT
 ------------------------------------------------------------------------------

 H4TU-C    RED(LOS/LOF) 01/01/00  00:00:05   01/01/00  00:00:05 Alarm      001
  (DSX-1)  YELLOW(RAI)                                          OK       000
           BLUE(AIS)                                            OK       000
 H4TU-R    RED(LOS/LOF) 06/01/03  23:46:22   06/01/03  23:46:22  Alarm    001
  (DS1)    YELLOW(RAI)                                          OK       000
           BLUE(AIS)                                            OK       000









 ------------------------------------------------------------------------------
       1. T1 Alarm             4. Span H4R1 to H4R2
       2. Facility Alarm       5. Span H4R2 to H4TU-R
       3. Span H4TUC to H4R1   C. Clear T1 Alarms
```

Figure 17. T1 Alarm History Menu

The HDSL4 Span History menu (**Figure 18**) provides a detailed alarm history and events log for the HDSL4 circuit. This screen includes a time, date, first and last occurrence, and count for each type of T1 alarm.

```
Circuit ID:                                                    06/01/04 09:29:45
                      Press ESC to return to previous menu

                              HDSL4 Span History
LOCATION    ALARM       FIRST                LAST               CURRENT   COUNT
-------------------------------------------------------------------------------
SPAN C-H1   L1  LOS                                              OK          000
            L2  LOS                                              OK          000

H4TU-C      L1  MRGN                                             OK          000
            L2  MRGN                                             OK          000
H4R1 NET    L1  MRGN                                             OK          000
            L2  MRGN                                             OK          000

H4TU-C      L1  ATTEN                                            OK          000
            L2  ATTEN                                            OK          000
H4R1 NET    L1  ATTEN                                            OK          000
            L2  ATTEN                                            OK          000

-------------------------------------------------------------------------------
    1. T1 Alarm             4. Span H4R1 to H4R2
    2. Facility Alarm       5. Span H4R2 to H4TU-R
    3. Span H4TUC to H4R1   C. Clear Span Alarms
                            Selection:
```

Figure 18. HDSL4 Span History Screen

The Event History screen (**Figure 19**) provides a log history of HDSL4 circuit events.

```
Circuit ID:                                                    06/01/04 09:29:45
                      Press ESC to return to previous menu

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

   1.  H4TU-C Powered Up                               03/25/04 11:52:00









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

                           Selection:
```

Figure 19. Event History Screen

The System PM/Screen Report option (**Figure 20**) offers four types of reports on performance monitoring. Selecting a report type will then display all the reports for that category on the screen at once, which is more efficient than stepping through the menus individually.

```
                          1.  HDSL4 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.  Virtual Terminal Control
                         12.  Troubleshooting
                         13.  Virtual Terminal Control

                           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 20. System PM/Screen Report Option

The Clear PM and Alarm Histories screen (**Figure 21**) initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu requires a confirmation to continue (Y/N).

```
Circuit ID:                                                 06/01/04 09:29:45

                           Adtran HDSL4 Main Menu


                          1.  HDSL4 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 21. Clear PM and Alarm Histories

The Troubleshooting screen (**Figure 22**) accessed from the Main Menu displays ADTRAN contact information along with two menu items at the bottom of the screen.

```
Circuit ID:                                                  06/01/04 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               3. Chronic Circuits Guidance
  Fax: 256.963.6217

                                            Selection:
```

Figure 22. Troubleshooting Screen

The Troubleshooting Guidance option causes the H4TU-C to read the operational status of the unit and return the probable cause(s) of the trouble, as shown in **Figure 23**.

```
Circuit ID:                                                  06/01/04 09:29:45
                     Press ESC to return to previous menu
                       DSX-1 Loss of Signal (Red Alarm)

- Patch test set REC jack into H4TUC MON TX jack to verify integrity of
signal to the H4TUC from the network (verify test set in MON mode).

- If signal to H4TUC is missing, insert test set at DSX panel IN Jack connecting
toward H4TUC (to verify wiring between DSX and H4TUC shelf). Check H4TUC 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 23. Troubleshooting Guidance

The General Information screen (**Figure 24**), from the Troubleshooting screen, provides a summary of the deployment guidelines necessary to provision this HDSL4 circuit.

```
Circuit ID:                                                  06/01/04 09:29:45
                     Press ESC to return to previous menu


HDSL4 Loop Guidelines for optimum operation
------------------------------------------
   Non-loaded cable pair
   Single bridge tap < 2 Kft
   Total bridge taps < 2.5 Kft
   Power influence <= 80 dBrnC
   Longitudinal Balance >= 60 dB (If using Wideband test at 196 kHz >= 40 dB)
   Foreign DC Voltage (t-r, t-g, r-g) < 3 VDC
   Loop Resistance <= 1000 ohms 1st segment
   Loop Resistance <= 920 ohms 2nd segment

The following guidelines are provided as a recommendation and may be superseded
by internal deployment guidelines
   Margin >= 6 dB
   Attenuation (1st Segment) H4TUC <= 30 dB, H4TUR/H4R <= 32 dB
   Attenuation (2nd or 3rd Segment) H4TUR/H4R <= 28 dB
```

Figure 24. General Information Screen

Chronic Circuit Problems Screen

Selecting the Chronic Circuit Problems screen (**Figure 25**) from the Troubleshooting screen gives the technician some general information about circuits with bad splices. Splices that are varying in impedance will cause the HDSL data pump to see a reduced and/or fluctuating signal quality (margin). The HDSL data pump 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:HNTSVLALHDSL4                                  06/09/04 12:16:05
                     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.(+/- 275 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

View Splice Results

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

- NTF - No Trouble Found
- LOS - Loss of Synchronization (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.

In this example, a detection has occurred approximately 650 feet from Loop 2 of the H4TU-C module.

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

```
Circuit ID:HTSVALHDSL4                                    06/17/04 07:32:04
                      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
   H4TUC          NTF           650              01              --------
   H4TUR          NTF           NTF              01              06/17/04
   H4RU1 NET      NTF           NTF              01
   H4RU1 CST      NTF           NTF              01            (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 its result decision. The definitions of abbreviations shown on this screen are as follows:

The first column, labeled Splice (feet), represents the distance from the H4TU-C that the anomaly detector is evaluating.

Column 2 indicates the respective transceiver that has reported the anomaly. The L1 and L2 columns represent Loop 1 and Loop 2 of the HDSL4 circuit.

Column 3 displays the count registered by the H4TU-R, also with Loop 1 and Loop 2 counts.

The remaining columns are for the H4R repeaters (numbered 1, 2, and 3 according to the number deployed in the circuit. HR1 N is the network side of the first repeater; HR1 C is the customer side of the repeater, and so forth.

In this example, the distances shown are corresponding to an H4TU-C module since that is the transceiver that has detected the anomaly. The count of 09 in the 650 feet row under the H4TU-C, Loop 2, column indicates that an anomaly has been seen 9 times at this distance from an H4TU-C module. Since 9 is larger than the count detection threshold of 8, this result is reported to the Splice Results Screen. Since all other columns show 00 for all counts, there is no reason to Change (C) the view of the distance column to show the distances an H4TU-R module is evaluating.

```
Circuit ID:                                                  06/17/04 07:33:06
                      Press ESC to return t
HTUC L1   (C) Change Distance Ref           Splice Histogram Screen
Splice |  H4TUC    H4TUR    HR1 N    HR1 C    HR2 N    HR2 C    HR3 N    HR3 C
(feet) |  L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2
------ |  -- --    -- --    -- --    -- --    -- --    -- --    -- --    -- --
 0100  |  00 00    00 00    00 00    00 00
 0650  |  00 09    00 00    00 00    00 00
 1200  |  00 00    00 00    00 00    00 00
 1750  |  00 00    00 00    00 00    00 00
 2300  |  00 00    00 00    00 00    00 00
 2850  |  00 00    00 00    00 00    00 00
 3400  |  00 00    00 00    00 00    00 00
 3950  |  00 00    00 00    00 00    00 00
 4500  |  00 00    00 00    00 00    00 00
 5055  |  00 00    00 00    00 00    00 00
 5610  |  00 00    00 00    00 00    00 00
 6165  |  00 00    00 00    00 00    00 00
 6720  |  00 00    00 00    00 00    00 00
 7275  |  00 00    00 00    00 00    00 00
 7830  |  00 00    00 00    00 00    00 00
 8385  |  00 00    00 00    00 00    00 00
 8940  |  00 00    00 00    00 00    00 00
 9495  |  00 00    00 00    00 00    00 00
```

Figure 27. Histogram Screen

Reset Splice Detector

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

The Virtual Terminal Session screen (**Figure 28**) allows control of the far-end HDSL4 unit provisioning from the H4TU-R. Select this option to begin a user-initiated session with the far-end unit. When the remote session is completed, Press CTRL+X to terminate the session.

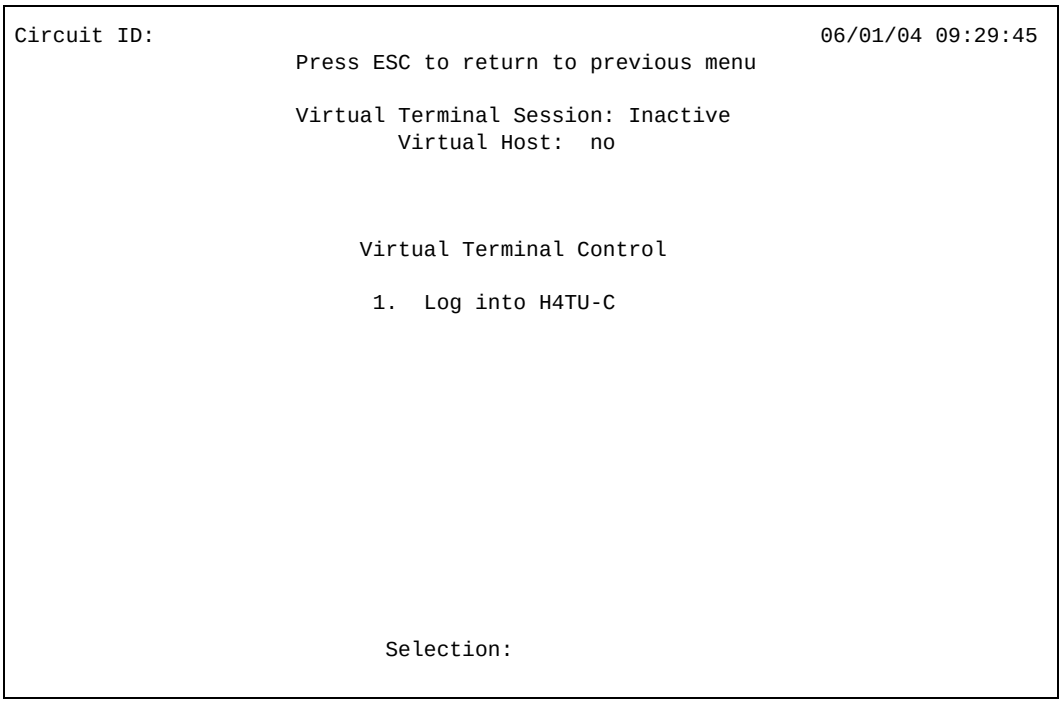


Figure 28. Virtual Terminal Session Screen

7. HDSL4 DEPLOYMENT GUIDELINES

The different segments of an HDSL4 circuit are defined in **Figure 29.**

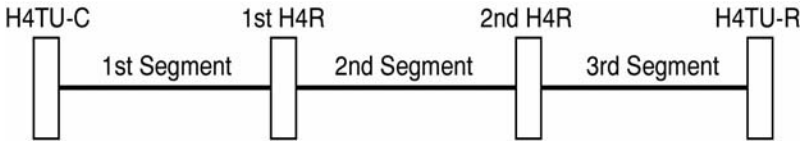


Figure 29. HDSL4 Circuit Segments

The ADTRAN HDSL4 system provides DS1-based services over loops designed to comply with the guidelines given below. These guidelines apply to the following circuit configurations:

- a single segment or an HDSL4 circuit with no H4Rs,
- a circuit having two segments (with one H4R), or
- a circuit having three segments (with two H4Rs).

The guidelines reflected herein are for worst-case scenarios, that is, for loops that contain a maximum amount of disturbers, noise, etc. Actual deployment guidelines may vary based on local policy. Please refer to those guidelines on an as-necessary basis to ensure optimum performance.

Designing a circuit with loop attenuation greater than the recommended maximum loss may result in compromised reliability of that loop. Follow the guidelines in this section to ensure that the circuit meets basic requirements:

1.All loops are nonloaded only.

2.Any single bridged tap is limited to 2 kft.

3.Total bridged tap length is limited to 2.5 kft.

4.Bridge tap within 1000 feet of units may affect performance of the circuit.

5.Loop Attenuation Limits. See **Table 5.**

6.DSL-Recommended Range Limits. See **Table 6** and **Table 7**.

NOTE

In three segment circuits (two H4Rs), individual segment resistance values *must be verified*. See step 7 below.

Table 5. Attenuation limits

	Recommended Maximum	
	Upstream	**Downstream**
1st segment	30 dB	32 dB
2nd and 3rd segment	28 dB	28 dB

Table 6. Range Limits: 26 Gauge / 70°F / PIC

26 Gauge	Recommended Maximum
1st segment	10,470 ft.
2nd segment	9,865 ft.
3rd segment	9,865 ft. (see note)

Table 7. Range Limits: 24 Gauge / 70°F / PIC

24 Gauge	Recommended Maximum
1st segment	14,770 ft.
2nd segment	14,050 ft.
3rd segment	14,050 ft. (see note)

7. Resistance Values. See **Table 8**.

   Each of the three segments associated with span powering two H4Rs and the H4TU-R must satisfy the DC resistance budgets in addition to the recommended loop attenuation requirements. In general, 22 and 19 AWG segments will be restricted by their loop attenuation while the DC resistance will restrict the segment reach for 26 and 24 AWG. When designing a dual H4R loop, the first segment should have lower DC resistance than the second segment.

   Single H4R spans do not require any restriction due to DC resistance.

NOTE

A circuit that otherwise meets attenuation requirements for cable reach will encounter span powering problems if resistance values are excessive.

The segment resistance ($\Omega_{segment}$) is determined using this equation:

$$\Omega_{segment} = L_{26} * \Omega_{26} + L_{24} * \Omega_{24} + L_{22} * \Omega_{22} + L_{19} * \Omega_{19}$$

where $L_{\#}$ is the length of # AWG cable (kft., excluding bridged taps) and Ω_{26} is the DC resistance of #AWG cable.

Table 8. Single Pair DC Resistance Value

Resistance (ohms/kft)				
AWG	**70°F**	**90°F**	**120°F**	**140°F**
19	16.465	17.183	18.261	18.979
22	33.006	34.446	36.606	38.046
24	52.498	54.789	58.225	60.516
26	83.475	87.117	92.581	96.223

Note: Interpolated between 70°F and 120°F data. Extrapolated from 70°F and 120°F data.

Once the resistance of each segment is confirmed, refer to **Figure 30** to decide if the H4TU-C is capable of span powering two H4Rs and one H4TU-R. Alternatively, the DSL Assistant program will automatically calculate this and report any violations.

To utilize the graph shown in Figure 30, perform the following steps:

a. Find the line on the graph that represents the known third segment resistance. These are the lines running diagonally across the graph labeled 300 - 1100 ohms. This line represents the upper limit for two H4Rs plus H4TU-R span powering.

b. Find the first segment resistance on the vertical axis.

c. Find the second segment resistance on the horizontal axis.

d. Find the instance where the two points from step b and step c meet on the graph.

The point found in step d must be below the upper limit line defined by the third segment measurement in step a. If the instance where these two points is above this line, the H4TU-C cannot span power two H4Rs and the H4TU-R.

Note that these measurements represent only one of the two HDSL4 pairs.

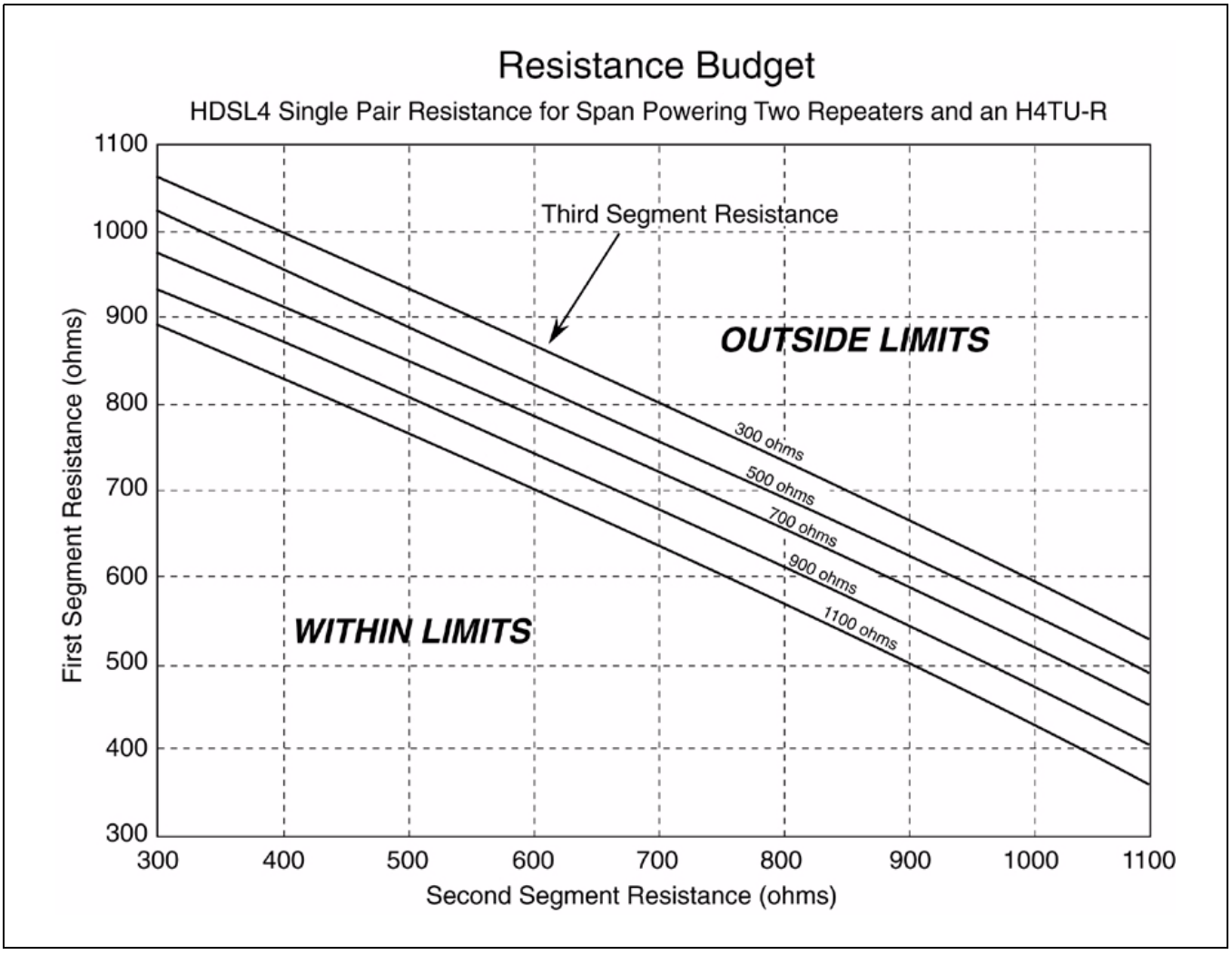


Figure 30. Resistance Budget Span Powering Two Repeaters

An example problem is illustrated in **Figure 31**. For this example, begin with three known measurements: 600 ohms first segment resistance, 700 ohms second segment resistance, and 900 ohms third segment resistance.

Refer to Figure 31 and the following steps to solve the example problem:

a. Find the 900 ohms third segment resistance line on the graph. This line is depicted in bold in Figure 31. This line is the upper span power limit.

b. Find the 600 ohms first segment resistance point on the vertical axis.

c. Find the 700 ohms second segment resistance point on the horizontal axis.

d. Find the instance on the graph where the points from step b and step c meet.

e. If this point is below the bold line defined in step a, a circuit with these parameters is capable of span powering two H4Rs and one H4TU-R.

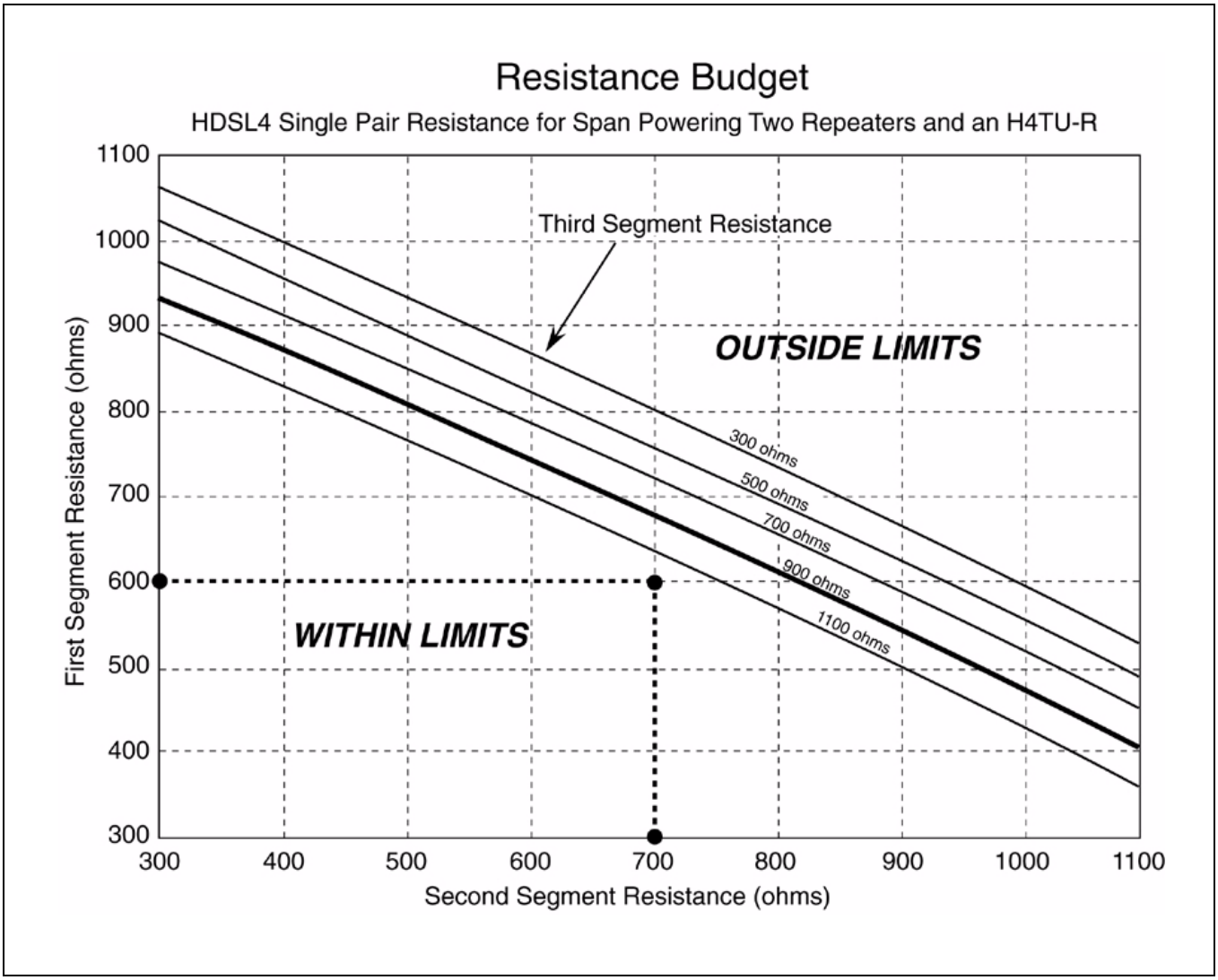


Figure 31. Resistance Budget Span Powering (Example)

8. MAINTENANCE

The 3192 H4TU-R, Span Powered requires no routine maintenance for normal operation. In case of equipment malfunction, use the front panel bantam jack connectors to help locate the source of the problem. Verification of possible trouble indications may be accomplished using the Troubleshooting Guide in **Table 9**.

ADTRAN does not recommend that repairs be attempted in the field. Repair services may be obtained by returning the defective unit to ADTRAN. Refer to the *Warranty and Customer Service* section for further information.

Troubleshooting

Table 9. Troubleshooting Guide

Condition: All front panel indicators are off. **Solutions**: 1. Make sure the H4TU-R is properly seated in the housing. 2. Verify that the H4TU-C is delivering sufficient simplex voltage to the loops. If steps 1 and 2 pass and front panel indicators remain off, replace the H4TU-R.
Condition: DSL 1/DSL 2 LED is red. **Solutions**: 1. Verify that loss (attenuation) on Detailed System Status screen is < 35 dB on the first segment of the circuit and < 31 dB on the second and third segments of the circuit. 2. Verify that the loop meets requirement stated in the *HDSL4 Deployment Guidelines* section of this practice. 3. Verify that noise on the HDSL4 loops is within acceptable limits. If steps 1-3 pass and LED is red, replace the H4TU-R.

9. SPECIFICATIONS

Specifications for the 3192 H4TU-R, Span Powered are detailed in **Table 10**.

Table 10. HDSL4 3192 H4TU-R, Span Powered Specifications

Specification	Description
Loop Interface	
Modulation Type	16 TC PAM
Mode	Full Duplex, partially overlapped echo canceling
Number of Pairs	2
Line Rate	1.552 Mbps
Baud Rate	261.333 k baud
Loop Loss	Refer to the *HDSL4 Deployment Guidelines* section for additional measurements.
Bridged Taps	Single Taps < 2000 ft., Total Taps < 2500 ft.
Performance	Compliant with T1.418-2000 (HDSL4 Standard, issue 2)
H4TU-C Transmit Power (Data) Level	14.1 ±0.5 dBm (0 to 400 kHz)
H4TU-C Transmit Power (Activation) Level	14.1 ±0.5 dBm (0 to 307 kHz)
Input Impedance	135 ohms
Maximum Loop Resistance	1150 ohms (nonrepeatered circuit)
Return Loss	12 dB (50 kHz to 200 kHz)
Network Interface	
DS1 Transmit Level	0 dB (default), –7.5 dB, –15 dB
DSX-1 Line Buildout	0–133 ft. ABAM (default)
	133–266 ft. ABAM
	266–399 ft. ABAM
	399–533 ft. ABAM
	533–655 ft. ABAM
DSX-1 Line Code	B8ZS (default), AMI
Power	
Tested with the ADTRAN H4TU-C (P/N 1223401L2) and H4R (P/N 1223445L1)	
H4TU-R Power Dissipation	3.8 watts
Span Power	190 VDC (from H4TU-C) Class A2 Compliant, GFI Current Limited at < 5 mA, Loop Current Limited at 150 mA
Fusing	1.00 A (not field-replaceable)
Clock	
Clock Sources	DSX-1 Derived (with HDSL4 frame bit stuffing)
Internal Clock Accuracy	±25 ppm (Exceeds Stratum 4), meets T1.101 Timing Requirements
Tests	
Diagnostics	Self-Test, Local Loopback (H4TU-C), Remote Loopback (H4TU-R)
Physical	
31912 Office Repeater Shelf-Mounted	
Dimensions	5.5 in. High, × 0.7 in. Wide, × 6.0 in. Deep
Weight	< 1 lb.

Table 10. HDSL4 3192 H4TU-R, Span Powered Specifications

Environment	
Operating Temperature (Standard) Storage Temperature	–40°C to + 70°C –40°C to + 85°C
Compliance	
UL 60950; GR-1089-CORE; GR-63-CORE; ANSI T1.418-2001, Issue 2; ANSI T1.102 (DS1 Interface)	
Part Number	
3192 H4TU-R, Span Powered	1223426L12

10. 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, 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

This page is intentionally blank.

Appendix A
HDSL4 Loopbacks

1. HDSL4 MAINTENANCE MODES

This appendix describes operation of the HDSL4 system with regard to detection of in-band and ESF Facility Data Link loopback codes.

Upon deactivation of a loopback, the HDSL4 system will synchronize automatically.

Loopback Process Description

In general, the loopback process for the HDSL4 system elements is modeled on the corresponding DS1 system process. Specifically, the H4TU-C loopback is similar to an Intelligent Office Repeater loopback, and the H4TU-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 insert or overwrite method. The HDSL4 elements respond to either method. The insert method produces periodic control sequences that are not overwritten by the DS1 framing bits.

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 greater 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 left-most bit transmitted first, and the ESF data link codes with right-most bit transmitted first.

Table A-1. HDSL4 Loopback Control Codes

Type	Source[1]	Code[2,3]	Name
Abbrevi-ated	(N)	3in7 (1110000)	Loopback data from network toward network in the H4TU-R
	(N)	4in7 (1111000)	Loopback data from network toward network in the H4TU-C
	(N)	2in6 (110000)	Loopback data from network toward network in first H4R
	(N)	3in6 (111000)	Loopback data from network toward network in second H4R
	(C)	6in7 (1111110)	Loopback data from customer toward customer in H4TU-C
	(C)	5in7 (1111100)	Loopback data from customer toward customer in H4TU-R
	(C)	4in6 (111100)	Loopback data from customer toward customer in first H4R
	(C)	5in6 (111110)	Loopback data from customer toward customer in second H4R
Wescom	(N)	FF1E (1111 1111 0001 1110)	Loopback data from network toward network at H4TU-C
	(C)	3F1E (0011 1111 0001 1110)	Loopback data from customer toward customer at H4TU-C
	(N)	FF04 (1111 1111 0000 0100)	Loopback data from network toward network at H4R1
	(N)	FF06 (1111 1111 0000 0110)	Loopback data from network toward network at H4R2
	(C)	3F04 (0011 1111 0000 0100)	Loopback data from customer toward customer at H4R1
	(C)	3F06 (0011 1111 0000 0110)	Loopback data from customer toward customer at H4R2
	(N)	FF02 (1111 1111 0000 0010)	Loopback data from network toward network at H4TU-R
	(C)	3F02 (0011 1111 0000 0010)	Loopback data from customer toward customer at H4TU-R
	(C)	FF48 (1111 1111 0100 1000)	Loopback data from customer toward customer at H4TU-R (FDL)
	(N)	FF48 (1111 1111 0100 1000)	Loopback data from network toward network at H4TU-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 ESF-DL.

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

Table A-2. Loopback Control Codes

Function	Code (Hex / Binary)	Response
ARM (in-band)	11000 (binary) also known as 2-in-5 pattern	If the pattern is sent from the network, the units will arm, and the H4TU-R will loop up if NIU Loopback is enabled.
ARM (ESF Data Link)	FF48 or 1111 1111 0100 1000 sent in the Facility Data Link	If the pattern is sent from the network, the units will arm, and the H4TU-R will loop up if NIU Loopback is enabled. When sent from the customer, the units will arm.
Disarm (in-band)	11100 (binary) also known as 3-in-5 pattern	When sent from the network or customer, all units are removed from the armed state, and loopbacks will be released.
Disarm (ESF Data Link)	FF24 or 1111 1111 0010 0100 sent in the Facility Data Link	When sent from the network or customer, all units are removed from the armed state, and loopbacks will be released.
H4TU-C Loop Up [1,2]	D3D3 or 1101 0011 1101 0011	If armed, the H4TU-C will loop up, 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 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 continue 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. In order to behave like a smartjack, the H4TU-R will not loop down from a network loopback in response to the 9393 pattern if NIU Loopback is enabled.
Loopback Query [1]	D5D5 or 1101 0101 1101 0101)	When the pattern is sent from the network, 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 nearest unit that is in loopback. As long as the pattern continues to be sent, errors are injected again every 20 seconds: H4TU-C 231 errors H4R1 10 errors H4TU-R 20 errors H4R2 200 errors
Loopback Time Out Override[1]	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. H4TU-C 231 errors H4R1 10 errors H4TU-R 20 errors H4R2 200 errors

Table A-2. Loopback Control Codes (Continued)

Function	Code (Hex / Binary)	Response
Span Power Disable[1]	6767 or 0110 0111 0110 0111	If the units are armed and 6767 is sent from the network, the H4TU-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 H4TU-C will reactivate span power. All units will then retrain and return to the disarmed and unlooped state.
First H4R Loop Up [1,2]	C741 1100 0111 0100 0001	If one or more H4Rs are present, the H4R closest to the H4TU-C will loop up toward the network, 2 seconds of AIS (all ones) will be transmitted, the looped data will be sent for 5 seconds, and then a burst of 10 logic errors will be injected. The burst of 10 logic errors will continue every 20 seconds as long as the C741 pattern is detected. When the pattern is removed, the unit will remain in loop-back. If the pattern is reinstated, the injection of 10 logic errors will continue every 20 seconds.
Second H4R Loop Up [1,2]	C754 1100 0111 0101 0100	If two H4Rs are present, the second H4R from the H4TU-C will loop up toward the network, 2 seconds of AIS (all ones) will be transmitted, the looped data will be sent for 5 seconds, and then a burst of 200 logic errors will be injected. The burst of 200 logic errors will continue every 20 seconds as long as the C754 pattern is detected. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 200 logic errors will continue every 20 seconds.
H4TU-R Address 20 for Extended Demarc [1,2]	C742 1100 0111 0100 0010	If armed, the H4TU-R will loop up toward the network, 2 seconds of AIS (all ones) will be transmitted, the looped data will be sent for 5 seconds, and then a burst of 20 logic errors will be injected. The burst of 20 logic errors will continue every 10 seconds as long as the C742 pattern is detected. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injec-tion of 20 logic errors will continue every 20 seconds.

1. Units must be armed with 11000b or FF48h before this code will work.

2. Loopback and error injection will only occur if the in-band code is received by the unit that is to go into loopback. In other words, if another loopback blocks the in-band code from being transmitted to the unit that is to go into loopback, loopback and error injection will not occur.

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

Appendix B
HDSL4 Features

1. HDSL NEW ENHANCED FEATURE OVERVIEW

The new HDSL2 and HDSL4 products contain new features to enhance their performance and help the customer reduce down time. Each new feature is listed and briefly described below:

- Splice Detection
- Fault (GFI, Short) Bridging
- Fast Retrain
- Splice Detection Feature

The Runtime TScan™ splice detection feature is an ADTRAN proprietary non-intrusive algorithm for detection of anomalies (bad splices) in the copper pair.

Data transmission transceivers (especially echo-cancelled technologies) are subject to performance degradations and errors in the presence of bad splices. A splice may be benign for a period of time, allowing a circuit to behave appropriately for portions of the day. However, over time the splice will oxidize and incur small, rapid changes in impedance. This inconsistency in behavior makes the problem difficult to locate. Additionally, an impedance change that is large enough to cause the transceiver trouble may still be small enough to be undetected by test equipment utilized on the copper pairs. Therefore a non-intrusive method of identifying these bad splices has been developed to aid the customer in troubleshooting their distribution plant.

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.

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

- Splice Detection Algorithm
- Screen Support
- EOC Support
- FDL Support
- EEPROM Support
- Event Support

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 – When this option is selected, a screen displays the results of the splice detection. These results are calculated for each receiver point on the circuit. If multiple bad splices are detected for a receiver, the worst is reported.
2. View Histogram Screen – When this option is selected, the Histogram Screen displays the raw counters for each distance 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-1**) displays general information about circuits with bad splices.

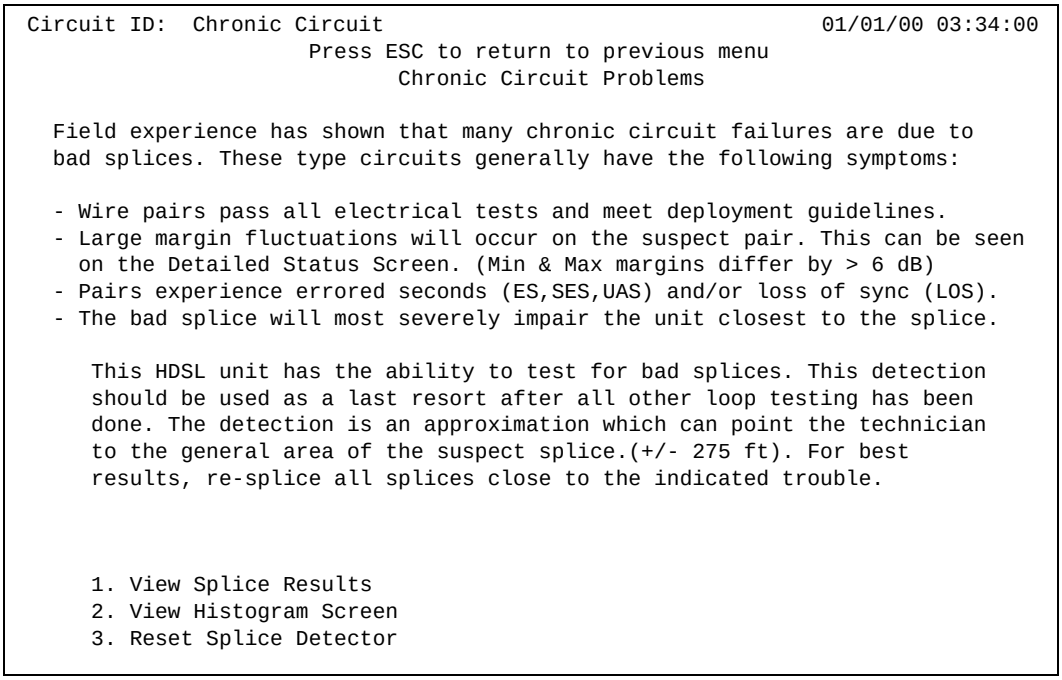


Figure B-1. Chronic Circuit Screen

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 data pump to see a reduced and/or fluctuating signal quality (margin). The HDSL data pump 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.

Three choices are provided on the Chronic Circuit screen:

1. View Splice Results
2. View Histogram Screen
3. 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.

View Splice Results Screen

Selecting the View Splice Results option from the menu displays this screen (**Figure B-2**). Results will be reported in the Splice Detection Results column for each transceiver:

- NTF - Reported if the unit is active and no problems have 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 650 feet from an H4TU-C module. The (B) Back command will allow the technician to scroll back through the last 14 days Splice Detection Results.

```
Circuit ID:HTSVALHDSL4                                    06/17/04 07:32:04
                     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
   H4TUC          NTF           650              01              --------
   H4TUR          NTF           NTF              01              06/17/04
   H4RU1 NET      NTF           NTF              01
   H4RU1 CST      NTF           NTF              01           (B)Back
```

Figure B-2. Splice Results Screen

View Splice Histogram Screen

The Splice Histogram Screen (**Figure B-3**) displays the counters that the splice detector uses to make its result decision. The definitions of abbreviations shown on this screen are as follows:

- The first column, labeled Splice (feet), represents the distance from the H4TU-C that the anomaly detector is evaluating.
- Column 2 indicates the respective transceiver that has reported the anomaly. The L1 and L2 columns represent Loop 1 and Loop 2 of the HDSL4 circuit.
- Column 3 displays the count registered by the H4TU-R, also with Loop 1 and Loop 2 counts.
- The remaining columns are for the H4R repeaters (numbered 1, 2, and 3 according to the number deployed in the circuit. HR1 N is the network side of the first repeater; HR1 C is the customer side of the repeater, and so forth.

In this example, the distances shown are corresponding to an H4TU-C module since that is the transceiver that has detected the anomaly. The count of 09 in the 650 feet row under the H4TU-C, Loop 2, column indicates that an anomaly has been seen 9 times at this distance from an H4TU-C module. Since 9 is larger than the count detection threshold of 8, this result is reported to the Splice Results Screen. Since all other columns show 00 for all counts, there is no reason to Change (C) the view of the distance column to show the distances an H4TU-R module is evaluating.

```
Circuit ID:                                                  06/17/04 07:33:06
                      Press ESC to return t
HTUC L2   (C) Change Distance Ref           Splice Histogram Screen
Splice |  H4TUC    H4TUR    HR1 N    HR1 C    HR2 N    HR2 C    HR3 N    HR3 C
(feet) |  L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2
------ |  -- --    -- --    -- --    -- --    -- --    -- --    -- --    -- --
 0100  |  00 00    00 00    00 00    00 00
 0650  |  00 09    00 00    00 00    00 00
 1200  |  00 00    00 00    00 00    00 00
 1750  |  00 00    00 00    00 00    00 00
 2300  |  00 00    00 00    00 00    00 00
 2850  |  00 00    00 00    00 00    00 00
 3400  |  00 00    00 00    00 00    00 00
 3950  |  00 00    00 00    00 00    00 00
 4500  |  00 00    00 00    00 00    00 00
 5055  |  00 00    00 00    00 00    00 00
 5610  |  00 00    00 00    00 00    00 00
 6165  |  00 00    00 00    00 00    00 00
 6720  |  00 00    00 00    00 00    00 00
 7275  |  00 00    00 00    00 00    00 00
 7830  |  00 00    00 00    00 00    00 00
 8385  |  00 00    00 00    00 00    00 00
 8940  |  00 00    00 00    00 00    00 00
 9495  |  00 00    00 00    00 00    00 00
```

Figure B-3. Splice Histogram Screen

Event History Screen

The Event History screen (**Figure B-4**) 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                                  04/14/04 03:31:36
                     Press ESC to return to previous menu

 Num   Description of Event                      Date     Time      Source
-------------------------------------------------------------------------------
   1.  H4TU-C Event Log Reset                    04/14/04 03:34:36  H4TU-C
   2.  H4TU-C Powered Up                         04/14/04 03:30:01  H4TU-C
   3.  H4TU-R Powered Up                         04/14/04 03:30:15  NO ID
   4.  Splice Detector Reset                     04/14/04 03:30:29  H4TU-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-4. Event History Screen

2. 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.

3. FAST RETRAIN FEATURE

Fast Retrain is an ADTRAN proprietary feature whose intent is to minimize downtime when an intermittent non power-related impairment (bad splice, noise burst, etc.) affects the HDSL loop and cannot be bridged.

HDSL-2 and HDSL-4 transceivers normally train in approximately 25 to 30 seconds. For an initial circuit turn-up, this is not a big issue. However, once service has been established on the circuit, any large downtime will interrupt communications on the circuit. A loss of synchronization on the HDSL loop can cause excessive down times due not only to the 30-second HDSL retrain time, but also further delays due to the higher level protocols in the network going through re-synchronization. On the older generation HDSL2 and HDSL4 units, a 1-second loss of HDSL frame synchronization would cause the data pumps to retrain. This retrain would take approximately 25 seconds during which AIS would be sent to the terminating equipment. The reception of AIS by the terminating equipment then might trigger higher level protocol re-synchronizations.

In an effort to minimize this down time, a Fast Retrain has been implemented. If an impairment (bad splice, for example) causes the HDSL data pump to lose frame synchronization for 500 msec or longer, instead of retraining, a fast retrain will be attempted. This abbreviated train can achieve data mode in 5 to 7 seconds. A successful fast retrain should be evident by watching the Span Status screen and by reduced unavailable seconds (UAS) in the PM data for each LOS alarm recorded.

NOTE

Fast-Retrain capable units must be installed on both ends of the HDSL4 circuit for this feature to function properly. Also, if there is a failure of a fast retrain attempt, for any reason, then the traditional (25-30 second) retrain will be initiated.

This page is intentionally blank.