T200 2-Wire HDSL2 Transceiver Unit for the Central Office Installation and Maintenance Practice

CONTENTS

1. General 1
2. Installation 2
3. Connections 6
4. HDSL2 System Testing 7
5. Control Port Operation 8
6. HDSL2 Deployment Guidelines 23
7. Troubleshooting Procedures 24
8. Maintenance 25
9. Product Specifications 25
10. Warranty and Customer Service 25
Appendix A. HDSL2 Loopbacks A-1

TABLES

Table 1. ADTRAN Unit Compatibility 1
Table 2. Compliance Codes 2
Table 3. DIP Switch Options 3
Table 4. Front Panel Indicators 4
Table 5. Provisioning Options 5
Table 6. HDSL2 Loss Values 23
Table 7. Troubleshooting Guide 24
Table 8. T200 H2TU-C Specifications 26

1. GENERAL

The ADTRAN T200 2-Wire HDSL2 Transceiver Unit for the Central Office (T200 H2TU-C), P/N 1223006L1, is used to deploy an HDSL2 T1 circuit using 2-wire metallic facilities. The unit occupies one slot in a Type 200 or Type 400 enclosure. An illustration of the T200 H2TU-C is shown in **Figure 1**.

Revision History

This third release of the documentation provides information regarding new hardware and firmware features and capabilities.

Description

HDSL2 provides extended range to DS1/T1 transport while providing spectral compatibility with ADSL and other transport technologies. DSX1 signals are provided to and received from the network while HDSL2 signals are provided to the local loop. The ADTRAN T200 H2TU-C works in conjunction with the ADTRAN H2TU-R (remote unit) to provide a DS1 service up to 12,000 feet on the local loop.

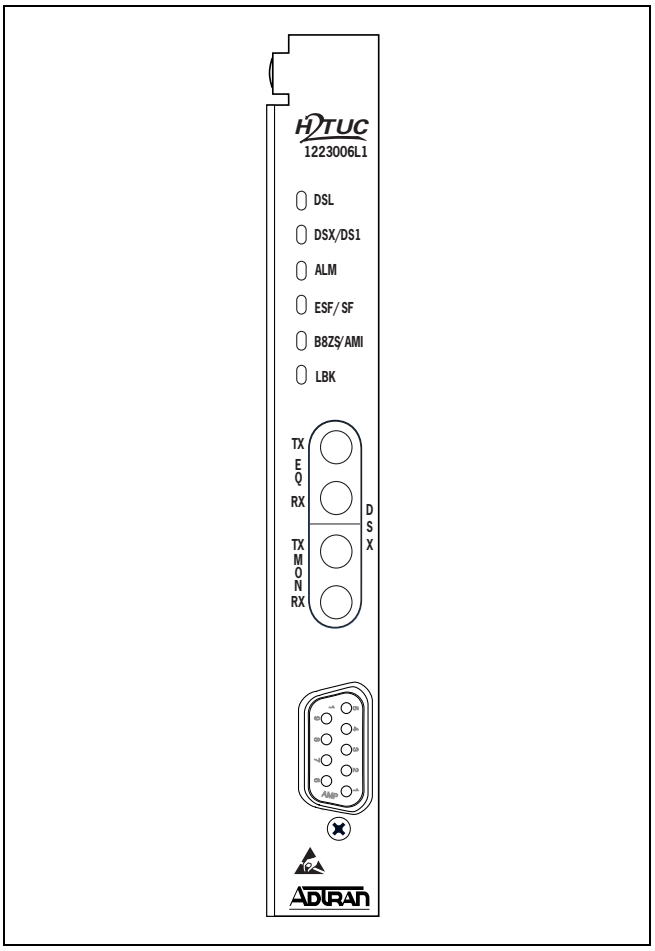


Figure 1. ADTRAN T200 H2TU-C

Compatible versions of the ADTRAN H2TU-R are listed in **Table 1**.

Table 1. ADTRAN Unit Compatibility

Unit Number	Description
122x026L1	T200 H2TU-R, Span Powered
122x024L1	T200 H2TU-R, Locally Powered

NOTE: x = any generic release number

Features

This release of the T200 H2TU-C provides new and/or enhanced features as described below:

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.

NOTE

For implementation of TScan please contact your local ADTRAN sales representative.

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

TScan performs the following functions (see **Figure 2**):

- Detection and location of an open, 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

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

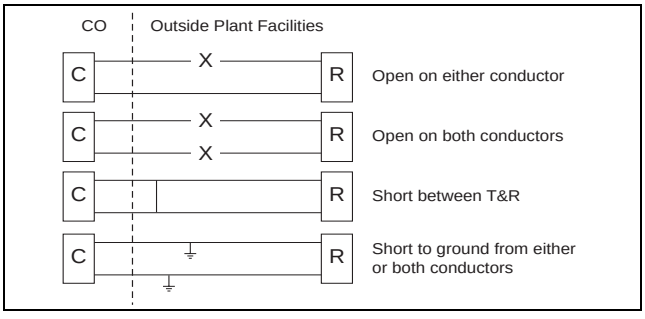


Figure 2. TScan Diagnostic Capabilities

Enhanced Performance Monitoring

This unit features new firmware to retrieve and reset Performance Data parameters.

Troubleshooting

New firmware detects the condition of the circuit and its components and provides guidance in troubleshooting any faults.

Compliance

Table 2 shows the compliance codes for the ADTRAN T200 H2TU-C. 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)	F	C
Telecommunication Code (TC)	–	X
Installation Code (IC)	A	–

2. INSTALLATION

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

After unpacking the T200 H2TU-C, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. Refer to the *Warranty and Customer Service* section for further information.

Shipping Contents

The contents include the following items:

- T200 2-Wire HDSL2 Transceiver Unit for the Central Office
- T200 2-Wire HDSL2 Transceiver Unit for the Central Office Job Aid

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.

Provisioning DIP Switch Setting

A seven-position DIP switch is located on the printed circuit board. The seven provisioning options controlled by this switch may not be controlled via terminal menus. The options are described in **Table 3** below.

Instructions for Installing the Module

To install the T200 2-Wire HDSL2 Transceiver Unit for the Central Office, perform the following steps:

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

WARNING

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

When the T200 H2TU-C first powers up it runs the power up self-tests. Once the power up self-test is complete the status LEDs will reflect the true state of the hardware.

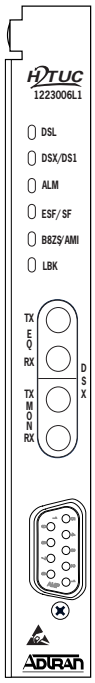
Table 3. DIP Switch Options

Switch Function	On	Off	Default
1. Line Build Out	133-266 ft.	0-133 ft.	Off
2. DS1 Signal	Unframed	Framed	Off
3. Frame Format	SF	ESF	Off
4. Line Code	AMI	B8ZS	Off
5. Loopback Time Out	Enabled	Disabled	Off
6. FT1 Loopback	Enabled	Disabled	Off
7. Span Power	Disabled	Enabled	Off

Front Panel LED Indicators

There are six front panel mounted status LED indicators. Each indicator is described in **Table 4**.

Table 4. Front Panel Indicators

Front Panel	Name	Indication	Description
	**DSL**	Green	DSL sync, no errors currently detected, and signal margin ≥2 dB
		Red	No DSL sync, errors being detected, or signal margin <2 dB
	DSX/DS1	Green	DSX-1 is present and no errors currently detected
		Red	No DSX-1 signal or signal is present with errors
	ALM	OFF	No active alarm present
		Red	Loss of DSX-1 signal to the unit
		Yellow	Loss of DS1 signal to the remote
	ESF/SF	OFF	Unit is receiving Unframed data
		Yellow	Unit is receiving ESF data
		Green	Unit is receiving SF data
	B8ZS/AMI	Yellow	Unit is receiving B8ZS line code data
		Green	Unit is receiving AMI line code data
	LBK	OFF	Unit is NOT in loopback
		Yellow	Unit is in loopback (network and/or customer)

Provisioning

The T200 H2TU-C DIP switch shown on Table 3 on page 3 controls several of the provisioning settings. Otherwise, configuration is performed via software discussed in the *Control Port Operation* section of this practice.

The provisioning settings can be viewed and manipulated through access to the firmware via the front panel RS-232 port. **Table 5** lists the available provisioning options and their factory default settings.

Table 5. Provisioning Options

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

[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] Latching Loopback Mode

- T1 — When optioned for T1 mode, the unit does not respond to DDS Latching Loopback codes.
- FT1 (Fractional T1) — DDS Latching Loopback operation is supported. The H2TU-C units which are in the HDSL circuit are treated as Identical Tandem Data ports and the HTU-R is treated as a different Tandem Data port.

  NOTE: When operating in FT1 mode and during periods of T1 loss of signal, LOS, or T1 AIS from the customer CI, the HDSL system will send in the network direction from the HTU-C a Fractional DS1 idle signal consisting of a repeating 7E (HEX) byte payload within a framed/unframed T1 signal. In addition, when optioned for FT1 mode, the setting for Customer Loss Response is ignored.

[3] 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 milli-second code burst of 7E (HEX).

* DIP Switch settings determine the settings for this option. Refer to **Table 3** on page 3 for the proper position of the switch.

Span Powering

The default span powering option is ENABLED. The T200 H2TU-C is capable of span powering the H2TU-R by applying current to the local loop. From 10 to 150 mA of current is coupled onto the HDSL2 span to power the H2TU-R when deployed (see **Figure 3**). The span powering option can be set to DISABLED if the H2TU-R is locally powered.

CAUTION

Disabling the span power removes all voltage from the HDSL2 loop. This will result in an absence of sealing current which could have an adverse effect on circuit continuity over an extended period of time.

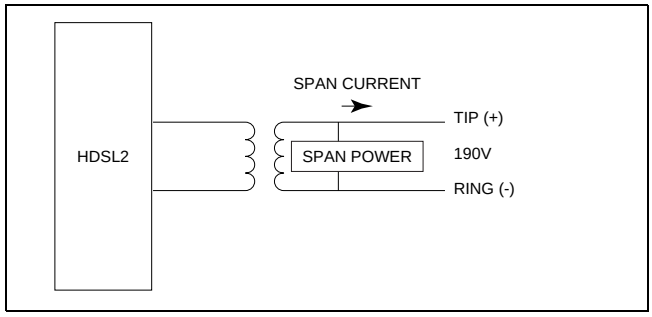


Figure 3. H2TU-C Span Powering Diagram

H2TUC Alarm Outputs

The T200 H2TU-C contains an onboard fuse. If the fuse opens, all front panel indicators will be *off*. This fuse is not designed to be replaced in the field. A blown fuse indicates that the card has malfunctioned and should be replaced.

3. CONNECTIONS

The T200 H2TU-C occupies one card slot in a T200 enclosure. Power and alarm signals are provided to the card through the backplane of the shelf. DSX1 and HDSL2 loop signals are connected to the wirewrap pins or mass termination (amphenol) shelf connectors corresponding to the slot the unit occupies. **Figure 4** shows the edge connection wiring for the T200 H2TU-C.

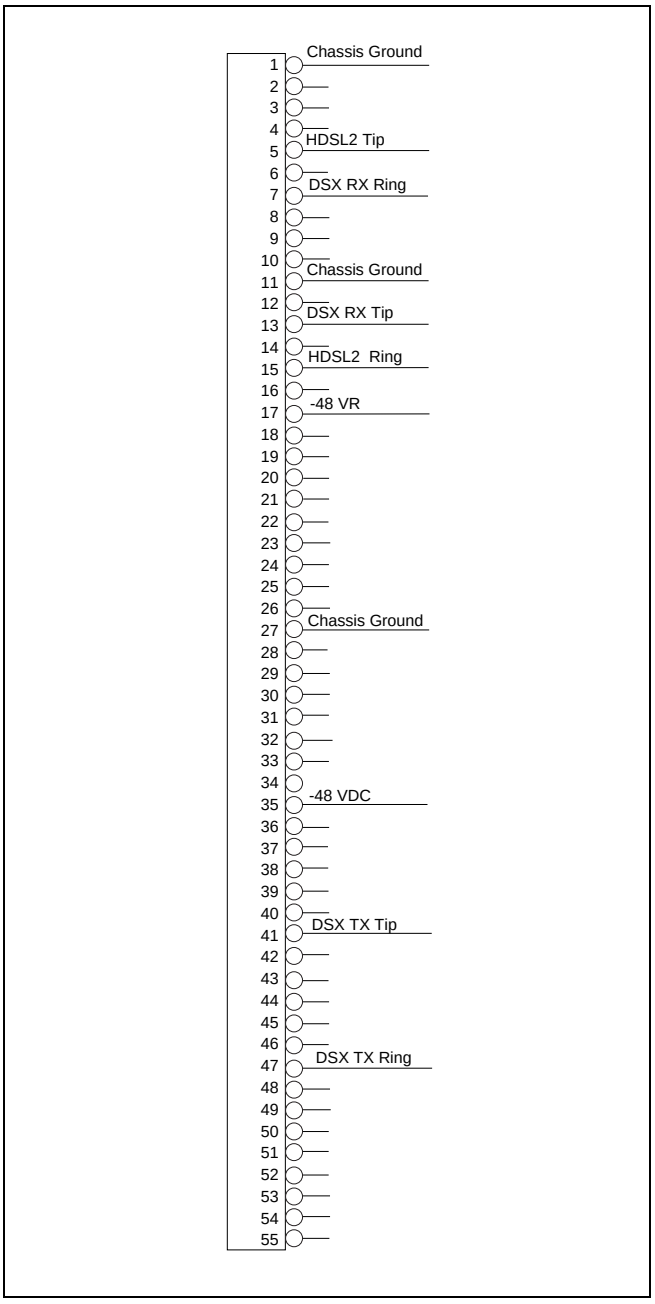


Figure 4. H2TU-C Edge Connector Wiring

4. HDSL2 SYSTEM TESTING

The ADTRAN HDSL2 system provides the ability to monitor the status and performance of the DSX-1 signals, DS1 signals, and HDSL2 loop signals. Detailed performance monitoring is provided by the front panel-mounted RS-232 Control Port. These features are valuable in troubleshooting and isolating any system level problems that may occur at installation or during operation of the HDSL2 system. The following subsections describe additional testing features.

H2TU-C Bantam Jacks

The front panel of the H2TU-C contains both monitoring and metallic splitting Bantam jacks. In general, the monitoring jacks provide a non-intrusive tap onto a signal line that permits the connection of test equipment to monitor the characteristics of that signal. For example, the DSX-1 monitor jack can be used to connect to a bit error rate tester to monitor for synchronization, test patterns, etc. The metallic splitting jacks provide an intrusive, signal interrupting access to the line. It is very important to know the direction of the access provided by a metallic splitting jack.

Figure 5 illustrates the complete Bantam jack arrangement and details for specific jacks.

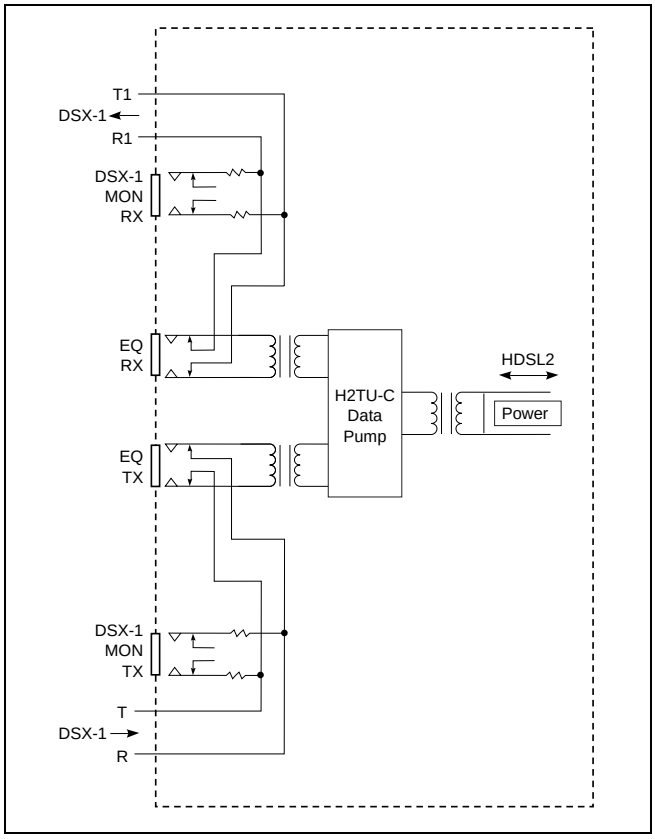


Figure 5. H2TU-C Bantam Jack Arrangement

H2TU-C Loopbacks

The H2TUC responds to two different loopback activation processes.

- First, loopbacks may be activated using the craft interface. The Loopback Options Screen that provides for the H2TU-C and H2TU-R loopbacks is described in the *Control Port Operation* section of this Practice.
- Second, the H2TU-C responds to the industry standard patterns for HDSL loopbacks. A detailed description of these loopback sequences is given in Appendix A.

This unit contains smartloop technology. That is, the unit will initiate the proper loopback regardless of how the loopback control sequence is sent (framed or unframed).

The loopback condition imposed in each case is a logic level loopback at the point within the H2TU-C where the DSX1 signal passes into the HDSL2 modulators. **Figure 6** depicts all of the loopback locations possible with ADTRAN HDSL2 equipment.

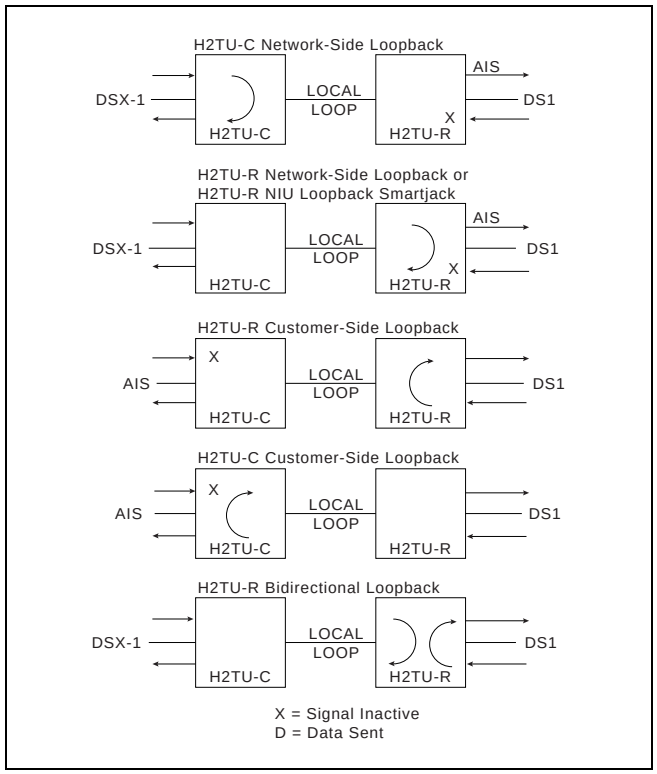


Figure 6. HDSL2 Loopbacks

In addition to network side loopbacks, the H2TU-C provides customer side loopbacks initiated by using either the terminal control port or in-band loop codes (see *Appendix A*). In this mode, an AIS signal is transmitted to the network.

5. CONTROL PORT OPERATION

The H2TU-C provides a DB-9 connector on the front panel that supplies an RS-232 interface for connection to a controlling terminal. The pinout of the DB-9 is illustrated in **Figure 7**.

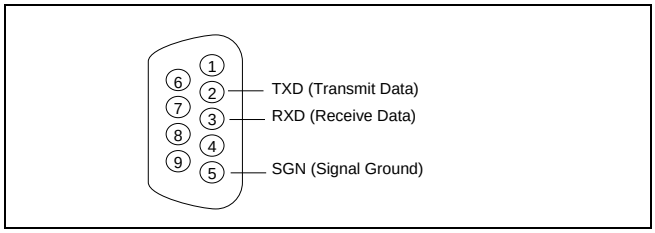


Figure 7. RS-232 (DB-9) Pin Assignments

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 line wrap feature of emulation programs should also be disabled.

The H2TU-C supports two types of terminal emulation modes. The Manual Update Mode is a dumb terminal mode, allowing easy access to print screen and log files commands. This mode also includes a "3 SPACES TO UPDATE" message on the top of the terminal screen (press the spacebar 3 times to update the screen).

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

The default terminal mode is Real-Time Update.

NOTE

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

The screens illustrated in **Figure 8** through Figure 31 are for an HDSL2 circuit deployed with the ADTRAN HDSL2 technology. The circuit includes an H2TU-C and H2TU-R. Other configurations are possible (for example, an HDSL2 repeater from 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 H2TU-C to determine the speed of the terminal. Once the speed has been determined, the ADTRAN HDSL2 Main Menu is displayed from which the various OAM&P (Operation, Administrative, Maintenance, and Provisioning) screens may be accessed (**Figure 8**). To display a particular screen from the menu, press the number key associated with the screen title and then press the ENTER key.

```
Circuit ID:                                              12/01/03 09:29:45

                          Adtran HDSL2 Main Menu


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


                         Selection:
```

Figure 8. ADTRAN HDSL2 Main Menu

The Unit Information Screen (**Figure 9**) provides detailed product information on each component in the HDSL2 circuit. ADRAN Technical Support contact numbers are also available from the Unit Information Screen.

The Provisioning Screen (**Figure 10**) displays current provisioning settings for the HDSL2 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 number and a new menu will appear with a list of the available settings. To return to the Main Menu, press <ESCAPE>. To re-deploy this unit, press D which will restore the factory default settings to those shown in Table 5.

```
Circuit ID:                                                  12/01/03 09:29:56
                     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: 1223006L1                     P/N: 1223026L1
              S/N: 123456789                     S/N: 123456789
             CLEI: T1L79B9AAA                   CLEI: T1L75ERAAA
             Manf: 11/01/2003                   Manf: 11/01/2003
              Ver: A01                           Ver: A01
```

Figure 9. ADTRAN Information Screen

```
Circuit ID:                                                  12/01/03 09:40:10
                     Press ESC to return to previous menu

                               Provisioning

                      1.  DSX-1 Line Buildout     =  *0-133 feet
                      2.  DSX-1/DS1 Line Code     =  *B8ZS
                      3.  DSX-1/DS1 Framing       =  ESF
                      4.  Forced Frame Conversion =  Disabled
                      5.  Smartjack Loopback      =  Enabled
                      6.  Loopback Timeout        =  *120 Min
                      7.  Latching Loopback Mode  =  *T1 (Disabled)
                      8.  DS1 TX Level            =  -7.5 dB
                      9.  Span Power              =  *Enabled
                     10.  Customer Loss Indicator =  AIS / CI
                     11.  PRM Setting             =  AUTO
                     12.  Loop Atten Alarm Thres  =  30dB
                     13.  SNR Margin Alarm Thres  =  04dB
                     14.  Remote Provisioning     =  Enabled
                      D.  Restore Factory Defaults

                * - Option can only be provisioned by card switches.

                              Selection:
```

Figure 10. Provisioning Screen

The Span Status Screen (**Figure 11**) provides quick access to status information for each HDSL2 receiver in the circuit.

The Status Screen Legend (**Figure 12**) provides a description of the messages that are used on the Status screens.

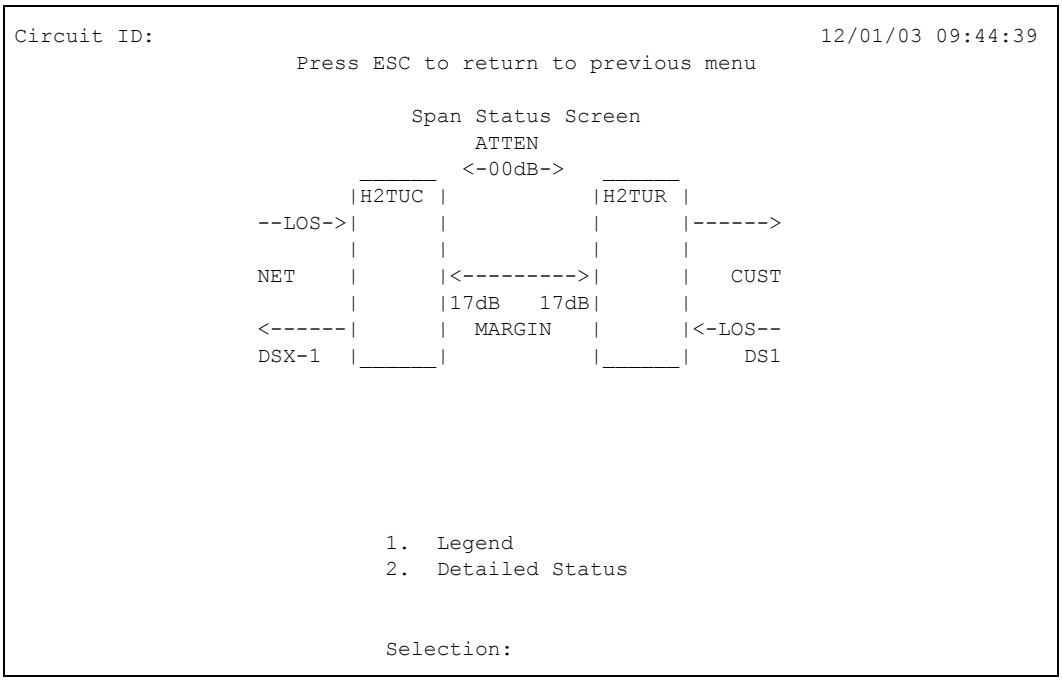


Figure 11. Span Status Screen

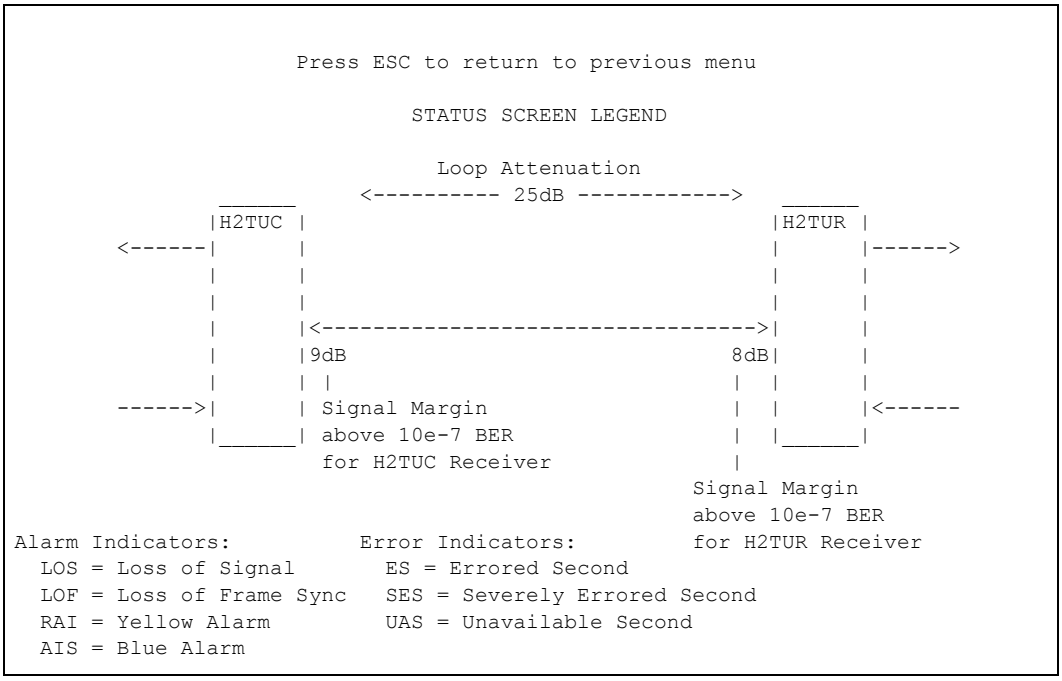


Figure 12. Status Screen Legend

The Detailed Status selection from the Span Status Screen menu (**Figure 13**) displays the T1 and HDSL2 status for each receiver point.

```
Circuit ID:                                                  12/01/03 09:45:49
                    Press ESC to return to previous menu

                        Detailed HDSL2 and T1 Status

                             HDSL2 RECEIVER DATA
                               H2TU-C    H2TU-R

                              --------  --------
          MARGIN(CUR/MIN/MAX): 17/00/17  17/00/17
               ATTEN(CUR/MAX):  00/00     00/00
                     ES 15MIN:   000       000
                    SES 15MIN:   000       000
                    UAS 15MIN:   000       000

                            T1 RECEIVER DATA
                         DSX-1                 DS1
                        -------               -------
            FRAMING:     UNFR                  UNFR
          LINE CODE:      AMI                   AMI
          ES-P/ES-L:    000/050               000/049        1. Zero Registers
        SES-P/SES-L:    000/050               000/049        2. Restart Min/Max
        UAS-P/UAS-L:    000/050               000/049
             ALARMS:      RED                   RED             Selection:
```

Figure 13. Detailed Status Screen

The Loopback and Test Commands screen (**Figure 14**) provides the user with the ability to evoke or terminate all available HDSL2 loopbacks. Each HDSL2 circuit component can be looped toward the network or customer from this screen. Unit self tests can also be initiated from this screen. A Loop Down ALL Units command is available in lieu of the Self-Test option when any loopback is active.

The Performance History Screens, illustrated in **Figure 15**, **Figure 16**, and **Figure 17**, display the historical HDSL2 and T1 performance data in several different registers. At each 15-minute interval, the performance information is transferred to the previous 15-minute performance data register. This unit stores performance data in 15-minute increments for the last 24-hour period.

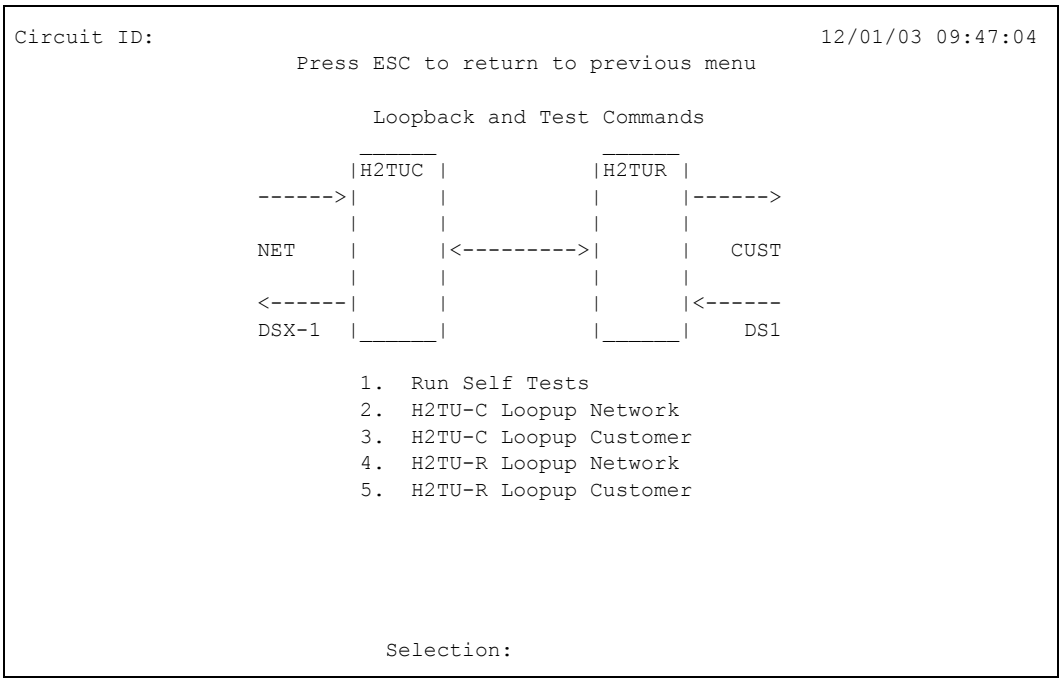


Figure 14. Loopback and Test Commands Screen

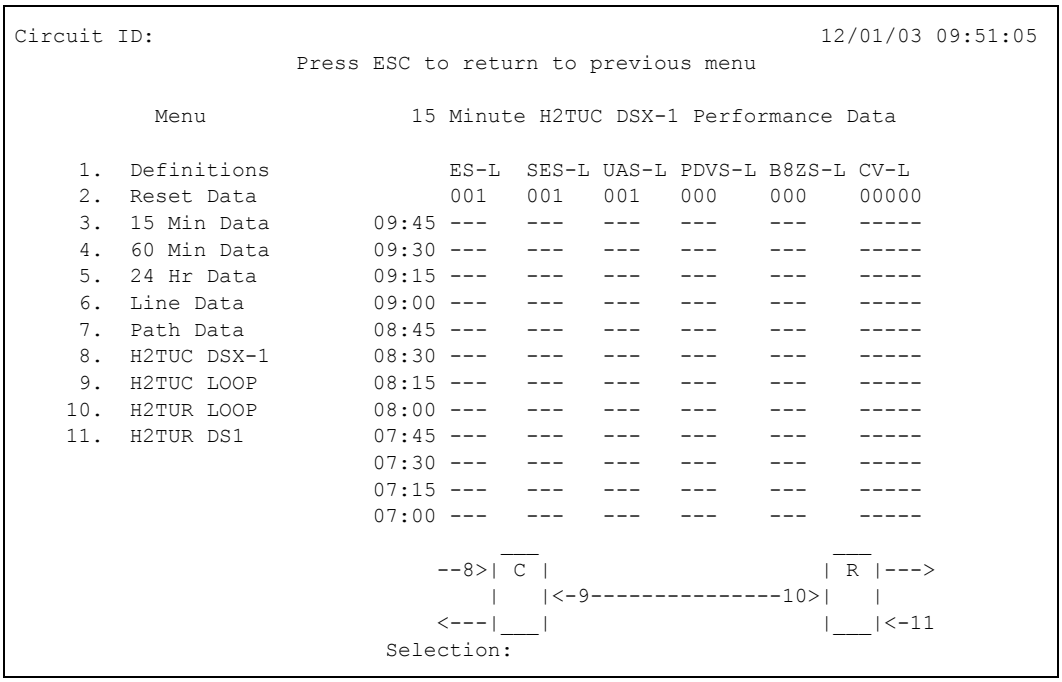


Figure 15. Performance History, 15-Minute Line Data

Additionally, some units store up to 48 hours worth of 60-minute interval data. At each 24-hour interval, the performance data is transferred into the previous 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. Line (L) and Path (P) can be viewed.

```
Circuit ID:                                                  12/01/03 09:59:45
                    Press ESC to return to previous menu

          Menu                60 Minute H2TUC DSX-1 Performance Data

     1.  Definitions                ES-P  SES-P UAS-P SAS-P ES-PFE CV-P
     2.  Reset Data                 0000  0000  0000  0000  0000   00000
     3.  15 Min Data      12/01 09:00 ----  ----  ----  ----  ----   -----
     4.  60 Min Data      12/01 08:00 ----  ----  ----  ----  ----   -----
     5.  24 Hr Data       12/01 07:00 ----  ----  ----  ----  ----   -----
     6.  Line Data        12/01 06:00 ----  ----  ----  ----  ----   -----
     7.  Path Data        12/01 05:00 ----  ----  ----  ----  ----   -----
     8.  H2TUC DSX-1      12/01 04:00 ----  ----  ----  ----  ----   -----
     9.  H2TUC LOOP       12/01 03:00 ----  ----  ----  ----  ----   -----
    10.  H2TUR LOOP       12/01 02:00 ----  ----  ----  ----  ----   -----
    11.  H2TUR DS1        12/01 01:00 ----  ----  ----  ----  ----   -----
                          12/01 00:00 ----  ----  ----  ----  ----   -----
                          11/30 23:00 ----  ----  ----  ----  ----   -----
                          11/30 22:00 ----  ----  ----  ----  ----   -----
                                 ___                          ___
                               --8>| C |                      | R |--->
                                   |   |<-9----------------10>|   |
                               <---|___|                      |___|<-11
                             Selection:
```

Figure 16. Performance History, 60-Minute Path Data

```
Circuit ID:                                                  12/01/03 10:01:08
                    Press ESC to return to previous menu

          Menu                24 Hour H2TUC DSX-1 Performance Data

     1.  Definitions            ES-L  SES-L UAS-L PDVS-L B8ZS-L CV-L
     2.  Reset Data             00000 00000 00000 00000  00000  0000000
     3.  15 Min Data       11/30 ----- ----- ----- -----  -----  -------
     4.  60 Min Data       11/29 ----- ----- ----- -----  -----  -------
     5.  24 Hr Data        11/28 ----- ----- ----- -----  -----  -------
     6.  Line Data         11/27 ----- ----- ----- -----  -----  -------
     7.  Path Data         11/26 ----- ----- ----- -----  -----  -------
     8.  H2TUC DSX-1       11/25 ----- ----- ----- -----  -----  -------
     9.  H2TUC LOOP        11/24 ----- ----- ----- -----  -----  -------
    10.  H2TUR LOOP        11/23 ----- ----- ----- -----  -----  -------
    11.  H2TUR DS1         11/22 ----- ----- ----- -----  -----  -------
                           11/21 ----- ----- ----- -----  -----  -------



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

Figure 17. Performance History, 24-Hour DSX-1 Data

Abbreviations used in the Performance Data screens are defined in the Data Definitions screens (**Figure 18** and **Figure 19**).

```
Circuit ID:                                                12/01/03 10:04:08
                     Press ESC to return to previous menu

                          Performance Data Definitions

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

DS1 and DSX-1 Line Related:             Superframe and Extended Superframe
  ES-L    Errored Seconds                 (BPV+EXZ)>=1 or LOS>= 1
  SES-L   Severely Errored Seconds        (BPV+EXZ)>=1544 or LOS>=1
  UAS-L   Unavailable Seconds             >10 cont. SES-Ls
  PDVS-L  Pulse Density Violation Secs    EXZ>=1; >7 zeros if B8ZS, >15 if AMI
  B8ZS-L  B8ZS Seconds                    B8ZS coded signal received
  CV-L    Code Violation Count            (BPV+EXZ) count

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


    N.  Next
    P.  Previous            Selection:
```

Figure 18. Performance Data Definitions, Loop

```
Circuit ID:                                                12/01/03 10:04:40
                     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 19. Performance Data Definitions, Path

The Scratch Pad, Circuit ID and Date/Time screen provides a logging medium for circuit information (**Figure 20**).

The Scratch Pad is available for circuit-specific notes and can hold 50 alphanumeric characters in any combination.

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 in the MMDDYY format. (For example, enter January 02, 2003, as “010203”.)

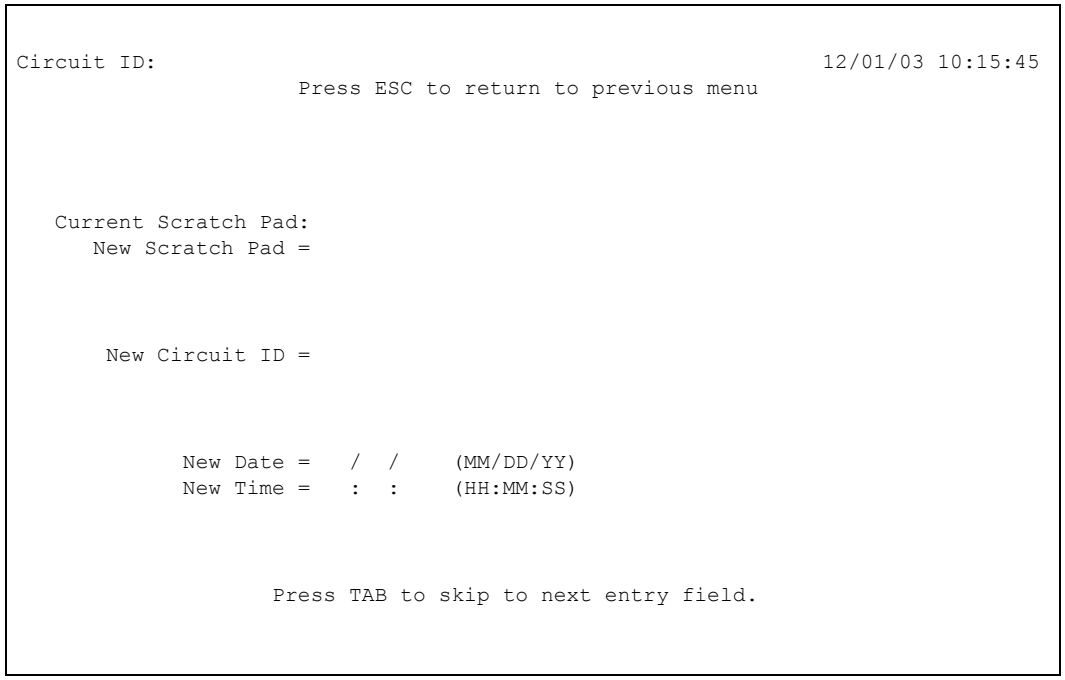


Figure 20. Scratch Pad and Circuit ID Screen

This unit includes two terminal emulation modes. The desired terminal mode can be selected from the Terminal Modes Screen, illustrated in **Figure 21**. Additionally, pressing CTRL+T while on any screen can toggle the two terminal modes.

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

The second terminal emulation mode is the Real Time Update Mode (VT100). This mode provides real time updating of HDSL2 circuit conditions and provisioning options as changes occur. The default mode is Real Time Update.

```
Circuit ID:                                                  12/01/03 10:30:45
                      Press ESC to return to previous menu
                            TERMINAL MODES MENU

    MANUAL UPDATE MODE:

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

    REAL-TIME UPDATE MODE:

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


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

Figure 21. Terminal Mode Screen

The Alarm History screens are divided into three separate screens: T1 Alarm History (**Figure 22**), HDSL2 Span History (**Figure 23**), and HDSL2 History (**Figure 24**).

T1 Alarm History screen (Figure 22) displays:

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

HDSL2 Span History screen (Figure 23) displays:

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

```
Circuit ID:                                                    12/01/03 10:42:53
                    Press ESC to return to previous menu

                              T1 Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
H2TU-C     RED(LOS/LOF) 01/01/00  00:00:04   01/01/00  00:00:04   Alarm      001
 (DSX-1)   YELLOW(RAI)                                            OK         000
           BLUE(AIS)                                              OK         000

H2TU-R     RED(LOS/LOF) 01/01/00  00:01:22   01/01/00  00:01:22   Alarm      001
 (DS1)     YELLOW(RAI)                                            OK         000
           BLUE(AIS)                                              OK         000









-------------------------------------------------------------------------------
 1. T1 Alarm       2. HDSL2 Span    3. Facility Alarm  C. Clear T1 Alarm
                            Selection:
```

Figure 22. T1 Alarm History Screen

```
Circuit ID:                                                    12/01/03 10:44:11
                    Press ESC to return to previous menu

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


H2TU-C           MRGN                                             OK         000
H2TU-R           MRGN                                             OK         000




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




-------------------------------------------------------------------------------
 1. T1 Alarm       2. HDSL2 Span    3. Facility Alarm  C. Clear HDSL2 Span
                            Selection:
```

Figure 23. HDSL2 Span History Screen

The Facility Alarm History screen (Figure 24) displays:

- DC Open
- Over-current (short)
- Ground fault
- Power cycle

```
Circuit ID:                                                  12/01/03 10:46:50
                     Press ESC to return to previous menu

                              Facility Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
FACILITY DC OPEN                                                  OK         000
FACILITY SHORT                                                    OK         000
FACILITY GROUND FAULT                                             OK         000

H2TU-C   POWER CYCLE   01/01/00  00:00:02   01/01/00  00:00:02   OK         001









-------------------------------------------------------------------------------
 1. T1 Alarm       2. HDSL2 Span    3. Facility Alarm  C. Clear Facility Alarm
                          Selection:
```

Figure 24. HDSL2 Facility Alarm History Screen

The Event History screen (**Figure 25**) provides a log history of HDSL2 circuit events. The following is a list of possible events:

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

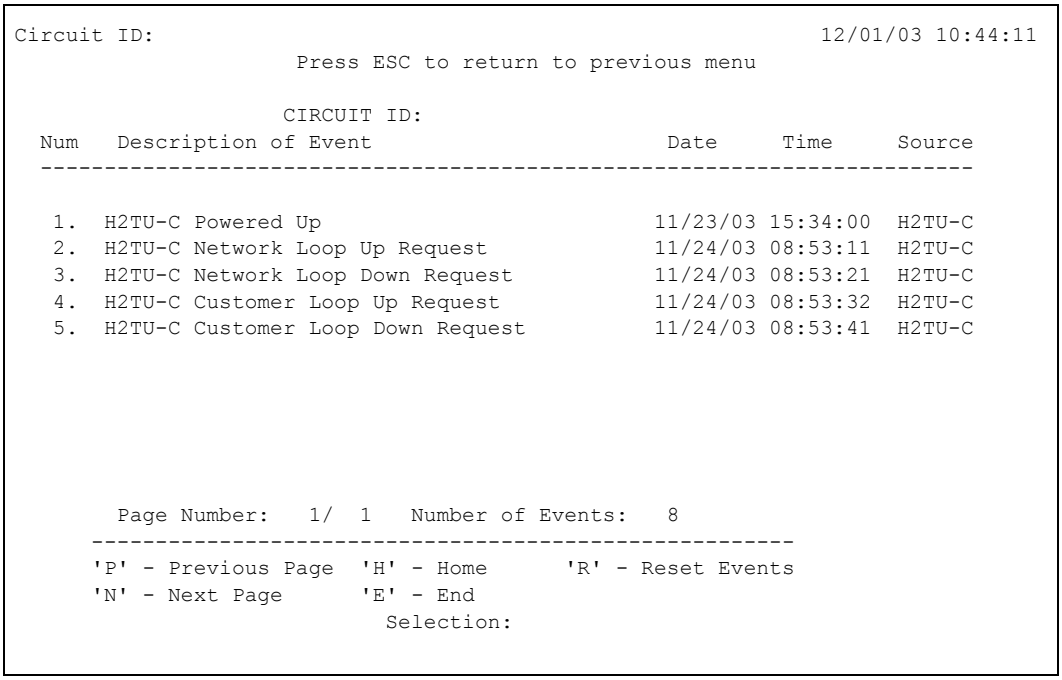


Figure 25. Event History Screen

The System PM/Screen Report option (**Figure 26**) 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.

The Clear PM and Alarm Histories screen (**Figure 27**) initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu displays a verification prompt, "(Y/N)?" Pressing N will display the message, "Performance and History data NOT cleared," and returns to the 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

                               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 26. System PM/Screen Report Option

```
Circuit ID:                                                 12/01/03 10:29:45

                               Adtran HDSL2 Main Menu


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

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

                               Selection: 11
```

Figure 27. Clear PM and Alarm Histories

Item 12 on the Main Menu displays the Troubleshooting screen (**Figure 28**). Helpful ADTRAN contact information along with two menu items appear on the bottom of this screen.

Selecting option 1 from the Troubleshooting screen causes the H2TU-C to read the operational status of the card and return Troubleshooting Guidance, or hints, as to the probable cause of the trouble, as shown in **Figure 29**.

```
Circuit ID:                                                  12/01/03 10:29:45
                      Press ESC to return to previous menu
                                Troubleshooting

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









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

                                          Selection:
```

Figure 28. Troubleshooting Screen

```
Circuit ID:                                                  12/01/03 10:29:45
                      Press ESC to return to previous menu
                        DSX-1 Loss of Signal (Red Alarm)

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

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

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

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

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

Figure 29. Troubleshooting Guidance

Selecting option 2 from the Troubleshooting screen accesses the General Information Screen (**Figure 30**) that summarizes the deployment guidelines necessary to provision this HDSL2 circuit.

The Virtual Terminal Session Screen (**Figure 31**) allows control of the Remote card provisioning from the H2TU-C. Press 1 from this screen to begin a user-initiated session with the Remote card. When the remote session is completed, Press CTRL+X to terminate the session.

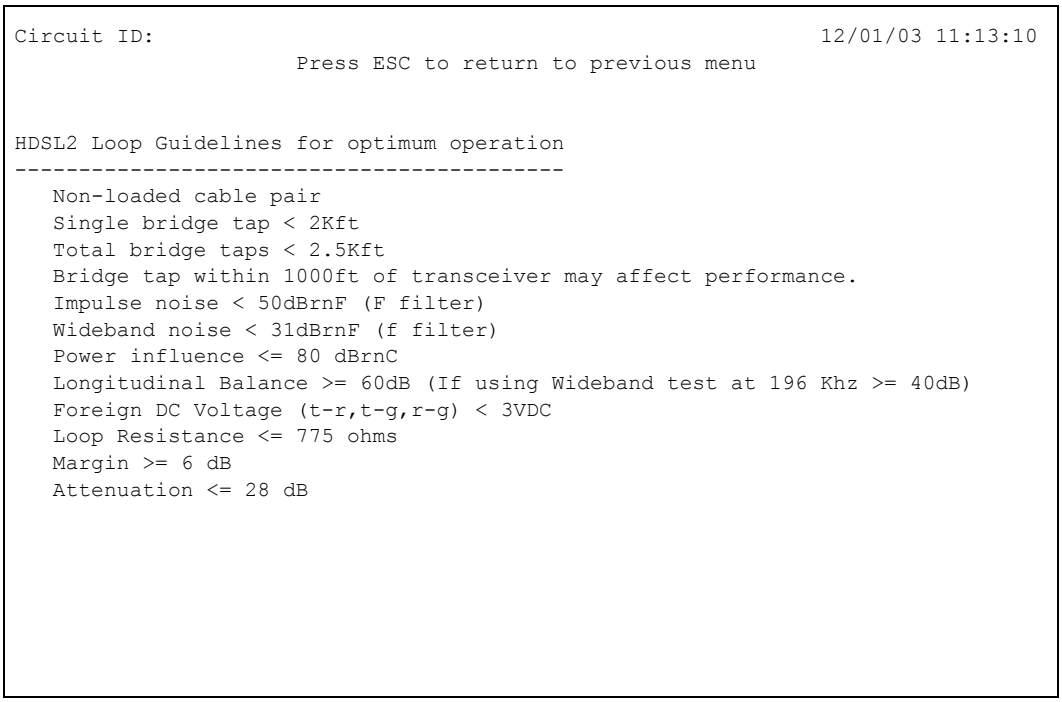


Figure 30. General Information Screen

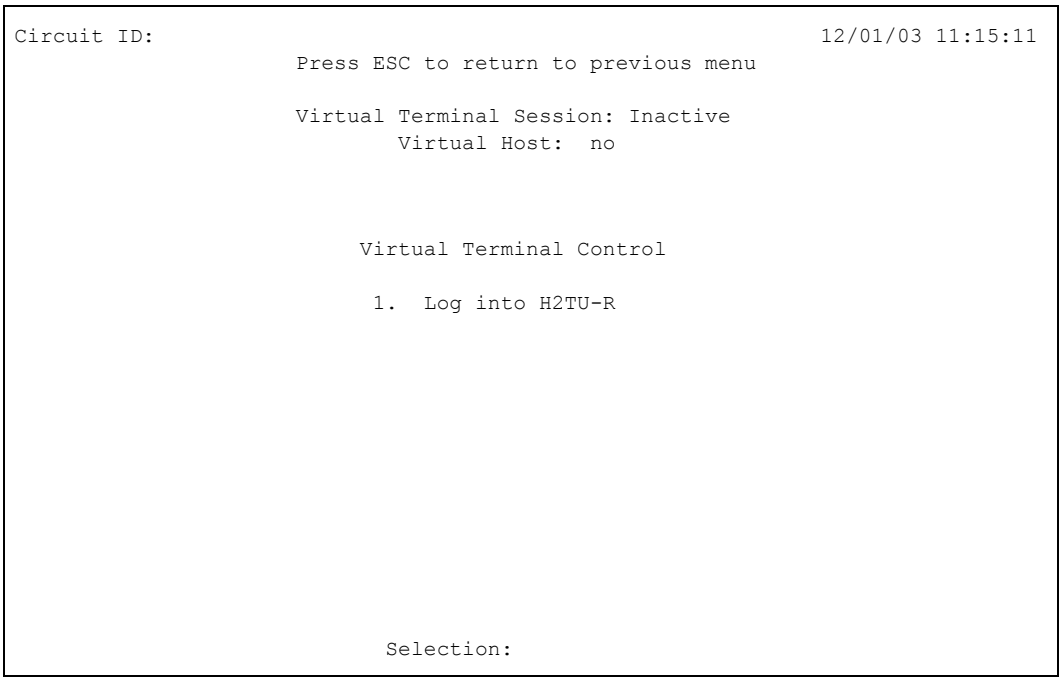


Figure 31. Virtual Terminal Control Screen

6. HDSL2 DEPLOYMENT GUIDELINES

The ADTRAN HDSL2 system is designed to provide DS1 based services over loops designed to comply with carrier service area (CSA) guidelines. CSA deployment guidelines are given below:

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

- $12 - \{(3*L_{26}) / (9- L_{BTAP})\}$ (in kft)
- L_{26} = Total length of 26-AWG cable excluding bridged taps (in kft)
- L_{BTAP} = Total length of all bridged taps (in kft)

These deployment criteria are summarized in the chart shown in **Figure 32**.

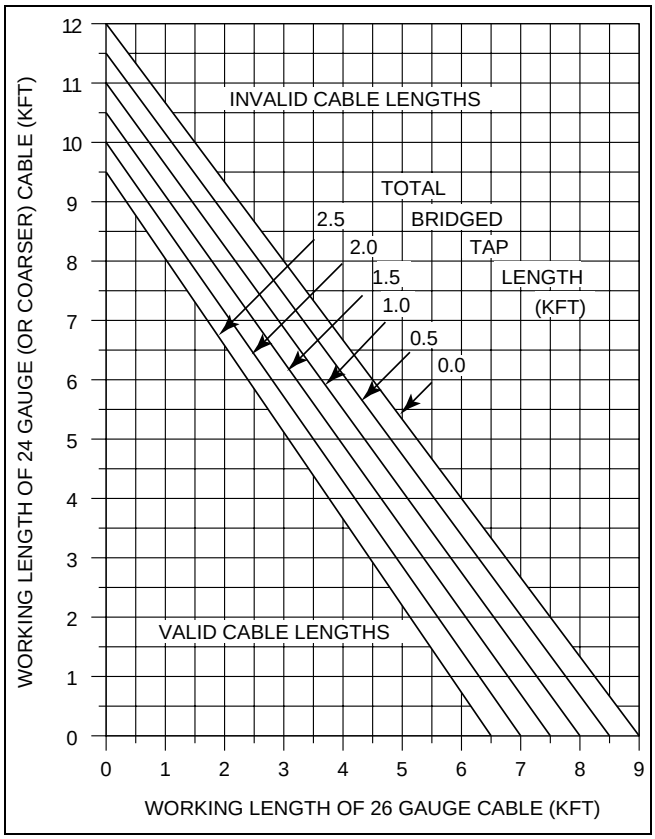


Figure 32. HDSL2 Deployment Guidelines

Loop loss per kilofoot for standard wire gauges is summarized in **Table 6**.

Table 6. HDSL2 Loss Values

Cable Gauge	Cable Type	Temperature 68°F	90°F	120°F
26	PIC	3.902	4.051	4.253
26	Pulp	4.030	4.179	4.381
24	PIC	2.863	2.957	3.083
24	Pulp	3.159	3.257	3.391
22	PIC	2.198	2.255	2.333
22	Pulp	2.483	2.545	2.629
19	PIC	1.551	1.587	1.634
19	Pulp	1.817	1.856	1.909

NOTE

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

An approximation for the maximum amount of wideband noise as measured using an F filter on an HDSL2 loop having 35 dB loss is < –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 ≤–38 dBrnF.

For additional information on these and other deployment issues, refer to HDSL Supplemental Deployment Information, document number 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.

7. TROUBLESHOOTING PROCEDURES

Table 7 is a troubleshooting guide for the T200 H2TU-C.

Table 7. Troubleshooting Guide

Condition	Solution
All Front Panel indicators are *Off*.	1. Verify that –48 VDC power is properly connected to the shelf. 2. Inspect the fuse to verify that it is not blown. 3. Insert the H2TU-C into a slot known to be in good working condition, and check the LEDs. 4. If Steps 1 and 2 pass, but Step 3 fails, replace the H2TU-C.
DSL LED is *Solid Red*.	Loop has poor signal quality or loss of sync. Basic troubleshooting procedures should identify a potential problem with the cable pair.
DSX/DS1 LED is *Solid Red*.	Errors are being taken on the DSX, DS1 or HDSL2 loop. The craft interface will identify the source. BERT tests to the appropriate loopbacks should also reveal the source of the problem.
Alarm LED is *Solid Red*.	Loss of DSX-1 signal to the unit.
Alarm LED is Yellow	If customer equipment is not installed, initiate an H2TU-R to Network Loopback and perform BERT test. If this test fails, or the craft interface indicates a loss of sync, then there is a potential problem with the cable pair that should be identified through basic troubleshooting procedures.

8. MAINTENANCE

The ADTRAN T200 H2TU-C requires no routine maintenance. In case of equipment malfunction, use the front panel bantam jack connectors 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 ADTRAN. Refer to the *Warranty and Customer Service* section of this Practice.

9. PRODUCT SPECIFICATIONS

Product specifications are detailed in **Table 8.**

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.

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

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

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

ADTRAN Sales

Pricing/Availability:
800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

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

ADTRAN Repair/CAPS

Return for Repair/Upgrade:
(256) 963-8722

Repair and Return Address

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

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

Table 8. T200 H2TU-C Specifications

Specification	Description
Loop Interface	
Modulation Type	16-TC PAM
Mode	Full Duplex, Partially Overlapped, Echo Canceling
Number of Pairs	1
Bit Rate	1.552 Mbps
Baud Rate	517.333 k baud
Service Range	Defined by Carrier Service Area Guidelines
Loop Loss	35 dB maximum @ 196 kHz
Bridged Taps	Single Taps < 2 kft, Total Taps < 2.5 kft
Performance	Compliant with T1.418-2000 (HDSL2 Standard)
H2TU-C Tx Pwr (Data) Level	16.8 ± 0.5 dBm (0 to 450 kHz)
H2TU-C Tx Pwr (Activation) Level	16.6 + 0.5 dBm (0 to 450 kHz)
Input Impedance	135 ohm
Maximum Loop Resistance	900 ohms per span
Return Loss	12 dB (50 kHz to 200 kHz)
Network Interface	
DSX-1 Output Level	0 dB, –7.5 dB (default), –15 dB
DSX-1 Line Build Out	0-133 feet (default); 133-266 feet ABAM; 266-399 feet ABAM 399-533 feet ABAM; 533-655 feet ABAM
DS1 Line Coding	AMI, B8ZS (default)
DS1 Framing Format	Auto, SF, ESF (default), Unframed
Power Tested with the ADTRAN H2TU-R (1223026L1).	
Total Power	–48 VDC @ 160 mA with H2TU-R
H2TU-C Power Dissipation	4.0 watts with H2TU-R
Span Power	–190 VDC (Internally Generated) Class A2 compliant, current limited at 150 *m*A
Fusing	1.00 A (on-board; not field-replaceable)
Clock	
Clock Sources	DSX-1 Derived (with HDSL2 frame bit stuffing)
Internal Clock Accuracy	± 25 ppm, (exceeds Stratum 4). Meets T1.101 timing requirements.
Tests	
Diagnostics	Self-Test, Local Loopback (H2TU-C), Remote Loopback (H2TU-R)
Physical	
Dimensions	5.5 in. high x .7 in. wide x 6 in. deep
Weight	Less than 1 lb.
Environment	
Temperature	Operating (Standard): –40°C to +70°C; Storage: –40°C to +85°C
Compliance	
UL Listed; Bellcore NEBS Level 3 (SR-3580); FCC 47CFR Part 15, Class A	
Part Number	
T200 2-Wire HDSL2 Transceiver Unit for the Central Office	1223006L1

Appendix A
HDSL2 Loopbacks

GENERAL

HDSL2 MAINTENANCE MODES

This appendix describes operation of the HDSL2 system with regard to detection of inband and ESF facility data link loopback codes.

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

Loopback Process Description

In general, the loopback process for the HDSL2 system elements is modeled on the corresponding DS1 system process. Specifically, the 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.

DDS Latching Loopback Operation

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

Loopback Control Codes

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

NOTE

In all control code sequences presented, the inband codes are shown leftmost bit transmitted first, and the ESF data link codes with rightmost bit transmitted first.

Table A-1. HDSL2 Loopback Control Codes

Type	Source [1]	Code [2,3]	Name
Abbreviated	(N)	3in7 (1110000)	Loopback data from network toward network in the 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 H2TU-R.
	(C)	6in7 (1111110)	Loopback data from customer toward customer in 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)	1in6 (100000)	Loopback data from network toward network 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.

[1] 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.

[2] All codes are in-band unless labeled ESF-DL.

[3] 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 will arm, and the H2TU-R will loop up 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 will loop down. The LBK LEDs will turn *off* on all units.
H2TU-C Network Loop Up	D3D3 (1101 0011 1101 0011)	(N)	If the units have been armed and no units are in loopback[4], the H2TU-C will loop up toward the network, 2 seconds of AIS (all ones) will be sent, 5 seconds of data will pass, and then 231 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 231 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 231 bit errors will resume at 20-second intervals.
HRE Network Loop up	C741 (1100 0111 0100 0001)	(N)	If an HRE is present, the units have been armed, the HRE will loop up towards the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and then 10 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 10 bit errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 10 bit errors will resume at 20-second intervals.
HTU-R Loop up	C742 (1100 0111 0100 0010)	(N)	When set from the network, an HTU-R network loopback is activated and a 20-bit error confirmation is sent every 10 seconds.
Loop down	9393 (1001 0011 1001 0011)	(N)	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 H2TU-R will not loop down from a network loopback in response to the 9393 pattern if NIU Loopback is enabled.
Loopback Time Out Override	D5D6 (1101 0101 1101 0110)	(N)	If the units are armed and this pattern is sent, the loopback time out will be disabled. The time out option will be updated on the Provisioning menu of the H2TU-R (viewable through the RS-232 port) to "None." As long as the units remain armed, the time out will remain disabled. When the units are disarmed, the loopback time out will return to the value it had before the D5D6 code was sent. 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 will deactivate its span power supply, turning off the H2TU-R. As long as the pattern continues to be sent, the span power supply will remain disabled. When the pattern is no longer being sent, the H2TU-C will reactivate its span power supply, turning the remote unit(s) on. All units will retrain and return to the disarmed and unlooped state.

[4] If smartjack is enabled, then the H2TU-R can be in network loopback when the H2TU-C loop-up codes are sent.