Total Access 3000 H2TU-C, HDSL2 Transceiver Unit for the Central Office Installation and Maintenance Practice

CONTENTS

TABLES

1. GENERAL

The ADTRAN Total Access® 3000 2-Wire HDSL (HDSL2) Transceiver Unit for the Central Office (H2TU-C) (P/N 1181113L2) is used to deploy an HDSL2 T1 circuit using 2-wire metallic facilities. The unit occupies one slot in a Total Access 3000 or Total Access 3010 Shelf. **Figure 1** is an illustration of the ADTRAN Total Access 3000 H2TU-C.

Revision History

This is the initial release of this document. Future revisions to this document will be explained in this subsection.

2. DESCRIPTION

The DSX-1 input signal can be supplied from the network or a Total Access 3000 Multiplexer (DS3, STS-1, or OC-3).

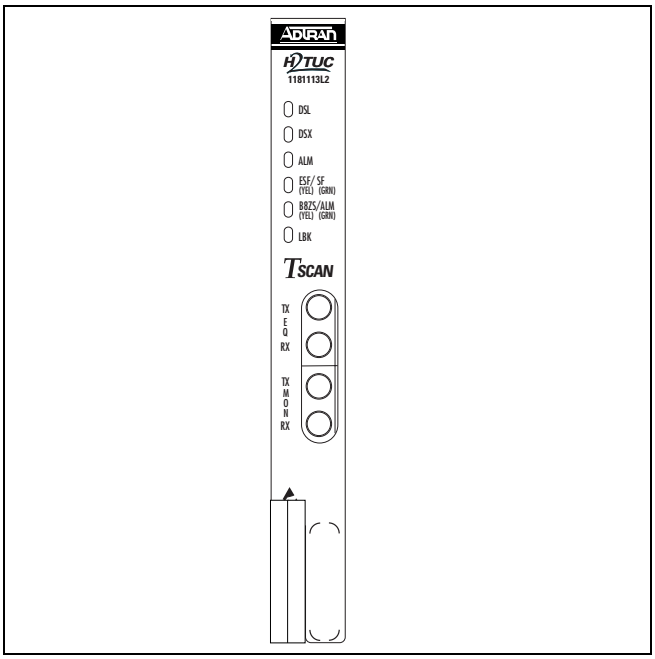


Figure 1. Total Access 3000 H2TU-C

DSX-1 signals are provided to and received from the network, while HDSL2 signals are provided to the local loop. The ADTRAN Total Access 3000 H2TU-C works in conjunction with the ADTRAN H2TU-R to provide a DS1 service up to 12,000 feet on the local loop.

Compatible ADTRAN units for this H2TU-C are shown in **Table 1**.

Table 1. ADTRAN HDSL2 Unit Compatibility

Part Number	Description
122x024L2	T200 H2TU-R, Local Power
122x026L2	T200 H2TU-R, Span Power

x = any generic number

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

Features

The basic features of the HDSL2 Total Access 3000 H2TU-C, (P/N 1181113L2) include the following:

- Auto In Service
- Bit Error Rate Testing (BERT)
- Flash Upgrade
- Troubleshooting Guidance
- TScan

These and other features will be discussed in the practice.

The H2TU-C contains an onboard fuse. If the fuse opens, it supplies a –48 VDC voltage to the fuse alarm bus, and all front panel indicators turn *off*. The fuse is not designed to be replaced in the field.

The H2TU-C uses a DC-to-DC converter to derive its internal logic and span powering voltages from the –48 VDC office supply. Span-powering voltages meet all requirements of Class A2 voltages as specified by Bellcore GR-1089-CORE.

System power and alarm bus connections are made through the backplane of the Total Access shelf. DSX1 and HDSL2 signals are connected through the 64-pin shelf connectors related to each individual slot.

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
- Ability to remotely detect the presence or absence of a ground connection in the remote mount.

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

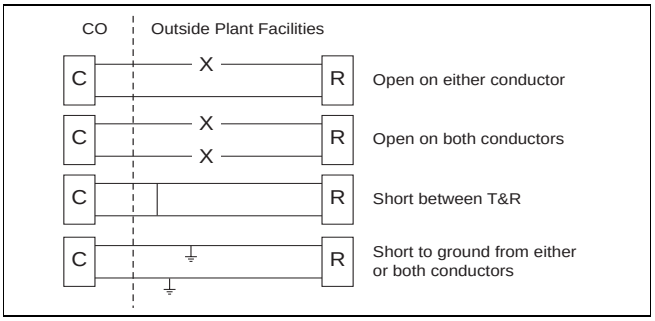


Figure 2. TScan Diagnostic Capabilities

Auto In Service

The Total Access 3000 H2TU-C supports the Auto In-Service feature that will automatically change the service state of the line card from Out-of-service Maintenance (OOS-MA) to In-Service and vice versa based on DSL loop synchronization and/or DSX-1/DS1 alarm presence.

This and other features are discussed in more detail in the *SCU Control Port Operation-HDSL2* section.

Bit Error Rate Testing (BERT)

This Total Access HDSL2 unit has the capability to initiate and record BERT via the Craft Access Terminal menus. It features eight timed and user-selectable data patterns as well as the ability to insert errors.

Compliance

Table 2 shows the compliance codes for the Total Access 3000 H2TU-C. The Total Access 3000 H2TU-C is NRTL listed to the applicable UL standards. The Total Access 3000 H2TU-C is to be installed in a restricted access location and in a Type “B” or “E” enclosure only.

Table 2. Compliance Codes

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

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

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

WARNING

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

NOTE

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

3. CONNECTIONS

The Total Access 3000 H2TU-C occupies one card slot in a Total Access 3000 Shelf. Power and alarm signals are provided to the card through the backplane of the shelf. DSX1 and HDSL2 loop signals are connected to the backplane on pins or mass termination shelf connectors (amphenol) corresponding to the slot the unit occupies. See **Figure 3** for H2TU-C edge connection wiring.

The Total Access 3000 shelf delivers DSX-1 from the network to the H2TU-C via connectors on the backplane labeled “Pair 7” and “Pair 8”. The HDSL2 signal is provided toward the customer via the backplane connector labeled “Pair 2”. Pins 1 and 33 of the connectors Pair 7 and Pair 8 are the DSX connections for the H2TU-C in Slot 1. Pins 2 and 34 of these connectors are associated with Slot 2. Pins 3 and 35 are associated with Slot 3, and so forth, up to pins 28 and 60 for Slot 28.

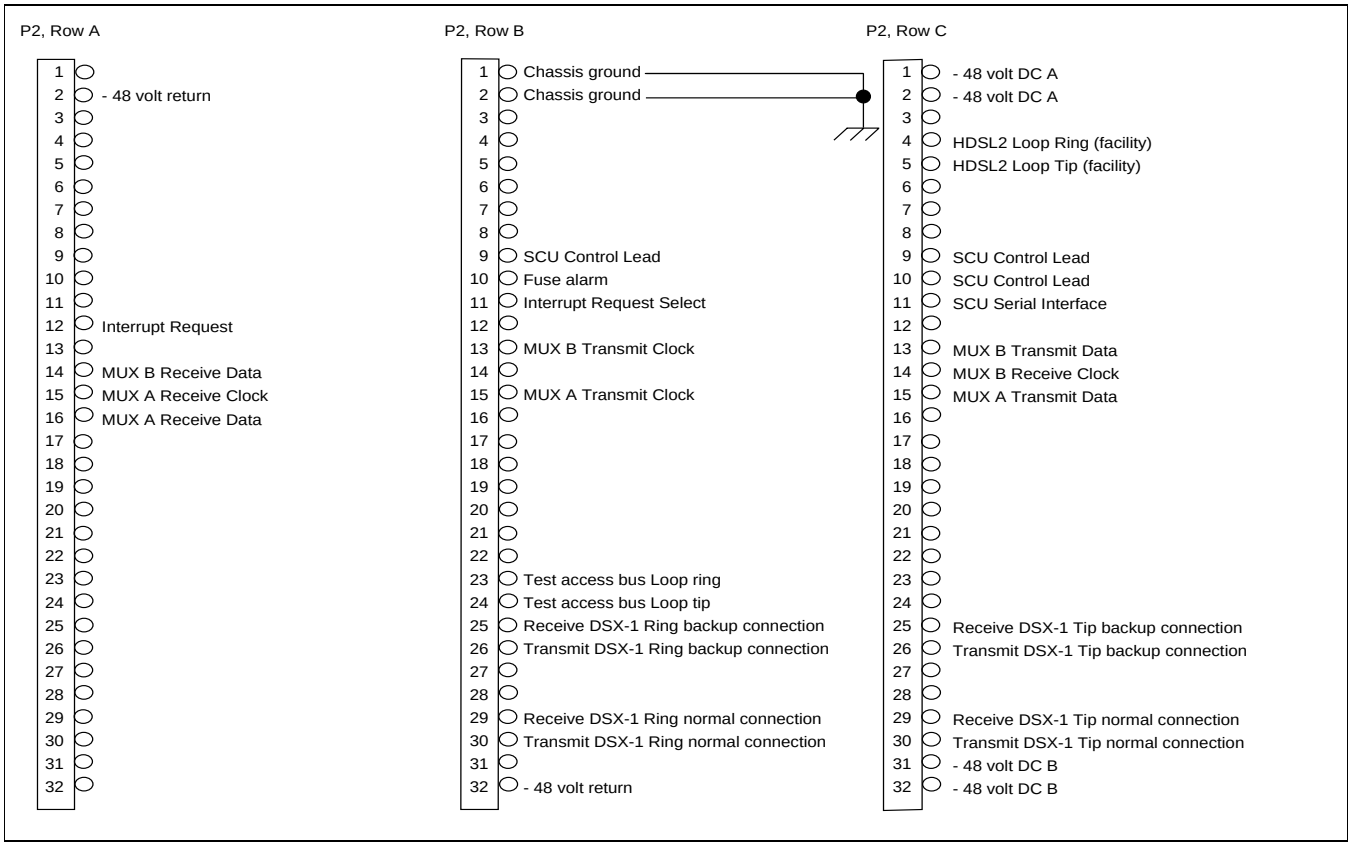


Figure 3. H2TU-C Edge Connector Wiring

Powering Modes

The 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 4**.)

If there is a need to remove an H2TU-C from the Total Access shelf, the H2TU-C should be provisioned for the Out-Of-Service-Maintenance or Out-Of-Service-Unassigned state. This will disable all HDSL2 level alarms from being sent to the shelf. Any HDSL2 alarm that occurred prior to changing the service will be set to Inactive status when the H2TU-C card is removed from the shelf.

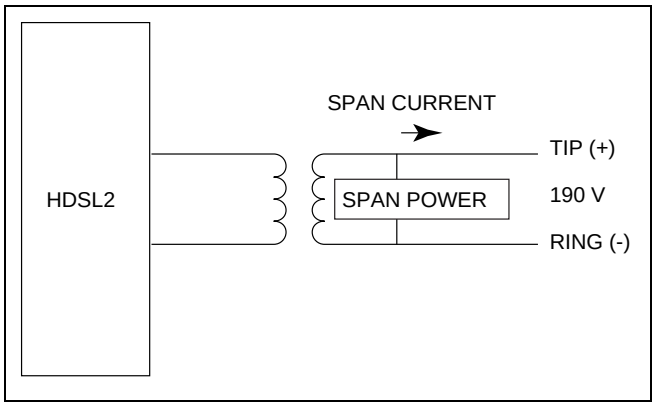


Figure 4. H2TU-C Span Powering Diagram

H2TU-C Alarm Outputs

Pin 32 of the H2TU-C edge connector interface provides a fuse alarm signal that connects –48 VDC to this pin in the presence of a blown fuse. This indicates the card has malfunctioned and should be replaced.

4. INSTALLATION

After unpacking the HDSL2 unit, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. Refer to the *Warranty and Customer Service* section for further information. If possible, keep the original shipping container for returning the Total Access 3000 H2TU-C for repair or for verification of shipping damage.

CAUTION

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

There are no configuration switches for the Total Access 3000 H2TU-C. Configuration is performed via software discussed in the *SCU Control Port Operation-HDSL2* section of this practice.

The Total Access 3000 H2TU-C plugs directly into the Total Access 3000 shelf. No installation wiring is required.

Powering Options

The H2TU-C is default enabled for span powering mode. The H2TU-C will power the H2TU-R, but it can be set to disable span power when the H2TU-R is being 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.

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

Instructions for Installing the Module

To install the Total Access 3000 H2TU-C, perform the following steps:

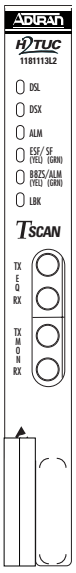
1. If present, remove the Access Module Blank from the appropriate access module slot of the Total Access chassis.
2. Pull the ejector latch, located on the lower left-hand side of the Total Access 3000 H2TU-C front panel, from its closed position.
3. Hold the unit by the front panel while supporting the bottom edge of the module with the ejector latch opened to engage the chassis edge.
4. Align the unit edges to fit in the lower and upper guide grooves for the access module slot.
5. 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 positioned against the backplane of the chassis.
6. Secure the Total Access 3000 H2TU-C in place by pushing in on the ejector latch.

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

Front Panel LEDs

The Total Access 3000 H2TU-C Access Module provides front panel LEDs to display status information. **Table 3** lists the front panel LEDs and their indications.

Table 3. Front Panel LEDs

Front Panel	Label	Status	Description
	**DSL**	Green Red	DSL sync, no errors currently detected, and signal margin ≥2 dB No DSL sync, errors being detected, or signal quality < 2 dB
	DSX/DS1	Green Red	DSX-1 signal is present and synchronized and no errors are being detected No DSX-1 signal, or signal is present with errors
	ALM	Off Red Yellow	No alarm condition detected Loss of DSX-1 signal to the unit Loss of DS1 signal to the remote
	ESF/SF	Off Yellow Green	Unit is provisioned for DS1 unframed operation Unit is provisioned for DS1 ESF framing mode Unit is provisioned for DS1 SF framing mode
	B8ZS/ AMI	Yellow Green	Unit is provisioned for B8ZS line code Unit is provisioned for AMI line code
	LBK	Off Yellow	Unit is not in loopback Unit loopback is active toward network or customer

5. HDSL2 SYSTEM TESTING

The ADTRAN HDSL2 system provides the ability to monitor the status and performance of the DSX1 signals, DS1 signals, and HDSL2 loop signals. Detailed performance monitoring is provided by the Total Access SCU via a 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 includes 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.

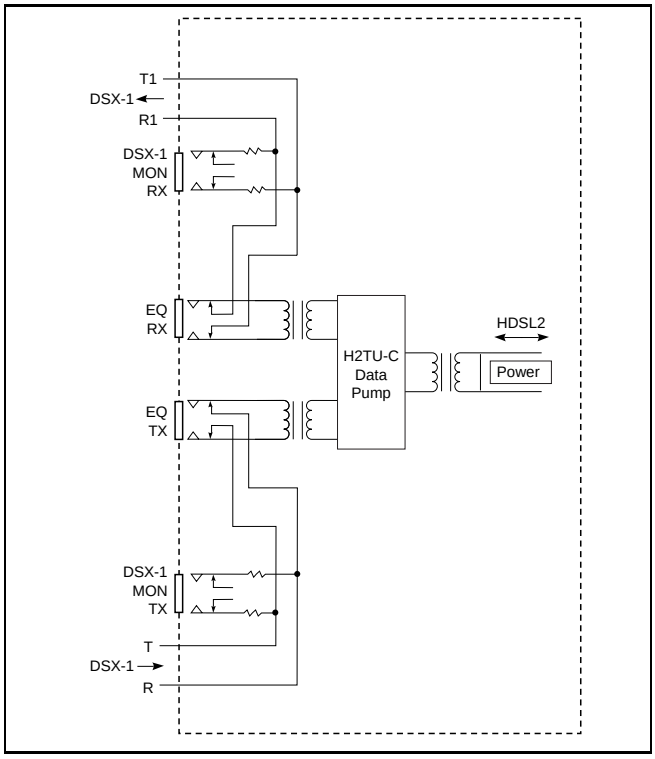


Figure 5. H2TU-C Bantam Jack Arrangement

H2TU-C Loopbacks

The H2TU-C responds to three different loopback activation processes. First, loopbacks may be activated using the craft interface of the Total Access 3000 SCU. The Loopback Options screen which provides for the H2TU-C and H2TU-R loopbacks is described in the *SCU Control Port Operation-HDSL2* section of this practice.

Second, the H2TU-C responds to the industry standard 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.

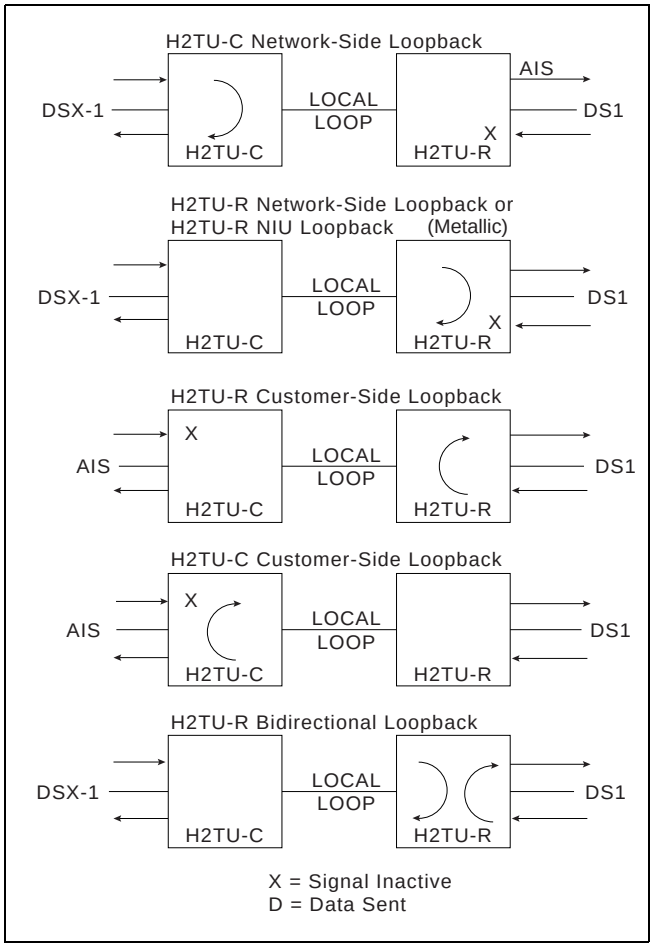


Figure 6. HDSL2 Loopbacks

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.

6. SCU CONTROL PORT OPERATION-HDSL2

The Total Access 3000 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 7**.

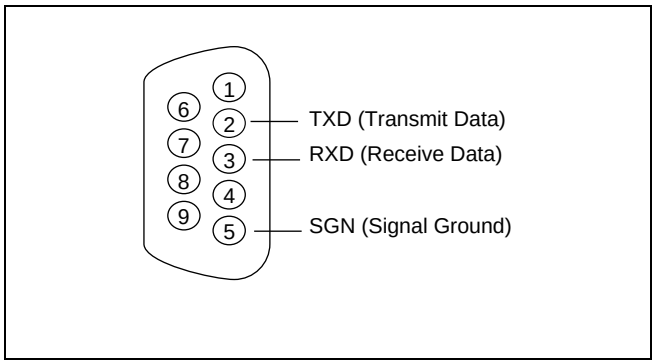


Figure 7. RS-232 (DB-9) Pin Assignments

The terminal interface operates at a data rate of 9.6 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 be disabled.

The H2TU-C supports two types of terminal emulation modes.

The Manual Update Mode is a dumb terminal mode, where the user can use print screen and log files commands easily. This mode also includes a "3 SPACES TO UPDATE" message on the top of the terminal screen. (Press the space bar three times to update the screen.)

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

NOTE

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

7. PROVISIONING

Through management access via the Total Access 3000 System Controller Unit (SCU), as detailed in the *SCU Control Port Operation-HDSL2* section, the provisioning settings can be viewed and manipulated.

Table 4 lists the available provisioning options and the factory default settings.

Table 4. Provisioning Options

Provisioning Option	Option Settings	Default Settings
1. DSX-1 Line Build Out	0-133 ft. 133-266 ft. 266-399 ft. 399-533 ft. 533-655 ft.	0 to 133 ft.
2. DSX-1/DS1 Line Code	B8ZS, AMI	B8ZS
3. DSX-1/DS1 Framing	SF, ESF, Unframed, Auto	ESF
4. Force Frame Conversion	Disabled, Enabled	Disabled
5. Smartjack Loopback	Disabled, Enabled	Enabled
6. Loopback Time Out	None, 120 Min	120 Minutes
7. Latching Loopback Mode	T1 (Disabled), FT1 (Enabled)	T1 (Disabled)
8. DS1 Tx Level	0 dB, –7.5 dB, –15 dB	0 dB
9. Span Power	Enabled, Disabled	Enabled
10. Customer Loss Indicator	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	Disabled, Enabled	Enabled
15. Service State[1]	In Service, Out of Service-Unassigned, Out of Service-Maintenance	Out of Service-Maintenance
16. Network Source	DSX, MUX A, MUX B, Auto MUX	DSX
17. External Alarms	Enabled, Disabled	Disabled
18. Auto In Service	Disabled, Enabled	Enabled
19. Auto IS Startup Period	1 hour, 4 hours, 8 hours, 24 hours	4 hours
20. Auto IS Off Period	1 hour, 4 hours, 8 hours, 24 hours	8 hours

[1]The Service State defaults to Out of Service-Maintenance. This setting allows active connections to the DSX or MUX interface; however, no alarms will be generated. The In Service setting allows full functioning connections to DSX or MUX interfaces. Out of Service-Unassigned allows the loops to train up but will not connect to the DSX or MUX interface.

The screens illustrated in **Figure 8** through Figure 42 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.

Accessing the HDSL2 circuit information via the Total Access 3000 SCU control port requires the user to logon by entering a password. See **Figure 8**. The default password is "PASSWORD." The 1181018L1 SCU also requires a username.

After successful logon, the Total Access System screen (**Figure 9**) will appear. Select Access Modules (option 4) from this menu.

```
TID:                          Total Access System          10/28/03 08:59
                                                          Unit Number:   1




                              Total Access System

                              Account Name :









                             '?' - System Help Screen
```

Figure 8. Logon Screen

```
Shelf: 1                      Total Access System          10/28/03 08:59
Unacknowledged Alarms: None




                              Total Access

                               1.  System Controller
                               2.  Common A - [.....]
                               3.  Common B - [.....]
                               4.  Access Modules
                               5.  System Alarms
                               6.  Network Management
                               7.  Logoff


                              Selection:




                             '?' - System Help Screen
```

Figure 9. Total Access Screen

The Access Module Menus screen (**Figure 10**) will display the access modules occupying the Total Access 3000 shelf. Select the corresponding channel slot number for the desired H2TU-C. To the right of each access module listed, the current alarm state is indicated.

First displayed is the ADTRAN HDSL2 Main Menu, from which the various OAM&P (Operation, Administrative, Maintenance, and Provisioning) screens may be accessed (**Figure 11**). To display a particular screen from the menu, press the number key associated with the screen title and then press the ENTER key

```
Shelf: 1                      Total Access System              10/28/03 08:59
Unacknowledged Alarms: None

                              Access Module Menus

             1 - H2TU-C L2... [None]      15 - ............ [None]
             2 - ............ [None]      16 - ............ [None]
             3 - ............ [None]      17 - ............ [None]
             4 - ............ [None]      18 - ............ [None]
             5 - ............ [None]      19 - ............ [None]
             6 - ............ [None]      20 - ............ [None]
             7 - ............ [None]      21 - ............ [None]
             8 - ............ [None]      22 - ............ [None]
             9 - ............ [None]      23 - ............ [None]
            10 - ............ [None]      24 - ............ [None]
            11 - ............ [None]      25 - ............ [None]
            12 - ............ [None]      26 - ............ [None]
            13 - ............ [None]      27 - ............ [None]
            14 - ............ [None]      28 - ............ [None]

                    Enter Channel Slot Number :
```

Figure 10. Access Module Menus Screen

```
Shelf:  1  Slot:  15          Total Access System              10/28/03 08:59
Unacknowledged Alarms: CRITICAL MAJOR            INFO
                      Circuit ID:

                               HDSL2 Main Menu

                              1.  HDSL2 Unit Information
                              2.  Provisioning
                              3.  Status
                              4.  Loopbacks and Test
                              5.  Performance Monitoring
                              6.  Scratch Pad, Ckt ID
                              7.  Alarm History
                              8.  Event History
                              9.  System Status/PM Report
                             10.  Clear PM and Alarm Histories
                             11.  Troubleshooting
                             12.  Flash Upgrade




                              Selection:
```

Figure 11. HDSL2 Main Menu Screen

The Unit Information Screen (**Figure 12**) provides detailed product information on each component in the HDSL2 circuit. ADTRAN Technical Support contact numbers are also available from the Unit Information Screen.

```
 Shelf:  1  Slot:  15          Total Access System                10/28/03 08:59
Unacknowledged Alarms: CRITICAL MAJOR            INFO
                     Circuit ID:
                                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: 1181113L2                     P/N: 1223026L2
              S/N: 123456789                     S/N: 123456789
             CLEI: T1L7HGLAAA                   CLEI: T1L7MERAAA
             Manf: 10/01/2003                   Manf: 10/01/2003
              Ver: 21  1 A01                     Ver: 16  2  A01
```

Figure 12. ADTRAN Information Screen

The Provisioning Screen (**Figure 13**) 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.

Note that there is more than one screen for the Provisioning Menu. Press the N (and ENTER) to move forward to the next screen. **Figure 14** shows the remainder of the Provisioning Menu. To return to the previous screen, press P. To return to the Main Menu, press <ESCAPE>. To re-deploy this unit, pressing "D" will restore the factory default settings as shown in Table 4.

The options shown in Table 4 are available with the 1223026L2 H2TU-R. Some settings may differ when using different H2TU-As.

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                              INFO
                     Circuit ID:

                                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            =  0 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
                      15.  Service State           =  OOS Maintenance
                      16.  Network Source          =  DSX
                       N.  Next Page
                             Selection:
```

Figure 13. Provisioning Screen, Page 1

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR               INFO
                     Circuit ID:HntsvlALMn0103

                                Provisioning

                      17.  External Alarms         =  Disabled
                      18.  Auto In Service         =  Enabled
                      19.  Auto IS Startup Period  =  4 hours
                      20.  Auto IS Off Period      =  8 hours

                       D.  Restore Factory Defaults
                       P.  Previous Page









                                Selection:
```

Figure 14. Provisioning Screen, Page 2

The Span Status Screen (**Figure 15**) provides quick access to status information for each HDSL2 receiver in the circuit.

The Status Screen Legend (**Figure 16**) provides a description of the messages that are used on the Status screens.

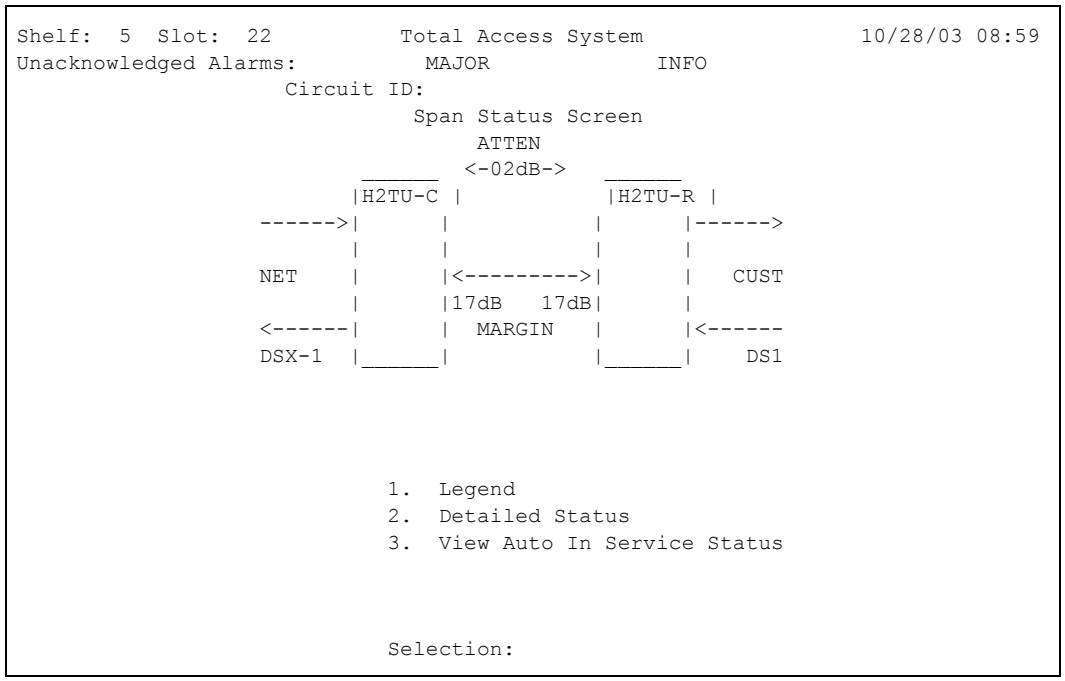


Figure 15. Span Status Screen

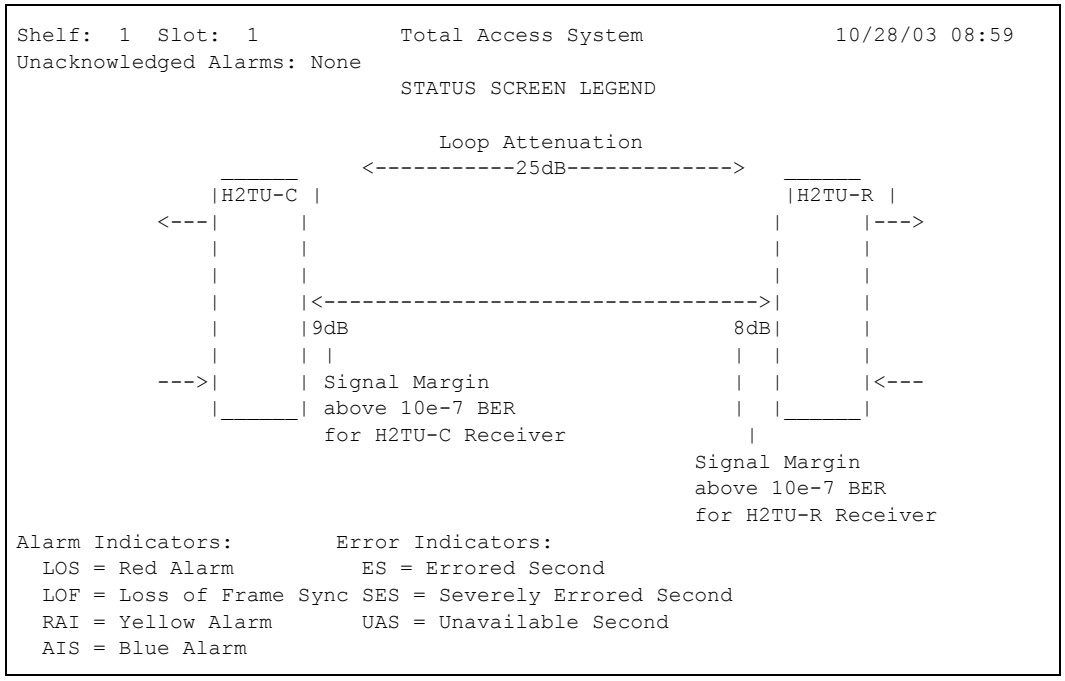


Figure 16. Status Screen Legend

The Detailed Status selection from the Span Status Screen menu (**Figure 17**) displays the T1 and HDSL2 status for each receiver point.

```
Shelf:  1  Slot:  1          Total Access System                10/28/03 08:59
Unacknowledged Alarms: None
                     CIRCUIT ID:
                          Detailed HDSL2 and T1 Status

                               HDSL2 RECEIVER DATA
                                 H2TU-C    H2TU-R

                                --------  --------
          MARGIN(CUR/MIN/MAX): 12/00/13  07/00/09
               ATTEN(CUR/MAX):  27/27     27/28
                     ES 15MIN:   001       254
                    SES 15MIN:   000       000
                    UAS 15MIN:   026       000

                              T1 RECEIVER DATA
                         DSX-1                 DS1
                        -------               -------
            FRAMING:      ESF                   ESF
          LINE CODE:     B8ZS                  B8ZS
          ES-P/ES-L:    000/000               247/255        1. Zero Registers
        SES-P/SES-L:    000/000               247/256        2. Restart Min/Max
        UAS-P/UAS-L:    000/000               176/159
             ALARMS:     NONE                  NONE             Selection:
```

Figure 17. Detailed Status Screen

The Auto In Service Status Screen (**Figure 18**) provides the status of the Auto In Service feature. Options for this feature are as follows:

The T1 alarm indications will display if the External Alarms option is enabled on the Provisioning Screen (Figure 13).

This screen also indicates the startup or exit period remaining as either 1, 4, 8, or 24 hours. This is the time during which the unit monitors both loop synchronization (Loop Sync) and T1 alarms (if enabled) and will only go into (or out of) service if the circuit remains synchronized and without T1 alarms during the entire measured period. These times are also set from the Provisioning Screen.

A link is provided (option 1) to view the Alarm History Screen. This screen is also available by selecting option 7 on the Main Menu.

System responses displayed in the status fields on this screen are shown in **Table 5** below.

```
Shelf:  1  Slot:  15          Total Access System                10/28/03 08:59
Unacknowledged Alarms: CRITICAL MAJOR             INFO
                     Circuit ID:
                         Auto In Service Status Screen

      Current Auto In Service State = Out-of-Service Maintenance
      Auto In Service Status        = Currently in Startup Period
      Auto In Service Criteria      = DSL Loop Sync (T1 alarms ignored)

            NOTE: The external alarms provisioning option determines
                  whether T1 alarms are an auto in service criterion.
                  Enabling external alarms sets T1 alarms as a criterion.

                             Criteria       Status
                           ---------------   ------
                           DSL Loop Sync      LOS


                           ---Startup Period Timer---
                            4 hrs  0 mins
--------------------------------------------------------------------------------
                             1.  View Alarm History

                             Selection:
```

Figure 18. Auto In Service Screen

Table 5. Auto In Service Status Indications

Status Field Name	System Indications
Current Auto In Service State (Line 1)	In-Service Out of Service-Maintenance
Auto In Service Status (line 2)	Currently in startup period Currently in exiting period OK, Startup Period COMPLETED OK, Startup INCOMPLETE (forced in-service)
Auto In Service Criteria (line 3)	DSL Loop Sync (T1 alarms ignored) DSL Loop Sync and absence of T1 alarms
Criteria (current status)	DSL Loop Sync = OK or LOS (LOS shown in Figure 18) T1 Alarm Status = Alarm or OK

The Loopback and Test screen (**Figure 19**) 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. Option 7 from this screen accesses the BERT Test Functions capability of the Total Access 3000 H2TU-C.

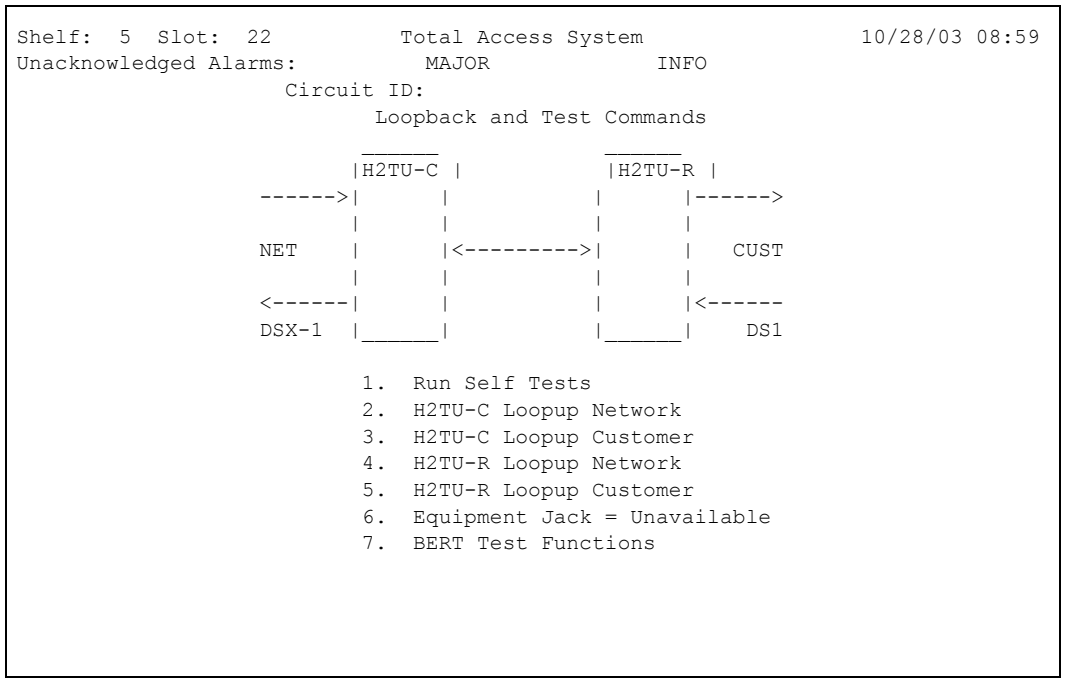


Figure 19. Loopback and Test Commands Screen

The BERT Test screen (**Figure 20**) is accessed by selecting the associated number on the Loopback and Test menu. A five-selection menu is at the bottom of the screen. Press the "1" key to start (or restart) a test, and "2" to manually stop the test.

NOTE

The BERT only runs unframed patterns. When the BERT is running, option 5 changes to "Inject Bit Errors".

Selecting number "3" from the BERT menu will allow the user to select the appropriate data test pattern for the desired results. **Figure 21** shows this screen with the menu of test patterns.

```
Shelf:  1  Slot:  18          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                                BERT Test Screen

                                  Test Results
               ---------------------------------------------------
                   Test Direction:              Customer
                   Unframed Pattern Generation: OFF
                   Pattern:                     QRSS Pattern
                   Line Coding:                 B8ZS
                   Bit Errors:                  0000000
                   Bit Error Rate:              0.0E-08
                   Pattern Sync:                N/A
                   Pattern Sync Losses:         000
                   Test Length (HH:MM:SS):      02:00:00
                   Time Elapsed (HH:MM:SS):     00:55:12
               ---------------------------------------------------
                                1.  (Re)start Pattern
                                2.  Stop Test
                                3.  Select Data Pattern
                                4.  Enter Test Timeout
                                5.  Toggle Test Direction
                              Selection:
```

Figure 20. BERT Test Screen

```
Shelf:  1  Slot:  18          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                           CUSTOMER Pattern Screen

                             Current Pattern = QRSS Pattern
                             ---------------------------------------

                             1. 63 Pattern
                             2. 511 Pattern
                             3. 2047 Pattern
                             4. REV. 2047 Pattern
                             5. 2^15 Pattern
                             6. 2^20 Pattern
                             7. QRSS Pattern
                             8. 2^23 Pattern




                           Selection:
```

Figure 21. Select Data Pattern

Selecting number "4" from the BERT menu will display the first of the BERT Test Functions, the Time-out Screen (**Figure 22**). The time out can run for a specific duration by entering the hours and/or minutes, or can run indefinitely by entering 00:00, per the note on the screen. With no test running, selection "5" from the BERT menu will allow the tester to toggle the test signal in the opposite direction (from customer to network and vice versa).

When "1" is pressed to start the test, option "5" changes to "Inject Bit Errors" as in **Figure 23**. This allows the tester to generate errors from this test origination point to validate the test results.

```
Shelf:  1  Slot:  18          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                           CUSTOMER Timeout Screen

                          Test Timeout(Hr:Min) = 02:00
                          ----------------------------
                          1. Change Timeout      02:00
                                                 02:00
                          *NOTE: When timeout is set to 00:00, the
                                 test will run indefinitely.









                          Selection:
```

Figure 22. BERT Test Functions Selection 4, Enter Test Time Out

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                            INFO
                     Circuit ID:
                                BERT Test Screen

                                  Test Results
               ---------------------------------------------------
                   Test Direction:              Customer
                   Unframed Pattern Generation: ON
                   Pattern:                     2^23 Pattern
                   Line Coding:                 B8ZS
                   Bit Errors:                  0000000
                   Bit Error Rate:              0.0E-05
                   Pattern Sync:                ACQUIRED
                   Pattern Sync Losses:         000
                   Test Length (HH:MM:SS):      02:00:00
                   Time Elapsed (HH:MM:SS):     00:02:32
               ---------------------------------------------------
                             1.  Number of Errors to Inject = 001 (Maximum=255)
                             2.  Inject Bit Error
                             3.  (Re)start


                          Selection:
```

Figure 23. BERT Inject Errors Screen

The Performance Monitoring screens (**Figure 24** and **Figure 25**) allow the user to select and display the historical HDSL2 and T1 performance data in several different registers. At each 15-minute interval, the performance information is transferred to the 15-minute performance data register.

This unit stores performance data in 15-minute increments for the last 24-hour period. At each 60-minute interval, the performance information is transferred to the 60-minute performance data register.

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.

```
Shelf:  5  Slot:  22          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
           Menu                15 Minute H2TU-C DSX-1 Performance Data

     1.  Definitions              ES-L  SES-L UAS-L PDVS-L B8ZS-L CV-L
     2.  Reset Data               128   129   129   000    000    00000
     3.  15 Min Data        07:15 900   900   900   000    000    00000
     4.  60 Min Data        07:00 900   900   900   000    000    00000
     5.  24 Hr Data         06:45 900   900   900   000    000    00000
     6.  Line Data          06:30 900   900   900   000    000    00000
     7.  Path Data          06:15 900   900   900   000    000    00000
     8.  H2TU-C DSX-1       06:00 900   900   900   000    000    00000
     9.  H2TU-C LOOP        05:45 900   900   900   000    000    00000
    10.  H2TU-R LOOP        05:30 900   900   900   000    000    00000
    11.  H2TU-R DS1         05:15 900   900   900   000    000    00000
                            05:00 900   900   900   000    000    00000
                            04:45 900   900   900   000    000    00000
                            04:30 900   900   900   000    000    00000

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

Figure 24. 15-Minute Performance Data Screen

```
Shelf:  5  Slot:  22          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
           Menu                60 Minute H2TU-C DSX-1 Performance Data

     1.  Definitions                ES-L  SES-L UAS-L PDVS-L B8ZS-L CV-L
     2.  Reset Data                 0002  0002  0002  0000   0000   00000
     3.  15 Min Data      08/12 07:00 ----  ----  ----  ----   ----   -----
     4.  60 Min Data      08/12 06:00 ----  ----  ----  ----   ----   -----
     5.  24 Hr Data       08/12 05:00 ----  ----  ----  ----   ----   -----
     6.  Line Data        08/12 04:00 ----  ----  ----  ----   ----   -----
     7.  Path Data        08/12 03:00 ----  ----  ----  ----   ----   -----
     8.  H2TU-C DSX-1     08/12 02:00 ----  ----  ----  ----   ----   -----
     9.  H2TU-C LOOP      08/12 01:00 ----  ----  ----  ----   ----   -----
    10.  H2TU-R LOOP      08/12 00:00 ----  ----  ----  ----   ----   -----
    11.  H2TU-R DS1       08/11 23:00 ----  ----  ----  ----   ----   -----
                          08/11 22:00 ----  ----  ----  ----   ----   -----
                          08/11 21:00 ----  ----  ----  ----   ----   -----
                          08/11 20:00 ----  ----  ----  ----   ----   -----

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

Figure 25. 60-Minute Performance Data Screen

Abbreviations used in the Performance Data screens are defined in the Data Definitions screens (**Figure 26** and **Figure 27**).

```
Shelf:  1  Slot:  1          Total Access System              10/28/03 08:59
Unacknowledged Alarms: None
                     CIRCUIT ID:
                          Performance Data Definitions

H2TU-C, H2TU-R, 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    (BPV+EXZ) count
  B8ZS-L  B8ZS Seconds
  CV-L    Code Violation 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 26. Performance Data Definitions, Loop

```
Shelf:  1  Slot:  1          Total Access System              10/28/03 08:59
Unacknowledged Alarms: None
                     CIRCUIT ID:
                          Performance Data Definitions

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


NOTE: Under a UAS-L or UAS-P condition, all other data 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 27. Performance Data Definitions, Path

On The Scratch Pad and Circuit ID Screen (**Figure 28**), the circuit ID can be any alphanumeric string up to 25 characters in length. The Scratch Pad is available for circuit-specific notes and can hold 50 alphanumeric characters in any combination.

The Alarm History screens are divided into three separate screens: T1 Alarm History (**Figure 29**), Facility Alarm History (**Figure 30**), and HDSL2 Span History (**Figure 31**).

T1 Alarm History screen (Figure 29) displays:

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

```
Shelf:  5  Slot:  22          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:



   Current Scratch Pad:
      New Scratch Pad =



       New Circuit ID =









                   Press TAB to skip to next entry field.


                             Press ESC to Exit.
```

Figure 28. Scratch Pad and Circuit ID Screen

```
Shelf:  5  Slot:  22          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                               T1 Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
H2TU-C     RED(LOS/LOF) 08/09/02  15:56:20   08/09/02  15:56:20   Alarm      001
 (DSX-1)   YELLOW(RAI)                                            OK         000
           BLUE(AIS)                                              OK         000

H2TU-R     RED(LOS/LOF) 08/09/02  15:54:27   08/09/02  15:54:27   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 29. T1 Alarm History Screen

Facility Alarm History screen (Figure 30) displays:

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

HDSL2 Span History screen (Figure 31) displays:

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

```
Shelf:  1  Slot:  15          Total Access System                10/28/03 08:59
Unacknowledged Alarms: CRITICAL MAJOR             INFO
                     Circuit ID:
                              Facility Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
FACILITY DC OPEN       01/01/00  00:00:03   01/01/00  00:00:03   Alarm      001
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 30. HDSL2 Facility Alarm History Screen

```
Shelf:  5  Slot:  22          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                              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 31. HDSL2 Span History Screen

The Event History screen (**Figure 32**) 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
- Network Source Setting Change
- NIU Loopback Option Change
- Option were Auto Provisioning from SCU
- Service State Setting Change
- Span Power Option Change
- Time/Date Changed From/To
- Loop Segment XX In/out of Sync

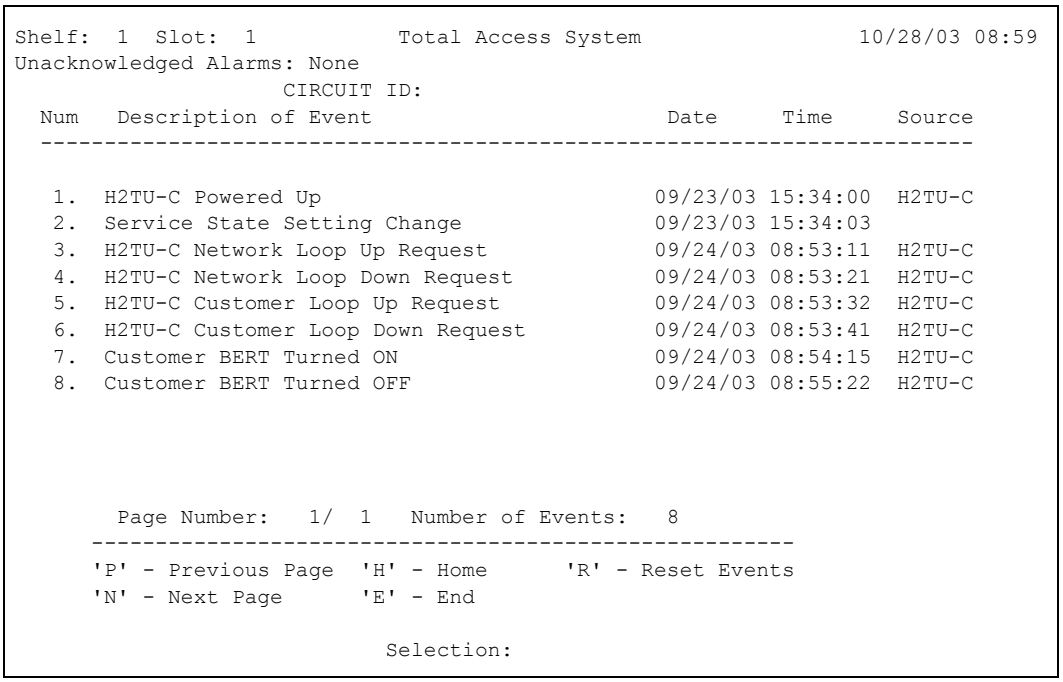


Figure 32. Event History Screen

The System PM/Screen Report option from the Main Menu (**Figure 33**) offers these four types of reports on performance monitoring:

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

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

The Clear PM and Alarm Histories option (**Figure 34**) initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu displays the prompt, "This will clear the history data for all elements in the circuit. Are you sure (Y/N)?"

```
                              4.  Loopbacks and Test
                              5.  Performance Monitoring
                              6.  Scratch Pad, Ckt ID
                              7.  Alarm History
                              8.  Event History
                              9.  System Status/PM Report
                             10.  Clear PM and Alarm Histories
                             11.  Troubleshooting
                             12.  Flash Upgrade




                              Selection:


        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 33. System PM/Screen Report

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:          MAJOR             INFO
                      Circuit ID:

                               HDSL2 Main Menu

                              1.  HDSL2 Unit Information
                              2.  Provisioning
                              3.  Status
                              4.  Loopbacks and Test
                              5.  Performance Monitoring
                              6.  Scratch Pad, Ckt ID
                              7.  Alarm History
                              8.  Event History
                              9.  System Status/PM Report
                             10.  Clear PM and Alarm Histories
                             11.  Troubleshooting
                             12.  Flash Upgrade

         This will clear the history data for all elements in the circuit.
                             Are you sure (Y/N)?

                              Selection: 10
```

Figure 34. Clear PM and Alarm Histories Screen

The Troubleshooting screen (**Figure 35**) compiles information received from all facilities and equipment in the circuit and presents them in both Real-Time and 7-Day historical format.

The Troubleshooting Guidance screen (**Figure 36**) option (accessed from the Troubleshooting screen) analyzes this information and makes repair recommendations.

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                              INFO
                     Circuit ID:
                                    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
```

Figure 35. Troubleshooting Screen

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                              INFO
                              Facility DC Open

- A DC Open condition is often caused by a lack of current flow on the DSL
loops. The condition should be resolved when an H2TUR (or H4R) is installed.

- If open is not due to absence of equipment, verify wiring in the H2TUR (or
H4R) housing. If still open, troubleshoot facility wiring for an open circuit.
Looking toward the CO, you should see approximately 190 volts across T/T1 and
R/R1 at any point. Also, if HDSL2 equipment is connected you should see a short
on both pairs in both directions. If not an open circuit still exists.

- If wiring and shelf OK, connect H2TUR at the frame and verify DSL sync can be
achieved. If not, replace the H2TUC and H2TUR one at a time to identify the
problem.
```

Figure 36. Troubleshooting Guidance Screen

The General Information screen (**Figure 37**) shows the Loop Deployment Guidelines for this type of circuit. Should trouble occur on the circuit, many test details are available here.

Ability to download new firmware for the unit is available via the Total Access H2TU-C Flash Image screen (**Figure 38**). This feature allows the download and installation of a firmware upgrade. Any existing provisioning setting will be retained, while new provisioning items will assume the factory default settings. Prior to installing, the H2TU-C will confirm that the firmware is correct. When initiated, setup instructions will be displayed on the craft access terminal.

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                              INFO
                     Circuit ID:

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


                                Selection:
```

Figure 37. General Information Screen

```
Shelf:  1  Slot:  14          Total Access System                10/28/03 08:59
Unacknowledged Alarms:                              INFO
                     Circuit ID:HntsvlALMn0103

                                          SW Ver  Checksum
                     H2TU-C Flash Image: A01       DD85



                               Software Update

                          1.  Download H2TU-C via Y-Modem
                          2.  Download H2TU-C via TFTP
                          3.  Boot Block Status and Overwrite Password









                             Selection:
```

Figure 38. Total Access 3000 H2TU-C Flash Image Screen

The Y-Modem Flash Upgrade screen (**Figure 39**) allows the user to initiate a Y-Modem file transfer from the computer connected to the SCU craft access port to the H2TU-C. This file is transferred to the SCU and downloaded to the H2TU-C at the SCU craft port baud rate; therefore, a higher-speed connection to the SCU is recommended (typically 115200 baud) to reduce file download times. At 115200 baud, a typical flash download to the H2TU-C will take less than 3 minutes. The file downloaded to the H2TU-C via the SCU should be of the ".bin" file type only and will be provided for feature enhancements/additions and bug fixes. **Figure 40** illustrates a Flash upgrade session in progress.

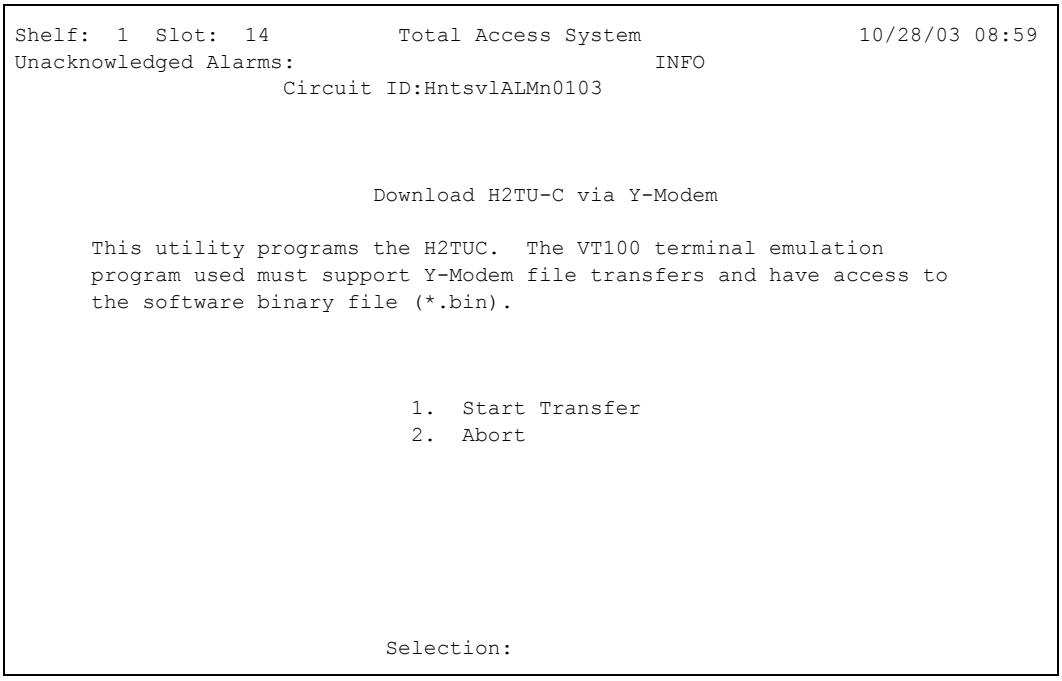


Figure 39. Flash Upgrade, Y-Modem Utility

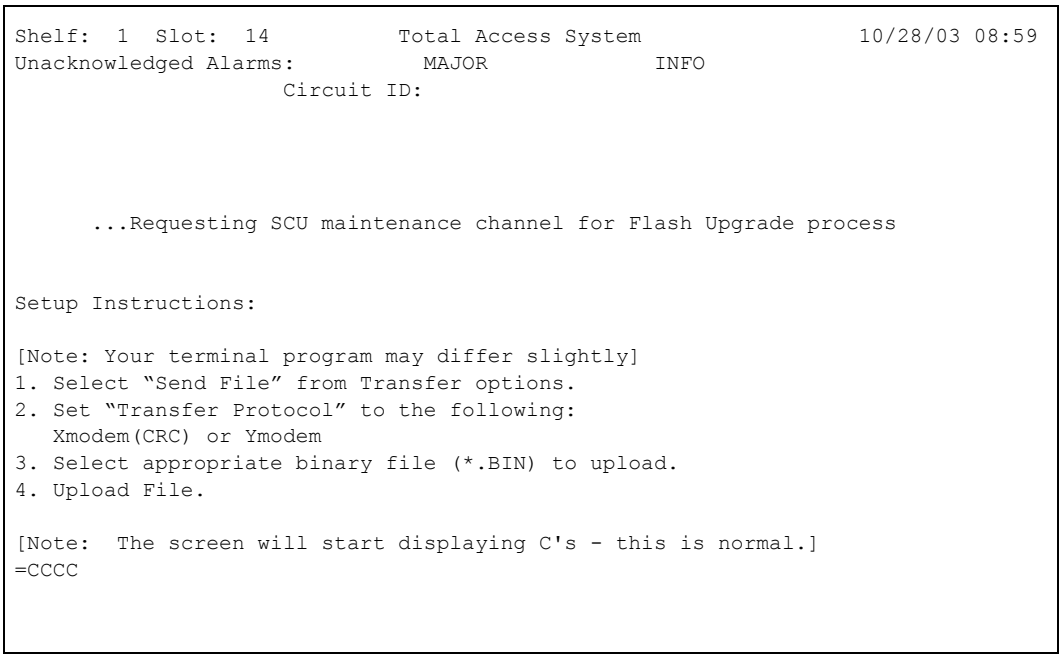


Figure 40. Flash Upgrade, Y-Modem in Progress

The TFTP Flash screen (**Figure 41**) is utilized to perform a TFTP file transfer from a remotely located computer/server to the H2TU-C. During TFTP transfers, the SCU continues to act as an intermediary to receive the file data from the remote computer and then send it to the H2TU-C unit. Before initiating a TFTP transfer from the menu screen, the user should first enter the TFTP remote filename that is listed on H2TU-C TFTP menu (option 1). The IP address of the remotely located computer must also be set from the network management menu on the SCU (note: this is an SCU menu option and not an H2TU-C menu option). In addition, the Ethernet interface of the SCU must also be provisioned properly for TFTP transfers. The Ethernet interface settings allow the SCU to communicate properly over the Ethernet network in which it is installed. Without setting these items up properly, neither telnet sessions nor remote TFTP file transfers will be available to the user.

The user should refer to the appropriate SCU Installation and Maintenance Practice for details on Ethernet settings.

Once the H2TU-C and SCU have been provisioned properly for the TFTP file transfer, select option 2 from the H2TU-C TFTP file transfer menu screen to initiate the TFTP file transfer from the remotely located computer to the H2TU-C. TFTP file transfers are typically faster than Y-Modem transfers. Once the SCU receives the file from the remote computer, the file is sent from the SCU to the H2TU-C to be downloaded (typically less than 2 minutes).

TFTP transfers can also be initiated remotely using SNMP - totally eliminating the need to physically be at the Total Access 3000 shelf to update the H2TU-C.

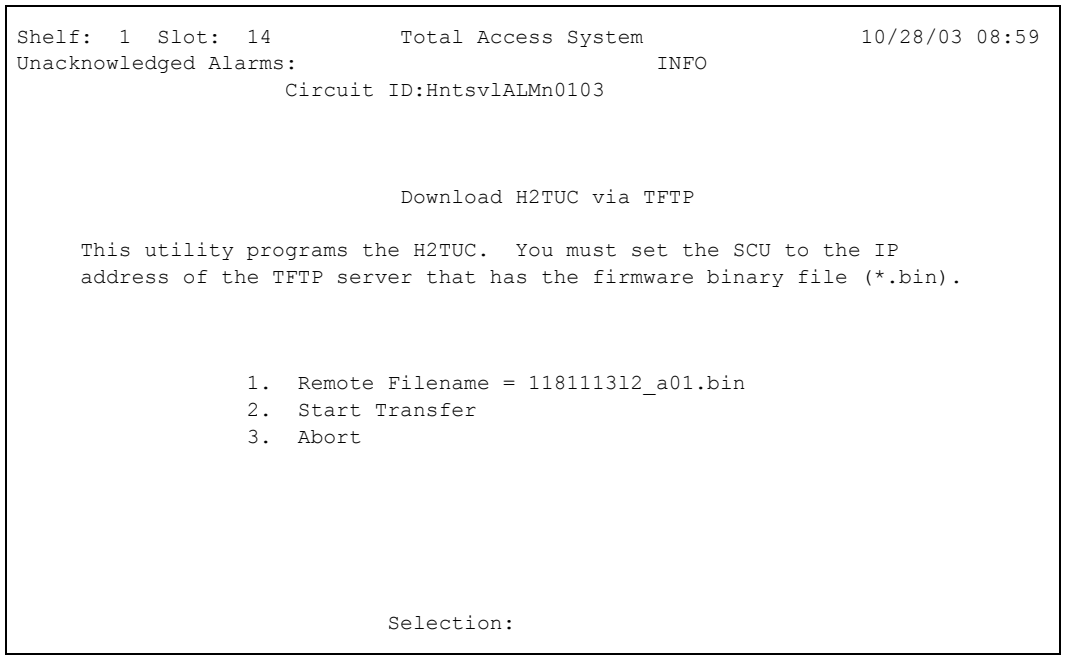


Figure 41. Flash Upgrade, TFTP Utility

The Boot Block Status and Overwrite Password screen (**Figure 42**) is typically not used. This screen provides a method by which the bootcode can be updated on the H2TU-C. The bootcode is seldom changed with new download code. The bootcode is the small piece of code that allows firmware upgrades on the H2TU-C unit. If it becomes corrupted, the H2TU-C will require factory service to restore it to a functional state. However, in the rare case to provide some new bootcode feature, this screen may be required to allow the bootcode to be overwritten by the newly downloaded firmware.

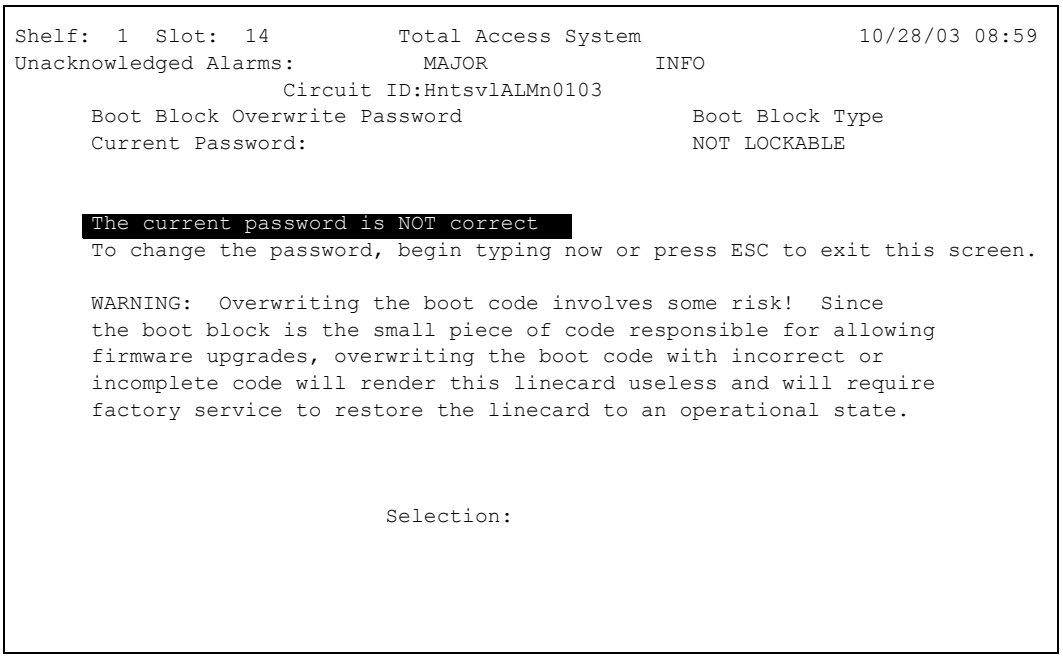


Figure 42. Flash Upgrade, Boot Block, Password

8. 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 43**.

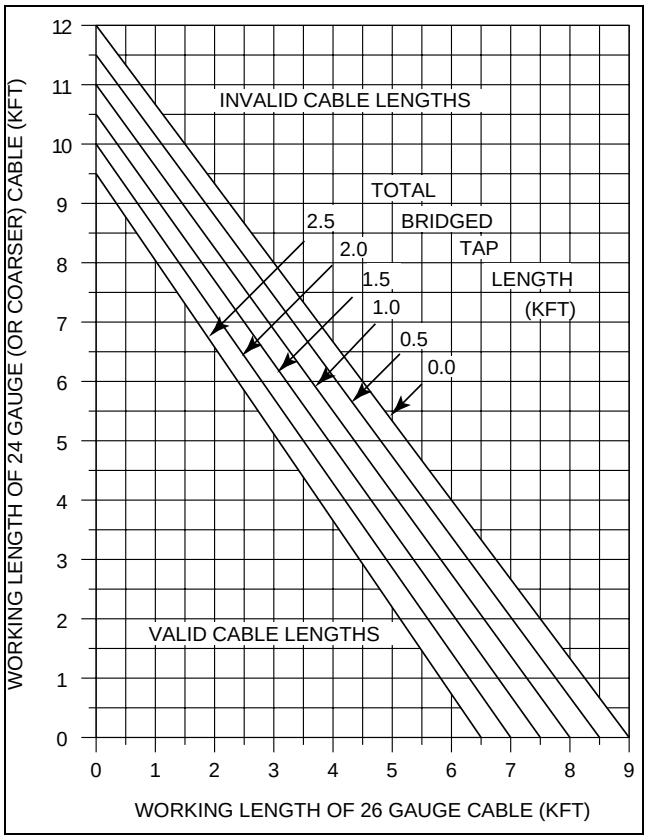


Figure 43. HDSL2 Deployment Guidelines

Loop loss per kft for other wire is summarized in **Table 6**.

Table 6. HDSL2 Loss Values

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

NOTE

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

9. TROUBLESHOOTING PROCEDURES

Table 7 is a troubleshooting guide for the Total Access 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. Insert the H2TU-C into an operational slot and check the PWR LED indicators. 3. If Step 1 passes, but Step 2 fails, replace the H2TU-C.

10. MAINTENANCE

The ADTRAN Total Access 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 *Warranty and Customer Service* section of this Practice.

11. PRODUCT SPECIFICATIONS

Product specifications are detailed in Table 8.

12. 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.

USA and Canadian customers can also receive a copy of the warranty via ADTRAN's toll free faxback server, 877-457-5007.

Carrier Networks Warranty - Document 414.
Enterprise Networks Warranty - Document 901.

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

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

ADTRAN Sales

Pricing and Availability
(800) 827-0807

ADTRAN Technical Support

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

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

ADTRAN Repair/CAPS

Return for repair/upgrade
(256) 963-8722

Repair and Return Address

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

Table 8. HDSL2 Total Access 3000 H2TU-C Specifications

Specification	Description
Loop Interface	
Modulation Type	16 TC PAM
Mode	Full Duplex, partially overlapped echo canceling
Number of Pairs	21
Line Rate	1.552 Mbps
Baud Rate	517.333 k baud
Loop Loss	Refer to the *HDSL2 Deployment Guidelines* section for additional measurements.
Bridged Taps	Single Taps < 2000 ft., Total Taps < 2500 ft.
Performance	Compliant with T1.418-2002 (HDSL Standard, issue 2)
H2TU-C Transmit Power (Data) Level	16.6 ±0.5 dBm (0 to 450 kHz)
H2TU-C Transmit Power (Activation) Level	16.3 ±0.5 dBm (0 to 350 kHz)
Input Impedance	135 ohms
Maximum Loop Resistance	900 ohms
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 H2TU-C (P/N 1223026L2)	
H2TU-C Total Power	–48 VDC @ 260 mA with H2TU-R
H2TU-R Power Dissipation	6.6 watts with H2TU-R
Span Power	–190 VDC (from H2TU-C) Class A2 Compliant, GFI Current Limited at <5 mA, Loop Current Limited at between 150 to 160 mA
Fusing	1.00 A (not field-replaceable)
Clock	
Clock Sources	DSX-1 Derived (with HDSL2 frame bit stuffing) MUX fed
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	
Total Access 3000 H2TU-C, Shelf-Mounted	
Dimensions	6 in. High, x 0.7 in. Wide, x 10 in. Deep
Weight	< 1 lb.
Environment	
Operating Temperature (Standard)	–40°C to + 70°C
Storage Temperature	–40°C to + 85°C
Compliance	
UL 60950; GR-1089-CORE; GR-63-CORE; ANSI T1.418-2002, Issue 2; ANSI T1.102 (DS1 Interface)	
Part Number	
Total Access 3000 H2TU-C	1181113L2

Appendix A
HDSL2 Loopbacks

HDSL2 MAINTENANCE MODES

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

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

Loopback Process Description

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

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

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

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

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

DDS Latching Loopback Operation

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

Loopback Control Codes

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

NOTE

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

Table A-1. HDSL2 Loopback Control Codes

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

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

Table A-2. In-Band Addressable Loopback Codes

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

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

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Appendix B
Front Panel DSX and MUX Mode Test Access

GENERAL

Figure B-1 through Figure B-3 are DSX-1 fed modes of operation, and Figure B-4 through Figure B-7 are MUX fed modes of operation. From the Provisioning screen (Figure 13), select "8" to choose the Network Source as MUX fed or DSX fed. When performing intrusive MUX mode testing, the equipment jack on the front panel can be configured to access the signal going to the Network or the Customer. Select "6" from the Test screen (Figure 17) to configure the equipment jack for Network or Customer. Every time the HTUC is power-cycled, it will default to the Customer direction.

DSX MODE TEST ACCESS

DSX MON, TX to Customer

The RX of the BERT receives data from the **TX MON** jack (**Figure B-1**). This data has a monitor jack impedance of 432 ohms and comes from the Backplane Network T1 DSX (the data that would go toward the customer). The **BERT TX** is not used. **This test is non-intrusive**.

NOTE

The H2TU-C must be provisioned for the Out of Service–Maintenance Service State when intrusive bantam jack testing is being performed.

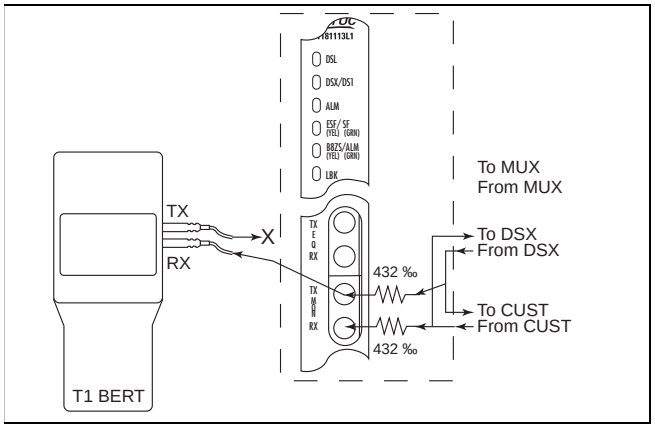

Figure B-1. DSX MON, TX to Customer

DSX MON, RX from Customer

The RX of the BERT receives data from the **RX MON** jack (**Figure B-2**). This data has a monitor jack impedance of 432 ohms and comes from the Customer originated data. The **BERT TX** is not used. **This test is non-intrusive**.

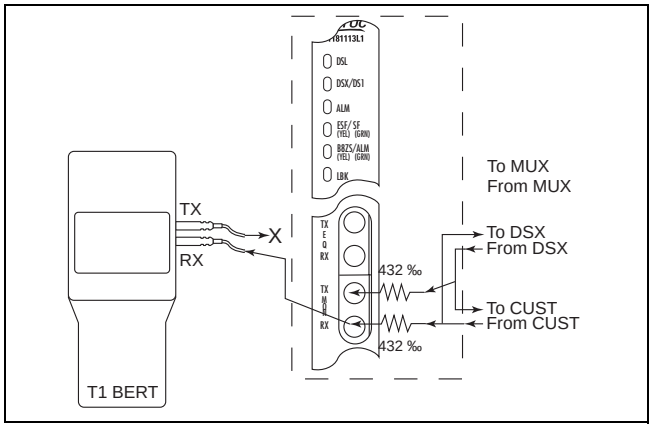

Figure B-2. DSX MON, RX from Customer

DSX EQ, TX to Customer, RX from Customer

The TX of the BERT goes to the **TX EQ** jack, and the RX of the BERT goes to the **RX EQ** jack (**Figure B-3**). The **TX EQ** data from the BERT is sent to the Customer. The **RX EQ** data to the BERT is data from the Customer. The **MON** jack **TX** and **RX** are 432 ohm replicas of the **EQ TX** and **RX** direct connections. **This test is intrusive**, as it connects the **EQ** jacks directly to and from the Customer data.

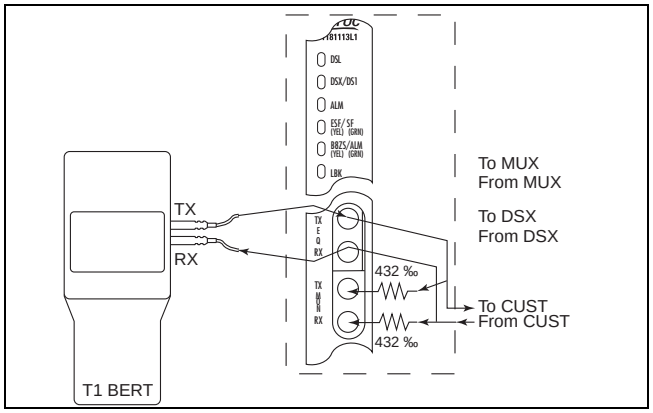

Figure B-3. DSX EQ, Tx to Customer, RX from Customer

MUX MODE TEST ACCESS

MUX MON, TX to Customer

The RX of the BERT receives data from the **TX MON EQ** jack (**Figure B-4**). This data is a copy of the data that the H2TU-C will transmit to the Customer. The TX of the BERT is not used. **This test is non-intrusive.**

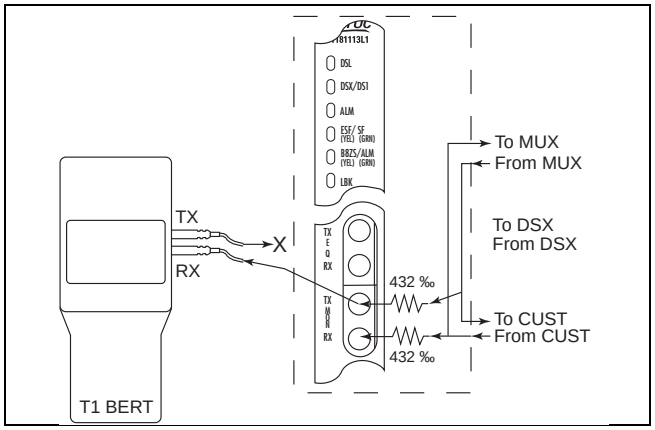

Figure B-4. MUX MON, TX to Customer

MUX MON, RX from Customer

The RX of the BERT receives data from the **RX MON** jack (**Figure B-5**). This data is 432 ohm copy of the data that the H2TU-C will receive from the Customer and route to the Total Access Shelf's MUX (Network). The TX of the BERT is not used. **This test is non-intrusive**.

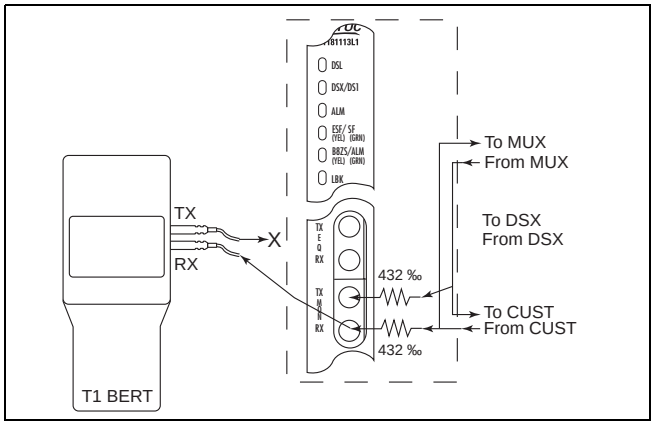

Figure B-5. MUX MON, RX from Customer

MUX EQ, TX to Network, RX from the Network

The TX of the BERT is connected to the **EQ TX** jack, and the RX of the BERT is connected to the **RX EQ** jack (**Figure B-6**). The TX of the BERT is then substituted for the data that the H2TU-C sends to the Total Access Shelf's MUX (Network). The RX of the BERT receives data directly from the MUX (Network). The **MON TX** and **RX** jacks are 432 ohm impedance copies of the **EQ** jack **TX** and **RX**. **This test is intrusive**.

NOTE

Via the Test screen, ensure that the equipment jack is in "To Network" mode. In "To Network" mode, AIS (unframed all 1's) is sent in the Customer direction.

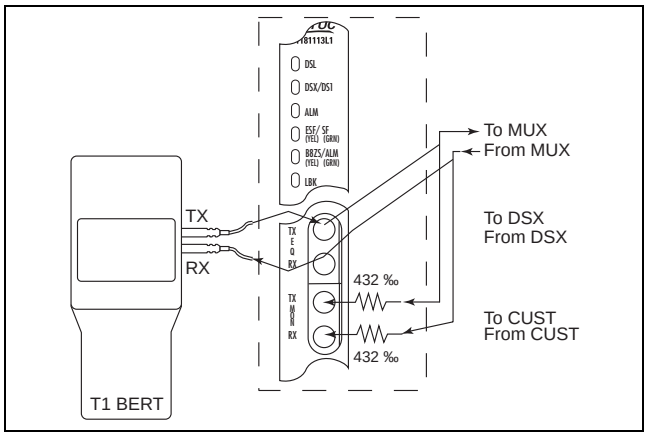

Figure B-6. MUX EQ, TX to Network, RX from Network

MUX EQ, TX to Customer, RX from Customer

The TX of the BERT is connected to the **EQ TX** jack, and the RX of the BERT is connected to the **RX EQ** jack (**Figure B-7**). The TX of the BERT is then substituted for the data that the H2TU-C sends to the Customer. The RX of the BERT receives data directly from the Customer. The **MON TX** and **RX** jacks are 432 ohm impedance copies of the **EQ** jack **TX** and **RX**. **This test is intrusive**.

NOTE

Via the Test screen, ensure that the equipment jack is in "To Customer" mode. In "To Customer" mode, AIS (unframed all 1's) is sent in the Network direction.

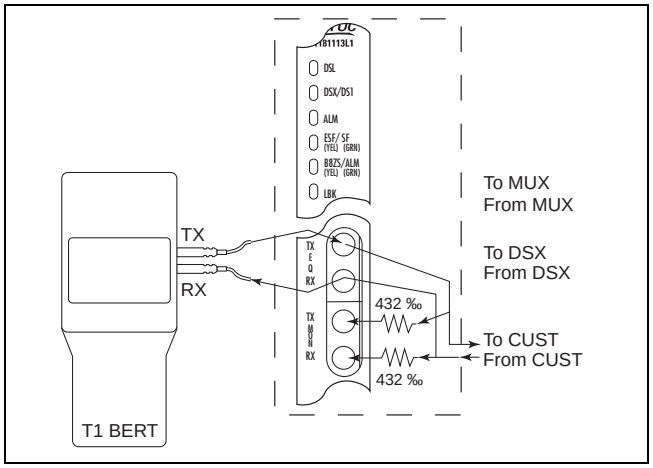

Figure B-7. MUX EQ, TX to Customer, RX from Customer